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OCEANOGRAPHIC SURVEY OF THE
GULF OF MEXICO

Office of Naval Research Project NR 083 036
Contract N7 onr-48702 Status Report
Navy Department October 1954
A&M Project 24-A Reference 54-59P

Annual Report For Period
30 June 1953 To 30 June 1954

Research Conducted through the
Texas A. & M. Research Foundation
COLLEGE STATION, TEXAS

THE AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
Department of Oceanography
College Station, Texas

Research conducted through the
Texas A & M Research Foundation

T&M Project 24A - Reference 54-58P

ANNUAL REPORT: 30 June 1953 to 30 June 1954

Project 24A is an Oceanographic Survey of the Gulf of Mexico sponsored by the Office of Naval Research (Project NR 083 036, Contract Nonr-487 T.O. II). The work reported herein is of a preliminary nature and the results are not necessarily in final form.

Report prepared September 1954

by

George E. Austin, Jr.

Carl E. Leipper - Project Supervisor

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B. Sea Surface Isohalines (‰) Cruise 10-2B

TASK ORDER

The Contractor shall furnish the necessary personnel and facilities for and, in accordance with any instructions issued by the Scientific Officer or his authorized representative, shall conduct a systematic survey of the Gulf of Mexico to procure information on oceanography and meteorology with appropriate analyses of the data collected, including salinity determination.

ABSTRACT

One deep water oceanographic cruise was undertaken with the new research vessel (see Figure 1) in March 1954. Two bay surveys were made of Mobile Bay, Alabama. Of sixteen total oceanographic cruises taken during the past year personnel of the project participated on eleven for a total of approximately 275 man days at sea. Fifty-six man days were spent in the field on the two bay surveys by personnel from the project.

Oceanographic data from M/V ALASKA cruises were processed and sent to the U. S. Navy Hydrographic Office for additional computation. Sixty-three deep sea reversing thermometers were calibrated in a tank built by the project for this purpose. Five technical reports were distributed during the year. A number of students and staff members were trained during the year and gained valuable experience both at sea and ashore.

INTRODUCTION

During the period of this report a number of varied, but basically important, changes took place which had several effects on the workings of the project.

The tug ALBEMARLE was turned back over to the Navy in August of 1953, which relieved this activity of that responsibility. The cooperative cruise arrangement which had existed for some three years with the U. S. Fish and Wildlife Service came to an end when the Texas A & M Research Foundation acquired a research vessel. A great portion of the year covered by this report was then spent in converting the schooner ATLANTIC into a safe seviceable oceanographic research vessel, A. A. JAKKULA, as the vessel has since been christened.

In April 1954, the three Office of Naval Research Contracts then in effect in the Oceanography Department were consolidated under one Contract N7onr-487 T.O. II.

This annual report covers a twelve month year which does not coincide with the date of contract now in effect. However, the next periodical report will be distributed on 31 October 1954 and will cover all three activities. Task Order 2 will have a four month report then and Task Orders previously described as 3 and 4 will have a six month report.

COLLECTION, PROCESSING AND ANALYSIS OF DATA

Cruises, General

From 30 June 1953 to 31 December 1953 a total of eight short cruises were made aboard the R/V ATLANTIC. These varied in length of time at sea from one day to one week. During this stage of operation the ship had not been converted to a research vessel, although conversion work had begun. In early June a deck laboratory had been constructed, a BT winch with boom installed and a small hydrographic winch with boom installed. The ship was new (different) and unfamiliar to both crew and scientific personnel. Observations were necessarily restricted to gathering weather and BT data; a few bottom samples and hydrographic samples were collected from shallow water only (500 ft. of wire). Lack of both radio transmitter and/or receiver also restricted the length of any one cruise.

During this six month period a total of thirty days was spent at sea divided among the eight cruises mentioned above.

On December 5, 1953 in a dedication ceremony in Galveston, Texas the ship's name was changed from ATLANTIC to A. A. JAKKULA in honor of the first executive director of the Texas A. & M Research Foundation. In future reports or letters the ship shall be referred to by the above name, A. A. JAKKULA.

In mid-December the A. A. JAKKULA was taken into dry dock at the Seabrook Shipyard where conversion and installation of new equipment was begun. It was not until February 1954 that the A. A. JAKKULA was ready for work at sea again.

By 30 June 1954 eight additional cruises had been taken and approximately 72 more days at sea had been completed. Of the sixteen cruises taken during the period of this report, one or more men connected with Task 2 participated in or conducted eleven.

It was necessary that project personnel first gain experience and subsequently train others in the safe use and care of shipboard oceanographic equipment.

A total of 1200 salinity titrations were run during the year. Approximately 700 BT observations were taken. Sixteen deep oceanographic stations were occupied and 125 shallow stations were made, some of which were repeated, as in the bay surveys. A total of 79 days was spent in the field by one or more members of the project.

Cruise 54-2 R/V A. A. JAKKULA

The ship departed Galveston, Texas on March 6, 1954 for the western Gulf of Mexico to complete a second oceanographic coverage of this area

(Figure 1). Mr. George Austin was chief scientist in charge. Dr. John Barlow, Messrs. Joe Howe, Rex Rainwater, Jean Pina de Ia, William Bradley and Dan Wray accompanied Mr. Austin and assisted in the work of the cruise.

Of twenty-eight oceanographic stations planned, sixteen were occupied, 89 BT and weather observations were made, 56 plankton samples were taken, a number of marine bacteria samples were acquired and a few bottom samples were obtained.

One week was spent in Port Isabel, Texas to make necessary repairs to the main propulsion engine. At this time a few changes in cruise personnel were also made. Dr. Barlow and Mr. Bradley were replaced by Dr. Walter Saucier, Mr. Phil Moore and Mr. Jim Sullivan. After leaving Port Isabel six stations had been occupied when the power steering unit and automatic pilot failed. A questionable reserve supply of fuel and water caused the Captain to put into Vera Cruz, Mexico which was nearby. Fuel was obtained, but no water as it was found to be unfit for drinking. No repairs could be made at this port to the steering mechanism. Two days were lost in Vera Cruz in clearing port. Upon leaving Vera Cruz it was decided to alter the cruise plan and return directly to Galveston. Hourly BT and weather observations were made on the return run, the ship arrived at Galveston on the 28th of March.

Inasmuch as Cruise 54-2 was the first extensive "deep water" oceanographic cruise that the A. A. JANKULA had made since conversion, this cruise was, in a sense a shakedown cruise for the ship, the equipment and the personnel. The A. A. JANKULA was found to be quite satisfactory as a work ship and should give years of useful, efficient, service as an oceanographic research vessel.

All temperature and salinity data from this cruise have been processed and much of the curve drawing has been completed. All data have been recorded on appropriate forms and checked.

