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Final
Environmental Impact Statement
for the
Kauai Acoustic Thermometry of Ocean Climate Project
and its associated
Marine Mammal Research Program

(Scientific Research Permit Application [P557E])
Hawaii Conservation District Use Permit Application [KA2734]

Volume II

Prepared by

Advanced Research Projects Agency
3701 North Fairfax Drive
Arlington, VA 22203-1714
and
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Protected Resources
1315 East-West Highway
Silver Spring, MD 20910

State of Hawaii
(State Accepting Authority)
Department of Land and Natural Resources
Office of Conservation and Environmental Affairs
1151 Punchbowl
Honolulu, HI 96813

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13. ABSTRACT *(Maximum 200 Words)*

Acoustic Thermometry of Ocean Climate (ATOC) is proposed as a proof-of-concept study funded by the Strategic Environmental Research and Development Program (SERDP). The primary prupose of ATOC is to make a contribution toward meaningful climate predictions. All vialble climate models show that the ocean plays a profound role in climate change. The ocean provides much of the memory which defines climate. No climate forecast, with all its consequences, will have any skill greater than that imbedded in the oceanic component. One will not get the atmosphere right unless one gets the ocean right.

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KAUAI ATOC MMRP FINAL EIS

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List of Agencies, Organizations and Individivals Consulted in Preparing the EIS

FEDERAL

U.S. Department of Interior, Fish and Wildlife Service

U.S. Department of Commerce, Office of Policy & Strategic Planning
National Oceanic and Atmospheric Administration, William Archambault

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
William W. Fox, Director
Jeannie Drevenak
Ann Terbush
Mary Freeman
Ken Hollingshead
Pamela Plotkin

U.S. Army Corps of Engineers

U.S. Department of the Navy, Space and Naval Warfare Systems Command, Dennis Colon

U.S. Department of Interior, Fish & Wildlife Services
Johnston Atoll, Chris Depkin, Roger Dirosa

Environmental Protection Agency, Region IX
Kathleen Johnson, Director

Marine Mammal Commission
Robert Hofman

STATE

Department of Business, Economic Development and Tourism
Ocean Resources Branch, MacDonald, Craig

Department of Land and Natural Resources, State Historic Sites Division

Department of Land and Natural Resources, Div. of Conservation and Environmental Affairs
Roger Evans, Chief

Department of Land and Natural Resources, Div. State Historic Sites

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Dennis L. Lau, Chief

Department of Health, Engineering Section
Edward Chen, Chief

Department of Transportation

Hawaii Office of Environmental Control
Betty Wood

Office of Environmental Quality Control

Pacific Missile Range Facility
P. McClaran

CITY AND COUNTY OF HONOLULU

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Center for Marine Conservation
Holly Price

Center for Seismic Studies
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Grotefendt, Rich

EBASCO Environmental, Inc.
Mari Smultea

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Rod Fujita

Friends of the Sea Otter
Ellen Faurot-Daniels

Hawaii Audubon Society

Hawaii Institute of Marine Biology
Paul E. Nachtigall

Hawaiian Islands Humpback Whale National Marine Sanctuary
Janet Sessing

Heller, Ehrman, White and McAuliffe

Hubbs Sea World Research Institute
Ann Bowles, Scott Eckert

Kauai Friends of the Environment
Beau Blair, Raymond Chuan

Kauai National Wildlife Refuge
Kathleen Viernes, Richard Voss

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Loyola University, Psychology Department
Richard R. Fay

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William T. Ellison

Marine Acoustics Inc., Arlington, VA
Lee Shores

Moss Landing Marine Laboratories
James Duffy, Gregor Calliet

Natural Resources Defense Council
Ann Nothoff, Joel Reynolds

Research Planning, Inc.
Al Cheaure

Save Our Shores, Santa Cruz, California
Vicki Nichols

Science Applications International Corporation, San Diego, CA
David W. Hyde

Science Applications International Corporation, McLean, VA
Peter Mikhalevsky, Ruth Keenan

Sierra Club Legal Defense Fund, Hawaii
Paul Atichoff, Mark Smaalders, Denise Antolini

Sierra Club Legal Defense Fund, Californias
Michael Sherwood, Torry Estrada

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Campus Planning Dept., Marilyn Cox

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University of Hawaii, Div. of Social Sciences
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University of Hawaii
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Peter L. Tyack

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Sylvia Earle, Marine Biologist

Lindy Weilgart, Marine Mammal Biologist

Hal Whitehead, Marine Mammal Biologist
Dalihouyse University, Ontario, Canada

APPENDIX F

Responses to Comments Raised by the Draft EIS

Introduction

This Appendix, Responses to Comments Raised by the Draft EIS, summarizes the comments received on the DEIS prepared for the Kauai Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program. This Appendix also provides the document's preparers' responses to public comments in accordance with the National Environmental Policy Act (NEPA) and the Hawaii Environmental Policy Act (HEPA). The preparers' comments are also provided via appropriate expansion, clarification, or revision of the DEIS.

The Advanced Research Projects Agency received 102 letters during the public comment period from January 6, 1995 through March 9, 1995. In addition, 24 statements were presented at the February 9, 1995 public hearing in Lihue, HI and 14 statements were presented at the February 10, 1995 public hearing in Honolulu, HI.

These comments contributed to the evolution of the research program that makes up the proposed action. This appendix clarifies the issues expressed by the commenters, and presents the preparers' final position on actions necessary for the most environmentally conscientious plan to conduct acoustic thermometry measurements and a Marine Mammal Research Program.

This Appendix is made up of three parts; 1) Kauai DEIS letter issues table, 2) preparers' responses to comments raised by the DEIS, and 3) copies of comment letters and public hearing transcripts. All comments from incoming letters, and statements from public hearings were numbered (left margin of comment letters and public hearing transcripts) and categorized into major issues and subissues (right margin). The following alphanumeric designations have been purposely omitted due to sequence reordering: 5.b, 6.j, 7.b, 7.f, 7.g, 9.b, and 10.b. Responses to these comments were then drafted and reviewed for scientific and programmatic accuracy. Where appropriate, the Marine Mammal Research Program Advisory Board was consulted in developing the comment responses.

The Kauai DEIS letter issues table is a matrix that reflects issues raised by each commenter, either via letter or public hearing. An 'X' is placed next to the commenters names for each issue they commented on. Following this are copies of the letters received and the public hearing transcripts. Where a comment generated a text change (including tables and figures) it is noted as a 'TC' in the right margin next to the comment. Where it is deemed that the EIS responds adequately to the comment, the appropriate section number is noted alongside the comment.

KAUAI EIS LETTER ISSUES

Name		Letter H Number	1 Funding of Program	2 Program EIS	3 Role of Acoustic Therm.	4 Altern. Site	5 Altern. Method	6 MMRP Protocol	7 Sound Fields	8 Biologic. Environ.	9 Physical Auditory Effects	10 Behavior Disrupt.	11 Potential for Habituat	12 Long-Term Effects	13 Potential Masking	14 Process of EIS	15 Insuff. Knwldge of LFS	16 General	17 ATOC/ MMRP Relation.	18 Social Environ.	19 Facility Const. & Removal	20 Cultural Religious Hawaii	21 Inciden. Take vs SRP	22 Text Change
Herman M.	Aizawa	1																						
Georgette	Alamani	64																		X				
Alicia L.	Alfonso	2	X	X										X								X		
Erin	Anakalea	64																		X				
Maria L.	Apilado	64																		X				
Paul	Atchitoff	105t		X	X													X						
Whitlow W.	Au	3																						
Jon R.	Backstrom	4					X																	
Rosalyn	Baker	136		X													X							
Beau	Barthel-Blair	5														X	X	X						
Beau	Barthel-Blair	75T																X						
Beau	Barthel-Blair	97T															X							
David	Beebe	6						X																
Laura	Bishop	64																		X				
Jill	Bornemann	7	X	X										X										
L.	Brelenfeld	67			X																			
Natalie	Broglie	64															X			X				
Chris	Busby	73												X						X				
Stan	Butler	109t		X				X		X							X							
Jane	Cartmill	8	X		X	X	X	X																
Tyron	Carvalho	64															X							
Doris L.	Carey	112					X																	
Sidney	Chapman	9					X																	
Ray	Chuan	65		X	X			X								X				X				X
Ray	Chuan	74T	X	X	X			X										X			X	X		
Ray	Chuan	98t																		X	X	X		
Chris	Clark	84T						X		X		X												

T Comments from Lihue Public Hearing, February 9, 1995
t Comments from Honolulu Public Hearing, February 10, 1995

KAUAI EIS LETTER ISSUES

Name		Letter # Number	1 Funding of Program	2 Program EIS	3 Role of Acoustic Therm.	4 Altern. Site	5 Altern. Method	6 MMRP Protocol	7 Sound Fields	8 Biologic. Environ.	9 Physical Auditory Effects	10 Behavior Disrupt.	11 Potential for Habituat	12 Long-Term Effects	13 Potential Masking	14 Process of EIS	15 Insuff. Knwldge of LFS	16 General	17 ATOC/ MMRP Relation.	18 Social Environ.	19 Facility Const. & Removal	20 Cultural Religious Hawaii	21 Inciden. Take vs SRP	22 Text Change
Chris	Clark	101t						X		X		X												
Derek	Cole	134			X																			
Mike	D'Angelo	10	X		X												X							
Steve C.	Davis	11			X																			
K. T.	Deibert	117						X																
Caren	Diamond	76T			X	X		X												X				
Haunani	Duterte	64															X							
David J.	Farrel	12		X	X		X	X		X				X			X					X		X
Hilary	Feldman	13				X		X				X				X								X
Darcia	Forester	138		X								X		X										
Andrew	Forbes	83T			X																			
Andrew	Forbes	99t		X																				
William	Friedl	14																						
Julian	Friedland	15	X	X										X								X		
Norman J.	Frisch	16	X											X		X								
Ann S.	Frisch	90T	X		X			X																
Norman J.	Frisch	91T			X																			
Moani Keala	Furtado	64			X															X				
Emily	Gardner	17						X									X							
Tracy J.	Gorton	62												X			X			X				
Sierra	Granda	64										X								X				
Jackie	Hale	64															X							
John T.	Harrison	115			X	X	X	X				X		X	X									X
Jack	Hashimoto	77T																		X				
Caroline	Haskin	18															X							
Don	Heacock	92T			X		X	X																
Patricia K.	Hebson	19																		X				

T Comments from Lihue Public Hearing, February 9, 1995

t Comments from Honolulu Public Hearing, February 10, 1995

KAUAI EIS LETTER ISSUES

Name		Letter # Number	1 Funding of Program	2 Program EIS	3 Role of Acoustic Therm.	4 Altern. Site	5 Altern. Method	6 MMRP Protocol	7 Sound Fields	8 Biologic. Environ.	9 Physical Auditory Effects	10 Behavior Disrupt.	11 Potential for Habituat	12 Long-Term Effects	13 Potential Masking	14 Process of EIS	15 Insuff. Knwldge of LFS	16 General	17 ATOC/MMRP Relation.	18 Social Environ.	19 Facility Const. & Removal	20 Cultural Religious Hawaii	21 Inciden. Take vs SRP	22 Text Change
Lea	Hennessy	64															X							
Sue V.	Herbich	139		X																				
B. Henry	Herman	68	X																					
Louis M.	Herman	20				X		X		X				X	X									X
Louis M.	Herman	103t				X				X		X			X									
Karen	Hewitt	78T			X																			
Don	Hibbard	116																						
Jennifer	Hillman	61	X														X							
Nelson	Ho	108t																						
Manfred M.	Holl	135			X																			
Arius	Hopman	94T																						
Brian	Imaok	64															X							
Thomas C.	Irvine	21	X													X								
Bruce	Jaffac	64																		X				
Melinda	Javier	114					X	X												X				
Francis	Jeffrey	113	X		X			X																
Kelise	Kashima	64						X												X				
	Kekila	64																						
Jeanine	Kepec	72												X						X				
Jenna	Kerr	118																		X				
Doug	Killpatrick	79T			X																			
Keith	Kitamura	64	X		X															X				
Joni	Konishi	120	X		X			X																
Owl	Koperman	22	X																					
Keith	Krueger	23	X	X		X		X						X			X	X	X		X			
Keith	Krueger	100t		X	X	X		X										X			X			
Robert	Kubota	64																		X				

T Comments from Lihue Public Hearing, February 9, 1995
t Comments from Honolulu Public Hearing, February 10, 1995

KAUAI EIS LETTER ISSUES

Name		Letter # Number	1 Funding of Program	2 Program EIS	3 Role of Acoustic Therm.	4 Altern. Site	5 Altern. Method	6 MMRP Protocol	7 Sound Fields	8 Biologic. Environ.	9 Physical Auditory Effects	10 Behavior Disrupt.	11 Potential for Habituat	12 Long-Term Effects	13 Potential Masking	14 Process of EIS	15 Insuff. Knwldge of LFS	16 General	17 ATOC/ MMRP Relation.	18 Social Environ.	19 Facility Const. & Removal	20 Cultural Religious Hawaii	21 Inciden. Take vs SRP	22 Text Change
Selomiti	Langi	64															X			X				
Lianne	Layaoen	64															X							
Douglas	Lewis	64																		X				
Ian	Looney	24	X	X		X										X						X		
Daina	Lopez	121																		X				
Alison	Lovell	64																		X				
Denise	Luttrell	25																						
Helen	Maher	26	X	X										X			X					X		
T. S.	Marshall	140																						
Johnathan	Matsumoto	64															X							
Brigid	McBride	27			X																			
Melanie	McCarthy	123						X												X				
Melinda	McComb	28				X		X										X	X					
Moana	McReynolds	124			X																			
John	Mento	29	X		X																			
Derek	Mercury	66																		X				
Jon A.	Mile	30												X			X			X				
Rebecca	Miller	31			X													X						
Rebecca	Miller	87T		X	X													X						
Patsy T.	Mink	32				X		X																
Sarah	Miquiabas	125	X																	X				
Keoni	Mira	64															X							
Joe	Mobley	111t			X													X						
Joe	Mobley	89T			X													X						
Sean	Moffitt	69	X																					
Jim	Moore	33				X		X					X											X
Allen	Morgan	34	X														X							

T Comments from Lihue Public Hearing, February 9, 1995
t Comments from Honolulu Public Hearing, February 10, 1995

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Kylie	Morishige	64																		X				
Joe	Moyer	122	X					X												X				
Leigh A.	Mumford	71					X																	
Walter	Munk	85T		X	X																			
Walter	Munk	102t			X																			
Kerrianne	Muraoka	64															X							
Kerry B.	Murnane	35	X											X			X					X		
Jay	Murray	80T																		X				
Jay	Murray	110t										X					X			X		X		
James A.	Nee	36				X																		
Jeane	Neuhia	64																		X				
Laura J.	Nevins	37			X									X			X			X				
Jason	Norni	64															X							
Dean	Oberste-Lehn	38			X	X		X			X			X		X								
Jessi	Ohai	64																						
Keani	Olanolan	64																		X				
Jocelyn	Olivas	64			X															X				
Curtis W.	Overacre	63															X							
Alberto	Partida	39	X		X																			
Alberto	Partida	88T	X				X															X		
Romeo	Parulo	64																						
Edwin	Perenz	64																						
Marica	Pielen	40					X																	
Jane S.	Podesta	41	X		X		X																	
Bryon	Pomg	64															X							
Kathleen	Potosnak	42	X		X			X								X								
Roy C.	Price	43																						

T Comments from Lihue Public Hearing, February 9, 1995
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Robynne	Reyes	64																		X				
Elizabeth	Riley	44	X	X				X																
Sarah	Riswold	64			X																			
Michelle	Roffman	45												X								X		
Dorothy	Roske	46					X																	
Shani	Sanchez	126	X																					
Melinda	Sandler	93T	X		X																			
Heather	Saunders	47															X							
Lindsey N.	Schnuat	128	X					X								X				X				
Alec	Schweir	129	X																	X				
Vincent	Segall	48															X							
David N.	Seielstad	49	X		X											X					X			
David N.	Seielstad	81T	X		X											X					X			
	Sharma	64																		X				
Kasey	Shibao	130	X													X								
Dan	Shook	86T			X		X	X																
Dan	Shook	96T			X		X																	
Cynthia	Simon	50			X									X			X					X		
Mark	Smaalders	104t		X	X									X				X						
Craig	Smith	64																						
Malia	Smith	64																		X				
William J.	Sparks	51			X									X			X					X		
Carl	Stipath	95T			X																			
Eliza	Stoker	52			X									X			X					X		
Kimberlee	Stuart	64																						
Summer	Surgart	119			X																			
Mary Ellen	Sussex	82T			X		X																	

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Claud	Sutcliffe	127						X										X						
Sarah E.	Sykes	53			X		X																	
Annie	Szvetecz	54	X	X		X	X	X	X	X				X		X		X	X					X
Leah	Thayer	131			X			X												X				
Benning W.	Ticke	55	X		X												X							
Erica	Torres	64																		X				
John R.	Twiss, Jr.	56						X	X	X		X		X										X
Natalie	Uaminska	64			X			X																
Susan	Urminska	64																		X				
Wayne	Vidinha	64																						
Michelle	Villabrille	64																		X				
Robert M.	Wagner	70												X		X								
Nicole J.	Walthall	57	X	X	X	X	X	X	X					X		X	X	X			X		X	X
Tiana	Watson-Souza	132	X					X																
Linda S.	Weilgart	60			X	X	X	X	X	X	X	X	X	X		X		X		X				X
Linda S.	Weilgart	107t			X			X	X			X	X	X		X		X		X				
Jeanne	Wheeler	58	X																					
Hal	Whitehead	59		X	X	X	X	X	X	X	X		X		X								X	X
Hal	Whitehead	106t		X			X	X		X				X			X	X						
Michael D.	Wilson	137		X																				
Tiffanie	Yama	133	X					X																
Jake	Youn	64																						
Lea	Young	64																						

T Comments from Lihue Public Hearing, February 9, 1995
t Comments from Honolulu Public Hearing, February 10, 1995

ISSUE 1: FUNDING OF PROGRAM

Comment: The Department of Defense (DoD) has no environmental mission and ATOC is, in reality, a military project, partially "classified," designed to support research into improving military capabilities.

Response: ATOC is funded by the Strategic Environmental Research and Development Program (SERDP). SERDP is mandated by Public Law 101-510 (40 U.S.C. §§2901-2904) to support environmental quality research, development, demonstration and applications programs. As such, SERDP is the Defense Department's principal technology development and transfer mechanism for environmental issues. The SERDP program identifies and develops technology to meet environmental commitments and to foster the exchange of scientific information and technologies. It thus interacts with other programs and applies defense technology to derive more usable and cost-effective approaches for reducing environmental risks.

SERDP is comprised of six Technology Thrust Areas: Global Environmental Change (GEC), Conservation, Cleanup, Compliance, Energy Conservation/Renewable Resources, and Pollution Prevention. The objective of the GEC thrust area (into which ATOC falls) is to focus on research which includes acquisition/organization of data and research results that quantify the total environment at global and regional scales. Integration of new and existing programs in data collection and analysis methodologies, process, study, research and environmental modeling are keystone features. GEC programs focus on improving access to Department of Defense/Department of Energy(DoD/DoE) data bases and facilities, developing DoD/DoE sensing capabilities and technologies. These programs support research into environmental change, process and modeling.

All projects funded by SERDP must survive an intense working group screening process, an evaluation and ranking by an executive working group, and if $1M or greater in value, rigorous review by an independent Scientific Advisory Board. To qualify as a SERDP program, proposed efforts must meet requirements of the law's authorizing language which describes SERDP's purpose, quoted here in part:

> To address environmental matters of concern to DoD and DoE through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations.
>
> To identify research technologies and other information developed by the DoD and the DoE for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies to address ... environmental concerns and to share such research, technologies and other information with such government and private organizations.

As part of GEC and the broader U.S. Global Climate Research Program, ATOC would transmit a signal to be received many thousands of miles away. Accordingly, the use of existing fixed undersea receivers of the Sound Surveillance System (SOSUS), a part of the Navy's

Integrated Undersea Surveillance System (IUSS), which were designed for precision acoustic reception, is completely within the letter and spirit of the SERDP legislation. ATOC's use of these Navy remote sensing capabilities would avoid major program costs. A specially-designed signal processing system installed at selected IUSS sites would "tap off" the uniquely-modulated ATOC signal.

It is true that certain attributes of SOSUS itself remain classified, specifically, exact location of the underwater receivers, or hydrophones, but ATOC project results would be entirely unclassified, since relative, not absolute, travel times are the primary measurement. All climate measurement data would be available to scientists at an unclassified level.

The ATOC project has no specific military purpose and is not designed to improve military capabilities. However, research that increases knowledge of the marine environment always offers the potential for discoveries that may prove useful for both civilian and military purposes.

ISSUE 2: PROGRAMMATIC EIS

Comment: A programmatic EIS forecasting and analyzing the environmental effects of the overall ATOC program for at least the next 10 years is required before any ATOC activities occur, including baseline studies providing information for the environmental review process. Alternatively, the process for evaluating subsequent ATOC actions should clearly be explained in the FEIS, and a programmatic statement should be prepared if the 10-year ATOC program proceeds. The EIS should evaluate all current project components, including components in New Zealand, Hawaii, and the fixed and drifting receivers. The relationship of the Kauai and California environmental review processes should be clarified. The comment periods for the California and Hawaii EISs should have been concurrent.

Response: The EIS identifies the reasons why future ATOC activities are too speculative to permit analysis of potential environmental effects at this time. Neither NEPA nor HEPA require speculation concerning future activities. EPA, the federal agency responsible for ensuring compliance with the NEPA guidelines, recommended that: "a broad programmatic EIS be developed for the 10-year ATOC program, should it occur, with tiered NEPA documents for each new sound source."

Both NEPA and HEPA require reasonable development of information necessary to support the EIS; by definition these studies must take place before the environmental review process is completed. Studies made under existing permits and analyses of available data have provided important information for preparation of the EIS.

Both the source technologies and source locations that would be proposed for a long-term ATOC effort presently are uncertain. If the ATOC feasibility study proves successful and funds are made available for future activities (both of which must be considered speculative at this time), the range of potential options for ATOC technologies includes: 1) moored autonomous sources with a high degree of siting flexibility and potentially located in very remote locations, 2) bottom mounted autonomous sources at locations in the deep sound channel, with somewhat less siting flexibility or, 3) cable powered sources that generally would need to be located reasonably close to developed land areas.

Autonomous sources, particularly if they are to be buoyed up on a mooring, require substantial engineering work before the capability is demonstrated; the likelihood that this work can be completed before future phases might be proposed is uncertain.

Several factors render speculative any detailed predictions concerning potential future ATOC project studies, including source sites. First, the importance of avoiding marine mammals should be understood better following the initial MMRP and feasibility study phase. Also pertinent to the location of future sound sources would be the degree to which additional research on marine mammals is considered important as an overall ATOC program goal.

The description of siting criteria set forth in Section 2 of the EIS provides the currently available information regarding the likely process for selecting any future ATOC source sites. It is anticipated that from one to several sound sources would be needed in each major ocean basin, but even that factor remains speculative until the results of the initial feasibility study have been obtained. In particular, it is not currently known whether there is a limiting range for the ATOC technology that would require more sources to obtain complete basin-level or global coverage. All of these factors would be considered following the feasibility study phase in developing any long-term program proposals.

The net effect of all these uncertainties is that the location of potential future ATOC sources and their nature and characteristics are currently speculative and the results of any environmental review based upon such speculation would likely be rendered obsolete by future developments in the program.

No proposed sites for additional ATOC sources have been identified. The shift in proposed location for the California ATOC source from Sur Ridge (preferred site) to Pioneer Seamount demonstrates both the flexibility of ATOC source siting decisions and the need to respond to evolving factors in focusing on specific proposals. If autonomous technologies are demonstrated in the future, this source siting flexibility will be even greater.

To the extent that cabled sound sources similar to those proposed for the California and Hawaii ATOC installations are utilized for future ATOC activities, and assuming similar siting criteria, the impacts could be anticipated to be similar to those analyzed in the respective environmental impact statements for the California and Hawaii cabled source operations. If future sound sources are located at more remote sites with lower abundances of marine mammals and other sea life, impacts could be reduced, but continued marine mammal research would likely be severely restricted or infeasible at those locations.

If the MMRP demonstrates any adverse impacts from ATOC sound transmissions or other ATOC activities, and if the ATOC concept proves successful and a long-term study warranted, a programmatic environmental impact statement likely would be required at that time, with tiered site-specific environmental review.

The complete ATOC program, as currently known, consists of the activities described and analyzed in the EIS/EIR for California and the EIS for Hawaii cabled source installations and related activities. These two documents incorporate one another by reference and when combined comprise a complete program-level analysis at this time.

All of the current project components that fall under the jurisdiction of U.S. federal and/or state guidelines or permitting requirements, including the pertinent fixed and drifting receiving arrays, are analyzed in the EIS. Specifically, the EIS, in Section 4.2.1.1, concludes that none of the receiving arrays, including those in non-U.S. waters (e.g., Guam, Rarotonga [New Zealand]) will have significant environmental impacts.

The DEISs for California and Hawaii were released as close in time as was practicable. It was determined not to delay release of the California EIS/EIR to permit identical review periods, since not all commenters are interested in both sites and such delay would have unnecessarily withheld information of concern to the public in California. Commenters interested in any combined effects of the California and Hawaii activities have been able to provide their comments as late as the close of the comment period on the Hawaii document (March 9, 1995).

ISSUE 3: ROLE OF ACOUSTIC THERMOMETRY IN ADDRESSING GLOBAL WARMING

a. CLARIFICATION OF ATOC OBJECTIVES/GOALS

Comment: 1) What is the primary purpose of ATOC? The project description is inadequate. 2) Why bother with the detection of greenhouse warming when we know already that it has taken place? 3) Why not just put a thermometer over the side of the ship and measure temperatures directly? 4) Won't your measurements take too long to do any good?

Response: 1) There is not yet sufficient agreement within the environmental scientific communities on the possible adverse effects of greenhouse warming and the extent that it may be occurring. The primary purpose of ATOC is to make a contribution toward meaningful climate predictions, which are a prerequisite to any effective national and international policy on fossil fuel consumption. In the future, validated climate models will be the primary tools available to persuade governments to adopt new policies toward energy consumption and renewal. Such scientific consensus was instrumental in arriving at the Montreal Protocol regarding CFC reduction/elimination.

2) Greenhouse warming may have been detected in the atmosphere, but has not yet been observed in the ocean. Climate models have been used to examine the ocean's response to greenhouse-induced atmospheric warming. Existing climate models differ widely in their predictions, partly as a result of the treatment of clouds and the so-called "flux correction" (the salt water/freshwater balance in the ocean changes over time. To keep the models in agreement it is necessary to "correct" for these changes). Climate modelers all agree that the ocean plays a vital role. You cannot get the atmosphere right until you get the ocean right. Further, the ocean is important in its own right, for predicting sea level changes, changes in coastal habitats, and changes in circulation affecting marine life globally.

The ATOC role is not to detect greenhouse warming in the ocean, but to test climate model predictions, whether ambient or greenhouse-related. Where we find the models to be inadequate, this would lead to an improved understanding and prediction of climate variability. So our initial effort would be devoted to test and improve ambient climate predictions, and this inevitably would lead to improved greenhouse climate predictions. We do not have to wait for a decade to provide much-needed data. As indicated in the EIS/, "...well before global climate change is evident in the data, ATOC will be able to contribute valuable sea-truth data to the climate-research modeling community, to improve their predictive capability." (Section 1.1.1).

3) The ATOC project provides for a new type of ocean measurement, acoustic thermometry, which complements satellite altimetry observations. These are by no means the only ocean measurements that are or should be taken, but they are unique in viewing the oceans on the scale of climate variability, from 5000 to 10,000 km. Averaging many hundreds of traditional point measurements can demonstrate climate variability and has, in fact, lead to much of what is now known about ocean climate. But there is an inherent advantage of conducting the ocean observation program on a scale commensurate with the scale of ocean features material to climate predictions.

4) Climate variability can be associated with: a) ambient processes which are not directly related to human activity; examples are the seasonal variation, and El Niño events; and b) variations associated with human activities, such as greenhouse warming. Separation of the former from the latter is not easy and will at best take many years. But by testing and improving the ambient climate models now progress can be made towards greenhouse prediction later. A model that fails to account for ambient variability will fail to properly predict greenhouse variations. Interplay of the observation and model will lead to model improvements and ultimately to model credibility.

Establishing the credibility of greenhouse prediction is an important element toward a rational public policy. Although global warming has been identified by the international climatology community as a very important problem, there is currently no agreement in the environmental scientific community on the extent and possible implications of the greenhouse effect. Acoustic thermometry can make a contribution towards credible model predictions that could go a long way toward fostering agreement among climatologists which, in turn, could enhance the possibility of national and international policy changes with respect to fossil fuel usage. See also response to Issue 3.d.

ISSUE 3: ROLE OF ACOUSTIC THERMOMETRY IN ADDRESSING GLOBAL WARMING

b. POTENTIAL FOR POLICY CHANGES TO CURTAIL GREENHOUSE GAS EMISSIONS

Comment: Since we already know that greenhouse warming is taking place, there is no need for further studies. Instead of spending money on such studies, why not put it into better conservation measures?

Response: Energy conservation measures should indeed be put into effect. Such measures are very expensive, and they have to be mounted on an international scale to be effective. To persuade governments to follow such a course will require clear evidence of the consequences of inaction. There have been numerous studies of the projected consequences (e.g., on agriculture, sea level, etc.). These are not based on the indicated warming by about 0.5°C in the last century, but on model predictions of much more severe future changes. These predictions differ from place to place, and generally point to greater warming in the northern hemisphere, particularly at high northern latitudes; and in some places a cooling is predicted. "There is important need for model predictions to be tested against observations, if the models are to serve as a persuasive basis for policy formulation." (Section 1.1.1, emphasis added). Also, see previous comment for additional response relevant to this comment.

ISSUE 3: ROLE OF ACOUSTIC THERMOMETRY IN ADDRESSING GLOBAL WARMING
c. ADEQUACY OF COMPUTER MODELS FOR CLIMATE PREDICTIONS

Comment: Adequate climate models already exist. A full explanation of the "global climate models" should be included in the EIS. Why spend money on an expensive and questionable ocean observation program?

Response: The majority of the climatology research community do not think existing models are adequate to project future changes (e.g., McDonald et al., 1994; Ehret, 1994). Among the uncertainties most often quoted are the role played by clouds (which is being intensively studied), the so-called "flux correction" (see Comment Response 3.a.) which needs to be applied to predictions to keep them calibrated, and which can measurably affect the predicted climatic change, and the dominant role played by the oceans.

During the first decade of numerical weather predictions in the early fifties, the predictive skill actually diminished relative to the previous manual predictions. The reason, it turned out, was that weather station observations were not properly assimilated into the computer prediction models. And without such data assimilation, weather predictions become useless after about ten days.

In weather predictions, the ocean plays a minor, passive role. In climate predictions, the ocean plays the major, dominant role. The ventilation of the interior ocean, associated with the formation of intermediate and deep water in the Greenland Sea and around the Antarctic continent, is one of the most important ocean processes. Manabe's climate model predicts the termination of this ventilation in a century or so, as a consequence of greenhouse warming. (Manabe and Stouffer, 1993). Even one year of lack of this oceanic ventilation process would have profound consequences on life on the earth and within the sea. Climate models need to be properly initialized by global ocean observations, and such observations need to be continuously assimilated to keep the predictions from running off track. For example, comparing the predicted seasonal change in upper ocean heat content with the closely related sea-level changes provided by the Topex-Poseidon satellite altimetry measurements reveals "unacceptable discrepancies." (NRL, 1994). A more detailed discussion of the climate models themselves is presented in the Introduction and Section 2.2.7.

Appropriate ocean measurements are an essential part of any climate prediction. "Global atmospheric climate changes cannot be predicted without understanding global ocean processes. Yet, to date, there are no large-scale observations of ocean temperature to compare with and verify the predictions of existing models." (Section 1.1.1).

ISSUE 3: ROLE OF ACOUSTIC THERMOMETRY IN ADDRESSING GLOBAL WARMING

d. DOES ACOUSTIC THERMOMETRY PROVIDE USEFUL CLIMATE SIGNALS (TOO DEEP, TOO LATE)?

Comment: The effect of greenhouse warming will take thousands of years to reach the depth of the sound channel, and the information will be too late to be useful. The ATOC data are limited to the deep sound channel, where there is a several year delay in responding to changes in surface temperature. ATOC will require decades (perhaps 100 yrs) to arrive at meaningful results, if it works at all. In what ways will results of ATOC provide important information for studying global climate questions?

Response: Many commenters have suggested that ATOC is not useful since it will take too long for the climate signal to penetrate to the depth of the acoustic source (about 1 km). It has been stated that it would take 10,000 yrs to be observable. There are two misconceptions underlying this assertion: 1) The above number is the characteristic time for the warming of the oceans by molecular diffusion but, in fact, heat is carried downward by convective processes, as shown by the penetration of CFC's to 1.5 km depth in only ten years. 2) Acoustic energy in the sound channel propagates, not along straight lines, but along rays which oscillate between the shallow and deep ocean. This acoustic method is sensitive to changes throughout the water column, not just at the source depth. This extensive vertical sampling is the basis of ocean acoustic tomography (a method of using a network of sources and receivers to produce a 3D image of the thermal structure of the volume of the ocean within the networks) and has been demonstrated in many experiments over the last 15 yrs.

Comment: A change in the depth of the sound channel associated with greenhouse warming, and the resulting alteration of ray paths, would cause changes in travel time that could be misinterpreted as changes in ocean temperature.

Response: The depth of the sound channel axis does not remain constant over time, but shifts (at least tens of meters) upward and downward with the movement of major water masses throughout the oceans. In the higher latitudes, where the sound channel is close to the surface, storm activity can cause the axis depth to move vertically in the water column. It has been demonstrated in ocean acoustic tomography on a 1000 km scale that the effects on acoustic travel time due to alteration of ray paths are much smaller than those associated with changes in temperature.

Comment: Changes in acoustic travel time may be more related to earth movements than changes in ocean temperature.

Response: For a typical 5000 km path, plate tectonics predicts changes on the order of 10 cm in 10 yrs, associated with a change in travel time of 10^{-4} sec. During such an interval, the expected change in temperature is on the order of 0.1°C, producing a change in travel time on the order of 1 sec. Therefore, changes in acoustic travel time due to earth movements will not mask changes in acoustic travel time due to global warming, and corrections can easily be made to account for the effect of earth movements.

ISSUE 3: ROLE OF ACOUSTIC THERMOMETRY IN ADDRESSING GLOBAL WARMING

e. ALTERNATIVE METHODS, SUCH AS POINT MEASUREMENTS, SATELLITES

Comment: Why not rely on alternate traditional methods which do not have the potential for interfering with marine life? Further, NASA and NOAA satellites have already proven changes in ocean temperature.

Response: The key problem with traditional point measurements has been noted in numerous scientific publications over the years (e.g., Munk and Wunsch, 1982; Baggeroer and Munk, 1989; Worcester et al., 1991) and was summarized in the EIS/EIR (Section 1.1.5): "...measurements at each point are contaminated by small-scale ocean variability," and "...by acoustically measuring average temperatures across distances extending to 5000 km or more, over extended time periods, short-term regional and mesoscale variations are averaged out, and the predicted global climate warming signal can be detectable."

Infrared measurements from satellites would be the best way of measuring temperature changes in the surface layers. Unfortunately these measurements are badly contaminated due to absorption by water vapor, and are masked by backscatter from clouds. The present precision of about 1° C is inadequate for any observation of global change in a practical time frame. Further, ocean measurements need to include the interior ocean which is not accessible to radiative measurements from above. (What evidence there is indicates that the greenhouse effects have already penetrated beyond a depth of 1 km).

On the other hand, satellite altimetry observations have established an astounding precision of about 2.5 cm in the vertical for measuring the global sea level. This has already proven useful in measuring ambient variability, and will ultimately be useful in measuring greenhouse effects. The ATOC proposal complements a parallel observational program, satellite altimetry, for estimating the heat content of the upper ocean, by using acoustic thermometry to measure the interior ocean.

ISSUE 3: ROLE OF ACOUSTIC THERMOMETRY IN ADDRESSING GLOBAL WARMING
f. PROBABILITY OF SUCCESS

Comment: ATOC scientists admit that they are not certain that acoustic thermometry will work. They should not be permitted to proceed until the method has been established. Since ATOC will lead to global networks functioning for many years, the EIS should be directed at such long-term global networks.

Response: Many comments have been directed at this issue. The ATOC project addressed in the EIS/EIR was originally proposed as a 2 ½ year experiment and, as with most scientific research, the outcome is somewhat uncertain. Two issues are involved, which are discussed below:

First, the principal investigators have developed acoustic thermometry (under the name ocean acoustic tomography) for the last fifteen years, and have established its validity to ranges of 1000 km. Some sparse measurements were carried out to 3000 km. There have been over 20 experiments world-wide. The fact that it is possible, by suitable signal analysis (similar to that used with deep space probes), to detect digitally coded, low frequency transmissions to 18,000 km (almost half way around the earth) was established in 1991 in the Heard Island Feasibility Test. Therefore, the ATOC project is based on solid scientific data. What is new is the attempt to apply the techniques to ocean climate scales, presumably 5000 to 10,000 km. We do not now know, nor will we know until ATOC measurements are carried out, what the geographical limits are.

Second, until these results are known, it is futile to speculate on possible future extensions of such work. It should be noted that the usefulness of ATOC as a contributor towards credible predictions of global climate change does not necessarily demand a global ATOC-like network. The testing of climate models in a few (2-4) key ocean regions (e.g., North Pacific, Atlantic, Indian, Arctic Oceans) might suffice to advance our understanding so that these models can be used globally.

ISSUE 4: ALTERNATE SITE

a. RATIONALE FOR ACOUSTIC SOURCE INSTALLATION IN MBNMS

Comment: There were 12 specific comments referring to the rationale for installing the ATOC source in Kauai waters.

Response: None of the proposed facilities or activities would be located inside the Humpback Whale National Marine Sanctuary off the north shore of Kauai. In 1992, Congress designated the Hawaiian Islands Humpback Whale National Marine Sanctuary as a part of the Oceans Act of 1992 (P.L. 102-587). The Sanctuary boundary was defined as including the waters from the high water mark to the 100 fath (200 m) isobar around the islands of Maui, Lanai, and Molokai; Penguin Bank, the Pailolo Channel and a small area off Kilauea Point, Kauai. The waters within 3 m (5.6 km) of Kahoolawe were not initially included, but would be considered for inclusion at a later date. Congress allowed the boundaries to be modified to fulfill the purpose of the Act.

The Sanctuary is preparing a draft environmental impact statement/ management plan, that will detail a modified preferred boundary alternative which would expand the boundaries of the sanctuary to include a larger area along the northern and eastern shore of Kauai from the shoreline to the 100 fath (200 m) isobar. The zone of greatest potential impact associated with the Kauai ATOC project does not project into either the designated or proposed modified boundaries of the Hawaiian Sanctuary. It should also be noted that for all but two months of the two-year project, there would be no sound transmissions 98% of the time (i.e., 2% duty cycle). See Sections 1.1.6, 2.2.1, 2.2.3, 4.2, 4.3, 5.4 and 5.5 for additional discussion on this topic.

Humpback whales (some with calves) have been reported off Johnston Island (Ludwig, 1982; U.S. Army Corps of Engineers, 1983a), as well as pilot whales and Cuvier's beaked whales (Lobel, pers. comm., 1995; Nitta, pers. Comm., 1995). However Johnston is not known as a major breeding or feeding area for any listed, proposed, or candidate endangered or threatened species of mammals (U.S. Department of Interior, 1990).

ISSUE 4: ALTERNATE SITE

b. CONSIDERATION OF CONDUCTING MMRP IN AREA RICH WITH MARINE MAMMALS, BUT INSTALLING SOURCE IN AREA DEVOID OF MARINE MAMMALS

Comment: There were 14 specific comments referring to the possibility of carrying out a MMRP in an area with large populations of marine mammals, but installing the ATOC source in an area devoid of marine mammals.

Response: If the MMRP and ATOC were carried out in different locations, the ATOC sound source could not be used for the MMRP observations. The MMRP would have to use a different sound source with different characteristics. One of the major benefits of using a stable, calibrated, controlled, monitored low frequency source for carrying out scientific research into the potential effects of low frequency sound on marine mammals is that replication of the signal characteristics is straightforward. Attempts to correlate data collected in the upper water column using a portable acoustic source (most likely with different transmission characteristics, including a lower source level) with a deep, bottom-mounted source could lead to extrapolation difficulties that could render the data unrelatable. What a portable, relatively low-powered low frequency source can accomplish is to establish some baseline measurements into the potential for causing behavioral effects on marine animals. For example, by employing a source (off a vessel) with a frequency bandwidth in the range of approximately 75-85 Hz, with a source level of about 175 dB, it could be verified whether or not there was any behavioral reaction to the low frequency sound presented in that manner. Although this would have provided data relevant to present discussions about ATOC effects, additional interpretation would be needed before applying that data to what might specifically be expected from the ATOC source. See responses to Issue 6 comments for further discussion of the use of boat-based acoustic playback experiments, and the use of noise from vessels to assess the potential impact of low frequency sound on marine mammals.

If the source site were to be moved to a location other than Kauai that could have the necessary physical attributes for conducting acoustic thermometry measurements (e.g., Johnson Atoll), the goal of conducting the research in an area devoid of marine mammals would still be unattainable. Conducting acoustic thermometry research in an area relatively devoid of marine mammals might be possible through the utilization of autonomous sources at mid-ocean sites, which are not technologically feasible now, or in the immediate future (see response to Issue 5.d comment below).

ISSUE 4: ALTERNATE SITE
c. ADDITIONAL ALTERNATE SITES

Comment: The discussion of alternatives in the DEIS fails to live up to NEPA standards.

Response: Reasonable bounds were required in selecting site alternatives. This led to the development of a set of siting criteria found in Section 2.2.3 of the EIS. Many of the siting criteria directly serve an environmental purpose and effectively offset potential adverse effects, and are thereby considered mitigation measures. Accordingly the project undertook a comprehensive review of all feasible acoustic sites and rated them using an aggregated combination of established criteria. No sites that could meet project objectives and that could reduce impacts were ignored.

Two sets of siting criteria were developed; one to achieve the ATOC project objectives and one to achieve objectives of the Marine Mammal Research Program. Certain locations were found to be strong in only one or two criteria (e.g., bathymetry/bottom topography, proximity of Navy equipment, as in the case of Barking Sands, etc.), while others had insufficient populations of marine mammals on which to base sound and robust marine mammal research. The latter case reflects the situation with respect to the site (Jasper Seamount) selected for the November, 1994, system Acoustic Engineering Test. That site was specifically chosen for its sparse population of marine mammals, as the test did not include any marine mammal study. Based on an Environmental Assessment prepared by ARPA and UCSD, it was determined that there would be minimal, if any, effects from the HX-554 sound source on marine animals (including endangered species) in the vicinity of the AET. It was determined that the mitigation measures (total of six) employed during the AET reduced the potential impacts to a negligible level. Further, based on this EA, no taking (harassment) of marine mammals or sea turtles was anticipated. However, this site is deemed inappropriate for a combined ATOC/MMRP project. It may, however, be an appropriate site for a future sound source.

As a result of the site screening process, the project initially deemed four locations sufficiently promising for further consideration. A detailed, comparative evaluation of all four sites is presented in Section 2 of the EIS.

Comment: A seamount would not have a 360° view, so it is ruled out, but neither of the source sites have more than a 180° view.

Response: Pioneer Seamount has been proposed for the California source site, and would have a view of approximately 145°. The Kauai proposed action site would offer a view of approximately 190°.

ISSUE 5: ALTERNATIVE METHODS

a. CONSIDERATION OF ALTERNATIVE METHODS AS SUPERIOR TO ACOUSTIC THERMOMETRY (INCLUDING NO ACTION ALTERNATIVE)

Comment: There are many existing climate change technologies (e.g., paleoclimate modeling intercomparision, satellite studies).

Response: The EIS prepares agree, and the proposed acoustic thermometry technique would employ or, use for supplementary data collection, all pertinent and available technologies to optimize the research procedures procedures presented in this EIS. See response to Issues 3.c and 3.e above, and Sections 2.2.7 through 2.2.12 for further discussion on this topic.

Comment: The DEIS provides an inadequate discussion of the "no action" alternative.

Response: The following comprises an expansion on the discussion of the no action alternative found in Section 2.2.2. The Strategic Environmental Research and Development Program (SERDP) is mandated by Public Law 101-510 (40 U.S.C. §§2901-2904) to support environmental quality research, development, demonstration and applications programs. See response to Issue 1 above for amplifying information regarding the implementation of this program. The no-action alternative would preclude the identification and development of technologies to meet environmental commitments, specifically within the Global Environmental Change (GEC) Thrust Area of SERDP, whose objective is to focus on research which includes acquisition/organization of data and research results that quantify the total environment at global and regional scales. Therefore, the no-action alternative would not fulfill the SERDP GEC goals of: 1) addressing environmental matters of concern to DoD and DoE through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations, and 2) identification of research technologies and other information developed by DoD and DoE for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies to address environmental concerns and to share such research, technologies and other information with such government and private organizations. In addition, an important opportunity for addressing the validated need for research on the potential impact of low frequency sound on marine mammals, as articulated by the national Research council's Ocean Studies Board in 1994, and others, would be lost.

Comment: The alternatives analysis is subjective and unsupported by data or evidence in the record; and is biased toward the preferred alternative.

Response: The EIS prepares believe that twelve alternatives, including four alternate sits, is a sufficient number of options, and information, on which to base a reliable, quantitative analysis for determining the best possible alternative. All available data and scientific evidence that is pertinent to either the acoustic thermometry measurements proposed or the MMRP have been reviewed and, in all possible cases, applied to the technical and environmental analyses that went into elimination of alternatives in order to derive a preferred alternative.

Comment: Instead of directly measuring temperature change in the ocean, why not measure rainfall on land as an indicator of ocean climate change?

Response: The primary indicator of global climate change in the ocean will be temperature, just as it is in the atmosphere. Rainfall is an indirect measure of climate change, and it depends on local and regional vertical convection, condensation nuclei, altitude and other factors, not simply water vapor pressure and temperature. Even if rainfall were a reliable indicator of climate change, there remains the difficulty of obtaining rainfall measurements over the ocean. Land-based rain gauges cover a small fraction of the earth's surface, and despite many efforts over the past 50 yrs to develop a reliable ocean rain gauge, only a few research prototypes exist. Commercially available, reliable, autonomous ocean rain gauges are still in the development phase.

Comment: Why not use a moored autonomous sound source to broaden the range of choice of possible source sites?

Response: The technical and engineering capabilities required to moor an autonomous low frequency sound source in the deep ocean do not currently exist. Higher frequency, smaller sources have been successfully moored in ocean acoustic tomography experiments, but placing a large, low frequency acoustic thermometry source, four times heavier, in mid-water, has not yet been achieved. Current battery technology would power an autonomous source for about a year at the 2% duty cycle proposed for the MMRP.

The need to replace batteries means that remote locations are impractical. This constraint outweighs any perceived advantage in locating a source in a remote area believed to contain few marine mammals. See response to Issue 5.d below for additional discussion on this topic.

ISSUE 5 ALTERNATIVE METHODS
c. RESTRICTED SOURCE TRANSMISSION TIMES

Comment: There is no evaluation of the possible advantages of terminating all sound emissions upon detection (visually or acoustically) of suspected sensitive animals, specifically the humpback whale and leatherback sea turtle. An additional mitigation to be considered might be for the 8% duty cycle to be scheduled during the summer months when whales are not in the vicinity of the Hawaiian Islands.

Response: The duty cycle for ATOC transmissions has been reduced from 8% to 2% for all but approximately 2 months of the experiment. At 2%, a full duty cycle would be 96 hrs long, consisting of one 20 min transmission every four hours for a day (24 hr period), then three days of silence.

As noted in Section 1.2.2. of the EIS, one of the objectives of the ATOC project is to determine the minimum duty cycle necessary for valid climate data, including the optimum characteristics of the acoustic signal. All acoustic parameters are subject to review for downward revision throughout the course of the experiment. Technical features have been incorporated into source operational control systems to make any needed changes, and source characteristics (intensity, duration, duty cycle) would be reduced to absolute minimums based on the results of the MMRP Pilot Study and early ATOC feasibility operations.

Section 1.2.1 cites as an objective of the MMRP to "detect and evaluate potential effects of ATOC sound transmissions on marine animals, particularly marine mammals and sea turtles." The transmission of sound is essential to achieving this objective. Faced with conflicting or unpredictable seasonality of key species (e.g., leatherback sea turtles, sperm whales) there is no scientific basis for restricting further the source duty cycle, and seasonal shut-downs or termination upon visual or acoustic detection would work against this goal.

The ultimate value of the MMRP depends upon the ability to study animals before, during and after they have been exposed to the acoustic transmissions of the ATOC source. The ability to study effects of low frequency sound on marine animals must be balanced against experimental objectives; i.e., balancing the goal to study effects of low frequency sound on marine animals with available equipment for observations, costs, weather factors, personnel, etc. A regularized operational cycle is economically sound and optimizes chances of gaining meaningful data irrespective of seasonal variations in animal species composition and abundance.

Sampling the ocean's temperature must be performed throughout the year to avoid introducing a seasonal bias into the results (i.e., summer temperature greater than winter). A low, steady duty cycle throughout the year is statistically and scientifically preferable to a sporadic duty cycle. The MMRP require sufficient observations of marine mammal behavior during ATOC transmissions as well as at times of no transmissions, to quantify the effects, if any, of the low frequency sounds on marine mammals.

At some stage during the first year of operations, transmissions must be conducted every day, for two months (8% duty cycle), rather than every fourth day (2%) This period will be deliberately chosen to coincide with the occurrence of the smallest number of marine mammals. This brief series of transmissions will enable tidal corrections to be made to all subsequent acoustic travel times.

Comment: ATOC transmissions should occur when good low frequency hearing animals are present, so that the MMRP can maximize its number of observations, including any possible behavioral reactions.

Response: Comment noted; the preparers agree.

ISSUE 5: ALTERNATIVE METHODS

d. MOORED AUTONOMOUS SOURCE POTENTIAL IMPACT ON SPERM AND BEAKED WHALES

Comment: Placing the source in deeper areas far offshore is likely to be less harmful to marine life (e.g., a moored autonomous source). Evaluation of potential impacts and the development of technology would provide more siting flexibility for ATOC feasibility studies (e.g., moored autonomous sources).

Response: There may be regions of the ocean that are relatively devoid of marine life, that would also have the physical characteristics necessary to conduct viable acoustic thermometry (see criteria in Section 2.2.3). Because of the inherent technical and engineering problems that have yet to be resolved for deployment and operation of remote, deep ocean autonomous sources (see Section 2.2.4.1), site selection for acoustic thermometry sources would necessarily be limited in the near-term by the need for frequent servicing, and might not include those remote oceanic regions that exhibit low densities of life. Nevertheless, because of its potential future applicability, the moored autonomous source alternative (Alternative 4) is carried forward in the EIS for further analysis and is included in the summary of consequences of alternatives.

ISSUE 6: MMRP RESEARCH PROTOCOL

a. POTENTIAL FOR DETECTING HARM TO MARINE MAMMALS

Comment: If any methods are employed to evaluate marine mammal noise tolerance levels, these must pose no risk of harm to these animals. The document fails to identify and adequately address concerns regarding the effectiveness and prudence of conducting such a complex and highly speculative scientific research project, especially given its potential impact on an area designated as one of the most protected and sacred marine resources in the world--the proposed Humpback Whale National Marine Sanctuary.

Response: Shipboard, aerial, and shore station observations and surveys have documented the abundance and distribution of marine animals in the area. If a significant change in this pattern occurs during sound transmission, the MMRP should be able to detect it (based on a statistical power analysis for the MMRP protocol, Appendix C). Further, the MMRP would assess any potential for acute or short-term effects on marine animals in the north Kauai area, particularly humpback whales and sea turtles (Appendix C), and the source transmissions would be shut down at the first indication of such effects (Table C-1).

Of the cetaceans, it is primarily mysticetes that are believed to hear well in the low frequencies that will be produced by the ATOC source. Of those animals, none are believed to dive the depths (670 m) to within 178 m of the source where the sound could induce a temporary threshold shift in hearing. Sperm whales and leatherback sea turtles may have some low frequency capability and can dive > 670 m, so they could dive to within the 150 dB sound field but it is believed that such occurrences would be rare.

See response to Issue 4.a. above for additional discussion regarding the fact that the source would not be located inside the Humpback Whale National Marine Sanctuary, and any sounds generated by ATOC that might reach the Sanctuary would be <120 dB received level, at a 2% duty cycle, for 22 months of the 24-month research program.

ISSUE 6: MMRP RESEARCH PROTOCOL
b. ADEQUATE TIME FOR PILOT STUDY

Comment: While the Pilot Study says it will measure short-term behavioral changes and long-term acute changes, the only effects considered 'unacceptable' are long-term effects (abandonment of high use areas, increase in sick and dead animals, decrease in reproductive rates). Since there is no way to determine in the 6-10 month Pilot Study whether these long-term effects are taking place, there is a high probability of reaching an unsubstantiated conclusion of no significant impact. The short Pilot Study period is insufficient to establish the needed baseline data of species population size and distribution, habitat use, and acoustic sensitivities. The types of observations being done may provide some indicators of direct, short-term physical responses to human-generated sounds, but they cannot provide answers to the long-term impacts and indirect effects. In the face of this vast sea of uncertainty nothing in the DEIS is advanced to indicate how a 6-month MMRP is expected to fill the knowledge gaps so that criteria for the assessment of potential impacts can be developed and used meaningfully to satisfy the requirements of the EIS.

Response: The Pilot Study is not designed to determine long-term or subtle changes. It is designed to examine acute and short-term effects (Table C-1). One can only examine long-term effects after the source has been in operation for a long period of time (several years). There is no intention for the MMRP to end after the Pilot Study. The Pilot Study is designed to establish whether animals respond to the operation of the source. The question of sufficient baseline data must account for the fact that MMRP research would continue after the Pilot Study, continuing to collect baseline data of species population size and distribution, habitat use, and acoustic sensitivities (see Appendix C). If, after the Pilot Study, there would be sufficient results to indicate that the short-term responses of animals are either non-existent or of minimal concern, the follow-on MMRP research efforts would examine potential longer-term effects of the project.

ISSUE 6: MMRP RESEARCH PROTOCOL
c. <u>ADEQUATE TIME TO ANALYZE PILOT STUDY DATA</u>

Comment: The ATOC schedule has only allowed one month to analyze the MMRP Pilot Study data. ATOC's own independent MMRP Advisory Board has stated that it is unrealistic to expect the MMRP to complete a substantive analysis of all types of behavioral reactions, and to prepare a comprehensive report suitable for external review, within one month after the end of data collection; and that site-specific, in-the-field, semi-empirical modeling capability and quick-look analysis will be needed to complete and report on some of the main analyses within the one month time span. To ensure that decisions to proceed with the ATOC project are based on sound science, not solely on vested interests in the project, review of Pilot Study and monitoring program data must be made by a technically qualified group independent of the project, and the independent group's findings must be released for public scrutiny. Continuation of the project, and any modifications to the MMRP, must be contingent on the group's findings.

Response: The MMRP Advisory Board has recommended that: 1) site-specific, in-the-field, semi-empirical modeling capability and quicklook analysis would be needed, and this is planned; and 2) the types of information and level of detail that would be required to be collected during the MMRP Pilot Study be determined in advance. The types of information and level of detail planned for data collection efforts during the Pilot Study are discussed in Appendix C. It is unrealistic to expect the MMRP to complete a substantive analysis of all types of behavioral reactions, and to prepare a comprehensive report suitable for external review in 1 to 2 months. However, should any marine mammal responses falling into the "shut-down criteria" be observed, routine ATOC operations would not begin until they were fully identified and evaluated.

The goal of the MMRP's quicklook, 1-2 months after completion of the Pilot Study, would be to identify and report on any observed acute or short-term effects seen that could be directly relatable to the ATOC source transmissions. Analysis of subtle behavioral responses, not considered to warrant shutdown even if they do occur, would require more time to complete. Indeed, a major objective of the MMRP is to identify whether these subtle effects do occur and, if so, characterize the circumstances. This would require a longer observation period to complete (several years).

Every two months status reports of results of ongoing data analyses and modeling efforts would be distributed throughout the Pilot Study to technically qualified groups independent of the project [i.e., the Marine Mammal Commission (MMC), NOAA's Sanctuaries and Reserves Division (SRD)], along with the Marine Mammal Research Program Advisory Board (MMRP AB) and National Marine Fisheries Service (NMFS). All of the independent groups' findings, based on the bi-monthly reports and the quick-look after the Pilot Study, would be available for public release. Continuation of the project would be contingent on the Scientific Research Permit (SRP) conditions issued by NMFS who, after the Pilot Study, would assess all independent groups' findings in reaching the decision whether or not to approve continuation of the research, including commencement of the ATOC feasibility transmission schedule.

Comment: ATOC climate-related transmissions should not proceed until the completion of the MMRP Pilot Study final report.

Response: If, at any time, during the conduct of the 6-10 month MMRP Pilot Study, quicklook data reveal any adverse effects (acute or short-term effects [Table C-1]) on marine species attributable to the source transmissions, operations would be suspended pending a review of the MMRP protocol, and decisions would be made as to whether and, if so, how, the study should continue. In the absence of identifiable adverse effects on any marine animals, it likely would be considered appropriate to proceed with the MMRP under the climate-related transmission schedule.

ISSUE 6: MMRP RESEARCH PROTOCOL
d. MINIMIZED EXPOSURE TO SUBSEA SOUNDS

Comment: Increasing the efficiency of the sound transmissions does not "reduce the exposure of marine animals to sound." It reduces the exposure of animals to more intense sound, but as the sound propagates further, a greater amount of ocean, thus life, is affected.

Response: By increasing the efficiency of the sound transmissions, it is possible that a lower source level and/or a shorter duty cycle could be used for the climate-related transmissions. These factors would reduce the exposure and levels of exposure of marine animals to the sound. Required source levels are those that will ensure the minimum level reaches the receivers so that the digital sequences can be combined and stacked for processing. Based on the processing of early receptions, the minimum required source level could be identified.

Comment: Instead of designing a research program to specifically study the effects of low frequency sound on marine resources, Scripps relegates the subject to an incidental and subsidiary adjunct to the ATOC project. There is a fundamental deficiency in all the proposed protocols of assessing impact on marine resources...all the observations deal only with marine mammals on the surface or very shallow depth.

Response: The MMRP is a prerequisite for, and an integral part of, conducting any climate study transmissions. Its results would determine whether climate study transmissions would continue. The MMRP protocols have incorporated a number of scientific methodologies to include research and observations on marine animals in the upper levels of the water column, and to the extent feasible, in the lower levels, in proximity to the source. See Appendix C.

Comment: It has come to our attention that it was reported in testimony received at the January hearing in California that marine animals have already been harassed, tagged, and moved on behalf of ATOC, even though this project, in its entirety, has yet to be officially approved. It appears that ATOC just continues to lurch forward as quickly as it can come up with ways to circumvent the intent of the permitting process. This pattern disturbs us deeply. When considering the impacts of human activities on other species, it is the belief of Animal Rights Hawaii that we have an ethical obligation to err on the side of conservatism.

Response: The only research activities that have been undertaken in Hawaii under the aegis of the MMRP have been all of a passive nature: standard aerial visual surveys and observations (conducted by the University of Hawaii under separate NMFS permit), shore-based visual surveys (no permit required) and acoustic data collection with a small bottom-mounted HLA (under separate DLNR authorization). California activities to date include only aerial and small boat visual surveys conducted by Cascadia Research and UCSC, respectively, under separate NMFS permits. No tagging or moving of animals has occurred under ATOC funding, nor were any such activities reported in testimony received at the California DEIS/EIR hearing.

ISSUE 6: MMRP RESEARCH PROTOCOL
e. BOAT-BASED ACOUSTIC PLAYBACK EXPERIMENT

Comment: The ATOC sources are not necessary to study the problem of low frequency noise in the ocean. There are other anthropogenic sources, or (for experimental work) special mobile, low-powered sources could be used. The alternative of using a low-power mobile source for the MMRP has been suggested several times by critics of ATOC, and recommended by members of the MMRP AB. This would be much more efficient and less potentially damaging to the environment.

Response: The recommendation by the MMRP AB to conduct boat-based playbacks has been adopted for sperm whales in the Atlantic Ocean (see Appendix C). A boat-based acoustic playback experiment was also planned for offshore of the north coast of Kauai prior to the conduct of any ATOC transmissions off either Hawaii or California. However, this effort was delayed due to local concerns. Boat-based acoustic playbacks are now included in both the revised Hawaii and California MMRP Research Protocols (see Appendix C). Any other playback experiments associated with the ATOC project would necessarily have to be authorized and approved via the appropriate federal and state permits. See response to Issue 4.b also.

Comment: Conduct the playback experiment in Hawaii before proceeding with the California ATOC source. The situation in Hawaii provides for a better controlled experiment with shore observations and baseline data on humpbacks. Adverse effects would be easier to determine there; if none are noted, then begin the California ATOC experiment.

Response: Playback experiments are planned for both Hawaiian and California waters; however, the schedules will be dictated by the timing of the permitting process and availability of indicator species. See also response to comment above relative to conducting a playback experiment in Hawaii.

ISSUE 6: MMRP RESEARCH PROTOCOL

f. USE OF NOISE FROM VESSELS TO ASSESS IMPACT OF LOW FREQUENCY SOUND ON MARINE MAMMALS

Comment: No new source of noise is required to study marine mammals' response to low frequency sound. There are plenty of already-existing sources of noise that could be used for a much more rigorous study than ATOC proposes.

Response: The 1994 National Research Council report, *Low-Frequency Sound and Marine Mammals; Current Knowledge and Research Needs*, states "There is need for planned experiments in which the received level of the sound and the behavior of the animal can be studied together. Such investigations would probably be logistically complex and would require scientific permits...It is the belief of this committee that an accelerated program of scientific studies of the acoustic effects of low frequency sound on marine mammals and their prey (including the studies described in Chapter 3) should be undertaken. These studies should be designed to provide the information needed to direct policies that will provide long-term protection to the species."

The use of existing shipping noise in the ocean to conduct studies of the potential impact of LFS on marine mammals is beyond the scope of the MMRP's charter and would be prohibitively expensive to include in the MMRP Research Protocol. The ship source characteristics (frequency, bandwidth, waveform, duty cycle, source levels) must be known during complex, calibrated studies to verify the experimental parameters that would permit the measurements needed to provide statistically meaningful results on which to base test findings that would be defendable to scientific peer review.

The proposed MMRP will collect ambient noise data using the passive bottom-mounted HLA. This would occur during time periods before Pilot Study signals commenced, and before and after each transmission period. MMRP Research Team members would attempt to correlate received levels between ATOC transmissions with known natural and human-produced sources (storms, ships, aircraft) in their efforts to ascertain some of the potential effects of non-ATOC sounds on marine species. This methodology is included in the MMRP Research Protocol (Appendix C).

ISSUE 6: MMRP RESEARCH PROTOCOL
g. SOURCE TERMINATION CRITERIA

Comment: Better defined, objective thresholds for adverse impacts that would result in termination of ATOC signals must be in place, and environmentalists and citizens-at-large must play an important role in defining and implementing those thresholds before ATOC is allowed to proceed further. Criteria that clearly define the kinds and levels of adverse impacts that would result in a cessation of ATOC signals are critical. In addition, the criteria should be flexible enough to allow for appropriate action should unexpected impacts be observed. The DEIS should specify that the criteria used to determine significant effects found in the Pilot Study must be approved by NOAA and must be linked to specific actions regarding further project operations.

Response: The shut-down guidelines defined in the MMRP Research Protocol, Appendix C, reflect discussions with federal and state organizations (NOAA/NMFS, MMC, NMML, NOAA Sanctuaries and Reserves Division, etc.) and the MMRP Advisory Board. These termination criteria would be required under a Scientific Research Permit, would be reviewed by the Kauai CAG prior to commencement of transmissions, and could be implemented by the marine mammal biologists conducting the MMRP, with oversight by NMFS. Every two months Pilot Study status reports would be a matter of public record and made available to all interested individuals/agencies upon request. The criteria for shut-down have been formulated to be as flexible as possible, with the *proviso* that the ultimate objective is to ascertain any potential adverse impact of low frequency sound on marine animals.

Comment: A more accurate and less extreme set of criteria must be identified as potential "Acute Responses" for ATOC suspension.

Response: The nature of assessing the potential impacts of low frequency sound on marine animals requires that experienced marine mammal biologists observe the animals' activities in the wild. Previous research has documented that many marine animals, particularly cetaceans, often exhibit random behaviors throughout their normal course of daily activities, in some cases for no apparent reason. Thus, the only way to determine if low frequency sounds may cause acute and/or short-term responses is to observe them occurring, (i.e., their type, time of onset, duration, etc.).

Comment: There is no evaluation of the possible advantages of terminating all sound emissions upon detection (visually or acoustically) of suspected sensitive animals (e.g., humpback whales).

Response: This technique would prove counter-productive, as the objectives of ascertaining the potential effects of low frequency sound on marine mammals could not be met. See response to comment above.

Comment: The MMRP should be expanded to include a criteria list to help differentiate between behavior modifications that could be considered minor (e.g., temporary deflection of direction of movement away from the sound source) and major (e.g., sea turtle floundering on the surface during sound transmission) as they pertain to potential modifications in the sound transmission cycle.

Response: Appendix C identifies the criteria to be applied. For example, a floundering sea turtle would fall under behavioral response category 6.b. Short-term Response (Potential injurious behavior [outside known baseline activities]).

Comment: The Final EIS should offer a more comprehensive, tiered management protocol to match its impressive tiered (and tested) data collection protocol. There are few really silly bits in the proposal, but the notion that the MRT Leader will suspend operations upon being informed of an "acute behavioral response" correlated with a specific transmission certainly qualifies...the protocol looks nice, but it won't happen that way (if shut-down is ever called for).

Response: See Appendix C for appropriate text changes that include the decision-making protocol. If the MRT Leader were found derelict in exercising the shut-down criteria as proposed, NMFS would nullify the SRP for the project.

Comment: Actually stopping the ATOC (not the MMRP) transmissions if adverse impacts are found is nowhere included as a mitigation measure.

Response: As is stated in the EIS, the MMRP would continue during ATOC feasibility operations, with the same source termination criteria applicable.

Comment: Guidelines for suspending operations should be described more fully; the points listed under section 6 of Table C-1 should be described in greater detail.

Response: See Appendix C for a more comprehensive description.

ISSUE 6: MMRP RESEARCH PROTOCOL

h. USE OF REPRODUCTIVE OUTPUT AS A MEASURE OF LOW FREQUENCY SOUND IMPACT

Comment: Humpback whale populations are only now beginning to show early signs of recovery, based on aerial survey data. What about measuring reproductive output--the most essential indicator of a population's well-being--for invertebrates and other small marine animals that are expected to provide minimal measurable indication of possible acoustic impacts?

Response: The MMRP includes the monitoring of reproductive output, to the extent practicable and feasible, for commercially-taken marine animals (e.g., fish, sharks, some invertebrates, such as squid and octopus) using fish stock assessments (via Western Pacific Regional Fishery Management Council catch-block landing data; LTPY, CPY and RAY data from NMFS, and interaction with local north Kauai fishermen). Mitigation Measures 10-1 and 11-1 refer to fish and sharks, and text changes to Section 4.3.2.3 address invertebrates.

ISSUE 6: MMRP RESEARCH PROTOCOL

i. AGREEMENT WITH MMRP ADVISORY BOARD RECOMMENDATIONS

Comment: Why is only one month allotted for the evaluation of the MMRP Pilot Study data, when ATOC's own Advisory Board has stated that this is an "unrealistic timetable?"

Response: As noted in Table 1.1.2-1 and the MMRP Research Protocol in Appendix C, the goal would be to have a quicklook report available 30 days after the conclusion of the Pilot Study. Data results will be compiled continually during the Pilot Study and disseminated to all concerned through status reports every two months. This will facilitate the rapid turnaround of a quicklook, but it is recognized that it could take up to twice the time (2 months).

Comment: The MMRP Advisory Board's recommendations seem not to be heeded with respect to consideration of boat-based playbacks.

Response: The MMRP Advisory Board's recommendation to consider the use of boat-based playbacks is addressed above. See response to Issue 6.e.

Comment: As part of NMFS' duty, it is requested that they call on its qualified scientific statisticians located in Seattle, Washington [NMML] to review the MMRP and confirm whether it can produce statistically significant data, and if it meets the stringent standards required by NMFS in other projects affecting marine animals.

Response: A NMML representative has the status of "observer" on the MMRP Advisory Board and, as such, that NOAA laboratory has always been cognizant of the potential for statistical significance during the development of the MMRP Research Protocol. The proposed MMRP research protocol and the results of the statistical power analyses for the proposed site are found in Appendix C, and have been reviewed and considered adequate for publication. The revised application for SRP for the proposed project will be subject to the same standards as other studies potentially affecting marine mammals and sea turtles.

ISSUE 6: MMRP RESEARCH PROTOCOL
k. DETERMINATION OF SIGNIFICANT IMPACT

Comment: In several places in the DEIS are found variants of "the lack of reliable information justifies the assumption of an unknown impact for purposes of this EIS, but at a minimal level. The presumption that impacts to mysticetes, odontocetes, pinnipeds, sea turtles, fisheries, and invertebrates will be either "minor" or "not significant" because of the lack of information, the patchy distribution of the species, and the unlikeliness of significant exposure is simply unfounded. HEPA regulations require that evaluation of impacts be based on scientific and factual data. We conclude, on the basis of all information presented, that other than the repeated use of the phrase "presumed to be minor," Scripps has failed to make a convincing case for the eventual finding of no significant impact.

Response: Most of the findings in the EIS regarding the significance of impacts to marine mammals and other special status species are based upon a combination of factors, including the types and degree of potential impacts to individual animals that are anticipated from currently available information, the numbers of animals that might be affected, the portion of the range of those animals that could be affected, etc. Generally, the standards of significance applied for determining the level of an impact on special status species through habitat reduction or impairment are framed in terms of potential impacts from the standpoint of the species as a whole. Many of the comments regarding the significance of impacts fail to distinguish between potential impacts to individual animals as compared to the species as a whole, fail to distinguish minor as compared to major impacts, and fail to relate the impact discussion to the criteria of significance.

Since the significance conclusions are based upon a combination of factors, it is important to distinguish the level of uncertainty faced when evaluating each of those factors. Specifically, there is a considerably greater degree of certainty regarding the abundance and distribution of special status species than there is concerning the potential impacts on individual animals of various species at particular noise level exposures. A conclusion that a less than significant impact to the species will result from the project, even where information concerning one or more of these factors is uncertain, can be supported by information regarding the other factors if the combination of factors warrant that conclusion.

In most instances of the type identified in the comment, it is acknowledged as uncertain whether given noise exposures could produce behavioral disruptions, TTS or similar effects on individuals. However, it can still be concluded that potential impacts to those species are minor or less than significant given the low abundances of most species in the study area, the infrequency of close encounters, and the relatively large range of most of the special status animals (and correspondingly small portion of the range affected by the ATOC source transmissions [i.e., 7.5-12 km radius of 120 dB sound field around source]). For example, even assuming, as calculated in one comment, that approximately one sperm whale would be exposed to 150 dB sounds during the initial study period, and that this exposure could produce a TTS in that animal, that single event would not constitute a significant impact on sperm whales.

As stated in the EIS, the conclusions regarding the significance of impacts (as defined by HEPA) are not intended to imply that less than significant impacts (i.e., potential annoyance or TTS in individual animals) are unimportant. In fact, mitigation measures are applied to many of these less than significant impacts even though not strictly required by HEPA or NEPA, in response to the public concern that has been expressed regarding those potential impacts -- a concern shared by the preparers and by the researchers involved in this project.

Comment: The National Research Council concluded that "Although we do have some knowledge about the behavior and reactions of certain marine mammals in response to sound, as well as about the hearing capabilities of a few species, the data are extremely limited and cannot constitute the basis for informed prediction or evaluation of the effects of intense low frequency sounds on any marine species." The DEIS consistently makes the error of concluding that if no evidence for a significant impact exists, the impact must be nonexistent, and in many cases overextends assumptions and inferences drawn from data on other species to conclude that impacts on marine mammals are likely to be less than significant. In may cases, evidence for significant impacts does not exist because no research has been conducted.

Response: See response to comment above. The National Research Council concludes that data in this area are limited, and research on the potential impacts of low frequency sound on marine animals is needed.

In each case of a finding of "minor" or "less than significant," the EIS lists assumptions, available supporting data, and analyses for reaching that conclusion. The EIS considers that a potential impact is deemed to exist only if some evidence clearly exists on which to base that premise, or through the application of prudent scientific reasoning (e.g., the potential for causing TTS in a non-diving seabird must be rated as negligible). The HEPA criteria for significance are cited in the Executive Summary (Hawaii Revised Statutes (HRS), Chapter 343, Section 11-200-12, 1992), as are the criteria for assessing the potential for non-negligible (acute or short-term impacts [Table C-1]) impacts on marine animals (adopted from MMC recommendations concerning these criteria).

Comment: The MMRP is not a well-controlled study, and cannot discover the most important impacts to the health of cetacean populations. How will the six-month Pilot Study provide critical evidence of behaviors specifically caused by the ATOC sound transmissions? What behaviors will be considered "acute?" How will subtle changes be detected; what is the statistical basis?

Response: A broad range of marine biological and acoustic research techniques were considered in developing the MMRP Research Protocol found in Appendix C. The control mechanisms have been thoroughly analyzed by independent scientists in order to optimize, within the limits of available funding and logistical resources, the potential for observing important biological and behavioral effects that cetaceans and pinnipeds (and sea turtles) could exhibit. Researchers would use visual and acoustic methods to maximize the possibility of discovering any impacts, whether in the wild (north of Kauai), in acoustic playback experiments that would be directly relatable to species at the source site, or in threshold testing on captive animals in laboratory situations, also to be correlated with animals at the source site. Those behaviors considered acute are delineated in Table C-1. The MMRP Pilot Study is not designed to detect subtle or long-term changes. See previous responses for further discussion of this topic.

Comment: "Leq calculations indicate that less than significant increases in average ambient noise levels will occur..." You have not defined what "significant" means so this is meaningless.

Response: The commonly accepted criteria of significance for noise impacts (under HEPA) evaluates whether: 1) the project would generate noise that would conflict with local noise ordinances, 2) the project proposes land uses that substantially increase noise levels in areas of sensitive receptors, 3) whether the land use projected by the project is compatible with baseline noise levels, and 4) whether State of Hawaii and local guidelines for long-term exposures are exceeded. Since no formal noise standards apply directly to the activity, the applicable criteria is 2, whether there will be a "substantial" increase in noise. The use of Leq averaging procedures is commonly accepted when addressing noise impacts and for that reason conclusions regarding noise increases on an Leq basis are presented to be consistent with common practice.

In addition, extensive discussions of potential noise impacts are included in the EIS, and they are also evaluated under the potential for impacts to special status species, discussed above.

Comment: The summary on the DEIS discussion of effects of ATOC on mysticetes, in Table 4.3.1.1.3-1 is a study in self-contradiction. On every one of the seven mysticetes listed there appear, under the column marked "Potential Effects", the phrases "Uncertain; however, no acute responses expected." The routine of self-contradiction and multiple caveats continues with the treatment of effects on odontocetes, pinnipeds, fissipeds, and sea turtles. Yet another tactic employed by Scripps on the assessment of impact is the illogical equating of "low rate of occurrence of significant effect" with the conclusion of "less than significant impact."

Response: See response to comment above. Uncertain does not mean unknown. Based on the best possible combination of available data and interpretation of scientific estimates of hearing specialists, marine biologists, and underwater acousticians (section 4.3.1.1), the EIS concludes that neither acute nor short-term responses (Table C-1) from mysticetes due to low frequency sound transmissions from the ATOC source would be expected.

The comment on odontocetes, pinnipeds, fissipeds, and sea turtles is difficult to support, particularly in light of the fact that no more than three of these group/species (sperm whale, beaked whales, leatherback sea turtle) are believed to have any measurable possibility of approaching the source close enough to incur a TTS, and the potential for that occurrence would be expected to be low. Temporary behavioral disruption could occur for those species with good low frequency hearing capabilities (e.g., baleen whales) that were within the 120 dB sound field during sound transmission (mostly 2% duty cycle), but because the proposed source location (14.7 km offshore) has not been identified as an important habitat for baleen whales. The potential impacts of any disruption are expected to be minor.

Comment: The DEIS states that Atlantic bottlenose dolphins and sea turtles receive sound through other body receptors and not solely with ear structures. Therefore, even if a species has not been documented to have low frequency hearing, it should not be dismissed as not being affected by the sound. The MMRP should have protocols to characterize potential effects to all species observed in the sound source vicinity, not just those with low frequency hearing.

Response: The EIS does not dismiss the potential for low frequency sound reception other than via ear structures as unimportant. The MMRP research protocols and shut-down criteria are designed to apply to any method of sound reception by the animals that would be under observation.

Comment: It is never made clear in the DEIS what the consequences to ATOC will be if the results of the MMRP prove inconclusive and it is never made clear that ATOC will not proceed if its transmissions are found to harm marine mammals and cannot be mitigated.

Response: Appendix C and text changes to Section 2.2 and Section 4 include the criteria that "Based on findings of no acute or short-term impacts (Table C-1) to marine animals during the Pilot Study, ATOC feasibility operations would be initiated (in accordance with the schedule provided as Table 1.1.2-1)." Climate-related transmissions would not commence until after review of the MMRP Pilot Study quicklook results by NMFS, MMC, MMRP AB, and the Kauai CAG, using the previously discussed criteria (see response above).

Comment: The DEIS uses HEPA terms of "significant" and "less than significant" but fails to offer bridging definitions to relate to federal MMPA terms of "negligible" and "non-negligible." To fulfill environmental impact requirements for both Hawaii (HEPA) and NEPA, definitions that bridge this gap must be provided in the joint FEIS. The FEIS should provide definitions, which the DEIS lacks, of terms for effects on marine animals; e.g., significant effect, less than significant effect; minimal effect; adverse effect; unacceptable effect.

Response: HEPA definitions for significance are stated in the Executive Summary. The term "negligible", as related to SRPs, is not defined in the MMPA, HEPA, or NEPA. The dictionary definition of "negligible" is "so small or unimportant or of so little consequence as to warrant little or no attention" (Mirriam-Webster, 1994). Other definitions for the potential effects on marine animals are provided in Appendix B of the EIS. The EIS provides criteria for negligible vs. non-negligible that would be utilized in MMRP activities (see response above).

Comment: The document oversimplifies and overstates the section on irreversible environmental changes. While there is no evidence for massive impacts, it is still inappropriate to state that the protective measures in the proposed protocol "will prevent any irreversible harm to marine mammals or other organisms in the affected environment." In fact, the project could kill a variety of small organisms (during equipment deployment on the benthic fauna, through effects on nearby pelagic plankton and fish), but the overall effects on the marine populations are expected to be negligible according to information provided in the DEIS.

Response: Text changes to the EIS reflect the response to this comment. However, because mitigation measures (see Executive Summary) are included in the proposed project protocol to minimize any irreversible harm to marine mammals or other organisms in the affected environment, these activities are not expected to result in significant changes to the marine environment. Irreversible harm could occur on a localized basis to some organisms (e.g., lichens, mussels, barnacles, limpets, anemones) that might be physically impacted during equipment (i.e., source, cable) deployment. However, the acoustic source's footprint of 4.7 m^2 is insignificant, as far as physically affecting benthic fauna or flora populations at the source site. The potential for the acoustic transmissions adversely impacting benthic fauna (that could not, or would not, depart the immediate vicinity of the source during the ramp-up period) or benthic flora in proximity of the source, would likewise not be expected to be significant in terms of population effects. Typically at the depth of about 850 m, the Mesopelagic zone [200-1000 m] is changing to the bathypelagic zone [1000-4000 m], where there is no light at all (Castro and Huber, 1992), meaning minimal photosynthesis can take place on the seafloor where the source would be located. Hence, there should be minimal plant life (or herbivorous animals) at that site, and any that would be there would not be expected to have low frequency hearing sensitivity (see Section 4.3.2.2, 4.3.2.3, and 4.3.2.4).

Comment: Although data concerning stock structure and population delineations are incomplete for many if not most of the cetacean species described in the EIS, there is no discussion of the relationship between the status of population sub-units and potential effects of the proposed project. If the analyses are based solely on cetacean (and in some cases pinniped) density and distribution information cited in the document, it is not clear if the potential for impacts are related to the percentage of individual animals of those that might be present within or pass through the project area over a season, a year, or the course of the project; or if these potential impacts are evaluated against a known population unit. This issue is addressed only in Appendix F where it is clear that the unit of analysis is the species level. In terms of assessing or determining the significance of potentially adverse impacts, it may be more appropriate to use population sub-units or stocks where these are known rather than species.

Response: Because data concerning marine animal stock structure and population delineation are incomplete for many of the protected species addressed in this EIS, most of the discussions in the section on the potential effects of low frequency sound transmissions (Section 4) deal with the possibility of impact on a particular species, based on that species' pertinent biological and spatial characteristics (i.e., low frequency hearing sensitivity, dive depth profile, distribution and abundance, and known behavioral patterns). The null hypotheses presented in Appendix C would be tested by conducting the MMRP, which includes the study of both individual animals (e.g., playback studies and audiometric measurements) and groups of animals (e.g., pods of cetaceans via aerial, vessel or acoustic detection).

There is a difference between effects that might occur on a single animal of a large population (e.g., fish) and an individual within a very small population (e.g., minke whale). Thus, the low total number of individuals would make for a lower potential for encounter and possible impact; however, if that impact were to occur to one or more individuals of a relatively rare species (due to unpredicted clumping, age/sex class groupings, etc.), this could be construed as a more significant impact. Based on the findings herein, the only documented evidence of good low frequency hearing capability is for baleen whales, none of which apparently dive deep enough to approach the source close enough to incur TTS. Sperm whales, some beaked whales and leatherback sea turtles can dive close to the source depth, but any evidence of low frequency hearing capability among these groups/species is anecdotal to date. Among these, the sperm whale and leatherback sea turtle are federally listed as endangered. However, based on the data presented herein, the proposed action site has not been identified as an important marine mammal habitat (i.e., feeding, breeding, migration route or comparable area).

If the MMRP goes forward, by virtue of its designated focused study area around the proposed source site, population sub-units or stocks local to Kauai (or at least the Hawaiian Islands) would necessarily be the focal animals/sub-units used in assessing the potential for adverse impacts on protected animals. The best available estimates of the stock of marine mammal and sea turtle species that would be expected to reside or pass through the general EIS study area during the course of the proposed two-year MMRP are listed in Section 3.3.1. MMRP population distribution and abundance data collected would supplement these estimates and support future research efforts that could use population sub-units or stocks as indicator groups for determining the potential for low frequency sound impacts on marine species.

ISSUE 6: MMRP RESEARCH PROTOCOL

1. INDICATOR SPECIES

Comment: Sperm whales, which might be most affected, are not an indicator species? It would make more sense to focus on one (or two) key indicator species that will provide adequate data to make some meaningful conclusions. Focus field behavioral studies on target species, those that may be most affected by the ATOC sound source; limit target species to the top two or three. Sperm whales are listed as one of the MMRP's indicator species and yet there is no special concentration of effort dedicated to sperms in the MMRP whatsoever. Unlike humpbacks, sperm whale vocalizations are not very amenable to cross-fixing detections, and yet sperm whales are supposedly an indicator species.

Response: The expected low abundance of sperm whales in the vicinity of Kauai makes it infeasible to target that species as an indicator species for the MMRP in that area. However, boat-based acoustic playback experiments with sperm whales are planned for the Atlantic Ocean (off the Azores and/or the island of Dominica) by Dr. Jonathan Gordon of Oxford University. Thus, cross-correlation of detections (to determine animal location) would not have to be relied upon.

It is appropriate to focus on key indicator species (see MMRP Research Protocol, Appendix C).

Comment: I would like to see less money focused upon one trophic group (top carnivores). I believe a smaller amount of money could yield more far-reaching results if it were spent on projects such as determining sound behavior in the oxygen minimum zone (OMZ)/deep scattering layer (DSL), local marine fish auditory/lateral line thresholds, fish behavioral responses to low frequency sounds, and crustacean/cephalopod auditory capabilities/potential impacts.

Response: There is a fairly well-defined OMZ in the oceanic water column at around 500 m, where the amount of oxygen can drop to nearly zero (Castro and Huber, 1992). The DSL, made up of fishes, krill, shrimps, copepods, jellyfishes. squids and other midwater animals, lies at depths of 300-500 m during the day, but at sunset rises closer to the surface. The MMRP Research Protocol (Appendix C) targets those marine species believed to be most susceptible to potential effects of low frequency sound, regardless of their habitat and predicted activity locations within the oceanic water column. Commercially-taken species of fish, crustaceans and cephalopods would be monitored through MMRP actions (see Appendix C, responses to Issue 5 above, and Section 4.3.2.3.1).

Comment: It is not evident why more than 50% of the winter residents could not potentially pass through the study area one or more times. If the Pilot Study indicates that ATOC sound transmissions affect the movements or behavior of humpback whales, determining the significance of those effects may require knowing what proportion of the population, and how frequently and for what periods of time particular animals (e.g., pregnant females and females with calves), may be present in areas where they could be exposed to ATOC sound transmissions. The DEIS does not, but should, note that the MMRP described in Appendix C will not resolve this uncertainty.

Response: Based on boat-based photo-ID data collected during the 30 January - 20 April 1993 time frame, mostly on the west side of Kauai, only 13.5% of the humpback whales seen were resighted, and the mean resighting interval was 14 days (range of 1-50 days). These data suggest that it would be highly unlikely that more than 50% of the entire population of humpbacks wintering in the Hawaiian Islands would pass through the study area one, or more, times.

ISSUE 6: MMRP RESEARCH PROTOCOL

m. RAMP-UP TIME

Comment: The proposed ramp-up time of 5 minutes preceding each signal may be too short to allow nearby animals to swim away. How would animals know which direction to swim, if the source is hard to localize?

Response: The 5-minute ramp-up is designed to alert nearby animals to the onset of a transmission. It starts at 165 dB (0.26 W) and increases 6 dB each minute for five minutes. During that five minutes, an animal would have to swim a maximum of 178 m to be outside the 150 dB isopleth (the sound level believed to be the threshold of potential TTS). This is equivalent to a swim speed of 0.6 m/s, which is well within the capability of all marine mammals, sea turtles, and fish.

Humans have difficulty sensing the location of a source of low frequency sound, especially so underwater. Some commenters have therefore assumed that marine animals are similarly handicapped, and might have difficulty determining which direction to swim away from the source. In fact, according to Atema et al. (1988) and Webster et al. (1992) marine animals have evolved specifically to process underwater sound and possess a far superior ability to localize or pinpoint the source of a signal.

One commenter confused the 5-minute ramp-up period with a provision in the Pilot Study MMRP protocol (Appendix C, page C-6) to start with a signal level of 185 dB (26 W) for the first two experimental periods, then increase to 195 dB (260 W) for the following observation periods. This approach is termed "varying the sound source level," not "ramping-up" the signal.

ISSUE 6: MMRP RESEARCH PROTOCOL
n. MITIGATION MEASURES

Comment: The mitigation measures proposed in the DEIS do not ensure avoidance of significant impacts to marine mammals. Since the MMRP and nearly every mitigation measure proposed in the DEIS is already included in the proposed action, these are not properly labeled and are not legitimate mitigation measures under HEPA. Monitoring of impacts is not an appropriate mitigation measure. An appropriate mitigation measure would include a provision that ATOC would not proceed unless it us determined by the MMRP that it will not have significant adverse impacts on marine mammals. The mitigation measure wording should be more precise and legally binding.

Response: For the reasons set forth in the EIS, all of the potential impacts of the project are believed to be less than significant as defined under HEPA, particularly after application of the mitigation measures proposed in the EIS. In any event, neither HEPA nor NEPA require that mitigation measures eliminate or reduce all potential impacts to a less than significant level. If potentially significant impacts remain after the application of mitigation measures, the project may nonetheless be approved. As to this project, all potential impacts have been determined to be less than significant (as defined by HEPA).

The MMRP, as well as various other project components that serve to reduce the potential for impacts, were identified as mitigation measures primarily to respond to concerns that otherwise these measures might not be enforceable. All of the mitigation measures identified in the FEIS would be made enforceable conditions of project approval.

The MMRP consists of more than a monitoring program, although observation and monitoring of marine mammal responses to the ATOC sounds would, of course, be part of that effort. The MMRP's principal mitigation value is derived from the feedback of MMRP results into ATOC decision-making, particularly the decision following both the Pilot Study and two-year MMRP research phases concerning whether or, how best, to proceed with any long-term ATOC experiment. The comment that these elements of the MMRP are not clearly articulated has been addressed through revisions to the MMRP Research Protocol at Appendix C. See also response to comment above regarding shut-down guidelines.

Comment: The rationale for Mitigation Measure 7-1, which indicates that the MMRP described in Appendix C will provide the information necessary to validate the assumption regarding Hawaiian monk seal distribution, is not evident and should be explained.

Response: Text changes have been made to explain that a goal of the MMRP would be to validate the assumptions regarding population distribution of the Hawaiian monk seal in the MMRP study area, via aerial visual survey methods.

Comment: How will reduction in duty cycle and power levels necessarily mitigate potential impacts? How can all the "unknowns" for all the species considered lead to the conclusion that this "mitigation measure" will be effective? This statement is obviously conclusory and invalid.

Response: For any species that incurred any level of impact, no matter how slight, from the source transmissions, a reduction of the power level (i.e., sound level in the water) and/or a reduction in duty cycle (amount of time the sound is in the water) would surely reduce the level of the potential impact on that species. For those species that experienced no impact, the reduction of power level and/or duty cycle would be inconsequential.

Comment: Mitigation Measures 3-1 and 6-1 seem to ignore the fact that an understanding of a species' hearing sensitivities is critical for "predicting the likelihood of exposure...," yet these are practically impossible to obtain for the great whales.

Response: The preparers agree that it is difficult to obtain hearing sensitivities for the great whales. See response to Issue 6.k above for further discussion on this topic.

ISSUE 6: MMRP RESEARCH PROTOCOL

o. SAMPLE SIZES FOR AERIAL LINE TRANSECT SURVEYS

Comment: Sample sizes for aerial line transect surveys seem totally inadequate, considering they are only executed 1 time every other month for aerial surveys. The cetacean behavioral observations are designed to be comprehensive; however, the observations planned for before, during, and after ATOC transmissions may be impossible to collect. This protocol relies on finding cetaceans at the appropriate time and being able to track them throughout, despite the low odds of having transmission days and vessel-worthy days coincide at the 2% duty cycle. Has a power analysis been performed to optimize this particular aspect of the MMRP? Data gathered from the preliminary baseline period will be used to assess how large a sample size is needed to get statistical power and conclusive results. What is the protocol if the data show that the data set is too small?

Response: The MMRP research protocol has been reviewed by a number of independent marine mammal biologists, acousticians and statisticians in order to maximize the potential for collecting adequate data points and, hence, sufficient statistical power on which to base MMRP Research Team conclusions. The Kauai MMRP Principal Investigator (Cornell University) has incorporated the results from the preliminary baseline data collection efforts into the research protocol, and a statistical power analysis has been completed for the research effort at the proposed site to ensure that the data set is large enough for statistical significance (see Appendix C). Issuance of the SRP will be predicated upon endorsement of the MMRP Research Protocol by the MMRP AB.

The sample sizes for aerial line transect surveys are necessarily smaller during the time period when humpback whales are absent from Hawaiian waters (May - November).

Comment: The high C.V. for pod sightings (51% in the northern Kauai region) cited in aerial survey work by Mobley et al. (1994) is a serious problem. With such variability, what search effort would be needed to detect a 10% real change in whale abundance during ATOC. Designing the study to detect a 20% change in behavior/abundance (vs. 5% or 10%) needs debate and justification.

Response: See Appendix C for the statistical power analysis results and discussions of the rationale for selecting specific percentage of change values.

ISSUE 7: SOUND FIELDS

a. NRC FINDINGS REGARDING THE "120 dB" CRITERION

Comment: While 50% of gray whales avoided continuous sounds at levels of 117-123 dB, depending upon the stimulus, the most sensitive 10% avoided drill ship sounds at levels of 110 dB.

Response: The National Research Council, Ocean Studies Board, stated that the "120 dB criterion" refers to a level of sound that has been identified informally as a level above which acoustic effects on marine mammals might occur. They concluded that although the field studies from which this criterion was derived "provided estimates of the sound exposure level in the vicinity of the animals while their behavior was being observed, there was considerable variation with some animals reacting at lower levels and some not reacting at considerably higher levels."

As is true of most field observations, many different interpretations of these results can be offered. For example, according to the studies mentioned, the change in behavior of the migrating gray whales was minor and brief, involving a slight deflection in the migratory path. One can argue that the animals simply detected a potential obstruction and made a relatively mild deflection in their course to avoid the obstacle. Certainly the energy expended in their response was minimal. Energetic effects were obviously greater for migrating bowhead whales. They apparently avoided an icebreaker-supported drillship by 10 to 30 kilometers (LGL and Greeneridge, 1987; Brewer et al., 1993). Additionally, in the case of the withdrawal of bowheads from feeding areas, the action was observed when a novel stimulus was introduced (Richardson et al., 1993; Richardson and Malme, 1993). Such withdrawal behavior might or might not quickly habituate if the sound were repeated, but that study was not able to obtain information about habituation. Furthermore, only two species of whales were involved, and the results of the same experiment would very likely be different for other species. Because of their apparent lack of sensitivity at these low frequencies, some toothed whales, for example, may not detect sound at the levels that affected the gray whales and bowhead whales.

That the 120 dB number is considered to be such an important regulatory criterion is testimony only to the paucity of our knowledge about marine mammals.

ISSUE 7: SOUND FIELDS
c. COMPARISON OF NATURAL AND HUMAN-MADE UNDERWATER SOUNDS (INCLUDING ATOC)

Comment: Natural and human-made levels of noise should not be equated. Marine animals have, over evolutionary time, most certainly become adapted to filtering out natural noise. The same cannot be said for the recent addition of human-made noise.

Response: The section in question (Section 4.3, masking) does not attempt to "equate" natural and human-made noise levels. Masking is a natural and highly variable phenomenon to which marine mammals are well adapted. Hence, marine mammals undoubtedly can tolerate, with few or no negative effects, some [human-made] increase in masking relative to natural levels (Richardson et al., 1991). Discriminatory hearing abilities of baleen whales have yet to be documented, but some other groups of marine mammals (particularly toothed whales) can discriminate intensities, frequencies and directions at levels comparable to or better than those of humans. Bearing this in mind, the hypothesis of Payne and Webb (1971) on the potential hearing abilities of baleen whales is in line with most data on other marine mammal hearing abilities. However, there are few data on hearing abilities of any marine mammal species at the low frequencies generated by baleen whales.

Comment: Figure 4.3.1.1.2-1: This seems to be a ridiculous comparison between a moving and stationary source.

Response: This figure is not meant to portray a supertanker transit lane over Sur Ridge (see text change) but, rather, it attempts to make a meaningful analogy between the sound fields of the stationary ATOC source and the sound fields associated with a moving source, like a ship (the primary source of low frequency sound in the world's oceans). See also response to comment Issue 7e below.

Comment: The EIS should be expanded to describe: 1) differences in low frequency sound transmission patterns and dissipation rates from surface vs. deep water sources; 2) possible differences in types and levels of background noises that might mask and affect responses to surface-generated and deep water-generated sounds; 3) possible differences in response to narrow- and broad-band sounds; 4) how the perceptions of and responses to low frequency sounds may vary if the sound source is stationary vs. moving.

Response: Section 2.2.1.1 covers the modeled propagation patterns and transmission losses for the ATOC deep water source. When a source and/or receiver is very close to the sea surface, the surface reflection of the sound can interact strongly with direct sound radiation, creating interference patterns that can cause transmission loss variability of up to twice that of normal spherical spreading. However, in the presence of a well-defined surface duct (at least 10 m deep from the surface), transmission losses can decrease to one-half that of spherical spreading. The ATOC source presents a different type of low frequency sound in the ocean because it is located at such a great depth, compared to most human-made oceanic sounds, which occur in the upper water column (ships/boats/thrillcraft, oil industry operations, aircraft noise, commercial and Navy active sonar transmissions).

Natural deep-water generated sounds include earthquakes, volcanic eruptions and vents along the edges of tectonic plates. All natural and human-made noises might mask some signals to and by marine mammals. Some toothed whales seem able to adjust the frequencies of their echolocation calls, within limits, in order to avoid frequencies where background noise levels are high (Au et al., 1974, 1985). See also response above.

Many species can produce both broadband and narrowband calls containing energy at a variety of frequencies or, at different times, produce narrowband calls at varying frequencies. When communication at one frequency is masked by strong human-made or natural noise, the calls or call components at other frequencies may still be audible (Richardson et al., 1991).

The principal difference in how a marine animal may perceive and respond to low frequency sounds emanated from stationary vs. moving sources include the following: 1) if the moving source happens to intersect a migration route or primary marine animal habitat, the animal must make substantial adjustments to its behavioral pattern to elude the source so as to avoid collision, and possibly to reduce acoustic interference; 2) moving sources can produce loud noise levels over a much larger area (see Figure 4.3.1.1.2-1).

Comment: The discussion of comparisons between natural and human-induced noise, and of sound transmission through the water and through the air, including Table 1.1.3-1 ("Natural and human-made source noise comparisons") is misleading.

Response: The EIS includes changes to the text and Table 1.1.3-1 that address this comment.

Comment: Fully explain the similarities and differences between the ATOC sound source (fixed location, moderate duration, repeated regularly, and deep) vs. those compared in the document (moving ships and drilling rigs), particularly as these characteristics influence the impacts on marine mammals.

Response: With the exception of the question on drilling rigs, this comment is addressed in previous responses above. Richardson et al. (1991) noted that cetaceans apparently avoid stationary industrial activities such as dredging, drilling and production when the received sounds are near-surface and intense, but not when the sounds are barely detectable (e.g., <10 dB above ambient). Some cetaceans do enter areas that are strongly ensonified by stationary industrial operations. For example, some beaked whales behaved normally in some areas ensonified by dredging noises at the construction site of an artificial island in the Beaufort Sea during 1980. Richardson et al. (1985c, 1990b) speculated that this may have meant that the whales habituate to noise from an on-going construction operation even if they are disturbed when they first encounter it. The radius of avoidance around industrial sites is normally considerably smaller than the radius of audibility (Richardson et al., 1991). Whether there is any reduction in utilization of areas that are ensonified but beyond the radius of demonstrated avoidance cannot be determined from the available evidence. The MMRP would provide valuable information to help resolve this issue (See Appendix C).

ISSUE 7: SOUND FIELDS
d. <u>AIR VS. WATER STANDARD</u>

Comment: The DEIS goes on to present Table ES-1 (Relationship of sound level of common sounds in air and water [20-1000 Hz]), which is completely worthless and without factual basis. The purpose of this table is clearly to make ATOC seem less loud to us, compared to familiar, in-air, sounds.

Response: A similar table is presented in the National Research Council's *Low-Frequency Sound and Marine Mammals; Current Knowledge and Research Needs*. All data points in this table are referenced in the EIS. Note changes to the EIS version of this table, which also respond to this comment.

Comment: What is the basis for comparing sounds produced under water with sounds produced in air? Using a conversion of 61.5 dB (rather than 26 dB) between sound power levels in air and water is unjustified, because we do not know which acoustic stimuli (energy flux or sound pressure) is the important one for hearing loss in marine mammals. The DEIS neglects to note that the NRC publication uses a conversion factor of only 26 dB, not 61.5 dB. Further, the DEIS itself uses only a 26 dB conversion factor in Section 4.5.1.1.

Response: Fay (1988) in *Hearing in Vertebrates: a Psychophysics Databook* noted that the commonly accepted term for underwater conditions is "sound pressure" ([particularly for] fishes and marine mammals) and for in-air conditions "sound pressure level, or SPL." He goes on to note that proper comparisons of hearing sensitivity in air and water are difficult to make, but one common method of comparison is to express both air and water thresholds in units of "sound intensity," (i.e., units of power/unit area; e.g., Watts/cm2) which takes into consideration the impedance of the medium. Using logarithmic units for comparison between sounds in air and in water we find that for equal intensity or energy transfer in each that the pressure levels must vary as:

$$10 \text{ Log}[(\rho c)\text{water}/(\rho c)\text{air}] = 35.5 \text{ dB}$$

For years the reference level for sound in air has been 20 μPa, and in water only 1 μPa. These are not air-to-water sound level conversion factors, they are units, just as we measure highway distances in kilometers or miles and people's height in meters or feet. So when, as in the NRC report, we add 26 dB to in-air values, it is only to make the units of both measurements the same. Hence 26 dB should be added to 35.5 dB to derive the 61.5 correction factor between air and water. We have adopted this convention, based on interpretation of the studies and analyses of a number of experienced acousticians (e.g., Potter, Berenak, Ellison).

The NRC publication does, in fact, acknowledge that "The difference in reference pressure level [not energy flux] is one complication in comparing sound in air with sound in water. Another is that, because the impedances of air and water differ, the actual power flow in them differs even if the pressures are the same. For example, a spherical sound source radiating a pressure of 1 dyne per square cm in air generates about 2.5x10-9 Watts per square cm. The same source in water radiating the same pressure generates about 4.7x10-13 W/cm2--an intensity ratio of about 5,000." This calculation (and Fay's, 1988) produces an intensity ratio of approximately 3550 (35.5 dB); thus, if anything, the estimates in the EIS are conservative, if compared with those of the NRC publication.

Regarding the comment that "the DEIS itself uses only a 26 dB conversion factor in Section 4.5.1.1," the calculation in question refers to a minimum human audibility level in water that was referenced to 20 μPa. Because the value was already a water standard, only the 26 dB correction factor need be applied to convert to a reference of 1 μPa.

Comment: Table ES-1 and related text clearly imply that power is the appropriate acoustic feature for perception of loudness and for auditory damage. This leads to a water standard that has much higher pressure levels for comparisons with the air standard. The NRC publication considered this issue, but did not include the intensity correction in such a table, and noted the different relationship between pressure and power in the two media. There are insufficient data on either hearing loss or perception of loudness in marine mammals to justify choice of one feature over another (pressure vs. power). This part of the EIS is not correcting a misconception as much as pushing a particular hypothesis about biological impact that has not yet been subject to empirical testing.

Response: No particular hypothesis is involved, rather the application of standard scientific methods to enable comparison between in-air and in-water sound intensities. See also response above.

ISSUE 7: SOUND FIELDS

e. <u>ACOUSTIC THERMOMETRY SIGNAL LEVELS VS. AMBIENT NOISE LEVELS IN SOUND CHANNEL</u>

Comment: Why are ambient noise levels in the deep sound channel tabulated in the EIS, higher than expected? Why use surface ambient noise levels for comparison with ATOC signals, rather than deep sound channel levels. As demonstrated in the HIFT, sound transmissions will travel huge distances across the oceans in the deep sound channel and will be detectable around the world; thus, ATOC's contribution to human-made noise in the deep sound channel must be quite substantial.

Response: There is a common perception that the ocean is much quieter at depth than near the surface. In fact, sound propagates efficiently in the ocean so that ambient (low frequency) noise levels at 4000 m depth are typically only 5 dB less than at 100 m (Morris, 1978). At 1000 m, in the sound channel, ambient noise levels are normally only 2-3 dB less than near the surface (Morris, 1978). At higher frequencies, the vertical variation is even less. Horizontal variation of ambient noise (up to 35 dB) and time variation are both much greater than vertical variation. As stated in Section 3.2.4.3, a good estimate (from 1994 MMRP data) of mean ambient noise level at 75 Hz and 120 m depth in the region of the study area would be 75.8-97.6 dB. It follows that the corresponding noise levels in the deep sound channel would be approximately 72.8-94.6 dB.

Most life in the ocean exists near-surface, in the photic zone (Castro and Huber, 1992) and it is generally appropriate to use near-surface ambient noise levels for comparison with ATOC sound levels. Signals will -- at long horizontal ranges -- be almost as high 100 or 200 m below the surface as at deep sound channel axis depth. As marine mammals are much more abundant in the upper 200 m than at axis depth, it is important to consider ambient noise near the surface. For those animals that dive to the axis of the sound channel and beyond, ambient noise levels are likely to be 2 to 3 dB less.

Section 1.1.3 explains the phenomenon of trapping sound energy in the deep sound channel for great horizontal distances, although the signal level would be below ambient there.

Comment: If a level of 90-100 dB in the (quieter) sound channel is harmful to fish or invertebrate reproduction, populations could suffer over a radius of about 3,500 km at depth around the ATOC source; i.e., over about 1/4 of the entire Pacific Ocean, as calculated by Scripps. This is a potentially serious ecological effect, and yet the DEIS states that impacts on fish and invertebrates are expected to be low.

Response: Sound levels of 90-100 dB, with ATOC source characteristics, have not been proven to be harmful to fish or invertebrate reproduction. Moreover, these sound levels are not uncommon in the sound channel (e.g., during natural evolutions such as storms, earthquakes, landslides, volcanic eruptions, and whale vocalizations; and human-related activities such as shipping noise and seismic profiling). Revised calculations for the extent of the ATOC sound field indicate that the level would be <88 dB in the sound channel within 500 km range.

ISSUE 7: SOUND FIELDS

h. 150 dB CRITERION FOR TEMPORARY THRESHOLD SHIFT

Comment: The analysis that TTS occurs at received levels ≥150 dB is extrapolated from human data. Hollien (1993) has stated that lower levels than this may cause TTS, and that it may not be conservative to extrapolate from studies of underwater hearing in human ears (which are adapted for hearing in air) to ears of marine mammals which are adapted for underwater hearing. Terrestrial mammals tend to show TTS when exposed to sounds >80 dB above their hearing threshold. Whether a similar dynamic range is characteristic of ears underwater has never really been tested for marine mammals. Until such data are provided, it may be over-confident to assume no impact to exposures <150 dB. The MMRP Advisory Board provided the following comment: "ATOC documents assume that hearing damage and/or TTS will not occur if received levels of ATOC sounds are <150-160 dB. The Advisory Board notes that this assumption may or may not be true, but that there are no supporting data from marine mammals. This and other auditory parameters may vary widely among the main marine mammal groups."

Response: There are no broad-based, direct, calibrated, quantitative, measurements of marine mammal TTS underwater that have been subjected to lengthy and detailed peer reviews and discussions. MMRP marine mammal bioacousticians therefore sought indirect evidence from research in the field of otology (a medical specialty concerned with the inner ear). Section 4.3.1.1.1 of the EIS explains in detail the reasoning used to establish 150 dB as the threshold for potential TTS to marine mammals. The EIS also states: "If a value lower than 150 dB is appropriate, then the received level that would cause TTS could be less than the assumed 150 dB." Conversely, the 150 dB value could just as easily be too conservative, meaning that it would require a value higher than 150 dB for marine mammals to incur TTS. Scientific research always involves some measure of uncertainty, and the MMRP proposed here is no different. A key question is how great is the potential of low frequency sound for causing physical auditory effects on marine mammals? In order to put this question into proper context, the following facts have been considered:

- To perceive sound, all mammals, terrestrial and marine, rely upon the same anatomical reception device, the cochlea (Ketten, 1992). Whales, dolphins and seals have ears like land mammals that are essentially a fluid-filled bony spiral containing a resonating membrane and a series of frequency-pressure-energy detectors. Marine mammals' inner ears are different from land mammals so that they can accommodate rapidly changing pressures encountered in deep dives, and dynamic ranges of acoustic power several magnitudes greater than in air. These adaptations could possibly decrease the potential risk of injury from high intensity underwater noise (Ketten, 1994).

- There is no evidence to suggest that marine mammals have better hearing acuity in water than terrestrial mammals do in air--if they do, the 150 dB value could be too high; if they do not, it could be too low.

- For any marine animal to detect and react to low frequency sound, that animal must exhibit sufficient sensitivity in the appropriate frequency band. In this case the ATOC source frequency band is 57.5 Hz - 92.5 Hz. Currently available data indicate that there are very few marine animals that appear to have the required sensitivity; among them are the baleen whales, and possibly the sperm whale and the leatherback sea turtle.

• Many baleen whales regularly produce low frequency sounds with source levels in the range of 180-190 dB. There is no evidence that this causes self-inflicted injury or TTS (it is unknown if they have an auditory reflex to protect themselves from their own calls), or affects nearby whales in any negative way (there is no evidence whether or not they emit calls at high source levels when conspecifics are nearby); and it is unlikely that the animal calls would be so strong if they did have these types of negative consequences (Richardson, pers. comm., 1995).

• In the course of their life underwater, all marine animals are subjected to low frequency noises from ships, volcanoes, earthquakes, landslides, lightning strikes, polar ice movements, oil and gas exploration and production activities, and most routinely, from storms at sea. These sound sources can generate sound levels of 185-280 dB.

• The National Research Council's *Low-Frequency Sound and Marine Mammals; Current Knowledge and Research Needs* states: "At its typical speed of 15 to 22 kts, the average supertanker produces a source level (calculated at 1 m from the source) having a spectrum level (energy in a 1 Hz band) of about 187 dB at 50 Hz and about 232 dB at 2 Hz.

• In order for any marine animal to encounter the 150 dB isopleth around the ATOC source at the proposed source site, it must be capable of diving deeper than 670 m. The only marine mammals found in the Hawaiian Islands region that are known to have the capability to dive this deep are the sperm whale, some beaked whales, and the leatherback sea turtle.

• On the rare occasion that an animal happened to be located within the 150 dB isopleth (at >670 m depth) during the 2%-8% of the time that source transmissions would be scheduled, it is assumed that if the animal considered the sound annoying during the 5-min ramp-up period, it would simply depart the area. All marine animals that are suspected of having low frequency hearing capability have adequate swim speed to accomplish this.

• If all the variables happened to coincide (animal is low frequency sensitive, is located within the 150 dB isopleth during the 2%-8% that the source is on, and the animal chooses not to, or is unable to depart the area during the 5 min ramp-up period, and remains within the 150 dB isopleth for most or all of the 20 min transmission) a TTS could be incurred by the animal. It should be noted that a single or occasional mild TTS would not be life-threatening, and would have no long-term effects on hearing ability (Richardson, pers. comm., 1995). It is expected that repeat exposures, necessary for injury beyond TTS (i.e., PTS), would be very rare given the small size of the sound fields compared to the range of exposed animals.

Comment: If humpback whale songs have an average source level of 155 dB and range from 144 to 174 dB, and the songs appear to have an effective range of approximately 10-20 km, one should be able to use this information to calculate expected sound levels at different distances from the sound source to estimate the possible received levels of humpback whale songs within the apparent effective range of 10-20 km. The estimated received level at 20 km could be indicative of the humpback whale's hearing threshold and could be used to better judge the possibility of a TTS.

Response: This calculation yields a hearing threshold of approximately 80 dB and, thus, a threshold for TTS of 160 dB--which is generally comparable to the 150 dB value used in the EIS.

ISSUE 8: BIOLOGICAL ENVIRONMENT

a. MARINE MAMMAL REFERENCES

Comment: "... there is no evidence that whales respond to one another over ranges greater than about 20-25 km." I believe SOSUS data have shown that blue whales change course to avoid Bermuda at ranges greater than 20-25 km, which may mean they are listening to far away acoustic clues.

Response: Until any data that supports this belief is processed, analyzed, and subjected to peer review, it must be stated that there is no evidence that whales respond to one another over ranges greater than about 20-25 km (Watkins, 1981b). Furthermore, reactions to conspecifics vs. possible reactions to a huge immobile, inanimate object (Bermuda) are not comparable phenomena (Richardson, pers. comm., 1995).

Comment: Section 3.3.1 is sloppy. There are good primary references to many of the points made, rather than the secondary, tertiary or personal communications that are cited.

Response: Many of the secondary, tertiary and personal communications references have been replaced in the EIS by primary references.

Comment: Tables 4.3.1.1.1-1 and 4.3.1.2.1-1 could be made more useful by adding a column indicating the known or presumed biological functions of the vocalizations listed in the column titled "Signal Type."

Response: The few data that are available are either included in the text of the document, or available in the references cited. The addition of this information in these tables is beyond the scope of the document; moreover, much of what would have to be included would be of a speculative nature.

Comment: The DEIS clearly demonstrates that there is a lack of information regarding baseline conditions for certain biological resources at the preferred sound source site. There is a critical need for sampling and monitoring to verify assumptions, especially given the known biological richness of the area. The FEIS should clearly address this information gap and describe existing and proposed sampling, monitoring and survey activities which will be implemented to ensure adequate baseline data are obtained prior to commencement of the ATOC feasibility study.

Response: The preparers agree with the need for baseline data. Existing pertinent data bases are either included or described in the FEIS, and proposed activities are described in detail in Appendix C.

Comment: Table 4.3.1.3.1-1 and the corresponding discussion usefully could be expanded to include a description and discussion of underwater sounds produced by southern hemisphere pinnipeds, particularly the Weddell seal.

Response: This information is deemed to be inconsequential to the purpose of this EIS, particularly for the Weddell seal, which inhabits Antarctica.

ISSUE 8: BIOLOGICAL ENVIRONMENT

b. POPULATION ESTIMATES (INCLUSIVE OF DIVING ANIMALS AND MULTIPLE TAKES)

Comment: It is noted that short-finned pilot whales essentially vanished from southern California waters (cause unknown, perhaps El Niño). This raises an important question: "if one or more species show a population change during this two-year study and there is an El Niño or other "extrinsic" event, how will "blame" be assigned?" For example, could the MMRP's conclusions be disputed on the grounds that local boat traffic had increased above some unknown threshold during the period? I see this as insoluble, and it vividly illustrates the need for more basic research on the natural history of marine mammals so that we understand, or at least can quantify, non-anthropogenic population fluctuations.

Response: The MMRP Research Protocol emphasizes the ability to detect any acute or short-term effects (Table C-1) on a marine mammal that could be related to ATOC source transmissions. The EIS explains the methodologies available for the MMRP to determine if there may be any other short-term effects from exposure to the signals (i.e., behavioral disruption and habituation), or long-term effects (i.e., displacement, stress, masking), or indirect effects (i.e., impact on the food chain). If one or more species would show a measurable population change (via aerial survey techniques) during the proposed ATOC operations, all known and quantifiable extrinsic oceanic events (natural and human-made) would be included to the greatest extent feasible in the final analysis of the MMRP Research Team to attempt to ascertain the most likely reason for the change.

There is indeed a need for more basic research on the natural history of marine mammals.

Comment: The statement in the Executive Summary that "estimates of the numbers of animals that could be affected were high because NMFS recommended including estimates of populations for the entire eastern Pacific stocks of most species as "worst case" or "upper bound" scenario" is deliberately misleading. The reason that entire eastern Pacific stocks of some species needed to be included is that the whole of these populations could (were thought to) migrate within the area influenced by ATOC (Zone of Influence). Also, the estimates may very well not be high--may even be low, since multiple takes of the same individual are not considered in the estimates.

Response: As noted previously, in the absence of data on the potential effects on marine mammals, it is not possible to accurately estimate the numbers that could potentially be harassed by low frequency sound transmissions. Thus, NMFS recommended including estimates of species/populations for entire Pacific stocks. However, it is inconceivable that the entire population of any animal species could migrate within the area influenced by the ATOC source transmissions (particularly if the zone of influence were established as the 120 dB sound field--see Section 2.2.1 sound field plots). Theoretically, animals could be exposed during each source cycle "on" period; exposures which would be considered multiple takes.

Comment: In Section 4.3.1.2.1, there is a calculation of the number of sperm whales likely to come within the 150 dB contour. When calculations are carried out correctly (including the whales missed when diving, the proportion of time at depth, the tidal sampling and the mean speed of movement of whales), the number of sperm whales affected is increased by more than a factor of 100.

Response: That calculation is in error in the DEIS, and it is corrected in the FEIS. Based on best available data and information from NOAA (NMFS/SWFSC, 1995), the number of whales that could potentially be affected is increased by a factor of 1.5 (i.e., 1.5% of the total N. Pacific population vice 1% in the DEIS), not by a factor of 100.

Comment: Are population estimates corrected for diving animals being missed on surveys (table 3.3.1-1)? If not, numbers of sperm and beaked whales will have been serious underestimates.

Response: Sperm and beaked whales are underestimated in the DEIS as no correction factors were applied. The EIS applies appropriate correction factors for these species (1.5x vice 1.0x for sperm whales, 2.0x vice 1.0x for beaked whales) based on information from NOAA (NMFS/SWFSC) (Barlow, pers. comm., 1995).

Comment: The population estimates for the proposed sound source area seem unusually low. The numbers are compounded by calculations of average densities in the study area (e.g., less than 1 sperm whale per 1000 km^2). Most of the marine mammal species do not travel singly, so this evenly spread distribution does not reflect the patchy nature of marine mammal populations. Where the probability states that 1 animal may be affected, the actual number of affected animals is likely to be somewhat larger (e.g., small cetaceans, pods may be counted in hundreds or thousands; California sea lions also travel in groups, as do sperm and other whales).

Response: Most marine mammal species do not travel singly. However, in attempting to use pertinent statistics to illustrate the potential for an animal, or animals, being in proximity to the source during transmission, it is inherently difficult to account for the patchiness of populations. Thus, in order to ensure conservative calculations, one or more of the variables have been increased to account for the possibility of multiple animals and the patchiness of populations (e.g., it is assumed that sperm whales spend 10-20 % of their time at depths >670 m, when in actuality they probably spend less then 10% of their time below 670 m [Lockyer, 1978]).

Comment: The DEIS does not consider the possibility of impacts beyond the immediate vicinity of the source, choosing instead to limit the discussion of impacts to those that marine wildlife might experience near the source. In so doing, the DEIS underestimates the true potential impacts of the transmissions. How will researchers detect, observe, and monitor distant marine animals avoiding the project and sound source area? What about those that are not at the surface, but at depth? And, those that cannot be acoustically tracked because they are not vocalizing?

Response: Although the 1994 NRC report downplays the use of 120 dB as a criterion for a level of sound that has been identified informally as a level above which acoustic effects on marine mammals might occur, the MMRP has chosen to err on the conservative side and use that value as an outer sound field boundary for dedicated observation and monitoring efforts. Section 2 gives the estimates for the radius and areal extent of this sound field, which delineates the region that the MMRP must focus upon.

Animals that are not at the surface during visual survey and observation efforts, and do not vocalize while underwater in the local area, will necessarily have to be accounted for using the best available correction factors from NOAA/NMFS/SWFSC (Barlow, pers. comm., 1995). Animals that vocalize while below the surface will be monitored acoustically (see Appendix C for estimates of acoustic coverage passive hydrophone arrays expected to be used during the MMRP).

ISSUE 9: POTENTIAL FOR PHYSICAL AUDITORY EFFECTS

a. CRITERIA FOR POTENTIAL PHYSICAL DAMAGE AND FOR PERMANENT THRESHOLD SHIFT (PTS)/ TEMPORARY THRESHOLD SHIFT (TTS)

Comment: Is 150 dB the appropriate level above which physical damage will occur? Commenters dispute Ketten's calculations of levels which produce a TTS, and suggest that TTS could occur at levels of less than 120 dB. Further, commenters estimate that such levels could be encountered as far away as 40 km or more from the source.

Response: It is acknowledged that Ketten's figures are estimates, based upon extrapolations from other mammals. Thus, it is possible that TTS may occur at levels somewhat different from those calculated. However, the following points are relevant:

1) Ketten chose the 150 dB level as the limit for TTSs because TTSs have been produced in humans with underwater sound sources at levels of 150-180 dB for frequencies between 700 and 5600 Hz, the most sensitive range of human hearing. It is, however, stated that TTS could occur in mysticetes at levels less than the 150 dB level. Hastings (1991) has stated that, within the 50-2000 Hz frequency band, received levels below 150 dB should not cause physical harm to fish.

2) For permanent damage to occur, the animal must either be near the damaging sound level for a prolonged period of time, or the level must be far above that at which slight TTS is first evident. In humans, the "80 dB above threshold" criterion for the likely onset of PTS applies to 8 hours/day of exposure for something on the order of 10 years. In humans, the received level must be far more than 80 dB above threshold in order for PTS to occur as a result of a single exposure.

3) It is important to put some context into the level of sound (both natural and non-ATOC human produced) encountered daily by marine mammals in order to better examine whether TTS or PTS is likely to occur. A number of natural, physically-produced ocean sounds have broadband energy levels in excess of 120 dB (e.g., ocean storms, volcanic eruptions, and earthquakes) (Section 1.1). The dominant calls of blue and fin whales (10-30 Hz) have source energy levels of about 160-188 dB (Cummings and Thomson, 1971; Watkins, 1981). It is unlikely that the animals would be producing sound at levels which would damage their own hearing. In addition, several common human-produced sounds have energy levels which exceed 120 dB (e.g., geological exploration devices, recreation vessels, container ships, supertankers, offshore oil rigs). Thus, marine mammals regularly encounter or produce sound levels which may exceed the 120 dB level.

ISSUE 9: POTENTIAL FOR PHYSICAL AUDITORY EFFECTS
c. SPERM WHALE DIVING PATTERNS

Comment: The statement that sperm whales make deeper dives in deeper waters and therefore would not reach the ATOC source (referenced to Rice [1989]) is wrong. Sperm whales cannot dive below the ocean floor, but in shallower waters (e.g., ca 850 m), they will often dive to it.

Response: The DEIS did not imply that sperm whales make all of their deep dives in deeper waters, thus not reaching the ATOC source. Watkins et al. (1985) reported that long dives by sperm whales are exceptional. Lockyer (1978) observed that 99.5% of all dives are less than 45 min long, and 96.7% are less than 30 min. Lockyer also reported that 99.9% of all dives are less than 1000 m deep, 88.3% less than 600 m, and 77.1% less than 500 m.

Rice (1989) stated that these animals generally make dives >800 m in much deeper water, and that crustaceans (on the bottom) are rarely eaten. However, it is believed that sperm whales sometimes do grub for food along the sea bottom (Leatherwood and Reeves, 1983) in shallower water (<850 m). The EIS also acknowledges that sperm whales off Dominica in the Atlantic Ocean appear to commonly dive almost to the bottom (Watkins et al. [1993]), where shallow water (<200 m) is found from 2-10 km offshore. However, because sperm whale dive depths no doubt depend on local food availability, depth-of-dive data from other parts of the world are only indirectly relevant.

Based on Lockyer's data, it appears that sperm whales reach the depth of the source's 150 dB isopleth (> 670 m) less than 12 out of every 100 dives. This, coupled with the requirement that the animal would have to be almost directly over the source to encounter the 150 dB isopleth, leads to the conclusion that the possibility of this occurrence is quite low.

ISSUE 10: POTENTIAL FOR BEHAVIORAL DISRUPTION

a. POTENTIAL FOR ATTRACTION OF LARGE NUMBERS OF MARINE ANIMALS TO THE ACOUSTIC SOURCE

Comment: If animals were curious about the ATOC sound, wouldn't they be attracted to the source site, disrupting their normal behavior?

Response: As noted in the EIS (Section 4.3.1.1.1), when recordings of humpback whale sounds were played back to other humpbacks, they were attracted to the sound source. (Mobley et al., 1988). However, in all other cases of noise exposure (Section 4.3.1.1.1), baleen and toothed whales were not attracted to the source of the sound but, rather, exhibited some level of avoidance or simply ignored it (Richardson et al., 1991). Various whales apparently are attracted to boats (mainly whale-watching vessels) after the animals have become habituated to them (Watkins, 1986). There are also other references to "ship-seeking" in minke whales (Joyce et al., 1989); Borchers and Haw, 1990) and the "curious whale" phenomenon in gray whales (Swartz and Jones, 1981; Jones and Swartz, 1984, 1986). Whether these phenomena are relevant to ATOC is unknown at this time. See also Section 4.3.2.2.1 for a discussion of the potential for attraction of sharks to low frequency sounds.

ISSUE 10: POTENTIAL FOR BEHAVIORAL DISRUPTION
c. MIGRATION PATTERNS

Comment: Could ATOC's signals disrupt marine animals' migration patterns? Initial findings from MMRP baseline data collection efforts suggest that some individual humpback whales may be repeatedly exposed to the sound source due to variable travel patterns, counter to the assumption that they are transient migrants in the study area.

Response: This question has been addressed in detail in Section 4 of the EIS. Some temporary change in swim direction, typical of object avoidance behavior, has been noted during several acoustic playbacks of human-made sounds on migrating marine mammals. There is no evidence that a minor change in an animal's track could have a significant impact on its migration pattern (Richardson, pers. comm., 1995). Migrating bowheads seem to avoid drillships and their associated support vessels by at least 10, and sometimes 20 or more, km (LGL and Greeneridge, 1986). Although source levels of those vessels are roughly similar to those of ATOC, any comparison must take into account the fact that the ATOC source is at 850 m depth and its duty cycle is 2-8%. Nevertheless, if the ATOC source were located in proximity to any marine animal's migration path or corridor, it could cause an adverse impact. However, based on the best available data, its location 14.7 km off the north shore of Kauai is not in the vicinity of the migration path for any marine animal.

The EIS does not portray the humpbacks that inhabit the Kauai area as transient migrants. In fact, Section 3.3.1.1 describes the densities of humpback whales and their locations around Kauai during three MMRP data collection efforts, two during 1993 and one during 1994. Based on these data, a very small number of whales would be expected to be located within the 120 dB sound field of the proposed source.

ISSUE 10: POTENTIAL FOR BEHAVIORAL DISRUPTION

d. ASSESSMENT OF BEHAVIORAL DISRUPTIONS AND AVOIDANCE/ ABANDONMENT

Comment: Behavioral changes generally are detected at sound intensities higher than the levels at which the sounds would be barely detectable--we do not know what levels are barely detectable to whale species, nor are we likely to detect anything but the most gross behavioral changes.

Response: The MMRP has adopted the MMC recommendations concerning criteria for ascertaining any non-negligible effects (i.e., acute or short-term effects) on marine mammals and other sea life (see Executive Summary, Section 4, Appendix C, and responses to Issue 6 above). All available marine mammal abundance and distribution data from aerial, ship and shore-based visual surveys have been incorporated into the MMRP research protocol. These data sets and the results of the statistical power analysis (Appendix C) provide the starting point for assessing any potential for avoidance and/or abandonment during and after ATOC acoustic transmission periods (both for the MMRP Pilot Study and for the proposed MMRP follow-on research related with ATOC feasibility operations).

Comment: Singing by humpback whales in Hawaiian waters is heard throughout the winter season day and night. In one study, sounds were recorded from the Barking Sounds Pacific Missile Range Facility located on the north shore of Kauai. Recordings were made for five-minute intervals on the hour every two hours throughout the 24 hour day, throughout the season. There was no time during that period when song was not heard. Singing is performed by males and appears in the least to maintain spacing between singers at several kilometers, and possibly to provide information to female listeners about the fitness of the singer. The male whales must be listening to each other's songs, since they copy each other's songs. Singers have been observed to stop singing and join with other whales, possibly females, who are at distances of several kilometers.

Response: The MMRP Research Team, made up of marine mammal biologists, is aware of the mentioned humpback whale behavioral patterns north of Kauai. Section 4 describes in detail the potential for impact to this species in the study area, and Appendix C delineates how the MRT plans to collect data to address the null hypothesis that ATOC signals would not cause humpbacks to modify their singing.

ISSUE 11: POTENTIAL FOR HABITUATION

a. MARINE ANIMAL'S PERCEPTION OF THREATENING SOUNDS (RELATIVE TO FEEDING ACTIVITY) AND POTENTIAL FOR HABITUATION DUE TO HEARING LOSS

Comment: Since the ATOC sound is novel, the reaction of marine mammals to the sound cannot be predicted. Physiological damage as a result of habituation to a sound source could occur. If there is behavioral habituation to intense sounds, animals might, to their detriment, re-enter regions with dangerously high sound levels, thereby risking additional hearing loss. Finally, while marine mammals have the capacity to leave the area during the ramp-up period they may remain in the area if engaged in a critical activity, such as feeding.

Response: In the case of baleen whales, those that have been studied often show avoidance reactions to steady low frequency sounds at received levels well below those speculated to cause TTS and far below those that might, upon brief exposure, result in PTS. Even for a near-surface source, it seems very unlikely that baleen whales would suffer hearing damage as a result of failure to move away from a strong sound source. This is even more unlikely in the case of a source that is so deep that it is doubtful baleen whales could dive deep enough to enter the area where TTS is a possibility.

Although the ATOC sounds may be novel, the reactions of whales to other novel sounds have been documented (Section 4.3). One response is habituation to those sounds that are not linked with harmful events. The ATOC signal would not be directly linked with any adverse stimuli; e.g., periodic or recurrent harassment from boats, or airplanes. MMRP aerial observations and surveys would be conducted both during source transmission "on" and "off" periods. Any potential disturbance of marine mammals from the aerial observations themselves should be considered separate and distinct from potential effects caused by the underwater acoustic transmissions, and would be expected to be of no greater consequence (i.e., minimal to negligible) than standard aerial surveys for which numerous permits have been issued.

Thus, it is possible that whales, if they chose to stay in the area, could habituate to the ATOC sounds. However, habituation is also only one possible response to the sound source. Given the relatively short duration of the sound (20 min), the warning or ramp-up period, and the ability of the animals to leave the area, habituation may not be the most likely option.

Comment: In the ATOC context, it is simply bad science to attempt to study the impact of sound in a system where the most sensitive animals presumably departed years ago, and the remaining ones are likely to have habituated to anthropogenic sounds. To the extent that Kauai is such a system, the MMRP (and hence ATOC) site should be moved to an alternative location.

Response: The response above answers this comment in part. There is no evidence that the. most sensitive humpback whales have avoided Hawaiian waters or, that the mammals that do make this area their winter home, have become habituated to anthropogenic sounds. See

Section 2.2 for detailed discussion of the rationale for selecting Kauai as the preferred site, which includes the factor of requiring a statistically significant density of animals with which to conduct research in order to derive meaningful results.

ISSUE 12: POTENTIAL FOR LONG-TERM EFFECTS

a. METHODOLOGY FOR MEASUREMENT OF ANY LONG-TERM EFFECTS

Comment: There are a number of potential long-term effects that, while subtle, may be important to marine mammals. Effects may occur at the individual level through hearing loss and stress-related responses. They may also occur at the population level via reproductive and survival rates or by shifting marine mammal distribution from areas that are important habitats for certain activities, such as feeding and breeding. Impacts that are individually minor may be collectively significant over time. It is the long-term effects which are of greatest concern for the health and recovery of the North Pacific humpback whale population; however, the long-term effects on individual animals or on the utilization or effectiveness of the Kauai habitat will not be possible to evaluate. The ATOC project does not have a specific program that can adequately monitor potential long-term responses to the sound source, particularly for cetaceans, and for adverse impacts on population growth rates for large whales. What statistical significance will be required before a determination of unacceptable long-term effects will be made?

Response: Based on current knowledge of the natural history of the animals in the study area, we do not expect exposure to the sound source to have any major adverse short or long-term effects. The proposed area to be ensonified is relatively small in relation to the animals' known home ranges. The structure of the proposed duty cycle allows a ramp-up period in which animals that are sensitive to the sound can avoid the area. It is expected that any extreme effects would be prefaced by some change in the behavior of the animal. The MMRP will monitor the distribution, abundance and behavior of animals in the area to attempt to detect these changes.

In addition, independent long-term monitoring of humpback whale and Hawaiian monk seal populations in the Hawaiian Islands is occurring at present, and will continue. From this information, we will be able to detect any large changes in population size, and possibly pupping and calving rates.

The main effect one would expect to find, if animals were affected by the sound, would be a temporary change in the abundance/distribution in the area during the times of transmission. There is no reason to believe that an animal would opt to stay in an area that is stressful/painful if other options are available.

Given the low probability that an individual animal will be exposed to high sound levels, the limited sensitivity of many animals to the frequency and level of sound produced, and the ability of all animals to leave a non-critical habitat, we suspect that the cumulative effects of the sound source will be low. If no adverse short-term effects are detected during the Pilot Study, and the project continues, the population health will be monitored by the previously mentioned ongoing longer-term research.

The monitoring for potential long-term effects on cetaceans, with the possible exception of sperm whales, is more problematical; however, MMRP marine biologists would work with all pertinent organizations (e.g., University of Hawaii, Kauai CAG, etc.) in attempting to ascertain any change in distribution or abundance of toothed whales over time. The significance to be applied for determination of unacceptable long-term effects is listed in the Executive Summary.

ISSUE 12: POTENTIAL FOR LONG-TERM EFFECTS
b. POTENTIAL FOR PHYSIOLOGICAL STRESS

Comment: In free-ranging cetaceans, physiological effects (e.g., stress) are extremely difficult, if not impossible, to detect given the current state of scientific and technological capabilities in this field of research. If marine mammals are subject to ongoing stress while in a noisy area, then there could be long-term effects on the individuals and the population. Physiological reactions, such as elevated heart rate, can occur even in the absence of overt behavioral responses.

Response: It is extremely difficult to monitor any potential stress effects on marine animals, and that behavioral stress probably does vary greatly among the different marine species. Stress is the physiological response of the body to a demand made upon it by one or more external stimuli, the "stressors" (Selye, 1973). Many studies of terrestrial mammals, including humans, have looked for evidence that chronic noise exposure causes stress. Some studies have provided evidence of noise-induced stress, but the majority have been inconclusive or have shown no such evidence (Kryter, 1985; Majors and Myrick, 1990 in Richardson et al., 1991). Marine mammals exhibit some of the same stress symptoms as found in terrestrial mammals, judging from the few species studied (Thomson and Geraci, 1986; St. Aubin and Geraci, 1988), but there has been virtually no study of noise-induced stress in marine mammals. The one exception is cited in Section 4.3.1.1.1, but the significance of this one study on white whales must be stated as unknown, particularly in light of the short durations of noise exposure (Richardson et al., 1991). Thus, it is not that the EIS gives short shrift to psychological/ physiological stress, but that there are no data points with which to establish any baseline for assessing whether low frequency sounds might cause stress in marine animals. Nevertheless, some, or all, of the revised criteria that would be used in the MMRP Research Protocol (Appendix C) to determine the potential for acute and/or chronic effects of low frequency sound could be stress-related (e.g., avoidance or abandonment of high-use areas, increase in emaciated or diseased animals, etc.).

ISSUE 12: POTENTIAL FOR LONG-TERM EFFECTS
c. CUMULATIVE EFFECTS (INCLUDING COMBINATION OF CALIFORNIA AND KAUAI SOURCE SOUNDS)

Comment: What are the full cumulative impacts of ATOC on the entire biological environment? If the cumulative effects of ATOC are not likely to be immediately recognizable, do we not have a moral obligation to halt the project until such a time as we can be reasonably sure of what its impacts would be? The DEIS fails to list present, past, and anticipated future projects, including those inside and outside the agencies' control, or to summarize the expected environmental effect of those projects. There is no talk in the DEIS of cumulative impact of the ATOC project as a whole (Kauai, California and New Zealand). The DEIS notes that only two sound sources are currently proposed and it is proposed to operate these sound sources 2-8% of the time (silent 92-98% of the time). The DEIS does not indicate whether the sound sources would be operated concurrently and, if not. whether marine mammals, sea turtles, fish, etc. in areas between the two sound sources could be exposed to sound from these sources for more than 2-8% of the time as indicated.

Response: The potential cumulative impacts of the ATOC low frequency sound source are addressed in Sections 4.2, 4.3, 4.4, 4.5, and 4.6. Section 4.6.8 specifically addresses the potential cumulative impacts of the Kauai and Pioneer Seamount ATOC sources. These sections cover all known present, past, and anticipated future projects (inside and outside the agencies' control) that are believed could realistically interact with the ATOC source transmissions to produce a cumulative effect. There is no cumulative factor from the two VLAs deployed along the radial between Pioneer Seamount and Rarotonga as they are strictly passive listening devices (for the one at approximately 6000 km range, the received level in the sound channel (from the Pioneer Seamount source) should be on the order of 80-83 dB). The sound sources at Kauai and Pioneer Seamount are not planned to be operated concurrently, but the minimum range at which a group of animals or an individual animal might be exposed to both source transmissions sequentially would be 1850 km from either source. At that range the received sound level should be 85-88 dB, which is within the range of ambient noise conditions the animal would normally be subjected to at that location. (see responses above and Section 4.6.8 and Issue 7).

Comment: Can the long-term and cumulative effects of the ATOC program be calculated during the MMRP Pilot Study? The DEIS discussion of cumulative sound potential is unacceptable, in failing to relate the degree to which ATOC sound energy would so markedly increase the total sound impacting marine mammals. who are already affected by existing stressors (e.g., container ship traffic) that a response threshold could be exceeded (causing the triggering of a response that would not be produced by the ATOC sound transmissions alone). The FEIS should include an expanded cumulative impact analysis which evaluates the potential ripple effect caused by the loss or reduction of prey species and the affect of other activities such as commercial fisheries, recreation, commercial shipping, and general harassment. The DEIS fails to discuss the cumulative impacts of the Hawaii/California feasibility study with the planned follow-on, long-term global ATOC project.

Response: The MMRP Pilot Study is designed to determine whether low frequency sound might cause acute or short-term effects (Table C-1) to marine animals. Any possible long-term and cumulative effects would be addressed in the follow-on MMRP research phase during the remainder of the two-year project. The potential cumulative impacts of the ATOC low frequency sound source (including merchant shipping and other vessel-related activities) are addressed in Sections 4.2, 4.3, 4.4, 4.5, and 4.6. Also see responses to Issues 6 and 7 above. The EIS includes cumulative impact analysis of the potential for loss or reduction of prey species (Sections 4.3.1.1.1, 4.3.1.2.1, 4.3.1.3.1, 4.3.2.1.1, 4.3.2.2.1, 4.3.2.3.1), and the potential affect of other activities, such as commercial fisheries (Section 4.3.2.2, and see responses to Issue 5 above), recreational water activities (Sections 4.3.1.1.2, 4.3.1.2.2, 4.3.1.3.2, 4.3.2.1.2, 4.3.2.2.2, 4.3.2.3.2), and commercial shipping (see above). General harassment is addressed through discussion of marine and near-shore construction and resort operations, aircraft operations, and research activities that could add cumulative noise stimuli to the marine environment (Sections 4.2, 4.3, 4.4, 4.5, and 4.6). Any attempt at quantifying potential cumulative impacts of the proposed Hawaii and California ATOC operations with a possible follow-on global ATOC project is speculative and infeasible at this time (see responses to Issue 2 comments above).

Comment: Discussion of these cumulative effects of oceanographic events such as El Niño should be included in some form within the final EIS. Describe and evaluate the potential cumulative impacts of increased low frequency noise pollution, when added to that generated currently by other known sources of acoustic research and/or military activities (e.g., GAMOT project, anti-submarine operations, etc.

Response: El Niño refers to changes in the distribution and depth of warm equatorial waters, ocean currents along the coasts of Chile and Peru, and changes in rainfall patterns from Australia to North America. It is correlated with changes in the atmospheric Southern Oscillation, which refers to a trans-Pacific relationship in atmospheric (barometric) pressure (Ramage, 1986). When the pressure is high over the Pacific Ocean, it tends to be low over the Indian Ocean, and vice versa. Because El Niño and the Southern Oscillation are both part of the same general phenomenon, they are now usually referred to by one name; ENSO. El Niño-Southern Oscillation (ENSO) is part of a complex interaction of ocean and atmosphere that affects a major portion of the planet. There is no known oceanographic, acoustic, or physical basis for linking ATOC low frequency sound transmissions to cumulate with pan-oceanic thermal discontinuities such as El Niño. ATOC's acoustic thermometry would be capable of detecting the temperature signature of El Niño events, and would most likely provide valuable new data on the phenomenon.

Sections 4.2, 4.3, 4.4, 4.5 and 4.6 describe and evaluate the potential cumulative impacts of increased low frequency noise pollution when added to acoustic research and/or military activities. There are no low frequency source operations currently underway, or planned, within the framework of the GAMOT project, that could possibly cumulate with the proposed ATOC acoustic source transmissions from Hawaii and/or California.

ISSUE 13: POTENTIAL FOR MASKING

a. POTENTIAL FOR MASKING ACOUSTIC SIGNATURE OF SEA TURTLE NATAL BEACH

Comment: I would think that masking the acoustic signature of a turtle's natal beach, to which it returns for nesting, could be very serious indeed!

Response: Lenhardt et al. (1983) stated that bone-conducted hearing appears to be a reception mechanism for marine turtles with the skull and shell acting as receiving surfaces, and that turtles are capable of receiving the low frequency spectrum of the natal beach, which may serve as one of the cues in nesting returns. As the DEIS stated, there is no documented evidence to this effect and, consequently, it must be considered speculative at this time. The concept of sound masking from human-made low frequency sounds (e.g., shipping traffic) in sea turtles has not been studied and the phenomenon, in fact, is difficult to apply to these animals. If sea turtles do use the reception of low frequency sounds from their natal beach, it is theorized they are using surf noise, which is somewhat higher in frequency than the ATOC source. Wilson et al. (1985) identifies the primary frequency band for surf noise as 100-700 Hz. This, coupled with the low duty cycle of the proposed source transmissions, and the lack of proximity of the proposed source site to known sea turtle nesting beaches, leads to the conclusion that the potential for masking the acoustic signature of a sea turtle's natal beach is minimal.

ISSUE 13: POTENTIAL FOR MASKING
b. POTENTIAL FOR MASKING ACOUSTIC SIGNALS IMPORTANT TO MYSTICETES

Comment: Sizable portions of the humpback whale song contain frequencies that fall within the range of the ATOC sound. In some sound playback studies directed toward humpback whales, responses to recordings of their own sounds were observed at distances of several kilometers and at sound intensity levels estimated to be only 100-110 dB. Whales listening to singers may be listening to rather low intensity levels if, as is typical, they are separated from the singer on the order of kilometers. The occurrence of the ATOC sound can thus mask the low frequency portions of the song, making it more difficult for the listening whale to detect, recognize, or judge the song. What impact that will have on vocal communication, or song convergence, on mate selection, cannot be assessed by any of the techniques proposed by the MMRP. Nor is there any ready way to implement such assessments. Hence, this problem is of great concern.

Response: The function of low frequency sounds produced by mysticetes is not clear, and it must be recognized that one potential function may be long-distance communication. Some elements of these communications might be masked during the ATOC transmissions. The EIS recognizes this, and points to present levels of human-produced sounds which mysticetes are presently exposed to and apparently coping with. The ATOC duty cycle would create a situation where masking could possibly influence some cetacean communications between 2% and 8% of the time (depending upon the duty cycle); however communications would not be expected to be totally eliminated. Vocalization rates of cetaceans measured acoustically (via the bottom-mounted HLA) before, during, and after duty cycling during the MMRP Pilot Study should provide information on the potential level of interference with mysticete communication due to masking.

ISSUE 14: PROCESSING OF EIS

a. INADEQUATE TIME FOR COMMENTS

Comment: The public must be offered adequate time and opportunity to review and comment on the ATOC program in its entirety; the agency has failed to provide this opportunity. From the beginning the ATOC office has been less than candid in informing the public about the nature of the project, and has gone to great lengths to keep opponents in the dark. The FEIS should be released more than 30 days after the close of the public comment period.

Response: Both NEPA and HEPA require only a 45 day public comment period on a DEIS; in this case the comment period was extended one third again as long as the minimum required. The number, degree, scope, and sophistication of the comments indicates that the public comment period was adequate. In particular, comments were received from a number of expert agencies, organizations and individuals with specialized and detailed knowledge in the field. Most commenters did not object to the length of the comment period. It is anticipated that most, if not all, of the additional comments that might have been made by the commenters requesting additional time were raised by others and responded to here. However, in the event that this assumption is incorrect, and although not required by NEPA, comments are solicited on the Final EIS for up to 30 days after notice of its availability in the Federal Register.

This Final EIS was released more than 30 days after the close of the public comment period.

ISSUE 14: PROCESSING OF EIS
b. SCOPING COMMENTS

Comment: Nowhere in the DEIS is there any response to the hundreds of public comments that were made at the scoping hearings on April, 1994 in Lihue and Honolulu. The response to public comments during the scoping period is woefully incomplete.

Response: Numerous comments from the public and from public interest groups were received during the scoping hearings. Pursuant to NEPA and HEPA requirements, these were aggregated into key issues and addressed in the development of the DEIS. The EIS has been prepared to respond to public concerns identified through both the federal and state public scoping processes, in addition to issues identified by the federal and state lead agencies.

Key scoping issues identified during the EIS development process include:

- Requirement for a programmatic EIS.
- Combining the Kauai and California sites in a single EIS.
- Consideration of alternatives, both locations and technological.
- Expansion of the treatment of biological resources to include, in addition to mammals, sea turtles, sea birds, fish, and invertebrates.
- Addressing the scientific uncertainty surrounding marine mammal response to low frequency sound.
- Justification of the MMRP, especially to determine if it is appropriately designed to resolve the scientific uncertainty.
- Articulation of standards of harm and delineation of source suspension criteria.
- Addressing adverse impacts on biological resources which could indirectly impact on tourism and fishing.
- Ensuring consistency with the Hawaii Ocean Resources Management Plan and the Hawaiian Islands Humpback Whale National Marine Sanctuary.

Each of these issues, as well as a large number of others, are explored in detail in the EIS. The level of critique concerning the MMRP resulted in a substantial modification of the ATOC/MMRP program, including a dedicated Pilot Study.

Section 1.4.3. contains the EIS overview of scoping issues and identifies specific locations in the document where each issue is treated in detail. In addition, Appendix D contains copies of the substantive scoping comments received, strictly complying with the prescribed NEPA and HEPA guidelines.

ISSUE 14: PROCESSING OF EIS

c. FEDERAL AND STATE CONSISTENCY ISSUES (INCLUDING WHALE RECOVERY PLANS)

Comment: The rationale given for Conservation District Use Authorization from DLNR (Section 5.2.2) states that the proposed project is consistent with several of the allowed uses, under Resources subzone of the Conservation District. However, the "monitoring, observing, and measuring natural resources" is under the MMRP and is not actually part of the ATOC program itself. And it is both subjective and highly debatable that "the ATOC program is an important government research project where anticipated benefits outweigh any impact on the conservation district." The DEIS erroneously concludes that the ATOC project would be consistent with other state and federal laws and with the Hawaiian Islands Humpback Whale National Marine Sanctuary and Humpback Whale Recovery Plan.

Response: "Monitoring, observing, and measuring natural resources" describes the acoustic thermometry activities as well as the MMRP. Monitoring, observation, and measurement of ocean temperatures on a large scale are the most basic of the project's purposes and activities. See discussion in Section 1.1.1. As noted, the MMRP also involves monitoring, observation, and measurement of natural resources. Only after this phase of the project shows that the ATOC sound source will not produce acute or short-term effects (Table C-1) on marine animals would actual ATOC feasibility operations commence. Given this confirmation process, the declaration that "the ATOC program is an important government research project where anticipated benefits outweigh any impact on the conservation district" is justified. See additional discussion, as well as discussion of new permitted use categories adopted by DLNR, in Section 5.2.2. The preparers affirm the content of Sections 5.4 and 5.5, which address the last two sentences of the above comment. See response to comment 4.a.

Comment: The DEIS maintains that ATOC is implementing Goal 1.3111 of the Humpback Whale Final Recovery Plan to "reduce noise disturbance in Hawaiian waters." There are plenty of other existing noise sources that can be studied without the addition of a new one.

Response: The Humpback Whale Recovery Plan does not prohibit research on the acoustic response of humpbacks using new sound sources. It is believed that the plan's authors recognize the potential impacts from low frequency sounds and the general need to reduce acoustic disturbances; however, they do not prohibit increases in noise, nor do they prohibit the types of research contemplated by this project. By adding to the much-needed knowledge base in this area, the MMRP could assist in the identification and development of sub-sea noise controls.

ISSUE 15: INSUFFICIENT KNOWLEDGE OF LFS EFFECTS ON MARINE MAMMALS

Comment: It is impossible to estimate the effects of high decibel, low frequency sound waves on marine mammals. The DEIS acknowledges that "available information on subsea noise and its biological impact ranges from incomplete to nonexistent," yet in the absence of this information, it repeatedly defaults to a conclusion of no expected significant impact, concluding that adverse behavioral impacts are expected to be minimal and less than significant. There is no adequate scientific basis set forth in the DEIS for these conclusions. The FEIS should describe the relevance of incomplete or unavailable information on the decision to proceed or not proceed with the proposed action. Given the lack of information on potential impacts, the FEIS should persuasively demonstrate that the tradeoff between potential impacts and information gained is justified.

Response: See response to comments in Issue 6.k. It is certainly true that data on the potential effects of low frequency sounds on marine mammals are scarce. But it is not accurate to state that such data are universally non-existent or that reasoned judgments based on available data on the potential effects of low frequency sound on marine mammals cannot be made. NEPA guidelines address this point (40 C.F.R. Sec. 1502.22), offering specific directions on how to proceed in the event there is incomplete or unavailable information. The EIS has followed these guidelines. It acknowledges the lack of information, links its relevance to the analysis, summarizes existing evidence and evaluates the impacts based on available information.

Moreover, the inability of project scientists to state unequivocally that there will be no or little impact (again based on scarce data) does not logically lead to the opposing presumption; i.e., that the impacts will be significant.

Available oceanographic and marine biological data provided in the EIS is taken from existing scientific literature. The EIS analyzes these data in arriving at its appraisals of the potential impacts of low frequency sound on marine animals. These analyses are based on the evidence supporting the hypothesis that impacts will be negligible and reflect the project scientists' understanding of the literature and their knowledge of ocean physics, acoustics, and marine mammal physiology. In response to MMC recommendations that the proposed criteria for judging possible non-negligible impacts on marine mammals should be brought forward from Appendix C to Section 4 of the document, the following has been added: "If the study results indicate that the sound transmissions are likely to have short-term-effects (Table C-1), they will be used to design a long-term monitoring program to verify that the operational ATOC project has negligible long-term effects. The following would be considered non-negligible long-term effects; 1) avoidance or abandonment of previous high-use areas, 2) increase in at-sea observations of dead animals or strandings of either live or dead animals in association with sound-caused hearing damage or other trauma, 3) increased incidence of emaciated animals and stress and associated disease, 4) decrease in calving/pupping rates and/or total population size."

In its report, *Low Frequency Sound and Marine Mammals: Current Knowledge and Research Needs*, the National Research Council's Ocean Studies Board strongly endorses expanded study and research on this subject. It specifically addresses the issue of acoustic oceanography as a valuable potential source of data on deep-diving marine mammals and prey. Other issues of concern to the OSB on which the MMRP is designed to collect data include measurements of received sound pressure levels, behavioral responses to human-made acoustic signals, and effects of sound on migration and other movement patterns of marine mammals.

Comment: The lack of information regarding the effects of noise on marine animals requires the agency to investigate this unknown, as it is both practicable and economically feasible to do so. NEPA requires agencies to satisfy certain detailed requirements when they confront incomplete or unavailable information. First the agencies must acknowledge that relevant scientific information is lacking. Second, they must obtain such information, with original research if necessary.

Response: Section 4.3 responds to this comment. The agencies have acknowledged that relevant scientific information is lacking. The proposed action would provide such information.

ISSUE 16: GENERAL

a. OBJECTIVITY AND NEUTRALITY OF EIS

Comment: The DEIS is not an objective and neutral evaluation of the proposed project but instead is impermissibly skewed in favor of the project to support a decision that already has been made. The DEIS reads more like a justification for the granting of permits for this project than an objective evaluation of the risks and alternatives to the proposed actions.

Response: An extensive review of available literature and other information sources, including consultations with numerous experts in the field, as well as initial baseline research around Kauai, was undertaken in conjunction with the preparation of the EIS. The potential environmental effects of the project and substantive comments concerning those potential impacts have been fully considered (see Issue 6 comments and responses above). In response to public comments, text changes in the FEIS reflect the preparers adherence to the requirement for an objective and neutral evaluation of the proposed project, including the potential risks and alternatives to the proposed action.

ISSUE 16: GENERAL
b. NULL HYPOTHESIS DERIVATION

Comment: The MMRP should adopt a null hypothesis that assumes there is an adverse effect, and then should be required to disprove this, rather than the other way around.

Response: Selection of the simplest, or minimal, assumption (which is that there would be no adverse effect from exposure to the ATOC acoustic sound) is an appropriate scientific technique, starting with a hypothesis that is often referred to as the *null hypothesis* (H_o) (Chapman and Schaufele, 1970). Chapman and Schaufele discuss the basic philosophy underlying this type of testing, outlined as follows. In most practical problems, a claim is made that a product is better or a procedure will have a particular outcome. Following the argument that such claimants be required to furnish statistical proof before we believe them, we set up the null hypothesis that the product is not better or, in this case, that the procedure (ATOC source transmissions) will not have the particular outcome (adverse effects on marine animals). To reject this null hypothesis would amount to acceptance of the claim that these low frequency sounds would adversely affect marine species. The emphasis is on rejecting H_0 and tests are normally chosen so that we will not reject H_0 unless the evidence is very strong.

ISSUE 17: ATOC/MMRP RELATIONSHIP

Comment: The MMRP is officially recognized as being associated with ATOC and is funded by ATOC (so) that the results of its research may bolster the argument that ATOC will not exert significant impact on marine mammals. The MMRP objective is stated before the ATOC objective, giving the impression that marine mammal studies are the driving force behind the ATOC program. The information produced by a properly constructed MMRP must be used to inform decision makers regarding the ATOC proposal. Who would make the decision that ATOC transmissions should stop if the MMRP demonstrates adverse impacts, and how precisely would that decision be made?

Response: At the time of its initial funding and startup, the ATOC project included a Marine Mammal Research Program. The linkage between these aspects of the overall effort has been openly recognized throughout and led to the filing of scientific research permit (SRP) applications over a year ago. It is not inappropriate that these two efforts proceed jointly, as the combined efforts of ATOC and the MMRP offer long-term (1+yrs) access to technology, and a demonstrated scientific methodology to measure the effects of sound, sound levels, and sound travel times--critical factors in achieving the scientific objectives of both programs.

