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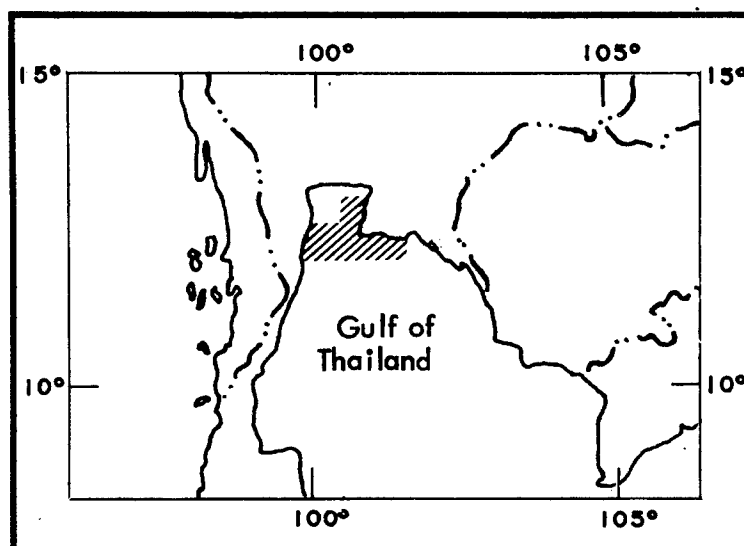
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INFORMAL REPORT

ENVIRONMENTAL DATA REPORT GULF OF THAILAND DECEMBER 1967 TO FEBRUARY 1968



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NAVAL OCEANOGRAPHIC OFFICE
WASHINGTON, D. C. 20390

INFORMAL REPORT

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ABSTRACT

The U.S. Naval Oceanographic Office and the Royal Thai Navy conducted a joint environmental survey in the Gulf of Thailand from 20 December 1967 to 21 February 1968. Operations included serial-depth temperature and salinity measurements at 57 station locations and current meter observations at 47 of the stations.

The area surveyed in the Gulf of Thailand was found to be nearly isothermal and isohaline throughout the water column, which attests to a well-developed mixing environment. The tidal currents in the gulf are thought to be responsible for the homogenous nature of the water. Characteristic of the region surveyed was the variance in current direction with depth for any one station location and the change in current vectors over short durations. Measured current speeds ranged to a maximum of 0.8 knot.

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This report has been reviewed and is approved for release as an UNCLASSIFIED Informal Report.



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I. INTRODUCTION

An environmental survey was conducted in the Gulf of Thailand as a joint operation of the U.S. Naval Oceanographic Office (NAVOCEANO) and the Royal Thai Navy aboard HTMS BANGRACHAN (MMC 1) from 20 December 1967 to 21 February 1968. Operations were performed in the inner gulf and in the inshore area southeast of Sattahip (Operation Numbers 928026 and 928029). Figure 1 is a locator chart of the survey area.

From 1959 to 1961, a comprehensive survey in the Gulf of Thailand was the Naga Expedition (Wyrcki, 1961). NAVOCEANO surveys aboard USS FIRM (MSO 444) and USS SERRANO (AGS 24) in 1959 and 1961, respectively, supplied further background data. Personal conversation with Royal Thai Navy Hydrographic Office personnel provided valuable information, especially on the oceanographic vagaries that may be encountered within the gulf.

II. OBJECTIVES OF THE SURVEY

The objectives of NAVOCEANO operations aboard BANGRACHAN were to obtain environmental oceanographic data in the inshore areas of the Gulf of Thailand. The data required were current measurements and serial-depth temperatures and salinities.

III. NARRATIVE OF THE SURVEY

Royal Thai Navy (RTN) personnel and one NAVOCEANO oceanographer collected the environmental data from BANGRACHAN. A total of 57 stations was occupied. At each station, a Nansen cast and a bathythermograph (BT) lowering were made, and at 47 of the stations, current measurements were obtained. Figure 2 shows the station locations with current vectors indicated for the stations. Table I presents a station data summary.

IV. METHODS OF COLLECTION AND ANALYSIS

A. Temperature.

A shallow water mechanical BT was lowered at each station location to ascertain the existing temperature structure. The BT traces showed the shallow gulf areas to be nearly isothermal throughout the water column. Because of the isothermal condition, three or four Nansen bottles, each with three protected reversing thermometers, were evenly spaced throughout the water column. The temperatures from the three thermometers were averaged if the values were within 0.05°C . When temperatures differed more than 0.05°C , the values from the more reliable thermometers, based on past performances, were accepted. Thermometer

Wyrcki, K., 1961. Physical Oceanography of Southeast Asian Waters.
NAGA Report. Vol. 2.

performance in the field was checked by rotating individual thermometers from one Nansen bottle to another. A correction factor for errant thermometers was then derived by statistical analysis from the different thermometer pairings. The temperatures from reversing thermometers, after applying standard and individual corrections, are considered accurate to $\pm 0.02^{\circ}\text{C}$.

B. Salinity.

Water samples were drawn from the Nansen bottles and forwarded to NAVOCEANO for salinity analyses. Salinities were determined with an Industrial Instruments RS-7A inductive salinometer. Results are considered accurate to ± 0.01 o/oo.

C. Conductivity.

Conductivity values were hand computed from Nansen cast temperature and salinity data by the method described in NAVOCEANO Special Publication No. 11, "Tables for the Rapid Computation of Density and Electrical Conductivity of Sea Water."

D. Current Measurements.

A Roberts current meter was used to obtain in situ current measurements. BANGRACHAN was anchored fore and aft, and the meter was suspended from the stern. Readings generally were obtained 3 meters below the surface, at middepth, and 2 meters from the bottom. Interference from the ship's hull precluded any accurate current measurement less than 3 meters below the surface. An EA Recorder was used to give continuous readings. Current velocities were recorded for 4 to 6 minutes or, when low current speeds were evident, until a record of sufficient length was attained to allow a recognizable trend in current vectors.

When current speeds were less than 0.2 knot, the recordings of current direction usually deteriorated. In the presentation of this report, current speeds less than 0.2 knot were not used but are listed on the oceanographic summary sheets in the Appendix as "<2 knot" to indicate the presence of some current.

E. Meteorological Observations.

Meteorological observations were recorded by the oceanographer utilizing hand held equipment and by visual observations. Recorded information consisted of wind vectors, humidity, weather, cloud, and sea and swell observations.

F. Tidal Data.

Tidal values are predicted values from USC&GS tide tables for

Sattahip and Bangkok, Thailand. Cotidal charts were used to approximate tidal ranges and times for the western coast of the survey area.

V. DISPOSITION OF DATA

The current measurement data are on file at NAVOCEANO, and Nansen cast data and BT slides will be on file at the National Oceanographic Data Center. Individual oceanographic summary sheets are presented in the Appendix.