Mobile Bay

Mr. Austin, Mr. Adams and Mr. Howe conducted a hydrographic survey of Mobile Bay during the period 29 October to 12 November 1953. Data were collected from 51 selected stations throughout the bay using a fast speed boat which was furnished by the Alabama Department of Conservation. Three to four runs were made on all stations to cover the different tide stages. Measurements for the determination of the currents, temperature structure and salinity distribution were made. Bottom samples were taken and at regular intervals, weather observations also.

In late June 1954, Mr. Austin with Mr. Martin Burkhead made a short one week survey of Mobile Bay in order to get a sampling of the summer season. Two runs were made at thirty stations with a fast boat and the sampling which was done closely followed that described above for the October-November Bay survey.

Processing of all the data from these two surveys is well under way. All water samples have been titrated for chlorinity, recorded and plotted on smooth sheets for analysis. The temperature and current data have been processed as well. Additional analysis of these data have been delayed from time to time as being of secondary importance in the work schedule. Oceanographic cruises, the processing of those oceanographic data, the maintenance of the ship and equipment all constitute the primary concern and effort for the project.

Cruises 8-3C and 10-2B M/V ALASKA

Salinity samples from Cruises 8-3C and 10-2B of the M/V ALASKA were titrated by the U. S. Fish and Wildlife Service in Galveston, Texas. There was some delay in receiving these data from them, meanwhile all temperature data had been corrected, plotted on smooth sheets and curves drawn from them. Salinity values for the two cruises above were received from the U. S. Fish and Wildlife Service by April 1954. These were immediately recorded, plotted and salinity-depth curves were drawn for each station. Values of temperature and salinity for both observed and standard depths were recorded, checked and these data were sent to the U. S. Navy Hydrographic Office for IBM computations of σ_t and ΔD .

Calibration of Equipment

In May, 1954 calibration of sixty-three deep sea reversing thermometers was begun by Mr. Howe in preparation for a month long oceanographic cruise scheduled for July. This work was done in a calibration tank which had been constructed by the project for this and other similar purposes. The temperature control and sensing unit was not complete at the time the calibrations were begun. By using a sensitive (large volume) toluene-mercury regulator, a Philadelphia differential thermometer and a Bureau of Standards' standard mercury thermometer, it was possible to control the bath temperatures to within $\pm 0.002^\circ\text{C}$. The calibrations and associated paper work were completed by mid-June 1954.

The platinum wire resistance thermometer which had been with the Bureau of Standards more than a year for calibration arrived late in June 1954. It will be incorporated in the regulating system of the calibration tank for future thermometer calibrations and temperature control.

Mr. William Clayton's Slide Rule for the determination of σ_t and $10^5 \Delta_{st}$ was completed during the past year. The rule was checked, tested and proven for accuracy and reliability. It has been used almost continuously since its construction by many of the projects in the Department of Oceanography.

Administration

On April 30, 1954 the three ONR contracts with the Texas A & M Research

Foundation were consolidated under one contract and task order (ONR Project 083 036, Contract N7onr 487 Task Order II). This unification has been accomplished with little or no interruption to the normal work schedules of the three separate efforts.

Figures, Description

Figure No. 1 shows the cruise plan which was followed on Cruise 54-2 of the R/V A. A. JAKKULA during March 1954. The dashed lines indicate breaks in the cruise plan for repairs to the ship.

Figures 2A through 6B show the distribution of salinities for each of five cruises displayed in two different ways. The Figures labeled "A" display the sea surface distribution of salinity as observed on each of the five cruises indicated. The Figures labeled "B" display the variation of salinity in the upper one hundred meters of the Gulf for each of the five cruises indicated. The figures are grouped in such a manner as to facilitate comparisons of salinity-depth variations with surface salinity values at different points.

Figure 7A illustrates the distribution of sea surface isotherms in ($^{\circ}\text{F}$) for Cruise 10-2B of the ALASKA and Figure 7B illustrates the distribution of sea surface salinity for this same cruise. Cruises 6 and 8-3C of the M/V ALASKA are not included here because of the lack of continuity (wide separation in space and time) of the station lines which were taken on these two cruises. " $S_{\text{sfc}} - S_{100\text{m}} = \text{Isolines of Salinity-difference } (\text{‰})$ " for Cruises 10-2B could not be presented because too many of the stations were in water less than 100 meters in depth.

Dotted or dashed lines in Figures 2A through 7B indicate close or unusual contour intervals, or if any part of a solid line contour is dashed, this indicates excessive or doubtful interpolation.

TECHNICAL REPORTS

Technical Report No. 8, "A Contribution to the Theory of Upwelling, Part II" by Koji Hidaka was distributed in August, 1953. This report together with Part I of the series was submitted to the American Geophysical Union for publication.

Technical Report No. 9, "Wind-driven Sea Level Change of a Shallow Sea Over a Continental Shelf" by Koji Hidaka was completed in September, 1953 and distributed in October 1953. This report represents a portion of a comprehensive work which the author is carrying out concerning the three-dimensional steady motion of water and the surface contours as generated by a steady wind.

Technical Report No. 10, "Submarine Topography of the Continental Slope of the Bay of Campeche" by Joe. S. Creager was distributed in November of 1953. This report constitutes the major portion of a thesis which the author used in fulfilling his master's degree requirements.

Technical Report No. 11, "Depth of the Motionless Layer in the Gulf of Mexico" by Richard M. Adams was distributed in January of 1954. Two methods for the determination of the depth of the motionless layer are compared and discussed using data collected by this activity.

Technical Report No. 12, "On the Circulation and Tidal Flushing of Mobile Bay, Alabama, Part I" by George B. Austin was distributed in April 1954. This report discusses the results of a hydrographic survey made of Mobile Bay. The report constitutes a portion of a master's thesis.

EQUIPMENT

The past year was the first year of ownership by the Texas A & M Research Foundation of the schooner, A. A. JAKKULA. Significant progress has been made in equipping the ship for oceanographic research. This has included the installation of many items of contract purchased and government furnished equipment which were available from the Navy through this project.

Utility items that were put into service during the past year were:

1. Electric range
2. Deep Freeze, General Electric, 11 cu. ft., 100 volts, A.C.
3. Converter for refrigerating and cooling units
4. Water cooler and bubbler, General Electric
5. Hot water heater, Electric Heater Co., 115 volts, D.C.
6. Refrigerator, Frigidaire

A major feature of the conversion activity was the installation of a 60 KW, 125 volt, DC Century generator coupled to a General Motors 671 Diesel engine. The set includes a heat exchange unit and a panel with junction boxes, circuit breakers and switches. The installation was made by Houston Armature Works of Houston, Texas. Small units installed by the same firm include two Allis-Chalmers 1 KW. motor generators.

The ship has been equipped with remote control for the main engine, a unit manufactured by Airesearch Manufacturing Company.