The discussion here is whether each of these projects should proceed independently and sequentially. By restructuring its original proposal, the ATOC effort takes a sequenced approach. The revised MMRP protocol (Appendix C), developed as a key mitigation measure in response to public debate, requires a six-month, independently managed MMRP prior to commencing any ATOC feasibility operations. Criteria for reacting to marine mammal and sea turtle responses, including termination criteria if adverse effects are noted, have been developed and clearly presented. If ATOC feasibility operations transmissions are allowed to start, both ATOC and the MMRP would proceed jointly for the remainder of the project. During this phase, the MMRP would continue to collect and provide information on marine mammals, as well as serve a protective function by continuing to monitor for any adverse impacts of the source transmissions. Plans also include audiometric measurements on captive cetaceans and one or more acoustic playback experiments.

As the EIS states, the goals of the ATOC project are to make a contribution toward more meaningful climate predictions, and demonstrate the feasibility of the acoustic thermometry technique for future global ocean climate monitoring programs. The objectives of the MMRP are to evaluate potential effects of low frequency sound on marine animals, particularly marine mammals and sea turtles. The overall scientific research permit application has a built-in condition; i.e., that ATOC feasibility operations would not commence if the system is determined by the Pilot Study to have acute or short-term effects (Table C-1) on marine animals, particularly marine mammals and sea turtles. Details regarding implementation of the shut down criteria are set forth in Appendix C.

ISSUE 18: SOCIAL ENVIRONMENT

a. DIVER ISSUES

Comment: The dive tables that we as divers use to calculate our available bottom time will be affected by ATOC transmissions.

Response: The official U.S. Navy Dive Manual does not list any corrections to dive decompression requirements based on exposure to underwater sound. The increased intrathoracic pressure, as discussed in the EIS, refers to the resonant enhancement of the sound pressure wave as it passes through the intrathoracic cavity of a fully submerged mammalian body, such as a human swimmer or diver. As a sound wave passage is composed of compression and relaxation of the medium though which it passes, the intrathoracic pressure increase is quickly followed by a similar pressure decrease, then a return to the "before sound wave" ambient pressure. Therefore, there is no net affect on the pressure a diver experiences, nor on "bottom time" determinants such as nitrogen, or other gas absorption rates, or tissue saturation. Consequently, "bottom time" limits and associated decompression requirements (due to blood gas saturation for example) will not be affected by the ATOC sound source.

Reference: U.S. Navy Dive Manual, 15 February 1993, sections 2 and 7.

Comment: There appears to be a very high state of interest from divers as to whether they will be able to hear/feel the ATOC transmissions.

Response: The EIS provides sound fields that are based on the predicted propagation of the sound source's energy. The source itself will be located 14.7 km out to sea at a depth beyond recreational diving (850 m) As part of the mitigation procedures, the output level and received levels of the ATOC source will be monitored. Additionally, the sound source signal will be slowly increased before each transmission to allow humans and animals to depart the area if they are annoyed. It is expected the source may be able to be heard by human divers underwater at distances up to approximately 30 km. However, at 2% duty cycle (for all except 2 months of the project), the source would transmit for 20 min every 4 hrs for a day (24 hr period), and then be silent for three days (72 hr period). This provides an off-duty quiet time of 98%. Although unexpected, the report of any verifiable observation of adverse effects on human divers will be immediately investigated, and if any significant adverse effects are attributable to the source, shut-down procedures would be implemented.

Comment: The effects of vibrating lungs would be very invasive and definitely annoying to all the species that will be subjected to this experiment.

Response: Physical vibration of the lungs is an effect that is highly dependent on matching a resonant frequency of the cavity in a very high level sound field (i.e., very close to the source). The sound field radius for which this phenomenon could possibly occur is believed to be inside the zones that could affect hearing and are thereby covered in the EIS. Further, as the EIS states, at (or near) the surface, 20 Hz appears to be the critical frequency for potential intrathoracic resonance; at 30 m depth, 40 Hz; at 50 m depth 50 Hz. Given these data, and the fact that the ATOC source energy is spread across a 35 Hz bandwidth (not concentrated in a narrowband tone, as experimental data [referenced in the EIS] were), it is reasonable to conclude that the potential for ATOC source transmissions causing resonance in any diver air-containing cavity is negligible.

Comment: The ATOC EIS is devoid of hard data concerning the effects of SOFAR transmissions on sea life (including human divers).

Response: The fact that the Sound Fixing and Ranging (SOFAR) channel is a very good sound guide and that ATOC transmission effectiveness is based on the relative position of the ATOC source to the SOFAR channel has been considered in calculating the sound fields around the ATOC source. The lack of hard data on the potential effects of SOFAR acoustic transmissions on marine animals and humans is recognized--the MMRP proposed would help reduce this data shortfall.

Comment: ATOC noise will be impossible to avoid unless you decide not to dive during transmission times. Not a pleasant thought, to say the least, and possibly a violation of divers rights.

Response: The ATOC source transmissions may well be audible to human divers for 30 km around the source site. However, the effect of hearing the sound at the levels expected (where human divers could be expected to be located) is highly subjective and dependent upon an individual's underwater hearing sensitivity.

Comment: A more fair comparison of the noise of a whale-watching boat compared to the sounds expected near the shore from the ATOC transducer would be to locate the whale-watching boat at the same distance from the receivers as the ATOC source vice showing it directly overhead, as presented by Prof. Jim Miller at the Santa Cruz Public Hearing of January 6, 1995.

Response: The comparison presented by Prof. Miller at the Santa Cruz public hearing was to discuss the sound heard at near-shore diving locations, not to directly compare the output of the ATOC source to a whale-watching boat. The ATOC source was clearly stated to be a more powerful source. Its positioning, offshore and near the SOFAR channel, was also explained to have been done to achieve the required transoceanic transmission distance with the smallest source possible. This location also minimizes effects in the near-shore areas, where marine life is more concentrated.

ISSUE 18: SOCIAL ENVIRONMENT
b. ECONOMIC IMPACT (COMMERCIAL, RECREATIONAL, AND SUBSISTENCE FISHING)

Comment: The MMRP should monitor fish stock assessments to assess whether ATOC is reducing fish stocks. The data on fish seem to be a real cause for concern. Just because a few of the most acoustically sensitive species that are known do not occur in the study area, does not mean there aren't species in the study area that are similarly sensitive -- only audiograms from a few species have been done.

Response: Section 4.3.2.2 provides detailed discussion of all pertinent available data on the potential for impact of low frequency sound on fish species, and relates this information to the known species that would be expected in the study area. The MMRP includes the mitigation measure of attempting to evaluate the potential for increased predation on fish, and the potential for impacts to the behavior of fish or invertebrates, relative to ATOC source transmissions, by monitoring fish stock assessments. It is recognized that the time lag for these data is measured in months, if not years. All aerial, vessel and shore survey/observation efforts would document any unexpected or peculiar activities (examples of these unexpected events could include large numbers of fish seen dead or disabled). Further, data would be compiled via Western Pacific Regional Fishery Management Council catch-block landing data; Long-Term Potential Yield (LTPY), Current Potential Yield (CPY), and recent Average Yield (RAY) data from NMFS; and interaction with the Kauai Community Advisory Group (CAG) and local fishermen to ascertain first-hand if their catches in the vicinity of the source site have increased, remained the same, or decreased. These efforts would be concentrated at the outset of the MMRP, such that any necessary adjustments could be made as early in the program as possible.

There has been no documented evidence in the oceanic environment of low frequency sound transmissions disrupting the fertilization of spawning fish, or causing premature release of their larvae. As noted in the EIS (Section 4.3.2.2.1), under laboratory controlled test conditions in an aquarium, the viability of the eggs of one species of estuarine carp (Cyprinodon variegatus) was significantly reduced when a low frequency noise source (40-1000 Hz) at 105-120 dB, which was approximately 40-50 dB above ambient noise conditions, was maintained over a number of consecutive days. Although at first it appears that this lab test might be relatable to ATOC source transmissions, it must be noted that there are significant differences between the laboratory test protocols and ATOC acoustic parameters: 1) the test fish were river carp, not found off the north shore of Kauai, or along the proposed cable route, 2) the test was conducted in a tank, thus offering the fish no means of eluding the sound stimulus, whereas the ATOC source is in an unconfined area so that species may depart the area if they so choose, and 3) the tank test source was transmitting over a number of consecutive days, whereas the ATOC source would be transmitting for the most part 2% of the time (intermittent every fourth day).

Comment: The proposed project will have significant potential impact on the Native Hawaiian population on the north shore of Kauai. These long-time residents of Kauai practice subsistence fishing in the waters surrounding Kauai. According to DLNR, the annual catch by Kauai fishermen in the area encompassing the intended ATOC sound source was 37,500 pounds in 1993. This group also qualifies as a low-income population. Because of the significance of this source of food, the DLNR placed a fish aggregating device (FAD) in this area to enhance the fishing potential, which further substantiates the significance of the need of this food source for Native Hawaiians.

Response: The preparers affirm the Section 4.3.2.2 discussions and findings that the potential for direct or indirect effects on the fish population off the north shore of Kauai is uncertain, but presumed low, provided assumptions are correct. The potential for auditory injury or deafness for any species of fish in the area is anticipated to be negligible. The potential for interaction between the ATOC source and the FAD is addressed in the EIS (Section 5.2.1), as is the issue of Environmental Justice in Minority Populations and Low-Income Populations (section 6.6). See also response to Issue 20.

ISSUE 19: FACILITY CONSTRUCTION AND REMOVAL

Comment: It is our understanding that cables have already been laid to the preferred site locations in both Hawaii and California. If this is true, then any discussion of alternative locations in the DEIS would appear to be nothing more than lip service. It is our understanding that ATOC issued an Environmental Assessment for their Acoustic Engineering Test off the west coast of the U.S. only days before beginning the actual experiment. There does not seem to have been reasonable opportunity for the public to scrutinize and provide input on this portion of the project.

Response: Section 1.1.6 describes the source power/monitoring cable and its installation relative to the proposed Kauai ATOC and MMRP activities. The Final EIS/EIR for the proposed California ATOC and MMRP activities, incorporated by reference in this EIS, describes the source cable and its installation for the proposed Pioneer Seamount site. As all the deployed equipment in both proposed sites is planned to be removed, the fact that some cable was laid in each region (on an opportunistic basis that provided cost savings to the government) prior to receipt of scientific research permits, does not obviate the selection of alternative sites. The California project bears this out, since the preferred site at Sur Ridge has, in fact, been eliminated with the new proposed site being that at Pioneer Seamount. Discussion of biological values and water quality considerations along the KAUAI cable route is contained in a letter dated December 7, 1994, from Andrew Forbes, Scripps, to Dennis Lau, Hawaii Department of Health, Appendix D.

Section 1.1.7 describes the AET, which was conducted at a remote location in the middle of the ocean, 550 km southwest of San Diego, 3400 km northeast of Hawaii, in November, 1994. All NEPA requirements were met pursuant to the development of an Environmental Assessment and the finding of no significant impact. Following incorporation of mitigation measures suggested by NMFS into the research protocols of the test, NMFS had no objections to ARPA's finding of no significant impact.

Comment: Describe the current plan for removal of ATOC facilities, including schedule and factors which might impact the removal. How does the removal of the ATOC facilities mitigate the impacts of installation? What constitutes "economically and practically feasible?"

Response: The physical installation of the cabled source is judged to be generally benign to the marine environment. Any physical alteration of the sea floor would be minor. The ATOC facilities have been designed with recovery in mind. The VLAs are moored with an acoustic release which, when activated, separates the array from its anchor (approximately 1724 kg) of iron railroad wheels, allowing the array to rise to the surface for recovery. The iron left on the bottom will eventually decompose through oxidation. The acoustic source would be deployed with a recovery line attached to a float with an acoustic release. Once released, the float takes the line to the surface, where it is recovered, attached to a winch and used to haul up the source. Both the VLA and the source have small "footprints" on the bottom, so removal of these units would have minimal impact on the seafloor, and would basically reverse the negligible effect of their installation.

major undertaking, mainly due to the fact that over time the cable would tend to bury itself in the soft bottom of the seafloor, and where not buried would have become encrusted by marine organisms. The cable is a benign system and would have virtually no impact if left unrecovered. However any effects of laying a cable on the seafloor in terms of breeding site alteration, or bottom habitat changes would be short-lived and the removal of the source cable and the return of the seafloor to its natural state would offset any short-term effects.

Every attempt would be made to remove the cable and the acoustic source from the seafloor. Nevertheless, there are some factors that could make removal "economically and practically infeasible." These might include loss of the source itself, extended unfavorable weather and sea conditions, or unexpected sharp increase in removal costs. The latter could result from increases in ship leasing costs; expanded costs for offloading and dry (on land) storage of the cable, or could result from expenditure of project funds for emergency or higher priority activities. Finally, removal of the ATOC equipment might be forestalled by the takeover of the system by another approved project or a follow-on experimental program.

ISSUE 20 CULTURAL/RELIGIOUS (HAWAII)

Comments: The issue of native Hawaiian's rights (specifically subsistence fishing in the waters around the ATOC sound source) is being brushed aside which violates an executive Order that Federal actions address environmental justice in minority populations.

Response: Consideration has been given to this issue. Because of the location and nature of the proposed acoustic thermometry and MMRP activities, based on the available information on the potential effect of low frequency sound on fish, and the mitigation measures incorporated into the project, it is concluded that the project would not interfere with native Hawaiian fishing rights. See Sections 3.3.3, 4.3.2.2 and 4.4. The Executive Order on environmental justice is addressed in section 6.6. See also Issue 18.

Comment: The FEIS should describe the Hawaiian Culture interest and provide information on measures taken by ARPA and NOAA to fully analyze the environmental effects on minority communities and present opportunities for affected communities to provide input into the NEPA process.

Response: See Sections 3.4.6, 4.2, 4.3, 4.4, 4.5, 4.6, and 6.6. Opportunities for minority communities to provide input on the potential for ATOC and/or MMRP activities affecting their communities have been available continually via both the NEPA and CEQA/HEPA EIS process. This opportunity will continue via the Kauai CAG.

ISSUE 21: INCIDENTAL TAKE VS. SRP

Comment: ATOC is not "scientific research on marine mammals" as defined in the MMPA and ESA, but rather a study on global climate changes; therefore, under the MMPA, this project should be permitted, if at all, under the incidental take permit requirements.

Response: In 1993, Scripps was informed by NMFS, Office of Protected Resources that a SRP, rather than an incidental take authorization, or application of a general authorization, would be the preferred permitting approach. This choice was guided, in part, by NMFS's concern that available information was insufficient to make the findings necessary (e.g., potential species/numbers that could potentially be harassed by the proposed sound transmissions) to issue an incidental harassment authorization, and that additional scientific research to evaluate the potential impacts of low frequency source transmissions on marine mammals was needed.

Benjamin J. Cayetano
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

HERMAN M. AIZAWA, Ph.D.
SUPERINTENDENT

OFFICE OF THE SUPERINTENDENT

February 7, 1995

Mr. Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA 22202

Dear Mr. Spikes:

SUBJECT: Draft Environmental Impact Statement
Kauai Acoustic Thermometry of Ocean Climate Project
Marine Mammal Research Program

We have reviewed the subject project and have no comment on the proposed study to measure long-term ocean climate changes and the potential effects of low frequency sound on marine animals.

Thank you for the opportunity to comment.

Sincerely,

Herman M. Aizawa, Ph.D.
Superintendent

HMA:jnl

cc: A. Suga

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

Pg1

Advanced Research Project Agency
Marine Acoustics Inc.
2345 Crystal Drive
Arlington, Virginia 22202

RECEIVED 3-8-95

To Clayton H. Spikes

I am wrighting to express my opposition to the ATOC project. The Draft Environmental Impact Statement (DEIS) fails to address the issues of alternatives and negetes potential impacts. In addition, the many concerns of the public expressed in prossed in previous hearings and in writing have not been met, including: native Hawaiian's rights, the segmentation of the EIS process, and ATOC's military applications

2.4 The issue of native Hawaiian's rights (specifically subsistance fishing in the water around the ATOC s sound sorce) is being brushed aside, which violates an order that Federal actions address 20 environmental justice in minority populations On page 103, section 4 the DEIS states that "there is insufficient information to determine whether any adverse long 2-1 term impacts to fish could result from low-frequency sound, thus, the potential (1)2a for this impact is uncertain."

The DEIS fails to discuss the obvious connection to the Monterey Bay ATOC feasibility project and the cumulative impacts of both the Hawaii and California ATOC 2-2 projects. NEPA requires that "proposals which are related to each other shall be 2 evaluated in a single impact statement. The proponents of ATOC have intentionally segmented the entire ATOC project into two separate projects (Hawaii and California)

Cont.

Finally, the DEIS does not adequately reveal the possible military applications of ATOC, nor does it fully and honestly 2-3 disclose the involvement of the DOD. 1 It is clear that the true intentions of ATOC have not been revealed to the public and further analysis must occur before this project is allowed to proceed.

Sincerely yours,

Alicia L. Alfonso

Alicia L. Alfonso
1122 Cole Street
San Francisco, CA 94117

MARINE MAMMAL RESEARCH PROGRAM
HAWAII INSTITUTE OF MARINE BIOLOGY
UNIVERSITY OF HAWAII
P.O. BOX 1106
KAILUA, HI 96734

(808) 247-5026
FAX: (808) 247-5831
email: au@humu.nosc.mil

RECEIVED 2-15-95

Feb. 7, 1995

Mr. Clayton H. Spikes
ARPA Contractor Representative
Marine Acoustics, Inc.
4 Crystal Park, Suite 901
Arlington, VA 22202

Dear Mr. Spikes:

I am writhing in support of the ATOC program, especially the initial phase involving bioacoustics experiments to determine the effects of the ATOC sounds on marine mammals. I would like to outline clearly the reasons for my support of the program.

1. One of my major concerns has been that people unfamiliar with underwater acoustics and marine mammal hearing have jumped into the fray. Decibels in underwater acoustics is not the same as decibels in airborne acoustics because of differences in references and also differences in the media, water being much denser than air. Therefore an underwater acoustic pressure level will have about 1/72,120 the intensity or acoustic power of an air-borne acoustic pressure in air, with the air-borne acoustic pressure being described in the standard manner for air-borne sounds.

2. From the physics of underwater acoustics with the ATOC source at a depth of 800 m or 2,625 feet and a source level of 194 dB re 1 µPa, some conservative estimates on the levels of the ATOC sound can be made. For a whale swimming at the depth of 100 ft directly over the source the acoustic pressure will be less than 136 decibels. If the whale is 1 mile from the source at 100 ft, the pressure will be 130 decibels. At two miles from the source at 100 ft, the pressure will be 124 decibels. Dolphins and small whales swimming at a depth of 100 ft above the source will bearly hear the ATOC sound, and will probably not hear the source if they are over 1/2 mile away. Even if a dolphin or small whale dove to a depth of 1000 ft, it would not hear the ATOC source if it was over 1 horizontal mile from the location of the source.

3. Available evidence seems to indicate that humpback whales congregate in the near-shore waters around the Hawaiian Islands over depths of less than 100 fathoms (600 feet) during their wintering activity. Therefore, there is no reasonable possibility that they would actually dive to such depths in the vicinity of the source. At a depth of 600 feet, the ATOC sound directly above the source will have a sound pressure level of about 138 dB, hardly enough acoustic pressure to be concerned with. This level would only be about 5 to 10 dB above the hearing threshold of dolphins and small whales. Sounds must be about 70-75 dB above the hearing threshold to cause mild temporary hearing threshold shift in humans.

4. Since we do not know how well large whales can hear, it is impossible to know what potentially harmful levels might be. However, we do know that a 70 hp outboard motorboat traveling at moderate speeds will produce at a range of 100 yards, louder low frequency sounds (100 Hz) than the ATOC sound would at a depth of 100 ft directly above the ATOC source. Furthermore, humpback whales themselves typically produce sounds of 154-160 decibels and as high as 184 decibels, and these levels are much higher than what would be received directly above the ATOC source at 100 feet. A companion humpback whale 10 yards from one singing at 160 decibels, will receive at the surface a much louder sound than the ATOC sound. It would need to dive to a depth of about

930 feet before the ATOC sound would be as loud as the received sound it heard from the singing whale. This is a much deeper than the typical dive pattern of Hawaiian humpback whales.

5. The effects of ship noise on whales are often not considered. Cruise ships and cargo carrying ships also produce sounds that can be much louder than the ATOC sound over a much larger frequency band. For example, a cruise ship will produce at 75 Hz (frequency of the ATOC sound) a sound level of about 170 decibels. At 100 feet away, the ship sound will be about 140 dB which is slightly higher than the ATOC for a whale swimming at 100 ft depth directly above the ATOC source. The effects of supertankers would be more severe since they are much louder than cruise ships.

In summary, it seems unlikely that humpback whales will be affected by the ATOC source, but in order to be sure, there is already in place a detailed plan to study the behavior of not only the humpback whale, but also of other marine species in the vicinity of the ATOC source. This behavioral assessment is being directed by a marine-mammal scientist with impeccable credentials and substantial expertise in marine mammal behavior and bioacoustics. On the basis of announcements from the ATOC program and from the marine mammal researchers involved in monitoring the experiment, I understand that the plans for sound production have been scaled back and that extremely effective experimental designs have been put in place to evaluate the effects of the sound source.

I understand that the Hawaiian Islands represent a very important endangered species sanctuary for the humpback whale. I am concerned about them, but I am also concerned about the other species on our planet, including you and me. I believe that the ATOC experiment is important for determining if global warming exists and what its rate may be. I don't know of any other technique that can determine this answer as quickly and accurately as the ATOC experiment. If the experiment can be conducted without harming the humpback and other whales, it is certainly worth pursuing. I also believe that the ATOC test can be conducted without harm to humpback whales and other marine mammals, and that scientifically reasonable precautions and comprehensive monitoring techniques are in place to evaluate the effect of the ATOC experiment on marine mammals.

Sincerely,

Whitlow W. L. Au

Whitlow W. L. Au, PhD
Chief Scientist

cc: Mr. Roy Schaefer
Mr. Eugene Nitta

RECEIVED 2-21-95

February 12, 1995

Advanced Research Project Agency
c/o Clayton H. Spikes
Marine Acoustics Inc.
4 Crystal Park, Suite 901
Arlington, VA 22202

Re: ATOC: Acoustic Thermometry of Ocean Climate

Please note my disapproval of this plan. It cannot help but be disruptive to marine life. Although we know little about the communication among various sea creatures, we have learned that their "songs" are very important to many species. It is inconceivable therefore that sounds loud enough to travel so many miles will not affect them.

I do not believe that the same scientists who want to pursue this experiment are in an appropriate position to be making the studies of the potential for damage to the environment.

1 Please find some less intrusive way to measure the warming trends of the oceans. I am sure there are other ways, possibly even less expensive. The potential damage to our marine life is just not worth the risk. 5a

Sincerely,

Jon R. Backstrom
549 West Dr.
Felton, CA 95018

RECEIVED 3/13/95

KAUAI FRIENDS OF THE ENVIRONMENT
P.O. Box 1183
Hanalei, HI 96714

Beau Blair, Co-chair
808-826-7038
Fax 826-6750

Ray Chuan, Co-chair
808-826-6814
Fax 826-1115

Advanced Research Projects Agency/
National Marine Fisheries Service
C/O Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA. 22202

March 6, 1995

Mr. Spikes,

In light of the failure of NMFS and ATOC to address any of our previous comments in the DEIS, I feel it necessary to submit these comments in writing. I as a public citizen and we as a citizen group heartily expect these comments to be fully addressed in your final EIS, along with the only prdent and fair finding of SIGNIFICANT IMPACT. The only fair and sound conclusion to the ATOC project should be that of NO ACTION.

Sincerely,

Beau Barthel-Blair
co-chair Kauai Friends of the Environment

KAUAI FRIENDS OF THE ENVIRONMENT
P.O. Box 1183
Hanalei, HI 96714

Beau Blair, Co-chair
808-826-7038
Fax 826-6750

Ray Chuan, Co-chair
808-826-6814
Fax 826-1115

February. 9, 1995

FAILURE OF ATOC AND THE DEIS TO RESPOND TO THE PUBLIC COMMENTS AND CONCERNS

I would like to take this very precious opportunity to thank all of the cooperating agencies who have so graciously allowed us to speak our piece this evening. I am not filled with confidence that they will bother to listen to us tonight when they have not found it necessary to do so yet, and so I question the interest of ARPA,NMFS,and SCRIPPS INST. in receiving informed public comments on ATOC and the DEIS.

1 The ATOC DEIS is a document that has been prepared at a great cost, in time and man hours, as well as financially. NOWHERE in the DEIS is there any response to the hundreds of public comments that were made at the scoping hearings in April,1994 in Lihue and in Honolulu. 14b

Repeatedly the concerned citizens of Kauai and the Hawaiian Islands stated their grave and valid questions as to the importance of substantiation regarding the effects or lack of effects of the ATOC sound source on the multitudes of sea flora and fauna, as well as those regarding the human population.
2 Where in the DEIS are there any valid responses to our questions? 15

The validity of this DEIS is questionable for many reasons, but of paramount concern to me is that it is blatantly a work of advocacy for a decision that has already been made to proceed with ATOC and the MMRP

Over and over the DEIS states "As stressed in this EIS, available information on subsea noise and its biological impact ranges from incomplete to nonexistent, depending on the species considered." (vol.1,4-6)
Each of the species examined for the benefit of the EIS had the same overall finding of 'no impact' whether there was a finding of impact or not.
Each time there was found to be an impact, it was "sluffed off" as being minimal or of no consequence.

I am offended by the bias projected forth in the DEIS in the assumptions that the ATOC sound transmissions simply will not adversely impact marine wildlife.
The collected data to substantiate these findings are so inadequate that even as a scientific layperson, I have to balk at the very minimal energies that were used to arrive at the 'fixed' conclusions.
This project has continually come up with findings of "NO IMPACT" at each juncture. This is a clear indication to anyone concerned that there was never any intention of a fair or un-biased finding to the contrary.

This 'document' leaves us with more questions unanswered now than before it was published.

For approximately 500 or so wasted pages of fluff, this DEIS challenges any of those of us who have bothered to take the time to look at the endless inconsistencies and compilations of useless disclaimers. We have not been taken seriously for our interest or our input. We have been asked to participate in a process that is an insult and a sham.
3 The burden of the EIS should be on the project proponents to prove that there will be no adverse impacts 16a
before being allowed to proceed, instead of assuming no or minimal impacts until observations prove the existence of impacts.
Unfortunately for ARPA, NMFS, and SCRIPPS INST., they will have to deal with us watching them at every step of this process until they take their responsibilities to our planet and all of its inhabitants seriously.

David Beebe
745 30th st #3
Boulder Co 80302

Advanced Research Project Agency
Marine Acoustics, Inc
2345 Crystal Drive
Arlington, Virginia 22202

To Clayton H. Spikes,

I am writing to express my opposition to the ATOC
1 project. The DEIS will adversely impact the marine life and 6c
the "research benefits" are uncertain. I will hope that the ATOC will not proceed without further analysis.

Thanks

David Beebe

RECEIVED 3-7-95

1225 18th Ave #1
Sunset
CA 94122-1851
7th March '95

Advanced Research Project Agency
Marine Acoustics Inc.
2345 Crystal Drive,
Arlington, Virginia 22202.

To Clayton H. Spikes.

I am writing to express my opposition to the ATOC project. The Draft Environmental Impact Statement (DEIS) fails to address the issues of alternatives and negative potential impacts. In addition, the many concerns of the public expressed in previous hearings and in writing have not been met, including: native Hawaiian's rights, the segmentation of the EIS process, and ATOC's military applications.

1 The issue of native Hawaiian's rights (specifically subsistence fishing in the water around the ATOC sound source) is being brushed aside, which violates an order that Federal actions address environmental justice in minority populations. On page 103, section 4 the DEIS states that "there is insufficient information to determine whether any adverse long term implications to fish could result from low-frequency sound thus, the potential for this impact is uncertain. 12a

The DEIS fails to discuss the obvious connection
2 to the Monterey Bay ATOC feasibility project and 2
the cumulative impacts of both the Hawaii and

California

Finally the DEIS does not adequately reveal the possible military applications of ATOC, nor does it fully and honestly disclose the involvement of the DOD. It is
3 clear that the true intentions of ATOC have not been revealed to the public and further analysis must occur 1
before this project is allowed to proceed.

I would appreciate a reply to this letter and answers to all the points that I have raised.

Yours Sincerely,

Vill Börneman

RECEIVED 3-6-95

Box 230946
Encinitas, CA 92023
February 22, 1995

Mr. Clayton H. Spikes
ARPA Contractor Representative
Marine Acoustics, Inc.
4 Crystal Park, Suite 901
Arlington, VA 22202

Re: ATOC

Dear Mr. Spikes:

I am writing to express my concerns about the ATOC experiments. I have done a fair amount of research into the theory and methodology of ATOC and am left with these considerations:

1 1. The link between Scripps Institute of Oceanography and the U.S. Navy in regard to marine mammal experiments is irrefutable and suspect, in spite of Dr. Walter Munk's public denials. 1

2 2. Physicist Dr. Norman Seaton has published significant data to indicate that the ATOC premise is flawed- that the technology is invalid and no baseline data exists to support it. 3d

3 3. More accurate and less risky methods already exist to measure global warming trends and to collect data: the simplest may be simple rainfall collection measurements. 5a

4. Unexplained mass strandings and beaching of marine mammals has been linked temporally to the beginnings of ATOC experimentation.

4 5. Even if ATOC studies demonstrated conclusive evidence of global warming, governments across the planet have no plans to address the matter in a serious way. There will be no remedy. 3b

5 6. Dr. Munk admitted in a public hearing that the location of the ATOC receivers and transmitters was based on expediency, "because we live here", rather than on science. The existing Navy equipment also dictated the location of the experiment. 4a

6 7. It is safe to say that NO-ONE is confident in predicting the level of possible harm to marine life from ATOC experimentation. Since Scripps and Munk readily admit that the entire project is "experimental", the risks to marine life seem to far outweigh the potential benefits when other, safer methods already exist. In short, there is no compelling reason to conduct these studies. 6a

Sincerely,

Jane Cartmill

Jane Cartmill
cc: Roy Schaefer
Dept. of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

RECEIVED 2-17-95

February 12, 1995

Advanced Research Project Agency
c/o Clayton H. Spikes
Marine Acoustics Inc.
4 Crystal Park, Suite 901
Arlington, VA 22202

Re: ATOC: Acoustic Thermometry of Ocean Climate

Please reconsider this plan! There is no way that it will not be disruptive to marine life. Although we know little about the communications among various sea creatures, we have learned that "singing" is very important to many species. It is inconceivable therefore that sounds loud enough to travel many miles will not affect them.

I am incredulous that the scientists who want to pursue this experiment are the same ones making the studies of the potential for damage to the environment. They cannot help but be biased.

1 Please find some less intrusive way to measure the warming trends of the oceans. I am sure there are other ways, possibly even less expensive. The potential damage to our marine life is just not worth the risk. 5a

Sincerely,

Sidney Chapman

Sidney Chapman
549 West Dr.
Felton, CA 95018

H-10

Advanced Research Project Agency
Marine Acoustics Inc.
2345 Crystal Drive
Arlington, Virginia 22202

Att: Clayton H. Spikes:

I want to say that I am opposed to the ATOC experiments. It seems like common sence would be enough to put an end to testing with low frequency, High decible sound at deep Ocean depths. Marine Mammals exist & Hear ultra sounds, I can't believe there test can 15 go on without considering the impact on The sea mammal population.

These experiments Aren't neccesary to prove Global warming. We know That the fossel fuels we all use deplete our ozone. 3a

I feel there is something fishy About this all being Funded by DOD it seems like something should be done To prevent the warming. I relly hope These test will be postponed for a ~~more thorough~~ longer public comment period. 1

SINCERELY,

Mike D'Angelo
601 Canyon Blvd.
Boulder, Colorado
80302

H-11

Marine Acoustics.

I AM WRITING IN REGARDS TO THE (ATOC) PROPOSED PROJECT OFF THE ISLAND OF KAUAI. RECENTLY I ATTENDED THE FEBRUARY MEETING ON KAUAI TO COMMENT ON THE (EIS). PUBLIC INPUT WAS UNANIMOUSLY AGAINST THE PROJECT. THE BOTTOM LINE IS THAT THE PROJECT IS NOT
1 NEEDED, CAN CAUSE MUCH MORE HARM 3a THAN GOOD. AND IS A WASTE OF OUR TAX DOLLARS. PLEASE PUT DOWN THAT MY FAMILY & I ARE AGAINST THE PROJECT.

A MAJOR LAW SUIT MAY COME ABOUT AGAINST MARINE ACOUSTICS AND THOSE INVOLVED IF THE PROJECT IS IMPLEMENTED, AGAINST THE WISHES OF THE PEOPLE OF KAUAI.

SINCERELY

Steve Davis
& Family

STEVE C DAVIS
POB 1907
LIHUE HI 96766-5907

RECEIVED 2-27-95

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

Febrary 13, 1995

Clayton H. Spikes
Advanced Research Projects Agency/
National Marine Fisheries Service
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, Virginia 22202

Dear Mr. Spikes:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the project entitled Kauai Acoustic Thermometry of Ocean Climate Project (ATOC), Kauai, HI. Our review is provided pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

The ATOC is proposed as a two year proof-of-concept study funded by the Strategic Environmental Research and Development Program (SERDP) to measure long-term ocean climate changes using acoustic sound paths in the deep sea as means of precise synoptic temperature data collection. If successful, a ten-year follow-on global ATOC program may be proposed. Two sound sources are currently proposed. One located offshore of central California near Pt. Sur, within the Monterey Bay National Marine Sanctuary, and the other located off the north shore of Kauai, HI. This EIS evaluates the Kauai, HI sound source, while a companion EIS has evaluated the California sound source. The proposed Kauai facilities would include a 260 watt output acoustic sound source to be located approximately 14.7 km (8 nm) offshore at a depth of about 850 m (close to 3000 ft).

There is limited research and information on the potential effects of low frequency sound on marine animals. ATOC feasibility operations will be preceded by a six-ten month Marine Mammal Research Program (MMRP), which will allow marine biologists to utilize the sound source strictly for research studies into the potential effects of low frequency sound on marine animals. Baseline marine animal population and behavioral data collection efforts have already been ongoing in the Kauai offshore area since mid-1994.

We commend the project sponsors for the modifications made to the project to address public concern regarding the lack of information on potential impacts. Reducing the proposed transmission schedule and placing the MMRP up front may help reduce potential impacts and increase the margin of safety. We believe the MMRP is critical for verifying assumptions and

providing essential baseline data. In fact, we recommend project sponsors consider extending the MMRP to ensure adequate
10 evaluation of potential impacts prior to initiation of the ATOC feasibility study. 6b

The research protocol for the HI MMRP states that research results will be reviewed by National Marine Fisheries Service, Advanced Research Projects Agency (ARPA), Scripps Institute, the Marine Mammal Commission, MMRP Scientific Advisory Board, the designated public Kauai Community Advisory Group, and other interested scientists. We urge that a two-day public workshop, App C
11 similar to the one proposed for the California ATOC project component, be convened to present and discuss findings of the study. Given the public and scientific controversy regarding potential impacts of the ATOC, we urge that there be a complete and open reevaluation of the ATOC in light of MMRP results.

If the ATOC proof-of-concept study is successful, a ten-year follow-on global ATOC project could be proposed. Thus, the current project will be setting the precedent for a long-term global program which may have significant worldwide impacts. It is therefore critical that the process of evaluating subsequent actions be clearly explained in the FEIS. We recommend that a broad programmatic EIS be developed for the 10-year ATOC program, should it occur, with tiered NEPA documents for each new sound source.

It is clear that essential information for determining potential impacts is lacking. Furthermore, existing evidence already suggests a decrease in marine mammal activity (e.g., humpback whales, pg. 4-29) in certain areas due to increasing human activity. In addition, EPA is concerned with the purpose and need for the project, potential cumulative impacts, and the lack of consensus within the scientific community regarding potential impacts. Based upon our review, the above concerns, and the potential precedence of the proposed project, EPA has classified this DEIS as category EC-2, Environmental Concerns - Insufficient Information (see attached "Summary of the EPA Rating System"). Our detailed comments are enclosed. EPA provided comments on the companion EIS on the California Acoustic Thermometry of Ocean Climate Project on January 31, 1995. These comments are incorporated by reference.

We appreciate the opportunity to review this DEIS. Please send two copies of the FEIS to this office at the same time it is officially filed with our Washington, D.C. office. If you have any questions, please call me at (415) 744-1584, or Laura Fujii, of my staff, at (415) 744-1579.

Sincerely,

David J. Farrel, Acting Chief
Office of Federal Activities

Enclosures: 4 pages

95-010
MI002373
filename: HIATOC.dei

cc: Jeanne Drevenak, NMFS, Silver Spring
John Naughton, NMFS, Honolulu, HI
Ralph W. Alewine, III, ARPA, Arlington, VA.
Edward Chen, HI DOH, Honolulu, HI
Bruce Anderson, HI DOH, Honolulu, HI

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no *more than minor changes to the proposal.*

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommend for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

DETAILED COMMENTS

Purpose and Need

The DEIS states that the ATOC project and associated MMRP is an effort to determine long-term ocean climate changes on global scales and to evaluate potential effects of low frequency sound transmissions on marine animals. However, there are many existing climate change technologies (e.g., paleoclimate modeling intercomparison, satellite studies) and marine animal research projects which could address the same purpose and need at probable lower risk to the marine environment. 5a

1 We understand that many of the existing climate change technologies have been incorporated into the ATOC project. However, the FEIS should clearly state what unique information would be provided by ATOC and the relevancy and critical need for this information in regard to the global climate issue. The level of confidence for successfully obtaining this information in a usable form at minimum risk to the environment should be fully addressed.

In addition, the DEIS clearly states that essential information for determining potential impacts of the proposed
2 action is lacking. The FEIS should describe the relevance of this incomplete or unavailable information on the decision to proceed or not proceed with the proposed action. Given the lack of information on potential impacts, the FEIS should persuasively demonstrate that the trade off between potential impacts and information gained is justified. 15

Cumulative Impacts

EPA recommended, in our scoping comments, that project sponsors consider preparing a programmatic EIS to address the alternatives and impacts of the ATOC program. Such an approach
3 would have provided a forum for evaluating potential cumulative impacts. Since this approach has not been followed, it is essential that the EIS include a comprehensive examination of potential cumulative impacts that may be reasonably expected from the California, Hawaii, and future sound source locations. 2

The DEIS appears to evaluate only the cumulative impacts of other potential noise sources (e.g., pg. 4-105). Cumulative impact is defined in NEPA as the impact which results from the incremental impact of the action when added to other past, 12c
4 present, and reasonably foreseeable future actions, regardless of what agency or person undertakes the other actions (40 CFR 1508.7). "Future actions" to be included in the cumulative impact analysis are not confined to actions which only produce

potential impacts similar to the proposed action. Therefore, pursuant to NEPA, actions other then noise generating activities should be considered when evaluating cumulative impacts. The FEIS should include an expanded cumulative impact analysis which evaluates the potential ripple effect caused by the loss or reduction of prey species and the affect of other activities such as commercial fisheries (e.g., fish harvests), recreation, commercial shipping, and general harassment.

Existing Environment

The DEIS clearly demonstrates that there is a lack of information regarding baseline conditions for certain biological resources (e.g., benthic infauna, pelagic invertebrates, pg. 3-27) at the preferred sound source site. There is a critical need 8a
5 for sampling and monitoring to verify assumptions, especially given the known biological richness of the area. The FEIS should clearly address this information gap and describe existing and proposed sampling, monitoring and survey activities which will be implemented to ensure adequate baseline data is obtained prior to commencement of the ATOC feasibility study.

Given the lack of baseline information on existing conditions and lack of knowledge of the effects of low frequency sound on marine animals, it may be wise to consider a more moderate research approach which would allow for the development of additional information and technologies. For instance, we 3a, 5d
6 encourage a shift in focus from verification of the ATOC technology to evaluation of potential impacts and the development of technology which would provide more siting flexibility for ATOC feasibility studies (e.g., moored autonomous source). Once supporting technologies are developed and there is adequate information to evaluate project impacts, further evaluation of ATOC technologies can be pursued.

General Comments

1. The FEIS should clearly describe future plans if the feasibility study confirms that ATOC technology is <u>not</u> feasible or if the MMRP demonstrates that there are significant adverse effects even at the reduced 2% transmission level. For instance, TC describe the process for determining whether to continue with the
7 2 month 8% transmission cycle. 12c

2. As stated in the DEIS, there are other marine research projects within the study area (pg. 3-40, 5-17). Although the proposed ATOC may provide beneficial educational opportunities, there may also be potential conflicts between ATOC effects and other research goals. For instance, if ATOC does have a chronic effect on marine mammals resulting in reduced populations in the

area, this effect could directly influence the outcome of ongoing population and behavioral research. The FEIS should thoroughly examine this issue and evaluate the potential for research conflicts.

9 3. The FEIS should describe the native Hawaiian cultural interest, if any, in the potentially affected biological resources or sound source site. Pursuant to Executive Order 12898, **Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations** (EO 12898), the FEIS should provide information on the measures taken by ARPA and NOAA to: 1) fully analyze the environmental effects of the proposed Federal action on minority communities, e.g. Native Hawaiians and low-income populations, and 2) present opportunities for affected communities to provide input into the NEPA process. 20

THE MARINE MAMMAL CENTER®

Marin Headlands
Golden Gate National Recreation Area
Sausalito, California 94965
(415) 289-SEAL

25 February, 1995

RECEIVED 2-28-95

Clayton H. Spikes
Advanced Research Projects Agency
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA 22202

Dear Dr. Spikes,

On behalf of the 35,000 members and staff of The Marine Mammal Center (TMMC), we would like to offer comments on the *Draft EIS/EIR prepared for the Kauai Acoustic Thermometry of Ocean Climate (ATOC) Program and the accompanying Marine Mammal Research Program (MMRP)*.

Many of our concerns apply to both DEIS/EIR documents, prepared *separately for the Point Sur, California, and Kauai parts of the project*. These comments were detailed in our letter of 27 January, 1995. We have some additional comments specific to the Kauai DEIS/EIR.

1 1. We would like to commend the investigators responsible for the Kauai MMRP. The research protocol is thorough and designed to obtain the maximum amount of data possible. Several points should be addressed, however, in the MMRP approach. There is no plan to monitor Hawaiian monk seals under the current protocol. Potential effects on monk seals are stated to be "negligible" (p. 4-68). While monk seals are only occasional in the immediate area of the sound source, individuals have been repeatedly sighted on Kauai, in areas such as the Point Kilauea lighthouse. A second, more pressing, consideration is the extremely small population size of this endangered species - such that any single individual may contribute to the long-term viability of the population. Although there is a low probability of monk seals encountering the preferred sound source area, the population size demands monitoring of the species as part of the MMRP. Additionally, while some pinnipeds may readily habituate to noise (p. 4-68), there is little evidence that this applies to monk seals. The only available data on monk seal sensitivity to LF noise is from a single animal - results may not be reliably extrapolated to females, pups, and other males without further information. App C 6d

The current sampling protocol may not be sufficient to detect effects on monk seals, or on sea turtles, especially if the effects are behavioral. We would like to see integration of the MMRP with long-term monitoring efforts by NMFS, to facilitate monk seal and sea turtle assessments. Additionally, Gary Matlock of NMFS raised another type of concern in his memo F/SW033:ETN (DEIS/EIR Volume II): the current MMRP does not address methods of monitoring effects on local resident populations such as spinner dolphins. Will there be any effort to integrate the shore and aerial observations to identify and track resident groups of individuals? These local residents may be better subjects for assessing long-term or cumulative effects from ATOC transmissions.

2 2. We were pleased to see some plan for direct feedback between MMRP observations and the ATOC transmission schedule (p. C-5). This relationship is alluded to in the document (such that adverse effects on marine mammals will inform the transmission part of the program, and these effects will be minimized). However, there is still insufficient planning for the process through which transmissions will reconfigure if marine mammals are negatively impacted. We would like to see a thorough management plan, such that when effect 'x' is seen (re: Table C-1), transmissions will App C 6g

change in fashion 'y' (e.g. adjustments of duty cycle, power levels, etc.). The sole consideration in the DEIS/EIR refers to acute or chronic behavioral responses in cetaceans. Some of the relevant criteria will be hard to detect (e.g. changing numbers of animals struck by vessels, abnormal activity, beached animals that wash up outside the sound source area). It will be harder still to correlate the observed response with a known acoustic transmission (unless the effects are <u>very</u> acute). The Final EIS/EIR should offer a more comprehensive, tiered management protocol to match its impressive tiered (and tested) data collection protocol.

3. There are several aspects of the MMRP study that we feel deserve increased emphasis in the body of the DEIS/EIR, including considerations raised in Appendix F (Kauai MMRP Baseline Data 1993-94). In 1993, the photographic identification report found the highest numbers of humpback whales in the North region, due in part to larger pod sizes and more surface activity (and with some possibility of biased sampling). In addition, the 1993 aerial surveys sighted a variety of cetaceans (including 24% of all humpback sightings) in waters deeper than 100 fathoms. The combination of these observations
3 contrast with the repeated statement that humpbacks "are generally found in shallow water shoreward 10c of the 200 m depth contour" (p. 3-13) and are therefore unlikely to be in the immediate area of the sound source (pp. 4-33, ES-8, and elsewhere). Effects on humpbacks are further assumed to be minimized by the tendency of these animals to travel through the affected area, despite some preliminary results that document individuals around Kauai for up to 43 days (or returning to the area after leaving more than a month earlier) (p. 34 of ATOC-MMRP Shore-Based Observations Preliminary Draft Report). In other words, initial findings suggest that some individuals may be repeatedly exposed to the sound source due to variable travel patterns, counter to the assumption that humpbacks are transient migrants in this area.

4. Pages 4-27 and 4-28 summarize information gathered on humpback whale responses to vessel traffic. The effects described include both minor and major behavioral changes, from changing direction to breaching and increased intolerance to disturbance. The projected maximum received level for humpbacks would be 136-140 dB (Table 4.3.1.1.3-1), which is relatively high and suggests that masking (and possibly TTS) may well occur. As a result of the information provided, it seems overly 6m
4 hopeful to presume that behavioral effects of sound transmission will be "low to moderate" although uncertain. This combines with comment #3 (above) to suggest that the Final EIR/EIS should state Sec more realistic possibilities for disturbance (and detail what the response will be by the researchers). For many of the possible effects of the transmission, the 5-minute ramp-up period is offered as a 4.3.1.1 mitigating feature. However, 5 minutes is a relatively rapid transition time, and may not offer the implied opportunity for animals to avoid or leave the affected area.

5. The possibility of effects on odontocetes may be greater than suggested in the DEIS/EIR. Several species may be capable of diving near the sound source, including sperm, short-finned pilot, pygmy sperm, dwarf sperm and some beaked whales, as well as rough-toothed dolphins (Table 4.3.1.2.3-1). TC
5 Additionally, odontocetes may remain in the area of the sound source for longer than assumed (the assumption of 3-24 hrs is apparently based on the idea that all individuals will be traveling through Sec and will avoid the immediate transmission area from ramp-up). Where potential effects are given as 4.3.1.2 "uncertain for deep-divers", this should translate to "moderate" as a conservative estimate (rather than low to none).

6. Section 4.3.2.5 (Seabirds) is inappropriately brief. While there are 56 seabird species that may inhabit the Hawaiian islands, none are thought to dive deeply. What information is available about these TC birds? Several of the species are listed as threatened, endangered or special status (p. 4-131), yet no
6 specific information is provided. Not only may deeper diving birds be potentially exposed, but birds Sec foraging at the surface over the sound source may experience some effects. The Final EIS/EIR should 4.3.2.5 provide relevant information equivalent to that for marine mammal species.

7. While we understand the constraints offered by alternative locations, the DEIS/EIR does not fully explore the possibility of a different sound source site. As with the California DEIS/EIR, the evaluation of alternative source sites is biased by its inherent and arbitrary weighting system (for

criteria selection, relative score criteria [H=10, M=5, L=1] and weighting factors). There is no discussion or justification for this particular scheme, which gives the Kauai site a large 'numerical' advantage over the other, limited, sites considered.

Additionally, as stated in our previous comments, the MMRP cannot be considered a goal of the ATOC program (it is, instead, a necessary outcome of the program's transmissions). Therefore, it is misleading to state that the ATOC program "is a foundation and resource for long-term marine animal
7 research" (p. 1-21). By the same token, it is not necessary to establish the source in an area of high TC marine mammal density. The alternative sites would offer less potential for information about low frequency sound effects on marine mammals (unfortunately), but - in turn - there would be less need 4b to assess such effects directly (fortunately). It is ironic that the valuable baseline data for the Kauai site are greatly enhanced by recent data (1993-94) collected specifically to aid the ATOC/MMRP program (and which could have been conducted at any potential site, such as Midway Island or Johnson Atoll).

It is interesting, in light of the considerations mentioned in the previous paragraph, that page 6-3 states "the principal unresolved issue presented by the proposed project is the degree to which subsea sounds in the low frequency range could potentially affect marine mammals", under the heading 'Summary Of Probable Adverse Impacts Which Cannot Be Avoided; Unresolved Issues'. Perhaps a sound source sited in an area with lower marine mammal densities might go some way toward 'avoiding' the problem.

8. The rationale given for Conservation District Use Authorization from DLNR (Section 5.2.2) states that the proposed project is consistent with several of the allowed uses, under the Resources subzone of the Conservation District. However, the "monitoring, observing, and measuring natural resources" is
8 under the MMRP and is not actually part of the ATOC program itself. And it is both subjective and 14c highly debatable that "it [the ATOC program] is an important government research project where the anticipated benefits outweigh any impact on the conservation district." Neither of these criteria necessarily fit the proposed project, although it certainly corresponds to the third criterion - "occasional use".

The concerns we have raised do not mean that we oppose the ATOC program or its aims, the investigation of oceanic variation as related to global climate changes and, peripherally, the study of marine mammal acoustics. However, we continue to have reservations about the experiment and its potential impact. Related to our concerns, we cannot support the permit application to NMFS unless some of the issues raised are fully addressed in the Final EIS/EIR.

Thank you for the opportunity to comment on this Draft Environmental Impact Statement/Environmental Impact Report. We look forward to seeing the revised Final EIS/EIR for the Kauai branch of the ATOC Project.

Yours Sincerely,

Krista Hanni
Director of Science

Hilary N. Feldman
Dr. Hilary Feldman
Staff Marine Biologist

cc: Peigin Barrett, Executive Director, TMMC
Jerry Gibbons, Chairman, Board of Directors, TMMC
Marilyn Cox, Campus Planning Office, UC San Diego
Dr. William W. Fox, Jr., Office of Protected Resources, NMFS
Roy Schaefer, Department of Land and Natural Resources

271 Àwakea Road
Kailua, HI 96734-3448
24 February 1995

RECEIVED 3-8-95

Clayton H. Spikes
ARPA Contractor Representative
Marine Acoustics, Inc.
4 Crystal Park, Suite 901
Arlington, VA 22202

Dear Mr. Spikes:

This letter concerns the *Draft Environmental Impact Statement for the Acoustic Tomography of Ocean Climate* (ATOC) project and its associated Marine Mammal Research Program. The Draft EIS is a well-substantiated document that addresses all issues and omissions that I noted in earlier versions which I reviewed at the request of the National Marine Fisheries Service. In my opinion, the recommendations in the Draft EIS are accurate and valid and I endorse the report's conclusions.

As a trained oceanographer, I hold the opinion that the ATOC project represents "leading edge" ocean science and is an efficient way to monitor whole-ocean thermal features and relate changes to putative shifts in global climate. The Draft EIS clearly outlines the ATOC project's rationale and examines potential alternative sites for the acoustic projectors. From an oceanographic standpoint, the Draft EIS presents more than adequate justification for positioning an acoustic projector north of the island of Kaua'i. The suggested alternative locations, quite simply, are not cost effective and make no sense for such an elegant experiment.

The Draft EIS is particularly strong concerning the potential effects of low frequency sounds on marine mammals. In my opinion, the Marine Mammal Research Program described in the Draft EIS is a rational approach to the question of potential impacts in the vicinity of the acoustic source and will fully address all reasonable concerns for the marine mammals' well-being during the ATOC tests. The Marine Mammal Research Program is also likely to produce a significant amount of detailed information on the abundance, occurrence and habits of several different species of great whales north of Kaua'i. As the co-author of a definitive, long-term, passive acoustic study of whales in the vicinity of O'ahu (enclosed), I look forward to the significant increase in information about great whales in Hawaiian waters that will result from the Marine Mammal Research Program outlined in the Draft EIS. More importantly, however, the Marine Mammal Research Program will provide the graded approach necessary to modify or even stop the overall ATOC project should the impacts on marine mammals prove adverse.

I am a charter member of the Society for Marine Mammalogy and of the Animal Bioacoustics Technical Specialty Group of the Acoustical Society of America. Thus qualified, I fully endorse the Marine Mammal Research Program presented in the Draft EIS because the Marine Mammal Research Program provides ATOC with the means to factual conclusions about the impacts of ATOC-generated low frequency active emissions on marine mammals. Furthermore, the overall management plan presented in the Draft EIS provides adequate means to use information from preliminary studies, such as the Marine Mammal Research Program, to modify and "fine-tune" the ATOC program to meet both oceanographic and environmental standards and requirements. I consider the analyses in the Draft EIS to be valid and I endorse the report's conclusions.

Yours truly,

W. A. Friedl

William A. Friedl

cc: Roy Schaefer, DLNR

RECEIVED

Dear Clayton H. Spikes:

I received a form letter in response to my opposition to the ATOC project. I am writing again to state that the Draft Environmental Impact Statement (DEIS) fails to address the issues of alternatives and negates potential impacts. In addition, the many concerns of public expressed in previous hearings and in writing have not been met, including: native Hawaiian's rights, the segmentation of the EIS process, and ATOC's military applications. The issue of Hawaiian's rights to subsistence fishing in the water around the ATOC sound source) is being brushed aside which
1 violates an order that Federal actions address environmental 20
justice in minority populations. On page 103, section 4 the EIS states that "there is insufficient information to determine
2 whether any adverse long term impacts to fish could result 12a
from low-frequency sound, thus, the potential for this impact is uncertain."

The DEIS fails to discuss the obvious ~~impacts~~ connection to the Monterey Bay ATOC feasibility project and the cumulative impacts of both Hawaii and California ATOC projects. NEPA
3 requires that "proposals which are related to each other shall be 2
evaluated in a single impact statement". The proponents of ATOC have intentionally segmented the entire ATOC project into two separate projects (Hawaii and California).

Finally, the DEIS does not adequately reveal the possible applications of ATOC, nor does it fully and honestly disclose the involve-
4 ment of DOD. It is clear that the true intentions of ATOC have 1
not been revealed to the public and further analysis must occur before this project is allowed to proceed.

Sincerely yours,
Julian Friedland

RECEIVED 2-22-95

Testimony submitted on the public hearings concerning the Acoustic Thermometry of Ocean Climate, Lihue, Kauai, HI, February 9, 1995

My name is Ann Stirling Frisch. I am Associate Professor of Education and Human Service at the University of Wisconsin Oshkosh. I have a PhD in Human Ecology from Michigan State University. I am concerned about ATOC as an environmentalist and, as a human service professional. So I am concerned about the broader issues of health and well being of the planet and of its inhabitants and for the appropriateness of the expenditure of 56 million dollars at a time of national, state and local budget cutting, particularly when we are cutting the poorest of the poor: our children.

I have already registered my protests elsewhere about the ATOC project, but having been in Kauai during the month of January, I want to further lend support to the Kauai Friends of the Environment in their protest of this expenditure of federal dollars as well as the project itself.

I have studied the proposals for the ATOC project and find them seriously flawed. The purpose and rationale for the project are
1 unclear, so it appears that there is some hidden reasons for the 1
project. The laundering of the federal funds is inexcusable. The lack of adherence to the environmental protection laws is
2 unacceptable. The spending of 56 million dollars for a project 14c
with no visible or important purpose is unacceptable and foolish.

What alarms me the most is that we do not know what the consequences will be of loud and repeated sounds under water? Even if there were some valid purpose, it probably should not be done. We should not be assume that we can monitor the movement of whales
3 at any level and conclude there is or is no impact. Harm to their 12c
sensory systems might not be detectable. Moreover, damage might not accrue for a decade after the project is over. Even if there were no damage to whales, it might damage other sea life and in fact, might change the entire ecosystem or critical parts of it. It might not result in damage until long after we stop monitoring. It might be too late to stop the damage.

If Scripps insists on conducting this experiment, may I suggest a more moderate course. Let's put the Scripps researchers underwater (in a tank so as to not harm innocent creatures). Subject them to low frequency sound for a comparable period of time. Observe them and monitor them for damage to their sensory systems.

Please, an emphatic NO on this project.

Ann Frisch

Testimony submitted on the public hearings concerning the Accoustic Thermometry of Ocean Climate, Lihue, Kauai, HI, February 9, 1995

My name is Norman J. Frisch. I am emeritus professor of mathematics at the University of Wisconsin Oshkosh. I have a PhD in Mathematics from the University of Michigan.

I am opposed to the ATOC project both in its purpose, methodology and *possibly harmful consequences*. *In terms of* purpose and methodology, it doesn't meet the requirements of good scientific research. The purpose is unclear and confusing, it appears, even to the researchers. The methodology of measuring low frequency sound waves at considerable ocean depth is not a good measure of global warming. The methodology of observing whales at surface is not a good measure of the effect to marine life at the depth of the sound waves. I believe it will not serve any useful purpose except the generous employment of researchers and lobbyists. I am opposed to the expenditure of funds when there are so many needed studies in the area of global warming and protection of marine life. This project would *do neither*. *Not only* would it not serve these purposes, but it could harm marine life in ways which we cannot anticipate.

Norman J. Frisch

RECEIVED 2-13-95

February 10, 1995

Mr. Clayton H. Spikes
Advanced Research Projects Agency
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, Virginia 22202

Ms. Ann D. Terbush
Chief, Permits Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway, F/PR1
Silver Spring, MD 20910

Mr. Roy Schaefer
State of Hawaii
Department of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

Dear Mr. Spikes, Ms. Terbush and Mr. Schaefer,

As a concerned citizen of the State of Hawaii I would like to take this opportunity to comment on the Draft Environmental Impact Statement (DEIS) for the Acoustic Thermometry of Ocean Climate (ATOC) Project and its associated Marine Mammal Research Program (MMRP) for which a Scientific Research Permit Application is currently pending (SRP P557C).

Like many Hawaii residents, I have developed a deep appreciation and respect for the waters surrounding our islands and the organisms which inhabit them. Just last summer I spent a week kayaking along the north shore of Kauai, very near to the location of the proposed ATOC facilities. I was amazed by the diversity and abundance of marine wildlife that I saw during my adventure which took me from Hanalei to Barking Sands Beach. Not only were there dozens of species of fish in the area, including sharks, but I remember being particularly impressed by the number of green sea turtles that I encountered. And although on that particular occasion I did not see spinner dolphins or humpback whales, on previous occasions I have.

As one who appreciates Hawaii's marine environment, and that of Kauai in particular, I was troubled to learn of the proposed ATOC project and was concerned about the potential impact that it might have on marine organisms which inhabit the surrounding environment. Unfortunately, in reviewing the DEIS that was prepared for the project, few of my concerns have been allayed.

My primary concern lies in the insufficiency of definitive
1 information regarding the potential effects that low frequency 15
sound may have on marine life. While I recognize that the MMRP is
designed to detect and evaluate ATOC's potential effects on marine
life, as proposed it is inadequate in scope to do so. According
to the experimental protocol set out in the DEIS (Appendix C), the
2 MMRP will only attempt to assess the effects of low frequency 6l
sound transmissions on a limited number of species (predominantly
cetacean species, with humpback whales noted as the "focal"
species). The effectiveness of the MMRP in assessing the effects
of low frequency sounds on other species known to inhabit the area
such as sea turtles, fishes and monk seals appears questionable.
Although the DEIS states that the MMRP will attempt to monitor the

potential impacts on leatherback turtles and monk seals, it does not set out a detailed plan of how it intends to do so (as it does for the humpback whales,) only that members of the marine mammal research team (MRT) intend to observe the animals during aerial surveys and from land stations and vessels and will record individual behavioral changes. It seems doubtful that subtle behavioral changes would be able to be detected in these species using these research techniques. Moreover, the MMRP has no provisions to monitor the effect on resident fish populations, which as the DEIS itself notes (*pg. ES-9*) "by far... comprise the greatest number of marine vertebrates that could be affected by the sound transmissions." The DEIS goes on to concede that "It is anticipated that some fish, particularly bottom dwellers, may be located very near to the source and could be exposed to loud sounds that could result in adverse behavioral effects". Given that fish are an important component of the area's ecosystem, not to mention the islands' economy, it would be unwise to proceed with ATOC without learning more about the potential effects that the experiments could have on them.

I am also concerned about the limited duration of the MMRP. While
a period of six to ten months, as proposed, may be long enough to
3 characterize short-term behavioral responses of humpback whales
(and perhaps other animals) to the sound transmissions, it seems 6b
that it would be impossible to determine the long-term
consequences that the experiments could have on whales or other
species in such a time frame. Six to ten months is too short a

time period to properly assess the expected impacts of ATOC on such a complex ecosystem. The duration of the MMRP should be extended at least through the following whale season so it could be determined whether the testing had any effect on the whales' return to the area.

In short, given its limited scope, the MMRP does not provide an adequate basis on which to make the decision of whether to proceed with ATOC. This is particularly true when as indicated in the DEIS (page 1-7), ATOC experiments would be permitted to proceed six to twelve months prior to the submission of the final MMRP report. As stated in the DEIS, the only thing required prior to the start of ATOC testing would be a "quick look" at the MMRP's preliminary results. This leads one to believe that the decision to proceed with ATOC has already been made, that the ATOC train is underway. In my opinion the train must be stopped. While I understand and appreciate the importance of finding out all we can about global warming patterns, it seems foolhardy to try and learn more about one of the problems humans have caused the environment without knowing whether or not in the process we may be causing another.

Thank you very much for your time and consideration.

Very truly yours,

Emily Gardner

January 24, 1995

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

Dear Mr. Clayton H. Spikes,

This letter is being written to express my discontent with the ATOC project. I do not believe that the Draft Environmental Impact Statement is adequate enough to satisfy the deep concerns that surround this questionable project.

So little is known about these vast oceans that contain mysterious marine life, that it seems
1 ridiculous to make such an irrational decision based on little knowledge and understanding. We do know that 15
marine life is especially responsive to sounds and their frequencies.

All of the millions of dollars going into the ATOC project could be spent more wisely on clean energy, energy efficiency, and other responsible efforts. Also, so much of this project is being covered up which makes me doubt the true intentions of ATOC. We need you to be more rational in these vital decisions and for you to be upfront with the public about this "operation". Think about it and take right action!

Thoughtfully,

Caroline Haski
864 Gold Run Rd
Boulder Co 805

H-19

RECEIVED 3/14/95

Mr. Clayton Spikes
ARPA Contractor Representative
Marine Acoustics, Inc.
4 Crystal Park, Suite 901
Arlington, Va 22202

March 6, 1995

Patricia Kathleen Hebson
P.O.Box 100
Kilauea-Kauai, Hawaii 96754

Dear Sir

As a resident of Hawaii, two boat owner, fishing and water sport enthusiast, and farmer I wish to make comments on the State/Federal Draft Environmental Impact Statement (EIS) for the Acoustic Thermometry of Ocean Climate (ATOC) and its associated Marine Mammal Research Program (Scientific Research Permit Application P557C). I believe this EIS shows that there is too much possible
1 personal injury to my above listed livelihoods due to possible damage to the environment that the actions ATOC proposes to take. 18b
Funds should be used in already proven beneficial avenues that are directly related to enhancing the environment and to what I personally spend my time doing. I do not support the project as presented and think it is too close to endangering my life to ever change my viewpoint. If you can respond with how the project would directly benefit me and my farming, fishing and State/Federal tax money expenditures during my immediate future please write me at the above address.

Sincerely,

Patricia Kathleen Hebson

Patricia Kathleen Hebson

H-20

RECEIVED 3/13/95

University of Hawai'i at Mānoa

Kewalo Basin Marine Mammal Laboratory
1129 Ala Moana Blvd. • Honolulu, Hawai'i 96814
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COMMENTS ON THE DRAFT EIS:
"ENVIRONMENTAL IMPACT STATEMENT FOR THE KAUAI ACOUSTIC THERMOMETRY OF OCEAN CLIMATE PROJECT AND ITS ASSOCIATED MARINE MAMMAL RESEARCH PROGRAM"

Louis M. Herman, Ph.D.
Director, Kewalo Basin Marine Mammal Laboratory
Professor, Department of Psychology, University of Hawaii at Manoa
Cooperating Faculty Member, Department of Oceanography, University of Hawaii

The goal of the ATOC project is to test the theory that ocean warming can be reliably measured and monitored by the average speed of sound through an ocean basin. For its first test in the North Pacific, the ATOC project has selected the north shore of Kauai for emplacement of a sound source for generating sound transmissions throughout the Pacific Ocean basin. If this project is allowed to proceed, low frequency (about 75 Hz), high intensity sounds (about 195 dB re 1 micropascal at the source) will be generated and broadcast for 20 minute periods six times a day, several times a week for several years. Inasmuch as Kauai, as well as the other main Hawaiian Islands, is a winter habitat and reproductive ground for humpback whales, an endangered great whale species, there is concern that the ATOC project may impact negatively on whales utilizing the Kauai habitat. The draft EIS "Environmental Impact Statement for the Kauai Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program" presents the details of a marine mammal monitoring program (MMRP) intended to evaluate whether the ATOC acoustic transmissions will have a negative impact. Two points are worth noting immediately. First, although short-term changes in the behaviors of individual humpback whales, such as changes in respiration or movement direction, may be detectable by the MMRP program, the long-term effects of these or other impacts on individual animals or on the utilization or
1 effectiveness of the Kauai habitat will not be possible to evaluate. Yet, it 12a
is the long-term effects which are of greatest concern for the health and recovery of the North Pacific humpback whale population. Second, it seems far from imperative that the ATOC project utilize Kauai to test the underlying theory. Alternatives sites exist, as discussed in the EIS, where endangered species of great whales are not found. In a peculiar bent of logic, one reason
2 given in the EIS why these alternate sites are less satisfactory than Kauai is 4b
that there are no or few populations of marine mammals there: therefore the MMRP program couldn't function. This flies in the face of the fact that the only reason for the MMRP was the great concern for the humpback whales at Kauai! There are other less intrusive, less expensive, and better controlled ways to test for the effects of low frequency sounds on marine mammals, than to couple such study with the ATOC project.

A major consideration is that the Federal Government has promulgated laws and strict regulations for protecting humpback whales and other endangered whales. In Hawaii, it is a violation of Federal Law to deliberately approach a humpback whale closer than 100 yards. Violators are subject to fines and imprisonment. Scientific research permits are issued by the Federal Government only for research that will likely be of benefit to the whales. Researchers possessing a Permit may approach a whale closer than 100 yards for purpose such as observation and photography and are limited in the number of whales so approached that may be incidentally disturbed. It is ironic, therefore, that the ATOC project is now contemplating placing a chronic acoustic stimulus in Hawaiian waters inhabited each winter season by humpback whales (from approximately December through early May), and which can be of no benefit to the whales and which may have adverse short- or long-term effects on the whales.

Specifically, the ATOC project should not take place off the Island of Kauai because *of the following specific* areas of concern and consideration with respect to humpback whales:

(a) the need for recovery of the North Pacific humpback whales from their endangered status;
(b) the emerging importance of Kauai as a winter habitat for these whales;
(c) the apparent extended length of residency of some individual whales at Kauai;
(d) the importance of singing as communication between whales and the prevalence of singing on Kauai;
(e) the potential masking effects of the ATOC sound on a listening whale's ability to detect or recognize low frequency portions of the song; and
(f) the availability of a reasonably suitable alternative to Kauai—Johnston Atoll.

Each of these areas is explained in more detail below:

a. Recovery: Whaling for humpbacks in the North Pacific only ceased after the 1965 whaling season. During the early 1960s, humpbacks were whaled intensively in the North Pacific. For example, 3455 humpback whales were reported killed
3 by Russian pelagic whalers during the two-year period 1963-64. By 1966, there 6h
were estimated to be perhaps only 1000 humpback whales remaining in the North Pacific. After 1965, populations have remained low, and are only now beginning to show early signs of recovery, based on aerial survey data. Current estimates of the eastern north Pacific population give figures generally of between 2000 and 3000 animals.

b. The Importance of Kauai as a Winter Habitat. All indications are that humpback whales whales are increasing in numbers throughout the main Hawaiian Islands. Kauai, in particular, is experiencing considerably more whales now than 10-15 years ago. A photographic *effort* during the 1993 season identified 251 unique individual humpback whales at Kauai—but this was estimated to be only a fraction of the true numbers visiting Kauai. Aerial surveys during 1980 sighted only 1.67 whales per flight, while 11 years later, in 1991, similar aerial surveys revealed 12.2 whales per flight, about a seven-fold increase in sightings.

c. Length of residency at Kauai: Photographic studies conducted during 1991 and 1993 showed that about 14% of whales photographed at Kauai were resighted there on a subsequent day or days. The range of days between resightings was

from 1 to 50 days, with the mean resighting interval being 14.7 days. Thisvalue is consistent with resighting data for other islands in Hawaii. The EIS statement that the maximum residency expected for any individual within the study area is 4 days is therefore not supported. Although whales have been
4 occasionally found to relocate from one major island region to another during the winter season—e.g., from the Big Island to the four-island region of Maui,
Molokai, Lanai, and Kahoolawe—there is no evidence so far of a whale moving 8b
from one island to another and then back again to the original island. This may occur, but it is likely to be a rare event, especially for Kauai which is relatively distant from other areas of whale concentrations. Thus, the resightings at Kauai may reflect in many cases true residency intervals.

d. The importance of whale song as communication. Singing in Hawaiian waters is heard throughout the winter season—from January through April, day and night. In one study, sounds were recorded from the Barking Sands Pacific Missile Range Facility located on the north shore of Kauai. Recordings were made for five-minute intervals on the hour every two hours throughout the 24-hour day throughout the season. There was no time during that period when song was not heard. Singing is performed by males and appears in the least to maintain spacing between singers at several kilometers, and possibly to provide information to female listeners about the fitness of the singer. The male whales must be listening to each other's song, since they copy each other's songs. Singers have been observed to stop singing and join with other whales, possibly females, who are at distances of several kilometers.

e. Masking effects of the ATOC sound. Sizable portions of the humpback whale song contain frequencies that fall within the range of the ATOC sound. In some sound playback studies directed toward humpback whales, responses to recordings of their own sounds were observed at distances of several kilometers and at sound intensity levels estimated to be only 100-110 dB. Whales listening to singers may be listening to rather low intensity levels if, as is typical, they
5 are separated from the singer on the order of kilometers. The occurrence of
the ATOC sound can thus mask the low frequency portions of the song, making it 13b
more difficult for the listening whale to detect, recognize, or judge the song. What impact that will have on vocal communication, on song convergence, on mate selection, cannot be assessed by any of the techniques proposed by the marine mammal research program. Nor is there any ready way to implement such assessments. Hence, this problem is of great concern and argues strongly against emplacing the sound source at Kauai.

f. Johnston Atoll as an alternative site. The ATOC project should seek an alternative site to Kauai that is reasonably suitable for their tests of sound transmission, but which does not have a population of humpbacks or other endangered whales. One such site is Johnston Atoll. The draft EIS gives Johnston Atoll favorable consideration as a reasonably suitable alternative,
although it may have somewhat reduced transmission and logistic characteristics TC
6 as compared with Kauai. Importantly, Johnston Atoll does not have any
population of humpback whales, or other endangered whales, except perhaps for Sec
an occasional stray. It has the necessary infrastructure to support the ATOC 2.2.3
project, and is only about two hours flight (~750 statute miles) away from Honolulu. No MMRP program would be necessary at that site, resulting in a considerable cost savings while the ATOC theory is being tested.

In conclusion, because of the presence at Kauai of the endangered humpback whale, and the delicate stage of its recovery and habitat utilization, Kauai should not be used to test the ATOC theory. Adverse long-term effects may occur, many of which will not be possible to detect by the proposed MMRP program. Among these is the potentially adverse effect of the ATOC transmissions on vocal communication among the whales. The ATOC program, instead, should proceed at a site free from the presence of endangered great whales. Johnston Atoll offers that characteristic.

For further details on the issues discussed, and for detailed references, see L. M. Herman (1994) "Hawaiian Humpback whales and ATOC: A Conflict of Interest." The Journal of Environment and Development, 3(2), 63-76.

Dear Clayton Spikes: Jan 24, 1995

I'm am very concerned about the ATOC
(Acoustic Thermometry of Ocean Climate)
Project. Please inform me as to why this
project is being funded by the
1 Dept of Defense. I know there are, 1
2 sides or more to every issue. I'm
not saying your involvement and
goals are wrong, I'm just curious
as to why this is happening. Please
send me information. I'm aware of
2 the short public comment period
and ask you to extend it. 14a
Please act in order to better the
World for us and future
generations. Thank-you.

Sincerely,
Thomas C. O'Irvine
THOMAS C. IRVINE
9220 4 MILE CANYON
BOULDER, CO 80302

To Clayton H Spiker:

I have recently heard that the US gov't, with top-secret components, has decided to do echoing in the oceans. It is clear that rigorous study of the effects of this on the ocean eco-systems has not been done. ATOC experiments must not progress until effects on Marine mammals are explored and deemed non-harmful. 1

Why rush through these hearings? — Why are we steamrolling this project through?

Owl Kopecman
515 S 40th St.
Boulder, CO 80303

ANIMAL RIGHTS
HAWAII

Aloha,

My name is Keith Krueger and I am submitting this testimony on behalf of Animal Rights Hawaii.

Our organization wishes to note that submitting these comments to a commercial contractor that has been retained by an agency that has a strong interest in the approval of this proposal seems less than appropriate. This holds especially true because the DEIS *fails* to adequately address the broad spectrum of concerns raised by the public to date.

1 Animal Rights Hawaii is disturbed by the tone of the DEIS, which reads more like a justification for the granting of permits for this project than an objective evaluation of the *risks* and alternatives to the proposed actions. We hope this does not mean that the decision to grant permits has already been made before the public has had a chance to review this project in its entirety and to give input as to its feasibility and appropriateness. 16a

2 The Sierra Club Legal Defense Fund, *Inc.* has prepared compelling testimony as to the questionable legality of the way in which the proponents of ATOC have attempted to circumvent the intent of permitting procedures that have been developed over many years in order to safeguard our environment. We wish to go on record as believing that a Programmatic EIS for ATOC is required by law. Simple logic would dictate that the full project should be thoroughly evaluated before parts of it are allowed to proceed, because if the initial premise is faulty, then the risks undertaken and impacts suffered as a result of the segmentation of this project will have occurred in vain. This is not an instance of well meaning but misguided members of the public trying, in their ignorance, to derail the advancement of the frontiers of human knowledge - there is genuine scientific disagreement not only over the potential impacts of this undertaking, but also over the premise upon which it is based. Dr. Norman T. Seaton, PhD. has testified that "There is not even the remotest possibility of using any measurement of sound velocity in the deep sound channel to indicate global warming, and to imply otherwise with a *name* such as Acoustic Thermometry of the Ocean Climate, is an affront to responsible science and the public pocketbook". 2

3 Because of the controversy surrounding ATOC it would seem premature to rush into implementing it, yet that is precisely what is being done. It is our understanding that cables have already been laid to the preferred site locations in both Hawaii and California. If this is true, then any discussion of alternative locations in the DEIS would appear to be nothing more than lip service. 19

ANIMAL RIGHTS HAWAII • P.O. BOX 61386 • HONOLULU, HAWAII 96839-1386

It is our understanding that ATOC issued an Environmental Assessment for their Acoustic Engineering Test off the West Coast of the U.S. only days before beginning the actual experiment. There does not seem to have been reasonable opportunity for the public to scrutinize and provide input on this portion of the project.

It has come to our attention that it was reported in testimony received at the January hearing in California that marine animals have already been harassed, tagged, and moved on behalf of ATOC, even though this project, in its entirety, has yet to be officially
11 approved. It appears that ATOC just continues to lurch forward as quickly as it can come 6d
up with ways to circumvent the intent of the permitting process. This pattern disturbs us App C
deeply. When considering the impacts of human activities on other species, it is the belief of Animal Rights Hawaii that we have an ethical obligation to err on the side of conservatism.

If the real purpose of ATOC is to measure global warming, we cannot conceive of proceeding in such an arrogant and devious manner. This leads us to ask whether there may be a hidden agenda at work here. We do not automatically object to the possibility of
4 there being military applicability to what is purported to be civilian research, but we do 1
strenuously object to legitimate concerns being ignored or sidestepped as part of a secretive and cavalier shell game being played on a global scale with our tax money without full disclosure.

The proponents of ATOC have spent a great deal of effort in trying to emphasize the care being taken to carry out a MMRP as a major component of their overall project. Yet this research represents only a small portion of their budget, and is designed to do little
5 more than provide partial data on the impacts of the ATOC experiment itself. A more 17
comprehensive and independently organized research regime should be carried out and made available for public review before it is decided whether or not the ATOC project should be allowed to proceed.

In their original proposal the proponents of ATOC admit that it is not possible to detect or even measure all of the potential impacts of their actions on marine mammals, yet they assert that they are willing to stop the experiment if these impacts occur. Given the former admissions we do not find the latter assurances very comforting, or for that matter, even logical.

6 We also question the scheduling of the feasibility portion of ATOC to begin before 6c
the MMRP Pilot Study Final Report is released.

If the cumulative effects of ATOC are not likely to be immediately recognizable, do we not then have a moral obligation to halt the project until such a time as we can be 12c
7 reasonably sure of what its impacts will be? And do we not also have an obligation to do more than guess at what effect an experiment of this magnitude will have on the multitude of other species that exist in our oceans?

Instead, what we have been offered in this DEIS is often little more than a series of negative declarations and wishful guesses. This document subjects the public to a litany of
8 statements that basically say that ATOC's scientific team doesn't really know but is assuming 15
that the impacts of their work will be low, PROVIDING THEIR ASSUMPTIONS ARE CORRECT.

The DEIS also muddies the waters of logic by explaining that the preferred sites were picked for their geographical advantages combined with their proximity to marine animal
9 populations so that research could be conducted on the impacts of the project on these 4a
marine communities. Speaking out of the other side of its mouth the same DEIS lists as advantages for moored autonomous sources (as an alternative) the ability to be placed in areas with low concentrations of marine life in order to mitigate the project's potential impacts. It would seem that during this demonstration or proof of concept phase that the
10 latter course of action would be more prudent. However, we must stress that nothing should 2
be done until after a Programmatic EIS is approved.

Given the lack of critical analysis and the prejudicial tone of the DEIS, Animal Rights Hawaii is deeply disappointed that NOAA, and more specifically NMFS, have allowed their agency names to be affixed to this document as preparing entities.

We feel that this document fails to adequately address many areas of concern. We also feel that there is a lack of consensus within the scientific community as to the feasibility of this project and what impacts it will have. It is therefore the position of Animal Rights Hawaii that the ATOC proposal poses unacceptable risks to our marine environment. We ask that permits for this project be denied.

Keith Krueger
for Animal Rights Hawaii

KK:lh

TO: CLAYTON H. SPIKES:

RECEIVED 3-8-95

I'm writing to express my opposition to the ATOC Project. The draft Environmental impact statement (DEIS) fails to address the
1 issues of alternatives and negates potential 4a impacts. In addition, the main concerns of the
2 public expressed in previous hearings and in 14b writing have not been met, including: native
3 Hawaiians rights, the segmentation of the 20
4 EIS process, and ATOC's military applications. 2
Hawaiian fishing rights are being brushed[2] aside

The DEIS does not adequately reveal the possible military applications of ATOC, nor
5 does it fully and honestly disclose the 1 involvement of the DOD.

Please get your act together.

Sincerely —

[illegible signature]

Denise Luttrell
3840 Dartmouth
Boulder, CO 80303

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, VA 22202

24 January 1995

To Clayton H. Spikes:

I am writing to express my opposition to the ATOC experiment involving the placement of acoustic sound transmitters on the ocean floor, in order to research global warming.

To disrupt ocean life to such an extent for the purpose of confirming countless other research projects that clearly show that we humans are directly affecting the global climate. Rather than research if any more, funds should be spent on reducing our impact. I ask that this project be cancelled and that the Scripp Institute put the 35 million dollars from the DOD towards research that will benefit our future and not cause further problems for our fellow species in the oceans.

Thank you for your consideration,

Denise M. Luttrell

RECEIVED 3-5-95

H-26

1677 Haight St. #3A
San Francisco
CA 94117
1 March 1995

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202.

To Clayton H. Spikes,

I am writing with reference to a response to an earlier letter that I wrote expressing my objection to the ATOC project. The Draft Environmental Impact Statement (DEIS) fails to address the issues of alternatives and negates potential impacts. In addition, the many concerns of the public expressed in previous hearings and in writing have not been met, including: native Hawaiian's rights, the segmentation of the EIS process, and ATOC's military applications.

The issue of native Hawaiian's rights is
1 being brushed aside, violating an order that 20
Federal actions address environmental justice in minority populations. On page 103, section 4 the DEIS states that "there is insufficient information to determine whether any adverse long term
2 impacts to fish could result from low-frequency 15
sound, thus, the potential for this impact is uncertain".

The DEIS fails to discuss the obvious connection to the Monterey Bay ATOC
3 feasibility project and the cumulative impacts 12c
of both the Hawaii and California ATOC projects. NEPA requires that "proposals which are related to each other shall be evaluated in a single impact statement." The proponents of ATOC have intentionally segmented the entire
4 ATOC project into two separate projects (Hawaii 2
and California).

Finally, the DEIS does not adequately
5 reveal the possible military applications of ATOC, 1
nor does it fully and honestly disclose the involvement of the DOD. It is clear that the true intentions of ATOC have not been revealed to the public and further analysis must occur before this project is allowed to proceed.

Yours Sincerely

Helen Maher.

H-26

RECEIVED

Feb 13, 1995

Clayton H. Spikes,

I have a few things I'd like to say about the 1 ATOC experiments that you would like to do. 3b

The bottom line is there have already been tests and studies on the causes and effects of global warming.

For instance, we already know that pollution from cars, jets, factories, pesticides, insecticides, the cutting down of forests are all contributing factors to global warming and the destruction of the ozone layer.

So instead of wasting

$35 million on another unneeded study, lets save the money and seriously correct the problems now while there is still time.

So I'd like to ask you, please think of all the children and children still to come into this world and stop all the wasteful, destructive and polluting things we know to cause global warming and the destruction of the ozone layer.

Mahalo,
Brigid McBride

Brigid McBride
P.O. Box 1476
Kapaa, HI 96746

RECEIVED 2-15-95

1545 Nehoa St., Apt. 702
Honolulu, HI 96822
Tel. (808) 941-3891 Home
Feb. 7, 1995

RE: Draft Environmental Impact Statement
Kauai Acoustic Thermometry of Ocean Climate Project
ATTN: Clayton Spikes
Advanced Research Projects Agency/National Marine Fisheries Service
Marine Acoustics Inc.,
Four Crystal Park, Suite 901
2345 Crystal Park Dr.,
Arlington, Virginia 22202

Dear Mr. Spikes;

Please permit me to express my concerns related to the Draft Environmental Impact Statement on the Kauai Acoustic Thermometry of Ocean Climate Project, which are outlined below. Please enter this letter as public comment/response into the DEIS formal record.

The proposal for a Marine Mammal's Research Project for 6-10 months preceding the implementation of a 2 year trial for the Acoustic Thermometry Project was added as a mitigation measure to alleviate concerns regarding the impact of additional man-made noises upon endangered species of Humpback whales, Sperm Whales and Leather Back Turtles in the area. The 6-10 month proposed duration of the project
1 will be inadequate to determine adverse effects upon longer term 6b
migration, feeding and mating patterns or cycles. The largely surface observations planned *will not be capable of determining the impact upon* sea life at the depth of the proposed "sound channel." The scope of the project should address the impact upon sea life that would be affected to be scientifically responsible; not limited to "legally protected" species only. The fact that the Marine Mammals Project will be funded by the same parties requesting the permit calls into question the possibility of undue influence and biased interpretation of the Marine Mammals Project's *results. The proposal for a Kauai Community Advisory* Group to monitor the project is a meaningless gesture toward community input as members would need sufficient academic & scientific background
2 to effectively monitor the project results and interpret data. 17

The Marine Mammals project is an attempted mitigation measure for the Acoustic Thermometry Project and is not related to the purpose of the ATOC, *therefore it should not be used as the basis for NMFS granting* a marine mammal "scientific research" related permit under the Marine Mammals Protection Act of 1972. The DEIS went so far as to completely turn around the facts to serve the purpose of the ATOC by stating that if ATOC weren't to go ahead we would loose the opportunity to gain knowledge of the impact of low decibel noise on marine mammals made possible by the MMRP! Harassing marine mammals with sound to see how they react is of no benefit to the animals involved and has as it's sole purpose the ultimate approval of the ATOC project.

The actual ATOC project will not enhance or maintain the habitat for endangered species and will not result in less disturbance to Humpback Whales from human disturbances as stated in the objectives of the Humpback Whale Recovery Plan of 1991 (adopted by the NMFS). Adding more noise on a continual basis does create an adverse modification to habitats. The DEIS reveals it's bias by stating "the probability of adverse impacts is speculative" however since at best the DEIS claims there is uncertain to minimal impact on marine animals and the impact of low decibel noise on most marine animals is unknown, the opposite
3 statement is more true; the probability of no adverse impacts is
speculative. To say there would be no impact defies everything we have 16a
learned about the impact of noise on humans. Noise disturbances do have profound psychological and physical effects; witness the noise ordinances on every jurisdictions' books, the housing requirements for soundproofing, even the use of noise by police & military as "psychological warfare." Everything we know about man-made noise points toward it being a disturbance to the natural ambient noise of the land and oceans. The assertion that it will not bother animals completely ignores human experiences and the observations of avoidance by marine mammals in 1991 at the Heard Island Facility.

The fact that shipping already creates more than desirable adverse noise *does not validate adding more noise*, particularly a reoccurring noise over a period of years at a "sound channel" depth where little is known about the lifeforms. Degrading and disturbing the habitat of endangered or other species is not warranted simply to see what the impacts are. Since the DEIS describes ATOC as "experimental and subject to fundamental uncertainties" why should we be willing to chance harming marine mammals when the effectiveness and use of this project are less than certain? *The scientific community has gone along with destroying* entire inhabited atolls in the Pacific to see what nuclear weapons will do; harming life under the guise of scientific research can no longer be tolerated or justified- we are dealing with endangered animals who
4 became endangered due largely to human activities. Limiting the scope
of alternate sites to Johnson Island was extremely biased as was 4a
limiting the investigation of alternative methods of obtaining the desired data to one. *The objective should be towards developing* an alternative "non-invasive" method, not limiting it to known ones.

In summary, the DEIS fails to address the effects of the proposed activity within the "sound channel" where lifeforms will receive the heaviest impact, assumes that harassing endangered species with sound testing for a 6-10 month period in the form of a Marine Mammals Project *will provide proof of a negative declaration and goes on* to presume this as a mitigation measure, and reveals a bias on the part of the authors in assuming "the probability of impacts is speculative" when everything we know on the effects of sound on other mammals and previous observations of marine mammals indicates otherwise. I continue to believe the ATOC is unnecessarily invasive of marine habitat and that encouraging less invasive methods of collecting ocean thermometry data would be more environmentally responsible. Respectfully submitted,

Melinda C. McComb
Melinda C. McComb

Mr. Clayton Spikes,

I am writing to you today out of my concern for the continuation of A.T.O.C.. I feel it is ludicrous to continue funding for this
1 research on global warming when there are 3a
many other, safer, ways to do scientific research.

I've learned that the Dept. of Defense is involved in this and that there are top secret
2 classified parts to this "research", which indicates 1
to me there is so much more to this that we the public don't know.

The E.I.S. should be done to include the effect on marine mammals more extensively than has been done so far.

Thank You
John Mento
1634 Spruce St.
Boulder, Co. 80302

8, March 1995
30 Edgerton St. #C,
Rochester, NY 146..

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

Dear Clayton H. Spikes;

I am writing to express my opposition to the ATOC project, specifically the implementation of acoustic sound transmitters at Kaihu Point in Kauai, Hawaii.

The Draft Environmental Impact Statement
1 for this site fails to account for the cumulative 12c
effects both proposed transmission sites will have on marine life in the pacific.

Are both sites not part of the same project?

Of specific concern at Kaihu Point is
2 the long term impact of low frequency 18b
sound on fish populations around the proposed transmission site - fish

native Hawaiians depend on for subsistence. The DEIS states that "the potential for this impact is uncertain," due to "insufficient
3 information." It is unacceptable to proceed on such uncertain, insufficient grounds. 15

241 PB1

The ATOC project as a whole is plagued by many such uncertainties. The certainty of global warming, however, is well established in scientific communities worldwide. The money for ATOC would be better spent in efforts to speed improved clean energy & energy efficient technologies.

I urge you to reconsider the ATOC project in light of its dubious necessity & uncertain destructiveness.

Sincerely,

[signature]

RECEIVED

To the Advanced Research Projects Agency -

My name is Rebecca Miller. I live in Hanalei, HI, and I am strongly opposed to the implementation of the ATOC project on the island of Kauai or in California. Please let the record show that I vote for the alternative of No Action.

The draft E.I.S. report for this project looks more like an advertisement from a salesman than a scientifically objective study searching for the truth. Basically what I read was mostly hype.
1 The ATOC project looks very suspicious to me, as 1b2
if something is being covered up. The proponents are eager to convince the public of its virtues without answering our questions or addressing our concerns.

I will not allow anyone to blast sounds across vast areas of the Pacific ocean for any purpose. If indeed the only purpose for this noise polluting ATOC project is to
2 check for global warming, which I suspect is false, 3a
then at the very least it is a gross misuse of taxpayers' dollars.

I support the re-directing of the money designated for the ATOC project to environmental clean-up projects, reforestation and alternative energy research.

In 1995 it is vital that we begin to undo the damage that has been done to the earth during the industrial age of this century.

Raising academic questions about whether global warming exists is insane in a time when our very lives depend on our ability to act quickly to save the only home we have.

There are many of us who oppose this project and we will be watching to make sure it never happens.

Signed,

Rebecca Miller
PO Box 471
Anahola, HI 96703
(808) 826-1332

PATSY T. MINK
SECOND DISTRICT, HAWAII

WASHINGTON OFFICE:
2135 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-1102
(202) 225-4906
FAX (202) 225-4987

DISTRICT OFFICE:
5104 PRINCE KUHIO FEDERAL BUILDING
P.O. BOX 50124
HONOLULU, HI 96850-4977
(808) 541-1986
FAX (808) 538-0233

RECEIVED 3/3/95

Congress of the United States
House of Representatives
Washington, DC 20515-1102

COMMITTEE ON STEERING AND POLICY
COMMITTEE ON BUDGET
COMMITTEE ON EDUCATION AND LABOR
SUBCOMMITTEES:
ELEMENTARY, SECONDARY & VOCATIONAL EDUCATION
POSTSECONDARY EDUCATION
LABOR MANAGEMENT RELATIONS
COMMITTEE ON NATURAL RESOURCES
COMMITTEE ON GOVERNMENT OPERATIONS (on leave)

February 28, 1995

Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Ste. 901
2345 Crystal Drive
Arlington, VA 22202

Dear Mr. Spikes:

RE: Acoustic Thermometry of Ocean Climate (ATOC)
Island of Kauai, State of Hawaii
Comment Draft Environmental Impact Statement

I have reviewed and would like to submit my comments on the Draft Environmental Impact Statement (DEIS) for the Kauai, Hawaii Acoustic Thermometry of Ocean Climate (ATOC) experiment, prepared by the Advanced Research Projects Agency (ARPA) and National Oceanic and Atmospheric Administration (NOAA), in conjunction with the State of Hawaii Department of Land and Natural Resources (DLNR).

1 The original premise upon which I opposed the ATOC experiment remains: the boundaries of a marine sanctuary must continue inviolate in the preservation and protection of natural habitat that it was established to conserve. I endure in my objection to the introduction of a foreign sound source that the DEIS says may cause behavioral changes in humpback whales protected by the Hawaiian Islands Humpback Whale National Marine Sanctuary. 4a

2 The DEIS proposes to conduct a Marine Mammal Research Program (MMRP) Pilot Study off the coast of Kauai with the ATOC sound source, which I strongly oppose. The MMRP will employ the same ATOC mechanism, through which marine mammals in Hawaiian waters could be "harrassed" or "takings" could occur. If any methods are employed to evaluate marine mammal noise tolerance levels, these must pose no risk of harm to these animals. 6a

If it is truly the intent of project managers, as the DEIS states, to comply with all applicable rules and regulations, it is clear that ATOC and the MMRP cannot be allowed to run in the

PRINTED ON RECYCLED PAPER

Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Ste. 901
February 28, 1995
Page 2

proposed Kauai location. Many in Hawaii have worked long and hard in an effective State and Federal partnership to fulfill the goals of the Sanctuary. The ATOC project represents an outright encroachment on the roles of this partnership.

Based on these reasons, I strongly recommend the agencies involved to pursue the "No Action" alternative.

I appreciate your serious attention to my views on this matter.

Very truly yours,

Patsy T. Mink

PATSY T. MINK
Member of Congress

UNIVERSITY OF CALIFORNIA, SAN DIEGO

UCSD

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RECEIVED 2-22-95

ARPA/NMFS
c/o Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington VA 22202

14 Feb 1995

Roy Schaefer
Dept. of Land and Natural Resources
Box 621
Honolulu HI 96809

RE: ATOC Kauai Draft EIS

I would like to start by expressing my appreciation for the opportunity to comment on the Draft EIS for the Kauai ATOC Project/MMRP. I would like to address the stated rationale for the MMRP and how that rationale affects weighting of the proposed alternative sites; I believe the Johnston Atoll alternative has been dismissed too hastily and strongly recommend that it be reconsidered.

The Objectives of the MMRP (p. 1-22) are to evaluate the effects of low-frequency sounds (from ATOC, ships and boats) on marine animals and to use the information gained to develop mitigation measures:

> "Information obtained from the research program on marine mammal reactions to subsea noise has the potential to inform management decisions needed to implement measures to protect marine resources" (p. 5-5).

> "The MMRP would, however, provide both important information to assess accurately the impacts of noise, and implement Goal 1.3111 [of the NMFS Humpback Whale Recovery Plan] to reduce noise disturbance in Hawaii. ... If the MMRP provides evidence that existing subsea noises are adversely affecting marine mammals, data from the study will help provide a foundation for noise controls which responsible agencies may seek to implement. The MMRP may thus help bring about long-term reduction of ambient subsea noise levels off Kauai" (p. 5-17).

> "Identification and quantification of the potential effects of low frequency sound on marine animals would help Kauai (and Hawaii) determine the need for possible operational restrictions on human-made noise sources (e.g., merchant ship traffic, whale-watching boats, etc.)" (p. 6-1).

It is clear from the above that in the context of the MMRP, the ATOC sound source is merely a tool in the investigation of a larger problem of broad geographic relevance. This is a proposal to *do important biological science*, not merely monitor a physicist's experiment for side-effects. As such I welcome it with enthusiasm.

Given that a major Project Objective is to study the effect of sound on marine animals (especially cetaceans), I am struck by what I see as odd logic in arguing for the Kauai site. When trying to study the impact of "X" on normal biological/ecological systems, it would be standard operating procedure to identify a study system in which X is largely absent and then add X under controlled conditions, to observe the results. To choose a system in which unspecified amounts of X have been present for decades, to varying degrees, and for which no good data exist prior to this exposure--this makes no sense unless there are strong practical constraints preventing any alternative.

In the ATOC context, it is simply bad science to attempt to study the impact of sound in a system where the most sensitive animals presumably
1 departed years ago, and the remaining ones are likely to have habituated to 11a
anthropogenic sounds[1]. To the extent that Kauai is such a system, the MMRP (and hence ATOC) site should be moved to an alternative location.

The one circumstance which would obviate this objection would be the absence of cetaceans from alternative sites, and this is in fact the concern raised in the Draft EIS. Johnston Atoll receives low marks in Table 2.4-1, the summary of alternatives, almost entirely because of the presumed scarcity of marine mammals at the site (p. 2-23-24). According to the EIS, humpbacks have been observed off Johnston "on rare occasions" (p. 3-15, citing 1982 and 1983 sources); for odontocetes, no sperm, false killer, pilot, or beaked whales "have been reported off Johnston Atoll" (p. 3-20). (I trust the concern over greater marine mammal impacts at Johnston "due to larger populations ...." expressed on p.4-55 is a typo?)

Reading this, I got on the phone with a friend who has worked at Johnston Atoll (Dr. Phillip Lobel). It turns out that in addition to humpbacks TC
2 (with calves), he has seen both pilot and Cuvier's beaked whales there, and 4a
noted that it was only since about 1984 that there has been significant oceanographic research carried out in the area. It was his understanding that the authors of the Draft EIS had not even contacted USFWS representatives familiar with the Atoll in the preparation of the EIS.

If I can get on the phone and in 10 minutes double the large whale species list presented for Johnston Atoll in the EIS, it strongly suggests that there has not been enough effort put into either primary or secondary

---

[1] Habituation should not be viewed with automatic complacency (cf. p. 4-5); recall the "boiling frog" principle.

research on the site to justify its rejection on the grounds of inadequate marine mammal population for the MMRP.

The only other category for which Kauai scores an "H" to Johnston's "M"
3 in Table 2.4-1 is in the ability to utilize existing U. S. Navy hydrophone arrays. 4a
In this context, note that in fact the primary Navy CEROS array off Kauai might __not__ be available to the Project, necessitating construction of an alternate HLA at that site (p. C-8). In light of this, the absence of an existing array at Johnston cannot be considered a serious problem.

If the MMRP really is about studying the effects of anthropogenic sound on marine animals, then the final site selection should not be made until proper aerial surveys of marine mammals off Johnston Atoll TC
have been conducted. If, as seems likely, adequate populations are discovered then Johnston Atoll is a better site at which to study those effects in a controlled setting.

__SPECIFIC COMMENTS__:

__Volume I__:
Appendix C:

I. A. To keep the experimental protocol really "clean" the MRT leader should not know what transmission type is occurring; since the actual signal to the sound source will be initiated by the computer at Barking Sands, this should not be difficult to arrange. The computer log should be secured and actual transmission types released to the team following analysis of the behavioral data. Otherwise the protocol is not really blind, and the efforts in that direction wasted. TC

4 App C

Similarly, as I understand it the protocol on pp. C-3 to C-4, the MRT Leader will be trying to ensure sampling effort during the 25 minutes prior to ramp-up; this sounds like it implies communication between MRT Leader and observation teams along the lines of "head's up!" -- which could clearly lead them to search for behavior changes 25 minutes from the call. Such a time-specific alert should be avoided.

I. C. 1. Shut-down guidelines. There are few really silly bits in the proposal, but the notion that the MRT Leader will suspend operations upon being informed of a "chronic behavioral response" correlated with a specific transmission certainly qualifies. Imagine a worst-case scenario in which a
5 whale is mortally injured--by the time it swam at full speed from the ATOC 6g
source to strand and die on the beach, even assuming it was instantly detected the causative transmission would be long over and the link indirect. The protocol looks nice, but it won't happen that way (if shut-down is ever called for).

5 **II. A. 2.** RE a second DAT recorder for recording to 20kHz -- this is a *question??* At least two recorders should be part of the field equipment to cover breakdowns; in the context of a multimillion dollar program, to do otherwise would be foolish. Given how little is known about high-frequency odontocete vocalizations and the fact that we don't know what sort of reaction might signal stress on their part, *of course* efforts should be made to monitor high frequency vocalizations. TC App C

II. D.1. I assume the ethograms for aerial observation (Table C-6) and shore (Table C-3) will be merged in some way?

6 **II. E.** "With enough aerial survey data available, there should be sufficient power to estimate numbers..." **PRECISELY**, but what is "enough"? This can be estimated (cf. Smultea et al; below) and the data existed when this DEIS was written to do so, but I see no formal attempt to do so. The 1993 and 1994 surveys flew approximately the number of flights proposed here (16; p. C-27), but results differ substantially (see below). I can only hope I've misunderstood something; otherwise, based on the preliminary data the aerial survey effort appears to be totally inadequate. TC App C

<u>Volume II</u>:

Cerchio, Jr. - Photo ID. p6 - It's important to emphasize that the low sighting rate reported for the North shore is likely due to seasonal bias in sampling; most North-shore observations were in April by which time whale abundance was at its lowest everywhere.

7 p 9--The greater abundance of surface active groups and lower incidence of calves off the North coast could be a seasonal effect but could indicate that it is a mating area (which would make sense; to miss a reproductive year would be costly for females so a last burst of mating before leaving the islands could act as "insurance" (comparable behavior has been reported for other taxa). As such, it might be a particularly sensitive area for the whales. 60

Mobley et al., 1993 aerial surveys. p 17-18-the high CV for pod sightings (51% for the Northern region) is a serious problem. With such variability, what search effort would be needed to detect a 10% real change in whale abundance during ATOC? [cf. Smultea et al. (1993: pp. 60-61, "*V. Recommendations...* "), though designing the study to detect a 20% change in behavior/abundance (vs. 5% or 10%) needs debate and justification].

Mobley & Grotsfendt, 1994 aerial surveys. Fin whale sighting (p3)--it is worth noting that as a result of commercial whaling finback populations had crashed to a fraction of their original abundance by ca. 1962, and were being severely reduced during the preceding decades. I don't know the history of search effort in the region pre-WWII, but we should consider the

possibility that finback and other mysticetes *were* more abundant in the region, and *could* be on the way back.

Aerial surveys (both years). This preliminary report does not compare 1993 and 1994 results. Roughly comparable distances were flown in the two years, and the results (# pods sighted) were something like:

	1993	1994
humpbacks	397	135
hump. indiv/nm	.0952	.0365
Stenella	15	6
pilot whale	12	11
Tursiops	5	10

<u>If</u> these are fair comparisons (I haven't stratified search effort by location etc) then there is clearly going to be difficulty separating possible ATOC effects from interannual variation in terms of impact on overall numbers; <u>much</u> greater search effort will be needed (cf. the point about CVs above).

8 **Smultea et al. Shore station reports:** comparison of 1993 and 1994 data would be critical for evaluating the research effort needed to detect potential changes in behavior. The copy of the DEIS I received has a cover page for the 1994 shore station report, but what follows is a different draft of Cerchio's 1993 photo ID report and so I can't comment on the comparison. A formal comparison such as Smultea et al. describe in their 1993 recommendations is essential. TC

Thank you very much for your attention.

Sincerely yours,

Jim Moore

Jim Moore
Assistant Prof.
jjmoore@ucsd.edu

NB: I was born and raised in Hawaii, and have participated in studies of spinner dolphin and humpback whales in Hawaiian waters. My formal academic training is in marine biology/animal behavior (Stanford University, AB, MS) and biological anthropology (Harvard University, PhD).

RECEIVED 2-27-95

To Clayton H. Spikes

I am writing to express my opposition to the ATOC project. The Draft Enviormental Impact Statement (DEIS) is inadequate to allow the ATOC project to proceed.

Both the adverse impacts to the marine life and the "research benefits" are stated in the DEIS as uncertain. It is impossible to
1 estimate the irreversible effects of the high decibel, low- 15
frequency sound on marine mammals such as gradual deafness and damage to reproductive and immune systems.

Scripps Institute has received 35 million dollars from the DOD to research global warming. If global warming was the true priority, then the expenditure of tax dollars would be better spent on clean energy, energy efficiency, and other responsible efforts to reduce our impact on the global climate. The "classified" nature of the ATOC project indicates that it has nothing to do with global
2 warming, and suggests that ATOC is a military operation to improve 1
submarine detection and make use of the SOSUS listening arrays which would otherwise be shut down.

It is clear that the true intentions of ATOC have not been revealed to the public and further analysis must occur before this project is allowed to proceed.

Sincerely yours,

Allen Morgan
3640 Hardin Way
Soquel, CA
95073

March 1, 1995

RECEIVED 3-8-95

Advanced Research Project agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, VA 22202

To Claylon H. Spikes:

I am writing again to express my opposition to the ATOC Project. The Draft Environment Impact Statement (DEIS) fails to address the issues of alternatives and negates potential impacts. In addition, the many concerns of the public expressed in previous hearings and in writing have not been met, including: native Hawaiian's rights, the segmentation of the EIS process, and ATOC's military applications.

The issue of native Hawaiian's rights (specifically subsistence fishing in the water around the ATOC sound source
1 is being brushed aside, which violates an order that 20
Federal actions address environmental justice in minority populations. On page 103, section 4, the DEIS states that "there is insufficient information to determine whether any
2 adverse long ~~term~~ term impacts to fish could result from 15
low frequency sound, thus, the potential for this impact is uncertain."

The DEIS fails to discuss the obvious connection
3 to the Monterey Bay ATOC feasibility project and the 12c
cumulative impacts of both the Hawaii and California ATOC Projects. NEPA requires that "proposals which are

relates to each other shall be evaluated in a single impact statement." The proponents of ATOC have intentionally segmented the entire ATOC project into two separate projects (Hawaii and California).

Finally, the DEIS does not adequately
4 reveal the possible military applications of ATOC, 1
nor does it fully and honestly disclose the involvement of the DOD. It is clear that the true intentions of ATOC have not been revealed to the Public and further analysis must occur before this project is allowed to proceed.

Sincerely Yours,

Kerry B. Murnane
3828 22nd St.
San Francisco, CA
94114

RECEIVED 3-9-95

2-2980 E. Cliff D
Apt. 10
Santa Cruz, CA
95062
March 2, 1995

Mr. Clayton H. Spikes
ARPA Contractor Representative
Marine Acoustics, Inc.
4 Crystal Park, Suite 901
Arlington, VA 22202

Dear Mr. Spikes;

This responds to the ATOC Kauai Draft EIS & its associated permit application P557C.

I am a certified Wildlife Biologist through The Wildlife Society, but my emphasis is on terrestrial mammals. Therefore, my remarks rely on the views of professional marine biologists cited in the DEIS.

There is much good science cited in the document and almost as many diverse predictions of the project's effects as there are reputable scientists expressing them. Sorting out all the expert opinions is like trying to understand the U.S. Economy by listening to the views of a panel of economists.

I have long considered Dr. Roger Payne, President of the Whale Conservation Institute, to be an objective and responsible cetologist. I side with his views cited on Page 17 of a May 14, 1994, letter from SCLDF (Sierra Club Leg. Def. Fun) to Drs. Alewine & Fox (Vol. II of DEIS, Paper sheet 31 from front cover). 4b

1 I say move the sound sources to areas with low concentrations of marine mammals & turtles.

Sincerely,

James A. Nee

Laura J. Navin
48 Birch Crescent Ap
Rochester, N.Y. 14607

Advanced Research Projects Agency
Marine Acoustics, Inc.
2345 Crystal Dr.
Arlington, Virginia 22202

To Clayton H. Spikes;

I am writing to express my opposition to the ATOC project, specifically the implementation of acoustic sound transmitters at Kaihu Point in Kauai, Hawaii.

1 The Draft Environmental Impact Statement for this site conspicuously fails to account for the cumulative effects both proposed transmission sites (Kaihu Point and Point Sur) will have on marine life in the Pacific. Are both sites not part of the same project? 12c

2 Of specific concern at Kaihu Point is the long term impact of low-frequency sound on fish populations around the proposed transmission site — fish native Hawaiians depend on for subsistence. 18a

3 The DEIS states that "the potential for this impact is uncertain," due to "insufficient information." It is unacceptable to proceed on such uncertain, insufficient grounds. 15

The ATOC project as a whole is plagued by many such uncertainties.
4 The certainty of global warming, however, is well established in scientific communities worldwide. The money for ATOC would be better spent in efforts to spread and improve clean energy and energy efficient technologies. 32

I urge you to reconsider the ATOC project in light of its dubious necessity and uncertain destructiveness.

Sincerely,

RECEIVED 3/13/95

6 March 1995

Advanced Research Projects Agency
c/o Clayton H. Spikes
Marine Acoustics Inc, 4 Crystal Park, Suite 901
2345 Crystal Drive, Arlington, VA : 22202

SUBJECT: ATOC HAWAII SITE DRAFT EIS COMMENTS

1 The Acoustic Thermometry of Ocean Climate (ATOC) proposed project should be terminated because the Draft Environmental Impact Statement (DEIS) has failed to either respond to, or adequately address, the major issues of concern expressed at the prior hearings and in correspondence to ARPA and NMFS. The DEIS acknowledges only three issues (p ES-4): 14b

- o "Potential effects of low frequency sound on marine mammals, sea turtles and other marine life;
- o Alternative technologies to conduct climate change studies; and
- o Whether an acoustic thermometry project is an appropriate activity at the proposed location"

2 The DEIS continues to ignore that the technical feasibility of the ATOC concept has been misrepresented and that relevance to climate has not been validated. The DEIS also refused to discuss the long-term global monitoring system based on the ATOC concept (p 1-21), which is essential for the ATOC concept to work at all, if technically feasible, and which is expected to be prohibitively expensive. 3a

Technical Feasibility and Relevance to Climate

Although the misrepresentation of the ATOC technical feasibility and non relevance to climatic research has been expressed at prior hearings and in prior correspondence, the DEIS continues to perpetuate inaccurate technical information and to claim relevance to climate.

The ATOC system measures the velocity of sound in the SOFAR channel. It does not measure water temperature per se. So the statements on p ES-1 "precisely measure average ocean temperatures", p 1-5 "precise measurements of temperature on an ocean basin scale", p 1-6 "travel time is a direct measure of the large-scale average temperature between the source and the receiver", p 1-8 "measuring ocean temperature", p 1-15 "measure average ocean temperature", are scientifically inaccurate and misleading.

3 In my prior correspondence to ARPA and at the Santa Cruz hearing, I presented the complexities of deriving temperature data from sound velocity measurements, which is partially repeated as follows: 3d

"The critical technical aspect of the ATOC concept is not the ability to transmit sound long distances through deep ocean waters utilizing the SOFAR channel, but being able to interpret the average sound velocities measured. As with any remote sensing system, be it electromagnetic transmission through the atmosphere, seismic transmission through the earth, or sonar transmission through the ocean, the signals recorded at the receivers have been changed by properties and heterogeneities of the intervening media.

Sound velocities in the ocean depend primarily on water temperature, salinity and pressure. These properties vary both in space and time. Because the ocean is not a homogeneous medium, sound transmission is absorbed, refracted, reflected and scattered depending on gradients, interfaces and matter within the ocean water; and on the characteristics of the ocean bottom and ocean surface. The SOFAR channel fluctuates in depth and dimension geographically and over time.

The sonar experiment proposed measures average sound velocity between transmitters and receivers separated by 1000's of miles. There are numerous uncertainties associated with trying to interpret the temperature component from the recorded signals. They include the complexities of the intervening media discussed above, resolution of human-activity caused temperature effects from naturally-occurring climatic trends and fluctuations, and perturbations caused by natural events such as large volcanic eruptions." Thus, temperature is interpreted from averaged sound velocity data - data that has been modified and influenced by all the factors discussed above..

The DEIS claims that the ATOC program will provide useful data on global warming due to the greenhouse effect. Not so. The earth's climate changes naturally over a large range of time intervals from glacial/interglacial periods (10,000s of years) to El Ninos (< 10 years).

To determine the human-activity component/effect on climate requires:

o Temperature trend data reflecting changes over relatively short time periods of a few years to a few decades. Thus the uppermost mixed layers and wind-driven circulations would provide the most appropriate temperatures; and

o Determining the amounts of carbon dioxide (and other gases) over the equivalent time intervals. Thus measurements or estimations of carbon dioxide deposited in coral reefs and other carbon deposits or indicators are needed.

The ATOC concept does not fulfill either of these requirements.

Contrary to DEIS statements that ATOC directly measures ocean temperatures (cited above), and that ATOC has climatic relevance (p ES-1, p 1-8), the admission that the ATOC concept may not be technically feasible or have any relevance to climate is expressed on p ES-2: "Yet, whether this technique will provide useful climatic information depends on surmounting a number of technical and other potential barriers. For example, ocean movements from tides, currents, internal waves, eddies, and other oceanographic features also affect acoustic transmissions. While traveling long distances, sounds could be scattered, distorted or otherwise rendered unusable."

Thus, the proposed ATOC sound transmissions may produce averaged sound velocities that can not be correlated to average ocean temperatures. And, any temperatures interpreted from the sound velocities, in turn, can not have relevance to climate.

Omitted from discussions of the SOFAR channel in the DEIS is that its waters vary in age as a function of water depth and latitude that can range from 10 years up to 100s of years, and that its depth and thickness fluctuate with time. Consequently any temperatures interpreted from the averaged sound velocities would represent a blend of highly differing ages, which would not be useful for climate changes as a function of time, especially those intervals of time relevant to human-activity influences on climate.

Higher resolution ocean measurements of physical, chemical, and biological parameters are needed to characterize the processes for the general circulation models, not ocean basin averaged data such as proposed by ATOC. High resolution data can be averaged if desired; but if
3 the original measurements are averaged values, the variabilities that give 3c
insight into the processes and how they affect climate can not be determined. In essence, the DEIS failed to explain how temperature values averaged over thousands of miles and encompassing a thick deep zone of waters representing time lags of tens of years is relevant to understanding ocean circulation processes and improving climate models which both require knowing about the variabilities as a function of space and time.

Proposed Source Transmission Sites

The proposed ATOC program should be designed to optimize the scientific aspects and criteria especially since the DEIS admits it does not know yet whether the concept is even feasible. Instead the location of existing
4 hardware - military facilities and subsea receiver arrays - are controlling 4a
the location of proposed source sound sites and the location of acoustic paths for measuring averaged sound velocities.

The source site off the north shore of Kauai was selected because:
- o The Kauai acoustic shadow plot (2000 m below axial depth) indicates that sound transmissions should be detected at the existing receivers in the north and northeast Pacific and at Guam to the west;
- o The Barking Sands military base on the west side of the island will provide facilities for monitoring the sound transmissions;
- o The source power/monitoring cable will be connected to an existing cable 1.3 km offshore of Barking Sands (pre-placed for ATOC?).

One of the source site criteria cited in the DEIS requires "minimum length of power cable to shore, to minimize cable costs and voltage requirements (most cables voltage-limited)" (p 2-16). The closest onshore power sources are at Hanalei and Princeville on the north shore of Kauai - a distance slightly more than 14.7 km (8 nm). Yet the proposed cable is about 51.5 km long (27.8 nm) - which trends directly toward the north coast, but then contours offshore around to the west side of the island to Barking Sands (Figure 1.1.6-3, p 1-19).

The ATOC preferred site at Kauai is compared to several alternative source sites: Johnston Atoll, Midway Island and Adak. The figures for Kauai are large-scale, detailed and good quality (p 2-12, 2-13). The figures for the alternatives are small scale, lacking details (no contour values) and poor quality (dark backgrounds) (p 2-19, 2-20, 2-21). However, there appears to be better source site locations for Midway than the one shown.

These four sites were evaluated on a variety of MMRP and acoustic thermometry feasibility (ATF) criteria (p 2-15 to p 2-17), which were rated and summarized in Tables 2.2.3.2-1 and 2.2.3.2-2. Not surprising that Kauai was rated higher than, or as high as, any of the alternative sites on these criteria because ATOC has been conducting studies (e.g., marine mammals) and making preparations (e.g., preplacement of cable) there for the past several years.

Many of the MMRP criteria evaluations are debatable or biased:
- o Kauai was rated high, all others rated low regarding a passive acoustic system. Kauai should also be rated low, because none currently exists there either (the CEROS array is only proposed).
- o Large marine population rated high (Kauai, Adak). However, acoustically adverse effects would indicate rating should be low.
- o Baseline marine animal population estimates available obviously favor Kauai because ATOC has been doing those studies around Kauai for several years.
- o Close to land for MMRP field study convenience rates high (Kauai, Johnston). Could also be high for Midway if site location modified as suggested above.
- o Close to other noise sources re effects on animals rated high. However, this is debatable because animals could have habituated to them.

The ATF criteria evaluation also have some debatable aspects:
- o If the Midway source site location was modified, about 5 of the criteria would be comparable to Kauai (which rated higher).
- o Kauai rates high on the cable armor/trench criteria because of pre-placement, which is a built-in bias if done for ATOC.

The Hawaiian Islands have several characteristics that unnecessarily complicate the already complex nature of sound velocity through the ocean. The Islands are the site of a tectonic hot spot that has two of the worlds most active volcanoes above sea level and a third active underwater vent zone. The hot lavas, reaching temperatures of 1200 degrees C (2200 degrees F), pour into the ocean periodically and heat flows continually from the shallow molten magma chambers beneath the sea floor. The volcanic gases released during eruptions contain CO_2 and SO_2.

Associated with the volcanism are earthquakes that can cause tsunamis and trigger underwater landslides. The sea bottom morphology and materials are complex between and around the Islands.

Kauai, noted as one of the wettest places on earth, averages more than 500 inches of rain per year. The large amount of fresh water runoff from Kauai and the other Islands into the coastal waters and the occurrence of off-shore fresh-water seeps cause salinity dilutions and anomalous gradients.

The combination of volcanism, earthquakes, complex sea bottom, and copious fresh water influx would complicate sound transmission near the sound source and add to the uncertainty of interpreting the signals recorded at the receivers. Thus, the proposed sound transmission site off
5 the north coast of Kauai is scientifically a poor candidate. 4a

Sound Sources, Transmissions, and Hearing Effects

The proposed sound source would be located 14.7 km north of Haena Point, Kauai. This location is near a portion of the Hawaiian Islands Humpback Whale National Marine Sanctuary along the northern coast of Kauai. The proposed source power/monitoring cable would extend for 51.5 km (27.8 nm) offshore from the Barking Sands military facility on the west coast of Kauai, contouring around to the north side of the island and then northward to the proposed sound source site.

The DEIS sound field spherical and cylindrical models show that the 120 dB ranges much farther toward the coast of Kauai than it does seaward (p 2-9, 2-11, 2-13) This relates to my scoping recommendation to conduct sound simulation studies to examine how sea bottom topography and ocean properties between the source site and shore could cause amplification of the acoustic waves. The models use simple geometric spheres and

cylinders, and do not consider attenuation/reinforcement of signal propagation (p 2-7), which is greatly influenced by the sea bottom and sea surface. Thus the sound level could be locally even more reinforced
15 (higher) as a function of actual sea bottom topography and water depth between the sound source and shore. Sec 2.2.1

Consequently the potential threat to marine mammals and other marine animals that inhabit the shallower coastal waters is much greater than the DEIS has acknowledged. This also includes marine mammals that are not deep divers.

The basic mechanisms that lead to hearing damage appear to be similar in all mammalian ears. Sound exposures potentially hazardous to hearing are usually defined in terms of sound level (measured in dB), frequency bandwidths (measured in Hz), and duration. To define what sounds can damage hearing, sound level (whether across all frequency bands or taken band by band) is not enough. The duration of exposure is critical. Short-duration sound of sufficient intensity may result in an immediate, severe, and permanent hearing loss, termed acoustic trauma.

6 Moderate exposure may initially cause temporary hearing loss, termed temporary threshold shift (TTS). After TTS and during a period of relative quiet, thresholds will return to normal levels. TTS may last for hours or days. There are two phases of recovery. First, a rapid phase of repair takes place within the first day of noise injury. A slow repair process then takes place, which may take as long as a month. 9a

Noise can cause chemical and physical damage to the delicate hair cells of the inner ear as well as swelling of nerve fiber endings inside the cochlea. With exposure to high frequency, the damage is usually confined to a restricted area in the high-frequency region of the cochlea. With a comparable exposure to low-frequency noise, hair cell damage is not confined to the low-frequency region but may also affect the high-frequency regions.

The resultant damage to the inner ear hair cells is irreversible. Once a sufficient number of hair cells are lost, the nerve fibers to that region also degenerate. NIHL is insidious, permanent, and irreparable. The only way to avoid NIHL is by preventing it in the first place.

A recent study of effects of noise on marine mammals concluded that "Prolonged or repeated disturbance, as might occur if a stationary and noisy human activity were established near a marine mammal concentration area, is a more important concern than isolated short-term disturbance". The proposed ATOC project constitutes a serious concern for marine mammals and other marine life.

Marine Mammal Research Program (MMRP)

The objective of the MMRP stated on p 1-22 of the DEIS - "Evaluate the potential effects of low frequency sound transmissions on marine animals, particularly the species of marine mammals and sea turtles that are common to Hawaiian waters" - can not be achieved.

7 The MMRP time period and schedules of field study intervals and species is insufficient to establish the needed baseline data of species population size and distribution, habitat use, and acoustic sensitivities and dependence. The primarily visual, and some acoustic, observations and monitoring by the ATOC marine scientists to detect deviations of 'normal' behavior due to human-generated sounds may provide some indicators of direct, short-term physical responses. However, they can not provide answers to the long-term adverse impacts and indirect effects that could physically damage the hearing of the acoustically dependent marine mammals and cause psychological damage that could suppress their immune systems, disrupt their social structure (e.g., communications, mating, birthing), and adversely affect their feeding. 6a

Many prey species of marine mammals may also be affected by intense low-frequency sounds. The sensory receptors of fish have the same type of sensory hair cell as found in the mammalian ear. Some groups of marine invertebrates have structural and functional similarities to the vertebrate ear. Damage to to the major sensory receptors of these species could harm a major food source for many cetaceans. Also there is laboratory evidence that high-intensity sounds may result in damage to other organ systems of these prey animals, such as egg viability and growth rates.

Hearing impairment and permanent loss are most likely to occur without evidence of some distinctive behavioral response, and would take longer than the time period allotted for the MMRP. There is no way to measure hearing impairment in the free-ranging marine mammals being studied. The inherent flaw is that to conduct sound tests to the point of detrimental harassment or injury violates the Marine Mammal Protection Act and Endangered Species Act, and short term results interpreted as 'non detrimental or acceptable harassment' can not be extrapolated to long-term harmful impacts on marine mammals and other marine life. Therefore, the ATOC sound phase of the MMRP should be canceled - that is, not permitted at all.

8 All marine mammals within the U.S. and territorial waters are currently protected by the Marine Mammal Protection Act (MMPA) of 1972, as amended. Humpback whales are also protected by the Endangered Species Act (ESA) of 1973, as amended, and have been protected by an international whaling moratorium since 1966. Humpbacks are further protected in Hawaiian waters by anti-harassment regulations that are enforced by NMFS (*Federal Register* 1987). Other endangered marine mammals inhabiting Hawaiian waters are sperm whale (toothed); blue, fin, and right whales (baleen); and the Hawaiian monk seal. 14c

Of the 5 sea turtle species known to inhabit these waters, the hawksbill is endangered; the green is threatened; and the leatherback, olive ridley, green and hawksbill are part of the Interim Hawaiian Sea Turtle Recovery Plan to reduce factors causing the decline of these turtles including human take and habitat alteration of the marine environment. Green sea turtles are known to feed and rest in the off-shore waters of Kauai, and to nest in the sandy bays along its northern coast.

Marine life is very rich in the ocean around the Hawaiian Islands. It includes endangered marine mammals that depend on their acoustical senses for echolocation, communication and feeding - essential for survival. Permit applicants have requested takes by acoustic harassment of about 17 species of marine mammals and 5 species of sea turtles. Estimates of potential take for 1994-5 total nearly 10,000 animals: humpback whales (1700); spinner, spotted and striped dolphins (2264); short-finned pilot whale (348); pigmy killer whale (200); killer whale (100); sperm whale (60); melon headed whale (100); beaked whales (6); rough toothed dolphins (120); bottlenose dolphin (14); monk seal (24);

green turtle (4000); hawksbill turtle (150); loggerhead turtle (100); leatherback turtle (100); and olive ridley turtle (20).

Of particular concern are the endangered humpback, sperm, fin and blue whales that have low frequency hearing capacity and vocalizations; and the endangered Hawaiian monk seal. The permit applicants report the lack of data for reliable population estimates of many of the above listed species. However they failed to include fin and blue whales whose sounds have been studied in the waters north of Oahu and results were published in a professional journal. Humpback whales constitute not only the largest number of whales expected to be impacted by the proposed sonar experiment, but also are the most vulnerable because a large portion of the central North Pacific stock resides in Hawaiian waters during the critical birthing and mating season for this species. Sperm whales, the deepest divers - which can exceed the depth of the proposed sound transmitter - have been recorded by hydrophones throughout the year in these waters. Their number is less than the other above listed endangered whales; however, they were nearly hunted to extinction, and their population recovery has been slow. Blue and fin whale sound recordings suggest seasonal migratory movements in Hawaiian waters.

Monk seals are especially endangered. The Caribbean monk seal is extinct, and the Mediterranean monk seal population, estimated at only 500, is declining. Since 1957 the Hawaiian monk seal population has declined by 60%, and currently there are only about 1200 individuals. There have been two major population declines in the H. monk seal's history. The first, in the 1800s, as a result of extensive seal hunting and the second, between the 1950s and 1970s primarily due to human disturbance of the seal's breeding areas. In 1990 only 143 births were observed - the lowest number of births ever recorded.

9 12a

Monk seal sightings around Kauai were 35 in 1987, 31 in 1988 and 45 in 1989. In 1988 seal births were observed on Kauai. Monk seals are extremely sensitive to human activity and disturbances - which can cause females to abandon their pups, resulting in increased pup mortality. In 1990 the Kauai sightings had dropped to 6 and only 3 individuals were sighted in 1993.

A Hawaiian monk seal recovery plan was initiated in 1983 by NMFS. Its objectives include mitigating effects of human activity and implementing

management actions for the seal's conservation and recovery. It is imperative to protect these highly endangered monk seals from any
10 further intrusion into their habitat. Although most of the breeding and 14c
births take place on the northwest Hawaiian Islands, H. monk seals are known to travel distances up to 1165 km in the open ocean and move as far as the main Hawaiian Islands and Johnston Atoll. Their maximum dive depths are about 120-175 m.

A critical element of the acoustic threat to marine mammals and other marine life is that ATOC is a repetitive long-term sound producing system. It would be more damaging than other equivalent sound level sources, and would cause continuing interference of marine mammal acoustics.

Long-Term Program Plans and Funding

The ATOC plan is to extend and expand the initial 2-year, 2-transmitter, 18-receiver north/northeast Pacific Ocean experiment to a 10-year, multiple-transmitter, numerous-receiver sonar system transmitting long-range sound pulses through out the Pacific, Atlantic and Indian Oceans. And because a 10-year interval is insufficient to determine any meaningful trend in the large scale fluctuations of global climate, the ultimate plan is to extend the ATOC project to 100 years.

The DEIS refuses to reveal or address the long-term ATOC program plans
11 (p 1-21). Understandably so. Since the opposition to ATOC and public 3a
exposure of its many flaws have become so strong, ATOC has been forced to admit that the project has "fundamental uncertainties about the extent to which acoustic means can detect ocean climate changes".

However, in the following paragraph the DEIS says "this initial phase should demonstrate that it is possible to construct and operate an affordable international network capable of detecting and characterizing ocean climate change." This is contradictory to the above quote, and definitely would not be affordable. The Kauai and Pt Sur site selections were both driven by the existing military facilities linked with the existing receiver arrays - to take advantage of huge cost savings. The many new monitoring facilities and numerous receiving arrays that would have to be constructed to effectively cover all the oceanic regions of the globe, would increase costs exponentially.

The current 2-year project, originally funded at $35 million, probably is over budget. The projected costs for the 10-year program - which would not be relevant to climate - would be prohibitively expensive. Cost guessimates for the 100-year program would stun even the biggest spenders on Capitol Hill. The ATOC concept is a prime candidate for termination by Congress, which has pledged aggressive spending cuts to balance the federal budget.

Conclusions

The ATOC proposed project should not be approved. The DEIS states "The project proponents recognize that they are ultimately accountable for providing accurate information so that the public and government agencies can make informed decisions" (p ES-5). Yet this document is peppered with inaccurate and misleading information, internal inconsistencies, and refusals to acknowledge or discuss pertinent issues.

12 o The ATOC concept lacks credibility that it can ever achieve technical feasibility to interpret ocean temperatures from measured sound velocities. And even if it could, the temperatures would not be useful for climate change. 3d

13 o The MMRP can not resolve the potential harm to marine life, especially the acoustically dependent marine mammals who are protected by the Marine Mammal Protection Act, because the program cannot observe/measure long-term hearing loss or stress that could cause irreversible damage to endangered and threatened species as well as other marine life essential to the marine ecology. 6a

14 o The proposed Kauai source transmission site is not an appropriate place for the ATOC system. Kauai is essentially within the Hawaiian Islands Humpback Whale National Marine Sanctuary - whales and other marine mammals and animals do not honor human designated boundaries in their ocean habitat - and part of the main Hawaiian Islands unique marine ecology that must be protected. The site also rates poorly scientifically because sound transmissions would be further complicated and degraded by anomalous water temperatures and salinity, and by a complex and unstable sea bottom. 4a

o The costs for a long-term acoustic transmission program consisting of a large network of source sites and receiver arrays criss crossing all the oceans of the globe would be prohibitively expensive.

Deane Oberste-Lehn

Deane Oberste-Lehn, PhD
Research Scientist
P.O. Box 369
Menlo Park, CA 94026

Global Warming (ATOC) E.I.S. 2-9-95
Public Hearing
Lihue, Kauai

H-39

RECEIVED

Aloha Kauai & World Public,

My name is Alberto Partida, a 16 year resident of Wainiha, Kauai. I Served 4 years in Military secret Warfare design branch of U.S. Navy; 20+ years experience in the High tech fields; teaching, military strategic and performing arts gives me specialized perspective and opinion. Following is my Testimony.

1 In my opinion, this Global warming experiment proposal and draft E.I.S. is scientific 'double speak' cover up for 3a more of the same Global exploitation pollution which adds to Global warming problem, not solution. More waste which we do not need, considering present World crisis and 40,000 and more children dying each day for lack of life energy. We can be more creative on how to spend this $36+ million tax dollars. Global preventive medicine measurements seems like a better direction only when Its sincere.

Big Business strategy is same as military War strategy. Please read "Art of War" manuals to see same tactics used in draft E.I.S. sales pitch and proposed experiments; such as divide, confuse, and conquer; disinformation, infiltration, secrecy, and other deception.

Genocide Warfare has many secret tactics. The Killing of the American Indian buffalo for hide profit was covert front to exterminate North American Indians to better steal their land and resources. Could Global warming testing be under cover (Big Business) front to exploit World Sea life food source? Is there any truth to "Master plan" to
2 exterminate all Hawaiians within 45 years 1
to better secure legal title of Hawaii land? Such <u>intentional</u> Waste is Genocide!

As Hawaiian sovereignty and Independence movement gains credibility momentum, military buildup gains more U.S. defense proposals and back ups like Star wars, latest super radar weapon on Kokee, nuclear submarines and other 'spy' monitoring systems. Perhaps all part of a much larger "New World Order" energy milking; control operation. Something of this magnitude does not happen overnight, but takes many years and parts to construct. All in progress, unfortunately, if we continue to allow It. This "Justifiable Conquest" Cancer.

World people exposure to what is nourishing for our World family Body and what is corruption, begets adjustments in more life constructive direction. 'People Power' pressure,

2-9-95

not corrupt U.S. legal system. It's very important to remember that it is same ATOC Scientists and others supporting this ocean climate testing program whom were caught. Red handed and exposed for conducting their under cover.. (money looting) front last year; In violation to Hawaiian People rights and U.S. laws and regulations. What we have here tonight at this Public hearing is more face saving defense. Can we really expect credibility from these ATOC People this time around? In my opinion, I think not! Too much like New Age "Tojan Horse" tactic!

Many years ago a Global hydrophone Submarine monitoring system was installed secretly, under National Security classification defense shield. Now as obsolete as the Cold War, unless we buy this "New Improved" Scam Insanity. Same World Control operation with new white" sugar coated covering. Putting focus on whale study and climate testing to 'Save the World' is but very clever war tactic; cover up for Global looting (Genocide) operation. "No action" is my vote for Draft/E.I.S. alternative action.

Mahalo,

Alberto Partida

Alberto Partida

826-6632

RECEIVED 2-17-95

Date: 2/13/95

Advanced Research Project Agency
c/o Clayton H. Spikes
Marine Acoustics Inc.
4 Crystal Park, Suite 901
Arlington, VA 22202

Re: ATOC: Acoustic Thermometry of Ocean Climate

I must go on record in opposition to this plan. It cannot help but be disruptive to marine life. Although we know little about the communications among various sea creatures, we have learned that "singing" is very important to many species. It is inconceivable therefore that sounds loud enough to travel so many miles will not affect them.

I do not believe that the same scientists who want to pursue this experiment are in any position to make objective studies of the potential for damage to the environment. They cannot help but be biased.

1 Please find some less intrusive way to measure the warming trends of the oceans. I am sure there are other ways, possibly even less expensive. The potential damage to our marine life is just not worth the risk. 5a

Sincerely,

Marian Piler

115 Majors St.
Santa Cruz, Ca. 95060
February 14, 1995

RECEIVED 2-27-96

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Office of Protected Resources.
1335 East-West Highway
Silver Springs, MC 20910

Dear NOAA People:

Having a sonar emitter placed off the shore of Kauai, an area rich in sea life, including humpback whales, fin whales, endangered monk seal and leatherback turtles is an ecological affront to those animals and, possibly, an ecological disaster for them and us.

1 On January 6, 1995, in Santa Cruz a hearing pertaining to the placement of a sonar emitter at Pt Sur was attended by about 200 people. The overwhelming testimony by environmentalists, marine life experts, citizens who want to preserve our Monterey Bay Sanctuary was a gainst the project. A number of people testified that we a lready have sufficient methods to test global warming. 3a

2 With Defense funding, there is always a question as to a military use for the project as well. 1

3 We must learn to respect the natural world, not use and manipulate it for our technical projects. So much of the natural world has been destroyed by our meddling. We must lea ve the sea and its creatures undisturbed in their world for their survival and ultimately for ours. 5a

I strongly urge you to deny a permit for the California Acoustic Thermometry of Ocean Climate Project and its Associated Marine Mammal Research Program.

Sincerely,

Jane S. Podesta

Jane S. Podesta

✓cc: Clayton H. Spikes, Marine Acoustics, Inc.

Roy Schaefer, Dept. of Land & Natural Resources
State of Hawaii, Box 621
Honolulu, Ha. 96809

Save Our Shores
2222 East Cliff Dr.
Santa Cruz, Ca. 95062

KATHLEEN POTOSNAK
4508 STARBOARD CT.
BOULDER, CO 80301

1/24/95

ADVANCED RESEARCH PROJECT AGENCY
MARINE ACOUSTICS, INC.
2345 CRYSTAL DRIVE
ARLINGTON, VIRGINIA 22202

TO CLAYTON H. SPIKES:

I AM OPPOSED TO THE ATOC PROJECT.

1 THE INTENTIONS OF THIS PROJECT ARE NOT CLEAR TO THE PUBLIC. 3a

2 I WOULD LIKE TO SEE AN EXTENSION GIVEN TO THE PUBLIC COMMENT PERIOD. 14a

3 HOW DO WE KNOW WHAT KINDS OF EFFECTS ON MARINE MAMMALS THIS PROJECT WILL CREATE? 6a

4 I AM ALSO CONCERNED THAT THIS IS A MILITARY PROJECT. 1

FURTHER RESEARCH MUST OCCUR BEFORE THIS PROJECT IS ALLOWED TO PROCEED!

SINCERELY—

Kathleen Potosnak

KATHLEEN POTOSNAK

H-43

BENJAMIN J. CAYETANO
GOVERNOR
MAJOR GENERAL EDWARD V. RICHARDSON
DIRECTOR OF CIVIL DEFENSE
ROY C. PRICE, SR.
VICE DIRECTOR OF CIVIL DEFENSE

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

PHONE (808) 734-2161

RECEIVED 1-30-95

January 24, 1995

Mr. Clayton H. Spikes, Contractor Representative
Advanced Research Projects Agency (ARPA)/National
Marine Fisheries Service
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA 22202

Dear Mr. Spikes:

Draft Environmental Impact Statement (DEIS)
Kauai Acoustic Thermometry of Ocean Climate Project (KATOCP)
and its associated Marine Mammal Research Program (MMRP)

We appreciate this opportunity to comment on the DEIS for the KATOCP and its associated MMRP, Kauai, Hawaii.

State Civil Defense (SCD) does not have negative comments specifically directed at this DEIS.

If you have any further questions, please call Mr. Mel Nishihara of my staff at 734-2161.

Sincerely,

ROY C. PRICE, SR.
Vice Director of Civil Defense

cc: Department of Land and Natural Resources/
Office of Conservation and Environmental Affairs

H-44

RECEIVED 2-14-95

February 6, 1995

Advanced Research Project
Marine Acoustic Inc.
4 Crystal Park, #901
2345 Crystal Drive
Arlington, Virginia 22202

Dear Mr. Spikes,

1 I oppose ATOC. You can't separate the Hawaiian components and the California components, they are one project. Both have adverse impact to marine life, and the "research benefits" that are stated in the DEIS are uncertain. 2

2 We don't know the effect of high decimal/low frequency sound on marine mammals. 6a

3 The classified nature of ATOC indicates that it has nothing to do with a test for global warming. And suggests that ATOC is a military operation to make use of SOSUS listening arrays, which would otherwise be shut down. 1

Please put a stop to ATOC.

Sincerely,

Elizabeth Riley

Elizabeth Riley

H-45

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Dr.
Arlington, VA 22202

To Clayton H. Spikes;

I am writing to express my opposition to the ATOC project, specifically the ~~implication~~ implementation of acoustic sound transmitters at Kaiku Point in Kauai, Hawaii.

1 The draft environmental impact statement for this site conspicuously fails to account for the cummulative effects both proposed transmission sites (Kaiku Point and Point Sur) will have on marine life in the Pacific. 12c

2 Of specific concern at Kaiku Point is the long term impact of low frequency sound on fish populations around the proposed transmission ~~site~~ fish native Hawaiins depend on for subsistence. The 12a

3 DEIS states that "the potential for this impact is uncertain," due to "insufficient information." It is unacceptable to proceed on such uncertain, insufficient grounds. 20

The ATOC project as a whole is plagued by many such uncertainties. The money for ATOC would be better spent in efforts to spread and improve clean energy and energy efficient →

technologies.

I urge you to reconsider the ATOC project in light of its dubious necessity and uncertain destructiveness.

Sincerely,

Michelle Roffman

Michelle Roffman
47 Nicholson St.
Rochester, NY 14620

H-46 RECEIVED 3-5-85

Dear Sir,

I am writing to express my total and complete disgust concerning your fine ATOC project. There are

1 many other ways this study without endangering the re-production and immune systems of any marine life. Impacts such as these will not be known for many years to come. We, as humans (some of us) can not continue to think that any thing we do is just fine. We must take responsability for all of our actions. We are tired of our goverments going head long into such endevers without thinking of the reprocusions. This has to stop. and It must be stopped NOW. Please respond

Dorothy Rocke
1948 McAllistar #4
SF Ca

H-47

To: Mr. Clayton H. Spikes

I am writting to express my concern with the effects that the proposed ATOC experiment will have on Marine Mammels and other
1 Marine life. I would like to express my opposition to this experiment until such a time as ~~as~~ the impact on ~~&~~ marine life has been completed 15

Sincerely yours
Heather Saunders

Heather Saunders
700 Mohawk dr. #106
Boulder, Colo. 80303

H-48

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington Virginia 22202

Vincent Segall
2355 Grove St #
Boulder CO.
80302.

To Clayton H. Spikes,

I am writing in opposition to the ATOC project. Since the adverse impacts to marine life and the "research benefits"
1 are stated as uncertain, the tax dollars would be better spent on clean energy, energy efficiency, and the research and development of alternative mass transit to help reduce our impact on the global climate. 15

Sincerly
V. Segall

RECEIVED 2-22-95

David N. Seielstad
P.O. Box 3245
Princeville, HI
15 February 1995

Mr. Clayton H. Spikes
Advanced Research Projects Agency
Marine Acoustics Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA 22202

Dear Mr. Spikes,

Subj: ATOC Kauai Draft Environmental Impact Statement

My name is David Seielstad. My wife and I reside in Princeville on the North Shore of Kauai. I oppose the ATOC proposal as delineated in the Revised EIS which was discussed at the hearing held in Lihue 09 February 1995.

From the beginning the ATOC proposal has had the aroma of a military research project. It is funded by DoD monies. It is administered by the U.S. Navy. The originators of the project seem to be going to great lengths to disguise and conceal the true nature and the purpose of the project. In the proposal (p. 62) provision is made to "manage classified aspects of the project...." The Johns Hopkins University Applied Physics Laboratory (a *major Navy research* and development contractor) is to use its clearances and store [any classified] data. 1

1 The military seems to have a penchant for secrecy. If a few words are committed to paper someone invariably will classify the document. There are numerous examples of reports being written and then labeled secret so that even the author of the docun nt cannot have access to it. Secrecy classifications are often used to coverup embarrassi g failures of military action. Seemingly nothing is immune from this military desire to hide information. A few years ago it was revealed that the U.S. Army had expended a large amount of money to study a sophisticated weapons system. The system was considered so advanced that a Top Secret classification was put on the study. What was this advanced weapons system? The bow and arrow. I *am sure our ancestors* would be astounded to learn that the technology of 35,000 years ago was considered a secret to be kept in the 20th century.

H-49

2 *From the beginning the ATOC office* has been less than candid in informing the public about the nature of the project. The first EIS was delivered just days before the public hearing. We were told that was an "oversight". *The first hearing was held in Silver Spring,* Maryland about as far from the site of the proposed experiment as possible. Since then the ATOC Office has gone to great lengths to keep opponents in the dark. Hearings are split up. Hearings are held in California, then in Hawaii, but on Oahu and Kauai. 14a

Andrew Forbes, ATOC Project Manager, testified that he has always been open and that ATOC has not tried to hide anything. If that is true how can the farce involving the CEROS *Horizontal Array project be explained?* Someone went to great lengths to disguise the source of this project. Monies were passed from the Defense Department to the State of *Hawaii to the Hawaii Department of Business and Economic Development* and Tourism then to the High Technology Development Corp. to the Center for Excellence in Research in Ocean Sciences and finally to Science Applications International Corp.

ATOC denied that one of its staff was working at PMRF on the cable. Then we learned that the cable had in fact secretly already been deployed and ATOC was requesting "after the fact permits." If the ATOC project is not engaged in secrecy then why did it not apply for and hold hearings on installation of the cable BEFORE it was installed.

3 What is ATOC *really? It is being promoted* as a study of global warming, perhaps to save the Planet. It is said great care is being taken to safeguard animals of the seas. Who could be opposed to that? If something is cloaked in the aura of environmental research I guess we are all expected to stand up and applaud it as good science. ATOC is not good science and it is only masquerading as environmental research. 3a

5 Why is the Defense Department funding this project? Why is the U.S. Navy involved? Why has one of the major submarine training ranges, PMRF, been picked as the site for part of the experiment. Why is all of this being brushed under the carpet? 1

If this is not an Anti Submarine Warfare or submarine communications experiment then what is the *explanation for* the actual laying of the necessary cable from PMRF to the site of the ATOC boom box by a U. S. Navy vessel? Why was this only revealed after the fact?

4 In September 1994 local divers reported that a woman was working on ATOC at PMRF. Scripps Institute ATOC liaison person, Ms. Cindy Rogers, denied that any ATOC activity was being performed at PMRF at that time. In the EIS Scripps discusses laying of a cable and connecting it to an on shore facility at PMRF (Draft EIS p. 5-12). In a related application to the DNLR (Conservation District Use Application KA-2734 dated 08/25/94) 19

Scripps requests "after the fact" permission for the cables. In a letter dated December 21, 1994 to Paul Kawamoto, State Aquatic Biology Program Manager, Andrew Forbes, ATOC Program Manager, admits that the cable was actually installed in October 1983 [sic] and *goes on to arrogantly state that since the Navy did this no permit was needed anyway.* When it suits their purposes the ATOC office hides its activities behind the military.

If this project is not about global warming, but rather an attempt to find a higher frequency, and thereby increase the baud rate of communications with U.S. Navy submarines, I
5 would appreciate it if the parties involved would admit it. The waters of Kauai do not have
to be used for such a project. The Navy already has numerous underwater arrays. There are 1
other places in the world from which VLF broadcasts can be made without harassing and driving whales away from their winter migratory waters off the North Shore of Kauai.

Thank you for this opportunity to recommend disapproval of the proposed ATOC experiment.

Sincerely,

David N. Seielstad

CC: Mr. Roy Schaefer
Representative Patsy T. Mink

248 P01

703-418-1042

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

To Clayton H. Spikes,

I am writing to express my opposition to the ATOC project, specifically the implementation of acoustic sound transmitters at Kaihu Point in Kauai, Hawaii.

The Draft Environmental Impact Statement for this site
1 conspicuously fails to account for the cumulative effects both
proposed transmission sites (Kaihu Point and Point Sur) will 12c
have on marine life in the Pacific. Are both sites not part of the same project?

2 Of specific concern at Kaihu Point is the long term impact
of low-frequency sound on fish populations around the proposed 15
transmission site - fish native Hawaiians depend on for
3 subsistence. The DEIS states that "the potential for this impact
is uncertain," due to "insufficient information." It is 20
unacceptable to proceed on such uncertain, insufficient grounds.

The ATOC project as a whole is plagued by many such uncertainties. The certainty of global warming, however, is
4 well established in scientific communities worldwide. The money 32
for ATOC would be better spent in efforts to spread and improve clean energy and energy efficient technologies.

I urge you to reconsider the ATOC project in light of its dubious necessity and uncertain destructiveness.

Sincerely,

Your Name

Cynthia Simm
501 Averill Ave.
#4
Rochester, NY 14607

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

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4 The ATOC project as a whole is plagued by many such uncertainties. The certainty of global warming, however, is well established in scientific communities worldwide. The money for ATOC would be better spent in efforts to spread and improve clean energy and energy efficient technologies. 3a

I urge you to reconsider the ATOC project in light of its dubious necessity and uncertain destructiveness.

Sincerely,

William J. Sparks
William J. Sparks
139 Tobey Rd.
Pittsford, NY 14534

---

18 Birch St.
Rochester, NY
14607

Advanced Research Project agcy
Marine Acoustics, Inc
2345 Crystal Drive
Arlington, Virginia 22202

To Clayton H. Spikes

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plagued by many such uncertainties. The certainty of global warming is, however, well established in scientific communities worldwide. The money for ATOC would be better 3a
spent in efforts to spread and improve clean energy and energy efficient technologies. I urge you to reconsider the ATOC project in view of its dubious necessity & uncertain destructiveness.

Sincerely,
Eliza Stoker
ELIZA STOKER

P.S.
This is my second letter. Your response to my first was appallingly insufficient. Why don't you try READING this one.

Sarah E. Sykes
February 2, 1995

RECEIVED 2-7-95

Mr. Clayton H. Spikes
ARPA Contractor Representative
Marine Acoustics, Inc.
4 Crystal Park, Suite 901
Arlington, Virginia 22202

Mr. Roy Schaefer
Department of Land and
Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

RE: ATOC KAUAI DRAFT ENVIRONMENTAL IMPACT STATEMENT

I object to granting any permits for any phase or portion of this project under any circumstances. I also object to any funding being granted to this boondoggle.

1 The ATOC project and its associated Marine Mammal Research Program is poorly conceived and planned. No reasonable justification exists for any action other than withdrawing the proposal. The project risks injuring and killing marine mammals, which are protected by the Oceans Act of 1992. No data generated is worth the environmental degradation and consequent loss of life. 5a

2 Almost as important in these belt-tightening times: no data generated is worth the cost to the taxpayers. These experiments' purpose is to tell us what we already know, but don't want to admit. We, the people, are destroying the earth, and all creatures both great and small who call it their home. We hide behind delaying studies such as these, to avoid immediately correcting our grossly wasteful, consuming and polluting lifestyles. We know the ozone layer is in trouble, we know global temperature fluctuations are exacerbated by pollution. We don't need another study to tell us to clean up our act. The project is just another big science boondoggle supporting bloated budgets. 3a

3 Worst of all, no one knows if the experiment will work, but they're still *proposing killing undeniably endangered species, at taxpayer expense.* End this debate by denying the permits so the funding might go instead to non-destructive, proactive, realistic need-meeting programs. 3f

Thank you for your attention to our concerns.

Sarah E. Sykes
Sarah E. Sykes

P.O. Box 370 Kaunakakai, Hawai'i 96748 (808) 553-3831


Sunrise, Mt McKinley Ansel Adams

SIERRA CLUB LEGAL DEFENSE FUND, INC.

The Law Firm for the Environmental Movement

223 South King Street, 4th Fl., Honolulu, HI 96813 (808) 599-2436 FAX (808) 521-6841

April 11, 1995

Advanced Research Projects Agency
c/o Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, Virginia 22202

Re: Comments on the Draft Environmental Impact Statement/Environmental Impact Report for the Kaua'i Acoustic Thermometry of Ocean Climate Project

Dear Mr. Spikes:

On behalf of a coalition of environmental and animal protection organizations[1], I submit the following comments on the Draft Environmental Impact Statement ("DEIS") for the Kaua'i Acoustic Thermometry of Ocean Climate Project (ATOC). Each of these organizations may submit individual comments as well; please consider all such comments to be incorporated by reference herein.

We have previously submitted detailed comments (dated April 14, April 29, May 6, May 14, June 14, November 4, and November 7, 1994) to the National Marine Fisheries Service ("NMFS") and the Advanced Research Projects Agency ("ARPA") regarding the scope of this DEIS and the related Draft Environmental Impact Statement/Environmental Impact Report ("DEIS/R") for the California component of ATOC as well as the Scientific Research Permit applications that have been submitted to NMFS by Scripps Institute of Oceanography ("Scripps") for the Hawaii and California components of the ATOC project. We have also submitted comments on January 31, 1995 on the California DEIS/R. These comments, remain relevant to the question of the adequacy

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[1] The coalition includes: Animal Rights Hawai'i, Citizens Against Noise, Earth Island Institute, Hawai'i Audubon Society, Hawai'i Fishermen's Foundation, Hawai'i's Thousand Friends, Kaua'i Friends of the Environment, Life of the Land, Save Our Surf and the Sierra Club Hawai'i Chapter.

of this DEIS, and we also hereby incorporate them by reference into these comments.

INTRODUCTION

In general, the DEIS is legally inadequate for a variety of reasons. Most fundamentally, it illegally treats the ATOC project in piecemeal fashion, evaluating only one small segment of the overall global ATOC project, thereby misleadingly minimizing ATOC's true overall impacts. Moreover, rather than being the objective, pre-decision document required by both the National Environmental Policy Act ("NEPA"), 42 U.S.C. §4321 *et seq.*, and the Hawai'i Environmental Policy Act ("HEPA"), Hawaii Revised Statutes Chapter 343, it is instead quite blatantly a work of advocacy for a decision that has apparently already been
1 made to proceed with the Kaua'i and California portion of ATOC, including the Marine Mammal Research Project ("MMRP"). This bias 1&2 is apparent in assumptions made throughout the DEIS such as that the ATOC sound transmissions simply will not adversely impact marine wildlife. Rather than err on the side of caution in respect to possible impacts on threatened and endangered species and other marine wildlife, as the law requires, the DEIS instead assumes no or minimal impacts until observations prove the existence of impacts. Instead the law requires the project proponents to demonstrate that there will be no adverse impacts before being allowed to proceed. The DEIS misleadingly minimizes potential impacts to marine wildlife. It fails to justify the need for ATOC at all, provides an inadequate discussion of reasonable alternatives to ATOC, including the "no action" alternative, and omits any discussion whatever of a range of reasonable and feasible alternatives.

ARPA AND NMFS MUST PREPARE A COMPREHENSIVE PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT ON THE ENTIRE ATOC PROJECT

2 It is clear that the Hawai'i ATOC feasibility study is part 2 of and connected to the similar California ATOC feasibility study, and that both of these in turn are merely the precursor to, and are intimately linked with, the long-term global ATOC program. Consequently, ARPA and NMFS must prepare a comprehensive and programmatic EIS that evaluates the need for, impacts of, and alternatives to the overall ten-year worldwide ATOC program. Only after having done so should ARPA and NMFS make the decision whether to proceed with the long-term project, and, in turn, whether to proceed with smaller incremental segments of the long-term project such as the Hawai'i feasibility study and MMRP. Tiered site-specific EIS's for the incremental

segments would then be appropriate. See 40 C.F.R. §§ 1502.4(d), 1502.20.

NEPA requires that "Proposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall be evaluated in a single impact statement." Council On Environmental Quality Regulations To Implement the National Environmental Quality Act (CEQ regulations), 40 C.F.R. § 1502.4(a). A programmatic EIS is required for broad

> federal or federally assisted research, development or demonstration programs for new technologies which, if applied, could significantly affect the quality of the human environment. Statements shall be prepared on such programs and shall be available before the program has reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives.

Id., § 1502.4(c)(3) (emphasis added). See also id. at § 1508.18(b)(definition of "major Federal action" to include "[a]doption of programs, such as a group of concerted actions to implement a specific policy or plan"). Where there are large scale plans for regional development, NEPA requires both a programmatic and a site specific EIS. City of Tenakee Springs v. Block, 778 F.2d 1402, 1407 (9th Cir. 1985) (citing Kleppe v. Sierra Club, 427 U.S. 390, 409-414 (1976)).

HEPA has a similar requirement. Hawai'i Administrative Rules §11-200-7 requires that a group of actions proposed by an agency or an applicant shall be treated as a single action when:

1) The component actions are phases or increments of a larger total undertaking;
2) An individual project is a necessary precedent for a larger project;
3) An individual project represents a commitment to a larger project; or
4) The actions in question are essentially identical and a single statement will adequately address the impacts of each individual action and those of the group of actions as a whole.

It is quite conceivable that after a comprehensive, programmatic evaluation of the global ATOC project the agencies

would decide that ATOC simply may not provide the hoped-for information concerning global warming, or that any potential benefits of the long-term ATOC project would be far outweighed by its potentially huge environmental and financial costs, and/or that less environmentally stressful means of achieving the same global climate measuring goals exist. In that case, any decisions to proceed with preliminary segments of the project would be unnecessary.

