H. B. Stewart, Jr.

Trip Diary Cuba 1972

(AOML Photo)

US Department of Commerce

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Oceanic and Atmospheric Research
Atlantic Oceanographic and
Meteorological Laboratory Miami, FL

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Trip Diary Cuba 1972

Linda Pikula and Ashley Jefferson (Editors)

ABSTRACT

This diary, written by Dr. Harris B. Stewart, first Director of the Atlantic Oceanographic and Meteorological Laboratory, Miami, Florida documents the travel experiences of the delegates to the Fifth Meeting of the International Coordination Group for the Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR). The science report of this Conference has also been scanned and attached as an Appendix to this Diary. The arrival of the group was delayed for three days when Hurricane Agnes prevented the Cubana de Aviacion plane from arriving in Mexico City to transport them to Cuba. By Resolution V-11 of the Fifth Session IOC adopted CICAR as an IOC program for international cooperation and established the IOC to coordinate the multi-nation investigation of the oceanographic characteristics of the Caribbean Sea and the adjacent regions. UNESCO had previously entered into an agreement with Cuba by which the host country had to agree to grant entry to accredited delegations from all eligible IOC nations. Since the U.S. had sent delegates to all previous IOC CICAR meetings, there was no reason not to do so for this one. Although this was the first official U.S. Delegation to visit Cuba in the 11 years that Prime Minister Fidel Castro had been in power. The State Department at that time reiterated that this in no way reflected a change in official U.S. policy towards the government of Cuba.

INTRODUCTION

When Dr. Harris Stewart left with the U.S. Delegation to Cuba on June 15, 1972, he also carried with him 90 pounds of paperwork on CICAR (The Cooperative Investigation of the Caribbean and Adjacent Regions).

In subsequent years the CICAR Working Group noted with pleasure that in many countries the very existence of CICAR has apparently resulted in much closer national coordination and cooperation among marine science activities as well as establishing close international associations that would allow continuing cooperation in the years ahead.

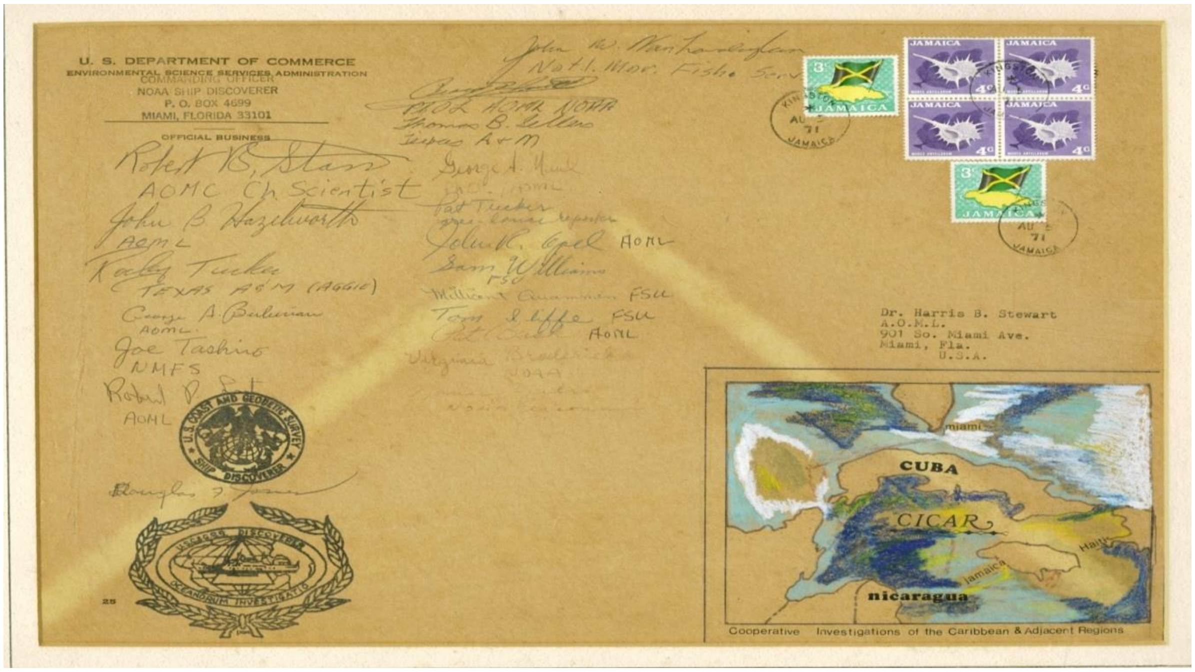
Dr. Harris Stewart ends his Cuba Diary in this way.

"It has been an interesting trip, but I think I will wait until Cuba is a happier city before I try it again" Perhaps now it is time to return?

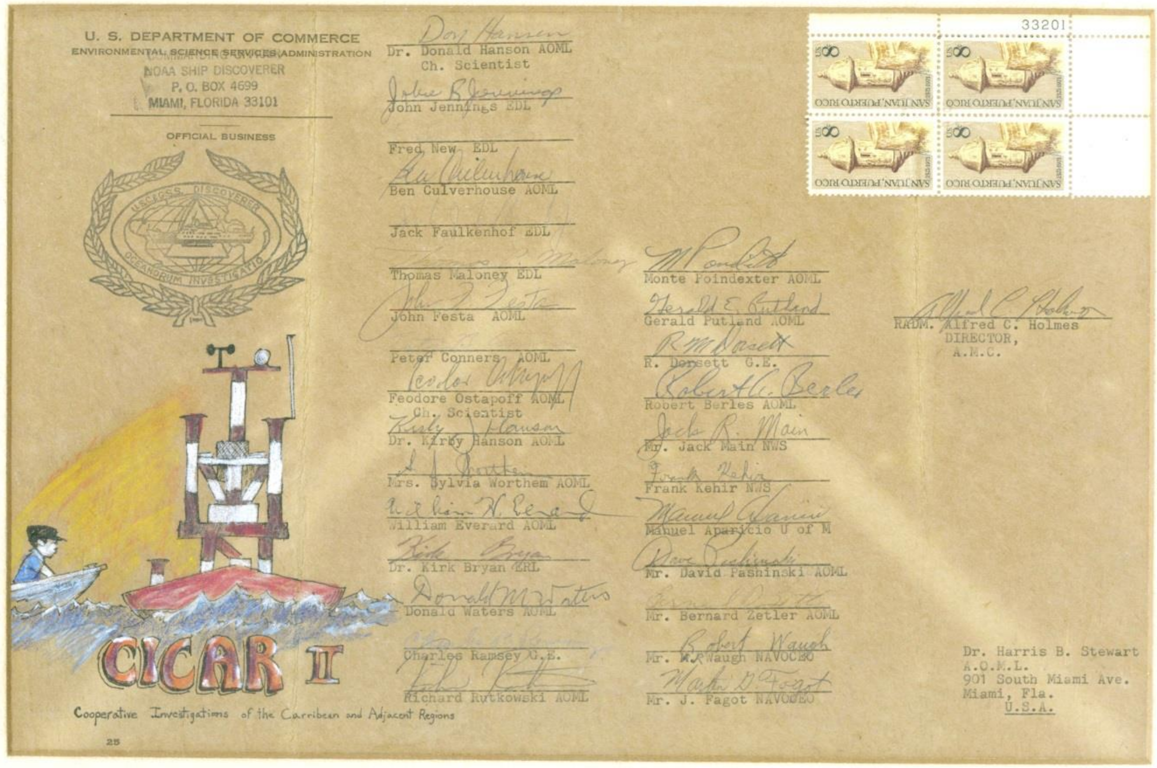
DIARY AND TRANSCRIPTION

The Stewart family donated the papers of Dr. Stewart to NOAA's Atlantic Oceanographic and Meteorological Laboratory upon his passing on April 25, 2000. Among the Stewart materials were 13 field diaries written over several decades, most during the time of great ocean exploration. The diaries are being transcribed and published as a series.

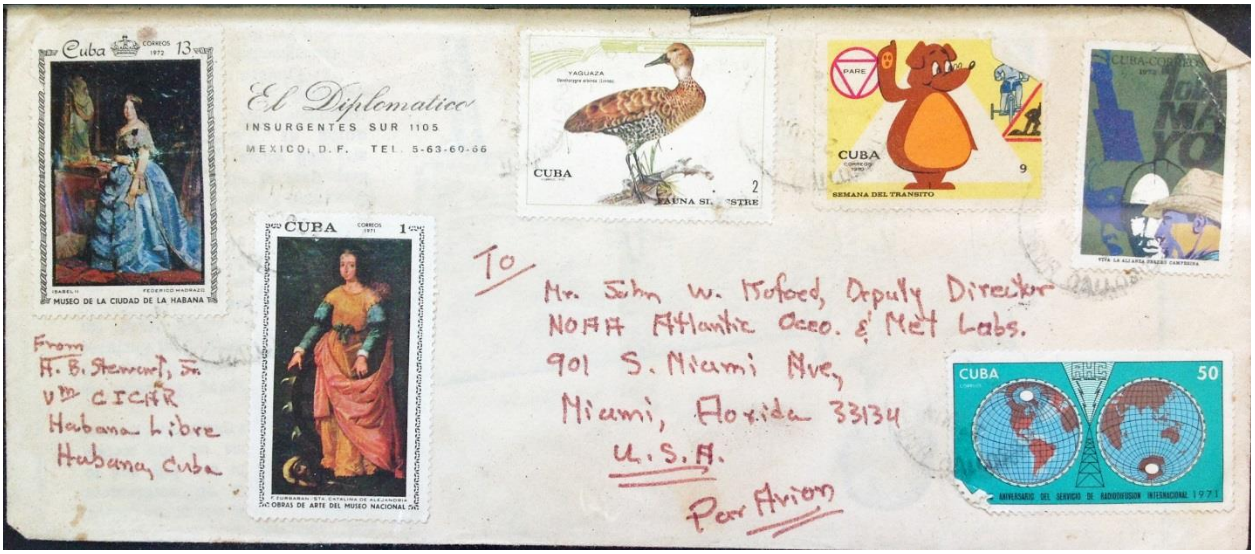
PHOTOGRAPHS



Stamped Envelope--from top to bottom/left to right: Robert B. Stan (AOML Ch. Scientist), John B. Hazelworth (AOML), Rocky Tucker (Texas A&M), George Berberian (AOML), Joe Tashiro (NMFS), Robert P. List (AOML), Douglas A. Jones, John M. VanLandingham (NMFS), Craig?? (PhOD AOML NOAA), Thomas B. Sellers (Texas A&M), George A. Maul (AOML), Pat Tucker (free-lance reporter), John R. Apel (AOML), Sam Williams (FSU), Millicent Quammen (FSU), Tom Schiffe (FSU), Pat Bush (AOML), Virginia Broderick (NOAA), Nancy Yates (NOAA).



Stamped envelope--from top to bottom/left to right: Dr. Donald Hanson (AOML Ch. Scientist), John Jennings (EDL), Fred New (EDL), Ben Culverhouse (AOML), Jack Faulkenhof (EDL), Thomas Maloney (EDL), John Festa (AOML), Peter Conners (AOML), Feodore Ostapoff (AOML Ch. Scientist), Dr. Kirby Hanson (AOML), Mrs. Sylvia Worthem (AOML), William Everard (AOML), Dr. Kirk Bryan (ERL), Donald Waters (AOML), Charles Ramsey (G.E), Richard Rutkowski (AOML), Monte Poindexter (AOML), Gerald Putland (AOML), R. Dorsett (G.E), Robert Berles (AOML), Mr. Jack Main (NWS), Frank Kehir (NWS), Manuel Aparicio (U of M), Mr. David Pashinski (AOML), Mr. Bernard Zetler (AOML), Mr. Robert Waugh (NAVOCEO), Mr. J. Fagot (NAVOCEO), RADM Alfred C. Holmes (Director, AMC).



Stamped envelope sent by Harris B. Stewart (CICAR, Habana Libre Hotel, Havana) to Jack Kofoed (NOAA/AOML, 901 S. Miami Ave., Miami). AOML was located at the South Miami Avenue prior to the construction of the building in Virginia Key. Stewart attended a CICAR (Cooperative Investigations of the Caribbean and Adjecent Regions) meeting in Habana in 1971. He stayed at the Habana Libre Hotel that was the Havana Hilton before it was intervened by the Castro Regime.

The envelope was from the El Diplomatico Hotel, Insurgentes Sur 1105, Mexico City, Mexico. The Cuban stamps from left to right are: Museo de la Ciudad de La Habana. Isabel II by Federico Madrazo, 13 cents, May 25, 1972; Obras de Arte del Museo Nacional, Sta. Catalina de Alejandria by F. Zurbaran, 1 cent, 1971; Fauna Silvestre, Yaguaza (Dendrocygna arborea; West Indian whistling duck), 2 cents, 1970; Semana del Transito, Prudence the Bear on duty, "Pare" (Stop), 9 cents, 1970; 1o de Mayo (First of May). Viva la Alianza Obrero Campesina, 1972; and Aniversatio del Servicio de Radiodifusion Internacional, 50 cents, 1971. (There are no standard stamp catalogs for Cuban postage stamps issued after the early 1960s.)

The U.S. Government delegation to the 1972 IOCARIBE inter-governmental meeting shown on their arrival at Jose Marti Airport at Havana, Cuba. (L to R) John Bruchs, Harris Stewart, Robert Molinari, Bernard Zetler, and John Antoine. *(AOML Photo)*

Photograph--from left to right: Dr. Harris B. Stewart, Dr. Robert Molinari, Mr. John Brucks, Dr. John Antoine at Habana Libre Hotel

McGillivray ADM Lungeraar HBS Mona

This picture turned up in Colombia – it was taken the year before at the Institute of Oceanography in Havana

Cuba Trip 15-16 June ‘72

for the

Vth International Coordination Group for CICAR

All crossed out U.S.A's at Vth CICAR

H.B.S. [Harris B. Stewart Jr.]Delegate

Dr. Robert Molinari (AOML) Alternate Delegate

Dr. John Antoine (TAMU) [Texas A & M]

Mr. John Brucks (NMFS)

Mr. Feodor Ostapoff (AOML) (Met. Coord)

Mr. Bernard Zetler (AOML) (S.L. for Tides)

Mr. Rene Cuzon du Rest (NODC) (Data Coord)

Dr. Robert Lankford (UNESCO)

Boure (FMO)

1.

Thursday 15, June, 1972

Destination Cuba! It sounds strange, but that is where we are headed. Now at something over 30,000ft over the Gulf of Mexico headed toward Merida on the Yucatan Peninsula en route to Mexico flight. But in our pockets are passports with special stamps to allow us to enter and leave Cuba. The Pan Am ticket girl back at Miami raised her eyebrows as she saw that our tickets to Mexico City went on to Havana. She looked at each of us in turn- me, BZ, Feo, Molinari, Rene and John Brucks- shrugged her shoulders as through to say “The world is full of crazy people” and added aloud, “I am glad to see you have return tickets.”

Pan Am Flight 552 was posted for a 6:15 AM departure, but it was after

2.

seven when we lifted off to climb steeply over Biscayne Bay. The plan banked sharply to the right through a layer of small clouds, and we settled back for the four hour flight.

Right behind us were Gines and Mendes from Venezuela, and their Delegation Head, Carlos Atilano, and his wife were up in first class. At the airport we had run into Rossignole from France, and he was aboard too, so we knew at least three countries would be represented in Havana.

A quick stop at Merida, and then

3.

Mexico City. John Antoine from Texas A & M met the plane along with a grad student of Bob Lankford's at UNAM called Eric Jordan (or HoarDAN as he called him) to the Public Affairs man at the airport helped speed us all through customs, Health and Immigration, our bags- loaded with some 90 pounds of reports – were piled into the University truck and we bucked thro busy evening traffic into the city and the Hotel el Diplomatico on Insurgentes Sur.

Bob Lankford, now with UNESCO in Mexico, met us there, as did Oleg Mamayer, the Soviet with IOC in Paris. We had a nightcap in the hotel and admired the busty singer belting out loud songs in Spanish, and were off to bed. It should be an interesting day tomorrow as we head for Havana.

4.

Friday, 16 June, 1972 Mexico City, D.F.

By 8:30 we were all breakfasted, checked out of our rooms, and our bags were neatly stacked near the hotel entrance ready for the trip to the airport and our 1130 flight to Havana- “But, Senior it is necessario that you arrive two hours before the departure”.

Then it started to happen! Oleg Mamayev reported that he had just had a call from Michel Angot that the flight to Havana on CU-465 had been “cancelled”. A few calls later we discovered that rather than cancelled, it was merely postponed, and it would leave tomorrow at the same time.   All bags went back up to the rooms – 108, 408, and 608 and Bob Lankford and Hoar DAN ran us all out of the city to the north, and we had a good day at the Pyramids of Teotihuacan, and the Temple of Quetzaleoah.

5.

I held a U.S. Delegation meeting in 608 about 6 PM and clued in the others on our instructions, position papers and the various do's and don'ts I had gotten from Joe Norberg and Ron Goddard at the Cuban Desk of State during my pre-Cuba briefing in Washington last Monday.

We all ate together at a fine Mexican restaurant on Insurgentes and took in the 3 hour show at La Terrace. All of us felt that the night life in Havana would probably be uninteresting to non-existent, so Thurs was our last fling.

Saturday 17, June, 1972

The wake-up call at 0700 seemed awfully early, somehow, but we were all packed and down for huevos rancheros and black coffee by 7:45. This time we left our bags in the room. Getting those 90 pounds of reports up and down between the lobby and the 6th floor – 3 trips so far- was

6.

bankrupting us in tips, so we left them up there until we knew for sure that CU-465 would leave this morning as advertised.

Rene- who speaks the best Spanish of us all – call the Cuban Airline at 0800, and the jinx is still on! The flight will not leave today at 11:15. It is expected to leave about 7 P.M. tonight, and we must be at the airport by 5:00, but we should check about 3:00 PM to see. We are all psyched up to go, and I could see the disappointment on the faces of the others. We are ready, and these repeated delays and uncertainties are frustrating.

There has been no explanation offered for the delays. Speculations include bad weather – and that is indeed possible, for there was a depression over the Yucatan Peninsula and the radio reported that Western Cuba got 12 inches of rain in

7.

24 hours. Others speculated that the Cuban Government just did not want a batch of curious foreign scientists wandering around Havana for two days waiting for some meetings to start. The 7:00 PM departure now projected would put us into Havana well after dark tonight and this strengthened the idea that Cuba was deliberate in allowing us the least possible chance to see and to photograph. Only time will tell – if even that.

About 1 PM after a long long walk, some tacos, a chile rellianos and a beer, I got back to the Diplomatico to find a note on a call that had come in to me last evening from a Mr. Geureia at Habana de Aviation with the same dope we got via Rene this morning but saying to call about 1:30 "if you have any doubts". I did and not only does it not go at 7: PM, it doesn't even go on

8.

Sunday – tomorrow. It is – he said- now scheduled for 1:45 PM on Monday! When I asked him, why? I was told "there is a hurricane at Havana". We are all getting a bit fed up with this one. If I am to have a few days off, Mexico City would not be my number one choice.

Mamayev is quite annoyed – too. He is calling the local U.N. office and I will call our Embassy here to be sure that the word gets back up to Washington on this one. All of us – but Rene & B.Z. who sacked out early – went to Room 108 where we worked away on some of the duty-free we brought with us – a good party. In the midst of it, I had a call from Tom Van Hof from Curacao. He and Langreraar, Postma & MacGillory from the Netherlands are all at the Holiday Inn out near the airport and they are a (along with Itenny from Trinidad)

9.

bit annoyed too. We now have the U.S., UNESCO, Venezuela, WMO, France, Netherlands, Mexico, and Trinidad and Tobago all here in Mexico City, so I suggested the Cubans come up here & we hold it here.

Senor Feo leaves for Rio the first of July – Saturday of the week we hope to leave Cuba – he felt that the departure might be as delayed as the arrival and he would be in trouble, so he heads back to Miami via New Orleans on Sunday.

Tomorrow I hope to sleep in and meet Langeraar et al. at the archeological museum in the late morning.

10.

Sunday, June 18th

At 8:45 Tom Van't Hof woke me with a telephone call – we will meet Langeraar et al. plus Scott from the unit who is now here also, at the National Anthropological Museum at 1300. Ayala, Mexican CICAR Coordinator called shortly thereafter, & he will meet with us at 1300.

Feo is off at 1 PM today for Miami via New Orleans, and I had a session with him so that I could double as the WMO representative in case we do get to Havanna. Ayala told me that there is a hurricane at Havana and this provides a good rationale for the repeated delays in the departure. Since Leelee will be worried, thinking I am in Havana, Feo will call her in Massachusetts tonight when he gets to Miami.

We had a good meeting at

11.

the National Museum of Antrhopology some 20 of us, then the tour through that magnificent museum, and I walked the six or so miles back to the El Diplomatico. En route I stopped at our Embassy and sent an airgram to State to alert them as to what had transpired and to set up Henry Postma of the Netherlands for a Visa to the U.S.

Since Feo has left, BZ has moved in with Rene and me, and he is sleeping peacefully. I finally managed to buy some stamps at the Sheraton Hotel on my long walk, so my letters to Leelee, Kofoed, and Itelles can go off in the morning.

12.

Monday, 19 June, 1972

Habana de Aviacion said this morning that they would fly today! I'll believe it when airborne and not before. So we are all packed up again and will leave the hotel about 10:30. I checked to try and get us all on the Havana Mexico flight on Friday the 23rd, as Langeraar & Mamayen have to leave Friday & I suspect the meetings will end Thursday. But the girl said it was full- no space, and no stand by list. So, it looks as though we will have to hole up in Cuba over next weekend. Perhaps we can get in some sightseeing.

We piled our bags into three taxis, & Mamayev, Lankford, and six of us from the USA roared off to the airport. Somehow the bar seemed to be where people were collecting. New additions to the group were Ingmar Emilsson – the Icelander now with

13.

UNESCO – and Luis Capurro-ditto but from Argentina, then Phil Kearey, geophysicist on HMS Heela who worked with the Discoverer: Capt Juan Pablo Rarran, Ortiz Borda, Haime Hernandez, and Constantino Topias all from Columbia, Michele Angot & Denise Myala, Caranza Frazier (and Ama Manza, who came to see him off and sent her love to Leelee), Itenny from Trinidad & Tobago, CDR Des Scott from the unit, 17 es Gillirry & Postma from the Netherlands, Rossingnoule from France, Mamayev & Lankford from UNESCO, and a gaggle of translators from Mexico, Colombia, & Venezuela.

More sitting, more waiting, and finally we were in a long line at the end of which was a party official in powder blue uniform under a sign that read Cubana si. The chances began to look better. Passports were checked and a boarding card was issued- mine was 10C, but it looked like IOC.

14.

Then there was a long wait in the departure lounge, and a nine year old boy did a good polish job on my shoes for two pesos ($0.24). It was by then after 4PM-for our 1:45 flight! Finally the call came over the speaker system, & we lined up, showed our passes, and walked out into the bright sunshine toward one of the 4-engine turboprop Bristol Brittania with “Cubana” in big letters on the side. At 4:36 we started to taxi for take-off. The girl came on in Spanish – then in English to say “Welcome aboard Cubana flight 465, destination Habana” plus the usual seat-belt and smoking admonitions, a slow bumpy taxi, and at 4:45 we were airborne for the 3 ¾ hr flight to Havana.

Even before the no smoking sign went off, the cabin steward passed out copies of today’s edition

15.

Of Granma billed as “Organo Oficial del Comite Central del Partido Comunista de Cuba.” It had photos of the storm tide from Hurricane Agnes and a map which showed her to be well north of Dry Tortugas, so I suspect Miami will miss this one.

There is a leak in the double window in my row, and a great fountain of bubbles grows steadily as air bubbles through the water collected between the two windows.

Dinner included a cup of warm very good consumme, but all the rest was stone cold – baked chicken, rice and mixed green beans, peas, & carrots. There were three slices of tomatoes, a good sponge cake of some sort with chocolate frosting, and a plastic cup of beer- refilled once. Interestingly enough, no coffee and no drinks. Later the chubby stewardess brought a small paper

16.

Cup with about 2 inches of black sweet Cuban coffee- on the cool side of warm, then came a tray with cigarettes in a five-per-pack configuration called “Habana-68,” and cigars. I picked “Habana-68.” They are non-filters, strong, and they do not stay lit but need a full supply of matches to keep them going.

At just 10 PM (EDT) the plane touched down at Jose Marti airport at Habana, and we had in fact arrived. The 30 or so CICAR people aboard were taken separately, by passing all the normal formalities with passports & public health, and led into a paneled room with big cocktail tables & chairs where Dr. Santander and the other Cubans waited for us. A Mr. Haeni from the Swiss Embassy introduced himself to me and offered to help in any way possible. We then met a most attractive black

17.

Cuban girl who has been assigned to the U.S. delegation. She is Miss Orlaida (Or-LIE-Da but has Leeda as a nickname), and of course she immediately became known as our fearless Leeda. She is just lovely, and the younger members plan already to take her dancing one night. Met Maria Diaz the Cuban UNESCO rep. here, and she said all the arrangements were made with the help of ICAP- for (approximately) Instituto Cubano por Amisdad por los Pueblos or Cuban Friendship Institute.

Miss Orlaida gave us each an ICAP from to fill out- name, country, address, and short bio statement asking for organization, title, degrees, etc. She then collected these – together with our passports, shot records, declaration and tickets, baggage checks, and landing card and we haven't seen them since. They did check them, because Cuzan du Rest was called out and had to get a

18.

Smallpox shot & one other. By then a man with a big tray was passing out ice cold daiquiris to all, and the level of noisy conversations rose a few decibels. Delegations were called out one or two at a time to collect their baggage. The customs man had me open each one, but his search was perfunctory. He was pleasant and helpful & stamped my tag with a smile.

A porter loaded all our bags under Leeda's directions, and we followed her and a Mr. Severano outside where three nearly-new Fiat 18 passenger buses waited for us. By then it was about 11:15 PM.

The ride into downtown Habana took about 25 minutes. There seemed to be much less light than one would expect of a big city and relatively few cars. We pulled up in the circular drive.

19.

Before the Hotel Habana Libre (the former Havana Hilton) and were ushered into the big bare lobby to sign in. There was relatively little confusion, rooms had been assigned, and our identification cards were all ready. Leeda came along and saw us all ensconced on the 19th floor overlooking the harbor – lovely at night.

The room is big. Twin beds, desk, chairs – no rug- and the bathroom is also large with a tub, shower, toilet, bidet, and a gray marble sink-shelf arrangement. On the desk were boxed gifts from ICAP, each with a big ICAMP printed on it: a bar of soap, a packet of 5 Cuban cigars, a box with four packs of B & S Visant Cigarettes, and a box with a tissue-wrapped bottle of Havana Club “Genuino Ron Cubano”. Then we were whisked back down in the fast elevator to the 2nd floor where

20.

three young ladies in red, green, and white striped dresses had our packets of papers – each in a black briefcase with V Reunion CICAR, Cuba'72 printed in white and a metal identification badge.

The next room was set up for food, so we all sat and had "fresca" or beer and good fresh pineapple and hard rolls & butter. Verera came by and said hello, and I introduced him to the others. By then it was after 1 AM, so we broke up & went up to bed.

Each of us has a single room with a balcony – really most attractive and I am glad to say with functioning air conditioning. I left a call for 0700 and unpacked for the first time in 4 days! The Havana Telephone book in room 1902 is the 1967 version, subtitled "1967, Ano del Viet-Nam Heroico."

21.

Tuesday. 20 June 1972

Last night's impressions have been a bit modified in the cold light of Cuban dawn. There is no hot water in the Habana Libre Hotel, and about a third of the CICAR delegates are sporting razor cuts today.

Breakfast (room & 3 meals $18 U.S.) was fried eggs with some sort of strong sausage – split and baked, hard rolls & butter. We have a special CICAR dining room, and all our meals are to be taken there. The first session was called for 0900, but it was 1005 AM before the Cuban Vice-Minister for Education arrived. He is Julio Le Revirandt, and he said all the proper things about science, the sea and the general improvement of man's lot on earth, and left. The meetings are being held in a salon on the mezzanine. There are brass name plates at each

22.

delegation location, and we are down front as Estudos Unidas. The headphones for simultaneous translation are self-contained sets made by Denon in Japan and work well. We will meet each day from 0900 to 1300, break for two hours, then 1500 to 1830.

At noon I wanted to go to the Swiss Embassy to checkin and planned to walk the 6 or 8 blocks, but Leeda insisted that she provide a car for me, and she ushered me to a 1958 Plymouth complete with driver. This was my first up-close daylight view of Havana, and it was indeed most depressing. One can only imagine what a lovely city it once was, but now it is shabby and very rundown. The grass grows long in the small plots along the streets. Every building needs paint. Broken windows stay broken, fences are

23.

down, torn awnings stay torn, and there are long queues outside the bread store. There are some foreign cars – relatively new, but such private cars as are in evidence are mainly U.S. made and all 1958 or 9 or earlier. They are all in bad shape – dented, rusted, and all clank loudly. Mostly they seem to be Chevys and Plymouths. Either they were the main ones that were imported or – more probably, they have a better survival factor. All, however, were in bad shape.

At the Milan Theatre, the movie playing was "La Fiesta de San Iorgen", and below the title were the words "Film Sovietico."

The former U.S. Embassy building on Calzada and the Malecon – right on the waterfront, is badly in need of repair. The grass is cut, but pieces of the outside have flaked off,

24.

Tiles are missing from the floor, and paint is needed everywhere. I gave my card to the man at the desk and asked for Mr. Haeni of the Swiss Embassy's Servicio de los Intereses Estrangeros. The Swiss cover not only the U.S. interests in Cuba but those of some seven other countries. The first couple of floors are filled with stuff stored from the days when the U.S. was in the building, one floor is devoted to the airlift operation, and the top floor is the Foreign Interests group. Mr. Haeni met me at the elevator – a most cordial and voluble Swiss – and we walked down the paneled corridor to his office. Behind his desk was a large map of Cuba, and on one wall were the standard U.S. Embassy black and white photographs of Mt. Vernon, the Washington Monument, and the Jefferson Memorial. We

25.

made small talk, and I told him of Feo's return, our flight, and that the meetings seemed to be going OK. I also told him that we would need Mexican re-entry visas. I assumed that since our passports were all being held, the Cubans would add the proper papers to insure that we left their island, but I wanted to be sure. Mr. Haeni said he would check on this for me. His assistant is a Mr. Hunkeler. For the record, the telephone there is 32-0551 or 0559, Haeni's private line at home is 21-8645, and Hunkeler's is 32-5646. A Mr. Inhelder joined us (32-3937) then we chatted about the Kurchatov visit to Miami, the U.S. position that being here reflected no change in U.S. policy towards Cuba, and the appallingly run-down condition of Havana.

My driver brought me directly

26.

Back to the hotel, but I did have a chance to see a bit more. What once must have been lovely apartment houses along the Malecon were badly run down. They evidently are jammed with people, for the bare front yards were full of barefoot kids playing, and the front steps were crowded with people just sitting. It reminded me of a cross between the slums of the lower East Side in New York and Manila just as WWII ended. The whole scene was very depressing, and I had the feeling that a once lovely city had lost all its pride and was rapidly going to seed.

Back at the Habana Libre, I changed a twenty dollar bill for 18 pesos, 40 centavos (not even a one to one conversion) and tried the door from the lobby into the branch post office. It

27.

Was locked – and so were all but one of the wide row of entrance doors to the hotel. At that door was a tall Cuban in green Castro-like fatigues and fatigue hate with a .45 at his hip. I'd not seen him before, and if he was guarding the place, he was doing a poor job, for he merely glanced as I went out and returned to his conversation with the short girl in a blue sort of uniform who was leaning against the open door. That door, like all the others has an automatic treadle-operated opener, but it evidently is broken, for a large cinder block (and a girl) holds it open.

Once, in the branch post office, I managed to convey the idea that I wanted four of each of their stamps, and I got 4.32 pesos worth. Some four

28.

Envelopes are now well stamped and go off today. I will be interested to see when – and if – they arrive.

The meetings broke up about 6:30, and we all returned to our rooms to prepare for an 8:00 reception on the 25th floor lounge. Zether has a portable radio and reported that he is able to get WIOD in Miami, but there was only music-no news.

The reception was nice and the conversations lively. Dario Guitart is no longer Director of the Instituto de Oceanologia, but is listed as an advisor. A younger man, Dr. Claro is the new Director. I had a good talk with Carlos Garcia who is the physical oceanographer with the Instituto Nacional de la Pesca of CIPCCentero de

29.

Investigariones Pesquerras). They have been doing a good deal of work in Campeche Bank working out the current patterns there, and he was particularly interested in our work from Virginia Key last month in the Yucatan Channel, so I put him and Bob Molinari.

We all danced with our little Molhur - Lueda, and the partly was still in full swing when I left about 11:00 to work up the summary statement of the U.S. National Programme (as they spell it in UNESCO) for CICAR.) They want for the formal report of the meeting.

30.

Wednesday, 21 June, 1972

Today was almost completely business. NOAA-AOML is the real hero of these meetings, & I am indeed proud. What with our 300+ page report, our NOAA Carib course this Fall for the education and training they are screaming for, our putting Pete Connors on the ARC San Andres of Colombia, and our MARMAP program for which we need the help of the CICAR nations, plus the work that Brucks, Molinari, and Antoine have put in the U.S. is smelling like a rose.

We have been getting the real VIP treatment. Tonight I met Comus of the French OSTRAN who is here in relation to some soils work for Cuba, and he had (been subjected to) a lengthy baggage search and had to

31.

declare all his money – all of this we were spared.

All day today has been work. I holed up in the room in the morning and wrote out a quick summary of the meeting programme for Ostapoff, a summary of the U.S. A. Program and draft resolutions on IGOSS and UNESCO support for the travel of CICAR nationals to and from the Discoverer on NOAA-Carib. All are now at the typist on the 17th floor. Getting them to her was less than easy, however. From the 19th floor, I rang and rang for the elevator with no results, so I decided to walk down the 2 floors to the 17th. I took the stairs, but at the 17th floor I found the door locked, so I went back up to the 19th floor, and found that had been locked behind me. I knocked for a

32.

while, but no answer. So I started down. There were no skeletons on the stair well, so I assumed that others had not been trapped there too long, but it was 18 doors later, on the ground floor-planta baja-that I finally got out and I almost kissed the fat Cubana maid that opened the door just as I got there.

After dinner tonight, Leeda – our fearless Leeda, took us on a walk, BZ Rene, Severano, and me. We walked down Calle 23 to the Malecon. From the old Esso map I got from Ron Goddard, I knew that the Malecon had been called Avenida George Washington, but neither Leeda nor Severanno knew that name. To them it had always been Malecon.

33.

Along the seawall families lolled and lovers necked, and the air was clean off the ocean. We walked along the Malecon to Calzada de Belacoan, and then back via Calle 25 to the hotel. It was a good walk, and the city looked much better at night when the unpainted and unrepaired parts were less visible.

Airgram to State was drafted and will go out tomorrow.

34.

Thursday, 22 June, 1972

This morning was all work. Scott from the U.K. nominated me for chairman of the working group on National Programs and John Antoine was rapporteur. By keeping things moving, we managed to wind up by 12:30.

Had a beer for lunch with Des Scott & Lankford, for I have been eating too much and no exercise to speak of.

Since we were about to go to the Instituto de Oceanologia, I called the Swiss Embassy, but there was a language barrier I couldn't break, other than to learn that Mr. Inhelder was at his "casa". I called there and he said he would collect my airgram here at the desk.

The Instituto de Oceanologia is

35.

Right on the shore east of the central city in what once must have been a lovely private home. Dr. Claro met our three Fiat buses, and we assembled in what once was the living room – open double doors to the sea on one side and to the central patio on the other. The walls held several framed scrolls from the local Cuban Workers Union attesting to the diligence of the Instituto and we sat on metal chairs while Dr. Claro explained his Institute in Spanish while big Maria translated. They are part of the Cuban Academy of Sciences, and the staff of about 40 is augmented by a dozen or so Soviets. Plankton, physical, Chemical, Icthyological, Geological, and Pollution labs were all visited. We all had the feeling that little research was going on. It just didn't "feel" like a working lab, and we all felt it.

36.

In the Chemistry lab, only the salinometer worked. Even the pH meter was inoperative. There were some scientific books about, but I did see one pub titled – approximately- “Results of the Symposium on Yanqui Genocide Program in Viet Nam, and the wall of each room had at least one political poster- usually quite colorful, and Che Guevera prominent in most of them. Instrumentation was almost nil. They are strictly a shelf group with much of their work concentrated in the coastal lagoons. The Golfo de Batabano between the main island and Isla de Pinos (Isle of Pines) is getting their special attention, and I was told that there is a plan to run a causeway-bridge all the way from Surgidero de Batabano on the coast (directly south of Habana) over some 70 miles to the Isle of Pines. In addition, there

(Opposite page 37) crossed out:

Venere-

Mendes (sh Plbm) unreadable

Hermano Genes – Pres LaSalle fndn

Perez Nieto- Geol, Golan's

Colombia

R unreadable

Ed. Hernandex (slight)

Ortiz Borda (Philby)

A. Tupras (Nixon)

37.

are plans to block off the mouth of Ensenada de la Broa- some 30 miles across!- and make it a fresh water lake.

The Instituto operates two boats, one 60 ft. – one about 70 feet, and both are used only for close-in work on the shelf. One of the U.S. I think Lankford, talked to an FAO man there who said that in the year he has been there, they have had one scientific seminar and 70 political ones. In the fisheries lab, there were 4 Russians who stood and looked embarrassed as we came in. They are working on fish vision and on schooling habits, have been there only a few weeks, & will stay for 6 months and then be replaced by another team.

The monument to the battleship Maine on the Malecon still stands, but the big eagle is gone from the top.

38.

“Our little mother” had had a birthday cake for Bob Molinari made – “Felicidades Molinari” it said on top. After dinner, we were bused off into the night to view three government-made documentary films. The best was one made of the first movie a hill town had ever seen. It was extremely well done- as was one on catching crocodiles. The one in the middle I missed completely – all talk & no action.

Afterwards we all went to the Tropicana – one of the world’s great nightclubs. It was a 1930-type spectacular and lasted some two hours. There were some 16 of us, and the bill came to 185 pesos –

about $201 U.S.! We had two bottles of rum and several buckets of ice, soda, and “fresca” – some $13 apiece.

39.

Friday, 23 June 1972

Again, today was a work day- all day. I had an 0600 call so I could go over John Antoine’s notes of the Working Group, skipped breakfast and went directly to the sessions. At the 1300-15—break for lunch, I skipped lunch in favor of a beer with John Antoine and Brucks and a trip to the Post Office to mail some gaudy envelopes.

What earlier I thought was just a misunderstanding about John Antoine’s Visa to re-enter Mexico, may be a very real problem. I alerted the Swiss Embassy people, and Inhelder has been on it today. Wires have gone off to Washington and to Mexico City, but

40.

no solution yet. He is cheerful about it, but he is beginning to worry too. If it is not cleared up today, I will skip the trip to the Fisheries Institute and help him if I can.

One of the UNESCO people met a cute girl at the Tropicana last night, and she agreed to meet him here at the Habana Libre for lunch. He told me later that she was extremely uptight about coming, as the hotel is known as “the police hotel” and Cubans try to stay away from it.

The work of the meeting wound up about 7:30PM, and all the US-ers retired to 1902 to cut Molinari's cake. At dinner, quite a group

41.

of us collected and somehow we began singing. There were the 5 ICAP Cuban girls; the Langeraars, Postma, & van't Hof from the Netherlands, Itenny from Trinidad, Scott & Kearey from England, Tapias from Colombia, the two Angots and Rossignole from France, Ayala and Lankford from Mexico and four Norte Americanos. The songs had an equally international flavor and ranged from Aloueta through Row Row Row Your Boat done "en ronde" to Cuban revolutionary songs about Fidel in the mountains. We had quite an audience collected by the time we quit about 1130 PM. It had been a good evening.

Incidentalia: 50 ¢ per kilo for beef and 40 cents for chicken. The Deauville has a special shop for Embassy people and

42.

VIP's. Rene reported that rum there was $2 per bottle but $20 on the open market. At the Habana Libre Hotel, rum drinks run 90¢ and others about $1.25. Housing is either provided free or very cheaply, and telephones and utilities, as well as medical and schools, are all provided at no cost. Thus a mason making $25 per month can make it OK.

One of the men last eve said that the reason the night clubs are full is that there are no luxury items available to buy. A man gets a permit for 2 pairs of shoes per year, but the shoes are not available in the stores. Long lines queue up for everything – bead to buses to ice cream.

43.

Molinari’s john won’t stop flushing, and mine won’t flush. Mentioning the 250,000 Cubans in Miami, I was told by Severeno that these were not Cubans- most insistant- not Cubans but “counter-revoluntionaries.”

The newspaper. Granma, daily has anti-Viet Nam articles of EEUU bombing atrocities in VietNam and spells Nixon’s name with a swastika throughout instead of the “x”.

Most of the CICAR people went out to the Centro Nacional de Investigaciones Cientificas this morning, but I stayed to try and get John Antoine's Visa problem squared away. It is now 1245, and it is far from settled. Leeda, Antoine, and I

44.

went to the Swiss Embassy about 9:00 AM to see what we could do next. It was closed, and although the man at the door made several calls, there was no word. Walter Haeni's telephone was still out, and there was no answer at Inhelder's home. I left word that I would be in room 1902 at the Habana Livre, and we came back. Haeni has sent messages to State in D.C. and to the U.S. Embassy in Mexico City. I alerted Ayala of Mexico that Antoine as well as the three non-governmental Colombians were all in the same fix. Ayala said this morning he had called Mexico City and that his office was trying to get the Secretaria de Gubernacion to telex or phone the

45.

Mexican Consulate in Havana to grant the visas. It is that Secreatria that must give the word before the Consulate here can move.

Then Inhelder called 1902 to say that he was trying to contact Mexico City and that the telex to Washington was broken down. He also said that the Consulate of Mexico here had told him that if they get the word today, Antoine will get his visa OK.

However, we wanted to be covered, so I sent Leeda & Antoine to Iberia to see if he could get on the Tuesday plane to Madrid. He can then get a Pan-Am flight back from there to Washington or New York. It developed

46.

That the cost was to be $325, and he didn't have it. I came up with $190 – saving enough to pay my hotel bill, as they will take only cash – he had about $90, and Molinari came up with the remaining $45. I think we still have enough to pay our hotel bills. Since the Iberia office closes at noon on Saturday and it ws a today or never situation, we worked as long as possible to get the word on a Mexican Visa, and at 1140 we sent Leeda off with our $325 to get Antoine's ticket. When she returned about noon, she was in tears – literally. The ticket was to be $375 – not $325. So we checked to see if the hotel would

47.

take American Express Travelers checks, and the answer was no. So we dug deeper. I gave up $20 and so did Molinari, & Antoine made up the rest, and Leeda ran off to inject all our money into the ICAP pipeline in hopes a redeemable ticket Havana-to_Madrid comes out the other end – and in time.

Inhelder called about 1:00 PM to say he had finally gotten through to the U.S. Embassy in Mexico City. They called the Secretaria de Gubernacion and were told the authorization to the Mexican Consulate in Habana had been sent yesterday. The U.S. asked them to back it up with a phone call. The U.S. in Mexico also called the Colombian Embassy to alert them that Ortiz Barda, Tapias, and Hernandez all the same Visa problem.

48.

I had already missed the tour in the morning on this Visa business, so I told Inhelder I would go with the group to the beach – and did. Some eight of us went with Leeda in the Fiat bus to Playa Santa Maria, good sun and a nice beach some 8 or ten miles east of Havana.

Back for a rushed dinner- no answer at Inhelder's – and off to "Cultural Activities". This was a packed Theater with a band, singers, a magician of sorts, and a really fine comic. Back to the Habana Libre and the cabaret – 2 Mexicans, 3 French, etc. and a pleasant evening of dancing – and 90 more dollars!

One of the Mexicans has become friendly with the floor

49.

maid, and every room is in fact bugged. She told him it was in the air conditioner and wrote a note to him, as she was scared even to talk in the room. Scott said the U.K. knows it, and he was so informed.

By the time the cabaret show was over, it was too late to call Inhelder again.

50.

Sunday, 25 June – 1972

As requested, the telephone woke me at 06:30 AM, and we were breakfasted and in the buses by 0830 & off on the 2 ½ hour run from Havana to Veradero Beach some 90 plus miles east of Havana along the north coast.

We ran along the Malecon to the harbor mouth across from Moro Castle, dropped down into the tunnel under the harbor, out the other side, and along the 6-lane road that goes at least to Playa Santa Maria.

Lots of USSR – built jeeps on the road, and an armed & helmeted guard at a military installation, but all seems quiet, and that ride is through some lovely rolling country, along the coastal plain at first, then up into the coastal hills with

51.

magnificent views across the palm-studded green inland valley to mountains in the distance. Then down the long grade to the city of Matanzas at the head of Matanzas Bay. Through the town – even more run-down than Havana, and along the flat coastal upraised reef surface, past the Veradero Airport, where the hijacked planes come in, and out along the long Veradero spit. On the ocean side are several miles of narrow trenches and occasional concrete bunkers – apparently empty.

We piled out of the three Fiat buses at the International Hotel at Veradero Beach – we were all in suits almost at once and across the very clean fine –grained sand into a very clear ocean. Mohitus (mojitos) around the pool later (that's rum & humidity),

52.

a good lunch in the ballroom, another swim and we were busing back to Havana. It was nearly 8 PM when we arrived. I called Inhelder immediately.

Yes, the Mexican Consulate had gotten the OK, and when he said they would deliver it at 8:30, we had just been talking about our 8:30 departure by plane, and I interpreted this as the passport would be delivered at the airport just in time to climb aboard.

Then a big flap, as ICAP will need it for at least a ½ hr. to massage it all somehow. We got Carranza to try to see if he couldn't find a way to get it sooner. Leeda was mad because I felt that if some 30 of us had to wait 4 days for their plane in Mexico City, certainly their plane could wait on hour for only one of us. About 10:30 PM I

53.

called Inhelder to get some telephone numbers of the Mexicans for Carranza to use & he told me that John's Visa had been delivered at the hotel at 8:30 this eve! I kept him on the line while Antoine went down 19 floors, and sure enough, it was there in his box!

We all had a few pieces of "Felicidades Molinari", a night cap, and all left. I packed, left a call for 5:30 AM, as we were supposed to leave the hotel at 6:00 and went to bed. Perhaps we would all get out after all.

54.

Monday, 26 June, 1972

They do take American Express Travelers Checks at the Habana Libre, but not the Am Ex cards. Since our $18 / day rate quotation was in Pesos – not dollars, our bills were all more than we had planned for. Most of us had contributed to the $375 for Antoine's Madrid tickets, and all were short. Fortunately BZ had Travelers checks, and all were checked out & paid up.

Back into the Fiats, a long wait at the airport, Antoine did get his $375 back with his ticket, and we were all paid off in the ready lounge. We all kissed Leeda goodbye, and walked out into the sun to cross the tarmack to the same Cuban de Aviacion plane that brought us down – I avoided the bubbling window this time.

Missed earlier: Our tourist map of Cuba has a note below

55.

Guantanamo that read (in Spanish) “Territory illegally occupied by the U.S. A.”!

Zetler discovered that children of working mothers can put their new children in a free “school” at age 45 days. Some of the women visited one and reported really fine facilities. He added that the several fine – looking marinas we passed en route to Veradero had not one boat in them – possibly a precaution. He discovered from Severano that numerous Cubans have money hidden away, and a vacation at Veradero “ is one way the Government can get it back”. You can have the cost of your vacation deducted from your salary in installments the following year.

MacGillavary (Netherlands) was walking along Veradero Beach – walking away from the Hotel and was told quite sharply that he was to

56.

return "to the recreation area".

Where the Milan Theatre was showing a "Film Sovietico" last week, this week it is a "Film Norteamericano" starring Buster Keaton. Leeda says they change weekly – USSR-USA-Italy, etc.

Kenny from Trinidad asked one of the better educated ICAP girls- two year of college – about the Maine and was told that the Norteamericans blew it up themselves so they would have an excuse to invade Cuba, and she had never even heard of the Yellow Fever Battle that really made the Caribbean safe to live in.

Most of us felt we were pretty closely watched all the time we were there. ICAP was, of course, one way. The

57.

ICAP people told us they had a room at the hotel to change in but that they went home each night, when in fact the 14th floor is primarily ICAP, and all stayed there each night. The evening at the Cabaret in the Habana Libre, two Cuban men took the table just behind the one the ten of us had. They looked most bored and stretched one drink each for the full two-hour show. Lankford – I think it was he – asked a Cuban girl at a nearby table to dance and his Spanish is good enough to know that she said “not while those two are there” and looked their way. We all danced with “our dollies” as Kenny calls the ICAP girls, and left about 2 AM after draining our resources even more. There were others still dancing, but we couldn't sleep in for long and left. I was

58.

the last out. Once out, I turned around and went back as though to get something at the table. The slighter of the two men was already at the door and stepped aside as I came back in and then went on out. The other man was still trying to get a waiter and looked eager to get out. When I went back out, all our gang was still waiting for the elevators, and the slight man was nowhere to be seen.

It is a very strange environment to work in, and I must admit I felt quite uneasy most of the time.

With the 2 hours switch in time between Cuba and Mexico City, and then back again between Mexico and Miami, I am all fouled up. We had about 3 hours to wait, boarded Aero Mexico #450 about noon for the flight

59.

home. Jake Kenny & Lennox Ballah of Trinidad are with us, and I will put them up at our house tonight, as they have a BWI flight to Trinidad tomorrow afternoon.

It has been an interesting trip, but I think I will wait until Cuba is a happier city before I try it again-
------

Harris B. Stewart Jr.
NOAA - AOML
Miami, Florida

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FEDERAL SUPPLY SERVICE
(GPO)

Harris B. Stewart Jr.
NOAA - AOML
901 S. Miami Ave
Miami, Florida
U.S.A.

Cuba trip 15 - 26 June '72

for the

Vth International Coordination Group

for

CICHP

DR. HARRIS STEWART .

608

MR. GARCIA FROM HABANA DE AVIACIÓN TO INFORM THAT THE PLANE TO CUBA WILL LEAVE TOMORROW (SAT. 17-72) AT 7:00 P. M.

THE GROUP MUST BE AT THE AIRPORT AT-5:00 P.M.

IF YOU HAVE ANY DOUBTS THE HABANA OFFICES WILL START TO WORK AT 1:30 P.M AN THE TELEPHONE NUMBERS ARE - 546-61-64 MR. GARCIA

1345 Mon—

Hurricane @ Habana—

16/VI/72

18:20

~~— U.S. P's at IVth CEAR —~~

~~H.B.S. jr. – Delegate~~

~~Dr. Robert Molinari (AOML) Alternate Delegate~~
~~Dr. John Antoine (TAMU) " "~~
~~Mr. John Brucks (NMFS) " "~~

~~Mr. Feodor Ostapoff (AOML) (Met. Coord.)~~
~~Mr. Bernard Zetler (AOML) (S.L. for Tides)~~
~~Mr. René Cason du Ret (NODC) (Data Coord.)~~

~~Dr. Robert Lankford (UNESCO)~~
~~Bruce (FAO)~~

Thursday 15 June, 1972

Destination Cuba! It sounds strange, but that is where we are headed. Now at something over 30,000 ft over the Gulf of Mexico headed toward Merida on the Yucutan Peninsula en route to Mexico City this seems like any other flight. But in our pockets are passports with special stamps to allow us to enter and leave Cuba. The Pan Am ticket ~~a~~ girl back at Miami raised her eyebrows as she saw that our tickets to Mexico City went on to Havana. She looked at each of us in turn – me, BZ, Feo, Molinari, René, and John Brucks – shrugged her shoulders as though to say "the world is full of crazy people" and added ~~to~~ me aloud, "I am glad to see you have return tickets!"

Pan Am Flight 552 was posted for a 6:15 PM departure, but it was after seven when we lifted off to climb steeply up over Biscayne Bay. The plane banked ~~steeply~~ sharply to the right through a layer of small clouds, and we settled back for the four-hour flight.

Right behind us were ~~James~~ Gines and Mendes from Venezuela, and their Delegation Head, Carlos Atilano, and his wife were up in first class. At the airport, we had run into Rossignole from France, and he was aboard too, so we knew at least three countries would be represented in Havana.

A quick stop at Merida, and then

Mexico City. John Ankerne from ~~the~~ Texas A&M met the plane along with a grad student of Bob Lankford's at UNAM called Eric Jordan (or Hoar-DAN as he called it). The Public Affairs man at the airport helped speed us all through Customs, Health and Immigration, our bags — loaded with some 90 pounds of reports — were piled ~~loaded~~ into the University truck and we bucked the busy evening traffic into the city and the Hotel el Diplomatico on Insurgentes Sur.

Bob Lankford, now with UNESCO in Mexico, met us there, as did Oleg Mamayev, the Soviet with IOC in Paris. We had a nightcap in the hotel and admired the busty singer belting out loud songs in Spanish, and were off to bed. It should be an interesting day tomorrow as ~~[illegible]~~ we head for Havana.

Friday, 16 June, 1972 Mexico City, D.F.

By 0830 we were all breakfasted, checked out of our rooms, and our bags were neatly stacked near the ~~door~~ Hotel entrance ready for the trip to the airport and our 1130 flight to Havana - "But, Senior, it is necessario that you arrive two hours before the departure".

Then it started to happen! Oleg Harnayer reported that he had just had a call from Michel Angot that the flight to Havana on CU-465 had been "cancelled". A few calls later we discovered that rather than being cancelled, it was merely postponed, and it would leave tomorrow at the same time. All the bags went back up to the rooms - 108, 408, & 608, and Bob Lankford and Hoar-DHN ran us all out of the city to the north and we had a good day at the Pyramids of Teotihuacan, and the temple of Quetzalcoatl.

I held a U.S. Delegation meeting in 608 about 6 PM and clued in the others on our instructions, position papers, and the various do's and don't's I had gotten from Joe Norberg & Ron Goddard at the Cuban Desk at State during my pre-Cuba briefing in Washington last Monday.

We all ate together at a fine Mexican restaurant on Insurgentes and took in the 3 hour show at La Terrace. All of us felt that the night life in Havana would probably be uninteresting to non-existent, so this was our last fling.

Saturday 17, June 1972

The wake-up call at 0700 seemed awfully early, somehow, but we were all packed and down for huevos rancheros and black coffee by 7:45. This time we left our boys in the room. Getting those 90 pounds of reports up and down between the lobby and the 6th floor - 3 trips so far - was bankruptcy us in tips, so we left them up there until we knew for sure that CU-465 would leave as advertised. This morning

René - who speaks the best Spanish of us all - called the Cuban Airline at 0800, and the jinx is still on! The flight will not leave today at 4:15. It is expected to leave about 7 PM tonight, and we must ~~should~~ be at the airport by 5:00, but we should check about 3:00 PM to see. We are all psyched up to go, and I could see the disappointment on the faces of the others. We are ready, and these repeated delays and uncertainties are frustrating.

There has been no explanation offered for the delays. Speculations include bad weather - and that is indeed possible, for there was a depression over the Yucatan Peninsula and the radio reported that western Cuba got 12 inches of rain in

24 hours. Others speculated that the Cuban Government just did not want a batch of curious foreign scientists wandering around Havana for two days waiting for some meetings to start. The ~~###~~ 7:00 PM departure now projected would put us into Havana well after ~~dark~~ tonight and this strengthened the idea that Cuba was deliberate in allowing us the least possible chance to see and to photograph. Only time will tell – if even that.

About 1 PM after a long long walk, some tacos, a chile rellianos, ~~[illegible]~~, and a beer, I got back to the Diplomatico to find a note on a call that had come in to me last evening from a Mr. Garcia at Habana de Aviación with the same dope we got via René this morning but saying to call about 1:30 "if you have any doubts". I did and did. Not only does it not go at 7: PM, it doesn't even go on

Sunday - tomorrow. It is - he said - now scheduled for 1:45 PM on Monday! When I asked him, why?, I was told ~~[illegible]~~ "There is a hurricane at Havana". We are all getting a bit fed up with this one! If I am to have a few days off, Mexico City would not be my number one choice.

Mamayev is quite annoyed - too. He is calling the local U.N. office and I will call our Embassy here to be sure that the word gets back up to Washington on this one. All of us - but René & B.Z. who sacked out early - went ~~out~~ to Room 108 where we worked away on some of the duty-free we brought with us - a good party. In the midst of it, I had a call from Tom van't Hof from Curacao. He and Langeraar, Postma, & McGillivray from the Netherlands ~~were~~ are all at the Holiday Inn out near the airport, and ~~they~~ they are a

along with Henny ~~Kenny~~ from Trinidad

Colombia, &

bit annoyed too. We now have the U.S., UNESCO, Venezuela, WMO, France, Netherlands, Mexico, and Trinidad and Tobago all here in Mexico City, so I suggested the Cubans come up here & we hold it here.

Since Freo leaves for Rio the first of July – Saturday of the week we hope to leave Cuba – he felt that the departure might be as delayed as the arrival and he would be in trouble, so he heads back to Miami via New Orleans on Sunday.

Tomorrow I hope to sleep in and meet Longacre *et al.* at the archeological museum in the late morning.

Sunday June 18th

At 8:45 Tom van't Hof woke me with a telephone call - we will meet Langeraar et al. plus Scott from the UK who is now here also, at the National Anthropological Museum at 1300. Ayala, Mexican CICAR Coordinator, called shortly thereafter, & he will meet with us at 1300.

Feo is off at 1pm today for Miami via New Orleans, and I had a session with him so that I could double as the WMO representative in case we do get to Havana. Ayala told me that there is a hurricane at Havana and this provides a good rationale for the repeated delays in the departure. Since Leslie will be worried, thinking I am in Havana, Feo will call her in Massachusetts tonight when he gets to Miami.

We had a good meeting at

GH

Since Feo has left, BZ has moved in with René and me, and he is sleeping peacefully. I finally managed to buy some stamps at the Sheraton Hotel on my long walk, so my letters to Leslie, Kofoed, & Steller can go off in the morning

the National Museum of Anthropology — some 20 of us, then the tour through that magnificent museum, and I walked the 3½ or so miles back to the El Diplomatico. En route I stopped at our Embassy and sent an airgram to State to alert them as to what had transpired, and to set up Henry Postma of the Netherlands for a visa to the U.S.

~~Since Feo has left, BZ has moved in with me & René, and he is sleeping peacefully. I managed to buy some stamps at the Sheraton Hotel on Reforma so my letters to Kofoed, Steller, & Leslie can go off in the morning.~~

Monday, 19 June, 1972

Habana de Aviación said this morning that they would fly today! I'll believe it when airborne and not before. So we are all packed up again and will leave the hotel about 10:30. I checked to try and get us all on the Havana-Mexico flight on Friday the 23rd, as Lengerauer & Niemayer have to leave Friday & I suspect the meetings will end Thursday. But the girl said it was full - no space, and no stand-by list. So, it looks as though we will have to hole up on Cuba over next weekend. Perhaps we can get in some sightseeing.

We piled our bags at three taxis, & Niemayer, Lankford, and six of US from the USA roared off to the airport. Somehow the bar seemed to be where people were collecting. New additions to the group were Ingvar Emilsson - the Icelander now with

Cap^t Juan Pablo Parran,
Ortiz Borda,
Harme Hernandez, and
Constantino Tupias all

(but from Argentina)
UNESCO - and Luis Capurro - ditto
Then Phil Kearey, geophysicist on
HMS Hecla who worked with the
Discoverer; ~~Parran and two others~~
from Colombia, Michele Angot & Denise,
Myala, Caranza Frazier (and Anna
Maria who came to see him off
and send her love to Lochea),
Kenny from Trinidad & Tobago,
CDR Des Scott from the U.K.,
McGillery & Postma from the
Netherlands, Rossignol from France,
Marmayer & Lankford from UNESCO,
and a gaggle of translators from
Mexico, Colombia & Venezuela

More sitting, more waiting, and
finally we were in a long line at
the end of which was a portly
official in powder blue uniform
under a sign that read Cubana,
so the chances began to look
better. Passports were checked and
a boarding card was issued - mine
was 10 C, but it looked like IOC.

Then there was a long wait in the departure lounge, and a nine year-old boy did a good polish job on my shoes for two pesos ($0.24). It was by then after 4 PM - for our 1:45 flight! Finally the call came over the speaker system, & we lined up, showed our passes, and walked out into the bright sunshine toward the the 4-engine turboprop Bristol Brittania with "Cubana" in big letters on the side. At 4:36 we started to taxi for take-off. The girl came on in spanish - then in english to say "Welcome aboard Cubana flight 465, destination Habana" plus the usual seat-belt and smoking admonitions, a slow bumpy taxi, and at 4:45 we were airborne for the 3¼-hr. flight to Havana.

Even before the "no smoking" sign went off, the cabin steward passed out copies of today's edition of Granma, billed as "Organo Oficial del Comite Central del Partido Comunista de Cuba". It had photos of the storm tide from hurricane Agnes and a map which showed her to be well north of Dry Tortugas in the Gulf of Mexico, so I suspect Miami will miss this one.

There is a leak in the double window in my row, and a great fountain of bubbles grows steadily as air bubbles through the water collected between the two windows.

Dinner included a cup of warm very good consummé, but all the rest was stone cold - baked (?) ~~chicken~~ chicken, rice, and mixed green beans, peas, & carrots. There were 3 slices of tomato, a good sponge cake of some sort with chocolate frosting, and a plastic cup of beer - refilled once. Interestingly enough no coffee and no drinks. Later, the chubby stewardess brought a small paper cup with about 2 inches of black sweet Cuban coffee - on the cool side of warm. Then came a tray with cigarettes in a five-per-pack configuration - called "Habana-68", and cigars. I picked "Habana-68". They are non-filters, strong, and they do not stay lit but need a full supply of matches to keep them going.

At just 10PM (EDT) the plane touched down at José Martí airport at Habana, and we had in fact arrived. The 30 or so CENR people aboard were taken separately, bypassing all the normal formalities with passports & public health, and led into a paneled room with big cocktail tables & chairs where Dr. Santander and the other Cubans waited for us. A Mr. Haenl ~~Hofmann~~ from the Swiss Embassy introduced himself to me and offered to help in any way possible. We then met a most attractive black (or-LIE-da) but has Leeda as a nickname

Cuban girl who has been assigned to the U.S delegation. She is Miss Orlaida ~~(or-LEE-da)~~, and of course she unpredictably became known as our fearless Leeda. She is just lovely, and the younger members plan already to take her dancing one night. Met Maria Diaz, the Cuban Unesco rep. here, and she said all the arrangements were made with the help of ICAP - for (approximately) Instituto Cubano ~~de~~ por Amisdad por los Pueblos or Cuban Friendship Institute.

Miss Orlaida gave us each an ICAP form to fill out - name, country, address, and short bio statement asking for organization, title, degrees, etc. She then collected these - together with our passports, shot records, declaration, ~~and~~ tickets, baggage checks, and landing cards and we haven't seen them since. They did check them, because Suzan du Rest was called out ~~f~~ and had to get a smallpox shot & one other. By then a man with a big tray was passing out ice cold daiquiries to all, and the level of noisy conversations rose ~~raised~~ a few decibels. Delegations were called out one or two at a time to collect their baggage. The customs man had me open each one, but his search was perfunctory. He was pleasant and helpful & stamped my tag with a smile.

A porter loaded all our bags under Lieda's directions, and we followed her and a Mr. Severano outside where three nearly-new Fiat 18-passenger buses waited for us. By then it was about 1:15 PM.

The ride into downtown Habana took about 25 minutes. There seemed to be much less light than one would expect of a big city and relatively few cars. We pulled up in the circular drive before the Hotel Habana Libre (the former Havana Hilton) and were ushered into the big bare lobby to sign in. There was relatively little confusion, rooms had been assigned, and our identification cards were all ready. Leeda came along and saw us all ensconced on the 19th floor overlooking the harbor - lovely at night.

The room is big. Twin beds, desk, chairs - no rug - and the bathroom is also large with a tub, shower, toilet, bidet, and a gray marble sink-shelf arrangement. On the desk were boxed gifts from ICAP, each with a big ICAP printed on it: a bar of soap, a packet of 5 Cuban cigars, a box with four packs of V&S Visant Cigarettes, and a box with a tissue-wrapped bottle of Havana Club "Genuino Ron Cubano". Then we were whisked back down on the fast elevator to the 2nd floor where three young ladies in red, green, and white striped dresses had our packets of papers - each in a black briefcase with V Reunion CICMR, Cuba '72 printed in white, and a metal identification badge.

The next room was set up for food, so we all sat and had "fresca" or beer and good fresh pineapple and hard rolls & butter. Verera came by and said hello, and I introduced him to the others. By then it was after 1 AM, so we broke up & went up to bed.

Each of us has a single room with a balcony - really most attractive and - I am glad to say - with functioning air conditioning. I left a call for 0700 and unpacked for the first time in 4 days! The room Havana Telephone book in 1902 is the 1967 version, sub-titled "1967 Año del Viet-Nam Heroico".

Tuesday. 20 June 1972

Last night's impressions have been a bit modified in the cold light of Cuban dawn. There is no hot water in the Habana Libre Hotel, and about a third of the CICAR delegates are sporting razor cuts today.

Breakfast (room & 3 meals $18 U.S.) was fried eggs with some sort of strong sausage - split & baked (?), hard rolls & butter. We have a special CICAR dining room, and all our meals are to be taken there. The first session was called for 0900, but it was 1005 AM before ~~the~~ the Vice-Minister for Education arrived Cuban He is Julio Le Revirandt, and he said all the proper things about science, the sea, and the general improvement of man's lot on earth, and left. The meetings are being held in a salon on the ~~mezzanine~~ mezzanine. There are brass name plates at each delegation location, and we are down front as Estados Unidos. The headphones for simultaneous translation are self-contained sets made by Denon in Japan and work well. We will meet each day from 0900 to 1300, break for two hours, then 1500 - 1830.

At noon I wanted to go to the Swiss Embassy to check in and planned to walk the 6 or 8 blocks, but Leeda insisted that she provide a car for me, and she ushered me to a 1958 Plymouth complete with driver. This was my first up-close daylight view of Havana, and it was indeed most depressing. One can only imagine what a lovely city it once was, but now it is shabby and very run down. The grass grows long in the small plots along the streets. Every building needs paint. Broken windows stay broken, fences are down, torn awnings stay torn, and there are long queues outside the bread store. There are some foreign cars - relatively new, but such private cars as are in evidence are mainly U.S. make and all 1958 or 9 or earlier. They are all in bad shape - dented, rusted, and all clank loudly. Mostly they seem to be Chevys and Plymouths. Either they were the main ones that were imported or - more probably, they have a better survival factor. All, however, were in bad shape.

At the Milan Theatre, the movie playing was "La Fiesta de San Iorgen", and below the title were the words "Film Sovietico".

The former U.S. Embassy building on Calzada and the Malecon - right on the waterfront, is badly in need of repair. The grass is cut, but pieces of the outside have flaked off, tiles are missing from the floor, and paint is needed everywhere. I gave my card to the man at the desk and asked for Mr. ~~Hanne~~ Haeni of the Swiss Embassy's Servicio de los Intereses Estrangeros. The Swiss cover not only the U.S interests in Cuba but those of some seven other countries. The first ~~fl~~ couple of floors are filled with stuff stored from the days when the U.S. was in the building, one floor is devoted to the airlift operation, and the top floor is the Foreign Interests group. Mr. Haeni met me at the elevator - a most cordial and voluble Swiss - and we walked down the paneled corridor to his office. Behind his desk was a large map of Cuba, and on one wall were the standard U.S. embassy black & white photographs of Mt. Vernon the Washington Monument, and the Jefferson Memorial. We made small talk, and I told him of Feo's return, our flight and that the meetings seemed to be going OK. I also told him that we would need Mexican re-entry visas. I assumed that since our passports were all being held, the Cubans would add the proper papers to insure that we left their island, but I wanted to be sure. Mr. Haeni said he would check on this for me. His assistant is a Mr. Hunkler. For the record, the telephone there is 32-0551 or 0559, Haeni's private line at home is 21-8645, and Hunkeler's is 32-5646. A Mr. Inhelder joined us (32-3937) then and we chatted about the Kurchatov visit to Miami, the U.S. position that our being there reflected no change in U.S. policy towards Cuba, and the apallingly run-down condition of Havana.

My driver brought me directly

back to the hotel, but I did have ~~to~~ a chance to see a bit more. What once must have been lovely apartment houses along the Malecon were badly run down. They evidently are jammed with people, for the bare front yards were full of barefoot kids playing, and the front steps were crowded with people just sitting. It reminded me of a cross between the slums of the lower East Side in New York and Manila just as WW II ended. The whole scene was very depressing, and I had the feeling that a once lovely city had lost all its pride and was rapidly going to seed.

Back at the Habana Libre, I changed a twenty-dollar bill for 18 Pesos, 40 centavos (not even a one to one conversion) and tried the door from the lobby into the branch post office. It was locked - and so were all but one of the wide row of entrance doors to the hotel. At that door was a tall Cuban in green Castro-like fatigues and fatigue hat with a .45 at his hip. I'd not seen him before, and if he was guarding the place, he was doing a poor job, for he merely glanced as I went out and returned to his conversation with the short girl in a blue sort of uniform who was leaning against the open door. That ~~one~~ door, like all the others has an ~~a~~ automatic treadle-operated opener, but it evidently is broken, for a large ~~a~~ cinder block (and a girl?) ~~see~~ holds it open. ~~confirm~~

Once in the branch post office, I managed to convey the idea that I wanted four of each of their stamps, and I got 4.32 pesos worth. Some four envelopes are now well stamped and go off today. I will be interested to see when - and if - they arrive.

The meetings broke up about 6:30, and we all returned to our rooms to prepare for an 8:00 reception on the 25th floor lounge. Zetler has a portable radio and reported that he is able to get WIOD in Miami, but there was only music - no news.

The reception was nice and the conversations lively. Dario Guitart is no longer Director of the Instituto de Oceano~~grafia~~logia, but is listed as an advisor. A younger man, Dr. Claro, is the new Director. I had a good talk with Carlos Garcia who is the physical oceanographer with the Instituto Nacional de la Pesca of CIP (Centro de

Investigaciones Pesqueras). They have been doing a good deal of work on Campeche Bank working out the current patterns there, and he was particularly interested in our work from Virginia Key last month in the Yucatan Channel, so I put him and Bob Molinari in touch.

We all danced with our little mother - Leeda, and the party was still in full swing when I left about 11:00 to work up the summary statements they want for the formal report of the meeting.

of the U.S. National Programme (as they spell it in UNESCO) for CICAR.

Wednesday, 21 June, 1972

Today was almost completely business. NOAA-AOML is the real hero of these meetings, & I am indeed proud. What with our 300 + - page report, our NOAA-Carib course this fall for the education and training they are screaming for, our putting Pete Connors on the ARC San Andres of Colombia, and our MARMAP program for which we need the help of the CICAR nations, plus the work that Bullocks, Molinari, and Antoine have put in, the U.S. is smelling like a rose.

We have been getting the real VIP treatment. Tonight I met Comus of the French OSTRAM who is here in relation to some soils work for Cuba, and he had a long tiny baggage search and had to been subjected to

declare
all his money — all of his men were spared.

All day today has been work. I holed up in the room in the morning and wrote out a quick summary of the met. programme for Ostapoff, a summary of the U.S.A. program, and draft resolutions on IGOSS and UNESCO support for the travel of CICAR nationals to and from the Discoverer on NOAA-Carib. All are now at the typist on the 17th floor. Getting them to her was less than easy, however. From the 19th floor, I rang and rang for the elevator with no results, so I decided to walk down the 2 floors to the 17th. I took the stairs, but at the 17th floor I found the door locked so I went back up to the 19th floor, and found that had locked behind me. I knocked for a while, but no answer. So I started down. There were no skeletons on the stair well, so I assumed that others had not been trapped there too long, but it was 18 doors later – on the ground floor – planta baja – that I finally got out and I almost missed the fat Cubana maid that opened the door just as I got there.

After dinner tonight, Leeda – our fearless leader – took us on a walk – BZ, Rene, Severano, & me. We walked down Calle 23 to the Malecon. From the old ESSO map I got from Ron Goddard, I knew that the Malecon had been called Avenida George Washington, but neither Leeda nor Severano knew that name. To them it had always been Malecon.

Along the sea wall families strolled and lovers necked, and the air was clean off the ocean. We walked along the Malecon to Calzada de Belascoain, and then back via Calle 25 to the hotel. It was a good walk, and the city looked much better at night when the unpainted and unrepaired parts were ~~are~~ less visible.

Airgram to State was drafted ~~drafted~~ and will go out tomorrow.

Thursday, 22 June, 1972

This morning was all work. Scott from the U.K. nominated me for chairman of the Working Group on National Programs, and John Ambrine was rapporteur. By keeping things moving, we managed to wind up by 12:30.

Had a beer for lunch with Des Scott & Lankford, for I have been eating too much and no exercise to speak of.

Since we were about to go to the Instituto de Oceanologia, I called the Swiss Embassy, but there was a language barrier I couldn't break, other than to learn that Mr. Inhelder was at his "casa". I called there and he said he would collect my airgram here at the desk.

The Instituto de Oceanologia is

night on the shore east of the central city in what once must have been a lovely private home. Dr. Claro met our three Fiat buses, and we assembled in what once was the living room - open double doors to the sea on one side and to the central patio on the other. The walls held several framed scrolls from the local Cuban Workers Union attesting to the diligence of the Instituto, and we sat in metal chairs while Dr. Claro explained his Institute in Spanish while big Maria trans-lated. They are part of the Cuban Academy of Sciences, and the staff of about 40 is augmented by a dozen or so Soviets. Plankton, Physical, Chemical, Icthyological, Geological, and Pollution labs were all visited. We all had the feeling that little real research was going on. It just didn't "feel" like a working lab, and we all felt it.

In the Chemistry lab, only the salinometer worked. Even the pH meter was inoperative. There were some scientific books about, but I did see one pub titled - approximately - "Results of the Symposium on Yanqui Genocide Program in Viet Nam", and the wall of each room had at least one political poster - usually quite colorful, and with Ché Guevara prominent in most of them. Instrumentation was almost nil. They are strictly a shelf group with much of their work concentrated in the coastal lagoons. The Golfo de Batabano between the main island and Isla de Pinos (Isle of Pines) is getting their special attention, and I was told that there is a plan to run a causeway - bridge all the way from Surgidero de Batabano on the coast (directly south of Habana) over some 70 miles to the Isle of Pines. In addition, there

Venez-

Mendes (shm pblm)
~~Armando~~ Gomes - Pres LaSalle fndn
Hermano

Perez Nieto - geol, Galans

Colombia

Rosson
Ed. Hernandez (sly ?)
Ortiz Borda (Philby)
A. Tupras (Nixon)

are plans to block off the mouth of Ensenada de la Broa - some 30 miles across! — and make it a fresh water lake.

The Instituto operates two boats, one 60 ft - one about 70 feet, and both are used only for close-in work on the shelf. One of the U.S. - I think Lankford, talked to an FAO man there who said that in the year he has been there, they have had one scientific seminar and 70 political ones. In the fisheries lab, there were 4 Russians who stood and looked embarrassed as we came in. They are working on fish vision and on schooling habits, have been there only a few weeks, & will stay for 6 months and then be replaced by another team.

The monument to the battleship Maine on the Malecon still stands, but the big eagle is gone from the top.

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12)185

"Our little mother" had had a birthday cake for Bob Molnari made – "Felicidades Molnari" it said on top. After dinner, we were bused off into the night to view three government-made documentary films. The best was one made of the first movie a hill town had ever seen. It was extremely well done – as was one on catching crocodiles. The one in the middle I missed completely – all talk & no action.

Afterwards we all went to the Tropicana – one of the world's great nightclubs. It was a 1930-type spectacular and lasted some two hours. There were some 16 of us, and the bill came to 185 pesos – about $ 201 U.S.! We had two bottles of rum and several buckets of ice, soda, and "fresca". – some $ 13 apiece.

Friday, 23 June 1972

Again, today was a work day – all day. I had an 0600 call so I could go over John Antoine's notes of the Working Group – skipped breakfast and went directly to the sessions. At the 1300-1500 break for lunch I skipped lunch in favor of a beer with Johns Antoine & Brucks and a trip to the Post Office to mail some gaudy envelopes.

What earlier I thought was just a missunderstanding about John Antoine's visa to re-enter Mexico, may be a very real problem. I alerted the Swiss Embassy people, and Inhelder has been on it today. Wires have gone off to Washington and to Mexico City, but no solution yet. He is cheerful about it, but he is beginning to worry you. If it is not cleared up today I will skip the trip to the Fisheries Institute and help him if I can.

One of the UNESCO people met a cute girl at the Tropicana last night, and she agreed to meet him here at the Habana Libre for lunch. He told me later that she was extremely up-tight about coming, as the hotel is known as "the police hotel" and Cubans try to stay away from it.

The work of the meeting wound up about 7:30 PM, and all the US-ers retired to 1902 to cut Molnori's cake. At dinner, quite a group of us collected and somehow we began singing. There were the 5 ICAP Cuban girls; the Langeraars, Postma, & van't Hof from the Netherlands, Menny from Trinidad, Scott & Kearey from England, Tapia's from Colombia, the two Angots and Rossignols from France, Ayala & Lankford from Mexico and four NortAmericanos. The songs had an equally international flavor and ranged from Alouetta through Row Row Row Your Boat done "en ronde" to Cuban revolutionary songs about Fidel in the mountains. We had quite an audience collected by the time we quit about 1130 PM. It had been a good evening.

Incidentalia: 50¢ per kilo for beef and 40¢ for chicken. The Deauville has a special shop for Embassy people and

VIPs. René reported that rum there was $2 per bottle but $20 on the open market. At the Habana Libre Hotel, rum drinks run 90¢ and others about $1.25. Housing is either provided free or very cheaply, and telephones & utilities as well as medical and schools are all provided at no cost. Thus a mason making $125 per month can make it OK.

One of the men last eve said that the reason the night clubs are full is that there are no luxury items available to buy. A man gets a permit for 2 pairs of shoes per year, but the shoes are not available in the stores. Long lines queue up for everything - bread to buses to ice cream.

Molinari's john won't stop flushing, and mine won't flush. Mentioning the 250,000 Cubans in Miami, I was told by Severeno that these were not Cubans — most insistent — not Cubans but "counter-revolutionaries".

The newspaper, Granma, daily has anti-Viet Nam articles of EE UU bombing atrocities in Viet Nam and spells Nixon's name with a swastika throughout, instead of the "x".

Most of the CICAR people went out to the Centro Nacional de Investigaciones Cientificas this morning, but I stayed to try and get John Antoine's visa problem squared away. It is now 1245, and it is far from settled. Leeda, Antoine, and I went to the Swiss Embassy about 9:00 AM to see what we could do next. It was closed, and although the man at the door made several calls, there was no word. Walter Haeni's telephone was still out, and there was no answer at Inhelder's home. I left word that I would be in room 1902 at the Habana Libre, and we came back. Haeni has sent messages to State in D.C. and to the U.S Embassy in Mexico City. I alerted Ayala of Mexico that Ambiso as well as the three non-governmental Colombians were all in the same fix. Ayala said this morning that he had called Mexico City and that his office was trying to get the Secretaria de Gobernación to telex or phone the

Mexican Consulate in Havana to grant the visas. It is that Secretaria that must give the word before the Consulate here can move.

Then Inhekker called 1902 to say that he was trying to contact Mexico City and that the telex to Washington was broken down. He also said that the Consulate of Mexico here had told him that if they get the word today, Antolene will get his visa OK.

However, we wanted to be covered, so I sent Lerda e Antonme to Iberia to see if he could get on the Tuesday plane to Madrid. He can then get a Pan-Am flight back from there to Washington or New York. It ~~developed~~ (developed that the cost was to be $325, and he didn't have it. I came up with $190 - saving enough to pay my hotel bill, as they will take only cash - he had about $90, and Molinari came up with the remaining $45. I think we still have enough to pay our hotel bills. Since the Iberia office closes at noon on Saturday, and it was a today or never situation, we waited as long as possible to get the word on a Mexican visa, and at 11:40 we sent Leeda off with our $325 to get Antoine's ticket. When she returned about noon, she was in tears - literally. The ticket was to be $375 - not $325, & we checked to see if the hotel would take American Express Travelers Checks and the answer was no. So we dug deeper. I gave up $20 and so did Molinari, & Altorno made up the rest, and Lerda ran off to inject all our money into the ICAP pipeline in hopes a redeemable ticket Havana-to-Madrid comes out the other end - and in time.

~~Inholder~~ Inholder, called about 1:00PM to say he had finally gotten through to the US ~~Em~~ Embassy in Mexico city. They called the Secretaria de Gubernacion and were told the authorization to the Mexican Consulate in Habana had been sent yesterday. The U.S. asked them to back it up with a phone call. The U.S. in Mexico ~~ath~~ also called the Colombian Embassy to alert them that Ortiz Bedela, Tapias & Hernandez all have the same ~~visa~~ visa problem.

I had already missed the tour in the morning on this visa business, so I told Inhelder I would go with the group to the beach - and did. Some eight of us went with Linda in the Hotel bus to Playa Santa Maria - good sun and a nice beach some 8 or ten miles east of Havana.

Back for a rushed dinner - no answer at Inhelder's - and off to "Cultural Activities". This was a packed theater with a band, singers, a magician of sorts, and a really fine comic. Back to the Habana Libre and the cabaret - 2 mojitos, 3 Tamales, etc. and a pleasant evening of dancing - and 90 more dollars!

One of the Mexicans has become friendly with the floor maid, and every room is in fact bugged. She told him it was in the air conditioner and wrote a note to him, as she was scared even to talk in the room. Scott said the U.S. knows it, and he was so informed.

By the time the cabaret show was over, it was too late to call Inhelder again.

Sunday, 25 June - 1972

As requested, the telephone woke me at 06:3 AM, and we were breakfasted, and in the buses by 0830 & off on the 2½-hour run from Havana to Veradero Beach some 90 plus miles ~~———~~ east of Havana along the north coast.

We ran along the Malecon to the harbor mouth across from Moro Castle, dropped down into the tunnel under the harbor, out the other side, and along the 6-lane road that goes at least to Playa Santa Maria.

Lots of USSR-built jeeps on the road, and an armed & helmeted guard at a military installation, but all seems quiet, and that ride is through some lovely rolling country, along the coastal plain at first, then up into the coastal hills with magnificent views across the palm-studded green inland valley to mountains in the distance. Then down the long grade to the city of Matanzas at the head of Matanzas Bay. Through the town – even more run-down than Havana, and along the flat coastal upraised reef surface, ~~so~~ past the Veradero Airport, where the hijacked planes come in, and out along the long Veradero spit. On the ocean side are several miles of narrow trenches and occasional concrete bunkers – apparently empty.

We piled out of the three Fiat buses at the International Hotel at Veradero Beach – we were all in suits almost at once and across the very clean fine-grained sand into a very clear ocean. Mohitos around the pool later (that's rum & humidity), a good lunch in the ballroom, another swim and we were busing back to Havana. It was nearly 8 PM when we arrived. I called Dihrekther immediately. Yes, the Mexican Consulate had gotten the OT, and when he said they would deliver it at 8:30, we had just been talking about our 8:30 departure by plane, and I interpreted this as the passport would be delivered at the airport just in time to climb aboard.

Then a big flap, as ICRP will need it for at least a 1/2 hr to massage it all somehow. We got Carranza to try to see if he couldn't find a way to get it sooner. Leeda was mad because I felt that if some 30 of us had to wait 4 days for their plane in Mexico City, certainly their plane could't wait one hour for only one of us! About 10:30 PM I to get some telephone numbers of the Mexicans for Carranza to use

called Inhelder & he told me that John's Visa had been delivered to the hotel at 8:30 - this eve! I kept him on the line while Antoine ~~was~~ went down 19 floors, and sure enough, it was there in his box!

We all had a few glasses of "Felicidades Molinari", a night cap, and all left. I packed, left a call for 5:30 AM, as we were supposed to leave the hotel at 6:00 and went to bed. Perhaps we would all get out after all.

Monday, 26 June, 1972

They do take American Express Travelers Checks at the Habana Libre, but not the Am Ex cards. Since our $18/day rate quotation was in Pesos - not dollars, our bills were all more than we had planned for. Most of us had contributed to the $375 for Antonne's Madrid ticket, and all were short. Fortunately BZ had traveling checks, and all were checked out & paid up.

Back into the Fiats, a long wait at the airport, Antone did get his $375 back with his ticket, and we were all paid off in the ready lounge, we all kissed Leeda goodby, and walked out into the sun to cross the tarmack to the same Cubana de Aviacion plane that brought us down - I avoided the bubbling window this time.

Missed earlier: Our tourist map of Cuba has a note below

Guantanamo that reads (in spanish) "Territory illegally occupied by the U.S.M."!

Zeller discovered that children of working mothers can put their ~~[illegible]~~ new children in a free "school" at age 45-days. Some of the women visited one and reported really fine facilities. He added that the several fine-looking marinas we passed en route to Veradero had not one boat in them - possibly a precaution. He discovered from Severano that numerous Cubans have money hidden away, and a vacation at Veradero "is one way the Government can get it back". You can have the cost of your vacation deducted from your salary in installments the following year.