VI. PRELIMINARY ANALYSIS

A. Temperature.

All 57 stations were occupied during the daylight hours from approximately 0800 to 1600 hours (local). Positive temperature gradients, resulting from back radiation during the night, were a common occurrence until late morning when the gradient assumed either an isothermal or a negative profile. The temperature range throughout the water column was 26.50° to 27.73°C. At any one station, the temperature difference from surface to bottom did not exceed 0.54°C, and at 70 percent of the stations, the difference was within 0.30°C. Sea surface temperatures off the western part of the inner gulf averaged 0.25°C higher than surface temperatures off the eastern part and 0.60°C higher than in the area southeast of Sattahip. The nearly isothermal structure observed within the Gulf of Thailand attests to a well-developed mixing environment.

B. Salinity.

The salinity values throughout the survey area ranged from 31.70 to 32.45 o/oo. At any one station, the maximum difference from surface to bottom was 0.10 o/oo, and for 81 percent of the stations, the difference was only 0.03 o/oo. This display of vertical homogeneity and relatively little horizontal variation in salinity values also attests to a region of well-developed mixing.

Salinities in the area southeast of Sattahip were 0.10 to 0.14 o/oo higher than those in the inner gulf. A higher salinity can often be expected in areas outside the inner gulf because of less stream discharge.

C. Current Measurements.

The circulation pattern in the gulf proper is most dependent on the monsoon season. A small, permanent counterclockwise gyre occurs within the inner gulf (from personal conversation with RTN personnel). Subsequently, the gulf, and especially the region where the inner gulf and the gulf proper adjoin (approximately 12°40.0"N), is an area of complex water movement. During the survey period, circulation

within the inner gulf appeared to be dominated by the tidal currents which are thought to be responsible for the homogenous nature of the oceanographic environment.

Measured current speeds ranged to a maximum of 0.8 knot. The higher speeds occurred in the inner gulf during the ebb tide, and the flow was predominantly to the south. Characteristic of the region surveyed was the variance in current direction with depth for any one station and the change in current vectors over short durations. Attendant to these characteristics was the fluctuations of current, for a given depth, between two distinct directions. Station 94 exhibited some of the above characteristics; i.e., at the surface, the current set was 290° ; at middepth, the set was either 270° or 070° ; and near bottom, the set was 070° .

Data from two 24-hour current stations from the 1961 SERRANO cruise are shown in a time-depth presentation in Figure 3. The two station locations are plotted in Figure 2. The area surrounding station 2 was surveyed by NAVOCEANO in three different years: March 1959, March 1961, and February 1968. Current flow in this area is strongly affected by the coastal topography and the tides and is predominantly of the reversing type with strong horizontal shear currents. Data from station 1A, which is located in the inner gulf, depict the variation in current direction with depth for any one time frame.

D. Meteorological Observations and Tidal Data.

The period of the survey was during the inter-monsoon season, and the winds displayed such random circulation patterns that their effect on the measured oceanographic parameters was masked by tidal influence.

Tides were chiefly diurnal or semidiurnal with large inequalities between the ranges of successive highs or lows. The maximum predicted tidal range at Sattahip on the eastern coast of the inner gulf was 9 feet 8 inches. The tidal range was slightly higher on the western coast.

VII. FUTURE WORK IN THE REGION

The Royal Thai Navy Hydrographic Office has an ambitious oceanographic program outlined for the waters contiguous to Thailand. The program will provide for a year-round study of Thai waters and will include the region surveyed by NAVOCEANO.