For example, the DEIS itself acknowledges that a fundamental question exists whether ATOC will do what it is supposed to do: "the ATOC project is experimental and is subject to fundamental uncertainties about the extent to which acoustic means can detect ocean climate changes." DEIS, p. 1-21. (Ironically, this acknowledgment appears in the DEIS as a justification for not preparing a programmatic EIS; it is, rather, a powerful reason why the larger project should be evaluated and a determination made whether it makes sense to pursue it before expensive and potentially very environmentally harmful preliminary segments are undertaken).

In short, by considering only one part of a larger project before having evaluated and made a decision about the larger project itself, the agencies have put the cart before the horse; a decision on the Hawai'i feasibility study at this time would be premature and legally impermissible. See Kleppe, supra, 427 U.S. at 410 (when several proposals that will have a cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together); see also City of Tenakee Springs v. Clough, 915 F.2d 1308, 1312 (9th Cir. 1990).

The DEIS's rejection of the public's call for preparation of a single, comprehensive EIS on the overall global ATOC program on the grounds that "any long-term ATOC program is highly speculative at this time, and cannot reasonably or feasibly be evaluated now in a programmatic EIS", DEIS pp. 1-21, 1-26, is unpersuasive and contradicted by the facts. In fact, the outlines of the long-term ATOC project, although only briefly mentioned in the DEIS, are quite well-known, at least to the project proponents. The California DEIS/R (which is incorporated in the Kaua'i DEIS by reference) refers to "a ten-year follow-on global ATOC program" (DEIS/R, Abstract). The Kaua'i DEIS states that the Hawai'i feasibility demonstration evaluated in the DEIS is "part of" the ATOC project. DEIS, p. 1-1. Similar statements throughout the Kaua'i DEIS and California DEIS/R make it clear that both sources and associated facilities are merely part of a larger global design.

Documents outside the DEIS underscore this, and provide more detail. For example, Scripps' December 6, 1993 Special Research Permit application to NMFS (P557A) for the California portion of ATOC notes that the proposed MMRP "will evolve into a long-range marine mammal monitoring plan in parallel with the anticipated 10-year global ocean climate monitoring program". P557A, p. 25. Further, in their report on the Heard Island feasibility test, the proponents of the ATOC project discuss "future plans" for a world-wide "permanent [ATOC] system," and state that "reliable performance for ten years" of the source "is especially important, because source deployment and recovery are expensive." W. Munk and A. Baggeroer, The Heard Island Feasibility Test (Physics Today 45(9):22-30)(September 1992), p. 30.

Some of these same authors have painted an even more telling description of what they envision as the global ATOC program in their ATOC technical proposal to ARPA. In Acoustic Thermometry of Ocean Climate, Technical Proposal (1992) (Technical Proposal), W. Munk, R.C. Spindel and D.W. Hyde describe a global ATOC network that would "require . . . 6-8 sources and 35-40 receivers for long-term global coverage". Id., p. 6. The first phase of the project would involve procuring three low frequency sound sources, "install[ing] and operat[ing] first two of these, and then the third after reliable operations are established", and "conduct[ing] a development and testing program for a ten year reliable sound source." Id., p. 8. Emphasis is made throughout that this is a ten-year program. At page 40, for example, the authors state, "These systems must be reliable if they are to last for the decade planned for the ATOC program."

The Technical Proposal also makes it very clear that the proponents of the ATOC program intend it to be worldwide. Munk et al plan to "work out, in concert with our design iteration for a global network, arrangements for projector and receiver sites strategically located around the Atlantic and Indian Oceans -- in Asia, South Africa, Europe and South America -- whose scientific and logistical coordination efforts will be vital to extending the network to the global ocean." Id. The technical proposal places great emphasis on the need for a strong international component of ATOC (eg., pp. 24-5), and indeed states that the proponents plan to place the third ATOC source in Japan and a possible fourth source off the Kamchatka Peninsula, Russia. Id., p. 26. See also id., Figure 2 (p. 7)(showing, in addition to the Kaua'i and California sources, "[a]dditional source sites near

Japan and Kamchatka that may be made possible by cooperative arrangements").

In our May 14, 1994 letter to Dr. Ralph W. Alewine, III (ARPA) and Dr. William W. Fox, Jr. (NMFS) (appended to the Kaua'i ATOC DEIS) in which we commented on Scripps' SRP applications for the Kaua'i and California ATOC feasibility projects, we discussed a host of additional evidence demonstrating that plans for a world-wide ATOC network and the related Acoustic Monitoring of Global Ocean Climate and Global Acoustic Mapping of Ocean Temperature (GAMOT) efforts are not only well-developed but have been funded in the amount of some $106 million, over $21 million of which had already been spent as of December 31, 1993. See pages 2-5. We incorporate that discussion herein by reference.

Apart from the question of a comprehensive programmatic EIS, this DEIS is legally inadequate because it fails to discuss the obviously connected Kaua'i ATOC feasibility project and the cumulative impacts of the Kaua'i and Point Sur projects. NEPA requires that closely related, or "connected", actions be evaluated in a single EIS. E.g., Thomas v. Peterson, 753 F.2d 754, 758 (9th Cir. 1985); 40 C.F.R. § 1508.25(a)(1). Connected actions include actions that "[a]re interdependent parts of a larger action and depend on the larger action for their justification." 40 C.F.R. § 1508.25(a)(1)(iii).[2]

The DEIS in various places acknowledges that the Kaua'i and California ATOC feasibility projects are closely related. For example, the Kaua'i DEIS refers to "this project" -- the ATOC feasibility study -- as using "two separate acoustic sources", one in Kaua'i, the other in California, and states that the DEIS will address only the "Hawaii portion of the proposed ATOC project." DEIS, p. 1-3. Similarly, the DEIS discusses the Hawai'i and California components of the MMRP in the same sentence, as components of a single project (DEIS, p. 1-5) and states that, as part of a single ATOC feasibility study, "two low frequency sound sources are planned for the North Pacific, one north of Kaua'i and one west of Pt. Sur, California." DEIS, p. 1-8. As further evidence that the projects are connected, part

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[2] Cf. Save the Yaak Committee v. Block, 840 F.2d 714, 720 (9th Cir. 1988)(sequential actions are connected if "it would be irrational, or at least unwise, to undertake the first phase if subsequent phases were not also undertaken"); Thomas v. Peterson, supra, 753 F.2d at 759-760 (preliminary segment is connected to subsequent phases if it does not have "independent utility").

of the function of the Kaua'i component of the project will be not only to transmit sounds, but to receive sound transmissions from the California source, and vice-versa.

THE DEIS DOES NOT FULLY DISCLOSE
POSSIBLE MILITARY PURPOSES OF ATOC

3 The DEIS does not adequately disclose possible military applications of ATOC. Specifically, the reason for the interest and involvement of the Department of Defense in the project must be fully and honestly disclosed. Why, at a time when both the Administration and Congress are speaking of huge government spending cuts to balance the federal budget, is the Department of Defense investing millions of dollars in ATOC? What are the possible "dual" uses for ATOC referred to at p. 1-24 of the DEIS? Why does Dr. Munk's technical proposal for ATOC submitted to ARPA in 1992 state that "[a]spects of this project may involve the use of classified assets"? Technical Proposal, supra, p. 62 (emphasis added). In short, the public and decisionmakers are entitled to know whether possible military applications of ATOC are in part the driving force behind the project, and the DEIS should disclose the information. 1

The draft EIS has not disclosed any information about the short and long-term fiscal impacts of this project. The sections relating to the "economic environment" omit an analysis of the past, present, and future expenditures needed for this proposed project. DEIS pp. 4:132-134.

THE DEIS IS NOT AN OBJECTIVE AND
NEUTRAL EVALUATION OF THE PROPOSED PROJECT BUT INSTEAD IS
IMPERMISSIBLY SKEWED IN FAVOR OF THE PROJECT

4 The fundamental purpose of an EIS is to force the decision-maker to take a "hard look" at the need for, the environmental consequences of, and possibly less-environmentally harmful alternatives to the proposal, before the decision to proceed with the project is made. See 40 C.F.R. § 1502.1 (Purpose of EIS); § 1500.1(b)("NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken"); Baltimore Gas & Electric v. Natural Resources Defense Council, 462 U.S. 87, 97 (1983). Thus, the law is clear that the EIS must be a pre-decision, objective and neutral document, not a work of advocacyto justify a decision that has already been made. As the CEQ regulations state, 16a

> Environmental impact statements shall serve as the means of assessing the environmental impact of proposed agency actions, rather than justifying decisions already made.

40 C.F.R. § 1502.2(g). See also Conner v. Burford, 848 F.2d 1441, 1446 (9th Cir. 1988), cert denied, 489 U.S. 1012 (1989)("[t]he purpose of an EIS is to apprise decisionmakers of the disruptive environmental effects that may flow from their decisions at a time when they 'retain [] a maximum range of options'").

Unfortunately, this DEIS assumes throughout that the project will in fact proceed, misleadingly minimizes the potential impacts of the project, and dismisses with inadequate discussion reasonable alternatives to the project, including the no action alternative.

In fact, it appears that the project proponents have already begun work on certain phases of the project, in violation of 40 C.F.R. § 1502.2(f), which states that "Agencies shall not commit resources prejudicing selection of alternatives before making a final decision."

For example, the DEIS discloses that a section of the ATOC source sea cable has already been laid, to the vicinity of the proposed site for the source. DEIS, pp. 1:17-20. This of course predetermines the site location, and exposes the discussion of alternative site locations as a sham.

Further work in support of ATOC that has already been conducted includes the acoustic engineering test off the California coast in November 1994. At the public hearing on the DEIS in Honolulu on February 10, Ralph Alewine, representing ARPA, admitted that Scripps was continuing work on ATOC in accordance with their contract with ARPA.

The eagerness with which the proponents of this project wish to proceed is further demonstrated in a letter dated November 29, 1994 from Andrew Forbes of Scripps to Peter Douglas, Executive Director, California Coastal Commission with respect to Coastal Zone Management Act certification. Mr. Forbes states, "It is extremely important to the ATOC project that all regulatory approval be secured and facilities installed by approximately April, 1995, so that the marine mammal Pilot Study can begin by May to June of next year [1995] during the prime early summer through early fall observation season . . .. [I]nstallation of all ATOC facilities, including the VLA and sound source, is necessary before the principle MMRP observations can commence." Id., p. 3 (emphasis added).

5 The objectives of the MMRP are variously stated to be to "detect and evaluate potential effects of ATOC source sound transmissions on marine animals," to identify mitigation measures to avoid the potential impacts, and to determine "the optimum acoustic source parameters for ATOC feasibility operations." The DEIS alleges that "demonstration phase climate-related transmission will only begin if the system is determined to be safe for marine animals." DEIS p. ES-3. This is clearly an impossible task given the lack of time and knowledge to determine effects on marine mammal populations (i.e. growth rates, fertility rates, mortality, etc.). The MMRP might provide more information about low frequency sound effects on cetaceans, but it can never determine the "safety". TC

6 Further, the "mitigation measures" sprinkled throughout the DEIS and summarized at ES:13-15 also assume that the project will proceed. The mitigation measures include such items, in addition to the MMRP itself, as utilizing sound frequencies "anticipated to have minimal impacts" on marine wildlife, "operating the sound source at the minimum power level necessary to support" ATOC, and operating the sound source "at the minimum duty cycle necessary to support" ATOC. Thus, the assumption in each of the mitigation measures is that ATOC will proceed, regardless of impacts, although at "minimum levels" necessary to satisfy ATOC objectives: actually stopping the ATOC (not the MMRP) transmissions if adverse impacts are found is nowhere included as a mitigation measure. App C Table C1 6g

7 The basic assumption throughout the MMRP, is that ATOC will have no impact; only if the results of the MMRP disprove this assumption does the DEIS admit of any possibility of modifying or terminating the sound transmissions. However, the proponents of the MMRP have acknowledged elsewhere that the MMRP is unlikely to be able to detect any short-term effects on marine animals. See, e.g., Special Research Permit Application P577A, p. 17 ("we do not expect any health effects (e.g., physiological stress) to be exhibited within the exposed animals. However, in free-ranging cetaceans, such physiological effects are extremely difficult, if not impossible, to detect given the current state of scientific and technological capabilities in this field of research") (emphasis added). 12b

The MMRP as currently designed has numerous other fundamental flaws. These include, but are not limited to, an inadequate length of time for the Pilot Study, insufficient time for analysis of the study results, inadequate public review of those results, the fact that the MMRP is linked to and dependent upon ATOC, and that ATOC transmissions are planned to begin even before the Pilot Study final report is available. In addition, 8 the DEIS does not adequately specify the decisionmaking protocol -- who would make the decision whether the results of the Pilot Study demonstrate that the ATOC transmissions will not harm marine wildlife and that those transmissions can safely proceed? 9 With what input from the public? In what time frame? Moreover, the safeguards written into the protocol are inadequately spelled out. Again, who would make the decision that ATOC transmissions should stop if the MMRP demonstrates adverse impacts, and how precisely would that decision be made? TC 6b,c 17

THE DEIS DOES NOT FULLY AND FAIRLY DISCUSS THE POTENTIAL IMPACTS OF THE ATOC PROJECT

An EIS must provide "full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment." 40 C.F.R. § 1502.1.

This DEIS fails on this count. As discussed below, its analysis of the alternatives to ATOC is inadequate; and it does not provide "full and fair" discussion of the impacts of ATOC. Rather, it consistently minimizes the potential impacts of the ATOC sound transmissions in a variety of ways, some of which are enumerated below.

10 First, as discussed above, it fails to consider the cumulative impacts of the Hawai'i and California portions of ATOC, and fails altogether to discuss the cumulative impacts of the Hawai'i/California feasibility study with the planned follow-up, long-term global ATOC project. The DEIS states that there will be "no overlap of the low frequency sound emissions" and "no direct physical cumulative impacts of the proposed Sur Ridge and Kaua'i sources" p. 4-147. Yet a written communication from Andrew Forbes (18 Oct. 1994) states that "the ensonified areas of the two Pacific sources would overlap by about 25% . . ." Also, p. 2-15 of the DEIS states that two source locations is preferable because of the overlapping sample areas. TC 12c

11 Second, the DEIS uses inaccurate and contradictory standards to evaluate sound impacts in the marine environment. Table ES-1, p. E-7 misleadingly seeks to make ATOC seem less loud to us, compared to familiar, in-air, sounds. The table uses an unjustifiable conversion of 61.5dB (to minimize the marine noise) between sound power levels in air and water. The National Academy of Sciences' National Research Council uses a conversion factor of only 26 dB; the DEIS itself uses only a 26 dB conversion factor when seeking to demonstrate why humans and birds will not be impacted by in-air noise. 7c 7d

12 Third, the DEIS does not consider the possibility of impacts beyond the immediate vicinity of the source, choosing instead to limit the discussion of impacts to those that marine wildlife might experience near the source. In its description of the affected "biological environment," for example, the DEIS discusses only the marine mammal fauna in the general region of the sound source. DEIS, p. 3-10. By so doing, the DEIS underestimates the true potential impacts of the transmissions. 8b The basic premise of ATOC, as demonstrated in the Heard Island study, is that the sound transmissions will travel huge distances across the oceans in deep sea acoustic sound paths and will be 13 detectable around the world. Thus, as breathtaking as the numbers of species and individual animals that may be affected near the source are, nevertheless the total number of animals that could be impacted may be vastly underestimated. 7e

14 The discussion of impacts is so misleadingly skewed and result-oriented that the DEIS makes the remarkable assertion that the intentional introduction into the marine environment of extremely loud noise would not only be consistent with, but would actually further the goals of the Hawaii's Coastal Zone Management Program ("CZMP") and Conservation District Laws, as well as the federal Humback Whale Recovery Plan and the Hawaiian Islands Humback Whale National Marine Sanctuary. As discussed below, this conclusion is absolutely erroneous; it could only have been arrived at by project proponents who have no interest in considering viable alternatives to addressing the question of global warming. 14c

THE DEIS'S DISCUSSION OF ALTERNATIVES IS INADEQUATE

The discussion of the alternatives to the proposed project, including the alternative of not proceeding, should be "the heart of the environmental impact statement." 40 C.F.R. § 1502.14. The EIS must "[r]igorously explore and objectively evaluate all reasonable alternatives". Id. While the discussion need not

address every conceivable alternative, Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council, 435 U.S. 519, 551 (1978), it must set forth "information sufficient to present a reasoned choice of alternatives." Natural Resources Defense Council v. Morton, 458 F.2d 827, 836 (D.C.Cir. 1972). The EIS may not disregard alternatives merely because they do not offer a complete solution to the problem. Id., 458 F.2d at 836. In addition, the EIS must provide support for its rejection of alternatives. Natural Resources Defense Council v. Callaway, 524 F.2d 79, 93 n.12 (2nd Cir. 1975).

15 The discussion of alternatives in the DEIS fails to live up to these standards. It fails to weigh objectively the benefits and costs of the alternatives it discusses, trivializing their benefits and emphasizing their deficiencies, while maximizing the benefits and downplaying or ignoring the impacts of the preferred alternative. 4c

16 Because of its bias towards the preferred alternative, the DEIS does not objectively evaluate less harmful, reasonable and alternatives to ATOC. In particular, the "no action" alternative is not given appropriate consideration. The DEIS fails to mention that the "no action" option would eliminate real and potential threats to the marine environment. Table 2.4.1. This alternative is "not preferred" because both the MMRP and climate-related research would be delayed or precluded. DEIS p. 2-14. This is an ironic conclusion given that ATOC and its "associated" MMRP are not "scientific research on marine mammals", as required by the SRP. 5a

17 The entire discussion of alternative sites for the ATOC scurce is flawed because the key criteria for the MMRP and the ATOC feasibility study are in direct tension with one another. A key criteria for the MMRP location is that the site be one where marine wildlife is sufficiently abundant so that there are animals to observe. Eg., DEIS, pp. 2-15, 16; Table 2.2.3.2-1 (p. 2-22)(MMRP source site selection criteria). Thus, Kaua'i is preferred "from a marine mammal research viewpoint" over other locations because abundant marine life exits there. 4b 5d

Yet this is clearly an inappropriate criteria for the location of the ATOC climate research sound transmission study; ATOC should properly be located in an area with little marine life, thus minimilizing possible impacts on such life. The DEIS acknowledges this with respect to certain disfavored alternatives, but is curiously silent on this point with resect to the preferred alternative. For example, Table 2.2.4-1 (p. 2-

35), summarizing the advantages and disadvantages of a moored autonomous source alternative, lists as one of its advantages that such a source "[c]ould potentially be placed in areas of low marine animal activity." Yet in discussing the relative advantages and disadvantages of the preferred alternative, the presence or absence of marine wildlife is not discussed as a factor. See Table 2.2.3.3-1 (p. 2-25)("ATOC source site selection criteria"), and so the Kaua'i site is again able to be selected as the most desirable of the four alternate locations from the perspective of ATOC operations, even though the other locations have less abundant marine wildlife, and are outside the Sanctuary. Table 2.4-1 (p. 2-48), summarizing the "relative response of the alternatives to the marine animal research and acoustic thermometry program criteria," is therefore misleadingly skewed in favor of the preferred alternative, because missing from the criteria for ATOC is any requirement that ATOC should minimize the possibility of adversely impacting marine wildlife by being located in an area of relative scarcity of such wildlife.

THE DEIS ERRONEOUSLY CONCLUDES THAT THE ATOC PROJECT WOULD BE CONSISTENT WITH OTHER STATE AND FEDERAL LAWS AND WITH THE HAWAIIAN ISLANDS HUMPBACK WHALE NATIONAL MARINE SANCTUARY AND HUMPBACK WHALE RECOVERY PLAN

18 Contrary to the claim in the DEIS (pp 5;3-15), the proposed action, particularly the acoustic thermometry research portions of it, is absolutely inconsistent with Hawaii's CZMP and Conservation District Laws. 14c

Both coastal recreation and ecosystem protection will be negatively impacted, making ATOC "inconsistent" with Hawaii's CZM program. Although the DEIS states on p. 5-5 that "the proposed project is not expected to have any negative impacts on recreational divers," the next sentence states that the transmissions will be similar to "a low rumble." Noise pollution does not have to cause hearing damage to be considered a "negative impact." Harassment of marine species and recreational divers is hardly justified by the potential success of a long-term global ocean temperature experiment which might provide additional arguments for better shoreline management decisions. DEIS p. 5-6. The DEIS assumes that the "MMRP would provide needed scientific data on the coastal marine ecosystem" without providing any explanation or proof of such a claim. "Disruption" or "adverse impacts" to the coastal ecosystems would not occur "provided that the scientific assumptions declared in this EIS are correct" (emphasis added). Unfortunately, the "science" in

this DEIS is only based on assumptions, and repeatedly the preparers and independent marine mammal biologists confirm that our knowledge of marine noise impacts is severely limited. A statement signed by fifteen prominent scientists was included in our April 14, 1994 letter to NMFS regarding the SRP applications.

The DEIS assumes that the proposed project is consistent with the laws allowing activities in the Resource subzone of Hawaii's Conservation District because the MMRP is consistent with "several of the allowed uses in the Resource subzone." DEIS p. 5-11. Fortunately, the Board of Land and Natural Resources determines what activities are "consistent," not the EIS preparers. HRS Chapter 190D-11(e) prohibits the Board from approving a Conservation District Use Permit "unless it finds that (1) the applicant has the capacity to carry out the entire project; and (2) the proposed project is clearly in the public interest upon consideration of the overall economic, social, and environmental impacts." This DEIS has not analyzed a project which has met either of these conditions.

With respect to the Humpback Whale Recovery Plan, the DEIS alleges that ATOC is consistent with, and will further, the goals of the Recovery Plan." DEIS, p. 5-18. The authors of the Humpback Whale Recovery Plan would no doubt be surprised to hear this. That plan lists among the "Known and Potential Impacts" to humpbacks, together with subsistence hunting, entanglement in fishing gear and collisions with ships, the problem of "acoustic disturbance." Humpback Whale Recovery Plan (NMFS 1991), pp. 25-7. The Recovery Plan states, for example, that "It would not be surprising if loud noises from ship engines or powerful sonar could potentially adversely affect humpback whales by disrupting resting, feeding, courtship, calving, nursing migration or other activities." Id., p. 27.

Far from encouraging the introduction of yet new unnatural sources of loud noise pollution into the humpbacks' habitat, the Recovery Plan lists, as a priority objective, "Reduce disturbance from human-produced underwater noise in Hawaiian waters and in other important habitats when humpback whales are present." Id., p. 40.[3] And far from recommending further research that

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[3]The Humpback Whale Recovery Plan states:

> Acoustic information is important in the life of a humpback whale. Feeding humpbacks may

necessitates increasing the amount of noise to which the whales would be subjected, the Recovery Plan notes that "Additional research could be performed, but it is likely to be expensive and may provide ambiguous results", and states instead that "A more direct and cost-effective approach will be to <u>work toward minimizing human-produced underwater noise</u>, particularly in critically important areas such as Hawaiian waters or other winter ranges, but also at other locations when whales are present." <u>Id</u>. (emphasis added). The Recovery Plan concludes by noting that "Reduction of human-produced underwater noise could also benefit other marine species present, including some endangered species." <u>Id</u>.

Finally, if approved, ATOC would certainly be inconsistent with the Marine Mammal Protection Act, 16 U.S.C. § 1361 <u>et seq</u>., and the Endangered Species Act, 16 U.S.C. § 1531 <u>et seq.</u>, which emphasize protection of marine mammals and endangered or threatened species, respectively, and prohibit harm to such animals. Each requires that federal agencies err on the side of protection. <u>See, e.g., Balelo v. Baldrige</u>, 724 F.2d 753, 756 (9th Cir. 1984), <u>cert denied</u>, 467 U.S. 1252 (1984). ("Congress' overriding purpose in enacting the MMPA was the protection of marine mammals"); <u>Tennessee Valley Authority v. Hill</u>, 437 U.S. 153, 174 (1978)(ESA); <u>Sierra Club v. Marsh</u>, 816 F.2d 1376, 1386 (9th Cir. 1987)("Congress clearly intended [in the ESA] that [federal agencies] give 'the highest of priorities' and the 'benefit of the doubt' to preserving endangered species"). Rather than erring on the side of caution and protection, this

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> key in on sounds produced by other individuals or by prey. Migrating humpbacks may listen for sounds produced by other individuals, animals on the bottom, or echoes of their own vocalizations. They may also listen for calls of killer whales as warnings of the presence of those potential predators . . . .
>
> <u>Human-produced noises could potentially reduce information available to whales, physically disturb them, prevent them from carrying out some activities, or even displace them from preferred habitats.</u>"

<u>Id</u>. (emphasis added).

DEIS instead proceeds on the unproven assumption that ATOC will not harm marine wildlife.

<u>CONCLUSION</u>

19 In conclusion, while we appreciate the obvious effort that has gone into the preparation of the DEIS, it is apparent that the object of that effort has been not to prepare an objective, neutral environmental evaluation of ATOC and the alternatives to it, but rather to advocate and justify a decision to proceed with ATOC. 16a Because this is a project with potentially adverse impacts on marine animals throughout the oceans of the world, a thorough and objective environmental review of not just the immediate component of ATOC but of the planned ten-year, world-wide project is essential.

For the reasons discussed above, this DEIS fails to provide the decisionmaker and the public with such a review. It is, in fact, so deficient and legally inadequate that it should be withdrawn and a new draft EIS circulated for public and agency comment. In the meantime, no further permits or approvals should be granted for any phase of the ATOC project, including the MMRP component, and no further work or expenditure of funds on any part of the project should take place.

Very truly yours,

Annie Szvetecz
Resource Analyst
Mid-Pacific Office

cc: Dr. William W. Fox, Jr.
Director, Office of Protected Species
National Marine Fisheries Service

Mr. Roy Schaefer
State of Hawai'i
Department of Land and Natural Resources

Hawaii Coalition on ATOC

Benning Wentworth Tike
2311 Spruce St
Boulder, CO 80302

Clayton H. Spikes
Advanced Research Project Agency
Marine Acoustics, Inc.
2346 Crystal Drive
Arlington, VA 22202

Dear Mr. Spikes

In recent times, many scientific projects and areas of "scientific research" have proceeded without an adequate Draft (or Final) Environmental Impact Statement. Some extremely visible projects and decisions have been railroaded through our governmental legislative process despite strong warnings concerning the unthorough research of environmental impact (Some examples: Clinton Forest Plan dealing with the Northern Range of spotted owls, the James Bay-Hydro Quebec issue dealing with hydroelectric power, and the North American Free Trade Agreement)

I am writing to express my concern surrounding the Acoustic Thermometry of Ocean Climate (ATOC) project. The DEIS for the ATOC project is not only one-sided, but sloppy and incomplete. How can any project ever begin or
1 continue when the DEIS labels several aspects of the study as "uncertain." 15
This exact language was used to describe both the "research benefits" and many
2 of the possibly adverse effects to marine life. 3f

This uncertainty in the "impact" to the natural environment of the oceans leads to uncertainty in my mind about the true nature and intent of the ATOC project. If the true purpose were one of concern for the environment and global warming,
3 then the project should never continue until all of the environmental impacts are 1
"certain." If your project should continue as is, then the $35 MILLION grant from the Pentagon's Advanced Research Project Agency will be exposed for the submarine/military project that it only now appears to be "below the surface."

Sincerely,
BTike
Benning Wentworth Tike

MARINE MAMMAL COMMISSION
1825 CONNECTICUT AVENUE, N.W. #512
WASHINGTON, DC 20009

RECEIVED 3-10-95

9 March 1995

Mr. Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA 22202

Dear Mr. Spikes:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the Draft Environmental Impact Statement for the Kauai Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program (hereafter referred to as the DEIS), with respect to the intents and provisions of the Marine Mammal Protection Act. The Commission offers the following comments, suggestions, and recommendations concerning the assessment of the possible effects on marine mammals of the Kauai Acoustic Thermometry of Ocean Climate Project (hereafter referred to as the ATOC Project) and its associated Marine Mammal Research Program.

General Comments

The DEIS provides a thorough and objective assessment of the possible direct and indirect effects on marine mammals of low-frequency sounds that would be used to carry out the ATOC Project and the pilot phase of the Marine Mammal Research Program. Although the title of the DEIS indicates that it provides an assessment of the possible environmental impacts of the Marine Mammal Research Program as well as the ATOC Project, it does not address all aspects of the Marine Mammal Research Program that possibly could affect marine mammals (e.g., aircraft and boat
1 surveys). Also, several parts of the DEIS refer to the Marine TC
Mammal Research Program as a mitigation measure, rather than part of the proposed action.

The DEIS includes assessments of the possible cumulative effects of low-frequency sounds on marine mammals. In some cases it does not, but should, consider other possible sources of human-related mortality and injury. For example, the assessment of possible cumulative impacts on Hawaiian monk seals should include assessment of the possible direct and indirect effects of commercial fisheries and lost and discarded fishing gear and other potentially hazardous debris on monk seals. Further, the assessments of possible cumulative effects do not, but should, recognize that animals may not respond to noise or other stimuli until the time, intensity, or frequency of exposure exceeds some threshold level and that the ATOC sound transmissions conceivably could add enough additional exposure to exceed the threshold level and trigger a response.

2 The DEIS indicates on page I-6 and elsewhere that climate-related transmissions would begin only if the transmissions are determined to be safe for marine animals, particularly marine mammals and sea turtles. The DEIS does not indicate what would be considered safe. Neither does it indicate the criteria that would be used to make this determination. TC 6K

If the climate-related sound transmissions could or would result in the taking of marine mammals by harassment or other means, the taking would have to be authorized under the Marine Mammal Protection Act and, if endangered or threatened species are involved, under the Endangered Species Act. Two means for authorizing possible incidental take are available under the Marine Mammal Protection Act: (1) waiver of the Act's moratorium on taking; and (2) a "small take" exemption authorizing unintentional taking of small numbers of marine mammals. The latter, provided for in section 101(a)(5) of the Act, requires that the Secretary [of Commerce in this case] (a) find that the taking of marine mammals to be authorized will have a negligible impact on the affected species or stock, and will not have an unmitigable adverse impact on the availability of the species or stock for subsistence taking by Alaska Natives; and (b) as applicable, prescribe (i) permissible methods of taking and means for effecting the least practicable adverse impact on the affected species or stock and its habitat, and (ii) requirements for monitoring and reporting of such taking.

Given the above-referenced requirement of the Marine Mammal Protection Act, it seems to the Commission that the objectives of the ATOC Project's associated Marine Mammal Research Program should be to determine whether the proposed climate-related sound transmissions could result in the taking of marine mammals by harassment or other means and, if so, (1) whether the taking would have a negligible impact on the affected species or stocks such that it could be authorized by a small take exemption; (2) what measures might be taken to have the least practicable adverse impact on the affected species or stocks and their habitats; and (3) what type and level of monitoring program would be required to verify that the climate-related sound transmissions do in fact have negligible impacts on marine mammals and their habitat.

3 <u>The Marine Mammal Commission recommends</u> that the EIS be expanded and revised to (1) explicitly note the relevant provisions of section 101(a)(5) of the Marine Mammal Protection Act; and (2) explain the rationale for believing that the Marine Mammal Research Program will provide the information necessary to TC Sec 2.2.1.1 App C App F

determine whether marine mammals may be taken incidental to the Kauai ATOC Project and, if so, whether the taking could be authorized by a small take exemption. With regard to the latter point, the EIS should explain the basis for believing that the Marine Mammal Research Program will provide the information necessary to (a) make the required finding that the authorized taking would have a negligible impact on the affected species or stocks, and (b) prescribe monitoring and reporting requirements. As possible, the EIS should indicate the statistical tests that will be used to analyze and interpret the study results, and prior analyses that have been done to determine whether the planned studies are likely to provide sufficient information to draw statistically meaningful conclusions.

The enclosed paper, by S.L. Swartz and R.J. Hofman, while outdated in some respects by the 1994 Marine Mammal Protection Act amendments, explains the intents and provisions of section 101(a)(5) of the Act and may be helpful in this regard.

Specific Comments

<u>Page ES-1, par. 4</u>: The second sentence in this paragraph states: "The travel time of a sound signal from a source near Kauai to a receiver near California, for example, will decrease if the ocean in between warms up, and will increase if the ocean cools down." The last paragraph on page ES-2 suggests that the 4 referenced statement would be true provided the changes in ocean TC temperature do not cause changes in the sound path between the source and the receiver and the effects of ocean tides, currents, internal waves, eddies, gyres, etc. on the sound path and transmission times can be identified and appropriate correction factors applied. Thus, the referenced statement probably should be qualified by adding something like the following -- "assuming the sound pathway does not change or changes can be detected and the measured travel times can be corrected accordingly."

<u>Page ES-3, par. 3</u>: Here and elsewhere, the DEIS indicates that the ATOC Project sound source "is comparable to or, less intense than, low frequency sounds produced by large container ships and super tankers." These statements appear to imply that 5 low-frequency sounds produced by large container ships and super TC tankers have had no adverse effects on marine mammals or other marine biota and that there consequently is no reason to believe that the ATOC sound transmissions would have any adverse effects. The basis for this apparent inference is not, but should be, explained clearly. For example, differences in the characteristics, pathways, and transmission loss rates of low-frequency sounds from surface ships and deep-water ATOC sound sources should be described. As noted earlier, the possibility should be recognized that response thresholds could be exceeded by the addition of ATOC sound transmissions to the low-frequency sounds already being produced by ship traffic and other

anthropogenic sources.

6 Page ES-3, par. 6: The first sentence in this paragraph states: "Demonstration phase climate-related transmission would only begin if the system is determined to be safe for marine mammals." As noted earlier, the DEIS does not, but should, indicate what would be considered "safe for marine mammals." TC

7 Page ES-3, last par.: The third sentence in this paragraph states: "During the Pilot Study, source transmissions would stop if the marine biologists observe adverse effects meeting the source termination guidelines of Appendix C." The referenced source termination guidelines, which are listed in the Table on page C-6 of the Appendix, seem reasonable and appropriate. However, there are no commonly accepted definitions or interpretations of some of the terms used in the guidelines, and they therefore could be interpreted differently by different people. For example, different readers could interpret terms such as "disabled," "injurious behavior," and "significant biological activity" differently. Likewise, it is not clear what level of increase might be detected in the numbers of marine mammals stranding and being struck by vessels and whether this would provide a useful indicator of the possible effects of ATOC sound transmissions. Also, it is not evident why increases in dead, disabled, and beached animals are considered an "acute behavioral response," while possibly harmful changes in behavior are considered a "chronic [rather than acute] behavioral response." TC App C

The potential effect of the Hawaii ATOC Project on marine mammals will depend in no small measure upon how these guidelines are interpreted and applied. Therefore, the EIS should explain them in greater detail.

8 Page ES-8, par. 1: Here and elsewhere, the DEIS indicates that the 120dB sound field is equivalent to levels found in some studies to produce detectable changes in swim directions in certain large whales. It does not, but should, make it clear that in the referenced studies 50% of the observed whales responded in detectable ways by the time the 120dB isopleth was reached -- i.e., half the observed animals responded in detectable ways to lower sound levels. TC

9 Page ES-8, par. 2: The second sentence in this paragraph indicates that, based upon observations to date, "it appears that one humpback whale (on average) would be found within the 120dB zone during any given sound transmission." If the number of humpback whales that could be within the 120dB zone is highly variable, the average may not be the appropriate statistic for assessing potential impacts. Therefore, the maximum and minimum, as well as the average, number of animals that could be within the 120dB zone should be indicated. TC

10 Page ES-8, par. 3: This paragraph indicates that sperm whale densities in the vicinity of the Hawaiian Islands are on the order of one per every 1000 km² and that, given this low density, "close encounters with the source are expected to be statistically rare (exposure of one sperm whale to a 150dB level or greater is expected to be less than once every 100 years, at a 2% duty cycle)." Using a density estimate to calculate the potential for exposure to a 150dB or greater sound levels is appropriate if the species in question seldom if ever occurs in groups (i.e., sighting of solitary individuals is the norm) and is distributed randomly or uniformly in the area where exposure could occur. The rationale for apparently concluding or assuming that sperm whales and other marine mammals seldom occur in groups and are distributed uniformly or randomly is not, but should be, provided. If evidence cannot be provided to support the conclusion or assumption that sperm whales and other marine mammals do not occur in groups and are distributed randomly or uniformly, more realistic estimates of the number of animals that potentially could be exposed to different sound levels should be provided. TC

11 Page ES-9, 1st comp. par.: Here and elsewhere, the DEIS states that monk seals are rarely seen around Kauai and there consequently is very little likelihood of adverse impacts. According to the National Marine Fisheries Service's Hawaiian monk seal scientific staff, small numbers of animals occur regularly on the north shore of Kauai, particularly in the vicinity of Kilauea Point National Wildlife Refuge and this suggests that some monk seals may occur in or pass through ocean areas where they could be exposed to ATOC sound transmissions. Very little is known about where monk seals go and what they do when they leave their present-day haulout and breeding sites in the northwestern Hawaiian Islands. The basis for the statement that monk seals probably have "poor low frequency hearing" should be further developed in section 4. National Marine Fisheries Service researchers indicate that a monk seal, with a depth-of-dive profiler attached, dove to the maximum depth that the instrument would measure, 500 m. Knowing that monk seals can dive deeper than 500 m suggests that the phrase "lacks deep diving capabilities" is incorrect and should be deleted. As a last point, since the Hawaiian monk seal is endangered and its numbers are continuing to decline, any effect could be adverse. TC

12 Page ES-13: Here and elsewhere, the DEIS lists the Marine Mammal Research Program Pilot Study as a possible mitigation measure. As noted earlier, it is our understanding that the Marine Mammal Research Program is part of the proposed action. This point should be clarified in the EIS. TC

Page 1-1 (Introduction, Purpose, and Need for Action): As presently drafted, this section of the DEIS does not provide an accurate description of the relevant provisions of the Marine

Mammal Protection Act. For example, it implies, incorrectly, that permits are required and can be issued under the Marine Mammal Protection Act for any activity that would result in the harassment of marine mammals. In addition, it implies, incorrectly, that a "small take" exemption is an alternative to a scientific research permit and that permits are issued to authorize take of small numbers of marine mammals under section 101(a)(5) of the Act. It also fails to clearly indicate what the Commission understands was the National Marine Fisheries Service's reason for advising the Scripps Institution of Oceanography that "a scientific research permit, rather than an incidental take authorization, would be the preferred approach for the initial source transmissions."

13 With respect to the last point, it is the Commission's understanding that the Service advised Scripps that available information was insufficient to make the findings required to issue a "small take" exemption and that the most cost-effective way to obtain the necessary information would be to restructure and expand the ATOC Project, as described in Appendix C of the DEIS, to experimentally determine how ATOC sound transmissions might affect marine mammals. TC

<u>The Marine Mammal Commission recommends</u> that this section of the EIS be revised to provide a clearer description of the relevant provisions of the Marine Mammal Protection Act and the rationale for considering the proposed action to be scientific research which can be authorized under section 104 of the Act. As noted earlier, the Commission also recommends that the research objectives be described with reference to section 101(a)(5) of the Act.

14 <u>Pages 1-13 and 1-15 (Section 1.1.5)</u>: This section might usefully be expanded to provide a brief description of the nature and results of the marine mammal study done as part of The Heard Island Feasibility Test. TC See 4.3.1.2

15 <u>Page 1-22 (Marine Mammal Research Program Objectives)</u>: For the reasons noted earlier, the Marine Mammal Commission believes it would be desirable to revise these Program Objectives to reflect the provisions of section 101(a)(5) of the Marine Mammal Protection Act. TC

16 <u>Page 2-4 (The second indented point)</u>: As noted earlier, the referenced guidelines for suspending operations should be described more fully. TC 69

17 <u>Page 2-12 (Figure 2.2.1.2-5)</u>: The legend for this figure is incomplete in the copies of the DEIS sent to the Commission. TC

<u>Page 2-15, par. 4</u>: The first of the indented points in this paragraph indicates that one of the site-selection criteria was

"[l]ocation at a site with sufficient populations of marine animal species of interest to ensure that researchers can obtain adequate data to produce <u>statistically meaningful results</u> (given that acoustic thermometry criteria are met, in the presence of some marine animals)" [emphasis added]. This statement infers that power analyses were done to determine whether researchers would be able to obtain adequate data at the various sites to produce statistically meaningful results. If power analyses were done, the nature and results of the analyses should be described. If power analyses were not done, this statement should be revised to read something like -- 18 TC App C

> "• Location at a site with sufficient populations of marine animal species of interest to ensure that researchers would have the opportunity to design and carry out studies which would produce statistically meaningful results...."

19 <u>Page 3-11 and 3-12 (Table 3.3.1-1)</u>: The title of this Table would be more accurate if it were changed to read "Estimates of the densities of marine mammals and sea turtles present in waters adjacent to the main Hawaiian Islands in January-May." Also, it is not clear how notes 6 through 15 relate to information presented in the Table. TC

20 <u>Page 3-13, par. 1</u>: All stocks of humpback whales are listed as endangered under the U.S. Endangered Species Act. Therefore, the word "status" in the first sentence in this paragraph presumably should be changed to "size," and the phrase ", all of which are endangered," could be usefully added after "stocks" and before "is." TC

21 <u>Page 3-21, par. 5</u>: This paragraph indicates that the distribution of the Hawaiian monk seal "is limited to the small, mostly uninhabited chain of islands and atolls stretching 1100 nm (2037 km) northwest of the main Hawaiian Islands." Later in the DEIS it is correctly noted that monk seals have been seen hauled out on, and immediately offshore of, Kauai, Niihau, the Big Island, and Oahu. Consequently, the distribution of monk seals clearly is not limited to the northwestern Hawaiian Islands. Also, as noted earlier, virtually nothing is known about the distribution and movement patterns of Hawaiian monk seals when they are at sea. TC

22 <u>Page 4-8, last par.</u>: Here and elsewhere the DEIS indicates that sounds from the proposed ATOC source "are expected to be 135dB at a radius of 1000 m...; 130dB to [at] a radius of 5 km; 120dB at 12 km shoreward and 7.5 km seaward from the source." The DEIS does not, but should, indicate what will be done to validate the accuracy of these expectations and those concerning expected sound levels at different depths, at different times of the year, and in different weather conditions. TC App C

Page 4-12, last par.: The last sentence in this paragraph states: "Based upon Ketten's findings and assuming that the calculated sound field levels are correct, to suffer TTS [temporary hearing threshold shift], the animal must be:

"• capable of hearing signals below 90 Hz and having hearing sensitivity below (better than) 70dB (150dB - 80dB = 70dB) for frequencies below 90 Hz (assuming that TTS would occur for received levels >80-100dB above the absolute threshold, as for humans listening in air, and that sound field levels are correct)." TC 7h

23 The third paragraph on page 4-9 of the DEIS indicates that humpback whale songs have an average source level of 155dB and range from 144 to 174dB, and that the songs appear to have an effective range of approximately 10 to 20 km. From this information, it should be possible to use the same model used to calculate expected sound levels at different distances from the ATOC sound source to estimate the possible received levels of humpback whales songs within the apparent effective range of 10 to 20 km. The estimated received level at 20 km could be indicative of the humpback whale's hearing threshold and could be used to better judge the possibility of a TTS.

24 Page 4-22, last par.: The paper by Bryant et al. 1984, referenced in the third sentence in this paragraph, is not included in the bibliography (Appendix A). TC

25 Page 4-26, (Section 4.3.1.1.2): The Table of Contents indicates that this section begins on page 4-25, not 4-26, of the DEIS. Also, this section does not, but should, note that humpback whales may not respond to noise or other stressors until some threshold level is exceeded. The correlation between increases in large tour ship visits and the egress of humpback whales from Glacier Bay, Alaska, in the late 1970s could be indicative of such a threshold effect. TC

26 Page 4-33, par. 2: Among other things, this paragraph indicates that up to 1700 humpback whales could enter the Hawaiian Island chain each winter and that "[a] very conservative estimate of 25-50% of these (i.e., 425-850 individuals) could potentially pass through the study area at least once." The basis for this estimate is not evident. Likewise, it is not evident why more than 50% of the winter residents could not potentially pass through the study area one or more times. If the Pilot Study indicates that ATOC sound transmissions affect the movements or behavior of humpback whales, determining the significance of those effects may require knowing what proportion of the population, and how frequently and for what periods of time particular animals (e.g., pregnant females and females with calves), may be present in areas where they could be exposed to ATOC sound transmissions. The DEIS does not, but should, note TC 6l

that the Marine Mammal Research Program described in Appendix C will not resolve this uncertainty.

27 Pages 4-42 and 4-45 (Potential for Physical Auditory Effects): This section describes conditions that would have to be met for the ATOC sound transmissions to cause temporary hearing threshold shifts. One additional factor should be noted -- i.e., that animals are not attracted to the sound source. TC 10a

28 Page 4-48, par. 3: Among other things, this paragraph indicates that the average annual density of sperm whales in the study area is estimated to be less than one animal for every 1000 km² and that "the statistical probability of even a single sperm whale being exposed to the 150dB sound field during the initial 2-year study period is less than 1%." As noted earlier, using average density to estimate the probability of exposure is inappropriate unless there is good reason to believe that the animals do not occur in groups and are distributed either randomly or uniformly throughout the study area. TC 8b

29 Pages 4-52 and 4-53 (Potential Cumulative Effects on Odontocetes): This section does not, but should, note the possibility that the ATOC sound transmissions, added to existing stressors, could cause a response threshold to be exceeded and trigger a response that would not be produced by the ATOC sound transmissions alone. TC 12c

30 Page 4-61 (Table 4.3.1.2.3-1): The section of this Table concerning potential cumulative effects should note the possibility of threshold responses. TC

31 Page 4-62 (Section 4.3.1.3): This section should be expanded to note that monk seals have been seen hauled out on, and immediately offshore of, Kauai, Niihau, the Big Island, and Oahu; that a pup was born on the north coast of Kauai in 1988 and another on Oahu in 1991; and that not enough is known about the at-sea distribution or movements of monk seals to conclude that the low numbers of monk seals sighted on the north shore of Kauai mean that monk seals will seldom occur in or pass through offshore areas where they could be exposed to the ATOC sound transmissions. All information in this and related sections should be reviewed and revised in consultation with the National Marine Fisheries Service's monk seal scientific program staff. TC

Also, it appears that much of the information in this section is taken from the Sierra Club Handbook of Seals and Sirenians, published in 1992. Substantial additional information is available in other documents, many published since 1992. A list of reports and publications resulting from the National Marine Fisheries Service's Hawaiian Monk Seal Research Program is enclosed.

32 If it has not already been done, the Marine Mammal Commission recommends that consultations be undertaken with the National Marine Fisheries Service pursuant to section 7 of the Endangered Species Act to determine whether the DEIS provides a realistic assessment of the possible impacts of the ATOC Project and its associated Marine Mammal Research Program on Hawaiian monk seals. The results of the consultations should be included in the FEIS. TC

33 Page 4-63, 1st sen.: This sentence identifies the possible direct and indirect effects of low-frequency noise on pinnipeds. It does not identify permanent hearing threshold shifts as a possibility. The reason for not including permanent threshold shifts is not evident, and should be explained. TC

34 Page 4-64 (Table 4.3.1.3.1-1): This table and the corresponding discussion usefully could be expanded to include a description and discussion of underwater sounds produced by Southern Hemisphere pinnipeds, particularly the Weddell seal. 8a

35 Page 4-67, par. 2: For the reasons noted earlier, there can be little confidence in the estimate that no more than one Hawaiian monk seal would be subjected to exposure to the 120dB sound field during the proposed 2-year acoustic thermometry study. Also, the rationale for Mitigation Measure 7-1, which indicates that the Marine Mammal Research Program described in Appendix C will provide the information necessary to validate the assumption regarding Hawaiian monk seal distribution, is not evident and should be explained. TC 6n

36 Page 4-68, last par.: As noted earlier, the basis for concluding that Hawaiian monk seals do not normally inhabit the proposed study area is largely speculative. Consequently, it is inappropriate to indicate, as is done here, that there is a factual basis for concluding that monk seals do not normally inhabit the proposed study area. TC

37 Pages 4-69 and 4-70 (Potential Cumulative Effects on Pinnipeds): This section does not, but should, describe the nature and possible causes of the ongoing Hawaiian monk seal population decline. TC

38 Page 4-99 (Mitigation Measure 10-1): The description of this mitigation measure indicates that the Marine Mammal Research Program "would monitor fish stock assessments to attempt evaluations of the potential for increased predation on fish by other marine animals (cetaceans, sharks, etc.), in relation to low frequency source sounds." It is not evident from the program description in Appendix C how this would be done. TC

Page 5-1 (Unnumbered Table): According to this table, consultations pursuant to section 7 of the Endangered Species Act

39 are proceeding "concurrent with EIS." It is not clear whether the results of the consultations will be included and considered in the FEIS. As noted earlier, the Commission believes that the results of the section 7 consultation should be described and considered in the FEIS. TC

40 Page C-2, par. 1: Among other things, this paragraph notes that the Marine Mammal Research Program Pilot Study is to be done in 1995-96 and "will encompass the field season for humpback whales in the Hawaiian Islands." It does not, but should, note that the research plan assumes that there is no significant inter-annual variation in the acoustic environment and the demography and behavior of humpback whales and other marine mammals that inhabit areas where they could be exposed to ATOC sound transmissions. TC

41.1 Page C-2, par. 2: This paragraph indicates that "[a] 6-10 month study period is proposed, beginning approximately in the June/July 1995 timeframe, and continuing through March/April 1996" and that this timing was chosen "to maximize opportunities with the focal species (humpback whales) and other less abundant species in the area off the north shore of Kauai." It is evident why this time period would maximize opportunities to observe humpback whales. It is not evident why it would maximize opportunities to observe other marine mammals. TC

42 Page C-6 (Table C-1): As noted earlier, the points listed under section 6 of this table should be described in greater detail. 6g

43 Page C-15 (Table C-2): It is not clear what is referred to by the "note" following this table. TC

* * * * *

I hope that these comments, suggestions, and recommendations are helpful. If you have questions about any of them, please let me know.

Sincerely,

John R. Twiss, Jr.
Executive Director

Enclosures

cc: Ms. Ann D. Terbush

HELLER EHRMAN WHITE & McAULIFFE

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March 9, 1995

98480-0005

VIA FACSIMILE AND FEDERAL EXPRESS

Advanced Research Projects Agency
c/o Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, Virginia 22202

Re: **Comments on Draft Environmental Impact Statement for the Kauai Acoustic Thermometry of Ocean Climate Project**

Dear Mr. Spikes:

On behalf of our clients, Natural Resources Defense Council, Earth Island Institute, and Coastal Advocates, we submit the following comments regarding the Draft Environmental Impact Statement for the Kauai Acoustic Thermometry of Ocean Climate Project:

GENERAL COMMENTS

1 A. Inadequate Time for Public Review and Comments. On January 3, 1995, the Advanced Research Projects Agency ("ARPA"), the National Marine Fisheries Service ("NMFS"), and the University of California, San Diego ("UCSD") submitted for public review and comment a Draft Environmental Impact Statement ("DEIS") for the Kauai component of the Acoustic Thermometry of Ocean Climate Project ("ATOC"). This two-volume document, including well-over 400 pages of text and tables, was produced after over ten months of intense effort by Scripps Institute of Oceanography ("Scripps"), ARPA, NMFS, and the other cooperating agencies. Initially, February 20, 1995 was set as the deadline to submit comments on the DEIS. During most of this period, the interested public was concurrently faced with a fast-approaching deadline for comments on an equally complex Draft Environmental Impact Statement/Environmental Impact Report ("DEIS/DEIR") for the California component of ATOC. Despite 14a

repeated requests for a substantial extension of the public comment period(s), the requests were denied in clear violation of the National Environmental Policy Act, 42 U.S.C. § 4371 et seq. ("NEPA") and the California Environmental Quality Act, Cal. Pub. Resources Code § 21000 et seq. ("CEQA"). See 40 C.F.R. § 1506.6 (regarding EIS). In accordance with the mandate of NEPA, such an extension would have contributed to a greater level of public understanding of the ATOC project -- a project that has generated an almost unprecedented level of public concern.

Instead, the January 31, 1995 deadline for comments on the California DEIS/EIR and the short extension of the Kauai DEIS comment deadline to March 9, 1995, offered just sixty-one days in which to review the California DEIS/EIR -- leaving just thirty-seven days to focus on the Kauai DEIS. These highly technical and complex documents purport to cover federal NEPA and state environmental policy act requirements, federal Endangered Species Act and Marine Mammal Protection Act permit requirements and various additional state and local permitting requirements. It is clearly unreasonable to expect the public to review, digest, evaluate and comment on two such multi-facetted scientific documents in such a short period of time, especially where a significant portion of the Kauai ATOC comment period overlapped with the comment period for the equally complex California DEIS/EIR. Unlike the agencies involved in this ATOC project, the interested public understands that the California and Kauai ATOC projects represent components of a single program. As such, the public must be offered adequate time and opportunity to review and comment on the ATOC program in its entirety. The agency has failed to provide this opportunity.

Given the extraordinary public interest in the ATOC project and the significant scientific controversy that surrounds it, the small extensions of the public comment period were simply insufficient. Therefore, we submit these comments without having had sufficient opportunity to thoroughly and comprehensively review and comment on the DEIS.

2 B. Inadequate Project Description. The project description is confusing and misleading. As such, the alternatives analysis is skewed to favor the proposed project. If correctly evaluated, the alternatives may demonstrate reduced adverse impacts as well as the ability to achieve the project goals. Therefore, the project description should be revised to correctly reflect the ATOC project as an experiment to measure deep ocean temperatures as they relate to global climate changes -- and nothing more. 3a

C. Disorganization. The DEIS is disorganized and intentionally confusing. The expressly admitted negative impacts of the proposed project are scattered throughout the DEIS. These and other negative impacts must be clearly stated and cumulatively evaluated.

3 D. Inadequate Evaluation of Cumulative Impacts. The treatment of cumulative impacts is inadequate. 12c

4 E. Inadequate Alternatives Analysis. The alternatives analysis is subjective and unsupported by data or evidence in the record. 5a

5 F. Inadequate Impacts Analysis. The document fails to identify and adequately address concerns regarding the effectiveness and prudence of conducting such a complex and highly speculative scientific research project, especially given its potential impact on an area designated as one of the most protected and sacred marine resources in the world -- the proposed Humpback Whale National Marine Sanctuary. 6a

6 G. Permitting. ATOC is not "scientific research on marine mammals" as defined in the Marine Mammal Protection Act, 16 U.S.C. § 1361 et seq. ("MMPA"), and the Endangered Species Act, 16 U.S.C. § 1531 et seq. ("ESA"), but rather a proposed study on global climate changes. DEIS at 1-4. *Therefore, under the MMPA,* this project should be permitted, if at all, under the incidental take permit requirements. The current permit application, therefore, must be rewritten and resubmitted as an incidental take permit application. 21

7 H. The DEIS Is Not An Objective and Neutral Evaluation of the Proposed Project. The DEIS must be a neutral explanation of the project and its potential impacts. 40 C.F.R. § 1502.1. Furthermore, NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken." 40 C.F.R. § 1500.1(b)(emphasis added). In contrast, the DEIS is skewed in favor of the proposed project. For example, under the guise of offering "clarification and explanation," a substantial portion of the Executive Summary is devoted to summarily discounting the very real concerns regarding the potential harm to the marine environment. 16a

Moreover, in violation of the NEPA process, it appears that the certain phases of the project have already begun. See 40 C.F.R. § 1602.2(f),(g) (Agencies shall not commit resources prejudicing selection of alternatives before making a final decision.; EIS's shall serve as the means of assessing the environmental impact proposed agency actions, rather than justify actions already made).

8 I. Ill-Defined and Inadequate Mitigation Measures. Measures derived from the current project description (as submitted in the revised permit application) are not properly determined "mitigation" measures. In the alternatives section, the agencies shall "[i]nclude mitigation measures not already included in the proposed action or alternatives. 40 C.F.R. § 1502.14(f). Because nearly every "mitigation measure" proposed in the DEIS is already included in the proposed action, these measures are not properly labelled as "mitigation measures." For example, Mitigation Measures A-1 through A-5 are already included in the proposed action. See DEIS at ES-13. Similarly, other so-called "mitigation measures" *cited throughout* the DEIS are nothing more than elements of the project description itself. See, e.g., DEIS at 2-4 to 2-39. 6n

When properly evaluated, the DEIS proposes only five mitigation measures. *The failure* to include mitigation measure monitoring plans leaves unanswered questions regarding the implementation of such measures. For example, with regard to Mitigation Measure 2-2, how will the MMRP be coordinated with other oceanographic and acoustic research efforts? What other activities, including U.S. defense activities, will be conducted? Are other activities currently permitted? Specifically how will scheduling and operational conflicts be avoided?

SPECIFIC COMMENTS

Executive Summary

The *executive summary must include* the conclusions, areas of controversy (including issues raised by agencies and the public), and the issues to be resolved (including the choice among alternatives). 40 C.F.R. § 1502.12. No comments regarding information in the text, summarized in the executive summary, will be raised here. All *such comments will* be addressed under each individual section, unless already fully discussed under general comments.

ES-4: The Areas of Concern must be more clearly and thoroughly addressed. This section lists only three concerns generated by this proposed project, and fails to adequately address them. First, the impact of the ATOC sound on marine animals, including mammals and sea turtles, is not addressed by reducing the transmission time if, as admitted, there is "*insufficient*" *knowledge as to the impact of the* ATOC sound on these animals. This concern is not alleviated by adding the MMRP, as that program is unlikely to generate statistically useful data. In any event, there is no indication that the results of the MMRP will be used to determine whether ATOC *should go forward. Similarly,* concerns regarding the use of alternative technologies and the proposed location of the project are inadequately evaluated here and throughout the DEIS. <u>See, infra</u> at pp. 9-16. This section should be more fully developed to adequately address these concerns.

9 ES-5-9: Why is such a large part of this "summary" devoted to the ATOC sound impact comparisons when, in fact, the ultimate conclusion of this DEIS is that the impacts are "unknown"? What is the basis for comparing sounds produced under water with sounds produced in air? 7d

10 ES-8: How was the estimate that one whale will be exposed to ATOC "less than once every hundred years" statistically derived? TC

11 ES-9: The humpback whales, sperm whales and leatherback sea turtles will be the focus of MMRP "to the extent that they are amendable to available research techniques." Is this qualifying phrase meant to infer that, if not amenable, the research with respect to one or more of these animals will be "skipped" and the ATOC project will go forward as planned? What does that statement mean? TC

1 - Introduction, Purpose and Need for Action

1.1 The ATOC Project

12 <u>Scope of Project.</u> NMFS and ARPA have already received numerous letters emphasizing the need to prepare a comprehensive programmatic environmental impact statement evaluating the cumulative environmental impacts of the ATOC Program as a whole. In particular, these letters have emphasized that the ATOC project lawfully cannot be parcelled into separate projects for purposes of evaluating the environmental impacts of each of these related projects in isolation. (<u>See e.g.</u> June 15, 1994 letter from Heller, Ehrman, White & McAuliffe; April 14, April 29, May, 6, May 14, November 4, and November 7, 1994 letters from Sierra Club Legal Defense Club, Inc.; March 17 and March 21, 1994 letters from Natural Resources Defense Council). 2

Under the law, NMFS and ARPA must prepare a comprehensive programmatic EIS that evaluates the cumulative impacts of the ATOC Program before any significant aspect of the program is implemented, and before resources are irrevocably committed. The DEIS, as currently drafted, does not satisfy this requirement.

In their efforts to avoid evaluating the environmental impacts of the ATOC Program as a whole, ARPA limited the scope of the DEIS to a six-month Marine Mammal Research Program ("MMRP"), designed to test the impact of the ATOC Low

Frequency Sound ("LFS") on marine animals, and a two-year, Hawaii-based "proof-of-concept" study of the ATOC program. The numerous other locations which have been proposed for ATOC-related projects, including California and New Zealand, cannot lawfully be excluded from the DEIS. "<u>The research project</u> plans to use <u>two acoustic sources</u> located at a depth of approximately 850 m (one 14.7 km of the north coast of Kauai, Hawaii. . . and one 40 km west of Pt. Sur, California . . .)." DEIS at 1-10 (emphasis added). The clear scope of this <u>single project</u> cannot be more plainly stated, yet the agencies insist that it is proper to bifurcate the ATOC program for purposes of environmental impact review.

Moreover, the full extent of the proposed ATOC Program cannot be ignored. "If successful, a ten-year follow-on global ATOC program would be proposed. . ." California DEIS/EIR at Abstract. The goal of ATOC is "proving the acoustic thermometry concept for future global ocean climate monitoring programs." DEIS at ES-2. Three new hydrophone receiver arrays <u>will be</u> installed -- near New Zealand, near Pt. Sur and south of Adak, Alaska, combined with up to 10 drifting receivers that <u>will be</u> deployed along selected transmission paths. DEIS at ES-2. "This initial phase should demonstrate that it is possible to construct and operate an affordable international network capable of detecting and characterizing ocean climate change." DEIS at 1-21.

Accordingly, this long-term project, the possible international/global system, as well as the ATOC-related projects proposed in other locations, are clearly part of the ATOC Program as a whole and, as such, are foreseeable, potential environmental impacts of the "proof-of-concept" study. Accordingly, the potential environmental impacts of the <u>entire</u> ATOC Program must be evaluated in a single programmatic EIS. For example, no consideration of the New Zealand and Alaska hydrophone arrays exists in this document, let alone the cumulative impacts of these projects. Moreover, what criteria will be used to determine the location of the 10 drifting receivers? Are there any possible environmental impacts of choosing such a location? Are there any mitigating factors that should be applied?

Until and unless the project is properly defined and a proper environmental impacts evaluation is drafted, the implementation of any aspect of the ATOC project will be in violation of NEPA.

This obligation cannot be avoided by alleging that a programmatic EIS may be "too speculative" or subject to "several key uncertainties." DEIS at 1-21, 1-22, ES-3. If speculative and baseless, why was the full 10-year ATOC experiment part of Scripps' initial permit application submitted to NMFS? <u>See</u> Research Permit P557A at 25. Only when faced with compliance with the NEPA process did Scripps and ARPA decided to artificially split this project to two, two-year phases located in California and Hawaii. The agencies' attempt to avoid its statutory and regulatory duties by misrepresenting the full scope of the proposed project is unseemly and patently unlawful.

Moreover, each of the smaller ATOC-related projects, including the recent Acoustic Engineering Test, which have improperly been proposed and conducted outside of the NEPA process, is a component of the proposed ATOC project. As such, each of these projects will have cumulative impacts when viewed with the other parts of the ATOC Program. See 40 C.F.R. § 1508.25(a)(2). Cumulative impacts, as closely related, "connected" actions, must be evaluated in a single EIS. Id. Therefore, the impacts of the entire ATOC Program must be fully considered, and alternatives to that program fully explored, in a complete EIS before any components of the ATOC Program are conducted.

Such a requirement ensures that before the ATOC program or any of its related projects can be implemented, a determination will be made whether measuring ocean temperature is the most prudent, practicable and feasible method to evaluate global warming and, if so, whether there are less intrusive means than the ATOC project to obtain those measurements. It is just this determination that ARPA, NMFS, UCSD and Scripps apparently seek to avoid. As currently drafted, the DEIS fails to analyze the proper scope of the ATOC project, and therefore, does not meet the legal requirements for such a document.

Military Purpose. The DEIS fails to disclose the military purpose associated with the ATOC project. In a letter dated September 21, 1994 from Harold Heilsnis, Director for Public Communication, Office of the Assistant to the Secretary of Defense, to Elena Flanagan, the Department of Defense ("DoD") admitted that the
13 ATOC project "provides the Defense Department a greater understanding of sound propagation in the ocean." For what purpose is such an "understanding" necessary? 1
What are the military uses associated with the ATOC project? All potential environmental impacts of these military uses must be evaluated as well as any alternatives to this project which will fulfill such military purposes. Is the funding provided by DoD a dual use or non-military use of DoD's funds?

Global Warming. The DEIS alleges that ATOC "is necessary to validate global climate computer models being used and developed to answer the question
14 whether our earth is warming as a result of the 'greenhouse effect.'" DIES at ES-1, 1-3. 7C
The document fails to explain how or why the ATOC data is "necessary," and how such measurements would "validate" other climate models. Without the supporting evidence and explanations, these bare representations fail to inform the public and assist agencies

in decision making. Therefore, a full explanation of the "global climate models" should be included in the EIS, as well as an appendix which includes the models themselves.
15 See 40 C.F.R. § 1502.24 ("Agencies shall insure that professional integrity, including scientific integrity, of the discussions and analyses in EISs. They shall identify any 3c
methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.") As currently written, the DEIS does not explain how the information generated by the ATOC experiment on the deep sea temperature will validate those models.

How will the ATOC project obtain any data on temporal variation in "large scale observations of ocean temperatures" useful for "comparing with and verifying the predictions of existing climate models"? DEIS at 1-5. The ATOC data is limited to the
16 deep sound channel axis where there is a several year delay in responding to changes in 3d
surface temperature. How will this data apply to existing climate models? Can statistically significant data be obtain over a two-year program? If not, then this document must evaluate the ten year program necessary to obtain this information, including all the environmental impacts and alternatives available for such a project.

Moreover, the DEIS proposes that certain computer models of global climate change "have been criticized as inaccurate and oversimplified. Therefore, they have had very little impact on governmental decisions to take action to curb emissions of greenhouse gases." DEIS at 1-5. It is further proposed that ATOC will fulfill the need for large-scale observations of ocean temperatures so that the models may serve as a
17 persuasive basis for policy formulation. Id. Such baseless statements fail to explain how 3b
the results of the ATOC project, even if considered accurate and precise, will result in governmental policy actions to curb greenhouse gas emissions. Moreover, if global warming policy change is a purpose of the ATOC project, then alternatives which will effect such a policy change must be included in the EIS. For example, an effective means to attain that goal is to direct the millions of dollars devoted to ATOC design and implementation towards demonstrating that it is economically feasible and scientifically prudent to take action now to abate the global warming problems -- without any further action towards proving that global warming exists.

1.1.2 The Marine Mammal Research Program

Determining deep sea ocean temperature, providing information for future global ocean climate monitoring programs, confirming computer models of global climate change, and allegedly affecting government policy determinations regarding the reduction of greenhouse gas emissions are wholly unrelated to marine animals or the effects of noise on marine animals. Yet, "the ATOC program recognizes a need to evaluate the potential effects of the proposed source transmissions on marine animals, in particular marine mammals and sea turtles." DEIS at 1-5. Obviously, the MMRP was designed for a single purpose -- to evaluate the effects of the ATOC source sound on marine animals.

18 Inexplicably, however, the DEIS alleges that the MMRP itself will govern the location of the ATOC project -- going so far as to claim that the presence of marine animals is a necessary element of the ATOC project. DEIS at 1-22. Clearly, to achieve its stated goal of global warming evaluation and governmental policy impact, the ATOC project need not involve the presence of marine animals. If the proposed project is located in an area nearly free of marine animals, particularly marine mammals and sea turtles, the possible impacts of the source noise emissions on marine animals would be greatly reduced, if not eliminated. The location of the ATOC source itself should dictate the parameters (and location) of the MMRP, not visa versa. 4b

19 However, the DEIS misstates the purpose and goals of the ATOC project throughout the text. "A goal of these experiments is to evaluate the potential impacts of low frequency sound on marine animals." DEIS at ES-11. The MMRP was neither a goal nor even a part of the ATOC project prior to the significant public outcry and pressure mandating that ARPA, NMFS and Scripps obey the law and comply with NEPA requirements. As admitted in the DEIS, the MMRP is a last-minute addition to the proposed project, added "in response to the question of potential effects" of low frequency sound on marine animals. DEIS at 1-5. It is entirely disingenuous to now claim that marine animal research is a part of ATOC. The MMRP is properly labelled a mitigation measure, intended to determine and monitor any adverse impacts of the ATOC source sound on marine animals. See DEIS at ES-14-15. TC

The unclear and confusing stated goals of the ATOC project as presented in the DEIS render the document inadequate and unlawfully insufficient. The entire alternatives evaluation is fundamentally flawed as it requires, as a necessary element of this project, the presence of an abundance of marine animals. Properly analyzed, the alternative site analysis would likely result in very different conclusions. Specifically, siting the ATOC project in the center of a Marine Sanctuary is clearly unnecessary.

1.1.3 The Acoustic Thermometry Program

20 1-8: In what way will the results of ATOC "provide important information for studying global climate questions"? 3d

21 Table 1.1.3-1: **This table is misleading and inaccurate; it fails to explain the basis for the sound comparisons, thereby leaving the reader with no understanding of its validity or accuracy.** TC

2.0 Alternatives

"This section is the heart of the EIS." 40 C.F.R. § 1502.14.; see also Grazing Fields Farm v. Goldshmidt, 626 F.2d 1068, 1072 (1st Cir. 1980)(NEPA's "primary procedural mechanism" is the requirement to discuss alternatives in the EIS). An EIS must "[d]evote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits." 40 C.F.R. § 1502.14(d).

Proposed Project:

22 2-4-5: What affect will the results of the MMRP have on whether the ATOC project will proceed? TC

23 2-14: Why are two sources (and presumably more pathways) necessary? Why are two sources necessary for the initial two-year, "proof of concept" experiment? TC

24 2-15: The MMRP Site Survey Criteria, as discussed above, are wholly irrelevant to the goals of the ATOC project. These criteria are included as a post-hoc justification for a previously chosen site -- the Proposed Marine Sanctuary. Sec 2.2.3.1

25 2-16: It is inappropriate to allege that aspects of the project itself qualify as mitigation measures. In any event, the explanation of the variable source numbers and pathways is ill-defined and confusing, especially with regard to how these variables will mitigation impacts. TC

26 Dismissed Alternatives. A project delay and a lack of development funding is not a valid basis for dismissing an alternative as infeasible or inadequate. ATOC is fully funded by the Department of Defense. To allege that delays and "uncertain" funding sources may arise is plainly disingenuous and invalid. Permitting decisions and environmental impact determinations are not limited by or based on funding sources. TC

27 2-23; Table 2.2.3.2-1: While we do not currently support location of the ATOC source at any proposed sites, the alternative locations considered were improperly deemed infeasible because of different technology, technology which has not been applied to this type of project, or a lack of the presence of marine species. First, if 4b

further testing must be done to properly design a moored autonomous source, then the agency must conduct this further research. Second, as discussed above, the presence of marine animals is clearly not required to meet the project goals of ATOC. Therefore, many alternative sites and technologies were improperly dismissed.

28 2-37: How and what studies indicate that the frequency proposed is "anticipated to have minimal adverse impacts"? What evidence is there, if any, that such an overlap of frequencies used by whales will not have impact, or that higher or lower frequencies would be better or worse? TC

29 Table 2.4-1 and Related Text: The entire alternatives analysis is biased toward the preferred alternative. Conveniently, the text and table artificially separate each component, avoiding a cumulative picture with which to properly analyze each proposed alternative. Moreover, the alternative ranking system in the DEIS uses a mathematical formula that is not explained and skews the outcome of the ranking. How were the percentages of "relative response criteria" determined? TC 5a

30 2-45: The evaluation of restricted source transmission times is inadequate. There is no evaluation of the possible advantages of terminating all sound emissions upon detection (visually or acoustically) of suspected sensitive animals, specifically the humpback whale and leatherback sea turtle. 5c

31 2-45-46: Every "alternative" deemed to be part of the project, it is not an alternative at all. As such, each of these "alternatives" should be fully evaluated as part of the "Project Description" as well as all of the potential impacts and alternatives thereto. These "alternatives" include, among others, computer models, satellite sensors, other sensors. TC 5a

32 Additional Alternatives Not Considered. The alternative of conducting the MMRP and ATOC at different sites was not considered. Failure to consider this alternative evidences the project proponents' attempt to ensure that the ATOC experiment is located in the Proposed Marine Sanctuary. The project proponents avoid this obvious alternative to avoid any indication that the ATOC source need not and ought not be located in the Proposed Marine Sanctuary. 4b

3 Affected Environment

The DEIS must describe the environment of the areas to be affected or created by the alternatives under consideration. See 40 C.F.R. § 1502.15. The DEIS offers forty-one pages describing the areas affected by this project -- evidencing the

33 significant impacts that this project is likely to have. The affected environment analysis includes a discussion of fifteen threatened or endangered species which depend on the ocean ecosystem for their survival. What is more, because this DEIS is singling out the Hawaii project, the DEIS fails to consider the potentially larger global affects of the ATOC project as currently planned. 2

4 Environmental Consequences

4.1 Introduction - General Comments

This section fails to adequately consider cumulative impacts, as required under NEPA. The DEIS fails to list present, past, and anticipated future projects, including those inside and outside the agencies control, or to summarize the expected environmental effects of those projects. See 40 C.F.R. § 1508.8 (definition of "effects"); 40 C.F.R. § 1508.7 (definition of "cumulative impacts"). TC

34 Examples of cumulative impacts which have not properly been considered here include: the potential to further reduce the severely depleted population of the endangered species proposed to be harassed; the effects of other present or future projects planned for the project location combined with the ATOC project; the potential impact on marine environment over the tens of thousands of miles that this sound is supposed to travel. These and other cumulative impacts must be fully disclosed and analyzed in this section. 12c

4-147: The cursory consideration of the California and Hawaii ATOC projects cumulative impacts is insufficient. What is the basis for each and every statement of fact on pages 4-147-148? For example, how will the MMRP determine the cumulative impact on the species as a whole? How will the currently proposed *mitigation measures* reduce that potential impact?

Tables: Notably, the DEIS offers separate tables purportedly evaluating the impacts of the proposed project and the alternatives on various types of animals. The DEIS fails to offer any comparative analysis of the cumulative impacts of the proposed project and the alternatives. Therefore, even if one alternative is clearly and expressly stated to have less impact than the others, the tables fail to reflect that fact.

Therefore, the tables render the comparison of alternatives skewed and inaccurate. The tables should be remodelled to reflect the cumulative impacts, in comparative format, of each alternative.

Clayton H. Spikes
Advanced Research Projects Agency
March 9, 1995

4.2 Potential Effects on the Physical Environment

4-1: The potential significant impact from construction of the facilities on
35 the physical environment is not fully explained. For example, how will trenching and pipe installation avoid a threat to the physical environment? Summary statements allegedly dismissing threat of impacts are not sufficient. 19

4-2: How will removal of ATOC facilities mitigate the impacts of installation? What is the current plan for removal? When is removal anticipated? What will define "economically and practicably feasible"?

4-2-3: Why is a long term average of ATOC sound used to determine
36 significance of the noise? Why is that "considered the most appropriate"? High ambient noise levels expected in the study area are not expected to occur during all hours of the day and night. TC Therefore, any evaluation of the noise significance must consider that the ambient noise levels will vary. Accordingly, the potential disturbance of the marine environment will vary.

4-3: Average ambient noise levels are not an indication of potential impact on marine environment at any given time. If the ATOC source is "turned on" during a
37 period of very low ambient noise, what will the potential impact be and what mitigation measures will be applied to reduce that impact? TC A single sentence is devoted to the MMRP vessels and aircraft impact on ambient noise levels. This is inadequate. What vessels and aircraft will be used during the ATOC and MMRP programs? What amount of noise will these vessels add to the ocean environment? What impacts will these vessels have?

4.3 Potential Effects on the Biological Environment

The bulk of the comments on this section will be submitted by scientists familiar with the studies and research purportedly relied upon in this section. General comments are presented below:

The cumulative effects analysis in this section is inadequate and understated. By breaking down the analysis of the cumulative effects by species, the
38 DEIS fails to properly evaluate the cumulative effects on the entire biological environment, including all species potentially effected and all effects cumulatively impacting those species. 12c What are the full cumulative effects on the entire biological environment?

H-57

Clayton H. Spikes
Advanced Research Projects Agency
March 9, 1995

4-5: The lack of information regarding the effects of noise on marine animals requires the agency to investigate this unknown, as it is both practicable and
39 economically feasible to do so. TC, 15 NEPA requires agencies to satisfy certain detailed requirements when they confront incomplete or unavailable information. First, the agencies must acknowledge that relevant scientific information is lacking. Second, they must obtain such information, with original research if necessary. 40 C.F.R. § 1502.22.

Despite a long list of studies which strongly indicate a potential for significant impacts, the DEIS concludes that the impact is "less than significant." What is the basis for that assumption? If the impact is truly unknown, the assumption should be that it is a significant impact. How will each of the unknown impacts be mitigated or eliminated?

Mysticetes: The impacts are inadequately stated, confusing, and ill-defined.
40 The proposed mitigation measures fail to address the potential impacts. TC

4-14: Mitigation Measure 3-1[1]: This measure merely proposes to determine the "likely exposure" of mysticetes to the ATOC sound source. Assuming they are exposed (because they are present), what relevance is their population distribution to the impacts of the ATOC sound?

4-21: Mitigation Measure 4-1[2]: How will reduction in duty cycle and
41 power levels necessarily mitigate potential impacts? How can all the "unknowns" for all the species considered lead to the conclusion that this "mitigation measure" will be effective? TC 6n This statement is obviously conclusory and invalid.

Odontocetes: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts.

Pinnipeds: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts.

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[1] This comment equally applies to Mitigation Measures A-1, 4-2, and 5-2, as they are the same.

[2] This comment equally applies to Mitigation Measures A-3, A-5, 2-1, 4-1, and 5-1 as they are the same.

Sea Turtles: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts.

Fish: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts.

Invertebrates: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts.

Plankton: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts.

Seabirds: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts.

Threatened, Endangered and Special Status Species: The impacts are inadequately stated, confusing, and ill-defined. The proposed mitigation measures fail to address the potential impacts by avoiding discussion of any anticipated impacts on these
42 species' population, breeding habitat, or recovery. 14c

Marine Sanctuaries and Special Resource Areas: The DEIR fails to adequately discuss any inconsistencies between the proposed project and the Marine Protection, Research and Sanctuaries Act, 40 U.S.C. § 1531 et seq., governing the Proposed Humpback Whale Marine Sanctuary. Any and all inconsistencies with the purpose and design of the above should be disclosed.

4-131: Sanctuaries are sensitive habitat for many species of marine animals. To state otherwise, without any support, is clearly incorrect. Therefore, all evaluations of potential impact on habitat in the area must be considered significant. This section fails to analyze the potential adverse impacts on the Marine Sanctuary or Wildlife Refuge.

5.0 Consistency with Federal, State, and Local Requirements, Plans and Policies

The relevant permitting agencies must consider ATOC's numerous permit applications after completion of the ongoing NEPA, CEQA and HEPA process. During the official application periods which will occur, if at all, after approval of the EIS, we will address in greater detail our comments on each of the permits for the ATOC project. Therefore, only our preliminary comments are set forth below. The DEIS must

evaluate all possible conflicts between the proposed action and the objectives of the Federal, regional, state and local land use plans, policies and controls for the area concerned. 50 C.F.R. §§ 1502.16; 1506.2(d).

5.1 Federal Regulatory Programs

ESA and MMPA: The proposed ATOC project is not "scientific research
43 on marine mammals" as defined in the MMPA and the ESA, but rather a proposed study 21
on global climate changes. Therefore, under the MMPA, this project should be permitted, if at all, under the incidental take permit requirements.

The Sanctuary: The Potential Humpback Whale Sanctuary Expansion, if approved, will be governed by the Marine Protection, Research and Sanctuaries Act, 40
U.S.C. § 1531 et seq. Marine sanctuaries are designated based on, among other things, 14c
44 the area's natural resources and ecological qualities, including its contribution to productivity and maintenance of threatened and endangered species and their habitat. See 16 U.S.C. § 1433(b). If expanded, the Humpback Whale Marine Sanctuary will secure federal protection and management of the conservation, ecological, recreational, research, educational, historical and aesthetic resources and qualities of the area. See 15 C.F.R. § 944.1. In order to preserve such an area of national significance, all activities proposed to be conducted within the boundaries of a Marine Sanctuary will be severely restricted and highly regulated. See 16 U.S.C. § 1431 et seq.

In stark contrast to the goals and objectives of marine sanctuaries, ARPA and Scripps propose to conduct their ATOC project in this pristine marine environment. The ATOC program, wholly unrelated to marine resource protection, is a study proposed to measure long-term ocean climate changes using acoustic sound paths in the deep sea by constructing a sound source within the Proposed Sanctuary which would transmit sounds across the entire North Pacific ocean basin. If successful, ARPA and Scripps intend to conduct a ten-year follow-on global ATOC program that would allegedly help determine the potential for global climate changes. See California DEIS/EIR at Abstract and ES-1-3.

Contrary to the allegations of ARPA and Scripps, the ATOC program clearly is not consistent with the goals and objectives of marine sanctuaries, and will not actively contribute to the research and education goals contained therein. The DEIS offers no basis for conducting this project in such a sensitive habitat.

Marine Mammal Research Program - Appendix C.

45 General Comments: The Marine Mammal Research Program is confusing and highly technical. As such, it fails to convey to the general public any significant information regarding the MMRP and its effectiveness. Moreover, as currently proposed, the MMRP will fail to achieve statistically significant data. The MMRP results will be unable to show any statistically significant difference in marine animal behavior when ATOC source is on or off. The ATOC project and its associated MMRP has far-reaching potential to harm a large number of marine species and their habitats. The impacts of this project have not been adequately discussed or mitigated and the MMRP, will not adequately serve this purpose. Therefore, the MMRP should not be implemented, nor accepted by the agencies as an effective proposal for monitoring the impact of ATOC generated noise on marine animals. See 40 C.F.R. § 1502.24 ("Agencies shall insure that professional integrity, including scientific integrity, of the discussions and analyses in EISs.") TC

46 Moreover, under the stringent standards set forth by NMFS for considering and issuing scientific research permits under the ESA and MMPA, the MMRP cannot be permitted. NMFS has established and enforced very strict monitoring programs for projects involving the production of ocean noise. NMFS must subject the ATOC project to the same strict protocols. If the ATOC project is subject to a "lesser standard" of marine animal impact monitoring, the DEIS/EIR must fully set forth the basis for the reduced efforts to protect marine animals as well as include, in its entirety, the two standards applied to monitoring projects -- one for ATOC and the other for all other projects. TC

Specifically, NMFS has imposed very strict scientific protocols to protect marine animals from the potential impact of oil drilling in the Arctic. Some of these very studies are cited in the DEIS at 4-25. The ATOC project should be subject to the same strict scrutiny as the oil drilling projects because the ATOC project will emit similar sounds into the ocean, at similar frequency and noise levels. Instead, NMFS has apparently abandoned its strict scientific standards and accepted, for purposes of the ATOC project, a low standard of scientific protocol.

47 As a cooperating agency with special expertise, NMFS is required to review the DEIS and offer comments with respect to its expertise. Marine mammal research and its concomitant permit requirements fall squarely within the purview and expertise of NMFS. Therefore, it is NMFS' duty to stringently review the MMRP and comment on its adequacy. As part of this mandatory duty, we request that NMFS call on its qualified scientific statisticians located in Seattle, Washington to review the MMRP and confirm, TC

as we suspect they will, that the MMRP cannot produce statistically significant data and falls well below the stringent standards required by NMFS in other projects affecting marine animals.

Specific Comments:

48 C-2: How will the six-month Pilot Study "provide critical evidence" of behaviors specifically caused by the ATOC sound transmission? What behaviors will be considered "acute"? What about subtle changes? How will subtle changes be detected? What number of observations of what type of each data is proposed for the MMRP? What is the statistical basis for that number? How is the MMRP different from the other acoustic studies which could not assess the potential long-term negative consequences of short-term stress on marine mammals? TC 6k 12a

49 C-2: How will the results of the MMRP be used? What impact will the results of the MMRP have, if any, on the ATOC project? TC

50 C-2: Why is a 20 minute signal duration being used? Without any knowledge of the impact of the ATOC source sound on marine mammals, this MMRP proposes to transmit at up to 195 dB for 20 minutes from the beginning of the experiment. Such extreme initial exposure will impede the effectiveness of the measures intended to protect marine mammals. The MMRP should be revised to address this serious deficiency. TC

51 C-2: If the ATOC sound-source were located in a less eco-sensitive area -- such as an area outside the Proposed Humpback Whale Marine Sanctuary -- would it be necessary to focus on humpback whales in conducting a MMRP? Why must this severely endangered species endure yet another "experiment" simply to justify the ATOC project. Relocation of the ATOC sound must be considered before subjecting endangered species to further harassment can be justified. 4b

52 C-7-12: What will be accomplished using acoustic surveys? How are these objectives different from other projects, such as oil drilling, for which NMFS expressly denied any use of acoustical data because of its unreliability and lack of statistical significance? How will acoustic detection of marine mammal vocalizing statistically function as any indication of perceived danger? Is there any baseline data to be used for comparison? Using the Leq method may not be appropriate for marine animals, especially in light of the possible cumulative impacts from short-term behavioral disruption. Moreover, is the acoustic testing planned to include measuring ambient noise App C

levels during different times of the day and night in order to assess the relative impact of the ATOC sound source at different times or different levels of ambient noise?

53 C-14-21: How will the effect of the observer, specifically the observation boat, be statistically eliminated? TC

54 C-22-26: How will the effect of the observer, specifically the survey aircraft, be statistically eliminated? TC

55 C-28-32: Even assuming that the data produced by the MMRP Pilot Study is statistically valid, how will the results be used? How will the data be statistically extrapolated? What statistical significance will be required before a determination of unacceptable long-term effects be made? TC 12a

56 How will the MMRP differentiate the effects of introduced noise from the ATOC source from noise produced by ships and seismic exploration? How will the effects of the tanker traffic, seismic exploration, weather, and earthquakes be statistically eliminated? TC App C

57 C-28: What is the purpose of the Quick-Look Report? What extent of harm, if any, will be acceptable to continue with the project? TC App C

58 C-29: What is the purpose of MMRP Pilot Study Full Report? What extent of impact, if any, will be acceptable to continue with the Project? How will the "statistical power" be analyzed? 6k

CONCLUSION

The foregoing comments are submitted in a sincere effort to identify the many deficiencies in the Draft EIS for the Kauai ATOC Project. We hope that each comment will be given serious review and consideration, resulting in a final document which fully comports with the strict requirements of both NEPA and HEPA.

Respectfully submitted,

HELLER, EHRMAN, WHITE & McAULIFFE

Nicole Walthall

Joshua R. Floum
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Attorneys for Natural Resources Defense Council, Earth Island Institute, and Coastal Advocates

cc: Joel Reynolds, NRDC
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Ann D. Terbush, NMFS
Michael Wilson, Department of Land and Natural Resources
Office of Conservation and Natural Resources
Office of Conservation and Environmental Affairs
CDUA # KA2734

5 March, 1995

To: Mr. Clayton H. Spikes
ARPA Contract Representative – Marine Acoustics, Inc

Dear Mr. Spikes –

We've never met, so I've no idea what your thoughts and feelings on the sacredness and future of ocean creatures (including mankind) are – but it has come to my attention in the past few years that many of the folks involved in the U.S. Defense Dept. are not nice people, and therefore

1 I don't trust any projects that have Defense Dept affiliation/funding – especially when classified material is involved. Hopefully these involved souls will grow in love and understanding, but until they see the light, I would ask that you might use your influence to prevent any potential abuse to earth life that could very possibly occur through implementation of this ATOC project. 1

Aloha to you and your loved ones –

Jeanne Wheeler

Box 1513
Hanalei, HI
96714

RECEIVED 2-28-95

Comments on:
DRAFT Environmental Impact Statement/Environmental Impact Report for the Hawaii Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program

by

Hal Whitehead, PhD

DATE: 23 February 1995

These are the comments of Hal Whitehead on the Draft EIS/EIR for the Hawaii ATOC project. I am an Associate Professor of Biology at Dalhousie University and a University Research Fellow of the Natural Sciences and Engineering Research Council of Canada. My graduate degrees are in mathematical statistics and zoology, and my research is principally on the population biology, social organization and ecology of the deep water whales (sperm and beaked whales). I have a number of detailed questions and comments on the document, but this is a summary of my major impressions.

The document was clearly put together with extreme haste. One of the results of this is shoddy presentation. For instance:

- many of the cited references are not listed (e.g. on pp 2-44, 3-5, 3-7, 4-102);
- inappropriate sources (such as the ATOC Scientific Research Permit Application) are cited for biological information (p. 3-20);

In the areas where I have most expertise, the document is often seriously wrong, invariably in the direction of minimizing the potential effects of the ATOC source on the marine environment.
1 For instance, on page 4-48, there is a calculation of the number of sperm whales likely to come within the 150dB contour. When calculations are carried out correctly (including the whales missed when diving, the proportion of time at depth, the tidal sampling and the mean speed of movement of whales) the number of sperm whales affected is increased by more than a factor of 100. TC 8b

Page 4-41. Individual residence times in an area cannot be estimated from densities. The statements that the "maximum residence within the general area...is estimated to be <24hrs" are completely false. Individual sperm whales, fin whales, blue whales and beaked whales are known to spend periods of weeks or more in small ocean areas.

Given these serious deficiencies in the areas where I know something, it is hard to take the other parts on faith.

The major structural problem with the document is that it refuses to consider the most sensible and environmentally acceptable alternatives as legitimate, especially:

<u>The No Action Alternative</u>.

Benefits (compared with ATOC):

1. No financial costs.

SOME DETAILED COMMENTS ON ATOC-HI DRAFT DEIS

By Hal Whitehead

February 23, '95

5 BS-8 The calculation of the number of sperm whales exposed to a level of 150 dB or greater is off by two orders of magnitude! See below comment for p. 4-48. TC 8b

6 1-1 ATOC is not "scientific research on marine mammals...", as indicated, for instance, by the statement on page 1-3 "..the global climate question that ATOC seeks to address." Thus, under the MMPA, it should be considered as an incidental take not marine mammal research. 2i

7 1-5 Time scales: ATOC will not obtain any data on temporal variation in "large scale observations of ocean temperatures" useful for "comparing with and verifying the predictions of existing climate models" for a decade or more, and then the information will be principally about the deep sound channel axis where there is a several year delay in responding to changes in surface temperature. 3d

8 1-5 ATOC is not a response to the need for data to test against global climate models. The basic program was suggested before there were useful climate models. 3a

9 1-6 The transmission schedule is NOT "the minimum time necessary to study the potential effects on marine mammals..." Other experimental designs, especially with a movable source, would be much more efficient and less potentially damaging to the environment. 6e

10 1-12 Table 1.1.3-1. This table integrates from 10-1000Hz, about 6 octaves, and so, for the man-made and non-biological sources, is totally incomparable to ATOC (about half an octave). For biological sources, the frequencies are different. This table is a blatant attempt to mislead the reader into thinking the ATOC source is not powerful. TC

11 1-13 "These sections take many weeks to complete and are rarely repeated." Using XBT's from ships of opportunity, sections could be sampled quickly, frequently and cheaply. 3e

12 1-17 What are the frequency sensitivities of the arrays? TC

13 1-21 There must be some discussion of extensions. If the minimum extension feasible for useful work on global climate is ecologically unacceptable, the project should be stopped now. There are potential extensions out there in the oceanographic literature. If there are no problems with stability, internal waves, acoustic propagation limits, or ocean boundary scattering, what would you do? We need to know. 2 3f

2. No short or long-term effects on the environment.

Possible costs (compared with ATOC):

2 1. Lack of knowledge gained about global ocean climate. As the acoustic method is only one (and a rather dubious one) of several methods of looking at ocean temperature changes, the loss of ATOC's potential results are of very little consequence. 3a 5a

2. Lack of knowledge gained on the effects of low frequency sound on marine mammals. As the portion of the MMRP dependent on the ATOC source has very poor statistical power, its results will largely be inconsequential. Moreover, The ATOC sources are not necessary to study the problem of low frequency noise in the ocean. There are other anthropogenic sources, or (for experimental work) special mobile, low-powered sources could be used. 6e

<u>Autonomous source for ATOC and low-power mobile source for MMRP</u>

This alternative has been suggested several times by critics of ATOC, and (at least the second part) recommended by members of the ATOC MMRP Scientific Advisory Board.

Benefits (compared with current proposal):

1. Possible lower cost (2-35).
2. Much higher statistical power, and greater temporal and spatial flexibility, for MMRP.
3. 3 Minimal effect on environment if source is placed in an area of low productivity. The suggested increased exposure of myctophids, for instance (4-106) by using the autonomous source is complete rubbish if the source is placed in an unproductive area--another example of the misleading nature of the document. 5d 6e
4. Shorter paths and lack of bottom effects would mean either lower source levels or higher received levels or both.

Costs (compared with current proposal):

1. Some additional engineering work (2-35).

4 Another major deficiency in the document is that there must be some discussion of potential extensions of the ATOC program. If the minimum extension feasible for useful work on global climate is ecologically unacceptable, the project should be stopped now. There are potential extensions out there in the oceanographic literature. If there are no problems with stability, internal waves, acoustic propagation limits, or ocean boundary scattering, how would the project ideally (in the oceanographic sense) proceed? According to the ATOC technical proposal (p 65) a high-powered team at Scripps and MIT have been working on global extensions to ATOC for some time. What are the results? We should be given a reasonable preview of future potential plans. 2

For these and the other reasons I view the document as an incomplete and misleading representation of the environmental effects of the proposed project.

14 2-4 The ATOC transmissions start before the pilot study report? 6c

15 2-14 (top) But "taking no action" would safeguard the marine environment, so it should be reasonably considered. 5a

16 2-15 (top) "at least two source locations were necessary to provide a greater number of acoustic pathways..." Greater than what? With one source? There is no logic here. This should read "The ATOC people want two sources, so we have two sources!" TC 3a

17 2-15 They chose the sites for places with lots of marine mammals to get statistical power!!!! OUTRAGEOUS! Use a low-power mobile source if you want statistical power. Then stick your main source away from the marine mammals. There will not be enough statistical power anyway to detect anything but the most blatant effects over a certain small range of time scales. You want statistical power, and then you also say you want a site with additional noise sources--these will heavily reduce your statistical power. This section is GARBAGE to a statistician who knows anything about marine mammals--it is a post hoc justification of the previously chosen site. 4b

18 2-17 A seamount would not have a 360° view, so it is ruled out, but neither of your two sources have more than a 180° view! 4c

19 2-25, Table 2.2.3.3.1 Absolutely no mention of environmental consequences! TC

20 2-35 A basic decision as to whether it is desirable to put the source in a biologically rich area (so you can study its effects) or a biologically poor area (so it harms as little as possible) must be made. You cannot argue things both ways. As we know so little, and in the immediate future will continue to know so little, the second option is preferable. Studies can be made in richer areas with low-level portable sources. 4b

21 2-40 Apparently El Niño type events can now be predicted in the Indian Ocean. TC

22 2-41 At what depths is ATOC measuring temperature? 3a 7e

23 Sections 2.2.7-2.2.11. So we have the models, and we have these methods of gaining data which can be used to validate them (SST measurements, sea level measurements, etc) none of which is perfect, so we want to add another (also imperfect, but potentially environmentally dangerous) technique, ATOC. Is this right? Stating this does not justify ATOC. 3c

24 2-44 The addition of copper, etc. to the ocean by XBTs. How does this relate to what is there anyway, or comes in through natural sources? You cannot dismiss XBT's without evaluating this. 5b

25 2-45 Why not just turn the source off when animals are nearby? 5c

26 3.3.1 This section is sloppy. There are good primary references to many of the points made. Instead, secondary, tertiary (e.g. Clark 1993) or personal communications are cited. TC 8a

27 3-11 Are population estimates corrected for diving animals being missed on surveys? They were not in earlier presentations of these data. If not, numbers of sperm and beaked whales will have been serious underestimates. TC 8b

28 3-19 But in some areas (e.g. off Nova Scotia) sperm whales are found in shallow waters. TC 9c

29 4-18 Individual mysticetes will often spend periods of weeks or more in a small area if there is food there (examples include Mingan Islands, Stellwagen Bank, San Juan Islands, Brier Island). Therefore the statement "the maximum residence time within the general area of the proposed action alternative for any individual mysticete is estimated to be <96 hrs" is totally wrong. You cannot estimate residence times from densities. Similarly for time in 120dB sound field. TC

30 4-13 Animals may have the capacity to leave the area during the ramp-up time, but will they, if their food is there (see Brodie 1981)? 11a

31 4-24,4-25 This section seems to say "We know nothing about masking. It could be important, or not. Let's assume it isn't and presume the effects are not significant." For instance, if Payne and Webb are even partially right then masking effects could be severe. 13b

32 4-57, Table 4.3.1.2.3-1 Individual odontocetes will often spend periods of weeks or more in a small area if there is food there (examples include Kaikoura for sperm whales, the Gully for beaked whales, etc.). Therefore the statement "the maximum residence time within the ensonified area for any individual odontocete is expected to be <24 hrs" is totally wrong. TC

33 4-48 The statement that sperm whales make deeper dives in deeper waters and therefore would not reach the ATOC source (referenced to Rice's general review) is wrong. Sperm whales cannot dive below the ocean floor, but in shallower waters (e.g. ca 850m), they will often dive to it. The statement in the document is contradicted by the next sentence--Watkins' work showing sperm whales diving to the bottom. The calculations on the risk to sperm whales are very wrong: TC 9c

Correcting for dives during surveys the density is about 4/1000km²;

Sperm whales spend about 50% of their time at depth (e.g. Whitehead and Weilgart 1990; Papastavrou et al. 1989), although, depending on the area, they may not dive below 650m. We do not know dive depths off Hawaii. Assume they do.

Sperm whales travel about 4km/hr while at depth. Therefore animals in an approximate horizontal area of 178mx2x4km/hrx20/60hr=.47km² would pass through or over the 150dB area in any transmission.

The number of transmissions is 1100, plus the tidal sampling (45 extra days at 6 per day)=270.

Thus an estimate of the mean number of sperm whales going within the area during broadcast during the project would be .004x.5x.47x1370=1.3 (not less than 0.01 as stated in the *DEIS*). Of course it could be much greater if *sperm* whales repeatedly feed in the area (something they can do).

34 4-51 Just because you can reasonably assume that masking effects are negligible on most odontocete species does not mean that they are for all--you mention the important exceptions of the sperm and pilot whales. Beaked whales should also be listed as a possible exception. TC

35 4-55 The moored autonomous source alternative would have more close encounters with sperm whales! The autonomous source could be placed in an area where sperm and beaked whales are almost absent. This is misleading. TC

36 4-106 Similarly, the autonomous source could be moored in an area of few myctophids. TC

37 Many cited references (e.g. Lewis 1994 on 2-44; Myrberg et al. 1978 on 4-102; NRDC 1994 on p. 3-5; Frankel 1994; in press on p. 3-7) are not in reference list. TC

Appendix C

38 C-2. Why shorten the time period if the start is delayed? I guess the MMRP isn't very important! 6b

39 C-26. I don't think there will be enough power to estimate sperm whale and spotted dolphin numbers and distribution. There were only 7 sightings of sperm whale groups, and 4 of spotted dolphins. TC

40 C-30-32. Estimates of g(0) for humpbacks inshore might not be representative of those when they are in deeper water and might show different behavior. TC

Seems a better set up than the California MMRP.

COMMENTS ON:

DRAFT Environmental Impact Statement/Environmental Impact Report
for the
Hawaii Acoustic Thermometry of Ocean Climate Project
and its associated
Marine Mammal Research Program
by

Linda S. Weilgart, PhD

DATE: 9 February 1995

I am a Research Associate at the Dept. of Biology, Dalhousie University. My graduate degrees are in the areas of whale bioacoustics and behavior, and my present research is on sperm whale acoustic communication.

1 My general impression of the DEIS is that it is unconscionably dismissive of likely adverse impacts on marine life. Moreover, it is sloppy, internally inconsistent, and shockingly inaccurate in places. Conclusions of "low impact" are repeatedly made, even when these conclusions are based on completely unsubstantiated assumptions. There is certainly no attempt being made to err on the side of caution. 16a

Behavioral disruptions and psychological stress are given very short shrift, if mentioned at all, even though this effect is likely to be dominant. Even low duty cycles and modest increases to ambient noise levels can cause a serious rise in stress levels, thus potentially placing populations in jeopardy.

2 The DEIS gives much greater emphasis to the impact of ATOC on the hearing *capabilities of marine organisms*. Yet here, the great gaps in knowledge often render the assumptions worthless. For instance, we are asked to assume marine mammals hear the same way humans hear, which is clearly not the case. We are asked to assume that the same relationship by which noise trauma to the human ear is estimated can also be applied to the marine mammal ear, even though *recent research* on pinnipeds seems to cast doubt on this assumption. And furthermore, we are asked to accept complete guesses at the auditory sensitivities (thresholds) of the vast majority of species in the study area, particularly the endangered large whales. If any of these "stabs in the dark" happen to be wrong, the radius within which animals could suffer potential hearing damage could increase from 178 m to 40 KILOMETERS or more. ATOC's own independent *scientific advisory board* states that "ATOC documents assume *hearing damage*...will not occur if received levels of ATOC sounds are below 150 dB. The Advisory Board notes that this assumption may or may not be true, but there are no supporting data from marine mammals." (MMRP-AB report, June 13, 1994). 9a

Ambient noise levels appear to be exaggerated to *downplay ATOC's relative* contribution to underwater noise. Ambient noise levels are repeatedly listed as being *around 90-100 dB in the DEIS*, yet these numbers do not reflect noise levels in the sound channel, which is most affected by the ATOC source. P. ES-9 of the California DEIS states "at *deep sound channel depths* the ocean is very quiet, with ambient noise levels considerably below those at the surface". Studies on fish and shrimp conclude

that sounds only 20-30 dB over ambient levels, or levels of only 100-130 dB, can significantly decrease growth and reproduction rates. If a level of 90-100 dB in the (quieter) sound channel is harmful to fish or invertebrate reproduction, populations
3 could suffer over a radius of about 3,500 km at depth around the ATOC source, i.e. 7e
over about 1/4 of the entire Pacific Ocean, as calculated by Scripps. This is a potentially serious ecological effect, and yet the DEIS states that impacts on fish and invertebrates are expected to be low.

We are asked to believe that the original calculations for the ATOC source's sound fields are wrong, even though these were presented in the previous permit application
4 (incidentally completed before there was any public outcry against the project). The TC
re-calculations made for this DEIS conveniently reveal a smaller area of high sound intensity. Such "re-calculations" do not inspire confidence.

Most incredibly, the DEIS actually maintains that ATOC is implementing Goal
5 1.3111 of the Humpback Whale Final Recovery Plan to "reduce noise disturbance in 4c
Hawaiian waters"! May I remind the ATOC team that there are plenty of other existing noise sources that can be studied without the addition of a new one.

In conclusion, this document consistently attempts to downplay the very real risks that this project presents, concluding low impact when effects are unknown or even 3f
6 with evidence to the contrary. All this for a project, which, as the DEIS concedes (p. ES-2) may or may not provide useful climatic information.

And finally, we are asked to trust the same people who included an inappropriate, not to mention untruthful, letter from Chris Clark attacking my name, under "Scoping TC
7 Comments", Vol. II. NMFS has agreed that this was wholely inappropriate and regrettable, but I have yet to receive an apology from ATOC. I view this as a deliberate smear campaign, typical of the tactics used by the ATOC team.

1

DETAILED COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE ATOC PROJECT--Kauai

22 February 1995

by

Linda S. Weilgart, Ph.D., Research Associate
Dept. of Biology, Dalhousie University
Halifax, Nova Scotia B3H 4J1 Canada

Both my M.Sc. and Ph.D degrees were obtained in the area of whale bioacoustics. I have been doing research on free-ranging whales for 13 years. The following are my comments:

8 1) EIS Abstract. Various places in the document refer to ATOC's purpose as "measur[ing] long-term ocean climate changes" (emphasis mine). p. 1-22 (under 3a
heading "Acoustic Thermometry Program Objectives") "Obtain early baseline data on transmission times in Pacific pathways to compare with data that may be obtained in a follow-on global program..." p. 1-22 - the EIS talks about a "...future ocean monitoring system." Munk et al. (1994) write "While the initial phase of ATOC concentrates its efforts in the Pacific, the long-term objective is to deploy sources and receivers in all the world's oceans. Plans are now being formulated in cooperation with several nations for monitoring the Atlantic, Indian, and Arctic oceans." (Munk, W., Spindel, R.C., Baggeroer, A., and Birdsall, T.G. 1994. The Heard Island Feasibility Test. J. Acoust. Soc. Am. 96(4): 2330-2342.).

Yet Dr. Munk wrote me that ATOC would only be used to refine current climate models. He writes in a 19 Oct. '94 letter "With regard to climate, my views of what we should focus on have been modified over the last two years. A stand-alone detection and mapping of the greenhouse-induced changes over and above the ambient changes will take a long time, a few decades if Manabe's predictions are correct. I now think our emphasis should be to test, and help improve, current climate models."

ATOC should be pinned down as to which of these objectives is the truth--a long-term measuring program or simply to improve climate models. If it is the latter, there should be justification of the duty cycles, intensity levels, etc. being the minimum necessary for this goal. If it is the former, given the uncertainties regarding ATOC's effects on marine life, ATOC's operation over such huge scales of space and time should be viewed as highly risky and should not be allowed to proceed at all, even for just the two years.

2) p. ES-2. "...whether the ATOC technique will provide useful climatic information
9 depends on..." (emphasis mine) and p. ES-3 "Since it is not presently known what 3d
will be learned from the demonstration phase [of ATOC]..." p. 1-21 "ATOC...is subject to fundamental uncertainties about the extent to which acoustic means can

detect ocean climate changes." A $35+ million project which puts the environment at risk should be required to provide a greater probability of success than that stated! Such uncertainty is not scientifically justifiable.

10 3) p. ES-3. "Demonstration phase climate-related transmissions will only begin if the system is determined safe for marine mammals and other sea life." This is a *completely impossible task for cetaceans. We can learn more about low frequency* sound effects on cetaceans, but we can NEVER determine safety as we cannot get at the most important effects on populations (growth rates, fertility rates, mortality, etc.). Even if this were possible, the ATOC schedule has only allowed 1 MONTH to analyze the MMRP pilot study data! ATOC's own independent Scientific Advisory Board has stated that "...the Board considers it unrealistic to expect the MMRP to complete a substantive analysis of all types of behavioral reactions, and to prepare a comprehensive report suitable for external review, within 1 mo. after the end of data collection." (MMRP-AB report, 13 June '94). Table 1.1.2-1, p. 1-7, shows Dec. '96 as the date at which *the pilot study final report is due, yet* 3 *mos. of* ATOC climate-related transmissions will have already been underway! 6c

11 4) p. ES-5. "...these estimates were artificially high because NMFS recommended using estimates of population for the entire Eastern Tropical Pacific stocks of most species as a 'worst case' or 'upper bound'." This is deliberately misleading--the reason that entire stocks of SOME species needed to be included is that the whole of these populations could (were thought to) migrate or occur within the area influenced by ATOC (Zone of Influence). Also, the estimates may very well NOT be high--may even be low, since multiple takes of the same individual are not *considered* in the estimates. 8b

12 5) p. ES-6. The document notes that many marine animals hear through different *means than humans do,* that sound behaves *differently* in water than in air, and that comparisons are risky between a marine animal's perception of the ATOC sound and a human equivalent--all of which are very true, and yet it goes on to present Table ES-1, p. E-7, which is completely worthless and without factual basis. The purpose of this table is clearly to make ATOC seem less loud to us, compared to familiar, in-air, sounds. 7d

Using a conversion of 61.5 dB (rather than 26 dB) between sound power levels in air and water *is unjustified, because we do not know which acoustic stimuli* (energy flux or sound pressure) is the important one for hearing loss in marine mammals. Section 1.1.4 (p. 1-10) talks about a 35.5 dB difference due to the differing impedance of air and water, yet there is no evidence whether this characteristic, rather than simply sound pressure, is damaging to the marine mammal ear. We need to know a lot more about factors such as sound pathways to the inner ear of marine mammals before we can come up with a realistic transformation between air and water. Therefore, while the physics is correct, the biology is not. The EIS (p. 1-13) goes on to state that the National Academy of Sciences' National Research Council,

in its publication "Low Frequency Sound and Marine Mammals", calls for caution in comparing sound levels in air and water, but the EIS neglects to note that the NRC publication uses a conversion factor of only 26 dB, NOT 61.5 dB! *Furthermore, the* EIS itself uses only a 26 dB conversion factor on p. 4-136 (last sentence, middle *para). The document notes that the conversion of sound pressure level from air to* water is speculative in the case of birds (p. 4-128) and even humans (p. 4-135): "IF *a realistic transformation between water and air could be determined...*" (emphasis mine).

13 6) p. ES-8. The 120 dB sound field looks to be more like 18 km around the source (Fig. 2.2.1.2-1, p. 2-8), rather than up to 12 km. 7c

14 7) p. ES-8. I think the alarming observations of Bowles et al. (1994) and Mate et al. (1994) *should be given more serious consideration* when evaluating noise impacts on sperm whales (as well as pilot whales and beaked whales). 7c

15 8) p. ES-8. Sperm whales are listed as one of the MMRP's indicator species and yet there is no special concentration of effort dedicated to sperm whales in the MMRP whatsoever! 7c 6g

16 9) p. ES-12, p. 2-23. Given the MMRP has a low ability to detect any effects of ATOC on marine mammals, it is VASTLY more important to safeguard marine mammals than to locate the source in an *area of high populations of marine animals! First, do no* harm. 4b

17 10) p. ES-14. Mitigation Measures 3-1 and 6-1 seem to ignore the fact that an understanding of a species' hearing sensitivities is critical for "predicting the likelihood of exposure...", yet these are practically impossible to obtain for the great whales. 6n

18 11) p. ES-14. "a goal of the MMRP would be to identify the...nature and frequency of any potential long-term impacts from source transmissions...". For cetaceans, this is absolutely impossible to do with any validity, as even the initial ATOC *permit* application to NMFS conceded. 12a

19 12) p. ES-15; p. 4-99 - "...potential for increased predation on fish"??? Is this supposed to imply that even if some fish will be harmed, they will serve as prey to other animals, thus there will be no net loss? Using this logic, almost any adverse effects on fish (explosives, etc.) can be excused! What about the research cited p. 4-26 where moderate increases in noise levels significantly reduced fish growth rates and egg viability? The MMRP should monitor fish stock assessments to assess whether ATOC is *reducing fish stocks. Fisherfolk have cause for concern.* 18c

20 13) p. 1-6. "Climate-related transmissions would begin only if the system is determined to be safe for marine animals..." This is an impossible task for cetaceans, 6c

at least. Also, why is only 1 month allotted for this most important of evaluations? ATOC's own Scientific Advisory Board has stated that this is an "unrealistic" timetable.

21 14) p. 1-6. The ATOC climate-related transmissions should not proceed until the completion of the MMRP pilot study final report, not 6 mos. before. 6c

22 15) p. 1-6. "Transmissions...would last for 20 min. every 4 hrs., the minimum time necessary to study the potential effects on marine mammals...". This is hogwash and has no biological justification. The duty cycle is solely designed to fit the needs of the oceanographers. TC

23 16) p. 1-12. The California EIS/EIR admits that ambient noise levels in the deep sound channel are considerably below those at the surface, yet comparisons throughout the document always refer to ambient noise levels at the surface, e.g. Table 1.1.3-1, p. 1-12. The ambient noise levels listed in the EIS are invariably inflated so that ATOC appears to account for only a small proportion of ambient noise. Instead of the figures of 75.8-97.6 dB (p. 3-7) or >100 dB (p. 4-18), a more reasonable, average value for ambient noise is probably 60-70 dB, certainly in the sound channel, at least. The figure on p. 2-40 seems to show an average value of about 75 dB for SURFACE ambient noise at ATOC's center frequency. TC 7e

24 17) p. 1-13. ATOC is also very costly and also will not be enough to demonstrate definitively whether the oceans are warming or cooling, overall. How can it determine whether systematic ocean warming is due to anthropogenic or natural causes? p. 2-44 - "XBTs...cannot be used alone to resolve global climate questions." Neither can ATOC. ATOC is only one small (likely unimportant) part of current ocean climate-measuring techniques. 5a

25 18) p. 2-4. "Source levels would also be reduced to the minimum necessary..." Why not start out at low source levels and work up as needed, rather than the other way around? TC

26 19) p. 2-17. Increasing the efficiency of the sound transmissions does not "reduce the exposure of marine animals to noise". It reduces the exposure of animals to more intense sound, but as the sound propagates further, a greater amount of ocean, and thus life, is affected. TC

27 20) p. 2-22, Table 2.2.3.2.-1. Columns such as "Sufficient Marine Animal Populations", "Baseline Marine Animal Estimates", and "Close to other Noise Sources" are ridiculous. Such factors are scientifically best addressed using lower intensity mobile sources and playbacks. The presence of other noise sources is only confounding. 6e

28 21) p. 2-29. It seems to me that receiver sites were chosen to be optimally located for the Kauai site. Not surprisingly, these may no longer be optimal for alternate sites. If alternate sites are to be realistically considered, new receiver sites may also need to be chosen. Sec 2.2.3.1

29 22) p. 2-36. "...restricting sound transmission times when humpbacks are present would prevent achievement of MMRP objectives." This is truly twisted and sick. Use a mobile source of lower intensity for the MMRP only and conduct playbacks to sufficient populations of marine animals, but don't place the main source there! 6e

30 23) p. 2-37. "...this operating band does not significantly overlap the frequencies of sounds known to be produced by whales..." It is unknown how SIGNIFICANT to the whales such overlap may be. The overlapped sounds may be the most essential ones. "...either a higher or lower frequency might be expected to result in increased impacts." A much lower frequency (<5 Hz) is much more likely to impact whales less. TC

31 24) p. 2-40. The EIS states that alternatives to ATOC such as satellites are inaccurate because they "use simplifications of the ocean...". So does ATOC. p. 2-44 - "Correlation between ice noise and air temperature...would be extremely difficult to calibrate or quantify...over a reasonable time period." ATOC also requires decades (perhaps 100 years) to arrive at meaningful results, if it works at all. 3d

32 25) p. 2-46. Why are XBT data integrated with ATOC measurements if they're as inaccurate as stated on p. 2-44? TC

33 26) p. 3-19. Sperm whales do NOT feed primarily on giant squid. There are much more up-to-date references available. The statement "...three well established [sperm whale] populations occur in each major ocean basin in also completely false. TC

34 27) p. 4-4. "Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time." Exactly. What about the cumulative impacts of ATOC? 12c

35 28) p. 4-5. "Sounds can result in behavioral changes...that can only be detected through sophisticated statistical analysis...". Or not at all! "Behavioral changes generally are detected at sound intensities higher than the levels at which the sounds would be barely detectable." We do not know what levels are barely detectable to whale species, nor are we likely to detect anything but the most gross behavioral changes. TC 10d

36 29) p. 4-5. Animals may become less sensitive over time to noise through habituation, but they also may be becoming hearing impaired. It is impossible to determine which is happening. 11b

30) p. 4-6. Natural and human-made levels of noise should NOT be equated. Marine
37 animals have, over evolutionary time, most certainly become adapted to filtering out 7c
natural noise. The same can not be said for the recent addition of human-made noise.

31) p. 4-6. We need to have a "better understanding of the functional importance to
38 mammals of faint sound signals from the same species, predators, prey..."? I think TC
we are not making too outrageous an assumption that the ability to detect faint sounds from predators, prey, mates is VITAL.

32) p. 4-7. "...many of the animals are small...and include invertebrates and other
39 animals that provide no measurable indication of...acoustic impacts." What about 6b
measuring reproductive output--the most essential impact to a population's well-being? *In fact, this has been done (p. 4-117) and the results raise serious concerns.*

33) p. 4-9,11,12. This section uses a number of unsubstantiated assumptions which do not err on the side of caution. 1) Marine mammals and terrestrial mammals are 9b
40 compared, ignoring the differences in specialized ear structures for their respective medium and the different sound pathways to the ear; 2) Ketten estimates that a sound must be 80 dB over the hearing threshold of the animal, at a given frequency, to produce a temporary threshold shift (TTS). There is no data on marine mammals to substantiate this. In fact, p. C-30 in the California EIS/EIR seems to contradict the 80 dB figure, stating "we have some evidence (in pinnipeds) that broadband noise at levels approximating 25-40 dB above threshold are sufficient to induce a TTS in air." 3) That a sound must be louder than 150 dB to cause a TTS assumes a hearing threshold of (150-80=) 70 dB. This figure is a complete guess as well. We only have audiograms for a few marine mammal species and several odontocetes have thresholds down to 30-40 dB (p. 4-47) at their peak sensitivity. Thresholds of 40-50 dB are probably average for most species, so why pick 70 dB?

If some species have thresholds at ATOC's frequency down to 40 dB, and assuming *the 80 dB figure is correct to calculate levels for TTS*, TTS could be occurring at only (40+80=) 120 dB!! If the 80 dB figure is too high (more like 25-40 dB), TTS or hearing damage could even occur at levels less than 120 dB. Thus, the calculation for the high intensity zone in which animals could suffer hearing loss could be seriously underestimated. *Instead of a radius of 178 m around the source*, animals as far away as 40 km or more could suffer hearing damage. This could completely change the EIS's conclusions of "low impact", as these conclusions are based on the relatively small area of the high intensity sound field. It is simply impossible to say, given all the assumptions upon assumptions.

150 dB is assumed to produce at most a temporary threshold shift. ATOC's Scientific Advisory Board (AB) states "ATOC documents assume hearing damage...will not occur if received levels of ATOC sounds are below 150 dB. The AB notes that this assumption may or may not be true, but there are no supporting data from marine mammals." (MMRP-AB report, June 13, '94). Why have an AB if the advice is not

taken?

34) p. 4-14 and elsewhere. An autonomous moored source would be highly unlikely
41 to affect INCREASED numbers of marine mammals, since sites of very low marine 5d
mammal abundance are quite easily identified and avoided.

35) p. 4-17. "If (marine mammals)...are subject to ongoing stress while in (a noisy) 12b
area, then there could be long-term effects on the individuals and the population."
42 Absolutely.
p. 4-23 also cites research which shows that "...physiological reactions, such as elevated heart rate, can occur even in the absence of overt behavioral responses."

36) p. 4-22. "These observations suggest that marine mammals...become less *sensitive to noise and disturbance to which they are repeatedly exposed*." This does
43 not mean that they are not being harmed and does not address the danger of 11b
habituating to noise which could cause hearing loss. The report "Low Frequency Sound and Marine Mammals" by the National Research Council, p. 66-67, states "Hearing loss induced by exposure to intense sound is painless, so the creation of an exposure-induced loss does not produce a concomitant motivation to avoid that high-level sound in the future in the exposed animal. Thus, were there behavioral habituation to intense sounds, animals might, to their detriment, re-enter regions having dangerously high sound levels, thereby risking additional hearing loss."

37) p. 4-25. "...there is no evidence that whales respond to one another over ranges greater than about 20-25 km." Such evidence would be difficult to obtain, but I 8a
44 believe SOSUS data (from Chris Clark) have shown that blue whales change course to avoid Bermuda at much greater ranges, which may mean they are listening to far away acoustic cues.

38) p. 4-26. "Thus, intense sounds (i.e., 165 dB), potentially could affect the
45 availability of organisms in the food chain...." In fact, the two studies cited found TC
detrimental effects at noise levels of only 105-120 dB (Banner and Hyatt 1973) and 100-130 dB (Lagardere 1982).

39) p. 4-27. *The possibility that whales could become habituated to ATOC is raised* TC
46 in the EIS, but that the opposite could occur i.e. that whales could also be sensitized, is only briefly noted, but not seriously addressed.

47 40) p. 4-28. Fig. 4.3.1.1.2-1. This seems to be a ridiculous comparison between a TC
moving and stationary source.

41) p. 4-32. "...the project's incremental contribution to any cumulative impacts from
48 other (noises)...are speculative." I think it safest and not unreasonable to assume the 7a
impact of fewer available "windows" of silence for broadcasting or listening animals,

for use in communication, orientation, prey or predator detection, is negative. ATOC's contribution to human-made noise in the deep sound channel must be quite substantial.

49 42) p. 4-40, Table 4.3.1.1.3-1. "Humpbacks...show some tolerance to noise-induced human activities in Hawaiian waters." Not according to p. 4-29. TC

50 43) p. 4-49. First para. I've checked the Tyack et al. 1993 reference, and the stated information is not present in this manuscript! Also, I believe there is a possibility that these animals might have suffered hearing impairment. TC

51 44) p. 4-50. The Bowles et al. (1994) study of the HIFT shows quite a strong effect on at least sperm and pilot whales. If these whales stopped vocalizing for more than a few hours, this is highly unusual, and in all likelihood, shows a detrimental effect, *as vocalizations are required for food finding, etc.* More schools of hourglass dolphins could have been sighted, not because they were attracted to the sound, but because they surfaced (thus making them more visible) to avoid higher sound levels at depth. Sea turtles have been shown to do the same (p. 4-80). The Mate et al. (1994) study is also extremely concerning. TC

52 45) p. 4-55. "...alternative, which would use a source buoyed up from the seafloor, could possibly result in more close encounters by sperm whales...". No, this is utterly false. Placing the source in deeper areas far offshore is likely to be less harmful to marine life. TC

53 46) p. 4-56. Table 4.3.1.2.3-1 and *elsewhere. For TTS and PTS to occur shouldn't* the animal be capable of only hearing below 110 Hz, not 90 Hz as stated, as the ATOC signal still has substantial energy at 110 Hz? TC See 4.3.1.2.3

54 47) p. 4-57. Above Table. I wouldn't consider cessation of normal vocalizations for a day or more a "minor" reaction of sperm and pilot whales to the HIFT. This is most unusual and in all likelihood represents a day without feeding and perhaps socializing! TC

55 48) p. 4-60. Above Table. Why is minimum impact of odontocetes' prey species expected? According to p. 4-105, myctophids (sperm whale prey) hear very well. TC

56 49) p. 4-66. See #5 above. In the Schusterman study, a TTS was observed in air at 100 Hz from a noise of average source level of 85-90 dB (air standard). If the air/water sound level conversion factor (26 dB) of the National Research Council's <u>Low Frequency Sound and Marine Mammals</u> (p. 82) is used, 85-90 dB in air converts to only 111-116 dB in water! This is much lower than the 150 dB figure repeatedly used *in the EIS below which supposedly TTS can not occur. Again, such air/water* comparisons are risky. TC 7d

57 50) p. 4-80. Just because deep dives are rare for leatherbacks, doesn't mean they're not important or even essential. TC

58 51) p. 4-83. "The proposed project will have no impact on coastal algae and *seagrasses..." Is there any evidence for this? Random noise has been demonstrated* to have a negative effect on plant growth (Woodlief, C.B., L.H. Royster, and G.K. Huang. 1969. Effect of random noise on plant growth. J. Acoust. Soc. Amer. 46(2): 481-482.). TC

59 52) Table 4.3.2.1.3-1, p. 4-89. I would think that masking the acoustic signature of a turtle's natal beach, to which it returns for nesting, could be very serious indeed! 13a

60 53) p. 4-91. A statement is made that a number of noise sources are expected to increase potential for masking in sea turtles, yet p. 4-89 states that sound masking is difficult, if not impossible, to apply to sea turtles. TC

61 54) p. 4-96. The data on fish seem to be a real cause for concern. Just because a few of the most acoustically sensitive species that are known do not occur in the study area, does not mean there aren't species in the study area that are similarly sensitive--only audiograms from a few species have been done. 18c

62 55) p. 4-101. Contrary to that stated in the EIS, the Banner and Hyatt study DOES, in fact, document ambient noise levels, and the levels to which the fish eggs and larvae were exposed were only 105-120 dB!!! TC

63 56) p. 4-101. Does Hasting's safe zone apply to fish fry and eggs as well? TC

64 57) p. 4-102. Ambient noise levels were recorded at 75.8 dB (p. 3-7) for Beaufort 2, not 90 dB. Why use an UPPER estimate for ambient noise? If average noise levels at ATOC's center frequency are 75 dB (p. 2-40; and p. 3-7 lists 75.8 dB as a lower limit), adding 30 dB produces a level of, not 120 dB, but only 105 dB, which could *affect shrimp production! This makes a huge difference in the amount of area* potentially harmfully exposed to ATOC. The levels of noise in the Lagardere experiment are actually presented in the paper as being between 100 and 130 dB, though, strangely, this isn't mentioned in the EIS. TC

65 58) p. 4-103 and Table 4.3.2.3.3.-1, p. 4-122. To say low impacts are expected on fish and invertebrates, in light of the Banner and Hyatt (1973) and Lagardere (1982) studies, is astounding. What we know about the effects of noise on these groups is *cause for concern. What if a large mass of eggs is ensonified? This may affect a* whole population. Also, see p. 4-106 - "...although the number of individual fish affected at any one time may be small, over a long period of time, the proportion of fish in a population exposed to the source could be larger." TC

66 59) p. 4-120. The planned ramp-up period isn't really all that helpful to invertebrates, I don't think! Many can't move so quickly nor may they know where to go to avoid the sound. TC

67 60) p. 4-120. "There is no clear evidence that many invertebrates are capable of hearing or intentionally producing sounds." Really? There are certainly some, like the cricket! TC

68 61) p. 4-133. "MMRP source transmission protocols would result in the termination of source transmissions before...impacts were realized." No, adverse impacts on population growth rates for many of the large whales would show up much too late to reverse. Their rates of increase are too slow. 12a

69 62) p. 4-141. Why is just ATOC's center frequency noted in the table? ATOC still has considerable energy at the critical frequencies of 100 Hz (172 dB according to Fig. 1.1.3-2, p.1-11), 40 Hz (158 dB), and 50 Hz (172 dB). TC

70 63) p. 4-147. "There would...be no overlap of the low frequency sound emissions". and "No direct physical cumulative impacts of the proposed Sur Ridge and Kauai sources would occur". Yet, I have a written communication from Andrew Forbes (18 Oct. 1994) stating that "the ensonified areas of the two Pacific sources *would overlap* by about 25%..." Also, p. 2-15 states that two source locations would preferably sample overlapping areas. What gives? TC 12c

"At (3700 km), the ATOC sound levels will be well below ambient background noise...". I believe ATOC sound levels will be 95.5 dB at 3500 km in the sound channel. If ambient noise *in the sound channel* is around 70 dB (see #16 above), then I would think ATOC would be above this level at 3700 km. Again, ATOC is exaggerating ambient noise levels in the sound channel.

71 64) p. 5-17. Goal 1.3111 focuses "on the need to reduce noise disturbance in Hawaiian waters" and "emphasizes reduction of human-produced underwater noise as more direct and cost-effective than additional research", yet STILL the EIS maintains ATOC is consistent with these goals???? HOW? The appalling bias of this document is blatantly exposed in such statements. TC 14c

72 65) p. 5-17. The fact that there are areas around Hawaii that are even more populated by humpbacks than Kauai isn't really reassuring or even relevant. TC

73 66) p. 6-1. It is quite likely that ATOC could result in major adverse environmental effects, both *short-term and long-term*. The MMRP and ATOC "...would not exploit resources over the short term at the expense of long-term environmental values." No, they would exploit resources over the LONG-term at the potential expense of long-term environmental values. TC 12a

74 67) p. 6-2. The project could well result in "irreversible changes to the commitment of nonrenewable or depletable environmental resources". See #61 above. 12a

75 68) C-5. "This also allows some baseline network receivers to be programmed to collect long-range acoustic data on a not-to-interfere basis with the MMRP pilot study". This statement makes me very uncomfortable and supports the perception that the MMRP is not at all as independent of the thermometry project as it claims. TC

76 69) C-6. Table C-1. Phrases such as "abnormal number of animals", "abnormal mother-calf activity" are rather vague and undefined, and therefore open to interpretation. TC

77 70) C-11. Unlike humpbacks, sperm whale vocalizations are not very amenable to cross-fixing detections, and yet sperm whales are supposedly an indicator species. 6l

Advanced Research Project Agency
Marine Acoustics, INC
2345 Crystal Drive
Arlington, VA 22202

RECEIVED 3-6-95

To: Clayton H. Spikes:

I am writing to express my opposition to the ATOC project. The Draft EIS is completely inadequate to allow the ATOC project to go forward !!

1 Both the adverse impacts to marine life and the "research benefits" are stated in the DEIS as uncertain. It is impossible to estimate the irreversible effects of high decibel, low-frequency sound on marine mammals, such as gradual deafness and damage to reproductive and immune systems. 15

Scripps Institute has received 35 million dollars from the DOD to "research global warming", however, if global warming was the ~~true~~ priority, the the expenditure of tax dollars would be obviously better spent on CLEAN ENERGY, ENERGY EFFICIENCY, and other responsible efforts to reduce our impact on the global climate. 1

2 The "classified" nature of the ATOC project indicates that ATOC has NOTHING TO DO WITH GLOBAL WARMING! And, it also suggests that ATOC is a military operation to improve submarine detection and make use of the SOSUS listening arrays which would otherwise be shut down.

It is clear that the true intentions of ATOC have not been revealed to the public and further analysis must occur before this project is allowed to proceed !!

PLEASE RESPOND !!

Jennifer Hillman
835 NW 60th St.
Seattle, WA 98107

Tracy J. Gorton
601 Averill Ave Apt #3
Rochester, NY 14607

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

Clayton H. Spikes,

I am writing to express my opposition to the ATOC project, specifically the implementation of acoustic sound transmitters at Kaihu Point in Kaihu, Hawaii.

1 The Draft Environmental Impact Statement for this site conspicuously fails to account for the cumulative effects both proposed transmission sites (Kaihu Point and Point Sur) will have on marine life in the Pacific. Are both sites not part of the same project? 12c

2 Of specific concern at Kaihu Point is the long term ~~the~~ impact of low-frequency sound on fish population around the proposed transmission site - fish native Hawaiians depend on for subsistence. 18b

3 The DEIS states that "the potential for this impact is uncertain," due to "insufficient information." It is unacceptable to proceed on such uncertain, insufficient grounds. 15

~~The ATOC proo~~ The certainty of global warming is well established in scientific ... and energy efficient technologies.

I urge you to reconsider the ATOC project in light of its dubious necessity and uncertain destructiveness.

Sincerely,
Tracy J. Gorton

H-63

March 01, 95

Advanced Research Project Agency
Marine Acoustics Inc.
2345 Crystal Drive
Arlington Virginia 22202

RECEIVED 3-7-95

TO Clayton H. Spikes:

I am writing once again to express my disgust with this ATOC Project. I did recive your standard form letter to pacify us activist. I am not buying it
1 Why do you want to threaten the lives of Sea Life with this riduculous Project? I don't feel like enough 15
Study has been done on The Impact on the Sea Life So please hold off on doing this Test!
Have Some Compassion Open Your Heart

Curtis W Overacre

Please Respond:
Curtis W Overacre
2017 23RD STREET
San Francisco CA 94107-3218

H-64

Dear Sirs,

My students have opinions about the ATOC project that they wanted to voice. These opinions were formed solely by themselves - Pro or Con. Please consider them.

Mahalo,

Kimberlee Stuart
Teacher
Kapaa High

March 2, 95

To whom it may concern,

Hi I am writing to you from the Island of Kauai. My name is Georgette Alamani & this letter is about a J.O.C. I am strongly against it because I love to go to the beach, I don't want to [illegible] the day & [illegible] the sound. Also because the ocean
1 is a main place we get our food & if you start using that who knows what it would do to the fish!! I know that this would be good to see if gobal warming is occuring but I think with the Thirty-five million dollars you could use it for something more important such as better school books, nicer parks & Recreational places. Thank you for reading my letter. May God bless you in what ever decision you make. 18c

Sincerily,
Georgette Alamani
P.O Box 179
Kealia Hawaii 96751

H-64

Erin Anakalea
4 period
Due: March 3

March 1, 1995

I feel that these boomers that are being put into Hanalei Ocean are not appropriate for the Island. This island was not put here for scientist to explore and test their creations. They are here for the culture and it should be treated as a culture island. To me, people who invent these things should take a poll from the people who live on the island and not ask only the mayor.

These people are spending 35 million dollars on this project. That money could be spent towards the island. The money should go towards the workers who clean our parks, camp grounds, and our trails. So that awe could keep our places we like to go and our tourist attraction open.

Another main reason I feel this project should not happen is because
2 it will affect our fishes. That is the fishes home and we don't see the fishes 18c
coming on to the earth and taking over our homes and hurting our lives.

1722 Mei Pl.
Kapaa, HI 96746

Erin Anakalea

March 2, 199-

Dear Sirs,

First of all, I think what you're doing with those speakers is wrong. There are many marine animals that could be affected by the boom and could be thrown off course, causing separation and possibly death.

One other reason is that, with the money that you are using for this project, you could be putting this money to better use. Like, in schools or for the parks that were being threatened to close.

My last reason for the wrong that you could be doing, is that you could also be hurting our tourist industry. I
1 think that when there is a speaker system with 18b
a boom that could be heard in certain parts of the world, no one would want to visit the origin of the speaker system.

Thank you for reading my views on the speaker system.

Sincerely,
Maria L Apilado

Maria L Apilado
P.O. Box 159
Kilauea HI 96754

To whom it may concern:

I am a tenth grade student from Kapaa High School. I live in Kilauea but spend every weekend in Hanalei, either on the beach or in the water.

I learned about ATOC when I signed a petition about it (against it) and I'm still against it. I realize this contraption might be able to; over-time. see if there is global-warming. and that would be great, but there are to many downfalls. to

First of all 33 million dollars could be spent on schools, our school is just one in desperate need of new books, facilities ect. It has never been made clear
1 if ocean animals are going to be effected. 18c
Third of all, you never bothered to ask the people of Kauai. I personally would hate to hear the Boom go off while im surfing, swimming or laying on the beach.

Thank-you for listening,
Laura Bishop

PO Box 46
Kilauea, Hi
96754

3-2-95

TO Whom it May Concern-

I feel that ATOC is not going to be worth going threw all the trouble that it will cause.

ATOC is a very expensive and time consuming project, and for what to find out if the world is getting warmer, we all ready know that due to the pollution caused by humans.

I also feel that if you don't know the initial effects of this project on sea
3 animals then you should hold off and try 15
to figure out the consequences on sea animals. If you can find problems you shouldn't go threw with ATOC.

Also you don't know ~~the~~ how loud it will be, the Hanalei Bay is a tourist spot on Kauai & I feel that if there are sounds caused
4 by the speakers it will drive the tourists away 18b
and they are very valuable to our island. Also if someone is fishing and the speakers sound off then it will chase their fish away and that is also important to our local fisherman and fish markets. Some people make a living by fishing and you would be destroying their job.

I hope that the speakers will not be placed in our byetiful and resourceful Hanalei Bay. Please find it in your heart to stop the speakers being put into our precious Bay.

Thank-you

Natalie Brodie 6611 Kipapa Rd.

To: Whom it may Concern,

I'm writing to you to let you know where I stand on the A.T.O.C. project. I am against the idea of the project for a couple of reasons. One of it is that I feel 35 million dollars could be very well spent on something else like a cure for cancer + Aids or maybe for shelter for homeless people. Another reason is that this project will find if we have global
5 warming, I think it should be a project to help 15
stop it not see if we have it. Also we don't know what kind of effect it will have on the marine + even endangered marine life. I'm curious about that because one day I'd like to become a Marine Biologist and help + study endangered animals.

A little letter about the A.T.O.C. program would be greatly appreciated.

Thanks,

Tyron Carvalho

P.S. Mailing Adrrse
P.O. Box 511
Anahola, Hi, 96703

Dear Sirs,   03-3-95

I disagree on the use of underwater speakers in Hawaii. This project is very expensive and I feel that the money would be more useful elsewhere.

6 Hawaii has many endangered animals and we dont know what the effect would be on them. Hawaii is also a tourist attraction as well as a favorite to many others. The effects on fishing and recreation are unknown. 15

Sincerely,

Haunani Putcatc
6138 A Kala Kea Pl.
96746, Kauai, Hi

01·02·96

To whom it may concern,

I am writing this letter in concern to the Speaker that they are planning to put in our ocean to Find out if our earth is getting warmer. I dont think thats such a good idea because 1st idea would take 20 years before we would Really find out the results and by then otherthings could be going on and there could be other ways of finding out about our earth. and wats happening. Second of all it would probally hurt our animals that live in our ocean because of the big boom and that would probally affect the way they live and when that affects the way they live it would probally hurt us to because Everything is mostly connected to each other. I also think that this Speaker idea would cause more problems that we allready have. because people would all have diffrent opions on it so 3d
7 they would just make a big fuss about it because they would probally have to cross alot of places or change alot of things and schedules because we would have to go around this Schedule of when this big boom would happen because there could be alot of dammage to peope if they are in the ocean diving Fishing, Swimming and doing our everyday thing and people would have to change plans because of this. I also think why are they doing a study on the world getting warmer when there is alot more serious problems to take care of And probally alot more diffrent and less expensive studies to Find out how the world is going and we could use this money to live today not in twenty years because we never know what could happen in twenty years. 18a

Adres: 5785 Lauloa Pl.
Kapaa Hi 96746

Much mahalo's
Moani-Kala Furtado

To whom it may concern: I am writing to you to express My opinion on The Under Water Speaker System That Suposedly will be placed in Hanalei Bay. I feel That it should not be placed There for a number of reasons.

8 1st It has been proven That whales are frightened by loud Sounds and will probably evacuate The area. 10d

Secondly This might cause Tourism
9 To slow down because of it. 13b

Thirdly, I have heard That The point of This experiment was To detect global warming. But once it is detected what will The next step be?

I Appreciate your concern for The planet but please Think about what I have said

Sincerely

Sierra Granda
Po Box 85, Kealia 96751 HI.

Feb. 22, 1995

To whom it may concern;

I'm a sophomore at Kapaa High School that's concerned about this ATOC project. We've made a list of pros and cons about this issue and we've only came up with 4 pros and 11 cons. That I guess shows you that i don't agree with this project. It doesn't seem like you have any proof that it'll work without any bad effects. It may
11 determine if global warming is occuring or the equipment 15
could possibly used for other things but -- it could also harm us. It's not known if the sound will effect marine life or even us, many endangered species could be harmed also. Do you know if it'll affect us while we are in the water or even on the beach? It may do some good but it could also do alot of bad. No one has any real proof that it'll work with out defects. I'm sure though there are others things they could do to find out if global warming is coming and that it won't be harmful in any other way. It may solve global warming but what if it brings a bigger problem on our hands. We can't afford to have anything else go wrong. I'm sorry but i disagree with it.

Sincerely,
Jackie Hato

Dear who ever it may concern.

I feel as a resident of the Hanalei area that you should not put your global warming boom box in Hanalei or anywhere. The reasons that I feel this way is because I was raised in the Hanalei area and for as long as I know, friends and family have had great respect and honor for its beautiful town and especially its bay. Placing a boom box in or even near the Hanalei Bay may damage the marine life within it. Friends, family and I have great respect for Hanalei, but Hanalei will never be the same if marine life no longer can be safe in their home. And what about us, say we go surfing or diving and the boom box goes off, will we be hurt? I am also upset because you never asked us, as residents + surfers family people that love to come to Hanalei how we feel about it.

The boom box is only going to tell you if global warming is happening not the cause of it. Even if there is global warming then what? whats next put boom boxes every where? Not only is the placement upsetting but the money spent as well. You are spending (wasting) 35 million dollars for the first two years to figure out if global warming is happening. 35 million dollars is only for the first 2 years then how much more will you spend? You are spending all that money and there are people that live everywhere that are dieing of hunger and dont have a safe living environment and so on.

Thank you for listening, but please take the time to think again Mahalo!

Lea Hennessy
P.O. Box 324 Hanalei
96714.

Dear Sirs.

This project wouldn't be such a good idea. With 35 million dollars you could save all of Hawaii's public State parks. Noone asked for Hawaii residents opinion about this. What about the marine life, say the sound is so loud that the fishes and mammals in Hawaii and maybe other
10 places n States get harmed. Also why should these people not 15
have to abide to Hawaii's laws. Hawaiian monk seals, whales and green turtles are prohibited by law to be even approached by one hundred feet. If this is allowed to go on the Natives of this Island will be very upset.

They should at least ask of Hawaii's opinion, on this issue. If majority of votes give it the ok., then noone should grumble. But if majority vote is no, then the project should be eliminated. That's just showing us the respect that we deserve.

Thank You

Brian Lmaok (Kapaa student gr. 10)
4704-C Akoa St.
Kapaa, Hi. 96746

TO WHOM MAY IT CONCERN,:

I THINK THAT THE GLOBAL WARMING TESTING AT HANALEI BAY THAT THEY WANT TO DO IS NOT A GOOD IDEA. I AM AGAINST THAT TESTING. I THINK THAT THE 30 MILLION DOLLARS COULD BE SPENT ON SOMETHING BETTER FOR THE ISLANDS. ALOT OF THE OCEANS CREATURES COULD BE HURT BY THE LOUD BOOM. THEIR ARE 11 MORE RECEIVERS THAT ARE PLANNED. WHAT IF WE ARE SWIMMING OR DIVING AND THE BOOM GOES OFF? WILL WE BE AFFECTED BY THE LOUD NOISE. IF WE

12 ARE FISHING FOR ULUA OR OTHER KINDS 18b OF FISHES, COULD THE FISHES RUN AWAY?

IF THEY DID WE WOULD NOT CATCH ANY FISH. I WOULD NOT LIKE IT BECAUSE I REALLY LIKE TO FISH.

FROM,

BRUCE

6473 KAWAIHAU RD

Kapaa, Hawaii 96746

To SIRS

No, I dont think you should do this because the monie could be used elsewhere. Nobody ever asked the residents of Kauai what they thought.

What would the effects of fishing and marine life be when this thing does

13 go off. I like to fish and when my son 18b gets older Im sure he gonna wanna fish too. So please think about the future generations before you start this project.

sincerely

Kelsie Kashima

Kelsie Kashima

Kelsie Kashima

4440 Manako Pl.

Kapaa, HI 96746

H-64

Kekila
3/2/95
Period-5

To Whom it may concern. I think that you folks shouldnt put the Speaker on Kauai Because We have lot's of endangered animal's that could be hurt By the Sound and money could Be used for other sources. It is not a good idea to because when People are swimming it could hurt their ears. And for fisherman it could be junk because the fish might not bite. Because there scared of the Sound

H-64

Keith Kitamura
160 Lau Ali Pl.
Kapaa Hi. 96746

To whom It may concern, [illegible]

I am refering to the underwater sound at Hanalei bay that will find out if the global oceans is getting warmer. I understand the valuable information you may recieve from this but I think this project is full of it. Cause it will only provide if the whether is getting warmer + might help
23 the military for unknown reasons 1
but so what if the oceans is getting warmer everybody knows
14 that already. All it would do 3a
is use a lot of money that should be use on schools + to prevent global warming not finding out if ocean is getting warm. And that sounds will probably affect the ocean sea life and scare all the fish
15 away and probably affect thier 18b
feeding habits and put them in danger of dying. Think if you can hear it with small waves from the beach imagine what is sounds like in the water. And
16 there could be someone diving down 13a
the road that hears the sound

and can cause some problems for them. The tourist attraction would
17 be ruined cause it will affect 18b
people who come there and hear loud sounds in the water.

So I think this is a bad idea cause it will affect everybodys life and people will hate you for it. Maybe you should use the time, effort and money into something more important like helping poor people and help the rainforest out.

Sincerely,
Keith Kitamura

H-54

Selomiti Langi
P.O. Box 456
Kilauea, HI 96754

To Whom it may concern,

HI!! I'm not a very good writer but I'm sure you'll understand were I'm coming from.

This thing to do with the speakers under water is not a very good Idea! I mean me who does not get too many ~~A~~'s or B's even C's. But even the dumbest person on earth would know its the biggest & dumbest move in the 90's for Hawaii even were those speakers would be put in.

One if you you put big loud
48 speakers under the sea you 15
may kill &or make Marine animals deaf or hurt their ear drums. If they die the we loose alot of fishes or seaanimals that are endangered & may loose alot of research on ~~ani~~ important animals. Also think of what

the Tourists say when they are laying on the beach relaxed and admirering the beauty. When a wave washes ashore dead beautiful exotic fishes. which forces them to vomit.

I know that you & ~~we~~ I

49 don't realy know if it will 186

hurt the marine animals but we should n't take any chances cause ~~we~~ you guys would not only kill mill. even trillions of fishes but also waste alot of money on some thing that can only last a year or two. I mean what ever happend to the We want the best for our schools?! We can't get better schools if ~~you~~ the govt. spends thousands of dollars on a project just to sea if the earth is getting hotter. When ~~new~~ schools need new supplies like books and stuff. Also Not only could be usedfull for schools but also for get is the earth is getting hotter clean

up the trash on our earth first. Because it don't matter a toomuch to us if the Eart is hotter because whats more important, that the earth is getting more hotter or if its polluting & becoming a toxic waste dump. Well to end my letter.

ITS NOT A GOOD IDEA TO CONTINUE THIS PROJ.

student at
Kapa'a High.

[signature]

To whom it may concern,

Hi! I am a sophmore of Kapaa'a high school high. My name is Lianne Layaoen. I am writingyou concerning about the ATOC of the ocean. I am against it because I feel that noone asked the people of Hawaii how we felt about this project. it will cost about thirty-five million of dollars and I think it could be better spent wisely elsewhere. It has it's negative and positive solutions for instance it may detremined it's global warming is ocurring, or equipment could be used for other functions. Some infromation could be learned from this project, but I strongly feel that I think we should not do it because it could

19 effect marine life. I'm not saying it will but it is not known if 15

the sound could hurt the marine animals and many endangered organisms maybe efeected. It is also a tourist destination . I feel that if we go on with this project it may effect not only us but the marine life. That's how I strongly feel.

sincerly

Lianne Layaoen

Lianne Layaoen

Lianne layaoen
P.o box 54 kilauea
Hi 96754

Dear Sirs,

This global warming project it a total waste of time and money. With 35 million dollars there are many other things we could use it for in this country. Plus the noise will probably kill most of the

20 endangered fish. Hanalei Bay is a 18b

nice place for tourist and people who live around there or enjoy visiting that place and we don't need no irritating noise to scare people away or out of the water

Thanks for reading,

Douglas Lewis

Dear Members of ATOC;

I am a resident of Kaua'i and I'm concerned about the booming in the ocean. I am against it because our endangered organisms may be affected by the booming. In Hawai'i, we have famous
21 tourists sites. Hanalei, Kaua'i is one of them 18b
and the booming will affect our recreational. Do you guys know what the effects of the booming will do to our marine life? If not, I think thirty-five million dollars can be spent elsewhere.

Much Aloha,

Alison Lovell
4702-C Mailihuna Rd.
Kapaa, Hi 96746

Dear Sirs,

To my concerns this underwater speaker to see how warm the ocean water is, is no use for anything. To me it's just a waste of time and money.

I could tell you many and many of reasons for not using this, but I'm only going to discuss a couple.

The first thing is all of this money you're going to use for this you could put it in and use it for the island like to fix roads, paying the people who take care of our parks, or make our schools better places to go to, and so much more uses.

Also another concern to me is you people don't ever ask our people on the island if we want this. You guys don't care what we think you just do. I thought this was a democratic government.

Now one of my last concern is what about the marine life, how will it affect them. Whales, dolphins, turtles,
22 and so many more I know will be 15
affected by this boom speaker. For now this is all but you'll be hearing from me much more.

JOHNATHAN MATSUMOTO
1577 KANEPOONUI RD.
KAPAA HI 96746

3/3/95

Dear Sirs,

I request that you do not conduct the ATOC project for a number of reasons. I will not bore you with all the reasons my classmates and I have come up with so I will just name a few I feel are very important.

23 - You do not have enough evidence that the sound will not harm or endanger the marine wildlife in anyway. 15
- The amount of $35 million could be better spent elsewhere.
- The effects could ruin the recreation of islanders.

I feel that there is no point in asking an already answered question... Yes, global warming is affecting the tempature of the water.

I appreciate your time, and I hope you understand my concern.

Sincerely,

Keoni Mira
131 Aleo St.
Kapaa, HI. 96746

Dear ATOC,

I am writing this letter to you because I am against the booming in the oceans. The boom box could affect our marine life and endangered organisms. It might also affect the people of Hawaii and our tourist population. People don't want to swim in oceans that have loud booming sounds that could hurt their ears. You could also be hurting the living things in the oceans and scaring them away. The tourists that come to Hawaii and that like to snorkel might not be able to see as much beautiful fishes and other living things in our
24 beautiful oceans because of that irritating 18b sound. I also think that you could use the money for something more useful that people will enjoy.

Kylie Morishige
P.O. Box 193
Hanalei, Hi 96714

Sincerely yours,
Kylie Morishige

March 03, 1995

To Whom It May Concern,

I am writing to you for the concerns of ATOC. My opinion on the underwater boomer is against it. The reasons for my opinions are to let you know how some of us feel about this experiments. The first reason why I don't like it is not knowing if the boomer will hurt the sea creatures. How can we be sure that it won't shock them. The second reason is if people are
25 diving, snorkeling or swimming can you guarantee 15
that it won't hurt us. If we can hear from the land how much effect will it take under the water. The last reason is the cost. Will taxes be raised for this experiments? If so do you think it will effect the economy, I surely think so. Please take a long time and think it over again.

Sincerely,
Keri'anne Muraoka

1111 Pu'uopae Rd
Kapa'a, HI 96746

ATOC

Dear Atoc

I Just want to say is that you sould not put the speckes under water Becouse we not going get fish and animal in the ocen. when
26 we go diveing what can we dive for 18b
there is noting Becauce there is no fish.

Thank you
Glace Nakama

PO Box 954
Kapaa Hi 96746

Dear Sir,

I am writing to you about the speakers that are going to be installed by the North shore. I think that all that money should be used for something else. Instead of closing the state parks, keep them open. I 27 bet a lot more people would like that. Also, no one knows the effects it could have on the environment, it could destroy the oceans ecosystems. 15 Aren't they doing an experiment in the arctic to find out about the global warming situation. Anyway this project will not identify the problem, it will only tell if it is happening, and I don't think that is worth the money.

Sincerely,
Jason [illegible]

221 Olona Place
Kapaa Hi
96746

To whom it may concern:

I think that ATOC is a bad idea because we know that global warming is occuring on our planet already, Secondly it cost to much money. We could be using that money elsewhere and last we don't know what effect it will have on marine life.

Sincerely
Jesse ohai

5493, Kawaihau Rd.
Kapaa, Hi 96746

March 2/95

To whom it may concern

Hi my name is Keani Olanolan and I was Born and Raised on Kauai. I was Practicaly Raised Right in Hanalei Bay and I feel that ATCC people or plan should not Be put in our Beautiful Hanalei Bay Because it will Ruin the mecnity of hanalei Bay. Because for me it will affect on our fishing that the locals dive to do out in the Bay. Also I think it most likly will hurt
28 the under water fish and Reefs 18b Because it so loud it will vibrate and are Reefs will start falling apart and if lapping on a fish can't hurt the fishes ears can you imagen what that will do? I can. I think if this was to follow through Kauai the town of Hanalei will go down Economicaly Because do you think the turist are going to enjoy swimming and going to this place where theres somthing that will hurt the fish and somthing the locals don't like? Also I think its Really unfair Because who ever is making this underwater thing gave not one person on Kauai our opinion and that thing going on to the middle of our Beautiful Bay is Really Sad I Really think its unfair that the people of Kauai have no choise you people want to just go ahead and do it. Why don't you put it somwhere where, where its not so Beautiful where theres not as much Beautiful under ocean world and Also a place where turist don't like to go surfing and snorkaling somwhere where nothing goes on. Well thanks for listening to what I have to say I hope we can Really work somthing out about this move it else where or not at all because no matter where it goes its going to harm somthing.

Thanks
Keani
Olanolan

PO BOX 833
Hanalei Hi 96714

March 2, 1995

Dear State Legislature,

My name is Jocelyn Olivas a resident of the island of Kaua'i. I am 15 years of age and attend (the sophmore class in) Kapa'a High and Intermediate School.

The reason for this letter is because I have my own point-of-view on the controversial issue of the ATOC (Accoustic Thermometry of the Ocean). I know that the ATOC has some pro's but have many, many cons. I believe that I should take a stand for what I believe is right, and excercise my rights as a young adult.

ATOC was meant for determining whether global warm-
29 ing is occuring. I'm sure that you could find another way 32a
that is not on such a high price and will be studied to
see if it could harm any living marine animals. No one
really asked the people of Hawai'i about it either. Aren't we
the residents of this beautiful island of Kaua'i? Don't we have
a right to know what is going to be put in our oceans?
This ATOC will cost 35 million, and that is only the initial
cost. This project/study is not even clear to the people.
Noone really understands what effect it will have on us, marine
and aquatic life. The 35 million dollars could be better spent
elsewhere such as in the schools or education department.
35 million dollars is alot of money to be spent on something
that could affect endangered organisms and something that
we hardly know about. Hanalei Bay is supposedly the loca-
tion of ATOC. This location is a big tourist attraction not
30 to mention a Marine Sanctuary. The effects on fishing 18b
and recreation are unknown. I just hope this letter
will really help to change your minds about this ATOC.

As I said, I am a resident of Kaua'i and I would hate to see any negative effect on the marine animals and the location of which ATOC was supposedly going to be located.

Thank-you so much for your time.

Mahalo,
Jocelyn Olivas
JOCELYN OLIVAS

Phone number: 822-2499
Address: Jocelyn Olivas
5311 Kula Mauu Rd.
Kapa'a, HI
96746

H-64

3/2/93

Dear ATOC Project People,

I think that you guys shouldn't put those underwater speakers in the waters because it can harm all the species and creatures that live in the ocean. Although you guys are using it for a good cause (to test for global warming) it can also waste alot of money because you guys spend 3.5 million dollars on it and that money can or could be spent on something better for the community and some other scientists are probably trying to find another way to test global warming. I am also one of those people who care for the environment and like the ocean alot. I also like to go diving in the ocean and what if I go diving and the speaker thing goes off will I get def?

Sincerely,
Romo Pomelo
1621 Pepeuu St.
Kapaa, Hi 96746

2-3-95

Dear Who it May Concern

Hi my name is Edwin Perez From Kapaa High & Inter'l School. I'm in the 10 Grade. I'm just Want to tell you that the Atoc Project is waste of money. because with 35 million dollars you could fix the roads in Kapaa. It is also Just because you guys don't have a cause. It may hurt the Humpback whales When they come here. I don't Want that Atoc thing here.

Sincerly: Edwin Perez
6611 Kuhaho st
Kapaa Hi 96746

H-54

March 3, 1995

To whom it may concern,

I'm writing to disagree with the boom box project outside Hanalei Bay. For one how do we the people know this will work. Second we don't
31 know how it will affect the envionment and the 15
wildlife. Lastly the 30 million used to spend on this project could be spent somewhere else, like on education or keeping our state parks open.