MacGillivray (Netherlands) was walking along Veradero Beach - walking away from the Hotel and was told quite sharply that he was to return" to the recreation area."

Where the Milon theatre was showing a "Film Sovietico" last week this week it is a "Film ~~Norteamericano" and Starring Buster Keaton~~ Norteamericano" starring Buster Keaton. Leeda says they change weekly - USSR-USA- Italy, etc.

Kenny from Trinidad asked one of the better educated ICAP girls - two years of college - about the Maine and was told that the Norteamericans blew it up themselves so they would have an excuse to invade Cuba, and she had never even heard of the Yellow ~~Fete~~ Fever Battle that really made the Caribbean safe to live in.

Most of us felt we were pretty closely watched all the time we were there. ICAP was, of course, one way. The

ICAP people told us they had a room at the hotel to change in but that they went home each night, when in fact the 14th floor is primarily ICAP and all stayed there each night. The evening at the Cabaret in the Habana Libre, two Cuban men took the table just behind the one the ten of us had. They looked most bored and stretched one drink each for the full two-hour show. Lankford — I think it was he — asked a Cuban girl at a nearby table to dance and his Spanish is good enough to know that she said "not while those two are there" and looked their way. We all danced with "our dollies" as Kenny calls the ICAP girls, and left about 2 AM after draining our resources even more. There were others still dancing but we couldn't steep in for long, and left. I was the last out. Once out, I turned around and went back as though to get something at the table. The slighter of the two men was already at the door and stepped aside as I came back in and then went on out. The other man was still trying to get a waiter and looked eager to get out. When I went back out, all our gang was still waiting for the elevators, and the slight man was nowhere to be seen.

It is a very strange environment to work in, and I must admit I felt quite uneasy most of the time.

With the 2-hour switch in time between Cuba and Mexico City, and then back again between Mexico and Miami, I am all fouled up. We had about 3 hours to wait, boarded ~~Aeronaves Mexicana~~ AeroMexico #450 about noon for the flight home. Jake Kenny & Lennox Ballah of Trinidad are with us, and I will put them up at our house tonight, as they have a ~~plane~~ BWI flight to Trinidad tomorrow afternoon.

It has been an interesting trip, but I think I will wait until Cuba is a happier city before I try it again——

REPORT

of the

UNITED STATES DELEGATION

to the

Intergovernmental Oceanographic Commission

Fifth Meeting of the International Coordination Group

for the

Cooperative Investigation of the Caribbean

and Adjacent Regions (CICAR)

Havana, Cuba

June 19 - 23, 1972

Submitted to the SECRETARY OF STATE

Harris B. Stewart, Jr.
Chairman of the Delegation
July 24, 1972

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I. Title of the Conference

The Fifth meeting of the International Coordination Group (ICG) for the Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR) was held in Havana, Cuba, 20-23 June 1972. Plenary and Working Group sessions were all held in the Habana Libre Hotel in downtown Havana. Although the Fifth ICG for CICAR was formally scheduled for 19-24 June, the arrival of almost all delegates was delayed when hurricane Agnes prevented the Cubana de Aviacion plane from arriving in Mexico City where we waited some three days. We finally arrived in Havana on the evening of Monday, 19 June, and the meetings began the following morning. The meetings ended late on the evening of Friday, June 23, but transportation out of Cuba for Mexico City was not available until the following Monday, June 26.

II. Background of the Meeting

The Havana CICAR meeting was the fifth in a series of similar meetings held in other national capitals within the CICAR area; previous ones being held in Curacao, Washington, Mexico City, and Port of Spain. Resolution V-11 of the Fifth Session of the Intergovernmental Oceanographic Commission (IOC) adopted CICAR as an IOC program for international cooperation and established the ICG to coordinate the multi-nation investigation of the oceanographic characteristics of the Caribbean Sea and the adjacent regions. At the Fourth ICG-CICAR Sessions, only the Government of Cuba offered to be the host for the next meeting. UNESCO then entered into an agreement with Cuba by which the host country had to agree to grant entry to accredited delegations from all eligible IOC nations. The U.S. was one such nation, and since we had sent delegations to all previous ICG-CICAR meetings, there was no reason not to do so for this one. It should be pointed out that even though this was the first official U.S. Delegation to visit Cuba in the 11 years that Prime Minister Castro has been in power, the Department of State has reiterated that this in no way reflects any change in official U.S. policy towards the government of Cuba.

III. Agenda as Adopted

There were some minor changes in the order of Agenda items as listed on the Provisional Agenda, primarily to present the several National Programs and the reports of the Assistant International Coordinators and the various Subject Leaders as early as possible on the Agenda. The Agenda as adopted is given in Annex A.

IV. Participation

The full list of participants is given as Annex B to this report. There were ten of the 15 CICAR countries represented (number of representatives from each in parentheses): Colombia (4), Cuba (29), France (1), Mexico (6), Netherlands (3), Trinidad and Tobago (2), U.K. (2), U.S.A. (4), U.S.S.R. (1), Venezuela (6). Also in attendance were the International Coordinator for CICAR, the Assistant International Coordinator for Fisheries, the Assistant Marine Biology Subject Leader, and the Subject Leaders for Tides and for Standard Sections. In addition, there were UNESCO representatives (4) and representatives from the U.N. Food and Agriculture Organization (8), the Scientific Committee on Oceanic Research (1), and the National Oceanographic Data Center - CICAR Data Center (1).

V. United States Delegation

Officially the United States had one Delegate and three Alternate Delegates:

Harris B. Stewart, Jr. (Delegate)
U.S. National Coordinator for CICAR
Atlantic Oceanographic and Meteorological Laboratories
National Oceanic and Atmospheric Administration
Miami, Florida

John W. Antoine (Alternate)
Department of Oceanography
Texas A & M University
College Station, Texas

John T. Brucks (Alternate)
National Marine Fisheries Service (NOAA)
Southeast Fisheries Center
Miami, Florida

Robert L. Molinari (Alternate)
Atlantic Oceanographic and Meteorological Laboratories (NOAA)
Miami, Florida

Two other United States citizens accompanied the U.S. Delegation in their roles as international coordinators:

Rene Cuzon du Rest
CICAR Data Coordinator
National Oceanographic Data Center (NOAA)
Washington, D.C.

Bernard D. Zetler
CICAR Subject Leader for Tides
Atlantic Oceanographic and Meteorological Laboratories (NOAA)
Miami, Florida

VI. Organization of the Conference

The Meeting was chaired by RADM W. Langeraar, International Coordinator for CICAR and Chairman of the Intergovernmental Oceanographic Commission. Robert Lankford of UNESCO was appointed Rapporteur. Within the U.S. Delegation, Antoine covered items related to marine geology and geophysics, Brucks covered the fisheries aspects, Molinari covered for physical oceanography and the CICAR Survey Months, and Stewart covered such items as remained. Most of the work was carried out in plenary sessions, but several working groups were established on an ad hoc basis to carry out the more technical aspects of the conference, and the members of the U.S. Delegation played prominent roles on each of these.

VII. Work of the Conference

Agenda Item 1--Opening of the Session

The meeting was opened by the International Coordinator for CICAR who introduced Dr. Julio le Riverend, Vice Minister of General Education and President of the Academy of Science of Cuba. Dr. le Riverend welcomed the delegates to Cuba and told of Cuba's increasing involvement in the oceans since "the transformations that started to take place on January 1, 1959" and that before that time, "Cuba ignored the sea."

Agenda Item 2--Adoption of the Agenda

See III (above). The Agenda as adopted is given as Annex A to this report.

Agenda Item 3--Notice of Adoption of the Report of the IVth ICG for CICAR

The International Coordinator informed the ICG of the adoption of the report from the IV ICG for CICAR meetings (Trinidad 1971) by the extraordinary ICG for CICAR meeting in Paris on 3 November 1971, pointing out that original recommendations 4.27 and 4.34 were not included in the report as adopted. These dealt with "conduct of oceanographic expeditions in waters under the jurisdiction of coastal states" and were not considered to fall within the purview of CICAR.

Agenda Item 4--CICAR-related Resolutions from the VIIth IOC Session

Resolutions 7.5, 7.6, 7.10, 7.14, 7.15, 7.21, and 7.26 of the VIIth IOC Session were considered by the meeting.

Resolution 7.5 on Mutual Assistance, Education, and Training requests the several IOC international coordination groups to pay special attention to the sea-going education and training needs of developing countries. Capurro (UNESCO) pointed out that this comes under Unnsteinn Stefansson at UNESCO who is trying to identify training centers which could assume new responsibilities in education and training. SCOR and ACMRR are being asked for advice. Carranza (Mexico) said that Mexico is now preparing a U.N. Special Fund request for just such education and training for secondary school teachers. Stewart (U.S.A.) summarized the plans for NOAA-Carib, a CICAR education and training cruise for Caribbean nationals this fall and asked Mamayev (UNESCO) if there were UNESCO funds available to assist these people to get to and from the Discoverer during NOAA-Carib and if Stefansson was the man to whom they should make their formal requests. Both the Chairman and Mamayev praised the NOAA-Carib concept, and the latter replied that on his return to Paris he would see what could be done to assist financially. The point was made, however, that all national sources for such funding should be exhausted before UNESCO aid was requested. At the request of the Chair, the U.S. Delegation prepared a draft resolution which was subsequently adopted (See Resolution 5.6, Annex C to this report).

Resolution 7.6 on Oceanic Data Management was considered, particularly the decision by IOC to use the ROSCOP form as the interim standard form for submitting data from international cooperative expeditions such as CICAR. Cuzon du Rest (CICAR Data Coordinator) pointed out the desirability of CICAR continuing to use the CICARDI forms rather than change to a new format at this stage. The Chairman agreed, and Cuzon du Rest added that the IVth ICG for CICAR had come to the same conclusion and he was glad to see this position reaffirmed. It was decided to continue using the CICARDI forms but to discontinue their use at the conclusion of CICAR.

Resolution 7.10 specifically on CICAR included items on (1) extending CICAR at least until 31 December, 1973, (2) encouraging continued cooperation in the area after CICAR is over, and (3) instructing the IOC Secretary to see how the CICAR Operations Analysis recommended in ICG 4.5 might be carried out. Items (1) and (2) were covered under Agenda Items 8 and 10 respectively of the present meeting; and on item (3) above, the IOC Secretariat representative (Mamayev) said he would report on this item later in the meeting. However, this was never done, and the meetings closed with no further mention of this analytical study.

Resolution 7.14 dealt with the Integrated Global Ocean Station System (IGOSS), and the Chairman summarized the Phase I and Phase II plans for IGOSS. Scott (U.K.) pointed out the importance of the IGOSS Bathy Project and added that CICAR should be willing to accept data from the IGOSS program but not press for anything else. Stewart (U.S.A.) disagreed saying that the IGOSS program would undoubtedly go on long after CICAR is completed and that we should urge that special consideration be given to the Caribbean area and its requirements for the types of data which IGOSS will generate. A resolution to this end was drafted and adopted (See Resolution 5.1, Annex C to this report).

Resolution 7.15 on the Monitoring of Marine Pollution drew little discussion once the Chairman had summarized the recent Stockholm meetings and their results insofar as pollution and the IOC were concerned. It appeared to be the consensus of the ICG that the data being developed by CICAR would be of use to those concerned with pollution monitoring but that we would stick to science in CICAR and leave the pollution problems to the IOC and others.

Resolution 7.21 instructed the IOC Secretariat to explore possibilities for an International Institute of Physical Oceanography. Mamayev (UNESCO) felt that this had nothing to do with CICAR, and the Chairman added that Item 12 of our agenda was the more appropriate place for discussion of this idea.

Resolution 7.26 covered Programs of Major Importance in LEPOR and was noted only, as no action was required on the part of CICAR.

Agenda Item 5--Reports of CICAR National Programs, Assistant International Coordinators, and Subject Leaders

(a) National Programs

The Chairman appointed an *ad hoc* Working Group to review the ten national program documents presented to the meeting, check for gaps and overlaps, evaluate the progress of CICAR as reflected by these reports, and consider the effectiveness of training and education. Stewart (U.S.A.) was named Chairman, and Antoine (U.S.A.) was Rapporteur. The report of this Working Group is included as Annex D,i, of the present report.

Notable was the apparent duplication in the geophysical work just completed in the Lesser Antilles by *HMS Hecla* and that just getting under way aboard *USNS Wilkes* for the U.S. Naval Oceanographic Office. Both the U.K. and U.S.A. National Coordinators sent messages from Havana to their respective governments as soon as the problem was discovered. [The U.S.A. National Coordinator on his return visited the Office of the Oceanographer of the Navy on June 28 and provided them with track charts of the *HMS Hecla*'s work and apprised them of the apparent duplication by the *Wilkes*.]

The Working Group drafted three resolutions that were subsequently adopted but are given here as part of the Working Group Report (Annex D,i) rather than with the other resolutions (Annex C): urging wide advanced disemmination of program information in a standard format, urging Member States to initiate studies of river discharge, and urging further progress in education and training.

Each National Coordinator was requested to prepare a short summary of his National Program for CICAR, and the summaries for Colombia, Cuba, France, Mexico, Netherlands, Trinidad and Tobago, U.K., U.S.A., U.S.S.R., and Venezuela are included as Annex E. Complete reports for Cuba, Mexico, Netherlands, U.K. and U.S.A. from which these summaries were made, are available from the U.S. National Coordinator. Only the brief summaries were available from Colombia, France, Trinidad and Tobago, U.S.S.R., and Venezuela.

(b) Reports of Assistant International Coordinators

i Fisheries--Tapias (Asst. International Coordinator for Fisheries) presented his report on the Program of Fisheries Resources (Annex F,i) which summarizes (in Spanish) work to date on juveniles, eggs, and larvae; on turtles, shrimp, mariculture, and marine pollution. The Chairman appointed an ad hoc Working Group on Fisheries Resources, Marine Biology, Coastal Lagoons, and Mariculture to review in detail the progress to date and to determine what action was required. This group was chaired by Kenny (Trinidad and Tobago) with Tapias (Colombia) as Rapporteur. Brucks was the U.S.A. representative on this Working Group, and their complete report is given as Annex D,iii. It was agreed that the FAO consultation on shrimp stocks held 13-17 June in Havana (U.S.A. unable to be represented) had been successful. The 24-page report on these meetings (in Spanish and on legal size paper) is not included here, but it will be duplicated on request to the U.S. National Coordinator for CICAR for any who have need of it. It was decided by the Working Group that a CICAR Workshop on Shrimp Stocks should be held in early 1973 and that the CICAR Assistant International Coordinator for Fisheries (Tapias of Colombia) would be responsible for organizing it. Brucks (U.S.A.) led the discussions of the bongo and nueston sampling gear and again offered such gear to all qualified CICAR countries and to provide training in their use and--hopefully--to provide training to CICAR workers on the taxonomy of fish eggs, larvae, and juveniles. He further offered to have CICAR participants work aboard the Oregon II (NOAA-NMFS) in February of 1973. The group further decided that Kenneth Sherman (NOAA/NMFS-MARMAP) should be the CICAR project leader in this work, that a plankton net intercomparison was required, and that a plankton workshop should be organized. In the area of pollution in the nearshore areas and in coastal lagoons, it was decided to use the questionnaire method to determine the extent of the problem in the CICAR area (in contrast to the earlier general agreement in plenary session), and Kenny (Trinidad and Tobago) will be responsible for this. (Additional information on the work of this working group has been provided by Brucks (U.S.A.) as an informal, internal NMFS report, and a draft is appended to Annex D,iii.)

ii Meteorology--The Assistant International Coordinator for Meteorology (Ostapoff-U.S.A.) was unable to attend, and his report was given by the U.S.A. Delegate, (Annex F,ii). The GARP Atlantic Tropical Experiment (GATE) was explained and ships of the CICAR countries were encouraged to participate. The availability of meteorological equipment through the Voluntary Assistance Program of WMO was outlined, and CICAR countries were encouraged to apply through their own WMO Permanent Representatives.

(c) Reports of Subject Leaders

i Standard Sections and CICAR Survey Months--Emilsson (Mexico) presented his report as Subject Leader for Standard Sections (Annex F,iii). This report summarizes the considerable number of transects that have been made on the several CICAR standard sections, e.g., section "d_1" across the Yucatan Channel had some 28 repeat occupations, of which 17 were during the April-May 1972 CICAR Survey Month-2. The dates, ships, and operations on these standard sections are also given in Annex F,iii, for research ships from Cuba, Colombia, Netherlands, Mexico, U.S.A., U.S.S.R., and Venezuela. An ad hoc Working Group on CICAR Survey Months was appointed with Van't Hof (Netherlands) as Chairman and Molinari (U.S.A.) as Rapporteur. It was agreed that additional CICAR Survey Months (CSM) would be scheduled, and these were established as a function primarily of ship availability. CSM-3 was rescheduled to run from 15 October to 15 November, 1972, to accommodate participation by research vessels from Colombia, Cuba, Mexico, Netherlands, U.S.A., U.S.S.R., and Venezuela. March and July of 1973 were designated CSM-4 and CSM-5 respectively. Standardization of biological and chemical techniques were recommended as was the appointment of a Subject Leader for Marine Chemistry. It was also recognized that the POSREP system for communication between CICAR ships and the CICAR Operations Center in Curacao had not worked sufficiently well to justify its continuation. The Working Group proposed instead that one month prior to a CICAR cruise the pertinent information be sent to Curacao for dissemination to the CICAR National Coordinators.

ii Tides--The Subject Leader for Tides (Zetler-U.S.A.) summarized his report briefly, for it had been previously distributed by mail. This report is attached as Annex F,iv, and the most recent progress on the CICAR Tides Program is summarized on p. 5 of that report.

As part of the presentation of the report on tides at the plenary session on 21 June, Mr. Zetler indicated a willingness to attempt to arrange for training for any CICAR nations in the preparation of tide predictions. The Cuban delegation, which previously had arranged through UNESCO for such a mission by Dr. Rossiter of the U.K., asked for assistance inasmuch as Dr. Rossiter died last month. After conversations with Adm. de Silva (Mexico) and Capurro (UNESCO), there is now an understanding that UNESCO will arrange for a one-month visit by Dr. Grivel of Mexico to Cuba to provide training in tide predictions.

On 22 June Mr. Zetler was with the group that visited the Instituto de Oceanologia and spent the entire time there discussing tidal procedures with interested members of the staff. Three came to the Habana Libre Hotel the following day for another 1½ hour session during the lunch break. These were Fernando Artamendi Leiva, Evidio Linares, and Rafael Cardenas. They are at a rather primitive stage in routine tide procedures and were unaware of an important 1969 U.S.S.R. paper on tides in the Caribbean despite the reference to it in Zetler's report at Trinidad in 1971. At Capurro's invitation, Zetler agreed to serve as a UNESCO consultant on tides insofar as his position at the University of California permits.

iii Biology--The Subject Leader for Biology (Wickstead-U.K.) was not present. A report on CICAR Marine Biology was given by Angot (UNESCO/Mexico) and is appended as Annex F,v. This report summarizes the biological stations taken during CSM-1 and CSM-2. Problems have been encountered in getting sufficient biological information, and Angot attributes these to difficulties in getting and using Bongo nets, lack of equipment for measuring primary productivity, and the need for technical help in carrying out the recommended observations to provide meaningful data.

iv Geophysics--The Subject Leader for Marine Geophysics (Bott-U.K.) was unable to attend, and Kearey (U.K.) presented the report attached as Annex F,vi. This report summarizes recent geophysical work in the CICAR area with particular emphasis on the work of HMS Hecla.

Agenda Item 6--Report by NODC on Data Received

The CICAR Data Coordinator (Cuzon du Rest-U.S.A.) summarized the NODC Report on Data Received (Annex G). He reported that the CICAR Bibliography Vol. II on Biology and Vol. III on Geology are now ready for printing and would be available this fall. Three copies will go to each National Coordinator and one each to Subject Leaders, etc. Over 6,000 references are contained in these two volumes. He summarized the NODC training courses in which there have been 23 participants to date from 16 countries, with 11 trainees from Central and South American countries. The Chairman asked if these courses would continue and was told that it was uncertain at this time but that funding might become available through the NSF-IDOE program. Emilsson (Mexico) congratulated NODC on this program and urged that it be continued.

Agenda Item 7---CICAR Survey Months

The report of the Subject Leader for Standard Sections (Annex F,iii) and of the *ad hoc* Working Group on CICAR Survey Months convened during the meeting (Annex D,ii) provides the background and most of the discussion and conclusions on this item (see discussion under 5,C,i, above). In plenary the Working Group report was presented by Molinari (U.S.A.). The 15 Oct.-15 Nov. 1972 dates for CSM-3, and the July 1973 date for CSM-5 were accepted, but Cuba wanted CSM-4 switched from March to 15 February to 15 March, and Brucks (U.S.A.) felt his ship schedule could be modified to meet that schedule, so CSM-4 is now 15 February to 15 March, 1973.

Agenda Item 8--Extension of CICAR to the end of 1973

The extension of the field phase of CICAR at least through the end of December 1973 was presented by the Chairman as a *fait accompli* resulting from the Paris meetings in the fall of 1971. Before voicing any objection to this, the U.S. Delegation waited to see the reactions of other delegations. Venezuela pushed for mid-1974, Cuba was "not against an extension," Mexico urged a re-examination after December 1973, and The Netherlands favored the extension. The U.S.A., realizing that the sentiment of the other CICAR countries was totally in favor of continuing, pointed out that our plans were all aimed at a December 1972 termination and that U.S. participation would perforce be on a considerably reduced scale in 1973 (see Plans for 1972-3 section of the U.S. CICAR Program Report to the Havana meetings). Scott (U.K.) said their program would be essentially completed by the end of 1972. The Chairman proposed the idea of restricting somewhat the scope of CICAR adding that his own ideas have changed to the extent that he now favors operations at sea being concentrated on one problem rather than trying to do physical, biological, geophysical, and chemical work from the same ship on one expedition. He feels perhaps CICAR is trying to do too much and that we should concentrate our efforts. Stewart (U.S.A.) proposed that CICAR's various activities be examined with a view to concentrating on those programs that 1) require international cooperation (e.g., synoptic studies), 2) are relevant to the CICAR area's needs (e.g., fisheries), and 3) are areas where CICAR to date has shown we can make a significant contribution (e.g., current studies in the northwest Caribbean and Gulf of Mexico). Although it was decided to continue the field phase of CICAR "at least through December 30, 1973," no decision was made on reducing the present scope of the program.

Agenda Item 9--Publication of Scientific Results and Proposal for CICAR-74 Symposium

After considerable discussion, it was decided that a CICAR Symposium on the scientific results should be held not less than one year following the termination of the field phase. This will go to the IOC as a recommendation (see Annex C, Res. 5.3). Mamayev (UNESCO) felt that UNESCO would be able to publish the results of the symposium, and this would be added to the recommendation to the IOC. He questioned, however, that the symposium would be able to cover all the results from CICAR. Scott (U.K.) pushed for atlases, and the general consensus was to wait and see if enough data for meaningful atlases were generated. It was decided that National Collected CICAR Reprints would be the route to go, with each country being responsible for putting out its own volume(s), and a resolution to this effect was adopted (Annex C, Res. 5.2). Capurro (UNESCO) and Stewart (U.S.A.) both added that UNESCO and possibly FAO should participate in the costs for publishing the results of this cooperative international expedition, and the Chairman decided to leave this aspect to the IOC.

Agenda Item 10--Post-CICAR Cooperation in the Caribbean

Bruchs (U.S.A.) started the discussion with a description of the Marine Resources Monitoring, Assessment, and Prediction (MARMAP) program of NOAA emphasizing that this would be a *de facto* continuation of CICAR-type cooperation among Caribbean countries and that the participation of the CICAR countries in the Caribbean was in fact required if MARMAP was to be a total success. Phase I is an ichthyoplankton and environmental survey operational test phase and will run for 15 months. Phase II in 1974 will concentrate on groundfish on the shelf, and Phase III on pelagic fishes offshore. The NOAA/NMFS Southeast Fisheries Center at Miami, Florida, will be responsible for MARMAP in the CICAR region, and education and training as well as some standardized sampling equipment now used in CICAR will be made available to participating ships. This program is one mechanism whereby cooperation among CICAR countries can be continued post-CICAR.

Langeraar (Chairman) felt that circulation studies, coastal lagoons, and mariculture would be subjects of continuing interest post-CICAR, and Santander (CUBA) added that oceanographic observations on standard sections, studies on the movements of shrimp, and mariculture and coastal lagoons were areas of high priority. Ortiz Borda

(Venezuela) added that at least six CICAR countries are involved in mariculture but that this should not be included in CICAR and the Venezuelan offer to host a session on Caribbean mariculture should be accepted. Stewart (U.S.A.) used this agenda item to again push for cooperation in GATE as another mechanism to continue cooperation at sea among the Caribbean nations.

No final decision was reached, rather it was decided that a seven-man group of experts would be appointed to present proposals to the IOC for future cooperation in the Caribbean area (See Annex C, Res. 5.5).

Agenda Item 11--A Central Spanish-speaking Meteorological Station

Acting on behalf of the WMO representative (Ostapoff-U.S.A.) who could not attend, the U.S.A. delegate presented the WMO position on this item. It was pointed out that a number of comparable facilities already exist in the CICAR area at the St. Jose University in Costa Rica, the Central University and Oriente University in Venezuela, Federal University of Brazilia, University of Rio de Janeiro, at UNAM in Mexico City, and at several U.S. universities. WMO is now trying to restructure their educational procedures to provide education at higher levels for persons who have had some experience in the national weather service, with these studies stressing maritime meteorology. It was stressed that any national interest in such a station should be channeled not through IOC channels but through national Permanent Representatives to WMO and directed to Canziani at the Latin American Desk of WMO in Geneva. The Chairman summarized by saying that there seemed to be quite a few such stations already but that revision of the present system is always possible. Santander (Cuba) felt that more information was needed and added that Cuba was well aware of this need and had just added a Cuban Meteorological Institute with courses available "at four levels." He referred to WMO Circular Letter 50 and provided a 16-page report on the four levels of training for Cuban meteorologists. This report is available at the Office of the U.S. National Coordinator and copies can be made on request for those interested.

The Chairman asked that the Assistant International Coordinator for Meteorology (Ostapoff-U.S.A.) report in writing as soon as possible on the exact viewpoints of WMO in regard to this item and how WMO might envision a reorganization of their present system for education and training. He further asked the CICAR National Coordinators to inform Ostapoff on what now exists in each country for the training of meteorologists. He wanted to know what the route to WMO would be and how they could help. Stewart (U.S.A.) reiterated that the route was through each nation's Permanent Representative to WMO and to Canziani in Geneva. The other request, he said, would be passed to Ostapoff on his return from sea.

Agenda Item 12--A Regional Institute for Physical Oceanography

This item became quite confused at the outset. Langeraar reported that the Stockholm Conference recommended locating a tropical marine institute to carry out research, education, and training. Hernandez (Colombia) said that the recent Foreign Ministers Conference at Santa Domingo had also agreed to establish an institute, and when Santander (Cuba) said Cuba was not at the Santo Domingo meetings, the Chair ruled that further references to that meeting would not be considered at this one. Capurro (UNESCO) added that an institute of tropical oceanography is also a GELTSPAP project and the GIPME has also recommended such an institute for pollution studies, and the IOC was asking tropical laboratories if they would be willing to assume such responsibilities, and a team will be organized to visit any such labs. Atilano (Venezuela) suggested CICAR offer to assist the working groups set up by the Santo Domingo Conference to look into this. Santander (Cuba) disagreed, because Cuba was not involved in that one. A long discussion ensued on new institute vs. strengthening the existing ones. It developed that much of the confusion arose because the English-speaking delegates considered "institute" to be as much as anything an organizational term; whereas in Spanish, "instituto" definitely implies a physical building. Recommendation 5.4 (See Annex C) was drafted; but on its presentation in plenary, the old argument on "instituto" started again. The final wording was left to the Chairman, but the meeting did agree to inform the IOC that the Vth ICG for CICAR felt that the Stockholm Conference institute, if established, should be established within the CICAR area.

Agenda Item 13-Any New Business

Questions had been raised on bongo net usage, and Brucks (U.S.A.) said NMFS was preparing additional information on their use. The Chairman noted the problem of sending different amounts of each CICAR Circular Letter to each National Coordinator. From now on each will get only one, and that will have to be duplicated for such internal national distribution as is required. Stewart (U.S.A.) brought up the problem of absent subject leaders who had not even sent in reports: Marine Biology (Wickstead-U.K.), Geology (Robinson-Jamaica), and Circulation Studies (Cochrane-U.S.A.) and suggested that these roles either be dropped or the present incumbents replaced. Langeraar volunteered to write accepting Wickstead's proffered resignation as Subject Leader for Marine Biology, will request a report on geology from Robinson (Jamaica), Subject Leader for Geology, and will write Cochrane at Texas A & M asking if he wants to continue as Subject Leader for Circulation Studies and, if not, whom he would suggest as a replacement.

Agenda Item 14--Time and Place of Next Meeting

Both Colombia and Venezuela offered to act as host for the VIth CICAR ICG meeting. They worked it out between the two delegations, and Venezuela will be host to the post-CICAR symposium with Cartagena, Colombia, as the site for the VIth CICAR session. The meeting will be held sometime during the second quarter of 1973.

VIII. Conclusions

(1) CICAR is in good shape as a cooperative international program, and the increasing degree of national participation in the CICAR Survey Months is a healthy sign.

(2) The continuation of the field program at least through December 31, 1973, even with considerably reduced U.S. and U.K. participation, will be of use scientifically and should benefit the several Caribbean nations participating--at least in part through increased national support of their oceanography and fisheries programs because of their association with this cooperative international program.

IX. Recommendations and Action Items

(1) Somehow the resolution from the Trinidad meeting calling on the IOC Secretariat to report on plans for the Operations Research Study of CICAR (Res. 4.5) was overlooked at the Havana meeting. This should be pointed out to the International Coordinator and scheduled as an agenda item for the Cartagena meeting in 1973.

(2) The U.S. National Coordinator should inform all U.S. CICAR participants that the POSREPS communications

mechanism has been terminated and that advance cruise plans are to be sent to Curacao for further distribution (see Annex D,i).

(3) He should also inform participants of the dates of CSM-3,-4,-5 and urge participation.

(4) NOAA-NMFS should be asked to modify its MARMAP cruise schedule so that these operations will be in the CICAR area during CSM-4 (15 Feb. to 15 March, 1973).

(5) The U.S. National Coordinator should inform U.S. participants of the need to provide copies of published articles for eventual inclusion in CICAR U.S. Collected Reprints and should investigate possible publication routes and sources of support (see Annex C, Res. 5.2 and discussion of Agenda Item 9).

(6) The Assistant International Coordinator for Meteorology must be alerted to the need to obtain information from WMO on their views on education and training of meteorologists in the Caribbean area (see discussion of Agenda Item 11).

(7) U.S. participants must be informed of the extension of the field phase of CICAR at least through December of 1973 and encouraged to maintain their research interests and participation in CICAR. (Items 1-7 above will be handled by the U.S. National Coordinator.)

X. Additional Observations

(1) Andres Mena Millar, Director of the Centro de Investigaciones Pesqueras, in Havana provided the U.S.A. Delegation with tags recovered from a turtle, a shark, and a bird together with the requested information on date and place of capture, etc. These have since been forwarded to the appropriate tagging agencies in this country whose addresses appeared on the tags.

(2) The U.S.S.R. participated with one delegate, and he did not enter into the discussions at all. The only information presented on the U.S.S.R. program in CICAR is the document included here in Annex E.

(3) The Mexican Sorting Center is now in operation at the University of Mexico (UNAM) with Biologist Roberto Perez Rodriguez as Director and Dr. Marta Vannucci (UNESCO) as International Curator. The address is:

Centro de Preclasificacion Oceanica de Mexico
c/o Instituto de Biologia
Universidad Nacional Autonoma de Mexico
Apartado Postal 70-233
Mexico 20, D.F., Mexico

(4) Moulter of the U.S. and Van Straaten of the Netherlands both plan work on Saba Bank in 1972-3, and Moulter has been told of Van Straaten's work.

(5) Menzies of FSU who is planning biological work in the Cayman Trough has been informed of the U.K. interest in the Cayman Trough hadal fauna and of the tentative plans of the RRS Shackelton in this area.

(6) On 28 June a complete "debriefing" on the trip was presented to the Cuban Desk of the Department of State, and an informal written report was delivered to them.

(7) Personnel of the Foreign Interests Group at the Swiss Embassy in Havana were most helpful. In particular Mr. Haeni and Mr. Inhelder went out of their way and worked nights and on the weekend to fix up a serious problem with Antoine's Mexican re-entry visa. Their assistance and courtesy are greatly appreciated by the U.S. Delegation, and the Department of State is hereby informed that the U.S. interests in Havana are in good hands.

DISTRIBUTION

Department of State, Office of International Conferences (12)
U. S. Participants in the Havana Meeting
- J. Antoine
- J. Brucks
- R. Cuzon du Rest
- R. Molinari
- F. Ostapoff
- H. Stewart
- B. Zetler

National Oceanic and Atmospheric Administration
- R. White (A)
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- P. Roedel (NMFS)
- A. Powell (NOS)
- T. Austin (EDS)
- H. Bullis (NMFS/SFC)
- K. Sherman (NMFS/MARMAP)
- D. Hansen (ERL/AOML)
- G. Keller (ERL/AOML)
- M. Hardison (EDS/AOML)
- C. O. DISCOVERER

U. S. Agencies and Institutions Participating in CICAR
- U. S. Coast Guard (Broida)
- U. S. Geological Survey (Garrison)
- National Science Foundation - IDOE (Jennings)
- State Department - COA (Sullivan)
- Oceanographer of the Navy (Snyder) (2)
- Naval Oceanographic Office (Purkrabek)
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- Lamont-Doherty Geological Observatory (Gerard)
- Duke University (Newton)
- University of North Carolina (Watkins)
- Florida State University (Jones)
- Florida SUSIO (Smith)
- University of Miami (Bader)
- Texas A & M University (Cochrane)
- Scripps Institution of Oceanography (Curray)
- Puerto Rico Department of Agriculture (Juhl)
- Caribbean Research Institute, V. I. (Towle)

ANNEXES

ANNEX A

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

International Coordination Group for the
Cooperative Investigations of the Caribbean and Adjacent Regions
(CICAR)

(Fifth Session, Havana, Cuba, 19 - 24 June 1972)

AGENDA

1. Opening of the Session by the International Coordinator.

2. Adoption of the Agenda.

3. Notice of the adoption of the report of the 4th ICG/CICAR Session (Trinidad and Tobago, 29 March-3 April 1971) during the extraordinary ICG/CICAR meeting in Paris (3 November 1971).

4. Discussion of relevant resolutions of the VII th Session of IOC.

5. National programmes and reports of the International Co-ordinator, Assistant International Coordinators and Subject Leaders.

6. Report by NODC on data received.

7. CICAR Survey Months (CSM's)

   a. CSM 1
   b. CSM 2 and 3 (additional observations)
   c. additional CSM's.

8. Extension of CICAR to end of 1973.

9. Discussion on the publication of scientific results. Proposal for CICAR-74 Symposium.

10. Continuation of cooperative work in CICAR area after termination of the project.

11. A central Spanish-speaking meteorological station.

12. A regional institute for physical oceanography.

13. Any other business.

14. Time and place of the next meeting.

ANNEX B

LISTA DE PARTICIPANTES/LIST OF PARTICIPANTS

PAIS/COUNTRY	NOMBRE Y DIRECCION/NAME AND ADDRESS	STATUS
BRASIL/BRAZIL	N O T R E P R E S E N T E D	
COLOMBIA	JUAN P. RAIRAN HERNANDEZ Oficial Naval Comisión de Oceanografía	Coordinador Nacional
	LUIS ORTIZ BORDA Decano de la Facultad de Ciencias del Mar Universidad de Bogotá	
	EDGAR JAIME HERNANDEZ División Oceanografía Dirección General Marítima y Portuaria	
	CONSTANTINO TAPIA RUEDA Proyecto de Desarrollo de Pesca Marina (INDEREMA FAO) Ap Aereo 17778 Bogotá	Coordinador Internacional Asistente para Pesquerías
CUBA	MARCOS SANTANDER BAEZ Director de Asistencia Técnica Instituto Nacional de la Pesca	Coordinador Nacional
	RODOLFO CLARO MADRUGA Director del Instituto de Oceanología	Coordinador Nac Asistente
	DALIA SALABARRIA FERNANDEZ Instituto de Oceanología Investigador	Coordinador Nac Asistente
	JUAN A. VAREA RIVERO Centro de Investigaciones Pesqueras Investigador	Coordinador Nac Asistente
	JOAQUIN FERNANDEZ JAGRENAUX Director de Relaciones Internacionales Instituto Nacional de la Pesca	Coordinador Nac Asistente
	JOSE R. DIAZ ARIAS Instituto de Meteorología Academia de Ciencias	Coordinador Nac. Asistente p. Meteorología

	ANDRES MENA MILLAR Director del Centro de Investiga ciones Pesqueras	Coordinador Nac Asistente
	CARLOS GARCIA Centro de Investigaciones Pesqueras	Observador
	SERGUEI BULANENKOW Centro de Investigaciones Pesqueras	Observador

PAIS/COUNTRY	NOMBRE Y DIRECCION/NAME AND ADDRESS	STATUS
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	MAR JUAREZ Centro de Investigaciones Pesqueras	Observador
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	ARMANDO OLAECHEA Centro de Investigaciones Pesqueras	Observador
	CARLOS A. CARLES MARTIN Centro de Investigaciones Pesqueras	Observador
	JOSE TOLEDO Centro de Investigaciones Pesqueras	Observador
	RAUL COYULA Centro de Investigaciones Pesqueras	O Observador
	MANUEL ORTIZ Centro de Investigaciones Pesqueras	Observador
	MARIA LLUIS RIERA Instituto de Oceanología	Observador
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FEDERAL REPUBLIC OF GERMANY/REPUBLICA FEDERAL ALEMANA	N O T R E P R E S E N T E D	
FRANCIA/FRANCE	MARTIAL ROSSIGNOL Director Centro Investigaciones ORSTOM	Coordinador Nacional
GUATEMALA	N O T R E P R E S E N T E D	
JAMAICA	N O T R E P R E S E N T E D	

MEXICO	AGUSTIN AYALA CASTAÑARES Director Instituto de Biología Universidad Nacional Autónoma de México	Coordinador Nacional
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PAIS/COUNTRY	NOMBRE Y DIRECCION/NAME AND ADDRESS	STATUS
PAISES BAJOS NETHERLANDS	HENDRIK POSTMA Instituto de Investigaciones Marinas Texel	Coordinador Nacional
	HENRY J MAC GILLAVRY Instituto de Geología Amsterdam	Coordinador Nacional Asistente
	TOM VAN'T HOF Ministerio de Educación y Ciencias Curazao	Coordinador Internacional Operaciones CICAR

PANAMA	N O T R E P R E S E N T E D	
TRINIDAD TOBAGO	JULIAN S. KENNY Universidad West Indies Departamento de Ciencias Biológicas St Augustine	Coordinador Nacional
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	ROBERT L. MOLINARI Oceanógrafo Físico Atlantic Oceanographic and Meteorological Laboratories Administración Nacional Ocean~~ográfica~~ ico y Atmosférica (NOAA) Miami, Florida	~~Coordinador Nacional Asistente~~
	JOHN ANTOINE Universidad A y M de Texas Dept. of Oceanography College Station, Texas	~~Coordinador Nacional Asistente~~

PAIS/COUNTRY	NOMBRE Y DIRECCION/NAME AND ADDRESS	STATUS
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	PABLO MANDAZEN SOTO Presidente Fundación La Salle Caracas 101, Apdo. 8150	Coordinador Nacional Asistente
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COORDINADORES INTERNACIONALES DE LAS ICCRA
INTERNATIONAL CO-ORDINATORS FOR CICAR

Contralmirante WIJMAND LANGERAAR Museo Oceanográfico Mónaco	Coordinador Internacional
MICHEL ANGOT Experto Proyecto UNESCO/MEXICO	Director Científico Asistente para Biología Marina

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ORGANISMOS ESPECIALIZADOS DE LAS NACIONES UNIDAS
UNITED NATIONS SPECIALIZED AGENCIES

Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura
United Nations Educational, Scientific and Cultural Organization (UNESCO)

O.I. MAMAYEV Secretario adjunto del COI UNESCO - París	Representante
Cap. LUIS CAPURRO Secretario adjunto COI UNESCO - París	Representante

R.R. LANKFORD
Experto en Geología Marina
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STIG H. FONSELIUS
Experto UNESCO

Organización de las Naciones Unidas para la Agricultura y la Alimentaci
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PAIS/COUNTRY	NOMBRE Y DIRECCION/NAME AND ADDRESS	STATUS
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	JOHN G. SIMPSON Director Internacional Proyecto de Investigación y Desarrollo Pesquero Venezuela	
	M. NIKOLIĈ Director Proyecto Desarrollo Pesquero UNDP/FAO/CUB 4	
	ARTHUR C. SIMPSON Biólogo pesquero Proyecto Desarrollo Pesquero UNDP/FAO/CUB 4	
	YOSHIMASA ENOMOTO Experto FAO/Cuba Fishery Biologist (Mariculture in coastal lagoons)	

Organización Meteorológica Mundial
World Meteorological Organization (WMO) - NOT REPRESENTED

Comité Científico de Investigaciones Oceánicas
Scientific Committee on Oceanic Research (SCOR)

H. POSTMA — Observador
Instituto de Investigaciones
Marinas
Texel

Centro Nacional de Datos Oceanográficos
National Oceanographic Data Centre

R. P. CUZON du REST — Coordinador de Datos CICAR
Centro Nacional de Datos
Oceanográficos NOAA

IMCO - NOT REPRESENTED

UNITED NATIONS - NOT REPRESENTED

ANNEX C

DRAFT RECOMMENDATION

The Fifth meeting of the International Coordination Group for CICAR:

Noting the progress being made in the IOC Programme for IGOSS, particularly in the BATHY Pilot Project,

Realizing the potential importance of IGOSS data to the countries in the Caribbean and adjacent regions during and after CICAR,

Requests the International Coordinator for CICAR to convey to the IGOSS Working Committee the consensus of the Fifth meeting of the ICG for CICAR that special consideration be given to the Caribbean as the site for IGOSS instrumented buoys for the following reasons:

1) The Caribbean each year is subjected to destructive hurricanes whose tracks could be more accurately forecast if data from IGOSS instrumented buoys were available to the forecasters.

2) Local weather forecasts within the Caribbean have been immensely improved by the data from the satellite programme, but these forecasts still suffer from the lack of meteorological data in the oceanic areas. The IGOSS programme would provide badly needed meteorological and sea surface data to those concerned with providing weather and sea state forecasts in the Caribbean region.

3) CICAR has provided new understanding of the circulation in the Caribbean Sea, but the availability of IGOSS data for research purposes will allow oceanographers to monitor the environmental variations resulting from variations in the circulation pattern and to continue the research started as part of CICAR.

4) The living resources of the Caribbean constitute an essential element of the regional economy, and the environmental data to result from the IGOSS programme will be most useful to those involved in the management and recovery of these resources.

V.2

DRAFT RECOMMENDATION

The International Co-ordination Group:

Believing that it is important to ensure that the results emanating from the CICAR project be made fully available to all participants, in particular the developing nations in the area;

Requests member-states to issue bound Reprint Volumes in due course of all their national papers resulting from work carried out during the Cooperative Investigation;

Requests further that Member-States consider the possibility of supporting the preparation and production of atlases for easier display of data obtained during CICAR, including both financial and/or scientific advisory assistance;

Recommends to the Commission that financial support be provided where needed to supplement the national efforts of the participating Member-States.

Recalling its recommendation 4.33 made at the Vth meeting of the ICG for CICAR

5.3

DRAFT RECOMMENDATION

The International Co-ordination Group:

Considers that it is highly desirable to terminate the CICAR project with an International Symposium in order to provide a forum for presentation of papers and an exchange of views on the work carried out during the Co-operative Investigation, for the lasting benefit of developing nations in the area;

Proposes that such a symposium should be held not less than one year after the completion of the CICAR project, in order to enable results of investigations to be worked up fully before presentation;

Requests Member-States to consider the proposal carefully, including venue, timing and financial implications, so that the matter can be discussed more fully at the 6th Session of the I.C.G. and practical arrangements started immediately thereafter;

Recommends that the Commission approve the holding of a Symposium and take steps to obtain the necessary support, including assistance from UNESCO, FAO and WMO.

5.4

RECOMMENDATION 5.4

A REGIONAL MARINE INSTITUTE

The International Coordination Group,

1. Being convinced
(reworded) of the desirability of creating a Regional Marine Institute in the Caribbean area carrying out research as well as education and training;

2. Having taken notice
of the last paragraph of Recommendation 236 adopted at the United Nations Conference in the Human Environment (see document A/CONF. 48/8 page 100) where it is recommended that the Secretary General of the United Nations ensure that IOC, with other intergovernmental agencies, explore the possibilities of establishing an international institute for tropical marine studies, which would undertake training as well as research;

3. Being of the opinion that

a. (reworded) a tropical marine institute of international scope should be developed by making all possible use of already existing facilities in a certain area --through adequate support and development where needed-- rather than through building a completely new and very expensive additional unit which would, moreover, drain scientific personnel from existing institutes,

b. a number of existing marine research facilities in the CICAR area already are well placed to contribute to the concept of an international institute for tropical marine studies and education, but that careful consideration must be given to necessary additional capabilities or improving existing ones,

c. it would be worthwhile to consider the needs and desirability of strengthening the overall capability of such a composite international institute, inter alia by providing assistance from a small number of highly competent mobile task groups;

Decides

to inform IOC of its unanimous opinion that the international institute for tropical marine studies which would undertake training as well as research --as proposed by the United Nations Conference on the Human Environment-- should be established in the CICAR area.

Recommends

that IOC, when studying this question, take account of the views of this ICG as laid down in the third preambular paragraph.

RECOMMENDATION 5.5

CONTINUATION OF COOPERATIVE WORK IN CICAR AREA

The International Coordination Group,

1. Recalling

   a. its Recommendations 4.1 and 4.6 with regard to establishing the basis for further international coordination in the CICAR area, so as to continue the form of international exchange and collaboration after the termination of CICAR;

   b. Resolution 7.10 adopted at the seventh I.O.C. Session in which the ICG for CICAR is requested to study the mechanisms needed to ensure that such coordination will be effective;

   c. the consensus ~~of opinion~~ that emerged from the discussions during the fifth meeting of the ICG for CICAR with regard to continued cooperation in the area;

2. Noting that

   a. current and proposed marine science activities in the CICAR area cover a wide range of subjects and, varying greatly in operational characteristics, call for a diversity of measures at the international level;

   b. after termination of the field programme, continued marine science activities and the associated training and education in the CICAR area require rigorous application of a set of operational criteria so as to enhance fruitful and really effective cooperation;

   c. there exists a varied degree of interest in the different projects for marine science activities at present being carried out in the area;

3. Being convinced that

a. the mechanism needed to ensure effective coordination of, and cooperation in, future marine science and training activities is dependant on the projects selected and on the amount of interest they will receive;

b. effective future cooperation and coordination can only be achieved on projects that:

1. require international cooperation or the continued exchange of information and results obtained,

2. have a high probability of providing near-future beneficial results,

3. do not require the continued availability of very large vessels or of highly sophisticated and expensive equipment and instrumentation, and

4. provide good opportunities for training and education on the scientific and technical levels of marine activities.

Decides that

1. a small group of experts be established consisting of not more than ~~five~~ seven persons ~~living in the CICAR area~~ which shall present its proposals for future cooperative marine activities to the ~~international coordinator~~ IOC for further distribution to all CICAR members, ~~covering the following subjects:~~ taking into account all the related documents from the UP IOC for CICAR

   a - ~~the possibilities and desirability to continue circulation studies and oceanic observations in standard sections, with due regard to the possibilities embodied in the IGOSS and GATE projects,~~

   b - ~~the possibilities of continuing or expanding the work on shrimps and/or other commercial species,~~

   c - ~~the desirability of stimulating studies of coastal lagoons on an internationally coordinated national basis, with particular emphasis on mariculture and the study of environmental management and conservation,~~

   d - the continued exchange of information or results obtained.

   e - improvement of the possibilities for training and education in all levels of marine activities, and the most suitable and least expensive form of mechanism needed to start the necessary coordination work based on the projects for further study and collaboration selected.

2. this small group of experts shall ~~and comment~~ be appointed by IOC. The group will elect its own Chairman. ~~have the Assistant International Coordinator for Fisheries as its Chairman.~~

3. the work of this small group of experts shall be iniciated by correspondence and that its results shall be made available to the INTCO before 1 January 1973.

Recommends that

ask its advisory bodies each to nominate one member to the gp of experts and to

1. I.O.C. at its earliest convenience give close attention to the problem of enabling this group of experts to carry out its duties, inter alia by making available the necessary funds for travel and daily allowances,

2. I.O.C. sollicit financial and technical support for the continued cooperative work in the CICAR area from interested international agencies.

DRAFT RECOMMENDATION

The Vth meeting of the International Coordination Group for CICAR

Responding positively to IOC resolution 7.5 on mutual assistance, education and training which stated inter alia: "Requests the international coordination groups on the cooperative investigations to pay special attention to the needs of developing countries participating in those investigations, especially with a view to the possibilities of sea-going education and training",

Noting the plans of the USA for a CICAR education and training cruise aboard the NOAA DISCOVERER October-December 1972, and that funds to allow travel of CICAR nationals to participate in NOAA-Carib may not be readily available,

Commends the USA for undertaking this CICAR education and training cruise, and

Encourages the CICAR National Coordinators of Mexico, Jamaica, Trinidad and Tobago, Venezuela and Colombia to

a) formulate their research plans for the time at sea aboard DISCOVERER alloted to their country and to forward such plans by 1 August 1972 to the NOAA-Carib Coordinator (H.B. Stewart), NOAA-AOML, Miami, Florida and

b) to investigate all possible national sources for funds to support the travel of participants to and from the DISCOVERER, and

Requests the IOC Secretariat to bring this project to the attention of the proper authorities within UNESCO with the request that UNESCO attempt to provide funds in those cases where national funds are insufficient to allow full advantage to be taken of this opportunity for at-sea education and training in marine science.

ANNEX D

REPORT OF THE WORKING GROUP ON NATIONAL REPORTS AND PROGRAMMES

The following persons served on the Working Group:

H. Stewart (USA) Chairman
J. Antoine (USA) Rapporteur
A. Ayala (Mexico)
L. Ballah (Trinidad & Tobago)
D. Fuentes (Mexico)
J. Galavis (Venezuela)
P. Keary (United Kingdom)
H. MacGillavry (Netherlands)
J. Rairan (Colombia)
M. Santander (Cuba)
D. Scott (United Kingdom)

The Working Group heard summaries of the national reports of Colombia, Cuba, France, Mexico, Netherlands, United Kingdom, United States of America and Venezuela. These reports were reviewed within the terms of reference suggested by the ICG for CICAR with a view to

a) avoiding gaps and duplications and reporting eventual measures to remedy the situation

b) evaluating the degree of implementation these reports represent with respect to the objectives previously selected for CICAR, and

c) considering the effectiveness of the projects for training and education past and proposed.

Of the nations participating and those of in CICAR, no reports was received from Brazil or Jamaica, Trinidad & Tobago and ~~or~~ USSR were received too late for review. ~~and~~ the Working Group brings this to the attention of the ICG with the request that Brazil and Jamaica ~~these nations~~ be urged to submit their national reports at the earliest possible moment.

During the review, several programme overlaps were noted. In some cases these duplications are desireable, and the Working Group merely wanted to insure that the investigators were aware of the other work going on, e g., Multer of the USA and Von Stratten of the Netherlands are both to be working on Saba Bank, and the green turtle is being studied by researchers from Cuba, Mexico, USA, and Venezuela. In the case of the apparent undesireable duplication of the planned geophysical work of the USNS Wilkes (USA) and the just completed geophysical work of HMS Hecla (UK) in the same area, both governments have been informed by wire, and the UK National Coordinator will visit Washington next week to confer with Navy representatives.

It was also noted from the programme reviews that all institutions that had been able to participate in the projects of other CICAR nations had benefited greatly. Realizing the importance of these points, the Working Group prepared the following draft resolution for consideration by the ICG:

Draft Recommendation

The International Coordination Group:

Recognizing that many opportunities for integration and co-ordination of CICAR projects, and for participation by scientists in the projects of other countries, can be missed by poor advance dissemination of programmes and ship cruises, both internationally and nationally between laboratories and institutions:

Urges ~~Member States~~ National Coordinators to: i) ~~submit~~ circulate regular reports in a brief standard format (as given below*), in advance of each meeting of the ICG; and

* Reports should be bilingual (Spanish and English) and include statements on completed projects and future activities. The following information on planned programmes is required in as complete a form as possible:

a) Project;
b) Ship(s) and other facilities;
c) Institution.
d) Chief Scientist and address;
e) Track Chart or Geographical Area;
f) Dates of Start and Finish of Project;
g) Objectives.
h) Available accommodation for visitors.

the International Coordinator, Assist. International Coordinators, the Specialists of Centres, the Coordinator

and NODC

ii) circulate information on planned cruises and projects during the planning stages to National Co-ordinators and Subject Leaders, in order to provide an opportunity for Member States to propose participation by their scientists and observers.

Requests the Assistant International Coordinators and Subject Leaders to circulate reports on achievements in their disciplines, collected in accordance with Circular Letter Nº42, in advance of each meeting of the ICG.

The national programme reviews also indicated that the high priority project of monitoring river discharges has been largely ignored by all countries other than Mexico and Venezuela. Due to the extreme importance of these studies, the following draft recommendation was prepared ~~drafted~~ by the Working Group for consideration by the ICG:

Draft Recommendation

The International Coordination Group:

<u>Recognizing</u> that the monitoring of river discharges is now proving to be of increasing importance in the field of marine pollution,
Noting the IOC effort through RIOS (River Inputs to Ocean Systems)

<u>Wishes to reinforce</u> statements made at earlier meetings of the ICG on the need for such projects and their coordination and standardization, and

<u>Urges</u> member states to initiate studies of this type.

Noting the many references in the various national programme reports to the achievements to date in the area of education and training, the Working Group prepared the following recommendation to the ICG:

<u>Draft Recommendation</u>

The International Coordination Group:

<u>Recognizing</u> the importance of Training and Education and

<u>Noting</u> the progress achieved in 1971.

<u>Considering</u> that there is still a strong requirement for further efforts to be made in this field;

<u>Draws the attention</u> of Member States and International Organizations once again to Recommendation 4.31, recommendations (a) to (l); and

<u>Requests</u> that every effort be made to achieve further progress along the lines presented in detail at the 4th Session of the ICG.

The Working Group noted with pleasure that in many countries the very existance of CICAR has apparently resulted in much closer national coordination and cooperation among marine science activities as well as establishing close international associations that will allow continuing cooperation in the years ahead.

The review of the national reports received to date indicates that much progress has been made toward achieving the goals of CICAR.

REPORT ON THE CICAR SURVEY MONTH WORKING GROUP

Terms of Reference for the C.S.M. Working Group

1. Bring up to date Dr. Emilsson's Report on C.S.M. 1 and 2.

2. Assist Dr. Angot in preparing a report on C.S.M. 2 Biological Stations.

3. Give consideration to the most effective period for C.S.M. 3 taking into account ship's availability.

4. Consider the follow-up of C.S.M.'s after C.S.M. 3.

5. Review the effectiveness of and suggest improvements in scientific data to be collected during C.S.M.'s.

6. Suggest improvements to the system of regional communication.

7. Consider the offer of the USA delegation to enhance standardization of equipment and methodology and the necessary technical training, and report on its possible implications.

8. Consider the desirability of, and organizational framework to, having Dr. Marta Vanucci, Curator of the International Collection of the Oceanic Sorting Center of Mexico, directly concerned with marine biology in general and Biological Stations on Standard Sections in particular.

The meeting of the CSM working group was convened at 9:24, 21 June 1972 by the Chairman, Mr. Van't Hof. The rapporteur was Dr. Molinari. Present as delegates were: Hernández of Colombia; Dalia Salabarría, Mena and Arias of Cuba; Silva-López of México; Van't Hof of the Netherlands; Molinari of the USA; Evlanov of the USSR; and Pérez-Nieto of Venezuela. The UNESCO, Emilsson, Angot and Fonselius attended, and as observers Garcia, Bulanencov, Riera and González were present. The following items from the Terms of Reference were considered.

Item 1

The report of Dr. Emilsson on CSM 1 and 2 was considered. The delegates of Colombia, Cuba, Mexico, USA, USSR and Venezuela indicated that the listing of their activities was accurate and complete.

Item 2

The following replies to Dr. Angot's request for information on the occupation of standard biological stations were given:

Country	Colombia	Cuba	Mexico	Netherlands	USA	USSR	Venezuela
CSM I	No	yes ~~No~~	Yes	No	Yes	No	~~No~~ yes
CSM II	yes ~~No~~	yes ~~No~~	Yes	yes ~~No~~	No	~~Unknown~~ yes	Unknown

The working group recognizes the difficulties encountered through the use of Bongo Nets as the acceptable standard biological station, and we also note the numerous data collected during CSM I and II by other means. We recognize the position of the Sorting Center in giving priority to the Bongo Net samples as specified at the Trinidad meeting. [~~Because of the limited number of vessels having Bongo Net capabilities and because of the availability of other collecting methods, we recommend that a study be initiated to investigate the problems that have been encountered with the standard biological station.~~]

Item 3

To include the greatest number of participants and to use the time interval between CSM 2 and CSM 3 as established at Trinidad, we recommend that the dates of CSM III be shifted to 15 October to 15 November. This proposed change will permit vessels from Colombia, Cuba, Mexico, the Netherlands, the USA, the USSR and Venezuela to participate in CSM 3. Also, we recommend that the invitation of Colombia to have five scientists and/or students participate in a training and education capacity aboard their CSM 3 vessel be considered.

Item 4

The working group recognizes the importance and value of the CICAR Survey Months in the CICAR program. Therefore, we recommend that additional survey months be considered. In particular, because of the paucity of data during certain months, we recommend that March and July 1973 be designated as CSM's 4 and 5.

Items 5 and 7

The working group recognizes that the classical methods of physical oceanography are well known, permitting intercomparison of collected data. As the methods of biological oceanography are not as well standardized, we recommend that careful consideration be given to the offer of the USA to enhance standardization of equipment and methodology in this field.

The working group also notes that little consideration has been given to the standardization and intercomparison of chemical analysis techniques. In view of the importance of chemical oceanography to such areas as pollution and nutrients, we recommend that a Subject Leader for Chemical Oceanography be appointed. Among his duties should be a survey of the analytical methods now employed by the CICAR participants with the goal of developing a Standard Chemical Station. In particular, the manual developed during a cooperative study of the Baltic Sea mentioned by Dr. Fonselius should be investigated.

Item 6

The working group recognizes the problems inherent in the present communications system. Therefore, we recommend this system be abandoned in favor of the following plan. One month prior to a CICAR region cruise, the chief scientist should forward to Curaçao Headquarters the study plan, to include tracklines, data to be collected, and methods to be used. During the cruise, status reports should be sent to Curaçao, by cable, at weekly or bi-weekly intervals. Both the study plans and the status reports should then be forwarded to the other CICAR participants. In the event of available berths for scientists and/or students, the institute also should announce this directly to interested parties at least three months prior to the cruise.

Item 8

The working group recognizes the expertise of Dr. Vanucci of ~~UNESCO Mexico~~ in the field of plankton collection and sorting. Because of this expertise and her position as Curator of the Sorting Center in Mexico, we recommend that Dr. Vanucci become directly integrated into the CICAR program. Also, we recommend that a new Subject Leader for Biology be appointed taking into consideration the possible resignation of the present Subject Leader.

REPORT OF THE WORKING GROUP ON FISHERIES RESOURCES, MARINE BIOLOGY AND COASTAL LAGOONS AND MARICULTURE

The participants of the working group are listed in Annex I.

The Chairman outlined the terms of reference of the group. The Assistant International Coordinator for Fisheries, Dr. Tapias, presented his report on the CICAR Fisheries Resources Programme (Annex II) and after a general discussion it was decided to review in detail the progress achieved and action required in each of the projects of the programme. The results of this review were as follows:

1. Appraisal of Resource Stocks, particularly Shrimps

The FAO Representative informed the group that a FAO consultation on Shrimp Stocks in the CICAR area had taken place from 13 to 17 June with participation of staff from FAO HQ, from five UNDP/FAO field projects operating in the area, counterpart staff from the projects in Cuba, Mexico and Colombia, as well as a delegation of scientists from Cuba. He introduced the report of this meeting and invited comments on the conclusions achieved and in particular on the proposals made in relation to future action in this field.

The group commended the results achieved by the FAO meeting and suggested that the consultation might serve as a pattern for other CICAR fishery activities. It emphasized the need for refining the assessment made of the shrimp fisheries in the CICAR area, in particular of those which had international character, as a basis for future management.

There was a general consensus for the need to hold a CICAR Workshop on Shrimp Stocks, based on the results of the FAO consultation as well as on further information to be compiled in the near future. It was decided that the Workshop be held about January, 1973, and that theAssistant International Co-ordinator be responsible for its organization. He was requested to prepare the Workshop along the lines proposed by the FAO consultation (See Report of this meeting, Annex 2, par. 21).

2. Appraisal and Management of Turtle Stocks

The group noted with satisfaction that several publications directly relevant to research and conservation of turtle resources, had recently been published by FAO, the Caribbean Research Institute of the Virgin Islands and Cuba.

Following a proposal by the Chairman, it was decided to appoint Dr. P. Bacon of the University of the West Indies, Trinidad and Tobago, to assist the Assistant International Co-ordinator (Fisheries) in the promotion and coordination of this project, hopefully with collaboration from the International Union for Conservation of Nature and Natural Resources (IUCN).

3. Species composition and relative abundance of juveniles and eggs and larvae of pelagic fish

The delegations from Cuba, Mexico and United States gave detailed accounts of their countries' activities in this field. The working group noted with satisfaction that considerable progress had been achieved at national level in this project. The Mexican Assistant National Coordinator forFisheries requested that his country's national programme be ammended to acknowledge for each of the fisheries projects the assistance of the UNDP/FAO Fishery Project in Mexico.

The compar bility of sampling gear and, in particular, the performance of the Bongo net array that had been adopted as the standard CICAR gear, were discussed in detail. Several modifications to the array (in speed and composition) were proposed by the US delegate. While recognizing the need for reducing the towing speed to 1.5 knots, it was decided that the small bongos of the array be retained in view of their past and present use for the general zooplankton programme of marine biology. With regard to the neuston net, it was noted that this gear had been introduced throughout the CICAR area as a standard equipment for surface sampling of juveniles of fishes. The delegate from the US offered to provide on loan, to all qualified CICAR countries participating in this project, bongo and neuston samplers, as well as to give training to scientists in the use of this equipment on board US research vessels operating in the area. He algo indicated the possibility of organizing in the near future, in the U.S.A., a training centre on taxonomy of fish eggs, larvae and juveniles for CICAR workers.

After discussion of possible activities for the forthcoming intersessional period, it was decided that:

(i) Mr. K. Sherman should continue to serve as the leader of this project.

(ii) An intercomparison experiment for plankton gear was required and feasible; arrangements for this experiment will be made by the project leader and the Operations Coordinator (Curaçao).

(iii) A workshop on fish eggs, larvae and juveniles should be organized prior to the VI ICG meeting of CICAR, to evaluate the data so far collected, and discuss in detail the ways and means to compile and present the results achieved by the project.

It was decided that the final results of this project might include standardization of sampling gear, mapping in time and space of the distribution of fish eggs, larvae and juveniles in the CICAR area, mapping of particular commercial species that can be readily identified, preparation of identification keys and identification sheets of the developmental stages of fishes, and the compilation of a comprehensive bibliography on ichthyo-plankton work in the area.

4. Marine Biology

Since the subject-leader was not present, Dr. Angot, at the request of the Chairman, reported on work that had taken place in this programme, indicating very little progress except that the "Oceanic Sorting Centre" in Mexico is now operational. Complete details for the use of this facility are given in the booklet distributed by the Mexican delegation. The group agreed to request in plenary that the countries that have shown interest in marine biological activities give greater support to the programme.

5. Pollution Studies

The group agreed that pollution in coastal waters and lagoons was a very important topic. It was further agreed that Drs. Postma, Carranza, Suárez, Kesteven and Kenny prepare a questionnaire to assess the various studies of pollution in coastal waters and lagoons: this questionnaire would be distributed to each CICAR country and replies collected and analysed by Professor Kenny.

5. Coastal Lagoons and Mariculture

It was noted by the working group that not much progress had been made on the implementation of the recommendations of the Trinidad meeting of the ICG (Recommendation # 8). It was therefore decided that since this area of study was of such importance to many CICAR countries, the matter should be referred to a sub-group of the working group for special consideration. After some discussion the sub-group agreed to recommend as follows:

1. That a questionnaire be directed to all CICAR members.
2. That the form of the questionnaire be drafted by a small group consisting of Dr. Buesa (Cuba), Dr. Carranza Frazer (Mexico), Dr. Ortiz (Colombia), Dr. González (Venezuela), Dr. Rossignol (France), Dr. Postma (Netherlands) and Dr. Squires (FAO).
3. That the questionnaire be broadly conceived to include studies topography; physical, geological, chemical and biological already carried out; methodology; personnel and laboratories involved; fisheries, pollution problems; uses for recreation; training and educational requirements.
4. That if possible the questionnaire be made available to National Coordinators during the present CICAR meeting, or if this is not possible, that they be sent out by the Chairman, Dr. Kenny in the near future, and that replies be forwarded within a month of receipt.
5. That an evaluation be made of replies immediately prior to the workshop on coastal lagoons and pollution, to be held in Venezuela in November 1972.

The working group endorsed this course of action.

7. General Topics

(i) Support for Assistant International Coordinator for Fisheries.- The group took special note of Dr. Tapia's observations on certain administrative aspects of his work and gave strong support to his recommendation that the Assistant International Co ordinator forFisheries should be given financial assistance to carry out his CICAR duties. Such assistance would cover costs of travel within the region, secretarial help as required, and postage, cables, and telephone calls.

(ii) The FAO Representative informed the group that identification sheets for more than 150 species of fish are being prepared with the collaboration of Drs. F. Cervigon (Venezuela), R. Vergara (Cuba) and F. Berry (USA) He stressed the importance of this work for the CICAR fishery programme and mentioned that these identification sheets might be ready for presentation to the VI ICG meeting.

8. Meetings

It was agreed that meetings/workshops be scheduled approximately as follows:

Coastal lagoons and Mariculture / Pollution	- Nov. 1972
Shrimp stocks	- Jan. 1973
Eggs and Larvae	- 2nd quarter of 1973

ANNEX I

WORKING GROUP

Raperteur	Tapias, R.C.	Colombia
	Ortiz, B.L.	Colombia
	Rossignol, M.	France
	Fischer, W.	FAO, Italy
Chairman	Kenny, J.	Trinidad/Tobago
	Mena, A.	Cuba
	Varea R., J.A.	Cuba
	Guitart, D.	Cuba
	Claro, M.R.	Cuba
	Carranza, F.J.	Mexico
	Díaz, G.O.	Mexico
	Brucks, J.	United States
	Postma, H.	Netherlands
	Atilano, G.C.	Venezuela
	Kensler, C.B.	FAO, Mexico
	Squires, H.J.	FAO, Colombia
	Simpson, J.G.	FAO, Venezuela
	Kesteven, G.L.	FAO, Mexico

Information provided by J. Brucks of NOAA National Marine Fisheries Service, Southeast Fisheries Center, Miami, Florida

Additional information concerning the Report of the Working Group on Fisheries Resources. . .

A. MARMAP - Fish eggs, larvae, and environment

Each country was asked to give an account of past accomplishments and future plans.

There were many negative expressions regarding the bongo net. So, in giving the U.S. report, I went into more detail than originally planned. I recapped the total MARMAP activities and bongo comparison tests, mentioned the recent tank and dye tests to establish net characteristics, and informed the delegates of the preliminary findings from the centrifuge separation studies. This information apparently not only impressed the members of the working group but also relieved them somewhat to be assured that the United States is staying on top of the situation.

As suggested by Mr. Kenneth Sherman in a memo dated June 12, I moved to:

1. Establish intercalibration cruises with Cuban and other CICAR scientists.
   a. Venezuela is prepared to rendezvous off Margarita Island in February.
   b. Colombia will meet our vessels off Colombia in February
   c. Mexico feels calibration cruise is possible in February and MARMAP must correspond through proper channels in order to establish data.
2. Welcomed CICAR scientists aboard MARMAP Atlantic vessels during February cruise.

   Results - At present, Venezuela will have two scientists on OREGON II and possibly 2 more persons for other vessels.

3. Encouraged the newly established Mexican Sorting Center to sort CICAR bongo and neuston samples.

   Results: - MARMAP office must establish the number of samples this may entail. Contact Dr. Marta Vanucci, Director Oceanic Sorting Center.

4. Informed CICAR participants that a taxonomic workshop may be possible in the near future. Countries would be notified if workshop becomes a reality.

   Results: - Lots of enthusiasm.

5. Offered Bongo and Neuston equipment to qualified scientists from CICAR countries.

   Results: - Venezuela gave me a list of equipment needs. Colombia and Mexico will submit lists upon conversation with scientists involved.

NOTE: I took it upon myself - after specifically stating that this was strictly conjecture - to have the countries include environmental and miscellaneous equipment in the list of equipment needs. Since Phase I of MARMAP includes environmental studies and since the Navy has converted to the total use of XBT's, I contend that environmental equipment might be obtained from surplus stock.

Conclusion: Throughout the meeting, a general trend became evident. Many countries are - without hesitation - stating that lack of training (procedural and operational) is hampering their studies as well as cooperative endeavors. For this reason, some disatisfactions were vented about promised calibrations cruises that did not materialize.

Having re-emphasized the willingness of the NMFS to loan Bongo and Neuston equipment, arrange for intercalibration/intercomparison cruises, and possibly the loan of some physical oceanographic equipment, I contend it is imperative that the MARMAP planning office takes proper action to assure these commitments are met. A friendly, responsible beginning is the best assurance we can offer the CICAR countries in order to achieve our MARMAP goals in this area.

B. Southeast Fisheries Center

An all out effort was made to entice CICAR countries to commit themselves to occupy some of the standard transects that fall under the responsibility of the SEFC. Mr. Tom Van'thof of Netherlands Curacao was of great assistance to me because he helped arrange luncheon meetings with Venezuela, Mexico and Cuba.

I. SEFC MARMAP

a. The first country to verbally commit itself was Colombia. It appears they are well equipped for oceanographic studies due to recent order of equipment. They are, nowever, most anxious to have training regarding the use of this equipment. I proposed our vessels meet in February at which time scientists can board the OREGON II for instruction in the use of specific equipment. In the meantime, Colombia is to send us a list of additional equipment needs.

b. The second country to agree on cooperative work was Venezuela. Venezuela is most directly interested in our MARMAP endeavors because they have an established program on fish eggs and larvae.

They offered to meet the OREGON II for training and inter-calibration between February 1-15, 1973 at Margarita Island. . .

Equipment needs for Venezuela include:

Bongo gear, thermometers (6 protected, 6 unprotected), mechanical BT, bottom grab sampler, H. O. charts for Venezuela and Guyana, bibliography of fish eggs and larvae.

c. Mexico offered assistance to begin in February but may have some conflict in ship schedules due to work in the Pacific. They will investigate and adjust the schedule if possible to resolve the problem.

SEFC must invite Mexico, in writing, to join our MARMAP studies. Mexico will send list of equipment needs shortly.

d. Cuba was present but offered no comment.

II. Fish eggs, larvae, and juveniles

This subject seems to generate many discussions. The most popular topic was lack of training, experience, and knowledge to sort, and identify species.

Workshops on fish eggs and larvae are of great interest to most CICAR countries, especially Mexico, Colombia, Venezuela, Cuba.

It was decided at this meeting to hold a workshop on fisheries (eggs and larvae) in Bogota, Colombia one week prior to the regular CICAR VI session. This meeting will be during the second quarter of 1973.

As suggested by Ken Sherman, I informed the delegates of the possibility that the U.S. sponsors a taxonomic workshop in support of samples collected during MARMAP/CICAR activities.

I discussed the subject of a taxonomic workshop with Dr. Craig Kensler (FAO Mexico) and we agreed that Mexico City might be the most beneficial site for this workshop. The reasons are two-fold.

1. A taxonomic workshop held in the new "Oceanic Sorting Center" would be most appropriate.
2. Cuba and some other CICAR countries could probably send scientists to Mexico City more conveniently and inexpensively than to the United States.

III. Shrimp

A workshop on shrimp - FAE consultation on shrimp stocks - was held the week preceding the regular CICAR meeting (see attached report).

Particularly important to the SEFC is the proposed workshop for early 1973 and also the regional preparatory meetings. The CICAR area is divided into four sub-divisions each of which is to hold a regional meeting of shrimp stocks.

Sub-divisions:

1. Gulf of Mexico
2. Coasts of Honduras, British Honduras, Nicaragua, Costa Rica, Guatemala.
3. Coasts of Panama, Colombia, Venezuela
4. Coasts of Guyana, Surinam, French Guyana, Brazil.

IV. Lobster

I presented a "feeler" during the working group on Fisheries Resources concerning lobster studies. Evidently, Mexico and Cuba have been studying lobsters but no comments were offered. Later I met Mr. R. J. Buesa of Cuba who expressed his personal interest in lobster studies. He informed me that he has worked for/with Mr. Engle and Mr. Witham of the University of Miami. Cuba is supposed to publish lobster information next year, but no particulars were divulged. Mr. Buesa is interested in our lobster studies and is willing to correspond with Al Jones.

V. Pollution

There was some debate as to interest on beginning pollution studies. It turned out that about six countries are interested in pollution studies and through interest of these countries, a program will probably evolve. There were discussions as to whether or not to ______ pollution studies in lagoons or in coastal waters. A date is to be established to hold a meeting in Caracas, Venezuela on coastal lagoons and pollution. Perhaps our Oil in the Sea Program should keep in touch with Venezuela for an update of information as this program develops.

VI. Turtles

Comments had to be prompted regarding the subject of turtles. Mexico and Costa Rica have programs dealing with conservation and reproduction. Cuba is also interested in conservation. Dr. Bacon (?) of Trinidad was appointed subject leader.

ANNEX E

DELEGACION DE COLOMBIA

INFORME RESUMIDO DE ACTIVIDADES RELACIONADAS CON EL CICAR

1.- ANTECEDENTES

1.1.- Reunión de Curazao.
1.1.1.- Ingreso de Colombia a la COI.
1.1.2.- Creación de la Comisión colombiana de Oceanografía.
1.1.3.- Adquisición buque oceanográfico y dotación de equipo para oceanografía.
1.1.4.- Entrenamiento de personal y conocimiento de los equipos oceanográficos.
A. Crucero "Oceano I" - Area Norte de las costas colombianas y zona de San Andrés y Providencia.
1.1.5.- Adaptacion del Buque oceanográfico para mejorar su maquinaria y la distribución de laboratorio y alojamiento para cientificos y estudiantes.

2.- ACTIVIDADES DOCENTES

2.1.- Convenio entre la Universidad de Bogotá J.T.L. y la Armada Nacional para la formación a nivel profesional de personal de Biología Marina y Oceanografía Física.

A.-	Biólogos marinos.............	31
	Tecnología pesquera..........	14
	Tecnología alimentos.........	9
	Geología Marina..............	1
	Oceanografía Química.........	1
B.-	Oceanografía Física..........	7

2.2.- Convenio entre la Universidad Nacional y la Armada para la formación a nivel profesional de geólogos marinos.
2.3.- Infraestructura para una Facultad de Oceanografía, que viene funcionando en Cartagena.
2.4.- Dotación de equipos para los laboratorios de Biología Marina, Oceanografía físico y Geología.
2.5.- Fundación de la carrera profesional de Tecnología pesquera.

3.- PROGRAMA DE INVESTIGACION

3.1.- Reportes de fluctuaciones de mareas en estaciones de Cartagena y Riohacho durante 1971.
3.2.- Participación en el CSM-2
A.- Oceanografía
B.- Biologia
C.- Meteorología
3.3.- Formación del Museo del Mar (10.000 ejemplares). Inventario de la Flora y Fauna Marinas.
3.4.- Convenio entre el Servicio Colombiano de Meteorología e Hidrología y la Armada Nacional para la recopilación procesamiento y distribución de informes meteorologicos.
3.5.- Cartas de Navegación para el Area de San Andrés y Providencia.
3.6.- Evaluación de los recursos pesqueros más importantes (camarón, langosta, etc.). Experimentos de cultivo de especies de aguas salobres.

4.- DIVULGACION

4.1.- Informe de resultados y parámetros encontrados en el Crucero "Océano I"
4.2.- Boletines de la investigación sobre pesquería.
4.3.- Informes meteorologicos parciales.
4.4.- Boletín del Museo del Mar.- Publicados los cuatro primeros numeros.

NATIONAL REPORT SUMMARY - CUBA

Actividades en 1971

Durante 1971 las instituciones cubanas participantes del programa CICAR, Centro de Investigaciones Pesqueras del Instituto Nacional de la Pesca e Instituto de Oceanología de la Academia de Ciencias, desarrollaron varios programas de investigaciones en la plataforma insular cubana y el Golfo de México, tal como se anunció en el folleto "Programas Nacionales" presentado al ICG durante la 4ta. Reunión del Grupo en Trinidad Tobago.

Los principales actividades realizadas fueron:

1. MESES DE ENCUESTA

Durante el primer mes de encuesta (julio-agosto), Cuba cubrió el transepto de Yucatán realizándose las observaciones habituales (T°C, O_2, S ‰ ; y observaciones meteorológicas) en las estaciones previamente establecidas por niveles estándar hasta 750 m de profundidad. (Los datos obtenidos fueron enviados al Centro Mundial de datos B en Moscu.)

2. MAREOGRAFIA

Durante 1971 se instalaron alrededor de la Isla 10 mareógrafos con carácter permanente y 20 con carácter temporal. Se confeccionaron los programas para el cálculo de constantes armónicas.

3. OCEANOGRAFIA FISICA Y QUIMICA

Se realizaron ocho cruceros al Golfo de México, durante los cuales se investigó el régimen hidrológico del Banco de Campeche, se hicieron mediciones de corrientes en el Banco empleando correntógrafos BPV-2 y se cubrieron los transeptos de Yucatán, Florida y Paso de los Vientos.

En la plataforma cubana se continuó el estudio de su régimen hidrológico según el plan nacional.

4. GEOLOGIA Y GEOFISICA MARINA

Se continuaron los estudios geológicos (sedimentos, mineralogía, etc.) en la región suroccidental de la plataforma cubana.

5. BIOLOGIA MARINA

Se ejecutaron proyectos sobre:

a) Producción primaria del macrofitobentos (plataforma cubana).
b) Determinación de la variación estacional de la producción primaria del banco de Campeche.
c) Distribución cuantitativa y composición del fitoplancton del banco de Campeche.
d) Producción del zooplancton en el banco de Campeche.
e) Estudios de las variaciones estacionales del plancton (fito y zooplancton) en la plataforma cubana.
f) Distribución cuantitativa y cualitativa de los invertebrados de fondo (plataforma cubana).
g) Estudios sobre contaminación y sus efectos sobre los organismos marinos.

6. RECURSOS PESQUEROS:

Se ejecutaron proyectos sobre:

a) Estudios sobre huevos y larvas de peces en la plataforma cubana y el banco de Campeche.
b) Cálculo de las reservas y otros parámetros de la población de bonito Katsuwonus pelamis.
c) Control estadístico biológico de las poblaciones langosteras.
d) Preevaluación de los recursos camaroneros de la plataforma suroriental de Cuba.
e) Biología pesquera de las especies comerciales más importantes del banco de Campeche.
f) Algunas características ecofisiológicas de tres especies del género Lutjanus.
g) Significado biológico del gregarismo en peces pertenecientes a distintos grupos ecológicos.

7. CULTIVO

Se continuaron los trabajos en cuanto a algunos estudios preliminares sobre cultivo de camarones y sobre la biología y cultivo del ostión del mangle (Crassostrea rhizophorae).

Los planes en ejecución durante 1972, así como otros detalles relacionados con los trabajos realizados en 1971 aparecen con mayor detalle en el folleto "Resumen de los proyectos ejecutados en 1971 y programados para 1972" preparados por la coordinación nacional cubana y distribuido al ICG CICAR en esta V Reunión.

FRENCH PROGRAM

Two fields of research concerning mariculture in French Guyana:

1) Shrimps:
The results of the two preceding years led us to start an experiment of shrimp culture in a marsh of this country, at the end of 1972 or the begining of 1973 (cf. preliminary report at the attention of the participants of CICAR).

2) Oysters:
Researches are going on. A preliminary report will be sent to the international and the national coordinators at the end of this year (1972).

PROGRAMA FRANCES

Dos campos de investigación que conciernen la maricultura en la Guyana francesa:

1) Camarones:
Los resultados de los dos años precedentes nos permiten comenzar un experimento de cultivos en una marisma de este país a finales de 1972 o comienzos de 1973 (ver informe preliminar a la disposición de los participantes de CICAR).

2) Ostras:
Se están llevando a cabo investigaciones. Un informe preliminar les será enviado a los coordinadores nacionales e internacionales a finales de este año (1972).

RESUMEN DEL PROGRAMA DE M E X I C O

Durante 1971 y 1972 se ha seguido trabajando intensamente en los programas de CICAR, correspondientes a las cuatro secciones que lo constituyen.

Recientemente fue designado un nuevo Coordinador Nacional Asistente, quien se encarga de lo referente a Recursos pesqueros dentro del Grupo Nacional de Coordinación.

Para la V Reunión del Grupo Internacional se presenta un folleto titulado "Programa Nacional de Mexico dentro de las Investigaciones Cooperativas del Caribe y Regiones Adyacentes (CICAR), actualizado, abril 1972.

El Programa Nacional de México es interinstitucional y se apoya en gran parte en las actividades del B/O "Virgilio Uribe" de la Secretaría de Marina.

Los aspectos sobresalientes son:

Oceanografía Física y Química.

Estudio de Mareas a largo plazo. Se continúan publicando las Tablas de Predicción de Mareas en el Golfo de México, incluyendo una nueva estación en Cozumel, Q.R.

Estudios Sinópticos de Circulación en el Golfo de México y Regiones Adyacentes. Se han realizado en 1971 y 1972 cuatro nuevos, entre ellos los Meses de Reconocimiento CICAR I y II.

Geología y Geofísica Marinas.

Se continuaron las investigaciones tridimensionales sobre la plataforma y talud continentales del Suroeste del Golfo de México, principalmente procesando datos y muestras ya colectados y realizando un nuevo crucero. En 1972 se llevará a cabo otra expedición.

Se continuará el estudio sistemático de la descarga de los ríos en el Golfo de México y procesos de sedimentación de la Laguna de Términos, Camp.

Biología Marina

Los estudios de producción primaria en el Golfo de México y resto del Mar Caribe fueron continuados.

Se colectó plancton en los Meses CICAR I y II.

Han continuado las investigaciones en lagunas costeras, con carácter interdisciplinario, particularmente en aspectos ambientales.

Para 1972 se programa incrementar las investigaciones en la Laguna de Términos.

Se terminaron los trámites necesarios para el establecimiento del Centro de Preclasificación Oceánica de México (CPOM) que inició sus actividades oficialmente el 1ro. de junio de 1972.

Recursos Pesqueros

Se participó activamente en los estudios de prospección y bioestadificación de peces pelágicos, a través de 6 cruceros. Ahora queda por realizar uno más durante 1972.

Se continúan los estudios sobre camarón, mero, langosta, tortugas marinas y cultivo ostrícola.

Educación superior.

Se han hecho esfuerzos especiales por impulsar la educación de postgrado, para lo cual el Programa Nacional de CICAR ha contribuído permitiendo amplia participación de estudiantes en la investigación.

La UNAM ofrece la maestría y doctorado en Ciencias (Biología Marina) y una especialización en Oceanografía Física y Geología Marina; para 1973 se espera ofrecerla además en Química Marina y Contaminación.

El Gobierno de México en su Programa Nacional para el PNUD presentará una propuesta para crear una Infraestructura Nacional en Ciencias y Tecnología del Mar, con participación de todas las instituciones de educación superior del país interesadas.

NETHERLANDS CICAR PROGRAMME

1. Review of 1971

Most investigations were carried out in the eastern Caribbean on board H.Nl.M.S. Luymes.

1.1 Physical and chemical oceanography and sedimentology in March and April 1971 in the coastal area between Surinam and Brazil; temperature, salinity, oxygen, nutrients, current velocity, bottom sediments, silt transport, optics, primary productivity.

1.2 Geophysics in January 1971 off the coast of South America between Trinidad and Brazil; combined gravity and magnetic survey. Participation in August and September in a U.S. Geological Survey cruise on the shelf of Venezuela and the transition to the Venezuela Basin.