A major feature of the conversion of the A. A. JAKKULA was the installation made by The Sperry Gyroscope Company. Included in this was a Gyro Compass, Mark XIV, which was accompanied by the following auxiliary equipment: compass repeaters (Mark XV), mounts (2), pelorus stand, motor generator, control panel, and alarm unit assembly. This company also installed an automatic pilot and a power steering unit. A hydraulic power pack and pressure control valve made by Vickers Brake Company is a part of the automatic pilot and a 3 H.P., DC, motor and starter is included in the power steering unit. The ship has also been equipped with a marine magnetic controller made by General Electric Magnetic Controller of Schemmady, N. Y. for start-stop control of two 15 H.P., DC motors.

Three small deck winches for handling the sails were installed. These were 115 volt, DC, small vertical capstan type, single speed winches made by the Ideal Windlass Company. A 15 H.P., DC, General Electric motor has been put in place to operate the large winch which came from the Humble Oil Company. This winch is located on the port side amidships. Another winch motor, 15 H.P., DC, obtained from E. D. Brazos Engineering Co. has been installed. It is coupled to the hydraulically controlled hydrographic winch which is located amid-ships on the starboard side.

A 4.5 H.P., DC motor driven Fairbanks-Morse pump has been obtained from Electric Wire and Cable Co. of Houston for use as a bilge pump. This piece of equipment has proved inadequate to handle the job and will be exchanged for a larger unit.

Two ten horsepower Evinrude motorboat engines have been supplied by the Navy for use on small boats carried by the A. A. JAKKULA. The Navy has also furnished three six-man type pneumatic liferafts and one An-Crt 3 Radio Set for emergency use.

Radio equipment supplied by the Navy consists of a Radio Transmitting and Receiving Set, TCP-3, made by Radiomarine Equipment of America; Radio Receiving Equipment made by E. H. Scott Radio Laboratories, Inc.; and a Magnavox Speaker-Amplifier Unit.

Two items of equipment have been transferred from the M/V ALASKA. These are a recording anemometer, direct reading, and a measuring set, AN/UMQ-5. Both were made by The Bendix Aviation Corporation.

An item that has been on hand, a Brown pyrometer, is now on the ship.

Two important pieces of equipment for hydrographic work have been furnished by the Navy. One is a Sonar Sounding Set, AN/UCN-1B, manufactured by the Edo Corporation, which was obtained thru the Bureau of Ships. This Set has been in use for several months. The other item, a Geomagnetic Electrokinetograph, from the Leeds and Northrup Company, has been installed and will be used on a cruise during the summer. Electrodes and housing have been fabricated for the GEK and 2000 feet of 5/16" O.D. phosphorbronze ocean cable have been obtained for use with the instrument.

The two remaining items for shipboard use supplied thru this project are 1200 feet of stainless steel nylon covered BT cable, 3/32" O.D. and 8000 feet of 3/16" 3 x 19 PREformed galvanized hydrographic cable.

During the year several items of scientific equipment were obtained for use on various aspects of the project. These were:

1. Spilhaus Sea Sampler, D. Ballauf, 0-450 ft.
2. Two 0-450 ft. bathythermographs, Engineering Laboratories Inc., Garland, Texas.
3. Genware Current Meter, Kahl Scientific Instrument Corporation.
4. Foerst Improved Water Sampler with messenger, capacity 1200 c.c., Foerst Mechanical Specialties.
5. Thermometer Reader, Kahl Scientific Instrument Corporation.
6. Four gross pharmacy bottles and neoprene liners.
7. Two Unprotected Reversing Thermometers, Janick and Gross.

During the past year a tank, a temperature control device, and a reversing mechanism were assembled so that reversing thermometers could be calibrated. Parts purchased for this purpose were:

1. Motor and gears for reversing mechanism. Geo. J. Fix Company.

2. Cathetometer telescope, Arthur S. LaPine and Company.
3. Differential thermometer, Fisher Scientific Company.

A Mueller Resistance Thermometer Bridge has been purchased from the Rubicon Company which will be incorporated in the temperature control mechanism of the tank when other components are delivered.

The one piece of office equipment purchased during the past year was a shaving machine for the Edison Voicewriter Ediphone.

Twenty salinity sample boxes have been constructed by the project which will be used on future survey cruises.

FUTURE PLANS

A two week college sponsored cruise will be made in early July to study the distribution of several chemical constituents of sea water in the Mississippi Delta region. Chemical determination of salinity, dissolved oxygen, total and particulate organic phosphates, nitrates, nitrites, copper, iron and the chlorophyl pigments will be made; many of these aboard ship. Results of this cruise will be utilized in the data and technical reports which this activity produces.

A month long oceanographic cruise will be made during August in the Eastern Gulf of Mexico to study the Gulf Stream and large scale eddy currents which may exist there. An attempt will be made to: 1) define the position of the Yucatan Current and any large scale eddies encountered on this survey; 2) determine, if possible, the movements of eddies in time and space; 3) establish whether there could be cyclic generation and decay of the eddies as related to the Gulf Stream system. This cruise also will be college sponsored, but the results will be utilized by this group.

Two project sponsored cruises are tentatively planned for the coming year. Both will be deep water cruises of about two to three weeks duration each. One will be primarily a GEK and BF cruise current study, and the other will be a western Gulf of Mexico survey to eliminate the holiday areas which presently exist in the data.

Emphasis in the coming year is to be placed on processing all cruises' data which have been collected by this project to date and in completing as far as possible the analyses of these data.

TRAVEL

Mr. Adams, Mr. Austin and Mr. Howe journeyed to Bayou La Batre, Alabama in November to conduct a two week hydrographic survey of Mobile Bay.

Mr. Austin and Mr. Martin Burkhead drove to Bayou La Batre, Alabama in June to conduct a short hydrographic survey for the summer season.

TALKS

Mr. Austin presented a short talk to a regional meeting of the Texas Academy of Science which was held on this campus in April 1954. The subject which was presented was "The March Cruise of the A. A. JAKKULA".

PERSONNEL

Richard M. Adams, Associate in Oceanography, (through February 1954)
George B. Austin, Associate in Oceanography
Mrs. Sarah W. Austin, Secretary-computer, half-time
Mrs. Iris Bell, Laboratory Technician-computer
Wallace Birkes, Draftsman-computer, part time
James Bush, Assistant in Oceanography, part time (through June 1954)
Koji Hidaka, Oceanographer (through September, 1953)
Joseph Howe, Marine Technician
Dale F. Leipper, Project Supervisor (part time)
Frank Moon, Research Assistant, half time
Jean Peña de La, Marine Technician (through March 1954)
Rex Rainwater, Marine Technician (through April 1954)
Robert O. Reid, Oceanographer, part time
Mrs. Myrtis Shrodc, Laboratory Technician-computer
Kenneth Stanton, Research Assistant (through December 1953)

OCEANOGRAPHIC RESEARCH VESSEL A. A. JAKKULA

The past year saw many improvements made in the conversion of the A. A. JAKKULA (formerly ATLANTIC) from a pleasure yacht to a deep water oceanographic research vessel.

Many days and weeks were necessarily spent at the dock or in the shipyard effecting this conversion. It was possible in spite of the delays and handicaps to accomplish ninety-four work days at sea during the period of this report.