Sincerly
Bryan Pong
6391 Olohena Rd.
Kapaa, Hi. 96746

H-54

March 2, 95

To whom it may concern,

This letter is regaurding the ATOC project in Hanalei. I dont think that its a good way to find out the oceans temperature. It could effect the marine life. The marine life is a part of tourist
36 excitment. If we lose the Marine life, we 18b
could also lose tourist industry.

Another reason is that its cost to much money. You could use the money for a better use, like in education, and parks usage. We could use some money to make Kauai a little better and to keep student out of trouble and off of drugs.

Also, although its a way to find to determine the global warning. I still think that its not a good idea. Thanks for taking the time and reading our letters

Sincerely,
Robynne Reyes
5731 Kuamoo Rd.
Kapaa, Hi, 96746

To Whom it may concern: 3/2/95

My name is Sarah Riswold and I go to Kapa'a High. I believe that ATOC is a bad method of researching global warming. It is important to study global warming because it is a serious problem facing the world, but ATOC could possibly harm marine life, some of which is endangered (Hawaiian monk seal).

37 An alternative method is using probes off ships. Although this is more expensive 3e it will not harm marine animals!

Another reason that I think ATOC is a bad solution is it could possibly interfere with recreational and commercial uses of the ocean.

My last response to ATOC is that the proposers of this project (Scripps Institute of Oceanography and Cornell Laboratries) never asked the residents of Kauai how they felt. This upset alot of people, including me!

Thank You,

Sarah Riswold

4665 Iwaena Loop
Kapa'a Hi
96746

H-54

3-2-95

Dear Sir,

I am writing this letter on the ATOC known as the under water boomer on Kauai because I am against it and I think it is totally wrong. My reasons for being against it are very logical, First of all if this ATOC cost 35 million I think that the 35 million should be spent else where. Second I dont really remember anyone asking us how we felt about the ATOC and it does not Identify what causes Global Warming and what about marine life how will it affect the fish whales and dolphins at Hanalei Bay. Isn't Hanalei Bay supposed to be a Marine Sancuary where animals are supposed to be protected. Last what about Recreation like what if you go fishing but there are no Fish or what if you are Snorkeling and the big boom underwater affect you and your hearing. This is a big world aren't there other places to put this big 35 million dollar Global Warming Machine which will probably cause harm to the animals of Hanalei Bay.

from,

Craig Smith

4152 WAIPUA ST
Kilauea HI

March, 3, 1995

Dear Sirs

I am writing this letter concerning the ATOC system which is suposed to be put into Hanalei bay. I am very concerned with a few things in particular. First of all there will be so much money put into this project when Im sure we could find so many more uses for all the money and effort. Another thing is Hanalei is a beautiful place that attracts visitors from all over the world, can
38 you Imagine them comeing all this way and 18b
spending all that money to hear a piercing buzzing sound in the water. And lastley I think it would cause great troubles to our endangered species., I just think this new idea would be very disturbing to our beautiful Island enviroment. On the otherhand by going trough with this project we might be able to learn new information that we don't know about yet. I just don't think Hanalei Bay is the place for this type of project.

Manalo
Ms Mallo Smith

My ADRess: 329 Hookipa St.
Kapaa, Kauai 96746

To Whom it may concern, 3·3·95

I am a concerned high school student about your ATOC project I justed wanted to share with you my opinions and concerns about your project. I think the 35 million could be spent on something better like to fix up our school or to build something we need I also disagree because it might kill the marine life. We use Hanalei as a tourist attraction and if there is no marine
39 life then we won't have it as a tourist attraction. It 18b
may determine Global Warming but it cant identify the causes. No one else bothered to ask the people of Hawaii. Thanks for listening to me.

From,
Erica Torres
6131 A Lokomaikai
Kapaa Hi 96746

3/2/95

Dear State Legislature

My name is Robert Kubota. I'm 15 and attending Kapaa High School. In my 10th grade biology class we are keeping up with the debate on whether or not to have the boomer in Hanalei bay.

Well I think we should not have the boomer cause we don't really know what it might do to the marine life. And I think the 35 million dollars can be spent in better ways.

40 For me I like to go diving. And what if I'm in the water diving at the time that the boomer goes off. Will it hurt me? 18a

And another thing No one asked the people of Kauai how we felt about placing the boomer in hanalei bay.

What about the reciver device it's like on a Marine santuary and would it hurt the fishes and other organisms there?

Well in conclusion I think we should not have the boomer put in Hanalei bay.

From a
Concerned Student
Robert Kubota

4-1300 Kuhio Hwy
Kapaa Hi 96746

March 2, 1995

Dear Sirs,

I am writing to you concerning the ATOC project, which has been proposed to take place in, among other places, the PRISTINE Hanalei Bay on the island of Kauai. I have concerns respecting this "undersea speaker" project, and I would like to share with you some of my biggest worries.

As a lifelong resident of Kauai, I am a witness to the serenity of our beaches and and the yearly winter "rituals" of beautiful humpback whales coming to mate in our warm waters. No where have I seen proof that the
41 whales and/or I will not be in at least 18b
some one way affected by the poulsating beats coming from humungous speakers. There is a serious lack of research concerning the effects ATOC may have on humpback whales and other marine mammals. The humpback whales are a major tourist attraction, without them our small island could seriously encounter economic difficulties.

Another concern I have about ATOC is the atrocious amount of money it will cost to run. In the first few years alone, an estimated 35 million dollars will be spent. That's a lot of money. Money that could be much better spent on our schools, our children and the elderly community. Thank you for taking the time to read my letter. Please take my concerns into consideration.

Sincerely,

Susan Urminska

To whom it may concern:

I feel that those speakers in the ocean are a complete waste of money. That money should have been better spent and been used for something meaningful. All that device will do is read the global warming. That's a foolish thing to do just to tell global warming. That device might also interupt with the ocean marine life.

This act I heard wasn't even voted on by the people who live where the speakers are located. They wasted 35 million dollars to just tell global warming. That was really really crazy. They should have found a cheaper way to tell global warming if they so smart. Oh well I'm con on the experiment that involves the ocean.

Sincerely,

[illegible]

5103 Hauaala Rd., 96746, HI

To whom it may concern,
The issue of the underwater speakers have a lot of concerns. I think that it is not a good idea, it costs a lot of money and it calid also affect the marine life. The endangered organisms could also be affected.

This also concerns me because my dad goes fishing in the ocean and it would really affect him. Like if he was out fishing and the speakers went off and it scared the fishes, then he wouldn't catch fish. It's
47 like a second job for him and 18b
if the fishes get scared then he can't catch the fish. It would also affect our family if he doesn't catch fish, we wouldn't have the extra money to pay for other things, that our family needs.

On the other hand the speakers might not affect the fishes and their enviorment, I still believe that they shouldn't even bother the ocean. And they should leave it alone.

Sincerely
Michelle Villabrille
5177 B. Hauaala Rd.
Kapaa, Kauai HI 96746

March 2, 1995

Dear Sirs,

I am writing to you in regard to the proposed ATOC projects. I have several concerns regarding its possible effects on Hawaii's unique sealife and exstensive financial drain which it would cause.

Although I understand that global warming is an important concern at this time,
42 this project will not identify the cause and therefore little can be done with the 3d
information collected. Furthermore, no proof has been given to show that adverse effects
43 will not occur to Hawaii's humpback whales 6a
or other ocean-goers.

Thirty-five million dollars have been proposed for the first year alone. This money could be spent much better at fixing up our parks and hiking trails, providing a better educational environment for the children or investing it into preservations for Hawaii's endangered and endemic animals.

Finally, no one asked Hawaii's people about their opinions regarding ATOC. The humpback whales who come here every winter have no voice in this matter, it is up to the individuals who choose

to speak out. Please take my concerns into consideration.

Sincerely,

Natalie [illegible]

P.O. Box 1323
Kapaa, HI
96746

March 1, 1995

Dear ________.

I am writing to tell you that I am against The Accustic Thermopathy of The ocean (ATOC).

I am against it because It cost #35 Million which could be used to buy Some-Thing better like improving Schools. Also It finds out if global warming is occuring but it does not identify the cause of global warming.

Also many Marine organisms and Species may be effected.

So I Think you Should think if you should put the speakers in the water or not

Sincerely -
JAKE Youn
Jake Youn

5991 Kuamoo Rd,
Kapaa HI, 96746

March 1, 1995

To whom it may concern,

I am a student at Kapaa High and Intermediate school and I would like to base my concerns and opinions about the ATOC program that they are thinking into puting in effect.

First of all, I dont know the whole purpose of the program but I do have some concerns about it. Such as, what will happen to the marine life? Will it effect them, or the endangered animals in the ocean? What about the effects of recreational activites at Hanalei Bay? Will it disturb the people sun bathing on the beach or people who live near the beach? Also what about the costs? How much more will all the tax payers have to pay? Some people do need to support their families... And will it effect the tourism at Hanalei Bay?!

Nonetheless, it may have some positive sides although it has not yet been proven yet like; it will determine if global warming is occuring (which is a concern right now) and the underwater sounds may not affect the marine life.

However, in my opinion, I dont think that the program should go into effect because nothing is certain yet and if it is put in effect, it could change the whole future of Kauai including our tourism and economy.

In closing, I would just like to say, to please consider any and all other options before puting the program into effect.

Sincerely,
Lea Young

Lea Young
5925 Ohe St.
Kapaa, Hawaii 96746

To SIRS.

I think that this thing that you are wanting to do is not a very good thing to do because it will cost alot of money which could be used for things that we need right away. Also it could be bad for
50 our marine life, cause maybe when the 18b
fisher man are fishing and the sound comes on the fish might get away and the fisher man would not be able to catch fish. Also we don't know if it will be harm to the whales and Dolphin since they communicate with sounds. And maybe it would bring less tourist to the island because they won't be able to swin in Hanalei Bay cause the, the speaker will go off, so maybe the tourist will stop coming cause they can't go places at a certain time. The people of Hawaii was not even asked about what they planed to do with this speakers they will put in the ocean at Hanalei Bay. Cause 35 million is alot of money to be spent on one thing. But maybe in the near future it would be more necessary then right now.

Sincerely,

Sharma
5158 Apelila St.
Kapaa, Hi 96746

RECEIVED 3/15/95

KAUAI FRIENDS OF THE ENVIRONMENT

P.O. Box 1183
Hanalei, HI 96714

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March 6, 1995

Advanced Research Projects Agency
c/o Clayton H. Spikes
Marine Acoustics, Inc.
Four Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA 22202

Subject: ATOC DRAFT KAUAI ENVIRONMENTAL IMPACT STATEMENT

Dear Sir:

The Kauai Friends of the Environment (KFOE) would like to take this opportunity to present our comments on the Draft Environmental Impact Statement of the Kauai ATOC issued in December, 1994. Since the Kauai ATOC Project is an integral part of thje overall ATOC project many of the comments elucidated below will apply equally to the California DEIS of ATOC; and these will be included by reference to these current comments as appropriate.

INTRODUCTION

KFOE believes the "No Action" Alternative should be the one to be selected by ATOC. This conclusion is based on detailed analyses of all the pertinent information gathered by us from March, 1994 to the present, information as officially presented by the ATOC project people as well as information independently obtained by KFOE through invocation of the Freedom of Information Act.

The DEIS makes no attempt to justify the scientific validity of the ATOC approach to the global warming problem. The Proposed Alternative is thus treated as a **"given"**, contrary to the intent of the environmental process.

The genesis of ATOC is by highly unusual means, bypassing the accepted solicitation and review processes for the conduct of scientific research.

The preparation of the Draft EIS does not take into consideration the extensive comments made by the public in the series of three Scoping Hearings in April and May, 1994.

The Marine Mammal Research Program, proposed (and already partially executed) by the Scripps Institution of Oceanography (SIO) to bolster ATOC is totally inadequate, and fails to support its claim of "no significant impact" on marine mammals, and ignores altogether any assessment of long term effects (longer than the six months duration of the MMRP).

ATOC has failed to assess its impact on Native Hawaiians, ignoring the letter and intent of the President's Executive Order of February 11, 1994 on Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.

In the following we will present specific analyses and factual information to support each of the above-named conclusions regarding ATOC.

1. THE NO-ACTION ALTERNATIVE

The central theme of the ATOC project is elucidated in the proposal submitted by the Scripps Insitution of Oceanography on 1 June, 1992, in response to the DARPA Broad Agency Announcement 92-24. On pp 2 and 3 of this proposal the purpose of ATOC is stated as being a two-fold engineering and measurement program (1) *To demonstrate the extension of HIFT acoustic techniques for integreated temperature estimation to spatial scales spanning gyre, basin and trans-global paths (of the order of 10 megameters) and temporal scales spanning several seasons, and hence demonstrate the principles underlying an affordable network for measuring global ocean temperature change in a way that optimally detects the effect of greenhouse warming. (2) To esptablish the baseline for an affordable long-term network using the minimum necessary number of paths, a reliable ocean hardware suite, and a design for data assimilation and analysis. The network is designed to foster international participation, both in connection with its operation and for the distribution and analysis of the data.*

Nowhere in the proposal, nor in any subsequent discussion of the scientific basis for the ATOC project, is there any discussion of the relationship between the greenhouse warming of the earth's atmosphere and ocean temperature. Yet ATOC is advertised to the public as a critical project to detect global warming. In fact, the "detection problem" - the coupling of greenhouse warming to ocean temperature - is regarded by the proposer as being *"non-trivial"*. On p. 18 of the proposal is the statement, *"A major focus of model use would be the distinguishing such natural variability from that induced by an increasing atmospheric greenhouse. The "detection problem" is a non-trivial one, involving trend detection in the presence of red-noise processes, and would eventually become a central issue....."* Yet nowhere is this central issue discussed, which compels one to conclude that ATOC could presumably map the temperature of the ocean on basin scales and over temporal scale of years or decades, without any idea of how this temperature data is to be interpreted in connection with the greenhouse warming of the earth's atmosphere. From a scientific research rationale standpoint it would seem imperative that one should at least pursue this "central issue" first to see if global warming due to the greenhouse effect can in fact be detected in the ocean on the same time scale, at least, as what can be measured in the atmosphere. Unfortunately, this issue is not addressed. There is merely the assertion that somehow, by measuring basin-scale averaged ocean temperature, greenhouse warming can be detected.

1 Sec 1.1.1 3a

Much is made of the HIFT experiment - the Heard Island Field Test - throughout discussions of ATOC. It is therefore useful to quote from the principal output of HIFT in the form of the special issue of the Journal of the Acoustical Society of America on HIFT (JASA

Vol. 96, No. 4, October, 1994). In the lead article "The Heard Island Feasibility Test", by Munk et al, one finds this statement, on p. 2331, *"...Finally, it is important to emphasize that acoustic thermometry asddresses the issue of measuring climatic change (ambient or otherwise) in the oceans; it does not tell us anything about the underlying causes and about the effects on the atmosphere."*

From a purely pragmatic standpoint the best that can possibly be said about ATOC might be that some time after (most likely decades after) atmospheric scientists have concluded without equivocation that greenhouse warming has arrived, Munk and company (or their descendents) could say "By gosh, you were right!" Thus there can be absolutely no public policy benefits to be derived from the ATOC experiment. It will remain an interesting exercise in developing signal-processing techniques for the study of acoustic propagation in the ocean.

ATOC proponents did make some perfunctory efforts at assessing alternatives to ATOC for monitoring global warming in the two draft environmental impact statements. But these can, at best, be characterized as "assertions" rather than assessments. This is nowhere better illustrated than in the Executive Summary of the Kauai DEIS, p. ES-11 (and, similarly, in the California DEIS, p. ES-12) where one finds the rather astounding assertion that *"Generally speaking, all of the alternative scientific methods for addressing the global warming problem are either included in the project as proposed, or would not meet project objectives."*

We have discussed the "alternatives" issue further in our Comments on the California DEIS, which is attached by reference to the present communication. (Section 3. Failure to Conduct Meaningful Analysis of Alternatives, p. 3, KFOE comments on California DEIS, submitted to ARPA January 31, 1995.)

2. THE GENESIS OF ATOC

The ATOC project presumably resulted from a Broad Agency Announcement issued by the Advanced Research Projects Agency (ARPA) BAA 92-24. In a letter to Representative Patsy T. Mink, dated 20 May, 1994, Mr. Gary L. Denman, Director ARPA, stated the following regarding the BAA process, *"In response to your questions on the selection process, that sequence is as follows. In early January, 1992, the Advanced Research Projects Agency (ARPA) issued Broad Agency Announcement (BAA) No. 92-24 requesting research and technology concepts 'for a program to demonstrate the feasibility of conducting a long-term global program which will measure the temperature of the ocean using acoustic techniques and will incorporate these measurements in appropriate climate models to quantify global climate variability.' The BAA vehicle (enclosed) was employed instead of a Request for Proposal (RFP) to afford the broadest possible response with conceptual and applied technology while retaining a highly competitive process."*

This statement in itself is contradictory, for by specifying the methodology (i.e. by acoustic thermometry) the announcement precludes "the broadest possible" response. In fact, the results of the solicitation consisted of only nine proposals submitted as parts of a whole, effectively a team bid headed by SIO. Two of the proposals dealt with the hardware for the sound source. Of the remaining seven, one, by SIO, addresses all the specific tasks delineated in the BAA, while the other six divided up the sub-tasks, with no overlap. There was thus, in effect, only one proposal, a situation that was essentially pre-ordained by the wording of the BAA. There was, therefore, no possibility of "retaining a highly competitive process" as claimed by Mr. Denman. There was, therefore, also no possibility of considering "alternatives" in terms of other "responses with conceptual and applied technology", as claimed by Mr. Denman, thus precluding, *a priori*, any assessment of "alternatives" in the environmental process that ensued after the ATOC contract was awarded to SIO.

The non-competitive, no-alternative procurement process that prevailed apparently also contibuted to the unusually expeditious evolvement of the proposal to contract and the rapid expenditure of funds. All these unusual expediting steps leave one with no alternative but to characterize the award of the ATOC contract as a so-called "wired" procurement, contrary to the claim of Mr. Denman in his explaining the process to Representative Mink, and, through her, to the public.

KFOE has earlier addressed the issues surrounding the award of the ATOC contract in its statement to ARPA and NMFS during the scoping process, in a letter to Dr. Alewine of ARPA and Dr. Fox of NMFS dated June 11, 1994. This letter is by reference made a part of the present communication. This June 11, 1994 letter, it should be noted, was the result of the announcement by ARPA and NMFS in their Notice of Intent to Prepare an Environmental Impact Statement and Request for Comment, published in the Federal Register on 12 April, 1994, and a similar notice by ARPA and NMFS published in the Federal Register on 3 May, 1994.

3. THE DRAFT EIS'S ARE NON-RESPONSIVE TO COMMENTS BY THE PUBLIC

While the California DEIS does not contain any record of public comments during the scoping process the Kauai DEIS includes a second volume which contains some of the public inputs, among which some pertain to proposed Kauai activities under ATOC while most address ATOC as a whole. The inclusion of public comments addressing ATOC as a whole in the Kauai DEIS constitutes, therefore, a tacit admission by SIO that the activities at the two locations cannot be treated separately. In fact, SIO clearly is unable to segment the public comments into two convenient categories so as to be able to include them separately in the California and Kauai DEIS's, which is precisely the point we at KFOE have been making all along, that the activities at the two sites cannot logically be treated separately in the environmental assessment process.

2 14b

Nothwithstanding this curious dilemma in logic faced by SIO the response to public comments during the scoping period is woefully incomplete. Despite elaborate recording system set-ups at the three scoping hearings none of the orally presented comments are included in Appendix D of the Kauai DEIS. Aside from a few lengthy comments from the Sierra Club Legal Defense Fund (SCLDF) and the Natual Resources Defense Council (NRDC) we find few if any other entries. In our own particular instance the KFOE comments submitted on June 11, 1994, referred to in Section 2 above, are not noted in the DEIS; nor are responses shown in Appendix D of the DEIS. The one communication from KFOE, dated November 4, 1994, to Dr. Munk of SIO, (and not to Dr. Alewine or Dr. Fox), shown in Appendix D, was not intended as our input to the scoping process (as was our June 11, 1994 letter to Alewine and Fox) but only addresses certain specific questions arising out of actions being undertaken by SIO during the summer of

1994 that we considered to be not appropriate while SIO was undergoing the environmental process.

3 In view of the absence of notice of and response to the large volume of public comments offered at the scoping hearings we at KFOE urge that the draft environmental impact statements offered by SIO be considered null and void, and that a single ATOC EIS be prepared which will include proper responses to public comments offered during the scoping process. The preparation of a single EIS would also relieve SIO of the dilemma of having to segment the comments as it clearly was unable to do. 2

4. INADEQUACY OF THE MMRP IN ASSESSING IMPACTS ON MARINE MAMMALS

While almost the entirety of Vol I of the Kauai DEIS addresses issues of ATOC impacts on marine mammals and other marine life forms, quantity unfortunately does not equate to quality. All the conclusions reached are based on unsupportable assumptions and self-contradictory assertions. In fact, the whole tenor of the treatment presented as science in this volume can be characterized by the following quotations:

From p. 4-6 of the Kauai DEIS, under the heading "Scientific Uncertainty", *"As stressed in this EIS, available information on subsea noise and its biological impact ranges from incomplete to non-existent, depending on the species being considered."* This is followed in the next paragraph (on p.4-7) by, *"As set forth below, the potential effects of the proposed acoustic thermometry project and MMRP are based on available information regarding the species potentially affected, which is analyzed in this Section. In some cases, the lack of available data necessitate a finding of uncertain or unknown, as to whether impacts are expected."*

It is interesting to note that this paragraph just quoted appeared in the California DEIS in a substantially different context. From p. 5-15, California DEIS, *"As set forth below, the ATOC project and MMRP are not anticipated, in most cases, to result in adverse effects on biological resources. This conclusion is based on available information regarding the species potentially affected, which is analyzed in this Section. In some cases, the lack of available data necessitate a finding of unknown, as to whether impacts are expected."* The underlines are ours, to indicate differences in the two statements as they appeared in the two DEIS's.

Apparently, the preparers of the DEIS had second thoughts on the obviously self-contradictory statements in the California DEIS, and sought to soften the effects in the Kauai DEIS. Unfortunately, this does not change the fundamental tenor of either DEIS, namely, nothing much is known about man-made sounds on marine life. Both versions of the DEIS go on to say, on p. 4-16 of the Kauai DEIS and on p. 4-26 of the California DEIS, *"In summary, variations in sensitivity to human-made noise between and within marine mammal species and lack of information about the consequences of short-term disruptions on marine mammals, make it difficult to define the criteria of their reponsiveness and to assess the consequences of a disruption in their natural activities."*

Cast in simple English what one reads in these DEIS's is that 1) Hardly anything is known about the effects of man-made sounds on marine life; and 2) There is no information upon which to develop criteria to judge whether man-made sounds would affect marine life.

Yet, one finds in the various tables summarizing potential impacts of the Proposed Action (namely, ATOC) such uniformly equivocating conclusions as:

"None, provided assumptions are correct."

"Uncertain, but presumed to be low to moderate, provided assumptions are correct."

4 *"Uncertain."* TC

"Uncertain, but presumed to be low, provided assumptions are correct."

(From Table 4.3.1.1.3-1, Kauai DEIS, pp 4-35-4-40, on Potential direct and indirect and cumulative effects on mysticetes.)

The same equivocating conclusions are to be found in:

Table 4.3.1.3.3-1, Potential direct and indirect, and cumulative effects on pinnipeds.

Table 4.3.2.1.3-1, Potential direct and indirect, and cumulative effects on sea turtles.

Table 4.3.2.2.3-1, On fish.

Table 4.3.2.3.3-1, On invertebrates.

It is again interesting to compare the conclusions in the Kauai DEIS with those in the California DEIS. The typical conclusion in the latter contains the phrase:

"Uncertain; however, no acute responses expected. Potential for occassional temporary threshold shifts."

There is obviously a change of criteria (even though none is supposed to be available) such that between the time of the completion of the California DEIS and the preparation of the Kauai DEIS *"No acute responses expected"* has changed to *"presumed low to moderate"* with an added degree of equivocation in the latter with the addition of the phrase *"provided assumptions are correct"*. There is no explanation as to what new data had become available or new criteria established for the DEIS preparers to change the degree of certainty (or uncertainty) on potential effects on marine biota.

In the face of this vast sea of uncertainty nothing in the DEIS is advanced to indicate how a 6-month MMRP is expected to fill the knowledge gaps so that criteria for the assessment of potential impacts can be developed and used meaningfully to satisfy the requirements of the 6b
5 Environmental Impact Statement.

We therefore must conclude, based on the work as expresssed by the preparers themsevles, that the Kauai DEIS has failed to develop any scientifically and pragmatically

meaningful assessment of the effects of the ATOC project on the marine environment.

5. ENVIRONMENTAL JUSTICE

The President's Executive Order of February 11, 1994, on Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations is cited in the Kauai DEIS; but is dismissed with the assertion that *"The proposed project would cause no adverse environmental effects on any minority communities and/or low-income communities."* This cavalier dismissal of the issue is further sullied by the equally irresponsible and condescending (unfortunately a common attitude of the majority population in dealing with a minority population) declamation, *"Furthermore, the public, including minority communities and low-income communities, have full and open access to this EIS and all public information that was compiled and incorporated to develop it."*. (Kauai DEIS, p. 6-4)

The proposed project will, in fact, have significant potential impact on the Native Hawiian population on the North Shore of Kauai. These long-time residents of Kauai practice subsistence fishing in the waters surrounding Kauai. According to the Hawaii State Department of Land and
6 Natural Resources (DLNR) - interestingly enough, in a letter cited in the Kauai DEIS from Mr. TC
Walter Ikehara, Aquatic Biologist, to Mr. Paul Kawamoto, Aquatic Biology Program Manager, 18b
dated September 6, 1994 - the annual catch by Kauai fishermen in the area encompasssing the intended ATOC sound source was 37,500 pounds in 1993. While this may not sound like an impressive number to the people of ATOC it neverthelss represents a significant source of food for the small Native Hawaiian population on the North Shore. This group also qualifies as a low-income population. Because of the significance of this source of food the DLNR placed a Fish Aggregating Device (FAD) in this area to enhance the fishing potential, which further substantiates the significance of the need of this food source for Native Hawaiians. It is ironic that some members of the DEIS preparation group included this particular correspondence in the DEIS, yet its was obviously missed by those who addressed (or pretended to) the environmental justice issue in another part of the DEIS. For otherwise it is inconceivable that anyone aware of the contents of the Ikehara letter could reach, with such dispatch, the conclusion on p. 6-4 of the Kauai DEIS.

CONCLUSIONS

Based on the presentation of factual information and data above, we at KFOE must conclude that the ATOC project

Has no demonstrable scientific merit pertaining to the study of global warming,

Is created through questionable procurement practices,

Has failed to respond to public comments,

Has failed to perform any meaningful assessment of its impact on marine biota, Has ignored its impacts on the Native Hawaiian population on Kauai.

Therefore, the only choice among the alternatives is the "No Action" alternative.

It is extremely unfortunate that SIO, with the encouragement of ARPA, has continued to expend public funds to pursue the project even before it has adequately demonstrated the environmental viability of the project. As tax payers and environmentalists we protest in the strongest possible term these unconscionable and possibly illegal acts of ARPA and SIO.

Sincerely yours,

Bean Blair

Raymond L. Chuan, PhD
Co-chairs
Kauai Friends of the Environment

Encl. KFOB letter of scoping comments to Alewine and Fox, June 11, 1994
KFOB letter of comments on California DEIS to ARPA, January 31, 1995

cc: (without enclosures)
Dr. William Fox, NMFS
Dr. Walter Munk, SIO
Representative Patsy Mink
SCLDF
Greenpeace, San Francisco
Mr. Michael Wilson, DLNR
Mr. Walter Ikehara, DLNR
Mr. Gary Gill, OEQC
The Honolulu Advertiser
The Honolulu Star Bulletin
The Garden Island
The Kauai Times

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

To Clayton H. Spikes,
I am writing to express my opposition to the ATOC project, specifically the implementation of acoustic sound transmitters at Kaihu Point in Kauai, Hawaii. 1

Of specific concern at Kaihu Point is the long term impact of low-frequency sound on fish populations around the proposed transmission site. I urge you to reconsider the ATOC project in light of its ~~dubious~~ uncertain destructiveness. 18c

Sincerely,
Derek Manning

Jan. 23, 1995

Advanced Research Project Agency
Marine Acoustics Inc
2345 Crystal Drive
Arlington, VA. 22202

To Clayton H. Spikes:

I am writing to you to register my strong opposition to the ATOC project. Per usual we are pushing ahead with an arrogant program of highly debatable value and impact to Marine Mammals. It is appalling that so little consideration
1 is being given to some of the earth's most magnificent beings. 3a

As regards the "Supposed" intention of studying Global warming . . . . wake up and smell the coffee. What we need is action, not study! Spend the money where it can do some good on alternative energy and efficiency. Or is the public once again being misled with a covert, classified military folly?!

We are paying attention —

Sincerely,

[signature]

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

RECEIVED 3-6-95

3-1-95

To Clayton Spikes

I am opposed to the ATOC project. The environmental impact statement is inadequate. I demand that you examine the real issues and alternatives and bear in mind the PROBABLE negative impact on marine life in particular marine mammals. You must respect the sovereignty of the "citizens" of California and Hawaii. Todeis does not take
1 into account these issues or the PROBABLE 1
military reason for these tests anyway. Please respect the earth, the oceans and all living creatures. Short term strategic or political or economic gain cannot out weigh threatened and endangered species or our heritage. Global warming is already a reality. Let's pursue the alternatives. Energy efficiency "self reliance" for individual homes and move away from fossil fuels. No more studies.

B. Henry Heizenray

"Advanced Research" Project Agency
Marine Acoustics Inc.
2345 Crystal Drive
Arlington, Va. 22202

To Clayton Spikes:

I am another person directly apposed
1 to expensive, Classified military operations being 1
disguised as environmental Research. Please Cancel
the ATOC Project in favor of actual environmental
research. The possibility for Massive injury
to marine life is to great to go ahead with this
Project.

—Thank you for your time

[illegible]

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia 22202

Dear Mr. Spikes

I am writing in regards to the ATOC Project and to clearly
express to you my opposition to the project for several reasons. First
of all, the secrecy with which this testing is being dealt does not
1 instill in me any confidence towards the Agency whatsoever. The
public comment period should be extended to allow for more input 14a
and increased public security and peace of mind. The steam-rolling
approach used by the proponents of ATOC make it obvious that there is
something about this project which needs to be kept secret. ie. military, submarine, etc.

Secondly, the risks to animal life in the testing waters is present.
2 Damage to reproductive, immune and sensory systems could result. If 12b
the purpose of ATOC is to conduct tests on global warming, there are
alternatives which are readily available. Actually, since global warming
has been tested in the past and found to be a problem, the tax dollars would
be better spent on energy efficiency, clean energy, and other efforts to
reduce our impact on the global climate.

Sincerely,
Robert M. Wagner

Advanced Research Project Agency
Marine Acoustics, Inc.
2045 Crystal Drive
Arlington, Virginia 22202

To Clayton H. Spikes,

I oppose ATOC! STOP the implementation of Acoustic Sound transmitters. At Kaihu Point in Kauai, Hawaii.

1 Why do we have to destroy? It affects All of us in the end. Energy efficient technologies really should be considered. 5a

Sincerely,
Leigh A. Mumford
Leigh Mumford
Greenpeace!

To Clayton H. Spikes:

I am writing to express my opposition to the ~~ATOC project~~ ~~more~~ specifically the implementation of acoustic sound transmitters at Kaihu Point in Kauai, Hawaii.

1 The Draft Environmental Impact Statement for this site conspicuously fails to account for the cumulative effects on both proposed transmission sites (Kaihu Point and Point Sur) will have on marine life in the Pacific. Are both sites not part of the same project? 12c

2 ~~Of~~ Specific concern at Kaihu Point is the long-term impact of low-frequency sound on fish populations around the proposed transmission site - fish native Hawaiians depend on for subsistence. The DEIS states that "the potential for this impact is uncertain," due to "insufficient information." It is unacceptable to proceed on such uncertain, insufficient grounds. 18c

The ATOC project as a whole is marred by many such uncertainties. The money for ATOC would be better spent in efforts to spread and improve clean energy ~~and energy efficient~~ technologies.

I urge you to reconsider the ATOC project in light of its dubious necessity and uncertain destructiveness.

Sincerely,
Jeanine Kopec

Advanced Research Project Agency
Marine Acoustics, Inc.
2345 Crystal Drive
Arlington, Virginia

To Clayton H. Spikes,

I am writing to express my opposition to the ATOC project, specifically the implementation of sound transmitters at Kaihu Point in Kauai, Hawaii.

The Draft Environmental Impact Statement for this site conspicuously fails to account for the cumulative effects BOTH proposed trans-
1 mission sites (Kaihu Point and Point Sur) will have on marine life in the Pacific. If both 12c
sites are part of the ATOC project, why are their effects exclusively separated?

Of specific concern at Kaihu Point is the long term impact of low-frequency sound on fish populations around the proposed transmission
2 site—fish native Hawaiians depend on for subsistence. The DEIS states that "the potential 18c
for this impact is uncertain," due to "insufficient information." It is unacceptable to proceed on such uncertain, insufficient grounds.

The ATOC project as a whole is plagued by such uncertainties. The certainty of global warming, however, is well established in scientific communities worldwide. The money for ATOC would be better spent in efforts to spread and improve clean energy and energy efficient technologies.

I urge you to reconsider the ATOC project in light of its dubious necessity and uncertain destructiveness. Thank you for your consideration.

Sincerely,

Chris Busby

Chris Busby

U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

PUBLIC HEARING ON SCIENTIFIC RESEARCH PERMIT APPLICATIONS P557 AND 1557A

Thursday

February 9, 1995

\- - -

The public hearing was held at Kauai War Memorial Auditorium, Lihue, Hawaii, at 6:00 p.m., Eugene T. Nitta, Hearing Officer, presiding.

PRESENT:

EUGENE T. NITTA

CINDY ROGERS

MARTIN FREEMAN, ESQ.

APPEARANCES:

RALPH ALEWINE

BEAU BLAIR

CAREN DIAMOND

JACK HASHIMOTO

DOUG KILLPATRICK

DAVID SEIELSTAD

ANDREW FORBES

WALTER MUNK

DAN SHOOK

REBECCA MILLER

ALBERTO PARTITO

JOE MOBLEY

DON HEACOCK

MELINDA SANDLER

ARIUS HOPMAN

CARL STIPATH

The testimony of Ms. Karen Hewitt was read into the record by Ms. Beau Blair.

The testimony of Mr. Jay Murray, Ms. Mary Ellen Sussex, Ms. Ann Stirling Frisch, and Mr. Norman Frisch was read into the record by Mr. Raymond Chuan.

The testimony of Mr. Chris Clarke was read into the record by Mr. Joe Mobley.

C O N T E N T S

P R O C E E D I N G S

(6:12 p.m.)

HEARING OFFICER NITTA: Good evening. My name is Gene Nitta, and I'm with the National Marine Fisheries Service, Southwest Region. I will be your Hearing Officer tonight.

Also in attendance from NOAA is Mr. Martin Freeman, Office of General Counsel, and up here with me is Dr. Ralph Alewine from the Advanced Research Projects Agency.

The National Marine Fisheries Service has responsibility for reviewing applications for scientific research permits involving marine mammals and sea turtles, and for issuing or denying such applications based on the best scientific information available at the time of review.

In accordance with the Marine Mammal Protection Act and Endangered Species Act guidelines, an application for a permit for scientific research on the potential effects of low frequency sound associated with the acoustic thermometry of ocean climate project off the north coast of Kauai has been

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submitted to the National Marine Fisheries Service by the Scripps Institution of Oceanography.

Because of potential environmental concerns regarding the proposed activities, a joint federal draft environmental impact statement has been prepared by the National Marine Fisheries Service and the Advanced Research Projects Agency, or ARPA.

This DEIS has also been submitted to the State of Hawaii, Department of Land and Natural Resources under the Hawaii Environmental Policy Act. In that regard, the Service notes that this is not a joint state-federal hearing. However, comments received on this DEIS will also be provided to the Department of Land and Natural Resources. It is my understanding that the Board of Land and Natural Resources may hold a public hearing on the pending conservation district use permit application after the final EIS is completed and accepted by the DLNR.

The comment period for this DEIS has been extended to March 9th, 1995, to coincide with the close of the comment period under the State of Hawaii's Environmental Policy Act.

Finally, the Service has recently received a revised scientific research permit application for the acoustic thermometry of ocean climate project, marine mammal research program, for the Kauai site from the Scripps Institution of Oceanography, which incorporates the DEIS as its basis.

Upon completion of the Service's internal review of the revised application, it will be made available to the public for a 30-day comment period. We look forward to hearing your comments tonight and to reviewing the written comments submitted to us on the DEIS.

At this time Dr. Alewine will submit a statement for ARPA.

DR. ALEWINE: Thank you very much. I'm delighted to be here.

This statement is made on behalf of the Advanced Research Project Agency, known as ARPA. ARPA is a separate federal agency under the Office of the Secretary of Defense, reporting to the Director of Defense Research and Engineering. ARPA is the central research and development organization for the

Department of Defense. Its mission is to develop imaginative, innovative research ideas which offer significant technological impact and to pursue those ideas from demonstration of technical feasibility through the development of prototype systems.

As we just heard, the purpose of this hearing is to accept testimony from the public on the draft environmental impact statement, or EIS, which has been filed by ARPA and the National Marine Fisheries Service in cooperation with the Scripps Institution of Oceanography of the University of California.

The draft EIS has been prepared to facilitate consideration by the National Marine Fisheries Service of an application by Scripps Institution of Oceanography for a scientific research permit to evaluate potential effects of low frequency transmission on marine mammals and sea turtles.

This research is part of a larger research project aimed at better understanding global environmental change.

It is universally recognized that global

energy cycles and the biological processes upon which all life depends are critically influenced by the ocean. Systematic, global observations of the world's oceans are required to improve our ability to predict the climate and for a more effective understanding of the marine environment.

Making accurate measurements of the ocean by means of conventional instruments is very difficult, time consuming, and cost prohibitive, if it can be done at all. This has led to the development of a technique called ocean acoustic thermography, which looks at the ocean on a large scale and creates a three-dimensional image of the area transversed by an acoustic signal.

Since the speed of an acoustic signal is influenced by the temperature of the water, it is possible to develop detailed technical information on the overall temperature of the oceans. To understand the climate variability and to eventually forecast this variability, an understanding of the ocean is crucial.

The acoustic monitoring of global ocean

climate experiment is the definitive study to show that ocean temperatures, which can provide direct evidence of the existence and amplitude of global climate change, can be measured accurately on this large scale. This is an experiment only at this stage.

The ATOC technology is expected to afford significant benefit to the understanding of global atmospheric and climate trends, and for continuing related research on marine biology and global warming environmental issues. The program should help to obtain and implement useful and affordable maps of internal ocean variability.

The ATOC project is part of the overall U.S. global change research program among whose major priorities is climate change and greenhouse warming. This project is one of many funded by the Strategic Environmental Research and Development Program, which is under the management of ARPA.

This Strategic Environmental Research and Development Program is called SERDA, was established by Public Law 101-510 in November of 1990 to address

environmental matters of concern to the Department of Defense, the Department of Energy, and the Environmental Protection agency. It is intended to identify and use research technology and information which have been previously developed by the Defense Department for national defense purposes that could be very useful to government and private organizations engaged in environmental research. Global environmental change is but one of six technologies that make up the SERDA program.

Active program participants in this ATOC program, in addition to Scripps, include the Woods Hole *Oceanographic* Institution, NOAA, the Navy Postgraduate School, the Naval Research Laboratory, Hubbs Sea World Research Institute, and in the academic community the University of Alaska, the University of California, Santa Cruz, Cornell University, Florida State University, MIT, the Massachusetts Institute of Technology, the University of Michigan, Mississippi State University, Pennsylvania State University, the University of Texas at Austin, and the University of Washington.

Australia, Canada, Japan, New Zealand, Russia, and Taiwan comprise ATOC's Pacific Basin international partners.

It is important to understand that the ATOC researchers have recognized from the very beginning that no harmful effects should occur to marine mammals and have committed to an unprecedented marine mammals study program as part of this project.

The marine mammal research program is motivated by the paucity of data regarding the possible impact of low frequency sound on marine mammals. It is noteworthy in this regard that ARPA is sponsoring additional research by the National Academy of Science, the National Academy of Science's Ocean Study Board in this very specific area of interest.

At the same time, the marine mammal research program will carry out broad-based research and will study the ecology and behavior of these animals throughout the ATOC experiment.

Simply stated, the proposed research program will provide extremely valuable scientific data and will serve as the benchmark for good

stewardship and responsibility in carrying out this program.

We look forward to your comments on the draft environmental impact statement here this evening.

Thank you very much.

HEARING OFFICER NITTA: Thank you, Dr. Alewine.

Before we begin, I would like to present a few ground rules for tonight's hearing. I am the Hearing Officer and will conduct this hearing so that everyone who so wishes may testify tonight. I will call the speakers. If he or she is not present, I must go on to the next speaker. At the end of the list of speakers, I will again call upon those who did not respond earlier.

I will entertain questions regarding procedure and process only. This is not an adversarial hearing. So there will be no questioning of the speakers, and I must reiterate that we are here to receive comments on the DEIS, not to engage in discussion or debate.

On the basis of the number of individuals signed up to testify tonight, I am limiting the speakers to five minutes and request that extensive comments be summarized and the complete text provided in writing.

If comments are being submitted, please leave a copy at the court reporter's table so that it may be entered into the record.

In this regard, if we do have time and there's a reasonable expectation that no more people will sign up, we may have time for people to expound on their testimony beyond five minutes, but there is no guarantee of that.

Please insure that your comments are pertinent to the subject at hand: the DEIS for the Kauai ATOC program. If you wish to support someone else's testimony, a simple statement to that effect will be sufficient.

I will call upon the speakers in the order in which I received the request to speak tonight. Thereafter, I will call upon those who signed up at the door.

Representatives from the Scripps Institution of Oceanography have requested that rather than make an extensive presentation at the beginning of this hearing, they be included within the list of speakers for tonight to allow more time for public testimony. Dr. Munk and his colleagues will be available after the hearing to answer any questions from the public.

Are there any questions before we begin?

(No response.)

HEARING OFFICER NITTA: Okay. The first speaker is Raymond Chuan. Please state your name for the court reporter when you come up to the podium.

MR. CHUAN: My name is Raymond Chuan, C-h-u-a-n, a resident of Hanalei, and I'm co-chair of the Kauai Friends of the Environment.

What we are here tonight is not a conflict between the environmental community and the scientific community. We're dealing with questions of social and environmental responsibility, with accountability to the public for expenditure of public funds and of obeying the law of the land, whether you're a logger, an oil driller, an astronomer, or an oceanographer.

Just as environmentalists object to logger clear cutting forests to the detriment of the spotted owl, we object equally to the leveling of the top of Mount Graham in Arizona, destroying the habitat of the red squirrel so that astronomers can erect a new telescope. So we also oppose the potential disturbance of the ocean environmental and its living creatures by the introduction of the ATOC, the effects of which are admittedly unknown and probably unknowable in the short term.

The provisions of the National Environmental Policy Act, NEPA, apply equally to tree loggers, astronomers, and oceanographers. That is the basic issue that has brought us to this hearing on the draft EIS of the ATOC requirement.

74-1

One of the basic requirements under NEPA is that an environmental impact statement must address the totality of the project over the entire projected duration of the project. This is known as a programmatic EIS.

The ATOC has not only failed to do this.

2

It has deliberately segmented the project first into two subunits, the California ATOC and the Kauai ATOC, and it has further segmented the Kauai part of the ATOC into the marine mammal research program, the playback experiment, and the so-called CEROS horizontal line array for which ATOC or its surrogates have asked for separate permits and in doing so while the EIS process is underway.

ATOC further segmented the testing of the sound source itself into a separate project called the acoustic engineering test for which it issued an environmental assessment exactly two days, two days, before the commencement of the test off the coast of Baja, California.

NRPA disallows segmentation of the environmental process. Yet the Scripps Institution of Oceanography and its sponsor, ARPA, have brought the art of segmentation to a hitherto unattained level of sophistication and egregiousness.

Now, taking the segmented Kauai draft EIS for what it is, we have the following categories of comment.

74-2

One, there is no scientific basis for the claim that measuring the average temperature of the ocean at 800 meters will relate in any way to global warming, the process by which the over $50 million granted or as awarded is highly suspect.

3a

74-3

Two, while most of the draft EIS deals with the marine mammal research program, the recurring theme is that almost nothing is known about the effect of low frequency sound on marine mammals, but there is presumed to be no impact. The six months MMRP cannot predict what the long-term effects might be over the decade or longer duration of ATOC.

6a

74-4

Three, several hundred people attended and presented comments at the two scoping hearings in Hawaii in April 1994. Yet these is absolutely no response from the ATOC people to these comments in the draft EIS. In other words, those hearings were a waste of time and effort by the people of Hawaii.

16a

Four --

HEARING OFFICER NITTA: Thirty seconds.

MR. CHUAN: I beg your pardon?

HEARING OFFICER NITTA: Thirty-seconds.

MR. CHUAN: Fine. ATOC's conduct in dealing with the public and public agencies has been disingenuous and duplicitous.

74-5

For example, the reference to the conservation district use application on the cover of the EIS is a joke because the cable for which the applications are made has already been made way back in October of 1993.

19

74-6

Five, ATOC hides its activities behind the shield of military secrets.

1.

74-7

Six, ATOC does not respect native Hawaiian rights and ATOC has ignored the principle of environmental justice as proclaimed in the presidential Executive Order of federal actions to address environmental injustice in minority populations and low income populations.

20

I will stop there, but other members of our group will address some of these issues in further detail, and all of these issues will be presented in detail in our written comment to be submitted by March 9th.

Thank you very much.

HEARING OFFICER NITTA: Thank you.

Beau Blair.

MS. BLAIR: Good evening. My name is Beau Blair, and I am the other co-chair of Kauai Friends of the Environment.

I would like to take this very precious opportunity to thank all of the cooperating agencies who have so graciously allowed us to speak our peace this evening. I am not filled with confidence that they will bother to listen to us tonight when they have not found it necessary to do so yet, and so I question the interest of ARPA, NMFS and Scripps Institute in receiving informed public comments on ATOC and the DEIS.

The ATOC DEIS is a document that has been prepared at a great cost in time and man hours, as well as financially, which is a whole other subject I'd love to address.

75-1

Nowhere in the DEIS is there any response to the hundreds of public comments that were made at scoping hearings in April 1994 in Lihue and in Honolulu. Repeatedly the concerned citizens of Kauai and the Hawaiian Islands stated their grave and valid

162

questions as to the importance of substantiation regarding the effects or lack of effects of the ATOC sound source on the multitudes of sea flora and fauna, as well as those regarding the human population. Where in the DEIS are there any valid responses to our questions?

The validity of this DEIS is questionable for many reasons, but of paramount concern to me at this moment is that it is blatantly a work of advocacy for a decision that has already been made to proceed with ATOC and the MMRP.

Over and over the DEIS states, and I'm quoting this, "as stressed in this EIS, available information on subsea noise and its biological impact ranges from incomplete to nonexistent, depending on the species considered." That's in Volume 1.

Each of the species examined for the benefit of the EIS had the same overall finding of no impact whether there was a finding of impact or not. Each time there was found to be an impact, it was sloughed off as being minimal or of no consequence.

Further, the overall time span of this

experiment has not been factored in. I'm offended by the bias projected forth in the DEIS and the assumptions that the ATOC sound transmission simply will not adversely impact marine wildlife. The collected data to substantiate these findings are so inadequate that even as a scientific layperson, I have to balk at the very minimal energies that were used to arrive at what I consider fixed conclusions.

This project has continually come up with findings of no impact at each juncture. This is a clear indication to anyone concerned that there was never any intention of a fair or unbiased finding to the contrary. This document leaves us with more questions unanswered now than before it was published.

For approximately 50 or so what I consider wasted pages of fluff, and I do intend to recycle it, this DEIS challenges any of those of us who have bothered to take the time to look at the endless inconsistencies. We have not been taken seriously for our interest or our input. We have been asked to participate in a process that is somewhat of an insult.

The burden of this EIS should be on the project proponents to prove that there will be no adverse impacts before being allowed to proceed instead of assuming no or minimal impacts until observations prove the existence of impacts. Unfortunately for ARPA, NMFS, and Scripps Institute, they will have to deal with us watching them at every step of this process until they take their responsibilities to our planet and all of its inhabitants seriously.

Thank you very much.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Sara Cash. Is Sara Cash here?

Linda Chandler.

Caren Diamond.

MS. DIAMOND: Aloha. My name is Caren Diamond and I live in Hanalei.

76-1

There's a glaring lack of scientific data and evidence supporting the theory that booming a loud sound through the ocean will somehow relate to the detection of global warming. There are many ways in

3d

place right now of detecting various temperature changes in the ocean.

When the sea surface temperature changes, that change is not mirrored 3,000 feet down where ATOC is measuring the average temperature across the ocean. With all of the available data confirming global warming, our government has taken little action to reverse the causes. Why should our sea creatures be experimented upon for yet one more potential confirmation of what is already known.

ATOC proposes to monitor marine mammals for six months while this experiment is proposed to go on for ten years. We cannot afford the Wells migration patterns to be altered. 76-2 6b

Here on Kauai our native population's main food source is fresh fish caught from their ocean. While the whales will be monitored, our people cannot afford to risk losing the food that feeds their families. This is an unacceptable risk for a population of people that rely on our ocean resources. 76-3 18c

Our marine life is abundant, our North Shore a pristine environment, relatively untouched by

commercial activity. The people of this North Shore community want our area to remain a pristine, abundant place to live. There is no reason this experiment should take place here, no reason our community should be an experiment at all.

This is home to many people, many dolphins, whales, sea turtles, monk seals, and countless varieties of edible fish. Hanalei is not a laboratory. It is our home. This is a community where there isn't money for a middle or high school for our children, no money for our library. We don't even have money for a decent playground for our children. Our state parks are in danger of closing due to lack of funds.

76-4 Yet ATOC proposes to spend upwards of $36 million. If you care about our island, please don't use it as a laboratory. You know the community is not in favor of this. Our natural resources are all we have. Don't play with them. Don't experiment with them. Take your ideas where you live. 4a

We don't want to hear unfounded statements like, "There is nothing likely to be any impact." The impacts here will be severe, unnecessary, and not easily reversible. With no peer review, with no clear knowledge of how acoustic sound relates to global warming, this proposal doesn't sound like sound science to me.

ATOC says they will make precise average measurements, two contradictory words. Things are either precise or average, not both.

Kauai is not the place for ATOC. We don't want it here. Don't harm our environment. Protect it.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Miguel Godinez.

Jack Hashimoto.

MR. HASHIMOTO: Aloha to you all.

I guess we're back to the same square. My name is Jack Hashimoto, born and raised in North Shore of Hanalei, have resided in this God blessed area for some 56 years, and I am proud of my birthplace.

I have not contemplated on voicing my

opinion this evening, but maybe I should say what my "manao" may be. Nowhere in the previous reports have I come across my statement concerning the deep sea 77-1 fishes, namely the ahi, wahoo, dolphin, bonito, and 18c skipjack. So my stand is still the same. I object to any testing.

Also, I spoke for my Hawaiian group, and our stand is still the same also. So all I and we ask, that our concerns be scrutinized and thought out carefully because once damage is done, it's not an overnight repair job.

Mahalo for your attention.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Karen Hewitt.

MS. BLAIR: I'm reading a very brief statement from Karen Hewitt of San Jose.

Neither the proposal nor the DEIS makes any serious attempt at justifying the scientific rationale of relating basic scale average deep ocean temperature 78-1 to global warming. In fact, the definitive statement 3b on this issue would appear to be contained in the lead article in the special issue of the <u>Journal of Acoustical Society of America</u> on the Heard Island experiment, wherein the authors, Monk, <u>et al</u>., state the following, quote: "Finally, it is important to emphasize that acoustic thermometry addresses the issue of measuring climactic change, ambient or otherwise, in the oceans. It does not tell us anything about the underlying causes and about the effects on the atmosphere."

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Doug Killpatrick.

MR. KILLPATRICK: In this time of deception, of misinformation, of elitist powers and the war machine at their use, the creations of love have little capacity to fight that which disables, maims, and kills their kind. The trees of the forests may cry and scream as the clear cut chain rips them from their symbiotic relations. The mammals of the ocean cannot come up to us and speak in a meeting center that the pain and the suffering is excessive

and will eventually kill them.

And I mention coral and how it is destroyed by big sounds, as by jets over the Florida Keys. The symbiosis of coral with the life on it.

The people living in harmony with the earth scream in protest. Legal, non-legal, and still after hundreds of years the power players hear little other than if it affects them in their capital gains, and when it does, weapons are raised and used.

To a species that lives peacefully with its environment, an instrument that alters it, their waves is a weapon of destruction. For an instrument that disrupts the natural waves will destroy the spirit of the creations. It's a documented and imperialistic mandate for the riddance of life which stands in the way of the processes ordered that destruction of the spirit will eliminate the will to continue in existence.

79-1

The scientific data being supplied on this project is obviously meaningless. If the powers that be are conducting surveillance of the so-called enemies at such depth, or maybe an alien race is based

3C

down there, the Pacific-whatever, to lie and manipulate will only result in a worsening of the situation for all involved.

Whales singing about the glory of the moment, their lineage, history, hugging each other and bellowing their joy of their creation, the basic tenet of love to be intentionally shattered by consistent waves of sound of such all encompassing magnitude as that it can be heard across the world.

The radar, their feelings, the reality is not only altered. It is destroyed, and as the list of extinct species grows larger and larger, the obviousness of alteration of a species habitat is quite evident.

Whatever defensive posture this device may be seeking and its utilization can be done differently. Perhaps the billions spent on this, as on the cure for cancer, can be spent on cleaning up the garbage that causes the cancer: the air pollutants.

79-2

32

It's obvious by the patterns of the atmosphere that a warming is upon us. It is possible

to help the earth heal from the centuries of abuse. *No need to rediscover its actuality. The only need is* to cease the destructive ways.

Fear and greed destroy. Use your amazing scientific knowledge to halt the destruction of the planet and not just catalogue it. Use the power to

79-3

3b

prosper in our world, to enhance all that exist. Please stop this elaborate charade. Help life create the music of harmony.

You in charge have the capacity to walk out of here and delude many that come your way with propaganda and falsification, manipulation. For whatever reason you hold so frighteningly that you aren't able to exist in a world of respect to *appreciation, deep in the ocean may exist a vast* abundance of creations that may be known to a few but are generally unknown to the many. Why interfere with their ways of life?

To me the justification provided by the institution conducting this experiment does not support any of the goals outlined.

Please stop.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Jan Murray.

MR. CHUAN: She hopes to be at the Honolulu meeting tomorrow to deliver a separate statement.

Good evening. While I am not able to attend tonight's proceedings, I appreciate the opportunity to have Ray Chuan from the Kauai Friends of the Environment express my concerns to the ATOC scientists, National Marine Fisheries Service, the agencies responsible for issuance of the ATOC permit, and especially the citizens of Kauai.

My name is Jay Murray, and I am a PADI divemaster working for Aquarius Dive Shop in Monterey, California. My duties include taking paid customers and checking out equipment, and so on.

As you may or may not know, divers in the Monterey Bay were subjected to low frequency sound transmissions during the months from July to December of 1994. These sounds were in the range of 33 to 76 hertz. When being subjected to this noise at high levels, divers' lungs tended to vibrate noticeably.

This has to be the most unusual sensation I have ever experienced either underwater or above water, for that matter.

This reaction to low frequency sound transmission is addressed in the Kauai draft EIS, in Section 4, page 139. The section is called "Potential Resonance of Air Containing Cavities."

80-1

The scientists here quote from studies that seem to conclude that there shouldn't be a problem from sound transmission between 20 and 100 hertz. I must say that through personal experience, these conclusions are dead wrong. I'm quite sure the 33 to 75 hertz transmissions produce exactly what the section heading addresses.

182

In the last sentence of Paragraph 2 they say, "This intrathoracic pressure is about twice that of the external incident pressure at the resonant frequencies, indicating a degree of enhancement of the pressure by resonance."

If interlung pressures are increased by resonance, then this will quite possibly affect the time divers can remain at any given depth. This time-depth relationship is governed by the amount of nitrogen forced into our blood streams by the increased pressure at depths.

If these very basic rules of diving are violated, divers risk getting decompression sickness, a dangerous and possibly life threatening condition.

I am trying to stay within my field of expertise as a diver, but I must say that if you have lungs the size of whiles and have to endure the effects of the resonating lungs over even a short period would be very unpleasant to say the least. To think that ATOC plans on long-term transmission is terrifying.

How would you like to be a humpback whale on a journey from northern feeding grounds to the waters of this beautiful island only to be confronted with ever increasing intensities of lung rattling, annoying and possibly dangerous sound waves?

I believe if ATOC is granted a permit to harass marine mammals, the ocean and the plant earth will never be the same. Look at the graph in Section 2, page 11. It clearly shows the ATOC HX-554

transducer will produce a level of 120 decibels at a range of 12 kilometers from the source. You then have to go to a range of 158 kilometers to reduce the sound level to 110 decibels. This is well above natural background noise. The ATOC transducers are designed to ensonify the entire northern Pacific, and that's exactly what they'll do if allowed to proceed.

HEARING OFFICER NITTA: Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you. David Seielstad.

MR. SEIELSTAD: My name is David Seielstad. My wife and I reside in Princeville on the North Shore of Kauai. I speak in opposition to the ATOC proposal as delineated in the revised EIS being discussed this evening.

From the beginning the ATOC proposal has had the aroma of a military research project. It's funded by DOD money. It's administered by the U.S. Navy. The originators of the project seem to be going to great lengths to disguise and conceal the true nature and the purposes of the project.

In the proposal, page 62, provision is made to, quote, "manage classified aspects of the project," unquote. The Johns Hopkins University applied physics laboratory, a major Navy research and development contractor, is to use its clearances and store any classified data.

The military seems to have a pension for secrecy. If a few words are committed to paper, someone invariably will classify the document. There are numerous examples of reports being written and then labeled secret so that even the author of the document cannot have access to it.

Secrecy classifications are often used to cover up embarrassing failures of military action. Seemingly nothing is immune from the military desire to hide information. A few years ago it was revealed the U.S. Army had expended a large amount of money to study a sophisticated weapons system. The system was considered so advanced that a top secret classification was put on the study.

What was the advanced weapons system? It's the bow and arrow. I am sure our ancestors would be

astounded to learn that the technology of 35,000 years ago is considered a secret to be kept in the 20th Century.

What is ATOC really? It is being promoted as a study of global warming, perhaps to save the planet. It is said that great care is being taken to safeguard animals of the seas.

Who could be opposed to that? If something is cloaked in the aura of environmental research, I guess we all are expected to stand up and to applaud it as good science.

ATOC is not good science. It is only masquerading as environmental research. Why is the Defense Department funding this project? Why is the U.S. Navy involved? Why is one of the major submarine training ranges, PMRF, being picked as the site of part of the experiment? Why is all of this being brushed under the carpet?

If this is not anti-submarine warfare or submarine communications experience, then what is the explanation for the actual laying of necessary cable from PMRF to the site of the ATOC boom box by a U.S.

Navy vessel? Why is this only being revealed after the fact?

In September 1994, local divers reported that a woman was working on ATOC at PMRF. Scripps Institute, ATOC liaison person, Ms. Cindy Rogers denied that any ATOC activity was being performed at PMRF at that time. In the EIS Scripps discussed laying of a cable and connecting it to an on shore facility at PMRF. That's in the draft EIS, page 5-12.

In a related application to the DNLR, conservation district use application KA-2734, dated 8/25/94, Scripps requests after the fact permission for the cable in a letter dated December 21, 1994, to Paul Kawamoto, State Aquatic Biology Program Manager. Andrew Forbes, ATOC Program Manager admits the cable was actually installed in October 1983. That's what his letter says. I believe he means '93, and goes on arrogantly to state that since the Navy did this, no permit was needed.

When it suits their purposes, the ATOC office hides its activities behind the military. If this project is not about global warming, but rather

an attempt to find a higher frequency and thereby increase the BAWD (phonetic) rate of communications with U.S. Navy submarines, I would appreciate it if the parties involved would admit it.

The waters of Kauai do not have to be used for such a project. The Navy already has numerous underwater arrays. There are other places in the world from which VLF and LF broadcast can be made without harassing and driving away whales from the winter migratory waters off the North Short of Kauai.

Thank you for this opportunity to speak in opposition to the proposed ATOC experiment.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Marlene Stelling. Marlene Stelling.

Mary Ellen Sussex.

MR. CHUAN: My name is Mary Ellen Sussex, a resident of Princeville, Kauai.

I oppose the ATOC project for the basic reason that it does not really do anything for the protection of our environment. No one from the ATOC

82-1

project has explained how measuring the temperature of 3c

1,000 feet down in the ocean is going to say anything about what is going on in the atmosphere above.

82-2 Why don't you people give some thermometers in the ocean not too deep down to get the temperature? That ought to be a lot cheaper than the 30 or $50 million you will spend, and it won't affect the whales or other creatures, including humans who may be swimming or diving. 5a

I think you people are just playing an expensive game with the taxpayers' money.

82-3 Even if you were to find out ten years or longer from now that there is global warming, what good will it do? It will already be too late to do anything about it. You should use thermometers if you must know ocean temperature, but use the big money to educate the public about conservation to avoid global warming. 3b

(Applause.)

HEARING OFFICER NITTA: Thank you.

Jake Welsh. Jake Welsh.

Andrew Forbes.

DR. FORBES: Good evening. My name is

Andrew Forbes. I'm program manager for the ATOC project. I come from Scripps Institution of Oceanography. I also come from an island community in the Southern Hemisphere, and my home institute is on the island of Tasmania, the southernmost part of Australia.

I'd like to address some points that have been raised in comments that we have received both on the California and the Hawaii EIS already. There are many positive and many negative comments on the EISes, but I'd like to just select a few to --

MR. CHUAN: (Inaudible.)

HEARING OFFICER NITTA: According to what I've heard, Dr. Forbes will be expounding on comments that have been received, scoping comments that have been received, in preparation of the EIS. Is that correct?

MR. CHUAN: (Inaudible.)

DR. FORBES: What I intend to do, Dr. Chuan, is to address then some of the commonly expressed concerns about the program, whether or not they have been received in a formal manner on the

EISes, but just as you addressed the issues that are of concern to you in the project and in the EIS, I would like to address some of the issues that are of concern to me as a result of receiving input, let's say, from members of the public.

HEARING OFFICER NITTA: I think that follows the guidelines of what we were talking about because we are talking about comments on the DEIS, and what Dr. Forbes will be talking about will be comments that were received during preparation of the EIS and during this process. So I believe that falls within the parameters of what we have been talking about.

DR. FORBES: Right. Thank you.

I'd like to say that we have a policy in the ATOC project of being as open as is humanly possible about our proposed activities. We have a policy of open communication, and although we're a scientific research program and do not have a public relations office like a developer perhaps would, I mean most, 99 percent of our funds are directed towards the research program itself, and we try to minimize the expenditure on any activity that could be

interpreted as wasteful PR, let's say.

But we do try and put together materials and communicate with people on an honest, open basis, and as I run the project office, I think quite objectively, I think we go to great pains to answer every inquiry that we receive and to make available to the public any information that is sought.

We do this also with the appropriate agencies and government representatives, and when we receive a letter, whether it's a scoping letter or a letter from an individual or from a group, we attempt to respond with the correct technical information.

As soon as any particular activity has some plans that are mature enough to be released to the public, then we do so, and for example, for one of our routine activities, which is the acoustic engineering test which we conducted in November, we, as early as July of 1994, stated our intention to conduct such a test at a San Francisco meeting convened by Dr. Sylvia Earle at the California Academy of Sciences in Golden Gate Park, and at that meeting many environmental groups, their attorney groups, like the Sierra Club

H-83

Legal Defense Fund and the Natural Resources Defense Council, attended that meeting, and we discussed quite openly our proposal to conduct an engineering test of the source in a location that at that time was unknown and not speculated up.

83-1 But we received input from many of the groups and individual environmental scientists at that meeting, and as the summer progressed and our plans matured, we tried to keep people informed as to what the nature of that test was and where it would be conducted and how long it would proceed. 3a

HEARING OFFICER NITTA: Dr. Forbes, I'm going to have to ask you to wrap up soon.

DR. FORBES: Right. So I just wish to say that we're not a secret organization. I spend a great deal of my time on the phone and in writing letters. In fact, this past year I have got much less than my normal amount of research work done and scientific publications on my computer. I spend a great deal of my time talking to people and writing to them both on the E-mail and electronic media, and I welcome your comments here and any comments received tonight will

H-83 H-84

be addressed in the final EIS.

Thank you.

HEARING OFFICER NITTA: Thank you, Dr. Forbes.

Chris Clarke.

MR. MOBLEY: I'm reading a statement by Christopher W. Clarke, Director, Bioacoustics Research Program at Cornell University and Director of the Marine Mammal Research Program for Scripps Institute of Oceanography.

The Marine Mammal Research Program for Kauai as associated with the ATOC project began two years ago. During those two seasons in 1993 and 1994, the primary goal of marine mammal research was to observe the normal winter breeding and calving activities of humpback whales off Kauai. 84-1 In this case "normal" includes all of those situations that involve a variety of human made activities, including boats, both private and commercial, ships, helicopters, and airplanes. Such human activities are known to introduce various amounts of unregulated and poorly documented disturbances into the whales' environment. 8a

Therefore, it was important to describe how the animals respond to this background prior to the operation of the ATOC source.

A second goal of the MMRP was to quantitatively document the distribution and relative abundance of whales throughout the Hawaiian Island chain. To accomplish these tasks, a team of some of the best marine mammal scientists in our country was formed. In 1993, Dr. Joseph Mobley of the University of Hawaii conducted over 4,600 miles of interisland surveys that have provided Hawaii with its first transect based aerial survey ever.

B4-2

This year Dr. Mobley is conducting another 4,600 miles of state-wide survey. Through this process the goal is to build a standardized series of surveys which if conducted at regular yearly intervals will serve as the basis for determining long-term population trends for the Hawaiian humpbacks and for evaluating whether their distribution around the islands is changing as a result of human activities, in this case the operational ATOC sound source.

This is the way that we chose to determine

8b

if the ATOC project is having a long-term impact on humpbacks in Hawaii. For the past two seasons we have successfully conducted the most extensive observations of humpback whales ever. This effort included observers on the cliffs in Princeville and on the Kalalau trail, using the best equipment and techniques available to describe the whales' movements and behaviors.

From dawn to dusk, from January through mid-April, observers in an airplane filmed and documented the behaviors of whales at and below the surface throughout the north Kauai region.

Finally, we used an entirely passive set of hydrophones for listening to the whales and all the sounds in their environment so that we could describe their singing behavior and to track movement of the singers.

As a result of these observations, we have collected over 1,000 hours of observations, describing the details of males competing for females, females nurturing their calves, singers crooning night and day, all within the normal daily routines of wind

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surfers, scuba divers, tow boats, fishing vessels, et cetera, and from this we now know that our techniques of observations that include carefully counting such things as breathing rate, duration of dive, the number of songs are sensitive enough to detect the subtle effects of one whale on another whale, as well as the effects of one boat on a whale.

And so we now know that we will be able to detect even subtle effects of the operational ATOC source on the whales should such effects occur.

This year, right now as this is being read to you, we had planned to take an important step toward answering a vexing question relating to the ATOC sound and humpback whales. Throughout this heated debate on the possible influence of ATOC on marine mammals, we have heard numerous predictions on what may or may not happen if the project is allowed to proceed. A lot of the argument has been based on the statement we don't know.

We don't know how whales and other animals might respond to the oceanographic sound because the sound is novel. For this reason the MMRP had planned

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to conduct a series of playback experiments in which sounds similar to those proposed for the ATOC project would be played back to whales using underwater loud speaker. The logic was simple: use a small version of the ATOC sound, in this case the sound of only one percent as loud as the one proposed by ATOC, and present this miniature version to whales after they had been carefully observed. If they respond by fleeing and evacuating, then we have every reason to strongly advise that ATOC not proceed.

If whales continue to behave as they do under normal circumstances, then the project would be allowed to proceed into a pilot phase, which would commence once the ATOC source was installed nine miles offshore one half mile deep.

During the pilot phase, we, the MMRP scientists, would have control over when, how often, and what intensity the ATOC source would be operated. This would give us enough time to evaluate the impact of the real source on the whales before it became operational.

Thus, for example, if during the playback

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experiments aerial surveys showed that whales were leaving the Kauai area or if observations revealed that whales were responding differently than they do under normal circumstances in a way that could prove harmful or decrease their population, then that would be evidence that ATOC should not become operational.

Unfortunately, as many of you know, I canceled this year's playback research project because opposition from certain groups and their legal representations threatened to sue the National Marine Fisheries and others because our research plans were not part of the EIS process, and so we reach the lofty plateau of Catch-22.

I can now say that several of the groups that threatened a lawsuit have decided not to pursue it because there is nothing to pursue.

Although humpback whales are the species of primary focus in Kauai, the MMRP team is also working on understanding other species as well. This includes toothed whales and turtles. For turtles in Kauai, we have conducted daily scans along the North Shore in order to document and describe the occurrence of green

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sea turtles. To better understand how the ATOC sound might affect sea turtles, I am working closely with Dr. Scott Eckert to conduct research on the response of leatherback turtles to ATOC and other low frequency sounds.

For toothed whales, several efforts are underway. Two Hawaiian marine mammal scientists with expertise in dolphin sounds and hearing are testing animals to determine their thresholds of detection to the ATOC source. By this effort, we hope to learn how well the animals can hear low frequency sounds and thus be better able to predict whether or not the ATOC sound could disrupt their lives.

HEARING OFFICER NITTA: Dr. Mobley, I have to ask you to wrap up shortly.

MR. MOBLEY: To summarize our research efforts, for the past two seasons the MMRP has collected and will continue to collect extensive baseline information on humpback distribution throughout the Hawaiian isles and the behaviors of these magnificent animals during their annual stay off Kauai. These data form the basis for evaluating potential effects of the ATOC sound on the whales should the ATOC source become operational.

It all comes down to a matter of principle and trust. Those of us who have committed ourselves to working on this ATOC marine mammal problem are dedicated to understanding the lives of marine mammals, how they survive, their populations, and the things that affect their lives and populations.

If all of us are going to make informed decisions about our actions on the environment, especially on this matter of human made sounds in the ocean, we must begin to gather knowledge about how well the animals hear and what they hear, how they use sounds in their lives, and what effect do human acoustic excursions have on their lives, especially as it relates to their chances of surviving and growing.

Thank you.

HEARING OFFICER NITTA: Thank you.

PARTICIPANT: I have a question.

HEARING OFFICER NITTA: Yes, sir.

PARTICIPANT: (Inaudible.)

HEARING OFFICER NITTA: They're allowed to

give public testimony as well. In my opening statement I explained that they would like to present testimony during the public statement period, their testimony.

PARTICIPANT: But they are --

HEARING OFFICER NITTA: Rather than giving long presentations as they have in the past.

PARTICIPANT: (Inaudible.)

HEARING OFFICER NITTA: Yes, they are.

PARTICIPANT: (Inaudible.)

HEARING OFFICER NITTA: That question, I think, is not applicable to this hearing, and I'd like to go on to the next speaker.

Dr. Munk.

PARTICIPANT: (Inaudible.)

DR. MUNK: My name is Walter Munk. I'm principal investigator of ATOC, and as was said, instead of taking the time with long public statements which we did a year ago, we thought it would be better if we make comments on the comments that we have received, which we hope will be useful information in trying to understand what we're trying to do, and I will proceed along these lines.

Beau Blair, if I may be permitted to say, quoted Karen Hewlitt; is that correct? In a statement about a paper of which I'm senior author, which is perfectly correct, quote -- and I just want to say that what the statement was is correct. Ours is a measuring program and not a program of building theories, and I will accept that.

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Now, many of the comments that have come into the office have dealt with the fact that global warming is already understood and why bother to spend public funds to learn something about it. You will find that people who write papers on the subject of global warming come to widely different conclusions. Some of the papers indicate some extremely severe changes in the ocean environment, so severe that I would think anyone who's concerned with the environment of the ocean would take these changes very seriously. They will affect every country in the world with a seacoast.

Others have come to the conclusion that because of certain physical phenomena, like feedback

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from clouds, certain types of computational problems, the validity of the concept is not established. I think the problem is wide open and my commitment to it is that I think there is a great danger to the environment and what it will require is observations to make clear whether something of this sort is going on, and I'm totally and happily committed in trying to make a contribution to a subject which I think is important to all of us.

Observations so far are mostly in the atmosphere. Yet everyone, people who disagree widely, have agreed that the ocean is the essential, the determining element in the atmosphere ocean system. If you don't get the ocean right, you're not going to get the atmosphere right.

Furthermore, the ocean changes are absolutely essential in their own right, quite aside from the relation to the atmosphere. They affect sea level in a very real way and one that should be of concern to the people who live on this island.

They affect the circulation of the oceans in a way that will be important to marine mammals.

Some of the predictions, in fact, say that the entire overturning and the entire access of the deeper ocean to mutants and gases will be stopped in about ten or 20 years by the increasing temperature of the upper ocean.

Now, let me comment on three or four things that are in my field which have been commented upon by many people. One, that the time constant, the time it would take for warming to reach a depth of 3,000 feet where our sources are located is 10,000 years, and therefore, what we're doing has no relation to global warming.

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The statement is wrong. The time it takes to affect waters at 3,000 feet is of the order of ten to 20 years. The statement is false.

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Secondly, the fact that our sources are at a depth of 3,000 feet means that we're measuring the ocean at 3,000 feet. False. Our -- even though the sources are at that depth, the information we get deals with the entire water column.

Another comment which has frequently been made, it goes under the name of problematic things

that we, starting a relatively short-term research problem, should be concerned about what would happen with the long-term results of such studies would be.

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We have refused to do so. We do not know how things will come out. There are many things we don't understand. We've always said so, and we refuse to fill papers and bore the public with idle speculation. We're not going to write a document about what might happen if we don't know anything about it.

HEARING OFFICER NITTA: Dr. Munk; I'll have to ask you to --

DR. MUNK: All right. I will wind up.

The reason why we're in this business is that we're as committed as others. We think the problem is vital. We think the information that exists is very sparse, and we think we have a contribution to make.

I'd like to remind you, as Dr. Nitta has said, that this is not a very good forum to answer many of the questions that were raised here, like the classification question. I would welcome if those of you who care to would stay behind at this meeting and give me a chance and give us all a chance to give you straight answers to any questions you care to ask.

Thank you.

HEARING OFFICER NITTA: Thank you.

(Applause.)

HEARING OFFICER NITTA: Dan Shook.

MR. SHOOK: My name is Dan Shook from Kilauea, Hawaii.

ATOC under its ridiculous disguise to in some way measure the effects of global warming, which may already be beyond the possibilities of a manmade remedy, does not in any way address the real problem at hand. It's the pollution of our planet and the destruction of our rain forest that need to be dealt with.

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I do not believe that this experiment which is financed by the Defense Department and could ultimately cost taxpayers up to $100 million could in any way possibly help to solve global warming. Why should we harass the depths of our ocean with noise pollution when we are doing little or nothing here on

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the surface to remedy the real problem? Wouldn't it make more sense to focus our time, energy, and money towards solutions instead, or will we continue to play experiments until it is too late to make an effective change?

The draft environmental impact study is a blatant example of wasting taxpayers' money and not honestly answering the real threats that will come from the ATOC project. Most of the draft EIS deals with the ATOC associated mammal research program, which should show hopefully that whales will not be affected. All the draft EIS really says is that almost nothing is known about the effects of low frequency sound on marine mammals. The effects are presumed to be insignificant, presumed to be insignificant.

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Presume is the same as not knowing at all. Insignificant? To whom? Perhaps to scientists who only really care about making a name for themselves, or the people involved who will get a piece of the millions that will be spent on this smoke screen, or insignificant to the Defense Department who we all know specializes in killing and wasting money.

Or how about this part? In summary, the potential for adverse impacts from long-term exposure to the source sound fields is unknown. However, all marine mammal exposures to subsea sounds will be minimized wherever feasible.

Or even worse, the conclusion for all six categories of potential effects ranges from uncertain to uncertain, but presumed low to moderate, provided assumptions are correct, to none, provided assumptions are correct.

Let's cut the crap and assume we really know nothing. ATOC is an example of total disregard for the well-being of marine life forms. We can effect a change today against global warming by

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encouraging fellow residents of our world to replant the forests. We should be developing alternatives to fossil fuels. We should stop burning holes in our atmosphere with rockets. We should stop wasting money we don't have on useless experiments that will not help solve anything.

We should respect our ocean as our mother,

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not as something to experiment with.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you. Rebecca Miller.

MS. MILLER: My name is Rebecca Miller, and I'm a resident of Hanalei.

I'd like to share some of my own experiences tonight that I think relate to the ATOC project. After I graduated from college and was working in an immunology lab 15 years ago, part of my job was to stay current with the latest scientific literature that pertained to our study. I learned to discriminate between the meaningful papers that were scientific, clear, simple, and unbiased, and the papers whose writers hoped to make an impression with their words to cover the weaknesses in their data.

I recently looked through the environmental impact statement for the ATOC project. I think an EIS report should be just as scientific as any research

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paper, but I did not see clear and simple, unbiased, scientific information. Instead, what I read were

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persuasive arguments for the ATOC and sweeping statements that were not backed by scientific research.

Personally I have no idea of what effect these projects might have on whales and sea turtles. As the EIS report states, there is very little research to draw on to determine if there may be a problem. No one really knows.

Yet the EIS report goes on to assure us that any problems are unlikely. We are left without any scientific evidence, only the word of the experts.

I feel we have good reason to question the validity of this ATOC project. I think it is important to determine whether the whales and the other sea creatures will be harmed by the noise pollution created by this proposed project, although I think there is an even greater concern.

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It has been approximately 30 years now that our nation has been aware of the environmental crisis on the earth. We know many of the effects of clear-cutting the rain forest, and we are aware of how devastating the pollution of air, water, and soil have

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been.

I think it is obvious to all of us here that now, after 30 years, we definitely have a problem. I think spending $50 million of taxpayers' money on a project that can only answer yes or no to the question, is there global warming, is a tragic waste of not only money, but precious time we could be spending on cleaning and caring for the earth.

The American citizens who would pay for it would still be living in a polluted environment, regardless of the outcome of this experiment.

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Another concern of mine is why the proponents of the ATOC project were so hesitant to do an EIS report in the first place. If they were truly interested in somehow saving our environment by measuring global warming like they say, then I would think they would be eager to study any ill effects the project might have on the earth.

I can see no purpose in checking for global warming other than to affirm what we already know, that we need to begin cleaning and caring for the earth, and we need to begin now.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Alberto Partita.

MR. PARTITA: Aloha. My name is Alberto Partita, a 16 year resident of Waimea, Kauai. I served four years in the military Secret Warfare Design Branch of the U.S. Navy. Twenty years experience in the high tech repair, healing military, strategic and performing arts gives me a specialized perspective and opinion.

In my opinion, this global warming experiment proposal and this draft EIS is scientific double talk, cover-up for more of the same global exploitation and pollution which adds to the global warming problem, not solution; more waste which we do not need, considering the present world crisis and 40,000 and more children dying each day from lack of life energy.

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We can be more creative on how to expend this 36 million tax dollars. Global preventive medicine measurement seems like a better direction. 1

Big business strategy is same as military war strategy. Please read art of war manuals to see same tactics used in draft EIS sales pitch and proposed experiments, such as divide, confuse, and conquer, dense information, infiltration, secrecy, and other deception tactics.

Genocide warfare has many secret tactics. The killing of American Indian buffalo for high profit

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was secret front to exterminate North American Indians, to better steal their land and resources. 20 Could this global warming testing be undercover and under ocean front to eradicate sea life food source? Is there any truth to master plan to exterminate all Hawaiians in 45 years, to better secure legal title of Hawaii lands?

As Hawaiian sovereignty and independence movement gains creditability and momentum, military build-up gains more U.S. defense proposals and projects like Star Wars' latest super radar weapon on Krokai (phonetic), and more nuclear submarines and monitoring systems, perhaps all part of a much larger new world order proposal or operation.

Something of this magnitude does not happen overnight, but takes many years in many parts to construct. All in progress unfortunately if we continue to allow it.

World people exposure to what is nourishing for our world family body and what is corruption begets adjustments in a more life constructive direction. People pressure not our corrupt legal system. It's important to remember it is same scientists and others for this global experiment who were caught red handed and exposed for conducting their under ocean, money spending front last year in secret and in violation to Hawaiian people and U.S. laws and regulations.

What we have tonight at this hearing is more face saving defense. Can we really expect credibility from these ATOC people this time around? In my opinion, I think not.

Proposed hydrophones in Waimea Bay is too close to my Wainea Valley home. The irony of this proposal for whale and global warming monitoring system is that many years ago a global hydrophone,

Cold War enemy submarine monitoring system, was installed secretly under national security classification defense code, all as obsolete as the Cold War unless be buy this new, improved scam application insanity. The same military operation with new, sugar coated covering.

Put focus on whale study and global warming testing is a very clever distraction, art of war strategy, tactic. Whether direct or indirect, I recognize in this ATOC project global genocide. No action is my vote in this draft environmental impact statement alternative.

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Mahalo.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Joe Mobley.

MR. MOBLEY: My name is Joseph Mobley. I'm associate professor of psychology at the University of Hawaii, West Oahu, and principal investigator of the aerial survey task for the ATOC MMRP. I am one of four co-principal investigators of the Kauai portion of the ATOC MMRP. The other principals include Drs.

Chris Clarke, Director of the MMRP; Bernd Wursig of Texas A&M University at Galveston; Adam Frankel of the Cornell Bioacoustics Research Program. These individuals are among the most knowledgeable in the country with respect to the acoustic lives of marine mammals.

The list of additional researchers who have been associated with the MMRP consists of another 20 or so scientists, all of whom possess years of experience in making quantified observations of marine mammal behavior.

I personally have been involved in marine mammal research with the U of H since 1978, with the primary focus on the behavior and distribution of humpback whales. For the past five years I have focused on assessments of the distribution and abundance of humpback whales throughout the Hawaiian Islands via our aerial surveys.

All of us on the MMRP are scientists who have dedicated our lives to seeking greater understanding of these magnificent creatures. All of us are committed to contributing information from this

project that will lead to the protection of these species for years to come.

It disturbs me that we are being cast on opposing sides of the fence on this issue, scientists versus environmentalists. I, like most marine mammal scientists, have always considered myself to be on the same side, and that we are both groups seeking ways to protect these animals.

In my case I do it by seeking answers to questions, like how many whales are there, what source of habitat do they prefer, do they react to things like vessels in their proximity.

The environmentalists protect these species and their habitat primarily by seeking the enforcement of existing laws and by advocating the creation of new laws where a need is perceived. In doing so, environmentalists have always relied on scientific findings as the basis for this process.

In this way we would seem to be in a symbiotic relationship of sorts. However, in this case that relationship has broken down in a way that troubles and perplexes many of us.

I lecture my students on the importance of distinguishing information accepted on faith versus information that is acquired empirically. Faith is sufficient for some aspects of life, like religion, but does not work well in providing evidence for science or law. One cannot challenge information accepted on faith, but one can challenge empirical information.

Very simply, if one can show it to be true using accepted methods, then one can accept it as such. What appears to be happening here is that many of the people testifying today have accepted on faith alone that the ATOC project represents the potential for devastating effects on marine species. I can safely say that it must be faith since I know that as yet there is little clear evidence that sounds of this type cause changes in the behavior of whales.

We simply need more evidence on this issue. 89-1 This project has given marine mammal scientists the chance to address that issue using the best methods known so that we can go beyond faith and on to true empirical understanding, and if it is shown to be so, 3d

then these results can be used as evidence to protect these species from other forms of low frequency sounds which have been routinely injected into the oceans for years.

The most disturbing statements I have seen in the press and elsewhere suggest that the MMRP scientists are in the least case biased in their approach to this problem or in the worst case totally bought out by the ATOC project.

Science is the pursuit of truth. All a scientist has is his or her reputation for telling the 89-2 truth. Without that we cannot do the work that we do. It ultimately comes down, as Chris Clarke stated in his testimony, to a matter of principle and trust. All of us have established reputations for telling the truth in our research communities. Otherwise we would not be involved with this project. We have no reason to start lying to the public now. 162

The truth is that we need to know what the effects of this sound and similar low frequency sources are, what sorts of changes occur in the behavior of animals exposed to them, and whether these

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effects represent the potential for harm or not.

We ask that we be given that chance. Let us do our work.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Ann Stirling Frisch.

MR. CHUAN: My name is Ann Stirling Frisch. I'm an associate professor of education and human services at the University of Wisconsin, Oshkosh. I have a Ph.D. in human ecology from Michigan State. I'm concerned about ATOC as an environmentalist and as a human service professional.

So I am concerned about the broader issues of health and well-being of the planet and of its inhabitants and for the appropriateness of the expenditure of $56 million at a time of national, state, and local budget cutting, particularly when we are cutting the poorest of the poor, our children.

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I have already registered my protests elsewhere about the ATOC project, but having been in Kauai during the month of January, I want to further

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lend support to the Kauai Friends of the Environment in their protest of this expenditure of federal dollars, as well as the project itself.

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I have studied the proposals for the ATOC project and find them seriously flawed. The purpose and rationale for the project are unclear. So it appears that there is some hidden reasons for the project. The laundering of the federal funds is inexcusable. The lack of adherence to the environmental protection laws is unacceptable. 3a

The spending of $56 million for a project with on visible or important purpose is unacceptable and foolish.

What alarms me the most is that we do not know what the consequences will be of loud and repeated sounds underwater. Even if there were some valid purpose, it probably should not be done. We should not assume that we can monitor the movement of

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whales at any level and conclude that there is or there is no impact. Harm to their sensory systems might not be detectable. 6a

Moreover, damage might not accrue for a

decade after the project is over. Even if there were no damage to whales, it might damage other sea life and, in fact, might change the entire ecosystem or critical parts of it. It might not result in damage until long after we stop monitoring. It might be too late to stop the damage.

Please, an emphatic "no" on this project.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Norman Frisch.

MR. CHUAN: My name is Norman J. Frisch. I'm emeritus professor of mathematics at the University of Wisconsin, Oshkosh. I have a Ph.D. in mathematics from the University of Michigan.

I am opposed to the ATOC project both in its purpose, methodology, and possibly harmful consequences. In terms of purpose and methodology, it

91-1 doesn't meet the requirements of good scientific research. The purpose is unclear and confusing, it appears, even to the nine researchers. 3a

The methodology of measuring low frequency

91-2 sound waves at considerable ocean depths is not a good 3d

measure of global warming. The methodology of observing whales at surface is not a good measure of the effect to marine life at the depths of the sound source.

I believe it will not serve any useful purpose except the generous employment of researchers and lobbyists. I am opposed to the expenditure of funds when there are so many needed studies in the area of global warming and protection of marine life. This project would do neither.

Not only would it not serve these purposes, but it could harm marine life in ways which we cannot anticipate.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Don Heacock.

MR. HEACOCK: Thank you.

My name is Don Heacock. I first want to come right out and say I'm undecided. I've critically read the EA and the draft environmental impact statement. I'm not an expert in marine mammals, although I can speak very highly for Dr. Mobley and all of the work they've done.

I want to bring out a couple of comments though that I think may help some of us here. I think it's really important what was stated earlier, that ATOC -- what is being proposed is simply a measuring process. It's not going to allude what we should do as a society or at a global level.

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Let me just briefly read what I prepared, and then I'd like to wrap up with something.

I think the concept of needing to measure from a scientific point to being able to document that temperature is either increasing, decreasing, or staying static is an important basic question, and that's what it is. It's basic research because you don't know what you will do with that information when you find it out.

For example, we know that cigarette smoking kills people, and yet we've been ineffective in Hawaii with even banning cigarette smoking in restaurants. It can't be done.

And I think I'm going to take Dr. Munk up on his offer to talk story afterwards. I think that

would be productive, but just briefly, I only have three short paragraphs.

I think regarding the MMRP I've worked indirectly with many of those people for a lot of years, and I'm not a whale expert. They are, and I do trust them.

However, I'm very concerned about the high technology developments corporation, that is, the Center for Excellence for Research in Ocean Sciences' recent withdrawal of their proposal. I know a little was explained why they withdrew, but we've lost a whole year's data on how those potential playback sounds might have affected whales in our near shore waters. I know we can't turn that back, but I think that's unfortunate.

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We do need to continue research on whales. They're of economic, environmental, and of social importance.

Secondly, I'm concerned that in the overall draft EIS there's been no apparent effort made to suggest other types of alternatives. For example, as Dr. Munk pointed out, it is a measuring device, and we're basically dealing with a very complex ecosystem, planet earth. The latent heat capacity of water, differential warming all over the globe. The ocean certainly is the largest body of water on planet earth, but we also have another ecosystem that may be very easy to measure and we may be able to gather data on increasing, decreasing, or static ambient water temperatures very quickly, and that would be by plugging into the program called GREEN, the global rivers environmental education network, and start to monitor spring ecosystems, "punawai," freshwater springs all over the tropical and subtropical world.

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I believe GREEN has about 137 countries, albeit they are mainly focusing on rivers and streams which have much more variability in ambient water temperature than do groundwater springs that spring out of, for example, here in Wili Wili, Waikaa (phonetic) spring that probably is fed by the base of Mount Waialeale. There are very homogenous, consistent water temperatures there.

If the null hypothesis were thrown out, are global tropical spring ecosystems increasing,

decreasing, or remaining the same, we might be able to do that in a similar time period, maybe even shorter. You might have some information in less than five years.

But again, how will we apply that information? How will we stop the burning of fossil fuels and the deforestation of tropical rain forests?

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I think I really am torn as a scientist and a citizen. There is no question that our most environmental pressing issue on this planet is global warming, and there is mixed opinion amongst the scientific community about that, as there are many issues, and the cost, the cost is important here, although we have spent -- "we," I mean the government generally -- has spent lots of more dollars on things that are less noble. I still have a concern about the cost.

The unknown environmental impacts, yes, but what is the consequences of us doing nothing? So, again, I'm undecided. I will send in my final comments. I believe the deadline is March 9th?

HEARING OFFICER NITTA: That's correct.

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MR. HEACOCK: And thank you.

I would take Dr. Munk up on his recommendation. Thank you.

HEARING OFFICER NITTA: Thank you, Don.

(Applause.)

HEARING OFFICER NITTA: Bridget McBride. Is Bridget McBride here?

Rob McReynolds?

Melinda Sandler.

MS. SANDLER: Hello. I'm Melinda Sandler, slightly short.

In the time available, I would like to discuss the issue of the scientific validity of the ATOC project. The Nuclear Monitoring Office of the Advanced Resource Projects Agency, ARPA, of the Pentagon issued a broad agency announcement in early 1992, supposedly to begin the process of soliciting proposals from the scientific community to study global climate.

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The Director of ARPA, Gary Denman, in a letter to Congresswoman Patsy Mink claimed that, and I quote, "the BAA vehicle was employed instead of a

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request for proposals to accord the broadest possible response with the conceptual and applied technology, while retaining the highest competitive process."

What happened with this highly competitive process seeking the broadest possible response is that a team of institutions bid together under the leadership of the Scripps Institute for Oceanography, and this was the only bid.

In the public and commercial sector, I believe this is known as "bid rigging." It's a common practice, but it's frowned upon in this country.

Furthermore, the Scripps proposal asking for a sum in tens of millions of dollars did not go through the customary peer review process. The proposal makes no attempt to justify the asserted relationship between deep ocean temperature and global warming other than to say that the problem is a nontrivial one.

I believe anyone in this hearing hall could have told them that, too, for free.

There's no reference in the proposal to any published work by the principal investigator on the

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subject of global warming, and in the face of work of dozens of researchers worldwide addressing specifically the problem of global climate modeling under the sponsorship of more than a dozen federal agencies with a budget in the billions.

Despite this glaring absence of scientific justification and the lack of reference to existing work, ATOC makes the astounding statement in the executive summary of the draft EIS: "generally speaking, all of the alternative scientific methods for addressing the global warming problem are either included in this project," meaning the ATOC as proposed, "or it would not meet project objectives." This is on page ES-11, Kauai DEIS.

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One wonders if all of these other scientists are just spinning their wheels while spending billions if the ATOC for a mere 30 or $40 million can supplant the work of all these others costing billions. I think someone should call Newt Gingrich or maybe his buddy, Rush Limbaugh.

Most of the draft EIS deals with the associated marine mammal research program, and

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presumably this is intended to show hopefully that the whales will not be affected by the ATOC, and since Chris Clarke isn't here, I certainly wouldn't be rebutting him to say that -- well, actually let me go to this first.

We have a joke about contract archaeologists on this island. If you get paid not to find something, you're not going to find anything. So, you know, as Mother always said, marine biologists who laid down with dogs wake up with fleas.

I'm going to yield the rest of my time because I'm getting mad.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Arius Hopman.

MR. HOPMAN: My name is Arius Hopman. I have a Bachelor of Science cum laude.

I think it's very interesting, the difference between the two groups: the scientists here and the people who testify on behalf of the planet. The scientists very coolly assume that they are the authorities here and that everybody else is some kind of a yo-yo.

What I would like to point out is that during this century science has been the primary motivator of global changes that we are now trying to study. The world life forms have been in existence for about a billion and a half years. There has been a dynamic balance for a billion and a half years. We come along and in one century we trash out this planet, and we think that we're scientists. We think that we are logical people. We think that we're in control, and the scientists, the universities still believe that they're in control of the situation.

And in the meantime, the whole planet is going down the drain. So there's obviously something the matter.

Freud discovered universal neurosis a century ago. It's been documented over and over again. Animals that are -- domesticated animals have also been proved to be neurotic while wild animals are not neurotic. One thing is very certain that psychology is finding again and again, is that the left brain, which is the conceptualizing brain, is out

of touch with reality. Concept overrides reality. That's what we see in these universities.

The universities still believe that they are in control of what's going on. What they're in control of us concept. We're a concept dominated society, and we're trashing out the plant. We have to start getting in touch with our feelings, and that's the difference between these two groups.

Technology has been trying to improve on nature. Look at what has happened. We've lost more than 50 percent of our topsoil because of technology. We have deforested over 90 percent of our virgin forests worldwide. We have pollution worldwide, atmospheric pollution, all kinds of pollution. Nuclear radiation is increasing. All of this has to do with science, by the way, and here we are mistrusting science and still science seems to be in control. Science assumes the authority.

I would like to include in the testimonial here a book by Cramer and Alstad. It's called The Guru Papers, Masks of Authoritarian Power, and I would like to have that addressed in the response.

I would like to include another book, _The Continuum Concept_ by Jean Lietloff, and a third book, _No Boundary_ by Ken Wilbur.

We have to start getting into our whole brain and stop existing out of our simulated reality brain. The simulated reality brain throws a veil over reality, over direct understanding. We have a natural ability to intuit.

When we go through 20 years of concept driven thinking, we are no longer in touch with our intuition. People in this audience who have testified here with their hearts and with their guts I trust a whole lot more than people who are coolly reasonable about seeing this planet going down the drain. It's like we standing in a house that is burning, and we're still trying to make studies of how hot it's getting instead of putting the fire out.

It's like we're just about to drive off the road, and we're doing nothing about. It's like we're just beginning to wake up to saying, "What's going on here?" We have to get in touch with our hearts, with our whole bodies. We're concept driven. It doesn't

work anymore. We can't keep pretending that we're going to fix. The "fix it" mentality is the very thing that has got us into this pickle in the first place.

"Fix it" mentality, we have been improving on nature, and this is the result of it. We have created a truly dangerous environment on this planet. It wasn't truly dangerous before. We are biologically adjusted to be in a natural environment. We are not biologically adjusted to be in an artificial environment. It doesn't work, and we can see the results right now on the plant. It does not work.

We have to step back from all of this nonsense of continuously trying to fix everything. The fixing itself is what is creating the problem. It's a vicious cycle, and this is what science and technology is doing, and we're crisis driven. Actually psychologists are very much aware that the whole Western world is crisis driven. We're in a crisis psychology mode that keeps creating more problems as it goes.

HEARING OFFICER NITTA: I'm going to have to ask you to close soon.

MR. HOPMAN: Thank you.

HEARING OFFICER NITTA: Thank you.

(Applause.)

HEARING OFFICER NITTA: Carl Stipath.

MR. STIPATH: Yes. My name is Carl Stipath. I happen to live in Haena, which is from my house I'll probably be able to see the boat, the ship that puts down this device that you're talking about. So I'm very, very concerned about what's happening here.

And I have a lot of questions about this project, and I'm sorry that I'm not more well informed, but it's very hard for me to believe people that I don't know and that I'm very concerned about how much they care about the island of Kaiuai.

I have a great deal of respect for the people who have testified, and I want to thank them for the education really that I've gotten this evening, and I know that we have some real experts in the audience today.

But one of the problems I see here is an

education or -- pardon me -- a communication problem, and I feel that the people of Kauai who happen to be one end of this project and this island of Kauai happens to be a very important part of this project, I guess, because you people keep coming back; we are not -- I don't know if you get the feeling -- we just don't feel like we're a part of what's going on, and I don't think that you folks mean it that way. I think that we need to be communicated with. We need to understand exactly what's going on here.

There are many questions that have not been answered, and I am very, very worried about a lot of things. I'm worried about a loud, booming noise that will be generated in the bottom of the ocean. I'm worried about Kauai, my home, where I live, where my children are growing up being an experiment by people who I really don't know.

I'm worried about the whales and the porpoises who I see play out in front of my house and in my neighborhood, where my children are growing up with this environment, and I think it's a real positive impact on the world.

I'm worried about people who live somewhere else coming here to where I live, making money on a project that's located here, and then leaving, maybe in a year, maybe in ten years. We're not sure yet. Whether there's damage done or not, they will leave. We will be here to live with the damage that has been created.

95-1 So I feel that we ought to try to make this an opportunity. We ought to try to generate something here that can work out for all the people that are involved. I think that there ought to be a base here. I think you folks ought to have an office here or some sort of installation here that I as a citizen or my friends that are in this audience, many of the people I know here and some of whom I don't can go in and ask people questions. 32

I'm very honored that you folks are here tonight, but it's eight o'clock on a Friday night, and I have a lot of things going on and families and things, and I'm not going to be able to spend a whole -- I live on the other side of the island. I won't be able to spend the evening here to answer and ask you

the questions that I would like to have you answer. I'm sorry.

But why can't we have a place here where we can go in and ask these questions in a regular basis, like I'm sure you have in California or the other end?

So I think that this could be an opportunity for local inhabitants of this island to become involved with your project, to learn about your project so that you could, when you leave, maybe you could leave an education behind you of some people who live here who had learned from you.

And not only that; we would have people that we know, that we trusted that would be working with you so that if something was going on -- now, it's like this big hocus pocus thing that's happening out here, and we're not sure what's going on, and we don't trust you, and we don't know you.

So I really think that in a lot of ways our main problem here is communication.

I would also like you to please, please be very careful with our future. You're playing with the future of our island where we live, and please be very careful not to damage it.

Thank you very much.

HEARING OFFICER NITTA: Thank you.

(Applause.)

HEARING OFFICER NITTA: I'll go through the list of people who weren't present earlier.

Cathleen Adams.

Sara Cash.

Linda Chandler.

Miguel Godinez.

Marlene Stelling.

Jake Welsh.

Bridget McBride.

Rob McReynolds.

Are any of these people present?

(No response.)

HEARING OFFICER NITTA: Is there anyone else present who hasn't signed up who wishes to testify tonight?

(No response.)

HEARING OFFICER NITTA: Okay. We have some time left, and I will leave it to, I guess, the

participants and those who are testifying tonight as to what your pleasure will be in this case. I can offer five minutes each for those who have testified already to expand their testimony again or we can close the hearing, and you may use that time to discuss your concerns with Dr. Munk and his group.

Is there anyone else who would like to have an additional five minutes to expound or expand on their testimony tonight who has already spoken?

(No response.)

HEARING OFFICER NITTA: If not, I declare this -- excuse me. Wait. Don?

PARTICIPANT: Some of us might want to make a one or two-minute summary of what we might have said earlier. (Inaudible.) But you might lessen that time and still have an opportunity to speak with Dr. Munk.

HEARING OFFICER NITTA: Okay. Well, I don't want to get into answers and cross-answers in the public hearing process. So I would rather have that done after the hearing, outside of the hearing.

Yes.

PARTICIPANT: (Inaudible.)

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HEARING OFFICER NITTA: Yes, please, and state your name for the record again.

MR. SHOOK: My name is Dan Shook from Kilauea, Kauai.

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I'd just like to put it on the record that I haven't seen any evidence anywhere that our government is doing anything whatsoever to really help to change the effect of global warming, and I think before we even ever begin on an experiment like this, we should see that we're doing something already working towards the global warming problem. 3b

We're talking about spending millions of dollars on something that isn't really going to help to change anything. It might tell us it's too late. It might tell us it is not as bad as we thought, but there are things that we can do today that would change, would work towards change, and we haven't seen any evidence in that.

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In the draft environmental impact report, it hasn't said any of the alternatives that could be done instead of this project. We could spend the millions on planting hardwood trees right here on this 6a

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island, and that would be a good start, for one.

We could encourage all of the Third World countries in the world to plant hardwood trees where they've cut them down. There's a lot of things we could be doing that we're not doing whatsoever, and I think before our government spends money like this on something that really isn't going to make an impact -- it might teach us something, but we already have learned one thing for sure: we've got to change our ways or we're going to disappear.

And so I just wanted to be on the record that before a project like this should be initiated, our government should be doing more to change global warming. We should be doing more to stop pollution, and I don't think that's happening. I think we're pissing away money on experiments like this, and we're really not doing anything on the other end where it really could make a change.

Thank you.

HEARING OFFICER NITTA: Thank you.

(Applause.)

MS. BLAIR: Beau Blair, again.

I'm just going to finish up a little thing here.

Most of the draft EIS deals with the ATOC associated marine mammal research program, which presumably is intended to show hopefully that the whales will not be affected and ATOC can proceed. So it is not surprising for one to find on reading the draft EIS the recurring theme that while almost nothing is known about the effects of low frequency sound on marine mammals, the effects are presumed to be insignificant.

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Some examples of the double speak on page 4-6 -- I think I said this once before -- as stressed in this EIS, available information on subsea noise and its biological impact ranges from incomplete to nonexistent, depending on the species being considered.

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Page 4-16, variations in sensitivity to human made noise between and within marine mammal species and lack of information about the consequences of short-term disruptions on marine mammals make it difficult to define the criteria of their

responsiveness and to assess the consequences of a disruption in their natural activities.

Page 4-23, in summary, the potential for adverse impacts from long-term exposure to the source sound fields is unknown. However, all marine mammal exposures to subsea sounds will be minimized whenever feasible.

I wonder what that means.

Then we come to the grand finale, Table 43113-1: potential direct and indirect and cumulative effects on mysticetes. I'm a good reader. The conclusion for all six categories of potential effects ranges from uncertain to uncertain, but presumed low to moderate, provided assumptions are correct, to none, provided assumptions are correct.

In plain, simple English this million dollar volume called the draft EIS is a bunch of double speak and, like the scoping hearings, a waste of money and the time of the readers.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

If there are no more speakers, I will close this hearing. Thank you very much for your attendance and your attention.

(Whereupon, at 8:07 p.m., the hearing in the above-entitled matter was closed.)

CERTIFICATE

This is to certify that the foregoing transcript in

the matter of:	NATIONAL ATMOSPHERIC & OCEANIC ADMIN. PUBLIC HEARING ON SCIENTIFIC AND RESEARCH PERMIT APPLICATIONS P557 AND 1557A
Before:	EUGENE T. NITTA, HEARING OFFICER
Date:	FEBRUARY 9, 1995
Place:	LIHUE, HAWAII

represents the full and complete proceedings of the aforementioned matter, as reported and reduced to typewriting.

Corbett Riner
CORBETT RINER

U.S. DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

PUBLIC HEARING ON SCIENTIFIC RESEARCH PERMIT APPLICATIONS P557 AND 1557A

Friday

February 10, 1995

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The public hearing was held at Mabel Smythe Building, 510 S. Beretania, Honolulu, Hawaii, at 6:00 p.m., Eugene T. Nitta, Hearing Officer, presiding.

PRESENT:

EUGENE T. NITTA

MARTIN FREEMAN, ESQ.

APPEARANCES:

RALPH ALEWINE

RAYMOND CHUAN

ANDREW FORBES

WALTER MUNK

KEITH KRUEGER

JOE MOBLEY

LOU HERMAN

MARK SMAALDERS

PAUL ATCHITOFF

NELSON HO

STAN BUTLER

JAY MURRAY

The testimony of Mr. Chris Clarke was read into the record by Mr. Joe Mobley.

The testimony of Mr. Hal Whitehead and Ms. Linda Weilgart was read into the record by Mr. Mark Smaalders.

CONTENTS

PROCEEDINGS

(6:13 p.m.)

HEARING OFFICER NITTA: My name is Gene Nitta, and I'm with the National Marine Fisheries Service, Southwest Region. I will be your Hearing Officer tonight.

Also in attendance from NOAA is Mr. Martin Freeman, Office of General Counsel, in the audience, and to my right is Dr. Ralph Alewine from the Advanced Research Projects Agency.

The National Marine Fisheries Service has responsibility for reviewing applications for scientific research permits involving marine mammals and sea turtles, and for issuing or denying such applications based on the best scientific information available at the time of review.

In accordance with the Marine Mammal Protection Act and Endangered Species Act guidelines, an application for a permit for scientific research on the potential effects of low frequency sound associated with the acoustic thermometry of ocean climate project off the north coast of Kauai has been submitted to the National Marine Fisheries Service by the Scripps Institution of Oceanography.

Because of potential environmental concerns regarding the proposed activities, a joint federal draft environmental impact statement has been prepared by the National Marine Fisheries Service and the Advanced Research Projects Agency, or ARPA.

This DEIS has also been submitted to the State of Hawaii, Department of Land and Natural Resources under the Hawaii Environmental Policy Act. In that regard, the Service notes that this is not a joint state-federal hearing. However, comments received on this DEIS will also be provided to the Department of Land and Natural Resources. It is my understanding that the Board of Land and Natural Resources may hold a public hearing on the pending conservation district use permit application after the final EIS is completed and accepted by the DLNR.

The comment period for this DEIS has been extended to March 9th, 1995, to coincide with the close of the comment period under the State of Hawaii's Environmental Policy Act.

Finally, the Service has recently received a revised scientific research permit application for the acoustic thermometry of ocean climate project, marine mammal research program, for the Kauai site from the Scripps Institution of Oceanography, which incorporates the DEIS as its basis.

Upon completion of the Service's internal review of the revised application, it will be made available to the public for a 30-day comment period. We look forward to hearing your comments tonight and to reviewing the written comments submitted to us on the DEIS.

At this time Dr. Alewine will present a statement from ARPA.

DR. ALEWINE: Thank you, Mr. Nitta.

I'm pleased to present this statement on behalf of the Advanced Research Project Agency or ARPA.

ARPA is a separate federal agency under the Office of the Secretary of Defense, reporting to the Director of Defense Research and Engineering. ARPA is the central research and development organization for the Department of Defense. Its mission is to develop imaginative and innovative research ideas and to pursue these ideas for the demonstration of basic research to the development of prototype systems.

As has been stated, the purpose of this hearing is to accept testimony from the public on the draft environmental impact statement, or EIS, which has been filed by ARPA and the National Marine Fisheries Service in cooperation with the Scripps Institution of Oceanography of the University of California.

The draft environmental impact statement has been prepared to facilitate consideration by the National Marine Fisheries Service of an application by Scripps for a scientific research permit to evaluate potential effects of low frequency transmission on marine mammals and sea turtles.

The ATOC project is an experiment only at this stage.

It is universally recognized that global energy cycles and the biological processes upon which all life depends are critically influenced by the

ocean. Systematic, global observations of the world's oceans are required to improve our ability to predict the climate and for a more effective understanding of the marine environment.

Making accurate measurements of the ocean on a large scale by means of conventional instruments is very difficult, time consuming, and cost prohibitive, if it can be done at all. This difficulty has led to development of a technique called ocean acoustic thermography, which looks at the ocean on a large scale and creates a three-dimensional image of the area of the ocean transversed by an acoustic signal.

Since the speed of an acoustic signal is influenced by the temperature of the water, it is possible to develop detailed information on the overall temperature patterns of the oceans. To understand the climate variability and to eventually forecast this variability, an understanding of the variability of the ocean is crucial.

The acoustic monitoring of global ocean climate experiment is the definitive study to show that ocean temperatures, which can provide direct evidence of the existence and amplitude of global climate change, can be measured accurately on this large scale.

The ATOC technology is expected to afford significant benefit for the understanding of global atmospheric and climate trends, and for continuing related research on marine biology and global warming environmental issues. The program should also help to obtain and implement useful and affordable maps of internal ocean variability.

The ATOC project will contribute to the overall U.S. national global change research program, among whose major priorities are climate change and greenhouse warming.

The project is one of many funded by the Strategic Environmental Research and Development Program or SERDA, and is under management by ARPA. SERDA was created by Public Law 101-510 by the Congress in November of 1990 as a program to address environmental matters of concern to the Department of Defense, the Department of Energy, and the

Environmental Protection agency. It is intended to use research, technology and information originally developed by the Defense Department for national defense purposes for use by government and private organizations engaged in environmental research.

Active program participants in this ATOC program, in addition to the Scripps Institution of Oceanography, include the Woods Hole Oceanographic Institution, NOAA, the Navy Postgraduate School, the Naval Research Laboratory, Hubbs Sea World Research Institute; in the academic community the University of Alaska, the University of California, Santa Cruz, Cornell University, Florida State University, the Massachusetts Institute of Technology, the University of Michigan, Mississippi State University, Pennsylvania State University, the University of Texas, and the University of Washington.

In addition, Australia, Canada, Japan, New Zealand, Russia, and Taiwan comprise ATOC's Pacific Basin international partners.

It is important to understand that ATOC researchers have recognized from the very beginning that no harmful effects should occur to marine mammals and have committed to an unprecedented marine mammals study program.

The marine mammal research program is motivated by a paucity of data regarding the possible impact of low frequency sound on marine mammals. In this regard, it is noteworthy that ARPA is sponsoring additional research by the National Academy of Science's Ocean Study Board in this very specific area of interest.

At the same time, the marine mammal research program will carry out a broad-based research program and will study the ecology and behavior of these animals throughout the ATOC experiment.

Simply stated, the proposed marine mammal research program will provide extremely valuable scientific data and will serve as the benchmark for good stewardship and responsibility with respect to the environment.

We look forward to the comments of the citizens of Hawaii on this draft environmental impact statement.

Thank you.

HEARING OFFICER NITTA: Thank you.

Before we begin, I would like to present a few ground rules for tonight's hearing. I am the Hearing Officer and will conduct this hearing so that everyone who so wishes may testify tonight. I will call the speakers. If he or she is not present, I must go on to the next speaker. At the end of the list of speakers, I will again call upon those who did not respond earlier.

I will entertain questions regarding procedure and process only. This is not an adversarial hearing. So there will be no questioning of the speakers, and I request that you refrain from rebuttal comments directed at previous testimony.

I must reiterate that we are here to receive comments and input on the DEIS, both technical and procedural, and not to engage in discussion or debate.

On the basis of the number of individuals signed up to testify tonight, I am limiting the speakers to eight minutes and request that extensive comments be summarized. If you have a copy of your statement, I request that you make it available to the court reporter so that he may verify spellings.

If written comments are being submitted, please leave a copy at the court reporter's table so that it may be entered into the record.

In fairness to all who wish to speak tonight, and especially those who must leave early, I request that you limit your presentations to the allotted time.

Please insure that your comments are pertinent to the subject at hand, the DEIS for the Kauai ATOC program. If you wish to support someone else's testimony, a simple statement to that effect will be sufficient.

I will call upon the speakers in the order in which I received the request to speak tonight. Thereafter, I will call upon those who signed up at the door.

Representatives from the Scripps Institution of Oceanography have requested that rather than make an extensive presentation at the beginning

of this hearing, as they have done previously, that they be included within the list of speakers for tonight to allow more time for public testimony. Dr. Munk and his colleagues will be available after the hearing to answer any questions if there is time.

Are there any questions before we begin?

(No response.)

HEARING OFFICER NITTA: Okay. The first speaker is Raymond Chuan.

MR. CHUAN: My name is Raymond Chuan. That's spelled C-h-u-a-n. I'm a resident of Hanalei, Kauai, and the co-chair of the Kauai Friends for the Environment.

This draft EIS for the Kauai ATOC has some fundamental flaws with it, starting with the cover. If you look at the cover pagé, it lists among the subject matter Hawaii Conservation District use permit application KA-2734. The problem here is that the action for which this application is being made and in support of which application this EIS is being presented to the public, this action has already been completed.

Application KA-2734 was first submitted to the DLNR on August 25, 1994. In comments prepared for the manager of the aquatic biology program, Mr. Walter Ikehara, aquatic biologist with the DLNR, had this to say, September 6th, 1994.

"In general," I quote, "the Division of Aquatic Resources supports research leading to greater knowledge of the ocean and its marine life. However, we do not condone after the fact approvals for the laying of the cable in October 1993 without approval," unquote.

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Not only was the cable laid without approval; the application and the accompanying EIS give no information about how and where this cable is to be laid or was laid, how it may affect the reef, the water quality or its impact on marine life and the activities of humans in that area.

Aquatic Resources was obviously unhappy with this application. So Dr. Andrew Forbes of the ATOC, on December 31, 1994, in a letter to Mr. Kawamoto of the DLRN had this to say, quote:

"The subsea cable which connects to a

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preexisting Navy cable offshore from Barking Sands was laid by the Navy at a time in October of 1993 when a Navy vessel was available for that purpose," end quote.

So what this amounts to is that an illegal act was okay because the Navy happened to be available, which is at least a curious excuse.

Dr. Forbes went on to say, quote, "Generally speaking, federal activities are exempt from any state requirements. However, in order to insure complete regulatory compliance, the Scripps Institution of Oceanography has requested that the Department of Land and Natural Resources issue it a permit for the installation of the cable on state land that was made by the Navy," unquote.

Now, in this process, it seems that this response represents a mighty big concession on the part of Scripps, first, to trample on state regulations and then come back to say that "we'll be big about it and make an application."

Sadly and unfortunately, this is the kind of hubris one can expect nowadays too often from the military-industrial-university complex.

We of the Kauai Friends of the Environment urge the DLNR to demand that Scripps take out the cable and reapply for a CDUP with all of the required information, including an EIS that specifically addresses the impact of this action.

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Another item that we'd like to touch upon has to do with a presidential executive order issued in February 11, 1994. It's an executive order on federal actions to address environmental justice in minority populations and low income populations.

ATOC has failed to address the issue of environmental justice. The boom box is to placed -- maybe it is already placed, judging by previous actions -- in an area where native Hawaiians practice subsistence fishing. The annual catch is, according to the DLNR, 37,500 pounds.

Now, this may sound like a pretty small number to the Scripps people, but for the small native Hawaiian population on the North Shore of Kauai, that is a big number.

Because of the importance of this source of

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food, DLNR has placed a fish aggregation device at a location which unfortunately will be, if ATOC goes through, only eight nautical miles from the site of the sound source. Yet in the by now familiar language that runs throughout the draft EIS, the Scripps people say, "While nothing is known about the effects of the sound on fish, we presume the impact will be minimal or insignificant."

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Is the livelihood of a population specially protected by this executive order on environmental justice to be sacrificed for the dabbling of some scientists engaged in a project of dubious value to the public good? We say no.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

The next speaker is Andrew Forbes.

DR. FORBES: Good evening. My name is Andrew Forbes. I'm an oceanographer from the Scripps Institution of Oceanography in La Jolla, California.

Tonight I'd just like to take a little time to tell you that there are two companion volumes to

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this EIS that we're discussing here tonight. The one of primary focus, of course, is the Kauai volume or component of the draft EIS. There's another, the California document. Both of these documents were drafted and are being scrutinized and commented upon on parallel tracks as far as is possible.

There are two companion volumes because there are two distinct biological and ecological provinces, one obviously in Hawaiian waters and the other in Californian waters, and therefore, the marine mammal research programs which are part and parcel of the ATOC program are different. The protocols that are used are different for each area, and so each of the two companion volumes of the EIS are tailored for its specific region.

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The Kauai draft EIS incorporates by reference to California EIS, and it does that so that the people who are interested in reading about the other area in which the experiment will be conducted have the opportunity to review and comment if they wish on the other volume.

Readers may, of course, choose to focus on

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their particular region of interest, and I expect most people to do that tonight, or they may read and comment on both.

Over 700 people have received both companion volumes of the EIS, and anyone who requests a copy of the final may receive either or both of the companion volumes. I'm just trying to stress to you that this is a project that has two distinct focal regions, which deserve careful description and assessment by both communities neighboring these ocean regions, and that the intent is to provide the most detailed and practical information to those people in each area.

I'd like tonight to yield the rest of my time to listen to you, and with that I'll close my remarks.

Thank you.

HEARING OFFICER NITTA: Thank you, Dr. Forbes.

(Applause.)

HEARING OFFICER NITTA: Keith Krueger.

MR. KRUEGER: Aloha. My name is Keith

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Krueger, and tonight I'm going to speak as an individual. Later on I'll submit comments on behalf of Animal Rights Hawaii in greater form.

I'd like to say first that or at least note that sending these comments to a commercial contractor that has been retained by an agency that has a strong interest in the approval of this proposal seems a little less than appropriate to me. This holds especially true because I've heard complaints that the draft EIS does not adequately address all of the concerns raised by the public to date.

I'm disturbed by the tone of the draft EIS, which reads more like a justification for the granting of permits for this project than an objective evaluation of the risks and alternatives to the proposed actions. I hope this does not mean that the decision to grant permits has already been made before the public has had a chance to review this project in its entirety and to give input as to the feasibility and appropriateness of this project.

The Sierra Club Legal Defense Fund has prepared compelling testimony as to the legality of

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the way ATOC seems to be proceeding, and I wish to go on record as emphatically believing that a pragmatic EIS for ATOC is required by law.

Simply logic would dictate that the full project should be thoroughly evaluated before parts of it are allowed to proceed because if the initial premise is faulty, then the risks undertaken and the impact suffered as a result of the segmentation of the project will have occurred in vein.

This is not an instance of well meaning but misguided members of the public trying to, in their ignorance, derail the advance of the frontiers of human knowledge. There is genuine scientific disagreement not only over the potential impacts of this undertaking, but also over the premise upon which it is based.

Dr. Norman Seton has testified that, and I'm quoting here, "there is not even the remotest possibility of using any measurement of sound velocity at the deep sound channel to indicate global warming, and to imply otherwise with a name such as acoustic thermometry of the ocean climate is an affront to responsible science and the public pocketbook," end quote.

100-3

Because of the controversy surrounding ATOC, it would seem premature to rush into implementing it, yet that is precisely what is being done. It is my understanding that the cables have already been laid to the preferred sites in both Hawaii and California. If this is true, then any discussion of alternative locations in the draft EIS would appear to be merely lip-service.

It is also my understanding that ATOC issued an environmental assessment for the acoustic engineering tests that took place off the West Coast of the United States only days before beginning the testing itself. There does not seem to have been reasonable opportunity for the public to scrutinize and provide input into this piece of the whole.

I have heard that in the January hearing in California it was reported that marine animals have already been harassed, tagged, and even moved on behalf of ATOC, even though this project has yet to be officially approved.

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There appears to be a pattern here. The ATOC project just keeps lurching forward as quickly as it can come up with ways to circumvent the intent of the permitting process. This disturbs me deeply because I've always assumed that most science was well intended.

If the real purpose of ATOC is to measure global warming, I cannot conceive of proceeding in such an arrogant and devious manner. I am led to speculate that there may be a hidden agenda at work here.

100-4

I do not automatically object to the possibility of there being military applicability to what is purported to be civilian research, but I do strenuously object to legitimate concerns being ignored or sidestepped as part of a secretive and cavalier shell game being played on a global scale with our tax money without full disclosure of its intent.

3a

The proponents of ATOC have spent a great deal of effort in trying to emphasize the care being taken to carry out a marine mammal research program as are currently planned.

I also have a very short resolution from the Whales Alive conference, which was held in Maui January 20th.

109-3

The participants of the third annual Whales Alive conference hereby express our concern that the proposed acoustic thermometry of ocean climate, ATOC, program and associated marine mammal research program present unacceptable risks to marine mammals in the ocean environment, particularly in view of the lack of knowledge about the effects of low frequency sound on marine mammals and other ocean inhabitants and the potentially disastrous effect on those animals and the marine ecosystems of the sound transmissions contemplated by ATOC project.

We call on Scripps Institute of Oceanography, the Advanced Research Projects Agency, National Marine Fisheries Service, Hawaii Department of Land and Natural Resources, and all others associated with the ATOC project to scrupulously follow the letter and spirit of all applicable environmental laws, including the Endangered Species

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Act, the National Environmental Policy Act, and the Marine Mammal Protection Act.

109-4

At a minimum, a programmatic environmental impact statement that thoroughly analyzes all alternatives to ATOC as a means of measuring global climate changes and analyzes the environmental impact of such alternatives must be prepared and subjected to public comment and hearing before any work associated with or funded by ATOC proceeds.

2

Furthermore, knowing that there are currently technologies in place that measure ocean climate and that it is agreed that global warming exists, we suggest that the $35 million budget proposed for ATOC be better utilized towards efforts to stop the causes of global warming.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Jay Murray.

MR. MURRAY: Good evening. My name is Jay Murray, and I'm a PADI divemaster working in Monterey, California, for a local dive shop. I've come to your island today to express my concerns and question certain areas in the ATOC draft EIS/EIR.

My duties as divemaster consist of taking people from all over the world on underwater tours of Monterey Bay national marine sanctuary and helping certify new PADI divers. Showing people what lies beneath the surface of the Pacific Ocean is a very relaxing and rewarding experience.

As you may be aware, the central California coast was subjected to low frequency underwater sound transmissions during the months from July to December 1994. The transmissions consisted of a high amplitude main wave of between 33 and 40 hertz, which was accompanied by a secondary lower amplitude wave of 68 to 78 hertz. Both of these frequency ranges were transmitted singly and in tandem.

110-1

While I have no proof who was responsible for these transmissions, I am in possession of a memo dated August 25th, 1994, released by the Naval Postgraduate School in Monterey that reveals a location, date, and deployment, and type of equipment they deployed. On May 24th, 1994, the Naval

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Postgraduate School began deployment of three 24 foot long SOFAR transducers off the California coast.

As the NPS is listed as a part of the ATOC scientific team, to me this is a direct violation of the required EIS/EIR.

At this point, since I can't prove who was involved, just let me say that 33 to 75 hertz transmissions are very invasive. When exposed at higher amplitudes, divers' lungs vibrate noticeably. After my first encounter with what has been termed "the Monterey mystery noise," I began to record the noise and later analyze it on my PC. I'm in possession of four recordings that clearly show the properties of the transmissions, and my results have been independently confirmed by Dr. Kashro Lashkari, the Monterey Bay Aquarium Research Institute.

It appears that the proposed ATOC wave form closely resembles the Monterey mystery noise. One of the main differences between ATOC and my records is the ATOC transmissions will have a pulse length of 20 seconds compared to the Monterey mystery noise's three quarter second pulse. This I am not looking forward to.

In Section 4, page 139 of the Kauai draft EIS/EIR there's a section called "Potential Resonance of Air Containing Cavities." It addresses the question of vibrating lungs. The graph on page 141 suggests there shouldn't be any impact from 33 to 75 hertz transmissions.

My experiences prove otherwise. I'm in direct opposition to the statement on page 141 that says, quote, "Given the above evidence, plus the fact that the proposed source energy is spread across a 35 hertz band width, not concentrated in a narrow band width tone as the stated experiment data were, it is safe to conclude that the potential for proposed source causing resonance of any diver air containing cavities would be negligible," end quote.

In analyzing different parts of my tapes I have found that the most invasive, that is, causing the most lung vibration sounds, were from transmissions with their energy spread across a 35 to 40 hertz band width. The narrow band width noises of similar amplitude were definitely not as annoying.

One of the main arguments presented by the ATOC scientists concerns the already high background noise and other manmade noise. They constantly try to compare high decibel shipping noise to the ATOC source, saying that since shipping noises created in the surface layer where almost all life is located and the ATOC source is placed deep within the sound channel, the effects of shipping noise are worse than ATOC.

This argument is easily defeated in my mind. Just look at the area of ensonification and it should be clear. Estimated ATOC transmissions will be at a level of 110 dB's at a range of 158 kilometers. This is the level expected at the surface. At the surface super tanker noise would be virtually nonexistent at 158 kilometers, or to put it another way, if the super tanker emitted noise directly into the deep sound channel, then it would be fair to compare ATOC to shipping noise.

Add to that oceanic shipping is a required fact of life, the Hawaiian Islands could not survive as we know them if it weren't for shipping. The ATOC device has been designed to transmit from California and be received in New Zealand, over 6,000 miles away, and that's exactly what it will do if allowed to proceed.

And I'd like to add the Heard Island experiment proved that you could detect these sounds over 18,000 miles.

Section 4, page 142, addresses, quote, "potential human acoustic annoyance." It must be obvious to the public and the agencies involved that I have been extremely annoyed by the transmission of low frequency sound in the Monterey area. If ATOC produces the same or similar results as Section 4 states it may, then you can be assured of a fire storm of protest from the dive industry.

I cannot allow the rest of my dive career to be influenced by resonance of my air containing cavities or even just basic human intrusion into the Pacific Ocean. I'm quite sure if the levels of sound that reach shore in Kauai are as high as expected, you will have dozens of aggravated divers on your hands.

At this point I'd like to say I feel lucky

to be able to get out of the water if I so desire, but what about all of the sea creatures that are unwilling subjects of this experiment called ATOC? I can only surmise that to be a humpback whale on its journey from northern feeding grounds to Hawaii and be confronted by ever increasing amplitudes of low frequency sound resonating throughout its enormous body would give a new meaning to the word "annoying."

Or how about sea turtles? They won't be able to swim far during a five minute ramp-up period. ATOC plans on transmitting every four hours for days on end. What about all of the sea creatures that sleep? Almost all inhabitants of the Pacific Ocean spend a portion of the day sleeping or resting. Studies on humans concerning sleep deprivation show dramatic ill effects when we are not allowed to follow normal sleep and waking biorhythms.

Let's consider what these effects may be over the life of the proposed ATOC experiment. Unknown at best, and certainly devastating at worst, but I guess if I multiply it by the duty cycle I would realize the effects would be negligible.

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110-2

Let's take a quick look at Section 4, page 102. In the first paragraph it states, quote, "Behavioral evidence indicates that sharks detect underwater sound at low frequencies, and that certain signals particularly in the 20 to 80 hertz range attract sharks," end quote.

In the next paragraph they cite studies that show a dramatic increase in the number of sharks, 253 as compared to 44 in the area of the study when low frequency sound was being transmitted.

A study by Nelson and Johnson in 1972 concluded that, quote, "the attractive value of low frequency pulsed sounds to sharks clearly is enhanced by intermittent presentation," end quote. This describes the ATOC transmission pattern exactly.

The reason sharks are attracted to these sounds is merely a feeding response. They think the sounds are being emitted by wounded prey. From these facts, it appears that divers, swimmers, surfers, and other water sports enthusiasts are faced with the prospect of an increased number of sharks which may be in an agitated condition. As sharks are a very

10a

important link the food change, rearranging their distribution will have some effect on the balance of nature in the area of the ATOC transmissions.

As we know, shark attacks in the Hawaiian Islands are rare. The facts I've just presented may change all of that.

Personally, I love to dive with sharks. That's one of the reasons I come to Hawaii, but to dive with them amidst low frequency sound transmission is another story. I believe this will cause a negative influence on tourism in the area, particularly on Kauai. Does this qualify as economic disruption? It certainly seems like it to me.

110-3

Finally, I'd like to point out in Section 6, page 4, there's a section called, quote, "Environmental Justice." The first two sentences read, quote, "On February 11, 1994, the President signed an executive order on federal actions to address environmental justice in minority populations and low income populations. The proposed project would cause no adverse environmental effects on any minority communities and/or low income communities,"

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end quote.

I would like to point out that on page 103 of Section 4 it states, quote, "There is insufficient information to determine whether any adverse long-term impacts to fish could result from low frequency sound transmissions, and thus, the potential impact is uncertain," end quote.

110-4

There are certainly low income people on the island who fish for subsistence purposes. The proposed project appears to clearly violate this executive order.

15

Thanks for your time.

HEARING OFFICER NITTA: Thank you.

(Applause.)

HEARING OFFICER NITTA: I'll Call Dave Rainey again. Is he here?

(No response.)

HEARING OFFICER NITTA: Okay. Is there anyone else who wishes to testify tonight who hasn't signed up yet?

Did I miss you, Joe? I'm sorry. Joe Mobley.

DR. MOBLEY: My name is Joe Mobley. I'm associate professor of psychology with the University of Hawaii, West Oahu, and principal investigator of the aerial survey task portion of the ATOC MMRP. I am one of four co-principal investigators of the Kauai portion of the ATOC MMRP. The other principals include Drs. Chris Clarke, Director of the MMRP; Bernd Wursig of Texas A&M University at Galveston; and Adam Frankel, the Cornell Bioacoustics Program.

These individuals are among the most knowledgeable in the country with respect to the acoustic lives of marine mammals. A list of additional researchers who have been associated with the MMRP consists of another 20 or so scientists, all of whom possess years of experience in making quantified observations of marine mammal behavior.

I personally have been involved in marine mammal research with the University of Hawaii since 1978, with primary focus on the behavior and distribution of humpback whales. For the past five years I have focused on assessments of the distributions and abundance of humpback whales throughout the Hawaiian Islands via aerial surveys.

All of us on the MMRP are scientists who have dedicated our lives to seeking greater understanding of these magnificent creatures. All of us are committed to contributing information from this project that will lead to the protection of these species for years to come.

It disturbs me that we are being cast on opposing sides of the fence on this issue, scientists versus environmentalists. I, like most marine mammal scientists, have always considered myself to be on the same side, and that we are both groups seeking ways to protect these animals.

In my case I do it by seeking answers to questions, such as how many whales are there, what source of habitat do they prefer, do they react to things like vessels in their proximity.

The environmentalists protect these species and their habitat primarily by seeking the enforcement of existing laws and by advocating the creation of new laws where a need is perceived. In doing so, environmentalists have always relied on scientific

findings as the basis for this process.

In this way we would seem to be in a symbiotic relationship of sorts. However, in this case that relationship has broken down in a way that troubles and perplexes many of us.

I lecture my students on the importance of distinguishing information accepted on faith versus information that is acquired empirically. Faith is sufficient for some aspects of life, like religion, but does not work well in providing evidence for science or law. One cannot challenge information accepted on faith, but one can challenge empirical information.

Very simply, if one can show it to be true using accepted methods, then one can accept it as such. What appears to be happening here is that many of the people testifying today have accepted on faith alone that the ATOC project represents the potential for devastating effects on marine species. I can safely say that it must be faith since I know that as yet there is little clear evidence that sounds of this type cause changes in the behavior of whales.

111-1 We simply need more evidence on this issue. This project has given marine mammal scientists the chance to address that issue using the best methods known so that we can go beyond faith and on to true empirical understanding, and if it is shown to be so, then these results can be used as evidence to protect these species from other forms of low frequency sounds which have been routinely injected into the oceans for years. 3d

The most disturbing statements I have seen in the press and elsewhere suggest that the MMRP scientists are in the least case biased in their approach to this problem or in the worst case totally bought out by the ATOC project.

111-2 Science is the pursuit of truth. All a scientist has is his or her reputation for telling the truth. Without that we cannot do the work that we do. It ultimately comes down, as Chris Clarke stated in his testimony, to a matter of principle and trust. All of us have established reputations for telling the truth in our research communities. Otherwise we would not be involved with this project. We have no reason 16a

to start lying to the public now.

The truth is that we need to know what the effects of this sound and similar low frequency sources are, what sorts of changes occur in the behavior of animals exposed to them, and whether these effects represent the potential for harm or not.

We ask that we be given that chance. Let us do our work.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you, Joe.

MR. CHUAN: Sir, may I ask that this (inaudible) be stricken from the record because this was a combination of (inaudible), rebuttal, and propaganda and has nothing to do with the comments. You said very clearly that the rule of the game is to make comments on the EIS, and this had nothing to do with comments, and I am not sure why these people do that. I mean they understand the rules as much as anybody else.

I objected to the same thing that Dr. Forbes did yesterday. Unfortunately, you were a major component of their overall project. Yet this research represents only a small portion of their budget and is designed to do little more than provide partial data on the impacts of the ATOC experiment itself.

A more comprehensive and independently organized research regime should certainly be carried out before ATOC is allowed to commence.

In their original proposal, the proponents of ATOC admit that it is not possible to detect or

100-5

even measure all of the potential impacts of their actions on marine mammals. Yet they assert that they are willing to stop the experiment if these impacts occur.

6a

Why is the feasibility portion of ATOC scheduled to begin before the marine mammal pilot study final report is released? If the cumulative effects of ATOC are not likely to be immediately

100-6

recognizable, do we not then have a moral obligation to slow the work down until we can be reasonably sure of what impacts there might be?

6c

And do we not also have an obligation to do

more than guess at what the effect of the experiment will be on other marine species?

Instead what we are offered in this draft EIS is often a series of guesses. Time after time I found myself subjected to a litany of statements that basically meant "we don't know for sure, but we're assuming that the impacts will be low if our assumptions are correct."

The DEIS also muddies the waters of logic by explaining that its preferred sites were picked for their geographic advantages, combined with their

100-7

proximity to marine mammal populations so that research could be conducted on the impacts of ATOC on these creatures.

4b

Speaking out of the other side of its mouth, the same DEIS lists as advantages for more autonomous sources the ability to be placed in areas of low concentrations of marine life. It would seem that during this demonstration or proof of concept phase that the latter course of action would be more prudent, but again, I must stress that nothing should be done until after a programmatic EIS is approved.

H-100 H-101

Given the lack of critical analysis and the prejudicial tone of the DEIS, I am deeply disappointed that NOAA, and more specifically NMFS, have allowed their agency names to be affixed to this document as preparing entities.

I ask that no permits for ATOC be granted until a programmatic EIS that includes a time table that would allow for the measurement of cumulative impacts and for considered input on the part of the public is developed.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Chris Clarke.

DR. MOBLEY: I'm reading a statement by Christopher W. Clarke, Director of the Bioacoustics Research Program at Cornell University and Director of the Marine Mammal Research Program for Scripps Institution of Oceanography.

The Marine Mammal Research Program for Kauai as associated with the ATOC project began two years ago. During those two seasons in 1993 and 1994,

H-101

101-1 the primary goal of marine mammal research was to observe the normal winter breeding and calving activities of humpback whales off Kauai. In this case "normal" includes all of those situations that involve a variety of human made activities, including boats, both private and commercial, ships, helicopters, and airplanes. Such human activities are known to introduce various amounts of unregulated and poorly documented disturbances into the whales' environment. 8a

Therefore, it was important to describe how the animals respond to this background prior to the operation of the ATOC source.

101-2 A second goal of the MMRP was to quantitatively document the distribution and relative abundance of whales throughout the Hawaiian Island chain. To accomplish these tasks, a team of some of the best marine mammal scientists in our country was formed. In 1993, Dr. Joseph Mobley of the University of Hawaii conducted over 4,600 miles of interisland surveys that have provided Hawaii with its first transect based aerial survey ever. 8b

This year Dr. Mobley is conducting another

4,600 miles of state-wide survey. Through this process the goal is to build a standardized series of surveys which if conducted at regular yearly intervals will serve as the basis for determining long-term population trends for the Hawaiian humpbacks and for evaluating whether their distribution around the islands is changing as a result of human activities, in this case the operational ATOC sound source.

This is the way that we chose to determine if the ATOC project is having a long-term impact on humpbacks in Hawaii. For the past two seasons we have successfully conducted the most extensive observations of humpback whales ever. This effort included observers on the cliffs in Princeville and on the Kalalau trail, using the best equipment and techniques available to describe the whales' movements and behaviors.

From dawn to dusk, from January through mid-April, observers in an airplane filmed and documented the behaviors of whales at and below the surface throughout the north Kauai region.

Finally, we used an entirely passive set of

hydrophones for listening to the whales and all the sounds in their environment so that we could describe their singing behavior and to track movement of the singers.

As a result of these observations, we have collected over 1,000 hours of observations, describing the details of males competing for females, females nurturing their calves, singers crooning night and day, all within the normal daily routines of wind surfers, scuba divers, tow boats, fishing vessels, submarines, helicopters, air flights, and commercial shipping, and from this we now know that our techniques of observations that include carefully counting such things as breathing rate, duration of

101-3

dive, the number of songs are sensitive enough to detect the subtle effects of one whale on another whale, as well as the effects of one boat on a whale. 10d

And so we now know that we will be able to detect even subtle effects of the operational ATOC source on the whales should such effects occur.

This year, right now as this is being read to you, we had planned to take an important step toward answering a vexing question relating to the ATOC sound and humpback whales. Throughout this heated debate on the possible influence of ATOC on marine mammals, we have heard numerous predictions on what may or may not happen if the project is allowed to proceed. A lot of the argument has been based on the statement we don't know.

101-4

We don't know how whales and other animals might respond to the oceanographic sound because the sound is novel. For this reason the MMRP had planned to conduct a series of playback experiments in which sounds similar to those proposed for the ATOC project would be played back to whales using underwater loud speaker. The logic was simple: use a small version of the ATOC sound, in this case the sound of only one percent as loud as the one proposed by ATOC, and present this miniature version to whales after they had been carefully observed. If they respond by fleeing and evacuating, then we have every reason to strongly advise that ATOC not proceed.

6e

If whales continue to behave as they do under normal circumstances, then the project would be

allowed to proceed into a pilot phase, which would commence once the ATOC source was installed nine miles offshore one half mile deep.

During the pilot phase, we, the marine mammal biologists, would have control over when, how often, and at what intensity the ATOC source would be operated. This would give us enough time to evaluate the impact of the real source on the whales before it became operational.

101-5

Thus, for example, if during the playback experiments aerial surveys showed that whales were leaving the Kauai area or if observations revealed that whales were responding differently than they do under normal circumstances in a way that could prove harmful or decrease their population, then that would be evidence that ATOC should not become operational.

10d

Unfortunately, as many of you know, I canceled this year's playback research project because opposition from certain groups and their legal representations threatened to sue the National Marine Fisheries and others because our research plans were not part of the EIS process, and so we reach the lofty plateau of a Catch-22.

I can now say that several of the groups that threatened a lawsuit have decided not to pursue it because there is nothing to pursue.

Although humpback whales are the species of primary focus in Kauai, the MMRP team is also working on understanding other species as well. This includes toothed whales and turtles. For turtles in Kauai, we have conducted daily scans along the North Shore in order to document and describe the occurrence of green sea turtles. To better understand how the ATOC sound might affect sea turtles, I am working closely with Dr. Scott Eckert to conduct research on the response

101-6

of leatherback turtles to ATOC and other low frequency sounds.

For toothed whales, several efforts are underway. Two University of Hawaii marine mammal scientists with expertise in dolphin sounds and hearing are testing animals to determine their thresholds of detection to the ATOC source. By this effort, we hope to learn how well the animals can hear low frequency sounds and thus be better able to

8a

predict whether or not the ATOC sound could disrupt their lives.

Sperm whales have received attention as well. However, since sperm whales are not in captivity so that we can test their hearing, we plan to conduct playback experiments with sperm whales using ATOC sounds at different frequencies. This research will be conducted this summer off the Azores by Dr. Jonathan Gordon of Oxford University in England, one of the foremost authorities on sperm whales in the world.

Jonathan has studied sperm whales for nearly two decades and has many years of baseline data for the Azores population. From this research, the goal is to determine whether or not sperm whales react to the 75 hertz ATOC sound and, if so, how much of a reaction do they have.

The recent work of Dr. Darlene Ketten from Harvard indicates the sperm whales probably cannot hear 75 hertz, but these pending playbacks will be the first attempt to answer the question from a behavioral perspective.

H-101

So to summarize our research efforts, one, for the past two seasons the MMRP has collected and will continue to collect extensive baseline information on humpback distribution throughout the Hawaiian isles and the behaviors of these magnificent animals during their annual stay off Kauai. These data form the basis for evaluating potential effects of the ATOC sound on the whales should the ATOC source become operational.

The Kauai marine mammal team, which is made up of experts from around the United States, has always and will continue to report and evaluate our results with full independence from the ATOC project. All of us have been guaranteed that should ATOC be permitted to become fully operational, a marine mammal research effort will continue for the duration of that project.

It all comes down to a matter of principle and trust. Those of us who have committed ourselves to working on this ATOC marine mammal problem are dedicated to understanding the lives of marine mammals, how they survive, their populations, and the

H-101 H-102

things that affect their lives and populations.

If all of us are going to make informed decisions about our actions on the environment, especially on this matter of human made sounds in the ocean, we must begin to gather knowledge about how well the animals hear and what they hear, how they use sounds in their lives, and what effect do human acoustic excursions have on their lives, especially as it relates to their chances of surviving and growing.

Thank you.

HEARING OFFICER NITTA: Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you, Dr. Mobley.

Dave Rainey. Is Dave Rainey here?

(No response.)

HEARING OFFICER NITTA: Dr. Walter Munk.

DR. MUNK: My name is Walter Munk. I'm principal investigator of ATOC.

I'd like to clarify a number of statements in the DEIS which I don't think have been properly stated. I'll confine my comments entirely to the problem of global climate change.

102-1

My first comment has to do with the suggestion that we already know how the climate -- that the climate is changing and how the climate is changing, and that, therefore, there is no need for investigations.

3c

To that we would like to comment that there are a number of investigations by climate modelers going on which differ very significantly. They vary all the way from those who predict very, very severe changes in the atmosphere and in the oceans, in the oceans predicting that the increased stability of near surface warning would lead to a cessation of the ventilation of the interior ocean, which if it took place would have very severe consequences, consequences including marine biological consequences.

There are other investigations largely based on the somewhat unknown effects of clouds which predict a very small change in consequence to the greenhouse gases.

We think that it is necessary instead of depending entirely on modeling to make observations,

and the ATOC project is dedicated not to emphasis of further theoretical work, but is dedicated to making observations.

Now, all climate modelers, even though they disagree considerably as to what the effect might be, agree on one thing, namely, that unlike weather prediction, the oceans are, in fact, an absolutely vital part of any climate change on the planet earth.

It is agreed that unless such climate models get the ocean right, they're not going to get the atmosphere right. Now, the ocean is important not only because it's part of the ocean atmosphere system, but in its own right. Changes in the ocean will affect sea level, possibly significantly. It will affect circulation. It will affect the ventilation of the interior waters, as I've already mentioned, and it has potentially some very serious and important effects.

Now, the kind of observations that the ATOC project is intending to do is actually twofold. One is altimetry, satellite altimetry. The Topex Poseidon Satellite, which has now been flying for two years can measure sea level to a precision of two centimeters, unbelievable precision, and it will give information on the heat content and exchanges in the upper layers of the ocean.

The ATOC acoustic thermometry has its emphasis on the interior ocean, and the two together augment one another very nicely, and our attempt would be to make these two types of observations as a way of validating and testing the climate models which are now being developed by various people.

One comment which is also frequently made and which we ought to respond to more clearly is: why bother? We already know that the oceans are warming. What's the use of studying it? The important thing is to do something about it.

We think that clear-cut, significant observations are the only way that something will be done about an important problem. I will remind you of observations of freon, CFCs, which have, in fact, already led to certain policy decisions which are leading to a reduction of the freons now being released into the atmosphere.

102-2

3b

I will also remind you that the observations of CO_2 on Mauna Kea, which was started by a Scripps Institution scientist in the early 1950s, are really the basis and still today the basis of all discussion, thought, and policy considerations of what to do about greenhouse warming. If these observations had not been started, the development of this important problem might have been very different.

It is our view, perhaps I should say our hope, that the ATOC *observations might in some sense* fulfill a role in the ocean which parallels that of the observations of the greenhouse gases which have been conducted.

I don't think anyone could say that the work that we're proposing would lead to a good policy making, but it seems to us that without clear evidence and without good data, there surely will not be any political and policy decisions along that line.

Now, there have also been great discussions as to whether ATOC is a reasonable method of learning about climate. One statement which is frequently made is that for warming to take place at the depth of

1,000 meters would take 10,000 years. The correct number is 20 years. It is not correct that it would take a very large amount of time for that effect to be proceeding downward.

And as was mentioned, we are going to be available after this session for discussion, and I can easily give you the basis for my statement.

It has also been said that since our acoustic source and receivers are largely at a depth of 3,000 feet, that one would have to wait. That ATOC measures the oceans at a depth of 3,000 feet. That is incorrect. Even though source and receivers may be at this depth, they do, in fact, monitor the entire ocean water column, and the statement as made is, therefore, not correct.

I want to close by saying that in our view the global climate problem is a very important problem, and even though it has been discussed for many years by many people, it doesn't go away. It's a problem that needs to be addressed.

ATOC is not the only contribution towards trying to measure what's happening, but we think we do

have a contribution to make. We're not looking for more dollars. We're not looking for more power. We're not having a secret Navy project attempting to solve some other problems. We are interested in the climate problem, and we think the acoustic method has some unique advantages.

And I do feel that there is a job to be done and that I personally would be irresponsible if I didn't attempt to pursue it.

Thank you.

MR. KRAUT: Thank you, Dr. Munk.

(Applause.).

HEARING OFFICER NITTA: Dr. Lou Herman.

DR. HERMAN: Good evening. I'm Lou Herman. I'm Director of the Kewalo Basin Marine Mammal Laboratory located here in Honolulu.

I've been studying humpback whales in Hawaiian waters since 1975 and have studied them each year, together with my students, throughout all of the islands. We've also conducted studies of humpback whales in Alaskan waters and in Japanese waters.

Many of my students are participating, in fact, in the ATOC program now, including Joe Mobley, Chris Gabriele, Adam Frankel, Allison Craig to just name some. So I have more than just a passing interest and stake in this program in a sense.

103-1

Now, I'm not opposed to ATOC in any way at all per se, but only to its location on Kauai. ATOC may very well contribute valuable information on ocean warming, and it will take many years to develop a suitable database for that. Thus, wherever it is sited, it will be so for a long time. Hence, any negative impacts of that siting have to be carefully considered.

Now, I'd like to raise some concerns I have about the potential impact on humpback whales. I've raised these concerns previously in an article I published last July in the Journal of Environment and Development entitled "Hawaiian Humpback Whales and ATOC, a Conflict of Interest." I have a few copies of that available after the session here if anyone's interested in receiving a copy.

The issues of concern I have are:

One, the emerging recovery of the humpback

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whales;

Two, the emerging importance of Kauai as a winter habitat for the whales;

Three, the length of residence of individual whales at Kauai;

Four, the importance of singing as communication and its prevalence on Kauai;

Five, the potential masking effects of the ATOC sound on a listening whale's ability to detect or recognize low frequency portions of the song;

And, six, the availability of a reasonably suitable alternative to Kauai, namely, Johnston Island.

I'll say a little bit about each of these point in more detail.

First, the emerging recovery of the whales. It seems clear to those of us who are conducting continuing studies that there is a recovery trend in effect on this endangered species. As many of you may know, they only came under protection in the North Pacific as of 1966, and at that time their numbers were estimated to be no more than 1,000 out of a population that may have been 15 or 30 times that number previously, previous to whaling, a lot of which took place in the early 1960s.

103-2

The whales are emerging in abundance throughout all of the main islands of Hawaii, including Kauai. During the years of 1979, '80, and '81, I and my students conducted aerial surveys around all of the Hawaiian Islands, including Kauai and Niihau, and it was quite clear that there were very few whales to be found around Kauai at that time. We might see three, four, or five whales per aerial survey flight around the entire island of Kauai.

8b

In 1991 or thereabouts, I believe, similar studies were conducted by Joe Mobley and others using techniques that we were using in 1979 through '81, and the number of whales counted per flight increased substantially. I think it was six or seven times what we had seen ten or 15 years earlier.

Ground based surveys reveal the same kinds of effects.

A photographic effort by Sal Cerchio during the 1993 season, for example, where he went out in

small boats, two small boats, to photographically identify through fluke coloration individual whales counted 251 unique individuals, that is, photographically identified, in that season.

Cerchio, however, estimated this to be only a fraction of the true numbers visiting Kauai based on the fact that he continually obtained new sitings as the season wore on, and also that he could only conduct a limited effort, daily effort, weather permitting, and the constraints of two small boats trying to cover the entire coastline of Kauai.

Now, the issue of residency of whales at Kauai, I think, is a very important factor to consider. The draft EIS says that at most we can expect a maximum stay of four days on Kauai for any individual humpback whale. In fact, this doesn't gibe

103-3

10c

with the data that was collected by Cerchio, who showed that about 14 percent of the whales photographed at Kauai were resighted there on a subsequent day or days. The range of days between resightings at Kauai was from one day to 50 days, with the mean resighting interval being 14.7 days.

Now, the intervals between resighting doesn't mean that the animals were there the entire time. Yet it doesn't seem plausible that a whale will travel, for example, from Kauai to Maui and then back to Kauai and so forth. I know of no instance where there has been a resighting on one island and then another island and then once again on the original island, at least not between Kauai and any other location.

We have seen movement of whales between particular islands, but I know of no back-and-forth movement, to my knowledge.

Now, singing is heard throughout the winter season on Kauai, from January through April day and night. In one study we did back in 1989, we recorded sounds from the Barking Sands range located on the North Shore of Kauai. We made recordings for five minute intervals on the hour every two hours throughout the 24-hour day throughout the season and then we listened to those tapes. There was no five minute interval throughout that period when we did not hear singing, and this seems to be true today, as

103-4

136

well, based upon reports of the singing heard from the sonobouys emplaced two years ago on Kauai. Again, singing is heard continuously.

Now, singing is performed by males and appears to, in the least, to be used to maintain spacing between singers on the order of several kilometers and to provide information to female listeners possibly about the fitness of the singer.

Now, the male whales must be listening to each other's song since they copy each other. We see song convergence. Singers have been observed also to stop singing and to join with other whales, possibly females, at distances of several kilometers. So there is some vocal communication apparently taking place at that level also.

Now, what about masking? Sizable portions of the humpback whale song contain frequencies that fall within the range of the ATOC sound, below 100 hertz and down as low as 40 hertz. The ATOC sound is roughly between 70 to 90 hertz, somewhere in that range.

In some of our playback studies conducted back in 1985 and thereabouts, we've observed whales responding to recordings of their own sounds at distances of several kilometers and at intensity levels estimated to be perhaps only 100 to 110 decibels re. one micropascal.

HEARING OFFICER NITTA: Dr. Herman, I'll ask you to close soon.

DR. HERMAN: I'm almost there.

HEARING OFFICER NITTA: Thank you.

DR. HERMAN: Whales listening to singers may also be listening to rather low intensity levels if, as is typical, they are separated from the singer on the order of kilometers. The occurrence of the ATOC sound can then mask the low frequency portions of the song, making it more difficult for the listening whale to detect, recognize, or judge the song.

What impact that will have on vocal communication cannot be assessed by any of the techniques proposed by the marine mammal program. The program can only principally measure short-term changes in behavior, such as changes in movement characteristics. Long-term effects with either be

impossible to detect or be detectible only after a long term.

Can we afford to wait and see? I think not.

Finally, in the article I published last July I urged the ATOC principals to consider alternative sites that may be suitable enough for the needs, but yet not have present a population of humpbacks or other endangered baleen whales. One such site was Johnston Atoll.

103-5

4b

I'm glad to see that they have considered it. Although it may have somewhat reduced transmission and logistic characteristics as compared with Kauai, it does not have any humpback whales present, except perhaps for an occasional stray.

Therefore, I would urge ATOC to please test the efficacy of the ATOC theory at Johnston and not at Kauai. If the theory holds promise after several years of study, establish a more permanent site there, and as necessary afterwards, seek out other similar sites that leave the humpbacks or other large baleen whales having excellent low frequency hearing undisturbed for sure.

Thank you.

HEARING OFFICER NITTA: Thank you, Dr. Herman.

(Applause.)

HEARING OFFICER NITTA: Mark Smaalders.

MR. SMAALDERS: My name is Mark Smaalders. I'm a resource analyst with the Sierra Club Legal Defense Fund here in Honolulu.

We're a nonprofit environmental law firm and represent through our Hawaii and San Francisco offices a total of 26 groups on the larger ATOC project.

My testimony may seem familiar to those of you who have attended previously ATOC EIS scoping hearings held on Kauai, in Honolulu, and in Santa Cruz, California last spring. That is because the fundamental issue at hand, which is the failure of Scripps Institution of Oceanography and the Advanced Research Projects Agency at the Department of Defense to follow the law, has not changed.

We have not criticized ATOC because of

allegiances owed to other researchers or from a conviction that ATOC will not deliver as promised, although we certainly lack information that demonstrates beyond a reasonable doubt that it will.

Nor do we attend these hearings and submit lengthy written comments because of the potential for financial gain. No group has compensated us for the long hours spent on this issue or for our not inconsiderable expense.

We are motivated instead by a simple premise: that no agency, institute, or individual is above the law, no matter how true their motives and potentially beneficial research. I offer the following comments in that spirit.

In general, the draft EIS is legally inadequate for a variety of reasons. Most fundamentally, it illegally treats the ATOC project in 104-1 piecemeal fashion, evaluating only one small segment of the overall global ATOC project, thereby minimizing ATOC's true overall impacts. 2

Secondly, rather than being the objective pre-decision document required by both NEPA and HEPA, it is, instead, quite blatantly a work of advocacy. Reading this EIS, one has a distinct impression that a decision to proceed both with granting of a scientific research permit and with ATOC sound transmissions has already been made.

104-2 16a

This bias is apparent in assumptions made throughout the draft EIS, including the fundamental assumption that the ATOC sound source will not adversely impact marine life. Rather than err on the side of caution as the law requires and assume that impacts will occur unless evidence indicates otherwise, the draft EIS assumes an absence of impacts and proposes ATOC proceed unless observations prove the existence of impacts.

In addition, the draft EIS misleadingly minimizes potential impacts to marine life compounding the bias the document shows.

Finally, it fails to justify the need for ATOC at all and provides an inadequate discussion of reasonable alternatives.