1.3 A standard measuring programme was carried out throughout the year including the following disciplines: bathymetry, tides, bathythermography, meteorology, aerology and biology (birds and plancton), from January-April in the Guyana Basin and from May-September near Aruba-Bonaire-Curacao.

2. Programme for 1972

2.1 Sedimentology and Biology. In March-June a study will be made of the Saba Bank, including investigations of subsea terraces. In August a sedimentological programme will be carried out in the coastal area between Surinam and Brazil.

2.2 Standard measuring programme. Executed as in 1971, from February-June on the Saba Bank and from July-October near Aruba-Bonaire-Curacao.

2.3 Standard sections. In April and October H.Nl.M.S. Luymes will carry out measurements along section B 2.

3. Programme for 1973. Investigations will be restricted to coastal studies in Surinam and Aruba-Bonaire-Curacao.

TRINIDAD AND TOBAGO

SUMMARY OF NATIONAL REPORT

During 1971 work continued principally in the field of marine biology. The principal projects included growth studies on *Crassostrea* and *Modiolus*, a study of the frequency of nesting of marine turtles, population dynamics of *Melongena*, population dynamics and reproductive biology of *Scomberomorus* and the autecology of coral communities under high stress conditions.

The principal projects to be developed in 1972 include field trials on cultivation of *Crassostrea* and *Modiolus* and an extension of the investigations of coral communities on the east coast of the island.

UNITED KINGDOM

Activities in 1971 and the first half of 1972

The United Kingdom Programme booklet, revised to September 1971, which was distributed to all National Coordinators and Subject Leaders in advance of the 5th Session of the ICG, gives details of work carried out in the CICAR area by the United Kingdom during 1970, the first year of the CICAR programme, and in lesser detail in 1971. Results, including papers and processed data from the 1970 season are now starting to appear.

During 1971, HMS Hecla, a 2,800 ton Ocean Survey Ship of the Royal Navy, spent some four months in the Caribbean. Her main task was to carry out a detailed geophysical survey of an east-west strip 100 km in width and some 600 km in length reaching from the southern end of the Aves Swell where it joins the Venezuelan shelf, through the Antilles Arc and out into the Atlantic 200 km east of Barbados. This survey has been continued in 1972 to cover the Aves Swell to north of Aves Island, in close co-operation with the Venezuelan government who have had observers on board in both years for training.

In April 1972, a detailed seismic Crustal Structure investigation was carried out in the Lesser Antilles region. Seismic receiving stations were located on islands in the Antilles Arc, by the French on the islands of Guadeloupe and Martinique, on Aves Island with the co-operation of the government of Venezuela and on board NOSS DISCOVERER of the United States. The preliminary results show that this survey has been highly succesful.

At the same time an extensive coring programme was carried out on the slopes and in the deep basins in the areas covered by the detailed 1971 survey.

One of the most detailed surveys known of a submarine volcano was carried out over the "Kick 'em Jenny" volcano just north of Grenada, in conjunction with scientists from the University of the West Indies, Trinidad.

In addition, a study of sediment and microfaunal patterns has been carried out in the reef areas and channels around Union and Palm Islands in the South Grenadines and a study has been made of the geochemical behaviour of Trace Metals in the area between Barbados and the Aves Swell, as a base-line study of pollutant levels.

HMS Hecla will be arriving in Kingston, Jamaica shortly to undertake geophysical work in the Hispaniola Passage in co-operation with scientists from the University of the West Indies, Jamaica; it is planned to investigate the general crustal structure in the area, including examination of a reported submarine volcano and known earthquake zones.

During 1973, the two smaller survey/research ships HMS FOX and FAWN (1,080 tons) will be returning to the Caribbean and working for most of the year in the northern Antilles: their area of work will adjoin the Barbuda Channel area in which they worked in 1970. Hydrographic Surveys will be carried out including most likely some sub bottom profiling and studies of the microfauna and sediments in the area. This, with work done by the Dutch will complete a close study of the bathymetry, with determination of cill depths, from Puerto Rico to Guadeloupe.

U.S.A. NATIONAL PROGRAM

SUMMARY

1971-2

Physical Oceanography

U.S. physical oceanographic studies within the CICAR framework were concentrated in two major areas the passes between the Antillean Islands, and in the northwest Caribbean, Yucatan Channel, and southern Gulf of Mexico. Both areas of study are part of the overall CICAR circulation program directed toward understanding the major features of the circulation of the Caribbean and adjacent regions.

The R/V KNORR from Woods Hole worked in the passes of the northern Antilles following up on the work of the ATLANTIS II the previous year in the passes of the southern Antilles. The R/V TRIDENT of the University of Rhode Island worked the Jungfern Passage and studied the microstructure in the passes north and south of St. Croix. Even as the 5th CICAR meeting is in progress, the USNS WILKES of the Naval Oceanographic Office is occupying moored current buoy stations at 15 locations in the passes between the Antillean Islands. The WILKES project runs from June until September of 1972.

During CICAR Survey Month (CSM-I) in August of 1971, various vessels of the Florida State University System Institute of Oceanography (SUSIO) worked in the eastern Gulf of Mexico and the Yucatan Channel. In addition, the OREGON II of the NOAA National Marine Fisheries Service studied the currents in the Gulf, and the DISCOVERER and RESEARCHER, working for NOAA's Atlantic Oceanographic and Meteorological Laboratories in Miami, worked in the Yucatan Channel and the southern Gulf of Mexico studying the dynamics of the Yucatan Current, the Loop Current, and the various water masses in the area with Dr. Donald Hansen and Dr. Robert Molinari as Chief Scientists.

On CSM-II in April and May of 1972, the GULF STREAM of Nova University and the Nova aircraft worked the two standard CICAR Sections from Cabo San Antonio to Isla Mujeres (Yucatan Channel) and from Habana to Key West (Florida Straits). Texas A&M with the ALAMINOS also worked the Gulf of Mexico Loop Current during this period as did scientists from the University of South Florida. The NOAA-AOML R/V VIRGINIA KEY made repeated STD/XBT sections along the CICAR standard section across the Yucatan Channel during this period, and Dr. Robert Molinari of NOAA-AOML is working to pull all of the physical data together for analysis of the CSM-I and CSM II operations in the northwestern Caribbean.

Additional physical oceanographic work included shallow oceanic sea-floor tide, current, and temperature measurements in the western Caribbean and deep-sea tide measurements (4 km) near an amphidrome south of Puerto Rico by B.D. Zetler, CICAR Subject Leader for Tides. The DISCOVERER occupied the CICAR Standard Section along 63°W and carried out a mixed-layer study north of Puerto Rico with Feodor Ostapoff (AOML) as Chief Scientist. The results to date of the CICAR Drift Bottle Program under John Brucks of the NOAA National Marine Fisheries Service is summarized in the USA report. Finally, the first of six oceanographic/meteorological buoys was emplanted in the Gulf of Mexico in mid-June of 1972 and five more will be set out during the next four months. Sensors on these buoys and suspended below them will measure temperature, salinity, and currents as well as meteorological characteristics. The data will be telemetered to Miami for immediate use in weather forecasting and for later research use.

Marine Geology and Geophysics

The R/V CHAIN from Woods Hole with Dr. E. Uchupi as Chief Scientist made extensive geophysical measurements in the Yucatan Channel.

The R/V TRIDENT made two geophysical cruises in the Lesser Antilles, and the DISCOVERER, under Dr. George Peter of NOAA-AOML, carried out bathymetric, seismic, magnetic, and gravity measurements between the Antilles and the Mid-Atlantic Ridge and worked cooperatively with Dr. Martin Bott of the U.K. on a Reading University project of heat-flow measurements and seismic refraction studies north of the Barbados Ridge in the Lesser Antilles Island Arc and the Aves Ridge. The U.S. Geological Survey aboard the UNITEDGEO-I carried out extensive marine geophysical operations in the Bay of Campeche, Yucatan Channel, Eastern Greater Antilles, and the Venezuelan Continental Borderland. USGS scientists also worked cooperatively with Mexican scientists aboard the URIBE on the Mexican shelf. The Navy research ships KANE and WILKES ran magnetic and seismic reflection lines extensively throughout the CICAR area, and Dr Orin Pilkey aboard the R/V EASTWARD studied submarine volcanoes and turbidites off Puerto Rico. Extensive reef studies off British Honduras were also carried out under Dr. Robert Ginsbufg of the University of Miami in cooperation with other U.S. university scientists and Dr. Judith Lang of the Discovery Bay Marine Laboratory of the University of the West Indies. The ALLANORA working for several Caribbean research groups is undertaking beach and reef studies during her primarily biological circumnavigation of the Caribbean.

Marine Biology

R/V TRIDENT (URI) did bioacoustical and other marine biological work in the northeastern passes and mid-water trawls and net tows in the Lesser Antilles. The numerous EGMEX cruises coordinated by SUSIO made extensive biological observations and collections on the west Florida shelf, and Texas A&M University scientists aboard the R/V ALAMINOS on cruise 71-A-6 did biological work, productivity and chlorophyll studies. Puerto Rican scientists studied coelenterates and lobsters and did exploratory fishing work off Puerto Rico, and the Caribbean Research Institute (Virgin Islands) studied the green turtles on, and the fishes around, Aves Island. The ALLANORA (V.I.) worked on studies of birds, reef ecology, sea turtles, and the munk seal. The OREGON II of the NOAA National Marine Fisheries Service did considerable icthyoplankton work with the Southeast Fisheries Center, and the Miami Lab of that NMFS Center provided bongo nets to the USSR ship AKADEMIC KURCHATOV during her March 1972 visit to Miami. The R/V EASTWARD with Dr. Ivan Goodbody of Jamaica did marine biological studies off Jamaica, and various marine biologists and ecologists worked extensively on the coral reefs off British Honduras under Dr. Robert Ginsburg of the University of Miami.

Marine Chemistry

The R/V TRIDENT (URI) did some chemical work east of Barbados, and Texas A&M from the R/V. ALAMINOS did chemical work on cruises 71-A-5 and 71 A-12. The PuertoRico Nuclear Center and the University of Puerto Rico carried out trace element studies off Puerto Rico, and the ALLANORA did some pollution studies in the U.S. Virgin Islands. The DISCOVERER under George Berberian of NOAA-AOML did chemical studies and trace metal studies in the Gulf of Mexico and Yucatan Channel during CSM-1, and Dr. Neil Andersen of the U.S. Coast Guard working from the CGC ROCKAWAY carried out extensive chemical studies in the Gulf of Paria and Cariaco Trench.

1972-3

Briefly, the current work in the Antillean passes will continue with Nova University's aircraft doing an aerial study of the currents in all the major Antillean passes, and the WILKES working for the Naval Oceanographic Office will also be working the passes with 3 week series of measurements from taut-wire current meter arrays. The NOVA R/V GULF STREAM will be studying the currents of the Florida shelf, and the R/V VIRGINIA KEY under George Maul of NOAA-AOML will be making monthly observations across the Loop Current and in the Yucatan Channel.

Most geological and geophysical plans for 1972-1973 are still very tentative, but the plans are firm for the USNS WILKES' geophysical work in the Lesser Antilles during June to September of 1972 to provide bathymetric, magnetic, and seismic information through several of the major inter-island passes. The need for bathymetric data in these passes was particularly stressed during the 4th ICG for CICAR in Trinidad last year.

Biologically, there are two major 1973 efforts in the CICAR area. The MARMAP cruises under NOAA's Southeast Fisheries Center will concentrate on systematic icthyoplankton surveys, and the Cayman Trough Expedition-I, run jointly by Florida State University and the University of North Carolina, will investigate the deep fauna of the Cayman Trough and the hyperbaric aspects of deep organisms.

Chemically, the Curiaco Trench investigations will be continued, and Dr. Holger Jannasch of Woods Hole aboard the R/V ATLANTIS II will be studying the trench's microbial sulphur cycle, and Dr. Claes Rooth of the University of Miami aboard the R/V GILLISS will be investigating the distribution of tritium and cesium in the main thermocline between the Sargasso Sea and Puerto Rico.

Primarily to provide a sea-going facility for the education and training of students in the marine sciences in Mexico, Jamaica, Puerto Rico, Trinidad and Tobago, Venezuela, and Colombia, the DISCOVERER of NOAA will work in the CICAR area from October 6 to December 16, 1972. Called NOAA-Carib, the expedition is being coordinated by NOAA's Atlantic Oceanographic and Meteorological Labs in Miami and will carry out research projects presently in the planning stages by senior scientists in each country involved.

NATIONAL PROGRAM OF THE USSR FOR COOPERATIVE INVESTIGATION OF CARIBBEAN SEA AND ADJACENT REGIONS (CICAR) FOR 1972

General trends of investigations

It is planned for 1972 the continuation and broadening of the investigations according to CICAR programs in the fields of Physics and chemistry of the sea, geology and geophysics, biology and fisheries resources. The main trends of work are the study of the structure of water masses of Caribbean and adjacent regions, the investigation of water exchange between the Caribbean sea and Atlantic Ocean through the straights, the study of the dynamics of the main currents in CICAR area, the study of biological productivity of the Caribbean Sea and the Gulf of Mexico, as well as of the migration and increase of stock of pelagic and demersal fish of commercial interest, and the study of the deep fauna of Caribbean, its composition and conditions of its existence.

Expedition works

The investigations in 1972 in accordance with CICAR programs will be conducted on four cruises of the research vessels "Akademik Kurchatov" (Cruises XII and XIV), "Akademik Vernadsky" (Cruise VI), "Vasily Golovnin", "SRT-R" (or "SRT-M").

1. Cruise XII of the R/V "Akademik Kurchatov" (February-May 1972) has as its main purpose the investigation of the region of origin of the Antil-Guyana Countercurrent, the study of large-scale variability of this current and water exchange between the Caribbean Sea and Atlantic Ocean. It is planned for this cruise to carry out investigations in oceanography, biology, geology and geophysics on three sections in the eastern part of the Caribbean and on four sections in the Atlantic in the areas adjacent to the Bahamas and Antilles Islands. In the course of the study, it is planned to carry some of the CICAR standard sections in April 1972 (CSM-II)

2. Cruise XIV of the R/V "Akademik Kurchatov" (December 1972–May 1973) has as its main purpose the comparative investigations of the biology, oceanography and geology of the abyssals, deeps and trenches of the Caribbean Sea, Gulf of Mexico and the Puerto-Rican Trench. The investigations of the deep fauna, its composition, peculiarities of its adaptation and conditions of existence are carried out for the reason of study of the origin of the "deeps" of the Caribbean. These investigations will be carried on the polygons in the regions of the Puerto-Rican Trench, deeps of the Caribbean Sea and Gulf of Mexico over on the depths of 8.5–9.2 km.

3. Cruise VI of the R/V "Akademik Vernadsky" (September–December 1972) has its main task in the investigations of water exchange between the Caribbean and the Atlantic and the Gulf of Mexico through the passages of Greater and Lesser Antilles, the Yucatan, Florida, Nicolas and Santa-Santaren Straights, and also in the study of the conditions of origin of Caribbean and Florida Currents and of their main characteristics. Physical and chemical oceanographic studies on sections will be carried on in these straights, as well as on the standard section across the Caribbean, along the meridian of Mona Passage, which was occupied by different ships in the 30s, 50s and 60s, thus providing the possibility for study of multi-annual variability of the regions. On the buoy and drift stations will be carried the investigations in hydrochemistry, biology, geology, hydro-optics, turbulance, measurements of the heat balance of the sea surface. During the whole cruise, echo-sounding and magnetometric measurements will be carried on.

4. The cruise of the oceanographic research vessel "Vasily Golovnin" (April 1972) will be occupy sections of CSM-II with investigations in oceanography and meteorology and measurements of the currents. Oceanographical investigations on section will be carried at standard depth down to the bottom. With the aid of GEK currents will be measured, on anchor buoy stations as well.

Exchange of data

The exchange of data will be done through WDC-B, Oceanography (Moscow), by the forms approved.

The following data, collected by the USSR vessels during the CICAR period, will be subject to international exchange:

Descriptive oceanography, "Do":

a) temperatures, salinities and densities on standard depths down to the bottom;

b) BT measurements down to the 200 m depth;

c) dissolved oxygen contents and other chemical data on standard depths.

Elements of currents, "Cm":

- results of measurements of currents by GEK on buoy stations

Meteorological Data, "Mt":

- results of meteorological observations on oceanographical stations

Geological data, "Gg":

- echo-sounding data, data on bottom substrate, geomagnetic measurements data

Biological data, "Ps", "Ab":

- data on distribution of biological species and biomass

PROGRAMA NACIONAL DE VENEZUELA (1971-1972)

Batimetría y Cartografía

Para investigaciones batimétricas, geológicas y geofísicas se llevaron a cabo seis cruceros a bordo de los buques venezolanos "Las Aves-T.12", "Puerto Santo-H.01" y "La Salle" Se participó activamente en los trabajos de barcos oceanográficos foráneos en el Mar Caribe. Fueron estudiados algunos sectores de la Plataforma Continental (Zona Deltaica del Orinoco, Golfo de Paria, Nororiente, Fosa de Cariaco, Banco de La Guayra, Golfo Triste, Ensenada de la Vela, la Prominencia e Isla de Aves, la Fosa de Bonaire, el Archipiélago de los Roques y la Isla de la Orchila.

Se terminaron dos cartas marinas: "Isla de Aves", "Costas de Venezuela" (en tres versiones). Se están procesando datos sobre otros sectores.

Geología y Geofísica Marinas

Se hizo un estudio sedimentológico y geomorfológico del margen continental del Caribe Oriental Venezolano. Se cubrieron unos 46,000 km^2 entre los meridianos que pasan por Cabo Codera al W y Punta Piedras al E y el paralelo 12^{o}N y la costa venezolana. Se colectaron 1300 muestras de fondo. Se hicieron estudios de geomorfología litoral y submarina, paleogeografía, faciología y dinámica sedimentaria.

Se estudió el fenómeno llamado "fluff" en Boca Grande", Delta del Orinoco. Se hicieron mediciones de la radiactividad natural, in situ, por espectrometría gamma y con técnicas clásicas de dinámica sedimentaria y geoquímica marinas. Las investigaciones probaron la presencia de una elevada concentración de partículas sedimentarias en suspensión en las aguas estuarinas a lo largo del canal artificial de navegación en la desembocadura del Orinoco. (Este fenómeno es denominado "crema de fango", "capa crema", "borra de café" y "fluff")

Se terminó el estudio de los sedimentos recientes a lo largo del Litoral Central entre Cabo Codera y Puerto Cabello. Se elaboraron mapas de facies sedimentarias y de distribución de minerales pesados.

Se iniciaron investigaciones de geología litoral y marina en Golfo Triste, entre Puerto Cabello y Chichirivicho, en la región centro-occidental de Venezuela. (Nota.- También se hacen estudios biológicos, bacteriológicos y físico químicos.)

Se terminó un estudio sobre los foraminíferos planctónicos vivos del Margen Continental del Norte de Suramérica, desde la Guagira hasta la Guayana Francesa. Se estudiaron las variaciones temporales en tres puntos representativos de condiciones ambientales distintas: Fosa de Cariaco, Talud Continental y el área oceánica del Archipiélago de Los Roques.

Se hizo un estudio sísmico batimétrico de la Ensenada de La Vela en la Plataforma Occidental de Venezuela. Se cubrieron unos 3,000 km^2. Los equipos utilizados fueron ecosonda, "sparker", "boomer" y "sonar" de barrido lateral. Se están procesando los registros.

También se efectuó un estudio sísmico-batimétrico, con eco-sonda y "sparker", del "Banco de la Guayra". Se están analizando los datos.

Se iniciaron estudios de las playas del Litoral Centro Oriental con fines turísticos, recreacionales, urbanísticos y conservacionistas. Se están haciendo investigaciones de oceanología en general y en particular de geología litoral y marina, batimetría de precisión en aguas someras, distribución de facies sedimentarias y dinámica de los sedimentos

Oceanología Química y Física

Dentro del programa de las secciones standard se llevaron a cabo dos cruceros: en agosto de 1971 (C S M -I) y en abril de 1972 (C.S.M.II) a lo largo de los transeptos a y bl. Los resultados fueron enviados al NODC.

Se continuaron los estudios indicados en el "Programa Nacional de Venezuela" para 1971 (IV Reunión del CICAR en Trinidad y Tobago), en particular en la Fosa y Golfo de Cariaco. Se iniciaron estudios sobre la físico-química de las aguas de Golfo Triste.

Meteorología

La Universidad Central de Venezuela (Caracas), la Universidad de Oriente (Cumaná), la Comandancia General de la Marina (Caracas) y la Comandancia General de la Aviación (Maracay) continuaron y ampliaron sus labores de enseñanza y entrenamiento así como de recolección, procesamiento y distribución de datos meteorológicos.

BIOLOGIA DE PECES Y PESQUERIAS

Programa de evaluación de recursos pelágicos

En Venezuela se lleva a cabo un intensivo programa de muestreo de las siguientes especies:

Sardina - Sardinella anchovia
Machuelo - Opisthonema oglinum
Rabo amarillo - Categraulis edululus
Cataco - Selar crumenophthalmus
Lisa - Mugil curema
Lebranche - Mugil lisa
Atún aleta amarilla - Thunnucs albacares
Albacora - Thunnus alalunga
Otros atunes - Thunnus obesus, Sarda sarda
Carites - Scomberomorus maculatus y cavalla
Cachorreta - Scomber japonicus

En total se muestrearon 20,000 ejemplares de 15 especies distintas.

Se recopilaron estadísticas de capturas y esfuerzo con respecto a las pesquerías de sardina, atún y carite.

Se terminó un estudio de la relación entre las capturas de sardinas y la temperatura superficial y la salinidad del mar en el oriente deVenezuela, durante los últimos 8 años. Se prepara un informe sobre ese estudió.

En cuanto a las pesquerías de atún, se determinaron las tendencias de las capturas y la captura por unidad de esfuerzo y se analizaron las diferencias entre los recursos de atún aleta amarilla de las dos áreas principales de pesca (Caribe y Atlántico). El promedio de captura de atún (varias especies combinadas) durante 1971 fue de 1.17 pescados por cada 100 anzuelos en el Atlántico y de 1.93 en el Caribe.

La tasa media de captura de carito pintado (S. Maculatus) fue de 3.5 pescados aproximadamente por cada 100 m^2 horas de filete de ahorque calado.

Estudio de huevos y larvas.

Durante 1971 los trabajos de campo relacionados con huevos y larvas en la costa norte de la de Venezuela entre Cumaná y la Península de Paria abarcado los alrededores de la Isla de Margarita, que abarcó dos salidas durante el cual se capturaron 182 muestras, que se encuentran en procesamiento. Sobre este programa salió publicado el primer trabajo: "Distribución y abundancia estimada de huevos de la sardina 'Sardinella anchovia' en la Región Oriental de Venezuela, 1968 1969".

Prospecciones hidroacústicas

Durante 1971 se realizaron dos prospecciones hidroacústicas en aguas costaneras del Nordeste de Venezuela entre Enero 1 y Abril y de Mayo 1 a Julio 31. Se usaron una Supersonda Simrad tipo EH 2E y un Echo Scope (lupa de pesca) tipo CA2. En total se realizaron 22 cruceros, que dieron origen a 2 publicaciones, Informes Técnicos Nos. 32 y 33.

Programa de evaluación de recursos demersales

Las principales especies bajo estudio son:

Cazón especies - Mustelus canis
M. higmani
M. norrisi

Corocoro (varias especies) - Haemulon flavolineatum, H. macrostomum, H. melanurum, H. plumieri

Lamparosa - Vomer setapinnis
Roncador - Menticirrhu furnieri
Curvinata Macrodon ancyladon
Curvina Cynoscion maracaiboensis
Picúa - Sphyraen sp.

A los cuales se les obtiene datos acerca de longitud, peso, sexo, maduración sexual, grado de parasitismo.

Se estudia las pesquerías mediante durante un programa de Cuadernos de Bitácoras para determinar la unidad de esfuerzo pesquero de la flota pesquera de arrastre tanto del Oriente como del Occidente de Venezuela.

Quedó terminado un estudio de la biología y pesca de la curvina, CYNOSCION MARACAIBOENSIS, del Lago de Maracaibo, en el cual se determina que el desove de esa especie tiene lugar en la Bahía del Tablazo, Estrecho de Maracaibo, y la parte del norte del lago, con un período de máxima intensidad de desove de enero a abril. El primer desove se efectúa a los 35 - 40 cm de longitud total al finalizar el primer año de vida.

Se determina la edad y crecimiento de la especie por el método de las escamas con los siguientes resultados:

Edad	L 1	L 2	L 3	L 4	L 5	L 6	L 7
Talla promedio cm	20.9	40.9	54.9	68.6	17.6	83.3	88.6

Se estudió además la relación longitud-peso y el coeficiente de condición, alimentación y parasitismo en la especie.

Pesca exploratoria

Durante 1971 se llevaron a efecto cruceros de pesca exploratoria en el Delta del Orinoco y Golfo de Paria. En el Delta se descubrieron grandes concentraciones de camarones cerca de la Isla Redonda y en el Golfo de Paria las capturas más importantes fueron de camarones blanco, curvina, curvinata y bagra.

Programa de evaluación de crustáceos

Durante este período se estuvieron estudiando el recurso camaronero (Penaeus Schmitti, P. duorarum, P. aztecus, P. brasiliensis y Xiphopenaeus Kroyeri) así como el de los cangrejos (Callinectes sapidus yC. boucorti).

Ha quedado terminado el primer informe sobre el estado de los recursos camarones en el occidente de Venezuela. En él se ha hecho especial interés por resolver ciertos problemas relacionados con el reclutamiento, fluctuaciones mensuales del número de camarones de cada tamaño, por día de pesca. También se puso énfasis en obtener más datos sobre el desove durante ese período.

Asimismo quedó terminado una evaluación preliminar de la pesquería del camarón en el Oriente de Venezuela, la cual indica que la explotación del camarón aún no afecta las existencias. Se determinó como unidad de esfuer o el barco/mes.

En cuanto a cangrejo se inició un programa de muestreo biológico de rutina y el procesamiento de las capturas.

Programa de moluscos y maricultura

En Venezuela se lleva a cabo un activo programa de investigación de la biología de la ostra de mangle (Crassostrea rhizophorae) y mejillón (Perna perna), en cuanto a estudios de crecimiento, engorde, desove y maduración, parasitismo y competidores tanto en los bancos naturales como en viveros, con fines a utilizar esas especies para el cultivo en escala comercial.

Se inició ensayos de cultivos de camarón P. duorarum a partir de larvas en estanques de 0.4 hectáreas. En laboratorio se realizan experiencias para lograr larvas a partir de desoves inducidos de camarones.

Carta Pesquera del Nororiente y Guayana

Quedó terminado los trabajos de campo y análisis de más de 1,500 pescas de arrastre que conformará la carta pesquera del Nororiente y Guayana, la cual cubre las áreas del Caribe Sur-oriental venezolano, Golfo de Paria y plataforma atlántica hasta la desembocadura del río Esequivo. Los resultados serán dados en cuadrículas geográficas en términos de Kgs./Hect. y Kgs./arte/hora. Se apuntan las condiciones geográficas del área, tipo de fondo y distribución de las especies. Detalles de la biología de algunas especies de importancia económica.

Carta pesquera del Caribe Central Venezolano.

Se iniciaron los trabajos de campo para la exploración del área que comprende desde el Cabo Codera a Punta San Román en la Península de Paraguana e incluve las plataformas insulares de las islas La Orchila, archipiélago de los Roques v las Aves.

Tecnología y Educación

En 1971 se realizaron estudios comparativos de los diferentes artes de pesca utilizados en Venezuela.

En educación se inició en 1971 en la Universidad de Oriente cursos de post-graduados (nivel universitario) en las especialidades de Oceanografía Física, Química, Biología Marina, Biología Pesquera, como un programa multinacional bajo los auspicios de la O.E.A. para los países del área del Caribe.

BIOLOGIA DE PECES Y PESQUERIAS

Programa de evaluación de recursos pelágicos.

En Venezuela se lleva a cabo un intensivo programa de muestreo de las siguientes especies:

Sardina - Sardinella anchovia
Machuelo - Opisthonema oglinum
Rabo amarillo - Categraulis edululus
Cataco - Selar crumenophthalmus
Lisa - Mugil curema
Lebranche - Mugil lisa
Atún aleta amarilla - Thunnues albacares
Albacora - Thunnus alalunga
Otros atunes - Thunnus obesus, Sarda sarda
Carites - Scomberomorus maculatus y cavalla
Cachorreta - Scomber japonicus

En total se muestrearon 20,000 ejemplares de 15 especies distintas.

Se recopilaron estadísticas de capturas y esfuerzo con respecto a las pesquerías de sardina, atún y carite.

Se terminó un estudio de la relación entre las capturas de sardinas y la temperatura superficial y la salinidad del mar en el oriente de Venezuela, durante los últimos 8 años. Se prepara un informe sobre ese estudio.

En cuanto a las pesquerías de atún, se determinaron las tendencias de las capturas y la captura por unidad de esfuerzo y se analizaron las diferencias entre los recursos de atún aleta amarilla de las dos áreas principales de pesca (Caribe y Atlántico). El promedio de captura de atún (varias especies combinadas) durante 1971 fue de 1.17 pescados por cada 100 anzuelos en el Atlántico y de 1.93 en el Caribe.

La tasa media de captura de carite pintado (S. maculatus) fue de 3.5 pescados aproximadamente por cada 100 m2 horas de filete de ahorque calado.

Estudio de huevos y larvas.

Durante 1971 los trabajos de campo relacionados con huevos y larvas en la costa norte de la de Venezuela entre Cumaná y la Península de Paria abarcado los alrededores de la Isla de Margarita, que abarcó dos salidas durante el cual se capturaron 182 muestras, que se encuentran en procesamiento. Sobre este programa salió publicado el primer trabajo: "Distribución y abundancia estimada de huevos de la sardina 'Sardinella anchovia' en la Región Oriental de Venezuela, 1968-1969".

Prospecciones hidroacústicas.

Durante 1971 se realizaron dos prospecciones hidroacústicas en aguas costaneras del Nordeste de Venezuela entre Enero 1 y Abril y de Mayo 1 a Julio 31. Se usaron una Supersonda Simrad tipo EH 2E y un Echo Scope (lupa de pesca) tipo CA2. En total se realizaron 22 cruceros, que dieron origen a 2 publicaciones, Informes Técnicos Nos. 32 y 33.

Programa de evaluación de recursos demersales.

Las principales especies bajo estudios son:

Cazón especies - Mustelus canis
M. higmani
M. norrisi

Corocoro (varias especies) - Haemulon flavolineatum, H. macrostomum, H. melanurum, H. plumieri.

Lamparosa - Vomer setapinnis
Roncador - Menticirrhu furnieri
Curvinata - Macrodon ancyladon
Curvina - Cynoscion maracaiboensis
Picúa - Sphyraen sp.

A los cuales se les obtiene datos acerca de longitud, peso, sexo, maduración sexual, grado de parasitismo.

Se estudia las pesquerías mediante durante un programa de Cuadernos de Bitácoras para determinar la unidad de esfuerzo pesquero de la flota pesquera de arrastre tanto del Oriente como del Occidente de Venezuela.

Quedó terminado un estudio de la biología y pesca de la curvina, CYNOSCION MARACAIBOENSIS, del Lago de Maracaibo, en el cual se determina que el desove de esa especie tiene lugar en la Bahía del Tabalzo, Estrecho de Maracaibo, y la parte del norte del lago, con un período de máxima intensidad de desove de enero a abril. El primer desove se efectúa a los 35 - 40 cm. de longitud total al finalizar el primer año de vida.

Se determina la edad y crecimiento de la especie por el método de las escamas con los siguientes resultados:

Edad	L 1	L 2	L 3	L 4	L 5	L6	L 7
Talla promedio cm.	20.9	40.9	54.9	68.6	17.6	83.3	88.6

Se estudió además la relación longitud-peso y el coeficiente de condición, alimentación y parasitismo en la especie.

Pesca exploratoria.

Durante 1971 se llevaron a efecto cruceros de pesca exploratoria en el Delta del Orinoco y Golfo de Paria. En el Delta se descubrieron grandes concentraciones de camarones cerca de la Isla Redonda y en el Golfo de Paria las capturas más importantes fueron de camarones blanco, curvina, curvinata y bagre.

Programa de evaluación de crustáceos.

Durante este período se estuvieron estudiando el recurso camaronero (Penaeus Schmitti, P. duorarum, P. aztecus, P. brasiliensis y Xiphopenaeus Kroyeri) así como el de los cangrejos (Callinectes sapidus y C. boucorti).

Ha quedado terminado el primer informe sobre el estado de los recursos camaroneros en el occidente de Venezuela. En él se ha hecho especial interés por resolver ciertos problemas relacionados con el reclutamiento, fluctuaciones mensuales del número de camarones de cada tamaño, por día de pesca. También se puso énfasis en obtener más datos sobre el desove durante ese período.

Asimismo quedó terminado una evaluación preliminar de la pesquería del camarón en el Oriente de Venezuela, la cual indica que la explotación del camarón aún no afecta las existencias. Se determinó como unidad de esfuerzo el barco/mes.

En cuanto a cangrejo se inició un programa de muestreo biológico de rutina y el procesamiento de las capturas.

Programa de moluscos y Maricultura.

En Venezuela se lleva a cabo un activo programa de investigación de la biología de la ostra de mangle (Crassostrea rhizophorae) y mejillón (Perna perna), en cuanto a estudios de crecimiento, engorde, desove y maduración, parasitismo y competidores tanto en los bancos naturales como en viveros, con fines a utilizar esas especies para el cultivo en escala comercial.

Se inició ensayos de cultivos de camarón P. duorarum a partir de larvas en estanques de 0.4 hectáreas. - En laboratorio se realizan experiencias para lograr larvas a partir de desoves inducidos de camarones.

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ANNEX F

Report of Asst. International Coordinator for Fisheries

PROGRAMA DE RECURSOS PESQUEROS

INTRODUCCION

Después de haber sido efectuada la designación del Coordinador Adjunto para Pesquerías de CICAR, las actividades a realizar consistían en planificar detalladamente la acción requerida para la cumplimentación del programa de recursos pesqueros aprobado durante la IV Reunión del ICG y, debido al hecho de que no pude asistir a esa reunión, las consultas se hicieron a través de FAO con el asesor de mi predecesor, el Dr. Kesteven (FAO, México). A este fin, se celebró una reunión ad hoc en ciudad México, del 12 al 13 de julio de 1971, en la que participaron el Dr. Kesteven, el Sr. K. Sherman (National Marine Fisheries Service, U.S.A.), el Sr. P. Lockerman (FAO, México), y el Dr. C. Kensler (FAO, México). Los resultados de dicha reunión fueron los que aparecen a continuación:

1. Designación de los siguientes directores de temas para tres proyectos:

   i. El Sr. Sherman para "Identidad y abundancia relativa de formas juveniles, huevos y larvas";

   ii. El Dr. Kensler para "Lagunas costeras y maricultura";

   iii. El Dr. Tapias R. para "Evaluación de existencias de recursos, particularmente de camarones".

2. Discusión y esbozo de las responsabilidades del Coordinador Internacional Adjunto (Pesca) y de los directores de proyectos, incluyendo los procedimientos que deben seguir al fomentar las actividades de la CICAR y sus métodos de comunicación.

3. Discusión de la estructura de los tres proyectos mencionados anteriormente y discusión general de otros proyectos pesqueros, i.e., evaluación y gestión de las existencias de tortugas, y contaminación marina.

4. Disposiciones inmediatas para ciertos elementos del programa de pesquerías, principalmente para un trabajo ulterior de intercalibración en el empleo de redes para plancton y peces juveniles.

Los detalles de las medidas tomadas en cada proyecto se ofrecen en las siguientes reseñas.

PROGRESOS ALCANZADOS EN LOS DIFERENTES PROYECTOS

IDENTIDAD Y ABUNDANCIA RELATIVA DE FORMAS JUVENILES, HUEVOS Y LARVAS.

Se le asignó máxima prioridad al hecho de facilitar y hacer más efectivas las operaciones en el mar relacionadas con este proyecto. Se realizaron varios intentos para instrumentar un experimento de intercalibración del aparejo para la recolección del plancton entre Cuba, México y los Estados Unidos. No obstante fue imposible, lamentablemente, llegar a un acuerdo sobre las diferentes fechas propuestas para llevar a cabo el experimento, razón por la cual éste no llegó a llevarse a cabo. Por consiguiente, la reunión programada para celebrarse en Miami, a fin de evaluar los resultados de dicho experimento de intercalibración, tuvo que ser cancelada. En cuanto a las actividades nacionales realizadas por los países miembros de CICAR con respecto a este proyecto, poseo una información muy limitada

El 20 de Marzo de 1972, fue enviada una carta circular dirigida a todos los Coordinadores Nacionales y Coordinadores Nacionales Adjuntos para Pesquería en la cual se solicitaba información sobre los cruceros para cumplir los fines de este proyecto, incluyendo área, métodos de muestreo, muestras recogidas, estado del procesamiento de las muestras y publicación de los resultados. Se recibieron respuestas de Colombia, los Países Bajos, Alemania, Reino Unido, Cuba, Venezuela y los Estados Unidos, pero solamente Cuba, Venezuela, los Países Bajos y los Estados Unidos indicaron que se había realizado algún trabajo. Supongo que los informes de dicha labor serán presentados por los Coordinadores nacionales.

EVALUACION Y GESTION DE LAS EXISTENCIAS DE TORTUGAS

No se recibió información alguna sobre las actividades nacionales relacionadas con este proyecto en respuesta a mi carta circular del 20 de marzo. Se solicitó a la Unión Internacional para la Conservación de la Naturaleza y los Recursos Naturales la colaboración, en este campo, de su grupo de especialistas en tortugas marinas. Se propuso que algunos especialistas en tortugas asistieran a la V reunión del ICG a fin de desarrollar una acción futura en este campo, en particular una investigación regional coordinada y un programa de gestión. También se sugirió la posibilidad de presentar un documento de trabajo en la reunión de CICAR en el que se resumiera todo el conocimiento que se posee sobre existencias de tortugas y el estado actual de explotación.

Lamentablemente, no había fondos disponibles para garantizar la asistencia de los especialistas en tortugas. No obstante, un trabajo sobre la "Distribución y gestión de las tortugas marinas del Caribe" (por Rainey y Pritchard) ha sido publicado recientemente. Asimismo, FAO ha publicado no hace mucho una sinopsis sobre la especie tortuga verde (Chelonia mydas) de Hirth. Se pondrá a la disposición del Grupo de trabajo sobre recursos pesqueros copias de estos documentos para su consulta y discusión.

EVALUACION DE LAS EXISTENCIAS DE RECURSOS, PARTICULARMENTE DE CAMARONES.

En la reunión ad hoc celebrada en México, se decidió organizar en La Habana un seminario sobre identificación de existencias de camarones que se celebraría la semana anterior a la V Reunión de la ICG de CICAR. Tras discusiones con la FAO, la cual había acordado contribuir con un número de documentos al Seminario; se decidió que el mismo discutiera la evaluación de existencias, en particular las evaluaciones del estado de las existencias de camarones en la región de CICAR como base para la gestión. La reunión fue denominada "Seminario sobre investigaciones de las existencias de camarones". Todos los Coordinadores nacionales y los Coordinadores nacionales adjuntos fueron informados acerca de dicho Seminario por carta circular de fecha 20 de marzo de 1972 y se les invitó para que tomaran las medidas necesarias a fin de que participaran en él los expertos sobre investigación de camarones de sus respectivos países. De igual forma se invitó a los Proyectos de pesquería de FAO que están en la región de CICAR a que enviaran sus biólogos internacionales de camarones y su contraparte. Sólo se recibió respuesta de Cuba y de la FAO. En vista de esta situación, se decidió posponer el seminario hasta un momento en que se pudiera esperar una mejor participación de científicos nacionales.

Puesto que la preparación de los documentos de trabajo para el Seminario y las disposiciones en La Habana estaban muy avanzadas, FAO decidió celebrar en vez del Seminario, una consulta interna sobre las existencias de camarones. Asistieron a la misma personal de la Sede de la FAO, de cinco proyectos de campo, y la contraparte nacional de Cuba, México y Colombia. Se aprobó la agenda del Seminario y se preparó un informe provisional de la Reunión de consulta, que está a la disposición de la V Reunión de la ICG de CICAR. Como se sugiere en el informe de la Reunión de consulta, las fechas, la preparación y la distribución de las responsabilidades de la organización del futuro Seminario debe ser discutida en detalle por el Grupo de trabajo sobre recursos pesqueros.

ESTUDIOS SOBRE LAGOS Y MARICULTURA

El Dr. Kensler viajó a Cumana, Venezuela, desde el 11 hasta el 15 de octubre de 1971, para asistir a la 9a. Reunión de la Asociación de Laboratorios Marinos Insulares del Caribe.

El principal objetivo era presidir una sesión relacionada con los proyectos de pesca de la CICAR, en particular de maricultura, camarones, huevos y larvas. Llegó a la conclusión que la mejor información recibida por CICAR fue el anuncio y los detalles de dos Seminarios que tendrían lugar en 1972: un Seminario sobre el Cultivo de Camarones, para biólogos latinoamericanos, y el Seminario de CICAR sobre Investigaciones de las Existencias de Camarones.

Kensler ayudó en la planificación, organización y funcionamiento del Seminario sobre el Cultivo de Camarones, auspiciado conjuntamente por el Gobierno de los Estados Unidos de Norteamérica y FAO. El seminario tuvo lugar en el Laboratorio Biológico de los E.U.A. en Galveston, Texas, desde el 20 hasta el 31 de marzo de 1972. Aunque el Seminario no se organizó dentro del marco de CICAR, la mayoría de los participantes se seleccionaron entre los países miembros de la misma. Asistieron dieciséis biólogos, en representación de los siguientes países: Brasil (2), Colombia (1), Cuba (1), México (3), Venezuela (5), El Salvador (1), Chile (1), Ecuador (1) y Uruguay (1).

El Seminario se preparó para que incluyera conferencias y ejercicios prácticos destinados a ofrecerle a cada participante experiencia en el uso de los equipos especializados y para presentarles los procedimientos técnicos útiles en la investigación del cultivo de camarones. Debido a que el Seminario resultó ser un éxito, se acordó que se celebraría otro en 1973.

Tanto el Dr. Kensler como el Dr. Kesteven (FAO, México) han efectuado muchos contactos con relación a los estudios de las lagunas. En el área de la CICAR hay trabajos sobre las lagunas que se desarrollan en Cuba, México, los Estados Unidos, Brasil, Colombia, Venezuela y Puerto Rico. No hay dudas que el interés en este campo es grande, especialmente las posibilidades de maricultura en agua salobre, así como que las consultas sobre el trabajo actual, la colaboración, la estandardización, etc., serían muy útiles en un futuro cercano. Sin embargo, tales consultas o un Seminario requerirían la participación de los países miembros de CICAR. Este tema será discutido seguramente por el Grupo de trabajo sobre recursos de pesca antes que se bosqueje un programa detallado.

ESTUDIOS SOBRE CONTAMINACION MARINA

Se solicitó a FAO que proporcionara asesoramiento sobre los lineamientos generales para definir un programa cooperativo en este campo y se sugirió que se podría tomar la siguiente medida: a) Primero, obtener tanta información como fuese posible sobre los diferentes datos disponibles, al igual que de los programas vigentes sobre la contaminación marina y sus efectos en los recursos vivientes de los países fronterizos al área de la CICAR; b) Designar un pequeño grupo de trabajo ad hoc que podría trabajar por correspondencia; c) Desarrollar planes para estudios básicos. Sin embargo, debido a la complejidad de los problemas de la contaminación marina y a la Conferencia de las N. U. en Estocolmo, se decidió no iniciar ninguna medida sin antes tomar en consideración cualquier recomendación o planes que resultaran de dicha reunión.

No se ha nombrado todavía al director de proyecto de esta actividad.

EVALUACION GENERAL DEL DESARROLLO Y CONCLUSIONES

En general el desarrollo alcanzado en el programa sobre los recursos pesqueros dista mucho de ser satisfactorio.

Hasta el momento el proyecto más prometedor parece ser Evaluación de las existencias de camarones, no sólo por sus implicaciones prácticas en cuanto a las pesquerías internacionales, sino también por el sólido apoyo que ha recibido de los proyectos de campo de FAO y UNDP. También debe mencionarse la proposición para un segundo Seminario sobre el cultivo de camarones, para biólogos latinoamericanos; dicho adiestramiento es valioso y aplicable a la mayoría de los países miembros de CICAR.

La razón por la cual el desarrollo del programa de recursos pesqueros dista de ser satisfactorio puede ser la falta de un interes sincero de parte de los países miembros, la insuficiencia de fondos para participar más activamente o la falta de información por parte de los biólogos de pesquería de los países miembros. Los problemas de comunicación han sido uno de los mayores obstáculos en mi trabajo, como por ejemplo, la respuesta a muchas de mis cartas y telegramas o bien eran imprecisas o bien no se recibían. Otra dificultad importante ha sido la de no contar con fondos para responder a las numerosas necesidades de carácter administrativo, i.e., trabajo de oficina, franqueo, telegramas y llamadas telefónicas.

No se contó con fondos para viajes dentro de la región y considero que ésto es un serio obstáculo para el éxito del programa de recursos pesqueros.

Creo que los elementos mencionados son esenciales para asegurar una medida efectiva por parte del Coordinador Internacional Adjunto para Pesquerías, y a menos que puedan brindarse, no podré continuar en el desempeño de este cargo. Espero sinceramente que pueda encontrarse una solución.

REPORT OF THE ASSISTANT INTERNATIONAL COORDINATOR FOR METEOROLOGY

(by H.B. Stewart, Jr.
for Feodor Ostapoff)

The detailed report on the status of meteorology in the CICAR region presented at the IVth. CICAR meeting remains essentially unchanged. No reports of CICAR meteorological activities were received, so only the activities of the Assistant International Coordinator for Meteorology's laboratory (the Sea-Air Interaction Lab of NOAA-AOML in Miami) are reported. With Ostapoff as Chief Scientist, the DISCOVERER in September and October of 1971 studied the reactions of the oceanic mixed layer to atmospheric variations using primarily instrumented buoys that measured both meteorological and oceanographic characteristics. Mr. Peter Connors of the Sea-Air Interaction Lab. joined the Colombian ARC SAN ANDRES at Cartagena and provided education and training in meteorological observation techniques.

The Global Atmospheric Research Program of WMO (GARP) is planning a GARP Atlantic Tropical Experiment (GATE) for July, August and September of 1974 in the equatorial Atlantic, and ships from the CICAR countries are urged to participate. The WMO Voluntary Assistance Programme will be able to provide meteorological instrumentation to such ships for use during, and retention after, the GATE operation. It is probable that physical oceanographic equipment can also be provided to participating CICAR ships. Requests should be made to the Voluntary Assistance Programme of WMO through your country's Permanent Representative to the World Meteorological Organization.

Vth Meeting of the CICAR Coordinating Group.

CICAR STANDARD OCEANOGRAPHIC SECTIONS AND SURVEY MONTHS

Activities, March 1971 to May 1972

Prepared by Ingvar Emilsson
(UNESCO/UNDP)
Subject Leader for
Standard Sections

Standard Sections.

In attention to what was recommended by the IV Meeting of the CICAR Coordinating Group (Recommendation 4.14,SC/IOC/CG-S(IV)12) the Subject Leader for Standard Sections undertook to establish the positions of the oceanographic stations along the 13 Standard Sections established in the CICAR region.

The nautical charts employed for this purpose were the BC and the GEBCO Series from the U.S.Oceanographic Office, which we believe contain the most detailed information on bottom topography in the region. The criterion applied to establish the station positions were mainly:

1. The topography of the area through which each Standard Section passes as well as the situation of this in relation to adjacent lands and shallow areas.
2. The density of stations should be such as to reveal the main features of the horizontal variation of the parameters along the section.
3. The number of stations along each section should be kept as low as possible so it could be covered by a normal speed vessel, employing classical methods, within a reasonable time.

A list of the station positions along the Standard Sections was distributed to the National Coordinators and other interested on July 26, 1971, through the circular letter Nr.74 of the International Coordinator.

On January 1972, the Subject Leader requested, through a circular letter to the National Coordinators, information concerning the activities on the Standard Sections as well as on participation in the CICAR Survey Months.

Relevant information was received from the National Coordinators of Brazil, Colombia, Cuba, Germany, Guatemala, Mexico, Trinidad and Tobago, United Kingdom, United States of America and Venezuela. Valuable information was also received from NODC (René Cuzon du Rest) and the Operations Coordinator in Curaçao (Tom Van't Hof). Although no direct information was receiv edfrom the National Coordinator of U.S.S.R., we are aware that several soviet research vessels have been working in the CICAR area, on the standard sections as well as during the Survey Months.

Annex I of the present report gives a summary of the activities carried out on the Standard Sections from March 1971 through May 1972. We are aware that this summary is incomplete and a criticism as well as additional data for its completion is highly appreciated.

It can be seen from this table that some Standard Sections have been covered very frequently during the period, while others received little or no attention. The most favored section is of course "d_1" in the Yucatan Channel, with no less than 28 coverages, whereof 17 were carried out during the CSM-II, April-May 1972.

Next on the list comes the section "i" in the SW Gulf of Mexico, with 9 coverages. The only section, as far as our information goes, which has received no attention during the period is "b_3", across the Mona Passage (Puerto Rico-Hispaniola). Other sections have been covered at least once during this period.

The work carried out on the oceanographic stations consisted mainly of hydrocasts to different depths; continuous vertical recordings of salinity and temperature by means of STD and MBT; in some cases, nutrients and trace elements have been observed, and planeton sampling by different methods was also done.

The Survey Months

CSM-I.- According to the information at hand, a total of 8 vessels participated in the operations of the First Survey Month in August 1971. The table (Annex II) shows that 6 ships of these were from the U.S.A., 1 from Mexico and 1 from Venezuela. The activities were mainly concentrated at the two extremes of the region, i.e. the East Caribbean and the NW-Tropical Atlantic, on one side, and the Gulf of Mexico and the W.Cayman Sea, on the other. The central part of the area was left open due to the circumstance that the Colombian vessel "San Andrés" was not ready for operation, as had been hoped.

It will be recalled that one of the reasons to choose the month of August for this cooperative activity was because this time of the year marks the beginning of the main season of intense tropical cyclones in the CICAR area. Therefore much emphasis had been laid on the air-sea interaction aspect of the operation. By a favorable coincidence at least one of the vessels, "Virgilio Uribe" of Mexico, manages to observe the oceanographical conditions before the hurricane "Chloe" passed the Standard Section "e_1" (Jamaica-Honduras) and then return to the same area immediately after, to repeat the stations.

The material collected on these cruises are of a special value for the oceanography of the area due to its simultaneous nature. In what regards the hydrographic data, Dr R. Molinari of NOAA's Atlantic Oceanographic and Meteorological Laboratories, Miami, has offered to put these together systematically. Such effort will constitute a very valuable contribution and all CICAR members should therefore assist Dr. Molinari in this task by sending to him relevant data either directly or through the CICAR Data Inventory.

CSM-II.- The second Survey Month was originally scheduled for the month of April, however, due to problems related to the availability of ships for the operations, the International Coordinator decided to delay the official beginning date to April 15.

From the table, Annex III, we see that 9 ships and 2 aircrafts participated in the operation. The main effort was concentrated on the flow through the Yucatan Channel and the Florida Straits and the dynamics of adjacent areas. To monitor the transport, 2 aircrafts equipped with "drop-sonds" were employed. The Mexican vessel carried also out GEK current observations in the area. At the same time the mass distribution in the upper 1000 m was observed by means of hydrocasts, STD and XBT.

This special cooperative venture was carried out by 3 U.S.

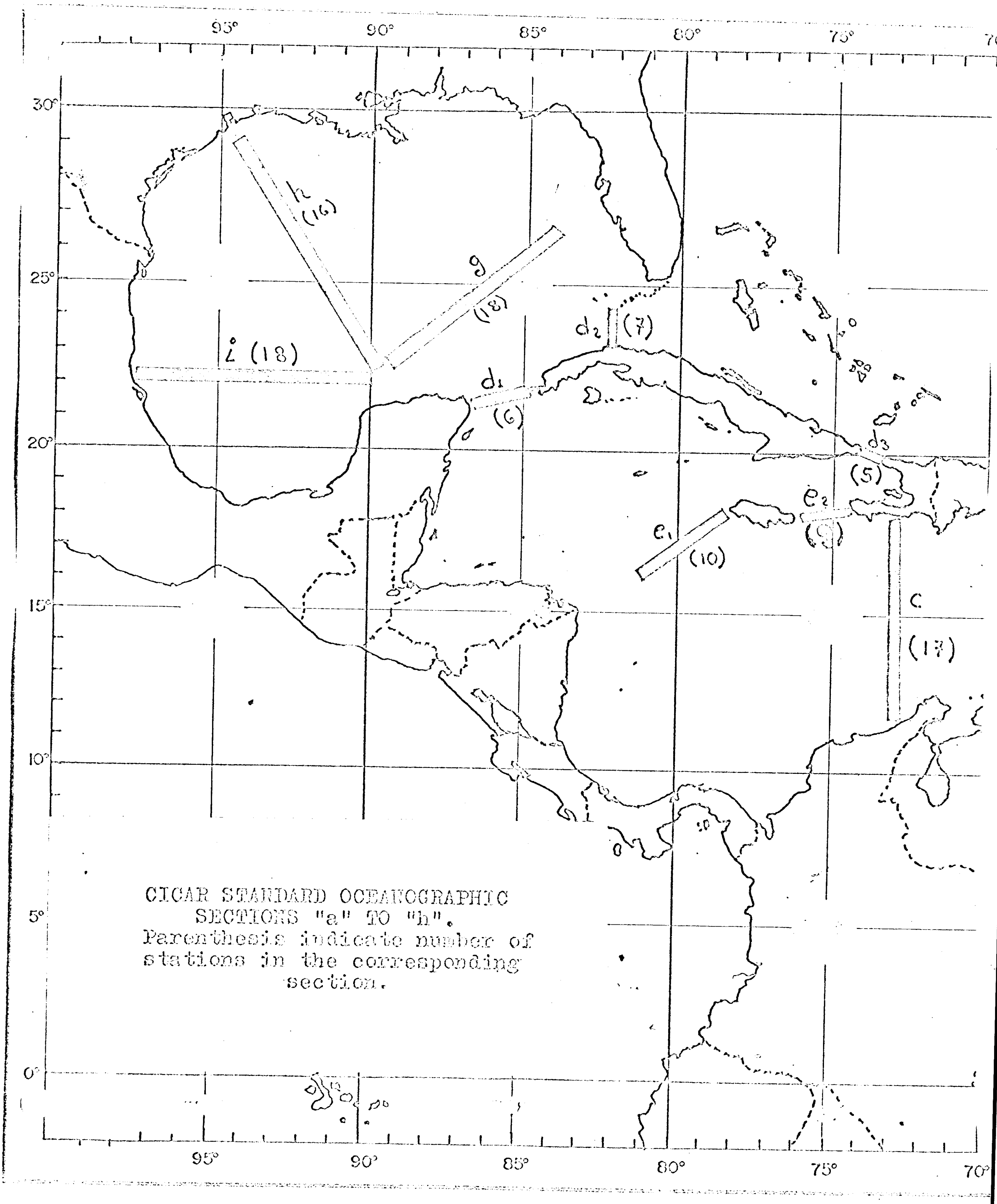
vessels: "Alaminos", "Gulf Stream" and "Virginia Key", 1 Mexican vessel, "Virgilio Uribe" and possibly also Cuban and/or Soviet vessels.

A special mention should be made of the heroic contribution of R.V. "Virginia Key" which, under the leadership of Dr. Robert Molinari, made 15 crossings of the Yucatan Channel in spite of its small size (60 feet), unfavorable weather conditions and other adversities.

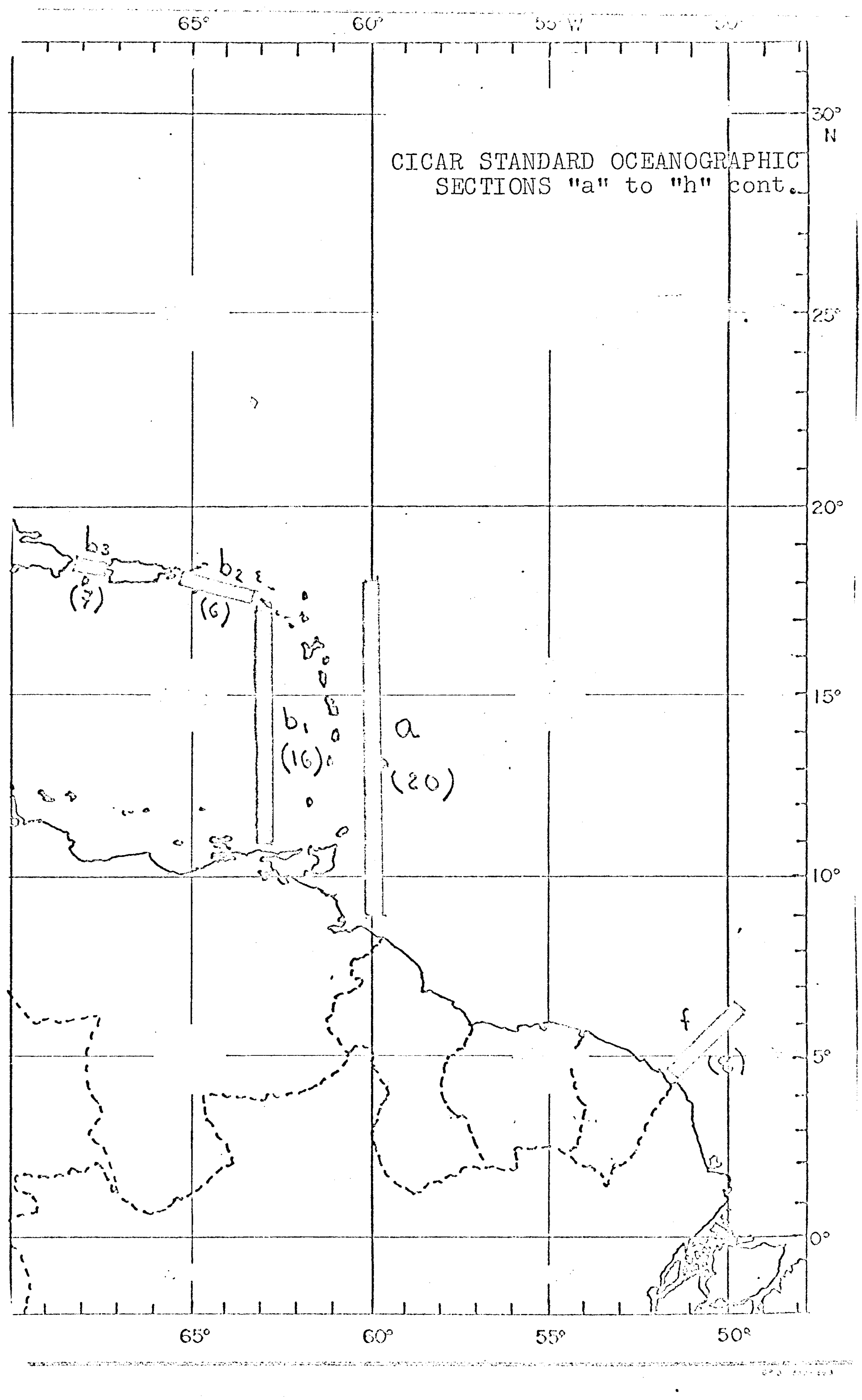
While this was going on in the Yucatan-Florida area, the Colombian research vessel "San Andrés" covered the Standard Sections "c" along the 73°W meridian as well as the Hispaniola-Honduras line (e_1, e_2, e_3).

We are also informed that the Dutch vessel "Luymes" was working in the East Caribbean (b_1) at this time and that the Soviet research ships "Akademik Kurchatov" and "Vassily Golovnin" were also doing oceanographic work in the area.

"En abril de 1972 el barco de investigación soviético Akademik Korchatov realizó un trabajo oceanográfico a lo largo de las Secciones estandar b_1; b_2; b_3. Durante esta travesía se investigaron las corrientes y las variaciones de las masas de agua.
En ese mismo período el barco de investigación Vassily Golovnin realizó investigaciones en el Canal de Yucatán y en la parte occidental del Caribe."



CICAR STANDARD OCEANOGRAPHIC SECTIONS "a" TO "h". Parenthesis indicate number of stations in the corresponding section.


65°
60°
55° W
30° N
CICAR STANDARD OCEANOGRAPHIC
SECTIONS "a" to "h" cont.
25°
20°
15°
10°
5°
0°
b3
(7)
b2
(6)
b1
(16)
a
(20)
f
65°
60°
55°
50°

Annex I

COVERAGE OF CICAR STANDARD SECTIONS

March 1971 through May 1972

S.S.	Date	Nr. of Stations	Ship	Country	Operations
a	Aug. 1971	10	LaSalle	Venezuela	Hydrocasts, nutrients, plancton, Met.
a	Aug.Sept. 1971	20	Rockaway	USA	Hydrocasts to over 2000 m, STD, XBT
b_1	March. 23 - 28 1971	15	HMS Hecla	U.K.	Hydrocasts, XBT (89)
b_1	Aug. 1971	10	LaSalle	Venezuela	Hydrocasts, nutrients, plancton, Met.
b_1	Sept.Oct. 1971	12	Discoverer	USA	STD, XBT, drift bottles
b_2	Sept.Oct. 1971	3	Discoverer	USA	STD, XBT, drift bottles
b_2	April 1972	6	Luymes	Neth.	Hydrocasts
c	April 1972	17	San Andrés	Colombia	Hydrocasts to standard depths, Ox., pH, nutrients, plancton
d_1	April 1971	5	Aliot	Cuba	Hydrocasts to 750 m, Met.
d_1	May 1971	5	Aliot	Cuba	Hydrocasts to 750 m, Met.
d_1	July 1971	5	Aliot	Cuba	Hydrocasts to 750 m, Met.

PARA EL ANEXO NO. 1

S.E.	Fecha	No. de la Estación	Barco	País	Operaciones
a	Abril/1972	20	La Salle	Venezuela	Mediciones hidrológicas, nutrientes, plancton, met.
b_1	Abril/1972	10	La Salle	Venezuela	Mediciones hidrológicas, nutrientes, plancton, met.
b_1	Abril/1972	?	A.Kurchatov	U.R.S.S.	Mediciones hidrológicas, Plancton, met.
b_2	Abril/1972	?	A.Kurchatov	U.R.S.S.	Mediciones hidrológicas, plancton,met.
b_3	Abril/1972	?	A.Kurchatov	U.R.S.S.	Mediciones hidrológicas, plancton, met.
d_1	Abril/1972	6	V.Golovnin	U.R.S.S.	Mediciones hidrológicas, met.

Anexo III renglon 9 : Sustituya ? por d_1

Sustituya en el Anexo III los dos últimos renglones por:

País	Barco	Agencia	Area	S.E.	Operaciones
U.R.S.S.	Akademik Kurchatov		Pasos de las Antillas y del NO del Atlántico Tropical	b_1;b_2;b_3	Mediciones hidrológicas, plancton, met.
U.R.S.S.	Vassily Golovnin		Caribe O. y Canal de Yucatán	d_1	Mediciones hidrológicas, nutrientes, met.
Venezuela	La Salle		Caribe Oriental, y NO del Atlántico Tropical	a, b_1	Mediciones hidrológicas, nutrientes, plancton, met.

Coverage of CICAR Standard Sections (continue)

S.S.	Date	Nr.of Stations	Ship	Country	Operations
d_1	Aug.15-16 1971	6	V.Uribe	Mexico	Hydrocasts to 1500 m, XBT, GEK, Synoptic Meteor.,Prim.prod., planeton
d_1	Oct. 1971	5	Foton	Cuba	Hydrocasts to 1000 m, Phos., Met.
d_1	Nov. 1971	5	Foton	Cuba	Hydrocasts to 1500 m, Phos., BT, Met.
d_1	Dec. 1971	5	Foton	Cuba	Hydrocasts to 750 m, Phos., current obs., Met.
d_1	Jan. 1972	5	Foton	Cuba	Hydrocasts to 750 m., Met.
d_1	Feb. 1972	5	Foton	Cuba	Hydrocasts to 750 m, Met.
d_1	March 1972	5	Foton	Cuba	Hydrocasts to 750 m, Met.
d_1	April 1972	-	Alaminos	USA	Hydrocasts to bottom, XBT to 1250 m
d_1	April 29 to May 22 1972	-	Virginia Key	USA	15 crossings with some 15 XBT and STD stations on each
d_1	May 2 1972	10	V.Uribe	Mexico	Hydrocasts to 1500 m, XBT, GEK, Synoptic Meteor., plancton
d_1	May 12 - 13 1972	8	V.Uribe	Mexico	Hydrocasts to 1200 m, XBT, GEK, Synoptic Meteor., plancton

Coverage of CICAR Standard Sections (continue)

S.S.	Date	Nr.of Stations	Ship	Country	Operations
d_2	April 1971	6	Aliot	Cuba	Hydrocasts to 750 m, Met.
d_2	May 1971	6	Aliot	Cuba	Hydrocasts to 750 m, Met.
d_2	June 1971	6	Aliot	Cuba	Hydrocasts to 1000 m, Met.
d_2	Oct. 1971	6	Foton	Cuba	Hydrocasts to 1000 m, Phos., Met.
d_2	Nov. 1971	6	Foton	Cuba	Hydrocasts to 1000 m, Phos., BT, Met.
d_2	Feb. 1972	6	Foton	Cuba	Hydrocasts to 750 m, Met.
d_2	May 1972	-	GulfStream	USA	Hydrocasts, current obs.
d_3	Nov. 1971	4	Foton	Cuba	Hydrocasts to 1500 m, Phos., BT, Met.
e_1	Aug. 22 - 25 1971	12	V.Uribe	Mexico	Hydrocasts to 1500 m, Prim.prod., planc ton
e_1	Aug. 1971	16	Discoverer	USA	STD, Ox., chemistry, drift bottles, XBT
e_1	April 1972	-	Alaminos	USA	Hydrocasts to bottom, STD to 1250 m

Coverage of CICAR Standard Sections (continue)

S.S.	Date	Nr.of Stations	Ship	Country	Operations
e_1	April 1972	10	San Andrés	Colombia	Hydrocasts, pH, nutrients, plancton
e_2	April 1972	9	San Andrés	Colombia	Hydrocasts, pH, nutrients, plancton
f	Aug.-Sept. 1971	8	Rockaway	USA	Hydrocasts to over 1200 m, STD, XBT
g	Aug. 1971	19	Oregon II	USA	Hydrocasts to 500 m(?), XBT, drift bottles, plancton
h	Aug. 1971	-	Oregon II	USA	Hydrocasts to 500 m(?), XBT, drift bottles, plancton
i	Apr.8-9 1971	7	V.Uribe	Mexico	Hydrocasts to 500 m, plancton, met.
i	June 1 - 3 1971	11	V.Uribe	Mexico	Hydrocasts to 1500 m., GEK, plancton, Met.
i	July 25 - 27 1971	7	V.Uribe	Mexico	Hydrocasts to 500 m, plancton, Met.
i	Aug.30 to Sept.1 1971	19	V.Uribe	Mexico	Hydrocasts to 1500 m, XBT, GEK, Prim.prod., Synoptic Meteor.
i	Oct. 13 - 14 1971	7	V.Uribe	Mexico	Hydrocasts to 500 m, plancton, Met.

Coverage of CICAR Standard Sections

S.S.	Date	Nr.of Stations	Ship	Country	Operations
i	Nov. 2 - 4 1971	11	V.Uribe	Mexico	Hydrocasts to 1500 m, XBT, GEK, Met.
i	Nov. 14 - 24 1971	6	Alaminos	USA	Hydrocasts, STD, plancton
i	Jan. 1972	7	V.Uribe	Mexico	Hydrocasts to 500 m, plancton(?)
i	May 15 - 17 1972	17	V.Uribe	Mexico	Hydrocasts to 1200 m, XBT, plancton.

Annex II

OCEANOGRAPHIC ACTIVITIES IN THE CICAR AREA
DURING SURVEY MONTH I (CSM-I) AUGUST 1971

Country	Ship	Agency	Area	Standard Section	Operations
Mexico	V.Uribe	Mex.Navy UNAM	S.-Gulf, Yucatan Channel, W.Cayman Sea	d_1, e_1 g(part), i	Hydrocasts to 1500 m, Prim.prod., plancton, Syn.Met., Solar radiation.
U.S.A.	Bellows		Straits of Florida		
U.S.A.	Dan Braman	SUSIO	N.E.Gulf of Mexico		B.T., plancton
U.S.A.	Discoverer	NOAA	Cayman Sea Honduras Bay	e_1	Hydrocasts, STD, XBT, Met.
U.S.A.	Oregon II	SUSIO	North and Central Gulf	g, h	Hydrocasts, XBT, drift bottles, plancton
U.S.A.	Researcher	NOAA	W.Cayman Sea, E.Gulf Florida Straits		Hydrocasts, trace elements, XBT, B.T., STD, dragues, drift bottles, Met.
U.S.A.	Rockaway	U.S.C.G.	Tropical NW Atlantic	a, f	Hydrocasts, STD, XBT, Met.
Venezuela	LaSalle	I.O.U.O.	NW Tropical Atlantic East Caribbean	a, b_1	Hydrocasts, nutrients, plancton, Met.

OCEANOGRAPHIC ACTIVITIES IN THE CICAR AREA DURING SURVEY MONTH II (CSM-II) APRIL-MAY 1972

Country	Ship	Agency	Area	Standard Section	Operations
Colombia	San Andrés	Colombia Navy	W. Caribbean	c, e_1, e_2	Hydrocasts, pH, nutrients, plancton
Mexico	V.Uribe	Mex.Navy UNAM	S.-Gulf, Yucatan Channel, W.Cayman Sea	d_1, i	Hydrocasts to 1500 m, XBT, GEK, plancton, Syn.Met., Solar radiation.
Nether-lands	Luymes	R.D.Navy	East Caribbean	b_2	Hydrocasts
U.S.A.	Aircraft N30BB N50BB	NOVA Univ.	Florida Straits, Yucatan Channel	d_1, d_2	Transport studies by W.Richardson's drop-sound technique. Conj.with work at "Alaminos","Gulf Stream", "V.Uribe" and "Virginia Key"
U.S.A.	Alaminos	Texas A & M Univ.	W.Caribbean, Cayman Sea, Yucatan Channel East Gulf	d_1, e_1	Hydrocasts to bottom, STD to 1250 m
U.S.A.	GulfStream	NOVA Univ.	Florida Straits	?	Hydrocasts, current obs.
U.S.A.	Virginia Key	NOAA	Yucatan Channel	d_1	15 crossings with some 15 XBT and STD stations on each
U.S.S.R.	Akademic Kurchatov		?	some	Physical and Biological investigations
U.S.S.R.	Vassily Golovnin		?	some	Physical and Biological investigations

REPORT ON CICAR TIDE PROGRAM

National reports on CICAR tides received subsequent to the 1971 Trinidad meeting are summarized in the attached report. Tide and tidal current observations and harmonic constants that have become available are identified and will be furnished upon request.

The reports cover contributions by Colombia, Cuba, Guatemala, Mexico, Netherlands, United Kingdom and the United States. Germany and the USSR indicated that they did not have a tidal program during this period.

If national reports have been improperly documented or omitted, I request that these corrections be called to my attention so that amendments can be prepared and distributed.

I deeply appreciate the cooperation I have received in the tide program from numerous individuals and institutions.

Bernard D. Zetler

Bernard D. Zetler
Subject Leader - CICAR Tides

12 June 1972

Colombia

Times and heights of high and low waters and hourly heights for

Cartagena - January - November 1971
Riohacha - January - December 1971

Cuba

Cabo de San Antonio - Hourly heights, July-September 1971 and tide curve, October-November 1971.

Guatemala

Tide station at Santo Tomas de Castilla (15°42'N, 88°37'W) was maintained during 1971.

Mexico

The tide station at Banco Playa, Cozumel Island, has been maintained during the year. Harmonic constants have been computed for a 369 day series starting 11 May 1970 as well as for numerous 29-day series.

Tide observations were obtained at Puerto Juarez, Q. Roo (21°10.0'N, 86°49.3'W) during July and August 1970 and two overlapping 29-day tidal analyses were computed.

Dr. Nicolas Grijalva Ortiz prepared a paper, "The M_2 Tide in the Gulf of Mexico." The paper has been published but the name and date of the publication have not been furnished.

Dr. Grivel contributed considerably to a research study on tides in the eastern Caribbean by computing numerous tidal analyses by the Doodsón method for tide observations at Magueyes Island.

Netherlands

A series of tide observations has been obtained for Kralendijk, Klein Bonaire, by placing a pressure gauge on the sea floor. The data were used experimentally in designing a computer program for tidal analysis of successive series of deployments at slightly different depths. The method is described in a paper by Zetler and Cummings (U.S. report). Harmonic constants are available for five 29-day series and for two analyses of 207 days of data for 29 and 32 tidal constituents respectively. The S_2 epoch obtained in the new analysis matches that at nearby places, in sharp contrast to the previously published value. Therefore, the S_2 amphidrome is no longer constrained to the immediate vicinity of Bonaire.

A series of tide observations on a shoal between Aruba and Venezuela (12°16'N, 69°50'W) has been analyzed. Because of significant wave action, the record is quite noisy and the Netherlands recommends that "the results should be considered with reservations."

Tide observations have been obtained at Klein Curacao, N.W. coast (11°59.65'N, 68°39.05'W) during 16 May to 12 June 1970 and 16 September to 15 October 1970, and at N.W. Aruba, Malmok Bay (12°36.55'N, 70°03.45'W), 31 May to 12 June 1970, 18 June to 20 July 1970, and 22 October to 23 November 1970. These data have been prepared on punched cards for computer processing but have not yet been analyzed.

A tide gauge was scheduled for deployment near St. Eustatius, Oranjestad Roads, Windward Islands in March 1972.

United Kingdom

Tidal constants have been furnished for:

Black River, Jamaica (18°01.1'N, 77°50.9'W), 43 days, 1970
Savanna La Mar, Jamaica (18°12.3'N, 78°08.1'W), 2 days, 1970
Anguilla, Road Bay, Leeward Isl. (18°14.0'N, 63°05.5'W), 2x30 days, 1970.

Tides may be observed during 1972 at Port Castries, St. Lucia and Aves Island.

United States

Tidal harmonic constants are available as follows:

Pelagic station at 4 km depth (16°30'N, 64°55'W), 29 days, 1971.
Rosalind Bank at 102 ft. depth (16°36'N, 80°20'W), 2x15 days (overlapping), 1971.
Andros I., Bahamas (24°42'N, 77°46'W), 365 days, 1968-'69.
Grassy Key, Fla. (24°46'N, 80°56'W), 29 days, 1971.

A 15 day series of tide observations on Misteriosa Bank, Caribbean Sea, has not yet been analyzed. A tide gauge was installed at Grand Cayman Island (19°18'N, 81°23.0'W) in November 1971. Tide observations were started at Point Tuna and Isla Verde, Puerto Rico, and continued at Port Royal, Jamaica; Guantanamo Bay, Cuba; San Juan and Magueyes Island, Puerto Rico; Antigua and Tobago.

Tidal current harmonic constants are available for:

Grenada Passage, depths 225 M and 427 M (11°32'12"N, 61°54'12"W), 29 days, 1970.
Grenada Passage, depths 423 M and 625 M (11°39'00"N, 61°54'12"W), 29 days, 1970.
Yucatan Channel, 20 M above bottom at 2,000 M depth, (21°42'N, 85°46'W), 29 days, 1970.
Yucatan Channel, depths 72 M and 392 M (21°33'N, 85°45'W), 12.5 days, 1969.
Misteriosa Bank, depth 15 M (18°53'N, 83°49'W), 29 days, 1971.

Near bottom current measurements are also available at Rosalind Bank and near the M_2 and S_2 amphidromes in the eastern Caribbean but these data have not yet been analyzed.

Future plans - A bottom tide gauge was deployed near the eastern Caribbean M_2 amphidrome in May 1972; it will be left for about six months as part of the "tides near an amphidrome" study to improve the signal-to-noise ratio through greater resolution implicit in a longer series of observations. A bottom tide gauge will be deployed in the middle of the Gulf of Mexico for about a month in late 1972; the results will clarify continuity calculations with respect to the K_1 tide in the Gulf.

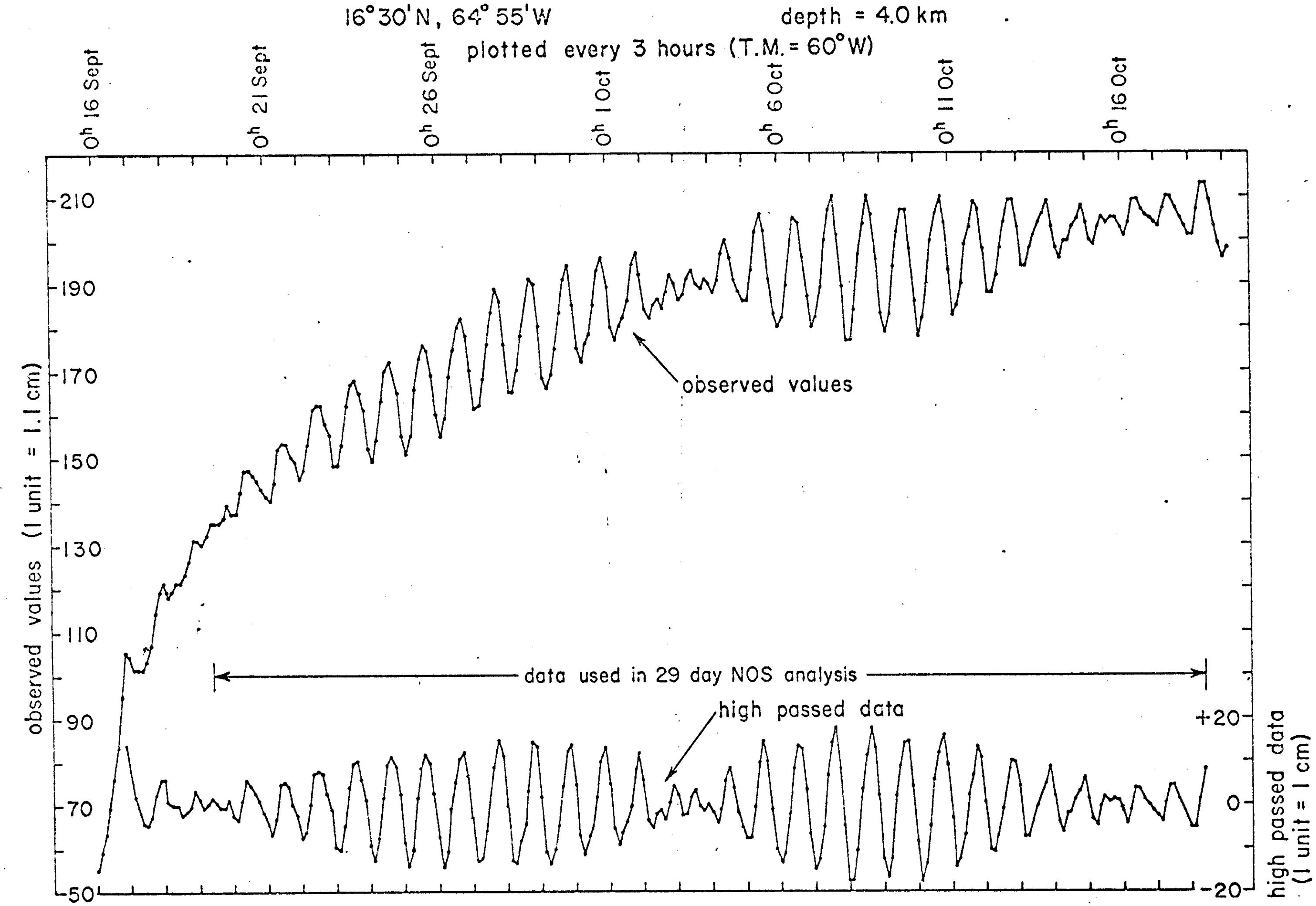
PROGRESS REPORT

Considerable progress has been achieved with respect to documenting the tidal regime in the CICAR area. The Mexican Yucatan tide stations have indicated that there is a rapid change in K_1 phase moving to the north in the Yucatan Channel and that the K_1 amplitudes are small, thus supporting the hypothesis for the K_1 tide in the Gulf by Zetler and Hansen. The recently received Cuban tide data for Cabo de San Antonio are a valuable addition inasmuch as they will permit a further check on the K_1 tidal regime in the area. The Yucatan near-bottom tidal current analysis does not support the continuity calculations for the Gulf by Zetler and Hansen; in a presentation by Hansen and Zetler (abstract in EOS, April 1972, p. 392), it is suggested that if the tidal amplitude on the shelf is significantly larger than off-shore, then continuity calculations should consider a concave lens rather than a tidal prism, in which case the observed K_1 tidal current may indeed fit the hypothesis. The tidal observations in the middle of the Gulf of Mexico, scheduled in late 1972, may resolve this problem. Another set of tidal current observations in the Yucatan Channel are described in a PhD dissertation, "Estimates of Diurnal Tidal Volume Transports Through the Yucatan Channel," by D. L. Durham, Texas A&M University, May 1972.

The study of the semidiurnal amphidromes in eastern Caribbean reasonably support the USSR cotidal and co-range charts reported on in 1971 at Trinidad. As noted in the Netherlands report, the additional Bonaire data have removed the discontinuity in S_2 phase previously reported in that area. Many aspects of this study will appear in a paper, "Tidal Observations Near an Amphidrome," by Zetler and Cummings, now in press in Geophysical Surveys. A plot of the pelagic tide observations at the depth of 4 km near the M_2 amphidrome is included in this report. As noted earlier, an attempt is now underway to obtain a six-month series at the same location.

The large variability in harmonic constants from successive 29-day series at Magueyes Island (summary from Zetler-Cummings paper attached) was considered at a meeting of the IAPSO/SCOR/UNESCO Working Group on Deep Sea Tides and contributed to a decision to de-emphasize the importance of precise location of amphidrome points. The procedures used for the combined analysis of multiple deployments of bottom tide gauges at Bonaire will be proposed for consideration at the next meeting of the Working Group.

Tide Observations in Eastern Caribbean on Sea Floor - 1971



Plot of tide record obtained near the M_2 amphidrome at a depth of 4 km. Creep, due to abyssal pressure on Bourdon tube of the tide gauge, was removed using Doodson sea level filter.

TABLE 1.

Tidal Constants - NOS Analysis

MaguEyes Island - 1969

	M_2		S_2		N_2		K_1		O_1	
	cm.	°	cm	°	cm	°	cm	°	cm	°
365 days	.70	278.4	.76	213.9	.40	277.9	7.92	166.3	5.36	160.
29 days										
Jan.	1.31	293.8	1.28	232.3	.67	346.0	7.10	168.7	5.46	163.
Feb.	.76	315.2	1.01	217.6	.82	311.8	6.95	166.5	5.67	155.
Mar.	1.07	283.2	.55	236.4	.52	338.2	7.89	158.3	5.88	154.
Apr.	1.10	335.9	1.31	211.3	1.19	238.1	8.56	157.2	5.55	156.
May	1.10	239.7	.67	195.3	.85	218.2	8.63	163.9	5.46	157.
June	.49	231.7	1.07	277.4	.46	369.1	7.68	164.3	5.18	162.
July	1.13	312.1	.40	158.3	.46	211.9	8.47	162.6	5.46	162.
Aug.	.58	330.1	.79	206.0	.49	324.4	8.84	165.3	5.55	163.
Sept.	1.16	286.0	.88	189.6	.27	284.4	9.11	173.3	5.46	161.
Oct.	.73	290.8	.98	214.9	1.40	290.8	7.71	176.0	5.49	155.
Nov.	1.55	236.5	.61	225.8	.61	215.9	7.35	170.6	4.66	160.
Dec.	1.34	236.8	.37	180.8	.49	157.0	7.35	169.0	5.12	158.
Mean of monthly values	1.03	282.6	.83	212.1	.69	275.5	7.97	166.3	5.41	159.
σ	.34	38.0	.30	30.4	.34	66.1	.73	5.6	.30	3.
σ/mean Ampl.	.33	--	.36	--	.49	--	.09	--	.06	--

Successive 29-day analyses indicate a large variability in harmonic constants obtained near the semidiurnal amphidromes.

INFORME SOBRE LOS ESTUDIOS DE BIOLOGIA MARINA DURANTE LOS MESES DE RECONOCIMIENTO DE LAS CICAR

por Michel ANGOT,
(UNESCO-México),
Scientific Adviser for the
Subject Leader in Marine
Biology.

Según la cuarta reunión del Grupo Internacional de Coordinación de CICAR en Trinidad y Tobago del 29 de marzo al 3 de abril de 1971, el Grupo recomienda (recomendación 4.28):

> "que se establezca una Estación Biológica Normal en cada parada de los barcos que realizan cruceros de las CICAR, al menos durante los estudios oceanográficos y, desde luego, en cada parada de los barcos durante los meses de reconocimiento de las CICAR;
>
> - que esa S.B.S. se ajuste al plan que figura en el Apéndice 5 al Anexo 3 (del informe de la cuarta reunión) ...
>
> - que las muestras de zooplancton se tomen por el método expuesto en el Apéndice 6 a este mismo Anexo."