In the conversion period, six bunks were installed to increase the capacity of the scientific complement from six to twelve. Fans were added or installed in all living quarters. Five new sails were purchased. A new GM diesel main engine was installed. All government furnished and contract purchased equipment described above under EQUIPMENT was installed during this period.

In addition to the above equipment, a BT winch, two large and one small hydrographic winches have been installed along with three outboard work platforms. Topping lifts and hydrographic booms were also added, two to each mast aft.

Plans are in effect to design and install a new keel to replace the light inadequate center-board and centerboard trunk. Future plans also call for installation of another diesel generator set, increased fore to aft forced ventilation, an RDF, a chart room and possibly a radar set. Of equal importance to the future operation of this vessel is increased fuel and water capacity. At the present time fourteen days is the maximum comfortable operating time which can be spent at sea between port calls.

TUG ALBEMARLE

On 28 August 1953 the tug ALBEMARLE was transferred from its berth in the Kane Shipyard in Galveston, Texas to the U. S. Naval Station at New Orleans, Louisiana. The removal of the ALBEMARLE from the responsibility of this project makes possible the use of the remainder of the original allocation of funds for the ALBEMARLE for the installation of equipment on the A. A. JAKULA.

BASE MAP
TEXAS A & M RESEARCH FOUNDATION
DIVISION OF OCEANOGRAPHY

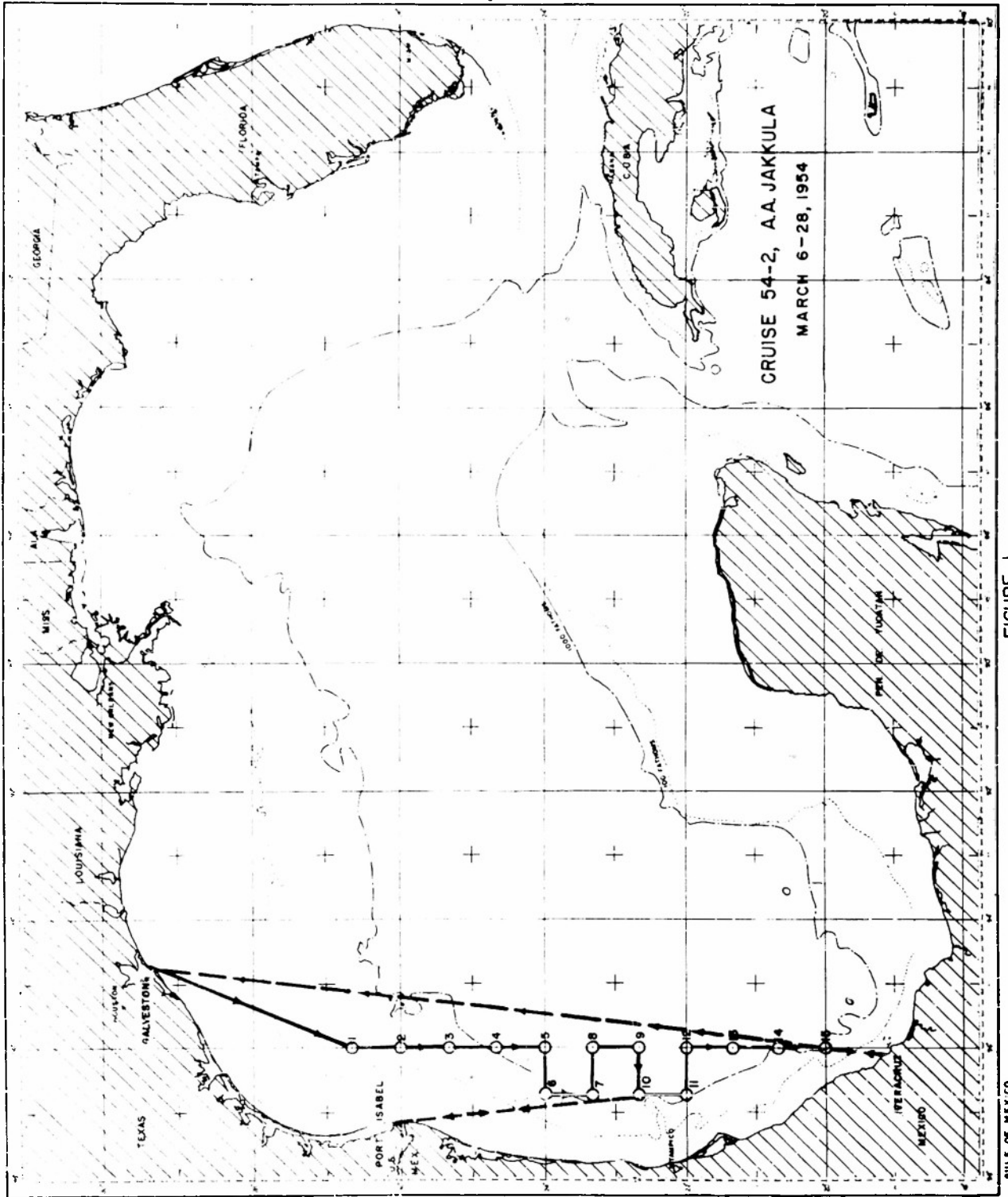


FIGURE 1

GULF OF MEXICO
FROM USCGS TOOT

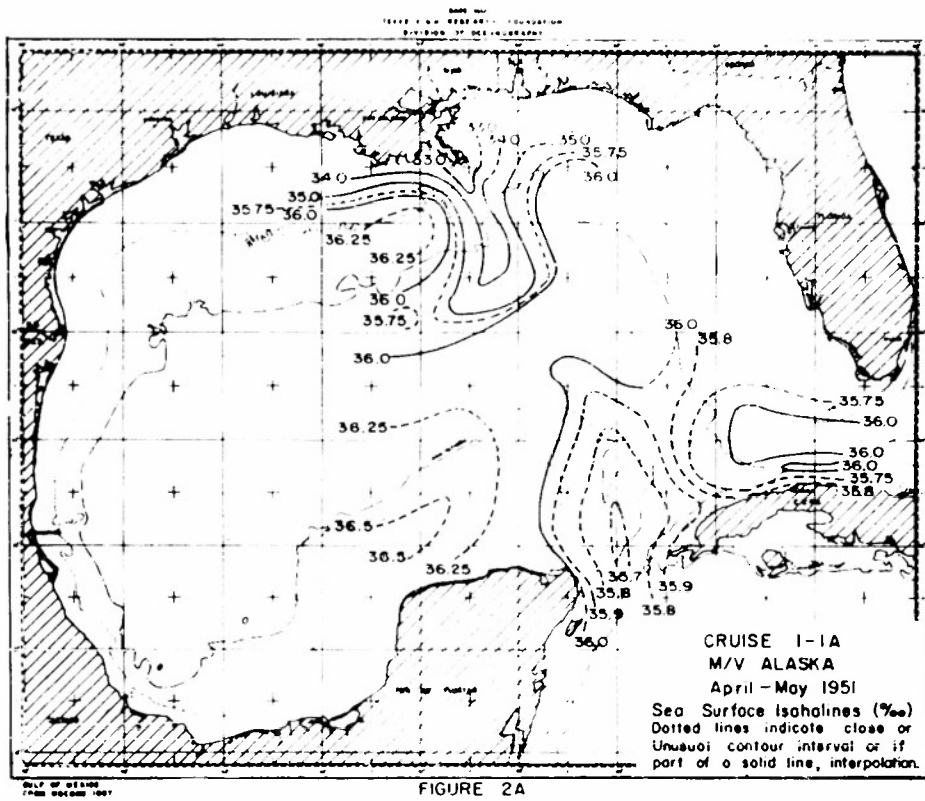


FIGURE 2A

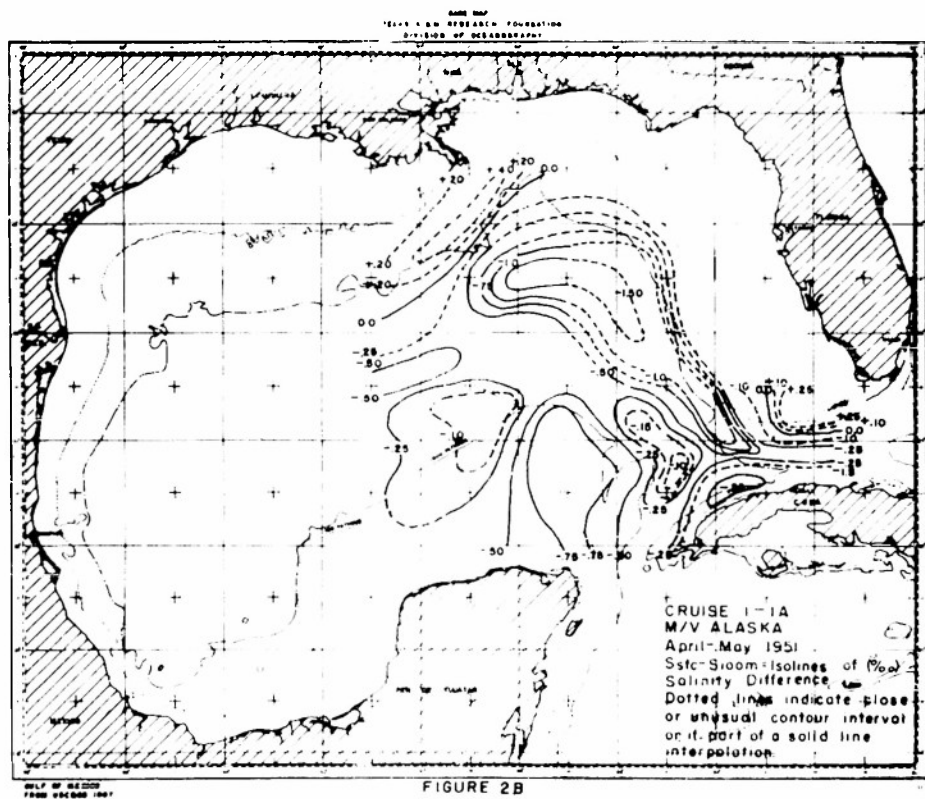


FIGURE 2B

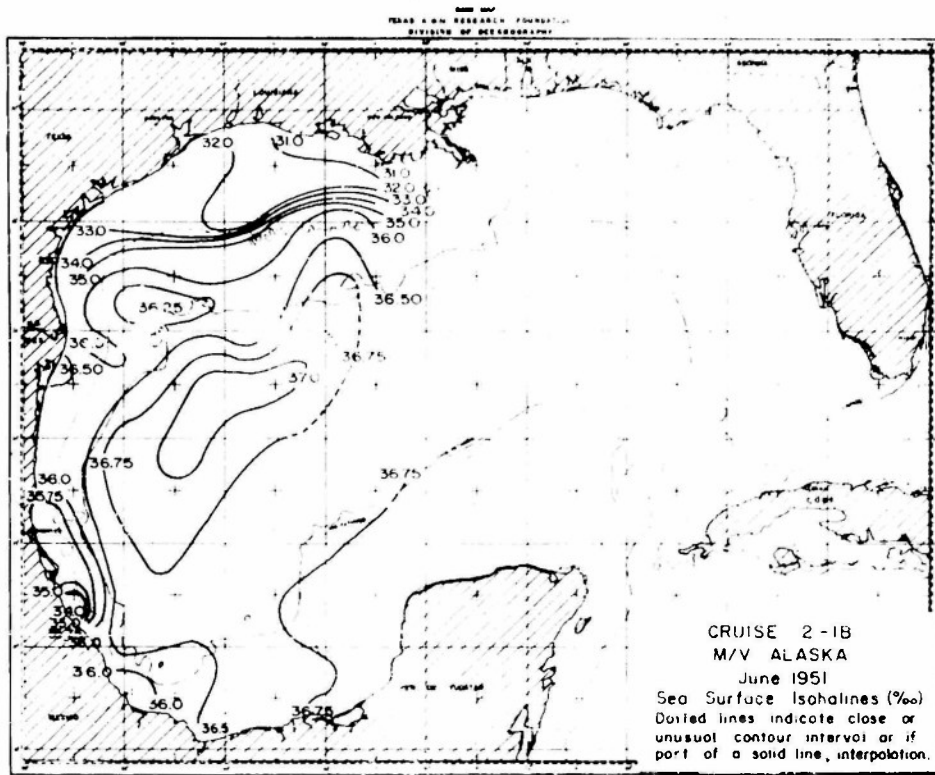


FIGURE 3A

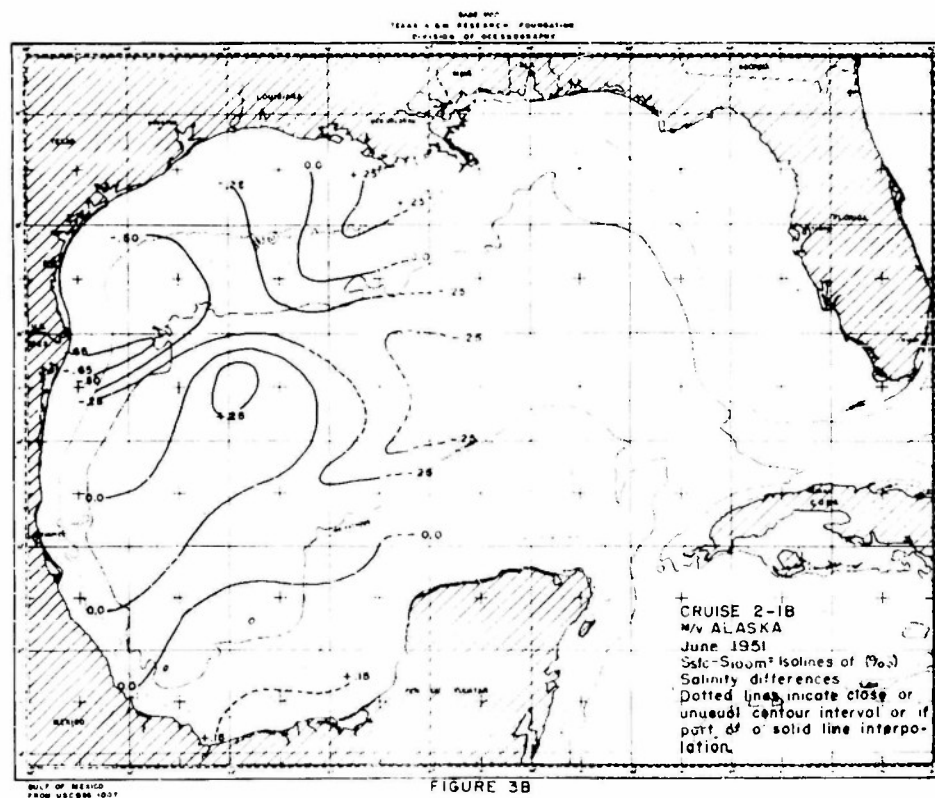