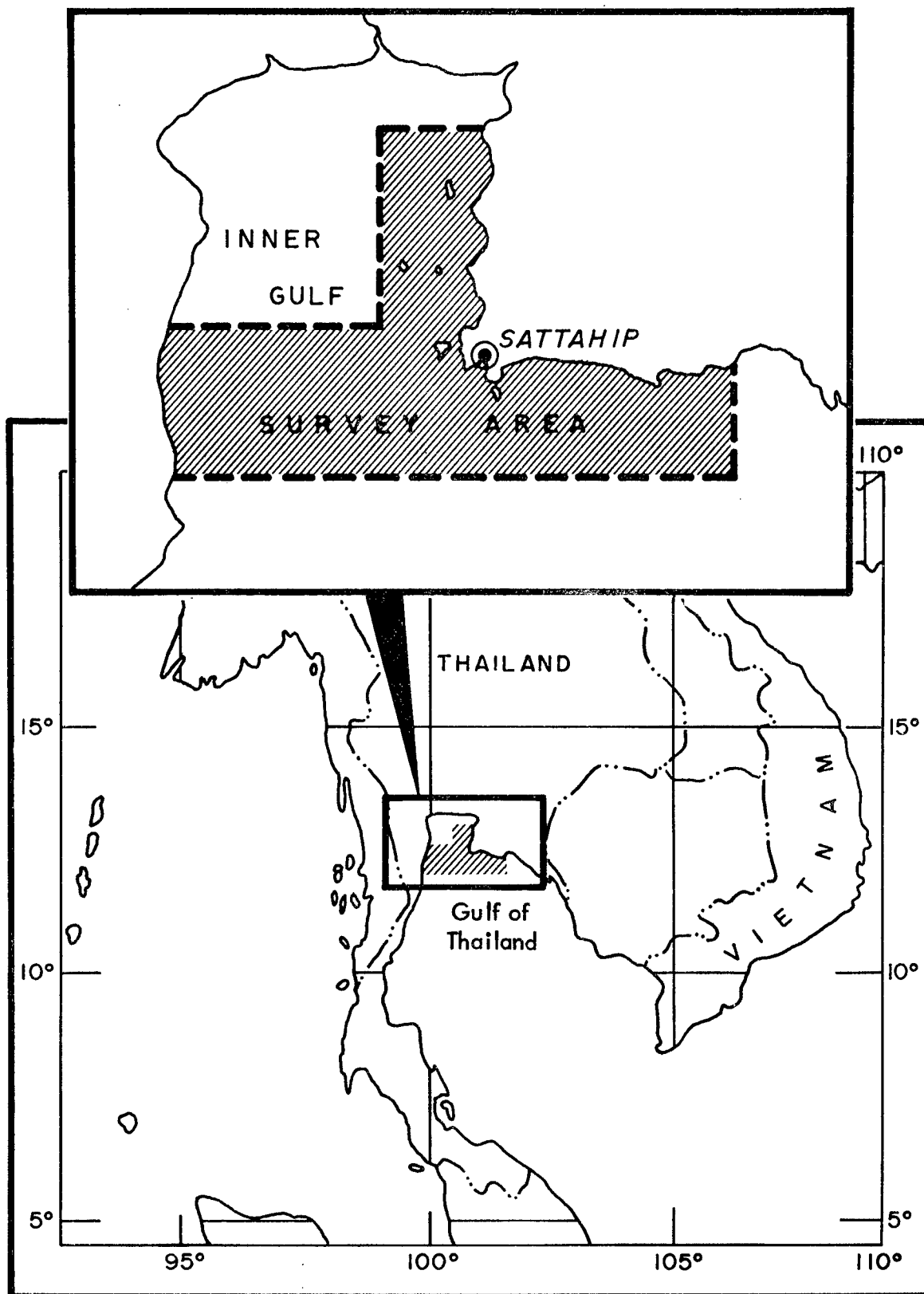
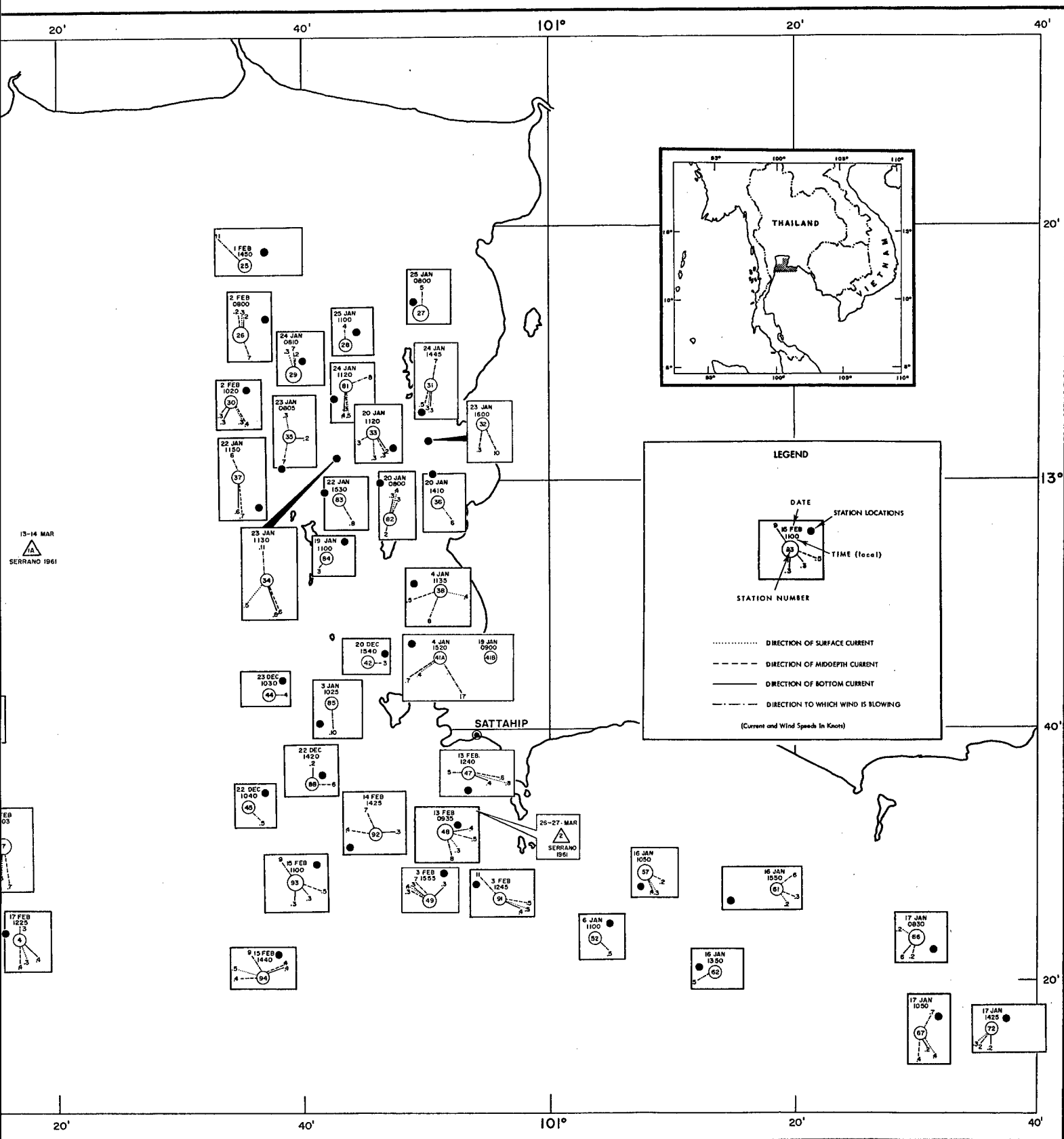


FIGURE 1. Locator Chart of the Survey Area.



locations. The observed current vectors at surface, middepth, and bottom are indicated.

2

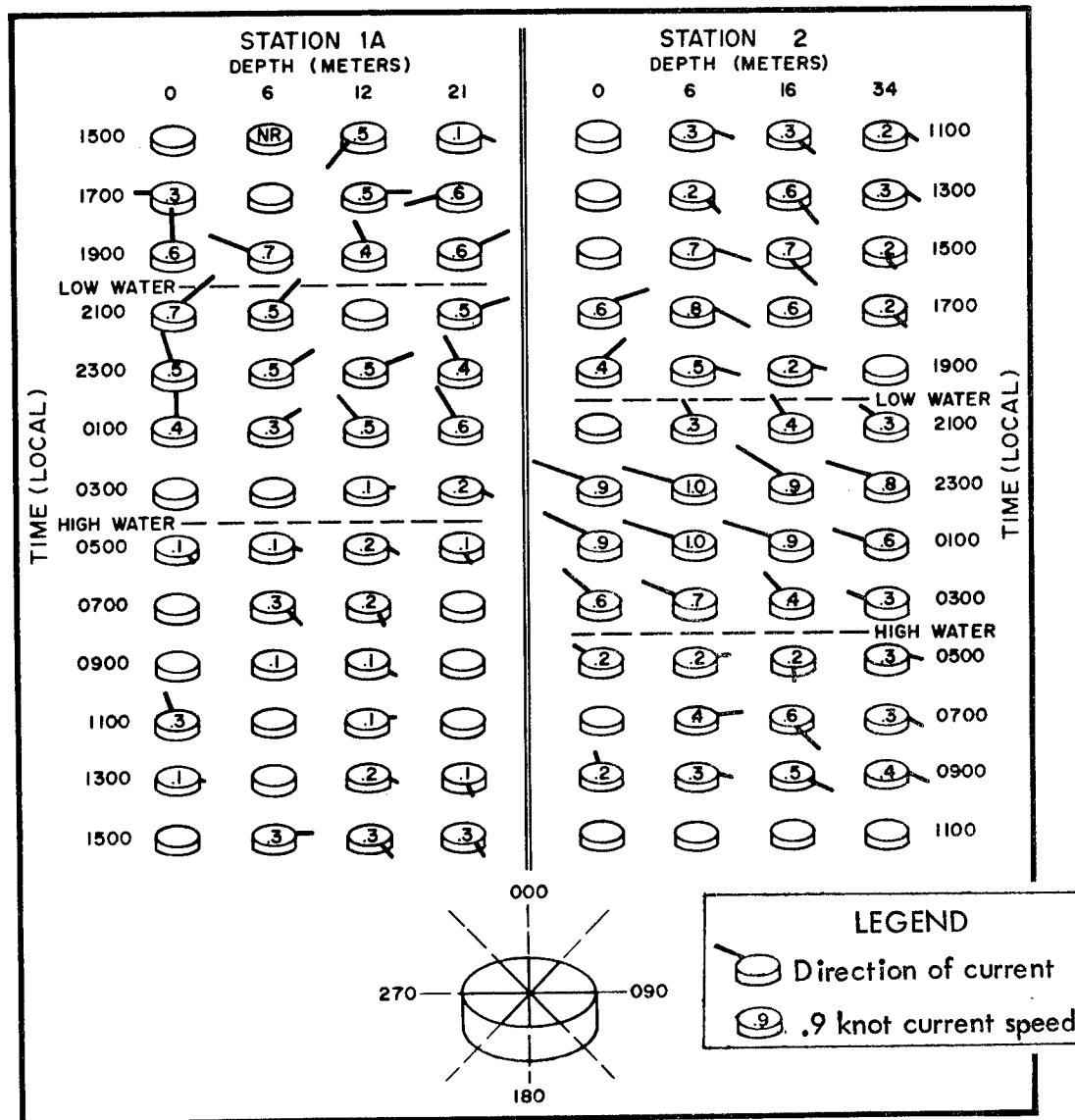


FIGURE 3. Current Data from Two 24-Hour Stations - 1961 SERRANO Cruise.