Las fechas de los Meses de Reconocimiento de las CICAR (o CSM) fueron: agosto de 1971 para CSM 1

15 de abril - 15 de mayo 1972 para CSM 2

La información que me fue posible reunir está resumida en los dos marcos siguientes, uno para CSM 1, el otro para CSM 2.

C S M I

PAIS	BARCO	RESPONSABLES	AREA	OBSERVACIONES
Cuba	Aliot		Yucatán, Banco Campeche	Muestreo de larvas y huevos de peces Material procesado
México	Virgilio Uribe	Marina UNAM	Sur del Golfo Canal de Yucatán Oeste del Mar	Muestreo en exacta conformidad con la recomendación de CICAR (producción y zooplancton)
E.U.A.	Dan Braman Tursiops Bellows Oregon 2 Nat. Mar. Fisheries	SUSIO	Norte del Golfo de México Noroeste del Golfo- Plataforma co continental al oeste de la Florida.	Muestreo de plancton, especialmente para larvas y huevos de peces Muestreo de plancton con redes que se cierran.
Venezuela	La Salle	IOUO	Noroeste del Atlántico tropical Este del Caribe	Muestreo de plancton

C S M 2

PAIS	BARCO	RESPONSABLES	AREA	OBSERVACIONES
Colombia	San Andrés	Marina	Oeste del Caribe	Muestreo de plancton con la red Neuston (imposibilidad de usar el Bongo) Inicio del estudio de producción primaria Necesita ayuda técnica
Cuba	Foton		Tránsectos a Florida, Canal de Panamá y estaciones en el Banco de Campeche.	Muestreo de plancton con la red Neuston y la red Juday No tiene red Bongo
México	Virgilio Uribe	Marina UNAM	Sur del Golfo, Canal de Yucatán Oeste del Mar Caimán, Golfo de Honduras	Muestreo de plancton con la red Bongo chica en arrastre vertical de 200 m a la superficie
Holanda	Luymes	Marina	Este del Caribe	Muestreo de plancton
URSS	Akademik Korchatov		Unos tránsectos normales	Muestreo biológico

Observaciones

Los resultados ya obtenidos con respecto al trabajo biológico durante los CSM de las CICAR según la recomendación de la cuarta reunión no son del orden que se habría podido esperar. Las razones que se expresan lo más frecuentemente para explicar esta escacez de datos son, en el orden de prioridad:

1. la dificultad de obtener la red Bongo,
2. la dificultad del uso de la Bongo, tanto con respecto a lo que es necesario a bordo del buque para usarla, como a las características propias de los barcos (velocidad lenta demasiado rápida) que impiden el uso correcto de las redes,
3. la falta de equipo para el estudio de la producción primaria,
4. la necesidad de una ayuda técnica para que los métodos recomendados puedan usarse de la mejor manera posible y que los datos obtenidos tengan el valor esperado.

Sin embargo, se debe aclarar que el consenso general es que estos tipos de estudios que se caracterizan por la simultaneidad en el tiempo, la normalización de los métodos y, como consecuencia, la comparación ulterior de los resultados, deben seguir adelante.

Podemos concluir diciendo que el principio de los estudios biológicos durante los CSM de las CICAR sigue siendo apreciado, pero que los medios para lograr los resultados esperados no parecen haber tenido éxito.

Finalmente, queremos insistir sobre la gran importancia de encontrar un tipo cualquiera de normalización del muestreo del plancton, en particular para aprovechar el máximo el trabajo del Centro de Preclarificación Oceánica de México.

C.I.C.A.R.

REPORT ON GEOPHYSICS GIVEN BY P. KEARY, DURHAM UNIVERSITY, ON BEHALF OF PROF. M.H.P. BOTT, INTERNATIONAL SUBJECT LEADER FOR GEOPHYSICS

In 1971, Durham University, working with the British Navy Hydrographic vessel H.M.S. "Hecla", completed the Survey of an east-west strip across the island arc of the Windward Islands bounded by 12°54'north, 13°54'north, 56°west and 65°west. Bathymetry, total magnetic field and gravity were measured throughout the Survey, and seismic reflection profiles made on three east-west lines across the width of the area using an air-gun system developed in Durham. Navigation was by Lambda electronic fixing checked by satellite navigator and radar, when in the proximity of land. East-west line spacing was 10 miles, with interlines at 5 mile spacing. The navy has produced bathymetric charts, while Durham has produced charts of free Air Anomalies and Bouguer Anomalies for density contrasts of 2.00 and 2.67 gm/cc. Magnetic charts with diurnal and regional effects removed are in preparation. Preliminary examination of the Bouguer charts show

1) the Venezuelan Basin has high regional gravity compared with the Aves Swell and Grenada Trough

2) the Aves ridge is a gravity high superimposed on a gravity low probably caused by "downwarping" of the Moho

3) the Grenada Trough is a gravity low superimposed on a gravity high

4) the island arc is a gravity high complemented by a gravity low on its eastern side on which the Barbados Ridge is superimposed as a gravity high.

In April this year, Durham, again working with H.M.S. "Hecla", completed a deep seismic refraction experiment, whose aims are to delineate the crust and define the Moho in the eastern Caribbean. Three seismic lines were run:

A - along the crest of the Lesser Antilles Island arc from south of Grenada to the north of Guadalupe

B - from the Aves Ridge at 13°39' north, 63°38' west to the east of Barbados at 12°55.4' north, 57°7' west.

C - along the crest of the Aves Ridge from Aves Island South to 13°2' north, 63°11.4' west.

Depth charges were dropped from Hecla and recorded at 27 recording stations in the Lesser Antilles, Barbados and, for part of the experiment, on Aves Island. Navigation during this experiment was by satellite navigator, radar, D.R., and taut wire. The NOAA ship "Discoverer" acted as a hydrophone station for Line B, being stationed at its eastern end allowing reversal of the profile. The recording stations were operated by Durham University, the University of the West Indies, Leicester University, the Seismological Observatories of Martinique and Guadaloupe and the Institute du Physique du Globe de Paris.

After this Survey, Durham and Hecla completed a survey of the northern Aves Ridge over an area immediately to the north of the western part of last year's survey area up to 16°10' north. Bathymetry, total field magnetics and gravity were measured on east-west lines of 10 mile spacing, with interlines at 5-mile spacing. One of the north-south lines was run to coincide with the seismic Line C (above) to allow a joint seismic refraction, gravity and magnetic interpretation at a later date. Navigation was by Lambda electronic fixing device checked by satellite navigator. Gravity results were reduced to Free Air Anomaly on line by shipboard computer.

During this year's cruise, a small geophysical survey was run over the submarine volcano "Kick-'em-Jenny" off North Grenada, "Hecla" and Durham working in cooperation with the University of the West Indies, Jamaica. Gravity, magnetics and bathymetry were measured in conjunction with a program of grab sampling, coring, dredging, XBT's, T.S.D. probes and water sampling.

Hecla, the University of the West Indies, Jamaica and Durham will perform a Geophysical Survey of the Hispaniola passage at the beginning of July, 1972. Bathymetry, magnetics and gravity will be measured in an area between Hispaniola and Jamaica, and it is hoped to take a series of cores in the area. Areas of interest are the Navassa Basins, the reported submarine volcanism between Hispaniola and Jamaica, the area of earth quake activity along the north Jamaican coast, and the area of "interaction" between the Nicaraguan Rise and Cayman Trough. A north-south gravity profile will be run to establish the regional gravity from the Cayman Trough to south of the Navassa Basins.

The United States have performed several geophysical investigations in the Caribbean. I will attempt to précis them, but refer you to the U.S.A. CICAR report for greater detail.

Texas A and M University, working off the ship Alaminos, have performed seismic reflection profiling and magnetic measurements in the central and western Caribbean. For the seismic work a 300 cu. ins. air gun was used. The principal areas surveyed were:

1) the Yucatan Straits from Cuba to Honduras
2) the northern part of the Nicaragua rise
3) sections across the Beata ridge from Hispaniola to the Colombian shelf
4) the Magdalene delta, this being done in co operation with Colombia
5) some additional work over the Cayman trough.

Woods Hole Oceanographic Institute have made seismic reflection profiles in the north-west Caribbean and Yucatan Channel.

The University of Rhode Island have measured magnetics and gravity, and have made seismic reflection profiles around the northern Lesser Antilles. This work was started in 1971 and continued this year.

NOAA in 1971 performed a magnetics, gravity and bathymetry survey with some reflection profiling between the Caribbean and mid-Atlantic Ridge. They have performed similar surveys on the Venezuelan continental margin and north-east of Trinidad-Tobago.

The U.S.G.S. have performed seismic reflection profiling in four main areas:

1) the Bay of Campeche
2) the eastern margin of the Yucatan Penninsula
3) the eastern Greater Antilles
4) the Venezuelan Continental Borderland.

The Netherlands have performed two geophysical surveys. The first a magnetic and gravity survey off the coast of South America between Trinidad and Brazil, the second, in conjunction with the U.S.G.S., a gravity, magnetic and seismic survey of the Venezuela Shelf and its transition into the Venezuelan Basin. I refer you to the Netherlands CICAR report for more detail.

Mexico has performed seismic reflection profiles over the continental shelf of the southwest coast of the Gulf of Mexico, and have studied four main topics:

1) Sedimentation of the delta del Río San Pedro and the zone of transition of the Banco de Campeche

2) the ancient coastline of the continental shelf

3) sediment transport in the Mexican part of the Gulf of Mexico

4) sedimentation processes in the tidal flats of the Laguna de Términos.

Again, for more detail, I refer you to the Mexican CICAR report.

REPORT OF THE
NATIONAL OCEANOGRAPHIC DATA CENTER
NOAA ENVIRONMENTAL DATA SERVICE

CICAR NEWS

Dearth of articles has prevented further publication of news from CICAR in the Environmental Data Service publication.

It is hoped that national coordinators or other interested individuals will take advantage of the opportunity still offered to disseminate news of their activities within the CICAR framework.

CICAR BIBLIOGRAPHY

Volume II Biology and Volume III Geology are now ready for printing and should be available in the fall of this year. Three copies of each volume will be sent to each National Coordinator and one copy to each Assistant International Coordinator, Subject Leader and correspondent. Additional copies can be obtained upon request. The deadline for insertion of new material was June 1971; by that time, a total of 3,496 references were obtained for Volume II with 3,280 references for Volume III.

NEWSLETTER

Recently Reported CICAR Cruises
(CICARDI forms received)

COUNTRY	VESSEL	DATED OF CRUISE	PROGRAM	AREA
Mexico	VIRGILIO URIBE	8/03/71 to 9/03/71	Descriptive oceanography current measurements, plankton, meteorology	Bahia de Campeche Yucatan Channel Caribbean Sea. MS 44,45,46,81,82
Mexico	VIRGILIO URIBE	2/12/72 to 2/26/72	Descriptive oceanography, current measurements, fisheries research, plankton, coral reefs	Yucatan Peninsula and Bahia de Campeche MS 45,46,81,82
Netherlands	H.Nl.M.S. LUYMES	2/22/72 to 3/01/72	Descriptive oceanography, plankton, meteorology	Information not available
Netherlands	H.Nl.M.S. LUYMES	3/13/72 to 3/29/72	Bathymetry, descriptive, oceanography, plankton, meteorology, geology	Information not available
U. K.	H.M.S. HECLA	4/09/72 to 4/23/72	Descriptive oceanography, geology and geophysics bathymetry	Lesser Antilles MS 42,43
U. S.	GERDA	11/10/71 to 11/10/71-	Descriptive oceanography, plankton, meteorology	Straits of Florida MS 81
U. S.	GERDA	2/01/72 to 2/08/72	Descriptive oceanography, plankton	Southeastern Gulf of Mexico MS 81

PUBLICATIONS RECENTLY RECEIVED AT THE NATIONAL OCEANOGRAPHIC DATA CENTER

"United Kingdom Programme", Revised September 1971
Natural Environmental Research Council Publications Series C N° 7
1972, 9 pages + chartlets - English and Spanish

Informe preliminar sobre los cruceros oceanograficos efectuados in 1970 Reporte N°1
Direccion General de Faros e Hidrografia, Mexico, D.F. 1972
30 pages

Informe preliminar sobre los cruceros oceanograficos efectuados in 1971 Reporte N°2
Direccion General de Faros e Hidrografia, Mexico D.F., 75 pages

"The potential for fishery development in the Caribbean and Adjacent Seas" Clarence P. Idyll 16 pages
University of Rhode Island, International Center for Marine Resource Development Bulletin Number 1.

"Investigaciones conjuntas Cubano-Sovieticas"
Instituto National de la Pesca Cuba, Centro de Investigaciones pesqueras, Contribuciones No. 28, 29 & 30, La Habana Novembre 1970.

"MARINE RESEARCH IN THE CARIBBEAN"

Selected articles from the Russian-language pamphlet Akademiya Nauk Ukrainskoy SSR, Morskoy Gidrofizicheskiy Institut, Issledovaniya v Atlanticheskom Okeane, Ekspress-Informatsiya, No. 1, 1965 Kiev.

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(Continued)

Now available from:

U. S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22151

Recently available in English

LIST OF CICAR DATA RECEIVED AT NODC
AS OF MAY 15, 1972

Computer printout, for any and all of these cruises can be obtained upon request.

With very few exceptions all data referred to in this text have been processed and transmitted to WDC-A, Oceanography, and are now available thru the World Data Center System.

COUNTRY	SHIP	ORIGINATOR'S CRUISE NUMBER	CRUISE DATES	TYPE OF DATA	NUMBER OF OBSERVATIONS	GENERAL AREA	ODC IDENTIFICATION NUMBER
U.S.	BELLOWS	SUS 7201	February 1972	Station Data XBT Data	19 3	Eastern Gulf of Mexico, MS 81	311907
U.S.	DAN BRAMAN	SUS 7125	September 1971	Station Data	30	Northeastern Gulf of Mexico, MS 81	311852
U.S.	DISCOVERER	RP-2-70	May 1970	XBT Data	39	Straits of Florida, Yucatan Channel, Western Caribbean Sea, MS 81, 44, 45	40547
U.S.	ISLAND WATERS	1W-7001	May 1970	STD Data	24	Eastern Gulf of Mexico, MS 81,	318165
U.S.	ISLAND WATERS	1W-7004A	11 June 1970 to 16 June 1970	Station Data Volume Scattering Sea Surface Temperature Zooplankton Data Zooplankton Volume Data	49 40 6 6	Eastern Gulf of Mexico, MS 81	311849
				XBT Data	30		41394
U.S.	ISLAND WATERS	1W-7004B	17 June 1970 to 26 June 1970	Station Data Volume Scattering Sea Surface Temperature Zooplankton Data Zooplankton Volume Data	86 86 62 28 28	Eastern Gulf of Mexico, MS 81	311849
U.S.	J.E. PILLSBURY	JP 004	April 1970 to May 1970	STD	37	Northeastern Gulf of Mexico, MS 81	318185

COUNTRY	SHIP	ORIGINATOR'S CRUISE NUMBER	CRUISE DATES	TYPE OF DATA	NUMBER OF OBSERVATIONS	GENERAL AREA	NODC IDENTIFICATIO NUMBER
Cuba	NA	NA	January 1970 to December 1970	Station Data	40	Yucatan Channel MS 45	CU0013
Mexico	VIRGILIO URIBE	12	October 1970 to November 1970	Station Data Transparency	53	Western Gulf of Mexico. Bahia de Campeche MS 82	57003
Netherlands	H.Nl.M.S. LUYMES	10	March 1970 to April 1970	Bathythermograph Data (Conventional and Digital)	92	Northeastern Coast of South America, MS 6, 43	
Netherlands	H.Nl.M.S. LUYMES	16	September 1970 to November 1970	Station Data	61	Northern Coast of South America off the Guianas, MS 6 7	023398
U.S.S.R.	ASKOLD	NA	June 1970	Station Data Water Transparency Water Color	25 12 5	Caribbean Sea MS 44, 45	90280
U.S.S.R.	AKADEMIK VERNADSKII	3	November 1970 to January 1971	Station Data pH	42 39	Caribbean Sea MS 44, 45	90281
U.S.	ALAMINOS	70-A-7	April 1970 to May 1971	Station Data STD Birdsightings	67 67 67	Yucatan Channel Western Caribbean Sea, MS 45	311654
U.S.	ALAMINOS	70-A-9	June 1970	Station Data STD	61	Gulf of Mexico MS 45, 81	318249
U.S.	ATLANTIS II	56	February 1970 to April 1970	Station Data Silicates Drift Bottle Observations	160 156 184	Western North Atlantic Lesser Antilles MS 79, 80, 43	311601
U.S.	BELLOWS	SUS 7127	September 1971	Station Data	29	Northeastern Gulf of Mexico, MS 81	311850

COUNTRY	SHIP	ORIGINATOR'S CRUISE NUMBER	CRUISE DATES	TYPE OF DATA	NUMBER OF OBSERVATIONS	GENERAL AREA	NODC IDENTIFICATION
U.S.	RESEARCHER	RP9	July 1971 to August 1971	Station Data	33	Straits of Florida	311898
				BT	262	Eastern Gulf of Mexico	
				XBT	393	Eastern Caribbean Sea, MS 45, 81	
U.S.	ROCKAWAY	RCC	July 1971 to August 1971	XBT	42	Off the Central part of the Northern Coast South America, MS 42	41744
				Station Data	42		318271
				Transparency	2		
U.S.	TURSIOPS	T7015	May 1970	Station Data	27	Eastern Gulf of Mexico, MS 81	318218
U.S.	TURSIOPS	SUS 7126	October 1970	Station Data	40	Northern Gulf of Mexico, MS 81	311851

COOPERATIVE INVESTIGATION OF THE CARIBBEAN AND ADJACENT REGIONS

U.S.A. - ACCOMPLISHMENTS IN THE CICAR AREA IN 1971-72

PLANS FOR 1972-73

Report of the U.S.A. National Coordinator
to the Fifth Meeting

CICAR International Coordination Group

Havana, Cuba

June 19-24, 1972

Table of Contents

Summary

1971-2

Physical Oceanography

U. S. physical oceanographic studies within the CICAR framework were concentrated in two major areas - the passes between the Antillean Islands, and in the northwest Caribbean, Yucatan Channel, and southern Gulf of Mexico. Both areas of study are part of the overall CICAR circulation program directed toward understanding the major features of the circulation of the Caribbean and adjacent regions.

The R/V KNORR from Woods Hole worked in the passes of the northern Antilles following up on the work of the ATLANTIS II the previous year in the passes of the southern Antilles. The R/V TRIDENT of the University of Rhode Island worked the Jungfern Passage and studied the microstructure in the passes north and south of St. Croix. Even as the 5th CICAR meeting is in progress, the USNS WILKES of the Naval Oceanographic Office is occupying moored current buoy stations at 15 locations in the passes between the Antillean Islands. The WILKES project runs from June until September of 1972.

During CICAR Survey Month (CSM-I) in August of 1971, various vessels of the Florida State University System Institute of Oceanography (SUSIO) worked in the eastern Gulf of Mexico and the Yucatan Channel. In addition, the OREGON II of the NOAA National Marine Fisheries Service studied the currents in the Gulf, and the DISCOVERER and RESEARCHER, working for NOAA's Atlantic Oceanographic and Meteorological Laboratories in Miami, worked in the Yucatan Channel and the southern Gulf of Mexico studying the dynamics of the Yucatan Current, the Loop Current, and the various water masses in the area with Dr. Donald Hansen and Dr. Robert Molinari as Chief Scientists.

The initial work on CSM-I was followed up by the multination operation on CSM-II in April and May of 1972. In addition to the URIBE of Mexico, the FOTON of Cuba, the ASKOLD of the USSR, and the ARC SAN ANDRES of Colombia, the GULF STREAM of Nova University and the Nova aircraft worked with the two standard CICAR Sections from Cabo San Antonio to Isla Mujeres (Yucatan Channel) and from Habana to Key West (Florida Straits). Texas A&M with the ALAMINOS also worked the Gulf of Mexico Loop Current during this period as did scientists from the University of South Florida. The

NOAA-AOML R/V VIRGINIA KEY made repeated STD/XBT sections along the CICAR standard section across the Yucatan Channel during this period, and Dr. Robert Molinari of NOAA-AOML is working to pull all of the physical data together for analysis of the CSM-I and CSM-II operations in the northwestern Caribbean.

Additional physical oceanographic work included shallow oceanic sea-floor tide, current, and temperature measurements in the western Caribbean and deep-sea tide measurements (4 km.) near an amphidrome south of Puerto Rico. This work will be reported to the 5th ICG for CICAR meeting by B. D. Zetler, CICAR Subject Leader for Tides. The DISCOVERER occupied the CICAR Standard Section along 63°W and carried out a mixed-layer study north of Puerto Rico with Feodor Ostapoff (AOML) as Chief Scientist. The results to date of the CICAR Drift Bottle Program under John Brucks of the NOAA National Marine Fisheries Service is also summarized in this report. Finally, the first of six oceanographic/meteorological buoys was emplanted in the Gulf of Mexico in mid-June of 1972 and five more will be set out during the next four months. Sensors on these buoys and suspended below them will measure temperature, salinity, and currents as well as meteorological characteristics. The data will be telemetered to Miami for immediate use in weather forecasting and for later research use.

Marine Geology and Geophysics

The U. S. contributions were directed mainly toward providing an understanding of the overall tectonic framework of the CICAR area. The R/V CHAIN from Woods Hole with Dr. E. Uchupi as Chief Scientist made extensive geophysical measurements in the Yucatan Channel.

The R/V TRIDENT made two geophysical cruises in the Lesser Antilles, and the DISCOVERER, under Dr. George Peter of NOAA-AOML, carried out bathymetric, seismic, magnetic, and gravity measurements between the Antilles and the Mid-Atlantic Ridge and worked cooperatively with Dr. Martin Bott of the U.K. on a Reading University project of heat-flow measurements and seismic refraction studies north of the Barbados Ridge in the Lesser Antilles Island Arc and the Aves Ridge. The U. S. Geological Survey aboard the UNITEDGEO-I carried out extensive marine geophysical operations in the Bay of Campeche, Yucatan Channel, Eastern Greater Antilles, and the Venezuelan Continental Borderland. USGS scientists also worked cooperatively with Mexican scientists aboard the URIBE on the Mexican shelf. The Navy research ships KANE and WILKES ran magnetic and seismic reflection lines extensively throughout the CICAR area, and Dr. Orin Pilkey aboard the R/V EASTWARD studied submarine volcanoes and turbidites off Puerto Rico. Extensive reef studies off British Honduras were also carried out under Dr. Robert Ginsburg of the University of Miami in cooperation with other U. S. university scientists and Dr. Judith Lang of the Discovery Bay Marine Laboratory of the University of the West Indies. The ALLANORA working for several Caribbean research groups is undertaking beach and reef studies during her primarily biological circumnavigation of the Caribbean.

Marine Biology

R/V TRIDENT (URI) did bioacoustical and other marine biological work in the northeastern passes and mid-water trawls and net tows in the Lesser Antilles. The numerous EGMEX cruises coordinated by SUSIO made extensive biological observations and collections on the west Florida shelf, and Texas A&M University scientists aboard the R/V ALAMINOS on cruise 71-A-6 did biological work, productivity, and chlorophyll studies. Puerto Rican scientists studied coelenterates and lobsters and did exploratory fishing work off Puerto Rico, and the Caribbean Research Institute (Virgin Islands) studied the green turtles on, and the fishes around, Aves Island. The ALLANORA (V.I.) worked on studies of birds, reef ecology, sea turtles, and the munk seal. The OREGON II of the NOAA National Marine Fisheries Service did considerable icthyoplankton work with the Southeast Fisheries Center, and the Miami Lab of that NMFS Center provided bongo nets to the USSR ship AKADEMIC KURCHATOV during her March 1972 visit to Miami to exchange CICAR information with U. S. scientists. The R/V EASTWARD with Dr. Ivan Goodbody of Jamaica did marine biological studies off Jamaica, and various marine biologists and ecologists worked extensively on the coral reefs off British Honduras under Dr. Robert Ginsburg of the University of Miami.

Marine Chemistry

The R/V TRIDENT (URI) did some chemical work east of Barbados, and Texas A&M from the R/V ALAMINOS did chemical work on cruises 71-A-5 and 71-A-12. The Puerto Rico Nuclear Center and the University of Puerto Rico carried out trace element studies off Puerto Rico, and the ALLANORA did some pollution studies in the U. S. Virgin Islands. The DISCOVERER under George Berberian of NOAA-AOML did chemical studies and trace metal studies in the Gulf of Mexico and

Yucatan Channel during CSM-I, and Dr. Neil Andersen of the U. S. Coast Guard working from the CGC ROCKAWAY carried out extensive chemical studies in the Gulf of Paria and Cariaco Trench.

All of this 1971-72 work in the CICAR area is reported extensively in the body of this report. Cruise reports and track charts are included where appropriate, and the principal investigators are identified for those CICAR participants who might wish further information on particular projects. For convenience, the material is presented on an institution-by-institution basis.

1972-3

Plans for the remainder of 1972 and tentative plans for 1973 are also given in detail in the separate sections of this report. Briefly, the current work in the Antillean passes will continue with Nova University's aircraft doing an aerial study of the currents in all the major Antillean passes, and the WILKES working for the Naval Oceanographic Office will also be working the passes with 3-week series of measurements from taut-wire current meter arrays. The NOVA R/V GULF STREAM will be studying the currents of the Florida shelf, and the R/V VIRGINIA KEY under George Maul of NOAA-AOML will be making monthly observations across the Loop Current and in the Yucatan Channel.

Most geological and geophysical plans for 1972-1973 are still very tentative, but the plans are firm for the USNS WILKES' geophysical work in the Lesser Antilles during June to September of 1972 to provide bathymetric, magnetic, and seismic information through several of the major inter-island passes. The need for bathymetric data in these passes was particularly stressed during the 4th ICG for CICAR in Trinidad last year.

Biologically, there are two major 1973 efforts in the CICAR area. The MARMAP cruises under NOAA's Southeast Fisheries Center will concentrate on systematic icthyoplankton surveys, and the Cayman Trough Expedition-I, run jointly by Florida State University and the University of North Carolina, will investigate the deep fauna of the Cayman Trough and the hyperbaric aspects of deep organisms.

Chemically, the Curiaco Trench investigations will be continued, and Dr. Holger Jannasch of Woods Hole aboard the R/V ATLANTIS II will be studying the trench's microbial sulphur cycle, and Dr. Claes Rooth of the University of Miami aboard the R/V GILLISS will be investigating the distribution of tritium and cesium in the main thermocline between the Sargasso Sea and Puerto Rico.

Primarily to provide a sea-going facility for the education and training of students in the marine sciences in Mexico, Jamaica, Puerto Rico, Trinidad and Tobago, Venezuela, and Colombia, the DISCOVERER of NOAA will work in the CICAR area from October 6 to December 16, 1972. Called NOAA-Carib, the expedition is being coordinated by NOAA's Atlantic Oceanographic and Meteorological Labs in Miami and will carry out research projects presently in the planning stages by senior scientists in each country involved.

Detailed descriptions of each organization's CICAR projects constitute the remainder of this report.

Woods Hole Oceanographic Institution

Woods Hole, Massachusetts

1971-2

Marine geology and geophysics - Uchupi aboard the R/V CHAIN carried out seismic profiling, 3.5 kHz sounding, and magnetic and gravity profiles in the northwestern Caribbean and through the Yucatan Channel. These data are still being processed, and results are not yet available.

Physical oceanography - Garry Metcalf and Marvel Stalcup aboard the R/V ATLANTIS II in February, March, and April of 1970 (Cruise 56) made extensive current measurements in the passes between the islands of the southeastern Caribbean. In 1971 the results of this work were worked up and published in two papers and two WHOI Technical Reports. The title page and abstract of each of these papers are included in this report.

The R/V KNORR, with Gerry Metcalf as Chief Scientist, from 13 March to 28 April of 1972 carried out bathymetric and current surveys in the passes east and west of St. Croix and east of Virgin Gorda. This work in northeastern CICAR area passes was strongly recommended by the 4th ICG for CICAR meeting in Trinidad in 1971. This work complemented the 1970 work to the south, and an "in-house" report on this cruise has been made part of this report.

1972-3 - Metcalf reports that he will be occupied in 1972-3 with working up the data already obtained in the Atlantic approaches to the Caribbean and will probably not be able to return to this project in the field until 1974. At that time, however, he is anxious to complete his studies by observing in shallow Mona Passage and in the Windward Passage between Cuba and Hispaniola. For this work, the cooperation of the Cuban government and Cuban scientists will be essential, and it is hoped that this project could get under way in the spring of 1974.

In 1973 Dr. Vaughan Bowen and others will be making a cruise from the Azores to Trinidad with two additional legs in the CICAR area. Following this work, Dr. Holger Jannasch will be studying the microbial sulphur cycle in anoxic marine waters using C^{14} techniques, in situ incubations, and other shipboard experiments.

This will be accomplished during a two-week period in the area of the Cariaco Trench. A copy of Dr. Bowen's proposed cruise plan and track chart is part of this report.

Woods Hole has no other plans for work in the CICAR area in 1972, although the R/V KNORR will be making a port call in Bridgetown, Barbados, in October of 1972 as part of her GEOSECS operation in the mid-Atlantic.

Current Measurements in the Passages of the Lesser Antilles[1]

MARVEL C. STALCUP AND WILLIAM G. METCALF

Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543

Direct-current measurements during March and April 1970, in the four major passages through the Lesser Antilles show a westward transport of about 26 $\times$ 10^6 m^3 sec^{-1}. This transport is divided between the Grenada, St. Vincent, and St. Lucia passages with, respectively, 10, 10, and 6 $\times$ 10^6 m^3 sec^{-1} flowing to the west. The transport through Dominica passage was less than 2 $\times$ 10^6 m^3 sec^{-1} during these measurements. This flow pattern is consistent with the distribution of variables as shown by data from hydrographic stations to the east and west of each passage. On the basis of the temperature-oxygen relationship, water that enters the Caribbean with a temperature between 16°–23°C comes from a broad band of water found east of the area.

DIRECT-CURRENT MEASUREMENTS BEFORE 1970

Between 1888 and 1890 *Pillsbury* [1890] made a series of anchored current-meter stations in all the major passages of the Antilles and across the North Equatorial current between the islands of Barbados and Tobago. His measurements in the North Equatorial current showed northwesterly (a current that flows toward the northwest) currents with highest speeds near Tobago. The measurements in the various passages revealed a complicated current pattern with a general flow into the Caribbean through the passages between the Lesser Antilles.

Many of the measurements made in the passages in 1888 were repeated in 1889 and 1890 and those made in successive years showed similar flow patterns. However, the 1888 measurements in Grenada passage showed easterly currents at all depths while measurements in the same passage in 1889 showed only westerly currents. In the St. Vincent and St. Lucia passages the currents were westerly with near surface speeds generally greater than 1 knot. Currents were weaker in Dominica passage; measurements in Anegada, Mona, and Windward passages showed only tidal currents.

In 1965 *Sukhovey and Metal'nikov* [1968] set anchored current-meter moorings in the Anegada and Windward passages. He found currents flowing into the Caribbean to depths of 600–700 meters with highest speeds near 300 meters. Below 700 meters the flow was out of the Caribbean with maximum speeds near 1200 meters.

Johannessen [1968] anchored a mooring that contained 4 current meters near Tobago in 1968. Unfortunately this mooring broke loose after 25 hours and drifted slowly toward the northwest. One current meter was lost, another flooded, and the remaining records showed northwesterly currents of 1 knot to 100 meters.

These observations serve to illustrate the scarcity of direct-current measurements in the eastern Caribbean and show the need for additional studies of the currents in this area.

FREE-FALL INSTRUMENTS

The instruments used in this study are similar to those described by *Richardson et al.* [1968]. Briefly they are aluminum cylinders that are ballasted to sink either to the bottom or to some intermediate depth where a weight is released and the float returns to the surface. If one knows the position at which the float is released, where it surfaces, the elapsed time beneath the surface and the depth reached, the average current speed and direction of the water column may be calculated. With a series of such drops across a passage it is possible to determine the transport through the passage.

Drops were made to the bottom and to intermediate depths (430 ± 20 meters) in several

[1] Contribution 2715 from the Woods Hole Oceanographic Institution.

WHOI
4.

V. T. BOWEN, W. G. METCALF,
AND J. C. BURKE

Shallow-water Strontium-90 Anomaly about the Antilles Arc—1970

ABSTRACT

Vertical profiles about the southeastern approaches to the Caribbean in early 1970 have shown a consistent Sr-90 inversion, with the maximum concentrations at depths of about 100 m. It appears that four water masses may be involved, in this area, in a very complicated mixing and overlayering phenomenon.

Introduction. During February, March, and April 1970, RV ATLANTIS II of the Woods Hole Oceanographic Institution was engaged in a detailed study of the hydrography of the southeastern approaches to the Caribbean Sea; the hydrographic data and station locations used in this study have been reported (Metcalf et al. 1971). At a number of these stations, vertical series of large-volume water samples were collected (Bodman et al. 1961) to be analyzed for longer-lived radionuclides delivered as fallout. The oceanographic interpretation of such data has been extensively described (Bowen and Sugihara 1965, Bowen et al. 1968, 1969, Volchok et al. 1971).

Although the radionuclide analyses of many samples are uncompleted, enough data are now available to show that the strontium-90 concentrations at these stations cast some unexpected light on the shallow-water circulation in this area. We believe that the distributions observed are interesting enough to justify this interim report; we cannot hope that analyses of all the samples will be completed before the end of 1972.

REPRINT FROM

SEARS FOUNDATION: JOURNAL OF MARINE RESEARCH

Volume 30, Number 1, January 15, 1972. Pp. 112–120

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

REFERENCE NO. 71-13

HYDROGRAPHIC STATION DATA FROM ATLANTIS II CRUISE 56 TO THE SOUTHEASTERN APPROACHES TO THE CARIBBEAN SEA, FEBRUARY - APRIL 1970

by

William G. Metcalf,
Marvel C. Stalcup and
Marguerite E. Zemanovic

FEBRUARY 1971

TECHNICAL REPORT

Sponsored by the National Science Foundation Grant GA 15730.

ABSTRACT

Hydrographic station data from 160 stations occupied during ATLANTIS II Cruise 56 are presented in tabularized form. The tables include the actual observations of temperature, salinity, oxygen and silicate along with various computed parameters such as potential temperature, density and various dynamic calculations. Nearly 90 of these stations, occupied during February 1970, were in two long hydrographic sections extending parallel to the chain of islands of the Lesser Antilles from Guadaloupe to the South American shelf. Vertical profiles of temperature, salinity, oxygen and silicate from these sections are included.

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts

REFERENCE NO. 71-51

CURRENT MEASUREMENTS IN THE LESSER ANTILLES

by

Marvel C. Stalcup, William G. Metcalf,
and Marguerite Zemanovic

July 1971

TECHNICAL REPORT

Supported by the National Science Foundation Grants GA-15730 and GA-27939.

ABSTRACT

A total of 175 lowered current meter stations, 58 hydrographic stations and 37 free-fall instrument stations were occupied in the passages of the Lesser Antilles in March and April, 1970. The data from these measurements together with that from 36 days of moored current measurements in the Grenada passage and the returns from 1000 drift bottles provide information on the transport of water through these passages.

Approximately 26 X 10^6 m^3 sec^{-1} entered the Caribbean through these passages. An average of 10 X 10^6 m^3 sec^{-1} flowed through the Grenada and St. Vincent passages and 6 X 10^6 m^3 sec^{-1} flowed through the St. Lucia passage. The current patterns in the Grenada and St. Vincent passages are shown in a series of isometric drawings.

The radar ranging system used to provide the navigational accuracy is described and the H/P 9100 calculator navigation programs are listed and their operation is explained.

R/V KNORR Cruise 25, Legs IV a, b and c 13 March to 28 April 1972

Chief Scientist - William G. Metcalf

Northeastern Approaches to the Caribbean Sea

The major objective of these portions of KNORR Cruise 25 was to study the water exchange between the Atlantic Ocean and the Caribbean Sea in that section of the Antillean Arc between Puerto Rico and Dominica. This is a sequel to ATLANTIS II cruise 56 in 1970 which was carried out between Guadaloupe and the South American Coast.

The work included bathymetric surveys of the passages east and west of St. Croix and east of Virgin Gorda. Two mooring assemblies, each with a current meter at 10 and 50 meters above the bottom,were placed near the sill in the passage west of St. Croix and left for 41 days. Hydrographic stations were occupied, STD lowerings and observations using current meters lowered from the ship and drogues were made. Drift bottles were released at intervals.

Two long sections of hydrographic stations were made between Puerto Rico and Dominica roughly following the 1500 meter isobath. One section was made on the Caribbean side of the island arc, and the other on the Atlantic side.

A considerable amount of work was carried out developing and modifying shipboard computer programs for processing data from hydrographic stations and STD lowerings. In addition, large volume sample stations were occupied for isotope studies, and several plankton tows were made.

Support for the water exchange studies was provided by the National Science Foundation through Grant # 20/27939.01. The computer work was supported by NSF 32761, and the large volume sample work and the plankton tows were supported by AEC 3563.

LEG IV a, San Juan, Puerto Rico to San Juan, Puerto Rico, 13 to 27 March 1972

A short bathymetric survey of the area east of St. Croix eliminated the possibility suggested by information received from other sources that the channel into the Caribbean Sea might be deeper there than on the west side of the island. A controlling depth of no greater than 1574 meters was found.

A more extensive bathymetric survey west of St. Croix confirmed earlier findings that this is the deepest passage into the Caribbean from the St. Croix and Virgin Island Basins to the north. A controlling depth of about 1818 meters was found, and the general situation was very much like that which Dr. W. Sturges of the University of Rhode Island had described to us as a result of his earlier work in this area.

Four current meters were set on two moorings very close to the sill. At each mooring, one current meter was placed 10 meters above the bottom, and the other, 50 meters above the bottom. An acoustic release was placed above the anchor in each assembly, and the instruments were retrieved on Leg IV c.

A series of hydrographic stations and STD lowerings disclosed the irregular occurrence of cold Atlantic water inside the Caribbean Sea near the sill indicating intermittant inflow. This cold water had the low silicate levels typical of Atlantic water and not found within the deep Caribbean Sea. Current meters were lowered from the ship in this region.

Five hydrographic stations were occupied in a section running across the Virgin Island and St. Croix Basins and up to the Anegada Passage where a bathymetric survey was made showing a sill depth of about 1911 meters. Hydrographic stations, STD and current meter lowerings were made in this region, also.

In all, 34 hydrographic stations, 14 STD lowerings, 14 current meter stations, 3 large volume sample stations, 4 plankton tows, and the release of 85 drift bottles were included in the work of this leg.

LEG IV b, San Juan, Puerto Rico to San Juan, Puerto Rico, 30 March to 14 April 1972

The major part of the work of this portion of the cruise was the occupying of hydrographic stations in two long sections between Puerto Rico and Dominica. These sections followed the 1500 meter isobath, more or less. The first section was on the Caribbean side of the island arc, and the second section was on the Atlantic side. Stations were spaced 5 miles apart abreast the major deep passages between the islands, and 10 to 15 (occasionally 20) miles apart abreast the islands and the shoal areas. Each section was made up of about 35 stations.

In addition, a 6,000 meter station was occupied north of the Anegada Passage for large volume samples for isotope studies, and other samples were obtained by Professor John Edmond of MIT who was aboard with three of his students for special studies of his own. Also, a 2500 meter station was occupied south of Puerto Rico for Professor Donald Atwood of the University of Puerto Rico who was aboard as a guest investigator.

In addition, further STD lowerings were made in the area west of St. Croix where previous studies had been carried out.

In all, 73 hydrographic stations, 8 STD lowerings, 6 large volume sample stations, 7 plankton tows were carried out, and 455 drift bottles were released.

LEG IV c, San Juan, Puerto Rico to San Juan, Puerto Rico, 17 to 28 April 1972

On the final portion of Leg IV, the greatest part of the work was again centered in the passage west of St. Croix with hydrographic stations and STD lowerings predominating. Again, intermittant charges of cold water were detected near the bottom in the sill region. This could never be traced any great distance from the sill; apparently it is mixed away quite rapidly.

A deep hydrographic station in some 5000 meters of water somewhat south of the sill was occupied in an attempt to see if any cold low silicate water could be detected at the bottom. A third cast to the station consisted of 14 bottles spaced 10 meters apart and lowered until the bottom bottle was barely above the sea floor. The results of this station have not yet been fully analyzed.

Just before leaving the sill area west of St. Croix, the 4 current meters were retrieved after 41 days of operation.

A large volume sample station was occupied in the Anegada Passage region.

On this portion of the cruise, 8 hydrographic stations, 19 STD lowerings, and 2 large volume sample stations were made and 210 drift bottles were released.

On the three parts of Leg IV, 114 hydrographic stations, 11 large volume sample stations, and 14 current meter stations were occupied. Also, 4 current meters were moored and retrieved, 41 STD lowerings were made, 750 drift bottles were released, and 11 plankton tows were made. On three occasions, attempts were made to obtain bottom samples with an 8" coring device, but no useful samples were obtained. A total of 3289 miles were steamed by the ship during the three portions of Leg IV.

The following is a list of personnel taking part on this phase of the cruise.

LEG IV a San Juan to San Juan 13 March to 27 March, 1972 15 days

Scientists aboard:

William G. Metcalf	Associate Scientist
Marvel C. Stalcup	Research Associate
Charles E. Parker	Research Associate
Richard G. Johnson	Research Assistant
John P. French	Guest Investigator, no affiliation
James Rudick	Guest Investigator, University of Michiga
John W. Cooper	Research Associate
Christopher F. Polloni	Laboratory Assistant
Randolph D. Borys	Research Assistant
John M. Scharff III	Laboratory Assistant
William Horn	Laboratory Assistant
Marguerite E. Zemanovic	Research Assistant
Karolyn J. Martin	Research Assistant
Kenneth R. Peal	Research Associate
John C. Burke	Research Associate
Lolita Suprenant	Research Assistant
Hugh Livingston	Research Associate

LEG IV b San Juan to San Juan 30 March to 14 April, 1972 16 days

Scientists aboard:

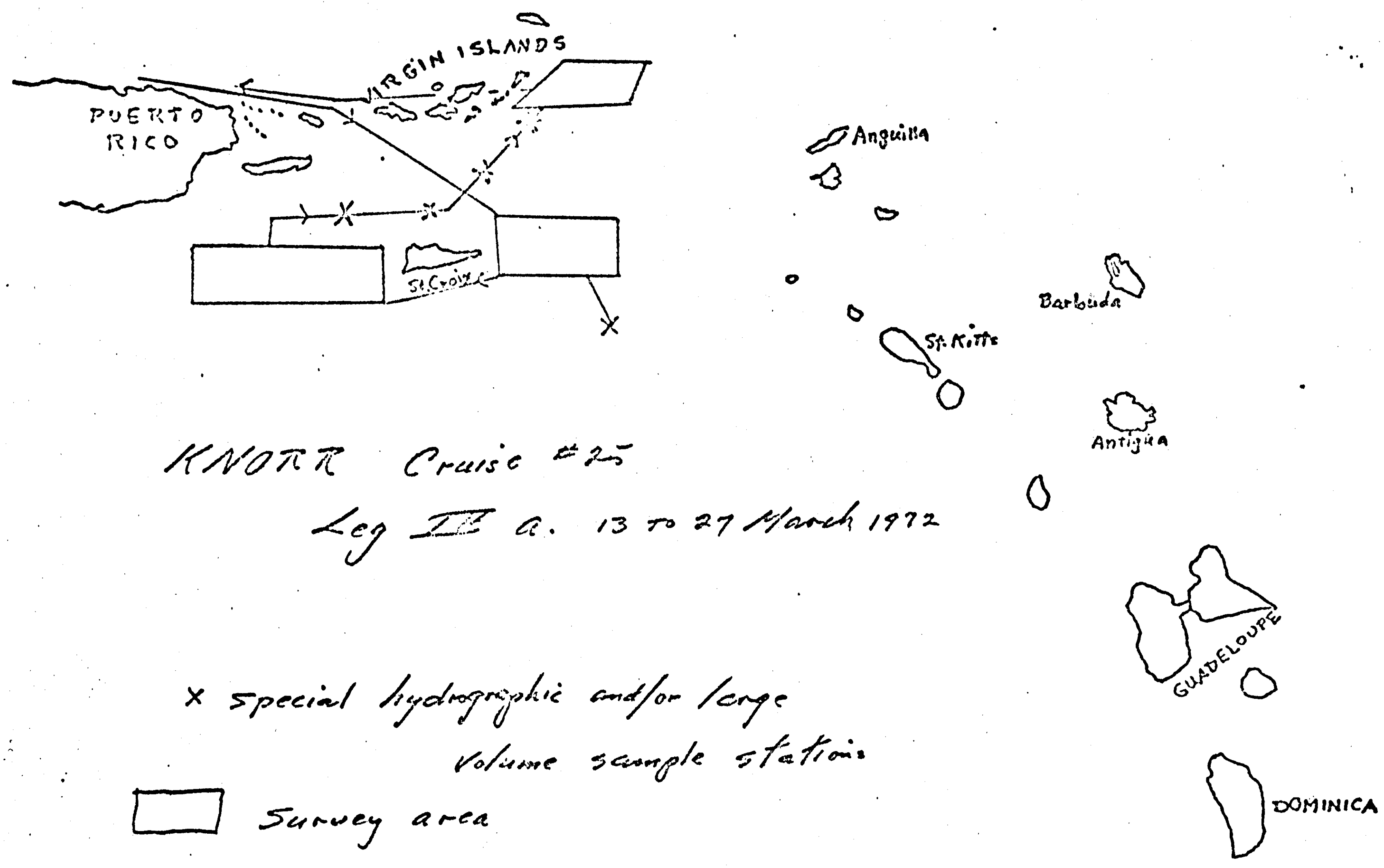
William G. Metcalf	Associate Scientist
Marvel C. Stalcup	Research Associate
Charles E. Parker	Research Associate
Richard G. Johnson	Research Assistant
John P. French	Guest Investigator, no affiliation
James Rudick	Guest Investigator, University of Michiga
John W. Cooper	Research Associate
Christopher F. Polloni	Laboratory Assistant
Randolph D. Borys	Research Assistant
Donald K. Atwood	Associate Prof. University of Puerto Rico
Marguerite E. Zemanovic	Research Assistant
Karolyn J. Martin	Research Assistant
David Schneider	Research Assistant
Paul A. Brezin	Research Assistant
John Edmond	Professor MIT
James Bishop	Student MIT/WHOI Joint Program
Edward Boyle	Student MIT/WHOI Joint Program
George Wong	Student MIT/WHOI Joint Program

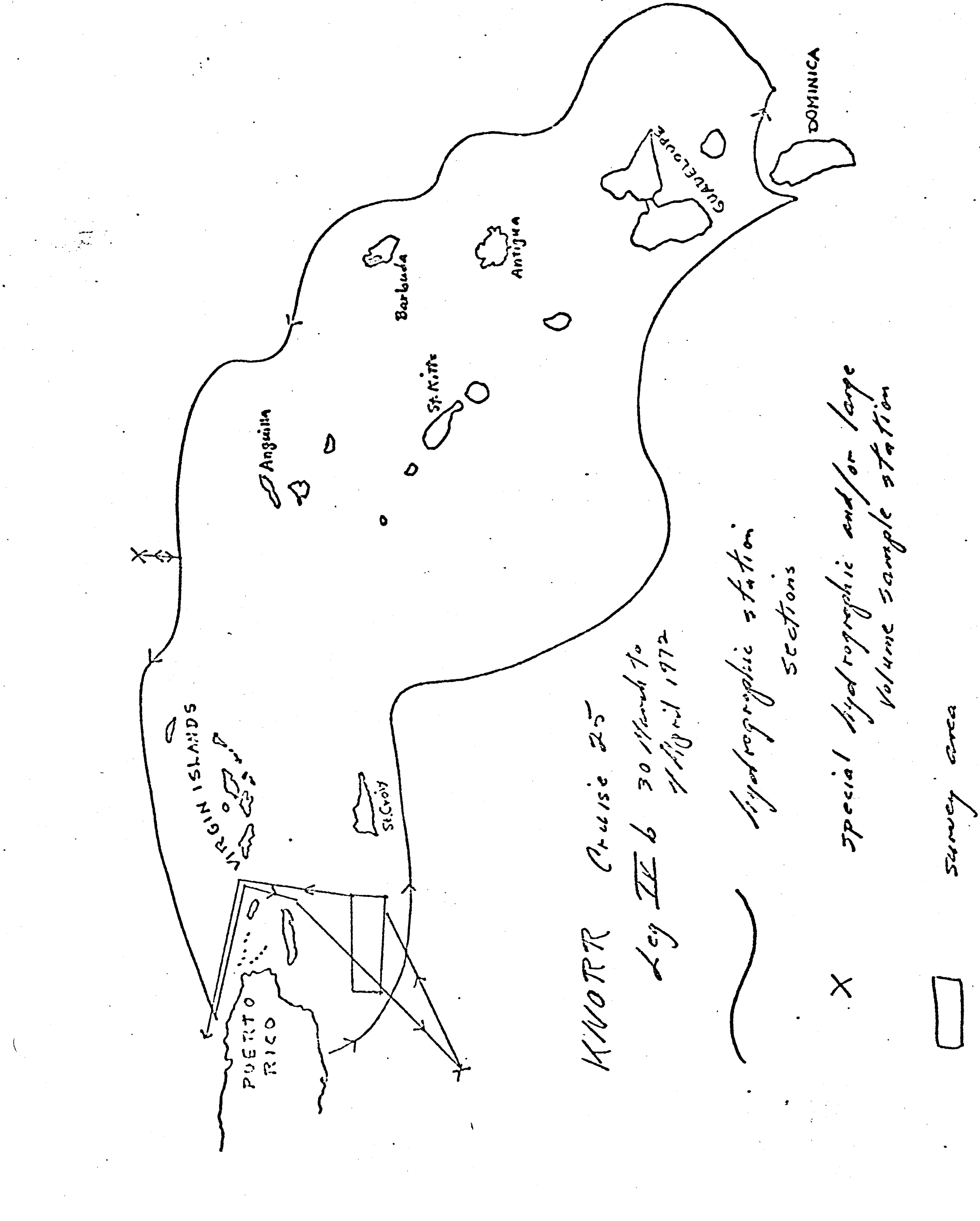
WHOI

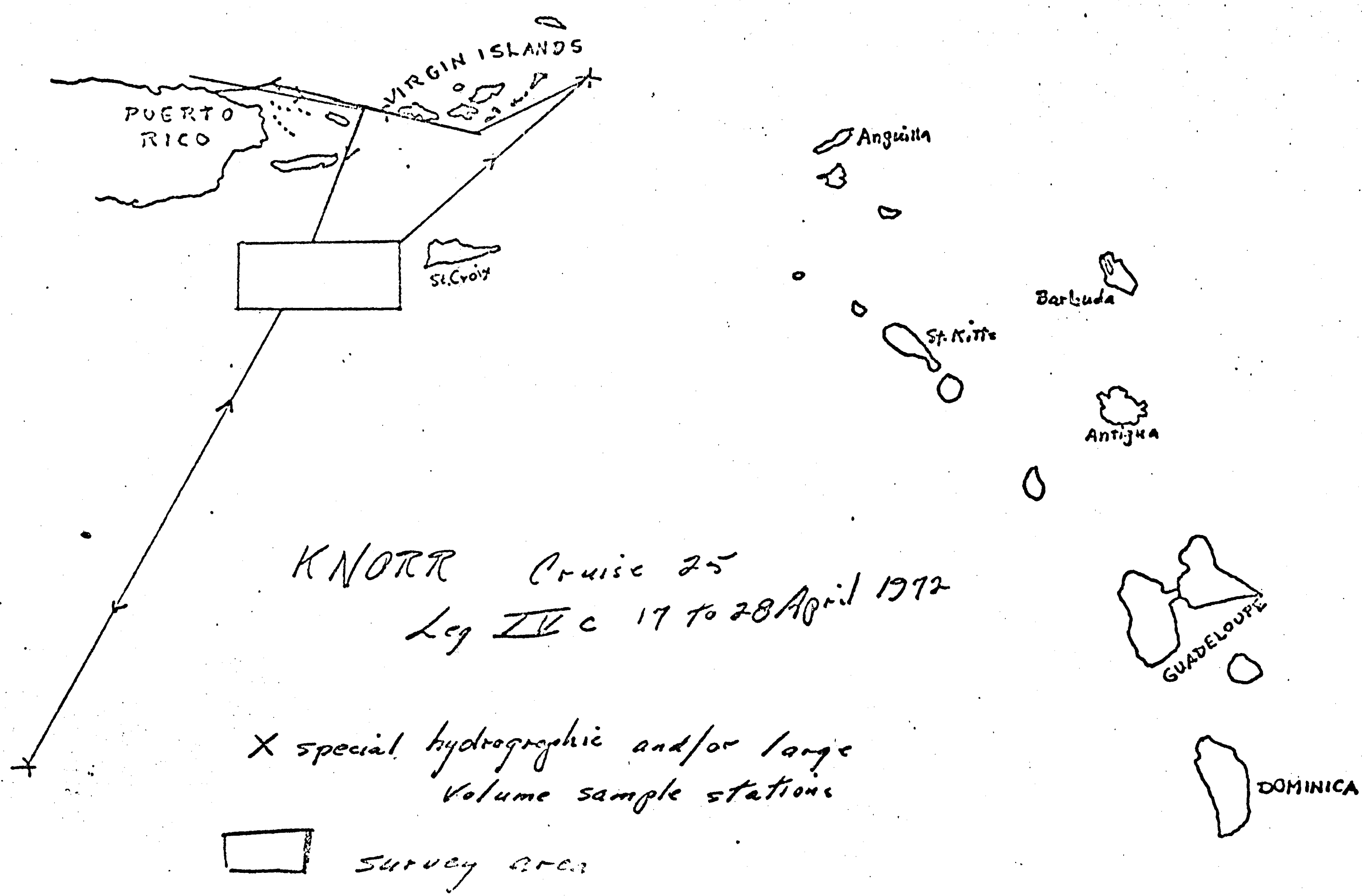
LEG IV c   San Juan to San Juan   17 to 28 April, 1972   10.   12 days

Scientists aboard:

William G. Metcalf	Associate Scientist
Marvel C. Stalcup	Research Associate
Charles E. Parker	Research Associate
Richard G. Johnson	Research Assistant
John P. French	Guest Investigator, no affiliation
James Rudick	Guest Investigator, University of Michigan
John W. Cooper	Research Associate
Christopher F. Polloni	Laboratory Assistant
Randolph D. Borys	Research Assistant
George Tupper	Research Assistant
Allan Gordon	Research Assistant
Ryszard Bojanowski	Guest Investigator, UNESCO fellowship
William Perl	Guest Investigator, Oceanographic Project Area of Natural Resources, Puerto Rico
Gilberto Cintron	Guest Investigator, Environmental Quality Board, Puerto Rico


PUERTO RICO
VIRGIN ISLANDS
St. Croix
Anguilla
St. Kitts
Barbuda
Antigua
GUADELOUPE
DOMINICA
KNORR Cruise #25
Leg III a. 13 to 27 March 1972
× special hydrographic and/or large volume sample stations
Survey area


KNORR Cruise 25
Leg IX b 30 March to 7 April 1972
Hydrographic station sections
Special hydrographic and/or large volume sample station
Survey area
PUERTO RICO
VIRGIN ISLANDS
St.Croix
Anguilla
St.Kitts
Barbuda
Antigua
GUADELOUPE
DOMINICA


PUERTO RICO
VIRGIN ISLANDS
St.Croix
Anguilla
St.Kitts
Barbuda
Antigua
GUADELOUPE
DOMINICA
KNORR Cruise 25
Leg IV c 17 to 28 April 1972
X special hydrographic and/or large volume sample stations
Survey area

Proposed Cruise Hi Saline Wedge Study
1973

Introduction: Three legs: Azores to Trinidad; Trinidad to 23°N,46°W to San Juan, P. R.; San Juan, P. R. via Caribbean and Guadeloupe-Antigua Passage to about 17°N, 53°30'W to Barbados.

Program: Leg 1: Hydrography, Large Volume Water samples, Mid-water Trawling, Plankton Towing, Sargassum Studies.

Leg 2: Hydrography, Large Volume Water samples, Mid-water Trawling, Plankton Towing, Hard Rock Geology on transect from Median Valley to Flarks (23°N, 46°W to 23°N, 60°W), Sargassum Stud

Leg 3: Hydrography, Large Volume Water samples, .Plankton Towing, Drogues and Current meters.

Scientists Cooperating: V. T. Bowen, R. H. Backus, G. Thompson, E. M. Hulburt, G. R. Harvey, C. C. Remsen, W. G. Metcalf, K. L. Smith, M. C. Stalcup.

Scientific Purposes:

1) Study of the pathways and speeds of advance of the 37,000 ‰ salinity subsurface water of the eastern Caribbean, from its probable origin as 37,000 ‰ or greater salinity surface water about 24°N between 24° and 53°W.
2) Study of the transport, in the subsurface high-salinity water, of strontium 90, cesium 137, plutonium 238, 239, and chlorinated hydrocarbon chemical pollutants.
3) Study of the meso-pelagic fish faunae in this region, which is already pinpointed as one of transition between several faunal provinces.
4) Study of the zooplankton faunae (especially Acantharia and Foraminifera in this area, to correlate with the fish boundaries. Also, study of possible transport of sarcodinan zooplankton in the subsurface salinity maximum.
5) Study of the west-east oriented convergence (in temperature, salinity, oxygen) along 16°N between about 60°W and at least 50°W, both as an hydrographic and as a zoogeographic phenomenon.
6) Collection of a suite of hard-rock samples of, hypothetically, increasing age, but all relatable to our considerable collections from the Ridge Crest and Median Valley in the 22° - 23°N area.
7) Study of Sargassum Communities along the west and south borders of the Sargasso Sea.
8) Study of hydrocarbon pollutants in open-ocean organisms in the sub-tropical Atlantic.

Detailed Planning:

Leg 1:	Steam (at 10 kts)	312 hrs. = 13 days	
	Science	12 days	25 days (Leg 1)
Leg 2:	Steam (at 10 kts)	270 hrs. = 11 days 5 hrs.	
	Science	17 days 6 hrs.	28.5 days (Leg 2)
Leg 3:	Steam (at 10 kts)	170 hrs. = 7 days 3 hrs.	
	Science	17 days	24 days (Leg 3)

"Hove-to ship time" would be assigned as follows:

Leg 1:	Hydrostations	44 for 100 hrs.
	L/V Stations	14 for 60 hrs.
	Plankton Tows	60 for 32 hrs.
	Mid-water Trawls	24 for 96 hrs.
Leg 2:	Hydrostations	40 for 80 hrs.
	L/V Stations	14 for 63 hrs.
	Plankton Tows	60 for 31 hrs.
	Mid-water Trawls	24 for 96 hrs.
	Geological Survey and Sampling	for 144 hrs.
Leg 3:	Hydrostations	12 for 24 hrs.
	L/V Stations	8 for 44 hrs.
	Plankton Tows	50 for 24 hrs.
	Buoy, Drogue and Current Meters	for 312 hrs.

Financing: Some programs are assured support of either AEC or NSF.
Proposals for others are pending with either NSF or private sources.
Proposals will be submitted for other parts of the program.

WHOI
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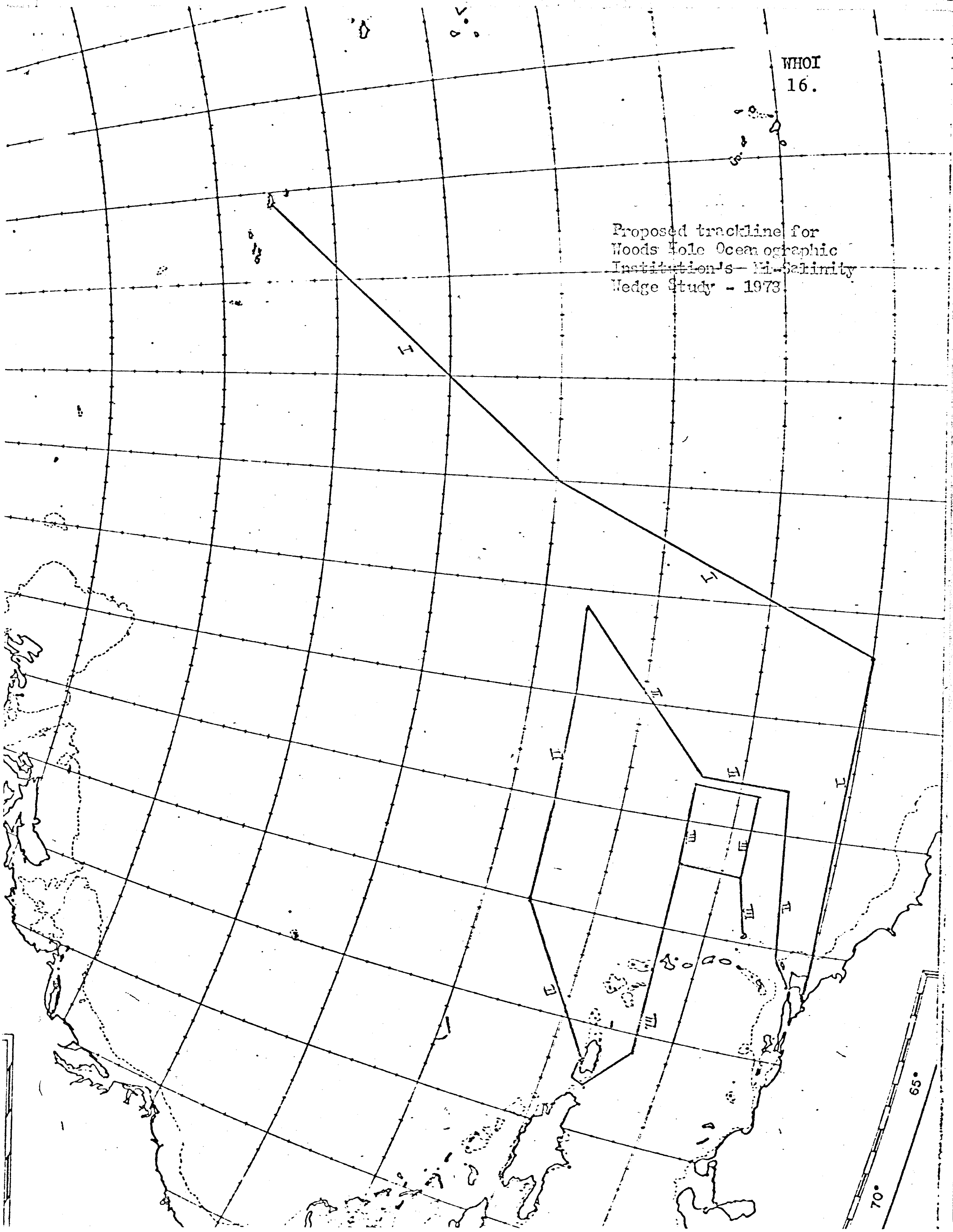

Proposed trackline for
Woods Hole Oceanographic
Institution's Hi-Salinity
Wedge Study - 1973
I
II
III
65°
70°

University of Rhode Island

Graduate School of Oceanography

Kingston, Rhode Island

1971-2

The 1971-2 CICAR activities of the University of Rhode Island's R/V TRIDENT are summarized in a set of ten cruise reports (R/V TRIDENT 92/94, 93, 95, 96, 97, 105-7, 106, 109 (plan), 110, and 111 (plan). These cruise reports are made part of this report. In summary, they covered the following areas:

92/94	-bioacoustics and marine biology, Anagada and Mona Passages, Virgin Islands and Puerto Rico (1971).
93	-bathymetry and current meter installations, Jungfern Passage (17°35'N, 65°14'W) (1971).
95	-currents in Jungfern Passage, whale acoustics, and microstructure measurements in the upper 700 meters (1971).
96	-marine geological and geophysical work, Anguilla to Guadeloupe (1971).
97	-midwater trawls and net tows for phytoplankton and eel larvae, Martinique to Bermuda (1971).
105-107	-density measurements applied to deep-ocean short-term water motions, Bermuda to Puerto Rico (1971).
106	-microstructure in the passes north and south of St. Croix (1971).
109	-abyssal circulation studies, zooplankton vertical migrations, dinoflagellate bioluminescense and growth rates, Rhode Island to Puerto Rico (1972).
110	-geophysical and geological studies of crustal structure of northern Lesser Antilles Island Arc, Puerto Rico to Barbados (1972).

111 -Chemical and geological studies, Barbados to Dakar, Senigal (1972).

1972-3

For 1972, the R/V TRIDENT is scheduled into the Gulf of Mexico 10 November to 10 December. She will be in the Caribbean from 22 January 1973 to 14 February working out of San Juan, Puerto Rico. The TRIDENT's tentative schedule for 1972-3 is part of this report.

CRUISE REPORT

R/V Trident # 92/94

PROJECT: Bioacoustics and marine Biology

CRUISE LEADER: H. E. Winn

DURATION: 3 January 1971 to 19 January 1971
Narragansett, R.I. to St. Thomas, V.I.
24 January 1971 to 1 February 1971
St. Thomas, V.I. to San Juan, P.R.

TOTAL DAYS: Cruise #92 -- 17 days; Cruise #94 -- 9 days
(Cruise #94 and #95 swapped 1 day's time)

AREA: Narragansett, R.I. to Sargasso Sea, Echo Bank, Anegada Pass, Virgin Islands, Mona Passage, Puerto Rico

SCIENTIFIC PARTY:	Aboard For Cruise #
Howard E. Winn, Cruise Leader	92, 94
Paul J. Perkins, Oceanographic Specialist	92, 94
Richard Edel, Graduate Student	92, 94
John Mason, Graduate Student	92, 94
Martin Hyman, Graduate Student	92, 94
Michael Fine, Graduate Student	92, 94
Algis Taruski, Graduate Student	92, 94
Robert Pikanowski, Graduate Student	92, 94
James Hain, Graduate Student	92, 94
James Parrish, Graduate Student	92, 94
John Casey, Field Party Chief, Nat'l Marine Fisheries Service	94
Charles Stillwell, Fisheries Biologist, Nat'l Marine Fisheries Service	94
Harold Pratt, Fisheries Biologist, Nat'l Marine Fisheries Service	94

GENERAL OBJECTIVES:

1. To continue the studies of humpback whales: movements, behavior, underwater sound production and reactions to pre-selected underwater sound playbacks.

2. En route to the humpback whale study area, to attempt to collect migrating or spawning European or American eels in the Sargasso Sea. Using the longline operation to examine stomach contents of the fish caught for adult eels and the full and half meter plankton net tows to collect eel eggs and larvae.

   In conjunction with the above objective, to investigate the area known as Echo Bank (Lat. 21°00'N and Long. 58°40'W) listed as a 'doubtful danger' by the Oceanographic Office to determine its existence as either a land mass or a mass of biologic origin (spawning eels). If Echo Bank is found, to fish the bank's reported depth (34 fathoms) for eels with longline, trammel nets, meter nets, handline or vertical haul nets.

3. To maintain a continuous whale and porpoise watch during daylight hours making a transect population census of all species observed. During the hours of darkness and/or special occasions, supplement the whale/porpoise detection procedure with frequent passive directional sonar searches while the ship is stopped.

4. To conduct simultaneous night light/drifting/underwater listening stations to carry out certain phases of numbers 2 and 3 above.

STATIONS AND NARRATIVE:

One hundred and seventy-two underwater sound stop/listening stations were made for the search, detection and tracking of humpback, sperm, minke, pilot whales and various porpoise/dolphin species.

Calling humpback whales were detected on the AN/BQR-3a directional passive sonar up to 8 miles.

Underwater sound recordings were made from calling humpback, sperm, minke, pilot whales and four species of porpoise (bottlenose dolphin, spotted dolphin, longsnout dolphin, and a yet to be identified *Stenella* species). Strong underwater sound pulses were recorded for the first time from minke whales when two repeatedly swam under the ship while it was stopped.

Pre-selected humpback whale sounds were transmitted to a calling humpback whale to see its effect on the calling sequence. Unfortunately, the whale was perhaps too far away to respond to our feeble 20 watt transmission. (It is recognized that a wide band audio 40-10,000 Hz transducer is necessary to do this task properly; a minimum of 1000 watts output is required.)

Closed circuit TV recordings, 16 mm color, black and white movie film and 35 mm film were made of family pods of humpback, sperm, pilot and minke whales.

The humpback whale breeding and calling grounds are the shoals and banks of the Lesser Antilles. Over 1500 nautical miles were transited using sound station stops for approximately 8 mile radius extended searching. Visual daylight sightings of whale spouts and splashes were restricted to approximately 2 to 3 miles. Twenty-two non-callers in family pods of 2-3 animals were sighted. Eleven calling whales were detected with no more than two calling at any one time, one close and one distant.

The transect population census of humpback whales for this area during this time of year appears to be fairly complete based on current literature and humpback sightings of previous Trident cruises. Our data supports the data that the Atlantic humpback population is very small. It is now feasible to make a population estimate of the Northwestern Atlantic humpback whale.

No adult American or European eels were found in the longline fish and shark catches, trammel and meter net operations.

Echo Bank was not found in the course of approximately 32 hours of search. The ship's Satellite Navigator was not aboard and the Loran systems were not reliable at this time. Celestial navigation was used to orient our search. The datum point of the search was the center of the smallest and nearly consistent cluster of five previously reported positions of Echo Bank.

Frequent stops to listen for Echo Bank were made. The reasoning behind this was that if the bank exists and the reported 34 fathoms is true, then the bank would have snapping shrimp. Snapping shrimp noise would give the bank a detectable distance (on our passive directional sonar) of up to 4 miles.

Future cruise searches for Echo Bank should be made during the months of January through July when eels are reported to be spawning. With the Satellite navigation system, the passive directional sonar and a smooth sea, a minimum of 3 days search time is needed. We have been requested by the U.S. Naval Oceanographic Office, Oceanic Bathymetry Division, to make a bathymetry survey around Echo Bank.

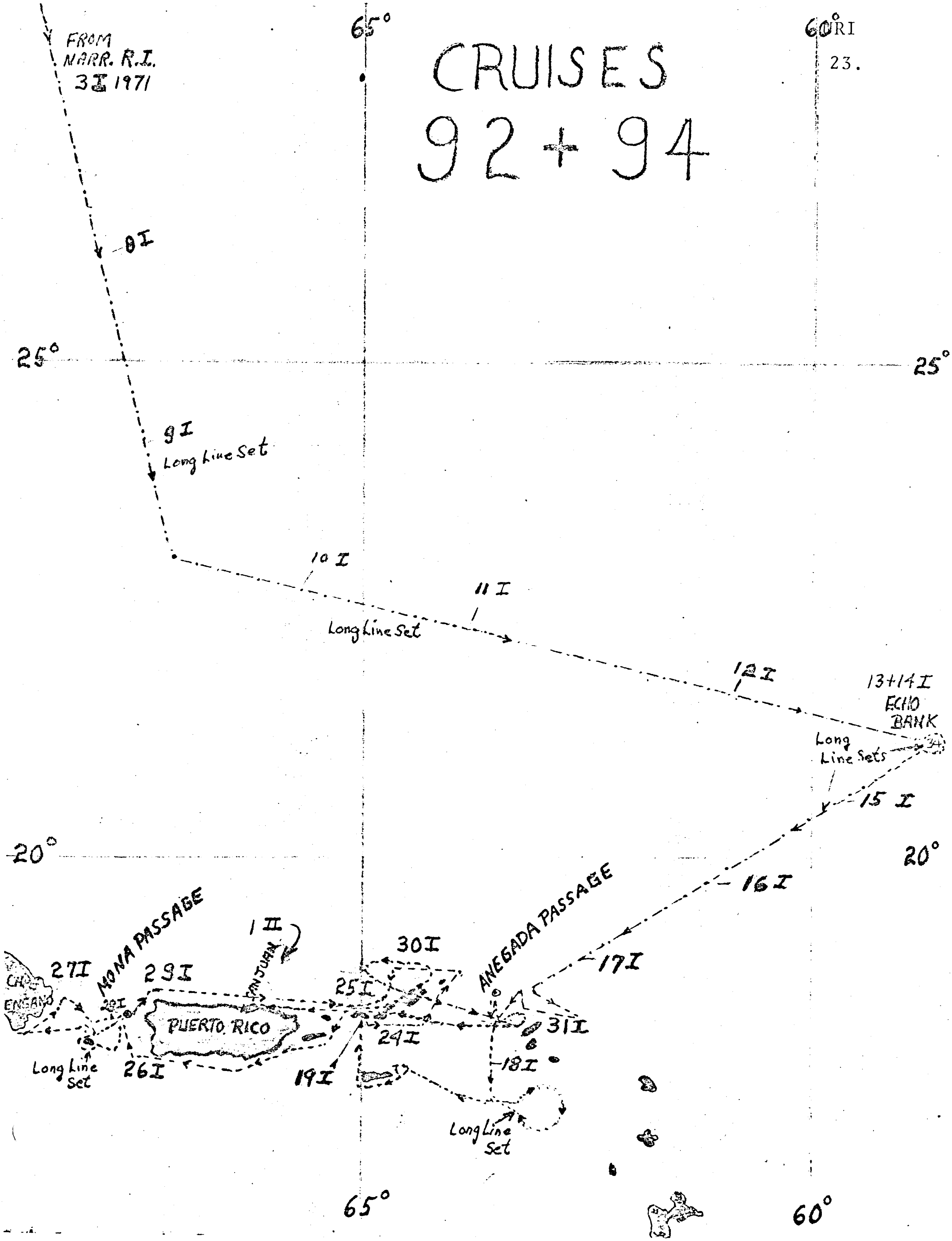
An attempt was made to collect living specimens of the leptocephalus larvae of *Anguilla*. A series of eight multiple-net oblique and stepped meter net plankton tows were made along the transect from Lat. 38°38.3'N by Long. 70°53.0'W, north of the Gulf Stream to Lat. 21°39.0'N by Long. 60°12.0'W, approaching the Echo Bank search area.

The proposed program sought to examine the behavioral response of the leptocephali to various experimental conditions to determine what, if any, directed orientation might play a part in the "passive drift" mechanism of classic planktonic transport. No *Anguilla* larvae were collected. A further attempt will be made in March-April on TR097.

CONTINUOUS OBSERVATIONS:

1. Near surface (10 feet below hull) temperature recordings, charts, 24 hours Taylor model were made for the entire Cruise #92 and 94. This recorder was calibrated against XBTs.
2. Daylight whale and other wildlife observations (sharks, turtles, birds, etc.) were made and recorded.

CRUISES 92 + 94



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
Narragansett Sport Fisheries Marine Laboratory
Narragansett, Rhode Island 02882

RV TRIDENT CRUISE #92 (Jan.5-Feb.2, 1971)
Cooperative Cruise - URI Marine Laboratory and NMFS,
Narragansett Sports Fisheries Marine Laboratory

CRUISE AGREEMENT: Professor Howard Winn of the University of Rhode Island invited NSFML personnel to participate in Trident Cruise 92 for the purpose of conducting longline fishing in the Sargasso Sea area. The mutual benefits anticipated from this cooperative effort were that he would be able to examine stomachs of the catch for the presence of eels; we in turn would be able to pursue the objectives stated below. NSFML supplied longline gear, personnel, and partial payment of travel expenses. Dr. Winn and the University of Rhode Island Graduate School of Oceanography bore all other expenses for the cruise.

AREA OF OPERATIONS: Sargasso Sea - Leeward Islands

ITINERARY: Departed Narragansett January 5, 1971 and conducted longline fishing in Sargasso Sea and Anegada Passage. NSFML personnel departed vessel at St. Thomas, V.I. January 21, 1971.

OBJECTIVES (NSFML):
1) to conduct deep water longline fishing for pelagic sharks, billfishes and tunas.
2) to tag sharks for migration studies.
3) to examine stomach contents and obtain samples of gonads for reproductive studies.

METHODS: Longline gear consisted of 250-390 hooks, baited with squid and mackerel; and buoyed at 10 and 15 hook intervals. The gear covered approximately 7 miles and over this distance we graduated the length of buoy lines to fish through a depth range of 160 fathoms to the surface. Chain weights (10-40 lbs) were attached to the deeper buoy lines which were 20, 50, 80, 100 and 140 fathoms long. The gear was set after dark and hauled the following day.

RESULTS: A total of six sets yielded sixty-five fish representing thirteen species (Table). Of these: 21 sharks; 1 swordfish; 1 sailfish; and 1 yellowfin tuna were tagged and released. Swordfish were caught at five stations and were generally taken where line depths exceeded 30 fathoms. Blue sharks were similarly caught on deeper hooks and the body temperature of both species ranged up to 2.5°C cooler than surface water temperatures at the time of capture. Typical BT profiles showed surface temperatures of 25°-26°C extended to depths of 45-65 fathoms.

RESULTS: (continued)

The remaining species were taken on shallower hooks with the exception of dolphin and tuna. However, their lively condition on the deep end of the line suggested they had been recently hooked and probably hit as the gear was being retrieved.

One female blue shark contained 84 embryos 16-18 cm long. Sperm smears and tissues were obtained from the testes of swordfish, dolphin; and blue, whitetip and silky sharks. Only the male blue sharks and both sexes of dolphin contained fully developed sex products (running ripe eggs and sperm in dolphin; an abundance of spermataphores in blue sharks).

Stomachs of sharks, swordfish, sailfish and tuna did not contain large amounts of food but recognizable remains included squid, lancetfish, parrotfish, and triggerfish with squid as the dominant food item.

Muscle samples were taken from all species for mercury analysis under an agreement with the Federal Water Quality Administration Laboratory in West Kingston, Rhode Island.

John G. Casey
Fishery Biologist

Scientific Personnel:

John Casey Field Party Chief
Charles Stillwell Fishery Biologist
Harold Pratt Fishery Biologist

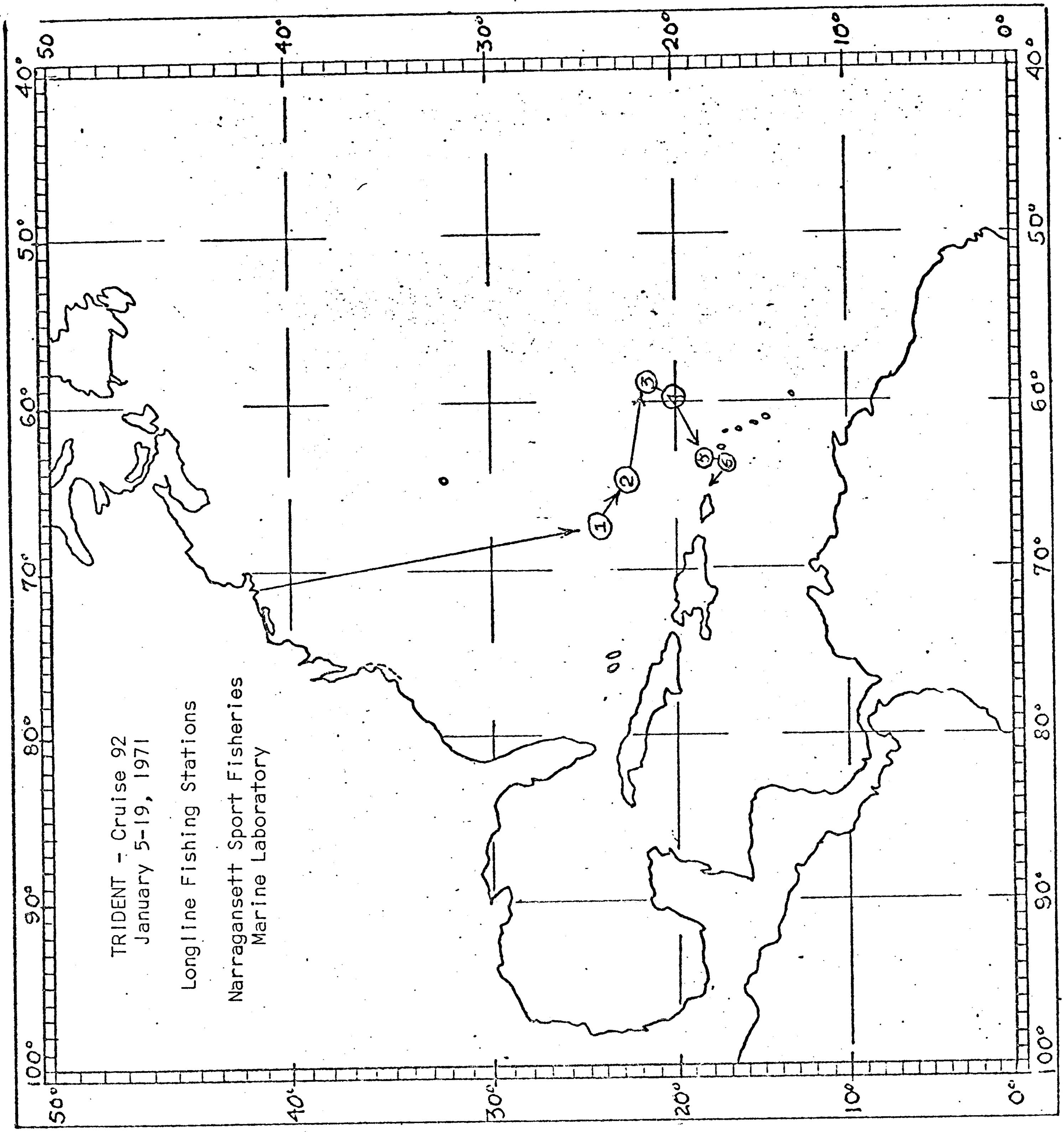
TABLE

Summary of Longline Catch

Trident Cruise #92 1/5-21/71

Set #	Date	#Hooks	Mko	Blu.	Wht.	Silky	Tiger	H.hd.	Sw.f.	Sail	BeT.	Yf.T.	Dol.	Lan.f.	Bara.	Total
1	1/09/71	390	-	2	3	-	1	-	2	-	1	-	5	-	1	15
2	1/10/71	340	1	1	3	-	1	-	1	-	-	2	-	-	-	9
3	1/14/71	350	-	1	1	-	-	-	-	-	-	-	1	-	-	3
4	1/15/71	300	-	-	1	-	-	-	3	-	-	-	2	2	-	8
5	1/16/71	348	-	-	-	9	-	1	3	-	2	-	-	-	1	16
6	1/18/71	250	-	-	-	7	3	1	1	2	-	-	-	-	-	14
	Total	1,978	1	4	8	16	5	2	10	2	3	2	8	2	2	65

Mko - Mako shark; Blu. - Blue shark; wht. - Whitetip shark; H.hd. - Hammerhead shark; Sw.f. - Swordfish; Sail - Sailfish; BeT. - Bigeye tuna; Yf.T. - Yellowfin tuna; Dol. - Dolphin; Lan.f. - Lancetfish; Bara. - Barracuda.


TRIDENT - Cruise 92
January 5-19, 1971
Longline Fishing Stations
Narragansett Sport Fisheries
Marine Laboratory

GRADUATE SCHOOL OF OCEANOGRAPHY, UNIVERSITY OF RHODE ISLAND, KINGSTON, R. I.

CRUISE REPORT

R/V TRIDENT

TR-93

SCHEDULE

Depart St. Thomas, V.I., 1000, 21 January 71.

Arrive St. Thomas, V.I., 1600, 23 January 71.

REGION INVESTIGATED

All scientific work was carried out within 3 miles of Jungfern Passage, near 17° 35' N, 65° 14' W, as shown in Figure 1.

TOTAL DAYS OF CRUISE

2¼ days (9 hrs transit time)

SCIENTIFIC PERSONNEL

P. Bedard	Electronics Engineer
J. Sammons	Research Technician
R.E. Smith	Oceanographic Specialist
J. Hain	Graduate Student
W. Hahn	Marine Technician
W. Sturges	Associate Professor

SCIENTIFIC PROGRAM

The purpose of this cruise was to put out an array of five current meters as a preliminary step for the work on cruise 95. Three separate operations were carried out. In the first, five new and overhauled acoustic release mechanisms were tested by lowering them over the side, on the hydrographic cable, and interrogating each release mechanism. The second part of the program was a bathymetric pattern, made just inside the Venezuela basin. Unfortunately the weather was much rougher than anticipated. The planned bathymetric pattern lay at such an angle to the wind and sea that the plan could not be carried out. A modified pattern was run, with reasonable satisfactory results.

The third and main part of the program was to launch the current meters, whose positions are shown in Figure 2. Each array has a current meter and a precision temperature recorder 10 m from the bottom. These temperature recorders required some additional electronics work after they were received from the manufacturer (Aquadyne Inc.). Bedard and Sammons were able to improve on their operation quite satisfactorily, and the instruments now have a resolution of .003° C. Our initial use of the instruments suggests that their drift over periods of a week or two is small enough to be in the noise level. At current meter number 5, a second current meter and temperature recorder was placed 50 meters from the bottom.