FIGURE 3B

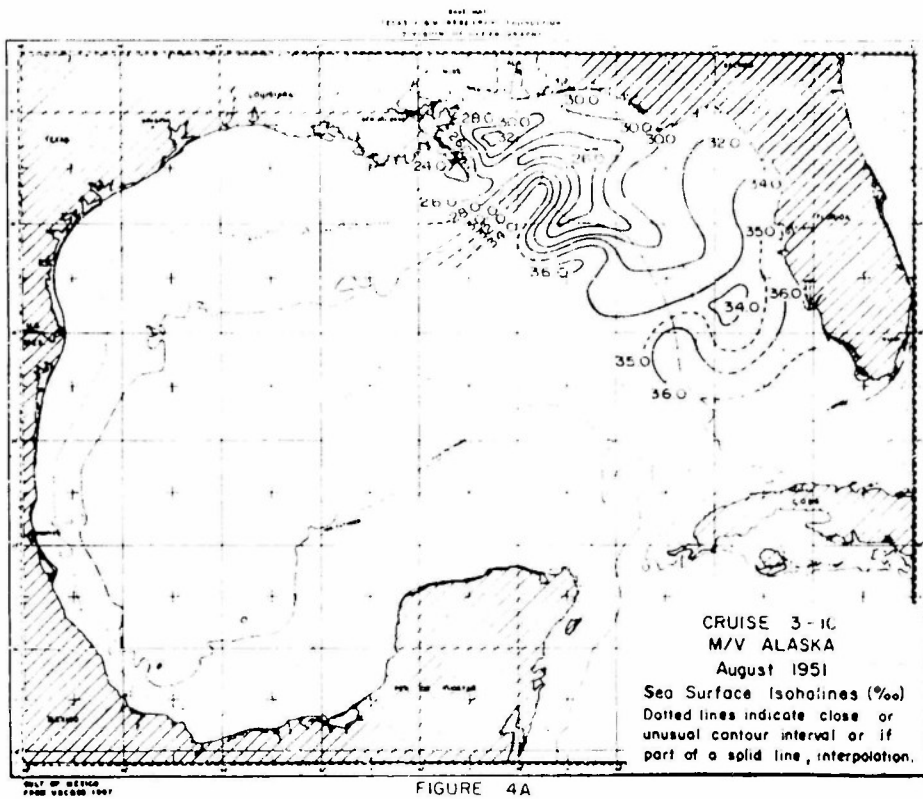


FIGURE 4A

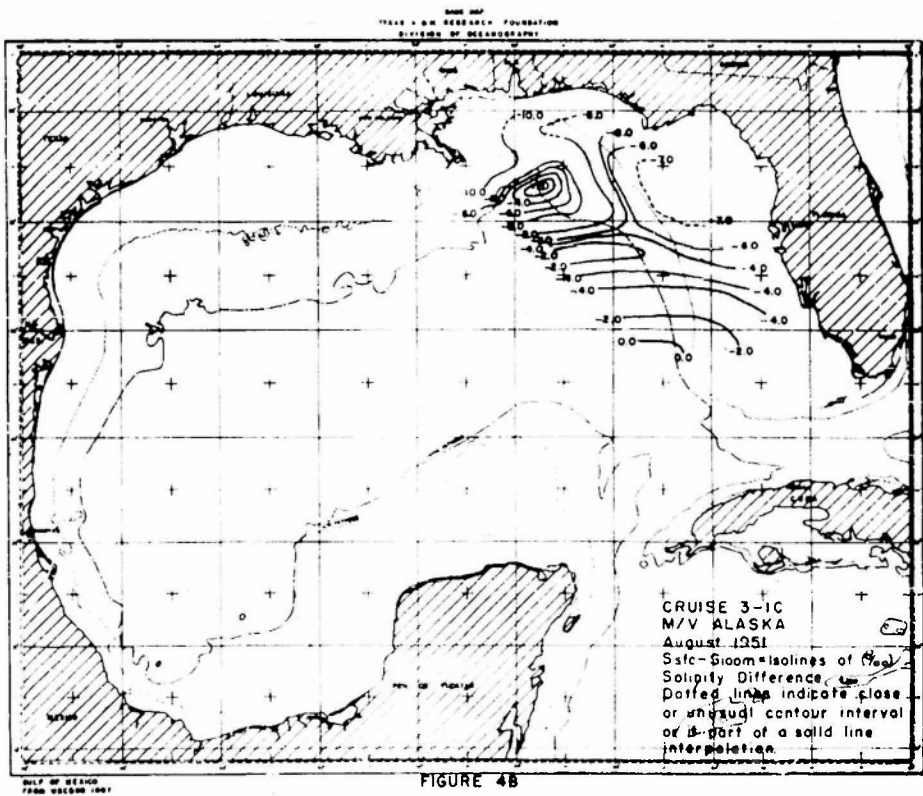


FIGURE 4B

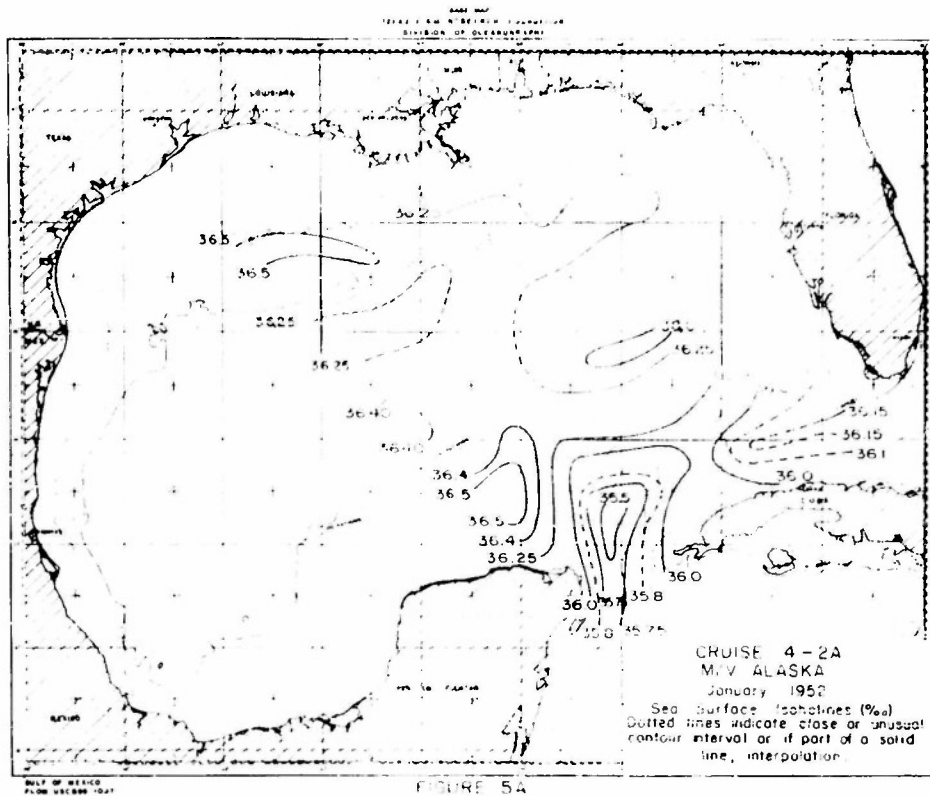


FIGURE 5A

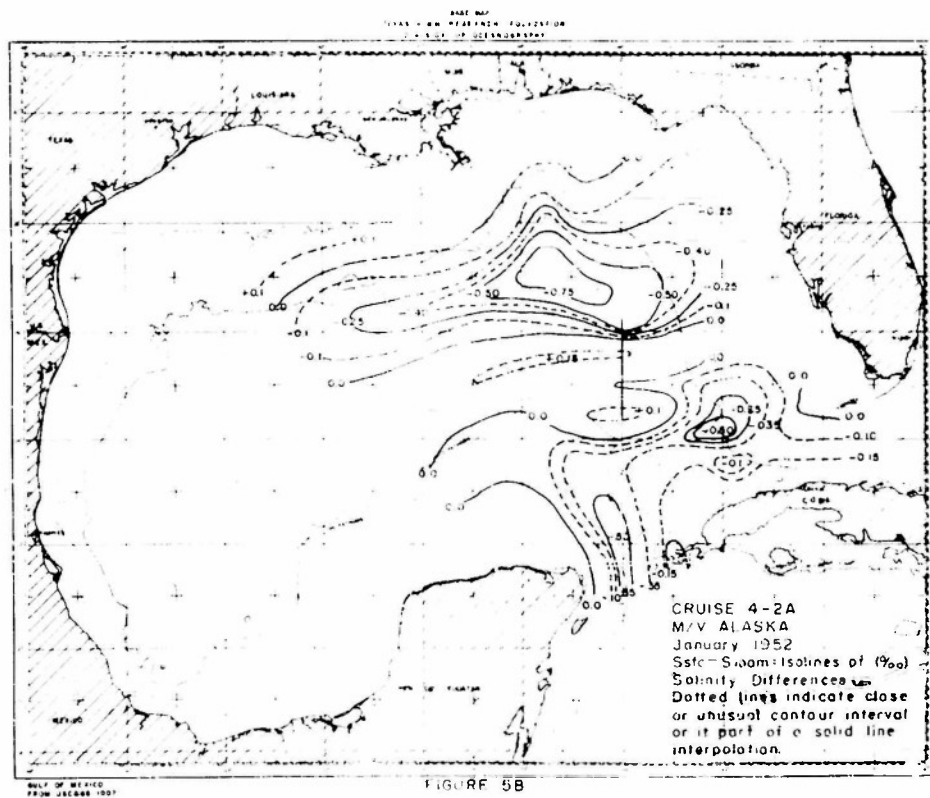


FIGURE 5B

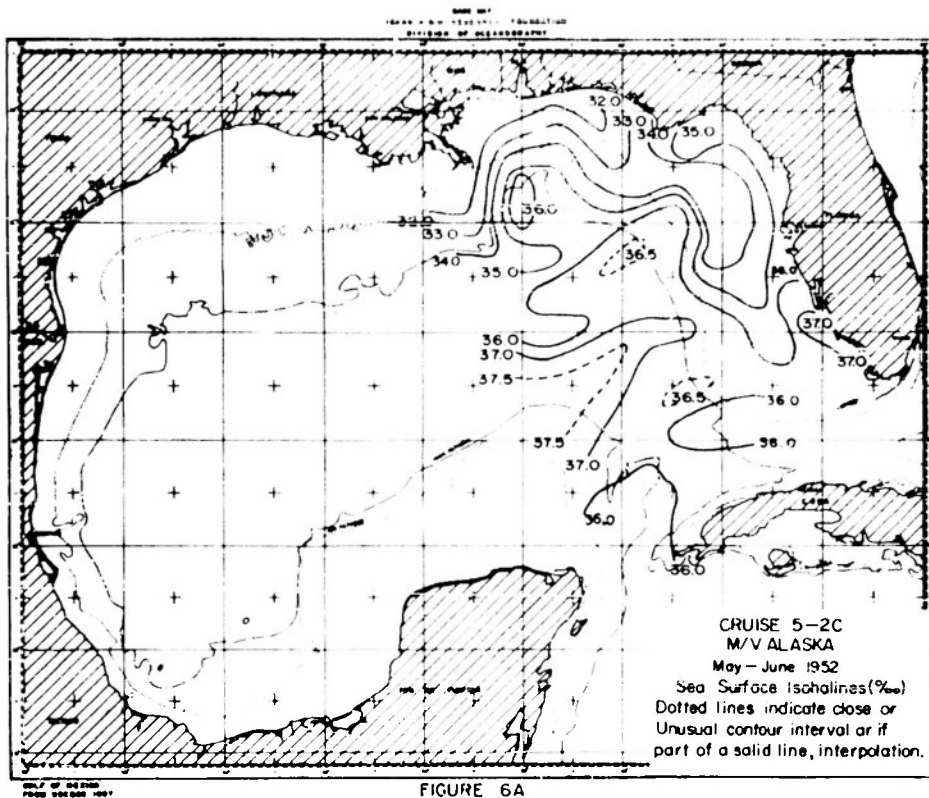


FIGURE 6A

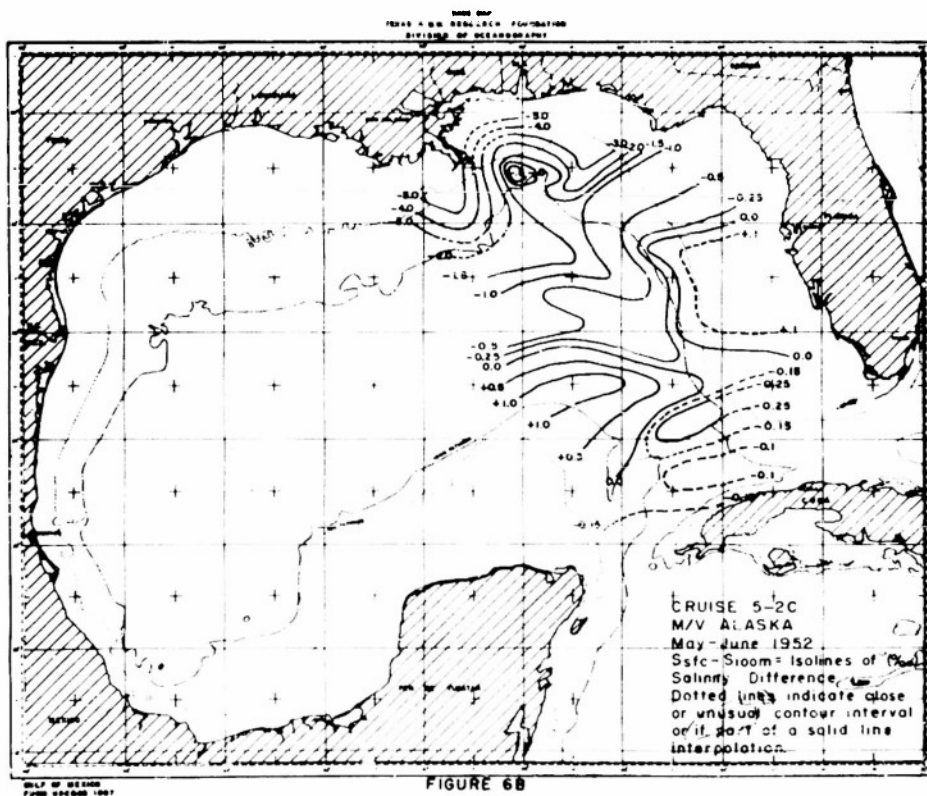
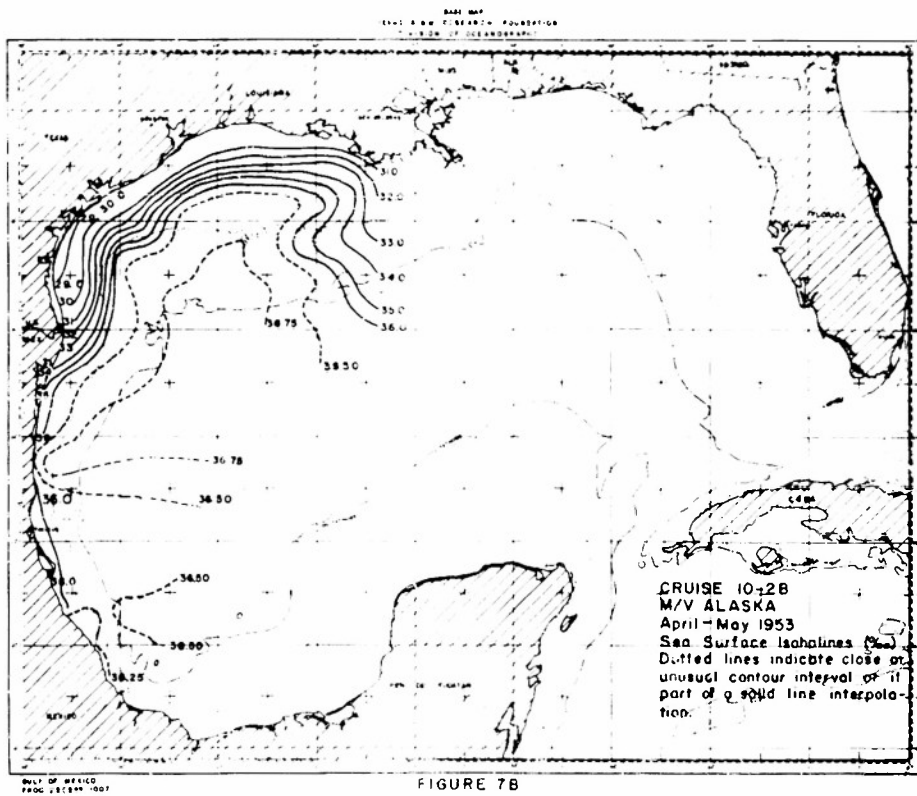
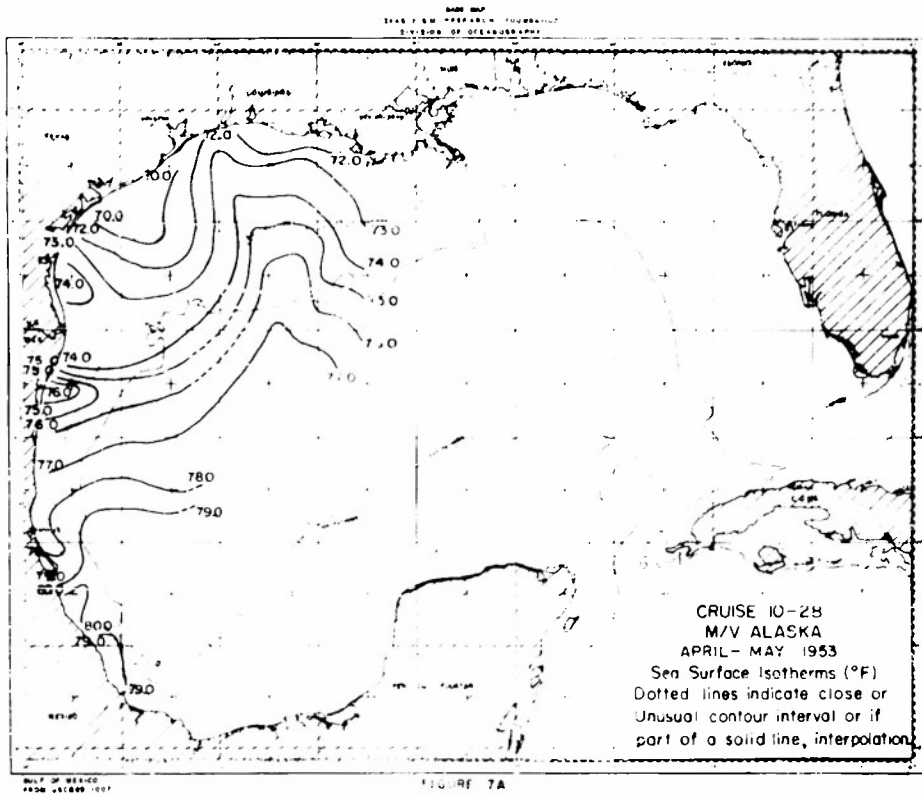


FIGURE 6B



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