104-3 3a

Time does not permit a detailed examination of any of these issues, but I'd like to briefly

highlight a few of the most fundamental. We'll provide a more detailed analysis of the draft EIS in our written comments.

As we've maintained for the past ten months, ARPA and NMFS must prepare a comprehensive programmatic EIS on the entire ATOC project. It's clear that the Hawaii ATOC feasibility study is part of and connected to the similar California ATOC feasibility study, and that both of these, in turn, are merely the precursor to and intimately linked with the long-term global ATOC program. Consequently ARPA and NMFS must prepare a comprehensive programmatic EIS that evaluates the need for, impacts of, and alternatives to the overall ten-year worldwide ATOC program.

Only after having done so should ARPA and NMFS make the decision whether to proceed with the long-term project and, in turn, whether to proceed with smaller incremental segments of the long-term project, such as the Hawaii feasibility study, MMRP, and the recently canceled playback studies. Tiered, site specific EISes for the incremental segments would then be appropriate.

We base this on NEPA's requirement that, quote, "proposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall be evaluated in a single impact statement."

NEPA also states that a programmatic EIS is required for, quote, "broad federal or federally assisted research, development, or demonstration programs for new technologies which, if applied, could significantly affect the quality of the human environment. Statements shall be prepared on such programs and shall be available before the program has reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives."

Not only is preparation of a programmatic EIS required by law; it's also a matter of common sense. It's quite conceivable that after a comprehensive programmatic evaluation of the global ATOC project the agencies would decide that ATOC simply may not provide the hoped for information

concerning global warming or that any potential benefits of the long-term ATOC project would be far outweighed by its potentially huge environmental and financial cost and/or that less environmentally stressful means of achieving the same global climate measuring goals exist.

In that case, any decisions to proceed with preliminary segments of the project would be unnecessary. As it stands, by considering only one part of a larger project before having evaluated and made a decision about the larger project itself, the agencies have put the cart before the horse. The decision on the Hawaii feasibility study at this time would be premature and legally impermissible.

A second fundamental flaw of the draft EIS is that it's not an objective and neutral evaluation of the proposed project, but instead is impermissibly skewed in favor of the project.

The fundamental purpose of an EIS is to force the decision maker to take a, quote, hard look at the need for, the environmental consequences of, and possibly less environmentally harmful alternatives to the proposal before the decision to proceed with the project is made.

The law is clear on this point. The EIS must be a pre-decision, objective, and neutral document, not a work of advocacy to justify a decision that has already been made.

As the Council on Environmental Quality Regulations state, environmental impact statements shall serve as the means of assessing the environmental impact of proposed agency actions rather than justifying decisions already made.

Unfortunately this draft EIS assumes throughout that the project will, in fact, proceed, misleadingly minimizes the potential impacts of the project, and dismisses with inadequate discussion alternatives to the project, including the no action alternative.

And I just reference Dr. Alewine's comments in the opening today that also sounded like a strong endorsement as opposed to an objective evaluation of this project.

In fact, also as Ray Chuan commented, it

appears the project proponents have already begun work on the first certain phases of the project in violation of NEPA which states that agencies shall not commit resources prejudicing selection of alternatives before making a final decision.

I refer now to the power cable leading from the Pacific missile range facility to the site of the sound source for which an after-the-fact conservation district use application has been filed with DLNR. A similar after-the-fact permit or a permit was granted for a laying of the cable off Point Sur for the California sound source.

Laying of cables, of course, predetermines the site locations and exposes the discussion of alternative site locations in both the Hawaii and California EISes as a sham.

In addition, much preliminary research work on marine mammals has already taken place in both Hawaii and California and serves to illustrate the presumption in the minds of the authors of these draft EISes that ATOC and the MMRP will be located off Kauai and at Sur Ridge in California.

104-4 Another fundamental way in which the draft EIS is skewed in favor of the proposed project is the series of null hypotheses contained in the MMRP. Each null hypothesis with respect to the impacts of ATOC transmissions on marine wildlife is, by definition, that there will be no impact. Nowhere is an alternative hypothesis stated that ATOC will cause adverse impacts on marine wildlife. 16b

Moreover, rather than being open minded and objective about what the results of the research might show, the MMRP states in numerous places that the researchers expect that the null hypothesis will be validated, that is, that there are no impacts.

The basic assumption throughout the MMRP, thus, is that ATOC will have no impact. Only if the results of the MMRP disprove this assumption does the draft EIS admit of any possibility of modifying or terminating the sound transmissions.

However, the proponents of the MMRP have acknowledged elsewhere that the MMRP is unlikely to be able to detect any short-term effects on marine animals. If you look at the scientific research

permit application, it states, "We do not expect any health effects, e.g., physiological stress, to be exhibited within the exposed animals. However, in free ranging cetaceans such effects are extremely difficult, if not impossible, to detect given the current state of scientific and technological capabilities in this field of research."

104-5 Moreover, MMRP is not designed to admittedly will not detect the perhaps more important long-term adverse impacts on marine wildlife, such as abandonment of previous Haieu serious (phonetic) or a decrease in calfing, pupping rates, and/or total population size. Yet the pilot study results will be used to, quote, help design a long-term program to determine if the operational ATOC program has unacceptable long-term effects. 12a

For all of these reasons we call once again for a programmatic EIS and hope that NMFS and ARPA will make the determination to prepare such an EIS prior to going forward.

Thank you.

HEARING OFFICER NITTA: Thank you.

(Applause.)

HEARING OFFICER NITTA: Paul Atchitoff.

MR. ATCHITOFF: My name is Paul Atchitoff. I'm a staff attorney with the Sierra Club Legal Defense Fund, which as Mark Smaalders just pointed out, represents 26 national and local environmental and citizens groups that have grave concerns about the way --

HEARING OFFICER NITTA: Excuse me. Can you adjust your mike? I don't think they can hear you.

MR. ATCHITOFF: Is that better?

HEARING OFFICER NITTA: Yes.

MR. ATCHITOFF: Thanks.

As Mark Smaalders has pointed out, the Sierra Club Legal Defense Fund is representing some 26 national and local citizens and environmental groups that have grave concerns about the way that this ATOC project is being approached.

I'd like to illustrate our concerns on the ATOC draft EIS with the following scenario. Say you've had a headache since yesterday. You're concerned. So you go to a doctor. The conversation

goes something like this.

The doctor says, "I've got this great new machine. It will bathe you in radiation for ten hours, and then maybe it will help us figure out the cause of your headache. It costs $1,000 for the session."

"What do you mean 'maybe,' Doctor? Haven't you been successful using this machine to diagnose headaches?"

"Well, not yet. As a matter of fact, I've never used the machine."

"But, Doctor, it's been tested, hasn't it? It does work, doesn't it?"

"Oh, sure, we've tested it. I turned it on just the other day myself. The radiation comes out just like it's supposed to."

"But I mean it has been shown to effectively diagnose headaches, hasn't it?"

"Not exactly, but I think it may work. After all, I am a man of science."

"By the way, Doctor, how did you happen to get this machine?"

"Well, since you asked, it was donated by the Defense Department."

"The Defense Department? They used it to diagnose illnesses?"

"Oh, my, no. They used it for military purposes, part of some kind of weapons system. So they didn't need it anymore, and they made me an offer I couldn't refuse. I get $10,000 every time I use it."

"Does it have any side effects, Doctor?"

"Oh, I doubt it, and after all, I am a man of science."

"You doubt it? You mean you want me to stand in front of that thing for ten hours and you don't know whether it will help me or hurt me?"

"Now, now, now, don't get so excited. It probably won't do you any harm. After all, it's just radiation. There's radiation everywhere. It's a natural phenomenon. The sun gives off radiation. You walk in the sun, don't you?"

"Doctor, don't you think it would be a good idea if I waited until we find out more about what

this machine can accomplish and what effects it may have on me?"

"Look. Since you're so paranoid, I'll tell you what we'll do. Why don't you just strip down and stand on that red circle over there? I'll turn on the machine, and we'll let her rip for, say, half an hour. If you seem okay after that, why, we'll bring you in tomorrow for the full ten hour session. What do you say?"

"But, Doctor, are you sure you'll be able to tell after only half an hour if this thing will cause any harm? And what if you turn it on and it fries me to a cinder on the spot?"

"My what a nervous nelly you are. I really doubt that you'll be incinerated. After all, I am a man of science, and anyway, if I can't do the half hour test run, how will I know whether that darn thing really does have any harmful effects? This is in the interest of science. We can learn a lot about the effects of radiation on people from this device, and I promise you if I notice you acting the least bit funny, I'll turn it off immediately. You have my word as a man of science."

"Doctor, aren't there any other ways you can diagnose my headache?"

"Oh, I suppose so. We could put the machine over on that side of the room and you could stand over there, but then I'd have to move the machine, and it's kind of heavy."

"No, Doctor. I mean any alternatives to that contraption."

"First, young man, this is not a contraption. I prefer to think of it as a symphony instrument like a cello. Second, take my word for it as a man of science. This machine is the way to go."

105-1

This little analogy illustrates what's wrong with the ATOC draft EIS. An EIS must present an objective, impartial analysis of the benefits and risks associated with the proposed action. It also must present alternatives so that the benefits and risks of the proposed action can be compared with those of the alternatives. 3f

This draft EIS doesn't do this. In this document it is admitted that no one knows whether ATOC

will measure global climate changes in a way that will ultimately be of value to anyone. It is admitted that no one really knows what effects the project will have on marine animals and the ocean ecosystem. All we have on either question are some vague assurances that the project will work and there won't be any real harm.

105-2

The document's lack of objectivity is palpable. It is one long sales pitch for ATOC. No attempt has been made to present and analyze any alternatives to ATOC as a means of measuring climate change. The many other methods for measuring climate change now being employed are completely ignored. 16a

No one in his right mind would commit his own resources and risk his own welfare by plunging ahead with any project without knowing whether the project will work, without knowing the risks, and without knowing whether there exists alternatives that accomplish some or all of the same goals with lower risks.

105-2

So we say to the ATOC proponents: not so fast. First, do a programmatic EIS. Tell us the 2

H-105 H-106

things the law says you must disclose, such as what alternatives exist to ATOC as a way to measure global climate change, what the cost is of those alternatives, what the environmental impacts of those alternatives are. Stop trying to evade this fundamental requirement of the National Environmental Policy Act. Stop trying to push ATOC forward just so you can get taxpayer money to fund research that you find personally intriguing.

Stop your persistent attempts to evade your legal obligations by segmenting your project into bits and pieces, such as the MMRP, the AET, and the playback studies, which you then put into the water as fast as you possibly can. First do an objective programmatic EIS. First justify ATOC as a whole. Then and only then start thinking about how best to go about it and how to determine its effects on marine animals.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you. Hal Whitehead.

H-106

MR. SMAALDERS: I've been asked to read the following statement.

Comments on the draft EIS for the Hawaii acoustic thermometry of ocean climate project and its associated MMRP by Hal Whitehead, Ph.D.

These are comments of Hal Whitehead on the draft EIS. I'm associate professor of biology at Dalhousie University and a university research fellow of the natural sciences and engineering at Research Council of Canada. My graduate degrees are in mathematical statistics and zoology. My research is principally on the population biology, social organization, and ecology of the deep water whales, sperm and beaked whales.

I have a number of detailed questions and comments on the document, but this is a summary of my major impressions.

106-1 The document was clearly put together with extreme haste. One of the results of this is shoddy presentation. For instance, many of the cited references are not listed. Inappropriate sources, such as the ATOC scientific research permit 162 application are cited for biological information.

In the areas where I have most expertise, the document is often seriously wrong, invariably in the direction of minimizing the potential effects of the ATOC source on the marine environment. For instance, on page 448, there's a calculation of the number of sperm whales likely to come within a 150 decibel contour. When calculations are carried out correctly, including the whales missed when diving, proportion of time at depth, the tidal sampling, and the mean speed of movement of whales, the number of sperm whales affected is increased by more than a factor of 100.

106-2

8b

A second example is found on page 441. Individual residence times in an area cannot be estimated from densities. The statements in the EIS that quote the maximum residence within the general area is estimated to be less than 24 hours, end quote, are completely false. Individual sperm whales, fin whales, blue whales, and beaked whales, are known to spend periods of weeks or more in small ocean areas.

Given these serious deficiencies in the

areas where I know something, it's hard to take the other parts on faith.

The major structural problems with the document is that it refuses to consider the most sensible and environmentally acceptable alternatives as legitimate, especially the following: the no action alternative. The benefits of this alternative compared with ATOC are no financial cost and no short or long-term effects on the environment.

106-3

5a

The possible drawbacks or costs as compared with ATOC are a lack of knowledge gained about global ocean climate. As the acoustic method is only one and a rather dubious one of several methods of looking at ocean temperature changes, the loss of ATOC's potential results are of very little consequence.

Two, lack of knowledge gained on the effects of low frequency sound on marine mammals. As the portion of the MMRP dependent on the ATOC source has very poor statistical power, its results will largely be inconsequential.

106-4

12a

Moreover, the ATOC sources are not necessary to study the problem of low frequency noise in the ocean.

106-5

6f

There are other

anthropogenic sources or for experimental work, special mobile low powered sources could be used.

The alternative of an autonomous source for ATOC and low powered mobile source for the MMRP have been suggested several times by critics of ATOC and at least the second part recommended by members of the ATOC MMRP Scientific Advisory Board.

106-6

The benefits compared with the current proposal are, one, possibly lower cost; two, much higher statistical power and greater temporal and spacial flexibility for the MMRP; three, minimal effect on the environment if the source is placed in an area of low productivity. The suggested increased exposure of myctophids, for instance, by using the autonomous source is complete rubbish if the source is placed in an unproductive area, another example of the misleading nature of the document.

Four, shorter paths and lack of bottom effects would meet either low source levels or higher received levels or both. The only costs associated with these alternatives are some additional engineering work.

6e

Another major deficiency in the document is that there must be some discussion of potential extensions of the ATOC program. If the minimum extension feasible for useful work on global climate is ecologically unacceptable, the project should be stopped now. There are potential extensions out there in the oceanographic literature.

106-7

If there are no problems with stability, internal waves, acoustic propagation limits, or ocean boundary scattering, how would the project ideally in the oceanographic sense proceed? According to the ATOC technical proposal, a high powered team at Scripps and MIT have been working on global extensions to ATOC for some time. What are the results? We should be given a reasonable preview of future potential plans.

For these and other reasons, I view the document as an incomplete and misleading representation of the environmental effects of the proposed project.

Thank you.

(Applause.)

2

HEARING OFFICER NITTA: Thank you.

Mark, stay there. Linda Weilgart.

MR. SMAALDERS: Here we go. I've been asked to read this statement as well.

Comments on the draft EIS by Linda Weilgart, Ph.D.

I'm research associate at the Department of Biology, Dalhousie University. My graduate degrees are in the areas of whale bioacoustics and behavior. My present research is on sperm whale acoustic communication.

107-1

My general impression of the DEIS is that it is unconscionably dismissive of likely adverse impacts on marine life. Moreover, it's sloppy, internally inconsistent, and shockingly inaccurate in places. Conclusions of low impact are reputedly made even when these conclusions are based on completely unsubstantiated assumptions. There is certainly no attempt being made to err on the side of caution. 16a

107-2

Behavioral disruptions and physiological stress are given very shrift, if mentioned at all, and even though this effect is likely to be dominant. 10d

107-3

Even low duty cycles and modest increases to ambient noise level can cause a serious rise in the stress levels, thus potentially placing the populations in jeopardy. 12b

107-4

The DEIS gives much greater emphasis to the impact of ATOC on the hearing capabilities of marine organisms. Yet here the great gaps in knowledge offered render the assumptions worthless. For instances, we're asked to assume marine mammals hear the same way humans hear, which is clearly not the case. We're asked to assume that the same relationship by which noise trauma to the human ear is estimated can also be applied to the marine mammal ear, even though recent research on pinnipeds seems to cast doubt on this assumption, and furthermore, we're asked to accept complete guesses at the auditory sensitivities or thresholds of the vast majority of species in the study area, particularly the endangered large whales. 11b

If any of these stabs in the dark happen to be wrong, the radius within which animals could suffer potential hearing damage could increase from 178 meters to 40 kilometers or more. ATOC's own independent Scientific Advisory Board states that, quote, "ATOC documents assuming hearing damage will not occur if received levels of ATOC sounds are below 150 decibels. The Advisory Board notes this assumption may or may not be true, but there are no supporting data from marine mammals." That's according to an MMRP report from June 13th, 1994.

107-5 6i

Ambient noise levels appear to be exaggerated to downplay ATOC's relative contribution to underwater noise. Ambient noise levels are repeatedly listed as being around 90 to 100 decibels in the DEIS. Yet these numbers do not reflect noise levels in the sound channel, which is most affected by the ATOC source.

107-6 7e

Page 9 of the California DEIS states, quote, "At deep sound channel depths, the ocean is very quiet, with ambient noise levels considerably below those at the surface," unquote. Studies on fish and shrimp conclude that sounds only 20 to 30 decibels over ambient levels or levels of only 100 to 130 decibels can significantly decrease growth and

reproduction rates.

If a level of 90 to 100 decibels in the quieter sound channel is potentially harmful to fish or invertebrate reproduction, populations could suffer over a radius of about 3,500 kilometers at depth around the ATOC source, in other words, over one quarter of the entire Pacific Ocean as calculated by Scripps. This is a potentially serious ecological effect, and yet the draft EIS states that the impacts on fish and invertebrates are expected to be low.

107-7 18c

We are asked to believe that the original calculations for the ATOC source's sound field are wrong even though these were presented in the previous permit application, incidentally completed before there was any public outcry against the project. The recalculations made for this draft EIS conveniently reveal smaller area of high sound intensity. Such recalculations do not inspire confidence.

107-8 7a

Most incredibly, the draft EIS actually maintains that ATOC is implementing goal 1.3111 of the humpback whale final recovery plan to, quote, "reduce noise disturbance in Hawaiian waters." May I remind

107-9 14c

107-10 the ATOC team that there are plenty of other existing noise sources that can be studied without the addition of a new one. 6f

107-11 In conclusion, this document consistently attempts to downplay the very real risks that this project presents, concluding low impact when effects are unknown or even with evidence to the contrary, all this for a project which, as the draft EIS concedes, may or may not provide useful climatic information. 3f

And, finally, we're asked to trust the same people who included an inappropriate, not to mention untruthful, letter from Chris Clarke attacking my name under scoping comments, Volume 2 of the EIS. NMFS has agreed that this was wholly inappropriate and regrettable, but I have yet to receive an apology from ATOC. I view this as a deliberate smear campaign typical of the tactics used by the ATOC team.

Thank you.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Nelson Ho.

MR. HO: Aloha. My name is Nelson Ho. I

am chair of the Sierra Club in Hawaii.

Sierra Club does not have the ATOC proposal nor the Kauai DEIS acceptable. To continue in this course without major change would be considered technology fascism. We find that there is much work that needs to be done before Sierra Club would support something like this.

We would just like to add that we would like to incorporate by reference the comments made by Mr. Ray Chuan and the Sierra Club Legal Defense.

Thank you very much.

(Applause.)

HEARING OFFICER NITTA: Thank you.

Stan Butler.

MR. BUTLER: My name is Stan Butler. I'm Director of Whales Alive, which is a project of Earth Island Institute.

Earth Island Institute has submitted testimony to the National Marine Fisheries Service which pretty much agrees with the previous comments made by Mr. Smaalders from Sierra Club Legal Defense Fund and also by Weilgart and Whitehead.

Also, personally I've been looking at humpback whales for a number of years, and they're right out here a couple of miles away, big animals. You can see them for miles. As Dr. Herman pointed out, there have been people going out and looking at them for about 20 years now, and we assume that they're out here giving birth and mating, and I say we assume because despite a number of highly credentialed people with government permits, as far as I know, it's never been documented. These huge animals that are visible for miles, we've never seen mating or calving.

And so I wonder how we're going to detect subtle changes in their behavior if we can't even after 20 years the results of such a large scale reproductive effort.

109-1 62

We also have some evidence that the singing that the humpback whales create is similar over thousands of miles. If we listen to records of the song in Japan and Mexico, which are 1,000 miles away, we find that there are similarities, and based on what we know or think we know about their hearing and their sound production, they shouldn't be able to hear each

109-2 82

other more than ten or 20 miles in the ocean. So how do these similarities occur?

And I wonder if maybe some simple ecological explanation like the large fit males, like many other marine mammals, sperm whales or elephant seals, simply swim out to the deep water where the sound channel may occur and dive to 2,500 feet and sing their songs and listen, and that low frequency sound would travel across thousands of miles of ocean and be heard by other humpback whales anywhere throughout the world's oceans.

It may be some other biological, esoteric kind of mechanism that we haven't dreamed of. I don't think 100 years ago we hadn't really dreamed that dolphins could see with echolocation, that they could see with sound quite as well as they do, but it turns out that they can.

I wonder what the effect of filling this channel of sound may be the means of communication between these animals might be, and in light of that I don't think I would like to see the ATOC hearings proceed as they're or the ATOC tests proceed as they (inaudible), but you allowed Dr. Mobley to go through the whole whatever --

HEARING OFFICER NITTA: As I --

MR. CHUAN: -- not comment. So, therefore, it should be stricken from the record.

HEARING OFFICER NITTA: Excuse me. When I opened the hearing, I laid down the ground rules, and I also talked about procedure, and in my mind in terms of procedure, we're talking about how things are -- how would I say it? -- done in terms of scientific method and how the science is accomplished in getting the information for the EIS. I would consider that part of the process of our procedure.

Perhaps there were some emotional statements that might be linked with what Dr. Mobley has talked about, but there were other statements throughout the testimony tonight that had the same emotional links, although maybe on the other side, and I see no reason to strike this testimony from the record.

If there are any other speakers who wish to testify who haven't done so, I'd like to know who they

are at this point.

(No response.)

HEARING OFFICER NITTA: If not, thank you very much for your attendance tonight. I know it's late. It's Friday night.

The hearing is closed.

(Whereupon, at 8:03 p.m., the hearing in the above-entitled matter was closed.)

CERTIFICATE

This is to certify that the foregoing transcript in

the matter of:	NATIONAL ATMOSPHERIC & OCEANIC ADMIN. PUBLIC HEARING ON SCIENTIFIC AND RESEARCH PERMIT APPLICATIONS P557 AND 1557A
Before:	EUGENE T. NITTA, HEARING OFFICER
Date:	FEBRUARY 10, 1995
Place:	HONOLULU, HAWAII

represents the full and complete proceedings of the aforementioned matter, as reported and reduced to typewriting.

Corbett Riner

CORBETT RINER

H-112

GERARD V. CAREY, CPA
11 NORTH RIDING DRIVE
CHERRY HILL, NJ 08003
(609) 428-7012

'95 FEB 6 AM 8:34

DLNR
OCEA

January 28, 1995

RS

Mr. Clayton H. Spikes
a ONR contractor representative
Marine Acoustics, Inc.
4 Crystal Park
Suite 901
Arlington, Virginia 22202

Dear Mr. Spikes:

Having reviewed the environmental impact
1 study I do not feel the Acoustic Thermometry of Ocean 5a
Climate is in the best interest of nature due to the
impact on our marine mammals.

Sincerely yours
Dori L. Carey

c.c. Roy Schaefer

H-113

RECEIVED

'95 FEB 1 AM 8:15

GREAT WHALES FOUNDATION

111 Hancock Street, San Francisco, CA 94114
tel: 800 421 WAVE --Richard B. Robertson, Exec. Dir., E-Mail: rbRobertson@mciMail.com

FROM:
Co-founder & Malibu volunteer coordinator: Francis Jeffrey, P.O.Box 6847, Malibu, CA 90264
tel: 310 457 6634, fax: 310 317 1414, E-Mail: francis@ELFNET.com

To: Mr. Roy Schaefer
Dept. of Land and Natural Resources
P.O.Box 621
Honolulu, HI, 96809

RJ

11:23:30 PST, Sat Jan 28 1995 [~~1-page fax~~]

Re: ATOC Hawaii Draft EIS

In response to a notice we received from the ATOC project office dated 20 January, we enclose herewith a copy of our comments on the California ATOC Draft EIS, whose main points are equally applicable to the Hawaii ATOC.

For The Public Record

GREAT WHALES FOUNDATION

Regional Headquarters: P.O. Box 6847, Malibu, CA 90264
Telephone: 310-281-8590 • Fax Number: 310-317-1414

World Headquarters: 111 Hancock Street, San Francisco, California 94114
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Telex 650 475 3409 MCI

TO: NMFS hearing officers & other concerned parties
RE: ATOC Draft EIR (Hearing 6 Jan 1995 @ Santa Cruz)
(Scientific Research Permit Application P557B)

Malibu, 4 January 1995

Deficiencies in the ATOC draft EIR are stark, fundamental and obvious:

(1) Significant alternatives are summarily dismissed. Under "Alternatives," the draft EIR (intentionally) omits substantive consideration of the most obvious, appropriate, and practicable alternatives; thus
1 tautologically arriving at the conclusion that there are no good alternatives to ATOC. Only the extremes of "no action", or trivial variations of ATOC, have been given 3e
real consideration as alternatives in the EIR. [1]

We propose a meaningful alternative, called "ATUT," as the best alternative (ie, Alternative Thermometry Using Thermometers). While ATUT may sound cute, it is actually serious, and we believe a statistical analysis will prove it is really superior to ATOC in achieving the stated aims of ATOC with respect to global warming. [2]

1 Sec 2.2 "Alternatives Considered and Rationale," page 2-1 of Draft EIS/EIR for the California ATOC Project, etc. (Scientific Research Permit Application P557B), prepared by ARPA, NOAA/NMFS and UCSD, November 1994. (See also page ES-12 for untenable rationale.)

2 Outline of argument. Point (A) The baseline problem. ATOC would need to operate over, at the very least, many decades to produce any potentially useful results in the form of a pattern of change over time; otherwise any global ocean temperature data derived from ATOC, however voluminous, would need to be compared with baseline data from earlier times before ATOC. Since such earlier data is relatively scant and resultant of different methods, the statistical significance of the vastly more intensive ATOC data collection will be lost in deriving the comparison figures. (A small increase in the joint significance could be purchased only at the expense of a relatively exponential increase in ATOC sampling.) ..Point (B) The chaos problem.

ATUT, in addition to being actually an effective method of achieving the stated purpose, has the benefit of prospectively involving the public world-wide in a necessarily long-term endeavor that will focus attention on the issues and mysteries of climate change and other looming environmental hazards. Thus instead of a sinister, invisible, obscure undersea high-tech acoustical nuisance, we can design a project with educational value and global media visibility.

The ATUT plan is to engage a large number of individuals, organizations and governmental agencies in frequently sampling local water and air temperatures, with the data flow directed to and organized by computer networks. Internet, global positioning and communication satellites, naval vessels on duty, and broadcast media would certainly have a role in this program. The successful designing and management of ATUT is assuredly within the capacity of the institutions currently proposing to run or to fund ATOC; while no doubt can seriously be raised on the potential for thermometer-based measurements to provide temperature data sufficient to any stipulated level of significance, over any desired time-frame, and all without the least adverse impact on marine mammals.[3]

The foregoing weaknesses are seen to be exacerbated to the point of total ineffectuality when we consider the problem of distinguishing systematic versus cyclical or chaotic change. The governing paradigm here is signal detection theory -- but applied finally to the over-all results of the research rather than to the atomic data events. This requires at minimum two components: (1) the complete body of experimental results at some point in time; (2) a model in which the the results are to be classified as either a hit or a miss with the hypothesis under consideration. Until a model has been formulated in which significant discrimination between a very weak hypothetical systematic influence can be discriminated from a stronger chaotic process (containing unknown hidden periodicities), there is no point in proceeding with component (1). (For general discussion of chaotic terrestrial processes, see bibliography in: R. Abraham, Chaos, Gaia, Eros, S.F.: Harper Collins, 1994. The theory of "interglacials" -- with a direct bearing on global warming detection, is discussed in the text.)

3 ATUT clearly overcomes the rationale, "Oceanographic point sensors...limited due to relatively small number of measurements ..." given on page ES-12, Draft EIS/EIR etc., op cit.

(2) **ATOC is speculative, therefore neither necessary nor sufficient.** The draft EIR discloses what was omitted from earlier proposals in favor of ATOC: That <u>ATOC is not a known reliable method of detecting global ocean temperature changes</u>, but rather is an open-ended project 2 of technology research and development to determine <u>whether</u> the proposed methods are suitable to the stated 3d purpose.[4] Thus ATOC is not actually a solution to the problem of detecting or answering the question of global climate change.

What it is applicable to, however, is the developmental testing of low frequency sound for submarine communication -- analogous to the so-called "acoustic modems" currently being tested in Monterey Bay to link research devices,[5] or for military communication with submarines and other naval vessels, and related acoustic imaging.

(3) **The Marine Mammal Research Project ("MMRP") is not rationally scoped.** We agree with the National Research Council committee report[6] that there is an abysmal lack of (public) knowledge about the hearing of marine mammals; however we do not believe the MMRP of ATOC will be very contributory to this area of knowledge, because 3 it amounts to an <u>ad hoc</u> adaptation of equipment designed 6a for other purposes. It would make more sense for the concerned institutions to rationally design and fund research focused on the basic questions at hand.

Furthermore, there are fundamental defects in assuming that acoustical impacts on cetaceans can be assessed with the behavioral and observational methods proposed. Indeed, we believe that <u>the most profound effects of the ATOC signal on cetaceans will NECESSARILY escape detection</u> by the proposed means, thus building a

4 "The proposed ATOC project is a demonstration or 'proof of concept' phase, with the goal of proving the acoustic thermometry concept for future global ocean climate monitoring programs." page ES-3 (top para.) in <u>Draft EIS/EIR.etc., op cit.</u>

5 (John Travis, reporter) "Dialing Up Undersea Data -- Long Distance," <u>Science</u>, 263:1223-1224, 4 March 1994.

6 D. H. Green (chairman, Committee on Low Frequency Sound and Marine Mammals, NRC) et al, <u>Low Frequency Sound and Marine Mammals: Current Knowledge and Research Needs</u>. Washington, D.C.: National Academy Press (National Research Council), 1994.

false conclusion of a negative finding -- a finding that can be predicted <u>a priori</u> from the research design.

If we want to do more than exploit the ocean's resources and marginalize its inhabitants, we will have to embrace a communicational -- as opposed to behavioristic -- paradigm for assessing our relational impact on cetaceans. As the NRC committee report points out, it is hard enough to assess the impact of acoustic signals on humans, where at least we can rely on the avenues of conversational interaction and symbolic expression. Given the large brain size, high neurological quality and vast communicational repertoire of cetaceans already established, it should be obvious that systematic or recurrent (as opposed to random noise) <u>acoustic emissions will be interpreted by them as communicational in nature</u>. What meaning they may construe in our signals is a matter that should concern us greatly.

While a considerable body of knowledge on the communicational attributes of cetaceans has been accumulated over the past three decades at public 4 expense, unfortunately an indeterminate fraction of that 1 information has been classified under military secrecy, or distorted into intentional misinformation for public consumption. As a minimum, first step toward scoping marine mammal research issues essential to the design of <u>any</u> future active-sensing oceanography, <u>the FULL record of publicly-funded marine mammal research and development must be PUBLICLY reviewed</u>.[7]

Finally, as representatives of the point-of-view of the whales, as far as it can be humanly known at this time, we object strenuously to the <u>tagging</u> of Blue Whales[8], and to all involuntary, confining, intrusive, invasive, deforming or degrading procedures applied to whales (and other marine mammals) -- in the name of research or anything else.

7 Environmental Task Force (established 1992 by Robert Gates, then-DCI, at request of then-Senator Al Gore -- the ETF reviews classified facilities to determine which can contribute to understanding of global climate change. (Richard A. Kerr, reporter) <u>Science</u>, 263:625-626, 4 February 1994.

8 Tagging of Blue Whales, page ES-8 in <u>Draft EIS/EIR.etc., opc it.</u>

As examples of a community-generated ethical policy respecting cetaceans, we cite the following civic resolutions from coastal communities:

Monterey County Resolution 92-260 declaring the Monterey coast a REFUGE for marine mammals.

Malibu City Resolution 92-88 establishing the Malibu coast as a human-dolphin shared environment, and asserting civic rights and protections for marine mammals.

Malibu City Resolution 94-300 declaring whales to be living cultural resources, and calling for their fuller international protection.

Submitted for the public record by

GREAT WHALES FOUNDATION

Francis Jeffrey

Francis Jeffrey, Volunteer Coordinator, for

Richard B. Robertson, Executive Director

Distribution:

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Monterey Bay National Marine Sanctuary board

GWF members and friends distribution list

FJ/1a:.../Dolphin/ATOC/ATUT4jan95

3-3-95

To whom it may concern

I am a concerned high school student and I'm bringing to your attention - my concerns about the ATOC project which in my opinion, clearly is a misguided project which apparently will endanger living creatures in our ocean.

1 First and formost it could kill and alter up their lifestyle patterns, effect and change the marine life, and could change the natural habitat of their living. Possibly it could lead to extinction of certain species. 6k

2 Secondly its all a waste of money because I think 35 million dollars could be spent better elsewhere for something more useful. 5a

3 Lastly if you could hear the sounds on a calm day it would be annoying and would effect the people and the tourist wouldn't like to go to the beaches. Many people like to fish so the sound would annoy them 18c

3-3-95

and their wouldn't be any fishes biting.

In conclusion - I want to thank you for your time in considering my feelings/opinions about this very important subject. It is my hope that you will seriously consider the points I have outlined for you, so that definitive action may be taken to protest the natural living creatures which inhabit our oceans.

Sincerely,
Melinda Javier
Melinda Javier

4754 A Pelehu Rd
Kapaa Hi 96746

University of Hawai'i at Mānoa
Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawai'i 96822
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'95 MAR 13 PM 2:51
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OCEA
RE:0657
RS

March 6, 1995

Mr. Roy Schaefer
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Schaefer:

Draft Environmental Impact Statement (EIS)
Kauai Acoustic Thermometry of Ocean Climate
Offshore, Kauai

The Kauai Acoustic Thermometry of Ocean Climate (ATOC) project intends to test the theory that ocean warming can be measured and monitored reliably using the average speed of sound through an ocean basin. The referenced Draft EIS addresses the proposed emplacement of a sound source on the north shore of Kauai. The source will generate low frequency (about 75 Hz), high intensity sounds (about 195 dB referenced to 1 micropascal at the source) for 20 minute periods. Initial transmissions will be made every four hours, every fourth day over a period of from six to ten months. Then, for a two month period, transmissions will occur daily every four hours. The initial transmission regime then will resume for the duration of the experiment.

A 260 watt output acoustic sound source will be located 14.7 kilometers offshore at an approximate depth of 850 meters. A cable connected to a signal generator and power amplifier in an existing building at Barking Sands, Kauai will power this source.

We have reviewed this document with the assistance of Richard Brock of the Sea Grant Extension Service; Louis M. Herman of the Kewalo Basin Marine Mammal Laboratory; Fred Mackenzie of the School of Ocean and Earth Sciences; and Malia Akutagawa of the Environmental Center.

Overview

Concerns of the comunity are focused on three major issues:

1) potential effects of low frequency sound on marine mammals, turtles, and other marine life;

2) alternative technologies to conduct climate change studies; and,

3) whether an acoustic thermometry project is an appropriate activity at the proposed location.

First, it should be recognized that the ATOC experiment is just that, an experiment. there is no guarantee of success. There are several technical and other potential barriers to success, including the problems of sound scattering and distortion as the sound travels in the acoustic "waveguide"
1 deep within the ocean. Second, there are several technologies 3f
currently in existence designed to detect a global warming, including, as pointed out in the Draft EIS, measurements of sea surface and atmospheric temperatures directly and by instrumentation on satellites and balloons. However, neither of these statements detract from the arguments put forth by the ATOC proponents for doing the research.

We have a well-documented 100-year record of global temperature change that shows that the planetary near-surface has warmed about 0.5°C. Global temperature change over the past two decades is somewhat more equivocal. The records from near-ground level and at the sea surface indicate an overall warming trend, but the micro-wave satellite record of temperature change in the mid-troposphere is dominated by ENSO events and volcanism. However, the most recent analysis of all the current records shows that between 1958 and 1993, 3d
2 global temperatures rose about 0.1°C per decade. Thus, it is
not a matter of detecting global warming; a certain degree of warming has been detected. It is a matter of whether or not the warming is a result of an enhanced greenhouse effect brought about by emissions of CO_2 and other greenhouse gases to the atmosphere as a result of fossil fuel combustion and land use change. The ATOC experiment in the long run may detect temperature change in the ocean and perhaps a global warming, but its attribution to an enhanced greenhouse effect will not necessarily be resolved by the experimental results. The ATOC project will have to continue for several years and be strongly linked to other global climate change programs, including the use of the ATOC temperature data to validate and refine global climate models, for it to have any relevance or impact.

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Section 2.2.1 - Proposed Action and Mitigation Measures

Generally, the transmission protocols involve sufficiently small proportional durations (2% duty cycle) that any effect on whales or other biota is likely to be minimal. 5c
3 We suggest that an additional mitigation to be considered
might be that the 8% duty cycle interval be scheduled during the summer months when whales are not in the vicinity of the Hawaiian Islands.

Section 3 - Affected Environment

Our reviewers expressed concerns regarding the description of biota in Sections 3.3.1 through 3.3.5. Evidently, the authors were not familiar with the literature base relating to Hawaiian marine communities or their functional and ecological relationships. Numerous pertinent references which are well-known among marine scientists locally are missing. In particular, descriptions of biota
4 along the cable route is quite cursory (Section 3.3.9). As TC
written, these sections lack comprehensiveness and should be revised and expanded. In particular, we suggest that extensive compilations of data on nearshore and oceanic biota found in much of the Ocean Thermal Energy Conversion (OTEC) documentation should be consulted and referenced. Additional data relevant to the proposed project may be found in various appendices to the Environmental Assessment prepared by R.M. Towill Corporation in January, 1993, for the GTE Hawaiian Telephone Interisland Fiber Optic Cable System.

The description of Hawaiian fisheries given in Section 3.4.1 contains inaccuracies. For example on page 3-36:

"Hawaii's nearshore fisheries produce the greatest proportion of catch; however, a deepwater fishery also exists for snappers and some tuna (Haight et al, 1993)."

The reported nearshore catch in the last 15 years has not been more than 15% of the total reported commercial catch. Thus, the statement above is erroneous and reflects an insufficiently detailed research effort regarding Hawaiian fisheries.

Section 4 - Environmental Consequences

The Environmental Consequences section is reasonably well done for sea turtles (Section 4.3.2.1). However, the authors
5 did not cite information available in recently published EIS's TC
that provide qualitative (as well as some quantitative) observations on green sea turtle responses to nearby noise and development. This would be useful and would, in general,

support some of the other conclusions regarding green sea turtles.

There are, however, errors in Section 4.3. One of these is on page 4-106 where the statement is made:

> "Similarly, many of the fish which inhabit a lower depth of the Hawaiian Archipelago slope are important commercial species, such as flatfish." TC

Flatfishes (families Bothidae and Pleuronectidae) are a very minor component of any catch made in the Hawaiian Islands. Citing the Department of Land and Natural Resources annual reported commercial landings for 1993, we find that 45 pounds of flatfishes were landed out of a total reported annual landing of 26,155,558 pounds. The appearance of misstatements like this undermines our reviewers' confidence in the authors' knowledge about Hawaiian marine biota and exploitation (fisheries) of that biota. These concerns only are heightened by the following quote (p.4-132):

> "In the shallow subtidal zone, kelp bed communities (particularly bull kelp and feather boa kelp) would only be affected if the cable happened to be laid across one or more of the plants themselves." TC

The biological expertise of the author of this sentence is questionable. Kelps are found in temperate waters, not subtropical settings such as Hawaii.

Additional confusion arises concerning description of the impacts that would occur with the laying of the cable from shore to the sound transmission system offshore. According to Section 4.2.1 (p.4-1):

> "No new cable installation will be placed through the surf zone, since that cable would be connected to an existing sea-shore interface several kilometers from shore" TC

However, Section 4.3.2.8 discusses cable installation impacts on biota as in the following passage found on page 4-132:

> "Species in the shallow nearshore region include fish (wrasses, goatfish, damselfish, etc.), and invertebrates, such as lobster, crab, sea stars, sea urchins, and reef-building corals. None of these would be expected to be affected by the cable either during or after its installation. Most species would merely move away during installation and return thereafter." TC

Without the examination of a precise route for the cable through the inshore area, no statement of impacts can be made. Additionally, reef-building corals as adults are sessile and cannot

> "merely move away during installation and return thereafter." TC

The subsequent Section 4.3.2.8.3 compounds the confusion:

> "No adverse effects due to the cable are anticipated on plant or animal species expected in the shallow subtidal or nearshore zone. Therefore, cable installation and subsequent operations should produce no material impacts on the biota along the cable route. There is minimal difference between the two alternate sites proposed, because neither of them should produce any serious impacts on the nearshore or subtidal biota that may be found along the cable routes." TC

If a cable is to be emplaced in the nearshore region, a more quantitative description of the biota in the vicinity of each cable route in shallow water (i.e., less than 100 feet) with a supporting analysis of impacts will be required.

In general, the marine biological sections in this Draft EIS reflect a strong emphasis on marine mammal issues, with somewhat less concern directed to other important biotic elements. In addition, there is some concern that knowledgable individuals familiar with local biota may not have been fully consulted prior to the preparation of this Draft EIS.

<u>Potential Impact to Humpback Whales</u>

Inasmuch as Kauai, as well as the other main Hawaiian Islands, is a winter habitat and reproductive ground for humpback whales, an endangered great whale species, there is concern that the ATOC project may impact negatively on whales utilizing the Kauai habitat. The Draft EIS and its associated Marine Mammal Research Program (MMRP) present details of a marine mammal monitoring program intended to evaluate whether 12a
6 the ATOC acoustic transmissions will have a negative impact.

Two points are worth noting immediately. First, although short-term changes in the behaviors of individual humpback whales, such as changes in respiration or movement direction, may be detectable by the MMRP, the long-term effects of these or other impacts on individual animals or on the utilization or effectiveness of the Kauai habitat may only be evaluated retrospectively. Yet, it is the long-term effects which are of greatest concern for the health and recovery of the North Pacific humpback whale population.

Second, alternative sites to test the underlying theory exist, as discussed in the EIS, where endangered species of great whales are not found, (although our reviewers disagree as to the suitability of some alternate sites; this disagreement is addressed further below.) In a peculiar bent of logic, one reason given in the EIS why these alternate sites are less satisfactory than Kauai is that there are no or few populations of marine mammals there: therefore the MMRP couldn't function. This flies in the face of the fact that
7 the only reason for the MMRP was the great concern for the humpback whales at Kauai! There are other less intrusive, 4b
less expensive, and better controlled ways to test for the effects of low frequency sounds on marine mammals, than to couple such study with the ATOC project. However, more research on the responses of marine animals to sound is needed, and this is the purpose of the MMRP parcel of the ATOC experiment. Indeed, the experiment may lead to more success in our learning about the behavior of marine animals with respect to sound transmission in the sea than to detection of a signal of global warming, and this fact should not be overlooked in the heat of the debate over the relative merits of the ATOC program.

Our reviewers suggest that the island of Kauai may be a less desirable location for the ATOC sound source because of the following specific areas of concern and consideration with respect to humpback whales:

(a) the need for recovery of the North Pacific humpback whales from their endangered status;
(b) the emerging importance of Kauai as a winter habitat for these whales;
(c) the apparent extended length of residency of some individual whales at Kauai;
(d) the importance of singing as a form of communication between whales and the prevalence of singing off of Kauai;
(e) the potential masking effects of the ATOC sound on a listening whale's ability to detect or recognize low frequency portions of the song; and
(f) the availability of a reasonably suitable alternative to Kauai.

Each of these areas is explained in more detail below:

8 a. Recovery. Whaling for humpbacks in the North Pacific only ceased after the 1965 whaling 6h
season. During the early 1960s, humpbacks were whaled intensively in the North Pacific.

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For example, 3455 humpback whales were reported killed by Russian pelagic whalers during the two-year period of 1963-65. By 1966, there were estimated to be perhaps only 1000 humpback whales remaining in the North Pacific. After 1965, populations have remained low, and are only now beginning to show early signs of recovery, based on aerial survey data. Current estimates of the eastern north Pacific population give figures generally of between 2000 and 3000 animals.

b. The importance of Kauai as a winter habitat. All indications are that humpback whales are increasing in numbers throughout the main Hawaiian Islands. Kauai, in particular, is
9 experiencing considerably more whales now than 10-15 years ago. A photographic effort during TC
the 1993 season identified 251 unique individual humpback whales at Kauai -- but this was estimated to be only a fraction of the true numbers visiting Kauai. Aerial surveys during 1980 sighted only 1.67 whales per flight, while 11 years later, in 1991, similar aerial surveys revealed 12.2 whales per flight, about a seven-fold increase in sightings.

c. Length of residency at Kauai. Photographic studies conducted during 1991 and 1993 showed that about 14% of whales photographed at Kauai where resighted there on a subsequent day or days. The range of days between resightings was from 1 to 50 days, with the mean resighting interval being 14.7 days. This value is consistent with resighting data for other islands in Hawaii. The statement in the EIS that the maximum residency expected for any individual within the study area is 4 days is therefore not supported. Although whales
10 have been occasionally found to relocate from one major island region to another during the TC
winter season -- e.g., from the Big Island to the four-island region of Maui, Molokai, Lanai, and Kahoolawe -- there is no evidence so far of a whale moving form one island to another and then back again to the original island. This may occur, but it is likely to be a rare event, especially for Kauai which is relatively distant from other areas of whale concentrations. Thus, the resightings at Kauai may reflect in many cases true residency intervals.

11 d. <u>The Importance of Whale Song as Communication</u>. Singing in Hawaiian waters is heard throughout the winter season day and night. In one study, sounds were recorded from the Barking Sands Pacific Missile Range Facility located on the north shore of Kauai. Recordings were made for five-minute intervals on the hour every two hours throughout the 24-hour day throughout the season. There was no time during that period when song was not heard. Singing is performed by males and appears in the least to maintain spacing between singers at several kilometers, and possibly to provide information to female listeners about the fitness of the singer. The male whales must be listening to each other's song, since they copy each other's songs. Singers have been observed to stop singing and join with other whales, possibly females, who are at distances of several kilometers. 10d

12 e. <u>Masking effects of the ATOC sound</u>. Sizable portions of the humpback whale song contain frequencies that fall within the range of the ATOC sound. In some sound playback studies directed toward humpback whales, responses to recordings of their own sounds were observed at distances of several kilometers and at sound intensity levels estimated to be only 100-110 dB. Whales listening to singers may be listening to rather low intensity levels if, as is typical, they are separated from the singer on the order of kilometers. The occurrence of the ATOC sound can thus mask the low frequency portions of the song, making it more difficult for the listening whale to detect, recognize, or judge the song. What impact that will have on vocal communication, or song convergence, on mate selection, cannot be assessed by any of the techniques proposed by the MMRP. Nor is there any ready way to implement such assessments. Hence, this problem is of great concern. 13b

13 f. <u>Johnston Atoll as an alternative site</u>. An alternative site to Kauai that is reasonably suitable for its tests of sound transmission, but which does not have a population of humpbacks or other endangered whales is Johnston Atoll. The Draft EIS gives Johnston Atoll some consideration as a reasonably suitable alternative, although it may have somewhat reduced transmission and logistic characteristics as compared with Kauai. TC Sec 2.2.3

H-115

However, the Johnston Atoll site lacks the excellent acoustic views to Alaska provided from Kauai. Detection of the sound emitted from the ATOC source at distances of thousands of kilometers requires very sensitive detection instrumentation and reduction in the possibility of sound scattering and distortion to the greatest degree possible. Location of the ATOC site at Johnson Atoll increases the likelihood of difficulty in receiving the signal and in detecting any evidence of global warming from changes in the velocity of the sound transmission.

However, and importantly, Johnston Atoll does not have any population of humpback whales, or other endangered whales, except perhaps for an occasional stray. It has the necessary infrastructure to support the ATOC project, and is only about two hours flight (approximately 750 statute miles) away from Honolulu. No MMRP would be necessary at that site, resulting in a considerable cost savings while the ATOC theory is being tested.

Conclusion

There is no question but that scientific data to be gained through the ATOC program powerfully enrich our understanding of global climatic trends. Without the knowledge accessible through these means, our ability to prudently evaluate conflicting policy alternatives in relation to future climate projections will be seriously compromised. Hence, every effort should be made to establish the ATOC program, while ensuring that the environmental quality which motivates the research is uncompromised. The Draft EIS satisfactorily addresses critical issues surrounding the project, with the few exceptions which we have noted.

However, it seems apparent that the most substantive barriers to project implementation presently appear to reside within the realm of public perception. The recent withdrawal of the Environmental Assessment for the CEROS passive array project signals the potent influence of public opinion on official considerations of the ATOC and related projects. We suggest that a distinct possibility exists that staging of the ATOC sound source on Kauai may not be politically feasible, given the prevalence of public opinion aligned against the project, irrespective of the merits of the popular arguments. In view of this political reality, a more detailed evaluation of the potential acoustic constraints on operations based on Johnston Atoll may be warranted. It is likely that logistic or acoustic suboptima attendant upon deployment of the sound source at Johnston Atoll may be acceptably balanced against the advantages of an absentee marine mammal population.

Thank you for the opportunity to review this Draft EIS.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Roger Fujioka
Richard Brock
Louis M. Herman
Fred Mackenzie
Malia Akutagawa
Andrew Forbes

January 30, 1995

MEMORANDUM

LOG NO: 13645
DOC NO: 9501NM16

TO: Roger Evans, Administrator
OCEA

RS

FROM: for Don Hibbard, Administrator
State Historic Preservation Division

SUBJECT: **Historic Preservation Review -- File No. KA-2734, Draft EIS for ATOC project (High Technology Development Corp., State of Hawaii)
TMK: 5-8-06:
Wainiha, Hanalei, Kaua'i**

Thank you for submitting the above project draft EIS for our review. **In general,** we agree with the statement found on page 3-38 and 3-39, that there are no known significant historic sites in the project area.

We assume that no subsurface work will be conducted since this is a temporary project and the cable will only be placed on the surface. Based on this information we believe that this project will have "no effect" on significant historic sites.

If you have any questions please call Nancy McMahon at 587-0047.

NM:amk

H-118

To whom it may concern:

I am writing [illegible] the [illegible] base. I feel [illegible] a [illegible]

First of all, [illegible] differs to detect [illegible] choice of [illegible] know, however, that [illegible] the keep [illegible] will happen. Instead of trying to [illegible] it [illegible] we [illegible] to preventing or [illegible] it.

1 We could by this prevent the inevitable. The under 1Bc water sound waves could also cause changes to our [illegible] something on which many of our inhabitants base their [illegible] and [illegible] could steer away tourist, our main industry, for fear of danger.

I hope you will seriously consider my views and take into mind the concerns of [illegible] inhabitants.

Sincerely, Jenna Kerr
Jenna Kerr

H-117

"TO WHOEVER IT MAY CONCERN."

I'M AGAINST THIS PROJECT BECAUSE I THINK THAT IT WILL DESTROY OUR UNDER WATER LIFE. THINK ABOUT IT IF YOU HEAR A LOUD NOISE IT HURTS YOUR EARS IMAGINE UNDER WATER WHERE SOUND TRAVELS 7 TIMES FASTER DONT YOU THINK THAT IT WILL AFFECT
1 LIFE UNDER WATER. EVEN IF FISHES DONT HEAR THEY CAN SENCE VIBRATION 62
NO MATER WHAT IT WILL AFFECT THEM. IT MIGHT EVEN KILL THEM AND THAT WILL JUST BE ANOTHER SPECIES INDANGERED BY US. ALTHOE THIS IS SUPOSETU HELP HUMANS THIS I RESPECT, BUT IT MIGHT KILL OTHER LIFE FORMS ON OUR PLANET.

WHY DONT WE JUST SEND ANOTHER SATELITE INTO SPACE UP THEIR IT WONT BE HERTING ANYTHING DOWN HERE. BECIDES WE COULD USE THE MONEY$ FOR CLEANING UP PARKS OR SOMETHING MORE USEFUL TO KEEP OUR ISLAND CLEAN AND MORE NATURAL.

FORM: DELBERT K.T.

Dear, Sirs,

I'm writing this letter in concern
to the project called ATOC. I
think putting Speakers in the Ocean
anywhere is a mistake, especially on
Kauai where everyone goes in the water.
How would you feel if you come here
to Swim and relax and Suddenly
a blaring noise went off in your
ears? It's also endangering many Ocean
animals, whales, dolphins, fish. you
don't know how they will react.
using 35 million dollars to detect
1 global warming isn't very intelligent, your 3a
just definining the problem, not fixing it.
That money could be used for more
important things like education.

Sincerely
Sommer Sargent
822-4383

March 3, 1995

To Whom it May Concern:

I am an eleventh grade sophomore at Kapaa High and Intermediate School. I am writing in response to the "Underwater Boomer" or ATOC that is going to be kept in Hanalei Bay. There are many reasons why people think that the "Underwater Boomer" is going to be an important step in technology towards the recent worries of Global Warming, but are all of these needs and reasons justifiable?

The reasons for having the "Underwater Boomer" was not clearly
1 identified. Right now we do not know what the "Underwater Boomer" 3a
is really for, whether it is to find hot spots in the ocean or oil underground, we do not know.

The people also have no knowledge about the extent of the equipment
2 damage on the wildlife in the ocean. We don't know if it will be 6a
hurting and killing the animals, or if it will not bother the animals and their habitat at all. If the "Underwater Boomer" is going to affect the wildlife of the ocean, what about the endangered species within that area. The Hanalei Bay is an official marine sanctuary. With the agreement to put this "Underwater Boomer" into the Hanalei Bay,

didn't you know that this was breaking the law due to the endangered species. These are the things that the people want and need to know.

Finally, what about the cost? We know that within the next two years, $35 million will be spent only on the "Underwater Boomer." 3 Couldn't the money used for this project be used for other things like, improving the education system of Hawaii. What about the years 1 following? Will there be more money put into this project? How much money are we willing to just give away for this "Underwater Boomer?"

I think that the "Underwater Boomer" could be an important piece of equipment if the use of it is proper, but if it is not we will only be wasting the tax payers money on something that is not needed. there are many other things that this money could be used for.

Sincerely,

Joni Konishi

Joni Konishi
5633 Kula Mau'u Street
Kapaa, HI 96746

To whom it may concern,

Hi, my name is Daina Lopez and I, as a resident of Kauai is very unhappy with the issue on you guys deciding on putting the speakers in our own Hanalei Bay.

I feel that we the people of Kauai will be losing lots of tourist because the Hanalei bay is known for fishing, surfing, snorkeling and just having fun with friends and family. Hanalei Bay is known to be one of the most liked attraction on the island of Kauai. But with those speakers the tourist will probally get irritated by it and not go to the beach anymore. Then our economy will go down.

Also alot of local people fish and just so happens a big ulua gets right by your pole and just then the speakers
1 gives off that loud noise that will make 18c
the fish go away. There could also be a great damage in the fish population.

I also feel that if this research of yours should fail than you will be wasting a great amount of money. Where as you could be using that money for a better cause. There fore as you can see I'm totally against your doing on putting the speakers in the water. Thank you for taking the time to read on what I have to say.

Yours truly, Daina Lopez

Koapuni St. 5030 / PO Box 1[illegible]

TO whom it may concern

My name is Joe and I am againts the ATOC project because of a lot of reason. First of
1 all, this project might effect the marine life 6a
and endangered species, and it also effect the Marine life habitate.

Second, this project will cost 35 million dollars. Why can't this money spent on something else?
2 Third, on a nice day in Hanalei bay will 1
the sound scare away the tourist. Tourist are important to us in Kauai and this might scare them away.

Although, it might determine if global warming is occurring, but I think it is occurring, 18b
3 because of the pollution we make everyday.

I think its a bad idea to run this ATOC project. Let it does run and it goes out well, we should learn more about it.

Thank you,
Joe Mayer

4849 ALIALI RD
Kapaa HI 96746

March 3, 1995

To whom it may concern,

I am a long time resident on Kauai and a student at Kapaa High School. I usually fill my spare time with countless hours of surfing out in Hanalei Bay. It is my most favorite and memorable place to surf. When I heard about the planned boom box to be installed in Hanalei Bay to enhance the research on Global warming I was outraged. Why had no anyone consulted the Hanalei community concerning this plan? How do you know this big, loud, thing will not have a negative
1 affect on the precious, endangered 6a
marine species in our warm Pacific waters? I have heard that useful information may be obtained from the use of this new technology. Yet tourist are not really looking for
2 technological sights. When they come 18b
to Kauai, they come because this is the garden isle. Also you may learn that the earth is warming up, but so is mankind in two different groups. The good and the bad. You already know it's going to happen, why don't you learn about the cause first and find a solution.

If it's in your heart to save the earth, look toward the Bible and may God please Bless You. If you are just for

for money and destruction, I'd just like to let you know that the destruction of the wicked system of things is very close at hand, and wicked hearts will go down with it. It's never to late to change! Please don't put one of those boom boxes in our pristine Hanalei Bay.

Thankyou.
Sincerly,

Melanie McCarthy
P.O. Box 1142
Hanalei, Hi. 96714

March 3, 1995

Dear Sir,

I am writing on the subject of the "Underwater Boom". As a student and as a resident I am very interested in the subject. I feel this particular experiment would be beneficial to the world in many ways. As I understand, there is much criticism concerning this matter. My opinion on this criticism is this: as it is with all experiments there is going to be those who disagree, due to lack of knowledge or disapproval on the matter in general; these people should be heard not ignored, and their opinions examined. Why are they forming these opinions? Is it because there was an insufficient amount of information supplied to the public? Were their opinions ignored? Or was their opinion ever asked? Many of the people on Kauai are forming negative assumptions due to the former. As residents, many are curious and angry that their opinion on the subject was never asked. These people need to know the facts. Stated as follows is why I feel this experiment is advantageous.

This experiment would measure the temperature in a large body of water or a certain fraction of the ocean. This data in the oceans 3a
1 temperatures would show over an amount of time if the ocean is growing warmer. This increase of temperature is used to show that the world is growing warmer, or that Global Warming is taking place. This knowledge would prove to companies or industries that are contributing negatively to Global Warming that their actions must be stopped to help decrease the damage that humans are inflicting upon our earth. This would be for the betterment of the world and not just certain individuals. This experiment would help gain knowledge on marine mammals biologically and physically. Marine animals must be studied very closely to determine if this is indeed affecting their lives. This would help marine scientists gain information on the animals, since such intense observation would be in action. This research would most likely prove to be an enlightenment on all aspects of the mammals lives. However, if this experiment does prove to be harmful to the animals of our oceans, I request that you alter the experiment so that no further harm is inflicted.

The equipment that is used could be beneficial in other ways. In the course of the experiment other uses may be discovered and the machine reused perhaps in a different way. Also when solving a question or obtaining Data, information other than what you're looking for can be discovered.

Scientists and others have tried to show that this experiment is a waste of time and money. They have tried to show that there are more negative effects than positive. However, to every opposition they provide there is a positive solution. The main problem is support. Too much of the public and others disapprove. This can be solved through information that informs the people of the advantages instead of always the disadvantages. In this information, the facts about the disadvantages must be addressed. *Providing solid proof, and lending an open ear to opinions, I feel,* would help this issue very much. Our ocean is a pool of undiscovered knowledge. This valuable experiment may be the key to unlocking some of the mystery.

Sincerely,

Moana McReynolds

Moana McReynolds
P.O. Box 767
Kilauea, Hawaii 96754

To whom it may concern.

I am writing to you about the underwater bomber. I strongly disagree with this experiment because we don't know what would be the effects. This kind of experiment need lots of money. Instead of using the
1 money for the experiment, we could use to repair roads, for education or other things that is important. 1
Also, people who like to go to Hanalei beach to rest and have fun swimming be able have it. For instant, when the people go swimming and the same time the experiment is going on, it wouldn't be nice to hear a loud
2 noise underwater. Lastly we don't know what would be the effect of this experiment to marine life. I hope that you will consider all possibilities first. Thank you. 182

Sincerely,

Sarah Miquiabas
5155 A Laipo Rd.
Kapaa, Hi. 96746

To whomever this may concern, 3-3-95

This project of yours, the boomer in Hanalei I think is a waste of time and money. The only thing that the boomer will proove is that we may be going through a global warming. It's a waste because no one can do anything about it. The people had to pay more taxes for this $35 million thing and we don't get anything out of it, we can't even do anything if the answer is yes, the earth is changing. Another thing is that no one asked us, the people of Hawaii, if we would except this expensive project in our waters near our land. There are better things that we can do with that money like pay the State park workers to keep our parks like Koke'e open for us, for our children and hopefully our grandchildren so they can grow up seeing all the beauty this island has to offer. 1

Shari Sanchez
228 Kamalu Rd.
Kapaa, Hi. 96746

P.S.
Is that boomer really there to find out global warming or something else. If it is, why? because no one can do anything about it anyway!

SAVE THE HUMANS

Center for World Peace, Waialua, Molokai 96748 Ph: 558-8923

Roy Schaefer
Dept. of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

March 9, 1995

Dear Mr. Schaefer:

1 I am writing to urge DLNR, in the strongest possible terms, to refuse to grant a Conservation District Use Permit to the Kauai Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Program. I have read through the 2 volume Draft Environmental Impact Statement for the project, and find it legally and scientifically inadequate. 16a

Legally, it is good that the ATOC project has agreed to restrict the proposed sound source transmission times and decibels, but it is not enough, unless they can 100% guarantee that no endangered Humpback whales will be harmed. The Final Humpback Whale Recovery Plan, approved by NMFS in 1991 included in its goals "identifying and reducing death, injury or disturbance to the whales caused by humans."

That means that granting this permit would break the law, since the Marine Mammal Research Program would deliberately use the ATOC source to disturb the humpbacks to see how much it disturbed them.

2 In terms of the science involved, there is what appears to be a serious potential conflict of interest. What good does it do to have such an elaborate double-blind research design, if the principal MMRP investigators -i.e., the people responsible for doing the data analysis- stand to benefit (in terms of x years more research contracts) if that data analysis supports the ATOC proposal? 6a

Furthermore, why not use alternative technologies to measure global warming that are both cheaper and faster? I can find no compelling reason to allow this Project to break the law further harass the Humpbacks.

Thank you for your time. Please refuse to grant the permit.

Malama Pono!

Claud Sutcliffe

Claud Sutcliffe, Ph.D.

RECEIVED
'94 FEB 1? ?? 8:22
DLNR
OCEA

March 3/95

Dear ATOC Representatives,

I live on the north shore of Kauai and I am concerned about the Acoustic Thermometry of the ocean (ATOC) project.

I feel that the project will not produce positive results. It may discover global warming (if it is in effect), but it won't discover the cause. Therefore
1 leaving us basically where we 1
started, only with millions of dollars less. The money that would be spent on this project could benefit many other problems in Hawaii and the U.S.

This reciever/speaker would be placed
2 in a Hanalei Marine Sanctuary, 14c
violating the Endangered Organism Act. Is this law something that the government plans to ignore?

H-128

Now, we don't know the effect this will have on marine life. It may
3 not affect them, but lets not 6a
wait till its too late to find out.

There will be a definite effect on all residents and tourist in the area, however. Imagine a fisherman ready
4 to pull in a twenty pound Ulua, 18c
but it is scared away by a massive "boom". Will it hurt the ears of snorkelers? What effects will it have on ocean waves and tides?

People go to the beach to get away and enjoy themselves in peace. The "booming" will not promote this kind of environment.

All in all, I do not think this is something the U.S. needs now and is definatly something to angrefy Kauai (especially the north shore). Please post-pone your plans until it is nessary.

Thank You,

Lindsey N Schmidt

P.O. Box 78
Kilauea, HI
96704

(808) 828-2092

RECEIVED
'84 FEB 8 AM 8:52

RS

Dear Sir,

I am aginst the DLNR OCEA project in Hanalei Bay. I was told that they were going to use it to find out if there is global warming, Once they find out then what? What do they expect to do? If the earth is getting warmer they will not be able to change it. Why can't the money be used for something more important, All thirty five million of it. And thats just the first year. 1 1

Won't it effect fishing? If people can hear it while sitting on the beach, fish will most likely be scared away into hiding when ever the thing goes off. 2 18c

Next If the thing does harm or scare fish, which is unknown, why is the first receiver being placed in a marine sanctuary?

I understand that many things can be [illegible] and it could be used for things like military stuff but I learned more negitive things about it then positive.

from
Alec Schwarz

2006 Kalu St, Lihue Hi. 96766

231

To Whom it May Concern,

I am a sophmore at Kapaa High School and I am writing to you to let you know how I feel about the ATOC boombox.

I am not pleased with the project. First of all, it will cost thirty-five million dollars
1 for just two years. The money could be used elsewhere. Besides, what are we going to do since global warming takes more than a few years to detect? Remember, it is already 1
costing us thirty-five million dollars! That's a lot of money gor this.

Perhaps the most disturbing thing to me is that no one asked the Hanalei people if they wanted to go along with it. They live there by this boombox and they should have a say in this.

Another disturbing fact is that the reciever is in a marine sanctuary. Many
2 endangered organisms could be affected. Hawaii already has the most amount of 14c
endangered or extinct species in our country. Why should we keeping adding to the list? This boombox could very well destroy marine life. It's their home, not ours to invade.

Sincerely,

Kasey Shibao

5298 A Kihei Rd.

Kapaa, Hi., 96746

To whom it may concern,

My name is Leah Thayer and I am currently attending Kapa'a High. I was born and raised on this beautiful island, Kauai. As a youngster, Hanalei bay was where I spent all of my free time, to swim, relax, and just enjoy the beauty of this wonderful place.

I was shocked to learn that Hanalei Bay was going to be used for testing grounds for ATOC. How is that possible? I asked myself. Why is it that we do not have any say in what is about to occur?

I understand that these tests will be used to determine if global
1 warming is occurring or not. But what if it is? There's not all that much that 3a
we can do about it. It will already be too late.

The sound that will be traveling through the ocean, back and forth to the receiver (not to mention is in a marine sanctuary, Montery Bay) doesn't 6a
2 sound all that safe for the marine life that we have surrounding our island. Isn't it true that they are not sure if the sound will have any effects? So, therefore impairments may be done to the marine life?

I also understand that this project will cost an insane amount, about 35
3 million dollars, and this will only cover the expenses for the first couple of 3b
years. Yes, I do see that we may learn from these studies. But if we are to learn about them, what will be done? What can be done?

Hanalei Bay is gorgeous, a pristine place for tourists to come and enjoy. It is the destination of peace and relaxation. But little do these 13b
4 tourists know that these sounds will be with hearing ability, which will disrupt the peaceful and quietness while they are laying on the white sands of Kauai.

My main concern is the animals. How can you be so sure that nothing
5 will happen to the marine life? It has been shown that whales are driven 6a
away from loud noises, why wouldn't this drive them away? Don't forget that the whales come here for a reason, they can't just pack up and leave.

I know that many residents, including myself find this activity appalling, maybe we haven't heard the other side to the story. But what I do know is that this does not sound right and a second thought should definitely be given to this matter.

Mahalo and Thank you for your time.

Sincerely,
Leah Thayer

P.O. Box 901
Hanalei, Hi
96714

March 3, 1995

Dear ATOC,

I am writing to you because I am against the Boom Box. I feel that you shouldn't use it because
1 we don't know how it will affect marine life and endangered 6a
species. We don't know how the life in the sea will react to the booming. And another reason is that it could affect tourism on our beautiful beach, no one would want to swim in the water with booming going on, it might make them deaf. Although it may be determine global warming we could use the 35 million dollars that they use every
2 two years for something else. They should use it for 1
other things like for school supplies, or of more Importance.

Sincerely,
Jeana Watson-Sou
Tiana Watson-Souza

To Whom It May Concern,

I am a tenth grade student at Kapaa High-school, and I am writing to let you know how I feel about the ATOC situation.

I feel that although the ATOC project has many good things about it, I think the problems that could occur from it out numbers them. I am studying Biology right now, and I have been learning how sensitive living things are to changes in their environment, and how those changes, although little, 1 can cause the extinction of a whole entire race. Even though it is not known if the equipment put into the ocean are going 6a to cause any harm to the marine life, I think the risk is just too great.

I also feel that this project would cost way too much money. 35 million dollars is money that I think could be better spent elsewhere. Everywhere there has been cutbacks on employees, supplies, and pay raises, because of a lack of 2 money, but with 35 million dollars, I think a lot could be done 1 to fix this. Don't get me wrong, I'm not saying that the ATOC project is senseless, because I do not doubt that some valuable information could be obtained, but I do doubt that the information could not be found in a much cheaper, and safer way.

Lastly, the problem that would most directly affect me. It is my understanding that the equipment in the ocean would send off a high pitch sound, that would be loud enough to hear if your relaxing on the beach on a calm day. Now I don't know about anybody else, but when I go to the beach, I go to relax, and I know I would not be able to relax if their was a constant hum, no matter how faint it was, so please consider what I have said, I would really appreciate it, and thankyou very much for you time.

Sincerely,
Tiffanie Yama

284 Kaulana R.d
Kapaa, HI 96746

Derek and Margaret Cole
1555 Merrill Street #97
Santa Cruz, CA 95062

CALIFORNIA ACOUSTIC THERMOMETRY OF OCEAN CLIMATE PROJECT

TO: ADVANCED RESEARCH PROJECTS AGENCY
c/o CLAYTON H. SPIKES, MARINE ACOUSTICS, INC., ARLINGTON, VIRGINIA.

Thank you for the privilege of sharing in commenting on this proposed project and for the opportunity to look over the very well produced and informative draft Environmental Impact Report.

My findings, concerns, and conclusions are listed below:

1. What a splendid heat sink the ocean provides, just what is needed to establish long-term heating or cooling effects, provided the mass as a whole is considered, which is not what this proposal proposes. I have a concern that the acoustic channels proposed are not sufficiently representative of the ocean at large, 1 even over a decade, to provide acceptable evidence for global warming. It may well be argued that the time changes expected are so small as to be lost in other time 3a influencing variations such as the combined effects of current flow, salinity and signal path dispersion within the acoustic paths. This could make the long-term information sufficiently unreliable that the transit time data would provide no proof, and the ten years time and money would have been better spent in reducing ozone depleting emissions.

2. It is of concern to me that the majority of the acoustic energy transmitted into the water will not travel in the desired direction. Why illuminate the whole marine sanctuary and cause undoubted distress, no matter what the sparse collected data indicates, unnecessarily? I have yet to encounter a scientist that can communicate with a whale, yet we purport to know what they hear and how they interpret it. Surely a 3f 2 more efficient transmitting array can be developed if it is to be mounted in a sanctuary. This would provide a better chance of an intelligible signal reaching its destination and may also enable a reduction in transmitted power. I can visualize that if the experiment is allowed to proceed as proposed, it will be discovered that the output power is too low for reliable reception, and the plea will go out that *now we have gone so far and* spent so much money, we must increase power by a moderate amount in order for the data to be gathered, or even worse, "lets tweak it up a little while no one is looking", the ends justify the means!

3. The whole premise of usable results relies upon a transmitter and receiver at a constant fixed distance apart. But what if the continental shelves upon which they are 3 mounted are in motion. Over a decade does anyone know the relative motion between 3f California and New Zealand? Are satellite measurements accurate to a yard over such great distances and time spans. If the answer is yes, then how has that been verified?

From my stated concerns I am forced to conclude that there are too many questionable factors, and any element of doubt must lead to at all costs protecting the marine sanctuary. Even if results are obtained supporting global warming I think they will be too little and too late, all at the cost of broken marine behavior patterns, resulting in who knows. what? In the name of scientific advancement we should not create a precedence that does not honor sanctuaries and seeks to prove theories at the expense of any part of this creation. Let us spend the time and money in funding and fighting the causes of ozone depletion, which as I understand is a proven and measured fact. Furthermore, the decade or more needed to collect data may be used as an excuse for not taking positive action in tracking and defeating the causes now.

Derek J. Cole - Retired Radar & Sonar Engineer
1/27/95

c.c Roy Schaefer, Dept. Land & Natural Resources
c.c Representative - Sam Farr

RECEIVED
'95 FEB 6 AM 8:12
DLNR
OCEA

June 24, 1994

Manfred M. Holl
25526 Carmel Knolls Dr.
Carmel, California 93923

Ms. Marilyn Cox
Campus Planning Office, 006
9500 Gilman Dr.
University of California at San Diego
La Jolla, California 92093

Dear Ms. Cox:

I'm quite disturbed about the merits claimed by the promoters of the ATOC Experiment. My concerns are detailed in the enclosure which I prepared for, and presented to, the Monterey Bay Marine Sanctuary Advisory Council, meeting May 27, 1994.

ATOC claims an astounding capability for categorically measuring ocean temperature. My colleagues and I are wondering what the EIR will offer in the way of explanations and substantiations. In particular, how will ATOC account for variations of path, depth and salinity, in relating travel time to a mean ocean temperature and what would this mean temperature represent ? It is not enough to claim that changes in the travel time directly relate to temperature change along a direct path.

Sincerely,

COPY

Manfred M. Holl, Ph.D.

Enclosure: "A Critique of the Acoustic Thermometry of Ocean Climate (ATOC) Experiment", White Paper Draft dated May 26A, 1994, supplemented by a resume of the author's credentials.

cc: Karin Strasser Kauffman,
Chair, Sanctuary Advisory Council

'95 FEB 6 AM 8:12

DLNR OCEA

COPY

January 29, 1994

25526 Carmel Knolls Drive
Carmel, California 93923

Advanced Research Projects Agency
c/o Clayton H. Spikes
Marine Acoustics Inc.
4 Crystal Park, Suite 901
2345 Crystal Drive
Arlington, VA 22202

Dear Addressees:

The proposed ATOC experiment is not as simple as it sounds, nor is it likely to demonstrate any capability as a means of measuring any trend in global ocean warming, even when expanded to criss-cross all the world's oceans.

The conduction and detection of sound propagation in the sea, over long distances, involves many variables and complications. These limitations are outlined in my white paper which critiques the ATOC proposal, refers to the wealth of data already produced by systems which continue to monitor the global oceans, and suggests that the ATOC proponents be obliged to carry out some "proof of concept" demonstrations by computer simulations using long-range acoustic propagation models and actual monitored and analysed resolutions of ocean variability distributions. These models compute for any specified route the distant arrivals of a multiplicity of the source signal in varying orientations, time lags, and intensities - - more information than could be resolved by any hydrophone array. Examination of such data reveals the general futility in this approach to measuring ocean temperature.

1 3d

My White Paper, dated May 26, 1994, was presented to the Monterey Bay Marine Sanctuary Advisory Council, meeting May 27, 1994, and also sent to the UC San Diego Campus Planning Office with cover letter, June 24, 1994. Enclosed is a copy of the White Paper and the cover letter.

The ATOC Draft EIS/EIR, dated November 28, 1994, provides no substantiations to back up astounding claims for categorically measuring ocean temperature. Nor does the Draft do justice to the wealth of alternatives in place, for monitoring ocean temperature variabilities. The premise that "The travel time is a direct measure of the large-scale average temperature between the source and receiver." is unfounded. The travel time relates to the variable path, undulating depths, and traversed temperatures and salinities. Furthermore the paths and signal arrivals are multiple; it is doubtful that this can be sorted out because the paths vary from moment to moment, day to day, season to season, and year to year.

38c

The only substantiated claim that the Draft makes is that "....low frequency sounds broadcast in the deep sound channel can be detected over great distances." In one paragraph (page ES-3) the draft admits that ATOC may fail to provide any useful climatic information because of the inherent complexities.

It is unfortunate that concern for the marine habitat has taken the spotlight away from the fatal flaw in the ATOC proposal: Ocean temperature cannot be resolved over long ranges by acoustic transmission. It has been tried, and will probably be tried by others who will stumble on this "bright idea".

I find the whole ATOC pitch to be arrogant and insincere, especially in linking the project to long term global warming concerns. It will likely move ahead, hopefully not in the Monterey Bay Marine Sanctuary. The prize of thirty-five million dollars has created a lot of vested interests. Even some mammal concerns appear willing to accept support to study the effects. DoD via ARPA funding will maintain some ocean-acoustic monitoring systems and efforts in signal processing. The opposition has little power against these forces. It is a pity that so much disturbance and division continues to be generated by so unworthy a proposal as ATOC.

Sincerely,

COPY

Manfred M. Holl, Ph.D.

Sent by overnight mail.

Copy: Karin Strasser-Kaufmann
Chair, Sanctuary Advisory Coucil

Sam Farr
Member of Congress

H-136

The Senate
The Eighteenth Legislature
of the
State of Hawaii

STATE CAPITOL
HONOLULU, HAWAII 96813

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DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

95-127

March 6, 1995

Mr. Mike Wilson, Director
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Wilson: Mike

I am writing to express my concerns over the permit application of the National Marine Fisheries Service for the Acoustic Thermometry of Ocean Climate (ATOC) experiment. This permit being considered would allow a team of scientists from the Scripps Institution of Oceanography to transmit a low frequency signal across the Pacific Ocean for a period of two years from a location on the Island of Kaua'i to monitor global ocean temperatures.

1 My concern stems from the possible harm done to marine life due to the scope of the experiment. While no concrete data is available to address the possible impact on marine life, I believe that this very lack of information should cause us to study the long term effects that this project could bear on our ocean environment. Particularly vulnerable are *humpback whales and other creatures that use sound* as a means of communication. I believe the environmental impact statement expresses this same concern and will caution against proceeding with this project. 15

2 I am also concerned about the projects' compliance with existing federal and state environmental laws as well as local land use laws. It is imperative that this project not violate any of these laws or negatively impact the community. 2

In light of my concerns, I respectfully request that the permit approval for the ATOC project be postponed until the referenced concerns, and those expressed by the community, are fully addressed.

If you have any questions please call me at 586-6070.

Sincerely,

Rosalyn Baker
Senator - 4th District
North/West Maui, Moloka'i & Lana'i

RB:ts

BENJAMIN J. CAYETANO
Governor of Hawaii

H-137

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. Box 621
Honolulu, Hawaii 96809

Chairperson
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Board of Land and Natural Resources

Deputy Director
GILBERT COLOMA-AGARAN

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Forestry and Wildlife
Historic Preservation
Land Management
State Parks
Water and Land Development

REF:OCEA:SOR

File No.: KA-2734

MAR 17 1995

Mr. Andrew Forbes
ATOC Program Manager
Acoustic Thermometry of Ocean Climate Project
University of California, San Diego
Scripps Institution of Oceanography (0225)
Institute of Geophysics and Planetary Physics
La Jolla, CA 92093-0225

Dear Mr. Forbes:

Subject: Draft Environmental Impact Statement for the Acoustic Thermometry of Ocean Climate (ATOC) Project, Offshore of the Island of Kauai

We have completed our review on your draft EIS for the ATOC project offsore of North Kauai.

1 The judgment in question will be whether the Final EIS is an acceptable or non-acceptable document under Chapter 343 Hawaii Revised Statutes, as amended. 2

In our view, acceptance means that the document fulfills the definition of an Environmental Impact Statement (EIS), adequately describes identifiable environmental impacts, and satisfactory responds to comments received during the review of the statement.

The EIS means to us that an informational document has been prepared in compliance with the Administrative Rules promulgated under Chapter 343-5 and which discloses the environmental effects of the proposed action, effects of the proposed action on the economic and social welfare of the community and State, effects of the economic activities arising out of the proposed action, measures proposed to minimize adverse effects and alternatives to the action and their environmental effects.

We are of the opinion that a major purpose in accepting or not/accepting a statement, as suggested under Title 11, Chapter 200 of the Administration Rules, is that the document adequately discloses environmental impacts and satisfactory responds to comments.

In our view, the document, in and of itself, should not be used as a vehicle to promote or detract from any required subsequent judgment on the proposed project itself. We have consistently maintained this posture in the past.

We should point out that the acceptability of this statement is based upon criteria set forth, in Title 11, Chapter 200 of the Administration Rules.

As such, we are enclosing comments submitted during the 45-day draft EIS review period for your response.

If you have any questions, please feel free to contact Roy Schaefer of my staff at (808) 587-0377.

Aloha,

MICHAEL D. WILSON

Enclosures

Darcia Forester
45-131 Lilipuna Street
Kaneohe, Hawaii 96744

January 10, 1995
National Marine and Fisheries Services
Advanced Research Projects Agency
Public Hearing on the Proposed Draft EIS of Kauai ATOC Testing

As a concerned citizen of the State of Hawaii, I would like to comment on the proposed Acoustic Thermometry of Ocean Climate (ATOC) testing off the coast of Kauai. I am concerned about the possibility of misuse and harm that ATOC testing has the potential to cause to marine life.

First, I would like to clarify my position. I am not opposed to ATOC testing. I advocate testing in a controlled and monitored environment that is sensitive to its effects on marine life. Because this type of testing is still in its infancy, any approval must take note of the lack of important information about the effects testing will have on marine life. This type of sustained and stationary testing has the potential to permanently harm the hearing of marine life, especially marine life dependent on sound for communication.

1 12a

I understand that there are two very important interests at stake here. One interest is the need to measure the effects of ozone depletion on the earth's environment. We must come to understand the green house effect and to plan for our future. Global warming will have devastating and severe effects on worldwide food production. To help facilitate the process of understanding and planning it is necessary to determine how fast global warming is occurring and what effects it is having on our ocean environment. On the other hand, there is the concern that ATOC testing will cause immediate and long term serious harm to marine life.

ATOC loudspeakers project sounds at 195 decibels. This is louder than the range of normal whale vocalizations. It has already been shown at the California testing cite that whales will change course to avoid the noise created by the loudspeakers. Obviously, the testing has caused and will cause changes in whale behavior. How it will effect their ability to communicate or their ability to hear has yet to be determined. 2 10d

It is my understanding that ATOC testing calls for testing during a 20 minute period every 4 hours. My common sense tells me that this continuous testing schedule has the potential to seriously disturb whale migration routes, breeding areas and birthing areas around Kauai. I feel testing should not occur during these critical times until more information is gathered about the effects that ATOC testing. In addition, I feel that a reduced testing schedule may be in order. Loud, disturbing and continuous noises would drive any human being "crazy" if subjected to it every 4 hours. Perhaps, a less rigorous schedule would be more acceptable. Testing frequency can be reduced and the time period during which the testing occurs can be reduced. 3 2

I ask that any approval of ATOC testing be given with strict conditions requiring a gradual and limited testing schedule and that marine life be closely monitored for adverse reactions to the testing. Caution is always prudent when beginning any program that has the potential to cause harm. I ask that the Advanced Research Projects Agency proceed with caution.

Thank you for your time and consideration.

Sue V. Herbich
652 N. Judd Street
Honolulu, HI 86817

February 10, 1995

National Marine Fisheries Services
Advanced Research Projects Agency

Honorable Commissioners:

I am a student at the William S. Richardson School of Law and I am writing as a concerned member of the community who is also interested in the administrative process that this hearing is involved. I would like the opportunity to express my view of an offer of compromise regarding the underwater sound tests proposed by the researchers of Scripps Institution of Oceanography in San Diego.

Although my knowledge regarding underwater sound tests and their effects on ocean mammals is limited, I feel that my concerns for a long-term healthy environment are reflective of many in my community and thus, it is important that they are heard.

My proposal today is a compromise that would allow the "boom box" experiment to proceed under strict terms and regulations so that it is friendly to the ocean's ecosystem while still allowing scientists to collect valuable data in their study of global warming. Because damaging our acoustically sensitive mammals is as onerous as allowing global warming to continue undetected, the sensible plan is to carefully balance science with nature. My proposal calls for more experiments with the effects of sound on marine mammals in controlled environments such as sea life parks and then eventually expanding such study to the ocean between smaller landmarks (i.e. between Santa Monica and Catalina Island or 1 2 between Oahu and Maui). If and when these experiments are determined to have minimal adverse effects on whales and other mammals, the sound tests can gradually be increased to reach the proposed scale. From my research, I do not feel that there are sufficient information at this time to subject as many as 677,000 mammals to the 195-decibel right from the start of the experiment. Because studies have shown that migrating gray whales will alter their course to avoid sound measuring at 120 decibels or more and that some whales can suffer temporary hearing loss when exposed to sounds at 150 decibels, there is little doubt that some whales will be unnecessarily harassed by this experiment.

Furthermore, although global warming is a tremendous threat to all life forms, it is not so imminent that its study cannot be administered with caution over time while more concrete evidence of its effects on ocean mammals could be gathered. In contrast, loud sound tests today may cause immediate and irreversible damage to many of our ocean's inhabitants.

Ultimately, a study of the earth's rising temperature is essential because this phenomenon would pose a far greater risk to marine life than the proposed sound tests. Nevertheless, I urge members of the Commission to consider other less intrusive modifications to the proposed project. Such a compromise will allow scientists to proceed in their study with the possibility of realizing the full-scale proposed project while minimizing the disruption and risk to the lives of hundreds of thousands of mammals.

Thank you very much for your time and your consideration of my comments.

Very truly yours,

Sue V. Herbich

7 February, 1995

Written Statement regarding the Acoustic Thermometry of Ocean Climate program off the north shore of Kauai, Hawaii

Submitted for hearing in Honolulu, Hi, 9 February, 1995

T.S.Marshall
2254 Metcalf Street
Honolulu, HI 96822
808 946-4975

Thank you for this opportunity to offer my concerns regarding this program. I make these comments in the hope that a less invasive technique can be found to conduct this important research on global warming or that, in the least, the experiment can be moved to a location where protected species would not be imperiled.

The importance of regarding the seas as resources in and of themselves was reemphasized when the U.S. ratified the treaty binding the nation to the Convention on the Law of the Sea last fall. The project being proposed here could have great impact on species and life forms beyond those which have been specifically studied and protected. The reasoning behind this project seems to be "we think there'll be no ill effects on humpbacks or sea turtles and we really don't have to think about the effects on other sea life". I want to remind the Service about the vast schools of fish and other non-mammals who dwell in this same habitat. Science simply does not know much about the inhabitants of the Pacific Ocean and their interrelationships. Studies regarding how this experiment would impact them are necessary.

This is not to say that all the concerns about the protected species have been answered. Dr. Monk has testified that a five-day test was conducted south of India using sound a thousand times louder than what is proposed here. He stated that a ship full of biologists nearby noted no change in the whales behavior. Observation from a nearby ship does not constitute scientific analysis. Only long-term study could determine whether the humpback whales, who use their singing to navigate, mate, and herd their young, have been affected by this. A five day period does not compare to the ten-year plan intended here. Moreover, I have seen no evidence that other protected species, the sea turtles for example, have received even this minimal level of study.

In addition to unanswered concerns about all forms of sealife, the ten-year term of this experiment is disturbing. While I understand the need for information over time, what is being proposed is twenty minutes of intrusive sound every four hours for ten

years - 3650 days, 21,900 blocks of sound at 195 decibels. The sheer magnitude of this intrusion demands that the Service exercise caution. The law requires that a less harmful way, if one exists, must be used even if it is more costly. A less harmful way is what required here.

I request that the ATOC researchers be required to bring more information to the table regarding the impacts on all sealife and alternatives to this long-term experimentation before they receive the permits. Thank you for this opportunity.

T.S.Marshall

APPENDIX G

Kauai Marine Mammal Research Program
Baseline Data (1993-94)

PHOTOGRAPHIC IDENTIFICATION OF HUMPBACK WHALES (*MEGAPTERA NOVAEANGLIAE*) OFF KAUAI, HAWAII DURING WINTER AND SPRING, 1993

Report to the

ATOC Marine Mammal Program

Salvatore Cerchio, Jr.

Moss Landing Marine Laboratories

October 30, 1993

Methods

Field Methodology

Identification photographs of humpback whales were collected during daily boat surveys, weather permitting, between 30 January and 21 April, 1993. Two boats were used: the "south shore boat" was a 17' fiberglass hull with a 75 hp outboard engine, and the "north shore boat" was a 18' fiberglass hull with twin 70 hp outboard engines. Boats were launched from one of three locations: Port Allen Harbor on the south shore, Kikiaola Harbor (Kekaha) on the southwest shore, and the Hanalei River on the north shore (Fig. 1). Regions covered on any given day were dependent upon prevailing weather patterns and distribution of whales, so sampling was unavoidably non-random. The north shore boat was not obtained until late March, so sampling on the north shore was limited to 25 March to 21 April.

A photograph of the pigmentation pattern on the underside of a whale's flukes was used to identify individuals (Katona et al. 1979). Photographs were taken using various 35 mm SLR cameras equipped with motordrives and telephoto lenses of focal lengths ranging from 180 mm to 300 mm. When several pods were sighted in an area, an attempt was made to approach all or as many pods as possible. All animals in a pod were photographed when possible. Approaches were terminated when all whales were photographed, due to poor weather conditions, or when it subjectively appeared that whales not lifting their flukes were not likely to do so. Two types of data were recorded: information about all pods sighted and approached for identification, and information about photographs.

Data on pods included time, location, number of whales expressed as a minimum and maximum estimate, pod class, direction of travel, whether the pod was approached within 100 yards for photographic identification, roll and frame numbers of photographs taken and comments on behavior. Before 6 March, location was determined by triangulating on three or more known landmarks with a handheld pistol-grip compass.

After 6 March, a Garmin handheld GPS unit was used to determine latitude and longitude. An attempt was made to record the location of pods at the start and end of an approach. For pods that were followed for extensive periods of time (i.e., greater then 20-30 minutes) locations were recorded during mid-approach as well. Pod class was recorded as one of six categories: a pod of all adults, either traveling or resting (A); a pod containing at least one juvenile, either traveling or resting (J); a singing whale (S); a mother and calf pod (MC); a mother, calf and escort(s) pod (MCE); or a surface active pod (SA). A pod was considered surface active when aerial or percussive behaviors were noted in conjunction with aggressive or agonistic interactions between individuals. Sightings of other species of cetaceans were also recorded.

Photographic information included date and time of photographs (recorded automatically on film after 20 March by a Nikon databack), pod number, and a short description of subject being photograph. Description included which animal in the pod was being photographed based upon letters or descriptive names assigned during the approach, and the subclass of the individual. Subclass was noted as one of eight categories: adult (A); juvenile (J); singing whale (S); mother (M); calf (C); escort of a mother and calf (E); and in the case of mother and calf pods with multiple escorts, whether the escort was the primary escort (PE) closest to the mother, or a secondary escort (SE) on the periphery of the pod, if this determination was possible. Descriptions also included whether the photograph was of the fluke, left or right side of the dorsal fin. Coloration of the fluke was noted based on a one to five scale, where one is all white and five all black. Photographs of dorsal fins were collected of particularly mothers and singers, for which it was often difficult to get a good quality fluke photograph, and also when a dorsal fin could be easily associated with a fluke.

An effort was made during the first and last three weeks of the season to collect acoustic recordings of singing humpback whales. Since the collection of photographs was suspended during these periods, the amount of time spent recording singing whales was subtracted in the computation of effort (see below).

Analysis

To examine relative effort, the island was divided into 12 zones from Niwiliwili Harbor (the most eastern point reached on the south side) moving clockwise to Kilauea Point (the most eastern point reached on the north side; Fig. 1). Each zone encompassed approximately five nautical miles of coast. Boundaries between zones were chosen arbitrarily according to landmarks that were easy to locate from offshore. Therefore, the area of each zone varies. To estimate the amount of time spent in each zone, positions were recorded each time the boat crossed a boundary. The time spent in each zone was then summed across the entire season to give an indication of relative effort around the island. The island was also divided into three regions: South, West and North (Fig. 1). Effort in each region was summed for the entire season and for each month. Regions were used as a basis of comparison of descriptive statistics and identification photographs (see below). Hourly rates of pods sighted and approached were calculated for each region as well as each month. Hourly rates were also calculated for total whales sighted and approached, using summation of minimum pod size estimates.

Locations of all pods were plotted on a chart of Kauai. Only the first location recorded for a pod was plotted. Separate plots were done for all pods sighted, pods approached for identification, and pods that contained a calf or a singer. A routine was written in Microsoft Excel 4.0 to triangulate positions from bearings to known landmarks. These positions were first calculated in terms of x,y coordinates and then converted to latitude and longitude (ANN B. note: I can give you more details on this technique if need be). Positions from GPS were plotted directly from the latitude and longitude coordinates.

Descriptive statistics were calculated for pods approached for identification. This was done for the total sample and for each of the three regions. Statistics included total number pods and whales approached, mean pod size, frequency distribution of pod sizes, and relative occurrence of different pod class categories. For pod size calculations, two pods that affiliated were counted as three observations of pod sizes: the two pod sizes before affiliation and the pod size after affiliation. In order not to bias towards large pods, this was not done in the case of a single animal joining a pod of five or more whales. Minimum pod size estimates were used for all pod size calculations.

Proofsheets of all film were examined and each identification in a given day was assigned an observation number. An individual received multiple observation numbers if it was photographed on different days or in more than one pod during a day. Prints were made of all observations, and were then compared among themselves to determine how many and which individuals were photographed on more than one occasion. If a photograph was judged to be of insufficient quality to make a conclusive comparison, the observation was removed from the analysis. Each different individual was then assigned a unique catalogue number. Observations of insufficient quality were assigned a separate series of catalogue numbers, preceded by the letters "PQ" (poor quality), rather than discarded completely.

On some occasions only one blade of a whale's flukes were photographed. Since left blades could not be compared with right blades, it was not possible to include all in the analysis. Photographs of right blades were more numerous than left blades, and since right blades could be compared to complete flukes, only photographs of left blades were removed from the analysis. These were also assigned a separate series of catalogue numbers preceded by the letter "L" (left).

For purposes of mark-recapture calculations, an "observation" was defined as an identification of an individual on one day, regardless of how many pods it was photographed in during the day. A "re-sight" was defined as an individual photographed on more than one day. The percentage of individuals re-sighted (re-sight rate) was calculated as the proportion of individuals that was observed on more than one day, regardless of how many days they were observed. The total number of days elapsed between first and last observation of an individual was averaged for all re-sighted individuals.

Mark-recapture data were used to determine whether whales were equally likely to be re-sighted in any of the three regions, as opposed to in the same region originally observed. The expected number of re-sights between regions was dependent on the total number of observations from both regions and the total number of re-sights within the cumulative sample. Therefore, expected values were computed by multiplying the total number of re-sights by the proportion of all observations from each region being compared. Expected values were compared to observed values using the chi square statistic.

Finally, the rate of discovery of new individuals was plotted. The number of new individuals were plotted against the number of observations in the order in which they were obtained. When all the individuals in a population have been photographed, the slope of this line becomes zero. Therefore, the slope of the resulting function at the end of the sampling period gives an indication of what portion of the total population has been photographed.

Results

A total of 395.9 hours were spent on the water during 60 days of surveys. The south shore boat worked on 58 days, whereas the north shore boat worked on 13 days. The mean work day was 5.6 hours long with a range of 1.7 to 10.9 hours. During the entire season, 32.3 hours were spent recording singing whales, which was subtracted for the following calculations of effort.

Effort was not equally distributed throughout the study area (Fig. 2). The most time was spent in the West region (199.6 hours), primarily because this region was most often in the lee of bad weather. Proportionally very little effort was made in the North region (39.3 hours), due to the late acquisition of the north shore boat and poor weather conditions. In the South region (total effort of 124.1 hours), the most time was spent in Zone 4, the zone in which Port Allen and the south shore theodolite station was located (Fig. 2b). In the West region, the most time was spent in Zone 7, most likely due to the disproportionate area that this zone covered and the fact that this zone was most often in the lee of prevailing easterly winds (Fig. 2b). In the North region, the most time was spent directly off Hanalei Bay and the north shore theodolite station in Zone 11, with very little time spent elsewhere (Fig. 2b).

Although total effort was distributed equally among months (effort in February = 112.7 hours, in March = 122.5 hours, and in April = 128.4 hours), it was not distributed equally among the regions through time (Fig. 2c). As previously noted, most of the North region effort was concentrated in April. Effort in the South region steadily decreased throughout the season, while effort in the West region steadily increased. This trend was due to the seasonal commencement and strengthening of easterly trade winds in mid-March to April.

Of 320 pods sighted over the entire sampling period, locations of 287 were recorded (Fig. 3). Of 222 pods that were approached for identification photographs, locations of 207 were recorded (Fig. 4). Sightings were distributed throughout the study range and most pods were sighted within or along the 100 fathom contour. Mother and calf pods and singers were sighted throughout the study area (Fig. 5).

Number of pods sighted per unit effort was greatest in the South region and least in the North region, although number of pods approached per unit effort was similar for all regions (Fig. 6a). Conversely, number of whales sighted and approached per unit effort was greatest in the North region although only slightly more than in the South region (Fig. 6b). The number of pods sighted and approached per unit effort steadily decreased throughout the sampling period from February to April (Fig 7a). The same decreasing trend was evident in number of whales sighted per unit effort (Fig 7b). When hourly rates of pods and whales sighted are divided among months and regions, the steadily decreasing trend across the months is evident in all regions (Fig 7c and d). Data from the regions were also more similar than when simply lumped for the entire season. For region by month calculations, any region which had less than 30 hours of effort in a month was deleted from that month; these were the North region in February (0 hours) and March (8.3 hours), and the South region in April (12.1 hours).

The 222 pods that were approached for identification were comprised of a minimum of 480 and maximum of 499 whales. Approximately 11% of these pods were approached in the North region, 54% in the West region and 35% in the South region (Table 1). Mean pod size for the entire sample was 2.26 / 2.35 (minimum / maximum) and varied among the regions (Table 1). The majority of pods approached contained three or fewer whales with a pod size of one being the most frequent (Fig. 6a). There was some variation among the regions: the modal pod size in the North region was two whales whereas the modes in the South and West regions were a pod size of one (Fig. 6b). Although the largest pods were seen in the South and West regions (> 10 whales), the North region had a greater proportion of large pods containing 5 or more whales (Fig. 6b).

The majority of pods approached were non-surface active pods of adults without a calf (Table 2). Pods containing a mother and calf comprised 14% of pods approached, and most of these were accompanied by one or more escorts (Table 2). There was variation among the regions with the highest proportion of calf pods encountered in the West region and the lowest in the North region; also the majority of calf pods in the West region were accompanied by an escort(s), whereas the North and South regions had equivalent proportions of calf pods with and without an escort(s) (Table 2). The proportion of surface active pods encountered in the North region was much greater than in the West and South regions (Table 2). The proportion of singers encountered was similar among the regions, although the South region had a slightly smaller proportion than the West or North regions. Only a small proportion of pods were reported as containing a juvenile (Table 2).

Photographic data yielded 291 observations of 251 unique individuals (Table 3). Thirty-three individuals were observed on more than one day for a re-sight rate of 13.15% (Table 3 and Table 5). The most observations of an individual was of a mother with calf, catalogue number 134, observed on four days during a period of 43 days (Table 5). Six individuals were observed on three days, and the remainder (26 individuals) were observed on two days (Table 5). Number of elapsed days between first and last observation for all re-sighted individuals ranged from 1 to 50 days with a mean of 14.9 days (Table 3).

The number of observations varied among the regions, as did effort and number of pods approached (Table 4). Re-sights between regions were similar to expected values, although there were fewer re-sights than expected within the South region and more than expected within the West region (Table 4). These relationships were not statistically significant, however, and it was not possible to reject the null hypothesis that whales are equally likely to be re-sighted in any of the regions (chi-square[5] = 6.593, $P > 0.10$).

The rate of discovery of new individuals was plotted along with a 1:1 function (i.e., if all observations were of new individuals) for comparison (Fig. 7). Although the observed function was sloping away from the 1:1 function after the 291st observation, it is apparent that the rate of discovery of new individuals was still high at the end of the sampling period.

Discussion

It is difficult to draw conclusions concerning the relative distribution patterns and abundance of humpback whales throughout the study area due to non-random sampling and unequal effort among the regions. This is particularly true when considering the North region. Any interpretations of data concerning the North region have to take into consideration the comparatively small sample from this area and the fact that it was gathered almost entirely during April.

Pods of whales were distributed throughout the study range and tended to be clumped just within or along the 100 fathom depth contour. It is possible that this observation is an artifact due to the non-random manner in which the surveys were conducted. However, effort was directed towards areas where there were concentrations of whales. Since blows of humpback whales can be seen from several kilometers on a clear day, it is unlikely that whales closer inshore and further offshore would not have been seen and approached. Furthermore, this distribution pattern has been previously reported (Can't find this REF, maybe you know it; I will ask Joe) and is confirmed by the aerial surveys conducted during this study.

Although the North region had the least number of pods sighted per unit effort, it had the greatest number of whales sighted, and approached, per unit effort. This is directly related to the observation that the North region had the highest mean pod size, a greater proportion of large pods (> 4 whales), and by far the greatest proportion of surface active pods among the regions. The North region also had the smallest proportion of calf pods. This may indicate some heterogeneity in pod characteristics among the regions: the rougher, more exposed North region may contain primarily large pods of active adults, and fewer small, resting or courting pods and calf pods. It is also likely that these observations are partly artifacts due to the small area covered, the small sample size and the timing of sampling in the North region. Similar data gathered from the theodolite station may represent a less biased view of pods off the north shore.

Most importantly, it is impossible to distinguish between effects of region and month on these data, since all regions were not sampled equally through time. For example, the observation of larger pods in the North region may also be correlated with the month of April. It is clear that the sighting rates of pods and whales decreased throughout the sampling period, probably due to decreasing density of whales from February to April. This obviously has a biasing effect on North region data. Overall sighting rates of both pods and whales are less in the West region than the South region.

However, when the data is viewed by month, the West region had a similar sighting rate as the South in February, and a slightly greater rate in March. It is quite possible that all regions had similar sighting rates across the season. This would indicate equivalent densities of whales among the regions, but without consistent sampling, no definitive conclusions can be made.

Only a small proportion of pods approached were reported to contain juveniles. This may not be reliable since there was no objective way to differentiate between a juvenile and small adult, and there was likely significant inconsistency among observers. For the purposes of this study, it is safer to lump pods containing a juvenile with pods of adults.

Photographic identification data indicated a potentially large population of humpback whales around Kauai. The minimum population size was 251, the number of different individuals identified; however, this number probably represents only a fraction of the actual population. A re-sight rate of 13.15 % of individuals identified is consistent with 1991 data (number of individuals = 206, re-sight rate = 15.05 %; Cerchio, Gabriele and Frankel 1991). This is a relatively small percentage and would result from a large and/or possibly transient population. The rate of discovery of new whales was still high at the end of the season, indicating that only a small portion of the total population had been identified or that there was an unknown degree of immigration and emigration during the season.

Cerchio et al. (1991) found only 40 of 1089 individuals in common between Kauai and the island of Hawaii, indicating only limited exchange between these areas. There may be more extensive exchange, however, between Kauai and Oahu or the Maui region. There is probably regular exchange between Kauai and Niihau, as indicated by concentrations of whales around Niihau and throughout the intervening channel (Mobley and Bauer 1991). It is not possible to assess the degree or effect of temporary immigration and emigration on mark-recapture without simultaneous sampling off the other islands. It is, therefore, not advisable to make inferences about population abundance using this data alone. Cerchio et al. (1991) estimated population abundance off Kauai at 3022 (s.e. = 841) using the Schnabel estimator and between year comparisons from 1989 to 1991. This estimate may also be inflated due to temporary immigration and emigration, and therefore, should be considered with some caution.

Elapsed days between first and last observations of re-sighted individuals may give an indication of residence time of whales around Kauai. The mean among all individuals of 14.9 days is consistent with the 1991 mean of 14.7 days (number of re-sighted individuals = 31; Cerchio et al. 1991). Probably the most noteworthy sighting record is of a female with calf that was photographed on four days between 10 February and 25 March, a period of 43 days. There was an elapsed time of 39 days between her first and second sighting, however, and it is very possible that she moved out of Kauai waters during that period. Cerchio et al. (1991) reported the shortest observed transit between Kauai and the island of Hawaii as 7 days. Whales can and do, therefore, move throughout the island chain in relatively short periods. It is very likely that the longer elapsed periods between sightings do not accurately represent residency as defined by site tenacity. The mean of 14.7 days would, therefore, be biased upwards. An accurate measure of residency around any region could only be confidently determined with the use of radio or satellite telemetry.

Between region re-sight data suggested random movement throughout the three regions, rather than affinities for specific areas around the island. Although the sample size from the North region was small and not concurrent with the other regions, it was statistically equally probable to re-sight an individual in any region once it was observed. This is not a surprising result considering the small area represented by Kauai waters in comparison to the entire Hawaiian Island chain. If animals move throughout the island chain during a season (Baker and Herman 1981; Darling and McSweeney 1985; Cerchio et al. 1991), it is probable that they move freely around any one island, particularly one the size of Kauai. Although statistically not significant, there was a lower than expected re-sight rate within the South region and higher than expected in the West region. This may indicate some degree of affinity for the West region, and transience in the South region; however, it may also be related to the sampling. The South region was sampled primarily in the first half of the season, whereas the West region was sampled more equally throughout the season, allowing a greater opportunity for re-sight within the West region.

Summary

Photographic identification surveys were done during February to April, 1993, to investigate distribution and movement patterns of humpback whales off Kauai. Pods were distributed throughout three regions of the study area (South, West and North sides of the island), primarily along and within the 100 fathom depth contour. Hourly rates of sighting whales decreased from February to March to April in each region. Photographic data yielded 291 observations of 251 unique individuals. A relatively low re-sight rate (13.15%) and a high rate of discovery of new individuals at the end of the sampling period suggested a much larger population of whales than the 251 identified. Mark-recapture of individuals suggested random movement among the three regions. Observations are presented on the composition of pods among the regions, however, caution is advised in the interpretation of such data due to unavoidable inconsistencies in sampling among regions and months.

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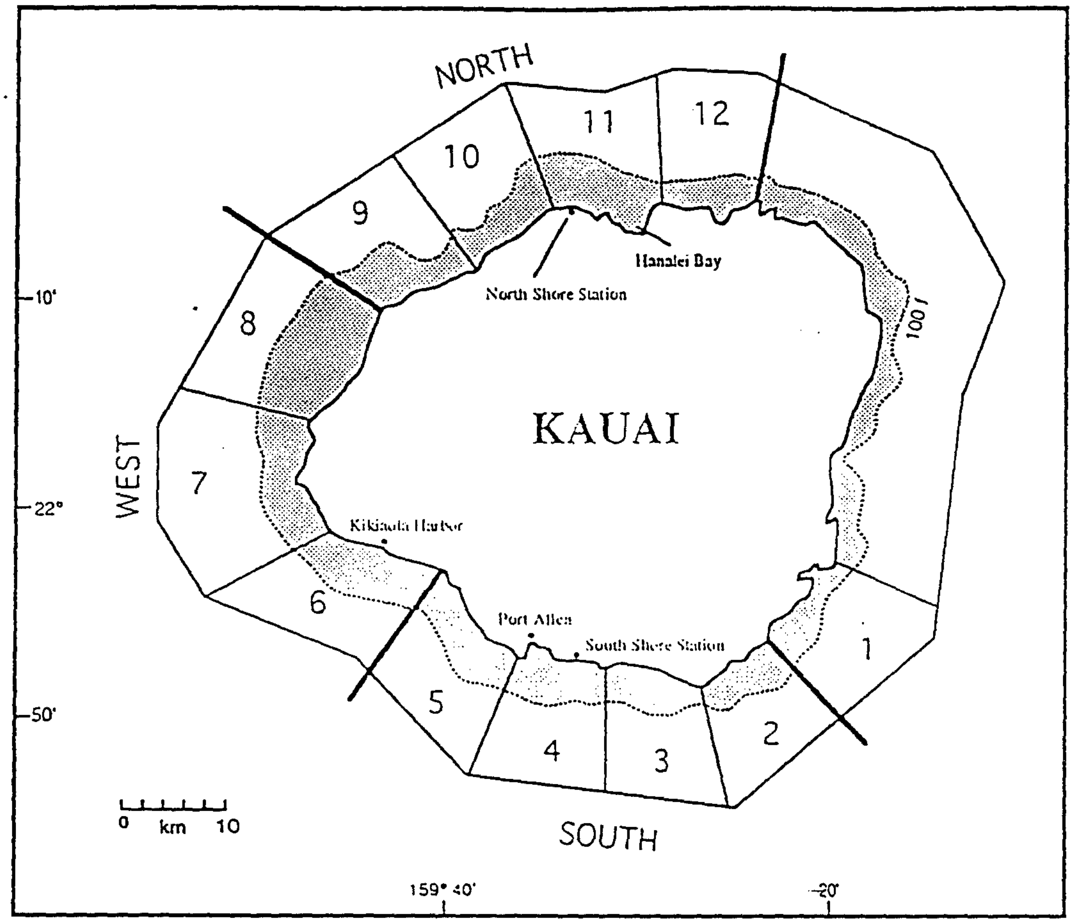


Figure 1. Chart of Kauai indicating locations of 12 zones and three regions used in analysis of sighting and photographic identification data.

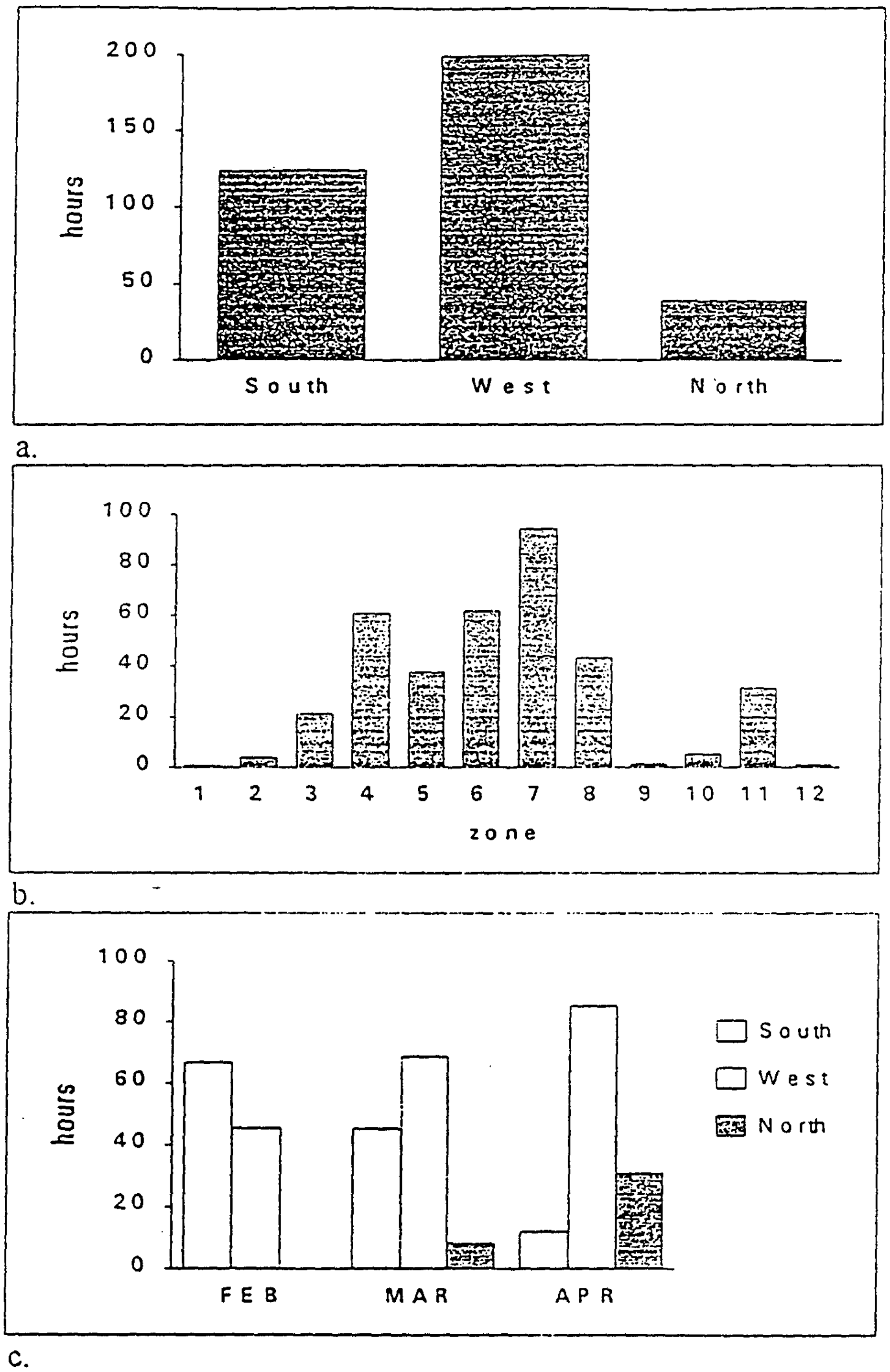


Figure 2. Effort as expressed by hours on the water off Kauai in 1993 for (a) each region, (b) each zone, and (c) each month and region. Time spent recording singers (32.3 hours) was subtracted from total time on water (395.9 hours) since pods were not being approached for photographic identification during recording sessions.

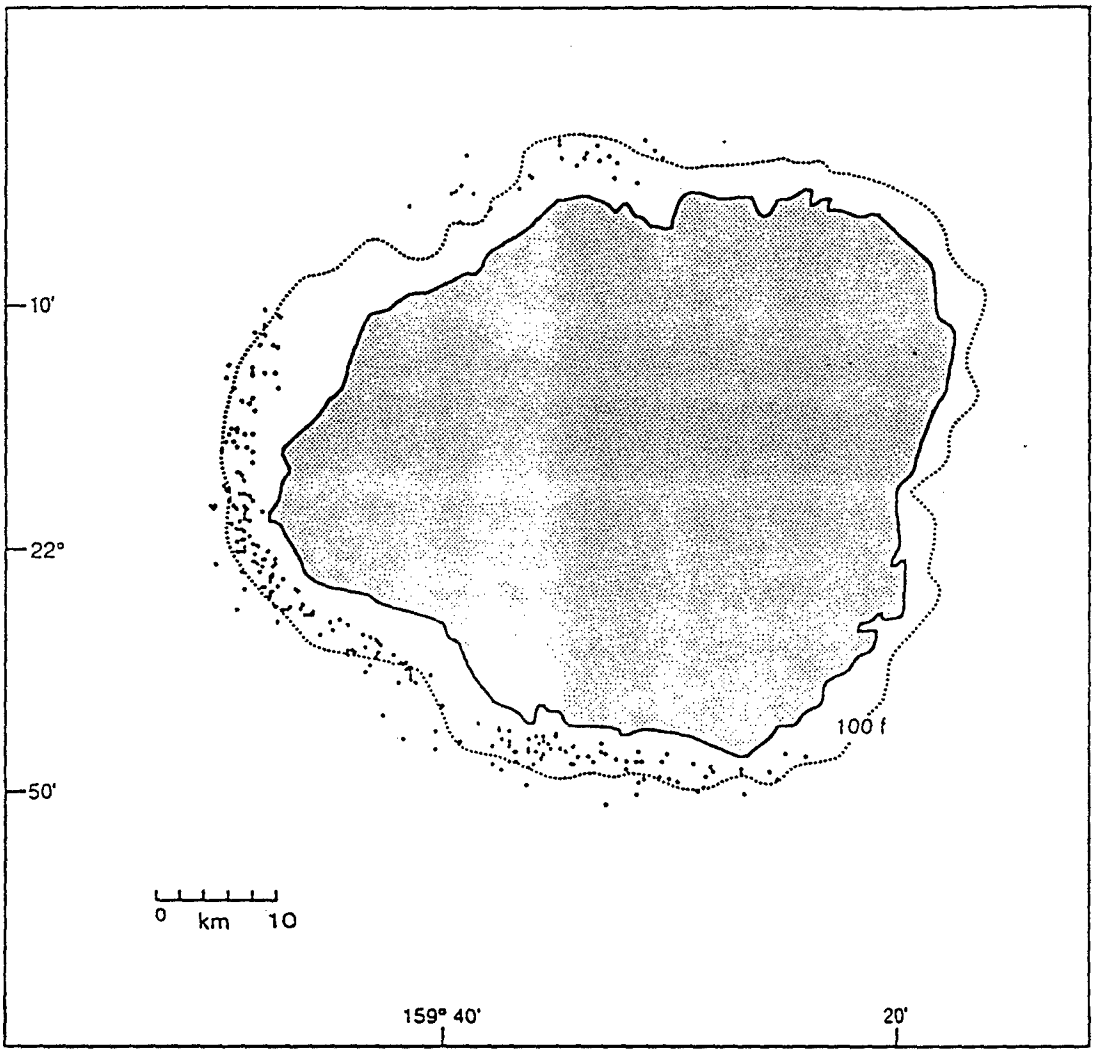


Figure 3. Chart of Kauai showing location of 287 pods of humpback whales sighted during photographic identification surveys.

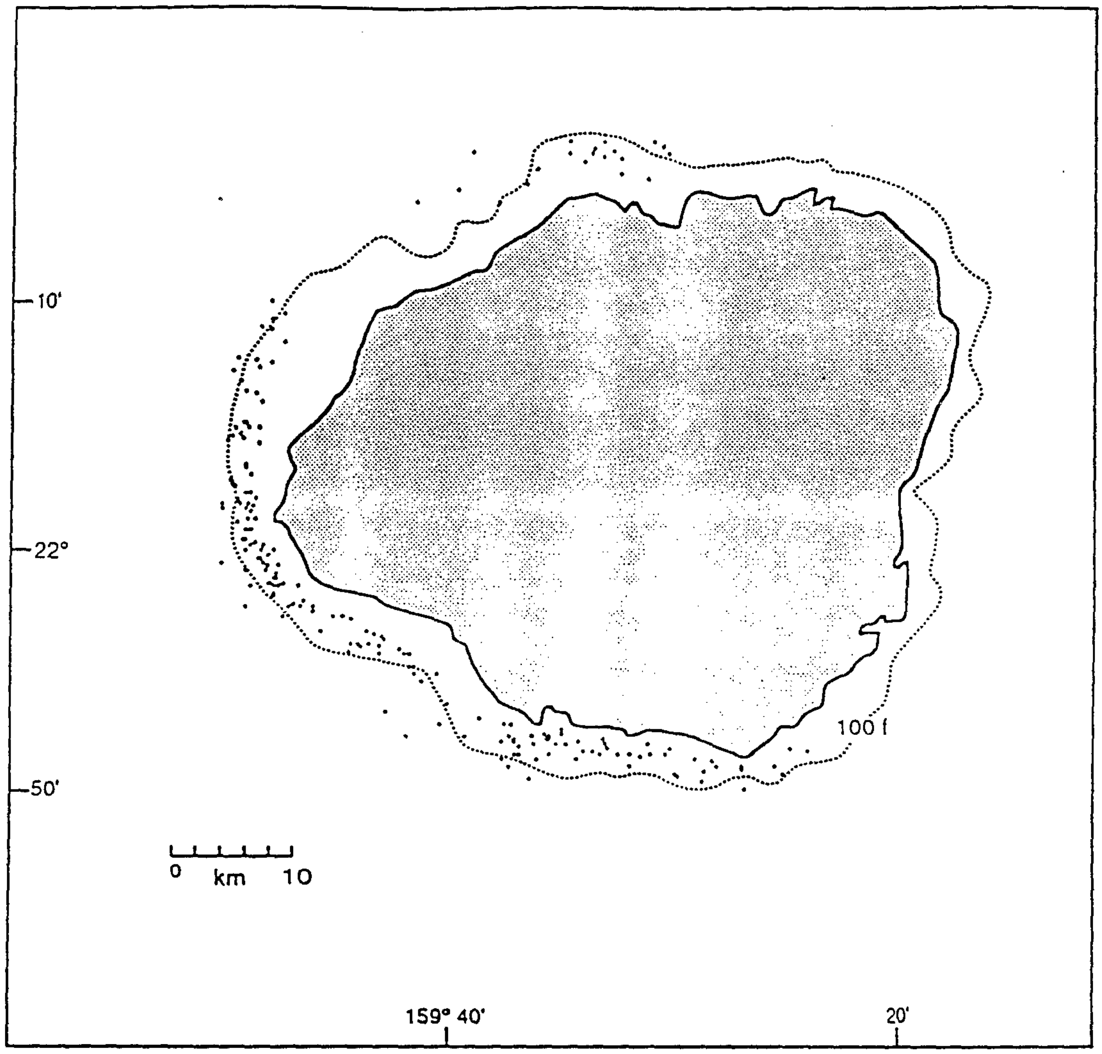


Figure 4. Chart of Kauai showing location of 207 pods of humpback whales approached for photographic identification.

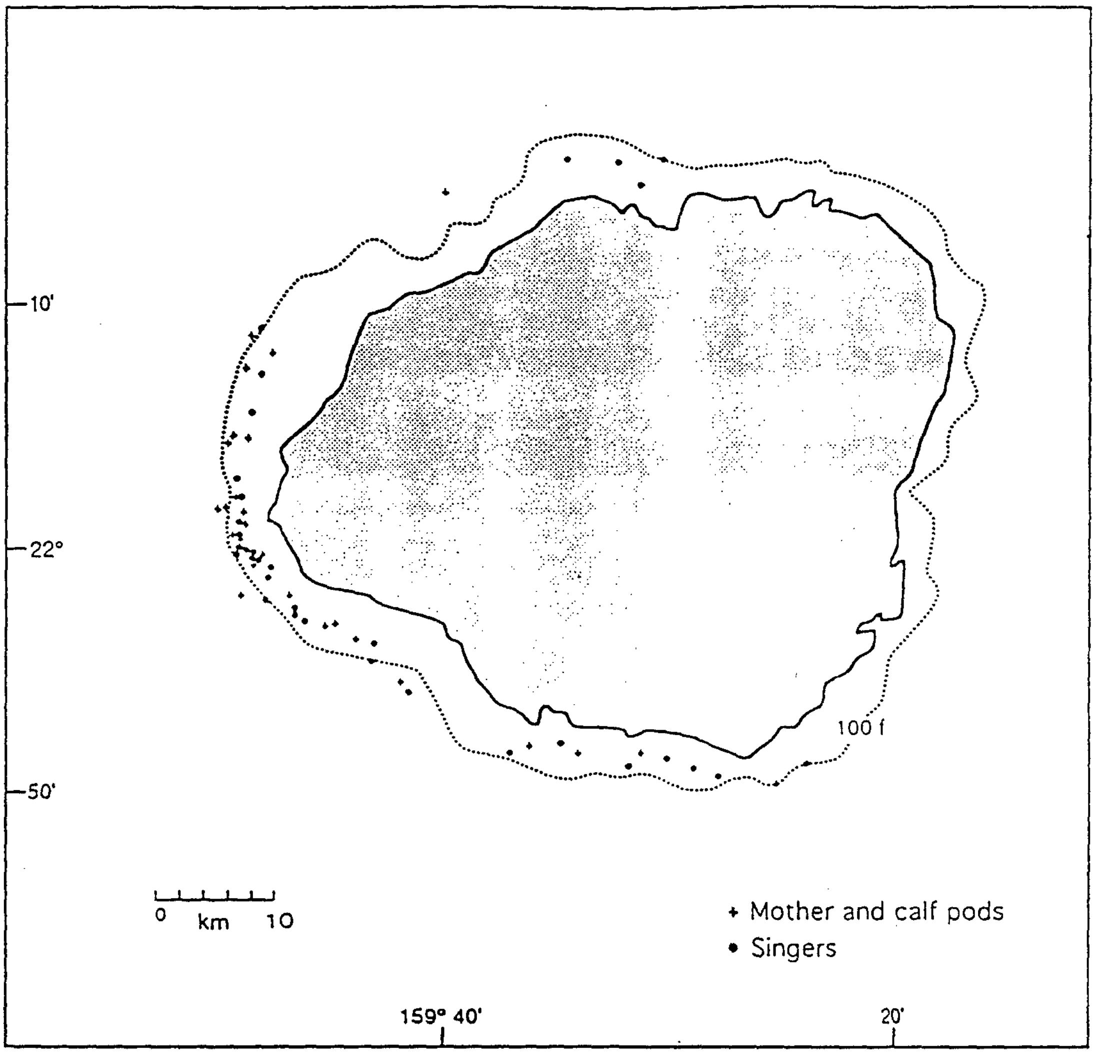
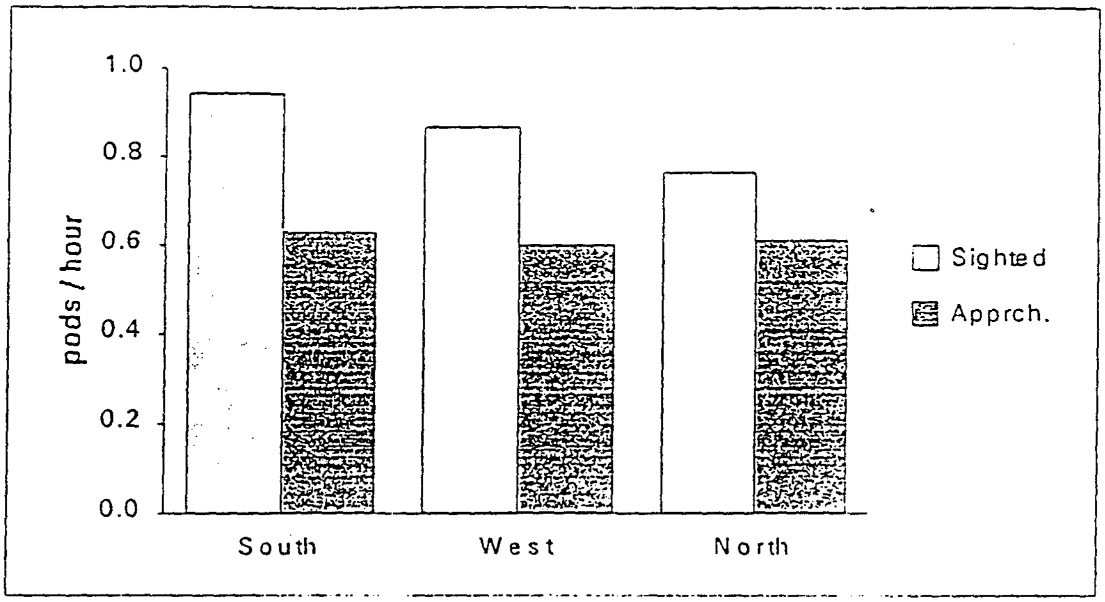
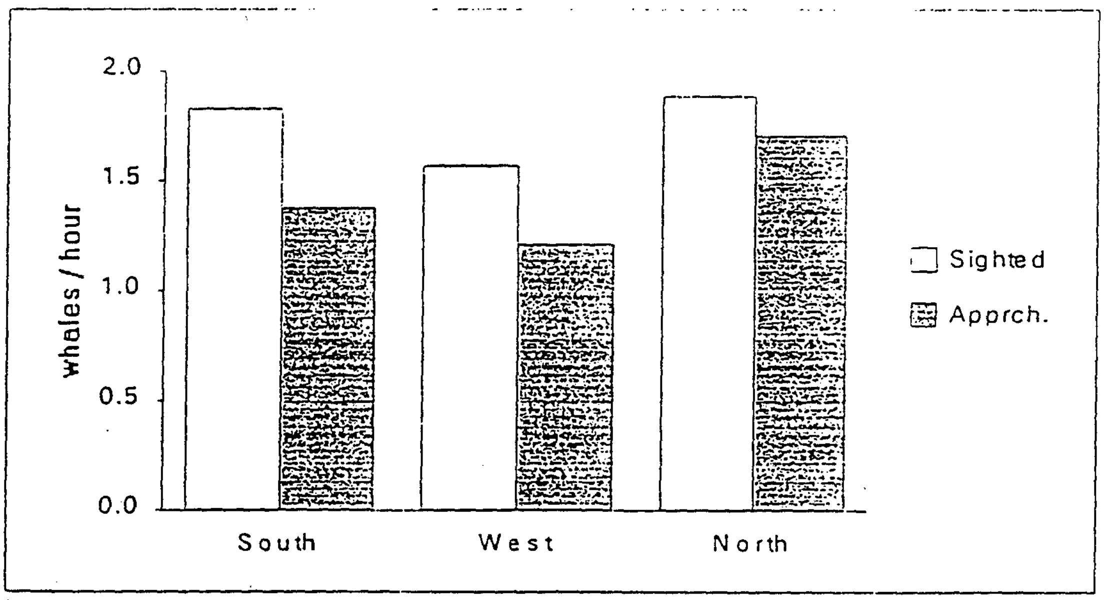


Figure 5. Chart of Kauai showing location of 29 mother and calf pods and 33 singers approached for photographic identification during 1993.



a.



b.

Figure 6. Hourly rates of (a) pods and (b) whales both sighted and approached throughout the season in each region. Rates were calculated by dividing the total number of pods and whales sighted or approached in each region by the total effort in each region. Summation of minimum pod size estimates were used for total number of whales.

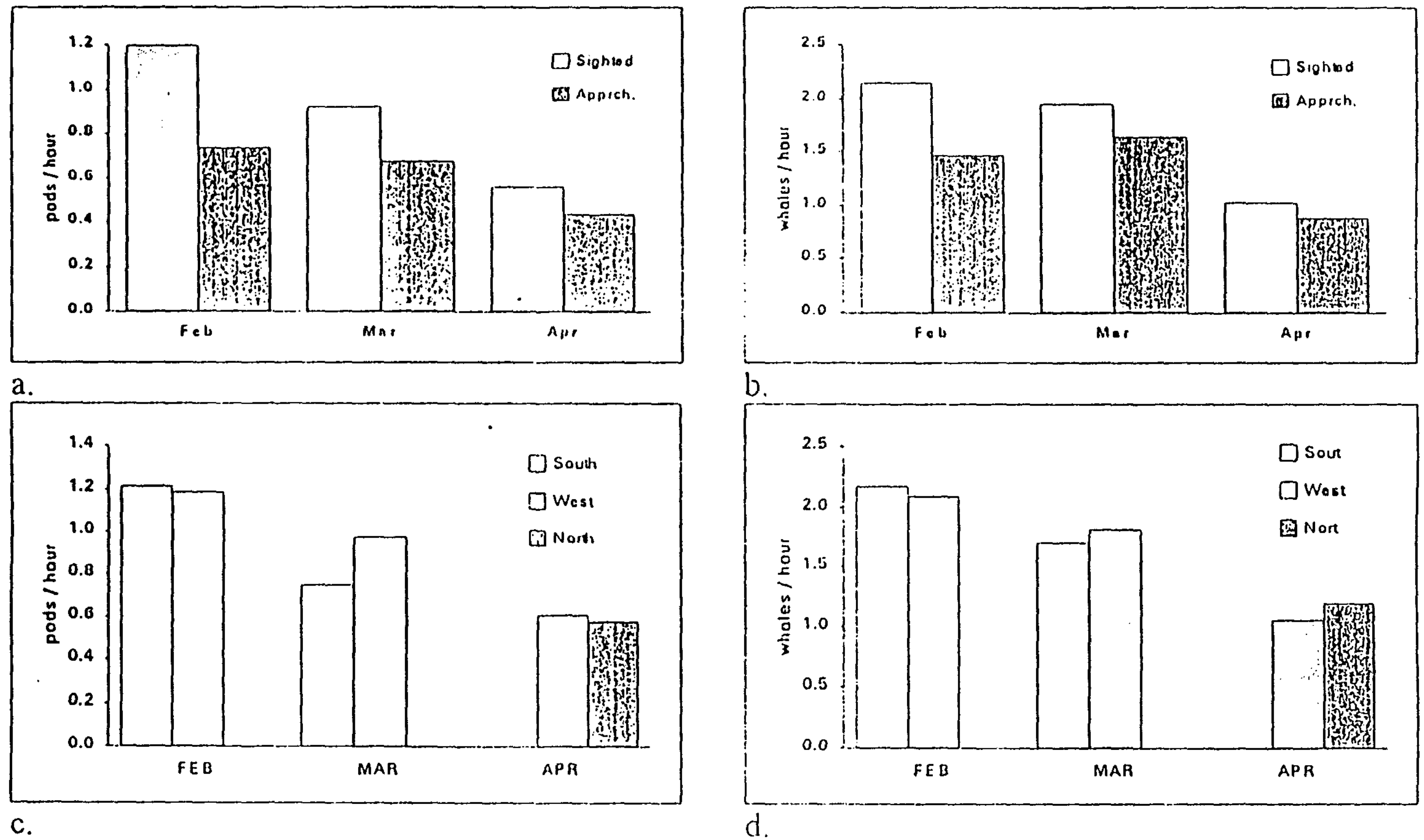
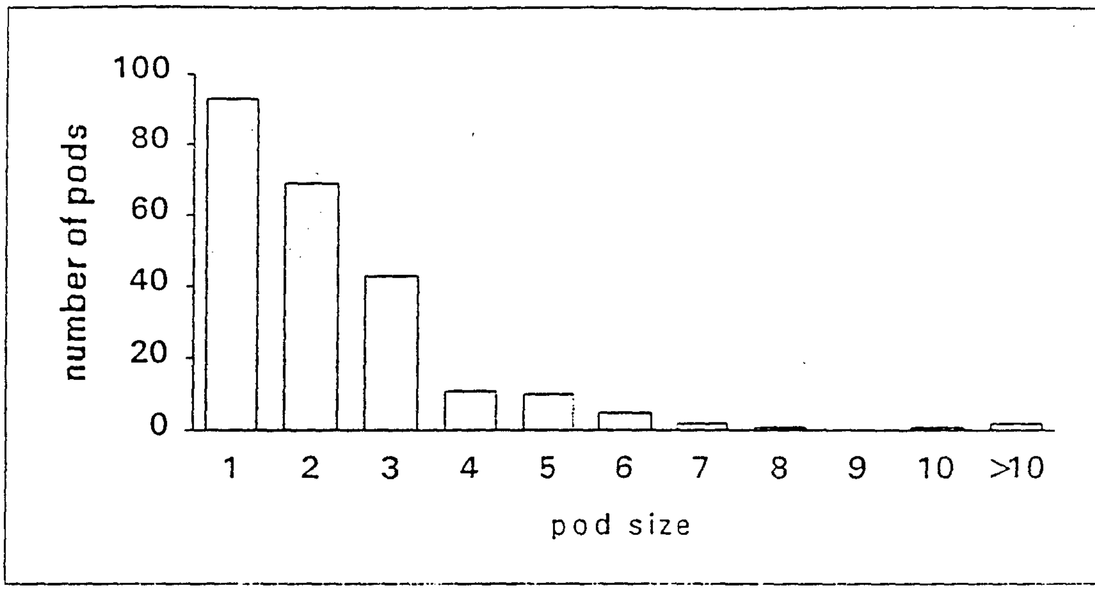
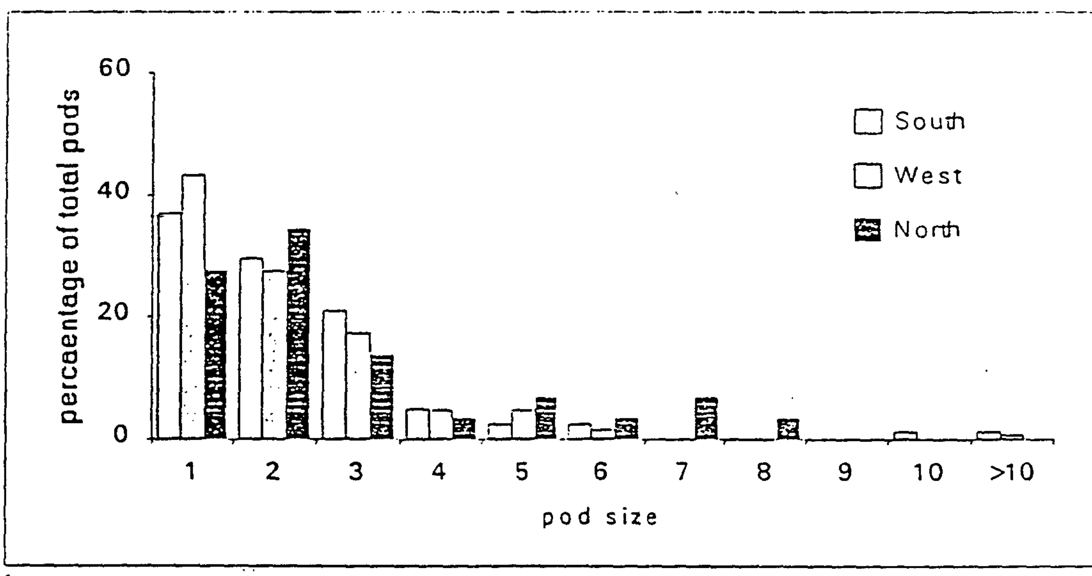


Figure 7. Hourly rates of (a) pods and (b) whales both sighted and approached throughout the entire study area in each month. Also shown are hourly rates of (c) pods and (d) whlaes sighted in each month divided among regions; missing bars indicate months when fewer than 15 hours of effort were dedicated to a given region. Rates were calculated by dividing the total number of pods and whales sighted or approached by the total effort. Summation of minimum pod size estimates were used for total number of whales.



a.



b.

Figure 8. (a.) Frequency distribution of minimum pod size for 237 pods of humpback whales approached for photographic identification off Kauai during 1993. Mean minimum pod size was 2.26 $\pm$ s.d. 1.73. (b.) Distribution of minimum pod size for each region as expressed as percentage of total pods approached in each region.

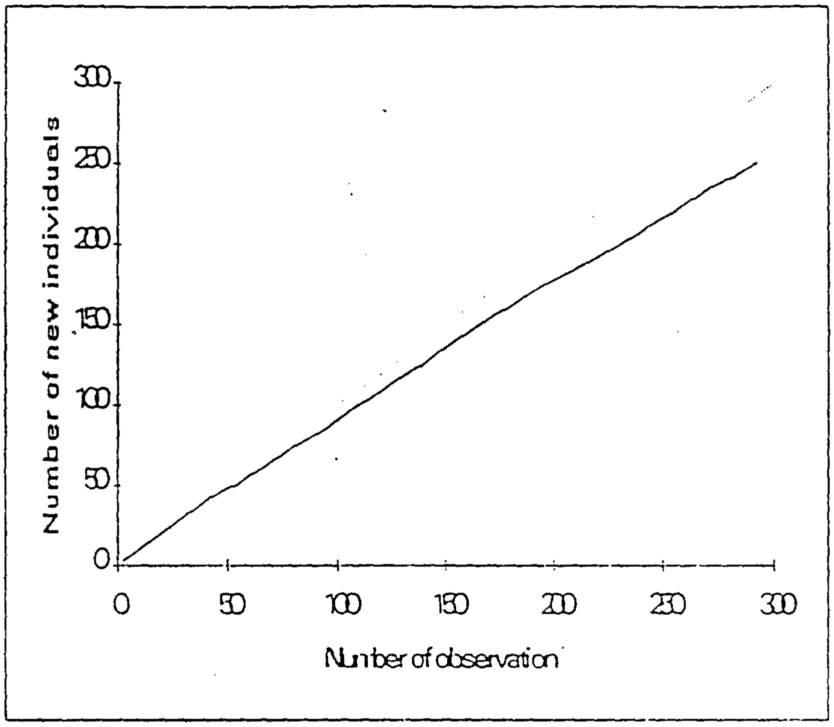


Figure 7. The rate of discovery of previously unidentified individuals off Kauai in 1993. Number of observations are plotted against the discovery of new individuals in the sample in the order in which they were obtained.

Table 1. Summary of pods approached for photographic identification off Kauai during 1993. Pod size was estimated as minimum and maximum for each pod. Regional totals are indicated. For mean pod size calculations, pods that affiliated were counted as three pods: two pods before affiliation and a third pod after affiliation (with the exception of a singleton joining a pod of > 5 whales, so as not to bias towards large pods).

	Total	South	West	North
No. pods approached	222	78	120	24
Minimum no. whales	480	171	242	67
Maximum no. whales	499	178	250	71
Mean min. pod size (s.d.)	2.26 (1.73)	2.30 (1.84)	2.11 (1.56)	2.83 (2.04)
Mean max. pod size (s.d.)	2.35 (1.80)	2.39 (1.86)	2.18 (1.61)	2.97 (2.28)

Table 2. Pod class for 222 pods approached for photographic identification off Kauai during 1993. The sample is sub-divided by region and values are expressed as percentages of total pods approached in each region.

	Total	South	West	North
Pods containing a calf	14.0%	10.4%	17.4%	8.3%
Pods of adults - trav. or resting	56.3%	64.9%	53.7%	41.7%
Mother and calf pods	4.5%	5.2%	4.1%	4.2%
Mother, calf and escort pods	9.5%	5.2%	13.2%	4.2%
Surface active pods	9.0%	6.5%	6.6%	29.2%
Singer pods	16.7%	13.0%	18.2%	20.8%
Pods containing juvenile(s)	4.1%	5.2%	4.1%	0.0%

Table 3. Summary of photographic identification data of humpback whales off Kauai during 1993.

Year	# Obs.	# Ind.	# Ind. RS.	% Ind. RS.	Mean # Days	Range Days
1993	291	251	33	13.15%	14.9	1 - 50

Obs. = Total observations of individual whales (1 observation = one or more photographic sightings of an individual during one day).
Ind. = Total of different individuals.
Ind. RS. = Number of individuals sighted on more than one day during a single season.
% Ind. RS. = Percentage of individuals sighted on more than one day during a single season.
Mean # Days = Mean number days between first and last sighting of re-sighted individuals.
Range Days = Range of elapsed days for re-sighted individuals.

Table. 4. Number of observations within each region and number of re-sights between each region. Expected number of re-sights between each region are shown within (), and were generated by multiplying the total number of re-sights by the proportion of observations from both regions. From this sample of photographs, it was not possible to reject the null hypothesis that there is an equal probability of sighting a previously sighted individual in any of the three regions (Chi-square [5] = 6.593, P > 0.10)

		# Re-sights		
	# Obs.	South	West	North
South	109	6 (11.2)	17 (14.5)	6 (4.2)
West	141		12 (18.8)	7 (5.5)
North	41			2 (1.6)

Table 5. Individuals sighted on more than one day during 1993 with pod and individual information for each sighting. (See bottom of table for heading descriptions).

Cat. #	Date	Zone	Reg.	dT	TOTdT	Sbcl.	Sex	Pod Size Min.	Pod Size Max.	Comp.	Calf
004	2/4/93	5	South			A	U	2	2	A	N
004	2/12/93	5	South	8	8	A	U	3	4	A	N
005	2/3/93	5	South			A	U	5	6	SA	N
005	2/18/93	7	West	15	15	A	U	3	3	A	N
131	2/6/93	5	South			A	U	3	3		
131	2/26/93	7	West	20	20	A	U	5	5	SA	N
132	2/6/93	5	South			A	U	3	3		
132	2/15/93	4	South	9	9	A	U	3	3	S/A	N
034	2/7/93	4	South			A	U	2	2	A	N
034	2/14/93	3	South	7	7	A	U	3	3	A	N
078	2/8/93	5	South			A		3	3	A	N
078	2/15/93	4	South	7	7	S	M	1	1	S	N
134	2/10/93	2	South			M	F	2	2	MC	Y
134	3/21/93	7	West	39		M	F	2	2	MC	Y
134	3/22/93	7	West	1		M	F	3	3	MCE	Y
134	3/25/93	8	West	3	43	M	F	3	3	MC	Y
201	2/11/93	5	South			A		6	6	A	N
201	2/27/93	7	West	16	16	S	M	1	1	S	N
091	2/11/93	5	South			S	M	1	1	S	N
091	4/2/93	11	North	50	50	A		8	10	SA	N
113	2/12/93	5	South			A	U	3	4	A	N
113	2/21/93	6	West	9	9	A	U	2	2	A	N
026	2/16/93	2	South			A	U	3	3	A	N
026	3/23/93	6	West	35	35	A	U	2	2	A	N
121	2/20/93	6	West			A	U	2	2	J	N
121	2/26/93	7	West	6		A	U	2	2	A	N
121	2/27/93	8	West	1	7	A	U	5	5	SA	N

Table 5. (continued)

Cat. #	Date	Zone	Reg.	dT	TOTdT	Sbcl.	Sex	Pod Size Min.	Pod Size Max.	Comp.	Calf
191	2/25/93	7	West			A	U	3	3	A	N
191	3/12/93	4	South	15	15	A	U	3	3	A	N
006	2/26/93	7	West			S	M	1	1	S	N
006	3/5/93	6	West	7	7	A		1	1	A	N
028	2/28/93	7	West			A	U	2	2	A	N
028	3/24/93	8	West	24		A	U	14	14	SA	N
028	4/11/93	7	West	18	42	A	U	4	4	SA	N
130	3/4/93	6	West			J	U	1	1	J	N
130	3/12/93	2	South	8	8	J	U	1	1	J	N
209	3/4/93	6	West			A	U	2	2	A	N
209	3/16/93	4	South	12	12	A	U	2	2	A	N
215	3/8/93	4	South			E	M	4	4	MCE	Y
215	4/4/93	8	West	27	27	A		3	3	A	N
139	3/8/93	4	South			A	U	5	5	A	N
139	3/24/93	8	West	16	16	A	U	14	14	SA	N
170	3/8/93	4	South			A	U	5	5	A	N
170	3/24/93	8	West	16		A	U	14	14	SA	N
170	3/25/93	9	North	1	17	A	U	2	2	A	N
138	3/8/93	5	South			A	U	1	1	A	N
138	3/25/93	9	North	17		A	U	2	2	A	N
138	4/2/93	11	North	8	25	A	U	8	10	SA	N
140	3/9/93	5	South			A	U	4	4	SA	N
140	3/24/93	8	West	15		A	U	14	14	SA	N
140	3/25/93	11	North	1	16	A	U	7	7	SA	N
045	3/17/93	4	South			A		10	10	SA	N
045	3/18/93	4	South	1	1	S	M	1	1	S	N
188	3/17/93	4	South			A	U	10	10	SA	N
188	3/19/93	5	South	2	2	A	U	14	14	SA	N

Table 5. (continued)

Cat. #	Date	Zone	Reg.	dT	TOTdT	Sbcl.	Sex	Pod Size Min.	Pod Size Max.	Comp.	Calf
221	3/17/93	4	South			A	U	10	10	SA	N
221	3/25/93	11	North	8	8	A	U	7	7	SA	N
225	3/19/93	5	South			A		14	14	SA	N
225	3/21/93	8	West	2	2	S	M	1	1	S	N
010	3/19/93	5	South			A	U	14	14	SA	N
010	3/24/93	8	West	5	5	A	U	14	14	SA	N
187	3/21/93	8	West			A	U	2	2	A	N
187	3/25/93	10	North	4	4	A	U	7	7	SA	N
105	3/22/93	7	West			E	M	4	4	MCE	Y
105	4/15/93	7	West	24	24	A		6	7	SA	Y
193	3/24/93	8	West			A	U	14	14	SA	N
193	3/25/93	10	North	1	1	A	U	4	4	SA	N
088	3/25/93	11	North			A	U	7	7	SA	N
088	4/9/93	8	West	15	15	A	U	4	4	MCE	Y
167	3/25/93	10	North			A	U	4	4	SA	N
167	4/1/93	11	North	7		A	U	6	6	A	N
167	4/11/93	7	West	10	17	A	U	4	4	SA	N
019	4/7/93	6	West			A	U	1	1	A	N
019	4/9/93	8	West	2	2	M?	F?	4	4	MCE	Y

Cat. # = catalogue number of individual
Reg. = region (south, west, north)
dT = elapsed days between consecutive sightings
TOTdT = elapsed days between first and last sighting
Sbcl. = subclass of individual (A = adult, J = juvenile, M = mother, E = escort of mother, S = singer)
Min. = minimum size estimate of pod
Max. = maximum size estimate of pod
Comp. = pod composition (A = resting or traveling pod of adults, J = pod containing a juvenile, MC = mother and calf pod, MCE = mother, calf and escort pod, SA = surface active pod, S = singer pod)
Calf = presence of calf (Yes or No)

RESULTS OF 1993 AERIAL SURVEYS IN HAWAIIAN WATERS

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1993 ATOC MARINE MAMMAL RESEARCH PROGRAM:
Annual Report to Advance Research Projects Agency

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I. BACKGROUND

A. HAWAIIAN CETACEANS

Research

With the exception of spinner dolphins and seasonally-resident humpback whales, there has been a lack of systematic research on Hawaii's resident cetacean species. Literature pertaining to humpback whales is considerably larger and is summarized in a separate section below. The presence ofother cetacean species has been documented incidentally in surveys of other species, primarily.humpback whales (Shallenberger, 1981). In many cases, these sightings have been unpublished and are based on personal communications.

Protection, Legislation and Management

All marine mammals within the U.S. and territorial waters are currently protected by the Marine Mammal Protection Act of 1972, as amended. The National Marine Fisheries Service (NMFS) of the National Oceanic and Atmospheric Administration (NOAA) is charged with the interpretation and administration of this act. Humpback whales are additionally protected by the Endangered Species Act of 1973, as amended, and have been protected by an international whaling moratorium since 1966. Humpbacks are further protected in Hawaiian waters by anti-harassment regulations that are enforced by NMFS (Federal Register, 1987). These regulations established a minimum approach distance of 100 yards for all Hawaiian waters and a minimum approach of 300 yards for the waters within Maalaea Bay, Maui and portions of Lanai coastal waters. Violators are subject to fines,imprisonment, or both. NMFS recently published the final draft of the Humpback Whale Recovery Plan (NMFS, 1991) that reviewed all pertinent literature and established objectives for population management.

Cetaceans Found in Hawaiian Waters

Shallenberger (1981) identified 24 species of cetaceans (five Mysticete and 19 Odontocete species) in Hawaiian waters on the basis of identification of stranded specimens or field observations (see Table 1). Nitta (1987) documented all cases of stranded cetaceans recorded between the years of 1936 and 1988 which included 11 of the species identified by Shallenberger. From both sets of data combined it is clear that of the Mysticete species, only the humpback whale (*Megaptera novaeangliae*) can be considered to be at least seasonally resident. Sightings of the remaining four Mysticete species (Bryde's, finback, minke and right whales) were so rare as to be considered anomalous.

Of the Odontocete species shown in Table 1, five were identified on only one or a few instances and are similarly designated as anomalous. The remaining 14 species are designated as rare, uncommon, or common in order of increasing occurrence.

Odontocete Prey Species

Unlike humpback whales, which presumably do not feed while wintering in Hawaiian waters (cf. Baraff, Clapham, Mattila & Bowman, 1991), the behavior and distribution of Odontocete species is presumably driven by the distribution of their prey species. What little is known of the feeding habits of Odontocete species in Hawaii has been gleaned from examinations of stranded specimens, occasional field observations and from generalizations based on more extensive literature for other regions. Shallenberger (1981) noted that a significant portion of the diet of smaller Hawaiian cetaceans is made up of epipelagic and mesopelagic fish and squid. Primarily this includes myctophid fish, some of which migrate at night to within 200 m of the surface, and several species of squid which also show vertical diurnal migrations, including *Abralia trigmura* and *A. astrostica*. Shallenberger underscored the importance of squid to Odontocete diets by noting that virtually every stranded specimen examined contained squid beaks in its stomach contents. The myctophid species of fish are also commonly found in Hawaiian cetaceans (Shomura and Hida, 1965). Local fish species of likely importance include: opelu (*Decapterus pinnulatus* and *D. maruadsi*) and akule (*Trachurops crumenophthalmus*). Shallenberger reported that larger cetaceans have been observed eating mahimahi (*Coryphaena hippurus*), yellowfin tuna (*Thunnus albacares*) and skipjack tuna (*Katsuwonus pelamis*). These species are all commercially important and their relative availability can be assessed using catch statistics (Shallenberger, 1981).

Predators

Information relevant to cetacean predation has been primarily anecdotal (Shallenberger, 1981). Sharks have been observed to feed on live cetaceans in other oceans (e.g., Leatherwood, Evans and Rice, 1972; Leatherwood et al., 1973) but, according to Shallenberger, have not been observed doing so in Hawaiian waters. Accounts exist of unidentified cetacean remains in the stomach contents of tiger sharks (*Galeocerdo covieri*) harvested in Hawaii, but it is not known whether the animals were alive or dead when eaten. Additional indirect evidence of shark attacks on cetaceans occur in the form of crescent-shaped scars on the bodies of living specimens. Hawaiian cetaceans are also frequently seen with the small circular scars characteristic of "cookie cutter" sharks (*Isistius brasiliensis*). These small bites generally heal and are not known to be fatal.

TABLE 1

Cetacean Species Found in Hawaii with Results of 1993 Aerial Surveys [a]

Common (Scientific) Name	Observations	Frequency	Depth of '93 sightings (fathoms) <100	>100
MYSTICETES:				
Humpback whale (*Megaptera novaeangliae*)	field obs (many) stranding (8)	Common	yes	yes
Bryde's whale (*Balaenoptera edeni*)	field obs (few)	Anomalous		
Fin whale (*B. physalus*)	stranding (1)	Anomalous		
Minke whale (*B. acutorostrata*)	field obs (1)	Anomalous		
Right whale (*Balaena glacialis*)	field obs (1)	Anomalous		
ODONTOCETES:				
Spinner dolphin (*Stenella longirostris*)	field obs (many)	Common	yes	yes
Spotted dolphin (*Stenella attenuata*)	field obs (many)	Common	yes	yes
False killer whale (*Pseudorca crassidens*)	field obs (many) stranding (4)	Common	yes	yes
Bottlenosed dolphin (*Tursiops gilli*)	field obs (many) stranding (3)	Common	yes	yes
Pilot whale (*Globicephala macrorhynchus*)	field obs (many) stranding (11)	Common	no	yes
Rough-toothed dolphin (*Steno bredanensis*)	field obs (many) stranding (5)	Common		
Sperm whale (*Physeter catodon*)	field obs (many) stranding (5)	Uncommon	no	yes
Pygmy sperm whale (*Kogia breviceps*)	stranding (8)	Uncommon	no	yes
Melon-headed whale (*Peponocephala electra*)	field obs (many) stranding (10)	Uncommon		
Pygmy killer whale (*Feresa attenuata*)	field obs (many) stranding (5)	Uncommon		
Striped dolphin (*Stenella coeruleoalba*)	stranding (13)	Rare [b]		
Risso's dolphin (*Grampus griseus*)	field obs (2) stranding (4)	Rare		
Goosebeaked whale (*Ziphius cavirostris*)	stranding (5)	Rare	no	yes
Densebeaked whale (*Mesoplodon densirostris*)	field obs (1) stranding (2)	Rare		
Common dolphin (*Delphinus delphis*)	field obs (1)	Anomalous		

Whitesided dolphin (*Lagenorhynchus obliquidens*)	field obs (1)	Anomalous
Dwarf sperm whale (*Kogia simus*)	field obs (1) stranding (1)	Anomalous
Killer whale (*Orcinus orca*)	stranding (1)	Anomalous
Bottlenose whale (*Hyperoodon ampullatus*)	field obs (1)	Anomalous

(a) Table adapted from Table 1 of Forestell & Brown (1992) which was based primarily on Shallenberger (1981). Stranding results are for period 1936-1987 as taken from Nitta (1987). Numbers in parentheses indicate numbers of strandings or field observations on record. Results of 1993 survey were added from unpublished data. Frequency is noted in decreasing magnitude as follows: common, uncommon, rare and anomalous.