The navigation on this cruise was greatly improved by the recently acquired satellite navigator. It turned out that some sea water leakage in the antenna cable had allowed corrosion of the cable termination at the navigator unit. A good many fixes were lost before this trouble was corrected, but thereafter the unit performed splendidly.

A Bisset-Berman STD unit on loan from ONR was tested briefly. An extremely noisy record was obtained, apparently owing to a leaky underwater cable termination. Bedard was able to correct this difficulty before cruise 95.

8 April 1971
Wilton Sturges

GRADUATE SCHOOL OF OCEANOGRAPHY, UNIVERSITY OF RHODE ISLAND, KINGSTON, R. I.

CRUISE REPORT

R/V TRIDENT

TR-95

SCHEDULE

Depart San Juan, P.R., 1300, 3 February 71.

Arrive St. Thomas, V.I., 1830, 17 February 71.

St. Croix, V. I., 7 - 8 February 71. (unscheduled)

REGION INVESTIGATED

Deep-water renewal work was carried out in the vicinity of Jungfern Passage, near 17° 35' N, 65° 14' W (see Fig. 1), extending approximately 15 miles to the south-west. Sonar stations, listening for whales, were made for Dr. H.E. Winn at the western end of Puerto Rico, in Mona Passage.

TOTAL DURATION

14¼ days, as follows:
- 16 hrs in transit
- 2½ days (1800, 4 February to 0615, 7 February) listening station and transit time

2 unscheduled port calls: Frederikstad, St. Croix, V.I. 1100, 7 February - 1530, 8 February, away from op. area; one for medical treatment for cook, the other to look for missing crew member.

9 3/4 days physical oceanography program

SCIENTIFIC PERSONNEL

P. Bedard	Electronics Engineer
W. Hahn	Marine Technician
E. Jernigan	Graduate Student
W. P. Kramer	Research Associate
R. B. Lambert	Assistant Professor
L. Miller	Graduate Student
J. Sammons	Electronics Technician

R.K. Sexton	Senior Marine Technician
R. Smith	Oceanographic Specialist
F. Steinhilper	Marine Technician
W. Sturges	Associate Professor, Chief Scientist

SCIENTIFIC PROGRAM

The purposes of this cruise were (1) to observe deep water inflow into the Caribbean Sea, (2) to attempt to make observations of mixing and entrainment as the renewal water sinks down the sloping bottom, and (3) to observe temperature and salinity microstructure in the upper 600 to 700 meters. All three programs had very good results. The use of an STD for two separate programs, one in the upper layers and one near the bottom, worked out very well and seemed to make efficient use of the equipment and ship time. In addition, several listening stations were made for Dr. Winn, in an attempt to record whale sounds in the vicinity of Mona Island.

As soon as the Trident arrived in the operating area we began recovering the current meters launched on cruise 93. Figure 1 shows the positions of all current meters launched for this program. Of the 5 arrays launched during cruise 93, only two could be recovered initially; a third was recovered near the end of this cruise (when the back-up timer fired). Our failure to recover this equipment at the beginning of the cruise hampered the remainder of the work, but enough equipment was recovered to allow a productive program to be carried out.

Several others arrays, usually of three current meters, were launched. While they were in place near the bottom, several series of drifting STD stations were carried out. Figure 2 shows the positions of several of these. The proceedure was to lower the STD to the bottom, at the beginning of one station, raise it approximately 150 meters off the bottom, and then go back to the bottom again, going up and down repeatedly, while drifting. The drifting stations were intended to pass through a region of cold renewal water that was flowing down the bottom, and several of these crossings proved very productive, as shown in Figure 3. Each STD lowering was intended to go completely across the sill, to obtain such a temperature distribution, with the end of the cast being determined by a failure to find cold water. Most stations were terminated, however, when the pinger could no longer give a useful bottom return.

One of the most interesting and exciting results came from the precision temperature recorders, which worked extremely well. The maximum temperature variation was found to decrease from about 0.2° C, near the sill, to about one-tenth that amount at the positions farthest from the sill.

The vertical temperature sections obtained while drifting and the precision temperature recorder records can not be fully interpreted until the current-meter records have been processed; at this writing we have not yet received this data from Geodyne.

The use of the so-called "Fish winch" for STD work has proven only moderately satisfactory. The winch speed is very slow, and furthermore, toward the end of the cruise the level-wind mechanism failed to such an extent that the cable was badly twisted (near the middle) and STD work had to be terminated. The chief engineer has suggested that the hydrographic winch could easily be used for STD work with only minor modifications. This change seems to be most desirable.

Toward the end of the cruise a dragging operation was tried, in an attempt to recover current meter number 4. The operation seemed to go well, but the grappling hooks apparently were not strong enough and the only accomplishment was to bend the hooks.

For each deep STD cast, water samples were collected for salinity and temperature calibrations of the STD, and a number of samples were also collected for silicate analysis. In addition, Mr. L. Miller carried out a deep hydrographic station for silicate observations at the depths we expect to be renewed by the tidal inflow.

Dr. Lambert is continuing his examination of the shallow STD casts. The initial results are that the step-like structure is not so pronounced in this data as from the previous cruise, in 1969.

The single most significant result from the deep-water renewal observations is that the coldest water does not lie merely downhill from the controling sill, but that the cold water continues to flow along an isobath in strongly geostrophic flow immediately inside the sill. The depths over which the cold water is found extend up to considerably shallower values (less that 1600 m) than had been suspected. It appears that the new estimates of renewal rate will be substantially greater than before.

April 8, 1971
Wilton Sturges

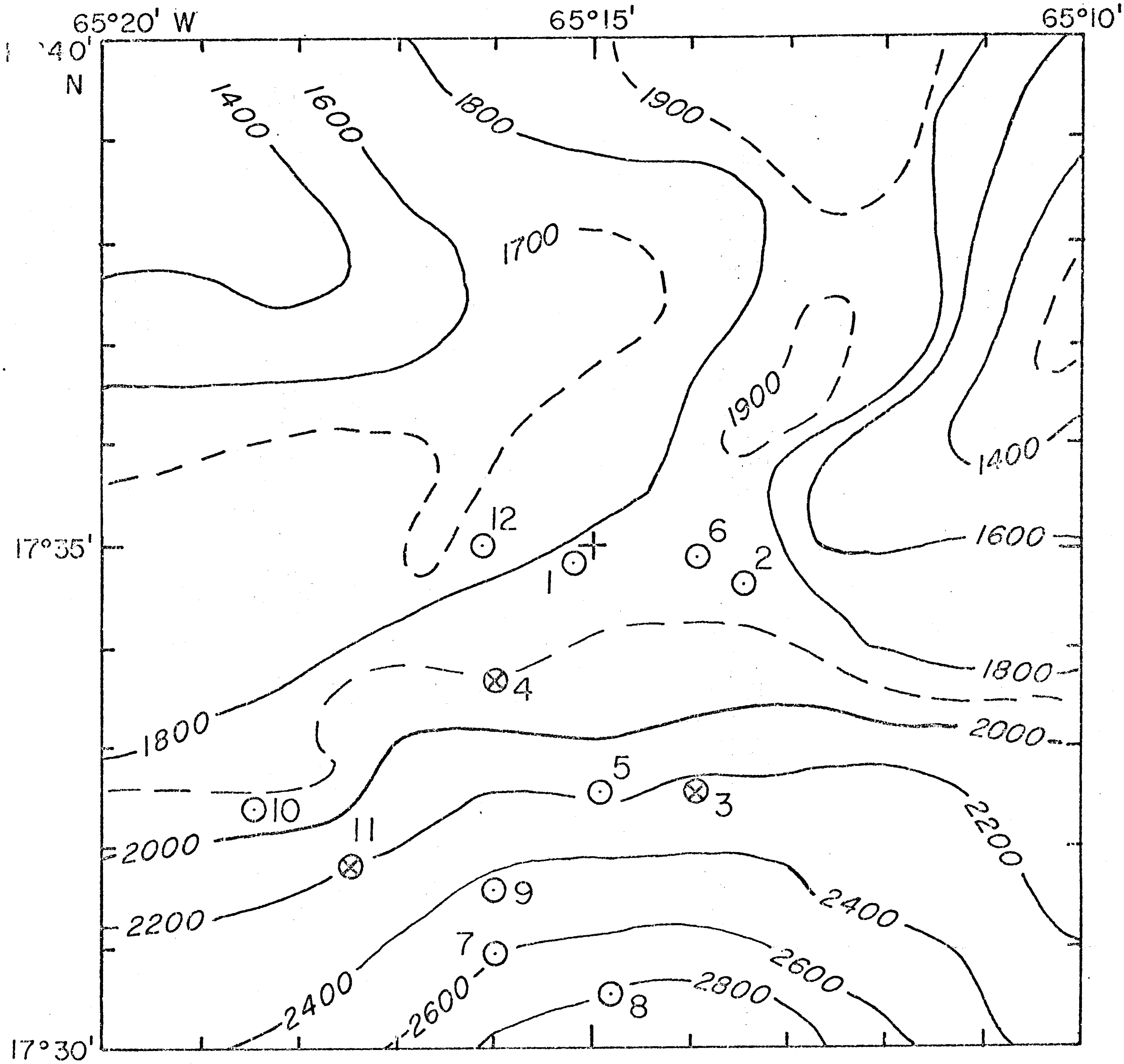


Figure 1 Location of current meters and temperature recorders launched on cruises 93 (1-5) and 95 (6-12), Jan - Feb 1971. Numbers 3, 4 and 11 have not been recovered.

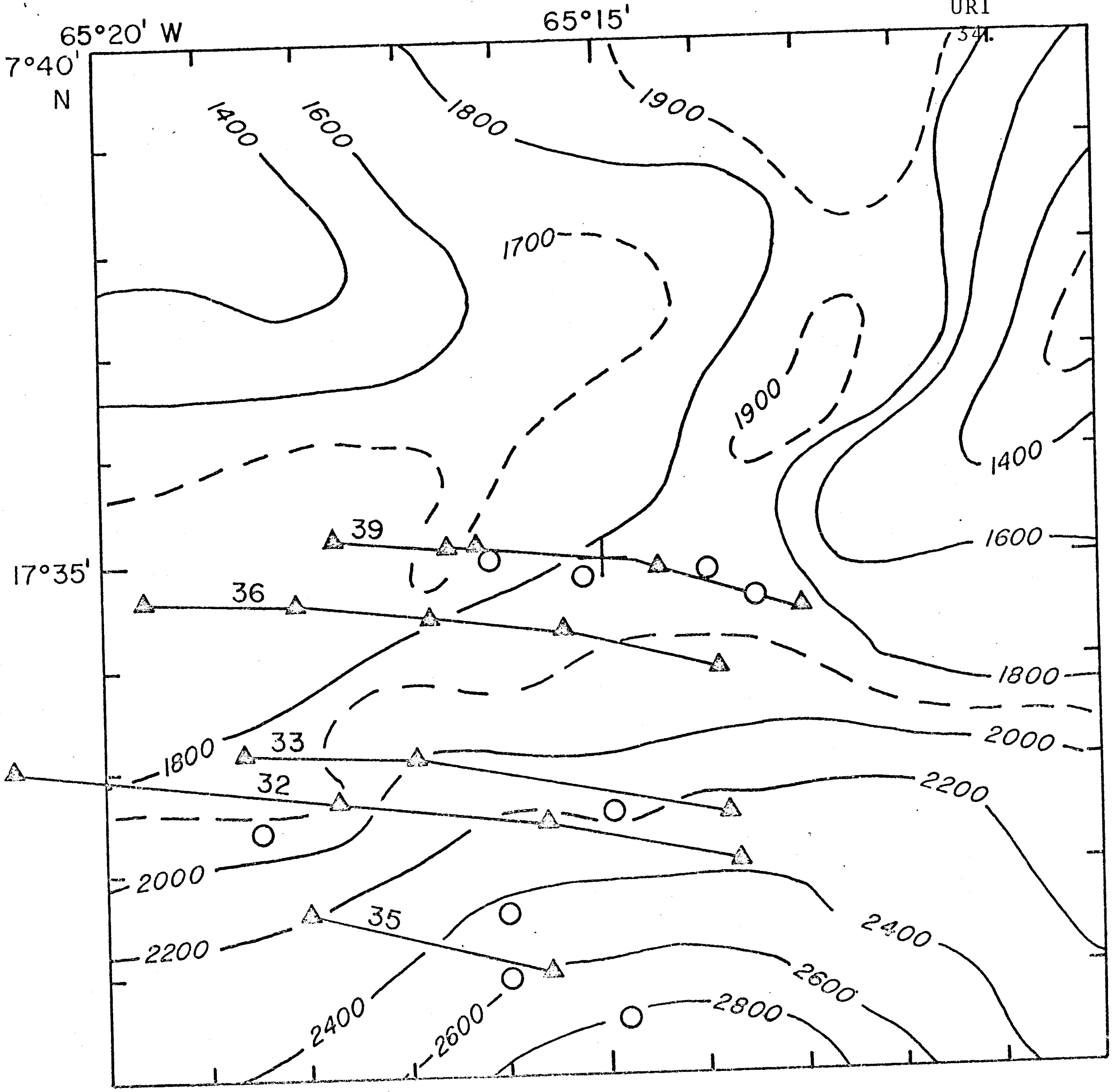


Figure 2 Tracks of several drifting STD stations, Trident Cruise 95. The numbers 32, 33, etc. refer to STD station number; Triangles show fixes by satellite navigator; circles show locations of bottom-mounted current meters and temperature recorders.

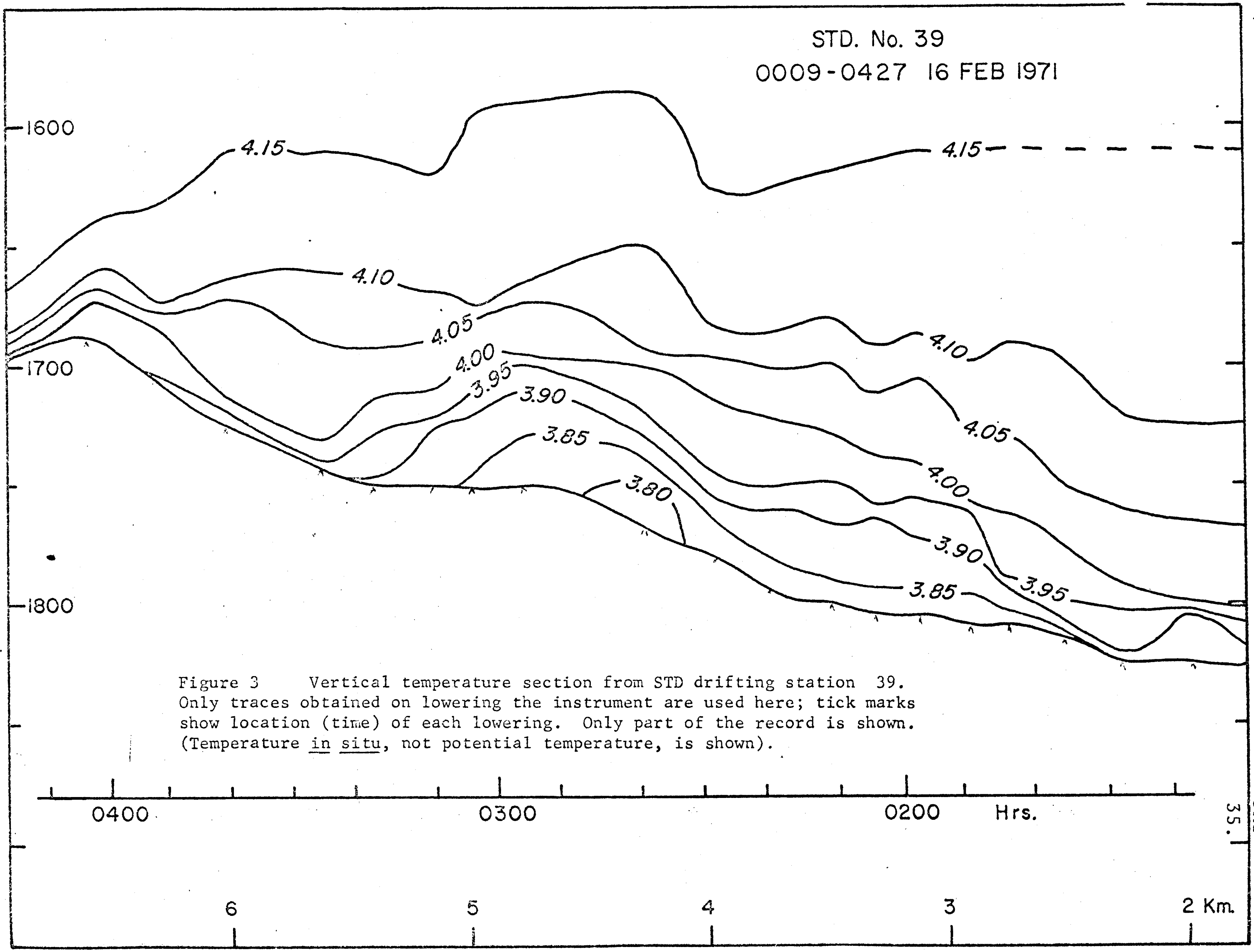


Figure 3 Vertical temperature section from STD drifting station 39. Only traces obtained on lowering the instrument are used here; tick marks show location (time) of each lowering. Only part of the record is shown. (Temperature in situ, not potential temperature, is shown).

U N I V E R S I T Y O F R H O D E I S L A N D
Graduate School of Oceanography

K I N G S T O N, R. I.
Narragansett Bay Campus

CRUISE REPORT
TR 096 (ARC II)
21 FEBRUARY - 28 MARCH 1971
R/V TRIDENT

The TRIDENT spent 35 days conducting marine geological and geophysical investigations in the northern part of the Lesser Antilles Island Arc. To make the most efficient use of ship time, the programs of Fink and Johnston (Schilling-sponsor) were combined over the length of the whole cruise.

SCHEDULE

Leg I	21 February - 10 March 1971	St. Thomas, V.I. to operating area, thence to Pointe-a-Pitre, Guadeloupe, F.W.I. (17 days)
	including 24 February - 1 March	in Pointe-a-Pitre for repairs
	11 March	Pointe-a-Pitre
Leg II	12 March - 28 March	Pointe-a-Pitre to operating area, thence to Fort-de-France, Martinique, F.W.I. (16 days)

SCIENTIFIC PARTY

Dr. L.K. Fink, Jr.	(Legs I-II)	Univ. of Maine	chief scientist, Leg I	USA
Thomas H. Johnston	(Legs I-II)	U.R.I.	chief scientist, Leg II	USA
Dr. Detmar Schnitker	(Legs I-II)	Univ. of Maine	micropaleontology	Germany
Dr. Michel Feuillard	(Leg I)	Univ. de Paris	seismology	France
Dr. Haraldur Sigurdsson	(Leg II)	Univ. of West Indies	geology	Iceland
C.K. Unni	(Leg I)	U.R.I.	geochemistry	India
David G. Johnson	(Leg II)	U.R.I.	geochemistry	USA
Charles Heinonen	(Legs I-II)	Univ. of Maine	geology	USA
Paul Rusanowski	(Legs I-II)	Univ. of Maine	botany	USA
James Martell	(Leg I)	George Washington Univ.	geochemistry	USA
Francois LeLann	(Leg I)	Bureau of Geologic Research & Mines, Orleans	geology	France
P-M. Thibaut	(Leg II)	BRGM, Fort-de-France	geology	France
Thomas Davis	(Legs I-II)		biology	USA
Art Buddington	(Legs I-II)	U.R.I.	marine technician	USA
Mark Weishan	(Legs I-II)	U.R.I.	marine technician	USA

SHIP'S COMPANY

.W. Clampitt, master
R.W. Reusswig, chief mate
David LaCasse, second officer
Clifford Oatly, ordinary seaman
Pat Neves, steward
Oscar Ammons, second cook

SHIP'S COMPANY (Continued)

Kyle Birk, radio officer
Henry Martin, bos'n
Robert Jenkins, AB seaman
Frederick Russell, AB seaman
John Stholberg, Jr., AB seaman
Barry McGuire, ordinary seaman
Peter Miller, ordinary seaman

J.P. Symonds, chief engineer
R.S. Martin, first engineer
Theo. Surette, second engineer
Harry Rougas, electrician
Joe Moscatelli, oiler
Neal Hovey, oiler

UNDERWAY OPERATIONS (Dr. L.K. Fink, Jr.)

Purpose

Previous geophysical investigations have revealed the relationship between the pre-Miocene and Miocene - Recent island arc ridges in the vicinity of Guadeloupe. This cruise was conducted to extend this detailed study to the entire northern half of the arc complex and to substantiate the continuity of this relationship. In addition the first studies to resolve the nature of the Aves Ridge and it's relationship with the Lesser Antilles Island Arc were initiated. It is recognized that detailed and closely spaced geophysical data are necessary to adequately define the complex associations of this area.

Method

To define these upper crustal structural relations, continuous seismic reflection profiles, and continuous bathymetric and magnetic profiles were obtained along the lines indicated in Fig. 1. These data were then utilized to determine the best dredging sites for obtaining samples of the rocks comprising the island arc ridge and the Aves Ridge.

Preliminary Results

The continuous seismic profiles were of exceptional quality, penetration was up to 2.5 seconds in such areas as the Grenada Trough. The acoustic basement was reached in most instances. A preliminary interpretation of the records suggests a young origin for the Aves Ridge accompanied by extensional rifting in the interarc basin. On the arc ridge crest the unconformity between the volcaniclastic products of the older and younger volcanic centers is clearly revealed.

The magnetic profiles are generally subdued everywhere in the area with the exception of the arc ridge crest where short wave length variations on the order of 100 to 500 gammas are associated with volcanic centers and minor faults in the acoustic basement.

The bathymetric data will be combined with other data on hand to produce a detailed bathymetric chart for the area north of Dominica. In general the existing bathymetric charts are a poor representation of the topography.

DREDGING OPERATIONS (T.H. Johnston)

This work has been carried out under the supervision of Dr. J-G. Schilling, U.R.I., and supported by his Office of Naval Research contract No. N00014-68-A-0215-0003.

Purpose

The subduction of oceanic lithosphere beneath island arcs is predicted by hypotheses of sea floor spreading and plate tectonics. Evolution of an island arc may involve melting of old oceanic lithosphere or spatially associated mantle at several levels. Dredging transverse fracture zones cross cutting the front of island arcs may expose either the basal part of such old volcanic edifice material or old oceanic crust.

Method

The dredging effort centered on the Desirade Scarp east of Guadeloupe. Five successful hauls here during TR 079 obtained greenstones, metagabbro, and quartz keratophyres. Further work was desirable to search for other rock types and possible layering by dredging along traverses at several depths. Along this scarp, the east flank of the arc edifice is offset, and a 40-km section of crustal interior exposed.

Preliminary Results

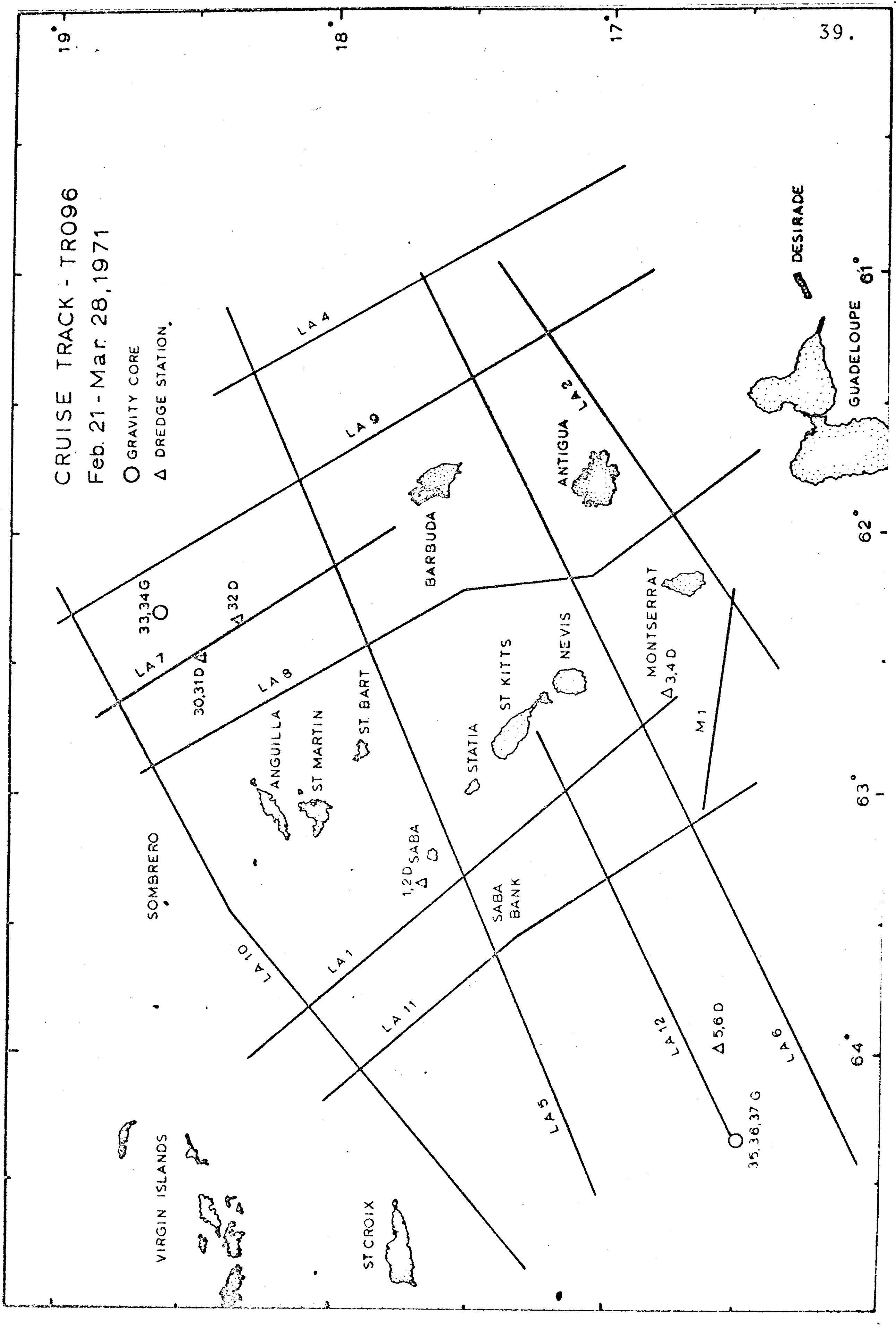
Five sub-bottom profiles (270 km) across the scarp were made, augmenting traverses obtained on TR 079. Nineteen dredge hauls were attempted on the scarp, of which 10 were successful, recovering a total of about 600 kg metamorphic and igneous rock. Rock types identified by preliminary inspection include greenstones, gabbros, basalts, and chert, some very fresh and others altered or sheared.

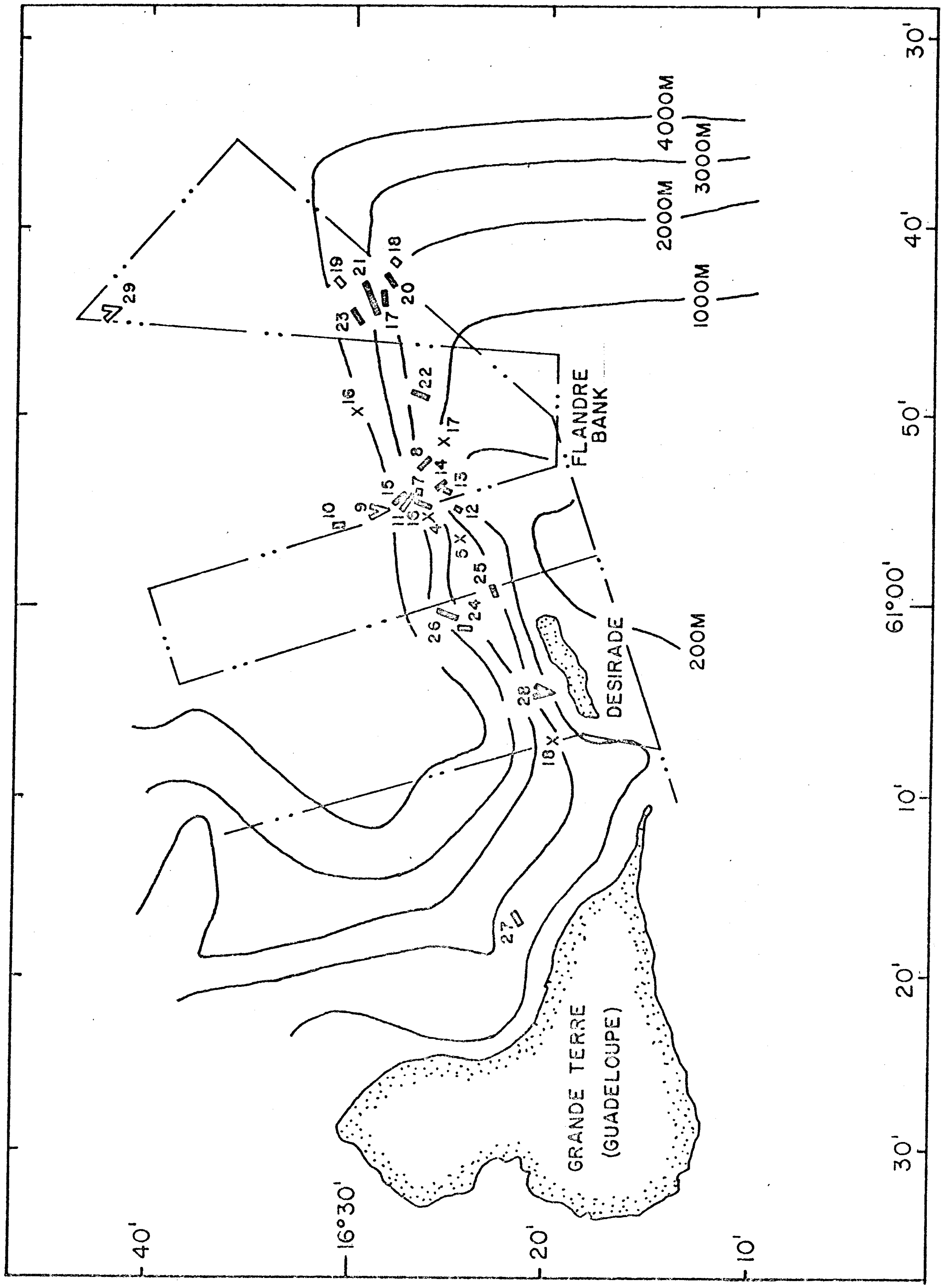
Three successful camera stations were completed, of which two cover sites dredged, and show the nature of outcrops on the scarp.

A one-day visit was made to Desirade Island. Samples related to those dredged were collected, and their field relationships observed.

Six successful dredge stations were completed near Montserrat and other locations in the Northern Lesser Antilles and Venezuela Basin, where the sub-bottom survey suggested exposed basement. Coquina and foraminiferal sediment were recovered, but not outcropping igneous rock.

Sediment cores were taken for benthic foraminifera studies at locations on the Atlantic floor and in the Venezuela Basin.


CRUISE TRACK - TR096
Feb. 21 - Mar. 28, 1971
O GRAVITY CORE
Δ DREDGE STATION.
19°
18°
17°
61°
62°
63°
64°
LA 4
LA 9
LA 7
LA 8
LA 2
LA 10
LA 1
LA 11
LA 5
LA 12
LA 6
M 1
33,34G
32 D
30,31D
1,2D
3,4 D
5,6 D
35,36,37 G
DESIRADE
GUADELOUPE
ANTIGUA
BARBUDA
MONTSERRAT
NEVIS
ST KITTS
STATIA
ST BART
ST MARTIN
ANGUILLA
SABA
SABA BANK
SOMBRERO
VIRGIN ISLANDS
ST CROIX



TRIDENT CRUISE TR096 LEG II 12 – 28 MARCH, 1971

TR096 - SUCCESSFUL TR096 - OTHER x TR079 - SUCCESSFUL

TR 096 STATIONS

Station	Type*	Date (1971)	Latitude (North)	Longitude (West)	Depth (meters)
1	D	2/22	$17^{\circ}39'$	$63^{\circ}20'$	500

Site : Saba Bank, east flank
Samples Recovered: one rounded cobble of hornblende dacite, two crinoids, coral debris

2	D	2/22	$17^{\circ}40'$	$63^{\circ}20'$	400

Site : Saba Bank, NE flank
Samples Recovered: none

3	D	3/2	$16^{\circ}48.5'$	$62^{\circ}39.0'$	700

Site : Seamount, 25 mi west of Montserrat
Samples Recovered: coral debris, one pumace pebble

4.	D	3/2	$16^{\circ}48'$	$62^{\circ}37'$	950

Site : Seamount, 25 mi west of Montserrat
Samples Recovered: one tunicate, one glass sponge, some coral debris

5	D	3/6	$16^{\circ}33.8'$	$63^{\circ}54.3'$	900

Site : Seamount, 60 mi NW of Aves I.
Samples Recovered: 20 kg fresh coquina, a few corals

6	D	3/6	$16^{\circ}34.3'$	$63^{\circ}52.4'$	800

Site : Seamount, 60 mi NW of Aves I.
Samples Recovered: 100 kg shell and foraminiferal coquina

7	D	3/14	$16^{\circ}27.0'$	$60^{\circ}54.2'$	1400

Site : Desirade Scarp, central
Samples Recovered: none

8	D	3/14	$16^{\circ}27.0'$	$60^{\circ}52.8'$	1600

Site : Desirade Scarp, central
Samples Recovered: 40 kg greenstones, metagabbros, and metabasalt

9	D	3/14	$16^{\circ}28.4'$	$60^{\circ}54.8'$	3900

Site : Desirade Scarp, central
Samples Recovered: none

10	D	3/14	$16^{\circ}31.1'$	$60^{\circ}55.7'$	4800

Site : Desirade Scarp, central
Samples Recovered: none

*D=dredge, C=camera, G=gravity core

TR 096 STATIONS (continued)

<table>
<tr><th>Station</th><th>Type</th><th>Date (1971)</th><th>Latitude (North)</th><th>Longitude (West)</th><th>Depth (meters)</th></tr>
<tr><td>11</td><td>C</td><td>3/15</td><td>$16^{\circ}27.8'$</td><td>$60^{\circ}55.2'$</td><td>2500</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, central, site of TR079 station 4D
Photographs : Camera failed to operate</td></tr>
<tr><td>12</td><td>D</td><td>3/15</td><td>$16^{\circ}25.6'$</td><td>$60^{\circ}54.8'$</td><td>500</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, central
Samples Recovered: none</td></tr>
<tr><td>13</td><td>D</td><td>3/15</td><td>$16^{\circ}25.6'$</td><td>$60^{\circ}53.7'$</td><td>360</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, central
Samples Recovered: none</td></tr>
<tr><td>14</td><td>D</td><td>3/15</td><td>$16^{\circ}25.8'$</td><td>$60^{\circ}53.5'$</td><td>570</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, central
Samples Recovered: 3 kg greenstone and breccia</td></tr>
<tr><td>15</td><td>D</td><td>3/15</td><td>$16^{\circ}27.8'$</td><td>$60^{\circ}54.2'$</td><td>3650</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, central
Samples Recovered: 50 kg fresh gabbro, greenstone</td></tr>
<tr><td>16</td><td>C</td><td>3/16</td><td>$16^{\circ}27.0'$</td><td>$60^{\circ}54.6'$</td><td>2300</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, central, site of TR079 station 4D
Photographs : about 500, rock outcrops</td></tr>
<tr><td>17</td><td>D</td><td>3/16</td><td>$16^{\circ}28.9'$</td><td>$60^{\circ}43.8'$</td><td>2550</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, east
Samples Recovered: 300 kg sheared basalts</td></tr>
<tr><td>18</td><td>D</td><td>3/16</td><td>$16^{\circ}28.3'$</td><td>$60^{\circ}42.2'$</td><td>1400</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, east
Samples Recovered: none</td></tr>
<tr><td>19</td><td>D</td><td>3/16</td><td>$16^{\circ}31.0'$</td><td>$60^{\circ}43.2'$</td><td>4400</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, east
Samples Recovered: altered basalt fragments, foraminiferal ooze</td></tr>
<tr><td>20</td><td>C</td><td>3/17</td><td>$16^{\circ}28.6'$</td><td>$60^{\circ}42.5'$</td><td>2200</td></tr>
<tr><td colspan="6">Site : Desirade Scarp, east, near station 17D
Photographs : about 400, rock outcrops, talus, and sediment</td></tr>
</table>

TR 096 STATIONS (continued)

Station	Type	Date (1971)	Latitude (North)	Longitude (West)	Depth (meters)
21	D	3/17	16°29.5'	60°43.5'	3500

Site : Desirade Scarp, east
Samples Recovered: 200 kg amygdaloidal basalt, gabbro, altered basalt, chert, and well lithified sediments

22	D	3/17	16°27.3'	60°48.7'	2300

Site : Desirade Scarp, east
Samples Recovered: 10 kg altered basalt, 20 kg mudstone

23	C	3/18	16°30.4'	60°44.4'	3450

Site : Desirade Scarp, east, near station 21D
Photographs : about 500, sediment bottom, a few fish.

24	D	3/18	16°25.1'	61°01.1'	2800

Site : Desirade Scarp, west
Samples Recovered: none

25	D	3/18	16°23.1'	60°59.5'	1500

Site : Desirade Scarp, west
Samples Recovered: 30 kg altered fine gabbro, 10 kg weakly consolidated foraminiferal siltstone

26	D	3/19	16°26.1'	61°00.6'	3400

Site : Desirade Scarp, west
Samples Recovered: 50 kg aphyric basalt, some amygdaloidal

27	D	3/19	16°21.7'	61°16.3'	850

Site : Desirade Trough, west
Samples Recovered: 5 kg chlorite mud

28	D	3/19	16°20.8'	61°04.7'	800

Site : Desirade Scarp, west
Samples Recovered: 25 kg trondhjemite, basalt breccia, and limestone

29	D	3/20	16°41.6'	60°43.8'	5400

Site : Desirade Trough, east
Samples Recovered: none

30	D	3/22	18°30.5'	62°28.5'	3200

Site : Anguilla Ridge, north scarp
Samples Recovered: none

TR 096 STATIONS (continued)

Station	Type	Date (1971)	Latitude (North)	Longitude (West)	Depth (meters)
31	D	3/22	18°28.0'	62°29.6'	2300

Site : Anguilla Ridge, north scarp
Samples Recovered: 25 kg tan foraminiferal ooze

32	D	3/23	18°21.5'	62°20.4'	2400

Site : Anguilla Ridge, south scarp
Samples Recovered: none

33	G	3/23	18°38.4'	62°17.9'	5970

Site : Atlantic floor, east of Anguilla
Samples Recovered: none

34	G	3/23	18°38.4'	62°18.4'	5600

Site : Atlantic floor, east of Anguilla
Samples Recovered: 1-1/2 meter light brown foraminiferal ooze

35	G	3/27	16°33.5'	64°19.7'	3475

Site : Venezuela Basin
Samples Recovered: none

36	G	3/27	16°33.5'	64°20.0'	3500

Site : Venezuela Basin
Samples Recovered: 2 meters light brown foraminiferal ooze

37	G	3/27	16°34.2'	64°20.5'	3525

Site : Venezuela Basin
Samples Recovered: 2 meters light brown foraminiferal ooze

RKS URI
45.

CRUISE REPORT

R/V TRIDENT 097

Leg I	Depart Martinique	0803	31 March 1971	09
	Arrive Bermuda	1233	8 April 1971	r
Leg II	Depart Bermuda	1702	10 April 1971	10
	Arrive Narragansett	0900	19 April 1971	

Area of Operation

Leg I Transect between Martinique and Bermuda

Leg II Ocean Acre: One degree square area southeast of Bermuda bounded by $31^{\circ}30' - 32^{\circ}30'$N and $63^{\circ}30' - 64^{\circ}30'$W.

19 days at sea

SCIENTIFIC PERSONNEL:

Henry Donaldson - Cruise Leader, Student, G.S.O., URI, Legs I & II
Elijah Swift - Faculty, G.S.O., URI, Legs I & II
Theodore J. Smayda - Faculty, G.S.O., URI, Leg II
Charles Brown - Underwater Sound Lab., New London, Conn., Leg I
Albert Brooks - Underwater Sound Lab., New London, Conn., Leg I
James Hain - Student, G.S.O., URI, Legs I & II
Ray Gerber - Student, G.S.O., URI, Legs I & II
Gary Hitchcock - Student, G.S.O., URI, Legs I & II
Raja Seshadri - Student, G.S.O., URI, Leg II
Mark Weishan - Technician, G.S.O., URI, Leg I
William Hahn - Technician, G.S.O., URI, Leg II

This cruise was in support of the Ocean Acre Program. The primary objective was to observe faunal and temperature changes between Martinique and Bermuda and collect crustaceans in the Ocean Acre area to be used for chemical analysis.

In addition to the trawling program Swift made several stations to study the life cycle of Pyrocystis, Hain sampled for eel larvae and Smayda examined the Sargassum weed community.

Midwater Trawl Program

Nansen Cast 1 at 32°N 64°W

XBT's - approximately one every hour while underway between 23°4'N 62°48'W and 31°00'N - 63°40'W.

Midwater Trawls

No.	Date	Position	Time	Depth
97-01	31 Mar '71	15°16.0'N 61°55.2'W	1622-2035	0-900 m
97-02	1 Apr '71	22°48.8'N 62°53.5'W	1835-2230	0-950 m
97-03	5 Apr '71	23°02.0'N 62°47.3'W	0810-1230	0-1300 m
97-04	5 Apr '71	24°15.1'N 62°31.8'W	1910-2305	0-900 m
97-05	6 Apr '71	26°01.3'N 62°13.3'W	0830-1230	0-1100 m
97-06	6 Apr '71	27°05.5'N 63°05.5'W	1907-2305	0-850 m
97-07	11 Apr '71	31°59.8'N 64°01.6'W	0110-0505	0-240 m
97-08	11 Apr '71	32°15.2'N 63°59.4'W	0516-1120	0-850 m

No.	Date	Position	Time	Depth
97-09	11 Apr '71	32°03.2'N 64°08.3'W	1520-1945	0-500 m
97-10	11 Apr '71	32°13.4'N 64°06.0'W	2000-2345	0-150 m
97-11	12 Apr '71	32°07.2'N 64°04.0'W	0845-1515	0-950 m
97-12	12 Apr '71	31°41.9'N 64°17.0'W	1525-1920	0-450 m
97-13	14 Apr '71	32°19.9'N 63°31.2'W	1035-1515	0-900 m
97-14	14 Apr '71	31°46.0'N 64°10.5'W	2000-2220	0-100 m
97-15	14 Apr '71	31°28.0'N 64°20.1'W	2225-0100	0-170 m

Phytoplankton Program

XBT's - 6 total

Station 1 19°28'N - 62°34'W

Net tows: 5 total

Temperature, salinity, and nutrient measurements: 5 total

Station 2 21°15'N - 62°48.8'W

Net tows: 5 total

Temperature, salinity, and nutrient measurements: 5 total

Station 3 23°4'N - 62°48'W

Net tows: 24 total

Temperature, salinity, and nutrient measurements: 20 total

Station 4 32°27'N - 64°13'W

Net tows: 5 total

Temperature, salinity, and nutrient measurements: 5 total `l Larvae Program

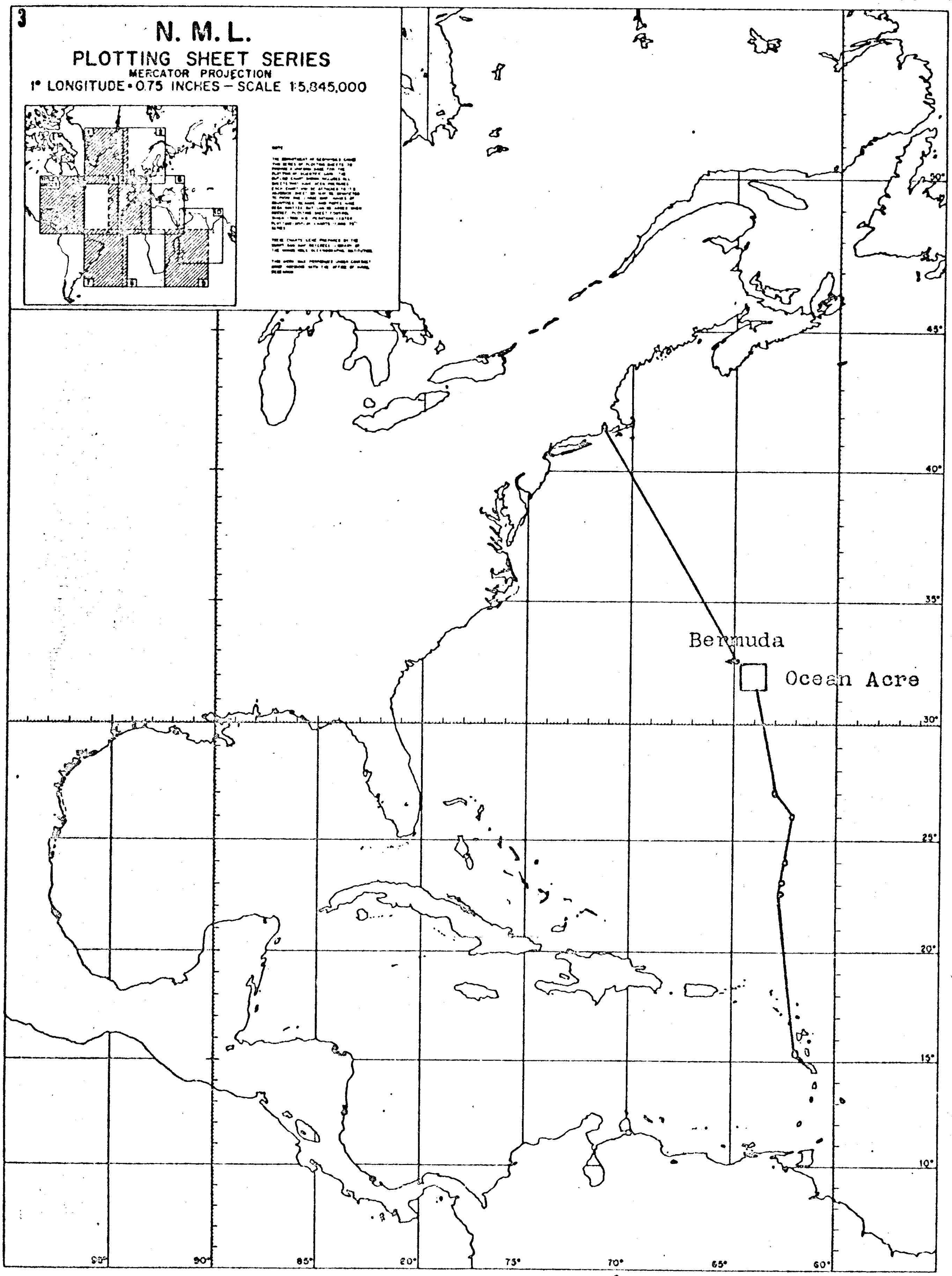
Meter Net Tows	Date	Position	Time		Depth
1	1 Apr '71	19°14.4'N 62°31.7'W	2100		0-30 m
2	1 Apr '71	19°14.4'N 62°31.7'W	2200		0-105-62 m
3	3 Apr '71	21°15.0'N 62°48.8'W	0145		0-47 m
4	3 Apr '71	21°13.5'N 62°50.1'W	0230		0-32 m
5	3 Apr '71	21°11.2'N 62°52.2'W	0540		0-150 m
6	4 Apr '71	23°05'N 62°47.6'W	0104		0-38 m
6B	4 Apr '71	23°04.4'N 62°48.4'W	0242		0-250-120-40 m
7	4 Apr '71	23°02.4'N 62°49.7'W	0615		0-228-120-48 m
8	4 Apr '71	23°04'N 62°48'W	2130		0-240-140-45 m
9	5 Apr '71	23°03'N 62°47.4'W	0215		0-130-35 m
10	4 Apr '71	23°02'N 62°47'W	0456		0-130-45 m
11	7 Apr '71	30°45'N 63°48'W	2050	Net a Net b	0-95-65 m 0-75-45 m
12	7 Apr '71	30°45.9'N 63°57.2'W	2200	Net a Net b	0-230-70 m 0-220-50 m
13	11 Apr '71	32°27.3'N 64°16.5'W	2315		0-90-45-M
14	12 Apr '71	32°27.4'N 64°13.5'W	0200		0-105 m
15	12 Apr '71	32°27.2'N 64°11.8'W	0500		0-250-110 m

Meter Net Tows	Date	Position	Time	Depth
16	12 Apr '71	32°21.5'N 63°55.0'W	2240	0-250-100 m
17	13 Apr '71	31°47.6'N 64°06.4'W	0006	0-100-60-21 m
18	14 Apr '71	32°17.0'N 63°32.2'W	1014	200-100-55 m
1 MT	16 Apr '71	34°19.5'N 67°18.0'W	0902	0-110-50 m

Observations on live larvae: 3 total

Sargassam Weed Program

Measurements: growth rate of the weed, respiration and excretion of the animals living on the weed.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N. M. L.
PLOTTING SHEET SERIES
MERCATOR PROJECTION
1° LONGITUDE = 0.75 INCHES – SCALE 1:5,845,000
Bermuda
Ocean Acre
50°
45°
40°
35°
30°
25°
20°
15°
10°
95°
90°
85°
80°
75°
70°
65°
60°

CRUISE REPORT

R/V TRIDENT - CRUISES 105 and 107

Cruise 105: Departed St. Georges Harbor, Bermuda on November 4, 1971. Arrived in San Juan, Puerto Rico on November 20, 1971.

Cruise 107: Departed San Juan on December 4, 1971. Arrived in Bermuda on December 18, 1971.

Lists of the members of the scientific parties for the two cruises are attached. Both cruises were similar in goals and procedures, and they will be described together.

The purpose of the cruises was a study of the applicability of density measurements and geostrophic current calculations to mesoscale short-term water motions in the deep ocean. Observations were almost all within a 50 km. radius of 70°W, 28°N. At the same time, as part of the MODE-0 experiment, an array of current meters was maintained in the same area by Woods Hole Oceanographic Institution and University of Rhode Island. Intercomparison of the two methods of measurement is a major goal of the experiment.

On cruise 105, observations were made with a Bissett-Berman STD. Fifty-one STD stations were made, to depths from 3,000 to 3,700 meters, using the conducting wire provided on the Trident. In addition, three hydrographic stations, with Niskin bottles and reversing thermometers, were taken when the STD system and winch were undergoing repairs.

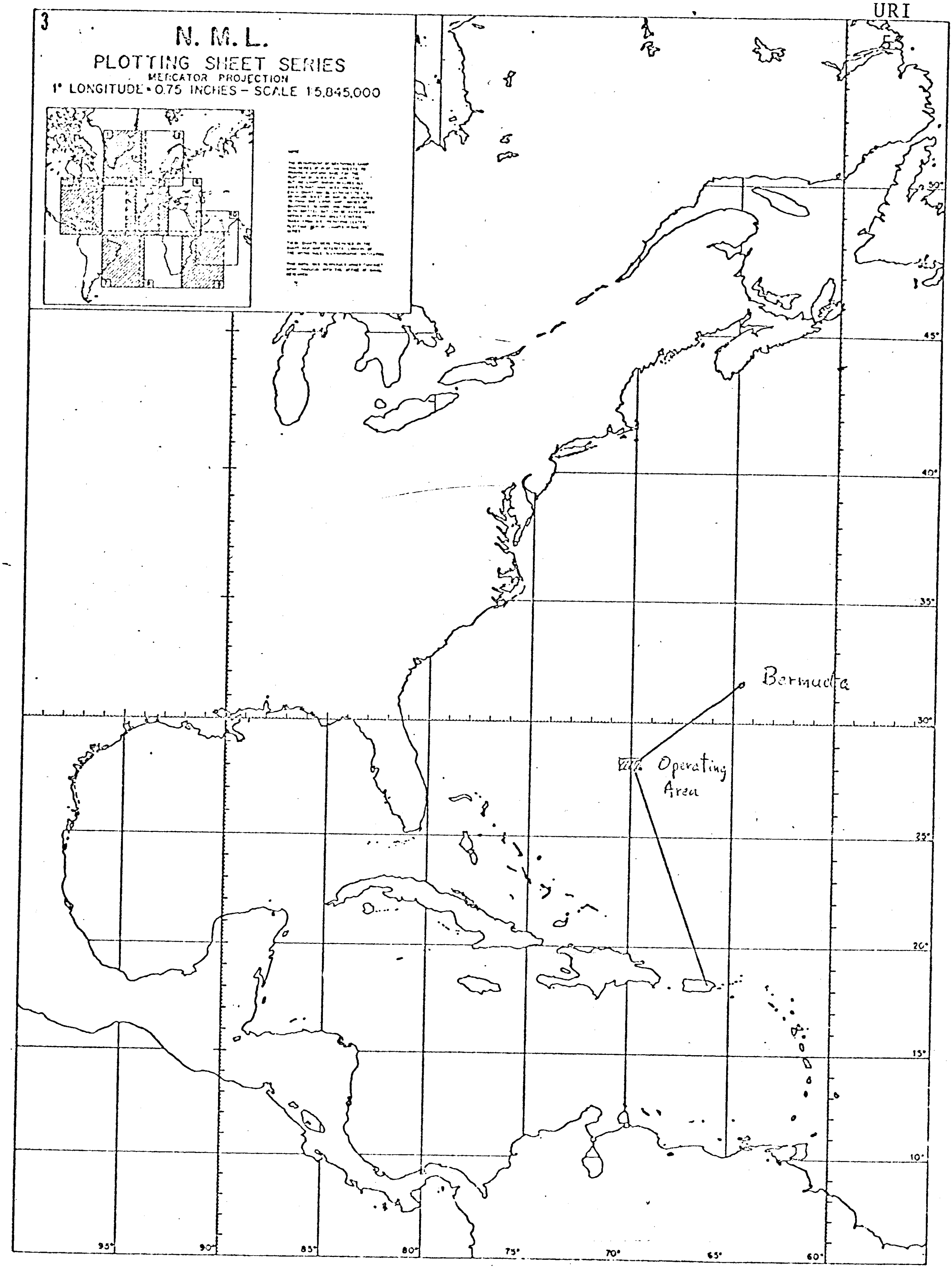
On cruise 107, a CSTD was used, and a longer conducting wire was mounted on the winch. Thirteen stations were taken to depths of greater than 5,000 meters, and forty-two to a depth of 800 meters. Some lowerings were repeated at varying speeds, to study the effect of lowering rate on STD data.

Very preliminary results indicate that density measurements with an STD system can resolve features over the scales of interest, if sufficient care is taken in operation and calibration of the system. In particular, features with spatial scales of the order of 100 km. and variability on the order of days to weeks, were found.

Richard Scarlet
3/22/72

SCIENTIFIC PARTY
CRUISES 105 and 107

Dr. Richard Scarlet	M.I.T.	chief scientist	cruises 105 & 107
Dr. Ants Leetmaa	M.I.T.	scientist	cruise 105
Dr. James McWilliams	Harvard	scientist	cruise 107
David Nergaard	M.I.T.	technician	cruises 105 & 107
Arthur Buddington	U.R.I.	technician	cruises 105 & 107
Edward Weitzner	U.R.I.	technician	cruises 105 & 107
Jack Lucas	Scripps	technician	cruises 105 & 107
James Broda	W.H.O.I.		cruise 105
Stephen Poole	M.I.T.		cruise 105
William Ackerman	M.I.T.		cruise 105
Alfred Picardi	M.I.T.		cruise 105
Barbara Altenburg	M.I.T.		cruise 105
Adela Hadiwono	M.I.T.		cruise 105
Lee Dantzler	Johns Hopkins		cruise 107
Peter Smith	Nova University		cruise 107
John Lockwood	W.H.O.I.		cruise 107
Dorothy Hansen			cruises 105 & 107



Trident - Cruises 105 + 107 1971

GRADUATE SCHOOL OF OCEANOGRAPHY, UNIVERSITY OF RHODE ISLAND, KINGSTON, R.I.

CRUISE REPORT TR-106

R/V TRIDENT

SCHEDULE

Depart San Juan, Puerto Rico 23 November, 1971, 1300

Arrive San Juan, Puerto Rico 30 November, 1971, 0300

PROGRAM

The purpose of the cruise was to study the physical microstructure in the passages north and south of St. Croix. In addition, two shallow hydrocasts were made north of St. Croix, and a Nephelometer was tested briefly. The total length of the cruise was eight days, of which four were spent on station, three were spent steaming between stations and to and from port, and one was spent in port.

SCIENTIFIC PARTY

Dr. Richard B. Lambert, U.R.I., Chief Scientist
Dr. Kim D. Saunders, M.I.T., Oceanographer
Dr. S. V. Letcher, U.R.I., Physicist
Mrs. Barbara B. Saunders, Harvard, Chemist
Mr. John Harvey, Lamont-Doherty, Technician
Mr. Julian Hillegas, Lamont-Doherty, Technician
Mr. Kimball Crocker, NUSC,* Oceanographer
Mr. David Evans, U.R.I., Research Assistant
Mr. Paul Temple, U.R.I., Research Assistant
Mr. John Timar, University of Massachusetts, Ocean Engineer
Mr. Arthur Buddington, U.R.I., Marine Technician
Mr. Edward Weitzner, U.R.I., Marine Technician
Mrs. D. Hansen, Narragansett, Assistant
Mr. R. Cheney, URI Research Assistant

*Naval Underwater Systems Center, Newport, Rhode Island

R/V TRIDENT PERSONNEL

T. Hansen	Master
C. Vanderhoop	Chief Mate
D. LaCasse	Second Mate
J. Dalgliesh	Radio Operator
H. Martin	Bos'n
F. Russell	Able Bodied Seaman
C. Galardy	Able Bodied Seaman
T. Breslin	Able Bodied Seaman
J. Stohlberg	Ordinary Seaman
E. Lackey	Ordinary Seaman
J. Symonds	Chief Engineer
T. Gelinas	First Assistant Engineer
T. Surrette	Second Assistant Engineer
H. Hovey	Oiler

J. Moscatelli	Oiler
T. Rosebach	Oiler
J. Neves	Steward
J. Ball	Second Cook

SCIENTIFIC OBJECTIVES

The main purpose of the cruise was to study temperature and salinity microstructure in the upper 1000 meters, and hopefully to find and track the sharp staircase structure in temperature and salinity found in this region on TR 095 in 1969. In addition, continuous measurements of dissolved oxygen were to be made in order to compare oxygen microstructure with temperature and salinity microstructure. Vertical resolution was to be enhanced by suspending the STD from a buoy and using the weight of the cable below the buoy to determine the fall rate. STD stations were made on four lines, two roughly parallel to, and two cutting across the ridge lying east of St. Croix and running NW-SE. Since the ridge generally comes up to less than 300 meters below the surface, the influence of bottom topography on internal waves ought to be evident.

On Station 30, a time-series experiment was attempted by raising and lowering the STD between 450 and 750 meters repeatedly over a period of approximately 15 hours. During this time the ship drifted approximately 7 miles due westward and the depth varied from 2300 meters to 1690 meters, so that both spatial and temporal variations must be considered in the analysis. Stations were also made in deep water southwest of St. Croix in order to test an in-situ nephelometer designed and built at the Lamont-Doherty Geological Observatory. Two two-bottle hydrocasts were made at stations 1 and 10 to provide support data for biological experiments being carried out by members of L.D.G.O. Three unsuccessful attempts were also made to recall two current meter arrays launched on TR 095 (positions marked with squares on detailed cruise track).

PRELIMINARY RESULTS

Stations 1-26 were made generally to 750m and occasionally to 1500m using standard lowering techniques with descent rates of 30-40 meters per minute. Excellent weather and calm seas helped to maintain the ship as a relatively stable platform (roll $\pm 4^{o}$). On Station 27 the STD was attached to a buoy, and from then on, fall rates of between 10 and 15 meters per minute were used. This technique proved simple and effective, and, is judged to be useful even under these ideal conditions, since considerable vibration transmitted down the wire is eliminated along with the roll. The resolution in the analog data, for most stations is estimated to be better than 0.01 C^{o} in temperature, .01 $^{o}/oo$ in salinity (except in regions of strong temperature gradients) and less than two meters in depth. This may be improved when the digital data on magnetic tape becomes available.

Although no sharp staircase structure was found, many sharp step-like features were evident, and many significant inversions were found. Almost every station showed at least one or two well-mixed isothermal layers, and several stair-like features in which the gradients were alternately weaker and stronger than the mean gradients. More than two-thirds of the stations contained well-resolved inversions in both temperature and salinity with temperature differences greater than 0.1C^{o}. In at least five different cases the temperature difference observed in the inversions was greater than 0.4 C°. Preliminary analysis of some of these inversions apparently shows the presence of real gravitational instabilities over short periods of time. Another persistent feature not found in 1969, was that at a depth of about 50 meters, just below the mixed layer, a layer of water, was observed to be consistently 0.5-1.0 C° warmer than the mixed layer, and from 10 to 35 meters thick. In addition, a surface layer five or ten meters thick was occasionally observed to be 0.1-0.3 C° warmer than the mixed layer. The strong salinity maximum characteristic of this region persisted at a depth of about 150 meters.

Unfortunately no useful oxygen data were recorded, due to malfunctions in the sea cable and in the oxygen sensor. Stations 5 and 26 were devoted to the nephelometer tests, but again no data were obtained due to equipment failures.

TR 106

STD Station List

Station Number	Date	Local Time (Start)	Local Time (end)	Lat (N) (start)	Long (W) (start)	Lat (N) (end)	Long (W) (end)	Sonic Depth (m)
1	24/X1/71	0540	0609	17°47.8'	64°49.6'	17°47.6'	64°49.8'	1250-1750*
2	24/X1/71	1906	2052	16°55.5'	65°20.1'	16°54.7'	65°22.7'	4610
3	25/X1/71	0130	0450	16°54.0'	65°11.0'	16°53.8'	65°11.0'	4530
4	25/X1/71	0800	1005	17°01.9'	64°45.0'	17°02.0'	64°47.1'	4070
5	25/X1/71	1230	1355	17°19.3'	64°30.4'	17°19.1'	64°31.0	3500**
6	25/X1/71	1740	1959	17°45.6'	64°04.5'	17°45.6'	64°05.0'	850
7	25/X1/71	2100	2255	17°51.4'	64°14.5'	17°51.4'	64°14.6'	1375
8	26/X1/71	0020	0225	17°57.3'	64°23.7'	17°57.3'	64°23.6'	1320-1380
9	26/X1/71	0325	0525	18°02'	64°33'			1860-1960 x
10	26/X1/71	0915	2013	17°57.2'	64°48.4'	17°56.8'	64°49.1'	4100-4150 xx
11	26/X1/71	2055	2255	17°59.4'	64°41.7'			3410
12	27/X1/71	0000	0234	18°02.3	64°33.9'	18°02.0'	64°34.7'	2000-2240 x
13	27/X1/71	0320	0516	18°06'	64°27.5			1650-1720
14	27/X1/71	0600	0740	18°08.1'	64°22.2'	18°07.9'	64°23.0'	1250
15	27/X1/71	0821	1039	18°10.7'	64°19.3'			1400-1600
16	27/X1/71	1145	1355	18°06.3'	64°09.6'	18°07.2'	64°10.6'	2780-2820
17	27/X1/71	1508	1635	18°02'	64°01'			2300-2400 x
18	27/X1/71	1740	1905	17°57.3'	63°51.7'	17°57.1'	63°51.6'	1725
19	27/X1/71	1939	2137	17°53.7'	63°56.4'			775-750
20	27/X1/71	2217	2355	17°49.8'	64°02.4'			775-790 ***

* 2-bottle Hydrostation   Test 3000m STD

** Test Nephelometer with 7000m STD

x DR Position only

xx Jettisoned inner wrap (160m) of conductor cable
2-bottle hydrocast

*** Used Pinger

TR 106

STD Station List
(continued)

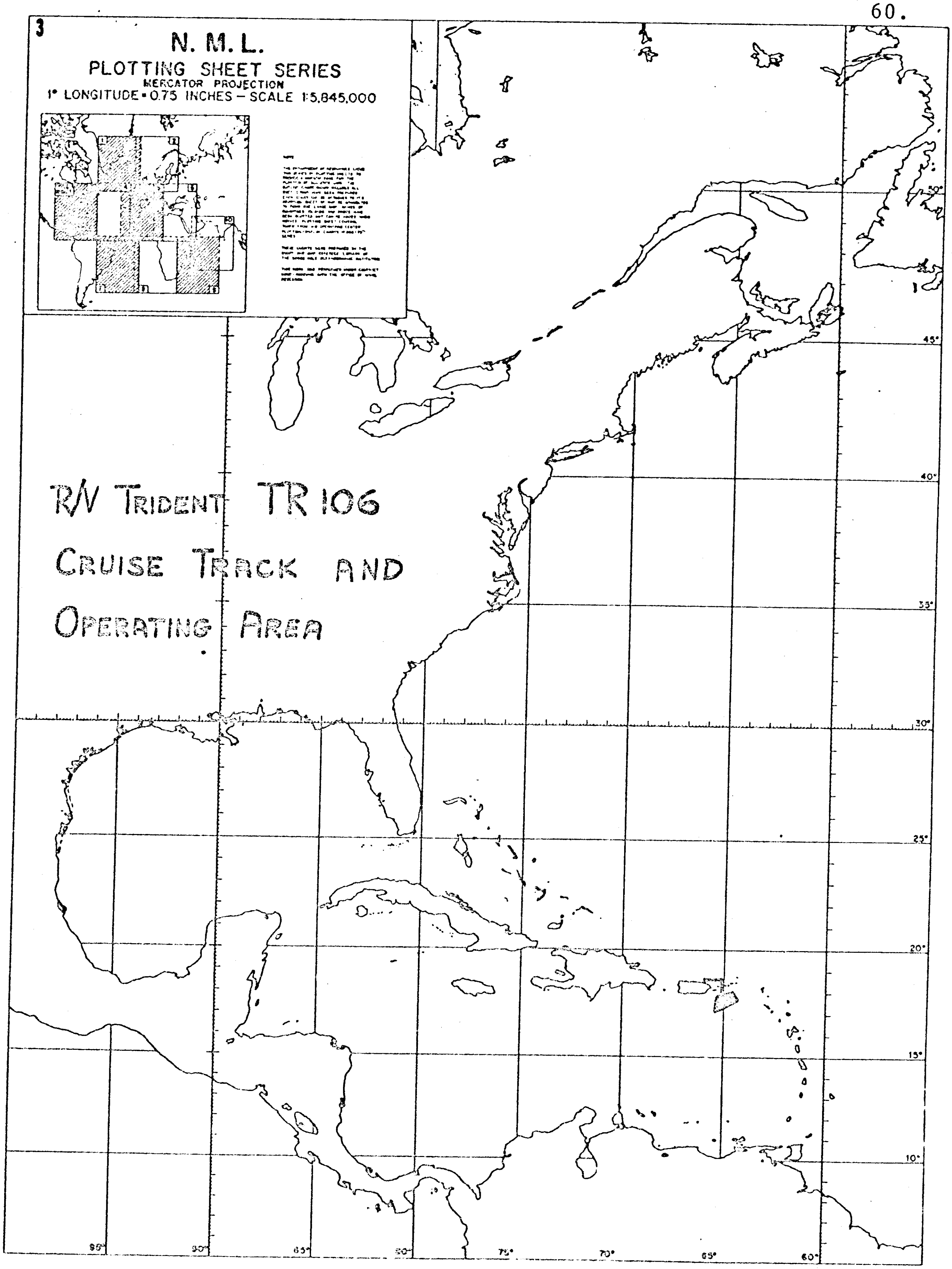
Station Number	Date	Local Time (Start)	Local Time (end)	Lat (N) (start)	Long (W) (start)	Lat (N) (end)	Long (W) (end)	Sonic Depth (m)
21	28/X1/71	0027	0240	$17^{o}46.0'$	$64^{o}07.2'$	$17^{o}45.7'$	$64^{o}07.8'$	880
22	28/X1/71	0311	0506	$17^{o}41.3'$	$64^{o}11.4'$			1700
23	28/X1/71	0605	0732	$17^{o}33.1'$	$64^{o}19.3'$			2975-3000
24	28/X1/71	0832	0945	$17^{o}25.0'$	$64^{o}26.1'$			3320-3290
25	28/X1/71	1053	1237	$17^{o}18.2'$	$64^{o}37.5'$			3610
26	28/X1/71	1340	1452	$17^{o}12.0'$	$64^{o}46.7'$			4130**
27	28/X1/71	1607	1900	$17^{o}12.3$	$65^{o}03.3$			4370****
28	28/X1/71	2005	2302	$17^{o}12.8'$	$65^{o}16.7'$	$17^{o}12.9'$	$65^{o}18.4$	4600
29	29/X1/71	0010	0216			$17^{o}23.6$	$65^{o}16.6'$	3860-3760
30	29/X1/71	0304	1550	$17^{o}31.9'$	$65^{o}15.6'$	$17^{o}32.8'$	$65^{o}23.5'$	2300-1690
31	29/X1/71	1709	1915	$17^{o}42.3'$	$65^{o}15.7'$	$17^{o}42.2'$	$65^{o}15.3'$	1800-1750
32	29/X1/71	2028	2230			$17^{o}53.4'$	$65^{o}17.2'$	2480-2530

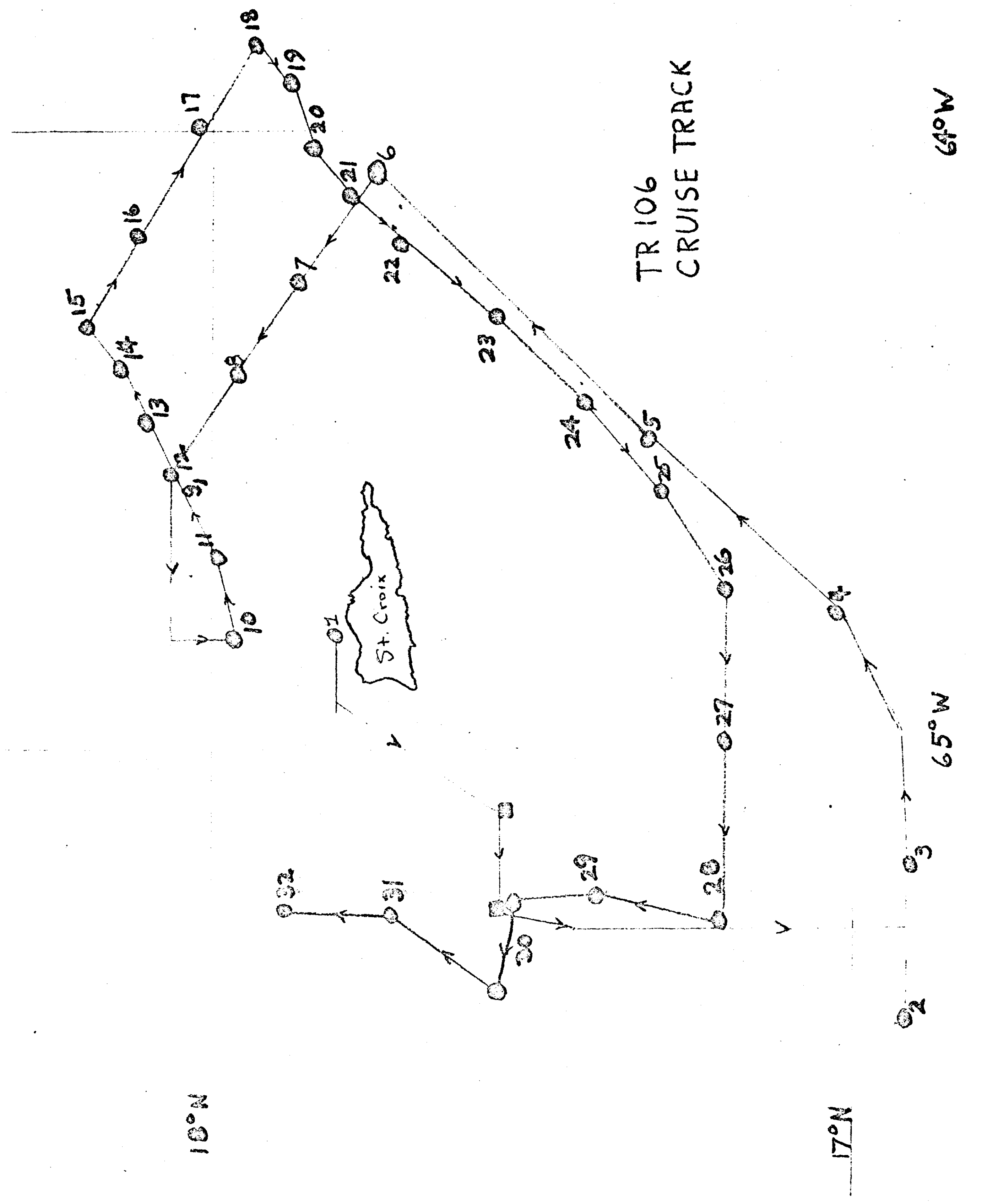
**** First Test with Buoy

TR 106

XBT Station List

XBT Number	Date	Time (local)	Lat(N)	Long(W)	Surface Temp (^{o}C)	Sonic Depth (meters)
1	24/X1/71	0304	18°05'	65°00'	27.8	2500
2	24/X1/71	0415	17°55'	64°53'	——	4040
3	24/X1/71	0906	17°42'	64°59'	27.8	1410
4	24/X1/71	0940	17°33'	65°07'	28.0	1833
5	24/X1/71	1518	17°28'	65°18'	28.2	
6	24/X1/71	1610	17°18'	65°18'	28.2	
7	24/X1/71	1700	17°10'	65°18'	28.3	4590
8	24/X1/71	1808	16°58'	65°18'	28.0	4641
9	24/X1/71	1838	16°55'	65°18'	27.9	4610
10	25/X1/71	1056	17°09'	64°40'	28.2	4080
11	25/X1/71	1147	17°15'	65°34'	28.2	3860
12	25/X1/71	1435	17°25'	64°25'	28.2	3390
13	25/X1/71	1530	17°32'	64°19'	28.2	3220
14	25/X1/71	1630	17°38'	64°12'	26.4	2300
15	25/X1/71	1735	17°46'	64°04'	27.9	820
16	27/X1/71	1110	18°08'	64°13'	28.2	2250
17	27/X1/71	1340	18°07'	64°10'	28.4	2820
18	28/X1/71	1313	17°15'	64°43'	28.3	3375
19	28/X1/71	1553	17°12'	65°00'	28.3	4310
20	29/X1/71	0240	17°23'	65°16'	27.9	3250
21	29/X1/71	1700	17°39'	65°18'	28.0	1800
22	29/X1/71	1955	17°47'	65°18'	27.9	1860
23	29/X1/71	2034	17°42'	65°15'	28.6	2525


3
N. M. L.
PLOTTING SHEET SERIES
MERCATOR PROJECTION
1° LONGITUDE = 0.75 INCHES – SCALE 1:5,845,000
R/V TRIDENT TR 106
CRUISE TRACK AND
OPERATING AREA
50°
45°
40°
35°
30°
25°
20°
15°
10°
95°
90°
85°
80°
75°
70°
65°
60°


TR 106
CRUISE TRACK
64°W
65°W
18°N
17°N
St. Croix

GRADUATE SCHOOL OF OCEANOGRAPHY, UNIVERSITY OF RHODE ISLAND, KINGSTON, RHODE ISLAND

PROSPECTUS FOR CRUISE 109 OF R/V TRIDENT

SCHEDULE

Depart Narragansett, Rhode Island, 3 Jan. 1972

Arrive San Juan, Puerto Rico, 19 Jan. 1972

SCIENTIFIC PERSONNEL (to date)

P. Bedard	Electronic Engineer, G.S.O.
W.H. Biggley	Co-investigator, Biology Department, The Johns Hopkins University
H. Bosch	Co-investigator, Marine Biological Laboratories, Woods Hole, Mass.
J.I. Sammons	Electronics Technician, G.S.O.
H.H. Seliger	Co-investigator, Biology Department, The Johns Hopkins University
F. Steinhilper	Marine Technician, G.S.O.
M. Stuart	Research Assistant, G.S.O.
W. Sturges	Co-investigator, G.S.O.
E. Swift	Chief Scientist, G.S.O.

LOADING

Items for the cruise will be loaded in Narragansett, Rhode Island.

TRAVEL

The scientific party will return by air from San Juan.

SYNOPSIS FOR WORK PLANNED

Dr. Sturges and party will retrieve current meters set on the ocean bottom at approximately 28°N 69°W. These current meters are part of a study of abyssal circulation.

Dr. Bosch and party will study the concentration and vertical migration of zooplankton species.

Dr. Seliger and Mr. Biggley will study the bioluminescence of oceanic dinoflagellates *in situ* and *in vitro*.

Dr. Swift and party will study the growth rates of dinoflagellates as they are affected by hydrographic conditions.

REQUIREMENTS FOR FIELD EQUIPMENT FROM THE SCIENTIFIC POOL

a. Satellite Navigator
b. Inductive salinometer
c. Beckman DU
d. O_2 rig
e. Protected and unprotected reversing thermometers
f. Five liter Niskin bottles
g. 30-liter Niskin bottles
h. Mechanical BT and 20 Slides
i. Deionized water system - 16 days

REQUIREMENTS OF TRIDENT EQUIPMENT AND SERVICES

a. Winch for BT operable
b. PESR - 5 days operation for DSL and 2 days for ONR hydrography.
c. Scientific locker-type freezer empty
d. Laboratory refrigerator and range will be used
e. Dark room clear, drawers and sink empty, work surfaces clear
f. Laboratory plumbing in good order
g. may need pressure air on deck to run a pump
h. On-deck pumping system for sea water cooling of experiments.

TR-110 CRUISE REPORT

Caribarc III

January 22 - February 9, 1972

R/V TRIDENT

SCHEDULE

TRIDENT departed San Juan, Puerto Rico at 1630 h on 22 January and terminated at Bridgetown, Barbados at 0700 on 9 February 1972. 18 days at sea.

SCIENTIFIC PARTY

Dr. L. K. Fink, Jr.	Univ. of Maine	Chief Scientist
J. Chalfant	Univ. of Maine	Research Assistant
K. J. Le Blanc	Univ. of Maine	Undergraduate Student (Geology)
P. Clark	Univ. of Maine	Undergraduate Student (Geology)
K. Trueman	Univ. of Maine	Graduate Student (Biol. & Ocean.)
G. Bilyard	Univ. of Maine	Graduate Student (Zoology)
A. Buddington	Univ. of R.I.	Marine Technician
M. Weishan	Univ. of R.I.	Marine Technician
W. Sanford	Univ. of R.I.	Marine Technician

UNDERWAY OPERATIONS

Purpose

This cruise was a continuation of studies commenced in 1971 to investigate the upper crustal structure of the Northern Lesser Antilles Island Arc and to resolve the relationship between the Aves Ridge and the Lesser Antilles Frontal Arc Ridge. Previous seismic reflection profiles indicated several likely dredging stations where samples of the Aves Ridge might be collected.

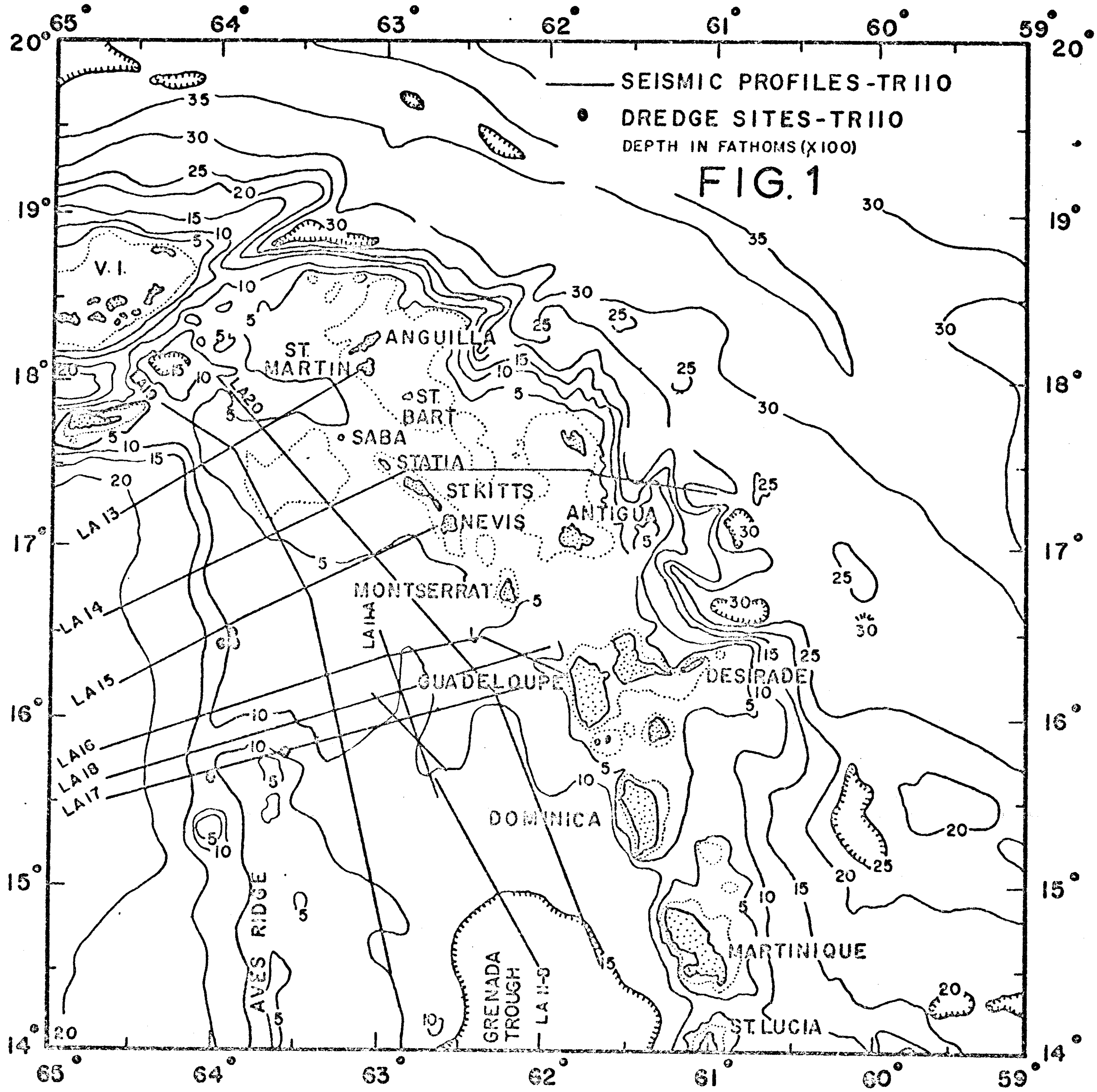
Method

To accomplish these objectives, continuous reflection, bathymetric, and magnetic profiles were obtained along the lines indicated on Fig. 1. Dredging was carried out on five stations along the Aves Ridge where profiles indicated good opportunity to sample rocks comprising the Aves Ridge. One camera station was occupied to cover the east flank of the Aves Ridge where dredging recovered carbonate reef debris.

PRELIMINARY RESULTS

In spite of almost continuous instrument and equipment breakdown, the reflection records were of exceptional quality with average penetration between 2 to 2.5 seconds and one instance where a deeplying ridge at greater than 4 seconds was clearly revealed. The records indicate a complex structure for the acoustic basement underlying the sediments between the Aves Ridge and Lesser Antilles Arc Ridge and confirm the preliminary interpretation that the Aves Ridge is a young feature. A malfunction of the magnetometer during TR-096 resulted in invalid magnetic data and the instrument problem was not corrected until this cruise.

The dredge samples recovered from the Aves Ridge were almost exclusively carbonate debris characteristic of a reef environment. The dredge stations are indicated on Fig. 1.


SEISMIC PROFILES-TR 110
DREDGE SITES-TR 110
DEPTH IN FATHOMS (X 100)
FIG. 1
V. I.
ANGUILLA
ST. MARTIN
ST. BART
SABA
STATIA
ST KITTS
NEVIS
ANTIGUA
MONTSERRAT
GUADELOUPE
DESIRADE
DOMINICA
MARTINIQUE
ST. LUCIA
AVES RIDGE
GRENADA TROUGH
LA 13
LA 14
LA 15
LA 16
LA 18
LA 17
LA 20
LA 14A
LA 11-S
65°
64°
63°
62°
61°
60°
59°
20°
19°
18°
17°
16°
15°
14°

UNIVERSITY OF RHODE ISLAND
KINGSTON • R. I. 02881

Graduate School of Oceanography • Narragansett Bay Campus

November 11, 1971

CRUISE PROSPECTUS

R/V TRIDENT CRUISE 111

Project: Chemical and Geological Studies Between Barbados and Dakar, Senegal.

Region of Investigation: See attached cruise track.

Tentative Schedule: Depart Barbados, 0800, 12 February 1972
Arrive Dakar, Senegal, 1200, 5 March, 1972.