TABLE I. STATION DATA SUMMARY

STATION NUMBER	SONIC DEPTH	STATION DEPTH	NANSEN CAST	CURRENT VELOCITY	BT
1	15	13	✓	✓	✓
2	19	17	✓	✓	✓
3	26	24	✓	✓	✓
4	32	30	✓	✓	✓
5	15	13	✓	✓	✓
6	21	19	✓	✓	✓
7	20	26	✓	✓	✓
9	15	13	✓	✓	✓
10	22	20	✓	✓	✓
11	25	23	✓	✓	✓
13	15	13	✓	✓	✓
14	15	13	✓		✓
15	22	19	✓		✓
17	16	14	✓	✓	✓
18	25	23	✓	✓	✓
19	24	22	✓	✓	✓
21	12	10	✓	✓	✓
25	16	14	✓		✓
26	19	17	✓	✓	✓
27	16	14	✓		✓
28	27	25	✓		✓
29	22	20	✓	✓	✓
30	22	20	✓	✓	✓
31	25	23	✓	✓	✓
32	19	17	✓	✓	✓
33	31	29	✓	✓	✓
34	21	20	✓	✓	✓
35	29	27	✓	✓	✓
36	19	18	✓	✓	✓
37	26	26	✓	✓	✓
38	21	20	✓	✓	✓
41A	22	20	✓	✓	✓
41B	19	18	✓		✓
42	24	23	✓		✓
44	30	37	✓		✓
45	33	31	✓		✓
47	25	23	✓	✓	✓
48	38	36	✓	✓	✓
49	40	38	✓	✓	✓
52	30	29	✓	✓	✓
57	22	21	✓	✓	✓
61	30	28	✓	✓	✓
62	31	30	✓	✓	✓
66	31	30	✓	✓	✓
67	34	33	✓	✓	✓
72	33	32	✓	✓	✓
73	17	15	✓	✓	✓
81	26	24	✓	✓	✓
82	31	29	✓	✓	✓
83	21	19	✓	✓	✓
84	34	32	✓	✓	✓
85	43	41	✓		✓
88	44	44	✓	✓	✓
91	35	33	✓	✓	✓
92	32	30	✓	✓	✓
93	32	30	✓	✓	✓
94	31	29	✓	✓	✓

APPENDIX

Oceanographic Station Summary Sheets

All measurements are expressed in Meters,
Centigrade, and Knots unless otherwise
stated.

WEATHER CODE

0/10 to 3/10 cloud coverage	=	Clear	(Clr)
4/10 to 6/10	=	Broken	(Bkn)
7/10 to 9/10	=	Cloudy	(Cldy)
10/10	=	Overcast	(Ovc)

CLOUD TYPE

Stratus	(St)
Cirrus	(Ci)
Cumulus	(Cu)
Cirro-Cumulus	(CiCu)
Strato-Cumulus	(StCu)

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	16 Feb. 68	TIME	0430 G.M.T.
OS NO	1	LATITUDE	12 23.2'N	LONGITUDE	100 03.3'E	CUR STA NO	1
DEPTH	15	WIND (E/N)	150	AIR TEMP	24.5	WEATHER	CLR
SEA SURF TEMP	27.42	DIR	150	WET	24.5	BAROMETER (25)	
WAVES	9 to 17	SEA	17	DRY	29.4	REMARKS	
DIRECTION (°T)	140	SWELL					
HEIGHT IN FEET	3						
PERIOD IN SEC							
DEPTH	0	TEMP	27.42	E.C. (‰)	32.36	CURRENT	
	9		27.18		32.37	SPEEDKTS	.4
	13		27.21		32.36	DIR (°T)	130
							125

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	17 Feb. 68	TIME	0100 G.M.T.
OS NO	3	LATITUDE	12 23.4'N	LONGITUDE	100 11.1'E	CUR STA NO	3
DEPTH	26	WIND (E/N)	180	AIR TEMP	25.0	WEATHER	CLR
SEA SURF TEMP	27.24	DIR	180	WET	25.0	BAROMETER (25)	
WAVES	4 to 8	SEA	8	DRY	29.4	REMARKS	
DIRECTION (°T)	170	SWELL					
HEIGHT IN FEET	3						
PERIOD IN SEC							
DEPTH	0	TEMP	27.24	E.C. (‰)	32.25	CURRENT	
	12		27.25		32.24	SPEEDKTS	.3
	24		27.27		32.27	DIR (°T)	130
							150
							160

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	16 Feb. 68	TIME	0725 G.M.T.
OS NO	2	LATITUDE	12 23.4'N	LONGITUDE	100 06.2'E	CUR STA NO	2
DEPTH	19	WIND (E/N)	140	AIR TEMP	25.0	WEATHER	CLR
SEA SURF TEMP	27.43	DIR	140	WET	25.0	BAROMETER (25)	
WAVES	7 to 14	SEA	14	DRY	29.4	REMARKS	
DIRECTION (°T)	140	SWELL					
HEIGHT IN FEET	4						
PERIOD IN SEC							
DEPTH	0	TEMP	27.43	E.C. (‰)	32.25	CURRENT	
	8		27.24		32.25	SPEEDKTS	.5
	17		27.18		32.25	DIR (°T)	300 to 050
							295 to 050
							280

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	17 Feb. 68	TIME	0525 G.M.T.
OS NO	4	LATITUDE	12 24.0'N	LONGITUDE	100 16.0'E	CUR STA NO	4
DEPTH	32	WIND (E/N)	190	AIR TEMP	25.0	WEATHER	CLR
SEA SURF TEMP	27.50	DIR	190	WET	25.0	BAROMETER (25)	
WAVES	1 to 4	SEA	4	DRY	29.4	REMARKS	
DIRECTION (°T)	160	SWELL					
HEIGHT IN FEET	2						
PERIOD IN SEC							
DEPTH	0	TEMP	27.50	E.C. (‰)	32.25	CURRENT	
	12		27.25		32.25	SPEEDKTS	.3
	30		27.28		32.24	DIR (°T)	160
							180
							132

[illegible]