(b) The sighting data of Shallenberger (1981) are at odds with the stranding data of Nitta (1987) for striped dolphins (*Stenella coeruleoalba*). Striped dolphins were noted as "rarely observed" by Shallenberger but were listed by Nitta as the species with greatest frequency of stranding. The source of this discrepency is unclear.

B. HUMPBACK WHALES

North Pacific Population of Humpback Whales

Humpback whales migrate each year from summer coastal feeding grounds in high latitudes to breeding and calving grounds near islands or shallow banks in low-latitude waters. Populations of humpback whales are found in most of the world's oceans, but intensive twentieth-century whaling reduced their numbers to a small fraction of their original abundance. The size of the north Pacific population was estimated earlier to be approximately 10% of the species' pre-whaling abundance (Rice, 1978; Wolman, 1978). Prior to the 1970s, most of the information concerning the natural history of humpback whales came from harvested specimens primarily in the southern oceans (e.g., Dawbin, 1966; Chittleborough, 1954, 1955). During the past two decades the focus of research has shifted to field studies of free-ranging specimens aided by the use of natural markings on the flukes to identify individuals. Analysis of photographs of these natural markings (primarily variations of black and white pigment found on the ventral surface of the flukes) have contributed substantially to our understanding of the population structure, social ecology and reproductive patterns of this species (see review in Perry et al. 1988).

The structure of the north Pacific population of humpback whales is poorly understood. Kellogg (1929), using the observations of early whalers, suggested that humpback whales in the north Pacific were divided into an American and Asian stock. He proposed that the Asian stock wintered in tropical waters south of Japan and traveled north to feeding areas in the Sea of Okhotsk and along the Kamchatka Peninsula. The American stock was thought to breed in the waters off the west coast of Mexico and travel northward along the coast of North America to feeding grounds in the Gulf of Alaska, the Bering Sea, and near the Aleutian Islands. At that time there was no evidence of exchange between the American and Asian stocks. Recently, however, Darling (1991) reported a resight of a humpback whale seen in the waters surrounding Ogasawara, Japan, as well as the island of Kauai. Recent analyses of humpback whale songs recorded in the wintering grounds off Mexico, Hawaii and Japan also support the possibility of cross-Pacific exchange (Helweg et al. 1993) since some "themes" (recurring features of song) were found common to all three wintering regions. The Hawaiian wintering grounds were apparently not known to Kellogg, nor to other authors discussing the north Pacific humpback whales (e.g., Nishiwaki, 1966). The Hawaiian grounds have been studied intensively only since the mid-1970s (e.g., Herman and Antinoja, 1977; Tyack, 1981; Darling, Gibson and Silber, 1983; Glockner and Venus, 1983). Herman (1979) proposed that the whales may have "arrived" in Hawaiian waters possibly no earlier than the mid-1800s. Among other evidence, Herman noted the fact that there is no specific word for "humpback whale" in the Hawaiian language and no mention of the existence of Hawaiian humpback whales in the logs of European whalers (despite the use of Lahaina and other ports for stocking whaling ships) until the mid-nineteenth century. Iftrue, this hypothesis might explain the lack of awareness of Kellogg and other earlier authors concerning the seasonal residence of humpback whales in Hawaiian waters. More recent photographic identification data, focused primarily on the habitats in the central and eastern north Pacific, have revealed patterns of exchange between southern wintering areas in Hawaii and Mexico, and northern feeding areas in the waters surrounding the Farallon Islands off the central California coast, Southeastern Alaska, and Western Gulf of Alaska (Perry et al., 1988). In contrast to migration from winter to summer regions, cases of movement from one summer feeding area to another are rare. Based on these patterns of movement, Baker et al. (1986) proposed that humpback whale groups in the north Pacific are best described as "structured stocks" that consist of several feeding herds which intermingle to breed on one or more wintering grounds.

Humpback Whales in Hawaiian Waters

Several authors have noted the tendency for humpback whales to congregate in shallow-water banks and island areas during the winter breeding season (Herman and Antinoja, 1977; Chittleborough, 1965). Though opportunistic feeding in low-latitude waters has been observed (Baraff, Clapham, Mattila & Bowman, 1991) humpback whales harvested in the southern breeding grounds typically have empty or near-empty stomachs (Dawbin, 1966; Tomilin, 1967) which suggests that feeding does not generally occur during the winter months. Thus, the preference for shallow water is not likely based on prey availability. Other authors have conjectured that: a) shallow, inshore waters offer greater protection from predators such as sharks, particularly of concern for calves (Baker, 1985); or b) warmer waters require less of an expenditure of metabolic energy, particularly important during a period of fasting (Brodie, 1975). Hawaii affords large expanses of relatively shallow water (less than 100 fathoms) and thus is well suited for breeding habitat.

Humpback whales are found in Hawaiian waters throughout the winter-spring season with peak abundance occurring approximately between mid-February and mid-March (Baker and Herman, 1981; Herman, Forestell and Antinoja, 1980; Forestell and Mobley, 1991). The social behavior of the whales while on the wintering grounds is presumably related to reproduction, since calves are born during the winter season and gonadal activity in both males and females increases in the winter months (Chittleborough, 1954, 1955; Nishiwaki, 1959). It appears that the mating system is polygynous or promiscuous (Mobley and Herman, 1985), characterized by complex acoustic displays (e.g., 'song'), and vigorous physical competition between males. Female humpbacks generally give birth to a single calf at two- to four-year intervals (Baker, Perry and Herman, 1987; Clapham and Mayo, 1988; Glockner-Ferrari and Ferrari, 1984), although some females may give birth two years in a row. The calf remains with its mother for approximately one year (Chittleborough, 1954). Current rates of neonatal mortality are unknown but of great importance to assessments of the rate of recovery of the species (Perry, Baker and Herman, 1990). Mother-calf pairs are frequently accompanied by a third whale--an "escort" (Herman and Antinoja, 1977). The escorts appear to be consorting with the mother in order to mate with her, and intense aggression between escorts and "intruding" whales has been observed (Baker and Herman, 1984; Mobley and Herman, 1985; Tyack and Whitehead, 1983). Although not all females ovulate post-partum, enough may do so to warrant the attention of males (Herman and Tavolga, 1980; Tyack, 1983). Humpback whales generally are difficult to sex in the field, however, in those cases where gender identification has been possible, singers and escorts have proven to be males (Glockner-Ferrari and Ferrari 1984; Baker and Herman, 1984).

Past Abundance Estimates

Of the known wintering and summering areas of humpback whales in the north Pacific, the Hawaiian Islands are considered to contain the largest seasonally resident population. Earlier shipboard surveys of the coastal waters of the Hawaiian Islands by the National Marine Fisheries Service during the winter seasons of 1976-1979 (Rice, 1978; Wolman, 1978) produced estimates of between 550-790 (mean estimate 650) whales. More recently, mark and recapture techniques have been applied to analyses of fluke identification photographs that estimated 1,407 whales (95% confidence limits 1,113 and 1,701) as having visited the Hawaiian Islands during a four-year period, from 1980-1983 (Baker and Herman, 1987; NMFS, 1991). Since these estimates were produced using different abundance estimation techniques, they are not directly comparable and, therefore, cannot be relied on to suggest population increase.

Mobley and Bauer (1991), comparing sighting rates of pods seen in the winter seasons of 1977-80 with those seen in 1990 using identical methods, found significant increases across the 10-13 year period. The authors concluded that either there has been an increase in the size of the north Pacific population, or that a greater proportion of the north Pacific population is wintering in Hawaiian waters.

Aerial surveys performed during the 1991 season by Forestell and Mobley (1991) using modified line transect methods estimated that 1,584 whales were present in coastal Hawaiian waters on the peak date for that season (Feb. 22, 1991). This survey series was limited primarily to waters within the 100-fathom isobath, however.

Distribution Trends

Earlier aerial surveys conducted during the 1977-80 winter seasons (Herman, Forestall and Antinoja, 1980; Baker and Herman, 1981) suggested that the majority of humpback whales were found in the shallow waters (< 100 fathoms) of the major Hawaiian islands. Non-systematic surveys were conducted in deeper waters during that time but no whales were observed beyond 100 fathoms (Univ. of Hawaii, unpublished data). Analyses of pod locations in the Four Island and Penguin Bank regions revealed that whales were not distributed homogeneously throughout the 100 fathom isobath but were generally found in considerably shallower water (modal depth=27 fathoms) (Forsyth, Mobley and Bauer, 1991).

The earlier surveys (1977-80) showed wintering humpback whales to be concentrated in the waters of the Four Island Region and Penguin Bank. The majority of pods containing calves were also found in these areas. A comparison with the 1990 aerial survey results showed that these regions were still preferred by adults and calves, but revealed substantially increased sighting rates around the islands of Niihau and Kauai. Arranged in order of decreasing sighting rate they are as follows: Penguin Bank, Four Island Region, Kauai/Niihau, Big Island and Oahu.

Preferred Cow/Calf Grounds

During the 1990 aerial survey series, all pods sighted were orbited to determine pod composition. For this reason, the 1990 results provide a more reliable indication of the number of calves present in recent years, as well as the regions preferred by pods with calves. Of the 361 whale pods observed (where pod composition could be confirmed), 79 (22%) contained calves. Sixty-eight percent of all calf pods observed were seen in the Four Island and Penguin Bank regions. Based on these data, Mobley and Bauer (1991) described these regions as preferred cow/calf grounds, probably due to the greater expanses of available shallow water.

1993 Aerial Surveys--Purpose

The 1993 aerial surveys were conducted as part of the ATOC Marine Mammal Research Program. The purpose of these surveys was to establish baseline parameters of abundance and distribution of marine mammals in Hawaiian waters, with special attention to wintering humpback whales, prior to commencement of the ATOC transmission currently scheduled for March, 1994. These surveys were the most extensive systematic surveys of marine mammals conducted to date in the waters surrounding the major Hawaiian Islands.

II. METHOD

Four survey flights were performed in waters surrounding the major Hawaiian Islands between Feb. 21 and March 26, spaced approximately one week apart (see Table 2 below). This period corresponds with peak densities of whales as shown in past surveys (Herman et al., 1980; Baker and Herman, 1981; Forestell, 1989; Mobley and Bauer, 1991). The surveys covered a total area of 20,180 sq nm involving a total of 8115.5 nm of survey effort.

TABLE 2

Summary of Flight Dates for 1993 Survey

Survey No.	Dates
1	Feb. 21, 22, 23, 24, 26
2	Mar. 4, 5, 6, 8
3	Mar. 15, 16
4	Mar. 24, 25, 26

Aircraft and Equipment

Two single-engine Cessna 172s were equipped with Collins ALT 50A radar altimeters and Morrow Apollo GPS receivers which outputted to a Compudyne 386 laptop computer. The computer captured the data using software developed by Enserch Environmental Corp. (EEC) and modified by Rich Grotefendt of EEC. This system automatically recorded positional data at 30-sec intervals and manually recorded whenever a sighting was made. Sighting angles to target pods were made using Suunto (Model PM-5) hand-held clinometers with analog display calibrated to whole degrees. These angles, in combination with the altitude data, allowed for the estimation of perpendicular distance from the sighting to the transect line. Given the average recorded altitude of 250.5 m (sd = 35.66 m), errors of $\pm$ one degree of angle yielded theoretical distance estimation errors of from 5.04 m at the minimum sighting angle of 70 degrees, to 762-1297 m at the maximum effective distance of 2 nm (sighting angle of 3.87 degrees $\pm$ one degree).

Personnel

Each plane was staffed by three survey staff including two observers and one data recorder, in addition to the pilot. Specific portions of the survey area were assigned to each of two teams. Team A (Observers: Joe Mobley and Mari Smultea, Alternate: Adam Frankel; Data recorder: Tom Norris) covered the area surrounding islands of Oahu, Kauai and Niihau. Team B (Observers: Rob Schick, Paul Forestell; Data recorder: Eric Brown) covered the Four Island region, Penguin Bank and the island of Hawaii (Big Island). All primary staff were experienced in line survey methods with a minimum of two winter seasons prior survey experience.

Trackline Design

Survey tracklines were designed based on distance sampling theory as described by Buckland et al. (1993) and Burnham et al. (1980). The survey followed north-south systematic lines spaced 14 nm apart in channel areas, 7 nm apart in major island regions, and 3.5 nm apart in the zone of influence (ZOI) for the ATOC source (Figures 1 and 2). Random startpoints were used so that the exact trackline configuration of each of the four surveys varied. The systematic lines projected 7nm past the 1000-fathom isobath, with random lines connecting endpoints. Tracklines were generated using the following rules:

1) Fly north-south lines 3.5, 7.0 or 14 nm apart (depending on level of effort required) starting with predesignated randomly chosen startpoints;
2) Fly to shoreline then connect to next systematic line by flying to a point 3-nm offshore of the starting point of that line;
3) All lines must be no closer than 1.5 nm to shore so both observers have equivalent strips;
4) Add one or two additional north-south lines in areas of known higher densities.

Portions of the survey where observers were off-effort (when overland or above designated altitude) were designated as dead-head lines and not counted in the results.

Data Protocol

Sightings were made by two observers, one on each side of the plane, and called verbally to a data recorder seated next to the pilot. When a sighting occurred, observers called out data in the following order: number of individuals, calf (if present), species, angle to sighting, and reaction (i.e., whether pod members appeared to react to plane). These data were then manually noted by the data recorder. At the start of each leg or when conditions changed, the observers also called out environmental information, including glare, visibility, and Beaufort seastate, which the data recorder also entered (see APPENDIX--datasheet showing environmental codes). The automated data, which indicated real time, latitude and longitude from the GPS receiver, and altitude (to the nearest foot) from the radar altimeter, were automatically written onto the hard disk of the laptop computer, and onto a 3.5" floppy disk as back-up. The manually-written data were keypunched into an ASCII file and were later merged with the computer-written data using software designed by Rich Grotefendt of Enserch Environmental Corp.

Analysis

Since former aerial survey results indicated heterogeneity of whale densities across regions and depths (Baker and Herman, 1981; Mobley and Bauer, 1991; Forestell, 1989; Forestell and Mobley, 1991; Forsyth, Mobley and Bauer, 1991), the results of the 1993 survey were straiefied by major island region depth with strata as follows: Island Region Strata: a) Kauai/Niihau; b) Oahu; c) Penguin Bank; d) Four Island Region (Maui, Molokai, Lanai, Kahoolawe); and e) Big Island (Island of Hawaii) (Figure 3).

Depth Strata: a) less than 100 fathoms; b) 100-1000 fathoms; c) greater than 1000 fathoms

In addition to analysis of state-wide data (all five regions combined), the data from the ATOC zone of influence (ZOI) (see Figure 10) were analyzed separately. Abundance estimates for humpback whales were generated using the DISTANCE program (version 2.03) developed by Jeff Laake of the National Marine Mammal Laboratory in Seattle.

Due to visibility limitations of the plane, only sightings to a maximum of 70 degrees from horizontal were possible. This created a blind area of 91.2 m on each side of the aircraft, which was not included in the computation of perpendicular distance data over all survey effort.

III. RESULTS AND DISCUSSION

The 1993 survey series consisted of four aerial surveys flown throughout the major Hawaiian Islands during February and March, 1993 (Figure 2). A total of 7331.6 nautical miles were flown across all flights. Twenty percent of survey effort (1500 nm) was within 100 fathoms; 44% of effort (3,200 nm) was between 100 and 1000 fathoms; and 36% of effort (2,600 nm) was beyond the 1000 fathom contour.

A. ODONTOCETE SPECIES

A total of eight species of Odontocetes were sighted during the 1993 winter season (Figure 4). Of the total of 58 sightings, 78% were positively identified by genus, and 72% by species. The results summarized here include all Odontocete sightings, regardless of distance from the trackline (i.e., no truncations of perpendicular distances were applied). In decreasing order of number of pods sighted, the positively identified species included: 15 Stenella sightings (including spinner dolphins, *Stenella longirostris*--13 sightings, spotted dolphins, *Stenella attenuata*--1 sighting, and 1 unidentified *Ste*nella sighting), shortfin pilot whales (*Globicephala macrorhynchus*--12 sightings), false killer whales (*Pseudorca crassidens*--8 sightings), Pacific bottlenosed dolphins (*Tursiops gilli*--5 sightings), beaked whales (*Ziphiid spp.*--3 sightings), pygmy sperm whale (*Kogia breviceps*--1 sighting), and sperm whales (*Physeter macrocephalus*--1 sighting). An additional 13 Odontocete pods were sighted where positive species identification was not made. Since the number of sightings for each species was so small, abundance estimation was not attempted.

TABLE 3

Summary of Odontocete Sightings by Species and Depth

Species	No. Pods	No. Anim.*	Mean Pod Size	No. of pods sighted by Depth Interval (fathoms): <100	100-1000	>1000
Stenella longirostris	13	518	39.8	4	9	
(Unid. Odontocete species)	13	56	4.3	4	6	3
Globicephala macrorhynchus	12	67	13.9		8	4
Pseudorca crassidens	8	229	28.6	1	7	
Tursiops gilli	5	77	15.4	1	3	1
(Unid. Beaked whale)	2	3	1.5			2
Stenella attenuata	1	5	5.0	1		
Physeter macrocephalus	1	4	4.0			1
Kogia breviceps	1	4	4.0		1	
Ziphius cavirostris	1	2	2.0			1
(Unid. Stenella spp.)	1	2	2.0			1
TOTALS:	58	1067		11	34	13
Percent of Total:				19%	59%	22%

* Note: Estimation of pod size was less accurate for larger pods

Distribution Trends

Table 3 shows the number of groups observed within each depth interval. The 15 observations of Stenella included 13 pods of spinner dolphins, one of spotted dolphins in water less than 100 fathoms, and one unconfirmed Stenella species in water deeper than 1000 fathoms. Spinner dolphins have been intensively studied in Hawaii (Norris et al., 1985) and these observations are consistent with previously reported data. In general, the average pod size of spinners observed between the 100 fathom and 1000 fathom contours was substantially larger than that observed in shallower or deeper waters by a factor of two or more.

Pilot whales (*Globicephala macrorhynchus*) were observed only in waters deeper than 100 fathoms. The largest group sizes for this species were found outside the 1000 fathom contour. The false killer whale sightings were generally of animals between 100 and 1000 fathoms, and included the largest group size of Odontocetes observed during the study. The five groups of bottlenose dolphins (*Tursiops gilli*) that we observed were widely distributed, and showed a fairly consistent average pod size between 10 and 20animals within each depth interval. We saw beaked whales (*Ziphiid spp.*) on three occasions. Group size was one or two in each case, and all sightings occurred beyond the 1000 fathom contour.

One sighting of four pygmy sperm whales (*Kogia breviceps*) occurred in waters less than 1000 fathoms, and one group of four sperm whales (*Physeter macrocephalus*) was observed in waters greater than 1000 fathoms.

Overall, 81% of the Odontocete pods sighted during the 1993 aerial surveys were found in waters deeper than 100 fathoms (Table 3). The modal depth interval was 100-1000 fathoms where 59% of all pods were sighted. Thirty-six percent of the sightings were in the vicinity of Kauai and Niihau and were sighted in waters surrounding the Big Island (Figure 4). Interestingly, the two areas favored by humpback whales, the Four Island (Maui, Lanai, Molokai and Kahoolawe) and Penguin Bank regions (Figure 5), showed the lowest incidence of Odontocete sightings. In general, it appears that humpback whales favor areas with extensive shallow shelves, while Odontocetes favor slopes, probably due to prey availability. The Stenella species, in particular, showed a tendency to locate along the edge of the 100 fathom isobath, as described by Shallenberger (1981). Zone of Influence (ZOI) Sightings Nine Odontocete sightings occurred within the 40-km zone of influence (ZOI), which corresponds to the 120-dB isopleth for deep-diving animals (Clark, 1993). These included three pods of shortfin pilot whales, three pods of Stenella spp., one pod of sperm whales, one pod of unidentified beak whales, and one pod of unidentifed Odontocetes. Among these species, only the sperm whales are presumed to have hearing capabilities sensitive to the low-frequency band of the ATOC transmission (Carder and Ridgway, 1990; Clark, 1993).

B. HUMPBACK WHALES

A total of 397 pods (consisting of 698 whales) were seen across the four surveys (total effort = 7331.6 nm) with an average pod size of 1.76 for all pods seen (Figure 5).

Sightings by Depth

Results of earlier work showed humpback whales to be nearly exclusively found within the 100-fathom isobath (Herman and Antinoja, 1977; Herman et al., 1980; Baker and Herman, 1981). However, very little systematic effort had been made in deeper water to test this assumption. Table 4 shows numbers of whale pod sightings and effort by depth (see also Figure 6). As shown, effort was primarily in deeper water--80% of effort was outside of the 100-fathom limit. Despite the favoring of deeper water by effort, 74% of all sightings occurred in shallow water less than 100 fathoms. The frequency of pod sightings by depth departed significantly from expected frequency based on effort [chi-square(2) = 742.97, $p < .0001$]. The majority of whales can be said to prefer shallower water, but the remaining 26% in deeper water is not trivial. This fact suggests that the earlier surveys which primarily surveyed waters less than 100 fathoms likely undercounted the wintering population.

TABLE 4

Total Effort and Humpback Whale Sightings by Depth

	Depth Interval (fathoms) < 100	100-1000	> 1000	TOTAL
Effort (nm)	1469.9	3209.1	2652.6	7331.6
Percent of Total Effort:	20%	43.8%	36.2%	100%
No. Whale Pods Sighted:	294	94	9	397
Percent of Total Whale Pods:	74%	24%	2%	100%
Encounter Rate (pods/nm)	.200	.029	.003	.054

Sightings by Region

As shown in Figure 7, distribution was not homogeneous throughout the five island regions. Frequencies of pod sightings by region departed significantly from expected frequencies based on effort [chi-square(4) = 745.82, p<.0001]. Penguin Bank showed the highest encounter rate--approximately three times more than that of the next ranked region, the Four Island Region. This difference is inflated, however, by the fact that effort on the Penguin Bank was limited to waters less than 100 fathoms. The rank order of regions from highest to lowest density of sightings were: Penguin Bank, Four Island Region, Kauai/Niihau, Big Island and Oahu. This is the same progression as reported by Mobley and Bauer (1991) for the 1990 season, and Forestell and Mobley (1991) for the 1991 season.

Calf Sightings

A total of 36 calves were sighted across all four surveys, which comprises only five percent of the total of 698 whales seen. This is lower than the typical seven to eight percent noted in previous surveys (Herman and Antinoja, 1977; Herman et al., 1980; Mobley & Bauer, 1991). Calf pods were likely undercounted during the 1993 survey since few pods were orbited to confirm composition, unlike previous surveys. As shown in Table 5 below, the majority of calf pods were seen in the Four Island and Penguin Bank regions, similar to previous reports (Herman and Antinoja, 1977; Herman et al., 1980; Forestell and Mobley, 1991; Mobley and Bauer, 1991).

TABLE 5

Calf Pod Sightings by Survey and Region--All Sightings

	Region:					
Survey No.	Kauai/ Niihau	Oahu	Penguin Bank	Four Island	Big Island	Total
1	3	0	0	4	3	10
2	0	0	3	5	0	8
3	1	0	0	3	1	5
4	1	1	6	5	0	13
Totals:	5	1	9	17	4	36

Reduction of Dataset for Abundance Estimation

Beaufort seastate and visibility. For the sake of abundance estimation, the influence of Beaufort seastate and visibility on sightings of whale pods was analyzed. The observed versus expected number of groups was significantly different overall [chi-square(30) = 206.8, $p < .01$]. The departure from expected frequency was greatest beyond a Beaufort 3 and visibility coded as "good" or better (Figure 8). Limiting the usable sightings to those of Beaufort 3 or better and good visibility or better reduced the total dataset from 397 to 311 (N=561) usable sightings of pods.

Perpendicular sighting distance. Figure 9 shows perpendicular distances of humpback whales sighted by intervals of 1,480 feet. Since there was no clear drop in sightability at increasing distance, a truncation point of approximately two nautical miles was chosen, such that only 5% of the perpendicular distances remained. Reducing the dataset further to only those sightings within 2 nm produced a total of 292 pods (N = 495 whales). Table 6 shows a summary of parameters for this final dataset, stratefied by depth.

TABLE 6

Summary of Parameters for Abundance Estimation (Stratefied by Depth)

--Truncated Dataset for Conditions Better than Good Visibility and Beaufort 3 Seastate (N = 292 pods)

	Depth Interval (fathoms)		
	< 100	100-1000	> 1000
Effort (nm)	897.3	1516.9	1371.2
Area (sq nm)	2214	8783	9183
No. Sightings	224	61	7
Encounter Rate (pods/nm)	.250	.040	.005
Average Pod Size	1.67	1.80	1.57

Abundance Estimation

The perpendicular distance data (Figure 9) were analyzed using the DISTANCE (ver. 2.03) program, developed by Jeff Laake of National Marine Mammal Laboratory. Three models were applied to these detection probability data to determine the best fit, including uniform, half-normal, and hazard rate models. The best fit was provided by the hazard rate model as shown in Figure 9.

When the abundance estimates were analyzed separately for each flight a range of coefficients of variation (CV) were produced from 17.3 to 39.0%. When all four flights were combined the CV dropped to 11.3%. The sum of the Akaike information criteria for the four surveys was less than the combined which suggests differences across surveys or these may reflect regional differences in densities and/or observer differences (Note: Aikaike's Information Criterion (AIC) provides a quantitative method for model selection. For a given data set, AIC is computed for each candidate model and the model with the lowest AIC is selected--see Buckland et al., 1993).

Table 7 shows the resulting abundance estimates by depth as well as for all depths combined. The overall abundance estimate of 669 whales was based on a depth stratified line transect approach using the hazard rate model with encounter rate and density by stratum, detection probability for all data combined, and pooled estimate of density from area-weighted stratum. As shown the 95% log-based confidence interval was 536-835 whales.

This estimate should be interpreted as a minimum estimate, in that it represents the number of animals detectable at the surface. It is not, therefore, a population estimate.

TABLE 7

Summary of DISTANCE Program Output--Humpback Whale Abundance Estimates

Depth Interval:	< 100 Fathoms	100-1000 Fathoms	> 1000 Fathoms
Density	.1709	.0297	.0033
Abundance Estimate	378	261	30
C.V. of Abundance	11.7%	30.4%	60.1%
95% Confidence Interval	301-475	175-387	10-89

All Depths Combined:

F(0)	.818
CV (F0)	5.21%
Density	.0332
Abundance	669
CV of Abundance	11.3%
95% Confidence Interval	536-835

Population Estimation--Issues

The distance sampling theory upon which DISTANCE and similar programs are based, assume the g(0), or the probability of detection on the trackline to be unity. As Buckland et al. (1993) have pointed out, this assumption is not true for cetaceans since they are only detectable at the surface for relatively brief periods. In order to produce a population estimate, one must know the probability that the animals in question will be at the surface at any given time. Different approaches to this problem have been proposed, including using two platforms and determining the proportion of overlapping observations (Calambokidis, Evenson, and Cubbage, 1993) or using respiration data to determine mean surface time (Barlow, Oliver, Jackson and Taylor, 1988; Calambokidis, Evenson, and Cubbage, 1993). Since the ATOC Marine Mammal Research Program includes shorestation observation adjoining the ZOI, the possibility of deriving a correction factor from these data exists. However, the sources of variance in respiration rates (differences across regions, pod types and levels of disturbance) must be considered before a single correction factor can be applied. We hope to establish a reasonable parameter for detection probability in the near future.

Zone of Influence Sightings

The 120-dB isopleth for surface-diving animals corresponds to an area of 25-km radius around the ATOC transmission source (Figure 10). For the purposes of this analysis, this 25-km area was considered the zone of influence (ZOI) for humpback whales (Clark, 1993). A total of 24 humpback whale pods (N = 46) were sighted in the 25-km ZOI across 184 nm of effort (all four surveys combined). When observations were restricted to those sighted in conditions of Beaufort 3/Visibility "Good" or better for purposes of abundance estimation, the number of sightings reduced to 15 pods (N = 32).

Table 8 below summarizes the DISTANCE (ver. 2.03) output for the 25-km ZOI using a half-normal model for best fit, as compared against the output for all regions combined using the hazard-rate model (using only sightings of good visibility and Beaufort 3 seastate or better in both cases). As shown, the results for the ZOI produce a CV of 51.5%, in contrast to the CV of 11.3% for all regions combined.

Potential for Exposure to ATOC Transmission

The 95% log-based confidence interval for the ZOI is from 15 to 106 pods. Again, this estimate is not corrected for whales which were underwater at time of survey. By comparing the abundance estimate from the ZOI against that for all regions combined, we can estimate that between 2.8 to 12.7% of all pods surveyed were in the ZOI. This estimate should be regarded as a minimum estimate, however. The potential for greater exposure exists, since photographic identification evidence shows movement of whales across island regions within a given winter season (e.g., Cerchio, Gabriele and Frankel, 1991). Thus, if the ATOC transmission is continuous throughout the humpback whale breeding season, assuming normal patterns of movement through the island chain, a substantial proportion of the wintering population could potentially be exposed.

TABLE 8

Abundance Estimates for 25-km Zone of Influence (ZOI) and All Regions Combined

	Model	CV%	Confidence Interval: Lower 95%	N	Upper 95%	Effort (NM)
All Regions:						
Density:	Hazard	11.3%	.0266		.0332	.0414
Abundance:	Rate	536	669		835	3785
25-km ZOI:						
Density:	Half	51.5%	.0297		.079	.211
Abundance:	Normal	15	40		106	184
Percent: (ZOI/All)		2.8%	6.0%		12.7%	

IV. SUMMARY

1) *Odontocete sightings.* Of the 14 species identified by Shallenberger (1981) as occurring with greater than "anomalous" frequency, eight were sighted during the 1993 surveys. Eighty-one percent were seen in waters greater than 100 fathoms, with a modal depth interval of 100-1000 fathoms where 59% were seen.

2) *Sightings of whales by depth.* Though 80% of effort occurred in waters deeper than 100 fathoms, 74% of all humpback whale sightings occurred in waters less than 100 fathoms. The fact that 26% of sightings fell outside the 100 fathom isobath needs to be considered when designing future surveys.

3) *Heterogeneity in distribution across regions.* Similar to findings for surveys conducted during the 1990 and 1991 seasons, the distribution of whales throughout the island regions showed substantial variation. From areas of highest to lowest density: Penguin Bank, Four-Island Region, Kauai/Niihau, Big Island and Oahu.

4) *Overall humpback whale abundance.* With all data combined, a hazard rate model produced an abundance estimate of 669 with a 95% log based confidence interval of 536 to 835 with a CV of 11.3% This should be regarded as a minimum estimate since it is uncorrected for whales not observable at the surface.

5) *Zone of influence (ZOI) sightings.* Between 2.8 to 12.7% of the whales sighted during the 1993 survey were located in the 25-km zone of influence (120-dB isopleth for surface-traveling animals) for the ATOC transmission. Considerably more whales, however, could be exposed given the inter-island transiting of whales which

ACKNOWLEDGEMENTS

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VI. FIGURE CAPTIONS

Figure 1. Map of 1993 study area showing tracklines from all four surveys combined based on GPS data.

Figure 2. Tracklines by survey based on GPS data.

Figure 3. Tracklines stratefied by major regions: 1) Kauai/Niihau; 2) Oahu; 3) Penguin Bank (area <100 fathoms only); 4) Four Island Region; 5) Big Island (Island of Hawaii).

Figure 4. Odontocete sightings based on GPS locations--all sightings.

Figure 5. Humpback whale sightings based on GPS locations--all sightings.

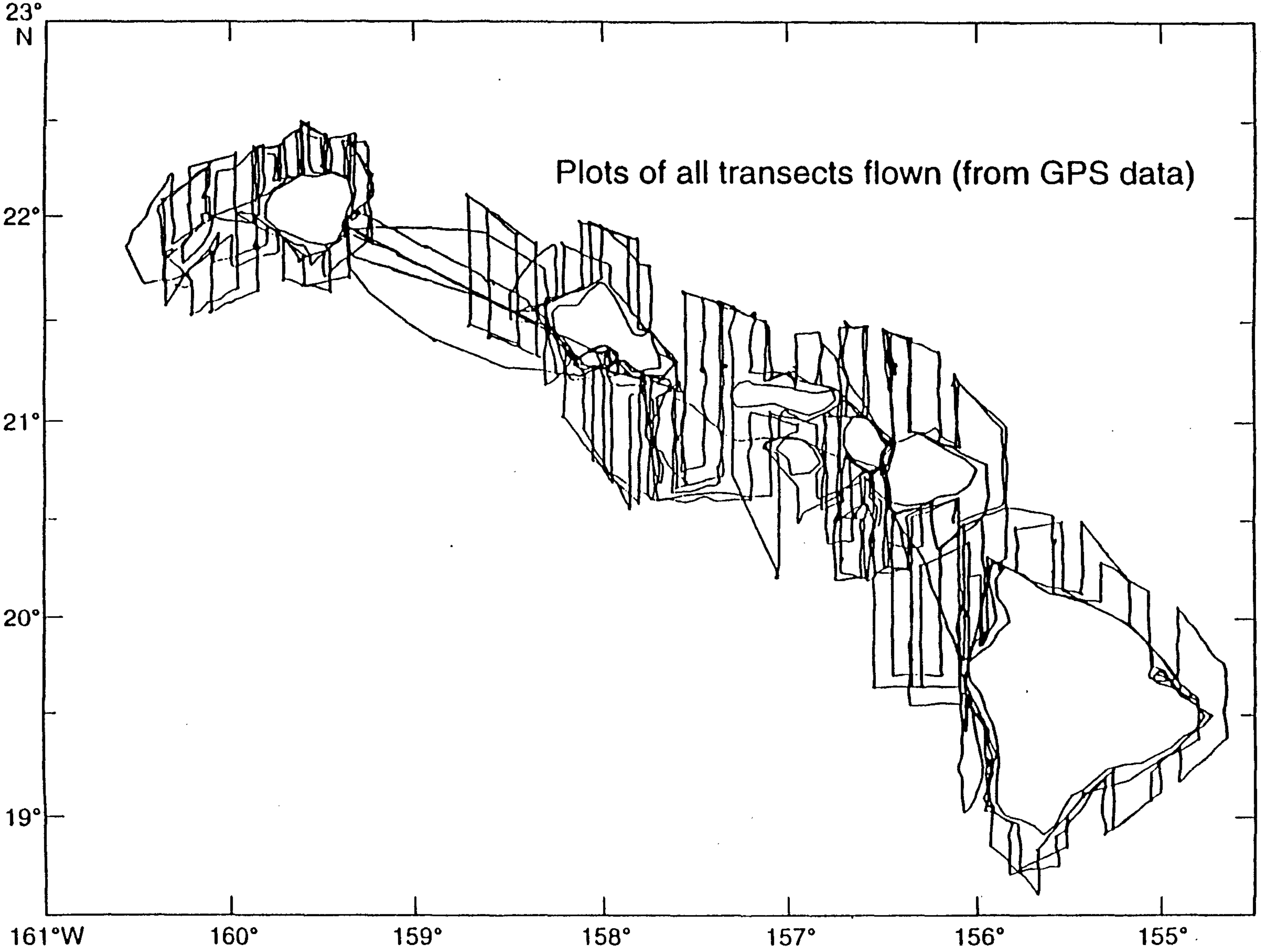
Figure 6. Humpback whale pod sightings and effort by depth.

Figure 7. Humpback whale encounter rates (ER) and effort by region.

Figure 8. Observed vs expected frequencies of whale sightings by Beaufort seastate and visibility (dotted lines show cut-off values of data used for abundance estimation).

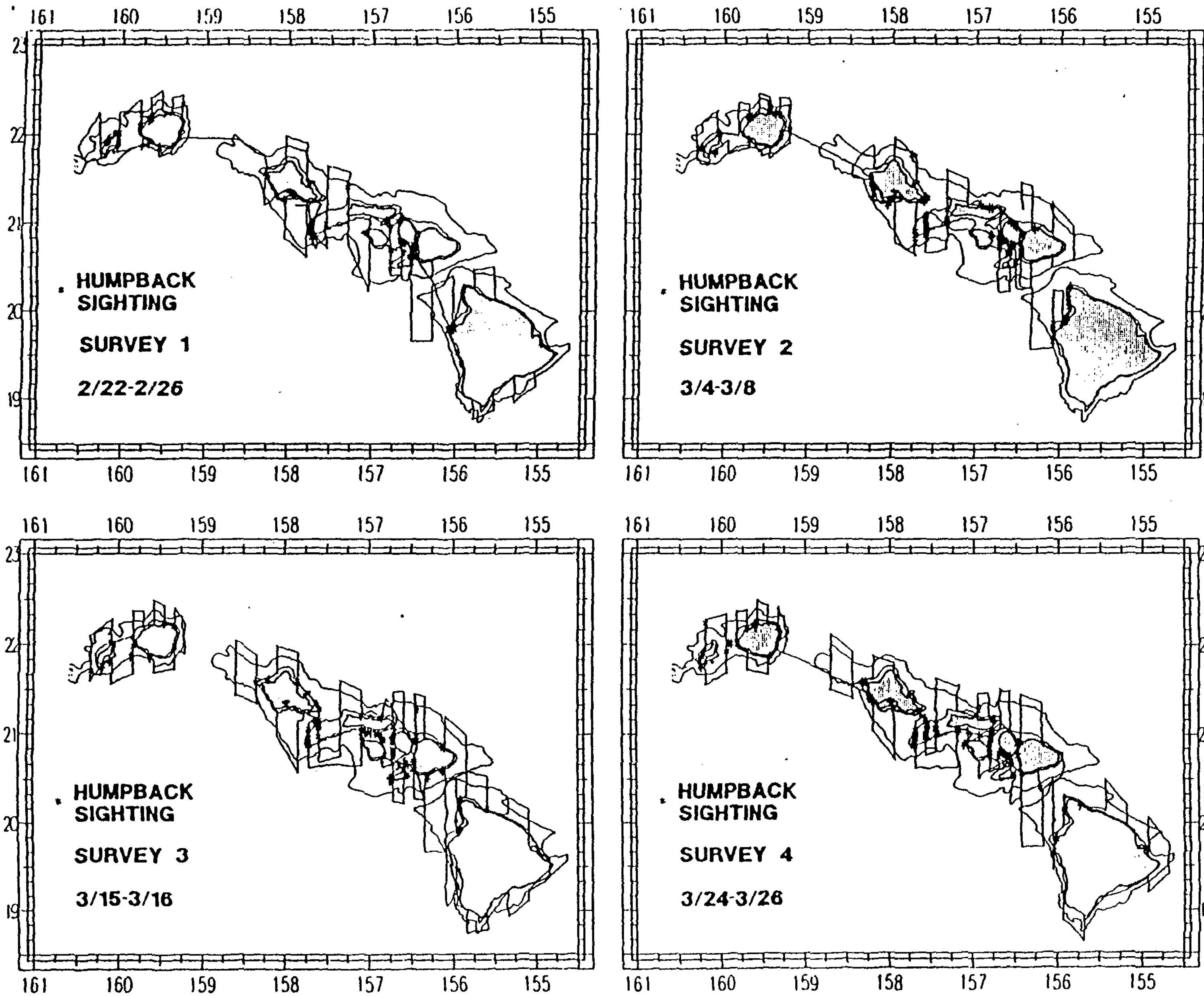
Figure 9. Detection probability by perpendicular distance to sighting. Fitted curve is based on hazard rate model.

Figure 10. Sightings of humpback whales in 25-km Zone of Influence (ZOI)--All sightings.



Plots of all transects flown (from GPS data)
23° N
22°
21°
20°
19°
161°W
160°
159°
158°
157°
156°
155°

Figure 1



HUMPBACK SIGHTING
SURVEY 1
2/22-2/26
HUMPBACK SIGHTING
SURVEY 2
3/4-3/8
HUMPBACK SIGHTING
SURVEY 3
3/15-3/16
HUMPBACK SIGHTING
SURVEY 4
3/24-3/26

Figure 2

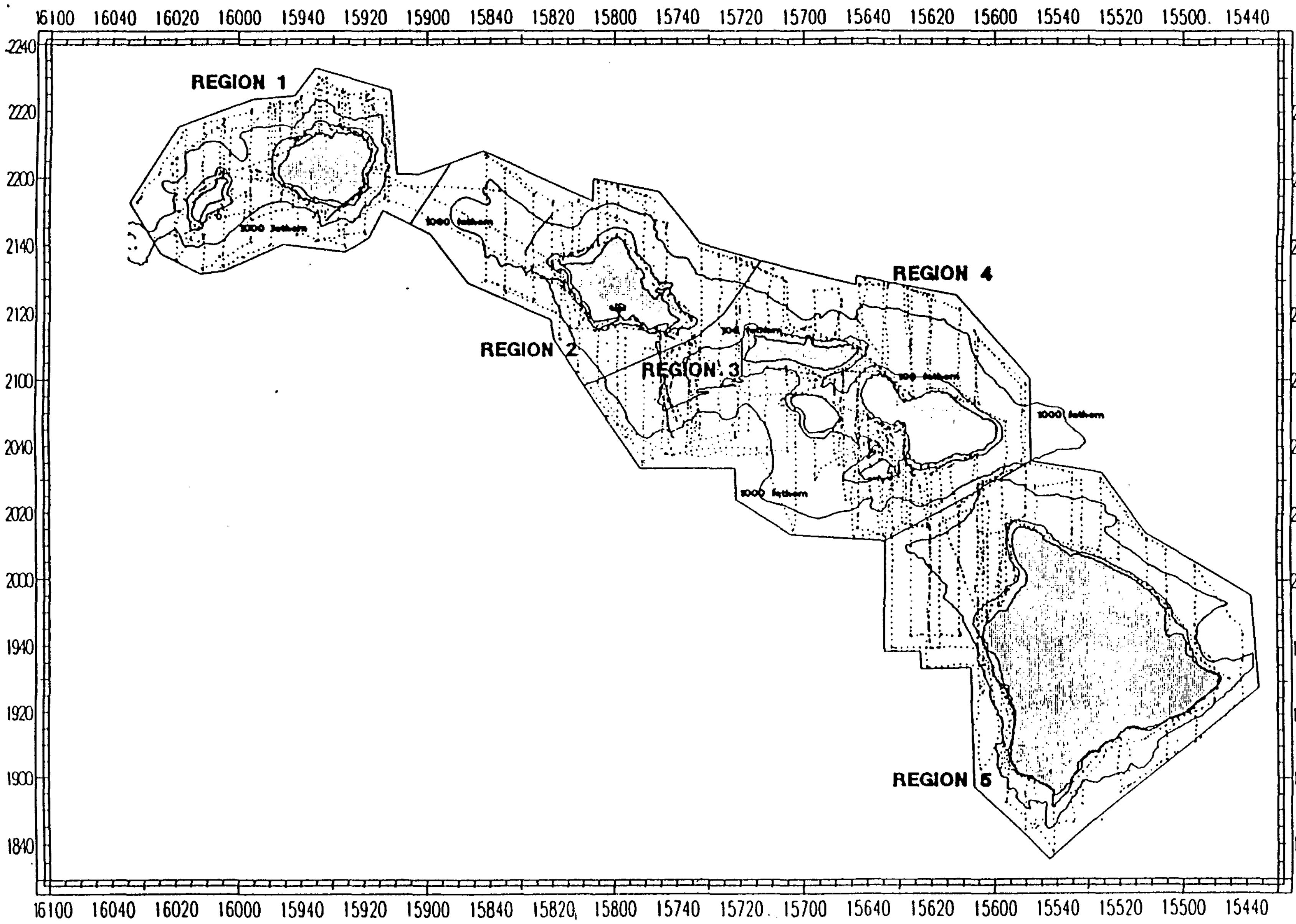

REGION 1
REGION 2
REGION 3
REGION 4
REGION 5
1000 fathom
1000 fathom
1000 fathom
1000 fathom

Figure 3

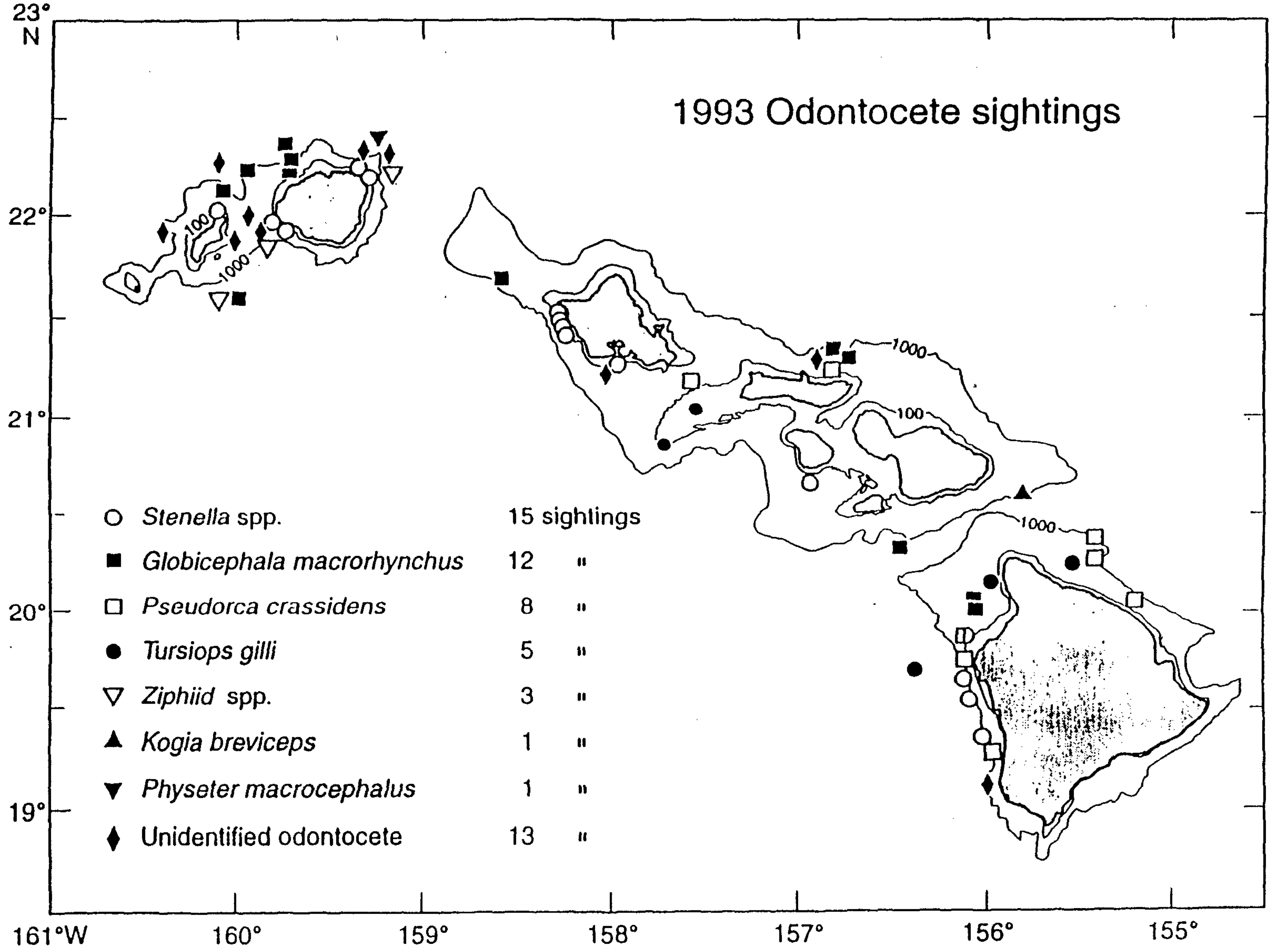

1993 Odontocete sightings
Stenella spp. 15 sightings
Globicephala macrorhynchus 12 "
Pseudorca crassidens 8 "
Tursiops gilli 5 "
Ziphiid spp. 3 "
Kogia breviceps 1 "
Physeter macrocephalus 1 "
Unidentified odontocete 13 "
1000
100
23° N
22°
21°
20°
19°
161°W
160°
159°
158°
157°
156°
155°

Figure 4

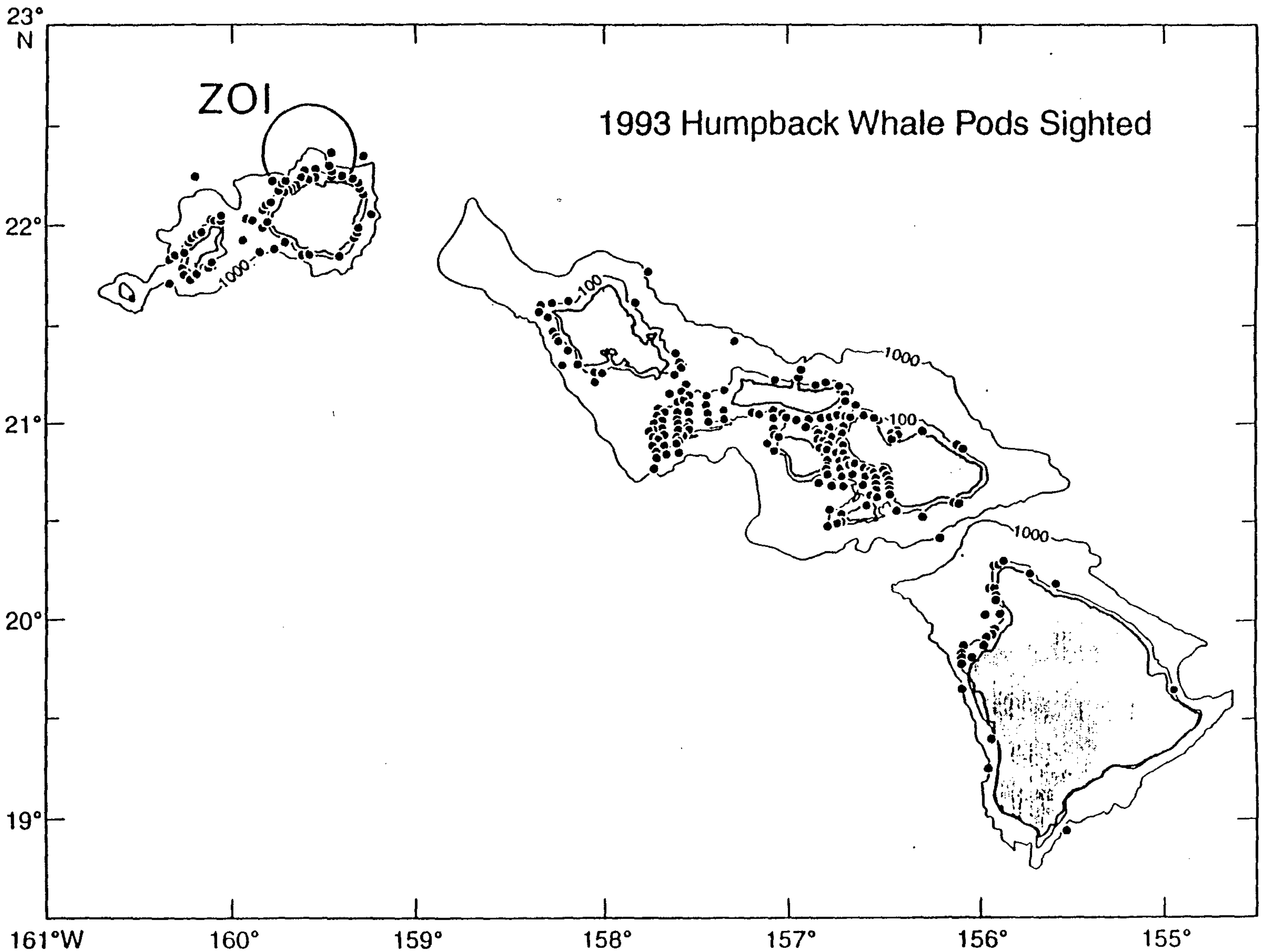

1993 Humpback Whale Pods Sighted
ZOI
23° N
22°
21°
20°
19°
161°W
160°
159°
158°
157°
156°
155°
1000
100

Figure 5

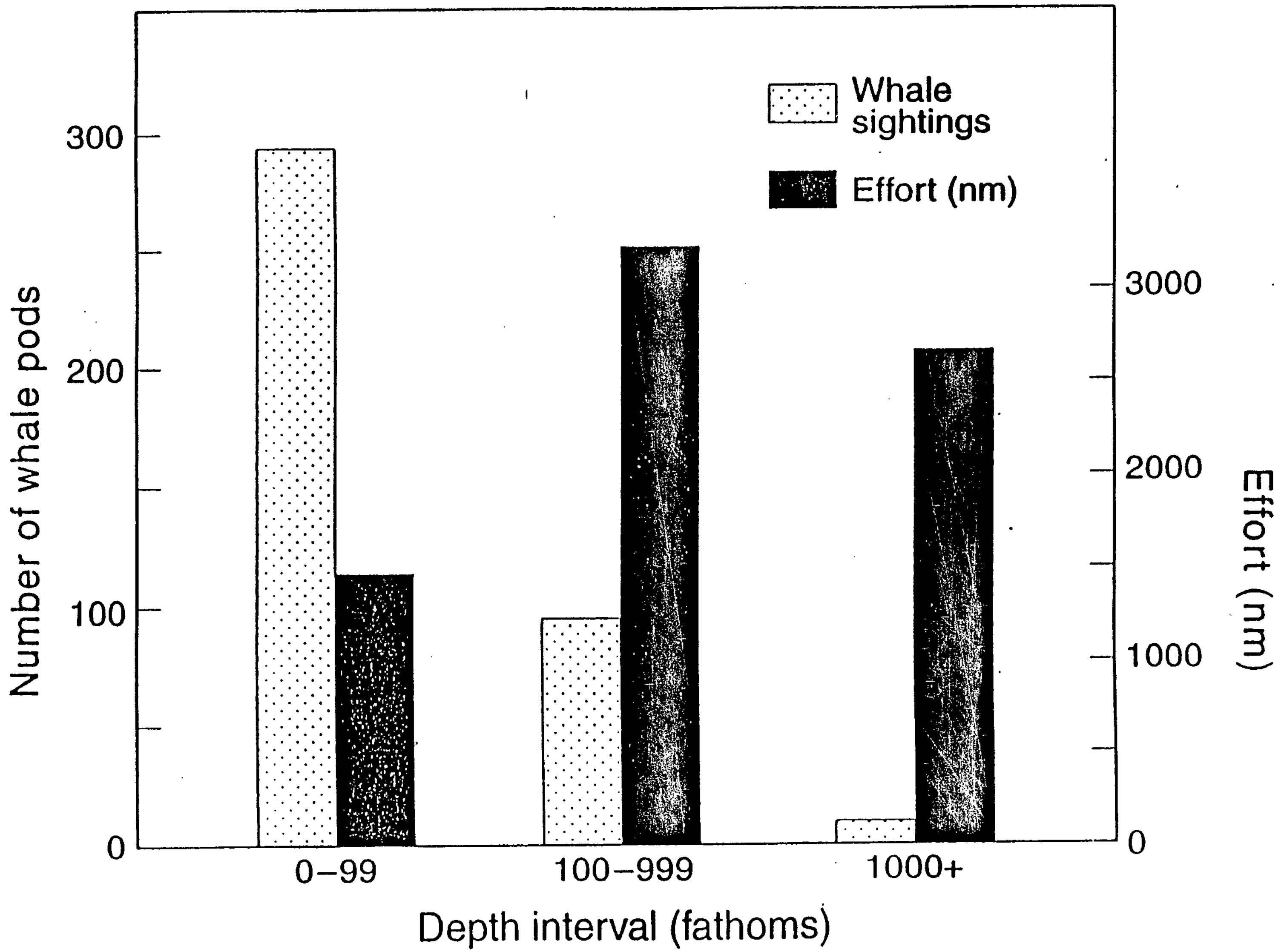

Whale sightings
Effort (nm)
Number of whale pods
300
200
100
0
3000
2000
1000
0
Effort (nm)
0–99
100–999
1000+
Depth interval (fathoms)

Figure 6

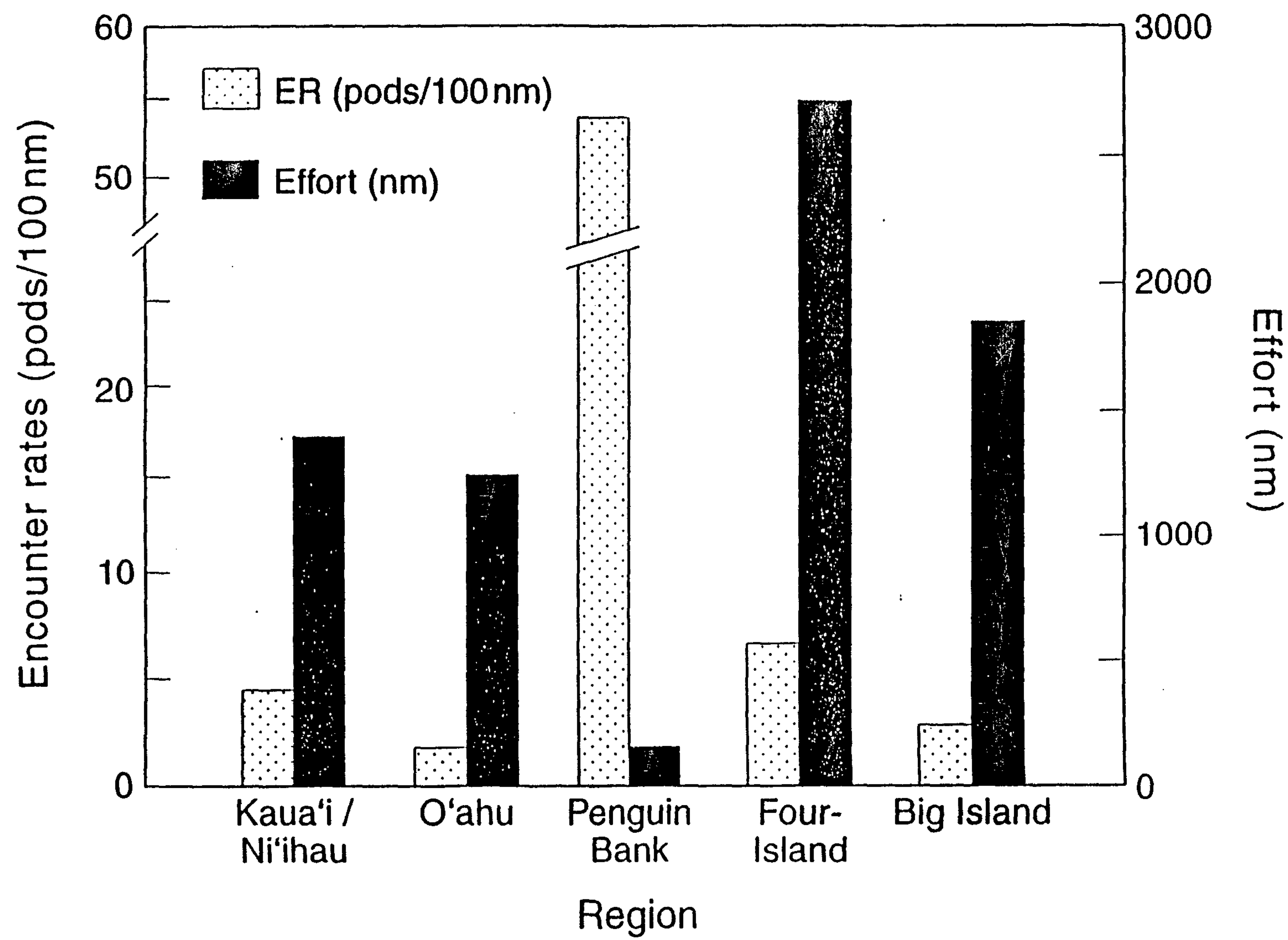

60
50
20
10
0
3000
2000
1000
0
ER (pods/100nm)
Effort (nm)
Encounter rates (pods/100nm)
Effort (nm)
Kaua'i / Ni'ihau
O'ahu
Penguin Bank
Four-Island
Big Island
Region

Figure 7

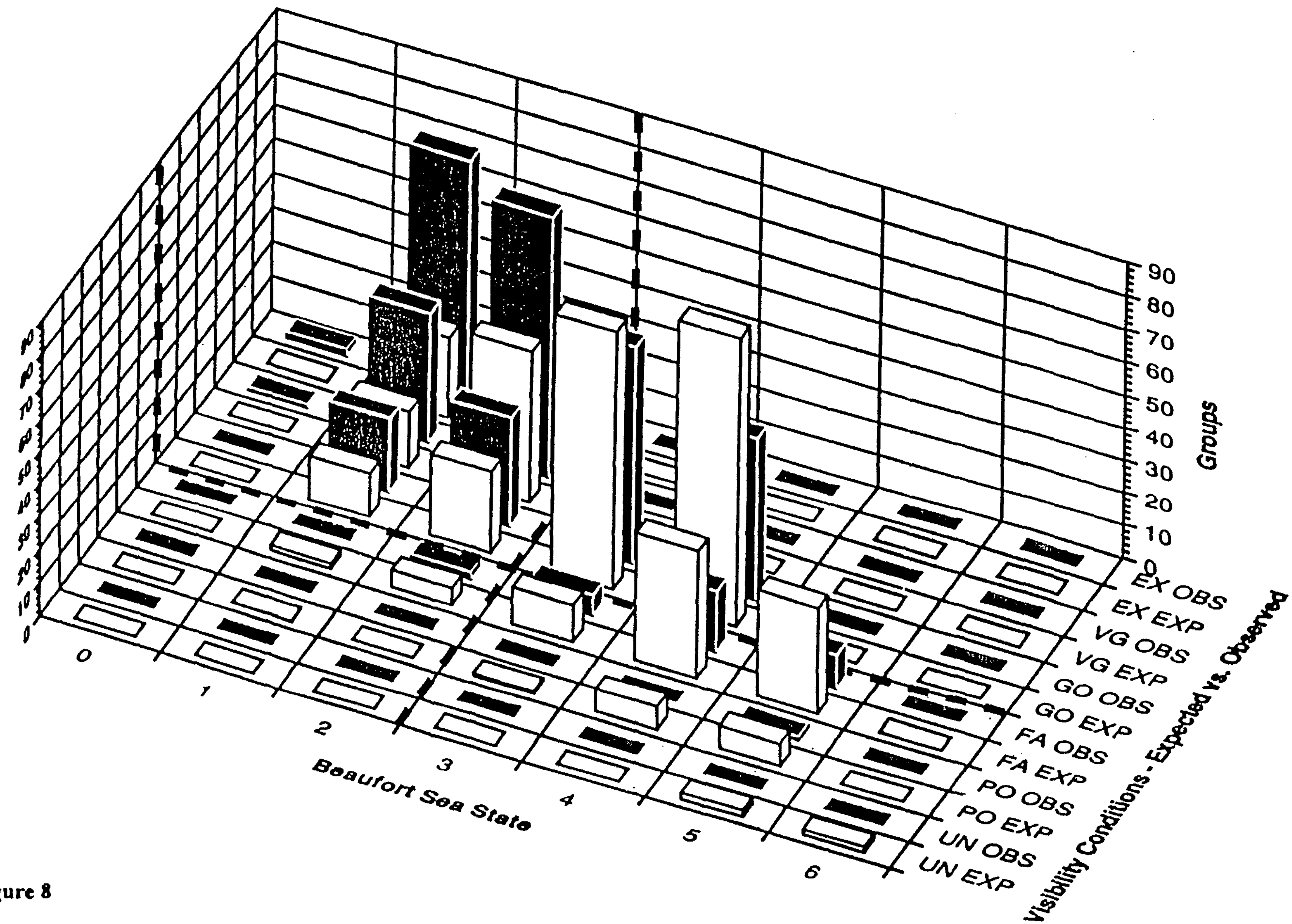
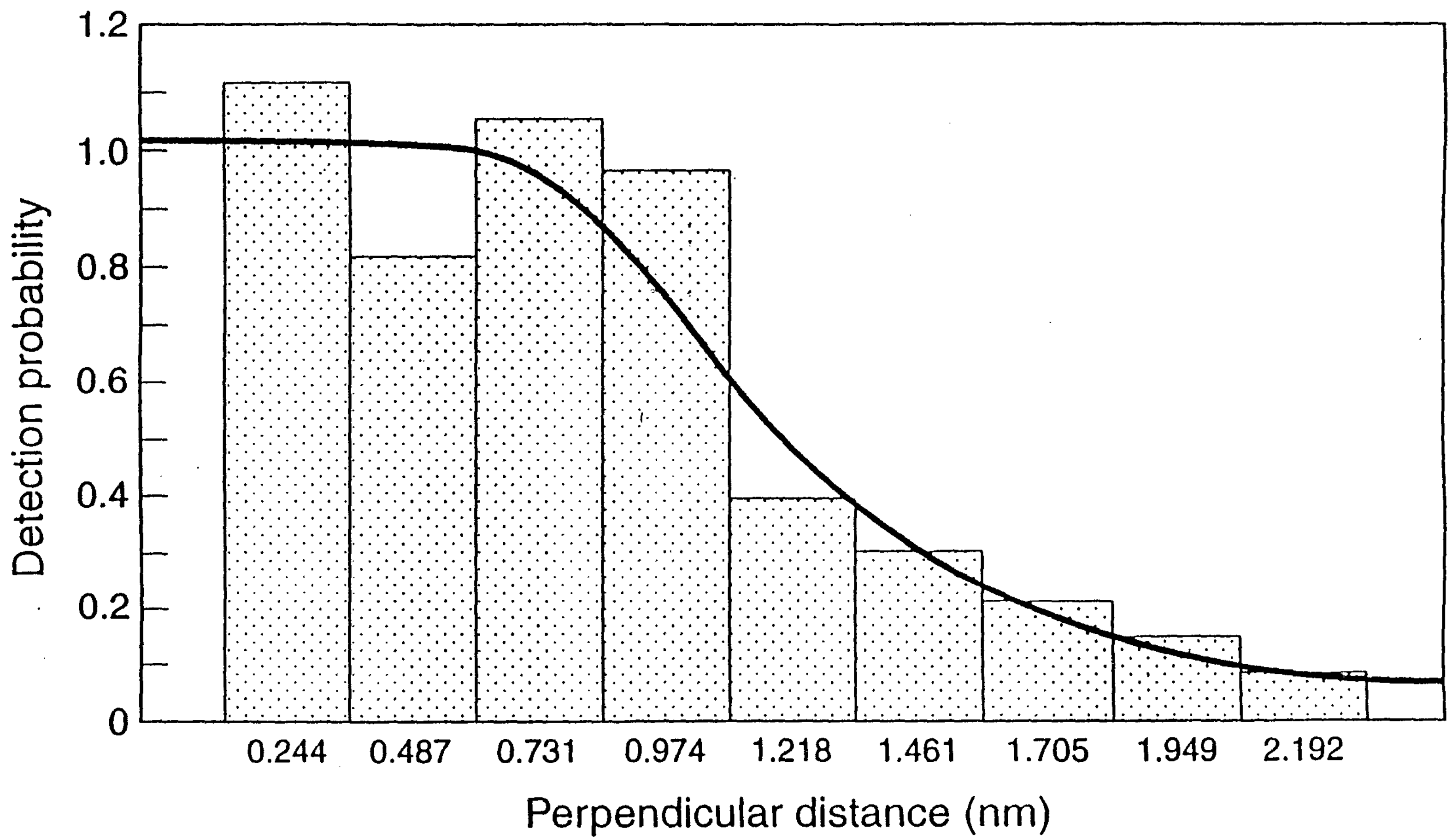


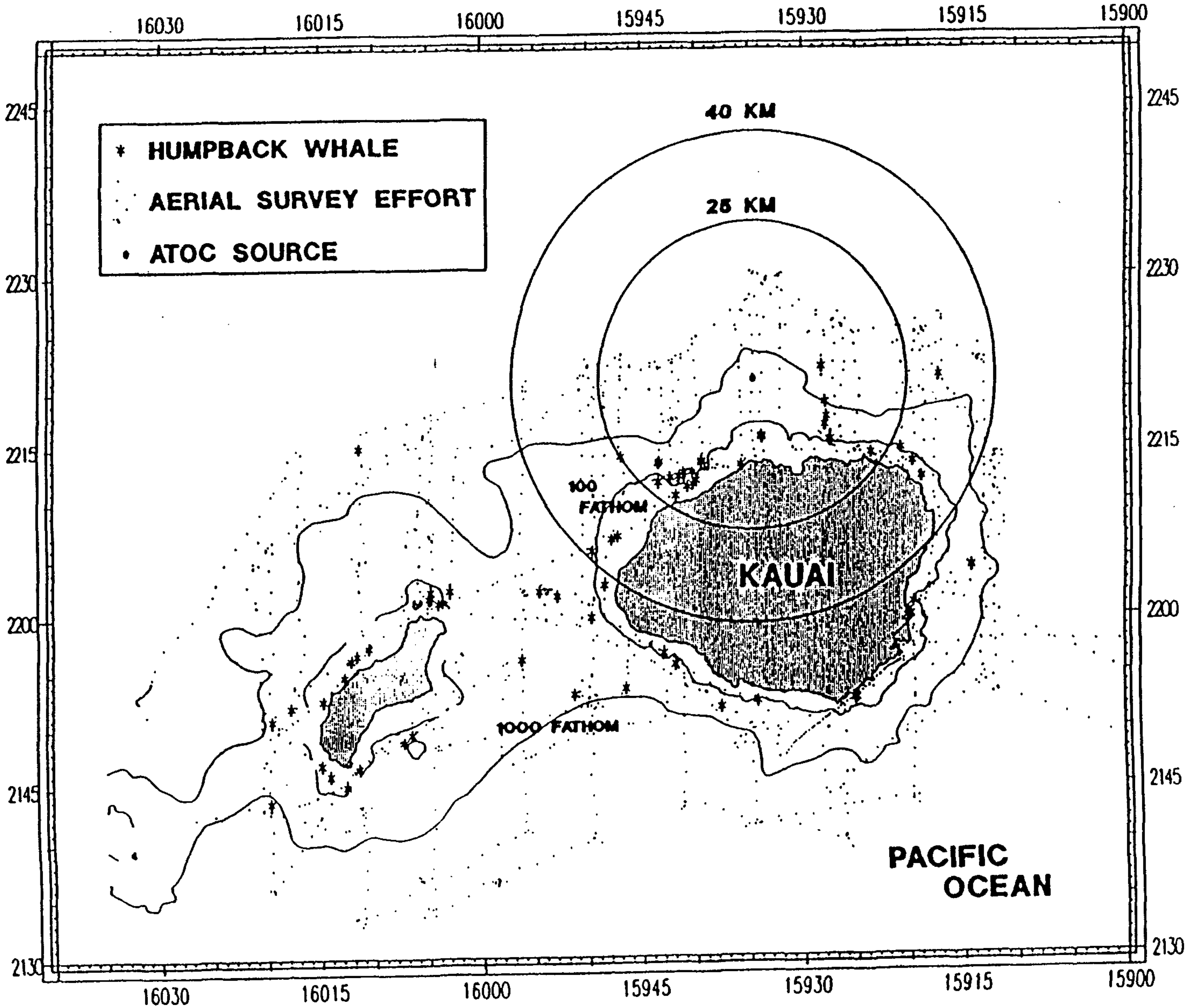
Figure 8

Observed versus expected groups seen in various sea states and visibility conditions.



1.2
1.0
0.8
0.6
0.4
0.2
0
Detection probability
0.244
0.487
0.731
0.974
1.218
1.461
1.705
1.949
2.192
Perpendicular distance (nm)

Figure 9



16030
16015
16000
15945
15930
15915
15900
2245
2230
2215
2200
2145
2130
HUMPBACK WHALE
AERIAL SURVEY EFFORT
ATOC SOURCE
40 KM
25 KM
100 FATHOM
1000 FATHOM
KAUAI
PACIFIC OCEAN

Figure 10

Codes for 1994 Humpback Whale Aerial Surveys
by Rich Grotefendt (revised 1/12/94)

Beaufort Scale	Sea Condition	Wave Height	Wind Speed	Wind Description
0	Smooth and mirrorlike	0	0-1	calm
1	Scale-like ripples without foam crest	1	1-3	light air
2	Small short wavelets; crests glass appearance and not breaking	2	4-6	light breeze
3	Large wavelets; some crests break; foam of glassy appearance; occasional white foam crests	3	7-10	gentle breeze
4	Small waves become longer; fairly frequent white foam crests.	4	11-16	moderate breeze
5	Moderate waves more pronounced long form; many white foam crests; there may be some spray	6	17-21	fresh breeze
6	Large waves form; white foam crests extensive; may be spray	10	22-27	strong breeze
7	Sea heaves; white foam from breaking waves blown in streaks in direction of wind; spin drift	14	28-33	mere gale
8	Moderately high waves of greater lengths; edges of crests break into spin drifts; foam blown in well marked streaks.	18	34-40	gale

EX Excellent (calm, clear, no glare)
VG Very good (some glare, surface ripple)
GO Good (light chop, glare, fog which makes viewing of less than 1/2 the survey strip troublesome)
FA Fair (chop, glare, shadows, fog, dirty ice, heavy rifting combine to make viewing of whole strip troublesome BUT all animals within line of sight are still visible)
PO Poor (some animals in survey strip are obscured due to weather conditions; survey data good for distribution analysis only)
UN Unacceptable (survey tract obscured; survey suspended)

Glare or Cloud Cover

		(Acceptable Ranges for given VIS) VIS	BEAUF	GLARE
blank if none		EX	0-1	blank
1 = 1-10%	VG	VG	0-2	0-1
2 = 11-25%	GO	GO	0-4	0-3
3 = 26-50%	GO	FA	0-5	0-4
4 = 51-75%	FA	PO	0-5	0-4
5 = 76-100%	UN	UN	0-8	0-5
X = stopped before end of leg				

Species code
MN = Humpback whale — Megaptera novaeangliae
BP = Fin whale — Balaenoptera physalus
TG = Bottlenose dolphin — Tursiops truncatus
PM = Sperm whale — Physeter macrocephalus
GM = Shortfin pilot whale — Globicephala macrorhynchus
PC = False killer whale — Pseudorca crassidens
SL = Spinner dolphins — Stenella longirostris
SA = Spotted dolphin — Stenella attenuata
SC = Striped dolphin — Stenella coeruleoalba
FA = Pygmy killer whale — Feresa attenuata
PE = Mellon headed whale — Peponocephala electra
KB = Pygmy sperm whale — Kogia breviceps
BE = Baird's beaked — Berardius bairdii
MD = Blainville's beaked — Mesoplodon densirostris
ZX = Cuvier's beaked — Ziphius cavirostris
SB = Rough toothed dolphin — Steno bredanensis
MK = Monk seal — Monachus schauinslandi
ST = Stenella species
UW = unidentified whale
UD = unidentified dolphin

Reaction N=None: no overt change in the direction of movement or behavior of an animal.
C=Change: overt change in the direction of movement or behavior of an animal.
E=Escape dive: dive associated with a splash or display of tail flukes.

Observer Codes
1=JM; 2=MS; 3=TN; 4=AF; 5=EB; 6= ; 7= ; 8= ; 9=RG

Position
1=left front; 2=right front (recorder) ; 3=left aft; 4=right aft.

Number
Total number of animals of the same species in a group, where a group includes all animals within four body lengths of one another.

Angle
Clinometer degrees (use the left scale on the clinometer) taken from platform to sighting on a line perpendicular to platform's direction of travel.

Altitude
Height of platform in feet.

Time Hours:Minutes:Seconds
Latitude Degrees:Minutes:Tenths of minutes (computer records hundredths mins)
Longitude same as latitude

Leg Number
Systematic legs are given a preassigned number. Deadheads start with one (1) each day and increment each time a deadhead is started. Randoms start with one (1) for the day and maintain the same number even when broken by a deadhead if the same flight path is resumed after the deadhead is concluded. Randoms increment when interrupted by a systematic or when the flight path has changed direction.

LEG TYPE
D Deadhead: For recording sighting data during reduced or undescribed observer effort. Also used on overland flights, commutes when not observing, during unacceptable weather conditions,...
S Systematic Straight flight of undefined length with beginning and ending positions systematically chosen. Observers on full effort.
R Random Straight flight path of underfined length with beginning and ending positions randomly chosen. Observers on full effort. On humpback 1994 study will also be lines connecting north-south systematic lines with observers on full effort. Will need to discuss modifications due to overlap.

LEG FLAG
1 = beginning of leg
2 = ending of leg
(note: At the end of each leg a duplicate line is written. The first line is a 2 and the next line is a 1. e.g 3S2
2D1

Wind speed Enter in knots.
Wind direction Enter in 0 to 360 degrees true.

DATE ___ / ___ / ___
mo da yr

1994 University of Hawaii
Humpback Whale Aerial Survey

RECORDER ____ PILOT ____
LEFT OBS ____ RIGHT OBS ____

Page ____ of ____

TOTAL NUMBER 1	CALF 4	SPECIES 6	ANGLE 8	REACTION	DUPS 11	OBSERVER	POSITION	ALTITUDE 15	TIME HOUR 19	TIME MIN	TIME SEC	LATITUDE DEG 25	LATITUDE MIN	LATITUDE TENTH	LONGITUDE DEG 30	LONGITUDE MIN	LONGITUDE TENTH	LEG NUMBER 36	LEG TYPE	LEG FLAG	SURFACE BEAUF	SURFACE VIS L	SURFACE VIS R	SURFACE GLAR L	SURFACE GLAR R	CLOUD 45

DRAFT

ATOC Marine Mammal Research Program (ATOC MMRP):

Preliminary Report: 1994 Aerial Surveys for Waters North of Kauai

Submitted by:

Joseph R. Mobley, Jr.
University of Hawaii-West Oahu

Richard Grotefendt
Enserch Environmental Corp.

Date:

September 18, 1994

DRAFT

ATOC Marine Mammal Research Program (ATOC MMRP):

Preliminary Report: 1994 Aerial Surveys for Waters North of Kauai

Introduction

This is a preliminary report of results of marine mammal surveys conducted during the second year (1994) of the ATOC Marine Mammal Research Project (ATOC MMRP). During the 1993 field season (Jan-Apr, 1993), we surveyed waters surrounding all of the major Hawaiian Islands for a total of four survey flights. These earlier surveys comprised a total of 7332 km of effort. Other than placing tracklines closer together in the 25-km ZOI (i.e., estimated 120-dB isopleth for humpback whales) during 1993, effort was relatively constant across all regions. Performing statewide surveys in this fashion permitted estimation of the proportion of the wintering population that would likely be exposed to the ATOC source during a given transmission. It also allowed us to assess the relative importance of the ZOI as a calving ground compared to other regions (see summary of results in Mobley et al., 1993).

During 1994, effort was limited to the 40-km range around the proposed ATOC source site ~~ZOI which corresponds to the estimated 120-dB isopleth for deep-diving species with good low-frequency hearing (Clark, 1993)~~. Weekly surveys were planned during the winter field season (Jan - April). Additionally, monthly surveys were planned beyond the winter field season, covering the period May through August, 1994 (though only two of these have been completed as of this date). All sightings of marine mammals and sea turtles were recorded and are included in this report.

Method

As of this preliminary report date, a total of 13 flights were performed, including eight complete, and five partial surveys (see Table 1) (Note: A survey was considered "complete" if all predesignated transects were completed without truncation due to weather conditions or military activity). Flights during the primary field season (Jan-April) were spaced an average of 8.5 days apart (SD = 6.3) with two additional "post-season" flights on May 11 and July 4 (Note: two more post-season flights are currently planned). Flights were truncated or canceled when Beaufort seastate consistently exceeded Beaufort 4, or when visibility was less than 2 miles.

Tracklines consisted of systematic north-south lines with random lines connecting endpoints. Systematic lines were placed using random startpoints either 7.5 nm or 3.75 nm apart, with the closer lines occurring near the location of the proposed ATOC source (Figure 1). Following completion of the ZOI survey, random lines were continued around the remainder of the island. Tracklines of individual flights are depicted in Figures 3-15.

A twin-engine Cessna 337 (Skymaster) was equipped with Collins ALT 50A radar altimeter and Morrow Apollo GPS receiver which outputted to a Compudyne 386 laptop computer. The computer captured data using software developed by ENSERCH Environmental Corp. (EEC) and modified by Rich Grotefendt of EEC. This system automatically recorded positional data at 30-sec intervals and manually recorded whenever a sighting occurred.

Table 1

Flight dates and effort

	Effort (km)				
Date	Systematic	Random	Deadhead	Total	Status
1/14/94	25	104	78	207	partial
1/16/94	410	192	18	620	complete
1/26/94	26	118	4	148	partial
1/29/94	441	160	112	713	complete
2/13/94	369	205	101	675	complete
2/19/94	370	275	225	870	complete
2/26/94	413	168	178	759	complete
3/04/94	398	201	148	747	complete
3/28/94	295	176	32	503	partial
4/01/94	372	192	150	714	complete
4/09/94	391	176	149	716	complete
5/11/94	270	147	270	687	partial
7/04/94	261	193	31	485	partial
Total:	4041	2307	1496	7844	

Sighting angles to target pods were made using Suunto (Model PM-5) hand-held clinometers with analog display calibrated to whole degrees. These angles, in combination with the altitude data, allowed for the estimation of perpendicular distance from the sighting to the transect line.

Sightings were made by two observers, one on each side of the plane, and called verbally to a data recorder seated next to the pilot. When a sighting occurred, observers called out data in the following order: number of individuals, calf (if present), species, angle to the sighting, and reaction (i.e., whether pod members appeared to react to the plane). These data were then manually noted by the data recorder. At the start of each leg or when conditions changed, the observers also called out environmental information, including glare, visibility, and Beaufort seastate, which the data recorder also entered. The automated data, which indicated real time, latitude and longitude from the GPS receiver, and altitude (to the nearest foot) from the radar altimeter, were automatically written onto the hard disk of the laptop computer, and onto a 3.5" floppy disk as back-up. The manually-written data were keypunched into an ASCII file and were later merged with the computer-written data.

Results

A total of 6,348 km effort (systematic and random tracklines only) was expended across the 13 flights reported here (see Figure 1). Effort was concentrated in the middle portion of the ~~ZOI~~ as a result of the closer spacing of tracklines in that region. ATOC source area

A total of eight identified species were sighted, including two baleen whales and six odontocetes. Figures 16-24 summarize locations of sightings for each of the positively identified species.

Baleen whales

The baleen whale sightings included humpback whales with the exception of one fin whale (sighted 2/26/94). A total of 135 pods of humpback whales were sighted, consisting of 232 individuals. As shown in Figure 16, the majority of humpback whale sightings occurred within or near the 100-fathom contour. This is consistent with the 1993 results where 74% of all humpback sightings occurred in waters less than 100 fathoms.

The single fin whale sighting was made on Feb. 26, 1994 (Figure 17). There are only several fin whale sightings on record for Hawaiian waters. We will be submitting a description of this sighting as a note to Marine Mammal Science.

Odontocetes

Figure 30 shows the locations of all Odontocete sightings. In contrast with the preference of humpback whales for coastal waters, the majority of Odontocete sightings occurred in waters greater than 100 fathoms, primarily in the central and eastern portions of the study area.

The rank order of sightings (Table 2) generally agree with those of the 1993 state-wide survey results (Mobley et al., 1994), with several notable exceptions. There were no sightings of false killer whales (*Pseudorca crassidens*) during 1994, as compared with 8 sightings made in 1993 for waters east of Oahu. Also, only one sperm whale (*Physeter macrocephalus*) sighting occurred in 1993 (north of Kauai), as compared with 5 sperm whale pods sighted in the study area, and one pod in Kauai Channel during 1994. ? Finally, there were no positive sightings of rough-toothed dolphins (*Steno bredanensis*) during 1993, as compared with four sightings during 1994.

Turtles

Figure 27 shows the locations of the four unidentified turtle sightings. As shown, all four occurred in near-shore waters, less than 100 fathoms.

Pending Analyses

We are still working on analyses stratefied by depth, similar to what we did for the 1993 report. These will include three depth strata: 0-100, 100-1000, and > 1000 fathoms.

Also, we will be performing abundance estimation for humpback whales only (since the number of pod sightings for all other species were less than our criterion of 15 pods). This will be done using the DISTANCE program developed by Jeff Laake of the National Marine Mammal Laboratory (Version 2.03).

These results will be included as part of our 1994 Yearly Report to be submitted by December, 1994.

Table 2

Summary of species sighted (in order of decreasing encounter rate)

Species	Sighting frequency: Pods	No.	ER (n/km)
humpback whales	135	232	.0365
spotted dolphins	3	190	.0299
shortfin pilot whales	11	160	.0252
spinner dolphins	2	80	.0126
bottlenosed dolphins	10	82	.0129
rough-toothed dolphins	4	35	.0055
sperm whales	6*	20*	.0032
fin whale	1	1	.0002
unidentified dolphin	18	71	.0112
unidentified Stenella spp	1	25	.0039
unidentified whales	14	17	.0027
unidentified turtles	4	11	.0017
unidentified beaked whale	1	5	.0006
Total Sightings:	210	929	

* Note: These include one pod of five sperm whales sighted outside of the 40-km ZOI, in the Kauai channel.
range around the ATOC source site.

References

Clark, C. W. (1993). Application for permit for scientific research under the Marine Mammal Protection Act, and for scientific purposes under the Endangered Species Act. Submitted to National Marine Fisheries Service, Oct. 25, 1993.

Mobley, Jr., J. R., Forestall, P. H. and Grotefendt, R. (1994). Results of 1993 Aerial Surveys in Hawaiian Waters. Final Report to ATOC Marine Mammal Research Program, February 20, 1994.

DRAFT ONLY 9/14/94 by Rich Grotefendt
(some checking still ongoing)

Table 1. Numbers and groups of all species sighted.
Numbers and groups of all species sighted by day.
Kilometers of effort by systematic, random, and deadhead legtype, and totals.
Encounter rate of numbers per total kilometers surveyed.

Thirty-three maps of 1994 Kauai aerial surveys (one of 93 & 94)

Map 1. All tracklines flown 1/14/94-7/4/94 drawn as lines.
Map 2. All tracklines flown 1/14/94-7/4/94 drawn as dots.

Map 3. Tracklines from 1/14/94 flight.
Map 4. Tracklines from 1/16/94 flight.
Map 5. Tracklines from 1/26/94 flight.
Map 6. Tracklines from 1/29/94 flight.
Map 7. Tracklines from 2/13/94 flight.
Map 8. Tracklines from 2/19/94 flight.
Map 9. Tracklines from 2/26/94 flight.
Map 10. Tracklines from 3/4/94 flight.
Map 11. Tracklines from 3/28/94 flight.
Map 12. Tracklines from 4/1/94 flight.
Map 13. Tracklines from 4/9/94 flight.
Map 14. Tracklines from 5/11/94 flight.
Map 15. Tracklines from 7/4/94 flight.

Map 16. Humpbacks.
Map 17. Fins.
Map 18. Shortfin pilot whale.
Map 19. Sperm whale.
Map 20. Spotted dolphin.
Map 21. Rough toothed dolphin.
Map 22. Spinner dolphin.
Map 23. Stenella sp..
Map 24. Bottlenose dolphin.
Map 25. Unidentified beaked whale.
Map 26. Unidentified dolphin.
Map 27. Unidentified turtle.
Map 28. Unidentified whale.

Map 29. All baleen (humpback and fin) and unidentified whales.
Map 30. Shortfin pilot, sperm, spotted, bottlenose, unidentified beak, rough toothed, spinner,stenella sp., and unidentified dolphin.
Map 31. All dolphins (spotted, rough toothed, spinner, stenella sp., bottlenose, unidentified dolphin).
Map 32. All whales and dolphins on one plot with tracks as dots.
Map 33. All whales and dolphins from 1993 and 1994 around Kauai.

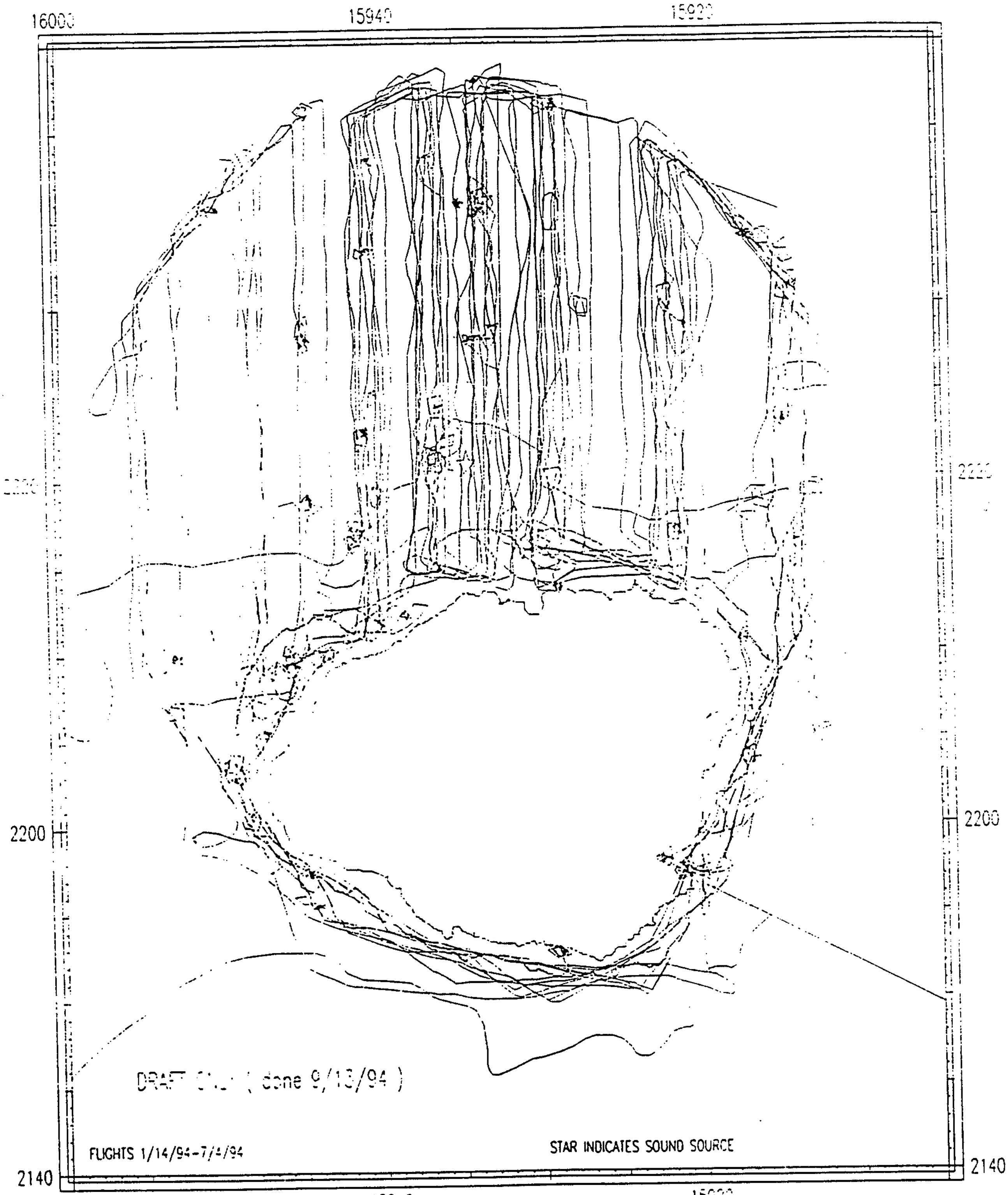
TABLE 1

Spe	Num	Grp *		Preliminary 1994 Aerial Survey Data Results
MN	232	135	humpbacks	
BP	1	1	fins	
GM	160	11	shortfin pilot	
PM	20	6	sperm	
SA	190	3	spotted	
SB	35	4	rough toothed	
SL	80	2	spinner	
SS	25	1	stenella sp.	
TG	82	10	bottlenose	
UB	5	1	unid. beaked	
UD	71	18	unid. dolphin	
UT	11	4	unid. turtle	
UW	17	14	unid. whales	
total	929	210	* may change due to duplicates	

date	n MN	g MN	n BP	g BP	n GM	g GM	n PM	g PM	n SA*	g SA	n SB	g SB	n SL	g SL	n SS	g SS	n TG	g TG	n UB	g UB	n UD	g UD	n UT	g UT	n UW	g UW
1/14/94	4	3																								
1/16/94	13	9																							1	1
1/26/94	7	4																			2	1			1	1
1/29/94	16	11			12	1			23	1											8	2	8	1		
2/13/94	31	21																							3	3
2/19/94	46	27			57	3			42	1			35	1			10	2			26	4	2	2	3	2
2/26/94	30	19	1	1	15	2	1	1			5	2					18	4	5	1	8	2	1	1	3	3
3/4/94	35	16							125	1	21	1	45	1	25	1					10	4			5	3
3/28/94	9	5															13	1								
4/1/94	22	12			57	3	1	1			9	1									5	2				
4/9/94	17	7			19	2	13	3													11	2			1	1
5/11/94	2	1					5	1									18	2								
7/4/94																	23	1			1	1				
total	232	135	1	1	160	11	20	6	190	3	35	4	80	2	25	1	82	10	5	1	71	18	11	4	17	14

	Kilometers of Effort				Encounter Rate (n/km) - (this uses total sys,rand,and deadhead kms)												
date	Sys	Ran	Dead	Total	MN	BP	GM	PM	SA	SB	SL	SS	TG	UB	UD	UT	UW
1/14/94	25	104	78	207	.0193	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
1/16/94	410	192	18	620	.0210	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0016
1/26/94	26	118	4	148	.0473	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0135	.0000	.0068
1/29/94	441	160	112	713	.0224	.0000	.0168	.0000	.0323	.0000	.0000	.0000	.0000	.0000	.0112	.0112	.0000
2/13/94	369	205	101	675	.0459	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0044
2/19/94	370	275	225	870	.0529	.0000	.0655	.0000	.0483	.0000	.0402	.0000	.0115	.0000	.0299	.0023	.0034
2/26/94	413	168	178	759	.0395	.0013	.0198	.0013	.0000	.0066	.0000	.0000	.0237	.0066	.0105	.0013	.0040
3/4/94	398	201	148	747	.0469	.0000	.0000	.0000	.1673	.0281	.0602	.0335	.0000	.0000	.0134	.0000	.0067
3/28/94	295	176	32	503	.0179	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0258	.0000	.0000	.0000	.0000
4/1/94	372	192	150	714	.0308	.0000	.0798	.0014	.0000	.0126	.0000	.0000	.0000	.0000	.0070	.0000	.0000
4/9/94	391	176	149	716	.0237	.0000	.0265	.0182	.0000	.0000	.0000	.0000	.0000	.0000	.0154	.0000	.0014
5/11/94	270	147	270	687	.0029	.0000	.0000	.0073	.0000	.0000	.0000	.0000	.0262	.0000	.0000	.0000	.0000
7/4/94	261	193	31	485	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0474	.0000	.0021	.0000	.0000
total	4041	2307	1496	7844	.0296	.0001	.0204	.0025	.0242	.0045	.0102	.0032	.0105	.0006	.0091	.0014	.0022

1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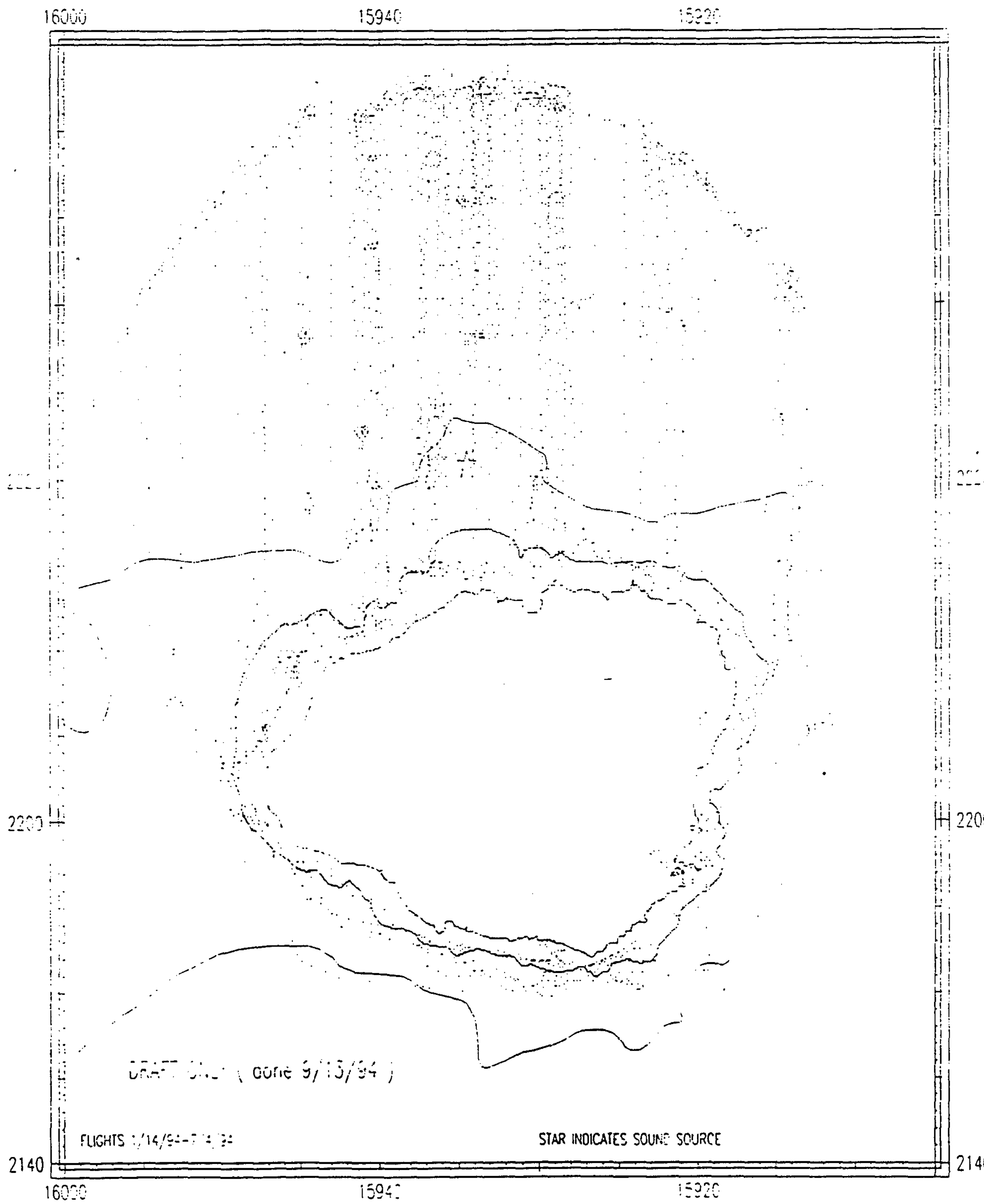

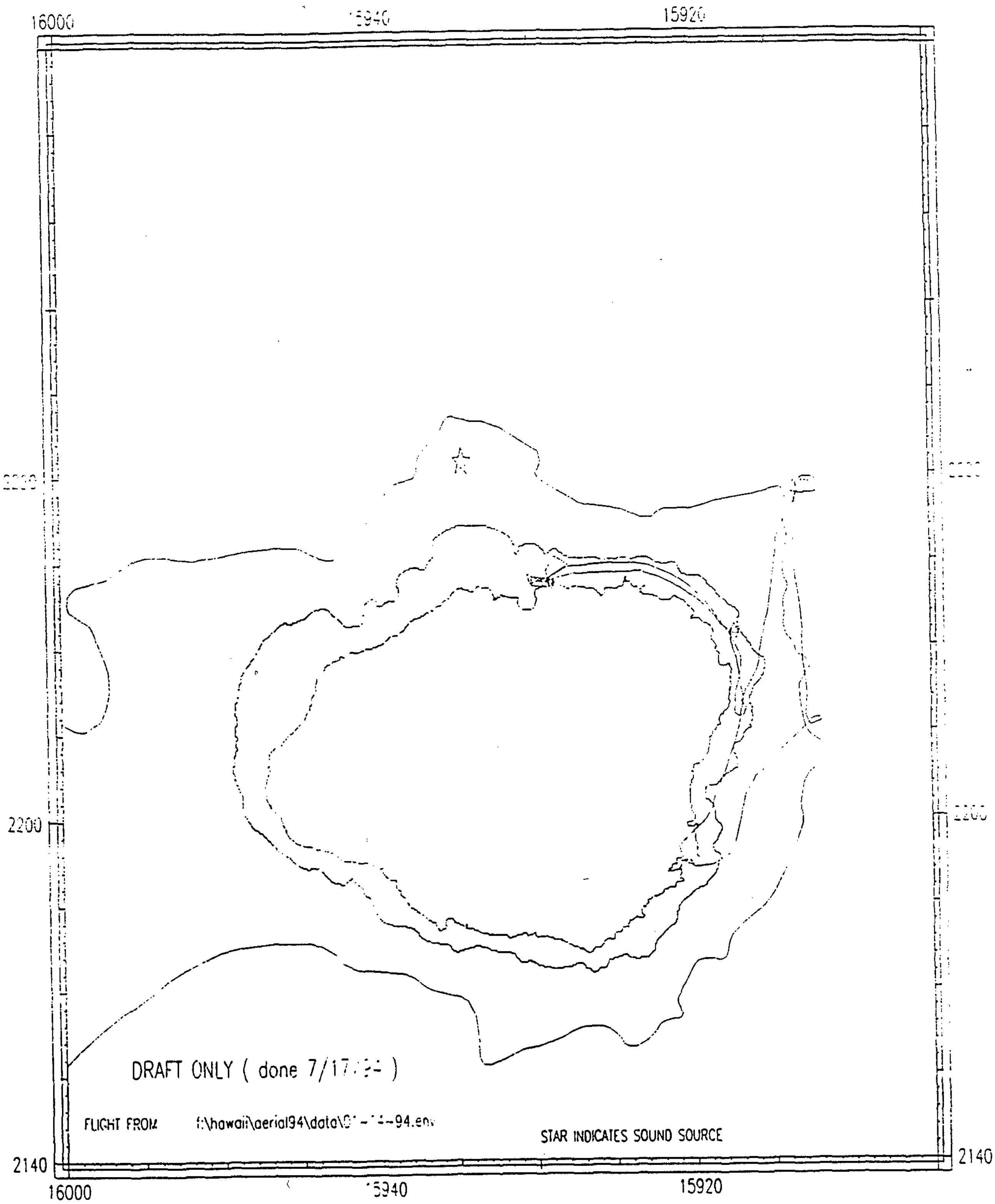
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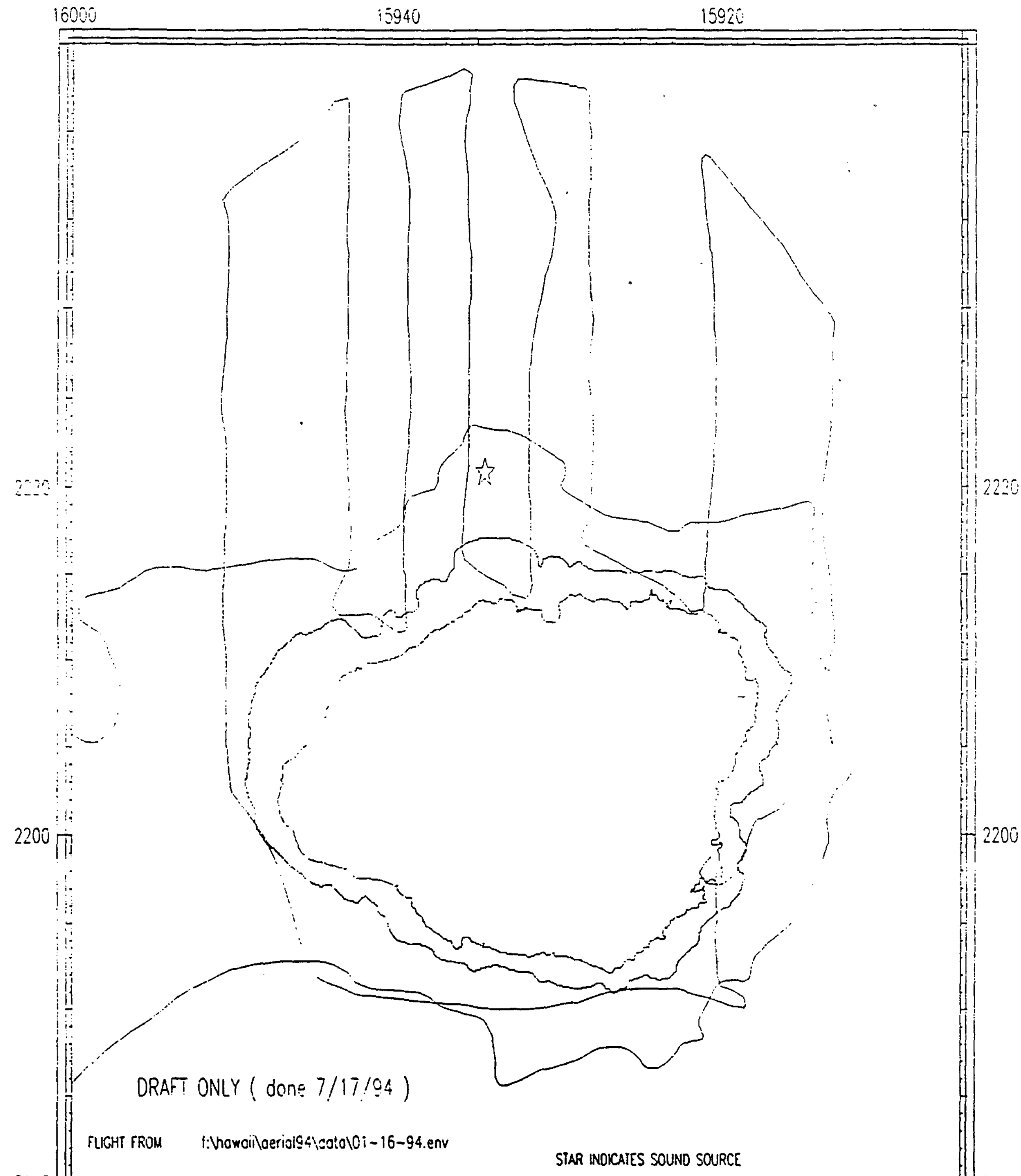
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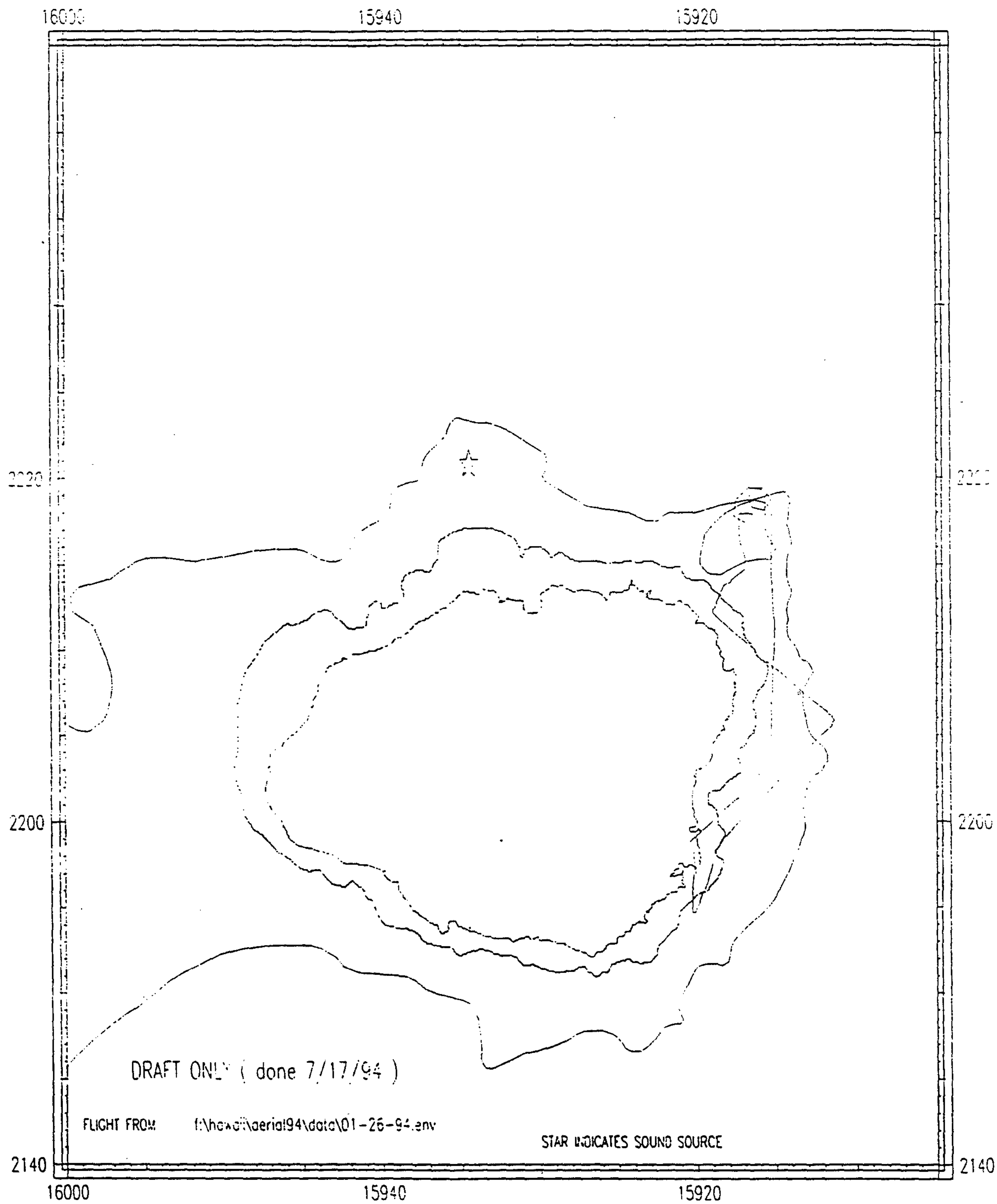

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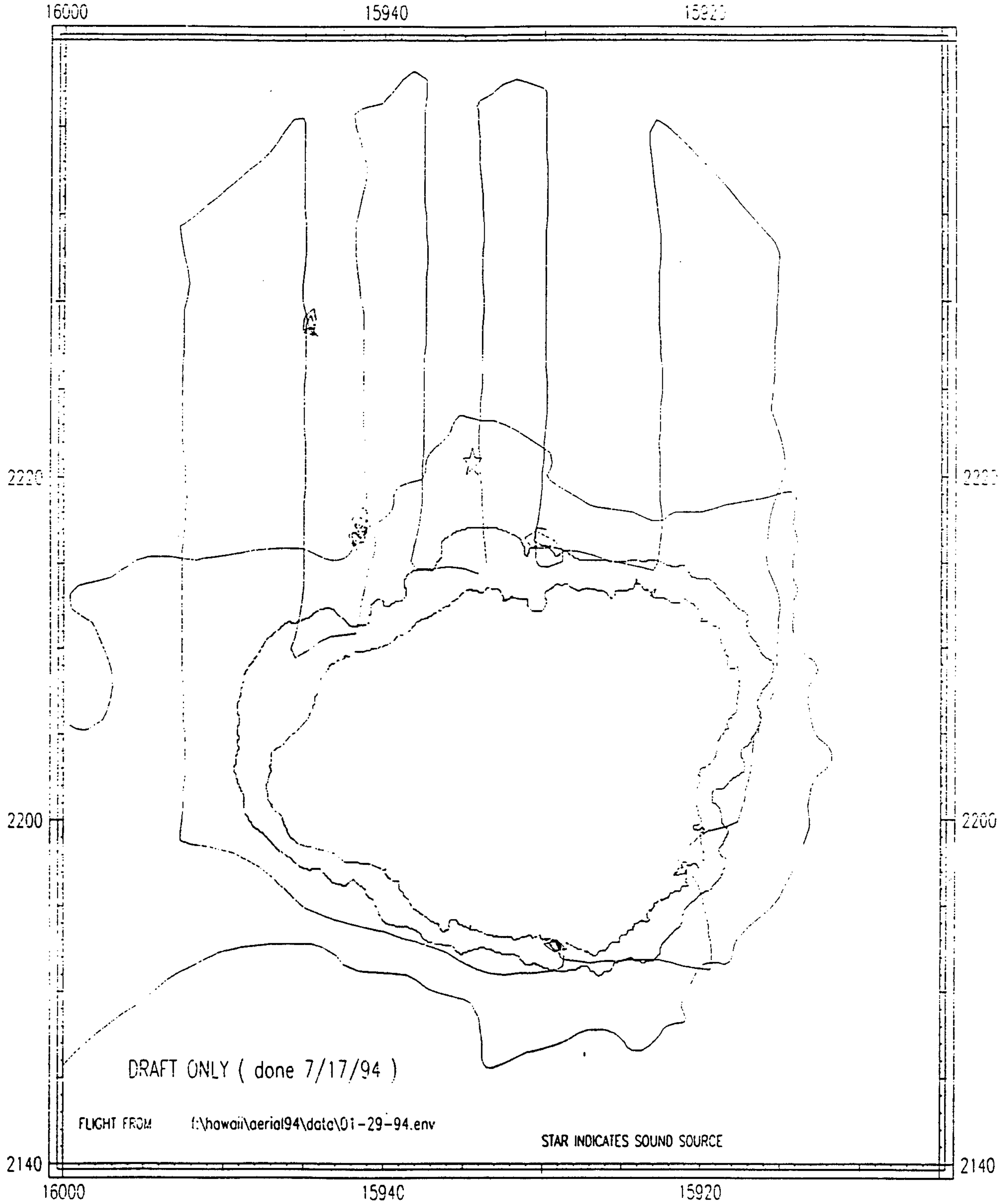
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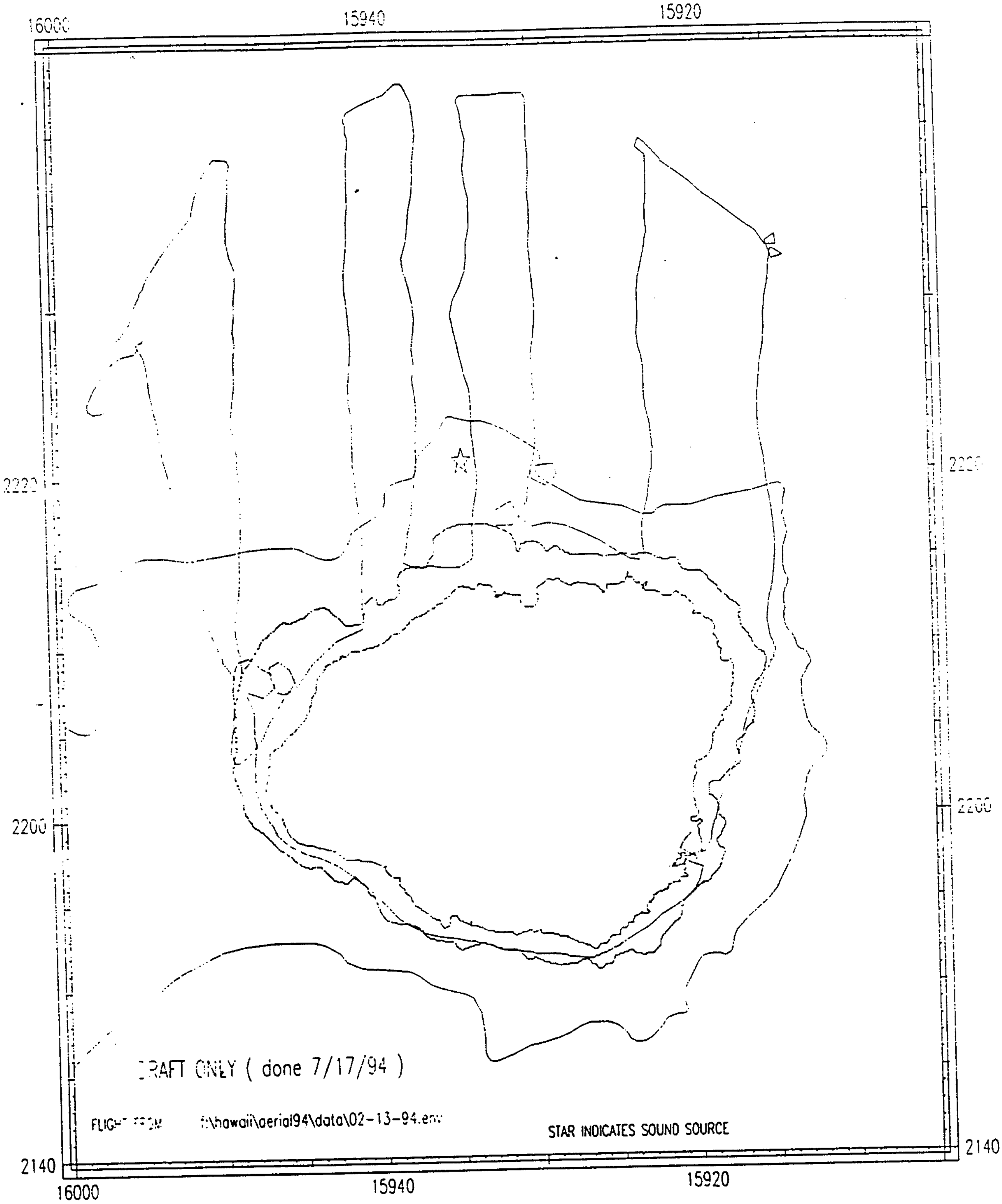
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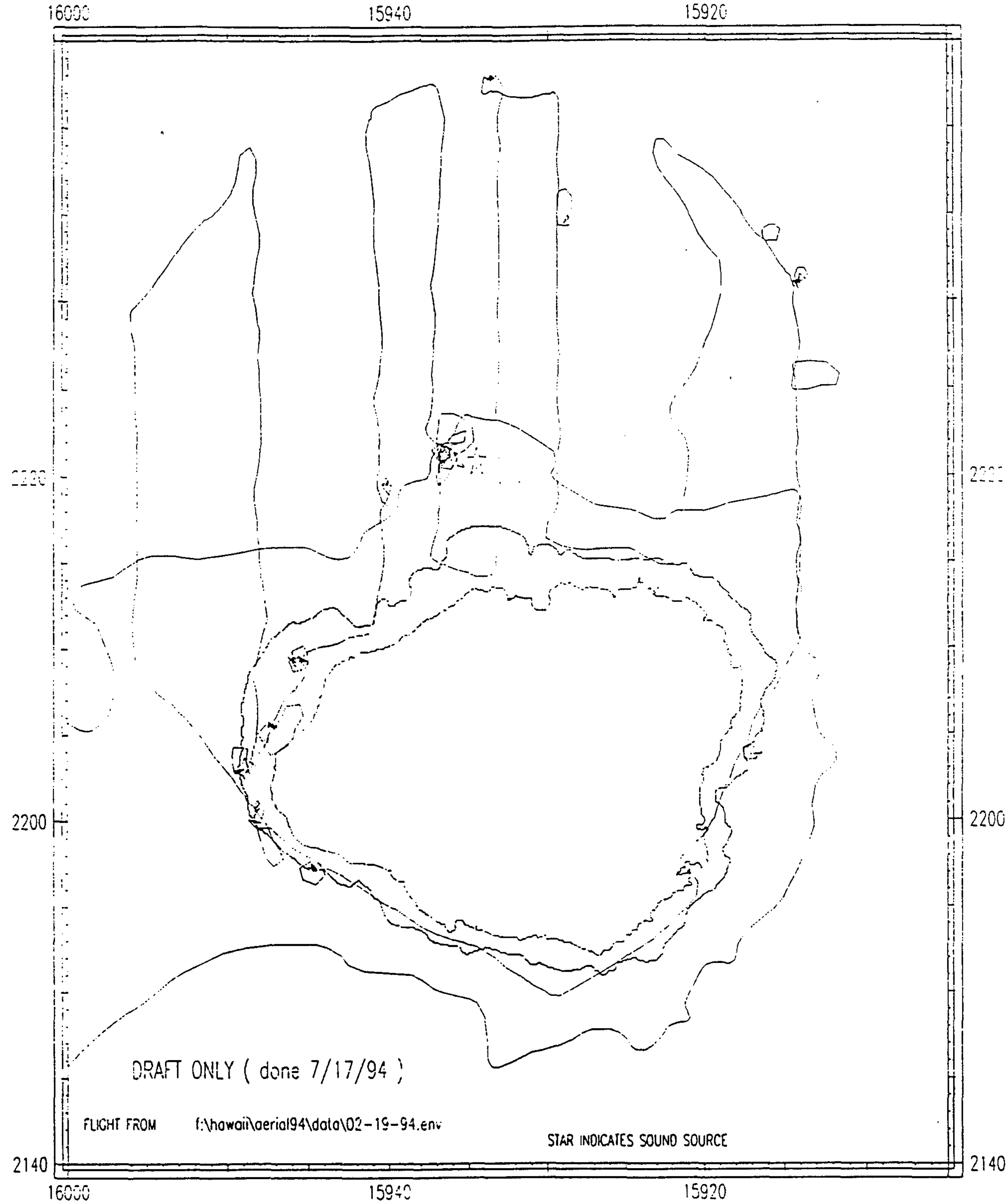

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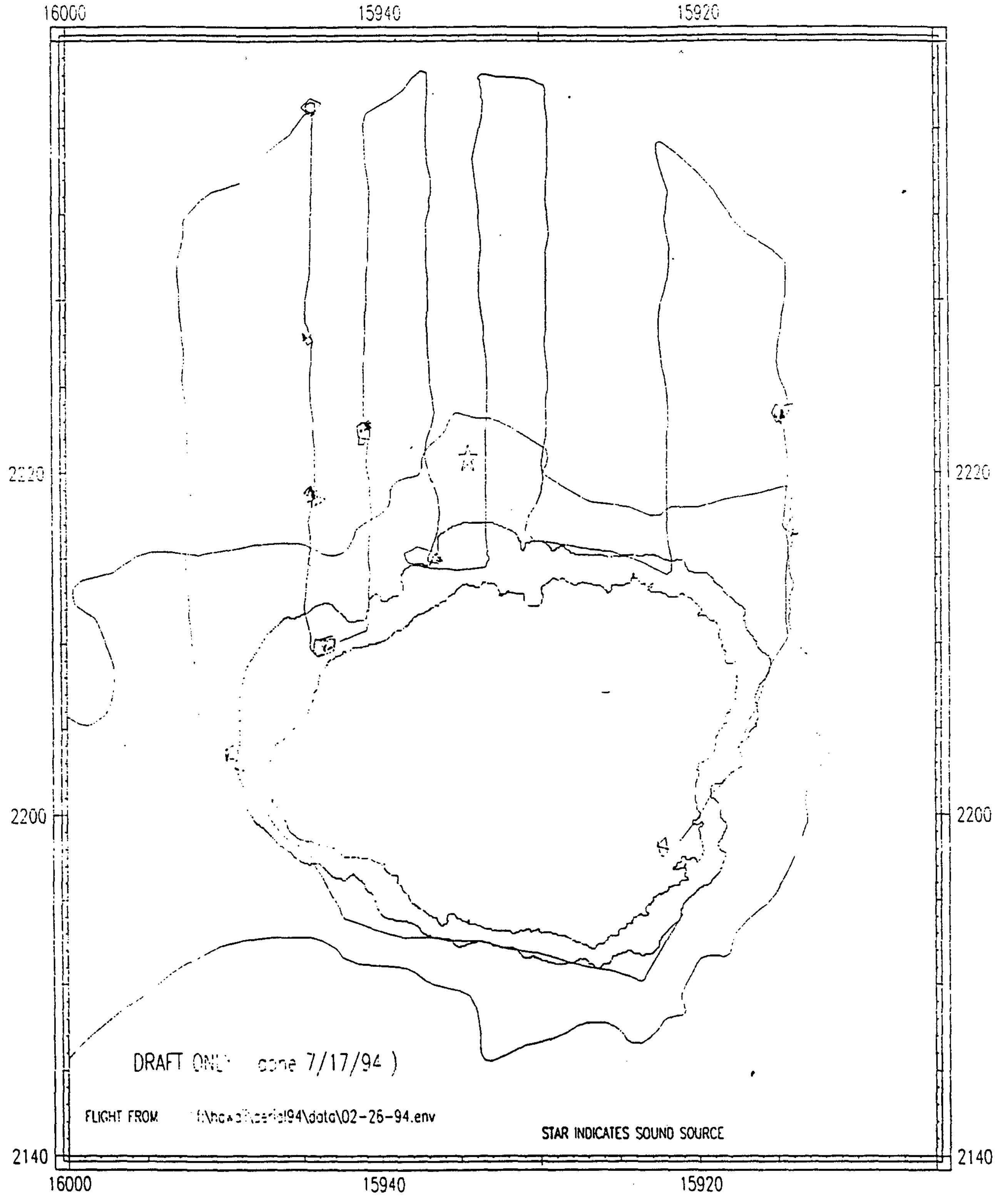
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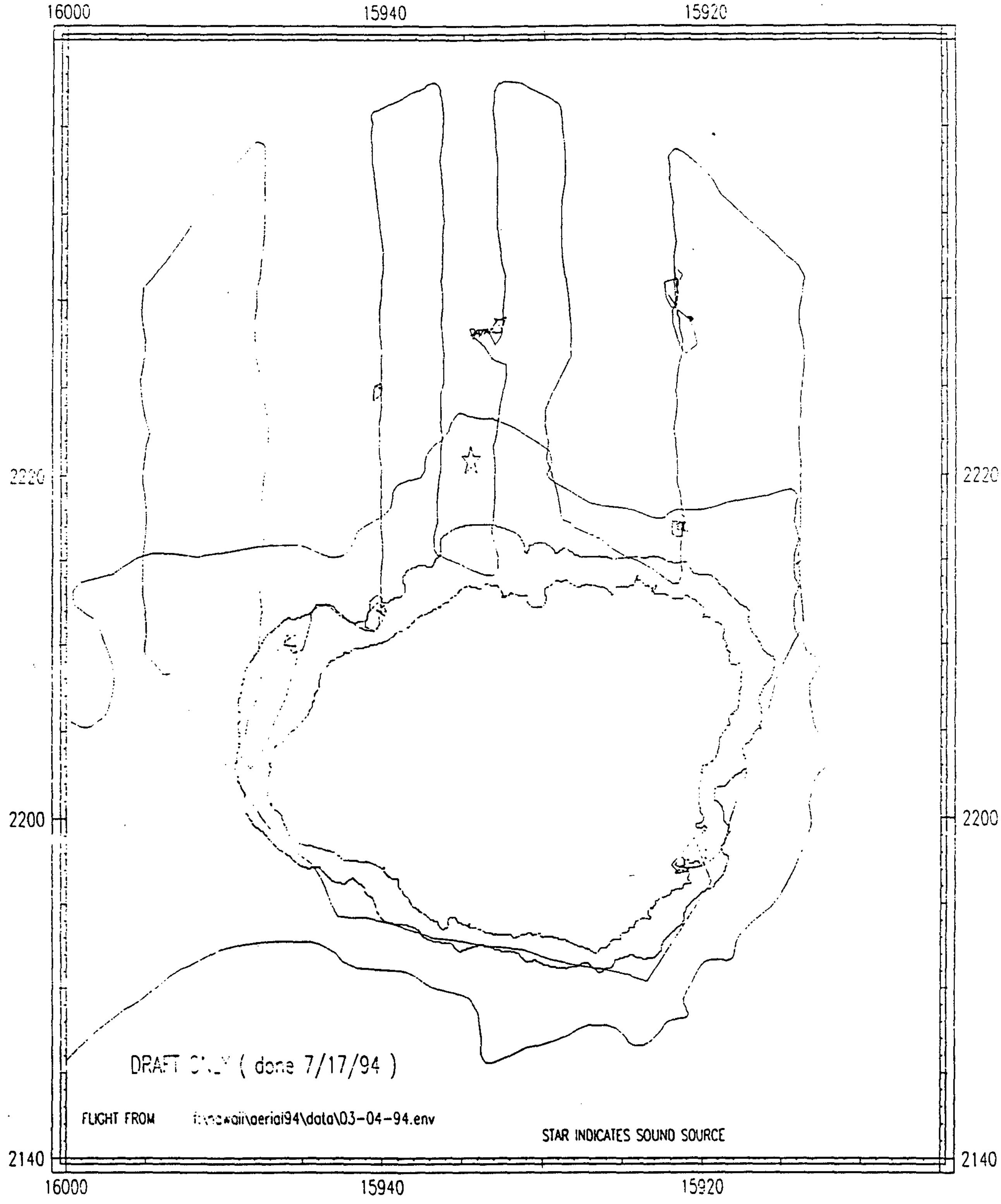
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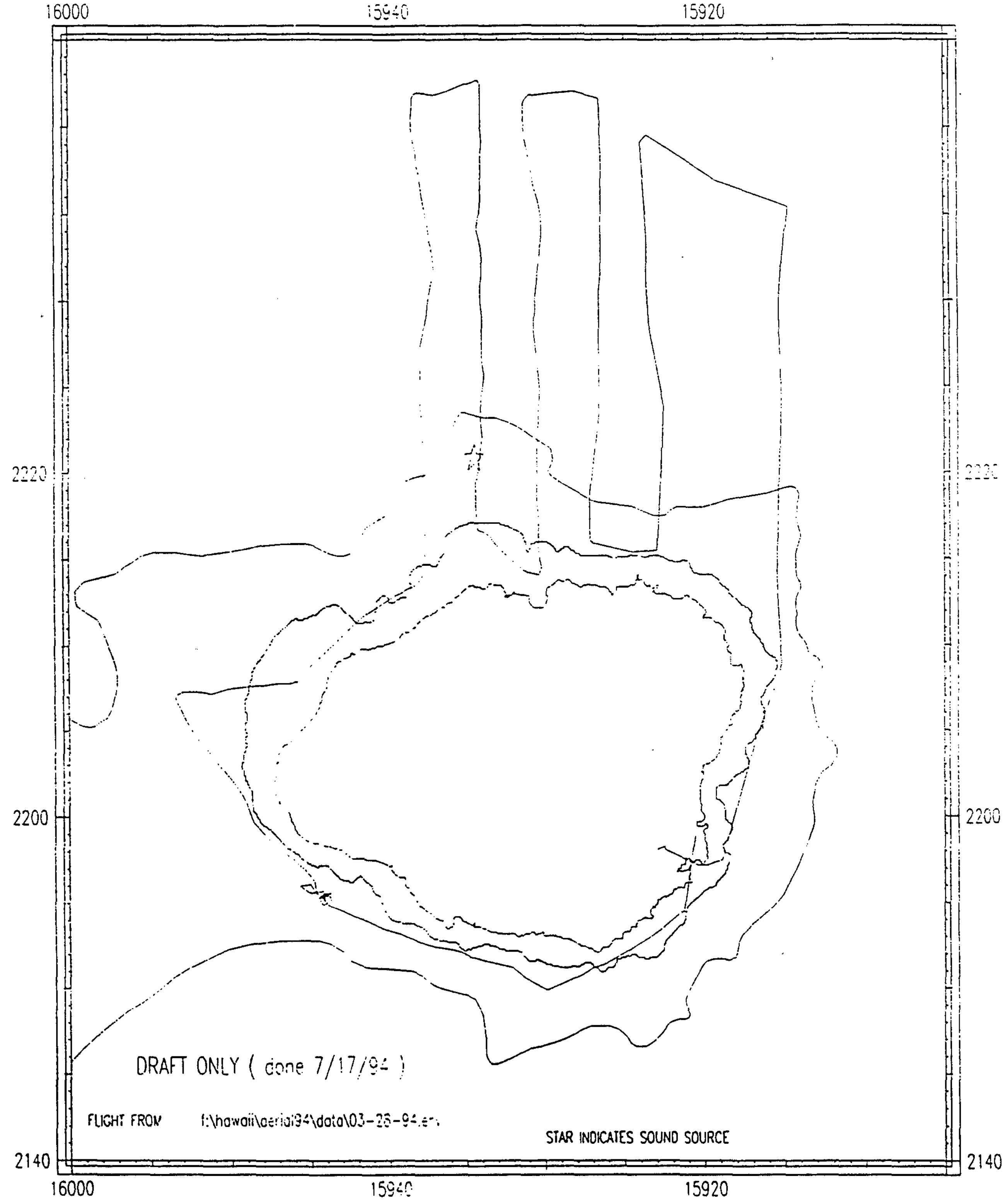
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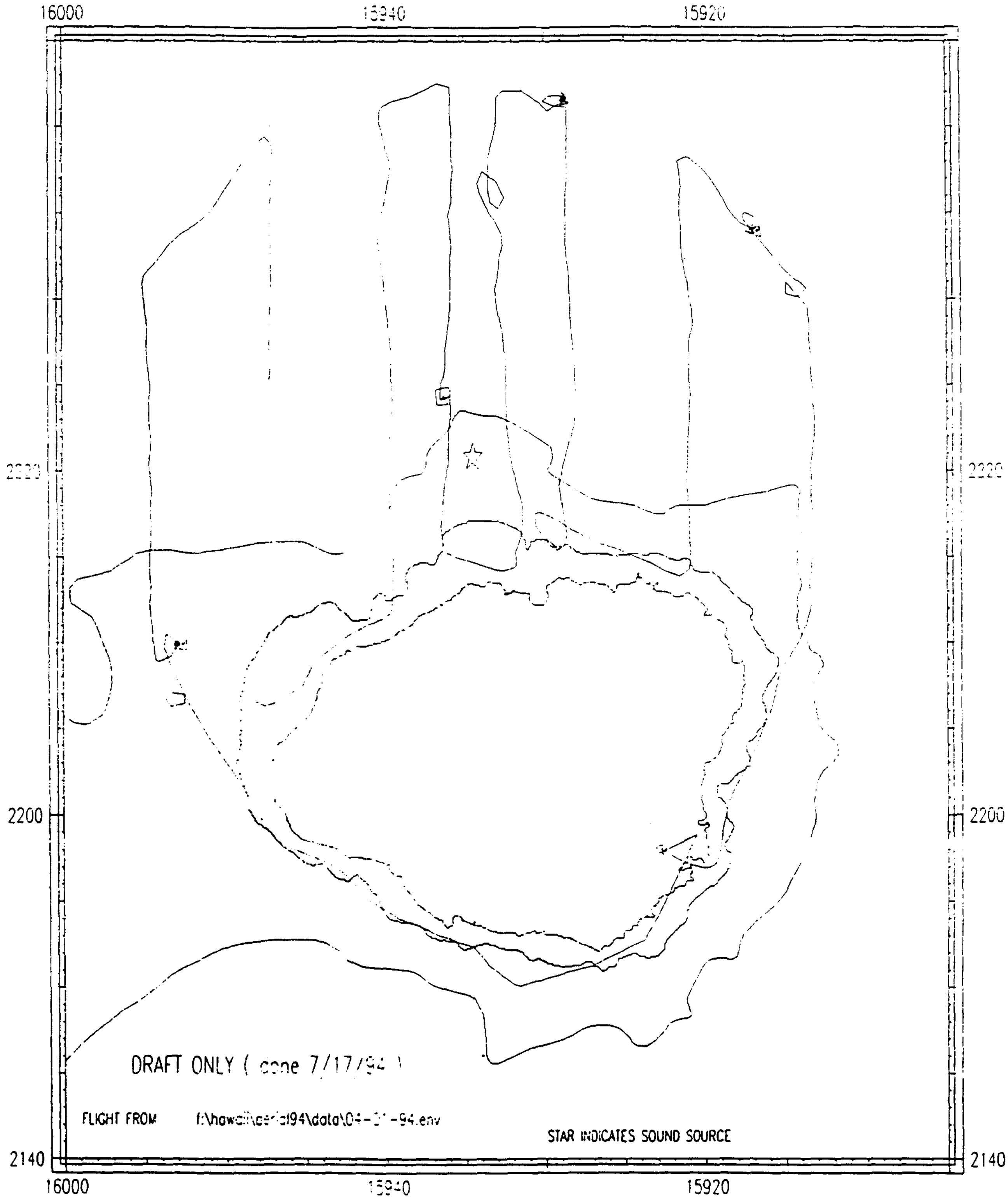
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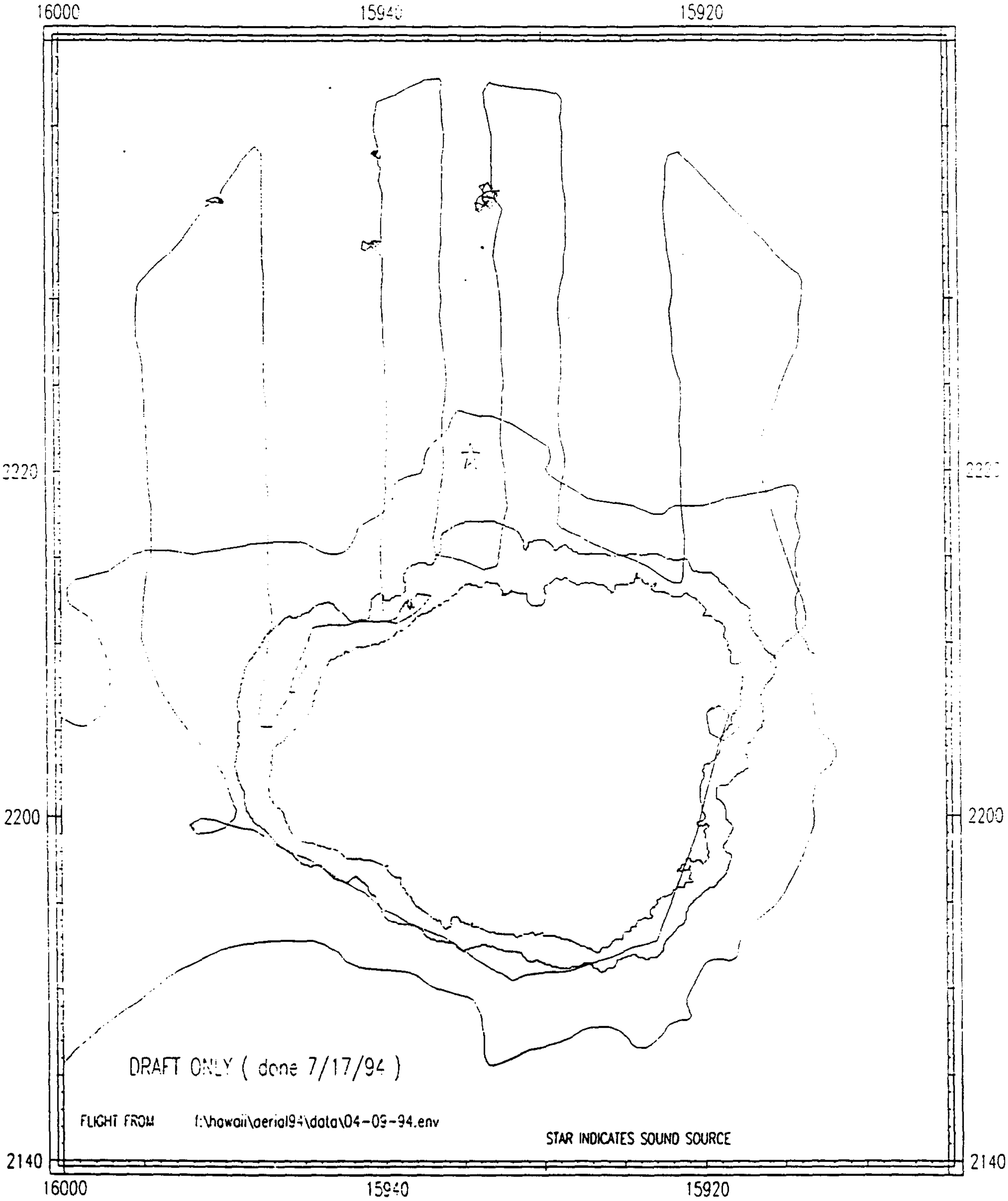
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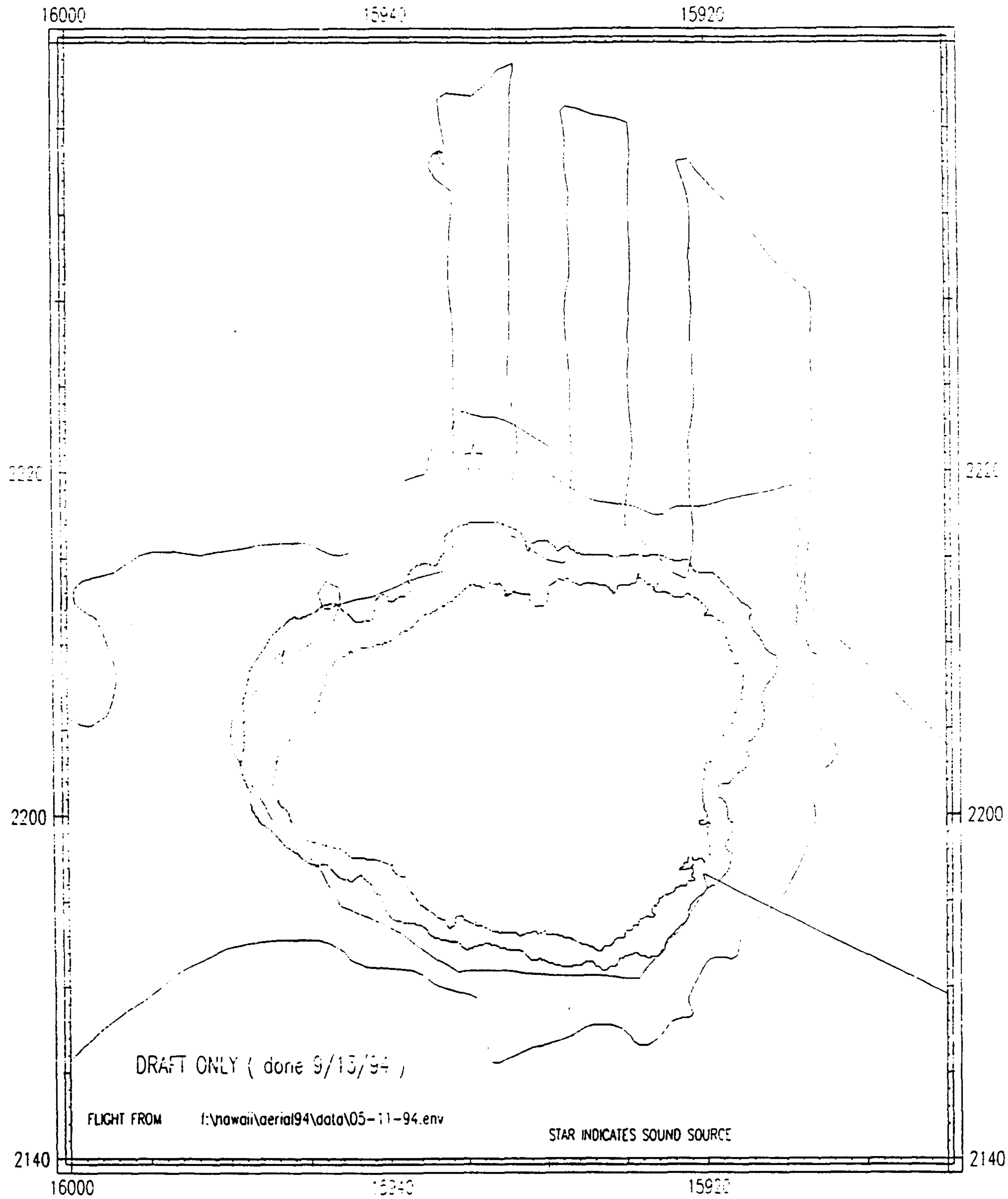
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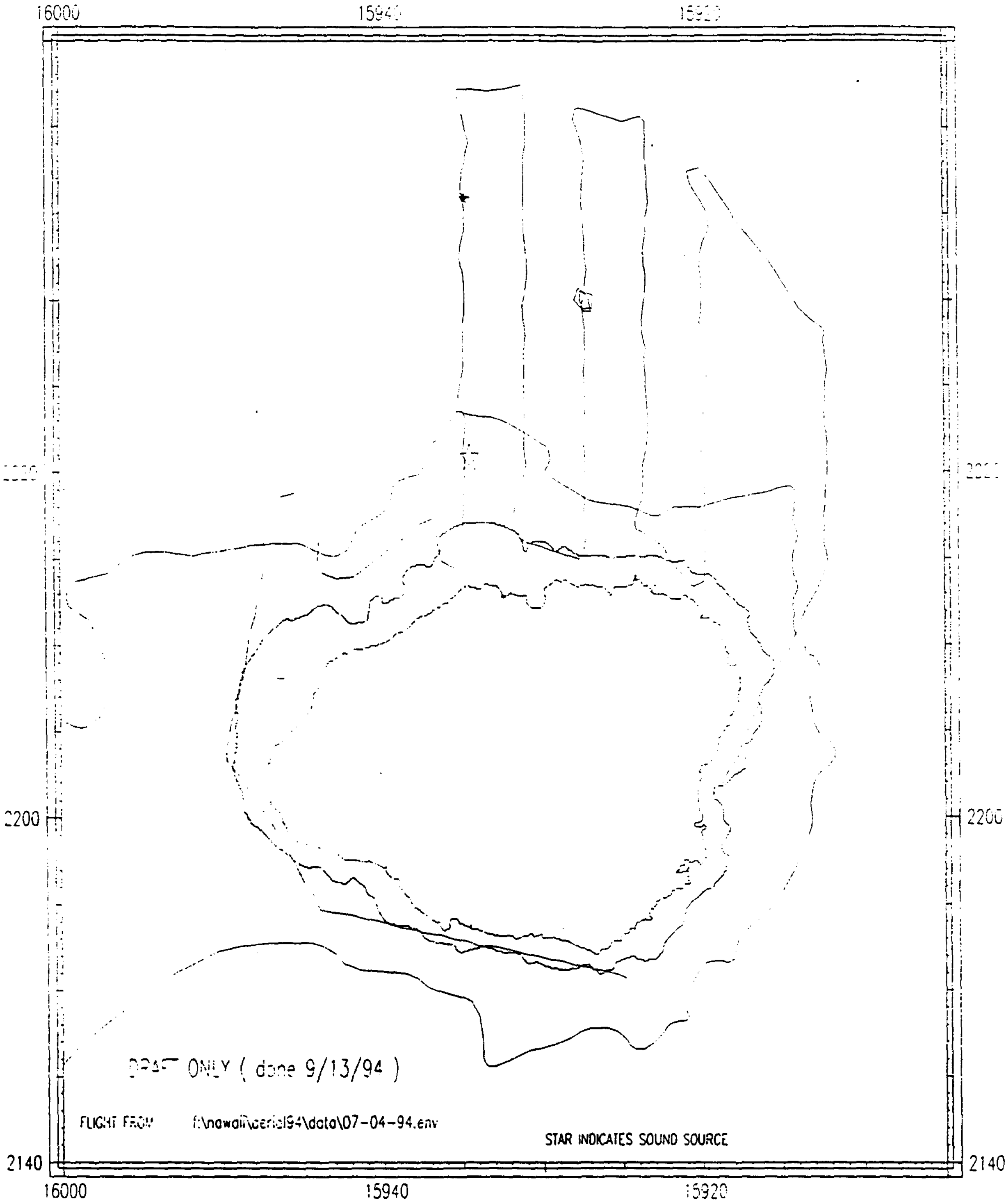
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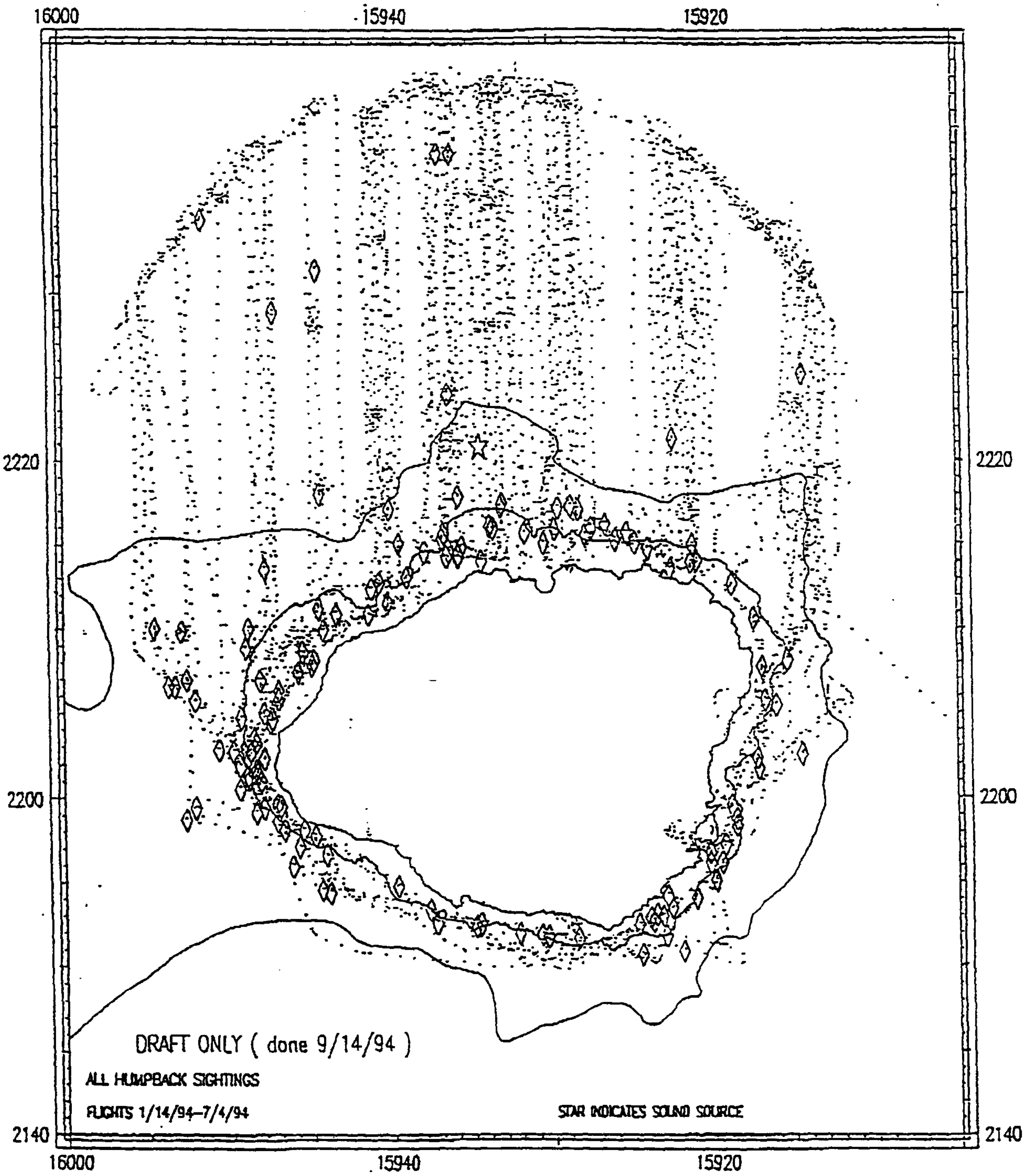
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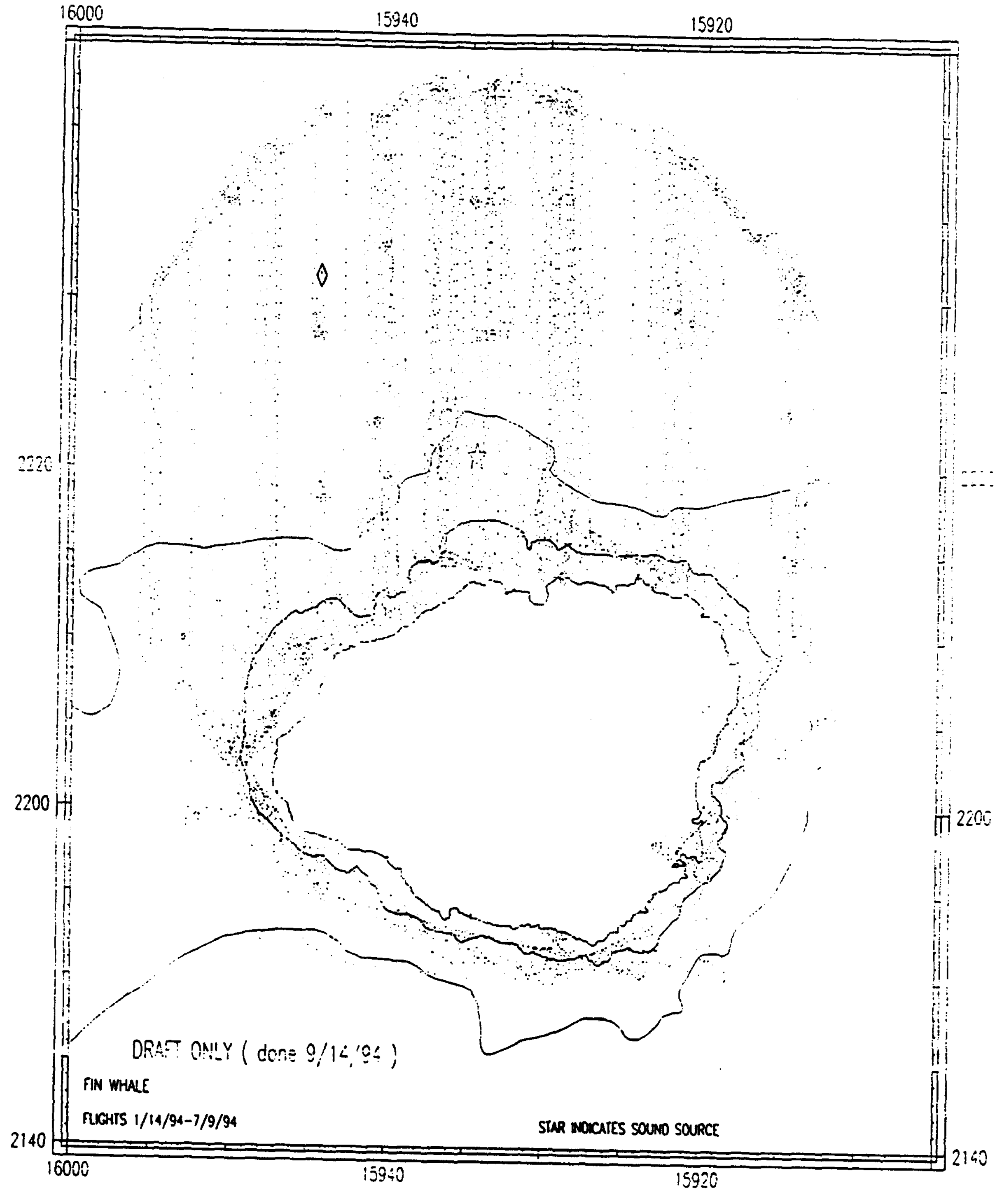
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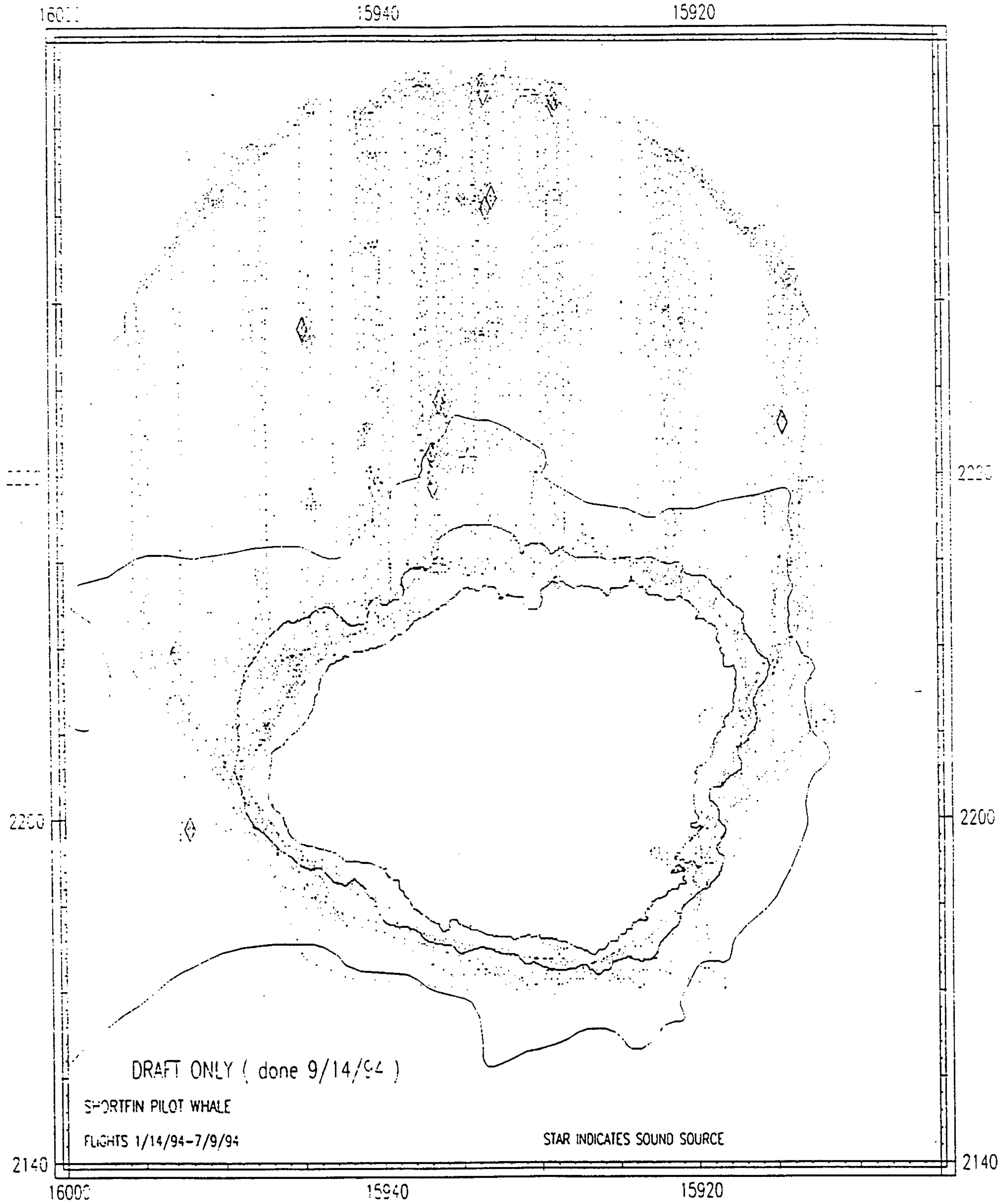
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2200
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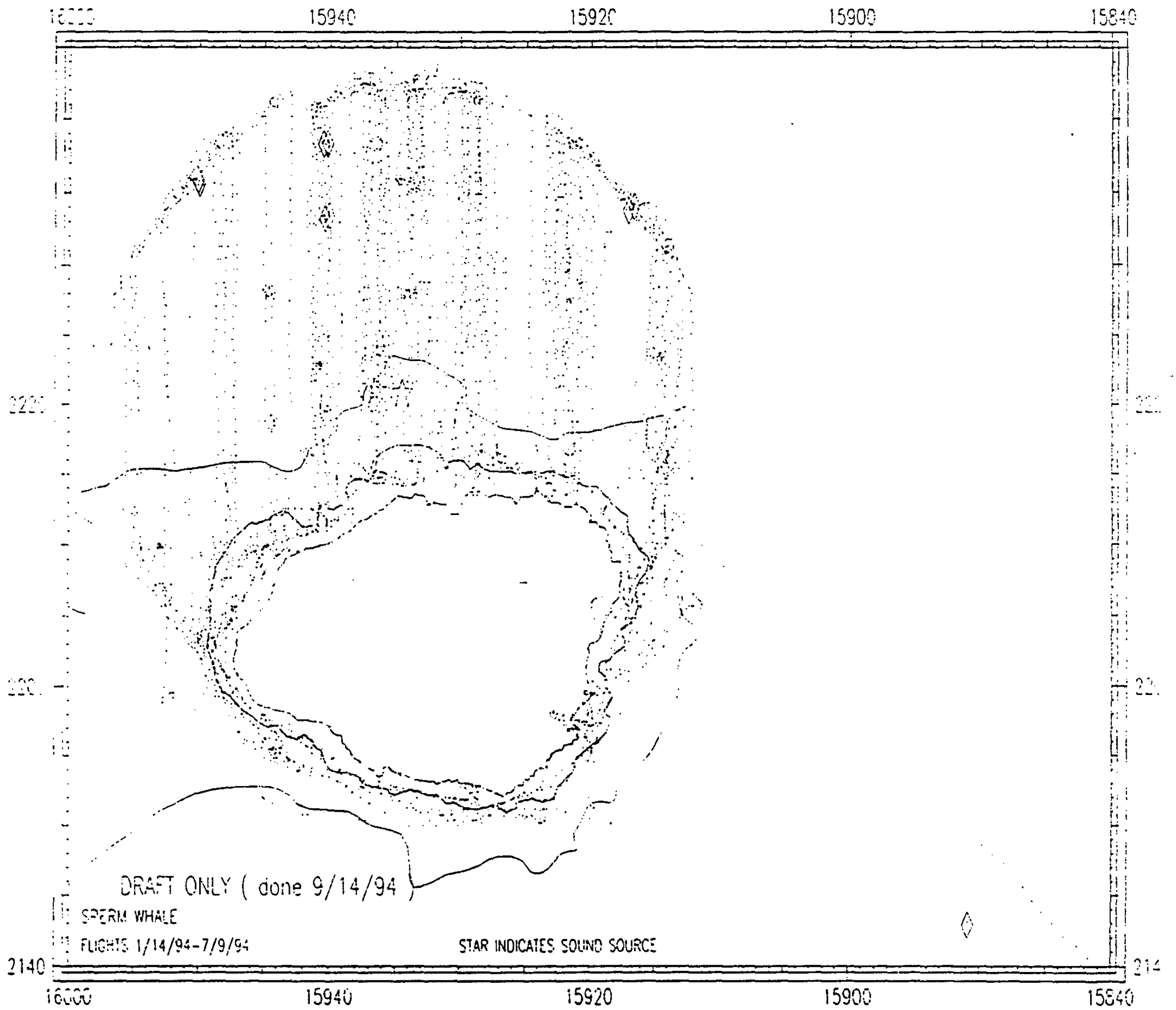
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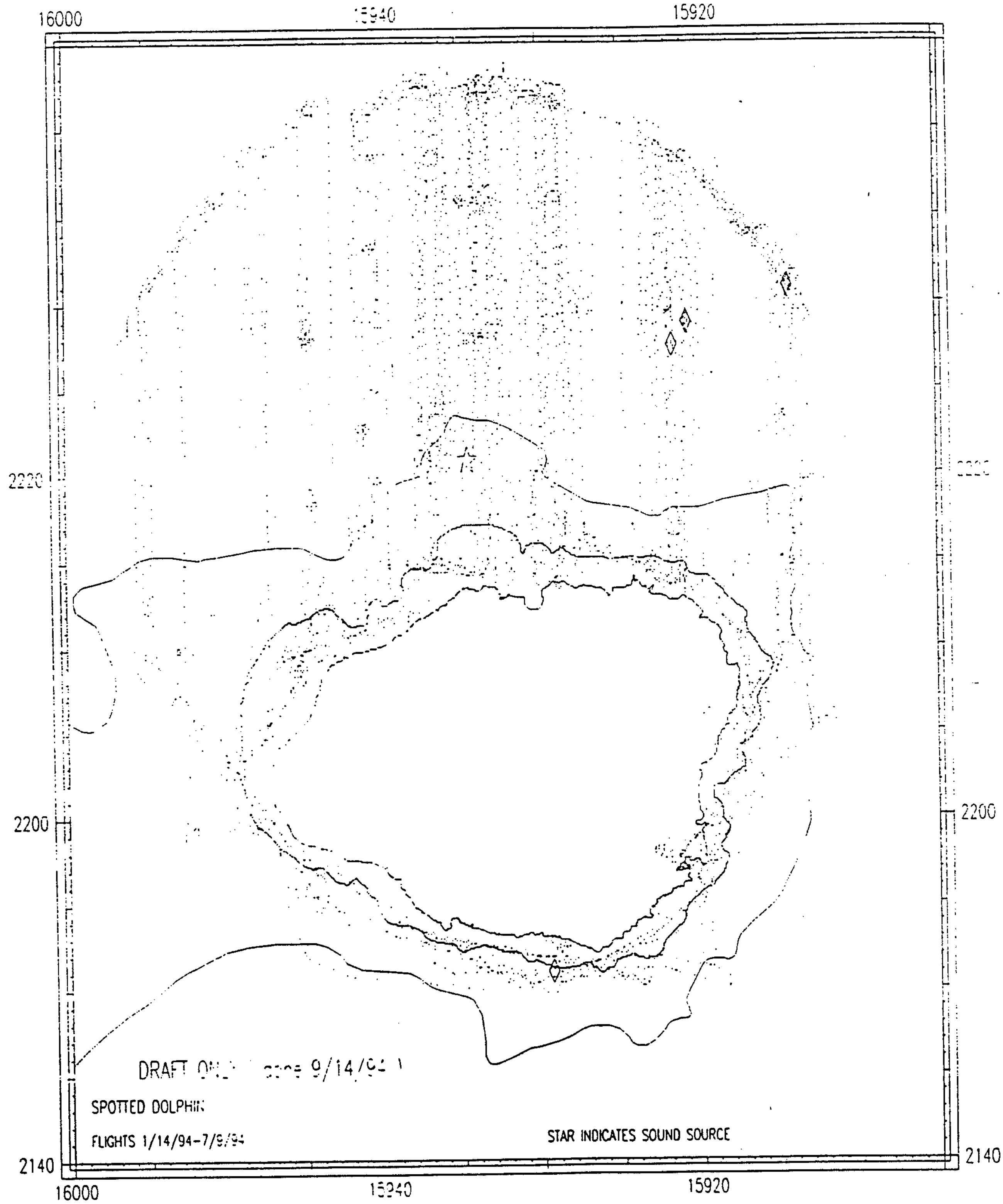