Scientific Party:

Robert A. Duce, Chief Scientist, U.R.I., (USA)
Detmar Schnitker, Co-Investigator, U. of Maine, (Germany)
Peter Betzer, Co-Investigator, U. of South Florida, (USA)
Ken Carder, Co-Investigator, U. of South Florida, (USA)
David Wallace, Technician, U. of South Florida, (USA)
Robert Crippen, Graduate Student, U. of Maine (USA)
Paul Deslauriers, Technician, U.R.I., (USA)
Mark Weisham, Oceanographic Technician, U.R.I., (USA)
Arthur B. Buddington, Oceanographic Technician, U.R.I. (USA)

Loading: Equipment must be loaded at Narragansett by 30 December 1971 or carried to Barbados.

Travel to and from Ship: Duce and Deslauriers will fly from Rhode Island to Barbados; Betzer, Carder, and Wallace will fly from Florida to Barbados; Schnitker and Crippen will fly from Maine to Barbados. Duce, Deslauriers, Schnitker, and Crippen will fly from Dakar back to the U.S.

Synopsis of Studies: R.A. Duce will be collecting sea surface micro-layer samples for trace metal and organic analyses as part of a study of chemical enrichment at the sea surface. Of particular interest will be the concentration of possible pollutants such as the heavy metals (lead, copper, vanadium, iron, etc.), fatty acids, hydrocarbons, DDT, and PCB's in the surface layer compared to water 20 cm below the surface.

Duce will also be collecting atmospheric particulate samples from the bow tower as part of a study of the atmospheric transport of African dust across this region of the North Atlantic on the prevailing tradewinds. D. Schnitker will be taking 8" diameter gravity cores as part of a continuing study of living abyssal foraminifera from the western North Atlantic. This investigation will test the possible existence of discrete foraminiferal distribution patterns and attempt to correlate these with patterns of deep water circulation. P. Betzer and K. Carder will investigate optically and chemically the distribution of suspended matter in waters of the eastern and western basins of the North Atlantic Ocean between Barbados and Dakar. Measurements of light scattering, particle size, particle number, and total suspended load will be made. In addition, particulate matter filtered from the water will be analyzed for aluminum, silicon, calcium, manganese and iron. Of special interest will be the nepheloid character of bottom waters from the eastern and western basins and that of shallow waters near topographical highs on the Mid-Atlantic Ridge. At selected stations samples will be collected for D. Kester's ONR sponsored studies of flouride and soluble iron in seawater.

Requirements of Marine Technicians: Maintain the operation of PESR, satellite navigator, XBT, and pinger, draw and run salinity samples, take thermometer readings, and in general assist with the hydro casts and gravity coring when possible.

Requirements for Field Equipment from Scientific Pool:

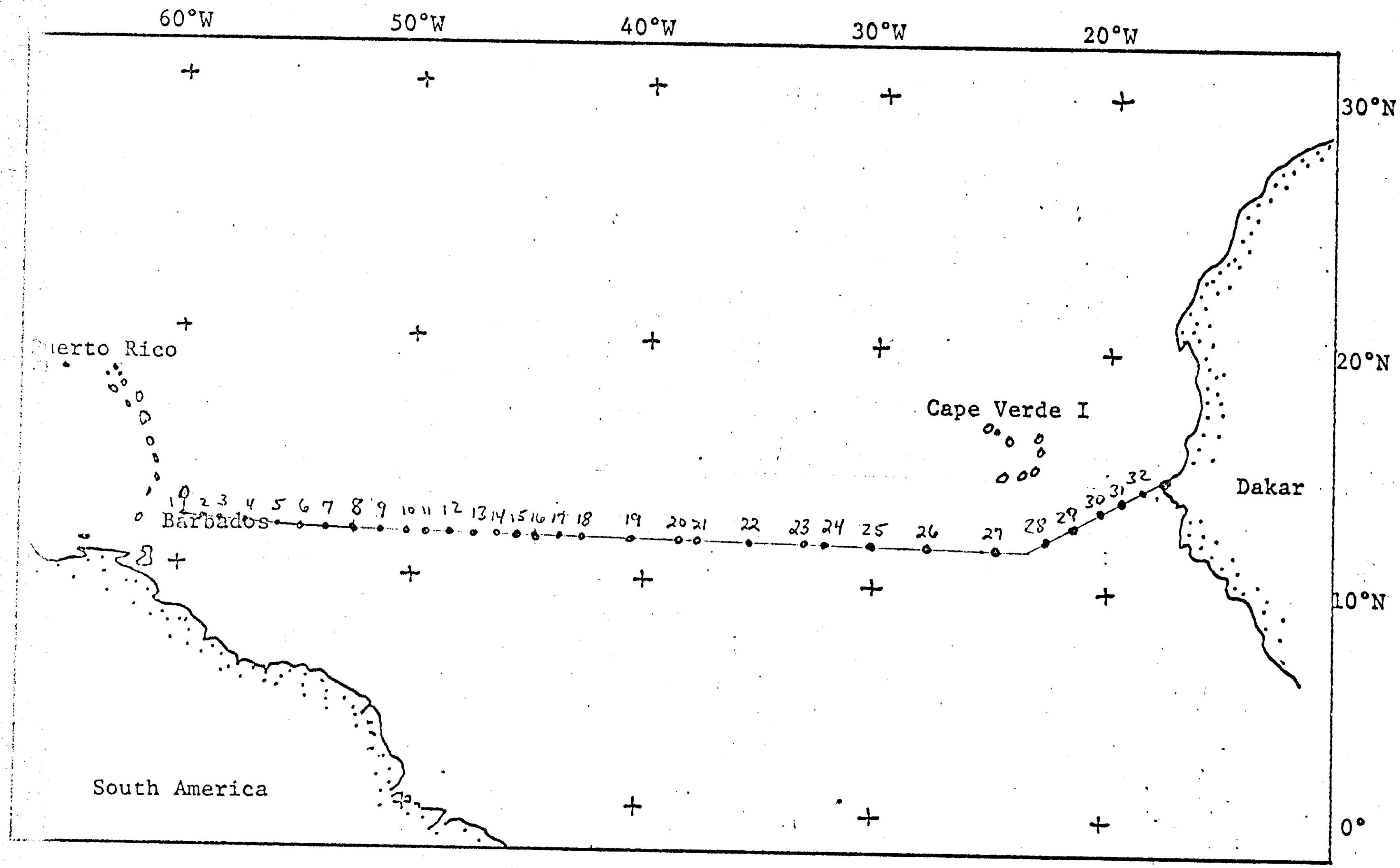
1) PESR (22 days operation for one recorder)
2) Satellite navigator
3) Pinger
4) Inductive salinometer
5) Beckman DU
6) Protected and unprotected reversing thermometers
7) Five liter Niskin bottles
8) Thirty liter Niskin bottles
9) XBT's (to be acquired externally)
10) Salinity bottles
11) Nephelometer
12) Bow tower for air sampling
13) Deionized water system operable for 22 days

Requirements for TRIDENT Equipment and Services:

1) Hydro winch and wire rigged for Niskin bottle and coring operations.
2) Communication phones between PESR pit and winch operation in good condition.

3) Rubber raft, outboard motor, oars, and gasoline for surface slick collection.
4) Scientific reefer
5) At least half of one scientific freezer for sample storage from Barbados to Dakar.
6) Low table on port side of main lab must be clear for portable clean bench
7) Drawers under benches and space under sinks in main lab and darkroom must be available for storage of chemical gear during TR-111
8) Laboratory plumbing in working order
9) Air conditioner in the PESR pit
10) EM log
11) Radar
12) XBT launcher and recorder operative

Tentative Cruise Track and Station Location for TR 111



17 May 1972

GRADUATE SCHOOL OF OCEANOGRAPHY

University of Rhode Island

R/V TRIDENT Tentative Ship Schedule

Cruise #	Chief Scientist/ Co-Investigator	Area	Departure	Arrival	No. of Days
116	Kennett	R.I. Sound	17 June 72 Narr., R.I.	18 June 72 Narr., R.I.	2
- - - - - - - - - -	-UPKEEP-	- - - - - - - - - - - -	19 June 72	19 June 72	1
117	Schnitker/Webb	N. Atlantic	20 June 72 Narr., R.I.	7 July 72 Faial	18
118	Schilling	Azores	10 July 72 Faial	24 July 72 Faial	15
119	Watkins/Kennett	Azores	27 July 72 Faial	9 Aug 72 San Miguel	14
120	Krause	Azores	12 Aug 72 San Miguel	30 Aug 72 Faial	19
121	Kester/Pilson Quinn	N. Atlantic	2 Sept 72 Faial	16 Sept 72 Bermuda	15
122	Sturges	N.W. Atlantic	18 Sept 72 Bermuda	27 Sept 72 Narr., R.I.	10
- - - - - - - - - -	-UPKEEP-	- - - - - - - - - - - -	28 Sept 72	24 Oct 72	27
123	Richardson/Lambert	Atlantic Coast	25 Oct 72 Narr., R.I.	7 Nov 72 Miami	14
124	Kennett	Gulf of Mexico	10 Nov 72 Miami	28 Nov 72 Veracruz	19
125	Betzer	Gulf of Mexico	1 Dec 72 Veracruz	10 Dec 72 Miami	10
126	Richardson	N.W. Atlantic	12 Dec 72 Miami	21 Dec 72 Narr., R.I.	10
- - - - - - - - - -	-UPKEEP-	- - - - - - - - - - - -	22 Dec 72	4 Jan 73	14
127	Swift	N.W. Atlantic	5 Jan 73 Narr., R.I.	19 Jan 73 San Juan	15
128	Kester/Betzer Carder, Lambert	Caribbean	22 Jan 73 San Juan	14 Feb 73 San Juan	24

Cruise #	Chief Scientist/ Co-Investigator	Area	Departure	Arrival	No. of Days
129	Lambert/Richardson	Gulf Stream	17 Feb 73 San Juan	6 Mar 73 Narr.,R.I.	18
- - - - - - - - - - - -UPKEEP-		- - - - - - - - - - - -	7 Mar 73	11 Mar 73	5
130	Sturges/Scarlet	28°N 68°W	12 Mar 73 Narr.,R.I.	9 Apr 73 Bermuda	29*
131	Duce	Sargasso	12 Apr 73 Bermuda	23 Apr 73 Bermuda	12
132	Sturges	28°N 68°W	26 Apr 73 Bermuda	20 May 73 Bermuda	25
133	Duce	N.W. Atlantic	23 May 73 Bermuda	30 May 73 Narr.,R.I.	8
- - - - - - - - - - - -UPKEEP-		- - - - - - - - - - - -	31 May 73	12 June 73	13
134	Kennett/ Schilling	N. Atlantic	13 June 73 Narr.,R.I.	2 July 73 Reykjavik	20
135	Schilling	Iceland	5 July 73 Reykjavik	24 July 73 Akureyri	20
136	Schilling	Iceland	27 July 73 Akureyri	15 Aug 73 Reykjavik	20
137	Schnitker	N. Atlantic	18 Aug 73 Reykjavik	2 Sept 73 St. John's	16
138	Webb	Grand Banks	5 Sept 73 St. John's	19 Sept 73 Narr.,R.I.	15
- - - - - - - - - - - -UPKEEP-		- - - - - - - - - - - -	20 Sept 73	28 Sept 73	9
139	Lambert/ Richardson	N.W. Atlantic	29 Sept 73 Narr.,R.I.	16 Oct 73 Bermuda	18
140	Smayda	Sargasso	19 Oct 73 Bermuda	4 Nov 73 Bermuda	17
141	Duce	Sargasso	7 Nov 73 Bermuda	24 Nov 73 Narr.,R.I.	18
- - - - -UPKEEP-----INSPECTION-		- - - - - - - - - -	25 Nov 73	4 Jan 74	40

* Includes a port stop for fuel and water.

Lamont Geological Observatory

Colombia University

Palisades, New York

1971-2

The summary of Lamont's work in the CICAR area and during 1971 and 1972 was not received in time for inclusion in this report.

1972-3

The tentative 1973 schedule for the R/V CONRAD is included in the UNOLS 1973 ship schedules at the end of this report.

Duke University Marine Lab

Beaufort, North Carolina

1971-2

In January of 1972 the R/V EASTWARD, with Dr. Orin Pilkey as Chief Scientist, carried out marine geological investigations off Puerto Rico and sampled for pollution studies on the Puerto Rican shelf. During February of 1972, working out of Kingston, Jamaica, the R/V EASTWARD with Dr. L. S. Land of the University of Texas as Chief Scientist, carried out studies of the deep transport and the diagenesis of reef sediments north of Jamaica. Later that month, Dr. Ivan Goodbody of the University of the West Indies (Jamaica) was Chief Scientist on the R/V EASTWARD for a training cruise in Advanced Zoology and Marine Biology, followed in February and March by a similar cruise for students in Advanced Submarine Geology with Dr. Bruce Heezen of the Lamont Geological Observatory as Chief Scientist.

1973

The R/V EASTWARD during 1973 has ten cruises tentatively scheduled for the CICAR area, and again Dr. Goodbody of Jamaica will be taking part. The tentative schedule for these 1973 cruises is given in the UNOLS section at the end of this report.

Nova University

Physical Oceanographic Laboratory

Dania, Florida

1972

The R/V GULF STREAM and two Nova oceanographic aircraft participated in the multi-nation CSM II of CICAR during April and May of 1972. The GULF STREAM departed April 25th for Key West and set up Hi-Fix stations at Key West and Marathon on the 26th and 27th. On June 8th she completed her 15th transect from Key West to the north coast of Cuba. On these transects she occupied typically 20 stations where STD drops to 700 meters and transport measurements to 200, 400, 600 and 800 meters were made. Thus, there will be available about 300 STD lowerings and 1200 transport measurements in sections taken approximately every other day.

The two aircraft (one dropping probes and the other photographing them) made 11 sections from Key West to the north coast of Cuba and 13 sections from Isle de Mujeres to Cabo San Antonio. These began on April 26th and continued through June 5th. These were done in groups of typically 5 on one section and 5 on the other, generally one transect per day. Some initial problems were encountered with the air probes, so the first few transects had only a few good stations; but after early June most of the transects had 12-18 good stations.

Data reduction of both the ship and air observations has begun and will take a month or two.

Dr. William Richardson, Chief Scientist on this Nova Program, reports excellent cooperation from all parties to the experiment, and that the Cuban Air Traffic Centers (Havana Radio and Boyeres Radio) were most helpful in filing flight plans and granting clearances in Cuban air space.

1973

Nova during the winter of 1973 plans a one-to-two month study of the transport into the Caribbean through the passages between the various islands of the Lesser Antilles from Venezuela to the Virgin Islands. This will be strictly an aircraft operation using the air-droppable current probes used so successfully during CSM II in 1972. This work will complement the shipboard work of Metcalf (WHOI) and Sturgis (URI) in the Antillean Passages. It is hoped that Cuba and other CICAR countries will be able to participate in this growing study of the mass transport through the passages between the Atlantic and the Caribbean.

Also, during the winter of 1973 and continuing through the next year or two, the Physical Oceanographic Laboratory of Nova University under Dr. Richardson,will be carrying out moored current meter observations off the Florida and Texas shelves in the Gulf of Mexico. These studies are primarily to look at the transient flows, which develop after the passage of strong meteorological pertubations.

University of Miami

Rosenstiel School of Marine and Atmospheric Science

Virginia Key, Miami, Florida

1971-2

Under Dr. Walter Duing as Chief Scientist, the Physical Oceanography group of the University of Miami during 1971 made cruises aboard the R/V PILLSBURY, R/V GERDA, R/V CALANUS, and R/V HUMBLE studying currents, light scattering, near-bottom plankton, and mass transport (from aircraft) in the Florida Straits off Miami and between Key West and Havana. The operations for 1971-2 are summarized on the following page.

1972-3

The R/V GILLISS of the University of Miami in early September of 1972 will be working off NE Providence Channel in the Bahamas, in the Sargasso Sea, and en route to Puerto Rico where she will make a port stop about 12 September. Dr. Claes Rooth is to be Chief Scientist, and the purpose of the cruise is to determine the tritium and radioactive cesium distribution in the main thermocline. Some of the scientific party are French nationals working with NOAA on a satellite buoy study.

Additional CICAR-area cruises by University of Miami ships tentatively scheduled for 1973 are included in the UNOLS "Tentative Research Vessel Operating Schedule-1973" at the end of this report.

Time	Equipment and Platforms	Location	Cooperating
Pre-SYNOPS May/June 1971	R/V PILLSBURY anchored; current profiling, STD, light scattering.	15 miles east of Miami	University of Miami
June 3-19, 1971 SYNOPS I	R/V PILLSBURY, GERDA, CALANUS, HUMBLE } anchored ORCA II - shuttle Current profiling, STD, O_2, light scattering, XBT's, moored current meter.	Along base line between Miami and Bimini	University of Miami
September 14-25, 1971	R/V GERDA anchored; current profiling.	Northern exit of Florida Straits ~ 50 miles east of Ft. Pierce	University of Miami
March 13-29, 1972 SYNOPS II	R/V GERDA, CALANUS 〉 anchored Current profiling, O_2, plankton near bottom (by H. Owre).	Both ships anchored ~ 15 miles offshore, but at 30 mile distance downstream.	University of Miami
	ORCA III, XBT's, shuttle	2 sections along both anchored ships.	
	Airplanes for mass transport sections.	2 sections along both anchored ships.	Sea-Flight Corporation, Ft. Lauderdale
	Bottom-mounted current meter mooring.	Miami Terrace to continue for 50 days.	
May 8-28, 1972	R/V ISELIN, GERDA 〉 anchored Current profiling.	Between Key West and Havara.	University of Miami, Nova University, NOAA, Texas A & M University

University of Miami
School of Marine & Atmospheric Science
Rickenbacker Causeway, Virginia Key
Miami, Florida

Professor Walter Düing
Chief Scientist

Physical Oceanography Cruises in the CICAR Area 1971-72

1971-12
For release; Immediate
Mrs. Jean Yehle
Public Information Officer
(305) 350-7269

U of Miami
78.

SCIENTISTS EXPLORE DEEP REEF

Taking turns as observers aboard the small deep-diving submersible NEKTON, six scientists are exploring an underwater frontier, the coral reef 300 feet below the surface.

Five men and one woman working as a team are bringing to the study of the deep reef their combined knowledge of biology, chemistry, and geology.

Dives sponsored by the National Science Foundation are being made in the western Caribbean along the coast of British Honduras on a barrier reef second only to the Great Barrier Reef of Australia in area.

Headed by Dr. Robert N. Ginsburg of the University of Miami's School of Marine and Atmospheric Science, the team members are Dr. Noel P. James, geologist, and Dr. Donald Marszalek, microbiologist, two co-workers of Ginsburg at the Miami School; Dr. John Wray, a specialist in fossil reefs from Colorado School of Mines; Dr. Lynton S. Land, geochemist from the University of Texas; and Dr. Judith Lang, coral biologist from Discovery Bay Marine Laboratory, University of the West Indies. They expect to complete this first systematic look at an essentially unknown region of the sea early in December, when they will return to Miami, Florida to analyze their observations.

Talking about the objectives of this unique research cruise, Dr. Ginsburg said that although the living reef top in the sunlit level of the sea has been studied for 150 years, the formation below the 300 foot depth remains a mystery. Recent work in Jamaica and Bermuda on the evolution of a reef indicates continuing processes at work inside the massive skeletal structure rising thousands of feet from the sea floor. Openings form and are filled again with crystals of calcium carbonate. Little understood biological and chemical changes occur that cement the reef, even to such an extent that the reef interior may become compact solid rock.

Dr. Wray added that fossil reefs are very similar to reefs forming today. Corals have lived for millions of years, and outcroppings of fossil reefs are found on all the continents. In some locations, fossil reefs have yielded oil. An understanding of reef formation may be helpful in future mineral explorations.

A tool with the capability of the versatile submersible, NEKTON, designed and built by Douglas Privitt of General Oceanographics, California, makes it possible to go down and investigate the clues to reef formation found in rock samples taken from surface vessels and in fossil reefs on land.

Working from a support vessel, SEAMARK, the little research sub can carry a passenger and a pilot 1000 feet into the depths, keeping them dry and comfortable at atmospheric pressure. Samples can be taken with a mechanical arm and placed in a sample container on the exterior of the hull, while an exterior strobe and cameras record the characteristics and the deep-dwelling inhabitants of the reef slope.

Dr. Richard A. Slater, a geologist himself, is the pilot of NEKTON.

December 1971
Public Information Office
Rosenstiel School of Marine and Atmospheric Science
(305) 350-7269

Florida State University

Department of Oceanography

Tallahassee, Florida

1968-70

Because these cruises in the CICAR area have not been reported previously, they are included here so the record will be complete. The Department of Oceanography of Florida State University in 1968, 1969, and 1970 carried out a set of four cruises to the Yucatan Strait aboard the R/V TURSIOPS. In general these were multi-disciplinary cruises covering geological, physical, biological, and chemical oceanography, and the relevant cruise reports are made part of this report.

1971-2

Florida State University's work in the CICAR area during 1971 and 1972 was carried out primarily as part of the State University System Institute of Oceanography (SUSIO) programs which are described separately in the section which follows.

1973

In 1973 the Department of Oceanography of Florida State University in conjunction with the Wrightsville Marine Bio-medical Laboratory of the University of North Carolina plans a cooperative international biological-ecological investigation of the deep fauna of the Cayman Trench and associated hyper-baric phenomena. Presently time is scheduled aboard the R/V ALAMINOS, and the Woods Hole submersible ALVIN is also scheduled to participate. It is hoped that marine biologists from other CICAR countries will be able to participate. The tentative plans for Cayman Trench Expedition - I are included as part of this report.

FLORIDA STATE UNIVERSITY

CRUISE REPORT
R/V TURSIOPS

Expedition YUCATAN I
(T-6801, T-6901)

Compiled by:
Harold Mattraw

Data Analyses by:
Cynthia Sward and
Stephan Chesser

Reviewed and Approved by:
Dr. James I. Jones
Chief Scientist
YUCATAN I

DEPARTMENT OF OCEANOGRAPHY

Florida State University

Cruise Report - Yucatan I

Cruises T6801 5-22 December, 1968
West Florida Shelf and Florida Straits

& Cruise T6901 3-22 January, 1969
Southeastern Gulf of Mexico, Yucatan Straits
and Northwestern Caribbean

I. Objectives

A. T6801:

1. Geologic sampling of the west Florida shelf, from $27^{\circ}30'$N to $25^{\circ}00'$W to a depth of 200 fathoms.

2. Characterize water structure of the Florida Straits by use of plankton-hydrography relationships.

3. Measure primary productivity variations at selected areas.

4. Investigate geologic zonation and ecology of selected south Florida reef areas.

B. T6901:

1. Characterize water structure of the southeastern Gulf of Mexico, Yucatan Straits, and northwestern Caribbean using plankton-hydrographic techniques.

2. Measure primary productivity of selected areas.

3. Collect extant phytoplankton populations along a north-south transect to determine diversity characteristics.

4. Measure cobalt uptake of natural phytoplankton populations,

5. Investigate geologic zonation and ecology of reefoid structures at Cozumel Island, Misteriosa Bank, and Grand Cayman Island.

6. Collect coralline skeletal material with in situ sea water samples to determine trace metal partitioning.

II. Actual Schedule - T6801

Date	Activity	Personnel
December 5	Depart Tampa, Geologic sampling.	Jones, Sward, Chesser, Hopkins, Turner, Austin
December 9	Arrive Fort Meyers; pick up additional geological sampling gear.	
December 10	Depart Fort Meyers, continue geological sampling.	
December 14	Arrive Key West, personnel change.	
December 16	Depart Key West, plankton stations.	Jones, Sward, Chesser, Austin, Combs, Mattraw, White.
December 17	Arrive Dry Tortugas, reef studies.	
December 19	Depart Dry Tortugas, plankton stations	
December 21	Arrive Ball Laboratory, Turkey Point. End of T6801	

III. Actual Schedule - T6901

Date	Activity	Personnel
January 3	Depart Marine Lab. Plankton stations	Jones, Sward, H. Austin, S. Austin, Jensen, Otto, Chesser.
January 7	Arrive Cozumel, reef studies.	
January 10	Depart Cozumel, plankton stations.	
January 13	Arrive Grand Cayman Isl.,	
January 17	Reef collections & zonation studies. Depart G. Cayman.	Jones, Sward, H.Austin, S. Austin, Jensen.
January 19	Arrive Key West, clear customs.	
January 20	Depart Key West.	
January 22	Arrive Turkey Point. End of T6901.	

IV. Operations

A. Geologic Sampling:

One hundred-six geologic stations were occupied on the West Florida shelf during T6801. Bottom samples were obtained every ten miles from nearshore to the continental slope (200 fathoms).on a mile wide grid south of Tampa Bay ($27^{\circ}30'$N) to 25°N.

The Dietz-Lafond Grab was used from 25' to 100'. The larger Petersen Grab was used to about 400' and a gravity corer (Holt-Chesser Corer) was used for greater depths. The material is being analysed for textural, mineralogic, and geochemical characteristics by Steve Cheser, in order to interpret the present-day geologic environment.

B. Plankton - Hydrography:

Thirteen stations employed plankton-hydrography relationships to characterize the water structure. Areas investigated include the Florida Straits, Southeastern Gulf of Mexico, Yucatan Strait, and Northwestern Caribbean.

Operations involved a determination of the thermocline position by bathythermograph, collection of water samples by Niskin Bottles for salinity measurements, temperature collections at 100 meters intervals by reversing thermometers, and flights of 1/2 meter, 200 u mesh, opening-closing, quantitative plankton nets at controlled depths, as monitored by time-depth recorders.

The information is being analysed by Dr. James I. Jones to establish the integrity of Caribbean water masses in the Gulf of Mexico.

C. Primary Productivity:

Seven sets (14 stations, Sward 01-etc.) of neritic-oceanic plankton samples were collected for the purpose of determining diurnal and spatial differences in productivity. Surface samples were taken three hours before and after the local apparent noon. The sample was divided and incubated in 250ml light/dark bottles. The Carbon-14 technique of S. Nielsen was used. The samples were filtered and stored for counting on a proportional counter at Florida State University, by George Knauer.

D. Phytoplankton Diversity:

250ml surface samples were collected at each half degree of latitude and fixed with a 3% Formalin solution. The samples are being analyzed for phytoplankton diversity by Dr. Walter Glooschenko.

E. Cobalt Uptake by Phytoplankton:

Cozumel surface samples were enriched in nutrients and incubated for 48 hours to produce a bloom. Radioactive cobalt (Co-60) was added and the culture divided into a standard set of light and dark bottles. 100ml samples were withdrawn every two hours, filtered, and stored for counting on a Geiger-Muller Counter. The work was undertaken by Miss Cindy Sward to determine phytoplankton uptake of cobalt relative to the photosynthetic process.

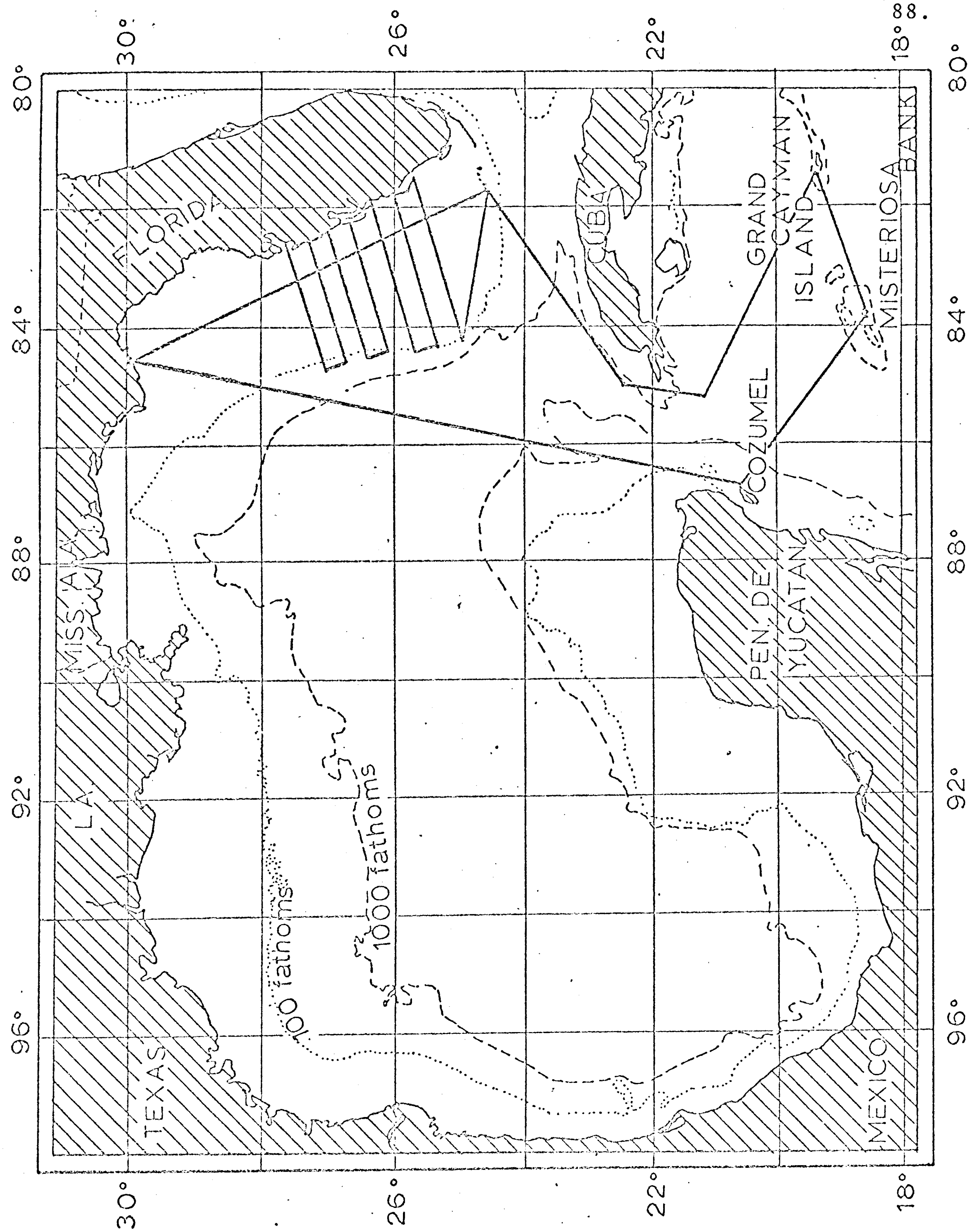
F. Trace Metal Partitioning in Corals:

Four varieties of coral and associated water at Palancar Reef, Cozumel were collected for measurement of trace metal partitioning in skeletal parts by atomic absorption. Miss Cindy Sward is studying the incorporation or exclusion of specific ions as an indicator of the calcification mechanism in corals.

G. Ecological and Geological Investigations of Coral Reefs and Reefoid Structures:

Four major areas of investigation were included in this aspect of the expedition, these included: the westernmost area of the Dry Tortugas, Palancar Reef off southern Cozumel, Misteriosa Bank, and selected areas off Grand Cayman Island. Major reef structures were observed and photographed. Details of specific zonation of selected coral genera were examined and compared to known zonations reported and observed from other regions in the Caribbean and the Bahamas. Photographic evidence of former lower stands of sea-level was obtained, as well as photographs of subaerial erosional phenomenon to depths greater than 200 feet.

Compiled by Harold Mattraw
Data analyses by Cynthia Sward and Stephan Chesser
Reviewed and Approved by Dr. James I. Jones, Chief Scientist, YUCATAN I
8 April, 1969


30°
26°
22°
18°
80°
84°
88°
92°
96°
FLORIDA
CUBA
GRAND CAYMAN ISLAND
MISTERIOSA BANK
COZUMEL
PEN. DE YUCATAN
MISS. ALA.
LA.
TEXAS
MEXICO
100 fathoms
1000 fathoms

DEPARTMENT OF OCEANOGRAPHY

Florida State University

Cruise Report - YUCATAN II

Cruise T-6909: 23 June - 2 July, 1969

Southeastern Gulf of Mexico, Yucatan Straits

and Florida Straits

I. Objectives:

A. To sample the plankton at selected localities in the eastern Gulf of Mexico, and western Florida Straits as part of the continuing program to investigate water mass characteristics and biorelationships in the Yucatan Channel, Florida Straits and Gulf of Mexico.

B. To sample selected physico-chemical parameters in conjunction with the plankton sampling process.

II. Actual Schedule - T-6909

Date	Activity	Personnel
June 23	Depart Ball Lab. en route to Key West, via 86°W Long. to 24°N Lat.	J. Jones, H. Austin, C. Sward, C. Combs, A. Henke.
June 27	Arrive Key West; refuel and re-supply.	
June 28	Depart Key West, via two transects from Key West to 20 miles off the Cuban coast and to point off Loggerhead Key light.	
July 2	Arrival at Ball Lab. End of T-6909.	

III. Operations

A. Hydrography

Hydrocasts were done at each station to determine selected chemical parameters of the water column. Temperature measurements and thermocline configurations were measured by use of the Bathythermograph and reversing thermometers to 450 meters.

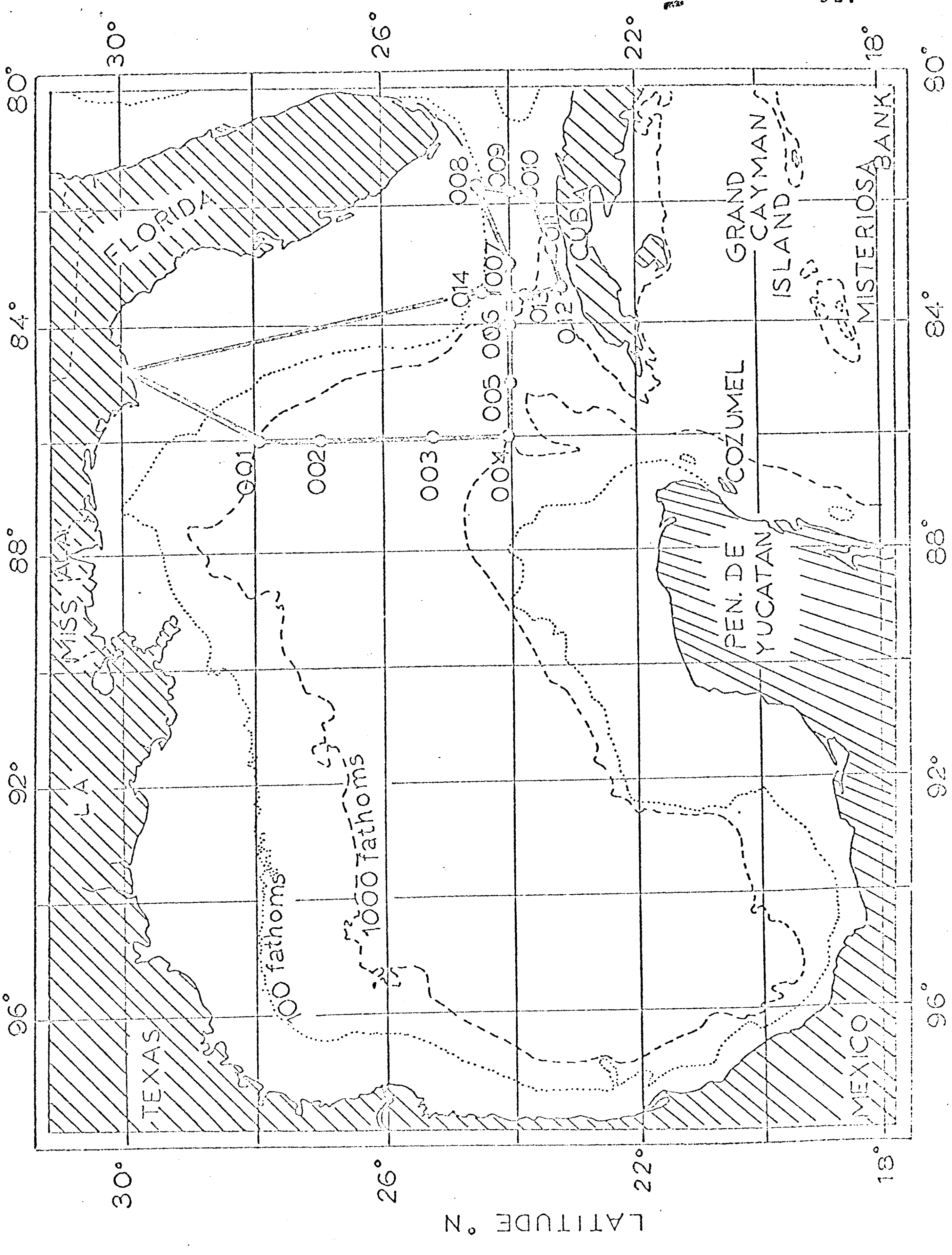
Water samples were collected by Niskin bottle casts for analyses of dissolved oxygen content and salinity. Oxygen was determined by the Winkler Titration Method, and salinity by inductive salinometer on-board ship.

Samples were collected at selected stations in the Florida Straits for Boron analyses.

B. Plankton

Fourteen plankton stations were occupied. At each a cast of eight 200 u mesh, opening-closing, metered plankton nets were fished at controlled depths, and monitored by time-depth recorders.

This information, combined with the hydrocasts, will be analyzed as part of the continuing program designed to investigate water mass characteristics and their physico-chemical and biological relationships in water masses in the Gulf of Mexico.


FLORIDA
CUBA
GRAND CAYMAN ISLAND
MISTERIOSA BANK
COZUMEL
PEN. DE YUCATAN
MISS
LA
TEXAS
MEXICO
100 fathoms
1000 fathoms
001
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008
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011
012
013
014
80°
84°
88°
92°
96°
30°
26°
22°
18°
LONGITUDE °W
LATITUDE °N

SCIENTIFIC LOG CRUISE T-7016 19.May-3.June 1970. FSU

J.Jones- Chief Scientist 93.

F.Fetter- Ass't Chief Scientist

L.Kadar

S.Moore

S.Williams

19. May, 1970.

1945 - Departed Ed Ball Marine Lab.

20. May, 1970.

1100 - Arrived at First Station: Lat. 28N. Long. 86W.

1106 - S.T.D. to 700m. Surface salinity #617.

Surface temperature 25.7°C.

1220 - 8 Net Cast lowered.4 T.D.R.

0140 - First messenger dropped

0230 - Second messenger dropped

0240 - Cast raised "E" Net lost due to improper choke rigging

"G" Net - choke line tangled

"H" Net - dont know fishing interval

1945 - Course changed for return to E. Ball Marine Lab. to avoid Hurricane Alma [Lat. 17.9N. Long 81.5W.].

21. May, 1970.

1445 - Arrived Ed Ball Marine Lab.

22. May, 1970.

1815 - Depart Ed Ball Marine Lab.

25. May, 1970.

0140 - Arrive Station Two: Lat. 27° 00"N. Long. 94° 00'W.

0155 - S.T.D. lowered.

0245 - S.T.D. raised.

0355 - Wire relayed on Hydrowinch.

0435 - Cast of 8 nets to 400m. opened.

0535 - Second messenger dropped - nets closed.

2050 - Arrive Station Three. Lat. 25°N. Long. 94°W.

2100 - S.T.I lowered. Surface salinity X 615.

Surface temperature 26.4°.

2135 - S.T.D. raised.

2203 - Eight net cast lowered. Messenger dropped - three heard.

2305 - Second messenger dropped. Cast raised D didnt open

E F G didnt fish

H didnt close

2348 - Recast of bottom five nets.

26. May, 1970.

0150 - Deep cast.

0250 - Second messenger dropped. Net I snapper block didnt open.

Net J didnt unroll, torn.

0342 - Deep cast redone.

0442 - Second messenger dropped.

0600 - Anchor aweigh.

27. May, 1970.

0115 - Arrive Station Four. Lat. 23°N. Long. 94°W.

0125 - S.T.D. lowered. Surface salinity X 614

Surface temperature 26.7°.

0256 - Net cast.

0442 - Recast of bottom 3 nets.

0820 - Anchor aweigh.

28. May, 1970.

0700 - Dredge Station I.

0725 - S.T.D.Surface salinity X 613.

Surface temperature 27.7°.

1530 - Arrive Progresso, Yucatan.

30. May, 1970.

2345 - Depart Progresso.

31. May, 1970.

0715 - Dredge Station Two. S.T.D. Surface salinity X 611.

Surface temperature 27.5°.

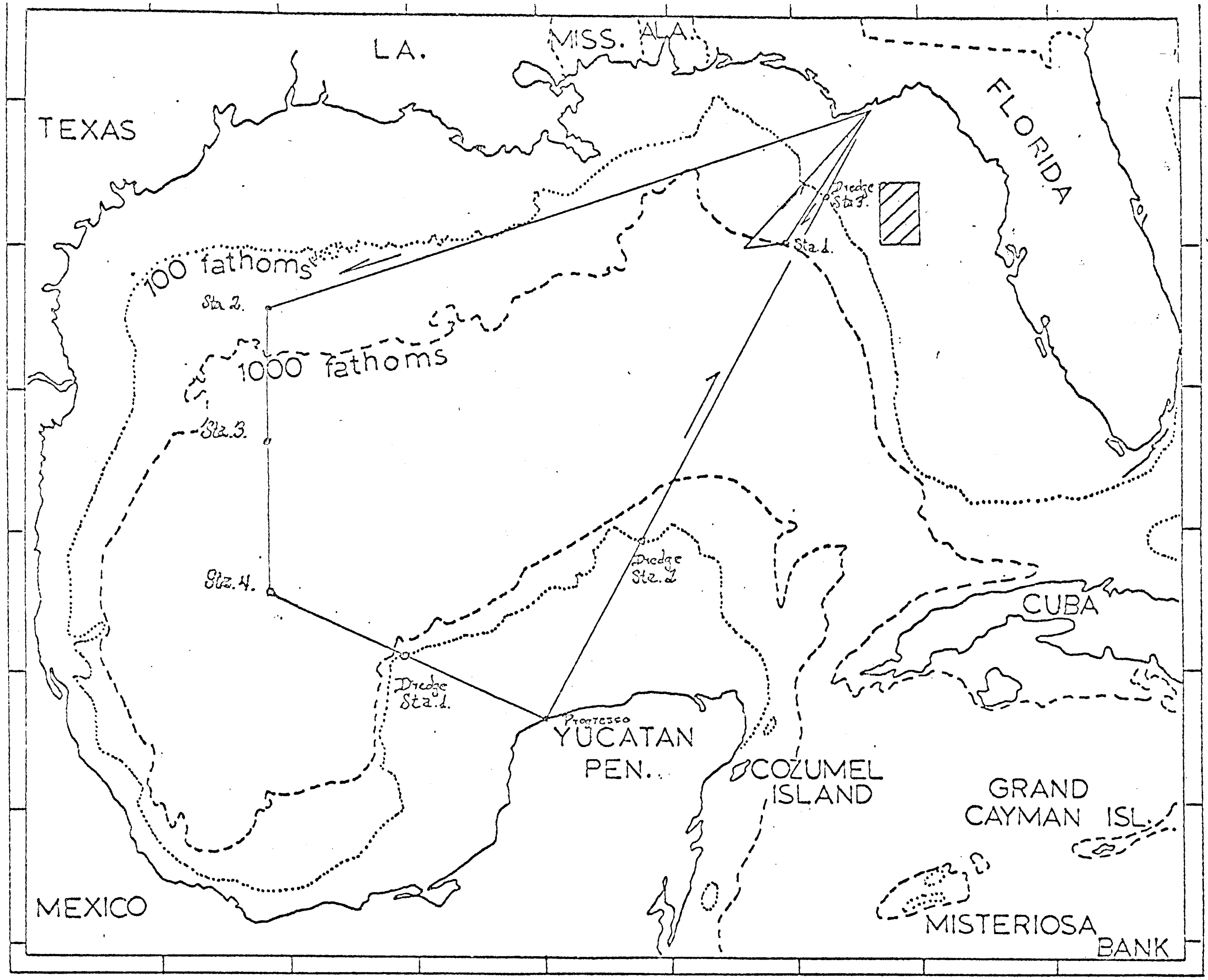
2. June, 1970.

1900 - Arrive Panama City - clear with Customs and Immigration.

3. June, 1970.

2200 - Arrive Ed Ball Marine Lab.

F.C.F.



GULF OF MEXICO-INCLUDING THE FLORIDA MIDDLE GROUND-

CRUISE TRACK - YUCATAN III

NET STATIONS 1-4.

DREDGE STATIONS 1-3.

DEPARTMENT OF OCEANOGRAPHY
FLORIDA STATE UNIVERSITY
CRUISE REPORT
YUCATAN IV
R/V TURSIOPS T - 7024
DECEMBER 10 - DECEMBER 23 1970

I OBJECTIVES:

a. To provide data and sample research materials for the continuing study of the relationship of the water masses of the Eastern Gulf of Mexico, Florida Straits and Yucatan Channel from the standpoint of physical, biological, and chemical parameters.

b. To study selected shallow bank areas by diving techniques.

c. To provide at-sea experience and training for oceanography students.

II PERSONNEL

J. Jones Chief Scientist
J. Fornshell Assistant Chief Scientist
R. Krishnamurti
L. Gonzalez
J. Cruise
D. Pearlman
J. Kraft
J. Marum

III ACTUAL SCHEDULE

TIME	DATE	ACTIVITY
10:50 (EST)	10 December 1970	Departed Ed Ball Marine Lab., Turkey Point, Florida
14:30	10 December 1970	Sta. 01, 29° 30.5' N. 84° 26.5' W Bottom water temperature measurements, surface temp., one bottle bottom hydrocast.
0602	11 December 1970	Sta. 02, 27° 14' N 84° 37.5' W ~~XBT~~.
0915		Sta. 03, 26° 54' N 84° 39' W ~~XBT~~
1209		Sta. 04, 26° 15' N 84° 42' W ~~XBT~~.
0900	12 December 1970	Arrived Key West, Florida.
1210		Departed Key West, Florida.

TIME	DATE	ACTIVITY
1600	13 December 1970	Sta. 05, 22°00' N 85°12'W ~~XBT~~, STD Hydrocast, Plankton cast, both 600 meters.
0010	14 December 1970	Sta. 06, 21°50'N 85°45'W ~~XBT~~ STD Hydrocast, Plankton cast.
0850	14 December 1970	Sta. 07, 22°00' N 86°15' W ~~XBT~~, STD, Hydrocast, Plankton cast.
1605	14 December 1970	Sta. 08a, 22°12' N 86°40.5'W ~~XBT~~ in boil.
1610	14 December 1970	Sta. 08b, 22°12' N 86°40.5'W ~~XBT~~ in boil.
1620	14 December 1970	Sta. 08c, 22°11.5' N 86°42' W ~~XBT~~ in boil.
1030	15 December 1970	Arrive Progresso,Mexico.
1515	17 December 1970	Departed Progresso, Mexico.
1205	18 December 1970	Sta. 09, 20°50' N 92°48' W ~~XBT~~,STD,Hydrocast, Plankton cast.
0815	19 December 1970	Sta. 10, Position Uncertain ~~XBT~~.
1245	19 December 1970	Sta.11, Position Uncertain ~~XBT~~,STD, Plankton cast. cast.
2300	20 December 1970	Landfall- just west of the mouth of the South West Pass of The Mississippee River, South of New Orleans
2330	21 December 1970	Arrived Panama City: Port of entry into U.S.A.
1615	22 December 1970	Departed Panama City
0430	23 December 1970	Arrived Ed Ball Marine Lab.

IV Operations

A. Bathythermic cast were made using reversing thermometers at stations 1,5,6, 7,8, and 9. An STD was used on stations 5,6,7, 9 and 11. An XBT was used on stations 2-11. XBT cast preceded sta. 5,6,7,8,and 9. Net and bottle spacing were based upon the traces.

B. Hydrographic casts were made using 1.7 liter NISKIN water samplers. Water samples were drawn as follows:

1) Oxygen- drawn at all depths at stations 1,5,6,7,8, and 9.

C. One-half meter square opening, 200 micron mesh plankton nets, equiped with NISKIN double trippers were cast at stations 5,6,7,9, and 11.

Submitted:
John A Fornshell
John A. Fornshell
Assistant Chief Scientist

Approved:
J. I. Jones
J. I. Jones
Chief Scientist

FSU

100.

ANNOUNCEMENT

CAYMAN TRENCH EXPEDITION 1973

A COOPERATIVE INTERNATIONAL DEEP-SEA BIOLOGICAL-ECOLOGICAL INVESTIGATION OF THE FAUNA OF THE CAYMAN TRENCH AND HYPERBARIC PHENOMENA

DATES: August to October 1973

LOCATION: Cayman Trench (S.E. of Cuba)

BASE OF OPERATION: Discovery Bay, Jamaica (probably)

CRUISE ORIGINATORS AND COORDINATORS: Dr. R. Brauer, Director
Wrightsville Marine Biomed. Laboratory
Head Marine Sciences
University North Carolina, Wilmington
and
Dr. Robert J. Menzies
Oceanography Department
Florida State University, Tallahassee

SHIP SPONSOR: UNOLS, National Science Foundation

SHIP: R/V ALAMINOS, coordinator "Tex" Treadwell
Oceanography Dept.
Texas A&M, College Station

SUBMERSIBLES:
a. Wet to 300 ft. 2 wet submersibles (W.M.B.L., U.N.C.)
? b. dry to 13000 ft. ~~? Deep Star?~~ ALVIN (sponsor not yet identified)
? c. dry to 12,000 ft. ? Trieste II ? (sponsor not yet identified)

Between August and October 1973 a cooperative international study will be conducted in the deep-sea fauna of the Cayman Trench. The investigation will be carried out at sea from the R/V ALAMINOS. jointly by scientists from FSU (contact Dr. R.J. Menzies) and the Wrightsville Marine Biomedical Laboratory (contact Dr. Ralph Brauer).

The cruise will be divided into two legs. One leg will emphasize zonation of fauna through the thermocline using a variety of submersibles (to 6000 meters). The other leg will emphasize deep-sea faunal composition, dispersion, density, and distribution (to 6000 meters). Both legs will be concerned primarily with hyperbaric phenomena and biology.

At this time research projects compatible with the aims of the cruise are being selected in the following fields:

1. Trace elements (heavy metals) concentrations in water, biota, and sediments.
2. Pesticide concentrations in water, sediments, biota.
3. Sea surface primary productivity.
4. Hyperbaric phenomena.
5. Systematics of deep-sea biota.

If you have an interest in one or more of the above areas then kindly contact the undersigned before 1 June 1972 with a statement of your interest.

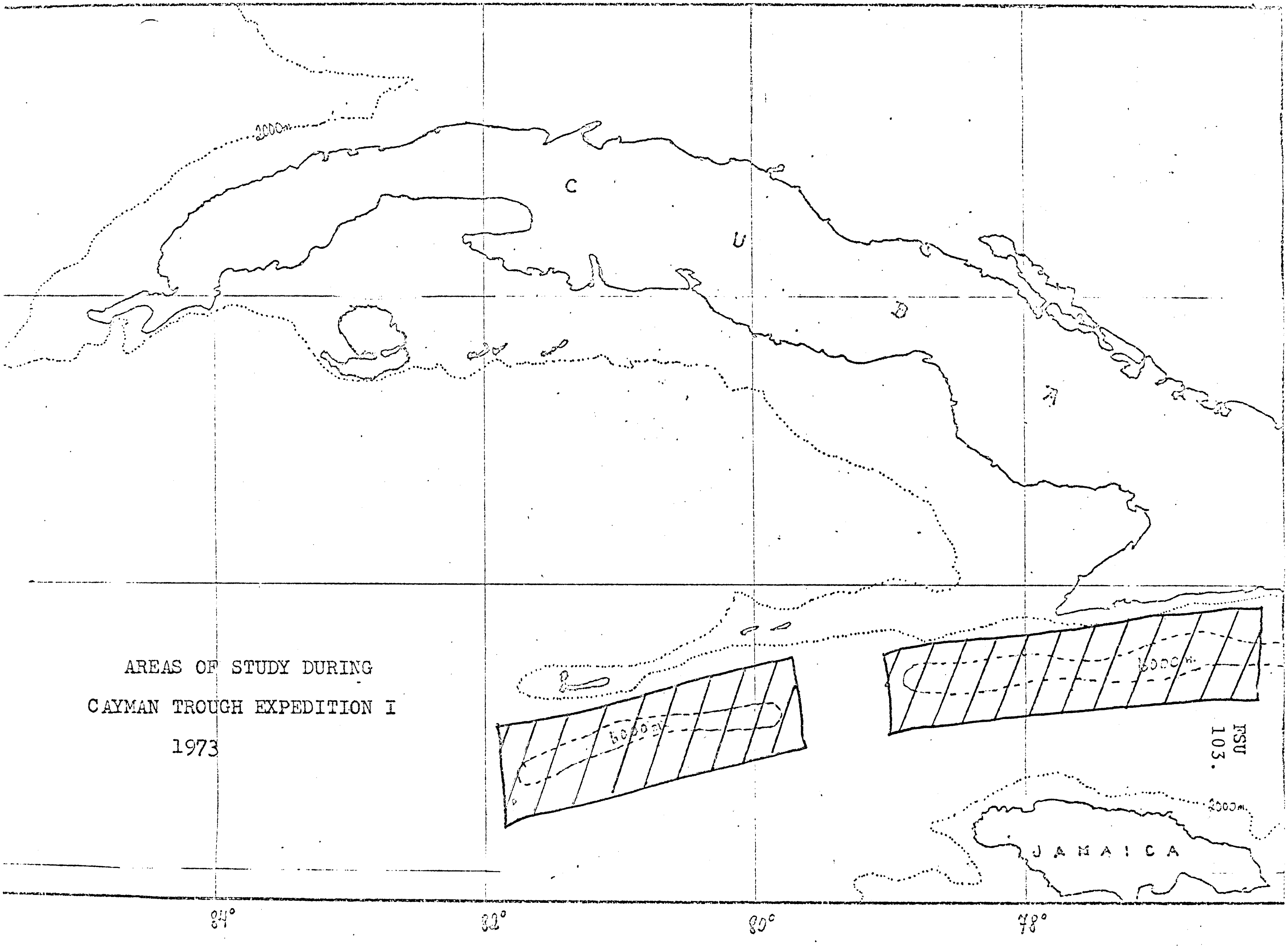
Robert J. Menzies
Cruise Planning Coordinator
FSU (599-3429) (385-3717)

Invited participants--confirmed

R. Brauer (USA)--Cruise Coordinator, Hyperbaric Phenomena
R. Menzies (USA)--Cruise Coordinator, Deep-Sea Biota
H. Fleming (USA)--Data Coordinator, Entire Cruise
S. Appan (USA)--Data Manipulation, Entire Cruise
J. Jones (USA)--International Coordinator, Geological Oceanographer
Fukuoka (Venez)--Descriptive Physical Oceanographer
Bacescu (Rum)--Deep-Sea Fauna
A. Clarke (Canada)--Deep-Sea Fauna
J. Madsen (Denmark)--Deep-Sea Fauna
I. Macdonald (UK)--Hyperbaric Phenomena
A.J. Southward (UK)--Deep-Sea Fauna
E. Southward (UK)--Deep-Sea Fauna
R. Bunell (France)--Bioacustics
R. Harriss (USA)--Pollutants
G. Knauer (USA)--Biochemist
R. Iverson (USA)--Primary Productivity
R. George (USA)--Deep-Sea Fauna

Invited participants--unconfirmed

Okuda (Venez)--Chemical Oceanographer
Belyaev (USSR)--Deep-Sea Fauna
H. Lowenstam (USA)--Deep-Sea Fauna
J. Garth (USA)--Deep-Sea Fauna
W. Pequanaut (USA)--Deep-Sea Fauna
L. Pequanaut (USA)--Deep-Sea Fauna
J. Knutsen (Denmark)--Deep-Sea Fauna
B. Hansen (Denmark)--Deep-Sea Fauna
G. Muller (Rum)--Deep-Sea Fauna
M. Fira (Denmark)--Deep-Sea Fauna
D. Debuteville (France)--Deep-Sea Fauna



AREAS OF STUDY DURING
CAYMAN TROUGH EXPEDITION I
1973

(Florida) State University System Institute of Oceanography

St. Petersburg, Florida

1970-1

A major contribution to the U. S. CICAR program in 1970 was the series of EGMEX cruises (for Eastern Gulf of Mexico) planned and coordinated by the State University System Institute of Oceanography (SUSIO). Maurice Rinkel of SUSIO has summarized EGMEX I, II, and III in the attached article, included here to make the record complete.

From a draft report on the activities of SUSIO for the years 1970 and 1971, those portions relevant to CICAR have been included in this report. These include 1) Studies of the Loop Current in the Eastern Gulf of Mexico (including EGMEX cruises for 1970 and 1971), 2) Studies of the continental shelf off the Florida west coast, and 3) Studies of the nearshore area and estuaries of the Florida west coast.

Also included is a list of the numerous vessels that SUSIO has utilized to carry out these programs,and a list of the published papers, reports, and oral presentations of the results of this CICAR work.

Seventeen Cruise Reports are available for the work of SUSIO vessels during 1971. These are too long for reproduction for this report, but the first page of each has been included for information. Those that would like the complete reports can contact either the U. S. National Coordinator for CICAR or the Director of SUSIO, Dr. Robert E. Smith, 830 First Street, St. Petersburg, Florida 33701, U.S.A.

1972-3

The schedule of SUSIO projects within the CICAR area for the rest of 1972 and through June of 1973 is included in the tentative project schedule and ship schedule included at the end of the SUSIO section of this report.

SUSIO
105.

Results of Cooperative Investigations — A Pilot Study of the Eastern Gulf of Mexico

M. O. RINKEL
State University System of Florida
Institute of Oceanography
St. Petersburg, Florida 33701

INTRODUCTION

The Loop Current of the eastern Gulf of Mexico is a mesoscale, hydrodynamic, temporal and spatial dependent phenomenon. In general terms, it might be described as a "river of Caribbean water" entering through the Yucatan Channel and proceeding northward into the eastern Gulf of Mexico, wherein it turns eastward in a semi-circular course until it flows southward along the western continental shelf of Florida to re-enter the Florida current in the Straits of Florida.

Over the last 30 years this "river" has been studied mainly by the physical oceanographers as a series of individual, independent cruises, rather than coordinated, cooperative, near synoptic investigations. A review of past studies indicates that this "river" may have eddies, which break off along its westward boundary to enter the western Gulf of Mexico. However, the extent and number of these eddies, their structural details, and their continuity throughout the year will require a more systematic, snyoptic type of approach. Too, if the varied effect of this "river" on the overall environment of the Gulf of Mexico is to be understood, additional studies must be conducted of an interdisciplinary, multiple-ship, cooperative nature.

Heretofore the current structure has been characterized by the classical definitions of geostrophic calculations, since adequate direct current measurements are extremely difficult and expensive to conduct. These calculations, as is true with many scientific methods, have inherent reservations which are dependent on the existing accepted methods, state-of-the-art of available equipment or instrumentation and operational factors. Ideally these calculations should be based on data where temperature is measured to within ± 0.02C and salinity within ± 0.03 parts per thousand ($^{o}/_{oo}$); with their profiles measured *in situ* and all relevant measurements madé šnyoptically. While oceanographic stations can generate this accuracy, only STD systems can provide *in situ* measurements.

Except for micro scaled pilot studies, no major attempts have been made to determine the structure and features of the Loop Current other than by the oceanographic station type of physical oceanography. No integrated, near-synoptic, interdisciplinary examinations have been made which would allow the inter-relationship of current with the other environmental features of the Gulf of Mexico.

During 1970, a set of unique conditions occurred which resulted in three such interdisciplinary studies of the Loop Current phenomenon. We feel these might be used as pilot studies for future interdisciplinary projects; too, they have served to generate background data for future detailed investigations in the field of physical, biological and chemical oceanography in the area. Members of the

U.S. Planning Group for Cooperative Investigations of the Caribbean and Adjacent Regions (CICAR) officially assigned the acronym EGMEX '70 to these expeditions. The conditions are: (1) The existence, in the State of Florida, of a coordinated oceanographic program and an agency, the State University System Florida Institute of Oceanography (SUSIO), to support cooperative activities between the various oceanographic activities in the State of Florida, with other oceanographic institutions outside of the state and at the federal level. (2) The ability to conduct the required coordinating activities at the working scientist level rather than the administrative level. This is, and was, vital. (3) The application in the planning of EGMEX of a total data management approach to the operation, data reduction and data documentation stages of the program. (4) The existence of a number of actively, or planned to be, funded individual projects to study this phenomenon. (5) The increasing awareness, within the universities, of the need for training graduate students in the requirements, problems of, and need for interdisciplinary programs.

EGMEX '70

EGMEX I '70

Under the State University System's FY '70 program, Dr. James I. Jones, Florida State University (FSU), submitted to SUSIO a proposal entitled, "Characterization, Definition, and Distribution of Selected Water Masses and Currents in Eastern and Central Gulf of Mexico and the Western Straits of Florida." This project required sampling across the Loop Current. Realizing the operational and financial limitations customarily imposed on the geostrophic method, he proposed to surmount these in part by using a biological indicator approach. Biological indicators were to be used in conjunction with geostrophic calculations to define the structure and location of the Loop Current.

In the past, Dr. Jones has related biological indicators to the results of direct current measurements in the Equatorial Atlantic undercurrent. This work has clearly shown that the concentrations of certain Foraminifera define the existence and location of the Equatorial Atlantic undercurrent (Jones, 1967, 1969). He has conducted a series of cruises on the Florida west coast continental shelf (Florida Middle Ground, 28° 30' N; 84° 20' W), in the Straits of Florida, and in the western Caribbean, which indicate that the same techniques could be used to define the location of the Loop Current (Jones, 1968). Based on the scientific merit of his proposal, it was approved by the Board of Regents Proposal Evaluation Panel for ship time, and his study was assigned to the R/V *Tursiops* (SUSIO FY '70 Program).

Dr. Jones, realizing that the study would require extremely close spatial sampling and near synoptic observations, requested that SUSIO attempt to arrange a multiple-ship operation across the Loop Current for this purpose. Fortunately, a series of events occurred which allowed SUSIO to arrange this: May 1-12, 1970, EGMEX I; June 1-14, 1970, EGMEX II; and October 24-November 2, 1970, EGMEX III. A listing of the vessels and their institutions or operating agencies, scientific parties, and industrial support is presented in Table 1.

Dr. Eugene Corcoran, University of Miami (UM), over the past decade, has been conducting a study of the discharge of trace elements and insecticides of the major river systems of the world. The final study in this series, the

5

Mississippi River, was scheduled for April-May, 1970, using the University of Miami's R/V *Pillsbury*.

Dr. Corcoran, during the EQUALANT cruises, had indications that the trace elements could be used as identifiers of the Equatorial Atlantic undercurrent. Based on these past observations, he believed that if the discharge from the Mississippi River was entering into the Loop Current the trace elements might be used as an indicator of this occurrence.

As a member of the SUSIO FY '70 Proposal Evaluation Panel, he was aware of Dr. Jones' proposed study. And, since he had in the past participated in interdisciplinary studies with Dr. Jones in EQUALANT, he recognized the mutual gains that would result from a similar cooperative investigation of the Loop Current in the eastern Gulf of Mexico. He stressed to SUSIO the importance of such a study and agreed to participate in it if adequate ships could be rallied for the purpose.

TABLE I
Participants in EGMEX '70 [1]

Vessel	Cruise	Operating university or agency	Scientific party
Alaminos	I–II–III	Texas A & M University	Texas A&M–FSU
Discoverer	I–III	National Oceanic and Atmospheric Administration	NOAA - FSU
Gulfstream	I–II–III	Nova University	Nova
Hernan Cortez	I–II	Florida Department of Natural Resources	DNR-NMFS-FSU
Island Waters	I–II–III	National Youth Science Foundation	SUSIO-USF-FSU HTI-UWF-NMFS
Joie de Vivre	I–III	Florida Institute of Technology	UF-UWF-FSU–HTI-NMFS
Peirce	III	National Oceanic and Atmospheric Administration	NOAA
Pillsbury	I	University of Miami	UM-AOML-FSU-HTI-NSF
Tursiops	I–III	Florida State University	FSU-UM
Virgilio Uribe	III	Mexican Government	Mexican Government

[1] The following organizations participated in EGMEX by loan of equipment or personnel not shown in Table 1: Bissett-Berman Corporation, CM2 Incorporated, General Oceanics and Mote Marine Laboratory.

During the period of discussion with Drs. Jones and Corcoran, SUSIO arranged with the National Youth Science Foundation (NYSF) to use its 82-foot *Island Waters* in the State University System of Florida Cooperative Oceanographic Teaching and Research Program. SUSIO then planned a three-ship operation.

SUSIO realized that in a cooperative investigation of this nature the density parameters, i.e., temperature and salinity, would represent a common environmental boundary condition to each of the interdisciplinary approaches. For this reason it was imperative that a thorough descriptive analysis be made of the geostrophic calculations and temperature and salinity distributions. SUSIO contacted Dr. Saul Broida (UM) to determine if he would coordinate such a descriptive endeavor under his Office of Naval Research (ONR) funding. He expressed an interest, as an extension of his study of the Florida current, and requested permission to discuss the entire study with Dr. John Cochrane, Texas A & M University (TAMU) (a longtime investigator of the current), as he knew that the R/V *Alaminos* would be operating within the eastern Gulf of Mexico and Caribbean during the time of the proposed study. This type of response, incidentally, is a prime example of the benefits of coordinating at the individual working scientist's level. Dr. Cochrane realized that the simultaneous operation of four ships across the Loop Current represented a unique opportunity to obtain a near synoptic description of the density field. He agreed to participate in the program and assist in the geostrophic description of the Loop Current. He also agreed to conduct the necessary biological and chemical sampling in support of the interdisciplinary studies in return for the logarithmic increase in density measurements.

At this stage in the development of EGMEX, it was realized that a critical mass of vessels and personnel had been reached which would result in a major interdisciplinary study. SUSIO therefore arranged a meeting of the scientists in St. Petersburg to agree on: the necessary pre-planning responsibilities; a common environmental sampling program; proper documentation of the data collection methods; standard data reduction techniques of the common sampling program; and a definition of the responsibilities of the individual investigators in the final scientific analysis of the EGMEX data.

The scientists agreed on the necessity of a synoptic determination of the density field of the current. In order to get this as near synoptic as practical, they agreed to conduct a rapid STD survey. The resulting description of the density field could enhance the proper sampling of the biological and chemical parameters of the current by a follow-up survey. This would allow the geographic and vertical locations of these samples to be based on temperature and salinity distribution and on the major inflection points of their vertical profiles. In short, the biological and chemical sampling would be directly related to the geographical location and the physical properties of the current.

To assure that these data were actually collected at these critical points, it was agreed that the sampling depth would be based on STD lowerings. Biological sampling was to be conducted at selected inflection points by flights of six plankton nets fitted with opening and closing devices. Water samples were to be collected by 12 to 14 Niskin bottle casts at the major inflection points for oxygen, inorganic phosphate, insecticide and trace element analysis. As an example, the resulting data would then allow both Drs. Corcoran and Jones to inter-relate their individual studies with supplemental data of the density field. It would allow studies of the current, using data from geostrophic calculations and the distribution and concentration of both biological indicators and trace elements.

To reduce the loss of data due to improper STD sampling locations, it was decided that SUSIO should contact the U.S. Coast Guard (USCG) and request Airborne Radiation Thermometer Program (ART) overflight support. Examination of existing historical data from the National Oceanographic Data Center (NODC) files indicated a clear probability that the distribution of the surface isotherms in May could, in fact, depict the boundary conditions of the Loop Current. SUSIO was successful in obtaining USCG aircraft support operations during the period April 24-May 13, 1970.

At the completion of the meeting, SUSIO realized that the unique sampling techniques and coverage would generate data of unusual importance to a number of organizations thus far not associated with this Loop Current study. Individual briefings were scheduled with the State of Florida Department of Natural Resources (DNR), National Oceanic and Atmospheric Administration (NOAA), Atlantic Oceanographic and Meterological Laboratories (AOML), National Marine Fisheries Service (NMFS), Hydrospace Technical Institute (HTI) of Florida Institute of Technology (FIT) and Nova University to explain this study of the Loop Current and the potential of the resulting data and samples for each of their organizations. From these briefings a number of agreements were made which resulted in the participation of these organizations in the sampling program; in the reduction, compression, and the analysis of the resulting data; the placing of personnel aboard vessels or aircraft; or by making available large amounts of equipment to the participating vessels.

During these briefings, members of the U. S. Planning Group for CICAR reviewed the planned Loop Current study and it was recommended and accepted as the first U. S. project of CICAR.

Because of the increased number of participants in EGMEX, a final planning session was convened in St. Petersburg by SUSIO to formalize an overall program management scheme. The delegation of responsibilities was agreed upon and accepted as follows: (1) SUSIO would coordinate the activities of the different vessels, the exchange of personnel and equipment between them, and transportation of the resulting samples or data. (2) SUSIO would document and transmit to the National Oceanographic Data Center (NODC) information on the standard data collection techniques and data compression methods. (3) SUSIO would coordinate through NODC the inventorying of all collected data on CICARDI forms and charts. (4) NODC would inventory the collections; it would key punch and process the resulting data for list-outs of Sigma T and dynamic heights, prepare a master list-out of station locations and samples, and would prepare plotting sheets compatible to a U. S. Coast and Geodetic Survey 1007 chart size (this would be furnished as part of the U. S. participation in CICAR). (5) To assure data verification for the common sampling program, it was agreed that certain organizations and individuals would be responsible for correcting, processing or analyzing the resulting data from certain collection systems. (a) Since the physical data would be used as the key to sampling in this interdisciplinary study, its compression procedures would have to reflect not only the density distribution but would have to meet the analytical requirements of the other disciplines. SUSIO would either compress or arrange for the compression of the STD data and its transmission to NODC. Since the data recording systems for STD's on the different vessels varied from analog alone to combination analog-digital type records, it was agreed, to assure data verification, that only the analog traces should be compressed. Digital tapes would be processed individually by the collector. Analog compression would consist of values for standard depths, half and whole degrees of temperature, 0.5 $^{o}/_{oo}$ salinity and inflection points of temperature profile defined by a linear relationship of $\pm$ 0.02C. The chemical profile would be reduced to observations at the depth of these STD values unless its profile showed an inflection point not defined by the density field. If this occurred, values for temperature and salinity would be entered for these depths. The processed and listed STD data from NODC would be sent to Drs. Broida (UM) and Cochrane (TAMU) and Mr. Austin (FSU) for geostrophic description of the Loop Current required by the other interdisciplinary studies. (b) Dr. Corcoran (UM) would supply all collection equipment and sample bottles, with the exception of Niskin bottles, for the collection of trace elements and insecticides. All samples would be returned to him for analysis. (c) Dr. Jones (FSU) would supply all plankton nets, open-closing mechanisms, depth recorders, flowmeters, and sample bottles for plankton tows. He would sort the resulting samples for foraminiferans, radiolarians, and pteropods for his biological indicator research. He would also sort out fish larvae for Dr. Richards (NMFS-Tropical Atlantic Biological Laboratory [TABL]), who would further sort the larvae to family. Dr. Richards would then distribute certain families to other participating scientists. (d) Mrs. Williams (DNR) and Mr. Brucks (NMFS–TABL) would supply 8,000 drift bottles and would analyze the returns and prepare same for publication. (e) Dr. Hebard (NMFS–TABL) and Mr. Deavers (USCG) would analyze the ART overflight data. SUSIO would forward to them surface temperature data from the vessels. (f) Dr. Carder, University of South Florida (USF), would arrange for optical samples to be collected for the *Alaminos, Pillsbury, Island Waters* and *Tursiops.*

A number of other sampling programs and analytic efforts were added to the program in support of specific projects. The participating universities and agencies are so numerous that they are summarized in Table 2.

To ensure proper sampling across the Loop Current, a proposed standard grid pattern for station locations was established, based on the examination of historical data from NODC, and on discussions with scientists who had studied the phenomenon in recent years. It was agreed that unless the location of the current could be determined by advance ART overflight, satellite or vessel data, or a combination of these, sampling would occur at these locations.

Since a near-synoptic STD survey would be made of the Loop Current the participants felt that a sampling program on the western continental shelf of Florida should be made to relate the current's effect on this environment. For this reason, and to supply needed baseline data for future studies on the shelf, a series of sections was planned and assigned to the *Joie de Vivre* and *Hernan Cortez.* These sections were to be sampled for temperature and salinity data by either a shallow depth STD, or by Niskin bottle casts and oblique plankton tows to the bottom or the depth of the thermocline. If a thermocline was present, an additional plankton tow would be taken below its depth. The operational procedure, techniques and sampling instructions are documented.

The shelf sections were of major significance if attempts were to be made to relate the effects of the Loop Current on basic physical, chemical, biological, geological and fishery problems of this area. As such, the resulting data would have a very practical application to the universities, government agencies and industry of Florida alike.

The USCG provided 9 days of ART overflights during the period of April 25-27, May 4-6, and May 9-11, 1970. The results of the April 25-27 flights are shown in Chart 1. These data were very important to the study, since they allowed a determination of the boundaries of the Loop Current. The scientists' ability to examine these data before the departure of the vessels on the May 4-6 STD survey allowed them to revise the proposed tracks to cover the meandering of the northern edge of the current and concentrate stations within it.

This survey to 1,000 meters was conducted aboard the *Pillsbury, Island Waters, Tursiops* and *Alaminos.* Examples of the resulting sections of temperature are shown in Figure 1 across the meandering northern boundary of the current, and Figure 2 in the more steady state conditions to the south. It is most

TABLE 2

Sources of Data or Analytical Results f   £X '70
by Organization and Investi;

	Florida Department of Natural Resources
E. Joyce	Fish larvae; Hourglass study
S. Kennedy	Physalia
J. Williams	Drift bottles
	Florida State University
H. Austin	Biological indicators/Loop Current*; Loop Current description
J. Cruise	Sergisted shrimp distribution+
A. Hanke	Boron in sediments*
J. Jones	Biological indicators; Training personnel
L. Kadar	Copepoda indicators+
R. Thomas	Squid larvae distribution+
S. Williams	Middle Ground larvae+
	Hydrospace Technological Institute (FIT)
T. Tealey	Marine technician training
	Mote Marine Laboratory
P. Gilbert	Elasmobranch distribution and habits
	NOAA - Atlantic Oceanographic and Meteorological Laboratories
F. Chew	Loop Current drogue measurements
D. Hansen	STD data reduction; Direct current measurements; Yucatan Straits bottom current measurements
G. Maul	'ART satellite
	NOAA - National Marine Fisheries Service
J. Brucks	Drift bottles
T. Costello	Shrimp larvae
J. Finucane	Threadfin herring and pompano larvae
P. Ford	Clupeid larvae other than threadfin herring
F. Hebard	ART overflights; Loop Current geostrophy; Shelf currents, temperature, salinity and oxygen
W. Richards	Tuna larvae

TABLE 2 (Continued)

Staff	NOAA - National Oceanographic Data Center CICARDI
	Nova University
W. Richardson	Florida current total transport
	St. Petersburg Beach Aquatarium
L. Kephart	Turtle migrations
T. Nickerson	Turtle migrations
	Texas A & M University
J. Cochrane	Direct current measurements; Loop Current; Caribbean currents, Campeche Bank upwelling
	U. S. Coast Guard
J. Deavers	ART overflights
	University of Florida
P. Brezonik	Inorganic phosphates EGMEX I
H. Brooks	Training personnel
J. Dinsmore	Sooty terns*
	University of Miami
S. Broida	Florida Current; Loop Current
E. Corcoran	Trace elements and insecticides; Inorganic phosphates*
E. Houde	Clupeid eggs, distribution and abundance
	University of South Florida
R. Baird	Midwater fish
K. Carder	Particle-biological relationships and distribution; Training of personnel
T. Hopkins	Micronekton
F. Schlemmer	Particle current indicator+
	University of West Florida
T. Hopkins	Training of personnel

*Subject for Ph.D. dissertation; +subject for M.S. thesis

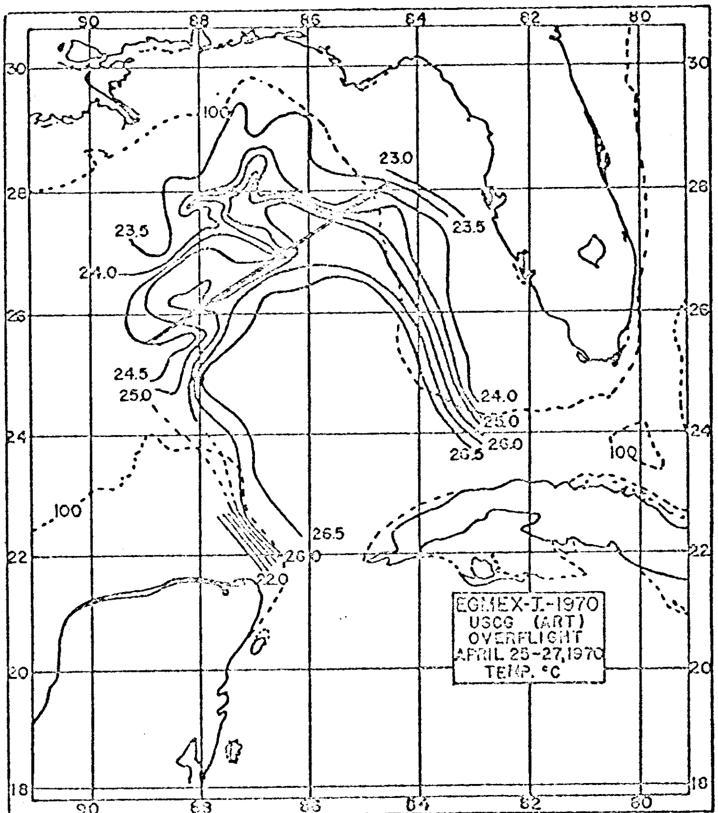


CHART I

significant that the surface temperature perturbations along the northern edge shown in the ART overflight data (Chart 1) are not merely a surface phenomenon. Figure 1 (taken along the heavy line on Chart 1) shows that this persists down to 1,000 meters. Without the change in the station sampling interval as the result of the ART overflight data, before this survey, these features might have been missed in the sampling.

On the basis of an examination of the vertical temperature and salinity section from this survey, the EGMEX station locations along the sections and section locations themselves were readjusted for the May 7-11 STD-biological-chemical survey. This allowed the appropriate sampling of the biological and chemical parameters across the current and in its well identified boundary areas. STD's, plankton tows, and oceanographic station casts were to a depth of 500 meters. Chart 2 shows the actual vessel tracks on EGMEX I '70. The flexibility of altering section locations and station intervals has been demonstrated in EGMEX.

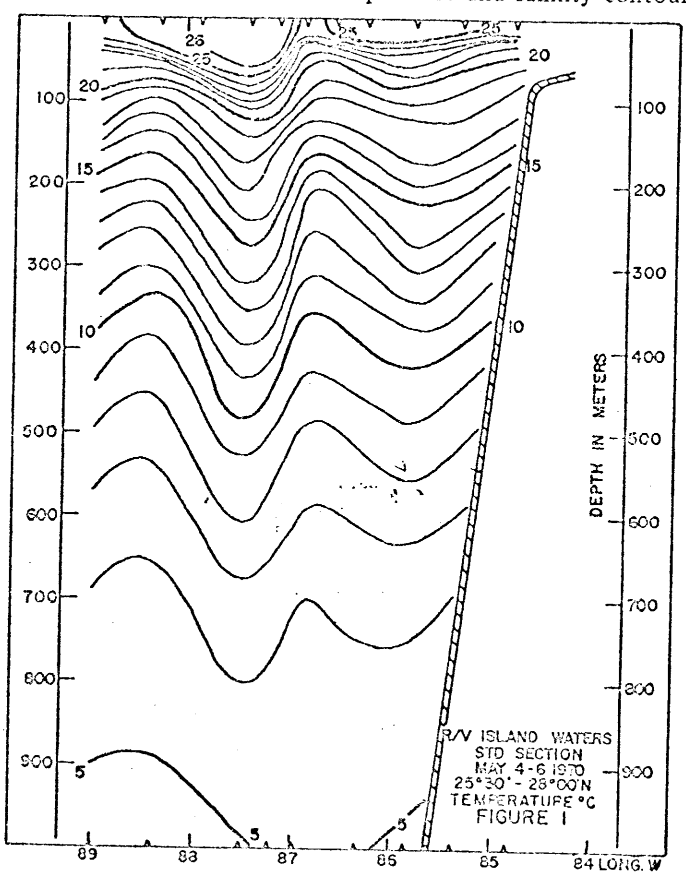
The surface flow in the Loop Current is not a direct wind driven current. A 2 1/2-knot surface current was measured in one of these perturbations moving against a 25-knot wind. This indicates that the Loop Current is similar to the Gulf Stream in its perturbations and is a definite water mass in transit through an area.

Again, there is a most interesting correlation between the Loop Current and the biology of the Gulf, as most of the scientists felt there would be. Even in an elementary feature, such as standing crop measurements, there is an apparent relationship. Chart 3 depicts the surface distribution of biomass measured in total displacement, in milliliters, of plankton materials sampled per cubic meter of water. Note the association between the perturbations of Chart 1 and certain of the concentrations on Chart 3. The concentration on Campeche Banks will be discussed later.

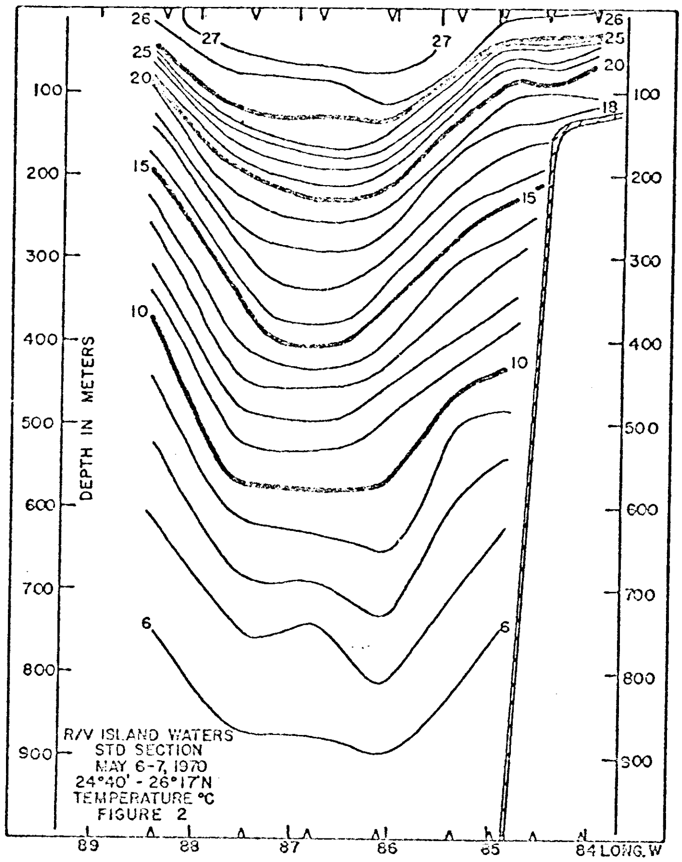
Approximately 80% of the EGMEX I operation was successfully completed. The major deletions were not across the Loop Current itself, which was 100% complete, but in the work on the continental shelf. This was directly accountable to weather conditions and partial break down of one of the research vessels.

At NODC there is an inventory of all data taken during the cruises on CICARDI forms. In addition, there is a master station file. NODC has constructed Station Location Plotting Sheets for: (1) STD stations, oceanographic station casts, and expendable BT's; (2) drift bottle releases; (3) plankton tows; (4) geological samples. These can be obtained from SUSIO or NODC.

The physical data have been reduced and submitted to NODC with values at standard depths and at the selected temperature and salinity contour intervals.



R/V ISLAND WATERS
STD SECTION
MAY 4-6 1970
25°30' - 28°00'N
TEMPERATURE °C
FIGURE 1



The drift bottle release locations have been inventoried and sent to NODC; copies to DNR and NMFS–TABL. The ART overflight data and surface temperature values have been sent to NMFS–TABL and the USCG for analytical work. FSU has sorted the plankton samples for the *Pillsbury, Island Waters, Tursiops, Hernan Cortez, Joie de Vivre* and *Alaminos* for foraminiferans and fish larvae. The fish larvae have been sent to Dr. Richards (NMFS–TABL) for reduction to families. The optical samples (particle) are under analysis by Dr. Carder (USF). Trace elements and insecticide samples are presently under analysis by Dr. Corcoran (UM).

The preliminary results of the physical data indicate that surface isotherms in May can be used as an approximation of the location of the Loop Current. While the boundaries are well defined in the southern extremities, the northern edge consists of fingers and eddies of considerable disconformity. These protuberances have relatively strong currents within their boundaries, up to 2 to 3 knots, and the water mass structure is affected to considerable depths. Since this is the first nearly synoptic study of the Loop Current the participants are most interested in determining its time variations, the degrees of its steady or non steady state, and movements of the fingers and eddies.