VESSEL		HTMS		AREA		GULF of		DATE		TIME	
BANGKRACHAN		THAILAND		LONGITUDE		100 11.7 E		20 Feb. 68		0305 $\frac{1}{2}$ M.T.	
OS NO	7	LATITUDE		12 29.0' N		100 11.7 E		DEPTH		BT SLIDE NO	
SEA SURF TEMP	27.31	WIND (KNOTS)	150	AIR TEMP	25.5	BAROMETRIC (IN. Hg)	29.23	WEATHER	CLDY	CLOUDS	COVER 7/10
DIRECTION (°T)	110	WET	25.5	DRY	27.2	TYPE Cu					
HEIGHT IN FEET	3	SEA		SWELL		REMARKS					
PERIOD IN SEC											
DEPTH	TEMP	E.C. (mbars)		SAL (°/00)		CURRENT					
0	27.31	.0516		32.24		DEPTH	SPEED(KTS)	DIR (°T)			
13	27.28	.0516		32.23		3	.5	185			
26	27.32	.0516		32.26		15	.7	175			
						26	.5	190			

[illegible]

VESSEL	HMS	AREA	GULF of THAILAND	DATE	TIME
BANGKACHAN		LATITUDE	LONGITUDE	DEPTH	SPEED KTS
OS NO	9	12 32.7'N	100 01.4'E	15	9
SEA SURF TEMP	27.59	WIND (Dir)	AIR TEMP	WEATHER	CLOUDS
DIRECTION	(°)	070	WET 25.0	CLR	COVER
HEIGHT IN FEET		2	DRY 29.4		TYPE
PERIOD IN SEC					
Current speeds less than 2 kt. Directions are unmeasurable.					
DEPTH	TEMP	E.C. (mhos)	SAL (‰)	DEPTH	SPEED KTS
0	27.59	.0516	32.02	1	See remarks
6	27.19	.0512	32.03	12	
13	27.10	.0511	32.01		

VESSEL	HTMS	AREA	GULF of		DATE	7 Feb. 68	TIME	0705	G.M.T.
	BANGRACHAN		THAILAND						
OS NO	10	LATITUDE	12 32.7'N	100 05.0'E	DEPTH	22	CUR STAG NO	10	38
SEA SURF TEMP	27.62	WIND (Kts)	065	AIR TEMP	24.5	WET	24.5	CLOUDS	3/10
		DIR	101	DRY	28.3			COVER	01
WAVES		SEA		SWELL					
DIRECTION (°T)	190								
HEIGHT IN FEET	2								
PERIOD IN SEC									
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	DEPTH	SPEEDKTS	DIR (°T)			
0	27.62	.0516	32.05	4	.3	160			
6	27.15	.0512	32.04	12	.3	145			
12	27.10	.0511	32.06	20	.3	125			
20	27.08	.0512	32.09						
									</

VESSEL	HTMS	AREA	GULF of THAILAND		DATE	9 Feb. 68	TIME	0115	G.M.T.
OS NO	13	LATITUDE		12 37.7'N	LONGITUDE		100 01.2'E	DEPTH	15
SEA SURF TEMP	27.09	WIND (KTS)		210	AIR TEMP		23.3	WET	23.3
		DIR		5	DRY		25.6		
WAVES		SEA		SWELL					
DIRECTION (°T)	120								
HEIGHT IN FEET	2								
PERIOD IN SEC									
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	CURRENT					
0	27.09	.0510	31.99	DEPTH	SPEEDKTS	DIR (°T)			
6	27.13	.0511	32.02	4	.2	180	045		
13	27.16	.0511	32.00	12	K.2	-			

Two distinct current directions at 4m.

VESSEL	HTMS	AREA	GULF of	DATE	7 Feb. 68	TIME	0405	G.M.T.
	BANGRACHAN		THAILAND					
OS NO	11	LATITUDE	12 32.7'N	LONGITUDE	100 09.3'E	DEPTH	25	CUR STA NO
								11
SEA SURF TEMP	27.43	WIND (KTS)	145	AIR TEMP	25.0	BAROMETER (ZSS)		WEATHER
		DIR	2	WET	25.0			CLR
		SPEED	2	DRY	30.0			
WAVES		SEA		SWELL		REMARKS		
DIRECTION (°T)	120							
HEIGHT IN FEET	2							
PERIOD IN SEC								
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	DEPTH	SPEED(KTS)	DIR (°T)		
0	27.43	.0515	32.07	4	.7	125		
10	27.09	.0511	32.06	13	.6	150		
23	27.09	.0511	32.06	23	.5	170		

VESSEL	HTMS	AREA	Gulf of	DATE	21 Feb. 68	TIME	0215	G.M.T.	
	BANGRACHAN		THAILAND						
OS NO	14	12 37.5'N	100 05.2'E	DEPTH	15	CUR STA NO		57	
SEA SURF TEMP	27.14	WIND (Kts)	050	AIR TEMP	23.3	WET	23.3	CLOUDS	6/10
		DIR	3	DRY	26.1			COVER	01
WAVES		SEA		SWELL					
DIRECTION (°T)				140					
HEIGHT IN FEET				5					
PERIOD IN SEC				6					
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	DEPTH	SPEED(KTS)	DIR (°T)			
0	27.14	.0512	32.12	-	-	-			
13	27.10	.0512	32.11						

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		21 Feb. 68	0655 G.M.T.
OS NO	LATITUDE	LONGITUDE	CUR STA NO	DEPTH	BT SLICE NO
15	12 37.3'N	100 09.9'E	22		58
SEA SURF TEMP	WIND (Knots)	AIR TEMP	WET	BAROMETER (25.5)	WEATHER
27.41	090	23.9			CLdy
WAVES	SEA	SWELL	REMARKS		
DIRECTION (FT)	080				
HEIGHT IN FEET	5				
PERIOD IN SEC					
DEPTH	TEMP	E.C. (mbars)	SAL (°/100)	CURRENT	
0	27.41	.0514	32.05		
19	27.17	.0513	32.10		

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		9 Feb. 68	0430 G.M.T.
OS NO	LATITUDE	LONGITUDE	CUR STA NO	DEPTH	BT SLICE NO
17	12 41.2'N	100 02.8'E	16		40
SEA SURF TEMP	WIND (Knots)	AIR TEMP	WET	BAROMETER (25.5)	WEATHER
27.69	140	25.0			CLr
WAVES	SEA	SWELL	REMARKS		
DIRECTION (FT)	120				
HEIGHT IN FEET	2				
PERIOD IN SEC					
DEPTH	TEMP	E.C. (mbars)	SAL (°/100)	CURRENT	
0	27.69	.0517	32.04		
6	27.29	.0514	32.09		
14	27.29	.0514	32.07		

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		10 Feb. 68	0135 G.M.T.
OS NO	LATITUDE	LONGITUDE	CUR STA NO	DEPTH	BT SLICE NO
18	12 41.0'N	100 07.8'E	25		42
SEA SURF TEMP	WIND (Knots)	AIR TEMP	WET	BAROMETER (25.5)	WEATHER
27.21	260	25.0			CLr
WAVES	SEA	SWELL	REMARKS		
DIRECTION (FT)	120				
HEIGHT IN FEET	3				
PERIOD IN SEC					
DEPTH	TEMP	E.C. (mbars)	SAL (°/100)	CURRENT	
0	27.21	.0512	32.06		
10	27.20	.0512	32.05		
23	27.21	.0512	32.05		