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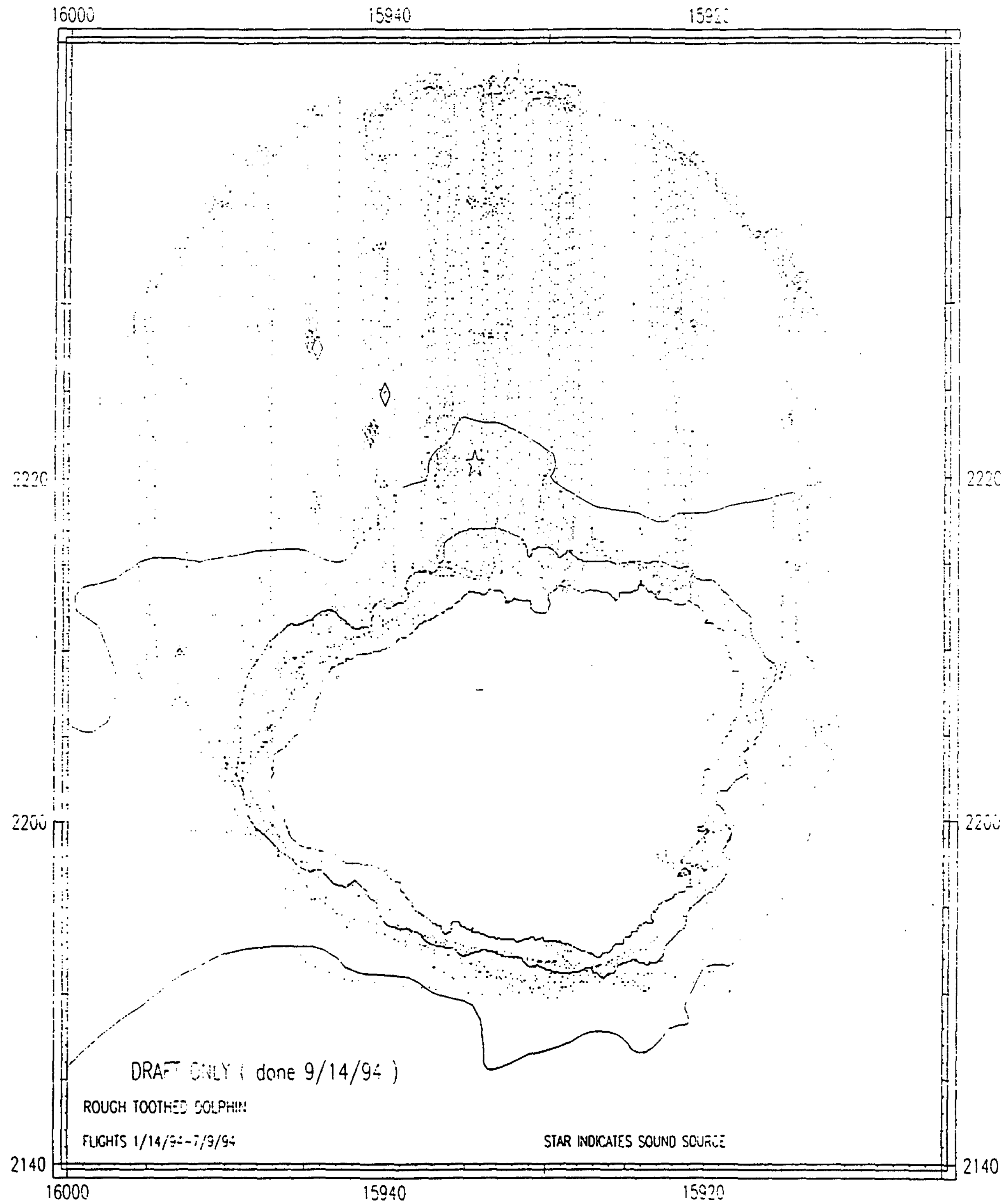
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FLIGHTS 1/14/94-7/9/94
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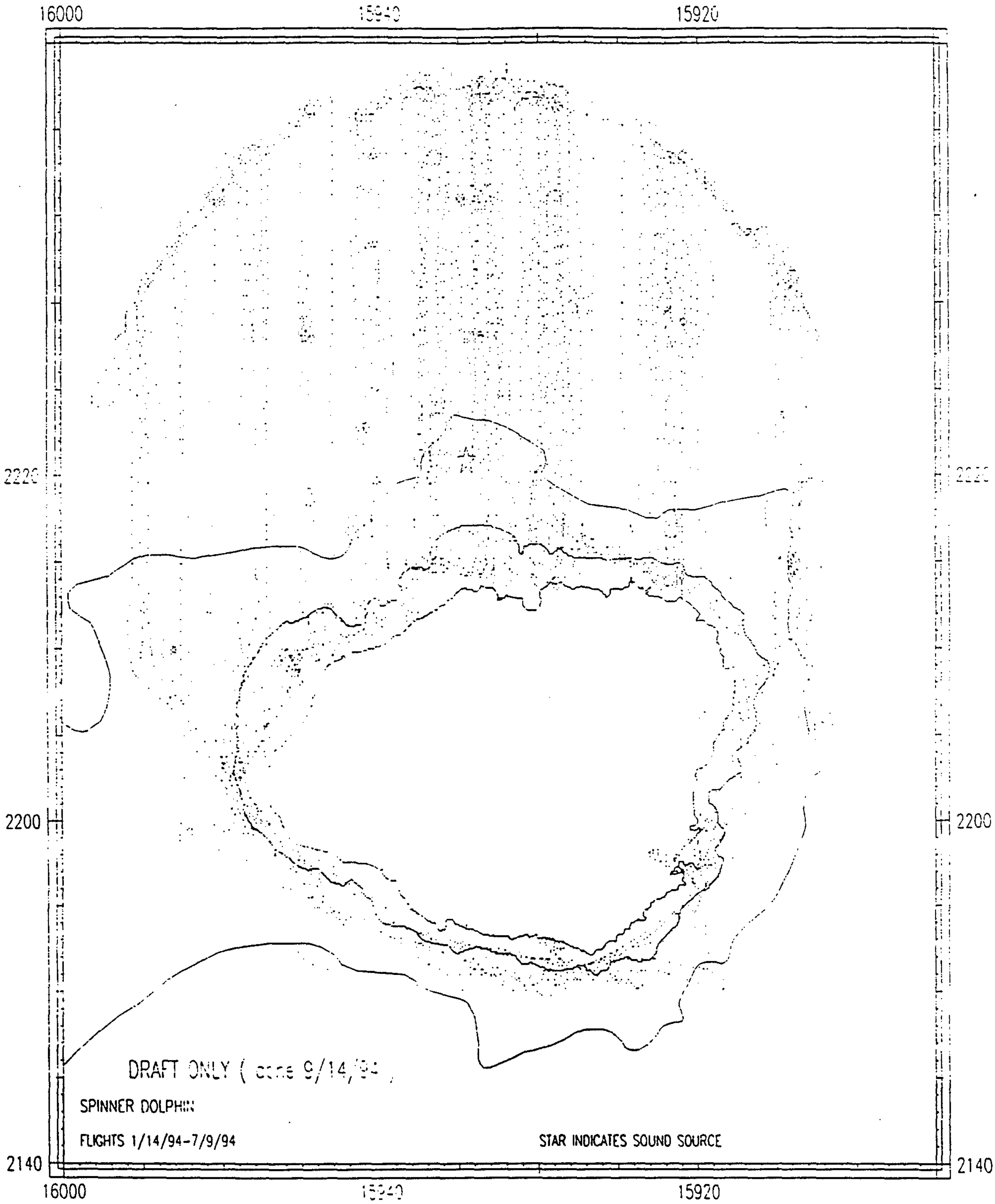

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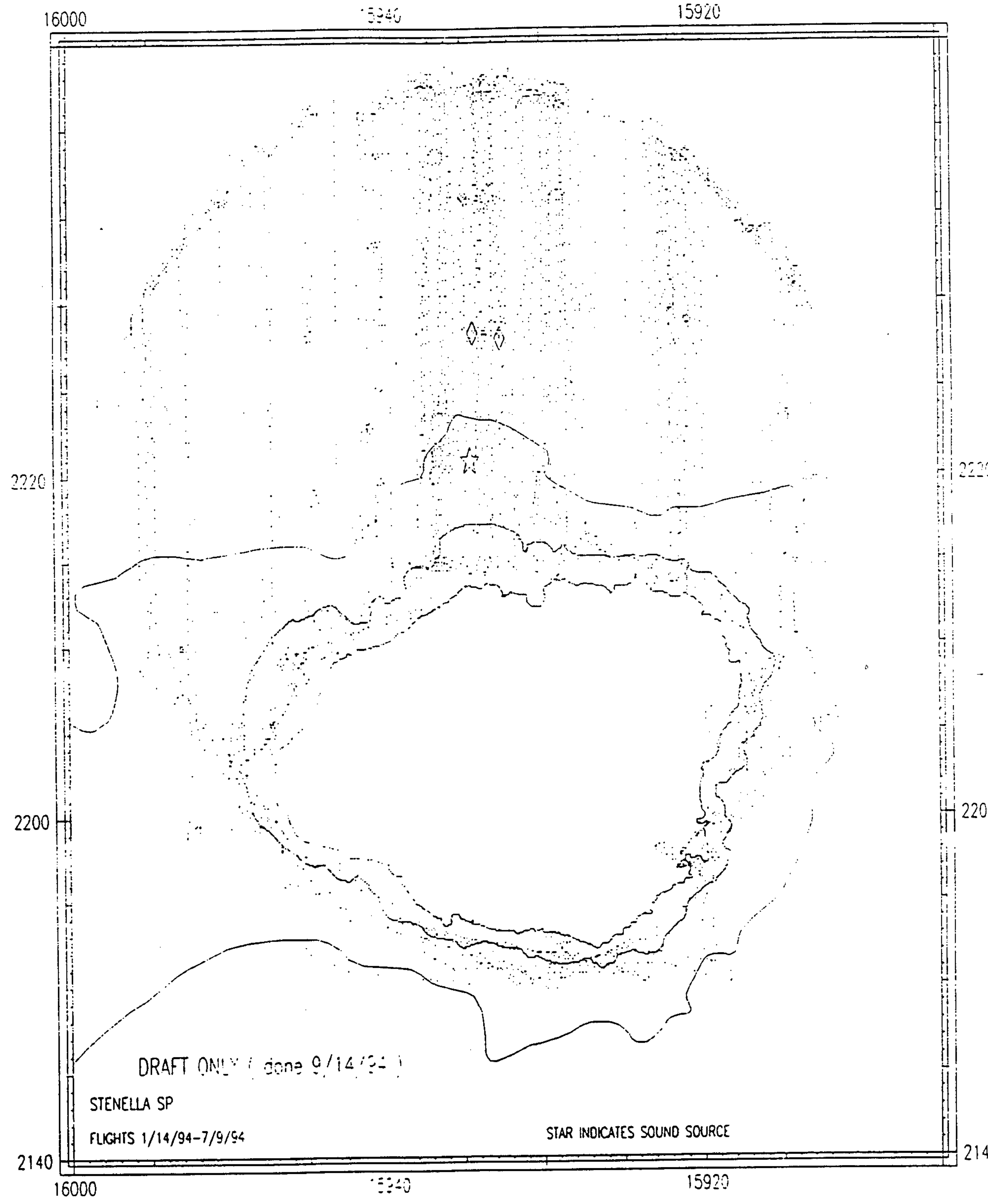
23



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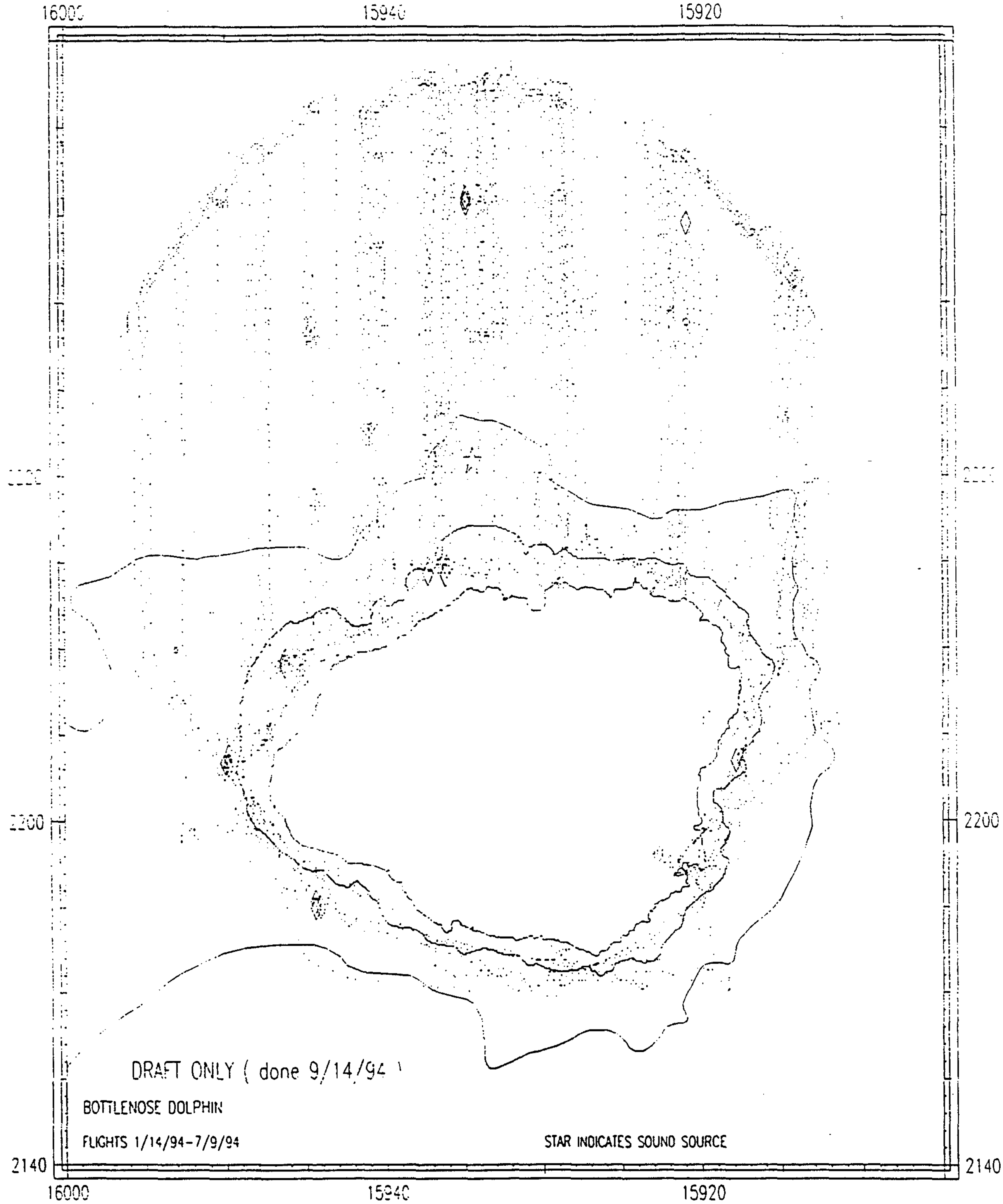

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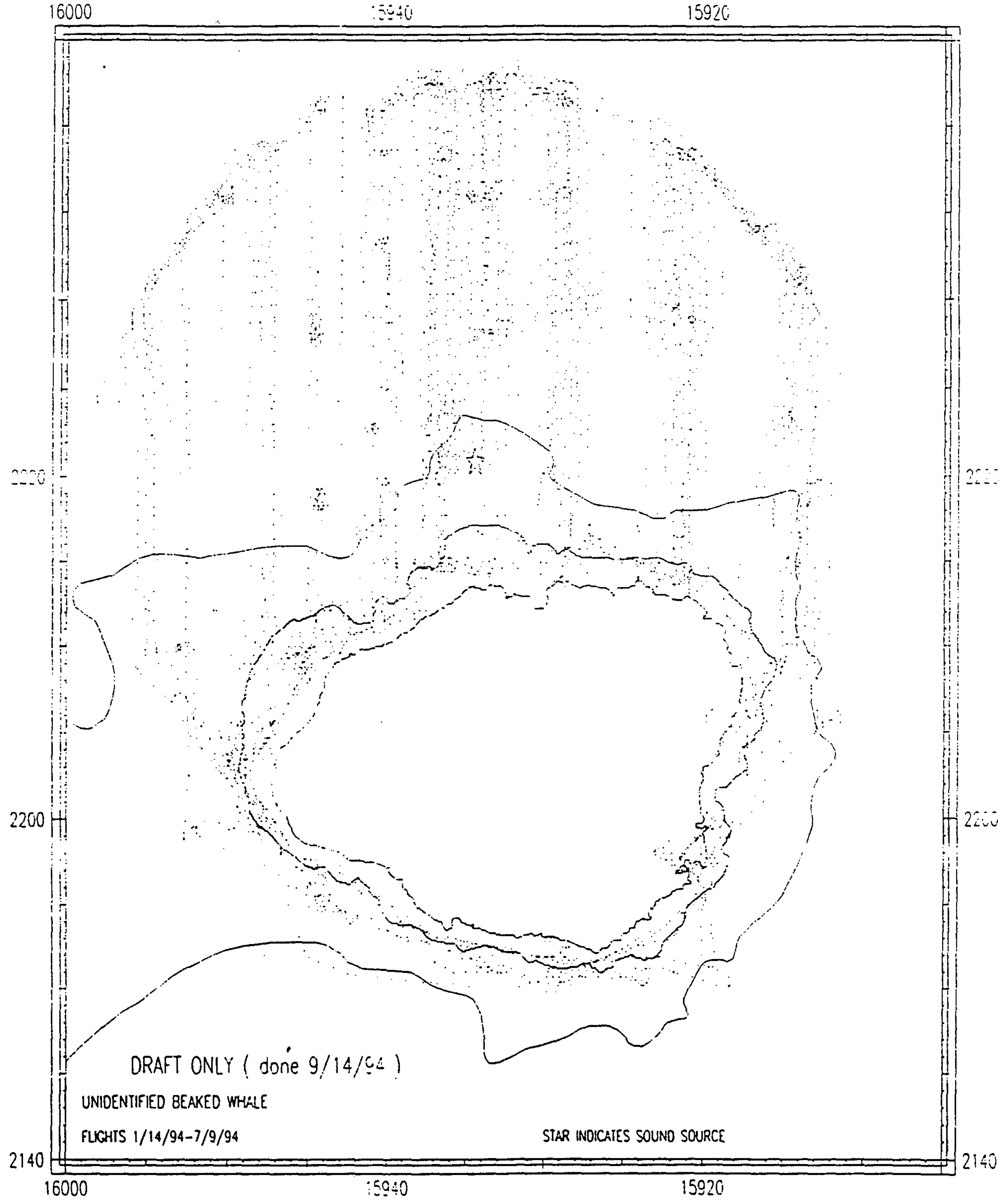
DRAFT ONLY (done 9/14/94)
BOTTLENOSE DOLPHIN
FLIGHTS 1/14/94-7/9/94
STAR INDICATES SOUND SOURCE

25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15940
15920
2200
2140
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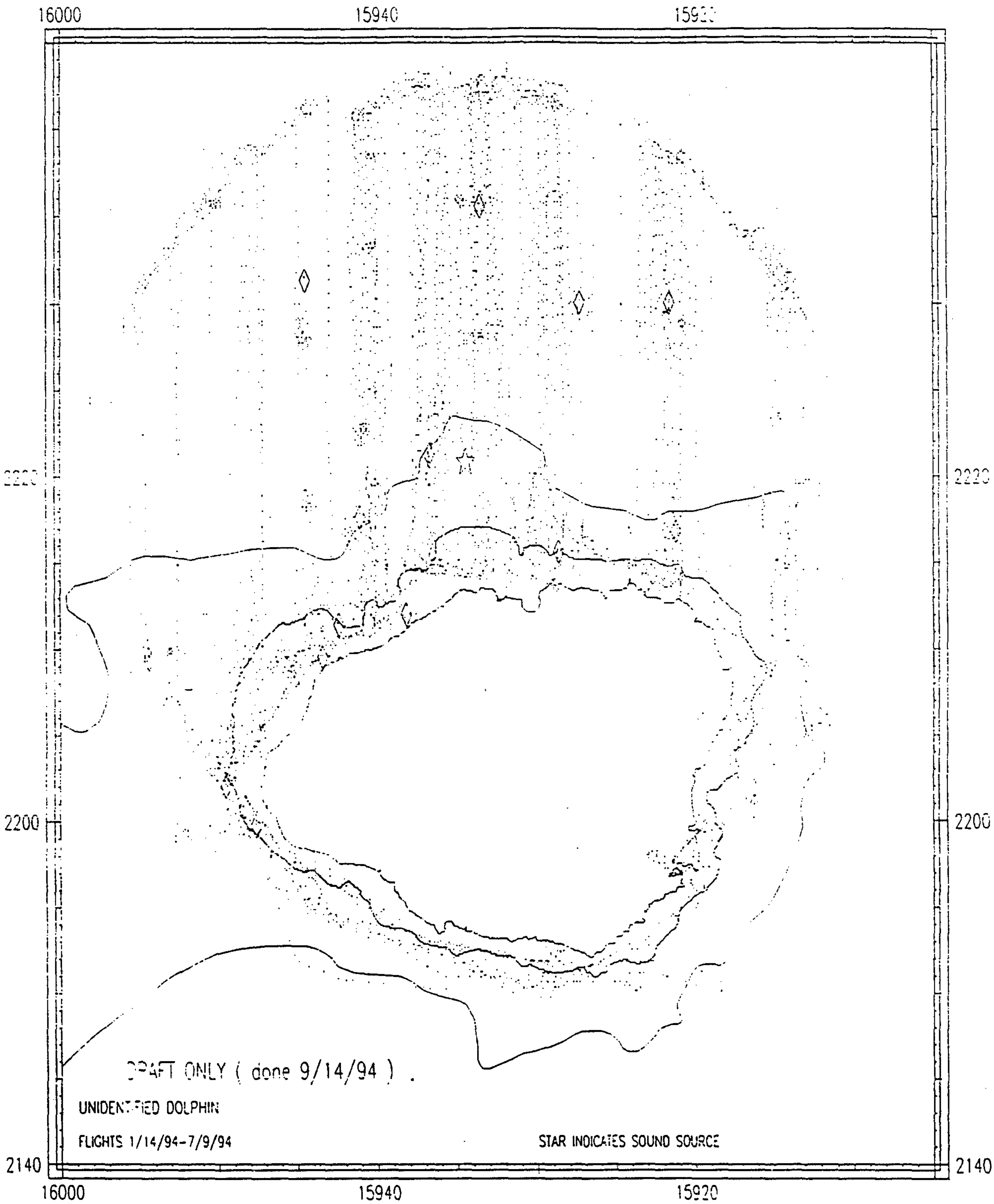
UNIDENTIFIED BEAKED WHALE
FLIGHTS 1/14/94-7/9/94
STAR INDICATES SOUND SOURCE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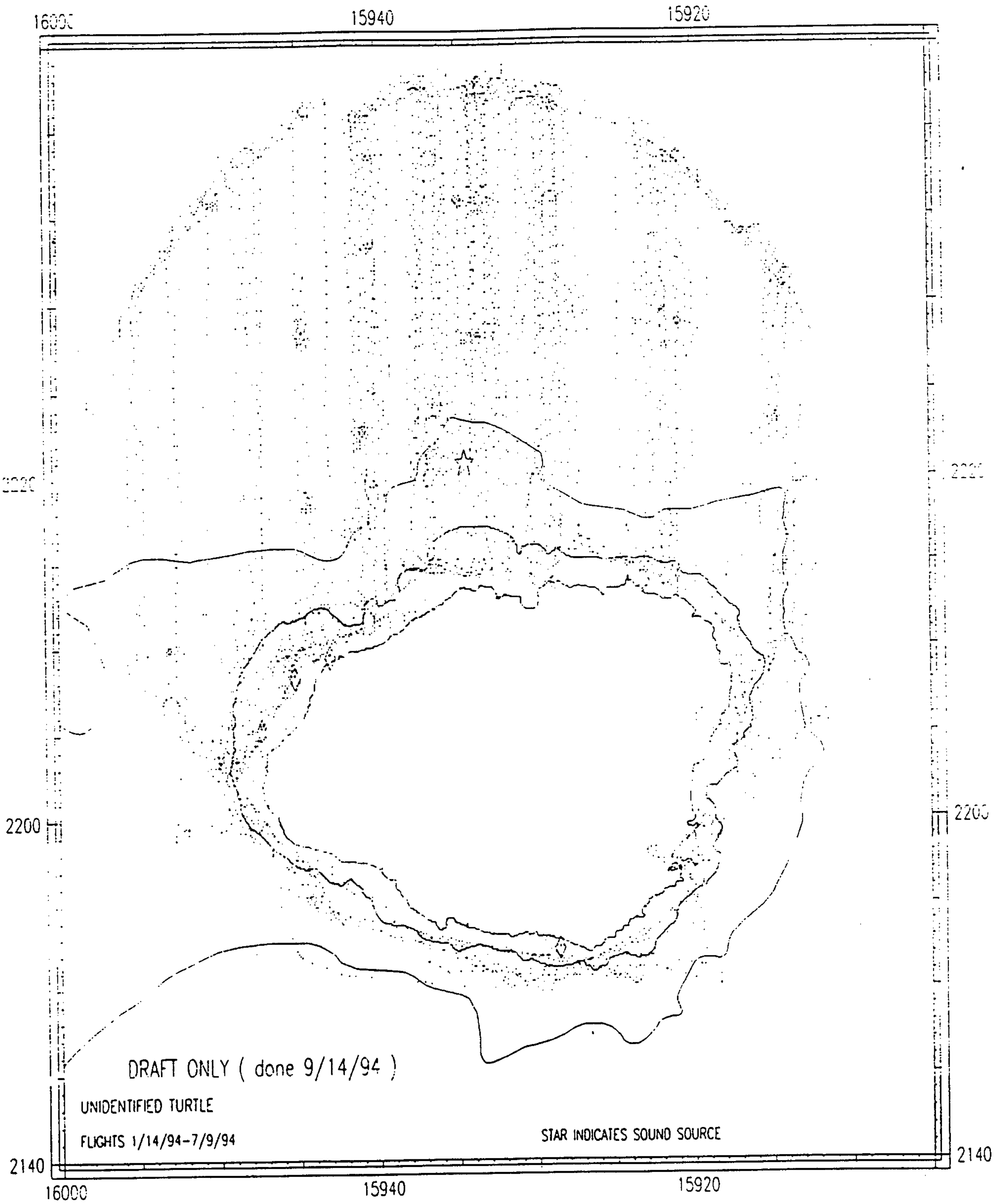
UNIDENTIFIED DOLPHIN
FLIGHTS 1/14/94-7/9/94
STAR INDICATES SOUND SOURCE


16000
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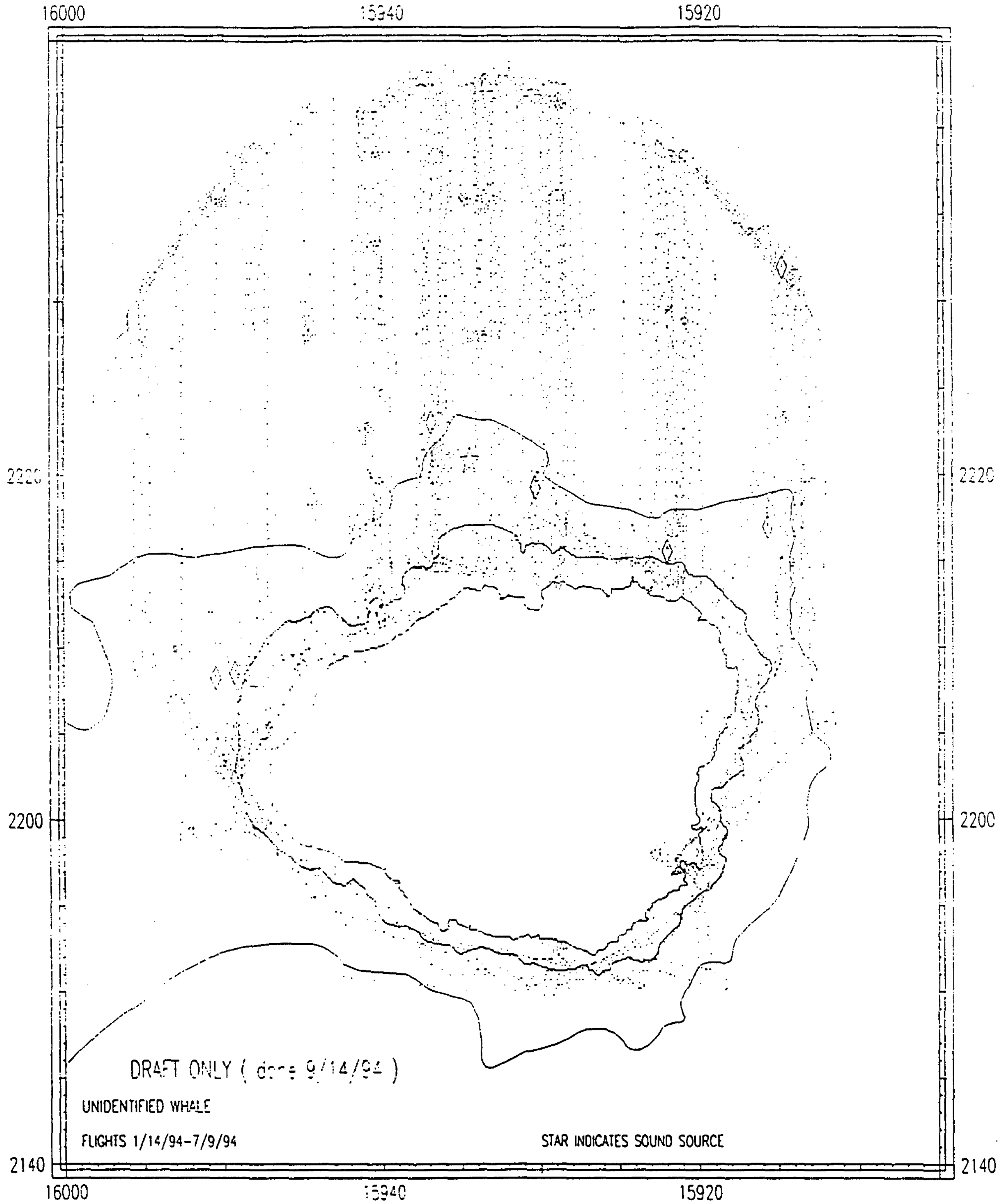
FLIGHTS 1/14/94-7/9/94
STAR INDICATES SOUND SOURCE


16000
15940
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DRAFT ONLY (done 9/14/94)
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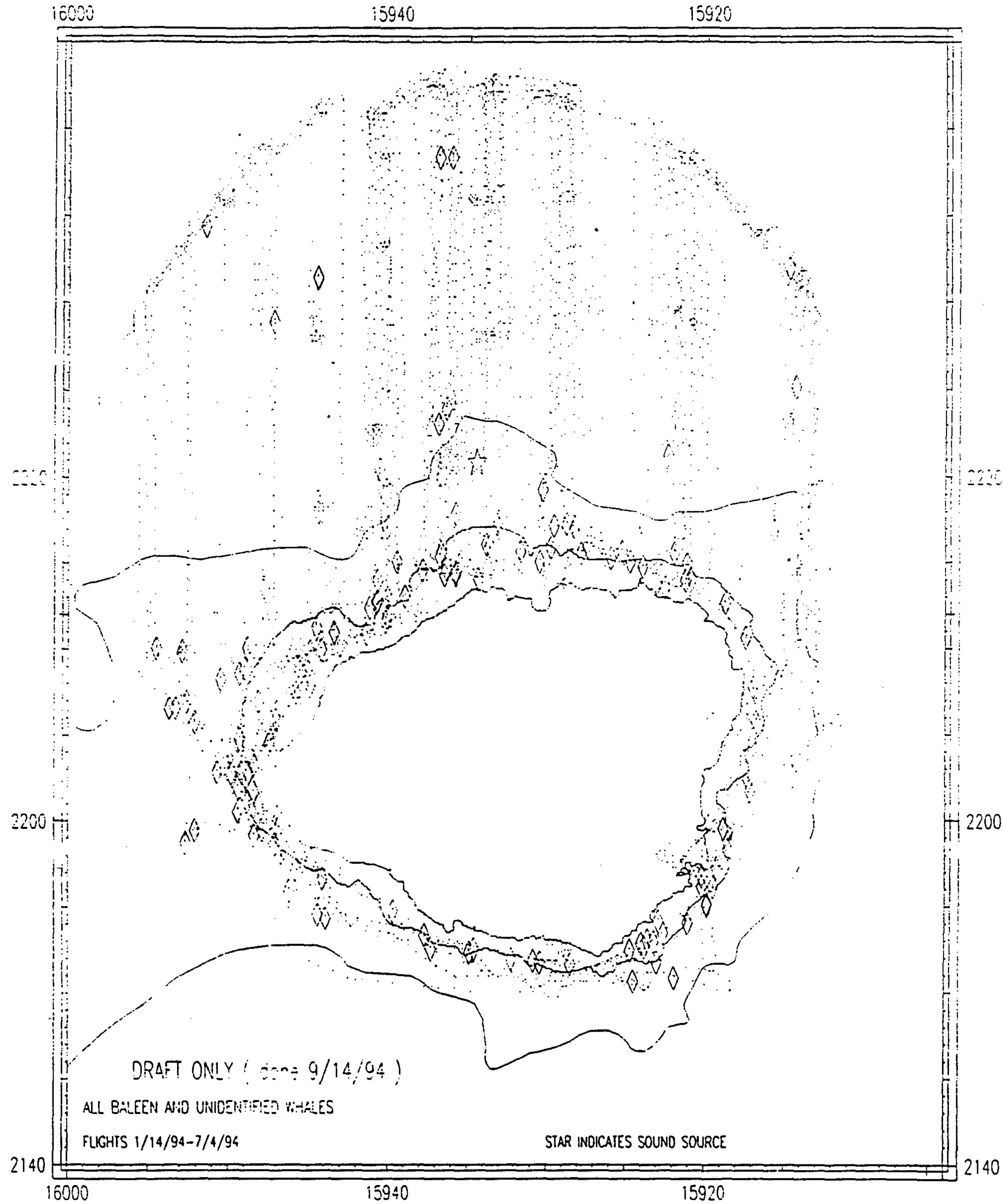
FLIGHTS 1/14/94-7/9/94
STAR INDICATES SOUND SOURCE
2140
2140
16000
15940
15920


16000
15940
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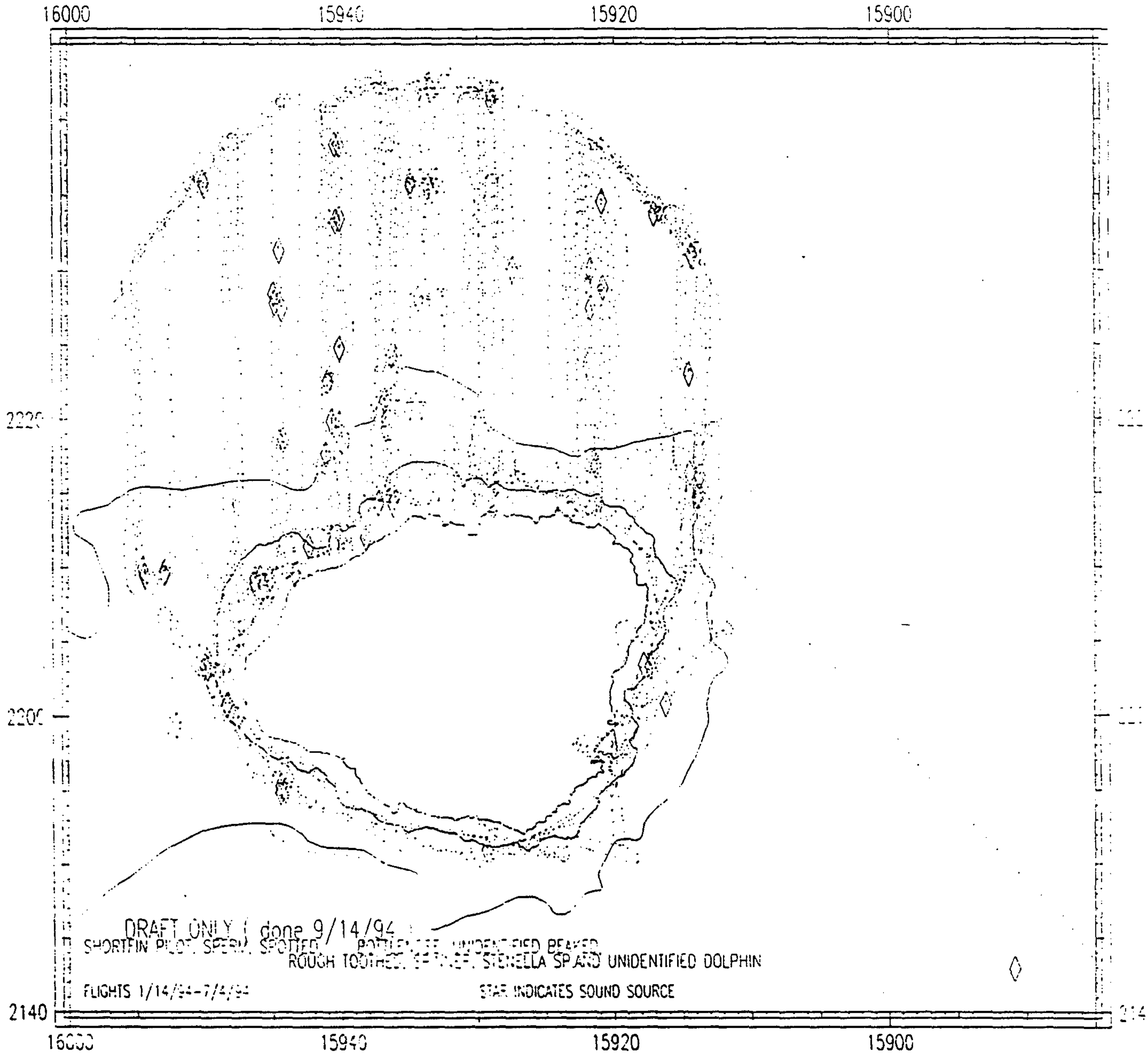
2200
2140
DRAFT ONLY (done 9/14/94)
ALL BALEEN AND UNIDENTIFIED WHALES
FLIGHTS 1/14/94-7/4/94
STAR INDICATES SOUND SOURCE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DRAFT ONLY (done 9/14/94
UNIDENTIFIED DOLPHIN
FLIGHTS 1/14/94-7/4/94
INDICATES SOUND SOURCE
16000
15940
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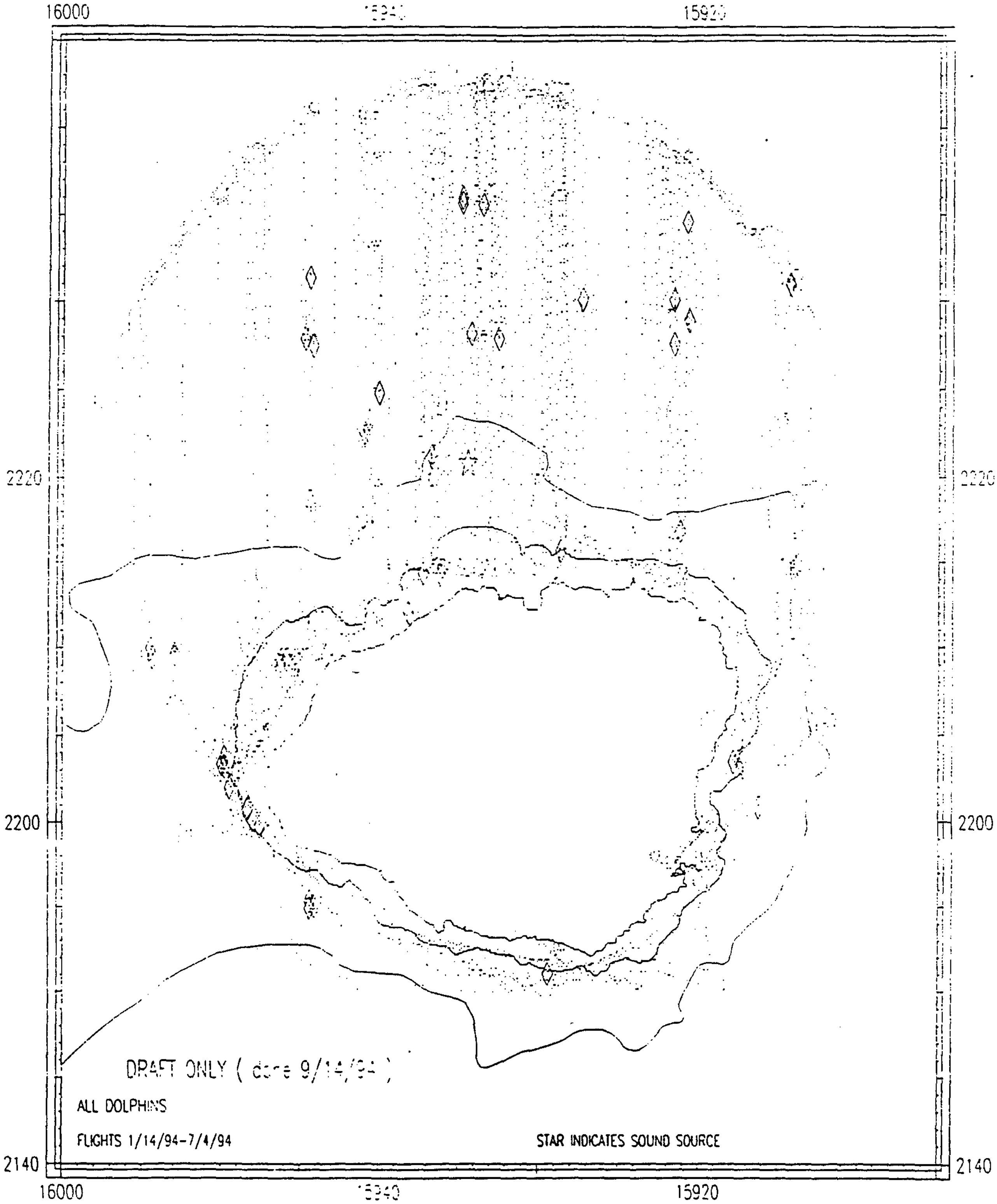
16000
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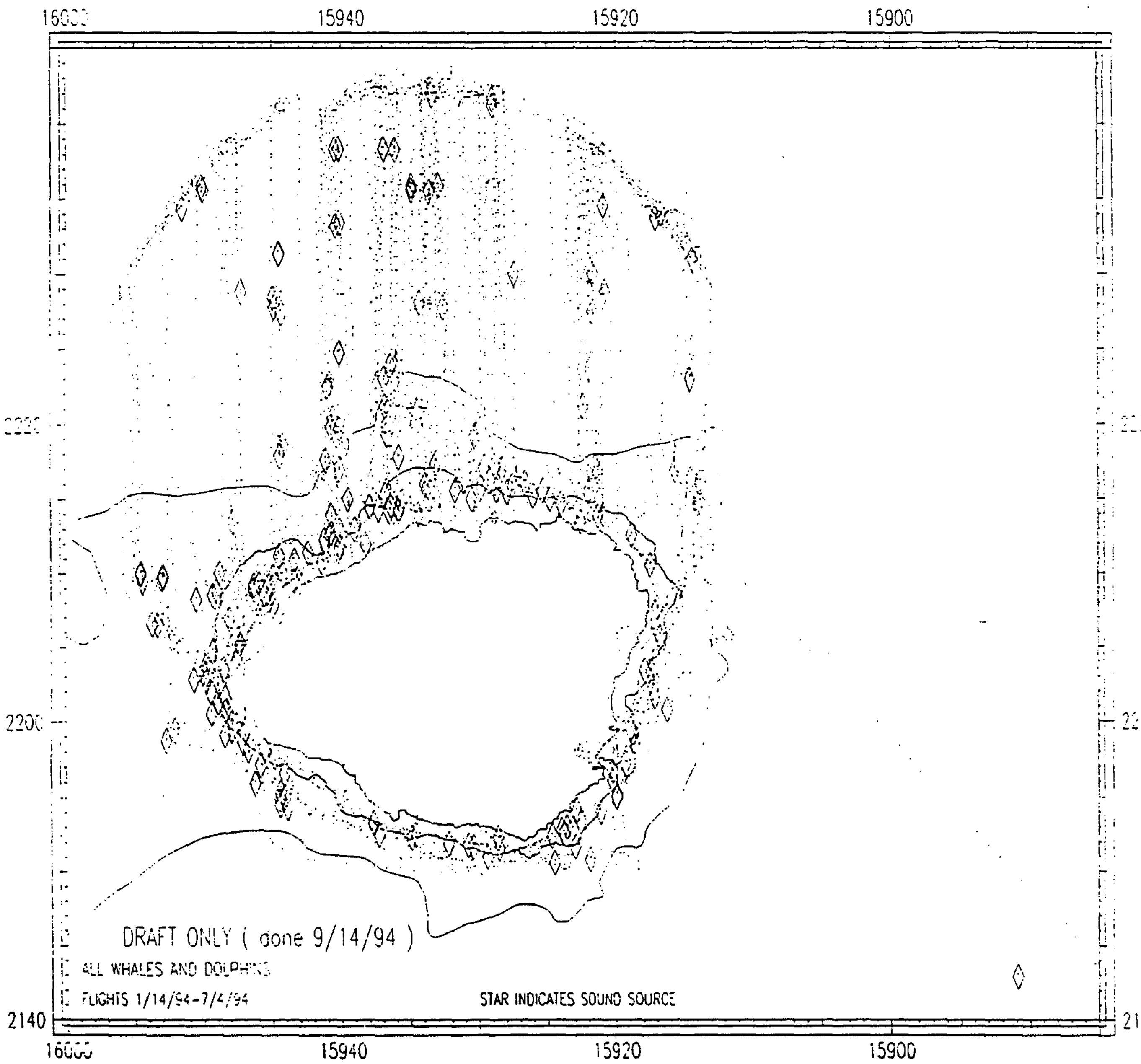
DRAFT ONLY (done 9/14/94)
ALL DOLPHINS
FLIGHTS 1/14/94-7/4/94
STAR INDICATES SOUND SOURCE


16000
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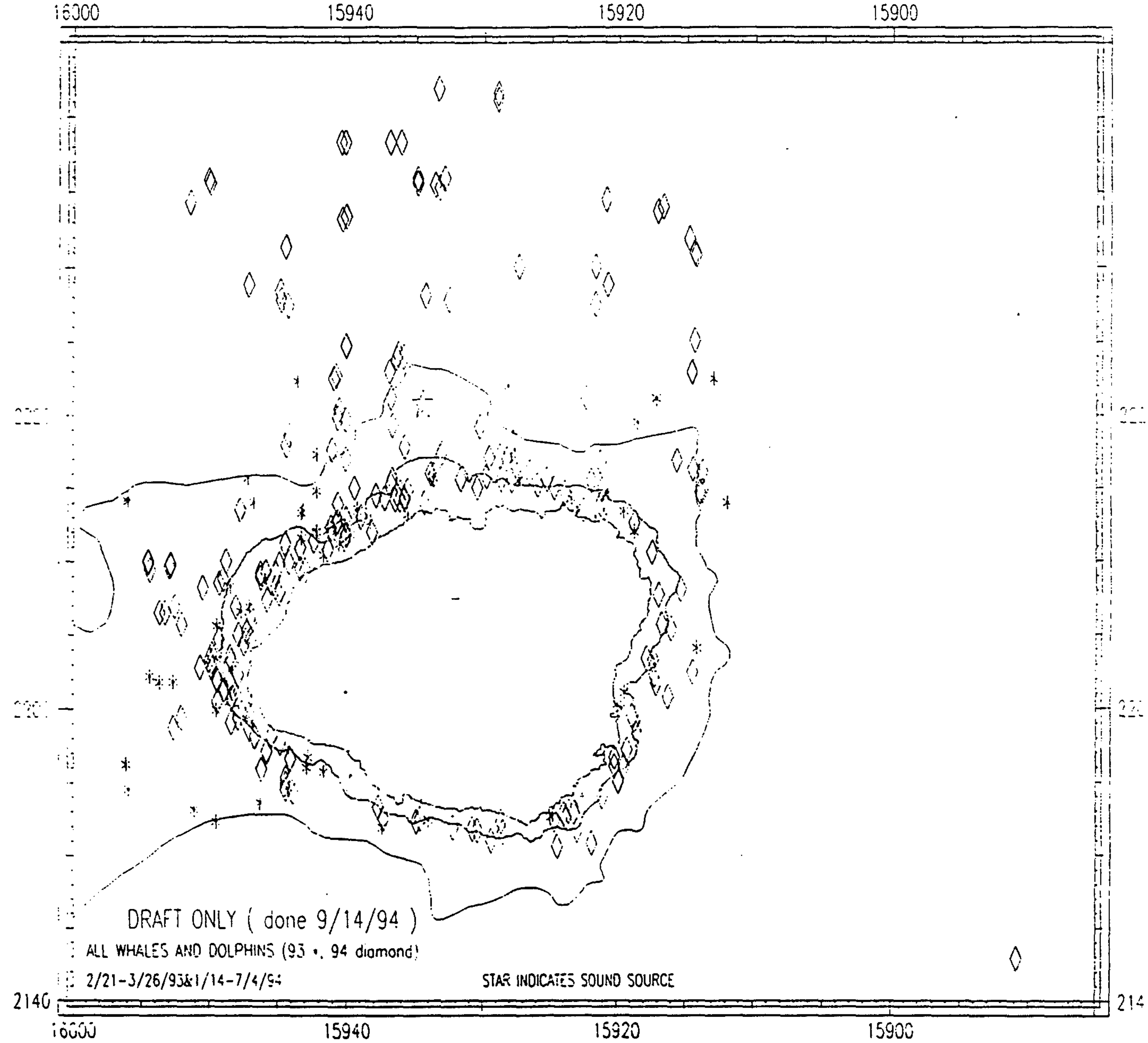
2140
DRAFT ONLY (done 9/14/94)
ALL WHALES AND DOLPHINS
FLIGHTS 1/14/94-7/4/94
STAR INDICATES SOUND SOURCE
16000
15940
15920
15900



15940
15920
15900
2140
DRAFT ONLY (done 9/14/94)
ALL WHALES AND DOLPHINS (93 •, 94 diamond)
2/21-3/26/93&1/14-7/4/94
STAR INDICATES SOUND SOURCE

RESULTS OF TRACKING, BEHAVIORAL OBSERVATIONS, AND SCAN SAMPLING FROM NORTH AND SOUTH SHORE STATIONS, KAUAI 1993.

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I. Introduction

During 1993, the shore-based portion of the study consisted of (1) focal pod samples to determine baseline behavior patterns of humpback whales before ATOC transmissions, (2) scan samples to assess the flow of whales passing by the shore station and the numbers of other disturbances present, principally vessel and helicopter traffic. Observations were conducted primarily from two stations located on the north and south shores of Kauai. This design was selected to provide baseline observations from the area to be ensonified during 1994 off the north shore of Kauai and from an area in the acoustic shadow of Kauai.

II. Methods

Study area and observation dates

The southern observation station was located approximately 3.5 km east of the Port Allen harbor near the McBryde Sugar Mill at 21°53'20" N and 159°33'31" W on a rock cliff at a height of 42.2 m (#12; Figure 3-1). This was judged to be the only area within the acoustic shadow of Kauai sufficiently high and close to the water's edge to allow detailed behavioral observations and precise theodolite tracking of whales. Locations on the north shore were selected based on proximity to the proposed ATOC source location, cliff height, and range of view. The primary observation station at the north shore was located along a trail approximately 1 km west of the Kalalau trailhead at 22°13'04" N and 159°

35'13" W on a rock cliff at a height of 139.8 m (#15; Figure 3-1). However, three other observation stations were initially used at the north shore for the following reasons: (1) the proposed location of the ATOC source changed during the observation season, (2) two observation teams briefly operated on the north shore due to initial logistical constraints, and (3) observations had to be made at several locations before a suitable site was selected. The second site was located in Princeville immediately east of the Princeville Makai Golf Course at the end of Punahele Road (22°13'47" N and 159°29'13" W) at a height of 47.2 m (#11; Figure 3-1). A third site was located at the Kilauea Point lighthouse at a height of 53 m (#14; Figure 3-1). The fourth site was also located in Princeville approximately 2 km NNE east of Hanalei Bay at Pu'u Po'a near Hanalei Bay Villas at an approximate height of 40 m (#13; Figure 3-1).

Station heights were determined by using the theodolite to take vertical readings of targets of known height and subsequently applying trigonometric calculations. Cliff heights at the south shore station and the north shore Kalalau station were determined by making repeated (> 30) theodolite readings (from the station) of the top and bottom of a vertically leveled stadia rod of known height located at sea level, and entering the mean reading into a computer program which calculated station height ("Pole" program compiled by A. Frankel, University of Hawaii, Manoa, 1989). The height of the Princeville Makai station at the north shore was determined by taking a vertically leveled theodolite reading of a stadia rod located on a charted landmark (a fire hydrant) of known height at a distance of <100 m from the shore station. It was not necessary to determine the exact heights of the Kilauea and Pu'u Poa stations because the theodolite was not used from there.

Shore-based observations were conducted between 30 January and 16 April 1993. Observation dates and effort are presented in Table 3-1. On the south shore station, observations were conducted between 30 January and 15 April for a total of 40 days. Observations from the Kalalau north shore station occurred on 34 days between 15 February and 16 April. Observations at the Princeville Makai Golf Course site occurred on 11 days between 4-18 February. Two and one observation days were conducted from the Kilauea Lighthouse and Pu'u Po'a, respectively, during February.

The study arena for focal behavior observations and scans was a circle with a radius of 4 km centered on the observation station. However, focal pods were sometimes tracked up to approximately 6 km from shore, dependent on observation conditions (e.g., Beaufort wind condition, visibility, swell), particularly at the Kalalau Trail site, which afforded a greater view due to its higher elevation. Non-focal pods and vessels were tracked up to 8 km from shore, dependent on observation conditions.

Apparatus

A surveyors's theodolite (Lietz/Sokkisha Model DT5A, 10-second-precision, 30-power magnification) was used to track pod and vessel locations as described by Tyack (1981) and Würsig *et al.* (1991). The theodolite measured horizontal bearings and vertical angles of target locations in degrees, minutes, and seconds. Horizontal bearings were referenced to magnetic north with a relative angle set consistently on a charted land mark. Vertical angles were referenced to the gravity-based leveling device on the theodolite. Subsequent analysis converted these angles into Cartesian coordinates for calculation of speed and direction of travel, with correction for curvature of the earth and theodolite height, the latter being measured each day from a set ground-marker. Since the fluctuation in tidal height off the Hawaiian coast is less than 30 cm, the minimal resultant error was ignored (Bauer 1986). Theodolite-measured target positions (fixes) were taken when the cross-hairs within the scope of the theodolite were positioned at the waterline of the target. To control for error, the horizontal and vertical reference points were checked approximately every 15-30 minutes and were reset if out of vertical balance or if off by greater than one minute of horizontal arc. Theoretical accuracy of theodolite measurements at distances of 4 and 8 km from the primary land stations are presented in Table 3-2, as is the potential error associated with a swell height of 2 m.

Fujinon (7 x 50) or Steiner (15 x 80) binoculars equipped with reticles and a built-in magnetic compass were the primary binoculars used to observe whales. Reticles were used to gauge distance of whales from the land station based on a formula using known height of observation platform and associated distance to the horizon (Dalheim *et al.* 1992). Time-event recorders (laptop field computers), which automatically assigned a real-time flag to each computer entry, were interfaced with the theodolite and were used to record behavioral codes and theodolite fixes. Three field computers were used during 1993: Toshiba T-1000, Tandy TRS-102, and Tandy TRS-80. During the first month of observations, two field computers were used at each station: one to record theodolite fixes and the second to record behavioral observations. This system was later replaced with one computer using a program which recorded both theodolite fixes and behavioral codes.

Data collection

Land-based observations were attempted every day, dependent on weather conditions. The observation crew generally consisted of three to four people: a primary behavioral observer, a theodolite operator, a computer operator, and a note-taker. When only three people were available, the computer operator also served as the note-taker. Environmental conditions were noted at least once an hour on the hour, or sooner if conditions changed. The following variables were recorded based on their occurrence within the 4-km radius of the arena (see Appendix A for definitions): cloud cover, visibility, Beaufort number, swell height, swell period, and glare. Observations were conducted primarily during a Beaufort wind condition of 4 (windspeed < 32 km/h, fairly frequent whitecaps) or less to permit detailed behavioral observations. However, observations were occasionally continued through a Beaufort 5 or 6 when whales could be tracked readily, e.g., when they were close to shore, to obtain the longest focal animal samples possible.

Focal behavior sampling

Focal individual and focal pod sampling was used to record humpback whale behavior. In this type of sampling, all behaviors of one pod were recorded for as long as possible (Altmann 1974). Data on individuals that could be distinguished reliably were recorded separately. Two or more animals swimming together were defined to be in the same pod if they were within 5 body lengths of each other and exhibited synchrony in behaviors such as respiration, surfacing, and diving. All non-calf whales were termed "adults", since it was not possible to differentiate subadults from adults consistently. A single animal was also referred to as a pod. It was generally not possible to distinguish individual animals from shore with the exception of single whales and calves. The selection of the focal pod was not random, but was deliberately biased toward small pods, pods containing calves, and pods close to the shore station. This facilitated the collection of accurate behavioral data, particularly respiration rate, which is regarded as an important index of disturbance (e.g., Bauer 1986, Baker and Herman 1989, Richardson *et al.* 1991). Moreover, small pods, especially those containing a calf, have been found to show more behavioral responses to disturbance than do larger pods (e.g., Bauer 1986).

Focal behaviors were tracked up to 6 km from shore, dependent on sighting conditions. Focal pod behaviors, including behavioral events and states (Altmann 1974), were classified according to an ethogram (Appendix A) modified from that of the Kewalo Basin Marine Mammal Laboratory (see for example Bauer 1986) and studies by Würsig *et al.* (1984) and Kieckhefer (1992). Specific behavioral events and states and associated information, were dictated by the primary behavioral observer and entered into the lap-top computer by the computer operator as 1-3 alphanumeric codes. The note-taker manually recorded any comments or observations (notes) which were necessary to describe events or highlight changes to be applied to the data during the subsequent editing phase.

An attempt was made to fix focal pods with the theodolite at least once per surfacing duration (as defined in Figure 3-2), or whenever a change in heading or speed occurred. The minimum time period between fixes was 45 seconds to minimize the possibility of obtaining spurious calculations of speed and/or direction as a result of increased theodolite and observer error (Bauer 1986). Pods, vessels, and aircraft were assigned chronological identification numbers, each with its own numerical identifier (e.g., pod numbers ranged from 501-550, while vessel numbers ranged from 901-950). Whenever pod composition changed as a result of an affiliation or disaffiliation, the pod was assigned a new identification number and was treated as a different pod with respect to behavioral observations. Selection of the new focal pod was noted manually by the note-taker and entered as a flag (header) into the computer.

Each focal pod observation was assigned a rating code to reflect the behavioral observer's confidence in and reliability of the data being collected (Appendix A). This rating code ranged from 1 (excellent respiration and behavioral data) to 5 (theodolite tracking only due to inability to reliably discern blows and behaviors). As a focal session progressed, the code changed to reflect changing conditions. The focal behavioral session was generally terminated when the focal pod left the study arena or when conditions were such that behaviors and/or respirations could no longer be observed reliably. However, theodolite tracking of focal pods often continued beyond the end of the behavioral observations.

In addition to whales, vessels were tracked by theodolite at all times, whether or not whales were present, to establish baseline information on occurrence of whales relative to occurrence of vessels and to describe general use of the study area by various vessel types. An attempt was made to track all vessels within 8 km of the land station with the theodolite, depending on visibility conditions, especially as they left or entered the observation arena. In addition, the following vessel descriptions were recorded: estimated length, type (fishing, dive, whalewatch, etc.), engine size/type if possible (inboard or outboard, twin-engine, etc.), any name or vessel registration number, color, and general descriptions that helped to differentiate vessels. It was assumed that whales > 4 km from small to medium-sized vessels (< 20 m long) were 'undisturbed' based on other studies (Bauer 1986; Baker and Herman 1989; Richardson *et al.* 1991). In addition, large vessels (>20 m long) were tracked up to 10-15 km from shore when possible because their underwater sounds travel farther. Humpback whales appeared to react to cruise ships up to 8 km away in other studies (Baker and Herman 1989).

An attempt was made to fix each vessel a minimum of three times as it passed within 8 km of the land station if it made no changes in direction or speed; stationary vessels were also fixed. Fixes were also attempted whenever a vessel changed orientation or speed, with priority given to those vessels nearest to the focal pod, particularly when within 1 km of the pod. In the latter case, fixes were attempted on the vessel each time the focal pod was fixed. In addition, vessel behaviors (e.g., changes in speed or orientation) were recorded and encoded on the computer for those vessels closest to the focal pod (generally < 1 km) and on any other vessels when feasible, again with priority given to those closest to the focal pod. The estimated closest point of approach (CPA) was also noted for any vessel approaching within 1 km of the focal pod, and both pods and vessels were fixed with the theodolite at this time when possible.

Scan Sampling

Scan sampling (Altmann 1974, Bauer 1986, Smultea 1991) was used to document sighting rates of whales. A position was obtained for every pod occurring within a pre-determined distance during a 15-minute period. Scans were designed specifically to determine relative sighting frequency of whales, pods and vessels within a defined arena (within 4 km of the shore station for whales and within 6.5 km for vessels [after Bauer 1986]), time of season, time of day, Beaufort number, pod behavioral state and pod orientation.

Scan samples were interspersed between behavioral observation sessions; thus, they did not begin precisely at the same time each day. Scans were conducted once during each of the following 1-hr block periods: 0800-0900, 1000-1100, 1200-1300, 1400-1500, 1600-1700. Scans were spaced at least one hour apart to minimize recounting the same individuals. Studies suggest that humpbacks are transient in Hawaii, predominantly traveling in apparent local migratory movement at a mean speed of 4 km/hr (Herman and Antinoja 1977, Baker and Herman 1981, Darling *et al.* 1983, Bauer 1986). Thus, scans were conducted at intervals assumed to be sufficient for most whales to move out of the scan arena.

Scans were conducted by the theodolite operator and the primary observer to maintain consistent effort. The primary observer scanned the arena (4-km radius) primarily with binoculars while the theodolite operator scanned primarily with the naked eye for a total of 15 minutes. A computer operator/notetaker(s) recorded data, but did not participate in scanning for pods. The following information was recorded for each pod sighted within the arena, based on theodolite and reticle (binocular) distance conversions made in the field: time of initial sighting, one theodolite fix (if this was not obtained, then the binocular reticle and bearing were recorded), pod size and composition, orientation, and behavioral state. An attempt was made to track pods until observers were confident of composition, although this was not always possible. When necessary, a 10-minute period after completion of the scan was used to verify pod composition. In addition, one position fix and a physical description of each vessel within 6.5 km of the shore station (Bauer 1986) were recorded prior to commencement of each scan. New vessels that entered the 6.5-km radius of the vessel arena during scans were also noted, and were fixed after the scan was complete. Initially, scans were conducted by three to five observers to maximize search effort; however, due to variability in the number of observers available each day, the protocol was modified after February 16 to limit scanning effort to two people (as described above) to standardize rather than maximize search efforts.

Non-focal pods were tracked opportunistically during focal pod sampling up to 8 km from the shore station, although detailed behavioral observations were not collected. The information gathered on non-focal pods was (1) location, (2) speed and orientation, and (3) general behavioral state. The theodolite operator attempted to fix non-focal pods once per surfacing duration, or at least when an obvious change in speed or direction occurred. Effort concentrated on monitoring pods as closely as possible to avoid mistaking them for nearby pods. However, this was not always possible during periods when many pods were in the arena, particularly when whales were affiliating and disaffiliating. Only those pods that could be tracked reliably were given pod numbers and notes were taken to indicate potential repeat sightings.

In addition to humpback whales, sightings of all other marine mammals and sea turtles were recorded. Fixes of all marine mammal pods were taken with the theodolite at least once.

Data analysis

Calculations: The following parameters were calculated to describe the tracks of whales (Malme *et al.* 1983): net speed, cumulative speed, milling (linearity) index, and net orientation (course bearing). Net speed was calculated by dividing the distance between the first and last point of a track or track interval (x_1, y_1 to x_n, y_n) by the time difference between the two points (t_1, t_n)

$$\text{Net Speed} = \sqrt{(x_n - x_1)^2 + (y_n - y_1)^2} \,/\, t_n - t_1$$

Cumulative Speed was calculated by accumulating the total length of the path taken by the track from beginning to end and dividing this length by the difference in times t_n and t_1.

$$\text{Cumulative Speed} = \sum_{1}^{N} \sqrt{(x_{i+1} - x_i)^2 + (y_{i+1} - y_i)^2} \,/\, t_n - t_1$$

Linearity index is a measure of the directness of the route taken by the whale from point (x_1, y_1) to (x_n, y_n).

Linearity index = Net Speed/Cumulative Speed

The linearity index is 1 if the net speed and cumulative speed are equal, that is, if the whale traveled in a straight line. The index approaches zero when a whale mills.

Net orientation denotes the bearing in degrees of a pod's overall track based on the angle between the first and the last positions of a pod. The angle is relative to an x-y coordinate system, with 0° corresponding to true north and the positive y-axis and 090° corresponding to the positive x-axis.

$$\text{Net orientation} = \arctan\,[(X_n - X_1),(Y_n - Y_1)]^{-1}$$

If the resultant angle is negative, then it is converted to a positive angle by adding 360 degrees (e.g., -090°+ 360°= 270°; formula developed by A. Frankel, University of Hawaii, Manoa).

Data Reduction: Initially, data were plotted and checked for normality. Detailed behavioral observations and theodolite position fixes of focal pods were used to calculate respiratory parameters (after Kieckhefer 1992; Figure 3-2),and speed and direction of travel. These dependent measures were compared using the following independent variables: (1) pod size and composition, (2) behavioral state, and (3) observation station.

Six respiratory parameters were calculated from the raw data on surfacings, blows, and dives: blow interval, surfacing duration, number of blows per surfacing duration, dive duration, blow rate during surfacing, and blow rate (Würsig *et al.* 1984; Dolphin 1987; Figure 3-2). Surfacing duration included the time whales were visible near the surface and all the surfacings with blow intervals of less than 60 s. A dive was defined as any blow interval greater than 60 s. The break-point at 60 s was chosen after examining the frequency distribution of pooled blow intervals for all age and sex classes of whales, which showed a distinct break-point in the range from 45-60 s. Posturing of the tail stock (arched peduncle or raised flukes) was not used as an indication of a dive due to its unreliable significance, especially with groups of 3 whales or more, and inconsistent sighting conditions from shore-based stations.

For focal pods with more than one whale, blow intervals could not be determined from the shore. The average number of blows per surfacing was calculated as the total number of blows divided by group size. Surface duration was terminated by a submergence with a blow interval exceeding 60 s. The first exhalation after this submergence (dive) marked the beginning of a new surface duration, thus starting the surface-dive cycle over again. Surface and surface-dive blow rates were calculated as the number of blows divided by surface duration and the number of blows divided by the sum of the surface duration and the succeeding dive duration, respectively.

Analysis: At the time of this report, results are limited to summary statistics and preliminary comparative statistics. Non-parametric tests used in the analysis included the Mann-Whitney U, the Kruskal-Wallis ANOVA by ranks, and the X^2 goodness-of-fit test. Parametric tests consisted of univariate and multivariate analysis of variance (ANOVA and MANOVA). The X^2 heterogeneity test was used to determine whether net orientation in degrees magnetic was randomly distributed, after breaking the data into 45-degree intervals (Zar 1984).

Because parameters from successive surfacings were not independent data points, the "standard" approach that treats each blow interval, dive duration, etc. as an independent point (e.g., Dolphin 1987; Guerrero 1989; Harvey and Mate 1984; Würsig *et al.* 1984,

1986) was not used here. To obtain observations independent of the mean, the mean for each individual pod was calculated and input as the dependent variable for further analysis (Zar 1984; Hoeskstra and Jansen 1986, Kieckhefer 1992). Nonparametric statistics were used on all respiration variables analyzed due to their skewed distributions. Significance of differences between the north and south shore stations in mean blow interval, number of blows per surface duration, surface duration, dive duration, surface blow rate, and surface-dive blow rate were tested using the Mann-Whitney U. All tests used $p < 0.05$ as the criterion for significance.

All respiration analyses were conducted on pods consisting of one adult (singletons) and two adults (pairs), due to their relatively adequate sample size compared to the other group sizes (i.e., > 2 adults and pods with calves). Means of respiration variables were calculated for each behavior category except for rest, which was never observed for singletons or paired groups.

Analyses of net speed, cumulative speed, linearity index, and net orientation were limited to focal and non-focal pod tracks meeting the following conditions: (1) a minimum of three theodolite fixes in one or more surfacings, separated by at least 45 seconds; (2) swell height ≤ 2 m; and (3) occurrence within 8 km of the shore station.

For scan data, the dependent variable was the number of whales (or pods) sighted per hour. This number was obtained by multiplying the number of sightings per 15-minute scan by four. The resultant hourly sighting rate facilitated comparisons with other studies. The independent variables included pod size and composition, Beaufort number, fortnight of the year (the study period was broken into two-week periods based on the Julian calendar), time of the day, and shore station. Basic summary statistics were calculated for vessel and aircraft sighting rates during scans.

Hypothesis Testing: Forms of analysis of variance, repeated measures analysis of variance, and multiple regression analysis are proposed to compare behavior of known whale pods tracked during and between exposure to ATOC transmissions and other disturbances (vessel approaches, aircraft overflights, encounters with other pods). These analyses have not as yet been conducted, pending the development of software and the resolution of several important statistical issues, specifically (1) the degree of dependence among successive respiratory parameters (e.g., successive blow intervals; see pp. 33); (2) the desirability of using the means of variables for each pod in the analysis; (3) methods for calculating variances in cases where means are used in the analysis; (4) the effect of pooling data from a number of pods and behavior states on the analysis; and (5) the possibility of transforming variables so that parametric statistical tests can be used. These problems are discussed in more detail in Chapter 4.

The dependent measures entered into further analysis will consist of the following: (1) respiration parameters (6 variables), (2) cumulative swim speed, (3) index of linearity and rate of reorientation, and (4) scan sighting rate. The independent variables will consist of (1) transmission period (on versus off or pre-, during, and post-transmissions), (2) pod size/composition, (3) other potential disturbance (vessel or aircraft presence/absence and related measures (e.g., CPA, vessel-whale distance separation categories, time-related exposure categories), (4) presence/absence of other pods within a set distance, and (5) behavioral state.

III. Results

A summary of effort, including the total number of effort hours, focal pods, and scan sightings are presented in Tables 3-1 and 3-3. Figures 3-3 to 3-5 show the tracks of whales passing the stations at the McBryde Mill, Kalalau Trail and Princeville Makai golf course. A total of 346 h were spent at all shore stations, 139 h at the south shore station and 119 h on the Kalalau Trail. Approximately one-third of all available effort days were "weather" days when observations could not be conducted due to rain or high wind conditions. Such days occurred more frequently in March and April than in February. Study results are presented separately for focal whale/pod observations and scan samples.

Focal behavior sampling

A total of 185 focal pods were followed (Table 3-1), with twice as many samples collected from the north (n = 125) as the south shore (n = 60). The larger sample of focal pods from the north shore was attributed to initial logistical constraints. In addition, there were more pods in the northern arena than the southern at any given time based on the results of scan sampling (Table 3-3). However, the mean length of a focal session was slightly longer at the south shore (mean = 42.6 min) than the north shore (mean = 33.5 min). This difference was attributed to a higher rate of affiliations and disaffiliations at the north shore. Because a focal session ended and a new one began when pod composition changed, more affiliations/disaffiliations resulted in a greater number of focal sessions. Most (41%) of the focal samples at the north shore stations consisted of groups of 2 adults, followed by 1 adult (37%), > 2 adults (18%), and pods with a calf (4%; Table 3-1). The relative proportions at the south shore were similar except for groups of 2 (35%) and 1 (44%) adult(s).

Effort at the north shore was divided among four stations. However, the majority (64%) of the focal sessions occurred at the westernmost Kalalau station (site 15), where all north shore effort occurred after February 18. For consistency's sake, some comparisons between the north and south shores considered only the south shore data from the last two weeks in February through the end of the study period (4/15).

Among focal pods, 74% fit the definition of "undisturbed" (no vessels < 4 km from the pod at any time; Table 3-1) at the north shore, compared with 29% at the south shore. Only the undisturbed data were used in comparisons of normal behavior between the north and the south.

A behavioral "time budget" was determined by calculating the percent of total observation time that focal pods engaged in 5 behavioral states (Figures 3-6 to 3-10). When all pod types were combined (n = 111 h), results indicated that pods spent most of the time traveling on both the north and south shores (54%; Table 3-4). However, surface activity was observed more frequently from the northern shore stations (20%) than the southern (13%). Resting (3%) was observed only from the southern station and only among pods with a calf. Stationary behavior was twice as common on the south (28%) vs. the north shore (12%). There were also differences among pod types. Pairs predominantly traveled (66% and 80% at the north and south shores, respectively), while groups of > 2 adults exhibited the most surface activity (47% and 51%, respectively). Activity of various pod types also varied between the north and south shores. Calf pods in the south (n = 8) spent the majority of observation time stationary (56%) compared to 9% in the north (n = 17), where calf pods predominantly traveled (61%). Pairs milled 23% of the time at the north (n = 56) compared to 0% at the south shore station (n = 22).

Proportions of time spent in each behavior state differed among sites on the north side of the island as well as between north and south (Figure 3-6 and 3-7 versus Figure 3-8 and 3-9). At the Princeville Makai site (11), adults were stationary as often (28% vs. 28%) as at the south shore site and surface active as little (14% vs. 13%). The similarity must be interpreted cautiously because the Princeville Makai site was active only during the first fortnight in February. However, pods seen off Princeville Makai were stationary more often (28% vs. 4%) and surface-active less often (14% vs. 28%) than at the Kalalau Trail site. Surface active behaviors on the south shore were lower in the period when the Kalalau site was active (2/15 - 4/14) vs. the period before (7% vs. 13%; Figure 3-8 vs. 3-10; Table 3-4). All other states were equally common in the two periods at the south shore.

Rates of aerial activities for pods without a calf generally increased with Beaufort wind condition (Figure 3-11), with the exception of a drop under Beaufort 4 conditions, at both the north and south shore stations (Figures 3-12 and 3-13). The reasons for the drop under Beaufort 4 conditions are not clear, but some bias in effort is possible -- the sample of observations under Beaufort 4 and 5 conditions was small and aerial behaviors tended to occur in lengthy bouts. Aerial behaviors were observed less frequently from the southern versus northern sites (Figures 3-12 and 3-13; 13.6 h [20%] in the north vs. 2.5 h [7%] in the south).

<u>Respiratory Behavior</u>

Analyses of respiration parameters were limited to undisturbed singletons (n = 51) and pairs (n = 78). Tables 3-5 and 3-6 give the summary statistics for singletons and pairs, respectively. For the most part, there was no significant difference in the respiration parameters of singletons or pairs at the north versus the south shores based on a comparison of the means for each pod. The only significant difference between north and south shore respiration variables was in mean surface blow rate and surface-dive blow rate for singletons when whales were engaged in surface active behavior ($Z=2.17$ and $Z=2.54$; $P < 0.05$; respectively). The samples were small and the data were tested multiply, so these differences could have been the result of artifact. Figures 3-14 and 3-15 show the results of the comparison graphically, using the raw dive durations, surface durations, and number of blows per surfacing duration.

Respiration parameters appeared to vary with behavioral state, not unexpectedly: (1) dives were longest while pods were stationary, (2) number of blows per surfacing duration was lowest during travel, and (3) pods tended to remain at the surface longest while surface active. These parameters were most variable in the data from the north shore in the stationary and surface active states. Differences in respiration parameters among behavioral states have not been compared statistically as yet.

Scan Sampling

A total of 72 scans were conducted from the south shore and 84 scans from the north shore (Table 3-3). Some pods of one and two adults (18% of all pods) were observed once briefly, and their composition was not confirmed; in these cases, scan observers indicated a minimum number of whales for the pod. Thus, whale numbers may potentially be underestimated. Hence, scan sighting rates are presented both as the number of pods and whales sighted per hour. Minimum numbers of whales and pods are also reported in Table 3-3.

Approximately 74% of the north shore scans were conducted from the Kaḷalau station with the remainder conducted from the Princeville Makai station. However, the north shore data were pooled because it was felt that valid comparisons could not be made between the two stations due to seasonal differences: scans occurred exclusively at the Princeville Makai site until February 16, with the remainder conducted from the Kalalau site (Figure 3-16). Moreover, the two stations were within 11 km of each other (Figure 3-1). Nonetheless, there was no significant difference in the overall number of pods sighted/h between the two northern stations (Mann-Whitney $U = 586$, $Z = -1.01$, $P < 0.50$).

Kruskal-Wallis tests indicated no significant difference in the sighting rates of pods or whales with Beaufort wind condition < 6 at either the north ($H = 2.07$ and 1.53, respectively, $df = 4$, $P = 0.73$ and 0.81) or south stations ($H = 6.44$ and 6.60, respectively, $df = 4$, $P = 0.13$; Figure 3-17). Thus, all data collected under these conditions were included in the scan summary statistics. There was a trend for the sighting rate to decline at the south shore in Beaufort conditions > 2; however, due to the small sample size associated with Beaufort conditions 1 and 2, valid comparisons limited to these conditions were not possible.

The overall sighting rates of pods and whales were higher at the north shore than the south shore ($H = 12.61$ and 13.35, $df = 5$, $P = 0.027$ and 0.020). Moreover, sighting rates were consistently higher at the north versus the south shore during every fortnight except the period from 12 to 25 March (Figure 3-16). Sighting rates of pods and whales also varied significantly between fortnights at the north ($H = 12.96$ and 14.55, respectively, $df = 5$, $P = 0.024$ and 0.013) and south shores ($H = 11.12$ and 12.83, respectively, $df = 5$, $P = 0.05$ and 0.025). The peak sighting rate at the north shore occurred between 26 February and 11 March (8.0 pods/h, 18.0 whales/h), although there were two other peaks from 29 January to 11 February, and from 26 March to 8 April. The peak sighting rate at the south shore occurred between 12 and 25 March (5.6 pods/h, 11.2 whales/h), followed closely by the period from 26 February to 11 March.

The relative sighting rates of various pod compositions also varied by fortnight period (Figure 3-18). At the north shore, pods of 1 adult were observed most frequently early in the season (29 January to 11 February); pods of 2 and > 2 adults peaked during mid-season (26 February to 11 March), coinciding with the overall peak sighting rate; pods with a calf were not observed until mid-March and did not exhibit a detectable peak, as they were sighted relatively infrequently. At the south shore, peak sighting rates of all pod types except pods with a calf occurred from 26 February to 25 March, coinciding with the overall peak of pod and whale numbers. Pods with a calf were observed most frequently during the last fortnight of observations from 9 to 14 April.

Overall, the relative proportions of pod types sighted during scans at the north (n = 121 pods) and south (n = 75 pods) shores indicated that large pods occurred more frequently at the north shore, while pods with a calf occurred more often at the south shore (Table 3-3). Pods of > 2 adults comprised 18% (n = 21) of all pods sighted at the north shore compared to 10% (n = 7) at the south shore. Pods with a calf represented 4% (n = 5) of all north shore pods compared to 11% (n = 8) at the south shore. In contrast, the relative proportions of pods of one and two adults were similar at the north and south shores, with each pod type comprising approximately 40% of all pods observed.

Scan sighting rates were also examined relative to time of day (hour of scan; Figure 3-19). There was no significant difference in the number of pods or whales sighted/h by 2-h block at either the north or the south shores (H = 2.18 and 1.25, respectively, df = 4, P = 0.70 and 0.87). Sample sizes were too small to examine the potential interaction between time of day and fortnight period.

The number of vessels and aircraft occurring within 6.5 km of the shore stations was also counted during scans. Helicopters were sighted more frequently at the north (0.40 helicopters/scan) than the south (0.07 helicopters/scan) shore. Helicopters on the north shore were generally touring the Nā Pali coastline, although they occasionally circled whales as well; helicopters in the south were generally transitting the area. Vessels were sighted four times more frequently at the south (2.1 vessels/scan) compared to the north (0.50 vessels/scan) shore (Table 3-3). Vessels in the south generally passed through the study area, but did not approach or pursue whales, whereas many of the vessels in the north were whale-watching, and therefore approached or pursued whales closely. Figure 3-20 shows the relative numbers of vessels, helicopters and light aircraft sighted from north and south shore stations.

In addition to scans, the minimum number of whales passing within 8 km of the stations was estimated based on opportunistic sightings made throughout each day, accounting for possible recounts of the same individual or pod as much as possible (Table 3-7). However, effort during non-scan periods was not systematic. These estimates were consistent with the results of the scans. They indicated that the mean sighting rate was higher at the north shore (2.7 pods/h, 4.2 whales/h) than the south shore (1.7 pods/h, 2.9 whales/h). Due to reduced effort, these sighting rates were less than the mean sighting rates calculated for scans at the north (5.6 pods/h, 11.0 whales/h) and south (4.5 pods/h, 8.1 whales/h) shores.

Pod speed and orientation

Analyses of theodolite data are limited at this time, pending completion of software to calculate pod and vessel separation distance and various other statistics. The tracks of 66% (n=152) of all pods (focal and non-focal) fixed with the theodolite at least twice from the southern shore station and the two northern stations are plotted in Figures 3-3, 3-4, and 3-5. This subset of data comprised the days when the greatest number of pods were tracked. General summaries of pod speed, orientation, and distribution are provided as well.

Swim speed was significantly different among pod types (Table 3-8). Pods with a calf swam at half the speed of pods of 1, 2, and > 2 adults (2.3 vs. 4.8-5.3 km/h, ANOVA, $P = 0.03$, $F= 3.02$, n=193 pods tracked > 2 times). There was no difference in swim speed between the north and south shores by pod type.

Frequency analysis of pod orientation and plots of whale tracks showed that most whales traveled parallel to the shoreline with little change in orientation (Figures 3-3 to 3-5). Most travel along the south shore was to the east (91°-135°) or to the west (271°-315°), with a larger proportion traveling eastbound (n=39) than westbound (n=16; $X^2 = 91.7$, df = 7; $P < 0.001$). On the north shore, the trend was exactly the opposite, with the largest proportion of pods (n=35) traveling eastbound (226°-270°) and the second largest (n=21) traveling westbound (46°-90°). There was also no significant difference in linearity index among pod types, although paths of calf pods tended to be more "random" than other pods (linearity indices of single individuals = 0.81, of pods with calves = 0.64, Kruskal-Wallis, $H = 6.14$, $P = 0.10$; Figure 3-21; Table 3-8).

IV. Discussion

Analysis of the 1993 shore data is still incomplete, particularly analysis of responses to disturbances such as vessels pending completion of software. However, the results provided so far are sufficient for a general description of undisturbed behavior of the humpback whale off Kauai.

Activities of humpbacks differed on the north versus the south shores of Kauai and to a lesser extent between the two northern shore stations. The proportions of time spent in behavioral states associated with active socializing and male competition for females (surface activity and milling; Tyack and Whitehead 1983, Baker and Herman 1984), were more prevalent around the broad, shallow shelves off Hanalei Bay and the west end of the Na Pali Coast as opposed to the southern coast, suggesting that these areas might be preferred sites for social activities (all north shore vs. all south shore station: stationary 12% vs. 28%, milling 14% vs. 3% , traveling 55% vs. 54%, surface activity 20% vs. 13%, Table 3-4; Figures 3-8 and 3-10). These results agree with the results of the aerial observations (Chapter 4). Time budgets off Princeville Makai, where the shelf just began to broaden, differed somewhat from the Kalalau Trail site (Kalalau [site 15] vs. Princeville [site 11] stations: stationary 4% vs. 28%, milling 13% vs. 9%, traveling 56% vs. 49%, and surface activity 28% vs. 14%; Table 3-4; Figures 3-8 and 3-9). Some of the difference between the two northern stations may be related to season as well as topography because the two stations were not operated simultaneously. Analysis of the 1994 data may clarify this issue.

In addition to season and bottom topography, differences in behavior may be related to differing sea state between the northern and southern stations. The rate of surface active behaviors appeared to correlate with Beaufort number (Figure 3-11), similar to results of Whitehead (1985). However, since sea states and surface active behaviors both increased toward the end of the season, the relationship may have been the result of seasonal changes in behavior. Pooling 1993 and 1994 data collected from both stations may clarify this relationship.

There was little difference between the north and south in respiratory parameters, once the differences in activity (time spent in each behavioral state) were taken into account.

Traveling was the most prevalent behavioral state in both singletons and pairs. Means of respiratory parameters did not differ significantly in traveling singletons and pairs (Table 3-5 and 3-6, Figures 3-14 and 3-15). The variability of respiratory parameters was greater between northern and southern sites in milling, stationary, and surface active whales. The significant difference between northern and southern blow rates in surface active singletons may have been the result of unequal variances, as well as small, skewed sample sizes (Table 3-5). Splitting behavioral states before further analysis may reduce variances. For example, stationary individuals might have been resting or singing, states that could be associated with very different respiratory patterns. Analysis of the acoustical data from 1994 on singing whales may allow "singing" to be treated as a separate behavioral state.

In previous studies, time spent at the surface correlated positively with the duration of preceding dive (Baker 1985; Bauer 1986; Dolphin 1987 a,b,c,d). This is also true of studies on other diving marine mammals, including Weddell seals (*Leptonychotes weddelli*; Kooyman et al. 1980), bottlenose dolphins (*Tursiops truncatus*, Ridgway 1986, Ridgway *et al.* 1969), gray whales (*Eschrichtius robustus*, Harvey and Mate 1984; Würsig 1984; Würsig et al. 1986), southern right whales (*Eubalaena australis*, Hamner *et al.* 1988), bowhead whales (*Balaena mysticetus*, Würsig and Clark 1993), and sperm whales (*Physeter macrocephalus*, Lockyer 1977). However, stationary singletons and pairs observed off Kauai displayed shorter surfacings preceded and followed by longer dives compared to traveling and surface active pods. In the previous studies, much of the relationship between surfacing duration and dive duration was determined from data on individuals swimming under controlled conditions or traveling. Other activities, such as singing, may force the whales to control oxygen intake in other ways, i.e. by changing the tidal volume of each breath, by altering the efficiency of oxygen uptake, or by functioning anaerobically.

Increasingly active states were associated with increasing blow rates, as might be expected from the increasing metabolic demands of greater activity (Sumich ****; Table 3-5, Table 3-6). Stationary singletons and pairs had blow rates of 0.3-0.4/min, traveling whales 0.5-0.6/min, milling whales 0.4- 0.6/min, and surface active pods 0.4-1.1/min. The increase appeared to be the result of decreasing dive duration with increasing activity. Blow intervals were relatively invariant across all behavioral states. Surfacing duration and blows per surfacing did not vary consistently with increasing activity. Single traveling whales blew fewer times per surfacing duration (2.7) than either stationary (4.1) or surface-active whales (4.7-6.5). The surfacing durations of stationary whales were marginally higher than that of traveling whales (1.1-1.4 min vs. 0.8 min), but around half that of surface-active whales (1.4-2.7 min). These inconsistencies may be the result of small sample sizes, but other constraints could have regulated time at the surface. For example, stationary whales might have been singing, resting or courting, states that might have had very different respiratory patterns. Caution should be used when interpreting trends in respiratory parameters, even blow rate, as indicative of metabolic demand -- the dividing line between blow intervals and dive durations is artificial and whales could compensate for increasing metabolic demands in undetectable ways, especially by increasing tidal volume (G.L. Kooyman pers comm.)

Sightability of blows might also have had a subtle effect on analysis of respiratory parameters. Blows were entered into the encoded data every time a whale's blowhole emerged from the surface (a rise) and there were sufficient observers on the shore stations to detect initial rises reliably. In states where blows were readily visible, such as traveling, the number of missed blows was probably small. However, the proportion of rises during which whales actually blew may have varied undetectably when whales spent long periods at the surface, particularly when they were surface active.

The composition of pods changed with season. Singletons and pairs were common throughout the season, but mothers with calves and large surface-active pods did not become prevalent until March and April. Cows with calves were not sighted at all until early March in 1993 and were not sighted along the north shore until the second fortnight in March. They were never as common in the north as in the south (4% vs. 11%; Table 3-3). Groups with more than 2 adults were sighted infrequently in the south and were most common at the peak of the season; in the north they were common from the first fortnight in March onward. Seasonal changes in pod composition and activity are consistent with reports from other Hawaiian islands (Herman and Antinoja 1977, Herman et al. 1980, Baker and Herman 1984, Mobley and Herman 1985, Forestell 1989).

Sighting frequency of whales calculated from scan samples varied across the season. By the time observations were underway in 1993, whales had already entered the region of Kauai. The sighting rates from the north shore suggest "pulses" of whales were entering the area, with peaks in the first fortnight of each month, whereas the sighting rates in the south peaked in March, decreasing afterward (Figure 3-16). Peak sighting rates, particularly off northern Kauai, occured later in the season than reported for other Hawaiian islands (Herman and Antinoja 1977, Herman et al. 1980, Mobley and Herman 1985). This suggests that northern Kauai may serve as a staging area for northwest-migrating whales at the end of the season, in agreement with the results of previous work (Baker and Herman 1981).

Whales stayed within the 100-fm isobath for the most part (Figures 3-3 to 3-5), consistent with reports of other authors (Chittleborough 1965, Herman and Antinoja 1977) and the results of aerial surveys (Baker and Herman 1981, Forsyth et al. 1991, Chapter 1). An unexpected observation was the generally eastward orientation of whales in the north and westward orientation in the south (Figure 3-21). These observations suggest that whales may circumnavigate Kauai in a predominantly clockwise direction (possibly including Niihau in the circuit). Analysis of the pooled data from both 1993 and 1994 on orientation and sighting rate, treating shelf width, time of day, fortnight, and tide as independent variables, may clarify both trends.

The apparent peak in sighting rate from both shores from 1400 to 1600 may be related to season as well (Figure 3-19). Most scans (56% of 18) between 1400 and 1600 occurred during the periods of peak sighting rates (2/26 - 3/25) because wind conditions in late March and April generally prohibited working after noon. Circadian rhythms are common in many species, including humpback whales. In other studies, frequency and size of breeding groups and aggressive surface activity appears to increase in the afternoon (Bauer 1986, Helweg 1989). However, sample sizes were too small to measure the interaction between fortnight and hour. Similarly, sample sizes were too small to measure the relationship between Beaufort number and fortnight, although the number of pods sighted per hour did not appear to be related to Beaufort number (Figure 3-17).

The analysis of behaviors of whales potentially disturbed by aircraft and vessels is unavailable, pending the completion of software to calculate vessel approach distances. It is tempting to assume that whales in the south were more disturbed than those in the north because there was a four-fold greater number of vessels that came within 4 km of pods at the south shore station. However, the vessels on the north shore were often whale-watching vessels that approached whales closely, whereas vessels in the south were generally fishing vessels that passed by whales without approaching them and without arousing obvious changes in behavior. Bauer (1986) has shown that humpback whales are sensitive to differences in vessel behavior, with approaching vessels and aircraft arousing greater changes in respiratory behavior than vessels passing by. Therefore, until the responses of whales to vessels at various ranges and behavior states are established, it will be difficult to characterize disturbances on either shore.

There is another source of 'disturbance' that remains to be characterized. Pods alter one another's behavior during close approaches and affiliations and disaffiliations (Baker and Herman 1984, Mobley and Herman 1985, Tyack 1981, 1982). Affiliations and disaffiliations were more common along the north shore, particularly off the Kalalau shore station. In the case of vessel approaches, several authors have reported that disturbed behaviors persist for 15-30 minutes after a vessel leaves an area (Bauer 1986, Baker and Herman 1989). These estimates were based on changes in respiratory parameters and swim direction. However, the duration of disturbances caused by other pods, measured using respiratory parameters, swim direction, and changes in behavioral state, may be much more persistent. Both man-made and natural disturbances may obscure the effects of the ATOC source transmissions. Therefore, further analysis of behaviors during and after pod interactions should be done in cases where individuals can be recognized.

V. Recommendations for 1994 and 1995

The analysis of respiration parameters should be re-examined. The use of means versus raw respiratory parameters should be examined in greater depth, including an examination of the independence of successive events (surfacing durations, dive durations, blow intervals), the minimum sample sizes needed to determine differences between categories, the value of transformations that may allow parametric methods to be used on the data, and the methods for defining behavioral states.

Based on the data from 1993, and using the variance of respiration parameters from traveling whales, the sample sizes needed to distinguish differences in an ANOVA with three treatment factors were calculated (Zar 1984, p. 174). In order to insure that differences of around 10-20% between disturbed and undisturbed can be detected, the following procedures should be adopted:

(1) Reduce variability of the sample, at the expense of sample size if necessary. The approach used in 1993 was to use the mean of respiration parameters for each pod in each behavioral state as inputs to the analysis. In the case of dive intervals, blow rates, surfacing durations, and blows/surfacing, the sample for each pod was often so small that this procedure had little effect (sample sizes of 2-3). In 1994, the duration of focal pod samples was increased by using high-powered "Big Eye" 25x150 binoculars so that within-pod comparisons might be possible; this will require determining the degree of independence among successive samples (blow intervals, dive durations, etc).

(2) Insure that the sample of focal pods of each pod type (e.g., singletons, adult pairs) is large enough (roughly 20-40 pods in each state before and during a disturbance based on the data from 1993).

To give an example, take the dive duration of singleton pods in the stationary behavioral state (Table 3-5). Given the grand mean of 13.3 min, if the coefficient of variation were 50% or greater, even an unreasonably large sample size (e.g., n=100) would not provide the test with great enough power (most 0.55). If the coefficient of variation were around 20%, a sample of 20 would have a power of 0.60, and a sample of 40 would have a power of 0.90. For a sample of 20, the Kruskal-Wallis ANOVA by ranks (the non-parametric equivalent), would have a power of 0.85.

(3) Re-examine the 1993 and 1994 data to determine whether behavior activity categories can be pooled, divided into categories with less variability, or eliminated.

(4) Examine changes in respiration rate of focal pods after interactions with other non-focal whales (e.g., affiliations, disaffiliations, and close passes).

Rates of aerial behaviors should be examined from the shore station data in relation to vessel and aircraft disturbances, to determine whether whales off Kauai engage in more aerial behaviors when disturbed. Aerial behaviors have been associated with responses to disturbance in a number of studies of humpback whales (e.g., Mobley *et al.* 1988; see Chapter 4).

The relationship between pod behaviors and environmental factors should be examined in further detail to see if some of the variability in the sighting rates, respiration parameters, and time spent in each behavioral state can be accounted for. Also, determine if net swim speed, cumulative swim speed, net orientation, and orientation at each surfacing can be correlated with these factors. Based on 1993 data, the most important factors are expected to be day of the season, water depth, shelf width in the area where the pod was tracked, time of day, and Beaufort number. Tide height (in lieu of current direction), temperature (if available), and other features of bottom topography, such as the availability of sandy shallows between coral reefs, may also be important.

Complete the analysis of pod swim speed and movements relative to other pods and vessels. This work is already planned.

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SHORE PROTOCOL

ATOC SHORE COMPUTER HEADERS & PROTOCOL 1993-95

(extracted directly from program)

DRAFT

1) HEAD-H (INITIAL HEADER INFORMATION)
   - Observational Station?
   - Focal Behavioral Observer?
   - Observational Period?
   - Total No. Vessels w/in a Session?
   - Pod Number?
   - Group Size?
   - No. of Calves?
   - Focal Pod Orientation?
   - Speed (0 to 3)?
   - Observation Conditions (Vis + Beauf)?
   - Cloud Cover (%)?
   - Glare (% + Section #'s)?
   - Swell Height (m)?
   - Swell Period (sec)?
   - Vessel Disturbance (U, P, D1, D2, or D3)?
   - Aircraft (plane & helicopter) Disturbance (U, PP, DP1, PD2, PD3, PH, DH1, PH2, or PH3)?

2) HEAD-R (BINOCULAR RETICLE CONVERSION + RATING)
   - Reticle Number? (Prints distance from shore in km)
   - Confidence Rating (1 to 5)?

3) HEAD-S (UPDATE POD ORIENTATION + SPEED)
   - Focal Pod Orientation?
   - Speed (0 to 3)?

4) HEAD-D (UPDATE DISTURBANCE LOGGING)
   - Vessel Disturbance (U, P, D1, D2, or D3)?
   - Aircraft (plane & helicopter) Disturbance (U, PP, DP1, PD2, PD3, PH, DH1, PH2, or PH3)?

5) HEAD-E (UPDATE ENVIRONMENTAL DATA)
   - Observation Conditions (Vis + Beauf)?
   - Cloud Cover (%)?
   - Glare (% + Section #'s)?
   - Swell Height (m)?
   - Swell Period (sec)?

*Note: Every hour you will be flagged w/ HEADE & beeps.

6) HEAD-A (WHALE AFFILIATION/DISAFFILIATION)
   - Affil/Disaffil (A or D)?
   - New Pod Number?
   - New Group Size?
   - No. of Calves?
   - New Observational Period?
   - Vessel Disturbance (U, P, D1, D2, or D3)?
   - Aircraft (plane & helicopter) Disturbance (U, PP, DP1, PD2, PD3, PH, DH1, PH2, or PH3)?

*Warning: HEAD-R, HEAD-O, and HEADE must be updated ASAP!!!

ATOC SHORE BEHAVIOR STATES 1993-95

Computer Function Keys

Key No	Code	Name	Definition
F1	rest	REST	indicated when a whale(s) lays horizontal and motionless near the surface in the same location for 5 sec or more.
F2	mill	MILLING	swimming with no obvious orientation (non-directional) characterized by asynchronous headings, circling, changes in speed, and no surface activity.
F3	trav	TRAVELING	swimming with an obvious orientation (directional), constant speed, no surface activity.
F4	stat	STATIONARY	little or no forward movement (<1 km/hr) between surfacing sequences, staying in the same general location (singers and tail-sailers fit in this state).
F5	smil	SURFACE ACTIVE MILL	non-directional swimming with the occurrence of aerial behavior that creates a conspicuous splash (include all head, tail, pec fin, and leaping behavior). This is also an *event* for non-focal pods.
F6	strv	SURFACE ACTIVE TRAVEL	directional swimming with the occurrence of aerial behavior that creates a conspicuous splash. This is also an *event* for non-focal pods.
F7	asyn	ASYNCHRONOUS	pods with respiration patterns out of synchrony where a whale(s) blows greater or less than 5 sec. from other whales (e.g., 2 whales surface and blow together while the other whale blows 5 sec later). During extended pauses (dives) try to make a *NOTE* of the number of asynchronous whales and their approx. distance from the core group. Not pressing the asyn function key will indicate the default that all whales in the pod are synchronous in their respiration's.

*Note: record approx. speed and compass direction when possible in the HEADS header.

0 = not moving forward
1 = slow (no wake, 1-2 km/hr)
2 = medium (small wake, 3-5 km/hr)
3 = fast (large wake, > 6 km/hr)

Events are instantaneous, while states have appreciable duration (Altmann 1974).

**Behavior States modified from: Baker et al. 1982, Würsig et al. 1984, Bauer 1986, and Richardson et al. 1991*

ATOC SHORE VISIBILITY & BEAUFORT CODES 1993-95

VISIBILITY:

CODE	NAME	DEFINITION
1	EXCELLENT	Surface water calm (Beaufort 0-1) with no sun glare or other environmental factors impeding ability to sight whales. Visibility > 5 km
2	VERY GOOD	May be slightly uneven lighting or light chop (Beaufort 2) but still relatively easy to sight whales. Visibility > 5 km
3	GOOD	Light chop with scattered whitecaps (Beaufort 3), significant swell (> 2 m) or some sun glare or other impediment (e.g., haze) in ≤10% of the study area. Whales can still be detected fairly easily.
4	FAIR	Choppy waves with fairly frequent whitecaps, low-light conditions (e.g., heavy overcast, dawn, dusk), or sun glare in ≤50% of study area. Some animals in study area likely to be missed
5	POOR	Numerous whitecaps (Beaufort 5) or sun glare or haze in >50% of the study area, impeding ability to sight whales. Many (>50% ?) animals in study area are likely to be missed
6	UNACCEPTABLE	Beaufort ≥6, or glare, haze, or other visibility impediment in >75% of study area. Detection of whales unlikely unless the observer is looking directly at the place where the animals surface.

*Note: Modified from Platform of Opportunity Program computer format designed for vessel-based marine mammal surveys

SEA CONDITION (BEAUFORT):

CODE	DESCRIPTION	WIND SPEED (km/h)	WAVE (m)
0	Smooth and mirror-like	Calm (0-2)	–
1	Light ripple	Light air (2-6)	0.3
2	Small wavelets, not breaking	Light Breeze (7-11)	0.6
3	Scattered whitecaps	Gentle Breeze (12-19)	1.2
4	Small waves, frequent whitecaps	Mod. breeze (20-30)	1.8
5	Moderate waves, many whitecaps	Fresh breeze (31-39)	2.0
6	All whitecaps, some spray	Strong breeze (40-50)	3.0
7	Breaking waves, spindrift begins	Near gale (51-61)	4.3
8	Medium high waves, foamy	Gale (62-74)	5.5

*Note: Beaufort 6-8 not meaningful (time to go home!).

ATOC SHORE ENVIRN COND. & RATING CODES 1993-95

ENVIRONMENTAL CONDITIONS:

CODE	NAME	DEFINITION
VIS	VISIBILITY	scale: 1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor, 6 = unacceptable (see visibility definitions).
BF	BEAUFORT	Beaufort sea state (see Beaufort definitions)
CC	CLOUD COVER	percent of study area covered by clouds.
GL	GLARE	percent of study area covered by moderate to severe glare, which affects ability to sight whales. Also note the "section" within which glares occur. A section = each quarter of the study area beginning to the left and looking clockwise. There are 4 section total.
SH	SWELL HEIGHT	estimated in meters.
SP	SWELL PERIOD	time between successive swells in seconds.

*Note: entered in the initial header (HEADH) and every hour on the hour in the update envirnomental header (HEADE)

BEHAVIORAL OBSERVATION CONFIDENCE RATINGS:

CODE	DEFINITION
1	Excellent respiration and behavioral data (confident that you are missing none).
2	Excellent respiration and "soft" behavioral data (confident you are seeing blows, but you may be missing some behaviors (<10%), usually due to distance or environmental.conditions).
3	Okay respirations (you think you're getting most blows) but shaky behavior (you feel you are unable to discern some (<25%) behaviors, generally due to distance or conditions).
4	Shaky respirations (the data will probably be useful only for surface and dive times) and only very obvious/conspicuous behaviors.visible.
5	Theodolite tracking only due to inability to discern blows and behaviors usually due to distance or conditions.

*Note: entered in the binocular reticle conversion + rating header (HEADR).

ATOC SHORE POTENTIAL DISTURBANCE CATEGORIES 1993-95

EXPERIMENTAL CONDITIONS (expt= computer 4-digit code):

1. Potential Vessel Disturbance:

U	(0)	Undisturbed (vessels > 4 km)
P	(1)	Potential Disturbed (vessels > 1 km and < 4 km)
D1	(2)	Type I Disturbance (vessels < 1 km, passing by)
D2	(3)	Type II Disturbance (vessels < 1 km and actively following)
D3	(4)	Type III Disturbance (our research vessel < 1 km engaged in photo ID work)

***Note:** these categories are broad classes of visual vessel proximity and their behavior to the focal whale(s). A **30 min buffer** will be applied prior to each entered code (e.g., if U then D1 and back to U edited data will add 30 min to D1's duration). Re-evaluation of these "flags" will be made in the final analysis when theodolite fixes have been determined.

2. Potential Aircraft (airplane & helicopter) Disturbance:

U	(0)	Undisturbed (**all aircraft** ALT > 1500 ft or 457 m)
PP	(1)	Potential Disturbed **airplane** (ALT > 1000 ft and < 1500 ft)
DP1	(2)	Type I Disturbance airplane (ALT < 1000 ft and passing by)
DP2	(3)	Type II Disturbance airplane (ALT < 1000 ft and actively circling)
DP3	(4)	Type III Disturbance airplane (ALT < 1000 ft and blatant harassment)
PH	(5)	Potential Disturbed **helicopter** (ALT > 1000 ft and < 1500 ft)
DH1	(6)	Type I Disturbance helicopter (ALT < 1000 ft and passing by)
DH2	(7)	Type II Disturbance helicopter (ALT < 1000 ft and actively circling)
DH3	(8)	Type III Disturbance helicopter (ALT < 1000 ft and blatant harassment)

***Note:** these categories are broad classes of visual aircraft proximity and their behavior to the whale(s). A **15 min buffer** will be applied prior to each entered code.

3. Potential ATOC Transmission Disturbance:

U	(0)	Undisturbed (no transmission)
P	(1)	Potential Disturbed (now none, but transmission <30 min ago)
D	(2)	Disturbance (present now)

4. Potential Military Transmission Disturbance:

U	(0)	Undisturbed (no transmission)
P	(1)	Potential Disturbed (now none, but transmission <30 min ago)
D	(2)	Disturbance (present now)

***Note:** in order to make unbiased and "blind" observations of the effect of ATOC & Military transmissions, times will be confirmed after the field season by hydrophone array or assumed based on reported Scripps times and incorporated into data analyses.

Modified LGL Coding and File Formats for Bowhead Behavioral Data (Richardson et al. 1991) and personal communication with Dr. Gordon B. Bauer (10/11/93).

COMPUTER TRANSLATIONS FOR ATOC SHORE ETHOGRAM 1993-95

Computer Number Codes (NC) & Field Letter Codes (LC)

RESPIRATION:

NC	LC	
01	FS	First Surface with No Blow
02	F	First Surface Blow
09	NF	Not First Surfacing? (whale seen at surface)
03	B	Blow
05	N	No Blow Rise (surface w/ no visible blow)
04	M	Missed Blow(s)? (breaks resp. sequence)

SUBMERGENCE:

NC	LC	
10	S	Slip Under (terminates rest bout)
06	A	Peduncle Arch (arching w/out lifting flukes)
08	D	Fluke Down Dive (arch and lifting flukes < 45 deg)
07	U	Fluke Up Dive (arch and lifting flukes > 45 deg)
15	SQ	Unidentified Submergence > 60 sec (?)

NON-RESPIRATORY MARKERS:

NC	LC	
12	NR	Missed Non-Resp Beh(s)? (breaks beh. sequence)
11	UB	Unidentified Behavior? (any NR not included below)

SUBSURFACE EXHALATIONS:

NC	LC	
13	BC	Bubble Cloud (single burst of bubbles)
14	BT	Linear Bubble Trail (stream of bubbles)

WHALE VOCALIZATIONS:

NC	LC	
17	TB	Trumpet Blow (blow modifier)
20	SR	Singing Reported (by research vessel)
21	SS	Singing Stop

HEAD & LEAPING BEHAVIORS:

NC	LC	
41	HR	Head Rise (Spyhop)
43	HL	Head Lunge (forward thrust < 45 deg)
45	MB	Motor Boating (S-shaped swim > 3 sec)
46	HS	Head Slap (forward thrust > 45 deg & slap)
47	BR	BReach (leaps out w/ twist)
48	US	Unidentified Large Splash?
49	OH	Other Head Behavior?

TAIL BEHAVIORS:

NC	LC	
51	TE	Tail Extension (holds in air > 3 sec)
52	TS	Tail Slap (slapping w/ ventral surface)
54	LS	Lateral Tail Slap (peduncle slap)
55	SW	Tail SWish (side-to-side motion)
56	LT	Lateral Tail Display
59	OT	Other Tail Behavior?

PECTORAL FIN BEHAVIORS:

NC	LC	
61	PE	Pec Extension (1 or both fins > 3 sec)
62	PS	Pec Slap (form unspecified)
65	RP	Rolling Pec Slap (rotating rostro-caudal axis)
68	OP	Other Pec Behavior?

BODY CONTACT:

NC	LC	
74	SB	Striking with any Body Part
75	WC	Whale Body Contact

**AGE MODIFIERS, FOCAL WHALE SAMPLING:*

NC	LC	
1NC	LC1	Adult (default, just enter beh. letter codes)
2NC	LC2	Mom
3NC	LC3	Calf
4NC	LC4	Escort

BEHAVIOR STATES (= function keys):

NC	LC	
1	F1	REST (rest)
2	F2	MILLING (mill)
3	F3	TRAVELING (trav)
4	F4	STATIONARY (stat)
5	F5	SURFACE ACTIVE MILL (smil)
6	F6	SURFACE ACTIVE TRAVEL (strv)
7	F7	ASYNCHRONOUS (asyn)

*Note: see behavior state definitions for detail.

FOCAL POD EVENTS:

NC	LC	
579	PD	Pod Decreases Speed
580	PI	Pod Increases Speed
581	PX	Pod Stops (X)
582	P45	Pod Changes Direction > 45 deg
583	P90	Pod Changes Direction > 90 deg

FOCAL VESSEL(S) EVENTS:

NC	LC	
986	V45	Vessel Changes Direction > 45 deg
987	VX	Vessel Stops (X)
988	VS	Vessel Starts
989	VC	Vessel Changes Speed Notably

**FOCAL POD AFFILIATIONS/DISAFFILIATION:*

NC	LC	
569	PAF	Pods Affiliate (2+ join to form one)
570	PDS	Pods Disaffiliate (pod splits)
571	SAF	Suspected Affiliation
572	SDS	Suspected Disaffiliation

*Note: a pod equals whales < 5 WLU.

LOST FOCAL POD/END SESSION:

NC	LC	
500	PU	Pod Identification Number Uncertain?
597	PL	Pod Lost – Note any Reason?!

COMPUTER & THEODOLITE AIDS:

NC	LC	
000	L	Lag (3 sec) in calling beh
0##	L##	Lag (+ no. of sec) in calling beh
999	X	Delete previous entry (X)
222	XX	Delete last sequence of entries (XX)
666	ZF	"Zero" reference Fix
677	NZ	Non-"Zero" reference fix
688	TF	Titty Peak Fix
699	BFN	Buoy (FAD) Fix - N shore
777	SSC	Start 15-min SCan
778	ESC	End 15-min SCan
650	TBC	Theodolite Bubble Check
660	RBT	ReBalance Theodolite

POD MODIFIERS & NONFOCAL SAMPLING:

NC	LC	
5##	P##	Theodolite Pod Fix + ID no.
9##	V##	Theodolite Vessel Fix + ID no.
6##	H##	Helicopter + ID no.
7##	AP##	Air Plane + ID no.
810	CA	Closest Point Approach (CPA, call < 1000 m)
815	SP	SPinner dolphin(s)
825	BN	BottleNose Dolphin (Tursiops spp.)
835	TU	Sea TUrtle(s) (green)

**Ethogram modified from: Baker et al. 1982, Würsig et al. 1984, Bauer 1986, Richardson et al. 1991, & Kewalo Basin Marine Mammal Laboratory.*

*Note: for computer analyses age modifiers & 2-digit beh number codes are split into separate columns (age & beh), all non-beh. 3-digit codes are placed in the same column with beh. codes, and behavior states are places in separate column (beh state).

Example Raw Computer Data w/ Headers, Behavior States, & Theodolite Fixes

```
FILE OPENED=07:18:22,04/13/93
HEADE=07:19:01,22,80,104,0.5,13
HEADT=07:21:53,666,0903750 2341510
HEADT=07:22:50,600,0533225 1310515
HEADN=07:24:11, 1 ,STARTING SCAN 0700
SSC,07:24:44
HEADN=07:27:33, 2 ,RAIN FRONT COMING IN FROM EAST, SECTIONS 3 & 4 OBSCURED
ESC,07:40:00
HEADN=07:41:39, 3 ,END OF SCAN
HEADT=07:59:22,501,0911920 0443835
HEADE=08:00:02,33,95,054,0.5,13
HEADT=08:04:12,502,0915025 0124645
HEADH=08:05:35,04/13/93,15,05,01,0,502,02,0,33,80,054,0.5,13,U,PP
HEADR=08:06:43,6.14,4
ASYN=08:06:43
TRAV=08:06:43
F,08:06:49
B,08:06:55
A,08:06:58
HEADN=08:07:47, 4 ,ONE ANIMAL UP THIS SURFACING
F,08:10:23
B,08:10:35
U,08:10:43
B,08:10:44
HEADT=08:10:47,502,0915335 0090225
B,08:10:57
B,08:11:05
B,08:11:16
B,08:11:18
HEADT=08:11:23,903,0925130 0412100
A,08:11:24
F,08:13:28
M,08:14:29
B,08:14:29
HEADN=08:15:20, 5 ,LAST SURFACING TWO WHALES UP
ASYN=08:15:57
TRAV=08:15:58
F,08:18:25
B,08:18:51
B,08:18:58
B,08:19:16
B,08:19:17
B,08:19:33
HEADT=08:19:41,502,0915610 3571110
B,08:19:55
A,08:19:58
B,08:20:36
U,08:20:45
HEADN=08:21:10, 6 ,BOTH UP BUT WHALE STILL ASYCH, MED TRAV WEST
HEADT=08:25:48,666,0903750 2341510
F,08:25:49
M,08:26:42
ASYN=08:26:42
TRAV=08:26:42
F,08:28:23
B,08:28:53
U,08:29:00
HEADT=08:29:01,502,0915555 3452730
```

Example Raw Computer Data w/ Headers, Behavior States, & Theodolite Fixes

```
HEADN=08:29:11, 7 ,ONE ANIMAL UP LAST SEQUENCE, ASYNCH
HEADE=08:32:29,34,70,00,0.5,13
M,08:34:07
F,08:36:22
B,08:36:54
B,08:37:36
B,08:38:00
B,08:38:05
U,08:38:07
HEADT=08:38:10,502,0920210 3342710
B,08:38:22
A,08:38:25
HEADN=08:39:30, 8 ,WHALES STILL ASYCH, 2 WLU APART, MED TRAV WEST
HEADR=08:40:56,4.28,3
AP01,08:41:12
Y10,08:41:22
F,08:43:15
B,08:44:50
B,08:46:10
M,08:47:03
HEADE=08:47:30,44,90,00,1.0,13
HEADN=08:51:34, 9 ,STRANGE LIGHTING, TAKING A LITTLE BREAK
P97,08:55:46
HEADN=08:55:49, 10 ,LIGHTING IS STRANGE/BAD VIS CONDITIONS
HEADN=08:56:17, 11 ,STARTING SCAN 0800 BLOCK
SSC,08:57:31
HEADE=09:00:14,44,100,000,1.0,13
ESC,09:12:33
HEADE=09:14:15,55,90,00,1.0,15
HEADT=09:15:36,666,0903755 2341525
HEADT=09:15:59,666,0903755 2341515
HEADT=09:16:50,600,0533230 1310530
FILE CLOSED=09:17:10,04/13/93
```

Example SpreadSheet

hh	mmss	group	expt	age	beh	stat	no. ves	rate/obsv	beh state	vis/beau
8	649	5020200	1000	1	2	15	1	405	3	33
8	655	5020200	1000	1	3	15	1	405	3	33
8	658	5020200	1000	1	8	15	1	405	3	33
8	1023	5020200	1000	1	2	15	1	405	3	33
8	1035	5020200	1000	1	3	15	1	405	3	33
8	1043	5020200	1000	1	7	15	1	405	3	33
8	1044	5020200	1000	1	2	15	1	405	3	33
8	1057	5020200	1000	1	3	15	1	405	3	33
8	1105	5020200	1000	1	3	15	1	405	3	33
8	1116	5020200	1000	1	3	15	1	405	3	33
8	1118	5020200	1000	1	3	15	1	405	3	33
8	1124	5020200	1000	1	8	15	1	405	3	33
8	1328	5020200	1000	1	2	15	1	405	3	33
8	1429	5020200	1000	1	4	15	1	405	3	33
8	1825	5020200	1020	1	2	15	1	405	6	33
8	1851	5020200	1020	1	3	15	1	405	6	33
8	1858	5020200	1020	1	3	15	1	405	6	33
8	1916	5020200	1020	1	3	15	1	405	6	33
8	1917	5020200	1020	1	3	15	1	405	6	33
8	1933	5020200	1020	1	3	15	1	405	6	33
8	1955	5020200	1020	1	3	15	1	405	6	33
8	1958	5020200	1020	1	62	15	1	405	6	33
8	2036	5020200	1020	1	3	15	1	405	6	33
8	2045	5020200	1020	1	7	15	1	405	6	33
8	2549	5020200	1020	1	2	15	1	405	6	33
8	2642	5020200	1020	1	4	15	1	405	6	33
8	2823	5020200	1020	1	2	15	1	405	6	33
8	2853	5020200	1020	1	3	15	1	405	6	33
8	2900	5020200	1020	1	7	15	1	405	6	33
8	3407	5020200	1020	1	597	15	1	405	6	34
8	3407	5020200	1020	1	4	15	1	405	6	34
8	3622	5030201	1021	1	2	15	1	405	2	34
8	3654	5020200	1021	1	3	15	1	405	2	34
8	3736	5020200	1021	1	3	15	1	405	2	34
8	3800	5020200	1021	1	3	15	1	405	2	34
8	3805	5020200	1021	1	3	15	1	405	2	34
8	3807	5020200	1021	1	7	15	1	405	2	34
8	4112	5020200	1021	1	901	15	1	305	2	34
8	4122	5020200	1021	1	810	15	1	305	2	34
8	4315	5020200	1021	1	2	15	1	305	2	34
8	4450	5020200	1021	1	3	15	1	305	2	34
8	4610	5020200	1021	1	3	15	1	305	2	34
8	4703	5020200	1021	1	597	15	1	305	2	34
8	5546	5020200	1021	1	4	15	1	305	2	44
8	5731	5020200	1021	1	777	15	1	305	2	44
9	1233	5020200	1021	1	778	15	1	305	2	44
9	1234	5020200	1021	1	4	15	1	305	2	44

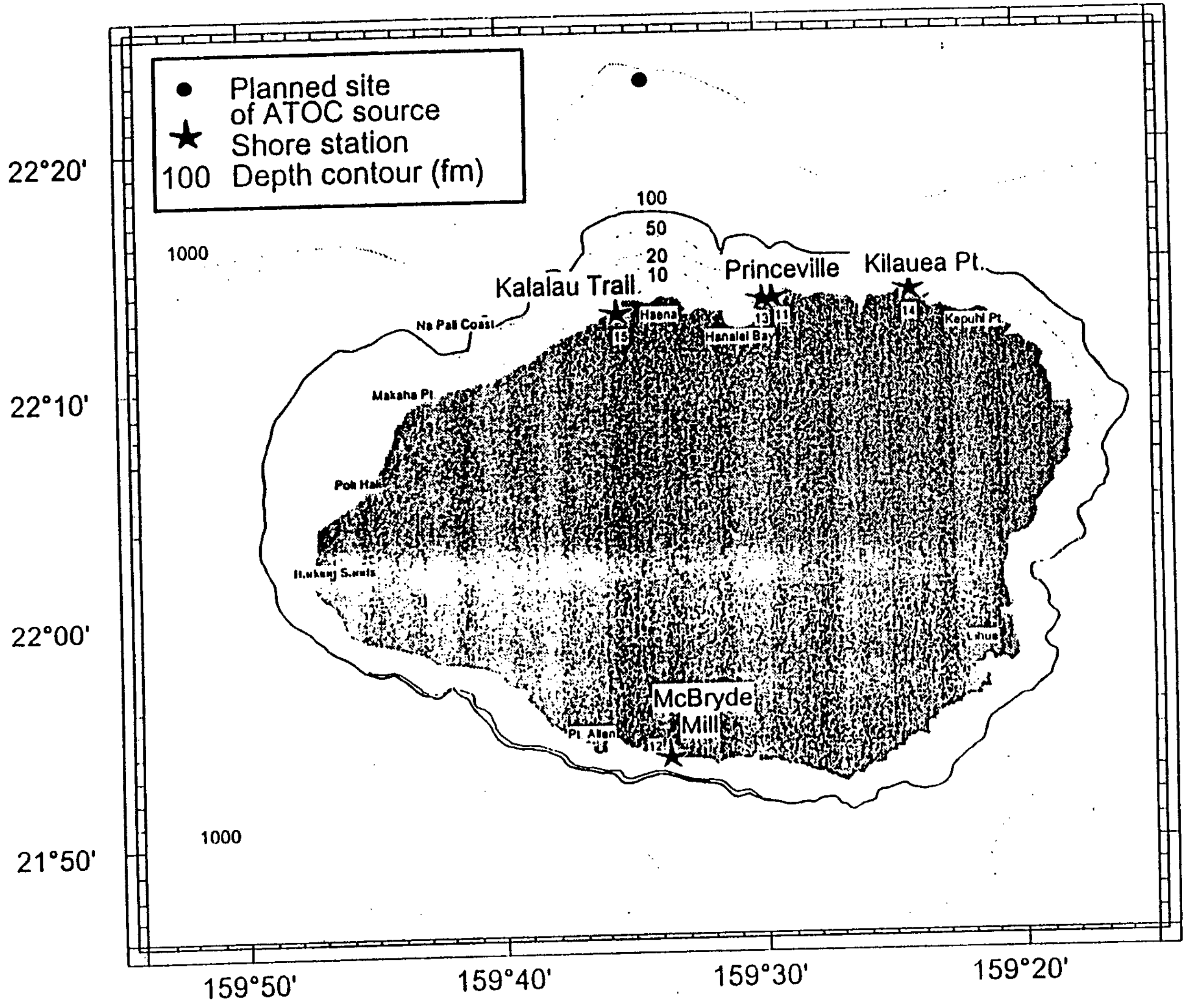

Figure 3-1: Map of Kauai, showing the location of the shore stations (with site numbers), the 100-fm isobath (dark line), and the planned site of the ATOC source.

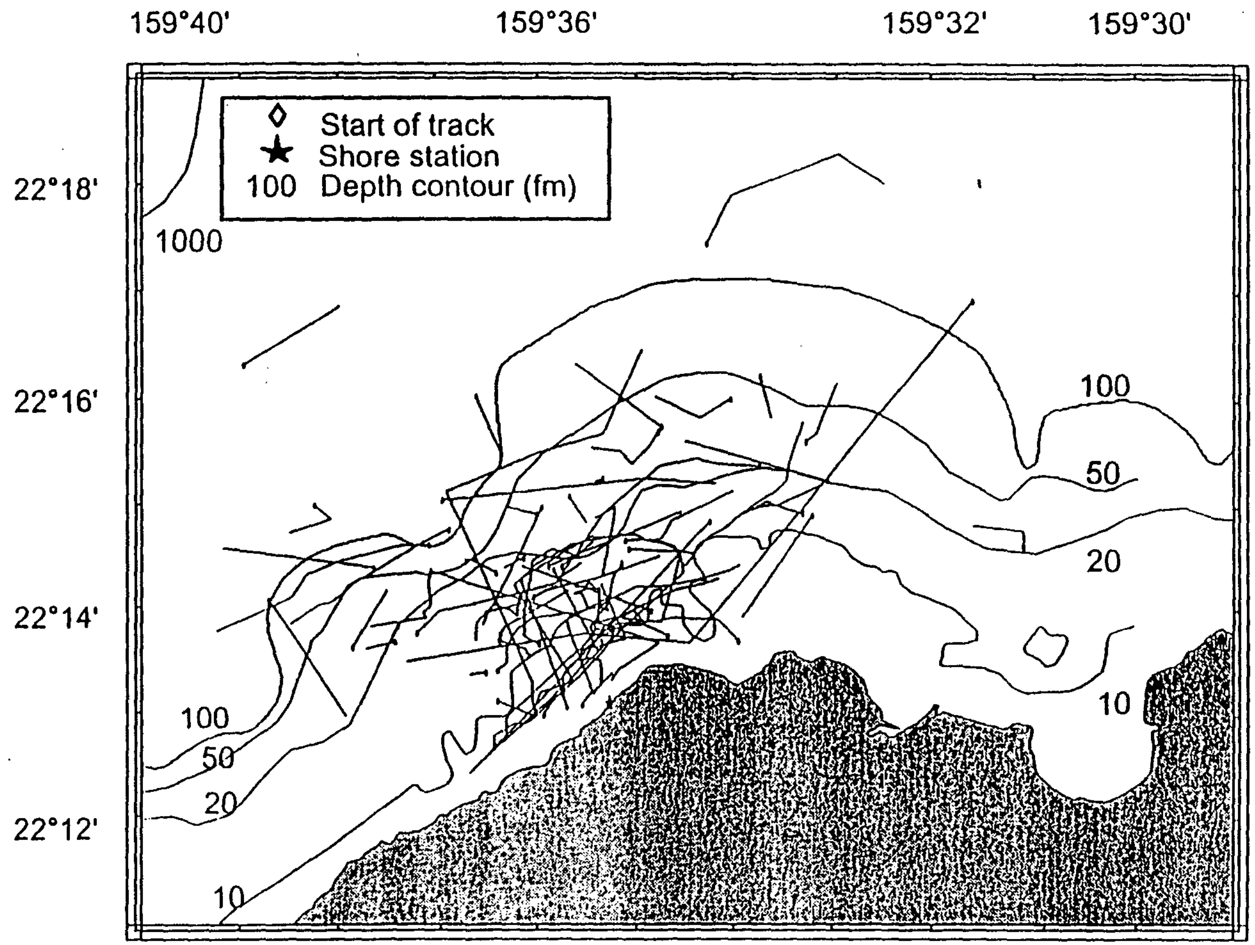

Figure 3-3: Tracks of pods sighted from the Kalalau Trail shore station in 1993.

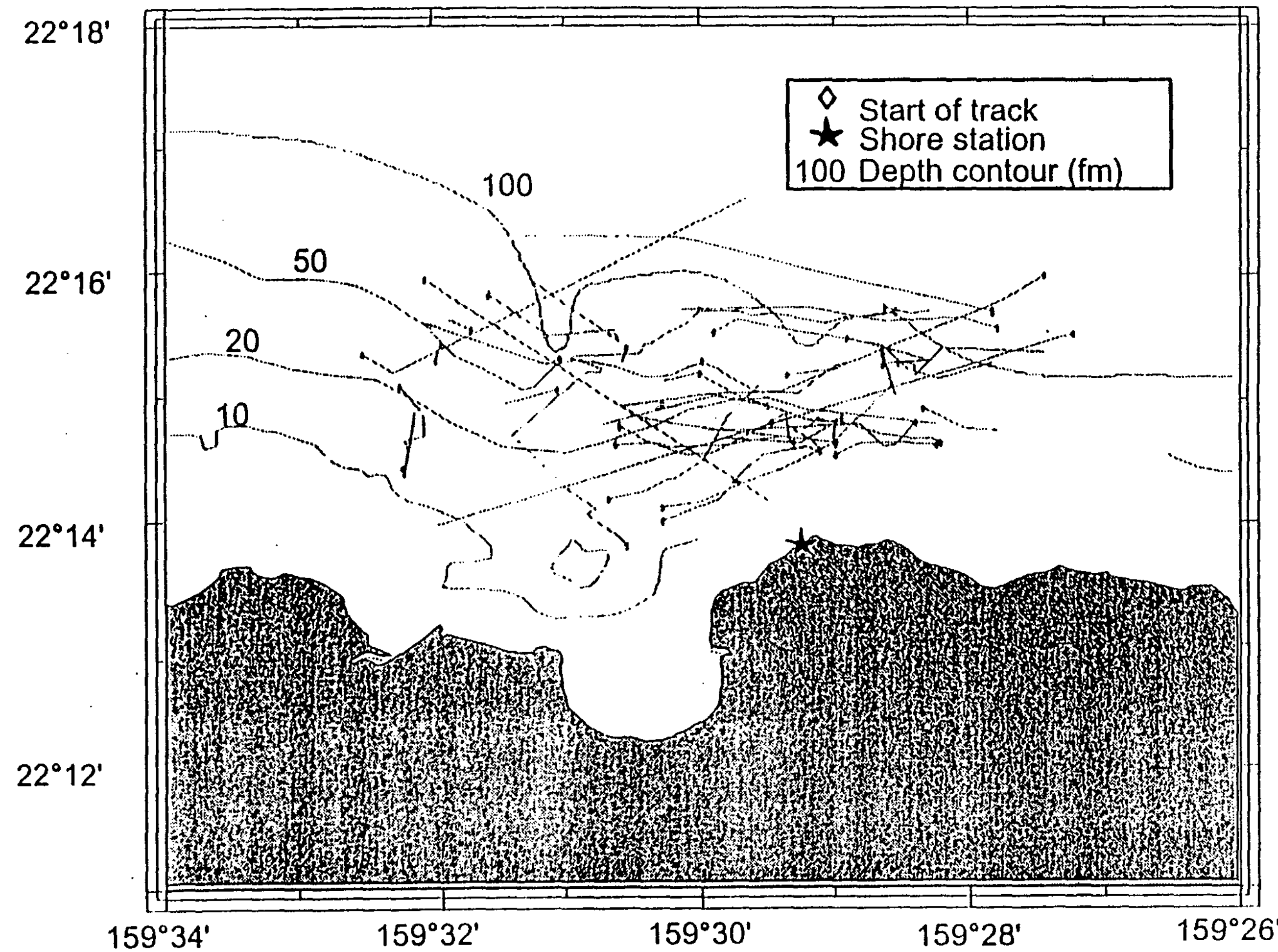

Figure 3-4: Pods tracked from the Princeville Makai shore station (2/4/93 -2/16/93).

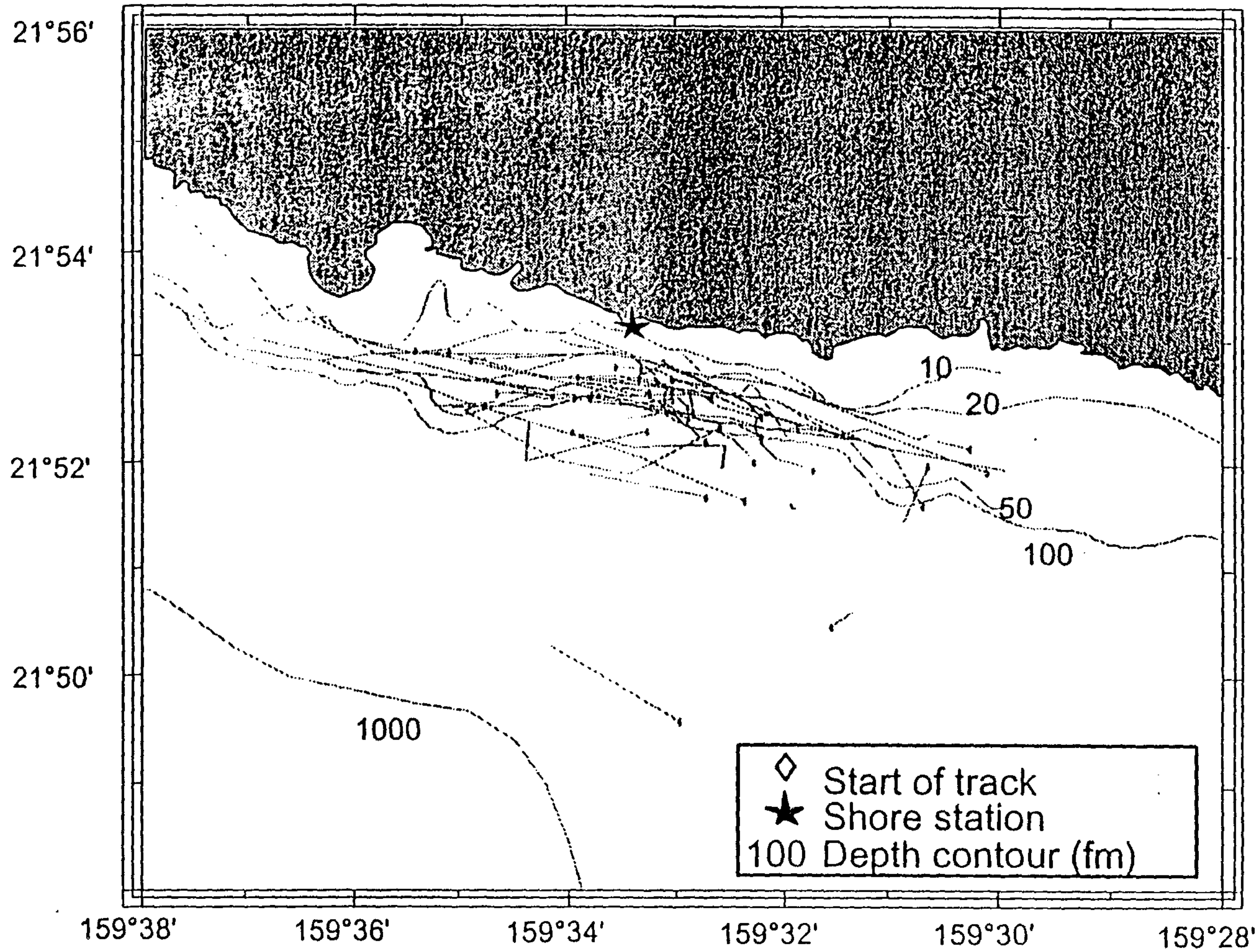

Figure 3-5: Tracks of pods sighted from the south shore station.

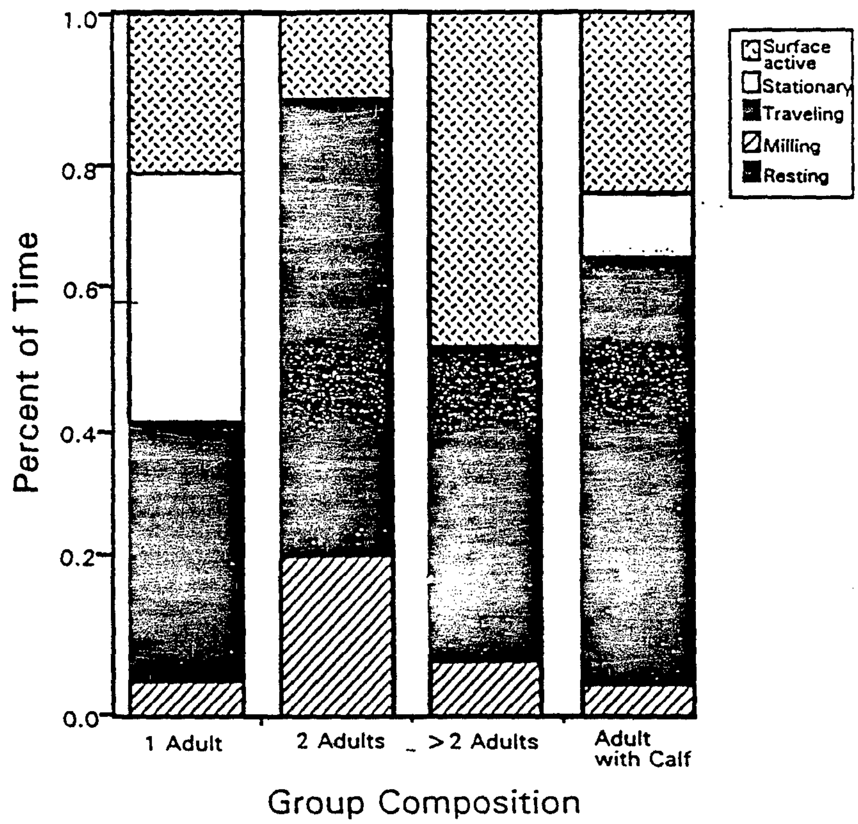

Figure 3-6: Percentage of time focal pods spent in 5 behavioral states off all north shore stations.

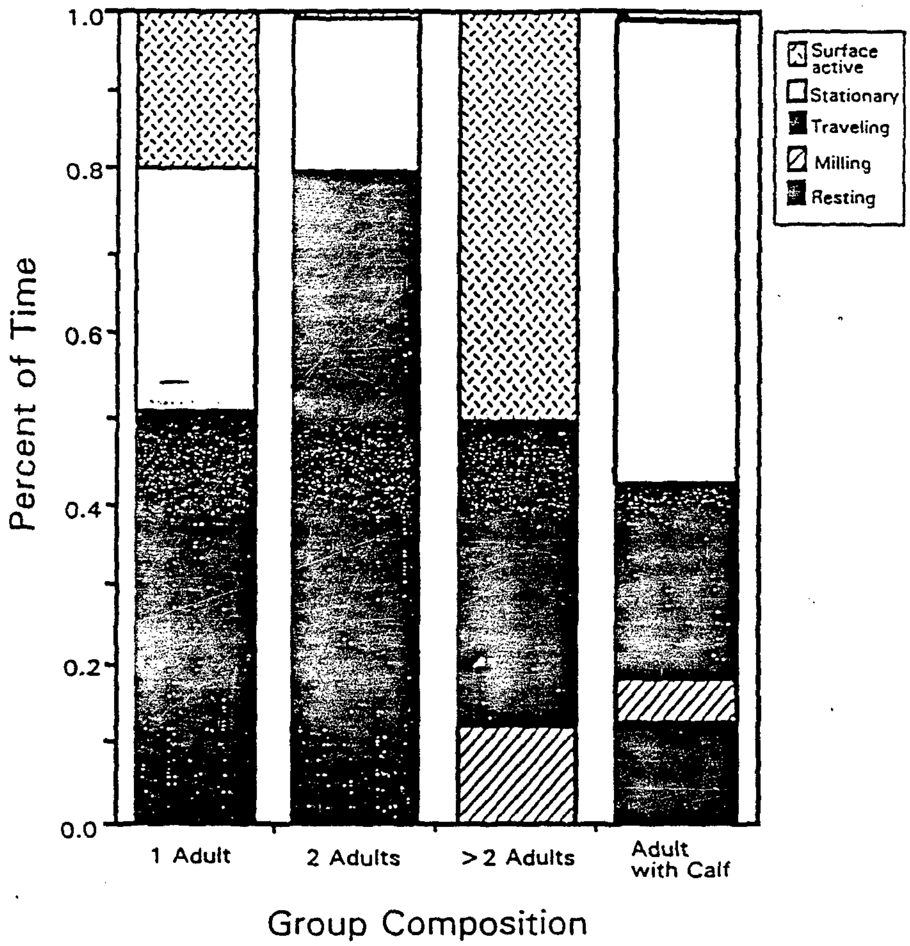

Figure 3-7: Percentage of time focal pods spent in 5 behavioral states off the south shore station.

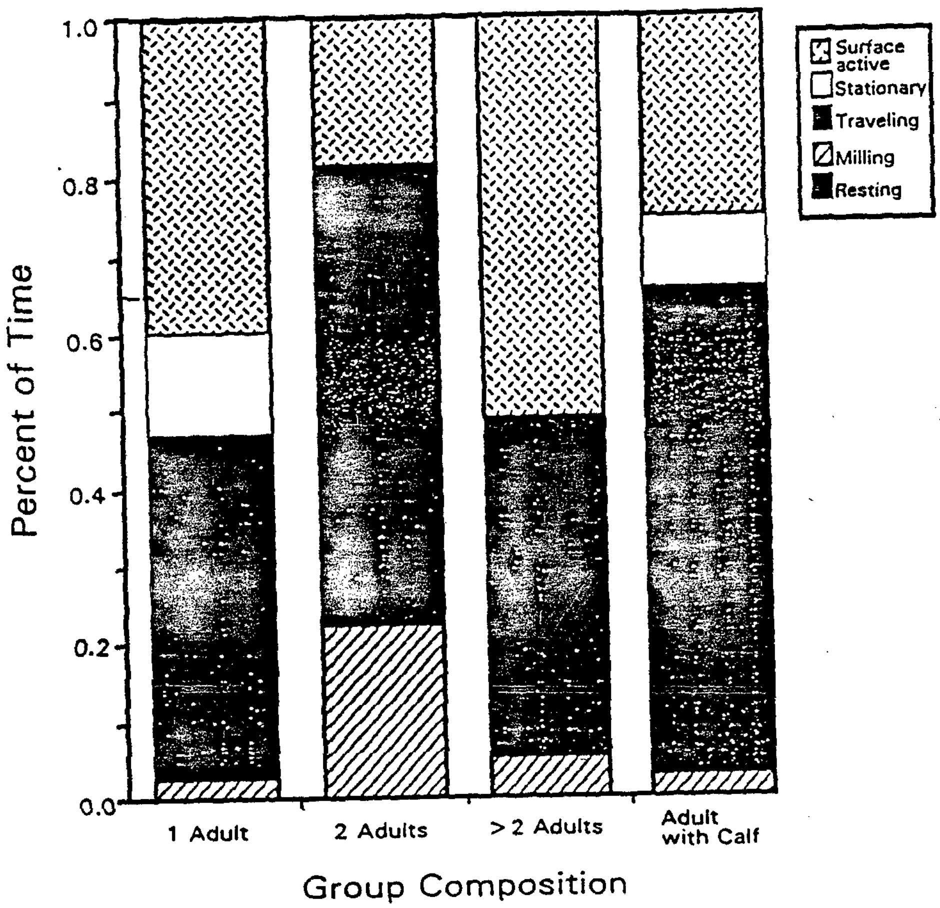

Figure 3-8: Percentage of time spent by focal pods in 5 behavioral states off the Kalalau Trail shore station (2/14/93-4/14/93)

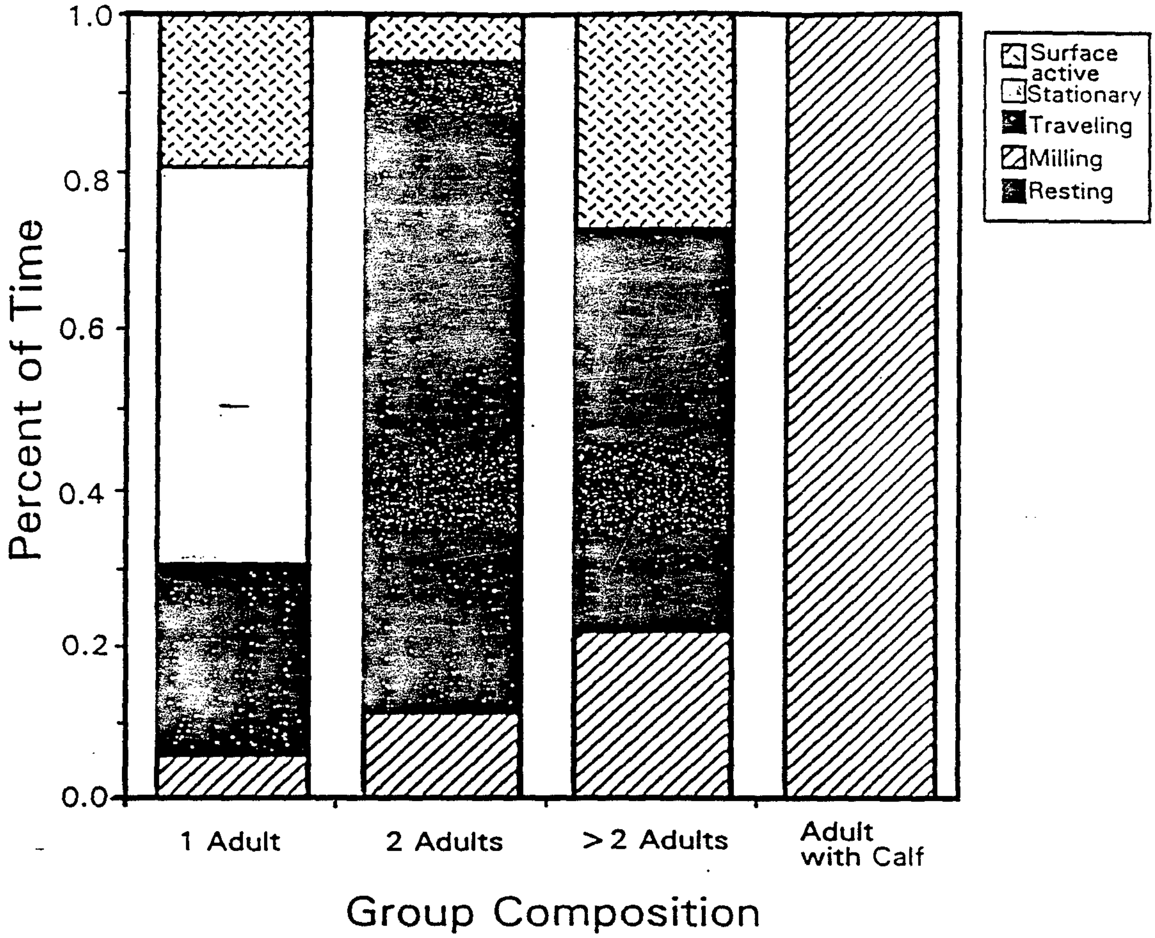

Figure 3-9: Percentage of time focal pods spent in 5 behavioral states off Princeville Makai shore station (2/4 - 2/16).