There was feeling among some of the scientists that not only could the 22-degree isotherm, as represented by Leipper (1968) be used to locate the Loop

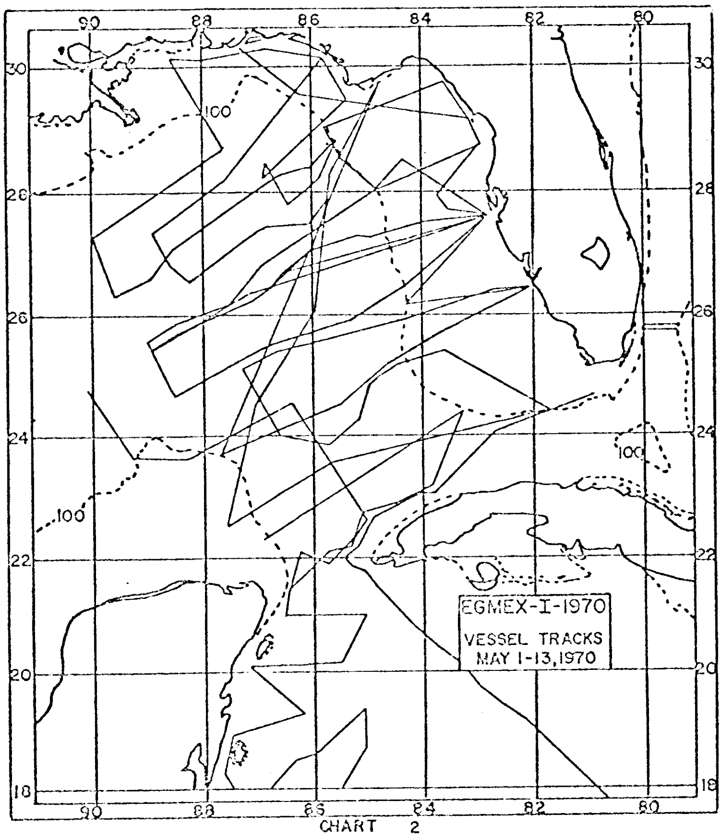


CHART 2

Current, but also possibly the 16-degree isotherm, when used in May. The existence of the perturbations and the associated concentrations of standing crops of plankton as biological indicators were very encouraging. The existence of shelf type foraminiferans at great depths along the western edge of the Campeche Banks and eastern edge of the continental shelf of Florida between Tampa and Ft. Myers indicates the presence of a phenomenon as yet unstudied. These concentrations of foraminiferans apparently have not mixed into the Loop Current, and yet were collected at a depth of 200 meters (personal communication, H. Austin).

The existence of a cold pocket of water on the continental shelf near the Crystal River area apparently represents a separation in the shelf transport. The preliminary results of an over 15% recovery of the drift bottles show that north of this pocket the bottles are drifting north and westward with recoveries as far west as Louisiana. South of the pocket the bottles are drifting southward and entering into the Florida current (personal communication, J. Brucks). This pocket of cold water covers an area known as the Florida Middle Ground, a major fishing area of Florida. For a period of some 18 months, a cooperative ecological study has been conducted at a fixed location, within these grounds, by Florida State University, University of West Florida, University of Florida and University of South Florida. The examination of the foraminiferans from this area which indicates the periodic presence of Caribbean water was the basis for Dr. Jones' original request to SUSIO to study the Loop Current (Austin, 1970).

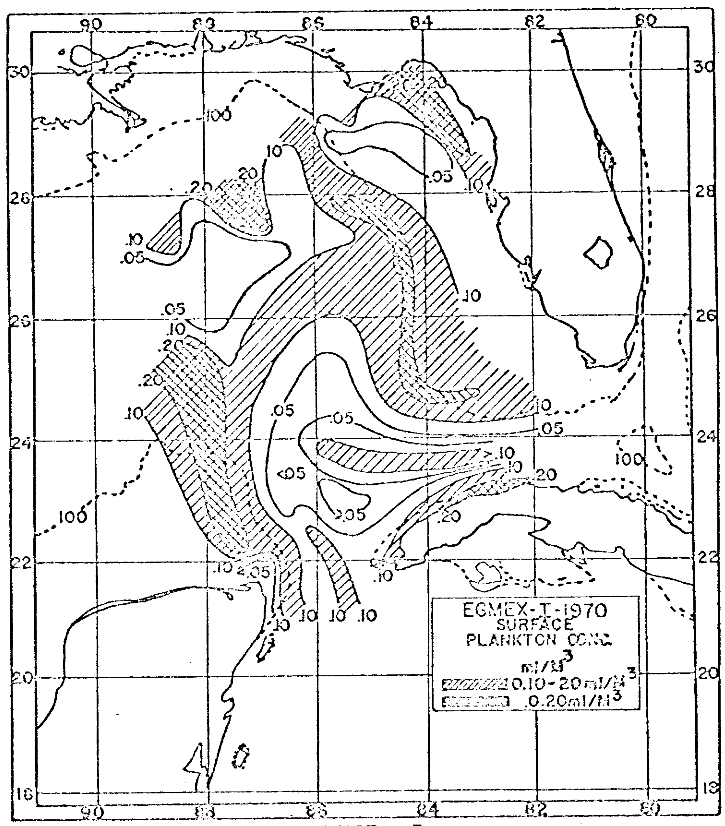


CHART 3

As was hoped, detailed information, as described above, of the association of the Loop Current with other environmental structures, will surely lead to new and varied types of investigations by the scientists in the eastern Gulf of Mexico. While the purpose of EGMEX I was to provide a monitoring of the Loop Current, it is these interrelated interface problems which represent the major interest within the State University System.

EGMEX II '70

As EGMEX I neared completion, Dr. Cochrane (TAMU) felt that the preliminary results were scientifically interesting and operationally significant enough to warrant a follow-up study if practical. He contacted SUSIO to determine the acceptability and feasibility of having another interdisciplinary, multi-ship operation during June. He felt that the quasi-synoptic data resulting from the STD's and ART overflights on EGMEX type operations presented a unique opportunity to determine time changes in the boundary conditions of the Loop Current, i.e., north-south seasonal movement and east-west displacement. SUSIO, by quickly polling other participants, learned this represented the consensus and interest of all.

Four ships, the *Alaminos, Island Waters, Hernan Cortez* and *Gulfstream,* participated in the study. Because of the reduced number of ships, the coverage and synoptic survey of the collections are not as complete as in EGMEX I, even though the data were taken over a 14-day period. The common sampling programs were the same as those in EGMEX I except for the deletion of inorganic phosphate and ART overflight.

Because of the limited number of vessels, it was agreed that the *Alaminos* would cover the western portion of the Loop Current while the *Island Waters* covered the eastern, and the *Hernan Cortez* sampled the low temperature pocket near Cedar Key. Modifications were made to the biological sampling program whereby samples were taken at fixed locations on the *Alaminos* sections, but varied on the *Island Waters* according to the results of the STD lowerings.

Although all areas were sampled, there was a subsequent modification to the *Island Waters* sections due to delays caused by the flooding of the STD unit; this mishap resulted in biological-chemical sampling along each section run, with their geographic locations dependent on examination of the observed vertical temperature and salinity field. The actual vessel tracks are shown in Chart 4.

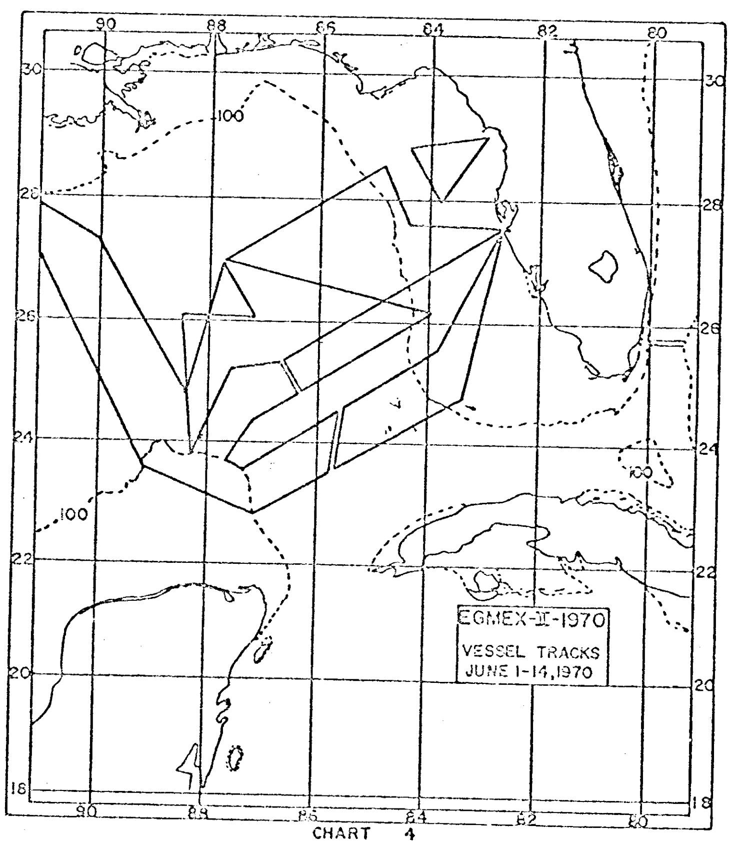


CHART 4

The results of EGMEX II are still under investigation. However, a rather detailed sampling of the unusual concentrations of foraminiferans described in EGMEX I by both optical and planktonic sampling has confirmed the concentration of shelf foraminiferans at 200 meters. This material is not mixing into the Loop Current. There is a similarity of the biological concentrations and the optical properties. This study has resulted in an accomplishment that SUSIO has continually fostered in the Loop Current investigations. Dr. Jones (biological indicators) and Dr. Carder (optical properties) have discovered that their work is complementary. The exchange of environmental information and proper sampling techniques have resulted in these two individuals realizing that to study this particular phenomenon it is beneficial, even essential, to coordinate their studies.

NMFS–TABL has agreed to sort all of the planktonic samples resulting from EGMEX II and III down to families.

The processing of the results of EGMEX II has been delayed because of a lack of adequate funds to reduce the data.

EGMEX III '70

Because of the successes of EGMEX I and II, NOAA-AOML requested a meeting of the participating scientists to determine if a multiple survey could be conducted during the period October-November 1970. This meeting was combined with the Physical Oceanographic Planning Section of CICAR. It was determined that a total of eight vessels was available for operation within the Loop Current area. Again, SUSIO was asked to coordinate the ship activities and assist in portions of the data reduction. At this meeting it was decided to repeat the sampling techniques and programs as conducted on EGMEX I and II with the following inclusions and deletions: (1) Deletion of the trace elements and insecticide program because of a lack of funds to reduce the data; (2) Inclusion of a joint inorganic phosphate program between the University of Miami and AOML; (3) Inclusion of a pre-EGMEX expendable BT and drogue measuring program by AOML to determine the location of the Loop Current in September; (4) The assumption by AOML of the reduction of the physical oceanographic data; and (5) The occupation of an inter-comparison ocean station at which simultaneous casts by the STD units and oceanographic station casts for temperature, salinity, oxygen and inorganic phosphate would be taken.

It was agreed that AOML would exchange with the participating vessels the results of their September XBT survey. On the basis of this survey the sampling program would be altered if necessary to coincide with the present location of the Loop Current.

EGMEX III was completed as planned, including the intercalibration stations between the *Alaminos, Discoverer, Island Waters,* and *Tursiops.* This operation has been completed such a short time that little or no results are forthcoming as yet. The processing of these collections is also limited by lack of funds to reduce certain of the physical, chemical and biological parameters.

Chart 5 shows the tracks of the vessels. The doubled lines are the sections on which plankton and oceanographic station casts were taken. The square is the location of the *inter-calibration* station. The dashed and dashed-dot lines represent the boundary of the Loop Current during September and October, based on the work of the R/V *Peirce* (October) and R/V *Island Waters* (October).

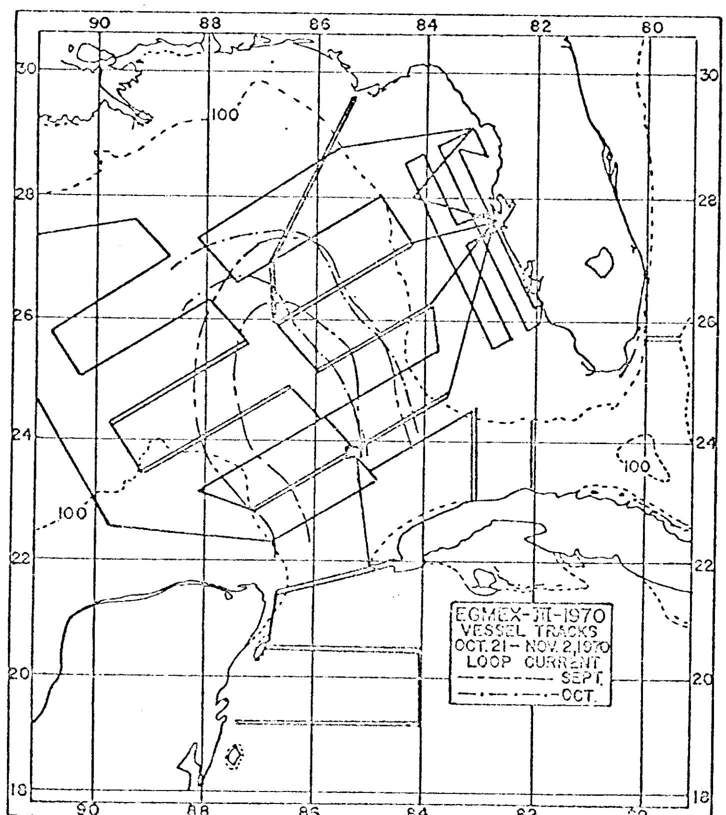


CHART 5

The importance of having a coordinating office whose principal purpose is to assist the scientists within the Gulf area has been adequately demonstrated by SUSIO during the planning and conduct of the EGMEX series. The removal of the major burdens of administrative and operational details from the participating scientists allows them to continue their productive work with minimal interruption.

Numbers of mutual gains have resulted from the EGMEX '70 series; some having been cited in preceding paragraphs. But to focus on the real importance of such studies to individual research scientists, let us use Dr. Jones, the initial instigator of the EGMEX operation, as an example.

Dr. Jones and his students now have data for geostrophic calculations having been collected with the required degree of accuracy of *in situ* measurements (each major vessel employed STD units); these are as near synoptic measurements as practical and can be used for inter-comparison with his biological indicators. In addition, he has received supplemental information that depicts the location and structure of the Loop Current derived from trace elements and optical clarity data.

An added feature of EGMEX is that arrangements have been established for loan of equipment between state and private universities, state and federal government agencies, and industries. And a liaison has been developed whereby data and samples are exchanged for individual uses in specialized projects of respective mission orientation.

It is significant to reiterate that:

The EGMEX operation was designed by the investigators and participants or both.

Most of the participants in the study had already planned to be in the EGMEX area for teaching or research purposes, consequently, with the added ingredient of coordination, an important and productive comprehensive study was molded from a broad cross section of disjunct projects, schedules, interests and needs.

The participating vessels, aircraft and personnel were funded from a variety of sources. However, the whole result of their efforts is much greater than the independent parts; the shared samples and data far exceeded what the individual projects could have yielded separately. As a consequence, each sponsor received substantially more than had been initially planned. For example, trace element samples were collected over the entire eastern Gulf area by the assistance of the other participants -- samples not limited to the cruise track of principal investigator.

Academic, industrial and state and federal organizations took active parts in the study; they shared costs, funding, personnel, equipment, samples and data.

The study involved teaching and research; the research represents both basic and applied.

The samples and data were reported to NODC, thus other potential users of these will become aware of their existence and availability through NAMDI and CICARDI.

The biological specimens collected during the numerous plankton tows are being shared by public universities, private universities, state and federal laboratories.

The biological collections have complementary-supplementary chemical and physical data taken at the same time and location; all data are available to all participants through appropriate data management.

The 8,000 drift bottles were supplied jointly by a state and a federal organization, and these were disbursed by the participants over a widespread area during a short time period; the results will be published as a co-authored report by scientists of the two organizations.

The physical data will be published in a co-authored report by scientists of Texas A & M University, Florida State University, University of Miami, and AOML.

Within the State University System alone, samples and data collected during the study are being used as major parts of at least eight master theses and doctoral dissertations.

The ships had interdisciplinary and multi-organizational scientific parties -- better understanding of one another's work, interests and problems is being fostered.

Substantial amounts of scientific equipment were furnished by participants to one another in order to provide each ship with adequate equipment suits -- truly a joint involvement.

Additional points could be reiterated, however, it is apparent that much good will continue to come out of EGMEX; scientists will work together; cooperative programs can be developed with proper coordination. Samples and data can and will be shared for multiple purposes.

CICAR-RELATED PORTIONS of the REPORT ON CALENDAR YEARS 1970 & 1971

STATE UNIVERSITY SYSTEM OF FLORIDA
COOPERATIVE OCEANOGRAPHIC TEACHING AND RESEARCH PROGRAM

Conducted by:

University of Florida
Florida State University
Florida A & M University
University of South Florida
Florida Atlantic University
University of West Florida
Florida Technological University

Coordinated through the

STATE UNIVERSITY SYSTEM

INSTITUTE OF OCEANOGRAPHY

(SUSIO)

OFFICE OF ACADEMIC AFFAIRS

CHANCELLOR'S OFFICE

STATE UNIVERSITY SYSTEM OF FLORIDA

Prepared
April, 1972

Robert E. Smith, Director
State University System of Florida
Institute of Oceanography
Bayboro Harbor
830 First Street South
St. Petersburg, Florida 33701

A. Study of the Loop Current Phenomenon of The Eastern Gulf of Mexico

As a result of the FY '70, '71 and '72 funding for implementation and continuation of the system's cooperative program, the university scientists have had an opportunity to organize and conduct a near synoptic study of the Loop Current phenomenon of the Eastern Gulf of Mexico (EGMEX). The operation was executed in May, 1970 and consisted of eight research vessels and an ART-equipped aircraft. In line with the stated goals of the system's cooperative program, EGMEX was developed as an interdisciplinary, interinstitutional, multi-agency working arrangement whereby state, private, and out-of-state universities participated, along with state and Federal Government agencies and industries.

Ships, equipment, samples and personnel were shared/used jointly. The resulting data and samples have been reported through the National Marine Data Inventory (NAMDI) and the Cooperative Investigation of the Caribbean and Adjacent Regions Data Inventory (CICARDI) in order to identify the resulting products to all prospective users. Sample NAMDI print-outs are presented as Appendix I. Samples of SUS Cruise plans and cruise reports are presented as Appendix J.

Based on the operational success and the scientific significance of the initial EGMEX study, a follow-up operation was recommended and EGMEX '70 II was planned and successfully conducted during June, 1970. The successful and equally scientifically significant EGMEX '70 I and II prompted the original and new participants to plan and to conduct EGMEX '70 III during late October and early November, 1970; likewise, EGMEX '71 IV took place in August, 1971, followed by EGMEX V in November, 1971. EGMEX VI is planned for May, 1972.

EGMEX has now been designated as the United States' first and one of its principle projects in CICAR. Mexico has designated its participation in EGMEX '70 III as its first CICAR project. The State University System, through SUSIO, is designated by the participants as the coordinator of the EGMEX series. The state universities through their EGMEX participation are receiving not only state and national recognition but international recognition also.

A summary of data and samples collected during the EGMEX operations is presented as Appendix K. A synopsis of uses and proposed uses of materials resulting from the study of the Loop Current phenomenon of the eastern Gulf of Mexico, as relates to EGMEX, is presented as Appendix L.

B. Study of the Continental Shelf of The Florida West Coast

Through joint working relationships, and mutual research interests, the faculty and students of the state universities have developed, with other participants of EGMEX, a similar type of multi-agency, interdisciplinary study to address the western Florida Continental Shelf. During May, 1971, a four ship operation was conducted in the subject area as an integrated cooperative investigation coordinated to complement/supplement the on-going Loop Current study.

The Shelf Program has been repeated on a quarterly basis since May, '71 and the fifth operation was conducted during February, 1972; Appendix M.

C. Study of the Nearshore and Estuaries of The Florida West Coast.

Based on the scientific merit of, and interests in, the EGMEX and Shelf programs, a number of state university scientists have commenced the development of a comprehensive, long-term study of the nearshore and estuarine environments of the Florida West Coast.

In December, 1970, SUSIO procured, by donation, a 65' self-propelled houseboat and has begun converting this vessel into a self-supporting mobile estuarine teaching and research laboratory. The vessel is being administered as an interinstitutional facility, used in support of the subject study.

The nearshore and estuarine program involves faculty and students from six state universities. The coastal areas being addressed extends from the Everglades northward to the Pensacola area. This particular program is most interesting in that it represents a joint effort among the universities, the Florida Department of Pollution Control (DPC), the Florida Coastal Coordinating Council (CCC), a number of Federal agencies, several regional planning councils and selected industries. In general, the universities are furnishing the scientists, DPC is furnishing selected goods and services, and CCC, the planning councils, and the industries are putting up operating capital. The data and resulting information from the study are being inventoried and are deposited in state and federal repositories whereby they can in turn be used for not only university type needs but for additional needs such as in support of planning, determining regulations and controls, and for the drafting of sensible and enforceable legislation.

A pilot study of the nearshore and estuarine program was conducted as Escarosa I during September, 1971. Three research vessels were operated simultaneously, transecting the nearshore area while smaller vessels were being operated within the adjacent estuaries. The collections were performed in a near-synoptic manner over a forty-eight hour period and all aspects of the operation have been documented. The analysis of the samples are, in most part, completed, and a formal report is in preparation.

VESSELS UTILIZED IN THE SUSIO PROGRAM

R/V TURSIOPS -- 65' LOA (converted "T" boat); used on cost-reimbursable basis, operated by Florida State University (FSU), Tallahassee, Florida

R/V GULFSTREAM -- 54' LOA (converted Chris Craft); chartered from Nova University, Fort Lauderdale, Florida

R/V BELLOWS -- 63' LOA (special design research vessel); chartered from Mr. L.F.R. Bellows, Tarpon Springs, Florida

M/V STAR QUEEN -- 85' LOA (commercial fishing boat); chartered from Capt. Davis, Panama City, Florida

R/V SEA URCHIN -- 35' LOA (converted pleasure cruiser); used on cost-reimbursable basis; operated by University of Florida (UF), Cedar Key, Florida

M/V SEA ROVER -- 36' LOA (self-propelled houseboat); obtained on no-cost loan from Sea Rover Houseboats, St. Petersburg, Florida

R/V JOIE DE VIVRE -- 50' (converted shrimpboat); chartered from Hydrospace Technical Institute (HTI) of the Florida Institute of Technology (FIT). Melbourne, Florida

R/V ISLAND WATERS -- 82' LOA (converted ocean-going pleasure cruiser); obtained on no-cost loan from National Youth Science Foundation (NYSF), South Orange, New Jersey.

R/V DAN BRAMAN -- 73' LOA (special design research vessel); chartered from Lerner Marine Laboratory, American Museum of Natural History, Bimini

R/V SUSIO -- 65' LOA (converted self-propelled houseboat); obtained on no-cost loan from Board of Regents Foundation

M/V HAPPY DOLPHIN -- 65' LOA (commercial fishing vessel); obtained on no-cost loan from Happy Dolphin Inn, St. Petersburg, Florida

R/V GULL -- 36' LOA (research and salvage vessel) chartered from NOVA University, Fort Lauderdale, Florida

"SHIPS OF OPPORTUNITY"

AGOR GILLIS -- (U.S. Naval Oceanographic Office)

R/V ALAMINOS -- (Texas A & M)

R/V PILLSBURY -- (University of Miami)

R/V OREGON II -- (National Marine Fisheries Service)

R/V RESEARCHER -- (National Oceanic and Atmospheric Administration)

USNS MIZAR -- (U.S. Naval Research Laboratory)

R/V GERDA -- (University of Miami)

Synopsis of Uses and Proposed Uses of Materials Resulting from the State University Systems Cooperative Oceanographic Teaching and Research Program

Data Management Services

Data and samples collected during the Systems operations are reported through the National Marine Data Inventory (NAMDI) and the Cooperative Investigation of the Caribbean and Adjacent Regions Data Inventory (CICARDI). The resulting products consequently can be identified, and print-outs of same can be obtained through the National Oceanographic Data Center (NODC) and World Data Center A (WDC A), Washington, D.C.

Dissertations and Theses Completed

Austin, H. M. The Characteristics and Relationships Between the Calculated Geostrophic Current Component and Selected Indicator Organisms in the Gulf of Mexico Loop Current System. June, 1971; Dissertation, 369 pages, Department of Oceanography, Florida State University, Tallahassee, Florida (Major Professor, Dr. James I. Jones).

Cruise, Jeanne The Planktonic Shrimp Genus Lucifer: Its Distribution and Use as an Indicator Organism in the Eastern Gulf of Mexico. August, 1971; Thesis, 185 pages, Department of Oceanography, Florida State University, Tallahassee, Florida (Major Professor, Dr. James I. Jones).

Schlemmer, Frederick C., III, Concentrations of Particulate Matter in the Eastern Gulf of Mexico: An Indicator of Surface Circulation Patterns. December, 1971; Thesis, 82 pages, Marine Science Institute, University of South Florida, Tampa, Florida (Major Professor, Dr. Kendall L. Carder).

Williams, Lorraine Kadar, Selected Planktonic Foraminifera as Biological Indicators of Hydrological Conditions in the Eastern Gulf of Mexico. December, 1971; Thesis, 154 pages, Department of Oceanography, Florida State University, Tallahassee, Florida (Major Professor, Dr. James I. Jones).

Publications and Papers Submitted for Publication

Austin, H. M. "The Florida Middle Ground." Marine Pollution Bulletin; Edinboro, Scotland, Vol. I, No. II, 1970, pp. 171-172.

Austin, H. M. "An Interdisciplinary Study of the Florida Middle Ground, A Model for Future Continental Shelf Exploration and Research; Annual Report 1970; The Department of Oceanography, Florida State University, Tallahassee, Florida.

(ustin, H. M. "Observations on the Ecology of Some Demersal Fishes on the Florida Middle Ground." To be re-submitted to the Fishery Bulletin.

Publications and Papers Submitted for Publication---contd.

Austin, H. M., "Contouring Zooplankton as a Function of Temperature and Salinity." To be submitted to the Journal du Conseil Int. pour L'exploration de la Mer. March 1, 1972.

Austin, H. M. "Overlay Contouring, a Method to Reduce Subjectivity in Biological Data Presentation." To be submitted March, 1972 (title provisional)

Austin, H. M. "Notes on Distribution of Phyllosoma of the Spiney Lobster Panulirus argus in the Gulf of Mexico." Accepted for publication in the Proceedings of the National Shellfisheries Association.

Austin, H. M. and James I. Jones, "Seasonal Variations in the Bulk Plankton and its Relations to the Water Masses of the Florida Middle Ground." To be re-submitted to Limnology and Oceanography.

Cochrane, John Separation of an Anticyclonic and Subsequent Development in the Gulf of Mexico Loop Current from May to September, 1969. Manuscript being reviewed by Dr. Walter Ewing; prepared for submission to Texas A & M University Oceanographic Studies Series. (In the paper Dr. Cochrane makes comparison of the 1969 data with EGMEX '70 data)

Corcoran, E. F. Distribution of Mercury in the Mississippi River Delta and Eastern Gulf of Mexico. Paper in manuscript form.

Glooschenko, Walter, "The Diel Variations in Chlorophyll on the Florida Middle Ground." Jour. Florida Academy of Science.

Reports

"Coastal Zone Management in Florida - 1971; A Status Report to the Governor, the Cabinet and the 1972 Legislature." Presented by the Florida Coastal Coordinating Council, December, 1971. Available through Florida Coastal Coordinating Council, Larson Building, Tallahassee, Florida 32304.

"Western Florida Continental Shelf Program." Prepared by the State University System of Florida Institute of Oceanography on behalf of the University of Miami, National Marine Fisheries Service, Atlantic Oceanographic and Meteorological Laboratory, University of West Florida, Florida State University, University of Florida.

Papers Presented

Allen, H. B. "Game Fish Exploration Off St. Petersburg, Florida." Paper given at Outdoor Writers Association of America Conference, June 23, 1971; Pensacola, Florida.

Austin, H. M. "The Use of Biological Indicators in the Gulf Loop Current During EGMEX '70 I." Presented at Symposium for EGMEX Participants, sponsored by State University System Institute of Oceanography, June, 1971; St. Petersburg, Florida

Austin, H. M. and J. Cruise, "Biological Indicators as a Means of Identifying the West Florida Estuarine Gyre." Accepted for presentation at the 35th Annual Meeting of the American Society of Limnology and Oceanography, March 19-22, 1972; Tallahassee, Florida.

Corcoran, E. F. "Pesticide Distribution in the Mississippi River Delta and Eastern Gulf of Mexico." Paper given at American Chemical Society Meeting, December 4, 1970; New Orleans, Louisiana.

Corcoran, E. F. "Distribution of Trace Metals in the Mississippi River Delta and Eastern Gulf of Mexico." Paper invited to be presented in March 31 - April 3, 1971 American Chemical Society Meeting; Puerto Rico.

Hebard, Frank and William Richards, "NOAA-National Marine Fisheries Service, Tropical Atlantic Biological Laboratory's Contributions to the EGMEX Program." Report presented at the Marine Resources Monitoring and Assessment Program (MARMAP) Workshop, October, 1970; Woods Hole NMFS Laboratory, Woods Hole, Massachusetts.

Hebard, Frank "NOAA-National Marine Fisheries Service, Tropical Atlantic Biological Laboratory's Contributions to the EGMEX Program." Emphasis: Oceanography. Report presented at the Marine Resources Monitoring and Assessment Program (MARMAP) Workshop, January, 1971; NMFS Office, Monterey, California.

Jones, James I. and Herbert Austin, "The State University System Middle Ground Environmental Survey." Presented March, 1970; Florida Academy of Sciences Annual Meeting; Jacksonville, Florida.

Mattlin, Robert H., Jr., "Chaetognaths as Bioindicators in the Gulf of Mexico." Presented at the Florida Academy of Sciences Meeting, April 6, 7, 8, 1972 at Rollins College, Winter Park, Florida.

Richards, William "NOAA-National Marine Fisheries Service, Tropical Atlantic Biological Laboratory's Contributions to the EGMEX Program." Emphasis: Ichthyoplankton. Report presented at the Marine Resources Monitoring and Assessment Program (MARMAP) Workshop, January, 1971; NMFS Office, Monterey, California.

Rinkel, M. O. "Results of Cooperative Investigations--A Pilot Study of the Eastern Gulf of Mexico." Paper presented at the 23rd Annual Meeting, Gulf and Caribbean Fisheries Institute; November 10, 1970; Curacao, Netherlands Antilles.

Schlemmer, F. C. and Kendall L. Carder, "Particles as Indicators of Circulation in the Eastern Gulf of Mexico. In vitro." Submitted to section on Oceanography of AGU for 53rd Annual (Washington) Meeting.

Papers in Preparation or Proposed to be Written

Abele, L. "A New Species of Decapod from the Florida Middle Ground."

Brucks, John and Jean Williams, Mr. Brucks and Mrs. Williams are in the process of receiving, recording, and analyzing the drift bottle reports resulting from the approximately eight thousand bottles disseminated as part of the EGMEX I and II operations; a co-authored paper is to be published on the results of same. (It is tentatively proposed to be submitted to the Bulletin of Marine Science).

Cochrane, John Paper proposed; "Geostrophic Description of the Loop Current of the Eastern Gulf of Mexico (EGMEX '70).

Cruise, Jeanne Paper being written using parts of her thesis work, "The Planktonic Shrimp *Lucifer*: Its Distribution and Use as an Indicator Organism in the Eastern Gulf of Mexico," proposed to be submitted to the Bulletin of Marine Science.

Finucane, John H. "Eggs and Larvae of the Fishes of Tampa Bay and Adjacent Gulf Coastal Waters."

Hebard, Frank and Joseph Deaver. Co-authored paper proposed presenting results of the three sets (nine days total) of ART USCG overflights in support of the EGMEX '70 I operation.

Houde, Edw. D. Manuscript titled "Guide to Identifying Eggs and Larvae of Clupeid Fishes in the Eastern Gulf of Mexico."

Humm, Harold and J. Dyer, "A Study of the Benthic Algae on the Florida Middle Ground."

Maul, George Comparisons of ART Satellite data are being made with USCG ART overflight and with sea surface temperatures collected from research vessels associated with EGMEX '70 and '71. An appropriate publication is to be forthcoming.

STATE UNIVERSITY SYSTEM INSTITUTE OF OCEANOGRAPHY

DEPARTMENT OF BIOLOGY, UNIVERSITY OF WEST FLORIDA

CRUISE REPORT

Houseboat "Queen Margaret" SUS 7101 A-C

21-25 February 1971

I. OBJECTIVES

A. Take vertical profiles of 45 pre-selected stations in Escambia Bay, Florida; parameters to include Temperature, Salinity, Dissolved Oxygen, pH, and Turbidity.

B. Evaluate POMDAC equipment under "real time" conditions.

C. Evaluate the houseboat "Queen Margaret" under "real time" conditions.

II. PERSONNEL

Hopkins, T. S.	Chief Scientist, UWF
Adams, K.	UWF Scientific Party
Barrineau, K.	UWF Scientific Party
Smith, R. E.	SUSIO, observer (Feb. 21 only)
Brainard, M.	POMDAC Representative
Symes, J.	FDAWPC, observer (Feb. 21 only)
Brown, W. R.	FDAWPC, observer (Feb. 21 only)
Waterman, J.	POMDAC technician (Feb. 21 only)
Bicker, G.	Undergraduate UWF, Feb. 23 & 25
Deaver, J.	Undergraduate UWF, Feb. 23 (only)
Etheridge, J.	Undergraduate UWF, Feb. 23 (only)
Flannagan, D.	Undergraduate UWF, Feb. 23 (only)
Stimmel, W.	Undergraduate UWF, Feb. 23 (only)

III. SCHEDULE

Time	Date	Activity
0830 CST	21 Feb. 71	Depart Runyan's, Bayou Chico
1045 CST	"	Arrive on Station
1230 CST	"	Begin Data Collection at Station 041
1830 CST	"	Secure at Anchor in Mulatto Bayou; Tornado watch
0630 CST	22 Feb. 71	Depart for Runyan's for Electrical Repair
1300 CST	"	Secure at Runyan's on Bayou Chico
1100 CST	23 Feb. 71	Depart Runyan's on Bayou Chico
1320 CST	"	Arrive Escambia River Mouth
1340 CST	"	Begin Data Collection at Station 041
0400 CST	24 Feb. 71	Secure at Anchor in Sullivan's Ditch, Escambia River
0810 CST	25 Feb. 71	Begin Data Collection at Station 041
1734 CST	"	Last Station, 142, Secure; Heading for Runyan's
2000 CST	"	Secure at Anchor Runyan's Boatworks,

DEPARTMENT OF ZOOLOGY

University of Florida

R/V SUSIO SUS-7103

CRUISE REPORT

April 17, 18, 1971

I. Objectives

A. To instruct graduate students in an advanced invertebrate zoology course in oceanographic data acquisition and processing techniques.

B. To provide students with practical experience in oceanographic techniques.

II. Schedule

TIME EST	DATE	ACTIVITY
0930	April 17	Arrive at Cedar Key; depart for Seahorse Key in University of Florida boat, URCHIN.
1035		Introduction of short course staff in University of Florida Marine Laboratory. Staff wcs Robert E. Smith and Murice O. Rinkel from the State University System of Florida Institute of Oceanography and James I. Jones, Department of Oceanography, Florida State University. Rinkel began program with a brief review of the history of oceanography.
1055		Smith described SUSIO program and objectives.
1130		Rinkel described the 1971 EGMEX program.
1140		Jones described briefly his work with bioindicators and presented examples demonstrating that organisms are more sensitive for certain parameters than instruments and offered new ways of describing and defining water masses.
1200		Rinkel began introduction of the reversing thermometer.
1230		Party went on board R/V SUSIO for remainder of cruise. All hands had lunch as vessel went from Seahorse Key for refueling.
1410		Departed Cedar Key for main ship channel south of Seahorse Key. Rinkel continued discussion of the reversing thermometer. This was followed by a demonstration of the Niskin bottle and cast loading technique with all students taking turns.
1730		Break for dinner. Return to and docking at Cedar Key.
1930		Slide talks by Jones and Rinkel. Rinkel and Smith described the R/V DAN BRAMAN which the class will utilize for a cruise April 23-25. Jones presented an illustrated talk on oceanographic vessels, cruises, and underwater coral reef studies.

STATE UNIVERSITY SYSTEM OF FLORIDA INSTITUTE OF OCEANOGRAPHY
FLORIDA STATE UNIVERSITY
UNIVERSITY OF WEST FLORIDA

CRUISE REPORT

SUS-7114 R/V TURSIOPS (T-7114)

FLORIDA CONTINENTAL SHELF PROGRAM

May 7-15, 1971

I. Objectives

As part of a cooperative interdisciplinary investigation of the Florida Continental Shelf by NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research projects were studied:

A. To determine the seasonal distribution and abundance of eggs and larvae of commercial fishes. (University of Miami & TABL-NMFS-NOAA)

B. A seasonal synoptic survey of the physical oceanographic parameters. (TABL-NMFS-SUSIO & University of Miami)

C. To determine the distribution and concentration of IPO_4, SiO_3, NO_2, and NO_3, and relate them to the water masses characteristics of the Loop Current and Caribbean waters. (AOML-NOAA)

D. To collect data to conduct model verification on numerical and experimental models of circulation on the continental shelf in the northeastern Gulf of Mexico. (Florida State University)

E. To evaluate the distribution and abundance of pelagic isopod crustacions in relation to the Loop Current. (Univ. of West Florida)

F. To develop effective methodology for utilization of the Neuston Net. (Univ. of West Florida)

G. To collect demersal fishes and macroinvertebrates for studies of their seasonal and areal distributions and abundances. (Fla. State University)

H. To train graduate students for Florida State and Univ. of West Florida.

II. Actual Schedule

DATE May	TIME GMT	ACTIVITY
7	1400	Departed Turkey Point
	1750	Started Section AB
8	0642	Completed Section AB, enroute to Section CD
	0825	Started Section CD
	2006	Completed Section CD, enroute to Section EF
	2145	Started Section EF
9	1025	
	1747	Anchored
	1814	Completed Section EF, enroute to Section GH

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NATIONAL MARINE FISHERIES SERVICE

CRUISE REPORT

R/V DAN BRAMAN SUS-7113

WESTERN FLORIDA CONTINENTAL SHELF PROGRAM

MAY 7-18, 1971

I. Objectives - As part of a cooperative interdisciplinary investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida and the State University System of Florida Institute of Oceanography, the following research projects were studied:

A. To determine the seasonal distribution and abundance of eggs and larvae of commercial fishes. (University of Miami, TABL-NMFS (NOAA))

B. A seasonal synoptic survey of the physical oceanographic parameters. (TABL-NMFS, SUSIO & University of Miami)

C. To determine the distribution and concentration of IPO_4, SiO_3, NO_2, and NO_3 and relate them to the water masses characteristics of the Loop Current and Caribbean waters. (AOML (NOAA))

D. To collect data to conduct model verification on numerical and experimental models of circulation on the continental shelf in the northeastern Gulf of Mexico. (Florida State University)

E. To determine the areal geology and substratum types of the slope and inner continental shelf of peninsular Florida. (University of Florida)

F. To take bottom pictures and sediment samples on the continental shelf. (University of Florida)

G. To determine the engineering properties of the sediments. (University of Florida)

H. To collect pelagic fish eggs and larvae to determine seasonal distribution, density, and speciation of sport and commercial finfish that spawn or occur in the coastal waters adjacent to Tampa Bay. (St. Petersburg NMFS (NOAA))

I. To collect and bring back to the laboratory living material to rear some fish species through metamorphosis to help make positive identification of eggs and larvae. (St. Petersburg Beach NMFS)

J. To make comparison tows using Bongo nets to determine catch efficiency between different collecting techniques.

UNIVERSITY OF SOUTH FLORIDA
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CRUISE REPORT

SUS-7113 R/V DAN BRAMAN (DB-7108)

EGMEX IV

July 25-August 1, 1971

I. Objectives

As part of a cooperative interdisciplinary investigation of the Loop Current in the Eastern Gulf of Mexico (EGMEX), to continue a deep-sea food chain study at a standard station. This study involves around-the-clock collection of micronekton and plankton, often using two trawls simultaneously at various depths to 1000 m.

II. Actual Schedule

DATE July	TIME GMT	ACTIVITY
25	0500	Departed Bayboro Harbor, enroute to Standard Station at 27°N, 86°W.
27	0200	Arrived at standard station, started trawling operation
31	1310	Departed station, enroute to St. Petersburg
Aug. 1	1300	Arrived at Bayboro Harbor, St. Petersburg

III. Station Positions

All trawling activities are within 15 miles of 27°N, 86°W.

STA. NO.	DATE July	TIME GMT	TRAWLING DEPTH (Meters)	TRAWL SIZE	TRAWL SUCCESS
039	26	0323	70	1.8x1.8	-
040	26	0430	70	1.8x3.7	-
041	26	0545	40	1.8x1.8	+
042	26	0612	35	1.8x3.7	+
043	26	1500	730	1.8x3.7	+
044	26	1914	350-500	1.8x3.7	+
046	27	0203	145	1.8x1.8	+
045	27	0223	120	1.8x3.7	+
047	27	0520	75	1.8x1.8	+
048	27	0535	80	1.8x3.7	+

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NATIONAL MARINE FISHERIES SERVICE

CRUISE REPORT

R/V TURSIOPS SUS-7121

EGMEX IV

WESTERN FLORIDA CONTINENTAL SHELF PROGRAM

August 7-25, 1971

I. Objectives

A. As part of a cooperative interdisciplinary investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research projects will be studied:

1. To determine the seasonal distribution and abundance of eggs and larvae of commercial fishes. (University of Miami, NOAA (NMFS-TABL)).

2. A seasonal synoptic survey of the physical oceanographic parameters. (NOAA (NMFS-TABL), SUSIO & the University of Miami).

3. To determine the distribution and concentration of IPO_4, SiO_3, NO_2, and NO_3, and relate them to the water masses characteristics of the Loop Current and Caribbean waters. (NOAA (AOML)).

4. To collect data to conduct model verification on numerical and experimental models of circulation on the continental shelf in the northeastern Gulf of Mexico. (Florida State University)

5. To determine the areal geology and substratum types of the slope and inner continental shelf of peninsular Florida. (University of Florida).

6. To take bottom pictures and sediment samples on the continental shelf. (University of Florida)

7. To determine the engineering properties of the sediments. (University of Florida)

B. To conduct a cooperative investigation of the Loop Current in the Eastern Gulf of Mexico (EGMEX IV).

1. To conduct a survey of the density field of the Gulf of Mexico (NOAA (NMFS-TABL), NOAA (AOML), University of Miami, and Florida State University)

2. To relate to the density structure of the loop current as defined by 1 above the following:

a. Biological indicators - Florida State University
b. Drift bottle releases - NOAA (NMFS-TABL)

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CRUISE REPORT

SUS-7120 R/V DAN BRAMAN (DB-7109)

EGMEX IV

WESTERN FLORIDA CONTINENTAL SHELF PROGRAM

August 9-23, 1971

I. Objectives

A. As part of a cooperative interdisciplinary investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research projects were undertaken:

1. The seasonal distribution and abundance of eggs and larvae of commercial fishes. (University of Miami, NOAA (NMFS-TABL)).

2. A seasonal synoptic survey of the physical oceanographic parameters. (NOAA (NMFS-TABL), SUSIO, & University of Miami).

3. The distribution and concentration of IPO_4, SiO_3, NO_2, and NO_3, in relation to the water masses characteristics of the Loop Current and Caribbean waters. (NOAA(AOML))

4. Collection of data to conduct model verification on numerical and experimental models of circulation on the Continental Shelf in the northeastern Gulf of Mexico. (Florida State University)

5. Collection of pelagic fish eggs and larvae to determine seasonal distribution, density, and speciation of sport and commercial finfish that spawn or occur in the coastal waters adjacent to Tampa Bay. (NOAA (NMFS) St. Petersburg Beach)

6. Collection and transport to the laboratory of living material to rear some fish species through metamorphosis to help make positive identification of eggs and larvae. (NOAA (NMFS) St. Petersburg Beach)

STATE UNIVERSITY SYSTEM OF FLORIDA INSTITUTE OF OCEANOGRAPHY SUSIO
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UNIVERSITY OF WEST FLORIDA 137.
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NATIONAL MARINE FISHERIES SERVICE

CRUISE PLAN

R/V DAN BRAMAN SUS-7120

EGMEX IV

WESTERN FLORIDA CONTINENTAL SHELF PROGRAM

August 9 - 24, 1971

I. Objectives

A. As part of a cooperative interdisciplinary investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research projects will be studied:

1. To determine the seasonal distribution and abundance of eggs and larvae of commercial fishes. (University of Miami, NOAA (NMFS-TABL)).

2. A seasonal synoptic survey of the physical oceanographic parameters. (NOAA (NMFS-TABL), SUSIO & University of Miami)

3. To determine the distribution and concentration of IPO_4, SiO_3, NO_2. and NO_3, and relate them to the water masses characteristics of the Loop Current and Caribbean waters. (NOAA (AOML)).

4. To collect data to conduct model verification on numerical and experimental models of circulation on the continental shelf in the northeastern Gulf of Mexico. (Florida State University).

5. To collect pelagic fish eggs and larvae to determine seasonal distribution, density, and speciation of sport and commercial finfish that spawn or occur in the coastal waters adjacent to Tampa Bay. (NOAA (NMFS) - St. Petersburg).

6. To collect and bring back to the laboratory living material to rear some fish species through metamorphosis to help make positive identification of eggs and larvae. (NOAA (NMFS)-St. Petersburg).

SUSIO

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U. S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE
SOUTH EAST FISHERY CENTER
FLORIDA STATE UNIVERSITY
UNIVERSITY OF WEST FLORIDA
STATE UNIVERSITY SYSTEM OF FLORIDA INSTITUTE OF OCEANOGRAPHY
TEXAS A & M UNIVERSITY

CRUISE REPORT

SUS-7123 R/V OREGON II (O-7129)

EGMEX IV

August 9-29, 1971

I. Objectives

A. To collect environmental and biological samples within the EGMEX IV and MARMAP programs.

B. To contribute to the continuing cooperative, interdisciplinary investigations of NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida, and SUSIO, of the Eastern Gulf of Mexico Loop Current.

C. To relate planktonic biological indicators collected with opening-closing nets to the density structure of the Gulf of Mexico Loop Current. (FSU)

D. To train graduate students at FSU and the University of West Florida in at-sea operations.

II. Actual Schedule

DATE August	TIME (GMT)	ACTIVITY
9	1800	Departed Pascagoula.
13	1300	Arrived Galveston. Attempted STD repair.
14	1200	Departed Galveston with reversing thermometers.
21	2300	Arrived Port Isabel.
22	1100	Departed Port Isabel with more reversing thermometers.
28	1200	Arrived Bayboro Harbor, St. Petersburg, Fla.

Cruise Track

SUSIO
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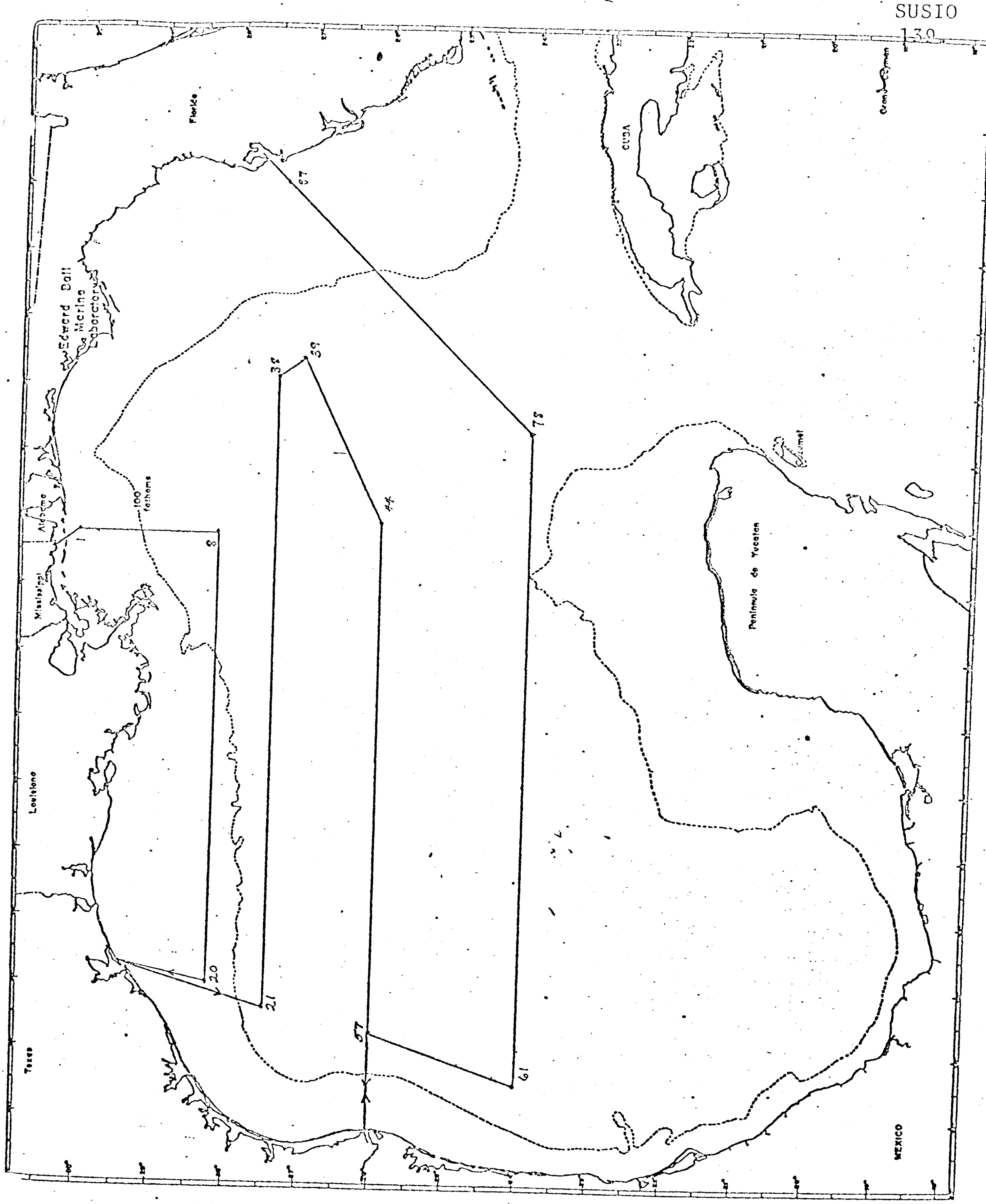

SUSIO 140.

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NATIONAL MARINE FISHERIES SERVICE

CRUISE REPORT

R/V BELLOWS SUS-7122A

EGMEX IV

WESTERN FLORIDA CONTINENTAL SHELF PROGRAM

August 20-27, 1971

I. Objectives

A. As part of a cooperative interdisciplinary investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research projects will be studied:

1. To determine the seasonal distribution and abundance of eggs and larvae of commercial fishes. (University of Miami, NOAA (NMFS-TABL))

2. A seasonal synoptic survey of the physical oceanographic parameters. (NOAA(NMFS-TABL), SUSIO & University of Miami)

3. To determine the distribution and concentration of IPO_4, SiO_3, NO_2, and NO_3, and relate them to the water masses characteristics of the Loop Current and Caribbean waters. (NOAA(AOML))

4. To collect data to conduct model verification on numerical and experimental models of circulation on the continental shelf in the northeastern Gulf of Mexico. (Florida State University)

B. To conduct a cooperative investigation of the Loop Current in the Eastern Gulf of Mexico. (EGMEX IV)

1. To conduct a survey of the density field of the Gulf of Mexico. (NOAA(NMFS-TABL), NOAA(AOML), University of Miami, and Florida State University)

2. To relate to the density structure of the loop current as defined by 1 above the following:

a. Biological indicators (Florida State University)

b. Drift bottle releases (NOAA(NMFS-TABL))

c. Light scattering measurements were taken along the boundaries of the Loop Current to establish whether a horizontal particle gradient exists and can be used to define the perimeter of the current.

UNIVERSITY OF WEST FLORIDA
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CRUISE REPORT

SUS-7124 R/V DAN BRAMAN (DB-7110)

EGMEX IV

WESTERN FLORIDA CONTINENTAL SHELF PROGRAM

AUGUST 25-29, 1971

I. Objectives

A. To conduct a cooperative investigation of the Loop Current in the eastern Gulf of Mexico to be called EGMEX IV.

1. Determine seasonal distribution and abundance of biological indicators during daylight hours. (Bongo Nets)
2. Determine seasonal distribution and abundance of biological indicators during night hours. (Bongo and Neuston Frame Nets)
3. Determine the seasonal distribution of temperature. (BT)

B. As part of a cooperative interdisciplinary investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research project will be studied: - determine the seasonal distribution of eggs and larvae of commercial fishes. (NOAA(NMFS-South East Fishery Center), University of Miami)

C. To train undergraduate and graduate students for the University of West Florida.

II. Actual Schedule

DATE Aug.	TIME GMT	ACTIVITY
25	1205	Departed Bayboro Harbor, St. Petersburg, Florida.
	1605	Started Section AB
27	2301	Completed Section AB, enroute to Section CD.
28	0153	Started Section CD
29	0325	Completed Section CD
	1245	Arrived at Pensacola, Florida

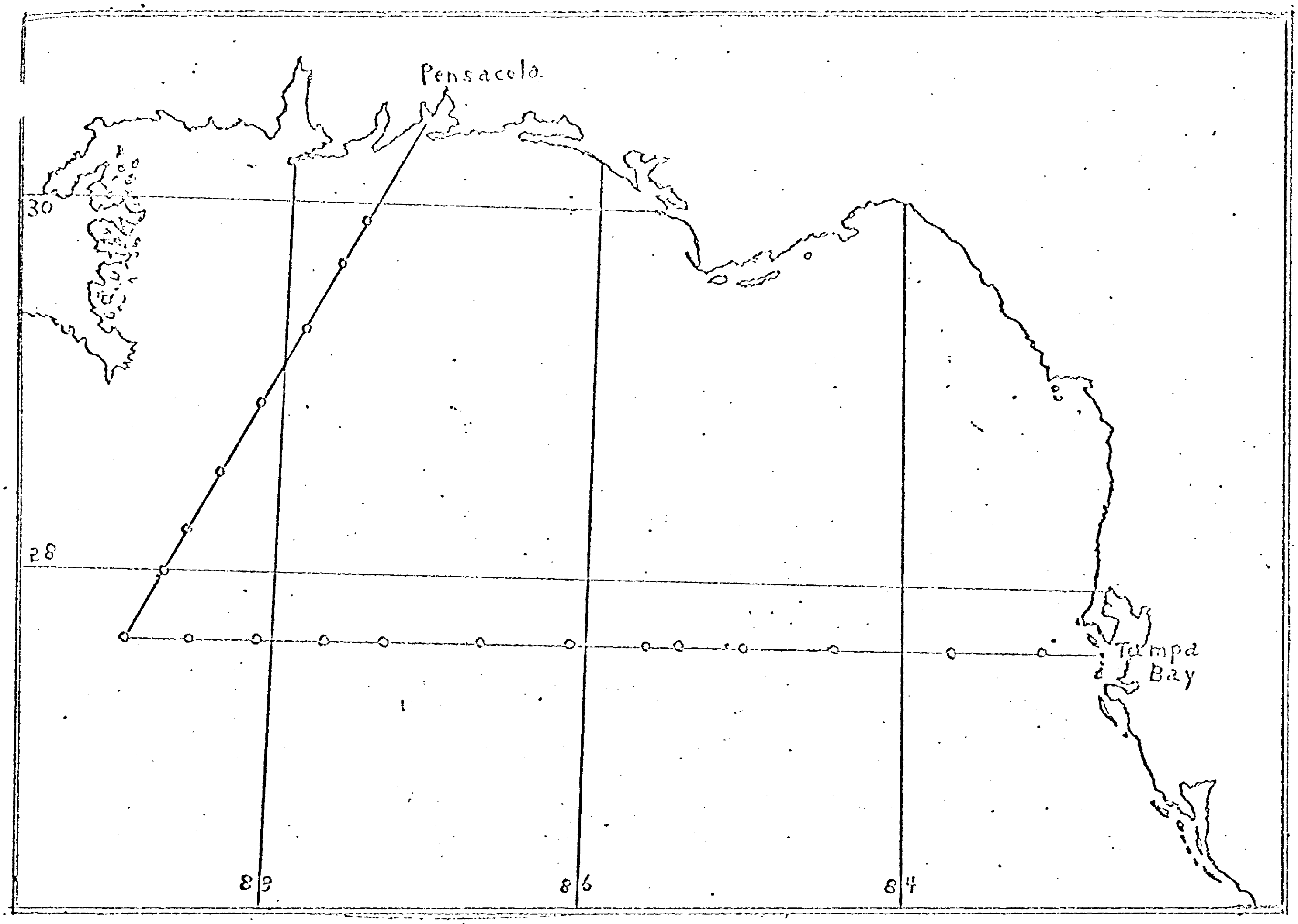

Figure 1. Cruise Track UWF - 1 (SUS - 7124)

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ATLANTIC OCEANOGRAPHIC AND METEOROLOGICAL LABORATORIES

CRUISE REPORT

SUS-7122B R/V BELLOWS (B-7104B)

EGMEX IV

August 28 - September 2, 1971

I. Objectives - As part of a cooperative interdisciplinary investigation of the Eastern Gulf of Mexico by NOAA, University of West Florida, Florida State University, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research and teaching projects were studied:

A. To determine the geostrophic velocity field of the Gulf Stream normal to the direct current measurements (Drogue tracking by R/V RESEARCHER) through study of XBT and STD sections. (NOAA(AOML)-FSU)

B. To support an ongoing project of remote sensing of the Gulf Stream front through light scattering measurements. (NOAA(AOML))

C. To relate the density structure of the "Loop Current" and the "Florida Current" to planktonic biological indicators. (FSU)

D. To determine dissolved organic carbon, particulate organic carbon, and inorganic carbon contents of the Florida Current as part of the study of their distribution and concentration as relate to the density structure of the Loop Current - Florida Current. (FSU)

E. To make direct current measurements of ship drift within the Florida Current by Loran readings. (NOAA(AOML) - FSU)

F. To train graduate students for Florida State University and the University of West Florida.

II. Actual Schedule

DATE	TIME GMT	ACTIVITY
Aug. 29	0115	Departed Bayboro Harbor, St. Petersburg, Fla.
30	0225	Docked at Ft. Jefferson, Dry Tortugas because of weather.
	1330	Departed Ft. Jefferson enroute to Section AB.
	1445	Started Section AB.
Sept. 1	0535	Completed Section AB, Started XBT Section CD.
	1152	Completed XBT enroute to St. Petersburg.
Sept. 2	1310	Arrived St. Petersburg, Florida.

ESCAROSA I

STATE UNIVERSITY SYSTEM OF FLORIDA INSTITUTE OF OCEANOGRAPHY
UNIVERSITY OF WEST FLORIDA
FLORIDA COASTAL COORDINATING COUNCIL
FLORIDA STATE UNIVERSITY

CRUISE REPORT

R/V TURSIOPS SUS-7126

September 13-16, 1971

I. Objectives

A. As a part of a cooperative interdisciplinary investigation of the Florida Territorial Sea Off Escarosa (from MHW to nine nautical miles offshore and from 86.48°W. to 88.00° W. Long.), by the University of West Florida, Florida State University, University of Florida, University of South Florida, University of Miami, NOAA, the Florida Coastal Coordinating Council of the Department of Natural Resources, the Florida Air and Water Pollution Control, EPA Pesticides Laboratory, Gulf Breeze, and the State University System of Florida Institute of Oceanography, the following research projects were studied:

1. To determine the distribution and concentration of the physical oceanographic parameters of temperatures, salinity, and oxygen. (NOAA(NMFS-TABL) & SUSIO)

2. To determine the distribution and concentration of the chemical parameters of IPO_4, SiO_3, NO3, and NO_2. (NOAA(AOML))

3. To determine the distribution and concentration of trace elements and pesticides. (U of Miami)

4. To conduct intercalibration comparisons of a number of different analytical methods for trace elements and pesticides from the water column and sediments. (U of Miami, FSU, Philco Electronics, Inc., Air and Water Pollution Control, and EPA Labs.)

5. To collect sediment samples for analyzation to determine minerology of the clay fractions, grain sizes, and other sedimentological determinations. (UF)

B. To interject data from item A above into the ongoing EGMEX and Western Florida Continental Shelf Programs. (SUSIO, NOAA(AOML) & NMFS-TABL)

C. To interject into existing MARMAP, EGMEX, and Western Florida Continental Shelf Program data, "The Study of Trace Elements and Pesticides of the Florida Territorial Sea Off of Escarosa."

ESCAROSA I

STATE UNIVERSITY SYSTEM OF FLORIDA INSTITUTE OF OCEANOGRAPHY
UNIVERSITY OF WEST FLORIDA
UNIVERSITY OF MIAMI

CRUISE REPORT

R/V BELLOWS SUS-7127

September 14-16, 1971

I. Objectives

A. As a part of a cooperative interdisciplinary investigation of the Florida Territorial Sea Off Escarosa (from MHW to nine nautical miles offshore and from 86.48°W to 88.00 W Long.), by the University of West Florida, Florida State University, University of Florida, University of South Florida, University of Miami, NOAA, the Florida Coastal Coordinating Council of the Department of Natural Resources, the Florida Air and Water Pollution Control, EPA Pesticides Lab., Gulf Breeze, and the State University System of Florida Institute of Oceanography, the following research projects were studied:

1. To determine the distribution and concentration of the physical oceanographic parameters of temperatures, salinity, and oxygen. (NOAA(NMFS-TABL) & SUSIO)

2. To determine the distribution and concentration of the chemical parameters of IPO_4, SiO_3, NO_3, and NO_2. (NOAA(AOML))

3. To determine the distribution and concentration of trace elements and pesticides. (U of Miami)

4. To conduct intercalibration comparisons of a number of different analytical methods for trace elements and pesticides from the water column and sediments. (U of Miami, FSU, Philco Electronics, Inc., Air and Water Pollution Control, and EPA Labs)

5. To collect sediment samples for analyzation to determine minerology of the clay fractions, grain sizes, and other sedimentological determinations. (UF)

B. To interject data from item A above into the ongoing EGMEX and Western Florida Continental Shelf Programs. (SUSIO, NOAA(AOML), & NMFS-TABL)

C. To interject into existing MARMAP, EGMEX, and Western Florida Continental Shelf Program data, "The Study of Trace Elements and Pesticides of the Florida Territorial Sea Off of Escarosa."

UNIVERSITY OF WEST FLORIDA
UNIVERSITY OF FLORIDA
FLORIDA COASTAL COORDINATING COUNCIL

CRUISE PLAN

R/V DAN BRAMAN SUS-7125

September 14 - September 16, 1971

I. Objectives

A. As a part of a cooperative interdisciplinary investigation of the Florida Territorial Sea Off Escarosa (from MHW to nine nautical miles offshore and from 86.48°W to 88.00° W. Long.), by the University of West Florida, Florida State University, University of Florida, University of South Florida, University of Miami, NOAA, the Florida Coastal Coordinating Council of the Department of Natural Resources, the Florida Air and Water Pollution Control, EPA Pesticides Lab., Gulf Breeze, and the State University System of Florida Institute of Oceanography, the following research projects will be studied:

1. To determine the distribution and concentration of the physical oceanographic parameters of temperatures salinity, and oxygen. (NOAA(NMFS-TABL) & SUSIO)

2. To determine the distribution and concentration of the chemical parameters of IPO_4, SiO_3, NO_3, and NO_2. (NOAA(ACML))

3. To determine the distribution and concentration of trace elements and pesticides. (U of Miami)

4. To conduct intercalibration comparisons of a number of different analytical methods for trace elements and pesticides from the water column and sediments. (U of Miami, FSU, Philco Electronics, Inc., Air and Water Pollution Control, and EPA Labs.)

5. To collect sediment samples for analyzation to determine minerology of the clay fractions, grain sizes, and other sedimentological determinations. (UF)

B. To interject data from item A above into the ongoing EGMEX and Western Florida Continental Shelf Programs. (SUSIO, NOAA(ACML) & NMFS-TABL)

C. To interject into existing MARMAP, EGMEX, and Western Florida Continental Shelf Program data, "The Study of Trace Elements and Pesticides of the Florida Territorial Sea Off of Escarosa."

STATE UNIVERSITY SYSTEM OF FLORIDA INSTITUTE OF OCEANOGRAPHY
FLORIDA STATE UNIVERSITY
UNIVERSITY OF WEST FLORIDA
NATIONAL MARINE FISHERIES SERVICE

CRUISE REPORT

SUS-7132 A&B R/V BELLOWS (B-7106)

EGMEX V

WESTERN FLORIDA CONTINENTAL SHELF PROGRAM

November 6-16, 1971

I. Objectives

A. As part of a cooperative interdisciplinary investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, the following research projects were studied:

1. To determine the seasonal distribution and abundance of eggs and larvae of commercial fishes. (University of Miami, NOAA (NMFS-TABL)).

2. A seasonal synoptic survey of the physical oceanographic parameters. (NOAA (NMFS-TABL), SUSIO & University of Miami)

3. To collect data to conduct model verification on numerical and experimental models of circulation on the continental shelf in the northeastern Gulf of Mexico. (Florida State University)

4. To collect pelagic fish eggs and larvae to determine seasonal distribution, density, and speciation of sport and commercial finfish that spawn or occur in the coastal waters adjacent to Tampa Bay. (NOAA (NMFS) St. Petersburg Beach)

5. To collect and bring back to the laboratory living material to rear some fish species through metamorphosis to help make positive identification of eggs and larvae. (NOAA(NMFS)St. Petersburg Beach)

B. To conduct a cooperative investigation of the Loop Current in the Eastern Gulf of Mexico. (EGMEX)

1. To conduct a survey of the density field of the Gulf of Mexico. (NOAA(NMFS-TABL), NOAA(AOML), University of Miami, and Florida State University)

2. To conduct a survey of Chlor $\overline{a}$.

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UNIVERSITY OF FLORIDA
NATIONAL MARINE FISHERIES SERVICE
NATIONAL OCEANOGRAPHIC DATA CENTER

CRUISE REPORT

SUS-7131 R/V TURSIOPS (T-7129)

November 9-15, 1971

EGMEX V

I. Objectives

As part of an ongoing cooperative interdisciplinary, interinstitutional investigation of the Western Florida Continental Shelf by NOAA, University of Miami, University of West Florida, Florida State University, University of Florida, University of South Florida, and the State University System of Florida Institute of Oceanography, data for the following research projects were collected:

A. Seasonal distribution and abundance of eggs and larvae of commercial fishes (NOAA-NMFS/Miami and University of Miami).

B. A seasonal synoptic survey of the physical and chemical oceanographic parameters associated with the Loop Current and contiguous waters. (SUSIO, NOAA-NMFS/Miami, and University of Miami)

C. Model verification of experimental numerical models of water circulation patterns on the Continental Shelf in the northeastern Gulf of Mexico. (Florida State University)

D. Determination of the areal geology of the inner continental shelf and slope of peninsular Florida according to substratum types. (Univ. of Florida)

E. Determination of the engineering properties of the sediments (Univ. of Florida)

F. Attempt to relate in situ surface water turbidity to onshore sources of marine sediments. (Univ. of Florida)

G. To train graduate students from the University of Florida and the University of West Florida.

II. Actual Schedule

DATE Nov.	TIME GMT	ACTIVITY
09	1423	Departed Ed Ball Marine Laboratory, Turkey Point, Fla.
	2125	Arrived Station 172 - started Section AB
	2335	Departed Station 172 - headed inshore seeking calmer waters due to extremely rough weather
10	0120	Anchored 3½ miles west of Cape San Blas until morning
	0800	Underway - headed for Station 171
	1740	Arrived Station 171 - continued Section AB

STATE UNIVERSITY SYSTEM OF FLORIDA
INSTITUTE OF OCEANOGRAPHY
830 First Street, South, St. Petersburg, Florida 33701
Phone (813) 896-5197

SUSIO
149.

May 31, 1972

PROPOSED 1973 INVESTIGATIONS IN THE CICAR AREA

(Gulf of Mexico)

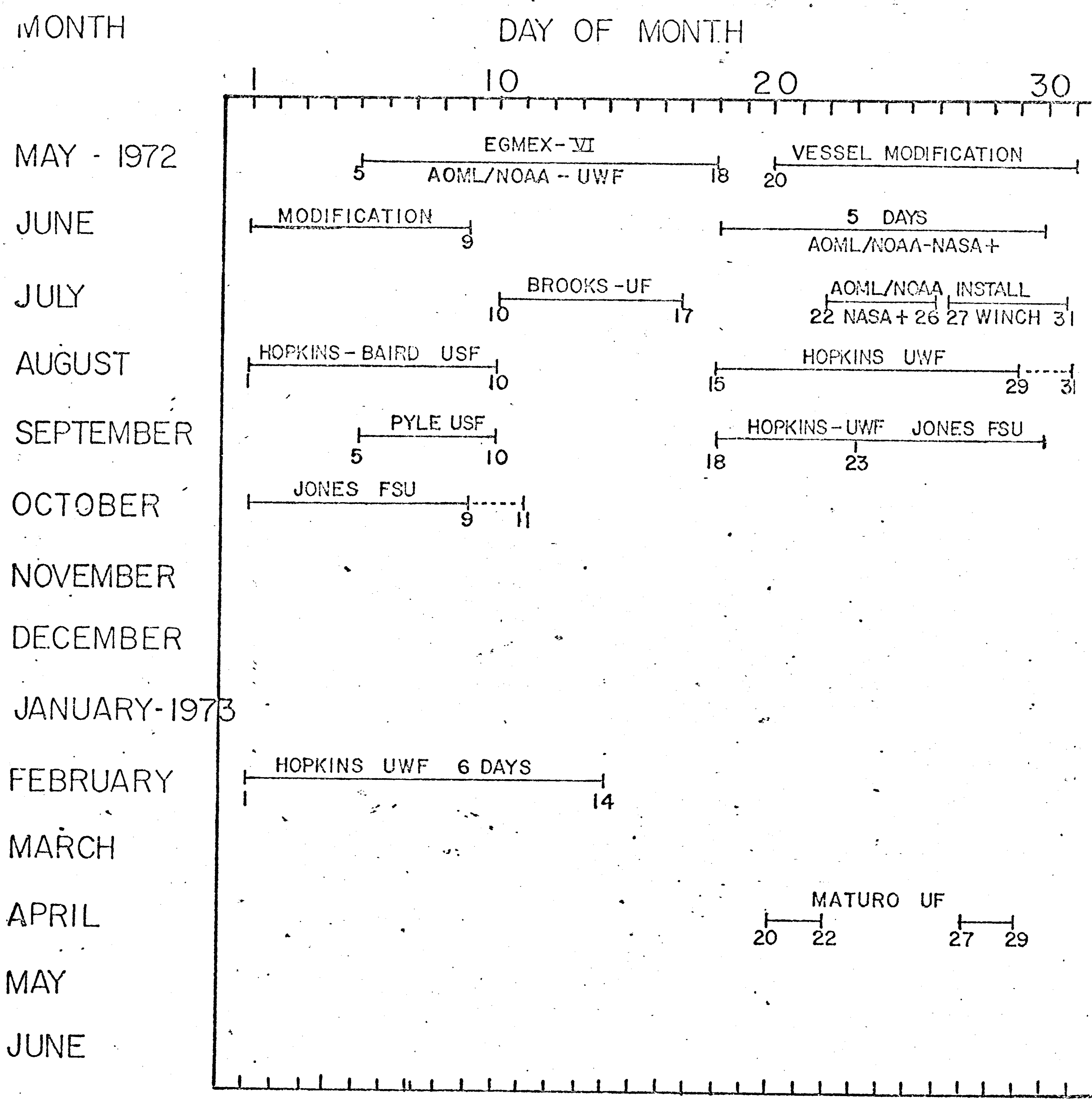
PRINCIPLE INVESTIGATOR	TITLE OF PROPOSAL	AREA OF OPERATION
Dr. T. S. Hopkins UWF	A Seasonal Training and Research Program for Graduate Students in Estuarine Biology and Oceanography	Estuarine and Adjacent Gulf Environment of NW Florida and the Florida Middle Ground
Dr. H. K. Brooks U of F	Research and Training Prop. Geologic History of the Reefs and Shoal of the Dry Tortugas	Dry Tortugas
Frank Maturo U. of F.	To instruct Grad. Students in an Advanced Invert. Zoo. Course in Oceanographic Data Acquisition & Processing Techniques	Area Adjacent to Cedar Key
Maturo	"	Transect SE From St. Pete to Key West
T. E. Pyle USF	Ship-Time in Support of Marine Geology Teaching & Research Programs	Inner Shelf Between Dunedin & New Port Richey 27°45'N 28°30'N Between 4m & 40m Isobaths
Hopkins & Baird USF	Ship-time in Support of Ecology of the Mid-water Fauna of the Eastern Gulf of Mexico	Eastern Gulf of Mexico
J. I. Jones FSU	A Geological Study of Escambia Bay	Escambia Bay

Murice O. Rinkel
Assistant Director

MOR/mc

SUSIO 150.

SUSIO SHIP SCHEDULE FY-73 PROGRAM



+ SHIP TIME TO BE PAID BY AOML/NOAA — NASA

├ - - ┤ TRANSIT TIME

Texas A & M University

Department of Oceanography

College Station, Texas

1971-2

During 1971, the Department of Oceanography of Texas A&M carried out five cruises in the CICAR area aboard the R/V ALAMINOS. These cruises included geological, seismic, and magnetic studies off the Magdalena River (Colombia), Beata Ridge, Venezuelan Boarderland, Bonaire Basin, Nicaraguan Rise, Cayman Trough, Yucatan Basin, and the Gulf of Mexico (Cruise 71 A 4). Other cruises included work on marine chemistry (71 A 5 and 71 A 12), on marine biology, productivity, and chlorophyll measurements (71 A 6), and physical oceanography (71 A 14). For 1972, cruises 72 A 7 and 72 A 8 were devoted to physical oceanography. Track charts for the chemistry and physical oceanography cruises are made part of this report, and the 1972 cruises in April and May were both part of the cooperative CICAR CSM II operation in the Gulf of Mexico, Yucatan Channel, and northwestern Caribbean Sea.

Texas A & M is also taking part in the Environmental Quality Program of the National Science Foundation's International Decade of Ocean Exploration, and a short summary of this work and track chart are also included in the present report.

REPORT ON CICAR ACTIVITIES
of the
TEXAS A&M UNIVERSITY DEPARTMENT OF OCEANOGRAPHY
February 1971 to May 1972

During the past year members of the faculty and staff of Texas A&M University Department of Oceanography have made cruises aboard R/V ALAMINOS which include work considered to be part of the CICAR program. These cruises are listed below along with their dates, chief scientists, main activities, and locations:

71 A 4. Geology, seismic and magnetic profiles, coring and dredging.

Leg I. 16 Feb. to 4 Mar. 1971, Antoine. Galveston to region off Magdalena River.

Leg II. 4 to 22 Mar. 1971, Bouma. Region off Magdalena River and depression south of Beata Ridge.

Leg III. 24 Mar. to 10 Apr. 1971, Bryant. Beata Ridge and deep region to its south.

Leg IV. 12 to 28 Apr. 1971, Rezak. Beata Ridge, region of ridges and troughs in the Venezuelan Borderland, and Bonaire Basin.

Leg V. 30 Apr. to 16 May 1971, Fahlquist. Nicaraguan Rise, Cayman Trough, Yucatan Basin, and Gulf of Mexico.

71 A 5. 29 May to 11 June 1971, Sackett. Chemistry, hydrographic casts as shown in Fig. 1.

71 A 6. 17 to 30 June 1971, El-Sayed. Biology, productivity and chlorophyll measurements, hydrographic casts as shown in Fig. 1.

71 A 12. 21 to 26 Oct. 1971, Sackett and Jeffrey. Chemistry, hydrographic casts as shown in Fig. 1.

71 A 14. 14 to 23 Nov. 1971, Ichiye. Physical Oceanography, hydrographic casts and STD's as shown in Fig. 2.

72 A 7. 25 Mar to 21 Apr. 1972, Cochrane and Caruthers. Physical Oceanography, hydrographic casts and STD's as shown in Fig. 3.

72 A 8. 23 Apr. to 1 May 1972, Ichiye. Physical Oceanography, hydrographic casts and STD's as shown in Fig. 3.

In all cruises satellite and Omega naviation was used. Bottom depth and sea-surface temperature were continuously recorded. Bathythermograms were made at regular interval on the Physical Oceanographic, Biological, and Chemical cruises, and occasionally when possible on Geological cruises. Oxygen and silicate concentrations were determined at most hydrographic stations and phosphate concentrations at a few stations.

John D. Cochrane   5 June 1972

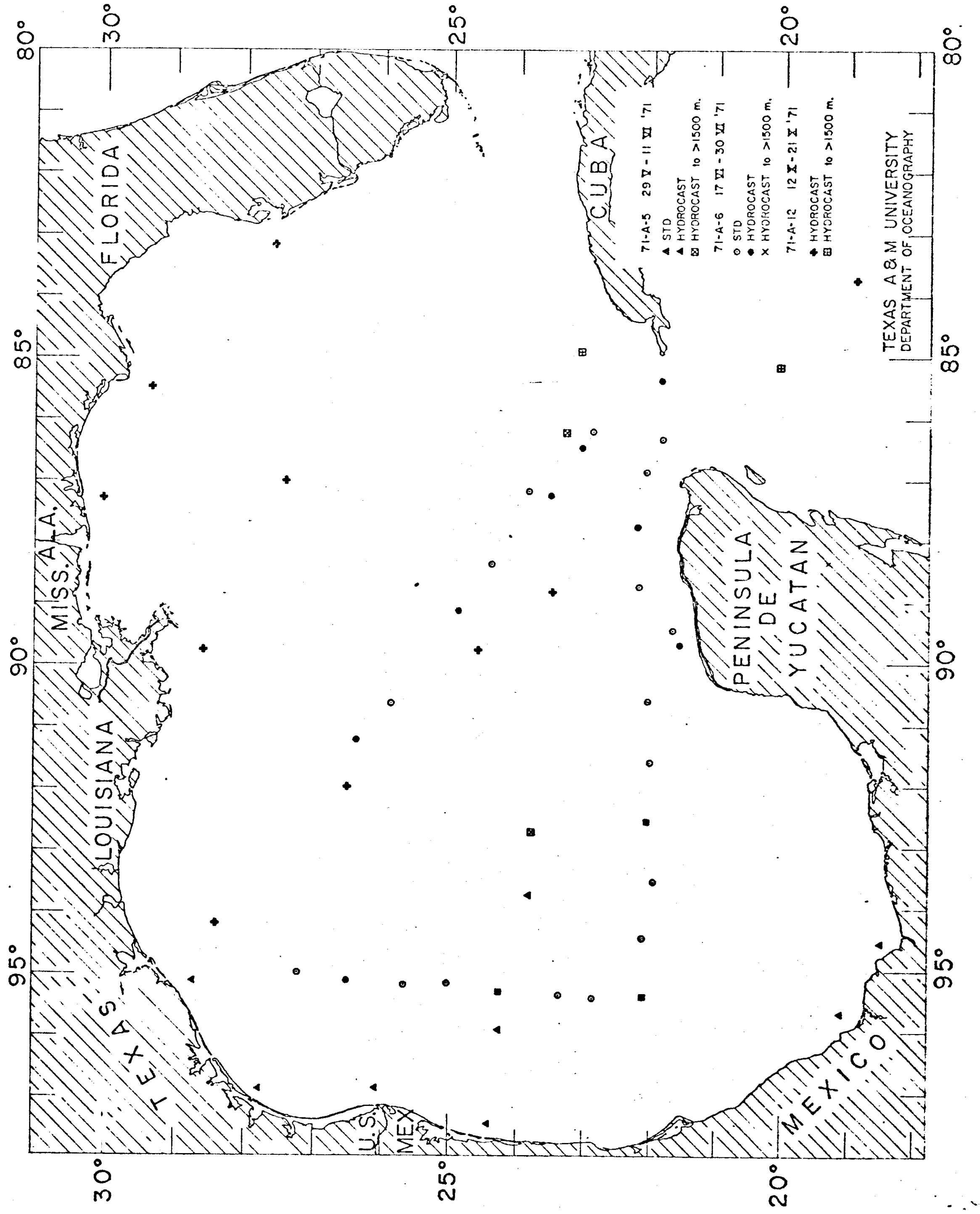

FLORIDA
MISS. ALA.
LOUISIANA
TEXAS
U.S.
MEX
MEXICO
CUBA
PENINSULA DE YUCATAN
71-A-5 29 V - 11 VI '71
STD
HYDROCAST
HYDROCAST to >1500 m.
71-A-6 17 VI - 30 VI '71
STD
HYDROCAST
HYDROCAST to >1500 m.
71-A-12 12 X - 21 X '71
HYDROCAST
HYDROCAST to >1500 m.
TEXAS A&M UNIVERSITY
DEPARTMENT OF OCEANOGRAPHY
80°
85°
90°
95°
30°
25°
20°

Figure 1

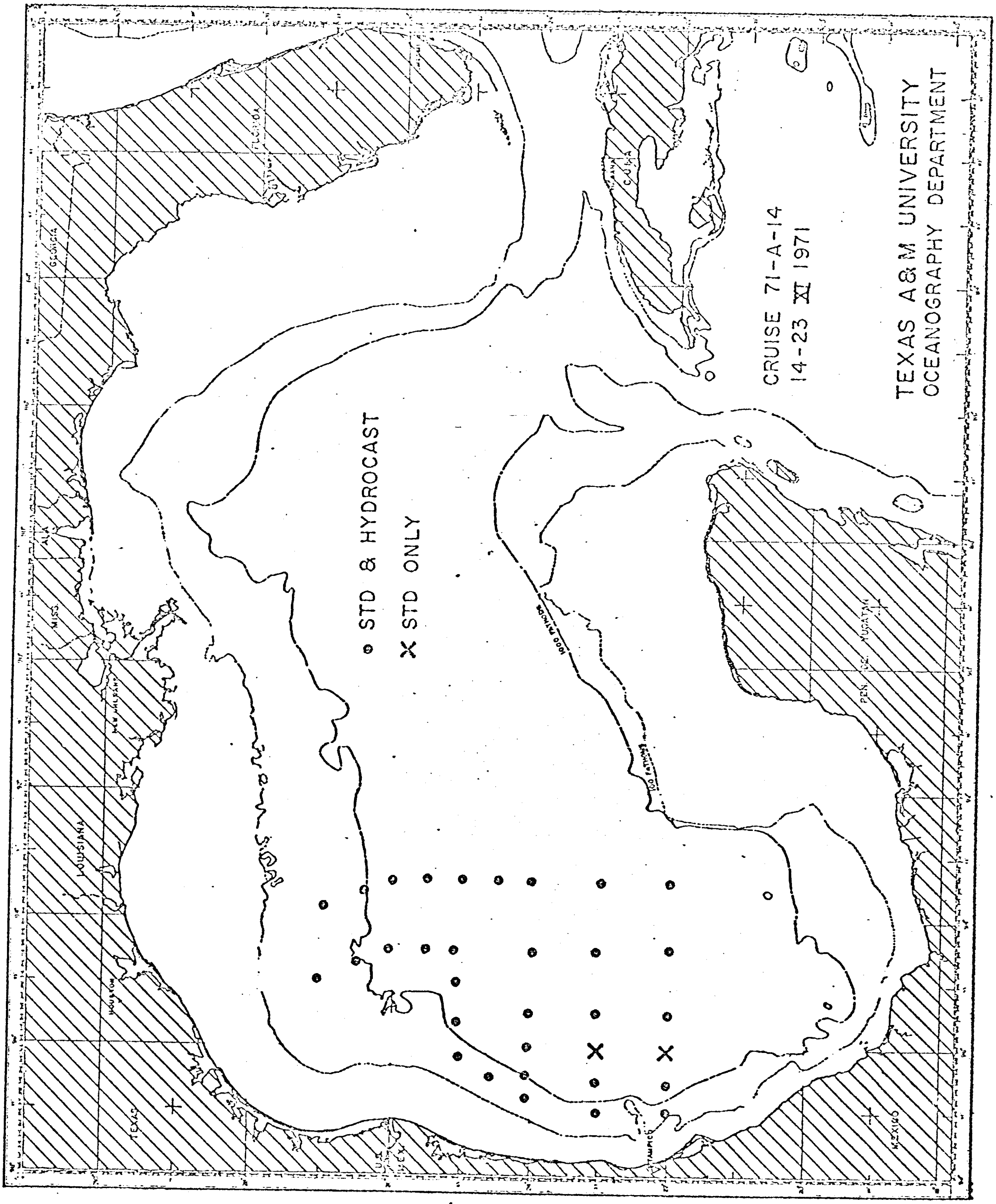

STD & HYDROCAST
STD ONLY
CRUISE 71-A-14
14-23 XI 1971
TEXAS A&M UNIVERSITY
OCEANOGRAPHY DEPARTMENT

Figure 2

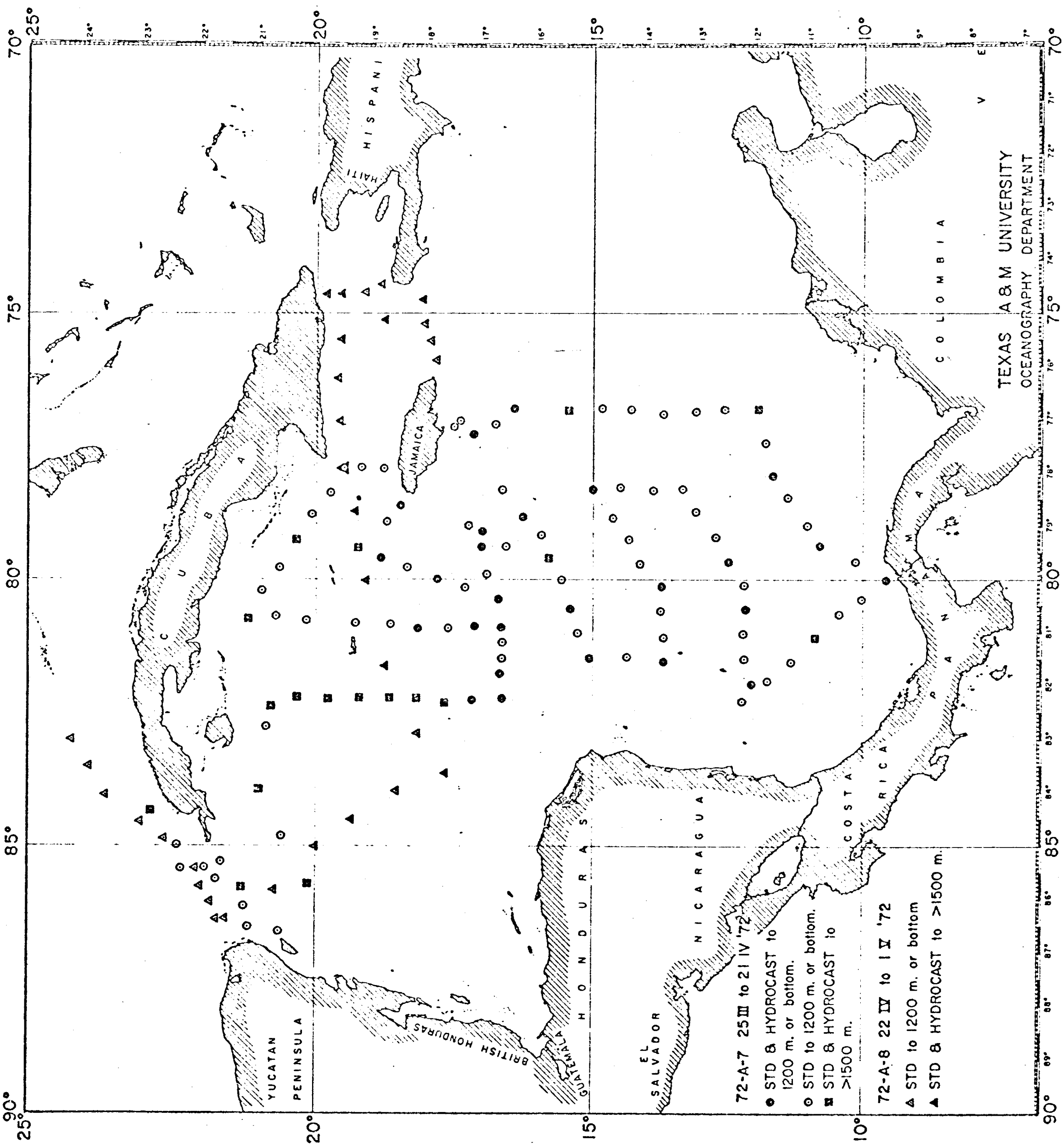

72-A-7 25 III to 21 IV '72
STD & HYDROCAST to 1200 m. or bottom.
STD to 1200 m. or bottom.
STD & HYDROCAST to >1500 m.
72-A-8 22 IV to 1 V '72
STD to 1200 m. or bottom
STD & HYDROCAST to >1500 m.
TEXAS A&M UNIVERSITY
OCEANOGRAPHY DEPARTMENT
CUBA
HAITI
HISPANI
JAMAICA
YUCATAN PENINSULA
BRITISH HONDURAS
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
V E
25°
20°
15°
10°
70°
75°
80°
85°
90°

Figure 3

From: October 1971 publication of the
National Science Foundation
"International Decade of Ocean Exploration"
Chapt. 2, Environmental Quality Program
pages 11-12

GULF OF MEXICO AND CARIBBEAN SEA

The group obtaining baseline data in the Gulf-Caribbean areas maintains coordination with the other two ongoing environmental quality studies in the Atlantic and Pacific Oceans. Coordination involves not only external exchange of sample material and standards with each parallel investigator, but also, the exchange of recommendations on procedures for sample collection, handling, preservation and processing. The groups that make up the Gulf-Caribbean study also practice internal liaison. This internal and external exchange of samples, standards and methodology will make the regional data more meaningful in determining pollution levels in the world oceans.