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		10 Feb. 68	0510 G.M.T.
OS NO	LATITUDE	LONGITUDE	CUR STA NO	DEPTH	BT SLICE NO
19	12 40.4'N	100 12.7'E	24		43
SEA SURF TEMP	WIND (Knots)	AIR TEMP	WET	BAROMETER (25.5)	WEATHER
27.50	110	25.0			CLdy
WAVES	SEA	SWELL	REMARKS		
DIRECTION (FT)	Calm				
HEIGHT IN FEET					
PERIOD IN SEC					
DEPTH	TEMP	E.C. (mbars)	SAL (°/100)	CURRENT	
0	27.50	.0516	32.10		
10	27.27	.0514	32.10		
22	27.29	.0514	32.10		

[illegible][illegible]

VESSEL	HTMS	AREA	GULF of	DATE	25 Jan 68	TIME	0345	G.M.T.
OS NO	28	BANGRACHAN	THAILAND	LATITUDE	13 11.7'N	LONGITUDE	100 44.8'E	ST SLIDE NO
SEA SURF TEMP	26.91	WIND (Knots)	180	AIR TEMP	WET 25.6	DRY 30.6	BAROMETER (25.5)	WEATHER
WAVES		SEA		SWELL				CLr
DIRECTION (°T)		190						CLOUDS
HEIGHT IN FEET		2						COVER
PERIOD IN SEC								TYPE
DEPTH		TEMP	E.C. (mbars)	SAL (‰)				CURRENT
0	26.91	.0511	32.14					DIR (°T)
11	26.68	.0508	32.09					-
25	26.60	.0507	32.11					
				</				

VESSEL		HTMS		AREA		GULF of		DATE		TIME	
BANGRACHAN		THAILAND						2 Feb. 68		0320	
GMT.											
OS NO		30		LATITUDE		13 07.3'N		LONGITUDE		100 35.7'E	
SEA SURF TEMP		27.09		WIND (Knots)		040		AIR TEMP		WET 23.4	
										DRY 28.4	
WAVES				SEA				SWELL			
DIRECTION (°T)				150							
HEIGHT IN FEET				1							
PERIOD IN SEC											

VESSEL		HTMS		AREA		GULF of		THAILAND		DATE		24 Jan. 68		TIME		0110		G.M.T.																	
OS NO		29		LATITUDE		13 09.5'N		100 40.4'E		LONGITUDE		100 40.4'E		DEPTH		22		CUR STA NO		29		ST SLICE NO		26		CLOUD		COVER 6/10		TYPE		Bkn		Cn	
SEA SURF TEMP		26.70		WIND (Knots)		170		DIR		24.4		WET		27.2		DRY		BAROMETER (25.5)		WEATHER		Bkn		CLOUD		COVER 6/10		TYPE		Bkn		Cn			
WAVES				SEA				SWELL										REMARKS																	
DIRECTION (FT)		170																																	
HEIGHT IN FEET		3																																	
PERIOD IN SEC																																			
DEPTH		TEMP.		E.C. (mbars)		SAL (‰)		CURRENT		DEPTH		3		.3		.2		Appx. 345																	
0		26.70		.0509		32.14																													
10		26.71		.0508		32.12																													
20		26.74		.0509		32.15																													

VESSEL		HTMS		AREA		GULF of		DATE		24 Jan. 68		TIME		0745		G.M.T.															
BANGRACHAN		THAILAND		LATITUDE		13 05.6'N		LONGITUDE		100 49.9'E		DEPTH		25		31		28													
SEA SURF TEMP		27.22		WIND (Knots)		190		AIR TEMP		WET 25.0		DRY 28.4		BAROMETER (25.5)		WEATHER		CLR		CLOUDS		COVER		0		0		TYPE		0	
WAVES		SEA		SWELL		REMARKS																									
DIRECTION (FT)		160																													
HEIGHT IN FEET		2																													
PERIOD IN SEC																															
DEPTH		TEMP.		E.C. (mbars)		SAL (‰)		CURRENT		DEPTH		SPEED(KTS)		DIR (°)																	
0		27.22		.0512		32.01				4		.3		190																	
11		26.84		.0509		32.10				13		.5		190																	
23		26.85		.0509		32.10				23		.3		185																	

[illegible][illegible]

VESSEL	HMS	AREA	GULF of	DATE	TIME
BANGRACHAN	THAILAND			20 Jan. 68	0420 G.M.T.
OS NO	LATITUDE	LONGITUDE	DEPTH	CUR STD NO	BY SLICE NO
33	13 02.6'E	100 47.5'W	31	33	19
SEA SURF TEMP	WIND (EAS)	AIR TEMP	BAROMETER(ES)	WEATHER	CLOUDS COVER TYPE
27.06	DIR 070 SPEED 3	WET 25.0 DRY 29.4		CLR	1/10 CU
NAMES	SEA	SWELL	REMARKS		
DIRECTION (MT)	-				
HEIGHT IN FEET	-				
PERIOD IN SEC					
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	CURRENT	
				DEPTH	SPEED(S) DIR (°T)
0	27.06	.0512	32.09	3	.3 180
7	26.87	.0510	32.10	10	.3 150
14	26.88	.0510	32.12	29	.2 145
29	26.89	.0510	32.11		

[illegible]

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	13 Feb. 68	TIME	0540 G.M.T.
OS NO	47	LATITUDE	12 35.5'N	LONGITUDE	100 53.5'E	DEPTH	25
CUR STA NO	47	ST SLIDE NO	45	WEATHER	OVC	CLOUDS COVER	10/10
SEA SURF TEMP	27.49	WIND (E/10)	095	AIR TEMP	22.8	BAROMETER (H/25)	27.2
WET	5	DIR	5	WET	27.2	DRY	27.2
WAVES		SEA		SWELL		REMARKS	
DIRECTION (FT)				120			
HEIGHT IN FEET				3			
PERIOD IN SEC							
DEPTH	TEMP	E.C. (mbars)	SAL (P/00)	DEPTH	SPEED(KTS)	DIR (FT)	
0	27.49	.0518	32.21	4	.8	105	
9	27.38	.0516	32.20	13	.6	100	
23	27.35	.0517	32.22	23	.4	110	

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	3 Feb. 68	TIME	0855 G.M.T.
OS NO	49	LATITUDE	12 29.8'N	LONGITUDE	100 51.0'E	DEPTH	40
CUR STA NO	49	ST SLIDE NO	35	WEATHER	Bkn	CLOUDS COVER	5/10
SEA SURF TEMP	27.63	WIND (E/10)	140	AIR TEMP	25.6	BAROMETER (H/25)	28.9
WET	7	DIR	7	WET	28.9	DRY	28.9
WAVES		SEA		SWELL		REMARKS	
DIRECTION (FT)				140			
HEIGHT IN FEET				3			
PERIOD IN SEC							
DEPTH	TEMP	E.C. (mbars)	SAL (P/00)	DEPTH	SPEED(KTS)	DIR (FT)	
0	27.63	.0519	32.24	4	.4	305	
10	27.30	.0516	32.22	20	.3	300	
24	27.29	.0516	32.23	38	.3	311 & 047	
38	27.30	.0516	32.23				

Two distinct directions
for the current at 38m.