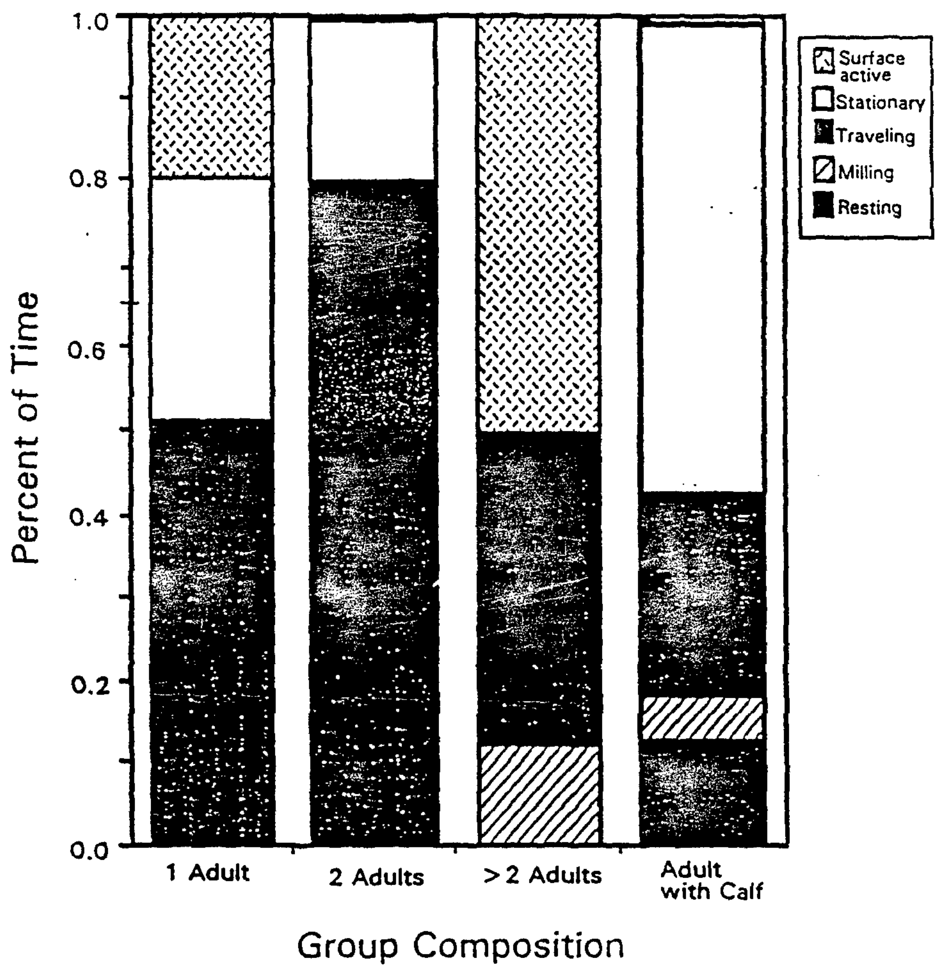

Figure 3-10: Percentage of time focal pods spent in 5 behavioral states off the south shore station between 2/14 /93 and 4/14/93.

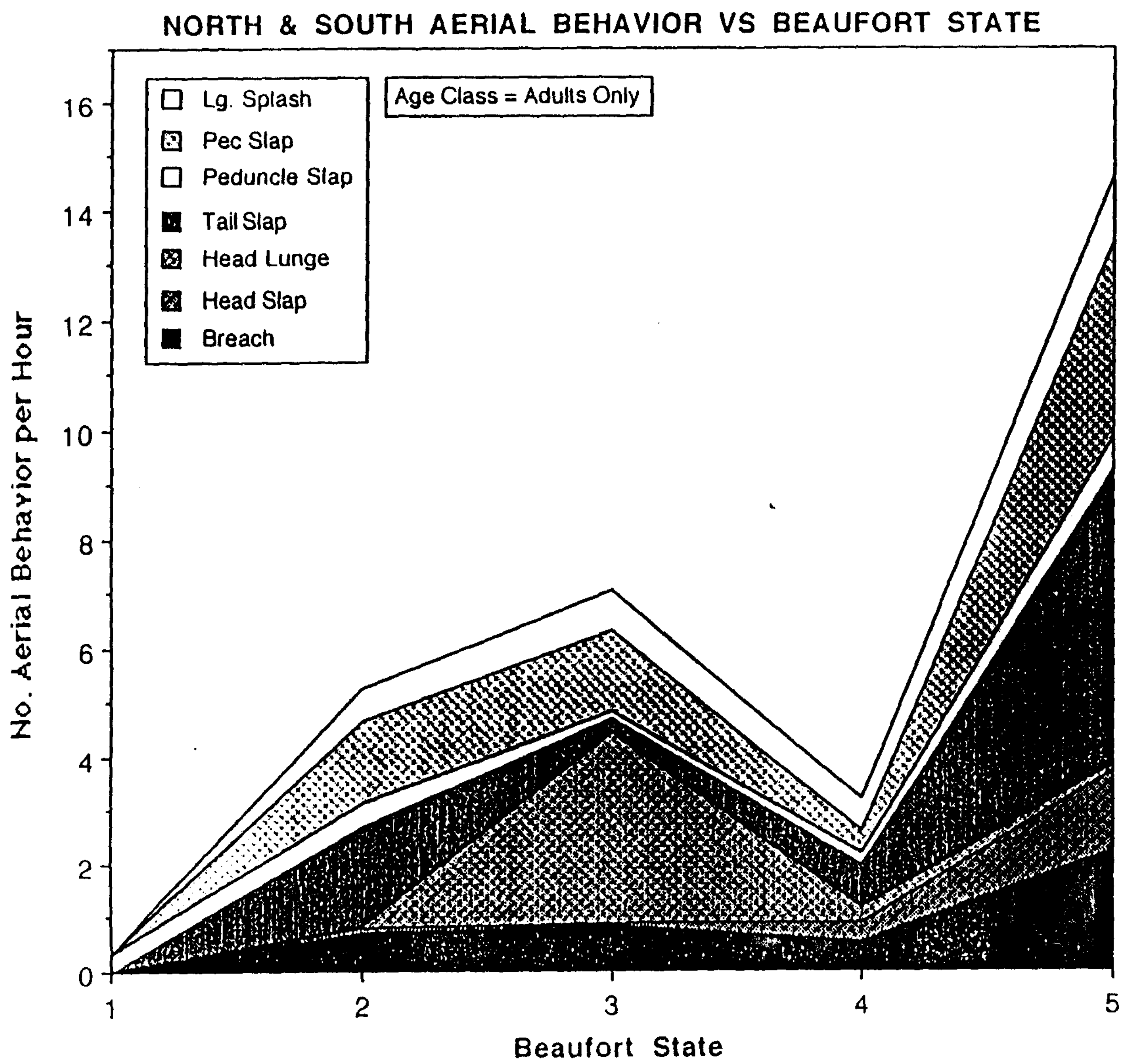

Figure 3-11: Rates of aerial behaviors (surface-active behaviors) by Beaufort wind condition from the focal pod data collected at all shore stations. Rates were expressed as counts of aerial behaviors per hour.

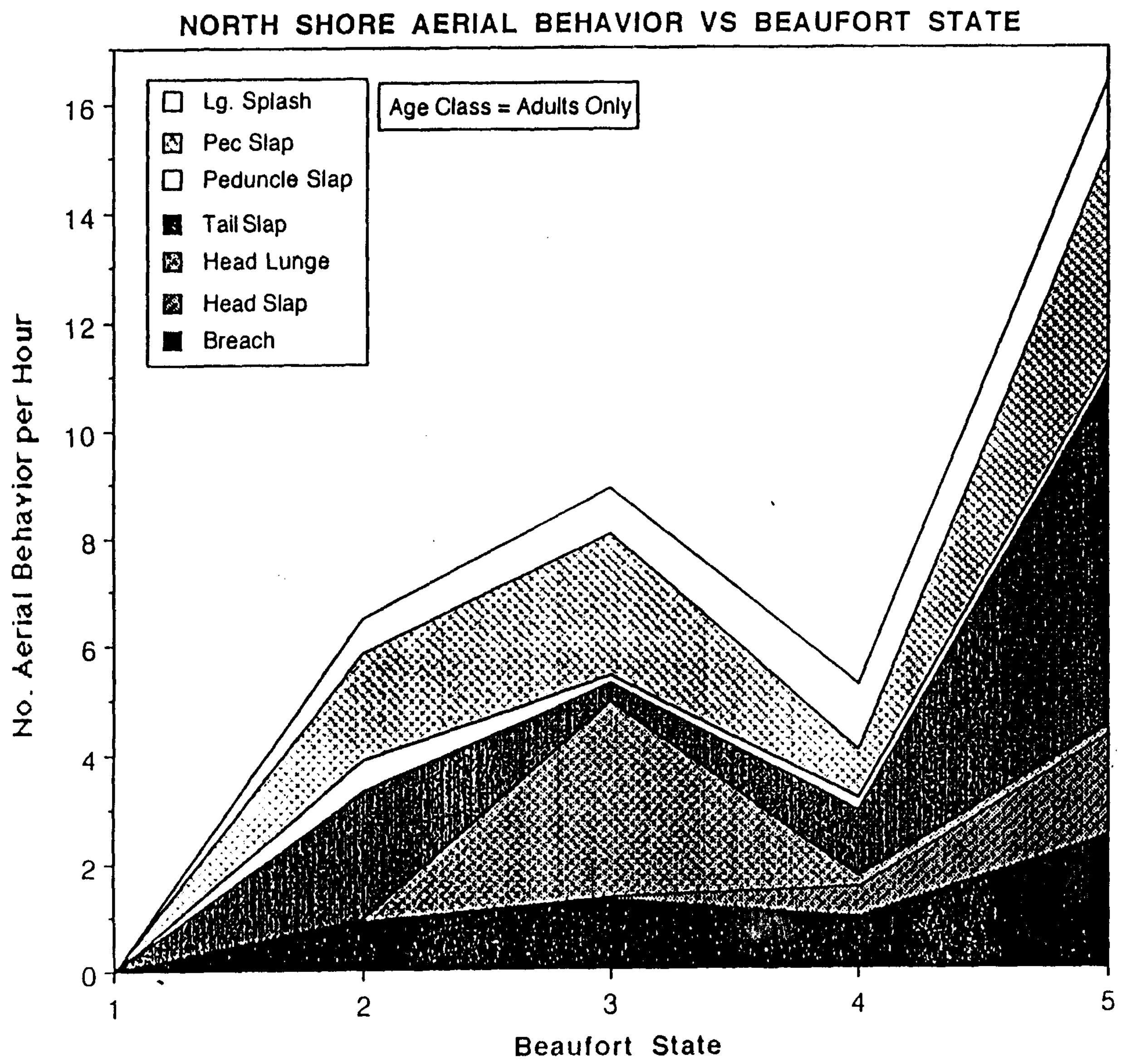

Figure 3-12: Rates of aerial behaviors (surface-active behaviors) by Beaufort wind condition from the focal pod data collected from northern shore

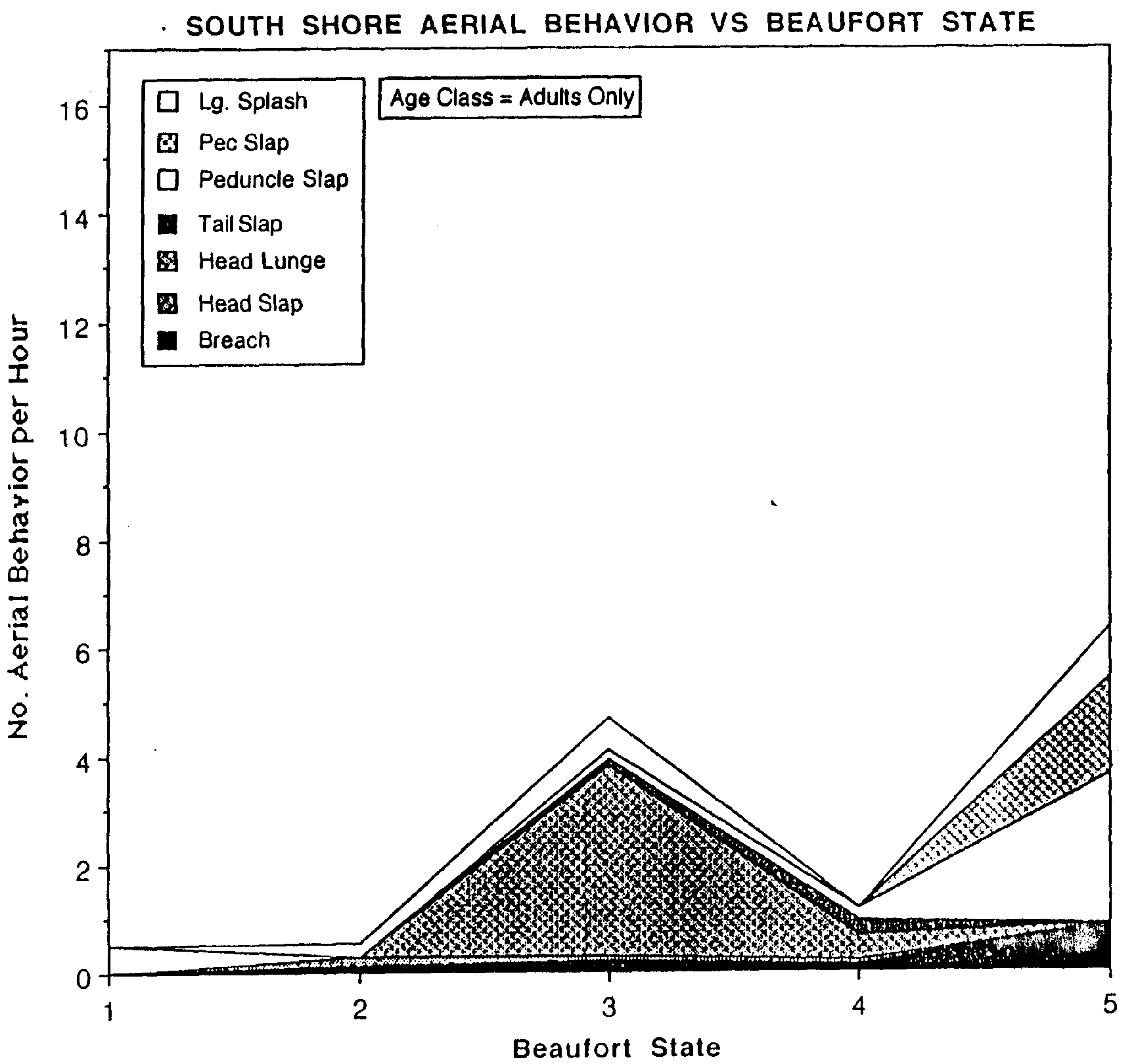

Figure 3-13: Rates of aerial behaviors (surface-active behaviors) by Beaufort wind condition from the focal pod data collected at the south shore station. Rates were expressed as counts of aerial behaviors per hour

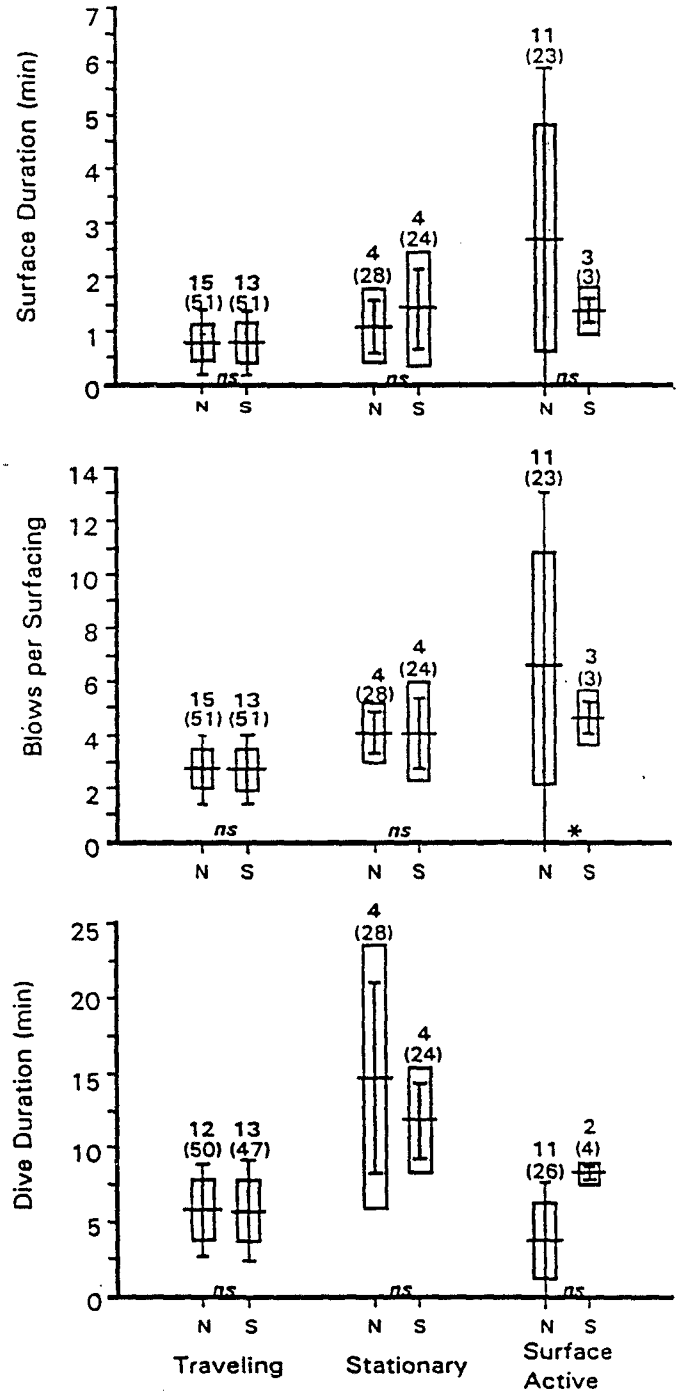

Figure 3-14: Surfacing duration, number of blows per surfacing, and dive duration for pods of one adult (singletons) at the north (N) and south (S) shores in three behavioral states (travel, stationary, and surface active). Mean (horizontal bar), ±1 standard deviation (vertical line), 95% confidence limits (box), number of whales (bold number), and sample size (parentheses) are indicated. Significance levels of between-shore comparisons using the Mann-Whitney U-test are shown (ns indicates difference not significant; * indicates $p < 0.05$).

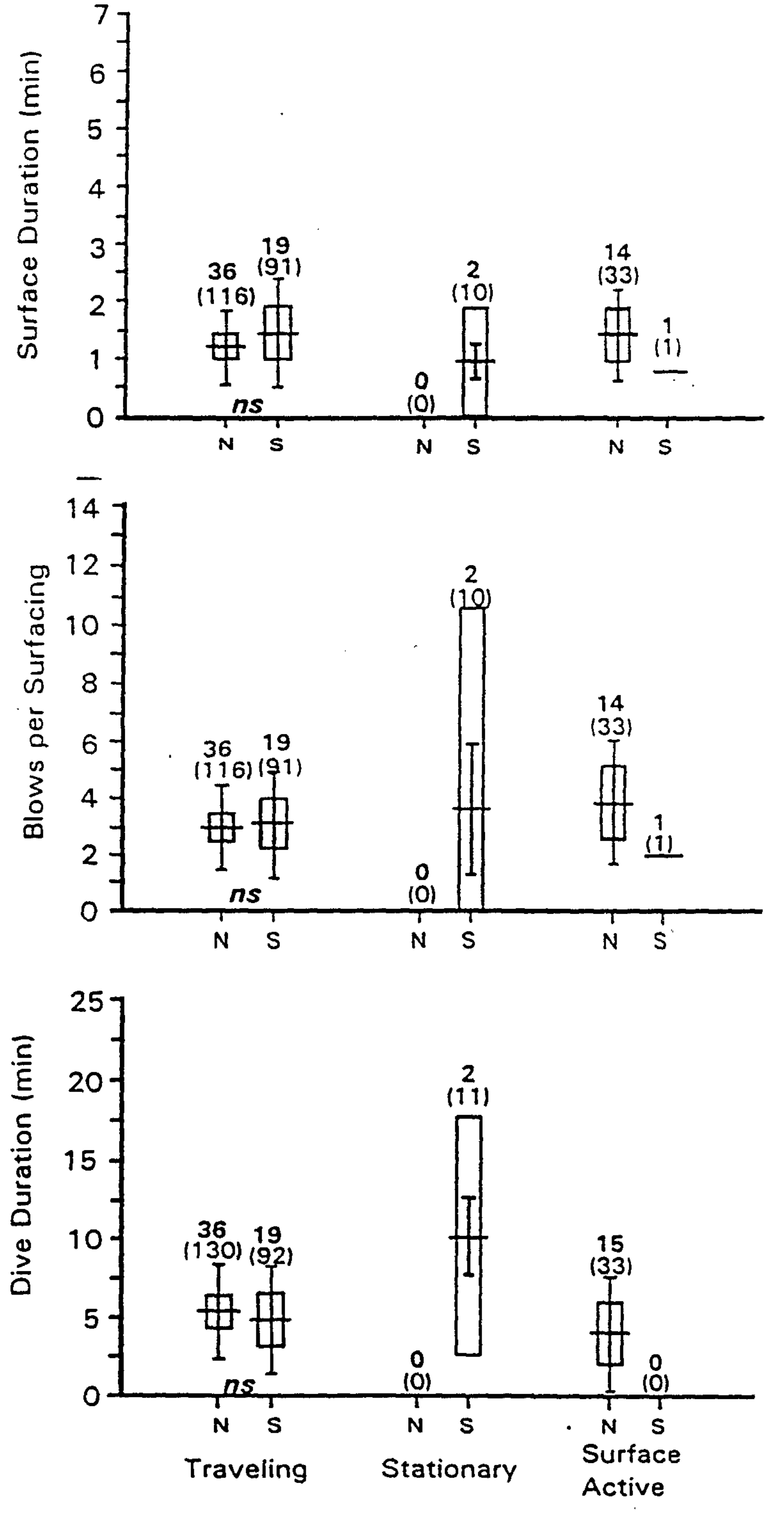

Figure 3-15: Surfacing duration, number of blows per surfacing and dive duration for pods of two adults (pairs) on the north (N) and south (S) shores in three behavioral states (travel, stationary, and surface active). Presentation as in Figure 3-14.

Figure 3-16a. Number of whales sighted per hour from the north and south shores of Kauai by fortnight period. Number of scans indicated above bars.

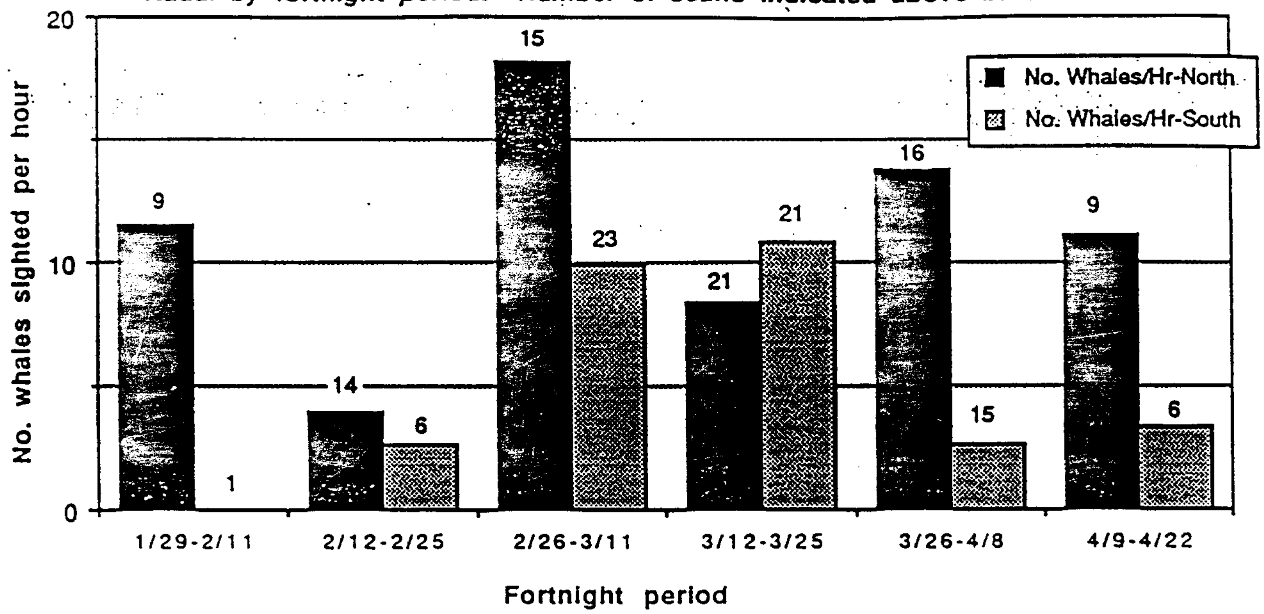

Figure 3-16b. Number of pods sighted per hour from the north and south shores of Kauai by fortnight period. Number of scans indicated above bars.

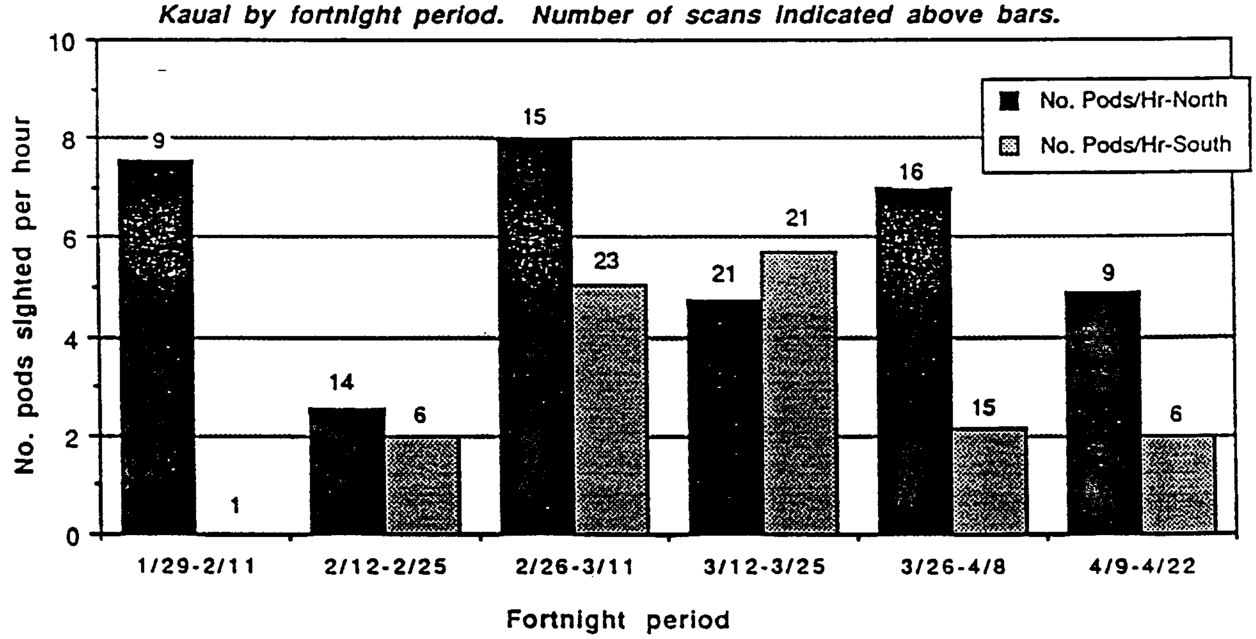

Figure 3-17a. ***Number of pods sighted per hour from the north and south shores of Kauai by beaufort sea state. Number of scans indicated above bars.***

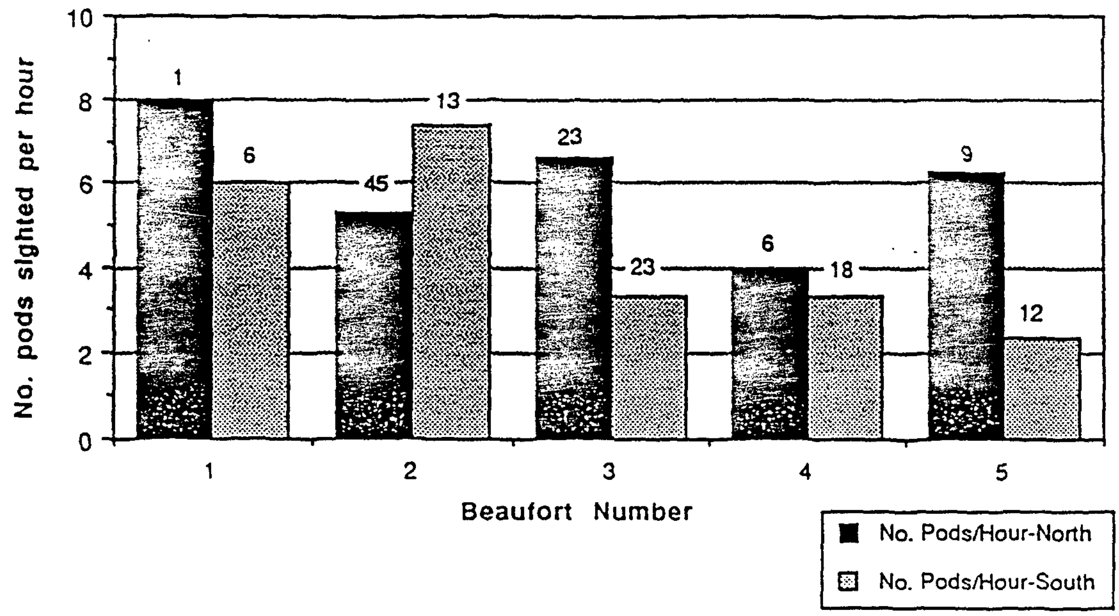

Figure 3-17b. ***Number of whales sighted per hour from the north and south shores of Kauai by beaufort sea state. Number of scans indicated above bars.***

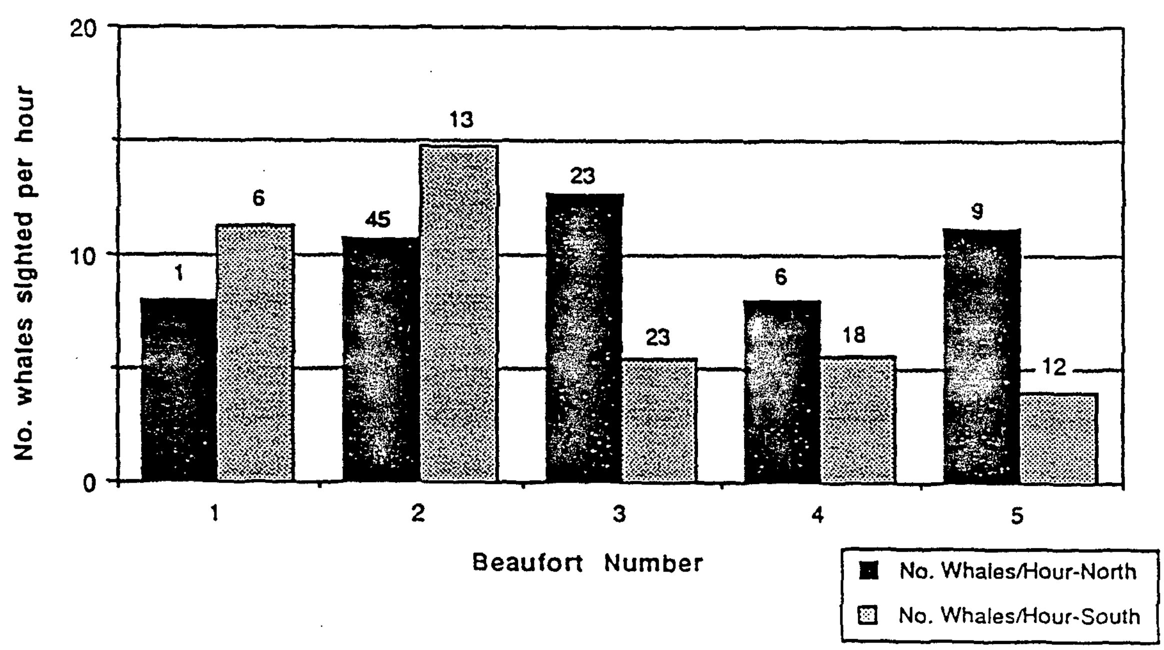

Figure 3-18 *Scan sighting rates of various humpback group types by fortnight. Number of scans indicated above bars. The north shore consists of pooled data from the Kalalau and Princeville shore stations.*

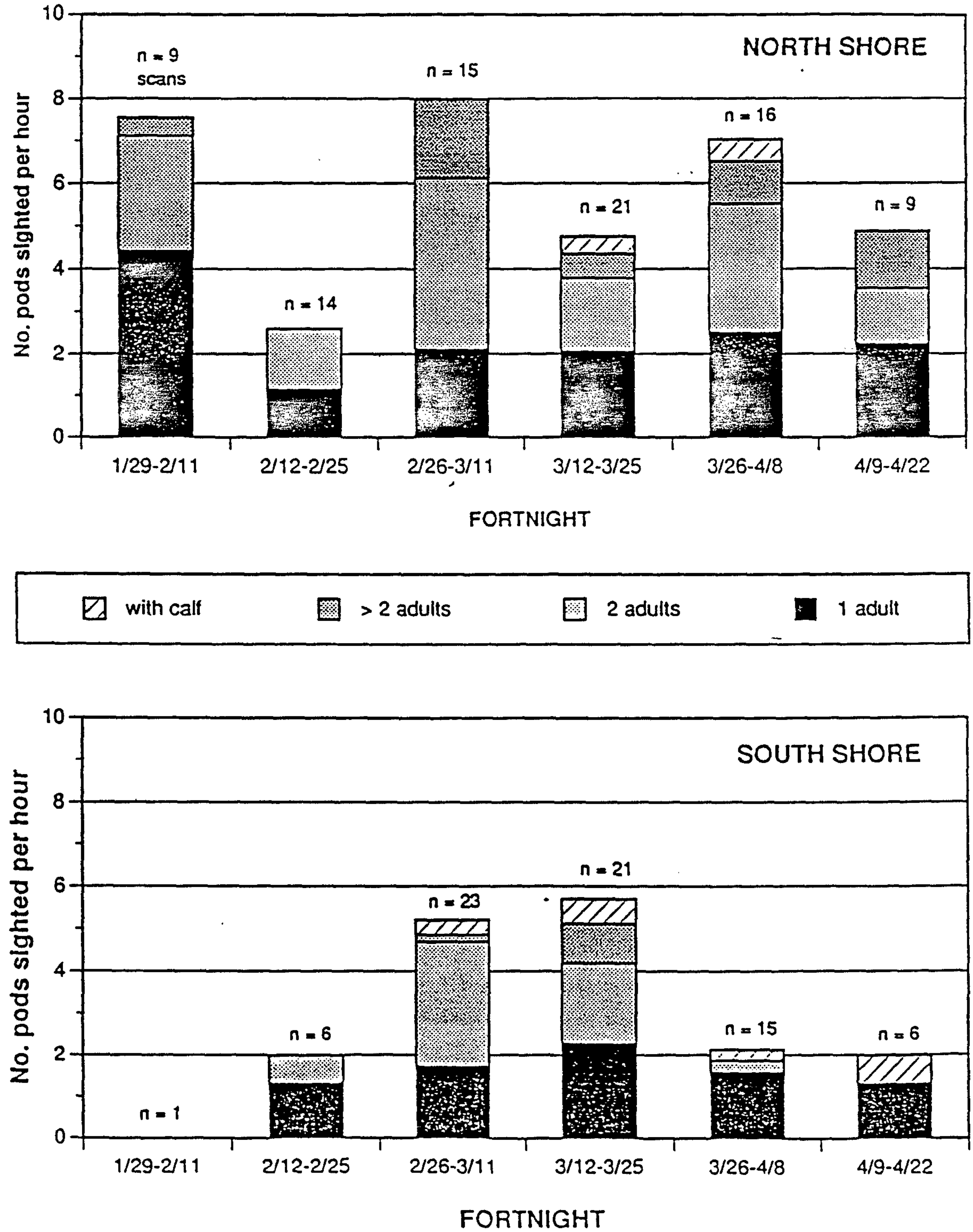

Figure 3-19a. *Number of whales sighted per hour from the north and south shores of Kauai by time of day. Number of scans indicated above bars.*

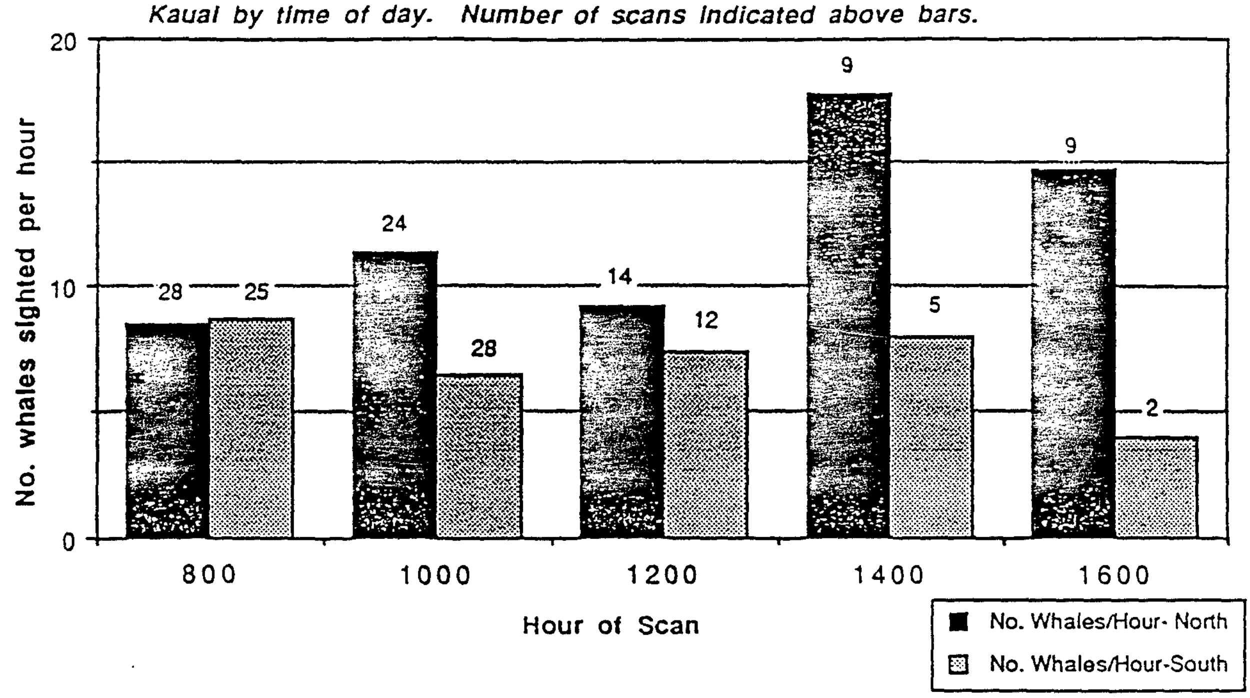

Figure 3-19b. *Number of pods sighted per hour from the north and south shores of Kauai by time of day: Number of scans indicated above bars.*

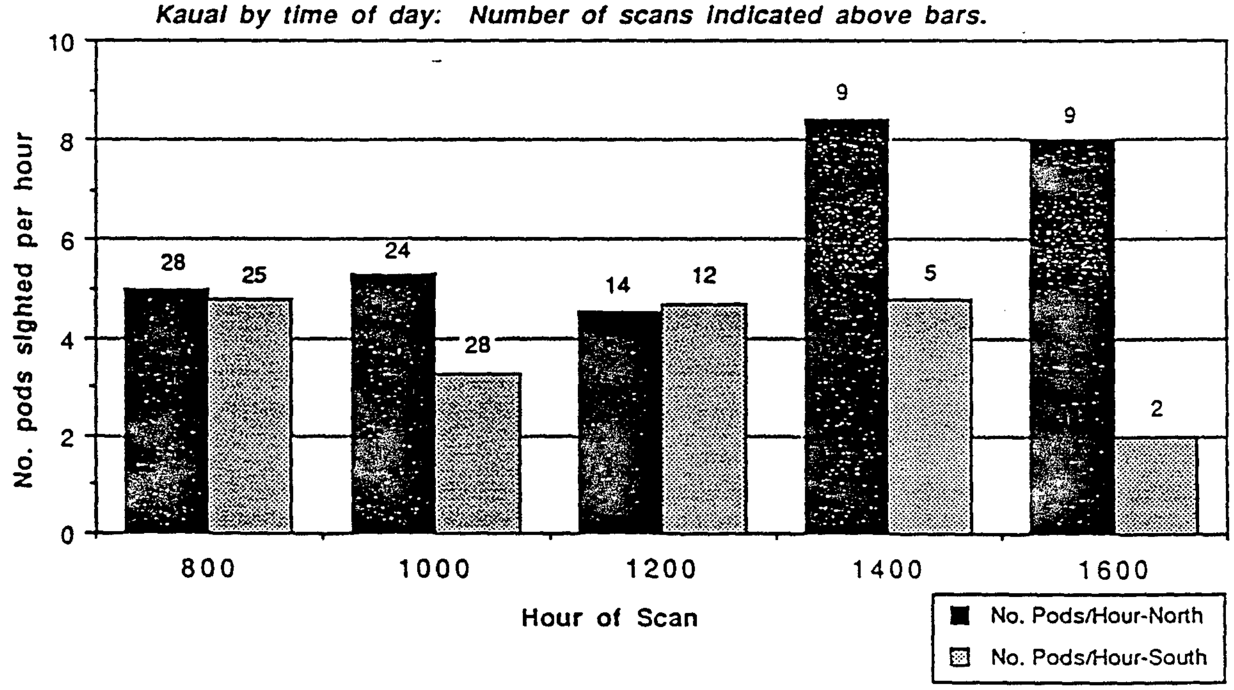

Figure 3-20. ***Number of vessels and aircraft sighted per scan from the north and south shores of Kauai. Number of scans indicated in parentheses.***

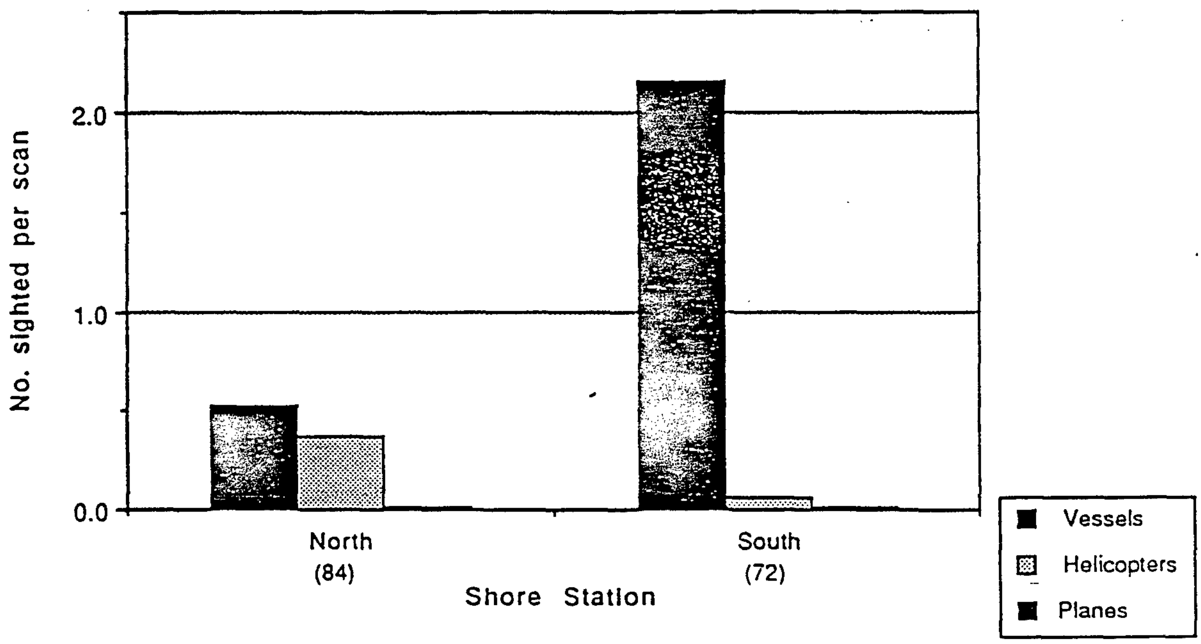

Figure 3-21. ***Frequency of the net orientation of pods at the south and north shore stations.***

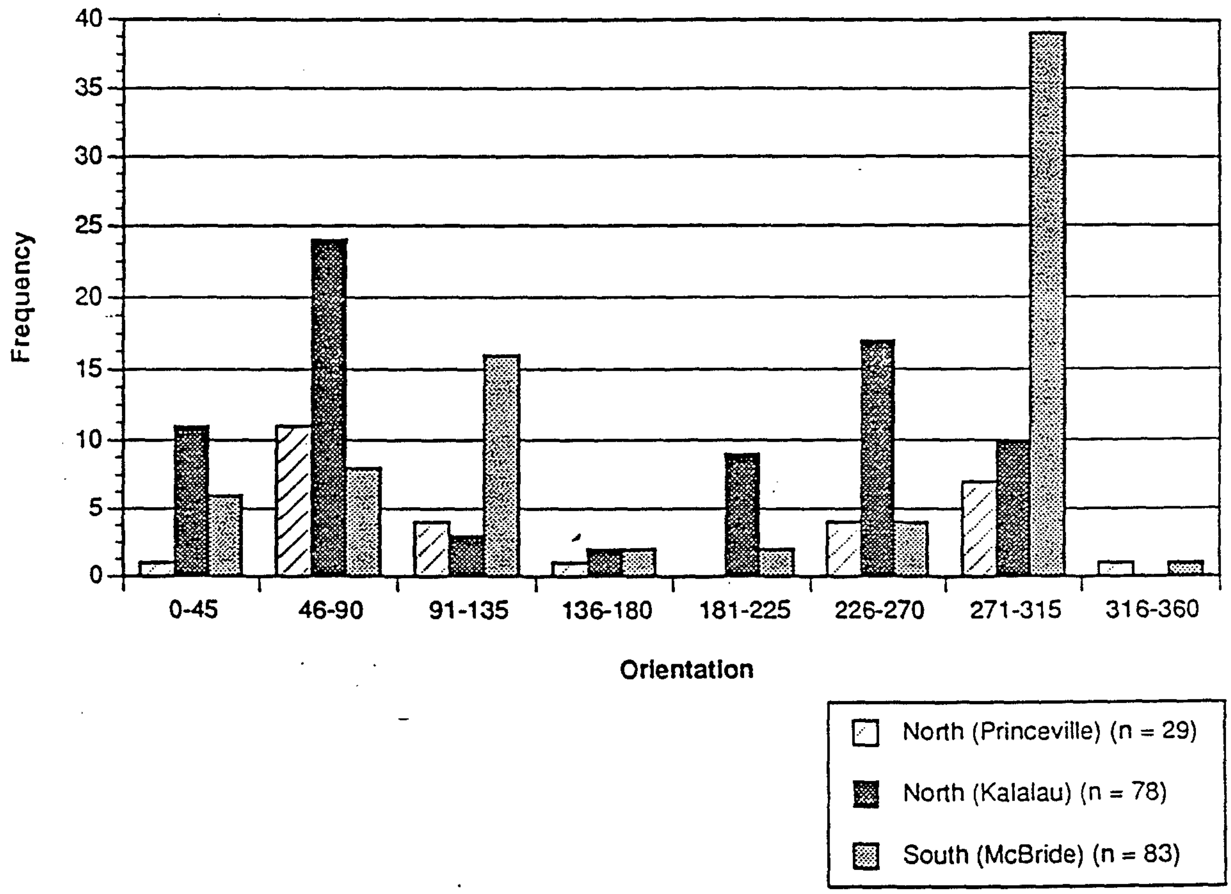

Table 3-1: Summary of effort at shore stations manned in 1993.

	McBryde Sugar Mill (site 12, South)	All North Shore Stations (sites 11,13,14,15)	KalalauTrail (site 15, North)	Princeville Makai (site 11, North)	Kilauea Point (site 14, North)	Pu'u Poa Point (site 13, North)	TOTAL
Observation Period	1/30-4/9	2/4-4/14	2/15-4/14	2/4-2/16	2/10-2/11	2/7	
Hours of Observation	138.5	207.2	118.6	70.4	11.9	6.3	345.7
Number of Days	30	40	27	10	2	1	70
Total Hours with Focal Pods	42.6	69.8	34.6	25.7	7.0	2.5	112.4
Mean Session Length (min)	42.6	33.5	25.7	48.2	46.2	49.7	36.4
Range (min)	1-145	2-189	2-149	2-189	12-92	5-117	
Number of Focal Pods							
1 Adult	21	30	14	13	2	1	51
2 Adults	22	56	33	14	7	2	78
> 2 Adults	9	22	18	4	0	0	31
Pod w/ Calf	8	17	16	1	0	0	25
TOTAL	60	125	81	32	9	3	185
Undisturbed Pods (no vessels < 4 km)	18 (29%)	92 (74%)	55 (68%)	26 (81%)	8 (89%)	3 (100%)	110 (98%)
Mean Vessels per Pod	2.5	0.6	0.7	0.3	0.1	0.0	3.1
Mean Beaufort State per Pod	3.0	3.0	3.2	2.6	2.8	2.7	6.0

Table 3-2: Predicted error in theodolite measurements of range to whales from each of the shore stations..

Station	Station Height (m) (Cliff + Theodolite Height)	Potential Error in Distance to Position on Water (m)			
		Theoretical Instrument Error		Error in the Presence of 2 m Swell	
		Error at 4000 m	Error at 8000 m	Error at 4000 m	Error at 8000 m
South Shore Station	43.7	±10	±40	±95	±208
North Shore Station (Albatross Hill)	48.7	±9	±36	±84	±183
North Shore (Kalalau Trail)	141.3	±3	±12	±29	±59

Table 3-3: Summary of scan samples collected in 1993.

	SOUTH	NORTH			TOTAL
		All	Kalalau Trail (site 15)	Princeville Makai (site 11)	
# Scans	72	84	62	22	156
Total whales (min estimate)	130	233	192	41	363
Total pods (min estimate)	72	121	95	26	193
1 Adult	32 (44%)	45 (37%)	32 (34%)	13 (50%)	77 (40%)
2 Adult	25 (35%)	50 (41%)	39 (41%)	11 (42%)	75 (39%)
> 2 Adult	7 (10%)	21 (18%)	19 (20%)	2 (8%)	28 (14%)
Pod w/Calf	8 (11%)	5 (4%)	5 (5%)	0 (0%)	13 (7%)
Mean pods/scan	1.0	1.4	1.5	1.1	1.2
Mean whales/scan	1.8	2.8	3.1	1.8	2.3
Mean pod size	1.81	1.93	2.02	1.58	1.88
Total Vessels (w/in 6.5 km)	155	44	31	13	199
Mean vessels/scan	2.1	0.5	0.5	0.6	1.3
Total Helicopters	5	31	30	1	36
Mean helicopters/scan	0.07	0.4	0.5	0.04	0.2
Peak fortnight period	3/12-3/25	2/26-3/11	-	-	-
Peak pods/scan	1.4	2.0	-	-	-
Peak whales/scan	2.8	4.5	-	-	-

Table 3-4: Activity budget of focal whales observed *from* sites on the north and south shores.

	All North Shore			North (Site 15)			North (Site 11)			North (Site 14)			North (Site 13)			All South Shore			South (14 Feb-9 April)		
	Hours	N	%	Hours	N	%	Hours	N	%	Hours	N	%	Hours	N	%	Hours	N	%	Hours	N	%
All																					
Rest	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	1.2	1	2.77	1.2	1	3.58
Stationary	7.9	5	11.69	1.3	2	3.62	6.7	3	28.03	0.0	0	0.00	0.0	0	0.00	11.9	8	27.91	9.6	7	28.49
Mill	9.4	22	13.85	4.5	11	12.93	2.1	6	8.85	2.0	3	28.06	0.9	2	34.68	1.1	4	2.54	0.7	2	2.09
Travel	36.9	87	54.45	19.4	54	55.97	11.6	23	48.76	4.6	7	65.90	1.4	2	55.65	22.9	47	53.68	19.6	40	58.41
Surface Active	13.6	49	20.01	9.5	38	27.48	3.4	10	14.35	0.4	2	6.04	0.2	1	9.68	5.6	9	13.11	2.5	3	7.49
1 Adult																					
Rest	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00
Stationary	7.3	4	35.01	0.6	1	12.92	6.7	3	49.34	0.0	0	0.00	0.0	0	0.00	3.9	3	29.23	3.9	3	29.98
Mill	1.0	4	4.75	0.1	1	2.71	0.8	2	5.76	0.0	0	0.00	0.1	1	100.00	0.0	0	0.00	0.0	0	0.00
Travel	7.9	17	37.89	2.1	7	44.38	3.4	8	25.41	2.3	2	95.88	2.3	2	95.88	6.8	17	51.36	6.8	17	52.67
Surface Active	4.7	12	22.35	1.9	6	40.00	2.6	5	19.50	0.1	0	4.12	0.0	0	0.00	2.6	3	19.41	2.2	2	17.35
2 Adults																					
Rest	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00
Stationary	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00	2.8	2	18.93	2.8	2	22.65
Mill	7.6	11	22.62	3.9	5	21.91	1.0	2	11.04	2.0	3	43.14	0.8	1	32.50	0.0	0	0.00	0.0	0	0.00
Travel	22.1	47	65.53	10.6	26	59.78	7.6	13	83.17	2.3	5	49.78	1.4	2	32.50	11.6	20	79.70	9.4	16	77.35
Surface Active	4.0	16	11.84	3.3	13	18.31	0.5	3	5.79	0.3	2	7.08	0.2	1	10.00	0.2	1	1.38	0.0	0	0.00
> 2 Adults																					
Rest	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00							0.0	0	0.00	0.0	0	0.00
Stationary	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00							0.0	0	0.00	0.0	0	0.00
Mill	0.5	5	7.69	0.3	4	5.12	0.2	1	21.74							0.6	3	11.58	0.3	1	16.34
Travel	2.7	12	45.15	2.2	10	43.90	0.5	2	51.09							2.1	6	38.42	1.0	3	66.01
Surface Active	2.8	16	47.49	2.6	14	50.98	0.3	2	27.17							2.7	4	50.00	0.3	1	17.65
w/ Calf																					
Rest	0.0	0	0.00	0.0	0	0.00	0.0	0	0.00							1.2	1	12.61	1.2	1	14.35
Stationary	0.6	1	9.18	0.6	1	9.35	0.0	0	0.00							5.3	3	56.20	2.9	2	36.08
Mill	0.3	2	4.37	0.2	1	2.67	0.1	0	100.00							0.5	1	4.81	0.5	1	5.54
Travel	4.2	11	61.22	4.2	11	62.31	0.0	0	0.00							2.4	4	25.43	3.6	4	43.84
Surface Active	1.7	5	25.22	1.7	5	25.67	0.0	0	0.00							0.1	1	1.38	0.0	0	0.00

Table 3-5. Respiration variables by behavioral categories of rest, mill, travel, stationary, and surface active singletons. Independent sampled means were calculated from the mean of individual whales (bold) for the North and South Shore Stations. Total number of sampled means are shown in parentheses. Between North and South Shore significance levels from Mann-Whitney U-test are coded as follows: * $P < 0.05$ and ns = not significant.

SINGLETONS	BEHAVIOR CATEGORY									
RESPIRATION VARIABLE	Rest		Mill		Travel		Stationary		Surface Active	
	N	S	N	S	N	S	N	S	N	S
Duration at Surface					ns		ns		ns	
mean (min)	--	--	**0.8**	--	**0.8**	**0.8**	**1.1**	**1.4**	**2.7**	**1.4**
SD	--	--	0.29	--	0.59	0.58	0.48	0.75	3.18	0.24
95% CL	--	--	0.53	--	0.32	0.35	0.67	1.04	2.11	0.44
n	0	0	3	0	15	13	4	4	11	3
(n)	(0)	(0)	(8)	(0)	(51)	(51)	(28)	(24)	(23)	(3)
No. Blows/Surface Duration					ns		ns		ns	
mean	--	--	**3.3**	--	**2.7**	**2.7**	**4.1**	**4.1**	**6.5**	**4.7**
SD	--	--	1.15	--	1.31	1.30	0.80	1.36	6.55	0.58
95% CL	--	--	2.10	--	0.72	0.78	1.11	1.89	4.35	1.06
n	0	0	3	0	15	13	4	4	11	3
(n)	(0)	(0)	(8)	(0)	(51)	(51)	(28)	(24)	(23)	(3)
Duration of Dive					ns		ns		ns	
mean (min)	--	--	**5.0**	--	**5.8**	**5.8**	**14.7**	**11.9**	**3.8**	**8.2**
SD	--	--	2.71	--	3.15	3.32	6.34	2.55	3.85	0.19
95% CL	--	--	8.23	--	1.98	1.99	8.79	3.54	2.55	0.58
n	0	0	2	0	12	13	4	4	11	2
(n)	(0)	(0)	(6)	(0)	(50)	(47)	(28)	(24)	(28)	(4)
Blow Interval					ns		ns		ns	
mean (sec)	--	--	**23.1**	--	**19.3**	**20.4**	**18.2**	**23.9**	**21.7**	**23.8**
SD	--	--	7.55	--	7.93	6.64	5.88	4.13	8.67	3.02
95% CL	--	--	10.48	--	4.38	3.65	8.16	5.73	5.45	5.56
n	0	0	4	0	15	15	4	4	12	3
(n)	(0)	(0)	(23)	(0)	(93)	(99)	(90)	(93)	(123)	(17)
Surface Blow Rate					ns		ns		*	
mean (no. blows/min)	--	--	**4.6**	--	**5.6**	**5.9**	**4.5**	**3.7**	**4.0**	**3.4**
SD	--	--	0.49	--	1.90	1.90	1.72	1.00	1.93	0.16
95% CL	--	--	0.89	--	1.05	1.14	2.38	1.39	1.28	0.29
n	0	0	3	0	15	13	4	4	11	3
(n)	(0)	(0)	(8)	(0)	(51)	(51)	(28)	(24)	(23)	(3)
Surface-Dive Blow Rate					ns		ns		*	
mean (no. blows/min)	--	--	**0.6**	--	**0.5**	**0.5**	**0.3**	**0.4**	**1.1**	**0.4**
SD	--	--	0.02	--	0.19	0.31	0.14	0.17	0.69	0.08
95% CL	--	--	0.06	--	0.13	0.18	0.19	0.24	0.49	0.26
n	0	0	2	0	11	13	4	4	10	2
(n)	(0)	(0)	(6)	(0)	(42)	(43)	(26)	(20)	(20)	(2)

Table 3-6. Respiration variables by behavioral categories of rest, mill, travel, stationary, and surface active pairs. Independent sampled means were calculated from the mean of individual whales (bold) for the North and South Shore Stations. Total number of sampled means are shown in parentheses. Between North and South Shore significance levels from Mann-Whitney U-test are coded as follows: ns = not significant.

PAIRS	BEHAVIOR CATEGORY									
RESPIRATION VARIABLE	Rest		Mill		Travel		Stationary		Surface Active	
	N	S	N	S	N	S	N	S	N	S
Duration at Surface					*ns*					
mean (min)	—	—	**1.1**	—	**1.2**	**1.5**	—	**1.0**	**1.4**	**0.8**
SD	—	—	0.62	—	0.66	0.93	—	0.30	0.79	—
95% CL	—	—	0.47	—	0.22	0.45	—	0.92	0.45	—
n	0	0	9	0	36	19	0	2	14	1
(n)	(0)	(0)	(37)	(0)	(116)	(91)	(0)	(10)	(33)	(1)
No. Blows/Surface Duration					*ns*					
mean	—	—	**2.3**	—	**3.0**	**3.1**	—	**3.6**	**3.9**	**2.0**
SD	—	—	0.96	—	1.49	1.87	—	2.30	2.22	—
95% CL	—	—	0.72	—	0.50	0.90	—	6.99	1.27	—
n	0	0	9	0	36	19	0	2	14	1
(n)	(0)	(0)	(37)	(0)	(116)	(91)	(0)	(10)	(33)	(1)
Duration of Dive					*ns*					
mean (min)	—	—	**7.4**	—	**5.5**	**4.9**	—	**10.2**	**4.1**	—
SD	—	—	5.37	—	3.04	3.43	—	2.47	3.61	—
95% CL	—	—	3.79	—	1.03	1.70	—	7.53	1.99	—
n	0	0	10	0	36	18	0	2	15	0
(n)	(0)	(0)	(38)	(0)	(130)	(92)	(0)	(11)	(33)	(0)
Surface Blow Rate					*ns*					
mean (no. blows/min)	—	—	**3.1**	—	**3.0**	**2.8**	—	**3.7**	**3.4**	**2.5**
SD	—	—	1.31	—	1.25	0.59	—	0.67	1.32	—
95% CL	—	—	0.99	—	0.42	0.28	—	2.05	0.76	
n	0	0	9	0	36	19	0	2	14	1
(n)	(0)	(0)	(37)	(0)	(116)	(91)	(0)	(10)	(33)	(1)
Surface-Dive Blow Rate					*ns*					
mean (no. blows/min)	—		**0.4**		**0.5**	**0.6**	—	**0.3**	**0.7**	
SD	—	—	0.21	—	0.27	0.27	—	0.08	0.31	
95% CL			0.17		0.10	0.13		0.23	0.18	
n	0	0	8	0	30	18	0	2	14	0
(n)	(0)	(0)	(31)	(0)	(97)	(75)	(0)	(8)	(28)	(0)

Table 3-7: Minimum number of sightings of pods out to 8 km during all observation hours.

	SOUTH	NORTH			TOTAL
		All	Kalalau Trail	Princeville Makai	
Hours of Effort	138.5	165.0	114.7	50.3	303.5
Minimum Pods	235	440	331	109	675
Minimum Whales	404	696	540	156	1100
Minimum Pods w/ Calves	18	16	14	2	34
Minimum Pods/hr	1.7	2.7	2.9	2.2	2.2
Minimum Whales/hr	2.9	4.2	4.7	3.1	3.6
Spinner Dolphin Schools	12	8	7	1	20
Bottlenose Dolphin Schools	2	0	0	0	2

Table 3-8: Summary of net swim speeds and linearity indices.

Pod Type	Sample Size	Mean Speed (sd) in km/hr	Mean Linearity Index (0 = mill, 1 = straight)
1 Adult	55	5.3 (3.49)	0.81
2 Adults	84	4.8 (2.73)	0.78
> 2 Adults	44	4.8 (2.28)	0.77
Pod with calf	10	2.3 (1.45)	0.64

PRELIMINARY RESULTS OF ATOC-MMRP SHORE-BASED OBSERVATIONS OF HUMPBACK WHALES INCLUDING SIGHTINGS OF OTHER MARINE MAMMALS AND SEA TURTLES

KAUAI 1994

1 OCTOBER 1994

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INTRODUCTION

As in 1993, the primary goals of shore-based visual observations during 1994 were to (1) determine baseline behavior patterns of humpback whales before ATOC transmissions, and (2) assess the distribution and sighting frequency of humpback whales and other marine mammals and sea turtles near the shore station. Shore-based observations were conducted from two stations located on the north shore of Kauai. Behavioral data collected during 1993 and 1994 will be used as a baseline comparison for behavioral data collected during ATOC transmissions. In 1993 and 1994, observations consisted of three types of data: (1) focal behavior sampling of humpback whales, (2) scan sampling to measure the relative numbers of humpback whales, other marine mammals, and sea turtles within view of the shore stations, and (3) opportunistic tracking of non-focal humpback whale pods and other marine mammals.

METHODS

Study Area and Observation Dates

The two observation stations used in 1994, Princeville (Site 11) and Kalalau (Site 15), were also used in 1993. These stations were located approximately 10 km apart. Both stations were selected based on proximity to the proposed ATOC source location, cliff height, and range of view. Both stations were located within the projected 120 dB isopleth (for waters <500 m deep) of the ATOC source. The easternmost observation station, Princeville, was located immediately east of the Princeville Makai Golf Course at the end of Punahele Road at 22°13'47" N, 159°29'13" W at a height of 47.2 m. The Kalalau observation station was located along a foot trail approximately 1 km west of the Kalalau trailhead at 22°13'04" N, 159°35'13" W on a rock cliff at a height of 139.8 m.

Station heights were determined with a "Total Station" electronic theodolite equipped with an electronic distance meter (EDM). The EDM projected an infra-red laser beam to an EDM reflector mounted on a standard hand-held stadia rod. The stadia rod was placed at the shore station and the theodolite was set up at sea level or vice versa. The crosshair within the theodolite eyepiece was aligned with the EDM stadia rod reflector, and the laser beam was reflected back to the theodolite. An internal computer inside the theodolite calculated the shore station height based on the vertical angle.

Marine mammals were tracked (by theodolite) within 10 km of the shore station. Focal behavior observations were conducted out to 7 km, depending on observation conditions. Specific scan areas are described later.

Shore-based observations were conducted between 13 January and 15 April 1994. At the Princeville station, observations were conducted between 13 January and 15 April for a total of 55 days. At the Kalalau staton, observations were conducted between 30 January and 15 April for a total of 45 days.

Apparatuses

A surveyor's theodolite (30-power magnification) was used to track pod and vessel positions as described by Tyack (1981) and Würsig et al. (1991). A Lietz/Sokkisha theodolite model DT5 (10-second precision) was used at the Princeville station, and a DT5A model (5-second precision) was used at the Kalalau station. The theodolite measured horizontal and vertical angles of target locations in degrees, minutes, and seconds. Horizontal angles were referenced to magnetic north with a relative angle set consistently on a charted landmark. Vertical angles were referenced to the gravity-based leveling device on the theodolite. Subsequent analysis converted these angles to Cartesian coordinates for calculation of speed, direction of travel, and separation distance of whales and vessels. Conversion of angles included corrections for curvature of the earth and theodolite height, the latter which was measured each day from a set ground-marker. Since the fluctuation in tidal height off the Hawaiian coast is less than 30 cm, the minimal resultant error was ignored (Bauer 1986). Theodolite-measured target positions (fixes) were taken when the cross-hairs within the scope were placed at the waterline of the target. To control for error, the horizontal and vertical reference points were checked approximately every 15 min and were reset if out of vertical balance by greater than 40 sec.

Fujinon (7 X 50), Steiner (15 X 80), or "big eye" (25 X 150) binoculars were used to observe whales. These binoculars were equipped with reticles and an internal compass or an external, daily-calibrated compass rose. Number of reticles was used to gauge distance of whales from the shore station by aligning the top reticle with the horizon and counting the number of reticles (hash marks) down from the horizon to the target (Dalheim et al. 1992). Reticles were converted to distance based on a formula incorporating known height of observation platform and associated distance to the horizon (pers. com., T. Gerrodette, Southwest Fisheries Center, National Marine Fisheries Service, La Jolla, California, April 1994). The formula was calibrated once from the Kalalau station by taking simultaneous theodolite and binocular (all three models) reticle readings of various locations of a dedicated boat that simultaneously took GPS positions. The formula was calibrated three other times by taking simultaneous theodolite and binocular reticle readings of various marks on a stadia rod. A time-event recorder (computer) (Tandy TRS-102 computer equipped with a Booster Pack) was interfaced with each shore station's theodolite to record theodolite fixes. The computers were also used to record identification and behavior codes. All computer entries were automatically assigned real-time flags.

Data Collection

Shore-based observations were attempted every day but were dependent on weather conditions. Both stations followed an extensively developed observation and tracking protocol (Appendices A-H) and occasionally interchanged personnel to ensure consistent observation procedures. The observation crew usually consisted of four people: (1) a primary behavioral observer, (2) a theodolite operator, (3) a computer operator, and (4) a note-taker. When only three people were available, the computer operator also served as the note-taker.

Environmental conditions were recorded and updated every hour or sooner if conditions changed. The following variables were recorded based on their occurrence within the viewing area (see Appendices A and B for definitions): Beaufort, visibility (sightability), swell height (estimated), and glare. Observations were conducted primarily during a Beaufort and sightablity of 4 or less (wind speed < 32 km/hr and fairly frequent whitecaps) to obtain detailed behavioral observations. However, observations were occasionally continued through a Beaufort 5 when whales could be observed and tracked reliably (e.g., when they were close to shore). Observations were generally terminated during a Beaufort or sightability code > 5, or during other precluding conditions (e.g., rain, high winds).

Focal Behavior Sampling

Focal sampling was used to record humpback whale behavior. In this type of sampling, all behaviors of one pod were recorded for as long as possible based on an ethogram (Altmann 1974, Appendices C and D). Two or animals swimming together were defined as the same pod if they were within five body lengths of each other and exhibited synchrony in behaviors such as respiration, surfacing, and diving (Würsig et al. 1984). A single animal was also referred to as a pod. All non-calf whales were termed 'adults' since it was not possible to consistently differentiate subadults from adults. If whales were individually distinguishable (e.g., cow (mom), calf and escort, or two uniquely scarred or pigmented adults) then the behaviors were described separately for each individual. However, this was generally not possible with the exception of cow and calf pods.

Selection of a focal pod was not random but was deliberately biased toward small pods, pods containing calves, and pods close to the shore station. This facilitated the collection of accurate behavioral data, particularly respiration rate, which is regarded as an important index of disturbance (Bauer 1986, Baker and Herman 1989, Richardson et al. 1991a). Moreover, small pods, especially those containing a calf, display more behavioral responses to disturbance than do larger pods (Bauer 1986). The primary observer used either the 7 X 50, 15 X 80, or big eye binoculars to determine whale behaviors. The selection of a binocular model was dependendent on the proximity of the focal pod and associated range of view.

Focal pod behaviors were recorded up to 7 km from shore, dependent on sighting conditions. These behaviors included behavioral events and states (Altmann 1974) that were classified according to a behavioral ethogram (Appendices C and D) modified from Baker et al. 1982, Würsig et al. 1984, Bauer 1986, Richardson 1991, and Kieckhefer 1992. Specific behavioral events, states, and associated information were dictated by the primary behavioral observer and entered into the computer by the computer operator as 1-3 alphanumeric codes. The note-taker manually recorded any notes which were necessary to describe events or highlight changes to be applied to the data during the later editing phase.

Focal pod sessions were continued for as long as possible until (1) a pod passed beyond reliable view (approximately 5-8 km), (2) a pod was lost from view (e.g., obstructed by tree, not sighted for > 40 min), (3) behaviors and/or respirations could no longer be observed reliably due to degradation of environmental conditions (e.g., poor sightability, Beaufort > 5), (4) identification became confused with other pods, (5) a pod affiliated or disaffiliated, or (6) a pod was reliably passed off to the other shore station's behavioral observer (this occurred once).

Each focal pod session was assigned a rating code to reflect the behavioral observer's confidence in the data being collected (Appendix A). Rating codes ranged from 1 (excellent respiration and behavioral data) to 5 (theodolite tracking only due to inability to reliably discern blows and behaviors). However, theodolite tracking of focal pods often continued beyond the end of the behavioral observations.

An attempt was made to fix focal pods with the theodolite at least once per surface duration (as defined in Appendix E), or whenever a change in heading or speed occurred. The minimum time period between fixes of a linear-moving pod was 60 seconds to minimize the possibility of obtaining invalid calculations of speed and/or direction as a result of increased theodolite and/or observer error at greater distances (Bauer 1986).

Pods and vessels were assigned identification numbers. When pod composition changed during an affiliation or disaffiliation, the pod was assigned a new identification number and was treated as a different pod with respect to behavioral observations. Selection of the new focal pod was noted manually by the note-taker and entered into the computer.

Vessels were tracked by theodolite at all times, whales present or not, to establish baseline information on occurrence of whales relative to occurrence of vessels, and to describe general use of the study area by various vessel types. All vessels <10 km from the shore station were tracked with the theodolite, especially as they left or entered the study area. The following vessel descriptions were recorded as possible: estimated length, type (fishing, diving, whalewatching, etc.), engine size/type (inboard, inboard/outboard or outboard, twin-engine, etc.), name or vessel registration number, color, and general descriptions that helped to differentiate vessels. Large vessels (> 20 m) were tracked out to the horizon because their underwater sounds propagate farther. Other studies indicate that humpback whales appear to react to cruise ships up to 8 km away (Baker and Herman 1989). However, since the theoretical accuracy of the theodolite declines rapidly at distances > 10 km, vessel positions near the horizon were considered useful for general location only.

An attempt was made to fix each vessel (stationary or moving) a minimum of three times as it passed the shore station. Fixes were also attempted when a vessel changed orientation or speed, with priority given to those vessels closest to the focal pod, particularly when within 1 km of the pod. In the latter case, vessel fixes were attempted each time the focal pod was fixed. In addition, vessel changes in speed or orientation (Appendices C and F) were recorded and encoded into the computer for those vessels < 1 km from the focal pod. Closest point of approach (CPA) of vessels approaching within 1 km of the focal pod were estimated and noted, and both pods and vessels were fixed with the theodolite at this time when possible.

Non-focal pods were observed and tracked opportunistically with the theodolite up to 10 km from the shore station, although detailed behavioral observations were not collected. The primary information gathered on non-focal pods was (1) location, (2) speed and orientation, and (3) general behavioral state (Appendix D). The theodolite operator attempted to fix non-focal pods once per surface duration, or at least when an obvious change in speed or direction occurred. Effort was concentrated on monitoring pods as closely as possible to avoid confusing them. However, this was not always possible during periods when many pods were in the area, particularly when whales were affiliating and disaffiliating. Only those pods that could be tracked reliably were given pod numbers and notes were taken to indicate potential repeat sightings.

In addition to humpback whales, opportunistic sightings of all other marine mammals and sea turtles were recorded and/or fixed with the theodolite.

Scan Sampling

Scan sampling (Altmann 1974, Bauer 1986, Helweg 1989, Smultea 1991) was used to document sighting rates of marine mammals, vessels, aircraft, and sea turtles. Scan sampling was conducted opportunistically within a pre-determined distance and duration. They were designed to determine (1) relative sighting frequency of pods of particular composition and size, (2) surface active rates of pods, and (3) orientations of pods, within and between shore stations based on year, time of season, time of day, Beaufort, and sightability.

Each observation day began with a scan sample. Subsequent scans were interspersed between focal sessions; thus, they did not begin precisely at the same times each day. Scans for marine mammals were 15-min in duration and were separated by at least one hour to minimize recounting the same individuals. Studies suggest that humpbacks are transient in Hawaii, predominantly traveling in apparent local migratory movement at a mean speed of 4-5 km/hr (Herman and Antinoja 1977; Baker and Herman 1981; Darling et al. 1983; Bauer 1986; Smultea et al. 1993, 1994). Thus, scans were conducted at intervals assumed to be sufficient for most whales to move out of the scan arena.

To maximize detection of whales in a short period of time, the scan area was divided into a 'nearshore' and an 'offshore' zone. Zones were scanned simultaneously by two different observers (one observer per zone). Observers did not alert one another about the presence of whales outside of their designated zone during the scan. Information on pods missed by the designated scan observers was discretely noted and transferred to the scan data sheet at the end of the scan by the notetaker.

The nearshore observer scanned from shore out to the approximate 100-fathom contour, since studies indicate that humpback whales prefer waters within this isobath (Herman et al. 1980, Forsyth et al. 1991, Mobley et al. 1994). This was a radius of 4 km at the Princeville shore station and 7 km at the Kalalau shore station. The nearshore observer scanned using multiple, left-to-right search patterns, alternating each sweep between the naked eye and 7 X 10 binoculars.

The offshore scan was designed to monitor any marine mammals, particularly deep-diving species (e.g., pilot whale, sperm whale) within the projected 130 dB isopleth (at depths > 500 m) of the ATOC source. This isopleth encompassed the region within a 10-km radius of the source. For purposes of the offshore scan, this region was converted to an arc bisected by the source and originating at the shore station. The arc was judged to allow maximal coverage of the 10-km radius area centered on the source, but was small enough to allow multiple, left-to-right search sweeps during the 15-min period. The offshore observer scanned from the approximate 100-fathom isobath to the horizon within the designated arc. At Princeville, the observer scanned a 64° arc (282° to 346° magnetic N) from 4 km to the horizon. At Kalalau, the observer scanned a 69° arc (320° to 029° magnetic N) from 7 km to the horizon. The offshore scan areas of the two shore stations partially overlapped as they were both focused over the source.

Scan samples were preceded by a scan for vessels. The vessel scan was performed by the theodolite operator who fixed all vessels within 10 km of the shore station. During this time, the primary observer scanned for turtles for 2 min duration in waters < 500 m from shore. The 15-min whale scan then followed the vessel scan. All aircraft passing directly in front of the shore station within 5 km of shore at < 2000 ft altitude during the 15-min whale scan were also recorded.

When an observer sighted a pod during a scan, the binocular reticle and bearing location of the pod were dictated to the note-taker. The observer continued to monitor the pod through the binoculars for at least one surface duration to determine: (1) species, (2) pod size and composition, (3) orientation, and (4) presence/absence of surface activity. The observer also directed the theodolite operator to the pod location. The theodolite operator then attempted to fix and follow the pod to confirm species, size/composition, and orientation. The theodolite operator continued to fix pods previously sighted by the observers, but not new pods, which might alert observers. When necessary, a 10-min period after completion of the 15-min scan was used to verify pod compositions or obtain a theodolite fix. Beaufort and sightablity were noted separately for nearshore and offshore zones based on conditions in the majority of each zone. If environmental conditions varied within each zone, conditions were described by subsections of each zone.

DATA ANALYSIS

Present analysis of 1994 data collected during shore-based observations is limited to summaries of effort and preliminary results of scan data. However, a description of all behavioral variables collected is provided, including the proposed approach to analyses of these data. Further results of analyses and a discussion section will be provided in the final report.

Data Reduction

The following dependent measures were collected during shore-based observations in 1994 and 1993 to determine baseline behavior of humpback whales and to assess potential effects of vessel and aircraft presence. The same measures will be used for periods before, during, and after ATOC transmissions. The general dependent variables included: (1) five indices of respiration (see Appendix B) (Würsig et al. 1984, Kieckhefer 1992), (2) various speed and orientation measurements (described later), and (3) scan sighting rates. The independent variables included (1) pod size/composition, (2) potential disturbance (occurrence of non-focal pods, vessel or aircraft presence/absence and related measures such as CPA and vessel-pod and pod-pod separation distance), (4) behavioral state, (5) date, (6) time of day, (7) Beaufort, and (8) sightability. These variables are described in more detail in the following paragraphs.

Results were considered significant for all $p \leq 0.05$ and marginally significant for $0.05 < p < 0.10$ (Richardson et al. 1991b). Results termed not significant or marginally significant at this time should not be interpreted as "no effect", as sample sizes may not have been adequate to determine effect/no effect. The power of the tests and minimum sample sizes required to conclude significance or non-significance will be included in the final report.

The following parameters will be calculated to describe the tracks of whales (Malme et al. 1983, Smultea et al. 1994): net speed, cumulative speed, milling (linearity) index, net orientation (course bearing), and reorientation rate. Net speed is calculated as the distance between the first and last positions of a series of theodolite fixes, divided by the difference in time elapsed between the first and last fixes. Cumulative (average) speed is calculated by summing the total length of the tracks from one surfacing to the next and dividing this length by the sum of times between fixes. A linearity index is used to measure changes in orientation (e.g., directness or linearity of the route taken by a pod from one point to the next). This measure is calculated by dividing the net speed by the cumulative speed. The linearity index ranges from 0 (indicating a random path) to 1 (indicating a linear path). Net orientation denotes the bearing in degrees of a pod's overall track based on the angle between the first and the last positions of a pod. Reorientation rate is calculated by dividing the sum of the absolute changes in orientation (in degrees) between consecutive fixes by the total observation time.

A chi-square test will be used to determine frequency of orientation based on magnetic orientation categories of 45-degree intervals (Zar 1984; Smultea et al. 1993, 1994). Analyses of the above parameters will be limited to focal and non-focal pod tracks meeting the following conditions: (1) a minimum of three theodolite fixes separated by at least 45 seconds of time, (2) a swell height less than or equal to 3 m, and (3) occurring within 10 km of the shore station.

For scan data, the dependent variable was the scan sighting rate. This was expressed either as the number of sightings per scan or the number of sightings per km^2 ("density"). The latter density index facilitated comparisons between the two shore stations and with 1993 data, as scan arenas differed in size due to differences in station elevation, associated range of view, and proximity of the 100-fathom isobath. The density index was obtained by dividing the total number of sightings during a 15-min scan by the size of the scan area in km^2. The nearshore scan area encompassed 26.40 km^2 at the Princeville station and 77.85 km^2 at the Kalalau station.

As pod size sometimes may have been underestimated, scan sighting rates were expressed both as the number of pods or the number of individual whales sighted per scan (or per km^2). This was because scan observers indicated a minimum number of whales on some pods of 1 or 2 animals if pod composition could not be confirmed. The primary goal of scans was to determine relative--not absolute-- measures of density, as no correction factor was available for distribution or sightability of whales as a function of distance from shore because (1) the aerial survey plane did not expend adequate effort within the scan arena to develop a correction factor, and (2) vessel transects were not conducted.

Independent variables for scans included pod size/composition, Beaufort, sightability, fortnight of the year (two-week periods based on the Julian calendar; Table 1), time of day (by 4-hr period), and observation site. Data were pooled into fortnight and 4-hr periods to increase cell sizes and test power. The three, 4-hr periods encompassed any scans which began within the following blocks of time: morning (06:00 to 09:59), midday (10:00 to 13:59,) or afternoon (14:00 to 17:59). Relatively few scans were conducted during afternoon periods because trade winds generally increased to Beaufort ≥ 5 at this time.

Distribution of scan sighting rates was positively skewed. Various transformations of data were attempted (e.g., arcsin, log, etc.) but did not better approximate a normal distribution. Thus, parametric tests (Mann-Whitney U and

Kruskal-Wallis) were used to examine scan sighting rates for one and two-factor analyses. Multivariate tests were conducted using parametric multivariate analysis of variance which are generally considered robust regarding unequal variance and distribution of means (Zar 1984). Summary statistics were calculated for vessel and aircraft sighting rates during nearshore scans.

It is probable that some of the same whales were sighted repeatedly between years, days, occasionally between scans, and to an undetermined extent between stations. However, since the goal of scans was to assess relative sighting rates within and between shore stations, and because consecutive scans were separated by at least one hour, independence of sightings was not considered a bias. Moreover, it would be impossible to correct for repeat sightings given the limited existing resources and information. However, we assumed that repeat sightings were low based on the following: (1) within-season resight rates of individual whales photoidentified near the south, west, and north shores of Kauai suggest that most individuals do not remain in the same area for more than a few days (Cerchio 1994); (2) whales near the shore stations in 1993 traveled along the coastline at a mean speed of 4-5 km/hr (Smultea et al. 1993, 1994) which moved them out of the nearshore scan zone between scans; (3) mean swim speeds and orientations of pods in 1993 (Smultea et al. 1993, 1994) demonstrated that less than one-half of the whales passed into the other station's scan arena in about 2 hr.

RESULTS

A summary of effort, including the total number of station hours, focal pods, scan sightings, and opportunistic sightings are presented in Tables 2, 3 and 4. A total of 544.9 hr of observation were spent at all shore stations: 323 hr at the Princeville and 221.9 hr at the Kalalau station. Approximately one-third of all available effort days were "bad weather" days when observations could not be conducted due to rain or high wind/Beaufort conditions. These included a stretch of 16 days from 11 to 26 March during persistent stormy weather. As in 1993, weather days occurred more frequently in March and April than in February. Study results are presented separately for focal pod sessions and scan samples.

Focal Behavior Sampling

A total of 226 focal pods were tracked from the two shore stations (Table 2). The mean duration of a focal session was slightly longer at Kalalau (mean = 0.78 hr) than at Princeville (mean = 0.73 hr). Most (44%) of the 133 focal pod samples at Princeville were pods of two adults, followed by one adult (28%), more than two adults (14%), and pods with a calf (14%) (Table 2). The relative proportions at Kalalau were similar: pods of two adults (41%), one adult (27%), more than two adults (12%), and pods with a calf (20%) (Table 2).

Scan Sampling

Nearshore Scans

A total of 126 nearshore scans were conducted from the Princeville station and 119 from the Kalalau station (Table 3). There were 302 humpbacks in 187 pods sighted from Princeville and 621 humpbacks in 342 pods sighted from Kalalau. Effort was limited to Princeville until 30 January due to logistical constraints at the beginning of the season. Only one valid scan was conducted during fortnight six (12 - 25 March) at either station when 16 days of stormy weather precluded observations.

Analysis of nearshore scan sighting rates was limited to scan conditions of a Beaufort/sightability < 5, since scan sighting rates generally declined during Beaufort or sightability conditions ≥ 5 (Figs. 1-4, Table 5). Eliminating these conditions at Kalalau reduced the variance of sighting rate due to degraded observation conditions; yet there were still significantly fewer sightings from Princeville during Beaufort and sightability 4 compared to 2 (Figs. 1 and 2, Table 5). However, there appeared to be no significant relationship between Beaufort or sightability and other variables of interest including fortnight of the year and time of day at either Princeville or Kalalau (Table 5).

Comparisons Betwen Shore Stations

Overall sighting rates, expressed as the number of pods (or whales) sighted per scan, were significantly greater at Kalalau than at Princeville (U' = 10,507 and 10,752, respectively, $p = 0.0001$) (Fig. 5). However, this was probably due to the larger area scanned at Kalalau. When sighting rates were corrected for size of scan zone and converted to a "density" index, there was no significant difference in the number of pods or whales sighted per km^2 by station location (U' = 6,021 and 5,833, respectively, $p = 0.15$ and 0.33) (Fig. 6). However, there was a significant relationship between stations and sightability for the number of whales sighted per km^2 ($F = 4.14$, $p = 0.017$); the relationship was marginally significant for the number of pods sighted per km^2 ($F = 2.87$, $p = 0.059$).

No significant relationship was apparent between stations and Beaufort number based on the number of pods or whales sighted per km^2 ($F = 0.80$ and 1.22, respectively, $p = 0.45$ and 0.30). There was no significant relationship between stations and fortnight based on the number of pods or whales sighted per km^2 ($F = 0.30$ and 0.72, respectively, $p = 0.88$ and 0.58). Nor was there a significant relationship between station and 4-hr period ($F = 1.89$ and 2.31 for pods and whales/km^2, respectively, $p = 0.15$ and 0.10). Further analyses were invalid for relationships between sightability, station, and fortnight or 4-hr period due to insufficient sample sizes resulting in empty cells.

Comparisons Within Each Shore Station

Results of each station tested independently indicated that sighting rates of pods and whales varied across fortnights. Peaks occurred from 12 February to 11 March at Princeville and from 29 January to 25 February at Kalalau (Fig. 6). These differences were not significant for the number of pods or whales sighted per km^2 at Princeville, but were at least marginally significant at Kalalau (Table 5). The only significant relationship between sighting rate and 4-hr period was with the number of whales sighted per km^2 at Kalalau (Table 5, Figs. 7 and 8). More whales were sighted during the afternoon (14:00 to 17:59) than the previous two periods (Fisher PLSD: morning vs. afternoon = 2.25; midday vs. afternoon = 2.29) (Table 5, Fig. 8). This was similar to 1993 results (Smultea et al. 1994). Sample sizes were too small to test for relationships between fortnight and 4-hr periods at Kalalau.

The relative sighting rates of various pod compositions also varied by fortnight period (Figs. 5 and 6). At both stations, pods of two adults generally comprised 50% of all pods observed until late March to April, when their relative sighting frequency decreased. Pods of one adult and pods with a calf together comprised the highest proportions of pods sighted at the end of the observation season (26 March to 15 April) from Princeville (67%) and Kalalau (74%) (Fig. 6). Pods of more than two adults were sighted relatively infrequently but peaked during the peak of all pods during late February/early March (10% at Princeville, 16% at Kalalau) (Fig. 6). These results were similar to 1993 results from the north shore of Kauai (Smultea et al. 1993, 1994).

Overall, pods of one and two adults were sighted with similar frequency from both Princeville (49% and 43%, respectively) and Kalalau (43% and 39%, respectively) (Table 3). Pods of more than two adults were observed relatively infrequently from Kalalau (13%) and less often from Princeville (7%). Very few pods with a calf were sighted from Princeville (1%) but they comprised a higher proportion of all sightings made from Kalalau (5%) (Table 3).

Offshore Scans

There were 125 and 118 offshore scans completed from the Princeville and Kalalau shore stations, respectively (Table 3). Sightings rates were generally lower in offshore than in nearshore scan areas, particularly from the Kalalau station (Table 3, Figs. 5, 9, and 10). Like nearshore scans, analyses of offshore scan sighting rates were also limited to Beaufort and sightability conditions < 5. Sighting rates generally dropped significantly during higher Beauforts and sightability conditions (Table 6).

There was no significant difference among offshore scan sighting rates across fortnight periods (Table 6). However, the highest sighting rates occurred between 12 and 25 February at Princeville and between 26 February and 11 March at Kalalau, similar to results of nearshore scans (Figs. 5, 9 and 10). The only significant difference among sighting rates by period of day occurred at the Kalalau station where fewer whales and pods were sighted during afternoon than during morning or midday periods (Table 6, Figs. 11 and 12). This was opposite the results of nearshore scans at Kalalau, where the highest sighting rates occurred during the afternoon (Table 5, Fig. 8). This relationship did not appear to relate to Beaufort or sightability conditions (Table 6).

Vessel and Aircraft Scans

The number of vessels and aircraft were also counted during scans. Vessels were sighted more frequently from Kalalau (2.20 vessels/scan) than from Princeville (1.62 vessels/scan) (Table 3). Helicopters were sighted much more frequently from Kalalau (1.71 helicopters/scan) than from Princeville (0.05 helicopters/scan). Helicopters and vessels at Kalalau were generally touring the Napali coastline and passed by the Kalalau shore station on their way to and from this destination located west of the Kalalau station. Helicopters often turned and vessels oftentimes stopped near the shore station probably because it was a viewpoint at the eastern end of the Napali coast. Many of the vessels observed from Princeville were likely the same tourboats observed from Kalalau. At Princeville, these vessels followed the coastline, passing within the western edge of the scan arena on their way to the Napali coast.

Turtle Scans

Sea turtles were sighted more frequently from the Princeville (0.44/scan) than from the Kalalau (0.18/scan) shore station (Table 3). However, because effort was prioritized on humpback whales, results of turtle scans should be interpreted as minimal occurrence. All turtles were probably green sea turtles (*Chelonia mydas*), although they were generally not identified to species due to distance and brevity of turtle time at the surface. The only other coastal turtles known to occur in the major Hawaiian Islands are the hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*), and olive ridley (*Lepidochelys olivacea*) turtles. The hawksbill is apparently limited to the islands of Molokai and Hawaii and the other two species are rarely sighted in Hawaii.

Other marine mammals

The presence of marine mammals other than humpbacks was also noted during scans. Spinner (*Stenella longirostris*) and bottlenose (*Tursiops truncatus*) dolphins were sighted occasionally during scans (Table 3). Species was not always confirmed, particularly in the offshore scan zone due to distance and/or sighting conditions. Information collected on other marine mammals during scans was the same as that noted for humpback whales. One monk seal (*Monachus schauinslandi*) was sighted from Kalalau during a turtle scan.

Opportunistic Sightings

The total number of sightings made during all effort hours (systematic and non-systematic) was tabulated to estimate the minimum number of humpbacks and other marine mammals and sea turtles passing within view of the shore stations. These sighting rates were expressed as the number of sightings per hour of observation effort (including scans) (Table 4). Search effort during non-scan periods was considered non-systematic since observers generally concentrated efforts on tracking focal pods, while scans were considered systematic effort.

Stenella sp. were sighted twice as frequently near Kalalau (0.14 pods/hr) than near Princeville (0.07 pods/hr) (Table 4). Thus, they were observed about once every 2-3 days from shore. When a species was confirmed, all stenellids were *Stenella longirostris*, although some mixed species pods may have gone undetected. Average estimated pod size of stenellids was 31.8 dolphins at Kalalau and 24.5 at Princeville. The only other confirmed marine mammal species observed from the shore stations were bottlenose dolphins and one monk seal (Table 4).

The total number of vessels and aircraft passing the shore station were also tabulated (Table 4). Most vessels were < 8 m (25 feet) long at both Princeville (51%) and Kalalau (57%). Relatively few (2-3%) vessels were > 23 m (75 feet) long and most of these occurred > 10 km from shore.

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Table 1. Inclusive dates of fortnight (two-week) periods based on the Julian calendar as applied to data.

Fortnight	Two-week Period
1	1 January - 14 January
2	15 January - 28 January
3	29 January - 11 February
4	12 February - 25 February
5	26 February - 11 March
6	12 March - 25 March
7	26 March - 8 April
8	9 April - 22 April

Table 2. Summary of field effort and focal pod observations during 1994 shore-based observations from the Princeville and Kalalau shore stations.

FIELD EFFORT	TOTAL	PRINCEVILLE	KALALAU
Time Period	1/13 - 4/15	1/13 - 4/15	1/30 - 4/15
Total No. Days	100	55	45
Total No. Hours	544.9	323	221.9
Mean No. Hours/Day		5.93 (±2.33)	4.93 (±2.36)
No. Bad Weather Days (% of attempts > 0.5 hr)	52	30 (35%)	22 (33%)
Mean No. Scans/Day	2.45	2.29	2.64
Mean No. Focal Pods/Day	2.26	2.42	2.07
Total Time with Focal Pods (hr)	169.5	96.5	73
Mean Focal Session Length (hr ± 1 SD)		0.73 (± 0.73)	0.78 (± 0.84)
FOCAL POD OBSERVATIONS			
Pod Type			
1 Adult	62 (28%)	37 (28%)	25 (27%)
2 Adults	96 (42%)	58 (44%)	38 (41%)
>2 Adults (no calf)	30 (13%)	19 (14%)	11 (12%)
Pod with Calf	38 (17%)	19 (14%)	19 (20%)
Total	226	133	93

Table 3. Summary of nearshore and offshore scan effort and sightings during 1994 shore-based observations from the Princeville and Kalalau shore stations. Means indicated in parentheses.

	TOTAL	PRINCEVILLE	KALALAU
NEARSHORE SCANS *(0 - 100 Fathom Contour)*			
No. Nearshore Scans	245	126	119
Mean No. Scans/Day	2.45	2.29	2.64
No. Individual Humpbacks	923	302 (2.40)	621 (5.22)
No. Humpback Pods	529	187 (1.48)	342 (2.87)
No. 1 Adult Pods	237 (45%)	91 (49%)	146 (43%)
No. 2 Adult Pods	214 (40%)	81 (43%)	133 (39%)
No. > 2 Adult Pods (no calf)	57 (11%)	13 (7%)	44 (13%)
No. Pods with a Calf	21 (4%)	2 (1%)	19 (5%)
No. Sea Turtles (Unident. sp.)	78	56 (0.44)	22 (0.18)
No. Stenella sp. Pods	9	4	5
No. Bottlenose Dolphin Pods	1	0	1
No. Unidentified Dolphin Pods	4	2	2
No. Unidentified Whale Pods	4	2	2
No. Vessels	466	204 (1.62)	262 (2.20)
No. Helicopters	210	6 (0.05)	204 (1.71)
No. Airplanes	6	4	2
OFFSHORE SCANS *(arc centered on source location from 100-fathom contour to horizon)*			
No. Offshore Scans	243	125	118
No. Humpback Pods	171	131 (1.05)	40 (0.34)
No. Individual Humpbacks	287	211 (1.69)	76 (0.64)
No. Stenella sp. Pods	8	2	6
No. Bottlenose Dolphin Pods	2	0	2
No. Unidentified Dolphin Pods	6	1	5
No. Unidentified Whale Pods	14	6	8

Table 4. Sightings made from the Princeville and Kalalau shore stations during all 1994 effort hours. Effort includes systematic (scan) and non-systematic (opportunistic) sightings.

	PRINCEVILLE		KALALAU	
	Total No.	No./hr	Total No.	No./hr
Total Effort (hr)	323		222	
Humpback Pods	775	2.40	661	2.98
Humpback Individuals	1272	3.94	1189	5.34
Adults	1250	3.87	1152	5.19
Calves	22	0.07	37	0.17
Bottlenose Dolphin Pods	5	0.02	5	0.02
Stenella sp. Pods	22	0.07	31	0.14
Unidentified Dolphin Pods	4	0.01	12	0.05
Unidentified Large Whale Pods	2	<.01	6	0.03
Unidentified Small Cetacean Pods	0	0.00	3	0.01
Unidentified Cetacean Pods	2	<.01	1	<.01
Monk seals	0	0.00	1	<.01
Sea Turtles	75	0.23	30	0.14
Vessel Passes* (% of station total)	591	1.83	581	2.62
Class 1 (length <25 ft)	303 (51%)	0.94	334 (57%)	1.50
Class 2 (length>25 ft <75 ft)	262 (45%)	0.81	227 (39%)	1.02
Class 3 (length >75 ft)	13 (2%)	0.04	16 (3%)	0.07
Class 4 (Sailboat)	6 (1%)	0.02	0	0
Unknown Class	7 (1%)	0.02	4 (1%)	0.02
Kayak/Canoe passes (no motor) **	9	0.03	2	0.01
Airplane Passes	19	0.06	44	0.20
Helicopter Passes	50	0.15	1309	5.90

* = A "pass" was defined as a vessel entering and leaving the field of view. Thus, some vessels and aircraft were counted more than once.

** = not classified as a "vessel" as canoes and kayaks did not have motors.

Table 5. Results of analyses of 1994 nearshore scan sighting rates of humpback whales by shore station*. Kruskal-Wallis (indicated by H statistic) and MANOVA (indicated by F statistic) analyses were conducted separately for each shore station using two dependent variables (no. whales/scan or no. pods/scan) by independent variable indicated to left.

INDEPENDENT VARIABLE	DEPENDENT VARIABLE: Princeville		Kalalau	
	No. Pods/sq. km	No. Whales/sq. km	No. Pods/sq. km	No. Whales/sq. km
Beaufort 2-5	$H = 6.93$ $p = 0.074$ $n = 126$	$H = 7.74$ *$p = 0.052$†*	$H = 7.94$ *$p = 0.047$†* $n = 119$	$H = 4.54$ $p = 0.21$
Beaufort 2-4	$H = 6.4$ *$p = 0.041$†* $n = 105$	$H = 7.27$ *$p = 0.026$†*	$H = 2.95$ $p = 0.23$ $n = 103$	$H = 1.77$ $p = 0.41$
Sightability 2-6*	$H = 12.57$ *$p = 0.014$†* $n = 126$	$H = 15.00$ *$p = 0.0047$†*	$H = 6.44$ $p = 0.092$ $n = 119$	$H = 3.45$ $p = 0.33$
Sightability 2-4	$H = 11.97$ *$p = 0.0025$†* $n = 105$	$H = 13.89$ *$p = 0.001$†*	$H = 0.44$ $p = 0.80$ $n = 103$	$H = 0.12$ $p = 0.94$
Fortnight **	$H = 3.55$ $p = 0.62$ $n = 105$	$H = 6.17$ $p = 0.29$	$H = 9.97$ *$p = 0.041$†* $n = 103$	$H = 8.85$ $p = 0.065$
Fortnight X Beaufort***	$F = 0.50$ $p = 0.85$ $n = 97$	$F = 1.20$ $p = 0.32$	$F = 0.86$ $p = 0.53$ $n = 99$	$F = 0.94$ $p = 0.47$
Fortnight X Sightability***	$F = 1.45$ $p = 0.19$ $n = 97$	$F = 0.78$ $p = 0.62$	$F = 0.35$ $p = 0.91$ $n = 99$	$F = 0.47$ $p = 0.83$
4-hr Period**	$H = 3.33$ $p = 0.19$ $n = 105$	$H = 1.50$ $p = 0.47$	$H = 3.47$ $p = 0.18$ $n = 103$	$H = 6.05$ *$p = 0.049$*
4-hr Period X Beaufort**	$F = 1.69$ $p = 0.16$ $n = 105$	$F = 1.23$ $p = 0.30$	$F = 1.05$ $p = 0.39$ $n = 103$	$F = 1.16$ $p = 0.33$
4-h Period X Sightability**	$F = 1.22$ $p = 0.31$ $n = 105$	$F = 1.26$ $p = 0.29$	$F = 0.94$ $p = 0.44$ $n = 103$	$F = 0.91$ $p = 0.46$

* Beaufort 1 and 2 and sightability 1 and 2 were pooled into Beaufort 2 or sightability 2 to eliminate empty cells due to small Beaufort 1 or sightability 1 sample sizes. No scans were conducted during Beaufort 6. No scans were conducted from Kalalau during sightability 6.

† significant at $p \leq 0.050$

** includes Beaufort < 5 and sightability < 5

*** includes Beaufort < 5 and sightability < 5; does not include fortnight 1 (n=2) or 8 (n=5) at Princeville or fortnight 8 (n=4) at Kalalau to eliminate empty cells due to small sample sizes of these fortnights.

Table 6. Results of analyses of 1994 offshore scan sighting rates of humpback whales by shore station*. Kruskal-Wallis (indicated by H statistic) and MANOVA (indicated by F statistic) analyses were conducted separately for each shore station using two dependent variables (no. whales/scan or no. pods/scan) by independent variable indicated to left.

INDEPENDENT VARIABLE	DEPENDENT VARIABLE: Princeville		Kalalau	
	No. Pods/Scan	No. Whales/Scan	No. Pods/Scan	No. Whales/Scan
Beaufort 2-5	H = 4.32 p = 0.73 n = 125	H = 3.84 p = 0.28	H = 16.94 *p = 0.00070†* n = 118	H = 17.33 *p = 0.00060†*
Beaufort 2-4	H = 1.29 p = 0.52 n = 77	H = 1.06 p = 0.59	H = 0.001 p = 0.99 n = 72	H = 0.01 p = 0.99
Sightability 2-6	H = 10.01 *p = 0.040†* n = 125	H = 6.14 p = 0.19	H = 6.56 p = 0.16 n = 118	H = 6.63 p = 0.16
Sightability 2-4	H = 1.63 p = 0.44 n = 77	H = 1.25 p = 0.53	H = 0.59 p = 0.74 n = 72	H = 0.80 p = 0.67
Fortnight **	H = 5.91 p = 0.21 n = 73	H = 0.28 p = 0.26	H = 0.21 p = 0.98 n = 72	H = 0.083 p = 0.99
Fortnight X Beaufort***	F = 1.25 p = 0.29 n = 73	F = 1.49 p = 0.18	F = 0.87 p = 0.52 n = 72	F = 0.70 p = 0.55
Fortnight X Sightability***	F = 0.31 p = 0.94 n = 73	F = 0.59 p = 0.76	F = 1.94 p = 0.10 n = 72	F = 1.85 p = 0.12
4-h Period**	H = 5.11 p = 0.078 n = 77	H = 4.52 p = 0.10	H = 7.10 *p = 0.029†* n = 72	H = 6.01 *p = 0.050†*
4-h Period X Beaufort**	F = 0.89 p = 0.47 n = 77	F = 1.14 p = 0.35	F = 0.57 p = 0.68 n = 72	F = 1.42 p = 0.24
4-h Period X Sightability**	F = 0.83 p = 0.64 n = 77	F = 0.69 p = 0.60	F = 0.18 p = 0.95 n = 72	F = 0.45 p = 0.77

* Beaufort 1 and 2 and Sightability 1 and 2 were pooled into Beaufort 2 or Sightability 2 to eliminate empty cells due to small Beaufort 1 or sightability 1 sample sizes. No scans were conducted during Beaufort 6.

† significant at $p \le 0.050$

** includes only Beaufort < 5 and sightability < 5

*** includes only Beaufort < 5 and sightability < 5; does not include fortnight 1 (n=2) or 8 (n=5) at Princeville or fortnight 8 (n=4) at Kalalau to eliminate empty cells due to small sample sizes of these fortnights

Figure 1. Nearshore scan: Number of humpback whale pods sighted per km^2 (± 1 standard devation) from the Princeville shore station. Number of scans indicated above bars. * indicates Beaufort numbers 1 and 2 combined due to small sample sizes.

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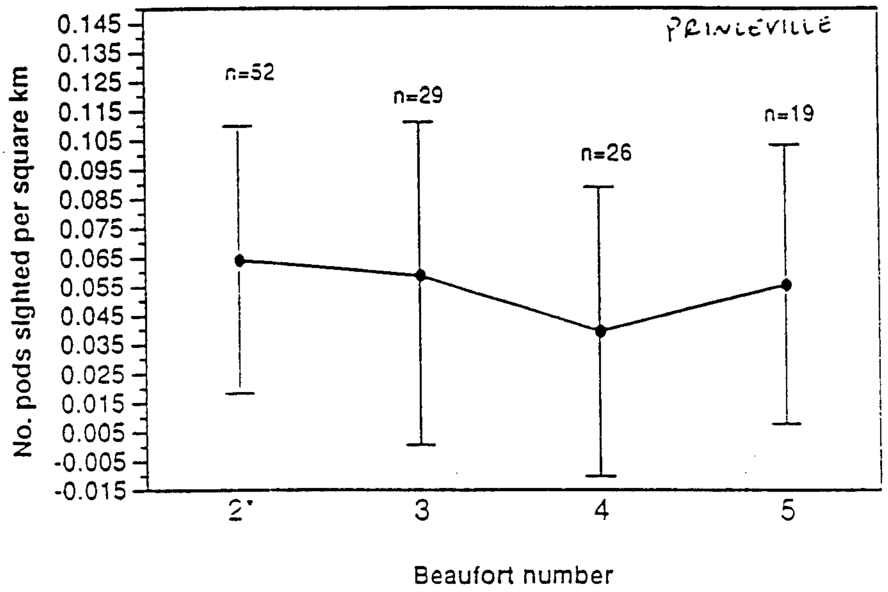

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Figure 2. Nearshore scan: Number of humpback whale pods sighted per km^2 (± 1 standard deviation) by sightability category from the Princeville shore station. Number of scans indicated above bars. * indicates sightability categories 1 and 2 combined due to small sample sizes.

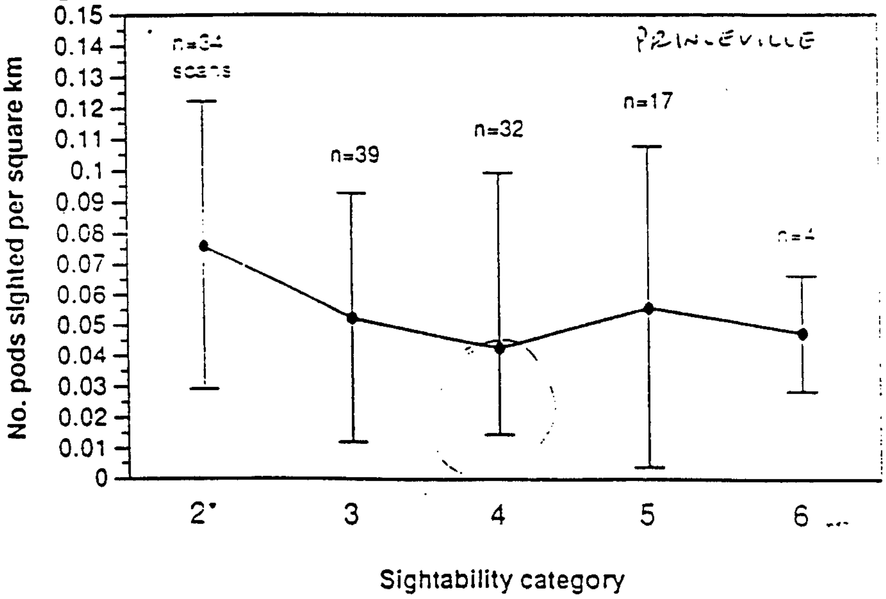

Figure 3. Nearshore scan: Number of humpback whale pods sighted per km^2 (± 1 standard deviation) by Beaufort number from the Kalalau shore station. Number of scans indicated above bars. * indicates Beaufort numbers 1 and 2 combined due to small sample sizes.

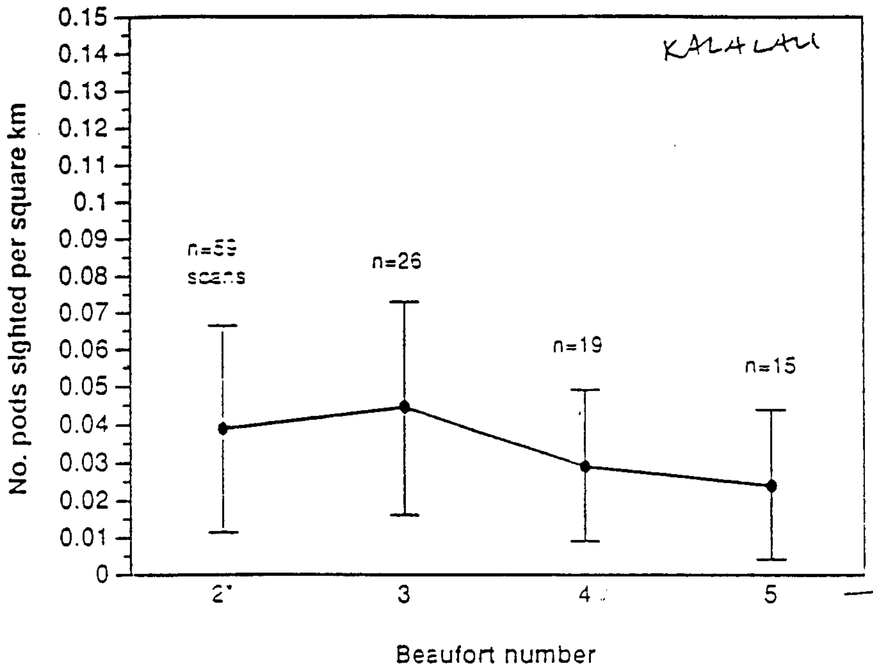

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Figure 4. Nearshore scan: Number of humpback whale pods sighted per km^2 (± 1 standard deviation) by sightability category from the Kalalau shore station. Number of scans indicated above bars. * indicates sightability categories 1 and 2 combined due to small sample sizes. No scans were conducted from Kalalau during a sightability 6 category.

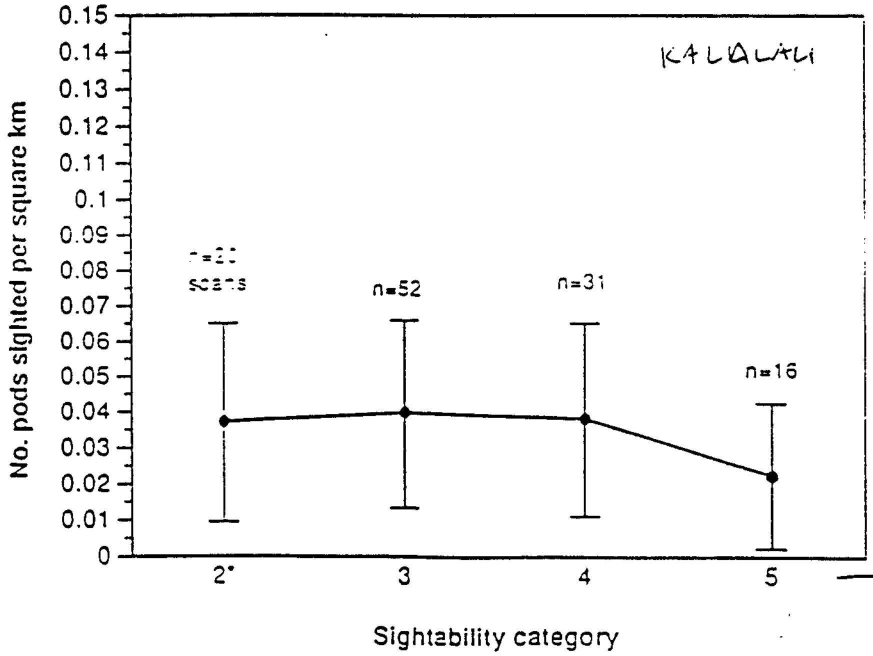

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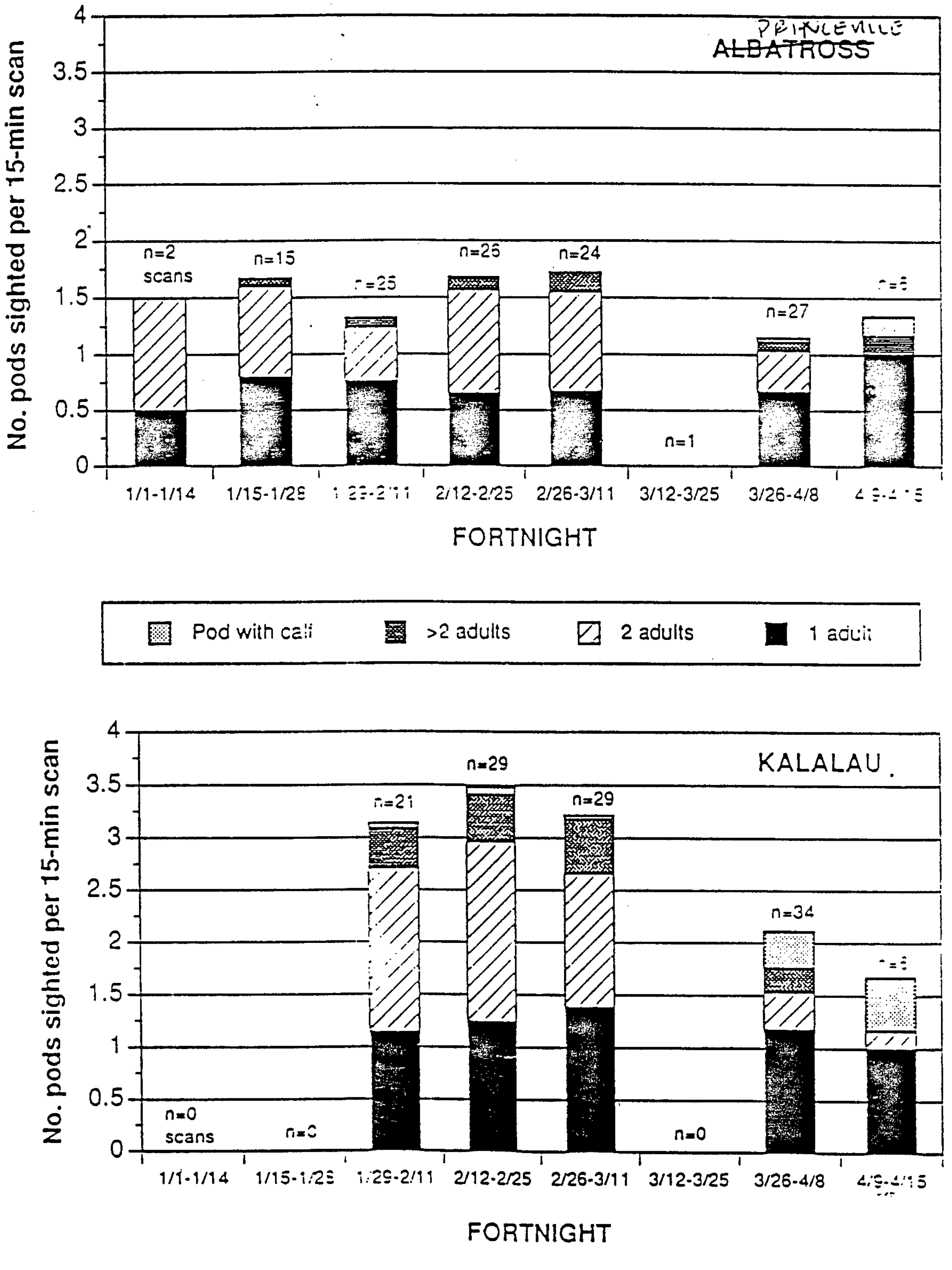
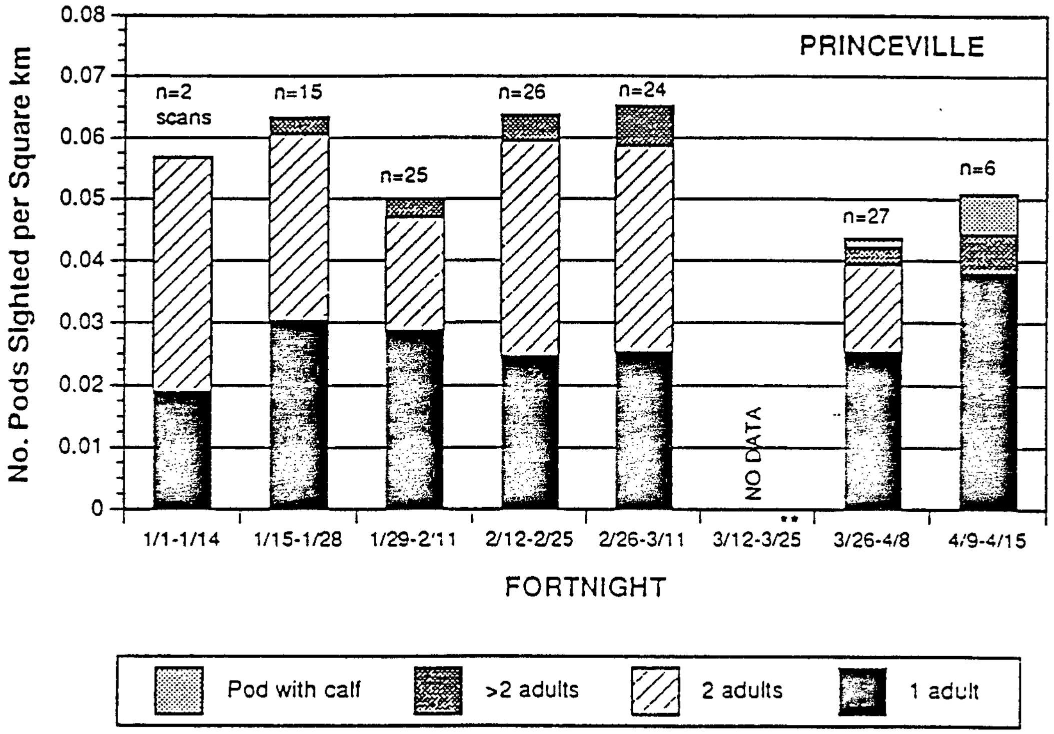
Figure 5. Nearshore scan sighting rates (expressed as number of pods sighted per scan) of various humpback group types by fortnight period from the ~~Albatross~~ and Kalalau shore stations. Number of scans indicated above bars.

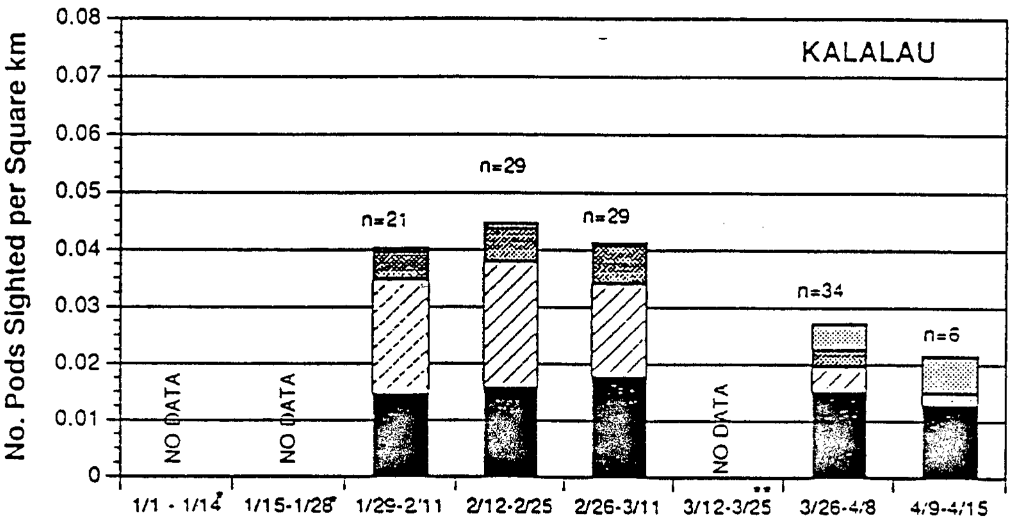
Princeville



NEARSHORE SCAN

Figure 6. Nearshore scan density (number of pods sighted per km^{2}) of various humpback group types by fortnight period from the Princeville and Kalalau shore stations. Number of scans indicated above bars.





* No effort because station not set-up yet.

** No data due to bad weather.

Figure 7. Nearshore scan: number of humpback whale pods sighted per km^2 (± 1 standard deviation) by 4-hour period from the Princeville shore station. Number of scans indicated above bars.

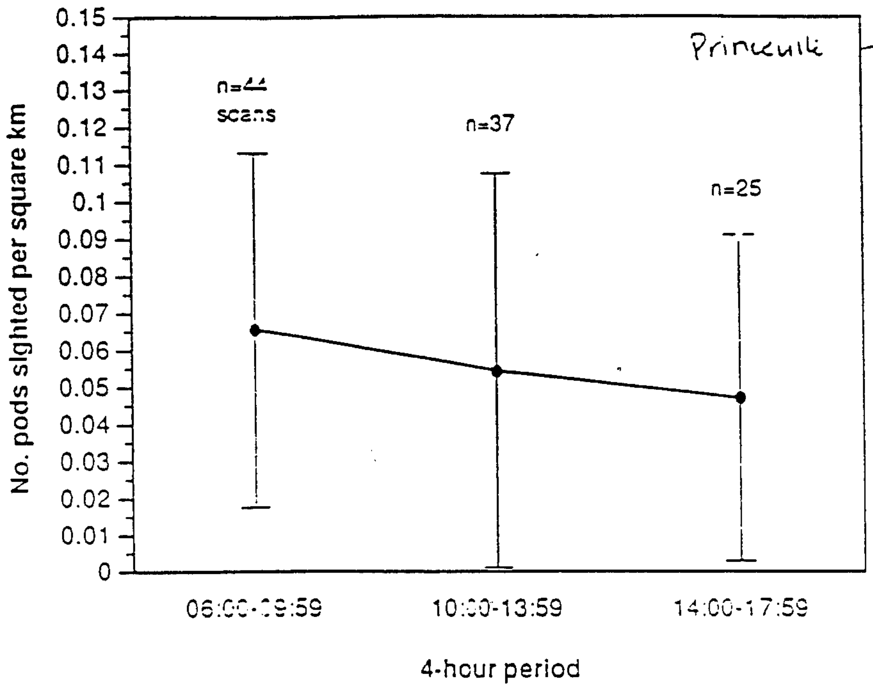
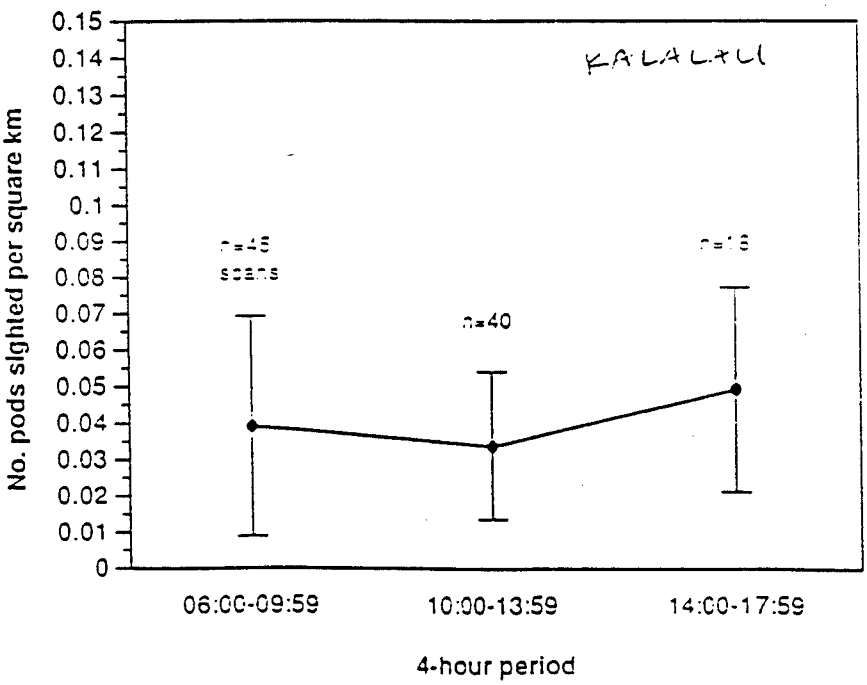


Figure 8. Nearshore scan: number of humpback whale pods sighted per km^2 (± 1 standard deviation, by 4-hour block period from the Kalalau shore station. Number of scans indicated above bars.



OFFSHORE SCAN

Figure 9. Offshore scan sighting rates by fortnight period at the Princeville shore station. No scans were conducted during fortnight six (12 March to 25 March). Presentation as in Figure 1.

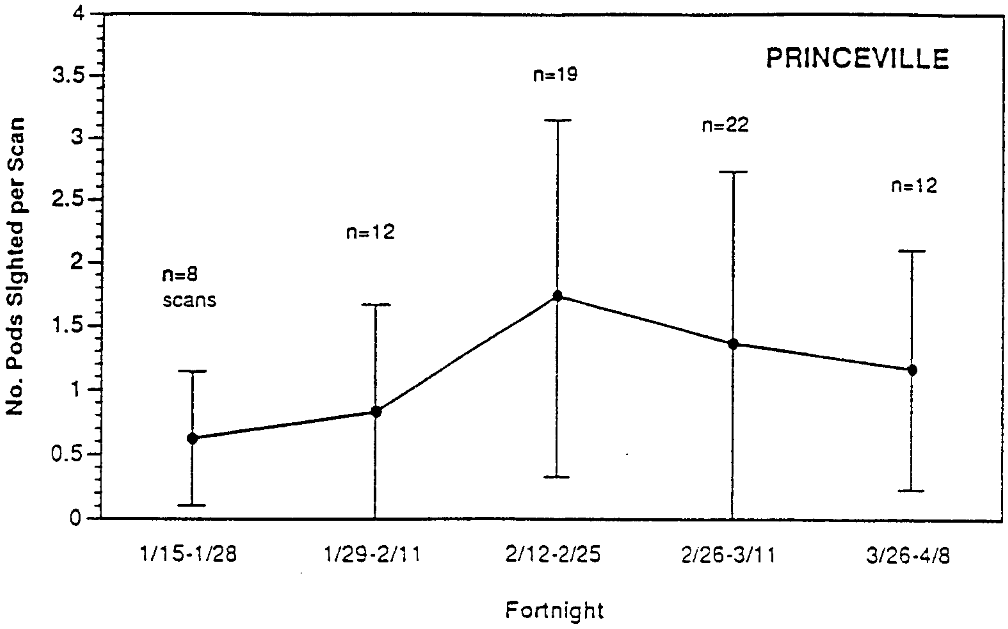
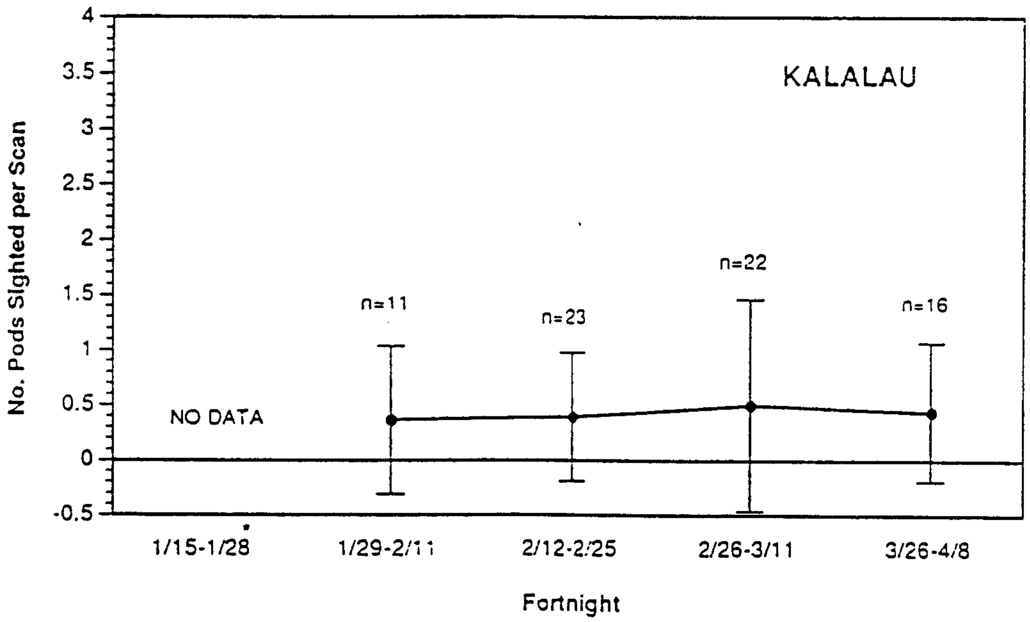


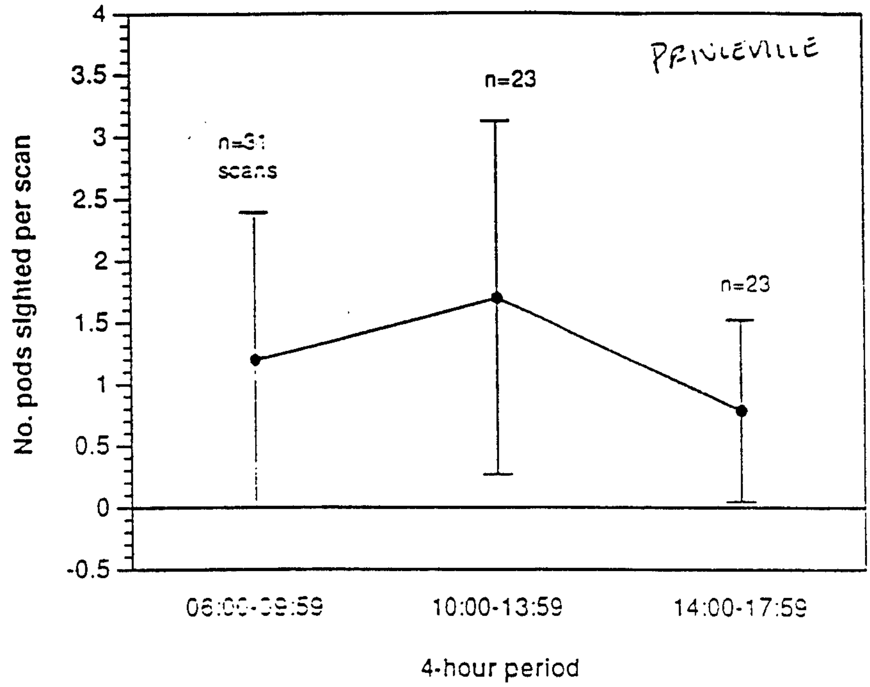
Figure 10. Offshore scan sighting rates by fortnight period at the Kalalau shore station. No scans were conducted during fortnight six (12 March to 25 March). Presentation as in Figure 1.



* No data because station not set up yet.

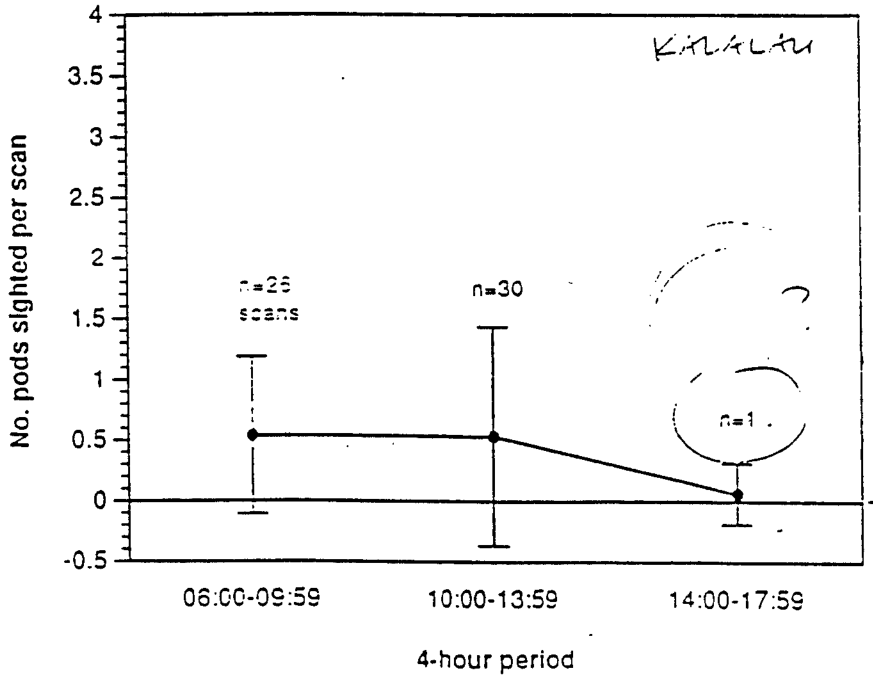
, Number of pods sighted per scan

Figure 11. Offshore scan ~~sighting rate~~ (± 1 standard deviation) by 4-hour ~~block~~ periods from the Princeville shore station. Number of scans indicated above bars.



, Number of how pods sighted per scan

Figure 12. Offshore scan ~~sighting rate~~ (± 1 standard deviation) by 4-hour ~~block~~ periods from the Kalalau shore station. Number of scans indicated above bars.



APPENDIX A
ATOC-MMRP SHORE ENVIRONMENTAL CONDITIONS & RATING CODES 1994

ENVIRONMENTAL CONDITIONS

CODE	NAME	DEFINITION
VIS	VISIBILITY (SIGHTABILITY)	scale: 1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor, 6 = unacceptable (see visibility definitions).
BF	BEAUFORT	Beaufort wind scale (see Beaufort definitions)
GL	GLARE (SCANS ONLY)	percent of study area covered by moderate to severe glare, which affects ability to sight whales. Also note the "section" within which glares occur. A section = each quarter of the study area beginning to the left and looking clockwise. There are 4 sections total.
SH	SWELL HEIGHT	estimated in meters.

Note: entered in the initial header (HEADH; and hourly update of the environmental header HEADE).

BEHAVIORAL OBSERVATION CONFIDENCE RATINGS*

CODE	DEFINITION
1	Excellent respiration (blows and no-blow rises) and behavioral data (confident that you are missing none).
2	Excellent respiration data (reliable for calculating respiration rates) and "soft" behavioral data (confident you are seeing blows and no-blow rises, but you may be missing some behaviors (<10%), usually due to distance or environmental conditions).
3	Okay respirations (you think you're getting most blows and no-blow rises) but shaky behavior (you feel you are unable to discern some (<25%) behaviors, generally due to distance or conditions).
4	Shaky respirations (the data will probably be useful only for surface and dive times) and only very obvious/conspicuous behaviors visible.
5	Theodolite tracking only due to inability to discern blows and behaviors usually due to distance or conditions.
6	Shaky blow data, good behavior data. Usually occurs in poor lighting conditions with pods that are close enough for most or all behaviors to be visible (including no blow rises), but blows are not seen reliably.

*Note: entered in the binocular reticle conversion + rating header (HEADR).

APPENDIX B
ATOC-MMRP SHORE VISIBILITY (SIGHTABILITY) & BEAUFORT CODES 1994

VISIBILITY:

CODE	NAME	DEFINITION
1	EXCELLENT	Surface water calm (Beaufort 0-1) with no sun glare or other environmental factors impeding ability to sight whales. Visibility > 5 km
2	VERY GOOD	May be slightly uneven lighting or light chop (Beaufort 0-2) but still relatively easy to sight whales. Visibility > 5 km
3	GOOD	Light chop with scattered whitecaps (Beaufort 0-3), swell (2-4 m) or some sun glare or other impediment (e.g., haze) in ≤10% of the study area. Whales can still be detected fairly easily.
4	FAIR	Choppy waves with fairly frequent whitecaps, low-light conditions (e.g., heavy overcast, dawn, dusk), swell 4-6 m or sun glare in ≤50% of study area. Some animals in study area likely to be missed
5	POOR	Numerous whitecaps (Beaufort 5), sun glare or haze in >50% of the study area, or swell > 6 m, impeding ability to sight whales. Many (>50% ?) animals in study area are likely to be missed
6	UNACCEPTABLE	Beaufort ≥6, or glare, haze, or other visibility impediment in >75% of study area. Detection of whales unlikely unless the observer is looking directly at the place where the animals surface. Time to go home!

*Note: Modified from NMFS Platform of Opportunity Program computer format designed for vessel-based marine mammal surveys

SEA CONDITION (BEAUFORT WIND SCALE -):

CODE	DESCRIPTION (*abbreviated*)	WIND SPEED (kts)	WAVE (m)
0	Smooth and mirror-like	Calm (0-1)	--
1	Light ripple	Light air (1-3)	0.3
2	Small wavelets, not breaking	Light Breeze (4-6)	0.6
3	Scattered whitecaps	Gentle Breeze (7-10)	1.2
4	Small waves, frequent whitecaps	Mod. breeze (11-16)	1.8
5	Moderate waves, many whitecaps	Fresh breeze (17-21)	2.0
6	All whitecaps, some spray	Strong breeze (22-27)	3.0
7	Breaking waves, spindrift begins	Near gale (28-33)	4.3
8	Medium high waves, foamy	Gale (34-40)	5.5

APPENDIX C
ATOC-MMRP SHORE ETHOGRAM 1994

RESPIRATION:
FS First Surface with No Blow
F First Surface Blow
NF Not First Surfacing? (whale seen at surface)
B Blow
N No Blow Rise (surface w/ no visible blow)
M Missed Blow(s)? (breaks resp. sequence)

SUBMERGENCE:
S Slip Under (terminates rest bout)
A Peduncle Arch (arching w/out lifting flukes)
D Fluke Down Dive (arch & lifting flukes < 45 deg)
U Fluke Up Dive (arch & lifting flukes > 45 deg)
SQ Unidentified Submergence > 60 sec (Q)

NON-RESPIRATORY MARKERS:
NR Missed Non-Resp Beh(s)? (breaks sequence)
UB Unidentified Behavior

SUBSURFACE EXHALATIONS:
BC Bubble Cloud (single burst of bubbles)
BT Linear Bubble Trail (stream of bubbles)

WHALE VOCALIZATIONS:
TB Trumpet Blow (blow modifier)
SR Singing Reported (by research vessel or array)
SS Singing Stop

HEAD & LEAPING BEHAVIORS:
HR Head Rise (Spyhop)
HL Head Lunge (forward thrust < 45 deg with splash)
MB MotorBoating (sustained head lunge)
HS Head Slap (forward thrust > 45 deg & slap)
BR BReach (non-forward leap)
US Unidentified Large Splash?
OH Other Head Behavior?

TAIL BEHAVIORS
TE Tail Extension (holds in air > 3 sec)
TS Tail Slap (slapping water surface with tail)
LS Lateral Tail Slap (peduncle slap)
SW Tail SWish (side-to-side motion)
LT Lateral Tail Display (no need to call with PS)
OT Other Tail Behavior?

PECTORAL FIN BEHAVIORS:
PE Pec Extension (1 or both fins > 3 sec)
PS Pec Slap (form unspecified)
RP Rolling Pec Slap (rotating rostro-caudal axis)
OP Other Pec Behavior?

BODY CONTACT:
SB Striking with any Body Part
WC Whale Body Contact (non-strike)

**AGE MODIFIER, FOCAL WHALE:*
1 Adult (default, just enter beh. letter codes)
2 Mom
3 Calf
4 Escort
*Note: focal whale mod. AFTER field letter code.

BEHAVIOR STATES (=computer function keys):
F1 REST (rest)
F2 MILL (mill)
F3 TRAVEL (trav)
F4 STATIONARY (stat)
F5 SURFACE ACTIVE MILLING (smil)
F6 SURFACE ACTIVE TRAVEL (strv)
F7 UNKNOWN (unkn)
*Note: see behavior state definitions for detail.

FOCAL POD EVENTS:
PD Pod Decreases Speed
PI Pod Increases Speed
PX Pod Stops (X)
P45 Pod Changes Direction > 45 < 90 deg
P90 Pod Changes Direction > 90 < 180 deg
P180 Pod Change Direction 180 deg

FOCAL VESSEL(S) EVENTS:
V45 Vessel Changes Direction > 45 deg
VX Vessel Stops (X)
VS Vessel Starts
VC Vessel Changes Speed Notably

*FOCAL POD AFFILIATION/DISAFFILIATION:
PAF Pods AFfiliate (2+ join to form one)
PDS Pods DiSaffiliate (pod splits)
SAF Suspected AFfiliation
SDS Suspected DiSaffiliation
*Note: a pod equals whales < 5 WLU.

LOST FOCAL POD/END SESSION:
PUN Pod Identification Number Uncertain?
PL Pod Lost -- Note any Reason?

COMPUTER & THEODOLITE AIDS:
L Lag (3 sec) in calling beh
L## Lag (+ no. of sec) in calling beh
X Delete previous entry (X)
XX Delete last sequence of entries (XX)
ZF# "Zero" reference Fix
NZ# Non-"Zero" reference fix
TF# Titty Peak Fix
BFN Buoy (FAD) Fix - N shore
SVS Start Vessel Scan
SSC Start whale SCan
ESC End whale SCan
TBC Theodolite Bubble Check
RBT ReBalance Theodolite

POD MODIFIERS & NONFOCAL SAMPLING:
P## Theodolite Pod Fix + ID no.
V## Theodolite Vessel Fix + ID no.
H## Helicopter + ID no.
AP## Air Plane + ID no.
CPA Closest Point of Approach
SP# Stenella SPecies (spotted and/or spinner dolphins)
BN# BottleNose Dolphin (*Tursiops spp.*)
TU# Sea TUrtle(s) (green)
OS# Other Species (ID species as comment)

*Ethogram modified from: Baker et al. 1983, Würsig et al. 1984, Bauer 1986, Richardson et al. 1991, Kieckhefer 1992.

APPENDIX D
ATOC-MMRP SHORE BEHAVIOR STATES 1994

Computer Function Keys

Key No	Code	Name	Definition
F1	rest	REST	indicated when a whale(s) lies horizontal and motionless near the surface in the same location for 5 sec or more.
F2	mill	MILLING	swimming with no obvious orientation (non-directional) characterized by asynchronous headings, circling, changes in speed, and no surface activity.
F3	trav	TRAVELING	swimming with an obvious orientation (directional), no surface activity.
F4	stat	STATIONARY	little or no forward movement (<1 km/hr) between surfacing sequences, staying in the same general location (singers and tail-sailers fit in this state).
F5	smil	SURFACE ACTIVE MILLING	non-directional swimming with the occurrence of aerial behavior that creates a conspicuous splash (include all head, tail, pec fin, and leaping behavior). This is also an *event* for non-focal pods.
F6	strv	SURFACE ACTIVE TRAVEL	directional swimming with the occurrence of aerial behavior that creates a conspicuous splash. This is also an *event* for non-focal pods.
F7	unkn	UNKNOWN	behavioral state undetermined/unknown

***Note:** record approx. speed and compass direction when possible in the HEADS header.

0 = not moving forward
1 = slow (no wake, 1-2 km/hr)
2 = medium (small wake, 3-5 km/hr)
3 = fast (large wake, > 6 km/hr)

Events are instantaneous, while states have appreciable duration (Altmann 1974).

**Behavior States modified from: Baker et al. 1982, Würsig et al. 1984, Bauer 1986, and Richardson et al. 1991*

APPENDIX E
ATOC-MMRP SHORE RESPIRATION VARIABLES 1994

Surface-dive cycles were used as primary means of quantifying differences in behavioral states. The following six variables of respiration were measured:

1. **Blow Interval** *(BI)* : time interval of 60 sec or less between exhalations at (or near) the surface.*

2. **Number of Blows per Surface Duration** *(NBS)* : number of exhalations during a surface period.

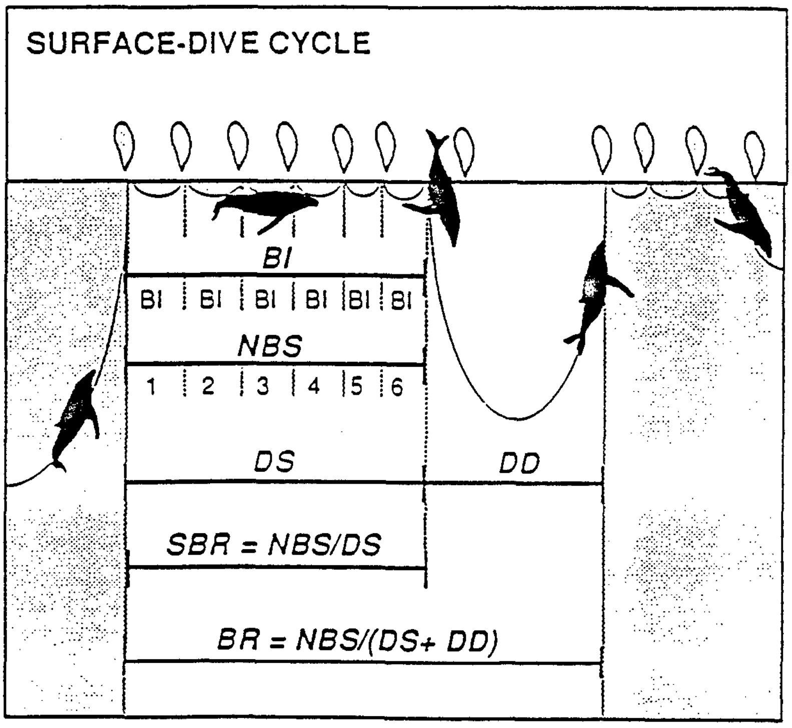
3. **Duration at Surface***(DS)* : period of time spent at (or near) the surface between successive dives. Surface duration was terminated by a submergence with blow interval exceeding 60 seconds.

4. **Duration of Dive** *(DD)* : period of time during a dive to first surfacing. First exhalation exceeding 60 sec in length marked the beginning of a surface duration.

5. **Surface Blow Rate** *(SBR)*: total number of exhalations divided by surface duration from each complete surface-dive cycles.

6. **Surface-Dive Blow Rate** *(SDBR)*: total number of exhalations divided by surface duration and dive duration from each complete surface-dive cycles.

*Note: 60-sec method was selected by cutting off the tail of a skewed frequency distribution of pooled blow intervals of adult humpback whales (including cows and escorts). Blow intervals of calves displayed a similar distribtution.



APPENDIX F
1994 ATOC-MMRP SHORE POTENTIAL DISTURBANCE CATEGORIES FOR FOCAL PODS

EXPERIMENTAL CONDITIONS (expt = computer 5 digit code):

1. Vessel Size

(0)	Presumably undisturbed (All vessels > 4 km)
(1)	Vessel ≤ 25 ft long
(2)	Vessel > 25 ft ≤ 75 ft long
(3)	Vessel > 75 ft long
(4)	Sailboat

2. Vessel CPA/Behavior Categories (called @ CPA and start of focal session)

(0)	All vessels > 4 km (= default; if not called assume "0")
(1)	CPA > 1 km and ≤ 4 km
(2)	CPA ≤ 1 km, linear pass-by
(3)	CPA ≤ 1 km, erratic travel
(4)	CPA ≤ 1 km, active following
(5)	CPA ≤ 1 km, stationary

3. Aircraft (airplane & helicopter) Type (≤ 1 km horizontal distance only)

(0)	Presumably undisturbed (All aircraft > 2000 ft alt. & > 1 km horiz.)
(1)	Helicopter or single-engine airplane (e.g., Cessna 172)
(2)	Small twin-engine airplane (e.g., ATOC behavior/survey plane)
(3)	Medium-size, commuter-type airplane (e.g., Twin Otter up to 40 passgrs)
(4)	Large airplane, > 40 passengers (e.g., Navy cargo)

4. Aircraft Altitude (feet) (≤ 1 km horizontal distance only)

(0)	ALT > 2000 ft (= default; if not called assume "0")
(1)	ALT > 1000 ft and ≤ 2000 ft
(2)	ALT > 500 and ≤ 1000 ft
(3)	ALT ≤ 500 ft

5. Aircraft Behavior (≤ 1 km horizontal distance only)

(0)	Presumably undisturbed (All aircraft > 2000 ft alt,. > 1 km horiz.)
(1)	Linear pass-by
(2)	Erratic pass-by (up & down, zig-zag flight)
(3)	Active circling or hovering

Modified LGL Coding and File Formats for Bowhead Behavioral Data (Richardson et al. 1991) and personal communication with Dr. Gordon B. Bauer (10/11/93).

APPENDIX G
ATOC-MMRP SHORE COMPUTER HEADERS & PROTOCOL 1994

1) <u>HEAD-H</u> (INITIAL HEADER INFORMATION)
   - Observational Station? (2 digits)
   - Focal Behavioral Observer? (2 digits)
   - Observational Period? (2 digits)
   - Total No. Vessels w/in a Session? (2 digits, enter 99. At end of day, this is the total # of vessels that occurred < 4 km from focal pod)
   - Pod Number? (2 digits, e.g. 01)
   - Group Size? (2 digits)
   - No. of Calves? (1 digit)
   - Speed (0 to 3)? (1 digit)
   - Orientation (deg mag)? (3 digits)
   - Observation Conditions (Vis + Beauf, 0 to 6)? (2 digits)
   - Swell Height (m)? (3 digits, e.g. 1.2)
   - Vessel Disturbance (0 to 4)? (2 digits)
   - Aircraft Disturbance (0 to 4)? (3 digits)

2) <u>HEAD-R</u> (BINOCULAR RETICLE CONVERSION + RATING)
   - Reticle Number? (Prints distance from shore in km)
   - Confidence Rating (1 to 6)? (1 digit)

3) <u>HEAD-S</u> (UPDATE POD ORIENTATION + SPEED)
   - Speed (0 to 3)? (1 digit)
   - Orientation (deg mag)? (3 digits)

4) <u>HEAD-D</u> (UPDATE DISTURBANCE LOGGING)
   - Vessel Disturbance (0 to 4)? (2 digits)
   - Aircraft Disturbance (0 to 4)? (3 digits)

5) <u>HEAD-E</u> (UPDATE ENVIRONMENTAL DATA)
   - Observation Conditions (Vis + Beauf, 0 to 6)? (2 digits)
   - Swell Height (m)? (3 digits, e.g. 1.2)

   *Note: Every hour you will be flagged w/ HEADE & beeps.

6) <u>HEAD-A</u> (WHALE AFFILIATION/DISAFFILIATION)
   - Affil/Disaffil (A or D)?
   - New Pod Number?
   - New Group Size?
   - No. of Calves?
   - New Observational Period?
   - Vessel Disturbance (0 to 4)? (2 digits)

APPENDIX H

ATOC-MMRP 1994 SHORE STATION AND OBSERVER CODES

RADIO HANDLES: Call sign WCD 5562

VHF CHANNEL: 72 (alternate = 69)

Albatross = Princeville shore site
Pali Mo'o = Kalalau shore site
Honu = Princeville house
Malolo = Boston Whaler (code V69)
Gooney Bird = Aerial Observation plane (code AP69)

OBSERVER IDENTIFICATION NUMBERS

01 = Adam Frankel	08 = Matt Irinaga
02 = Mari Smultea	09 = Mia Grifalconi
03 = Christine Gabriele	10 = Janet Doherty
04 = Alison Craig	11 = Dave Weller
05 = Tom Kieckhefer	12 = Christopher Clark
06 = Ann Zoidis	13 = Joe Mobley
07 = Tom Norris	14 = Bernd Wursig
	15 = Ann Bowles

KAUAI SHORE STATIONS

Code	Shore Station Name	Cliff Height Without theo	Distance to Horizon	Zero Reference	Reference Point and Angle
11	Albatross (Punahele Street)	47.12 m	27.4 km	magnetic north	Titty Peak 251° 59 '0"
12	Mc Bryde Mill (south shore)	42.20 m	25.7 km	magnetic north	Puolo Point navigation marker 264° 57' 40"
13	Pu'u Poa (Hideaways)	not measured	n/a	n/a	n/a
14	Kilauea Lighthouse	not measured	n/a	n/a	n/a
15	Kalalau Trail	139.41 m	46.5 km	magnetic north	Makuaiki Point 232° 21' 00'
16	Kaweonui Street	not measured	n/a	n/a	n/a