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	13 Feb. 68	TIME	0235 G.M.T.
OS NO	48	LATITUDE	12 32.5'N	LONGITUDE	100 52.5'E	DEPTH	38
CUR STA NO	48	ST SLIDE NO	44	WEATHER	Cldy	CLOUDS COVER	9/10
SEA SURF TEMP	27.46	WIND (E/10)	345	AIR TEMP	22.2	BAROMETER (H/25)	26.7
WET	7.09	DIR	7.09	WET	26.7	DRY	26.7
WAVES		SEA		SWELL		REMARKS	
DIRECTION (FT)				120			
HEIGHT IN FEET				4			
PERIOD IN SEC				5			
DEPTH	TEMP	E.C. (mbars)	SAL (P/00)	DEPTH	SPEED(KTS)	DIR (FT)	
0	27.46	.0518	32.26	3	.3	145	
10	27.49	.0518	32.23	19	.5	105	
36	27.52	.0518	32.22	35	.4	080	

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	6 Jan. 68	TIME	0410 G.M.T.
OS NO	52	LATITUDE	12 24.7'N	LONGITUDE	101 04.7'E	DEPTH	30
CUR STA NO	52	ST SLIDE NO	9	WEATHER	Clr	CLOUDS COVER	0
SEA SURF TEMP	26.58	WIND (E/10)	315	AIR TEMP	20.6	BAROMETER (H/25)	26.1
WET	5	DIR	5	WET	26.1	DRY	26.1
WAVES		SEA		SWELL		REMARKS	
DIRECTION (FT)				315			
HEIGHT IN FEET				2			
PERIOD IN SEC							
DEPTH	TEMP	E.C. (mbars)	SAL (P/00)	DEPTH	SPEED(KTS)	DIR (FT)	
0	26.58	.0504	31.91	3	<.2	-	
9	26.54	.0503	31.91	15	<.2	085	
19	26.55	.0504	31.91	28	<.2	-	
29	26.53	.0503	31.90				

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	16 Jan 68	TIME	0350 G.M.T.
OS NO	57	LATITUDE	12 27.7'N	LONGITUDE	101 07.3'E	CUR STA NO	57
SEA SURF TEMP	26.54	WIND DIR	340	AIR TEMP	20.0	WEATHER	Clr
		WIND SPEED	4	WET DRY	25.0	BAROMETER (25.5)	
WAVES		SEA		SWELL		REMARKS	
DIRECTION (PT)				000			
HEIGHT IN FEET				3			
PERIOD IN SEC				3			
DEPTH		TEMP	E.C. (mbars)	SAL (°/00)	CURRENT		
0		26.54	.0505	32.02	DEPTH	SPEEDKTS	DIR (°)
11		26.54	.0505	32.01	3	.3	150
21		26.56	.0506	32.04	10	.2	112
					20	<.2	103

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	16 Jan. 68	TIME	0815 G.M.T.
OS NO	61	LATITUDE	12 25.5'N	LONGITUDE	101 14.8'E	CUR STA NO	61
SEA SURF TEMP	26.75	WIND DIR	230	AIR TEMP	22.2	WEATHER	Clr
		WIND SPEED	.6	WET DRY	28.9	BAROMETER (25.5)	
WAVES		SEA		SWELL		REMARKS	
DIRECTION (PT)				220			
HEIGHT IN FEET				1			
PERIOD IN SEC				1			
DEPTH		TEMP	E.C. (mbars)	SAL (°/00)	CURRENT		
0		26.75	.0512	32.34	DEPTH	SPEEDKTS	DIR (°)
7		26.72	.0510	32.24	3	.2	145
28		26.66	.0510	32.25	8	.3	113

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	16 Jan. 68	TIME	0700 G.M.T.
OS NO	62	LATITUDE	12 21.2'N	LONGITUDE	101 12.3'E	CUR STA NO	62
SEA SURF TEMP	26.85	WIND DIR	060	AIR TEMP	21.7	WEATHER	Clr
		WIND SPEED	.5	WET DRY	27.8	BAROMETER (25.5)	
WAVES		SEA		SWELL		REMARKS	
DIRECTION (PT)				-			
HEIGHT IN FEET				-			
PERIOD IN SEC				-			
DEPTH		TEMP	E.C. (mbars)	SAL (°/00)	CURRENT		
0		26.85	.0514	32.35	DEPTH	SPEEDKTS	DIR (°)
10		26.77	.0512	32.34	3	<.2	-
20		26.76	.0513	32.36	10	<.2	150
30		26.75	.0512	32.34	28	-	-

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	17 Jan 68	TIME	0130 G.M.T.
OS NO	66	LATITUDE	12 22.6'N	LONGITUDE	101 31.3'E	CUR STA NO	66
SEA SURF TEMP	26.66	WIND DIR	040	AIR TEMP	21.7	WEATHER	Clr
		WIND SPEED	.6	WET DRY	25.6	BAROMETER (25.5)	
WAVES		SEA		SWELL		REMARKS	
DIRECTION (PT)				040			
HEIGHT IN FEET				3			
PERIOD IN SEC				-			
DEPTH		TEMP	E.C. (mbars)	SAL (°/00)	CURRENT		
0		26.66	.0512	32.37	DEPTH	SPEEDKTS	DIR (°)
15		26.65	.0511	32.36	3	.2	305
30		26.67	.0512	32.36	15	.2	195
					28	<.2	310

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		20 Jan. 68	0100 G.M.T.
OS NO	82	12 59.8'N	100 46.5'E	DEPTH 31	CUR STA NO 82
SEA SURF TEMP	26.81	WIND (KPH) DIR SPEED	015 25.0 28.3	WEATHER	Bkn
WAVES		SEA		REMARKS	
DIRECTION (°T)	130				
HEIGHT IN FEET	1				
PERIOD IN SEC					
DEPTH		TEMP	E.C. (mbars)	SAL (°/100)	CURRENT
0	26.81	0509	32.10	3	.4
9	26.83	0509	32.10	15	.3
18	26.80	0509	32.10	27	.3
29	26.79	0509	32.10		

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		19 Jan 68	0530 G.M.T.
OS NO	84	12 55.3'N	100 43.4'E	DEPTH 34	CUR STA NO 84
SEA SURF TEMP	27.39	WIND (KPH) DIR SPEED	035 24.5 27.8	WEATHER	Clr
WAVES		SEA		REMARKS	
DIRECTION (°T)	025				
HEIGHT IN FEET	1				
PERIOD IN SEC					
DEPTH		TEMP	E.C. (mbars)	SAL (°/100)	CURRENT
0	27.39	0516	32.20	3	-
11	26.97	0512	32.19	13	<.2
22	26.96	0512	32.19		150
32	26.94	0511	32.20		

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		22 Jan. 68	0830 G.M.T.
OS NO	83	12 59.0'N	100 42.9'E	DEPTH 21	CUR STA NO 83
SEA SURF TEMP	27.45	WIND (KPH) DIR SPEED	330 25.0 29.4	WEATHER	Clr
WAVES		SEA		REMARKS	
DIRECTION (°T)	180				
HEIGHT IN FEET	3				
PERIOD IN SEC					
DEPTH		TEMP	E.C. (mbars)	SAL (°/100)	CURRENT
0	27.45	0516	32.17	See remarks	
9	26.95	0512	32.17		
19	26.94	0511	32.18		

VESSEL	HTMS	AREA	GULF of	DATE	TIME
	BANGRACHAN	THAILAND		3 Jan. 68	0325 G.M.T.
OS NO	85	12 41.0'N	100 41.9'E	DEPTH 43	CUR STA NO 85
SEA SURF TEMP	27.05	WIND (KPH) DIR SPEED	000 20.0 27.2	WEATHER	Clr
WAVES		SEA		REMARKS	
DIRECTION (°T)	000				
HEIGHT IN FEET	3				
PERIOD IN SEC					
DEPTH		TEMP	E.C. (mbars)	SAL (°/100)	CURRENT
0	27.05	0510	32.03		
13	27.05	0510	32.03		
26	27.01	0510	32.03		
41	27.00	0510	32.03		

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	22 Dec. 67	TIME	0730 G.M.T.
OS NO	88	LATITUDE	12 36.9'N	LONGITUDE	100 41.4'E	DEPTH	46
		CUR STAN NO	88			ST SLIDE NO	3
SEA SURF TEMP	27.52	WIND DIR	275	AIR TEMP	23.9	WEATHER	Clr
		WET DRY	30.6	WET DRY	30.6	CLOUDS COVER TYPE	0
WAVES		SEA		SWELL		REMARKS	
DIRECTION (°T)							
HEIGHT IN FEET							
PERIOD IN SEC							
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	CURRENT	DEPTH	SPEED(KTS)	DIR (°T)
0	27.52	-	-		2	<.2	325
14	27.09	-	-		30	<.2	000
29	27.03	-	-		44	.2	015
44	27.07	-	-				

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	14 Feb. 68	TIME	0725 G.M.T.
OS NO	92	LATITUDE	12 31.0'N	LONGITUDE	100 44.4'E	DEPTH	32
		CUR STAN NO	92			ST SLIDE NO	46
SEA SURF TEMP	27.54	WIND DIR	160	AIR TEMP	25.0	WEATHER	Bkn
		WET DRY	30.6	WET DRY	30.6	CLOUDS COVER TYPE	4/10 Cu
WAVES		SEA		SWELL		REMARKS	
DIRECTION (°T)							
HEIGHT IN FEET							
PERIOD IN SEC							
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	CURRENT	DEPTH	SPEED(KTS)	DIR (°T)
0	27.54	.0517	32.20		4		
10	27.34	.0515	32.20		18	.4	285
30	27.35	.0516	32.19		30	.3	085

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	3 Feb. 68	TIME	0545 G.M.T.
OS NO	91	LATITUDE	12 27.8'N	LONGITUDE	100 54.0'E	DEPTH	35
		CUR STAN NO	91			ST SLIDE NO	34
SEA SURF TEMP	27.32	WIND DIR	140	AIR TEMP	25.0	WEATHER	Clr
		WET DRY	29.4	WET DRY	29.4	CLOUDS COVER TYPE	3/10 Cu
WAVES		SEA		SWELL		REMARKS	
DIRECTION (°T)							
HEIGHT IN FEET							
PERIOD IN SEC							
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	CURRENT	DEPTH	SPEED(KTS)	DIR (°T)
0	27.32	.0516	32.26		4	.5	110
8	27.32	.0516	32.26		19	.5	100
20	27.36	.0517	32.27		33	.4	115
33	27.03	.0513	32.27				

VESSEL	HTMS	AREA	GULF of THAILAND	DATE	15 Feb. 68	TIME	0400 G.M.T.
OS NO	93	LATITUDE	12 25.5'N	LONGITUDE	100 41.3'E	DEPTH	32
		CUR STAN NO	93			ST SLIDE NO	47
SEA SURF TEMP	27.27	WIND DIR	140	AIR TEMP	24.4	WEATHER	Ovc
		WET DRY	27.8	WET DRY	27.8	CLOUDS COVER TYPE	10/10 CiCu
WAVES		SEA		SWELL		REMARKS	
DIRECTION (°T)							
HEIGHT IN FEET							
PERIOD IN SEC							
DEPTH	TEMP	E.C. (mbars)	SAL (‰)	CURRENT	DEPTH	SPEED(KTS)	DIR (°T)
0	27.27	.0515	32.19		4	.3	130
15	27.26	.0515	32.19		15	.5	105
30	27.31	.0515	32.18		30	.3	180

VESSEL		HTMS BANGRACHAN		AREA GULF of THAILAND		DATE 15 Feb. 68		TIME 0740 G.M.T.	
OS NO	94	LATITUDE 12 22.2'N		LONGITUDE 100 38.0'E		DEPTH	31	CUR STA NO	94
SEA SURF TEMP	27.50	WIND TEMP	150	AIR TEMP	24.4	BAROMETER (22)		WEATHER	Clr
		DIR	8 to 10	WET	30.0	DRY		CLOUDS COVER TYPE	1/10 Cu
WAVES		SEA	SHELL		REMARKS				
DIRECTION (FT)		110			Two distinct current directions at 16m.				
HEIGHT IN FEET		4							
PERIOD IN SEC									
DEPTH	TEMP	E.C. (‰)	SAL (‰)	CURRENT					
0	27.50	.0518	32.27	DEPTH	3	SPEED (KTS)	.5	DIR (PT)	290
10	27.41	.0518	32.28	16	.4	070 & 270			
29	27.42	.0517	32.27	29	.4	070			

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13. ABSTRACT			
The U.S. Naval Oceanographic Office and the Royal Thai Navy conducted a joint environmental survey in the Gulf of Thailand from 20 December 1967 to 21 February 1968. Operations included serial-depth temperature and salinity measurements at 57 station locations and current meter observations at 47 of the stations. The area surveyed in the Gulf of Thailand was found to be nearly isothermal and isohaline throughout the water column which attests to a well-developed mixing environment. The tidal currents in the gulf are thought to be responsible for the homogenous nature of the water. Characteristic of the region surveyed was the variance in current direction with depth for any one station location and the change in current vectors over short durations. Measured current speeds ranged to a maximum of 0.8 knot.			

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14.

KEY WORDS

LINK A

LINK B

LINK C

ROLE

WT

ROLE

WT

ROLE

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GULF OF THAILAND
CURRENT MEASUREMENTS
ENVIRONMENTAL DATA

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