Unlike the open oceans of the Atlantic and Pacific, which have a greater dilution potential, the enclosed basins of the Gulf-Caribbean, especially the Gulf, may have experienced serious industrial and agricultural pollution. The Gulf is also unique in that it receives runoff from the Mississippi, one of the world's largest contaminated rivers, draining approximately half the area of the United States. The Gulf-Caribbean project therefore has a unique opportunity to evaluate: 1) the extent of pollution and the prediction of expected "hot spots"; 2) the sources and the rates of inputs of pollutants; 3) the biochemical and geochemical interactions of each pollutant to predict possible sites of accumulation; and 4) the contamination of local marine food products.

Pollution by organic matter, including petroleum, herbicides, and pesticides, is probably the most serious type in the Gulf of Mexico. Organic pollution is difficult to study because of the variety and complexity of organic molecules.

The deep water sampling of the Gulf and the Caribbean is being carried out by RV *Alaminos* and RV *Palumbo,* as shown in Figure 4. The present plan is to repeat transects across the northern shelf of the Gulf of Mexico and off Puerto Rico in order to determine seasonal variations of pollutant concentrations.

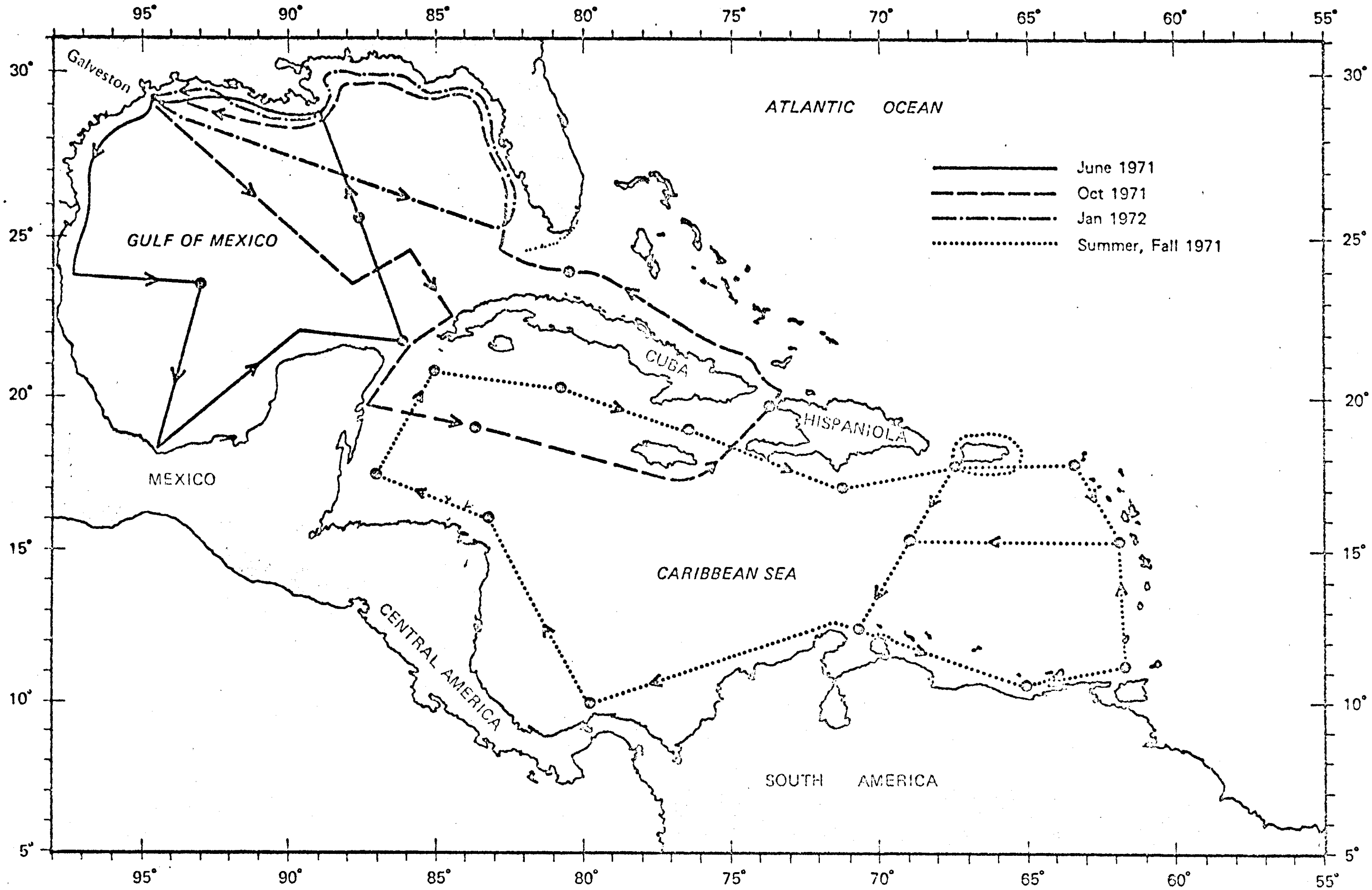


Figure 4. Gulf of Mexico and Caribbean Sea environmental quality baseline data-acquisition cruises.

Commonwealth of Puerto Rico

Department of Agriculture

Puerto Rico Nuclear Center

University of Puerto Rico

1971-2

The Puerto Rico Nuclear Center (Bill Forster) and the Mayaguez Campus of the University of Puerto Rico (Flavio Padovani) have been cooperating on a National Science Foundation supported study of the problems related to pollution as part of the International Decade of Ocean Exploration program of NSF (see summary under the Texas A & M section of this report). The title page, table of contents, and introduction to the Forster-Padovani report are included as part of the present report to the 5th ICG for CICAR.

The marine biological work carried out in Puerto Rico has been summarized in the March 27, 1972, letter from the Puerto Rico CICAR Coordinator (Dr. Rolf Juhl) to the Subject Leader for Biology (Dr. J. Wickstead) and that letter is also included. This work includes studies of noxious coelenterates, resource potential of the spiney lobster, and gear research and exploratory fishing. Also included is a list of publications resulting from this work.

Exploratory Fishing and Gear Tests were carried out on a series of four cruises during 1971, and the Cruise Reports are included as part of this report. Ting's work on the spiny lobster (Panulirus argus Latreille) off Puerto Rico is covered in his annual report (June 1970 to June 1971), and the title page, table of contents, and introduction are included here.

Moussa and Smith of the University of Puerto Rico's Institute of Caribbean Science at Mayaguez have compiled a fine summary of the Status of Geological Research in the Caribbean, of which only the title page is included here. Through the CICAR Coordinator for Puerto Rico, this report has been made available to all CICAR National Coordinators.

A Study Program to Identify Problems Related to Oceanic Environmental Quality in the Caribbean

by

Dr. William O. Forster - Principal Investigator
Dr. Elwyn D. Wood
Puerto Rico Nuclear Center

Dr. Flavio Padovani
University of Puerto Rico
Mayaguez, Puerto Rico

TABLE OF CONTENTS

Introduction

The following report summarizes the data gathered from the NSF sponsored base line study of the Caribbean Sea in which we attempted to evaluate the extent of trace element, hydrocarbon and chlorinated hydrocarbon pollution in the open sea water, the organisms living in these waters and the sediments below them. Interpretations concerning these data will be reserved until the May meeting in Brookhaven, N.Y. due to late processing of the data. However, the data has been organized to make quick comparisons between levels of pollutants and several summary figures are included to also show statistical relationships between them.

A final cautionary note is added. Every effort should be made to determine the natural seasonal variations of these pollutants in this and other large open ecosystems before the label pollutant is attached to the species examined.

The following data are grouped according to the methods of analyses; however the first part includes a physical picture of the sampling sites with physical and chemical oceanographic parameters included; the second part includes trace element data collected by atomic absorption spectrophotometry; the third part contains trace element data from neutron activation analysis; the last includes pesticide data from gas chromatography and election capture with ^{63}Ni detection.

COMMONWEALTH OF PUERTO RICO
Department of Agriculture
SAN JUAN, PUERTO RICO 00908

March 27, 1972

Dr. John H. Wickstead
Subject Leader
Marine Biology, CICAR
The Laboratory, Citadel Hill
Plymouth, PLI, 2PB, England

Dear Dr. Wickstead:

We refer to your request of January 27, 1972 for information on CICAR marine biology related activities.

On this we provide the following information:

1. What programs have been completed...

   (a) Completed in December 31, 1971 - "Investigation of noxious coelenterates and possible means of their control". This was a three year project undertaken in the coastal waters of Puerto Rico. The results will be published before June 30, 1972.

   (b) To be completed in June 30, 1972 - "Investigation on the resource potential of the spiny lobster (Panulirus argus, Latreille) in Puerto Rico". This is also a three year project, the final report will be published during 1972.

2. The following programs are being undertaken at present:

   (a) "Investigation of the resource potential of the spiny lobster (Panulirus argus, Latreille) in Puerto Rico"

   (b) "Further studies of the coelenterates in Puerto Rico", to be initiated in April of 1972.

   (c) "Gear research, exploratory fishing and demonstrations". This project is oriented towards commercial fisheries development, however, it also aims towards providing information on biological aspects of the fish and shell fish resources.

Dr. John H. Wickstead
Page No. 2
March 27, 1972

Brief summaries of the results achieved in the pertinent projects follow:

(a) Investigation of noxious coelenterates:

During the past year survey work in the six main bathing beaches of Puerto Rico was continued. Results indicate that free swimming coelenterates are seasonal in abundance and distribution. Several new species have been found and the life cycle of one, hither to unknown, Trepidalia has been determined.

(b) Investigation on the resource potential of the spiny lobster (*Panulirus argus*, Latreille) in Puerto Rico:

Collections of adult, juvenile and larvae lobster were continued in the S SW coastal areas of Puerto Rico. Repeating the previous years' results during October 1971, Pueruli larvae were taken but during November and December only post larvae were found. Tentatively the results show the average size of the adult lobster, in a general way, increased with increase in depth.

(c) Gear research, exploratory fishing and demonstrations:

In the last quarter of 1971 project activities were carried out off Vega Baja, East of San Juan, in depth from 10 to 150 fathoms. Commercially significant concentrations of silk and blackfin snapper (Lutjanids) were found in specific areas 1 to 1 1/2 miles from shore. In the first quarter of 1972 activities were conducted off Arroyo, S SW corner of Puerto Rico. Here, tests with snapper reels and fish pots resulted in moderate to substantial captures of grouper (Nassau, misty and yellowfin) were made in depth from 40 to 60 fathoms. Survey work will continue in Grappler Bank, which lies 12 miles S SE of Patillas. Detailed results of these three projects will be published before the end of 1972.

A list of publications follow:

1. "Status and potential of the fishery in the Caribbean" by Rolf Juhl, Pub. 1971, Proceedings of the Gulf and Caribbean Fisheries Institute, University of Miami.

2. "Fishery Resources of the Caribbean and their Potential" by Rolf Juhl. In press - "Proceedíngs, Conference on the Sanitary Quality and Microbial Safety of Fishery Products". Academic Press, N. Y. C.

Dr. John H. Wickstead
Page No. 3
March 27, 1972

3. "Life Cycle of *Tripedalia cystophora* Conant (Cubomedusae)" by Bernard Werner, Charles E. Cutress and John P. Studebacker.

Sincerely yours,

Rolf Juhl, Observer
Cicar, USA, Puerto Rico

EXPLORATORY FISHING AND GEAR TESTS
CRUISE REPORT
PHASE XI

This is the second time within a three year period that survey activities have been undertaken in the general area South of Ponce and during the same early part of the year, (Juhl 1969). Following the pattern described previously, grids Nos. 77 through 84 were covered. These grid squares lie within the coordinates 17°50'-17°56' N and 66°30'-66° 40' W. In addition, the Ponce Bay was also surveyed. The duration of the survey activities was approximately two and one half months, from January 15 through March 30, 1971.

During the initial three weeks most of the areas within the grid squares where tested with conventional fish pots and snapper reels. Thereafter efforts were concentrated in grids Nos. 77 and 81 through 84.

Repeated monofilament bottom gill net sets were made in several areas of the Ponce Bay.

Commercial fishing is conducted here to a limited extent, fish pots, gill net, hand lines and turtle tangle nets are the year most commonly used. The productivity of the fishery is relatively low.

The project vessel Agustin Stahl, a 37-foot modified lobster boat, was used for the survey. Part of the vessel's crew was composed of local fishermen who received instructions on the use of the gear, equipment and operation of the vessel.

In accordance with the cruise plan test fishing efforts were concentrated in the most productive areas in an attempt to evaluate their commercial potential. These areas proved to be grid squares 77, 81, 83 and 84 which lie along the edge of the shelf.

Near the edge, at depth from 15 to 18 fathoms yellowfin and Nassau groupers were taken in commercially significant numbers. Repeated sets produced from 5 to 35 lbs. per fish pot; this is 1 to 7 times the average commercial yield.

Repeated tests with a 3" monofilament gill net produced from 60 to 180 pounds of marketable fish per set. The following tabulation shows the species of fish most commonly taken and method of capture.

Lobster Pot:

Spiny lobster - *Panulirus argus*
Trunk fish - *Lactophrys sp.*

Fish Pot:

Silk snapper - *Lutjanus vivanus*

Blackfin snapper - Lutjanus buccanella
Lane snapper - Lutjanus synagris
Vermillion snapper - Rhomboplites aurorubens
Yellowtail - Ocyurus chrysurus
Rock hind - Epinephelus adscensionis
Red grouper - Epinephelus morio
Queen trigger fish - Balistes vetula
Squirrel fish - Holocentrus sp.
Porgy - Calamus sp.
White grunt - Haemulon plumieri
Amber jack - Seriola dumerili
Moray eel - Gymnothorax sp.

Gill Net:

Grey snapper - Lutjanus griseos
White mullet - Mugil curema
Yellowfin mojarra - Gerres cinereus
Snook - Centropomus undecimalis
King mackerel - Scomberomorus cavalla
Lookdown - Vomer setapinnis
Crevalle jack - Caranx hippos
Bone fish - Albula vulpes

Snapper Reel:

Silk snapper - Lutjanus vivanus
Black fin - Lutjanus buccanella
Amber jack - Seriola dumerili
Squirrel fish - Holocentrus sp.
Queen trigger fish - Balistes vetula

The table 8, which follows, shows the fishing results by gear, and Figure 8 shows the survey area and grid pattern covered.

TABLE 8 FISHING RESULTS

Grid No.	LP*	FP*	BG*	SR*
77	X	9 1/2	X	X
78	X	8	X	X
79	X	X	X	X
81	11	17	X	4 1/2
82	X	6 1/2	X	X
83	1 1/2	18 1/2	X	10
84	X	12 1/2	X	2 1/2
Ponce Harbor	X	X	95	X

*LP=Lobster pot, average weight of catch per pot in pounds to the nearest half pound.

*FP=Fish pot, average weight of fish per pot in pounds to the nearest half pound.

*BG=Bottom gill net, weight of fish catch in pounds per set.

*SR=Snapper reel, average weight of fish catch per reel per hour.

NOTE: The fish pot catch shown above for grid numbers 77, 81, 83 and 84 are averages of five to six lifts over a period of over one month, consequently the results are decidedly meaningful. The average catch of the commercial pot fishery is approximately 5.5 lbs., which is considerably less than the survey yield in the above mentioned grid square areas.

The gillnet was set at least 8 times, the soaking time was normally from 30 to 45 minutes. Again, the average yield of 95 lbs. per set is considered commercially significant.

Ref.:"Exploratory Fishing Surveys and Gear Tests in Puerto Rico", Departamento de Agricultura, Contribuciones Agropecuarias y Pesquería, Vol. 1, Núm. 1.(1969).

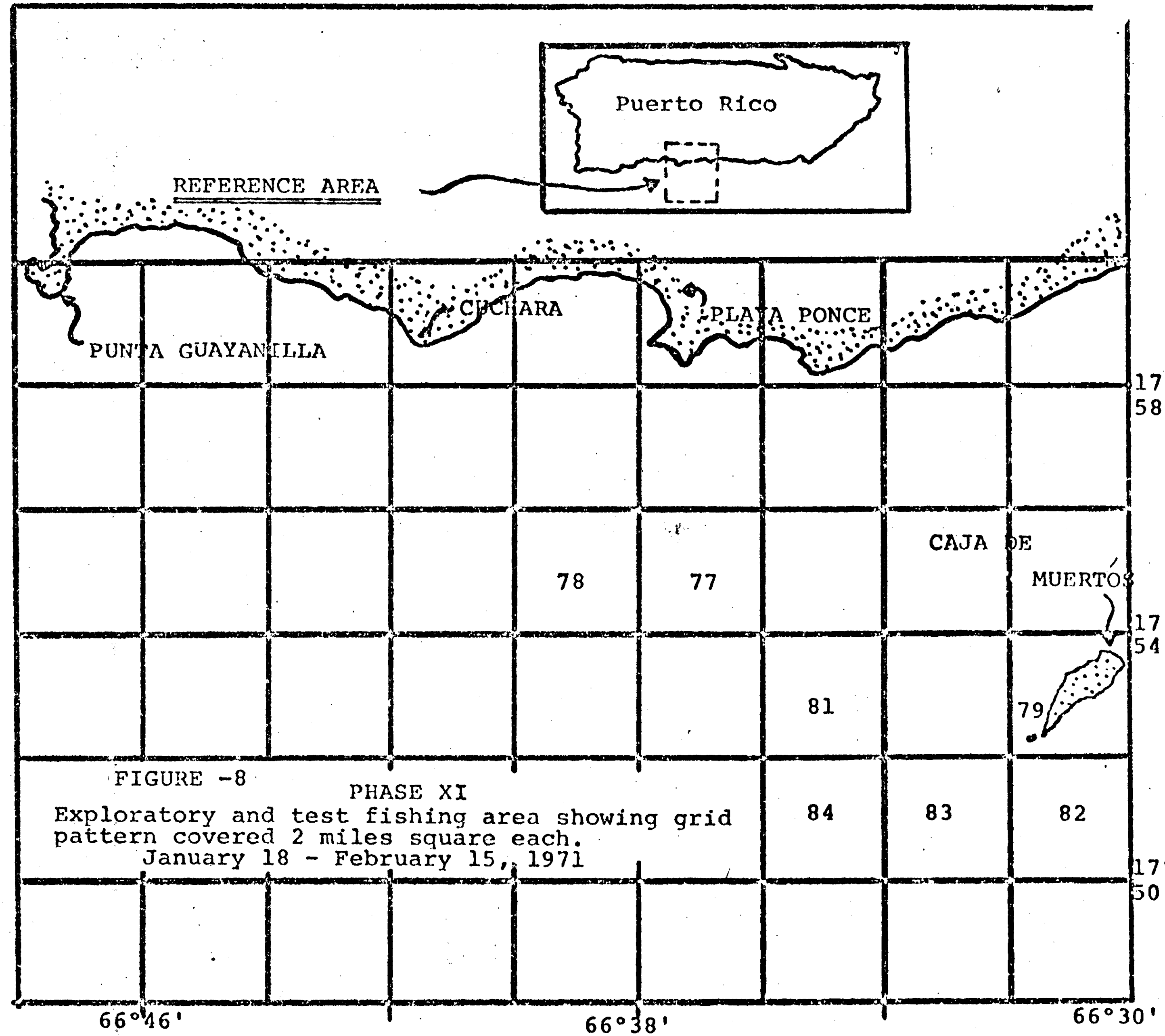
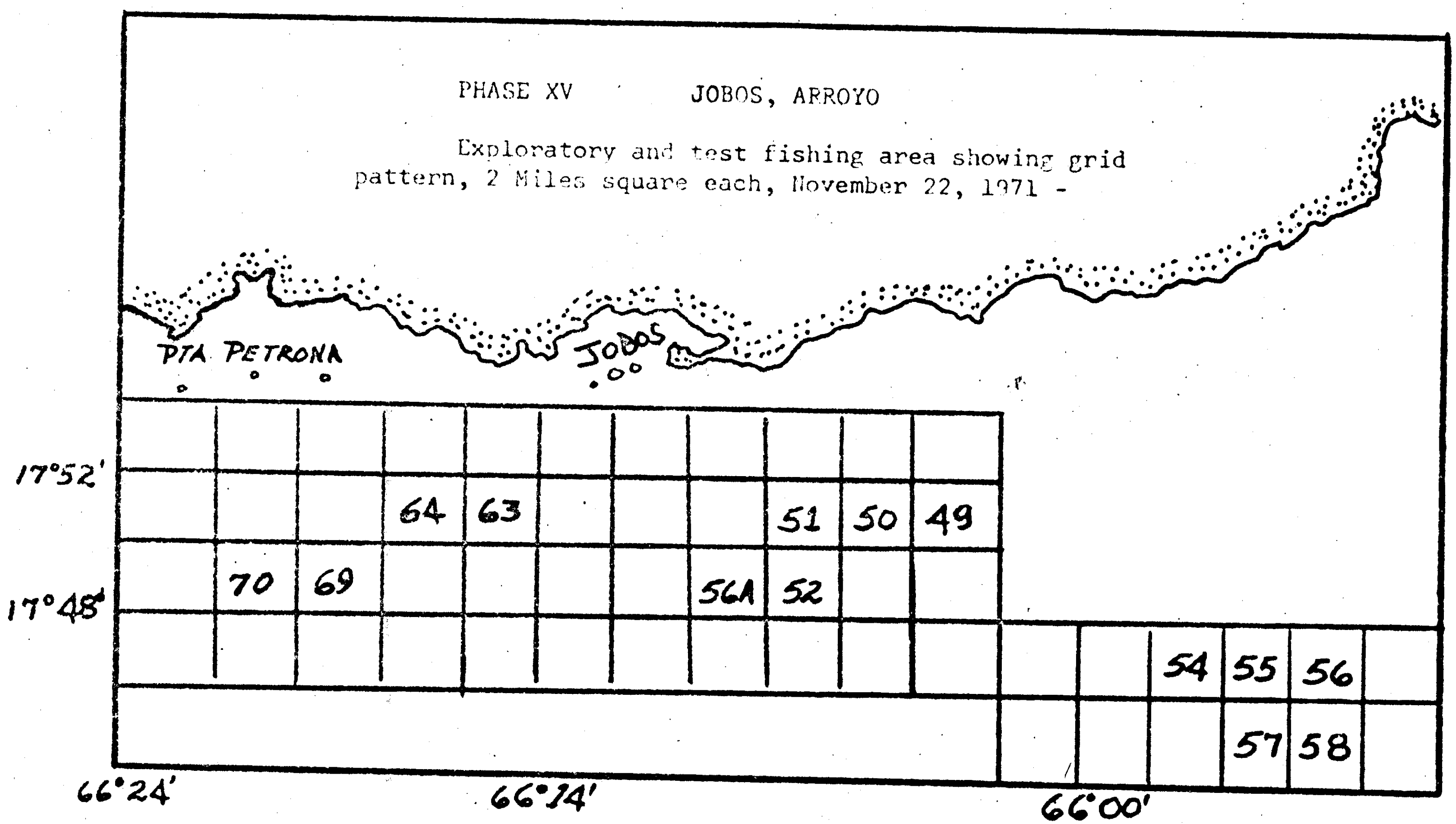


FIGURE -8

PHASE XI

Exploratory and test fishing area showing grid pattern covered 2 miles square each.
January 18 - February 15, 1971



PHASE XV JOBOS, ARROYO

Exploratory and test fishing area showing grid pattern, 2 Miles square each, November 22, 1971 -

EXPLORATORY FISHING & GEAR TESTS
CRUISE REPORT
PHASE XII

Exploratory Fishing and Gear Test activities were conducted from March 22, 1971 to the end of May in the area bordering La Parguera, on the SW part of Puerto Rico. This survey area is bounded by coordinates 17° 56' - 17°50' South and 66°56' - 67°10' West.

The shelf here is relatively wide varying from four to six miles; the edge of the shelf varies from 8 to 21 fathoms, the drop-off is steep. The bottom configuration is fairly even, interspersed with reef outroppings, sand flats and turtle grass areas. Commercial fishing has existed here for centuries, however in a limited degree owing to the restricted fishing grounds. Fish pot and gill net are the gear most commonly employed.

Project activities included the testing of fish and lobster pots, gill net and snapper reels. The latter to a limited extent owing to adverse natural conditions. Local fishermen were employed as crew members aboard the project vessels *Agustin Stahl* and *Facundo Bueso*, these were described previously (Juhl 1969).

In agreement with a cruise plan the vessels initially tested selected 2-miles grid squares Nos. 69 to 95 (See chart). There after efforts were concentrated in the more productive areas to determine their commercial potential.

Fishing results were not commercially significant, however there were strong ~~of~~ indications that the fish resources are being overfished. The lobster pot tests were less productive than the previous test performed two years earlier.

The following list shows the species of fish most commonly taken, by gear.

Lobster pot:

Spiny lobster	*Panulirus argus*

Fish pot:

Blackfin snapper	*Lutjanus buccanella*
Silk snapper	*Lutjanus vivanus*
Gray snapper	*Lutjanus griseous*
Mutton snapper	*Lutjanus analis*
Vermillion snapper	*Rhomboplites aurorubens*

Red hind	<u>Epinephelus adscencionis</u>
Red grouper	<u>Epinephelus morio</u>
Yellow grunt	<u>Haemulon flavolineatum</u>
White grunt	<u>Haemulon plumieri</u>
J ~~P~~olt head porgy	<u>Calamus bajonado</u>
Blue runner	<u>Caranx fusus</u>
Trigger fish	<u>Canthigaster sp.</u>

<u>Gill net:</u>

Blue runner	<u>Caranx fusus</u>
Gray mojarra	<u>Gerres cinereus</u>
Look-down	<u>Selene vomer</u>
King mackerel	<u>Scomberomorus cavalla</u>
Little tuna	<u>Euthynnus alletteratus</u>
Palometa	<u>Trachinotus goodei</u>
Yellowtail snapper	<u>Ocyurus chrysurus</u>

<u>Snapper reel:</u>

Silk snapper	<u>Lutjanus vivanus</u>
Blackfin snapper	<u>Lutjanus buccanella</u>
Vermillion	<u>Rhomboplites aurorubens</u>
Red hind	<u>Epinephelus adscencionis</u>
Jack crevalle	<u>Caranx hippos</u>

Table 9, which follows lists the fishing results by gear and Figure 9 the grid pattern covered during the survey.

TABLE 9 - FISHING RESULTS

Grid No.	LP*	FP*	BG*	SR*
69-A	0	1 1/2	X	X
71-A	1/2	1 1/2	18	X
86	1/2	X	13	X
86-A	0	X	16	2
87	1	1 1/2	7	X
88	1	2 1/2	X	X
89	1	2	X	X
90	0	1	23	X
90-A	1	4 1/2	10	X
91	0	1 1/2	5	X
91-A	X	3	66	X
93	X	9	X	11
94	X	6	X	5
95	X	16	X	6

*LP=Lobster pot, average weight of catch per pot in pounds, to the nearest half-pound.

*FP=Fish pot, average weight of fish per pot in pounds to the nearest half pound.

*BG=Bottom gill net, weight of fish catch in pounds per set.

*SR=Snapper reel, average weight of fish catch per reel per hour.

NOTE:

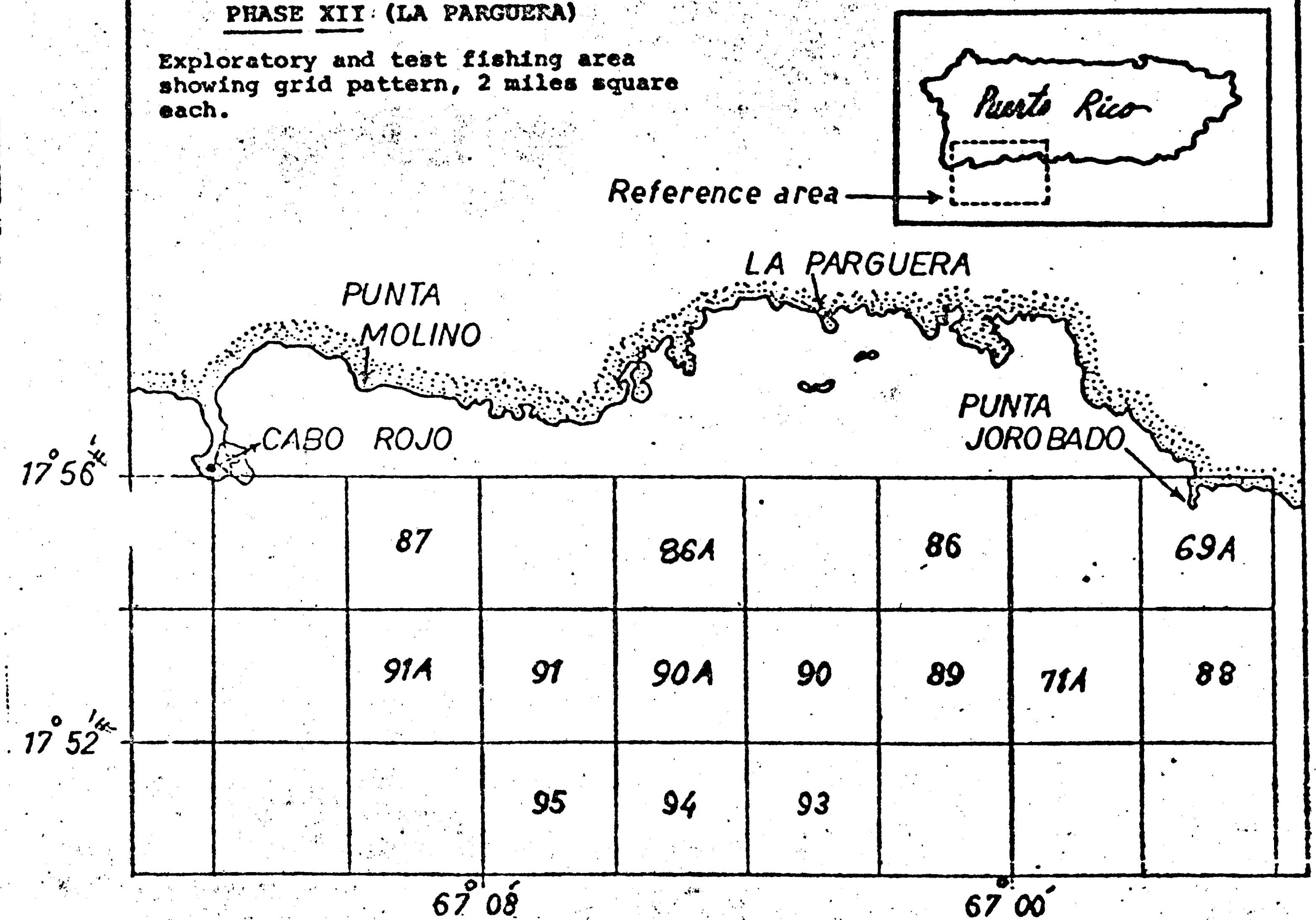
As shown in Table 9 the only areas in which fish pot production was above 5 lbs. per lift were from 93 to 95. These lie partly in water depth from 50 to over 100 fathoms and where the fishing tests showed higher yields. This area, the only one showing potential, is not fished commercially owing to its depth.

The fish taken in the shallower areas was generally smaller than that taken elsewhere, which indicates probable overfishing.

FIGURE 9

PHASE XII (LA PARGUERA)

Exploratory and test fishing area showing grid pattern, 2 miles square each.



EXPLORATORY FISHING & GEAR TESTS
CRUISE REPORT
PHASE XIII

The subject survey, Phase XIII, was conducted in the area directly west and W NW of Mayaguez, during the months of July and August 1971. This area is bounded by coordinates 18°12' to 18°20'N and 67°12' to 67°36' W. It embraces the northern edge of the wide shelf lying on the West Coast of Puerto Rico. In places the shelf is 26 miles wide, this occurs directly west of Mayaguez, and narrows to only 2 1/2 miles a short distance to the north of there. Since it also lies directly in the Mona Passage between Puerto Rico and Hispaniola fairly calm seas prevail during much of the year (prevailing winds are from the ESE, E, and ENE). The grids (2 miles square each) surveyed included 20-B to 22-B and 121 to 134. Further information about the area is contained in Cruise Report, Phase I, which was conducted during the same time of the year in 1970.

Again the vessels used during the survey were the Agustin Stahl, a modified 37-foot lobster boat and the 24-foot Facundo Bueso. The gear tested included fish and lobster pots, a bottom gill net and snapper reels.

The depths and type of bottom in which the vessels operated included the inshore sandy mud areas to the edge of the rock and sand bottomed shelf down to a depth of 145 fathoms.

Except for specific cases the results were commercially significant specially in the grids were repeated tests produced replicate catches. Lobster fishing was disappinting, as well as gill netting inside the Añasco (Grid No. 21-B) and Mayaguez Bays.

The following list shows the species of fish most commonly taken by gear:

Lobster pot:

Spiny lobster	Panulirus argus
Yellowfin grouper	Mycteroperca venenosa

Fish pot:

Silk snapper	Lutjanus vivanus
Blackfin snapper	Lutjanus buccanella
Vermillion snapper	Rhomboplites aurorubens
Queen snapper	Etelis oculatus
Black snapper	Apsilus dentatus
Yellowfin grouper	Mycteroperca venenosa

Misty grouper	*Epinephelus mystacinus*
Nassau grouper	*Epinephelus striatus*
Rock hind	*Epinephelus adscensionis*
Black jack	*Caranx lugubris*
Jolthead porgy	*Calamus bajonado*
Queen trigger fish	*Bolistes vetula*

Gill net:

Yellow jack	*Caranx bartholomaei*
Mojarra	*Gerres cinereus*
Look down	*Selene vomer*
Lady fish	*Albula vulpes*
Squirrel fish	*Holocentrus sp.*
King mackerel	*Scomberomorus cavalla*

Snapper reel:

Silk snapper	*Lutjanus vivanus*
Blackfin	*Lutjanus buccanella*
Vermillion snapper	*Rhomboplites aurorubens*
Black snapper	*Apsilus dentatus*
Rock hind	*Epinephelus adscensionis*
Trigger fish	*Canthidermis sp.*
Yellowtail snapper	*Ocyurus chrysurus*

Table 10 lists the fishing test results by gear and Figure 10 shows the grid pattern covered during the survey.

TABLE 10 - FISHING RESULTS

Grid No.	LP*	FP*	BG*	SR*
20-B	X	6	X	1
21-B	0	0	14	0
22-B	0	6	X	2
120	X	3	X	4 1/2
121	X	X	X	X
122	0	X	X	X
123	X	256	X	7
124	1/2	24	X	10
125	0	X	X	X
126	1/2	4	X	X
127	X	9 1/2	X	X
128	0	6	X	X
129	X	X	X	0
130	X	X	X	0
131	X	32	X	5
132	X	19 1/2	X	17 1/2
133	1/2	22	X	3
134	0	36	X	24 1/2
Mayaguez Bay	X	X	92	X

*LP=Lobster pot, average weight of catch per pot in pounds, to the nearest half pound.

*FP=Fish pot, average weight of fish per pot in pounds to the nearest half pound.

*BG=Bottom gill net, weight of fish catch in pounds per set.

*SR=Snapper reel, average weight of fish catch per reel per hour.

NOTE:

As shown by the Table 10 the fish pot production was the most significant, especially in the Grids 123-124 and 131 to 134. Of these, the latter group is considered of greater commercial significance because the results shown are on average of at least six trials. This is from four to six times greater than the average commercial production. The 256-lb. catch shown for Grid 123 was the productionof one pot in a single lift. It included five misty grouper ranging in size from 24 to 70 lbs. each. The figure shown for Grid 124 was the average of two sets. The areas discussed above are located from 12 to 20 miles offshore from Mayaguez and are normally not fished commercially.

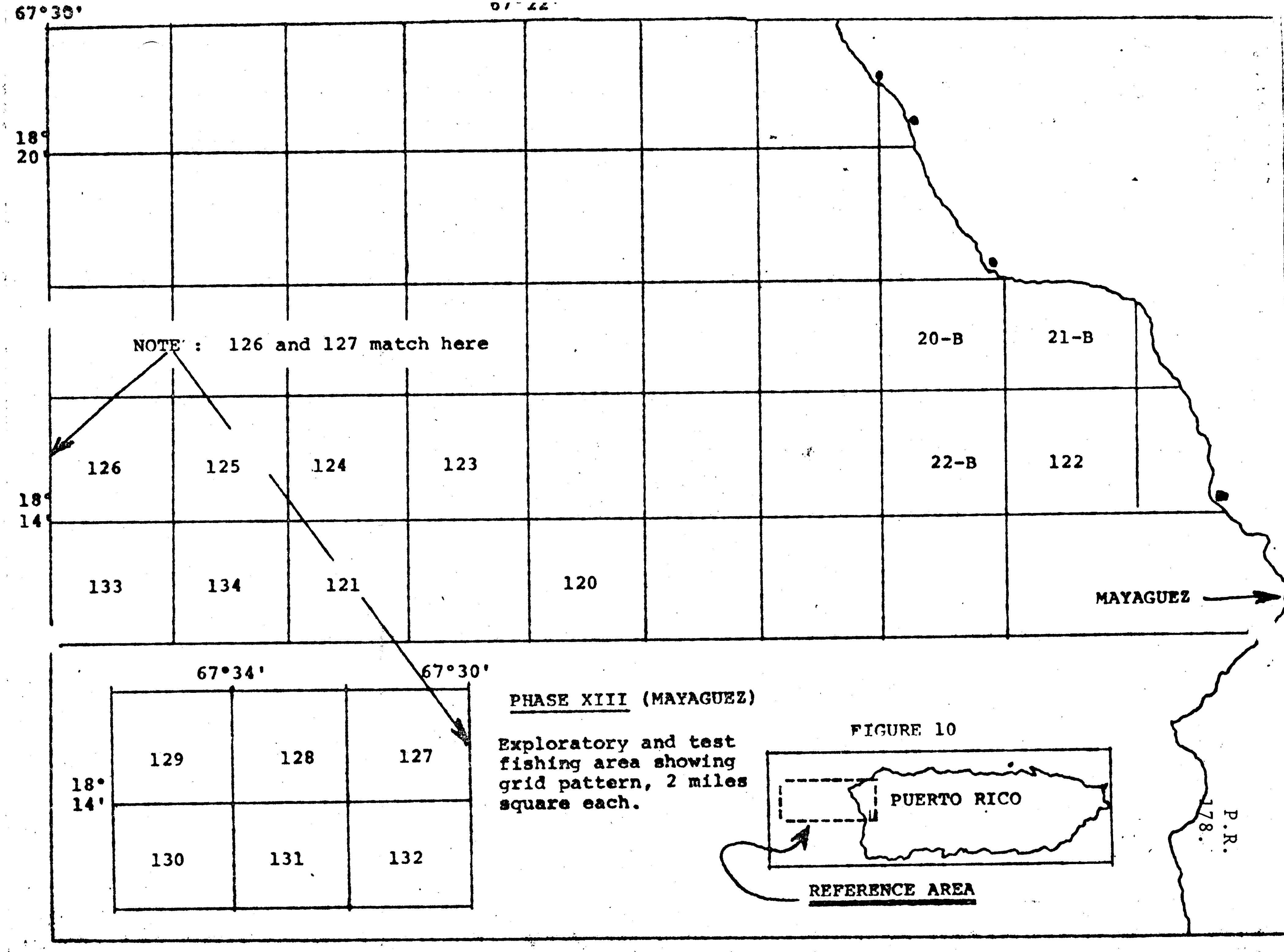


FIGURE 10

PHASE XIII (MAYAGUEZ)

Exploratory and test fishing area showing grid pattern, 2 miles square each.

EXPLORATORY FISHING & GEAR TESTS
CRUISE REPORT
PHASE XIV

From early September through October 1971 the boat Agustin Stahl was engaged in exploratory fishing, gear tests and demonstrations in the area off Cerro Gordo. This lies in the north coast of Puerto Rico approximately 20 miles west of San Juan. The survey area was bounded by coordinates 18°32' to 18°29' N and 66°13' to 66°27' W. Following the trend of almost the entire north coast the shelf here is narrow, from 1 to 2 miles wide; the slope is relatively gradual droping from 100 to 500-600 fathoms in five to six miles. The bottom strata is sand and mud inshore becoming sandier off-shore, interspersed with rock formations extending off the bottom and ravine-like canyons.

Commercial fishing in Cerro Gordo is limited to pot fishing in depth less than 20 fathoms, turtle tanglenet and some beach seining. The survey area was divided into a 2-mile square grid, which included numbers 124-A to 129-A and 134-A to 141-A, as shown in the accompanying Figure 11.

The gear used during the survey included fish and lobster pots, gill net and snapper reel. The depth fished was from the coastal shallows to 150 fathoms; the latter mainly with fish pot and snapper reel. Following the cruise plan, the grid squares were first tested to determine relative abundance of fish. Later efforts were concentrated in the grids which showed the greater yield to determine the commercial potential.

In general the fishing results showed promise for the off-shore areas beyond the 40-45 fathoms, consistent probably, with its relatively unexploited condition.

The following list indicates the species of fish most commonly taken, by gear.

Lobster pot: (none)

Fish pot:

Silk snapper	*Lutjanus vivanus*
Blackfin snapper	*Lutjanus buccanella*
Lane snapper	*Lutjanus synagris*
Mutton snapper	*Lutjanus analis*
Vermillion snapper	*Rhomboplites aurorubens*
Yellowtail snapper	*Ocyurus chrysurus*
Nassau grouper	*Epinephelus striatus*
Rock hind	*Epinephelus adscensionis*
Squirrel fish	*Halocentrus sp.*
Blue runner	*Caranx fusus*
Trigger fish	*Canthigaster sp.*

Gill net:

King mackerel	*Scomberomorus cavalla*
Look down	*Selene vomer*
Thread herring	*Opithonema oglinum*
Barracuda	*Sphyraena barracuda*

Snapper reel:

Silk snapper	*Lutjanus vivanus*
Blackfin snapper	*Lutjanus buccanella*
Mutton snapper	*Lutjanus analis*
Vermillion snapper	*Rhomboplites aurorubens*
Nassau grouper	*Epinephelus striatus*

Table 11 lists the fishing test results by gear and Figure 11 indicates the grid pattern covered during the survey.

TABLE 11 - FISHING RESULTS

Grid No.	LP*	FP*	BG*	SR*
124-A	X	16 1/2	X	1/2
125-A	X	15	X	0
126-A	X	18	X	7
127-A	X	18 1/2	X	3 1/2
128-A	X	21 1/2	X	4 1/2
129-A	X	19	X	4
134-A	0	X	X	X
135-A	0	X	X	X
136-A	0	X	7	X
137-A	0	X	23	X
138-A	X	X	X	X
139-A	0	X	39	X
140-A	X	X	22	X
141-A	X	14 1/2	X	18

*LP=Lobster pot, average weight of catch per pot in pounds, to the nearest half pound.

*FP=Fish pot, average weight of fish per pot in pounds to the nearest half pound.

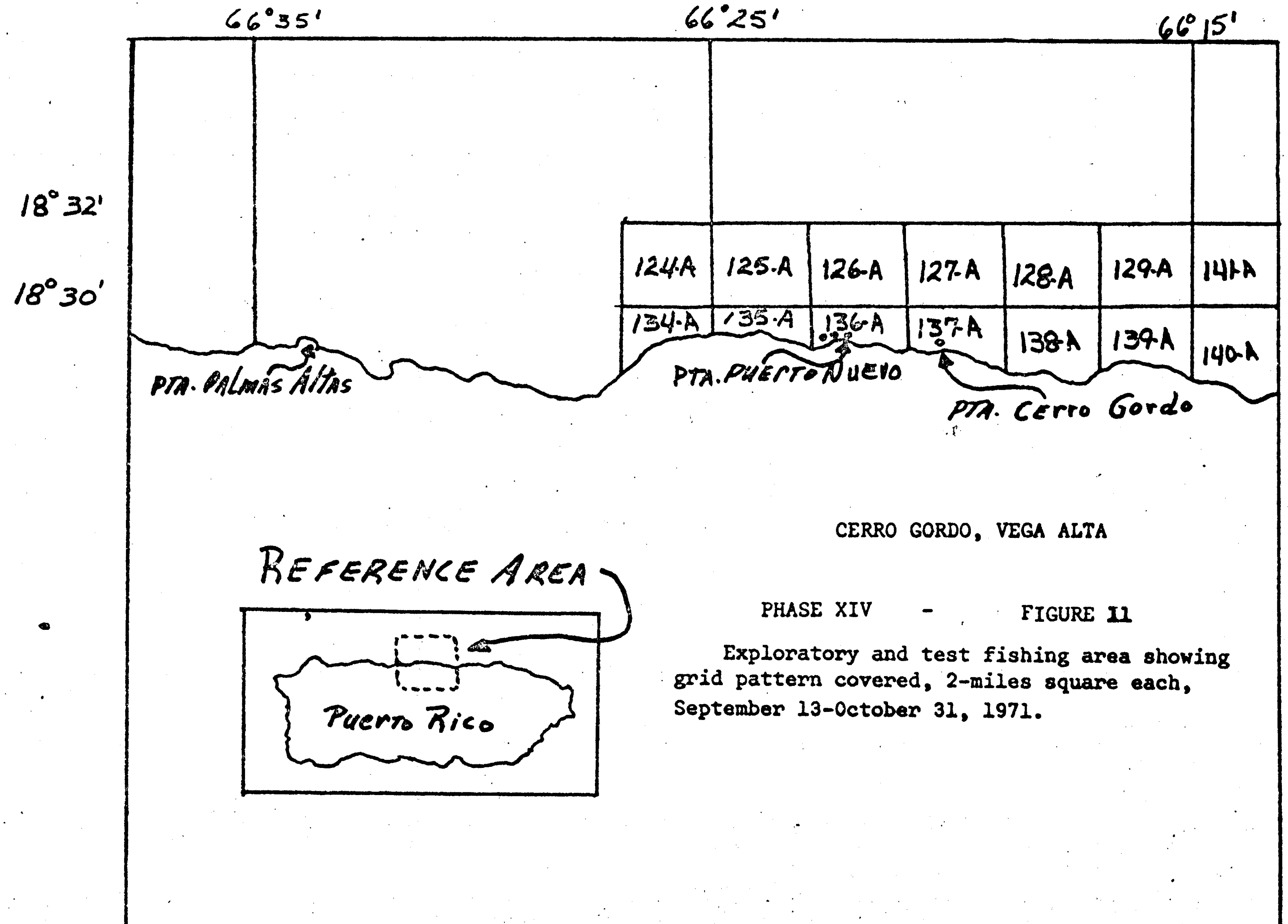
*BG=Bottom gill net, weight of fish catch in pounds per set.

*SR=Snapper reel, average weight of fish catch per reel per hour.

Significant results:

All the areas tested with fish pots within the edge and slope, which included Grids 124-A through 129-A and 141-A, produced 15 pounds or more of fish per lift per pot. These amounts are the average of three or more individual lifts. Compared with commercial yields this test fishing production was from 3 to 4 times better. In one case a fish pot was lifted after a 24-hour soak which contained 42 lbs. of silk snapper, a second soak of the same pot of only 2 hours produced 28 pounds of the same species.

Gillnet produced limited amount of fish and lobster pots nothing.



CERRO GORDO, VEGA ALTA

PHASE XIV - FIGURE 11

Exploratory and test fishing area showing grid pattern covered, 2-miles square each, September 13-October 31, 1971.

P.R. 183.

Only Title Page and Table of Contents included in this CICAR Report

Annual Report
July 1970 - June 1971

Investigations on the resource potentials of the Spiny lobster (*Panulirus argus* Latreille) in Puerto Rico
(Project number 2-97-R)

Robert Y. Ting
Principal Investigator
Department of Marine Sciences
University of Puerto Rico
Mayaguez, Puerto Rico 00708

Research project supported
by
Commercial Fisheries Research and Development Act (88-309)
Bureau of Commercial Fisheries
U. S. Fish and Wildlife Service
Department of the Interior
and
Department of Agriculture
Commonwealth of Puerto Rico

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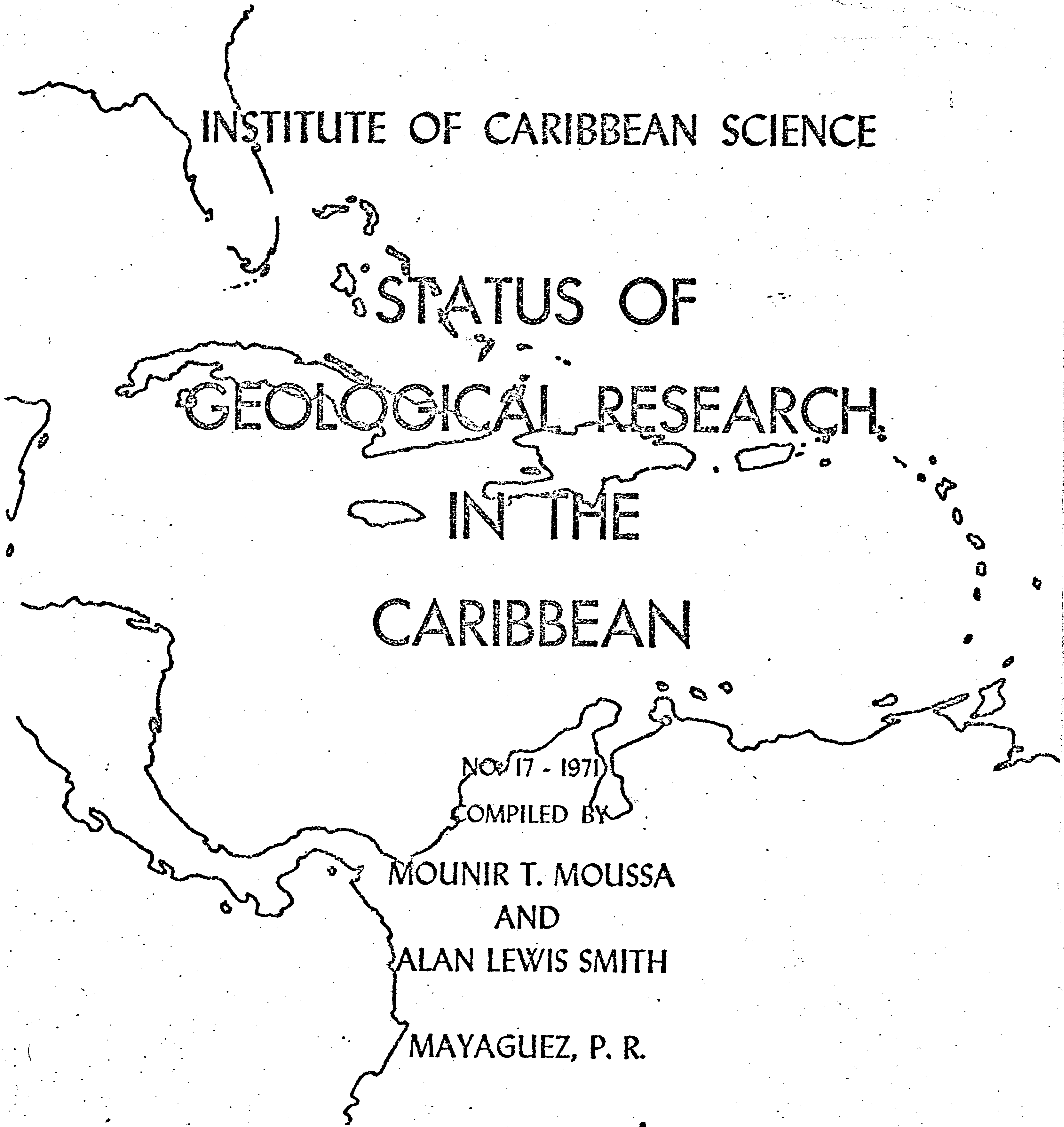

STATUS OF GEOLOGICAL RESEARCH IN THE CARIBBEAN

NOV 17 - 1971

COMPILED BY
MOUNIR T. MOUSSA
AND
ALAN LEWIS SMITH

MAYAGUEZ, P. R.

Island Resources Foundation

Caribbean Conservation Association

Caribbean Research Institute of the

College of the Virgin Islands

St. Thomas, Virgin Islands

1971-2

The Caribbean Research Institute and the Caribbean Conservation Association supported a Green Turtle expedition to Aves Island in 1971, and a copy of the title page of William E. Rainey's report on this work is included in this report. The fishes of Aves Island were studied by Smith and Brownell of CRI, and the title page and introduction of their report is also included.

At the time of the Vth ICG meetings for CICAR in Havana in June of 1972, the M/V ALLANORA under the sponsorship of the Dave Hokin Foundation, IRF, CCA, CRI and the Explorers Club is engaged in a two-month circummavigation of the Caribbean Sea to study beaches, birds, cays, and reefs. The cruise plan for this M/V ALLANORA cruise is attached.

IRF-CCA-CRI
187.

Caribbean Conservation Association

FOUNDED 1967.

PLEASE REPLY BY AIRMAIL TO:
c/o Caribbean Research Institute
College of the Virgin Islands
St. Thomas, V. I. 00801

June 1, 1972

Dr. Harris B. Stewart, Jr.
U. S. National Coordinator for CICAR
U. S. Department of Commerce
National Oceanic and Atmospheric Administration
Atlantic Oceanographic and Meteorlogical Laboratories
901 South Miami Avenue
Miami, Florida 33130

Dear Dr. Stewart:

Thank you very much for your letter of May 25, 1972, inquiring about the M/R ALIANORA's research trip which is currently underway in the Caribbean basin. I am enclosing a copy of the itinerary of the vessel, and I would be happy to provide you with a track chart which will be sent under separate cover.

I am more than happy to accept your offer to consider the program as part of the U. S. effort in CICAR, and we will provide you with copies of all the data which we are currently collecting. We would very much like to receive a copy of what additional information you have on the CICAR program. We have followed the CICAR activities from afar and found very useful the Symposium on Investigations and Resources of the Caribbean Sea and Adjacent Regions preparatory to CICAR which was published by FAO following the Curacao meetings in November, 1968.

I am also enclosing copies of three reports which have come from two previous expedition efforts to Aves Island in the eastern Caribbean and operational reports of these expeditions one of which was in August and one of which was in November can also be forwarded if you feel they would be useful.

A summary of our projected work for the next year will also be forwarded to you under separate cover. With kindest regards and appreciation for your interest in our work, I remain,

Cordially yours,

E L Towle

Edward L. Towle, PhD.
President
ELT/hd
Encls.

THE SAN JUAN STAR, August 17, 1971

Foundation Set Up In V.I. For Study Of Island Systems

By THOMAS W. ORR

CHARLOTTE AMALIE, St. Thomas (AP)—A research foundation to study all aspects of island systems in various parts of the world has been established in the Virgin Islands.

The announcement was made Monday by Edward L. Towle, president of the Caribbean Conservation Association, a regional coalition of island governments, national trusts, and conservation organizations.

Recently incorporated, the Island Resources Foundation (IRF) will deal with special problems and potentialities of islands, Towle said, and will aim specifically to improve utilization of the limited resources of island communities.

Towle, who also heads the Caribbean Research Institute at the College of the Virgin Islands, indicated that the new foundation will be an in-

(See STUDY, Page 26)

Study Group Aims To Improve Use Of Islands Resources

(Continued From Page 15)

dependent, international, non-govermental, non-profit service organization.

It is designed to assist existing local institutions and organizations working on problems unique to islands, in addition to developing its own programs and projects, he pointed out.

"The foundation can provide a vital combination of focus, leadership, innovation, and a broadly concerned interdisciplinary approach to the unique types of resource development problems of all small island groups," Towle said.

The foundation was organized in the Virgin Islands, he noted, but will draw its financial support and working personnel from all parts of the world.

Economists, marine scientists, geologists, sociologists, psychologists, political scientists, ecologists, and other specialists will undertake projects that have special significance to the conditions on islands and among island populations, he explained.

These could include such activities as the study of fisheries, development of museums and programs for environmental education, and analysis of psychological characteristics and needs of island people.

Other possibilities might be training of islanders for ocean-related industries, promotion of aquaculture and marine pharmacology to enrich island economies, and establishment of improved procedures for resource management.

Towle said that Norwell Harrigan, a Virgin Islander, has been named vice president of the foundation. Harrigan— a former government secretary in the British Virgin Islands— is director of the Inter-Virgin Islands Study Project at the College of the Virgin Islands.

IRF-CCA-CRI
189.

Only the title page reproduced for
this report to the Vth
ICG for CICAR

Report of the CRI-CCA Aves Expedition
24-27 July, 1971

RECONNAISSANCE OF THE GREEN TURTLE, CHELONIA MYDAS

NESTING AGGREGATION AT AVES ISLAND, LESSER ANTILLES

William E. Rainey

Expedition sponsored by

Caribbean Research Institute-Virgin Islands Ecological Research Station
Caribbean Conservation Association

LRF-CCA-CRI
190.

Only the Table of Contents reproduced for this report

CARIBBEAN CONSERVATION ASSOCIATION

ENVIRONMENTAL NEWSLETTER

Vol. 2, No. 3, October, 1971

CONTENTS

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DRAFT COPY -- NOT FOR PUBLICATION.

SURVEY OF THE FISHES OF AVES ISLAND

Barry A. Smith

and

Willard N. Brownell

Caribbean Research Institute, College of the Virgin Islands, St. Thomas, Virgin Islands

Introduction

Aves Island is a small, uninhabited Venezuelan island in the east-central Caribbean Sea about 160 miles southeast of St. Croix (15°42' N latitude, 63°38' W longitude). It represents the only aerial exposure of the Aves Swell, a submarine mountain range. The island is essentially a low, footprint-shaped sandbar with the long axis oriented in a north-south direction. Its total length is 550 m, width ranges from 30 to 140 m, and maximum elevation is 3 m (Maloney et al., 1968). The northern end of the island is broader and slightly higher than the southern end.

The geology and physical structure of Aves has been described (Zuloaga, 1955; Mitchell, 1957; Maloney et al., 1968). The island serves as the nesting area for a number of species of marine birds (Zuloaga, 1955; Lazell, 1967) and apparently provides the most important remaining green turtle nesting beaches in the eastern Caribbean (Parsons, 1962). It is additionally inhabited by two species of low, ground plants (Zuloaga, 1955) and a number of invertebrates (Lazell, 1967). To our knowledge, however, no published information on the aquatic inshore fauna of this island is available.

Proposed
Circumnavigation
and Environmental Survey
of Remote Beaches, Islands and
Cays in the Caribbean Basin
May 15 - July 15, 1972

with special emphasis on
- Sea turtle nesting and exploitation
- Sea turtle tagging
- Glovers Reef
- Marine Pollution Survey
- Monk seal search
- Reef ecology

Vessel: M/V Alianora, 72 ft. ketch

Sponsors: Dave Hokin Foundation
Island Resources Foundation
Caribbean Conservation Association
Caribbean Research Institute
Explorers Club

Directors: Dr. E. L. Towle
President,
Caribbean Conservation Association
and
Director,
Caribbean Research Institute

and

Mr. Myron Hokin
c/o Dave Hokin Foundation
Chicago, Illinois

Research Personnel: Dr. E. L. Towle, CCA, CRI, IRF
Mr. William E. Rainey, CRI, CCA, IRF
Mr. Anton R. Teytaud, CRI
Mr. Robert Bernhard, IRF
Dr. Paul Burkholder, CRI, CCA
Mr. Carl Pechman, Explorers Club

Invited or Potential Institutional Participation:

Smithsonian (CITRE)
College of the Virgin Islands
✓ CICAR
National Geographic
INTECMAR (Venezuela)

Tentative Itinerary:

Leg#1
15 May — Depart Grenada for Aruba (7 days total, 4 days transit)
via (a) Los Roques, Venezuela

(b) Los Aves, Venezuela
alternate stop - La Blanquilla

Leg #2
22 May — Depart Aruba for Panama (7 days, 4 in transit)
via (a) Riohacha (also called La Hacha), Columbia
alternate stop - nesting beach between Rio Don Diego and Rio Buritaca, 50 miles east of Santa Marta, 73° 40'
(b) Santa Marta, Columbia
alternate - Acandi nesting beach, west shore of Gulf of Uraba.

alternate - Isla Rosario

(c) San Blas cays, Panama

Leg#3
29 May — Panama Canal Zone survey and provisioning (6 days)

Leg #4
4 June — Depart Panama for British Honduras (13 days, 7 in transit)
via (a) Chiriqui Lagoon region, Panama, specifically Chiriqui Beach and Bocas del Toro.

(b) Albuquerque Cay (U. S. and Columbia)
alternate - Courtown Cays (Columbia)
2nd alternate - Corn Island

(c) Serrana Bank
alternate - Roncador Bank
2nd alternate - Quitasueño

(d) Banco Gorda, Gorda Cay, and Farrall Rocks
(Long. 83 Lat. 16° N)

(e) Seal Cays. (North of Cabo Falso. 16N, 83° 20'W)

(f) Bay islands Roatan and Banacca, the Bay islands of Honduras

(g) Arrive British Honduras, enter, provision, pick up support boats

(3)

Leg #5
17 June -
1 July — British Honduras Reef System Survey (16 days)

Note 1: An additional support boat will be available for special survey work.

Note 2: Study site selection subject to adjustment upon arrival.

Note 3: General operating pattern will commence at southern end of the reef system, with M/V Allanora anchoring behind the barrier for 24 to 36 hours as a base of operation, then moving north to 10 to 20 miles to a new support anchorage, and so forth north to Banco Chincorro.

(a) Glovers Reef (4 - 6 days)
(b) Seal Cay
(c) Lighthouse Reef (and associated cays)
(d) Columbus Cay
(e) Bancho Chinchorro

Leg #6
3 July-
19 July — British Honduras - St. Thomas, U.S.V.I. (16 days)
via (a) Banco Chinchorro and the mainland coast of Quintana Roo, Mexico

(b) Cayman Islands or Swan Island
alternate - Pedro Bank, Jamaica

(c) Morant Cays, Jamaica

(d) Selected offshore islands of Dominican Republic and Haiti

Leg #7
20 July-
21 July — St. Thomas - Unloading stop (2 days)

Leg #8
22-24
July — St. Thomas - Grenada (3 days with possible Aves stop)

Planning Chart Reference: Admiralty #762, West India Island and Caribbean Sea.

National Oceanic and Atmospheric Administration (NOAA)

Atlantic Oceanographic and Meteorological Labs. (AOML)

Virginia Key, Miami, Florida

Marine Geology and Geophysics

1971-2

The NOAA Atlantic Oceanographic and Meteorological Laboratories' 1971-2 marine geophysical work in the CICAR area is limited to the Equatorial Atlantic Plates (EQUAP) Program. This CICAR project is based on 1) the realization that systematic geophysical data are in great need between the Lesser Antilles Island Arc and the Mid-Atlantic Ridge; 2) previous accomplishments of the Atlantic Oceanographic and Meteorological Laboratories (AOML) in the Caribbean area (see attached title pages of publications); and 3) arrangements made under the Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR).

The EQUAP project intends to establish a high density geophysical data traverse over the margins of the North Atlantic, Funnel-Smith, and Caribbean crustal plates. The work is envisioned as a start on continuing systematic scientific investigations of the equatorial Atlantic area in order to outline the fracture pattern and crustal plate structure, all of which are of major importance in the construction of working models related to the evolution of the Atlantic Ocean and the adjacent Caribbean Sea.

The project in 1971 consisted of the collection of data on a system of east-west oriented tracklines spaced 20 n. miles apart between 42°W and 62°W longitudes, and 14°N and 17°30'N latitudes. The tracklines accomplished during 1971-72 by the EQUAP project are shown on the attached figure. Magnetic and gravity data were obtained over 95% of the lines shown, bathymetric data were collected by the narrow-beam echo sounder on all north-south tracklines and on most of the east-west lines. Additional geophysical coverage included seismic reflection profiling with a 120-cu.in., 300-cu.in., or two 300-cu.in. air guns across the Barbados Ridge and the immediately adjacent Atlantic Ocean floor. Several seismic refraction profiles were also run using air guns and sonobuoys.

Other scientific projects carried out included:

1) A detailed seismic reflection and geophysical survey in an area north of the Barbados Ridge. The goal was to determine whether the Desirade or Barracuda faults form a structural boundary, cutting off the Puerto Rico Trench on the south.

2) A number of heat-flow observations were made at the southwestern tip of the Barracuda fracture zone in order to test the heat-flow variation related to subbottom geologic structure. This study was carried out in cooperation with Dr. R. P. Van Herzen of Woods Hole.

3) The NOAA Ship DISCOVERER participated in a multinational seismic refraction program across the Lesser Antilles Island Arc and the Aves Ridge, as part of the AOML contribution to the CICAR program. Instrumentation and participants were provided by Dr. H. P. Bott, University of Durham, the principal coordinator of this project and CICAR Subject Leader for geophysics.

The major scientific aim of the project is to define the plate margins through the identification and correlation of magnetic anomaly lineations, and through the detailed study of the gravity anomalies and the morphologic provinces in the area.

Preliminary analysis of the records suggests that the faults offsetting the ridge crest end at approximately 53°W. The abyssal plain to the west of the ridge province has a different east-west fault pattern that may extend westward onto the Barbados Ridge. The east-west faults of the abyssal plain all appear as down-to-north normal faults. Near one of the faults at 12°30'N, 57°05'W, a flat, ancient sea floor, upon which the sedimentary prism of the Amazon River was deposited, comes within 200m of the present sea floor (this same reflector is well below 1000m just 40 miles south of the fault). At this same location, approximately 400m below the sea floor, a prominent reflector that may represent the oceanic basement was also found. Since this location is near the island arc, it has been recommended to JOIDES for possible drilling, with the hope that some of the oldest rocks in the equatorial Atlantic may be reached there.

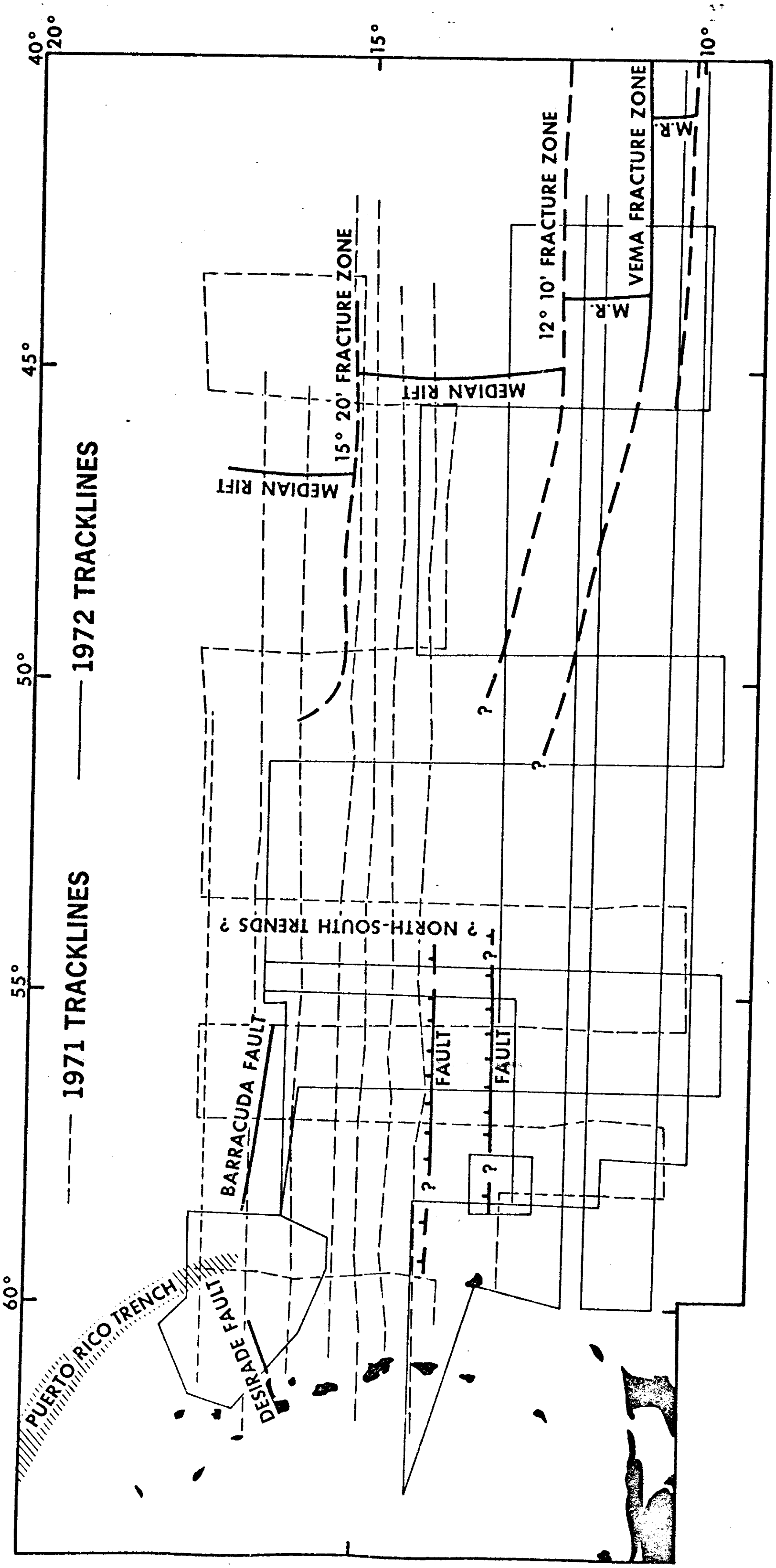
A preliminary look at the magnetic anomalies suggests that with the exception of the immediate vicinity of the ridge crest, the anomaly pattern does not resemble the characteristic pattern of the North Atlantic. Further studies of the data are required, however, to delineate adequately the magnetic anomaly pattern of this area.

1973

With the realization of the importance of the structure of the equatorial Atlantic Ocean in the development of working models for the evolution of the Atlantic and Caribbean regions, and the fact that the area essentially lacks systematic geophysical data, a new proposal has been submitted to the IDOE office of the National Science Foundation for a systematic study of the entire equatorial Atlantic area.

Related to this expanded program, there will be several north-south geophysical traverses between the Barracuda and the Vema fracture zones in order to define the fault pattern suggested by our surveys in 1971-72. In addition, several lines will be run to define the extension of the Vema fracture zone and the Romanche fracture zone in the western half of the Atlantic.

The title page and abstract of several recent CICAR-related papers by members of the Marine Geology and Geophysics Lab. of AOML are included as part of this report.


1972 TRACKLINES
1971 TRACKLINES
15° 20' FRACTURE ZONE
12° 10' FRACTURE ZONE
VEMA FRACTURE ZONE
MEDIAN RIFT
MEDIAN RIFT
M.R.
M.R.
? NORTH-SOUTH TRENDS ?
BARRACUDA FAULT
FAULT
FAULT
DESIRADE FAULT
PUERTO RICO TRENCH
20°
15°
10°
40°
45°
50°
55°
60°

NOAA-AOML
199.

U.S. DEPARTMENT OF COMMERCE
Peter G. Peterson, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

ENVIRONMENTAL RESEARCH LABORATORIES
Wilmot N. Hess, Director

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Geology and Geophysics of the Venezuelan Continental Margin Between Blanquilla and Orchilla Islands

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ABSTRACT

A study of the geology of the continental margin of northeast Venezuela was conducted by marine magnetic, gravity, seismic reflection, and bathymetric investigations, and by a program of dredging of submarine rock outcrops.

Previous surveys have established that geophysical anomalies associated with discrete tectonic elements of the Lesser Antilles Island Arc continue southwestward onto the continental shelf of Trinidad and Venezuela. This study demonstrates the extension of these tectonic elements westward to 65°W, where they either truncated or are interrupted by a major northwest-southeast trending fault system. The bordering faults of the Los Roques Canyon and the Urica and possibly the San Francisco faults form a continuous, northwest-southeast trending discontinuity, whose existence since Cretaceous time mitigates against large east-west displacements along the northeast Venezuelan margin during the Cenozoic.

Geophysical measurements indicate that west of the Urica fault the Bay of Barcelona is underlain by rocks that probably belong to the seaward extension of the tectonic belts of the western Serrania del Interior mountains. Over the island platforms these measurements indicate the presence of igneous rocks. Sampling of basement outcrops on Blanquilla platform yielded granites, granodiorites, quartz monzonites, and metabasalts. A potassium-argon age of 81 m.y. was obtained from the biotites of one granite sample, which is consistent with the ages of similar rocks dated on Curacao, Aruba, and the southern part of the Aves Ridge.

The major fault systems and the numerous minor faults offsetting the sea floor along the continental margin attest to Late Tertiary to Holocene tectonic activity, that most likely was responsible for the subsidence of several basins on the continental shelf.

The American Association of Petroleum Geologists Bulletin
V. 55, No. 10 (October 1971), P. 1719-1729, 8 Figs.

Marine Geophysical Reconnaissance of Continental Margin North of Paria Peninsula, Venezuela[1]

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Abstract Marine geophysical observations north of the Paria (Venezuela) Peninsula and westernmost Trinidad have delineated three features that dominate the shallow structural pattern of the shelf: (1) Carupano Sea Valley, which extends eastward along the Paria-Araya shoreline and occupies a structural depression bounded on the south by a major fault system; (2) Cumberland Rise, a locally complex structural and topographic high north of the sea valley; and (3) Tobago Trough, which appears to extend southwest across the shelf almost to the Paria-Trinidad coast. The orientation of the positive elements of Cumberland Rise and the trend of magnetic anomalies that seem to be associated with the Carupano depression suggest that both features may be related to the Lesser Antilles arc. Detritus eroded from the Paria-Araya Peninsulas is inferred to have been transported eastward through Carupano Sea Valley into Tobago Trough; the Paria shelf has been built upward and northward by sediments which bypassed the valley and were carried directly offshore, over the Cumberland Rise, to be deposited as foreset beds on an old erosion surface.

The extension of the Lesser Antilles arc southwest into the Paria-Araya shelf is marked by a +60 to +100 mgal free-air gravity anomaly. A shallow igneous intrusive extends from Los Testigos Islands northeast along the trend of this anomaly to the upper continental slope, where the intrusive is truncated by a northwest-southeast fault. The fact that the trends of the arc can be traced well into the Paria shelf militates against the presence of an east-west transcurrent fault between Carupano Sea Valley and the Grenada platform.

Introduction

As part of an Environmental Science Services Administration program for the investigation of the structure of ocean basins and their margins, marine geophysical observations have been made in an extensive area of the Caribbean Sea and Atlantic Ocean adjacent to the Paria-Araya Peninsulas of Venezuela, and surrounding the islands of Trinidad, Tobago, and Grenada. The results of reconnaissance seismic-reflection, bathymetric, gravimetric, and magnetic observations made by USC&GSS *Discoverer* in the summers of 1968 and 1969 will be presented in a series of reports, the first of which are three papers in this issue of the *Bulletin*. Our study, which covers measurements made over the Paria-Trinidad shelf and Grenada platform between 61°30′W and 63°00′W (Fig. 1), is addressed to two specific objectives: (1) determination of the structure of the Paria-Trinidad shelf and its relation to the Lesser Antilles island arc and the South American continent; and (2) location of the transcurrent or transform fault which, according to the hypotheses of the "new global tectonics" (Isacks *et al.*, 1968), must separate the Caribbean "plate" from the South American continent.

Previous Study

The earliest marine geophysical observations in the southeast Caribbean were isolated submarine gravity measurements made in 1936–1937 (M. Ewing *et al.*, 1957). In 1947, additional gravity measurements were made along a northwest-southeast traverse of the Paria shelf (M. Ewing *et al.*, 1957). The first detailed bathymetric map of the Paria and Trinidad shelves was published by Koldewijn (1958) as part of a study of the near-surface sediments. Seismic-refraction investigations of the shelf, Tobago Trough, and adjacent parts of the Lesser Antilles arc, conducted by Lamont Geological Observatory in 1955, were reported by J. Ewing *et al.* (1957) and Officer *et al.* (1959). This and subsequent work have been summarized and reviewed by Edgar (1968) and J. Ewing *et al.* (in press).

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The writers thank the officers and crew of USC&GS (now NOAA) ship *Discoverer*, W. W. Doeringsfeld, Jr., William Everard, G. A. Lapiene, Jr., N. J. Maloney, Wendell Mickey, and Paul Miller, for their support and cooperation in conducting the field work. G. H. Keller served as chief scientist during part of the survey. Geophysical data were reduced and plotted using programs developed by Paul Grim and Bobby Bassinger. Sue O'Brien drafted the figures. The paper was reviewed critically by L. W. Butler and B. J. Szenk.

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Marine Geophysical Study Northeast of Trinidad-Tobago[1]

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Abstract Marine geophysical measurements off Trinidad-Tobago delineate prominent structural trends revealed in the shallow sedimentary strata. Pilar block is one of the prominent structures along the boundary between the South American continent and Caribbean plate. The block is a narrow horst bounded on the north and south by major fault zones, which apparently continue from the Araya Peninsula of Venezuela eastward to about 58°50′W. Structural features north and south of the Pilar block either die out at the block or veer subparallel with it. North of the block, the Barbados Ridge is an anticlinorium which shows evidence of folding and fracturing apparently as a single tectonic unit. Long-period, high-amplitude magnetic anomalies, forming a zone somewhat parallel with the Lesser Antilles arcuate trend, suggest that the prominent trends of the anticlinorium extend across the continental shelf to the Pilar block. Within the study area, the geophysical data show no evidence for extensive translation between the South American continent and the Caribbean plate in comparatively recent time.

Introduction

During the summers of 1968 and 1969, the USC&GS ship *Discoverer* conducted reconnaissance marine geophysical investigations in the area off northern Venezuela and Trinidad and around the southern end of the Lesser Antilles arc. Ship's traverses for this study covered the area south of 12°30′N between the Tobago Trough and Trinidad to 58°30′W (Fig. 1). The investigation was designed to study the eastward extension of the predominantly east-west-trending structures of northern Venezuela and Trinidad, and their structural relation to the island of Tobago and the Barbados Ridge on the north. Data collected west of the study area are presented by Lattimore *et al.* (1971). Regional implications of both studies are discussed by Weeks *et al.* (1971).

Seismic reflection profiles (SRP) were made only on traverses across postulated major structural trends. Continuous gravity, magnetic, and bathymetric observations were recorded on all traverses. Within the study area of this paper, geophysical data were obtained along approximately 3,430 km (1,850 n. mi) of ship's track with SRP records made over about 2,410 km (1,300 n. mi) of the area traversed. The sound source for the SRP system was a 164-cc (10 cu in.) pneumatic gun. Gravity and magnetic observations were made with an Askania seagravimeter and a Varian nuclear resonance magnetometer respectively. Position control was determined by the best source available—dead reckoning, land ties by visual fixes and radar, Loran A and C, and Omega. These data were collected by methods described in Lattimore *et al.* (1971).

The track-line pattern and bathymetry in the study area are shown in Figure 1 of Weeks *et al.* (1971). Line drawings of representative SRP records correlated with gravity and magnetic observations are presented in Figure 2. Parts of original SRP traverses are reproduced in Figures 3–7. In the interpretation of the SRP records, the reflector generally referred to as basement is the deepest observed reverberant reflector beyond which no penetration is obtained within the resolution of the equipment. This reflector, varying in acoustic character over the study area, corresponds in depth to the 3.97 km/sec (13,000 ft/sec) or higher velocity material reported by Ewing *et al.* (1957).

Previous Investigations

Geologic structures of the islands of Trinidad-Tobago and surrounding area have been described by numerous investigators. Some of the results have been presented by Schuchert (1935), Maxwell (1948), and Suter (1960). In the study area, near-surface, shallow-water sedimentation and geologic structure were studied by Koldewijn (1958), van Andel and Sachs (1964), and van Andel (1967). Deep crustal studies based on seismic refraction results in

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The writers are grateful to the officers and men of the USC&GS (NOAA) ship *Discoverer* and the AOML personnel who participated in the project. We are particularly indebted to G. A. Lapiene, Jr., and L. W. Mordock (USESSA) for their assistance in conducting the field work and to Sue O'Brien and George Merrill for drafting the figures. L. W. Butler and G. H. Keller critically reviewed the paper.

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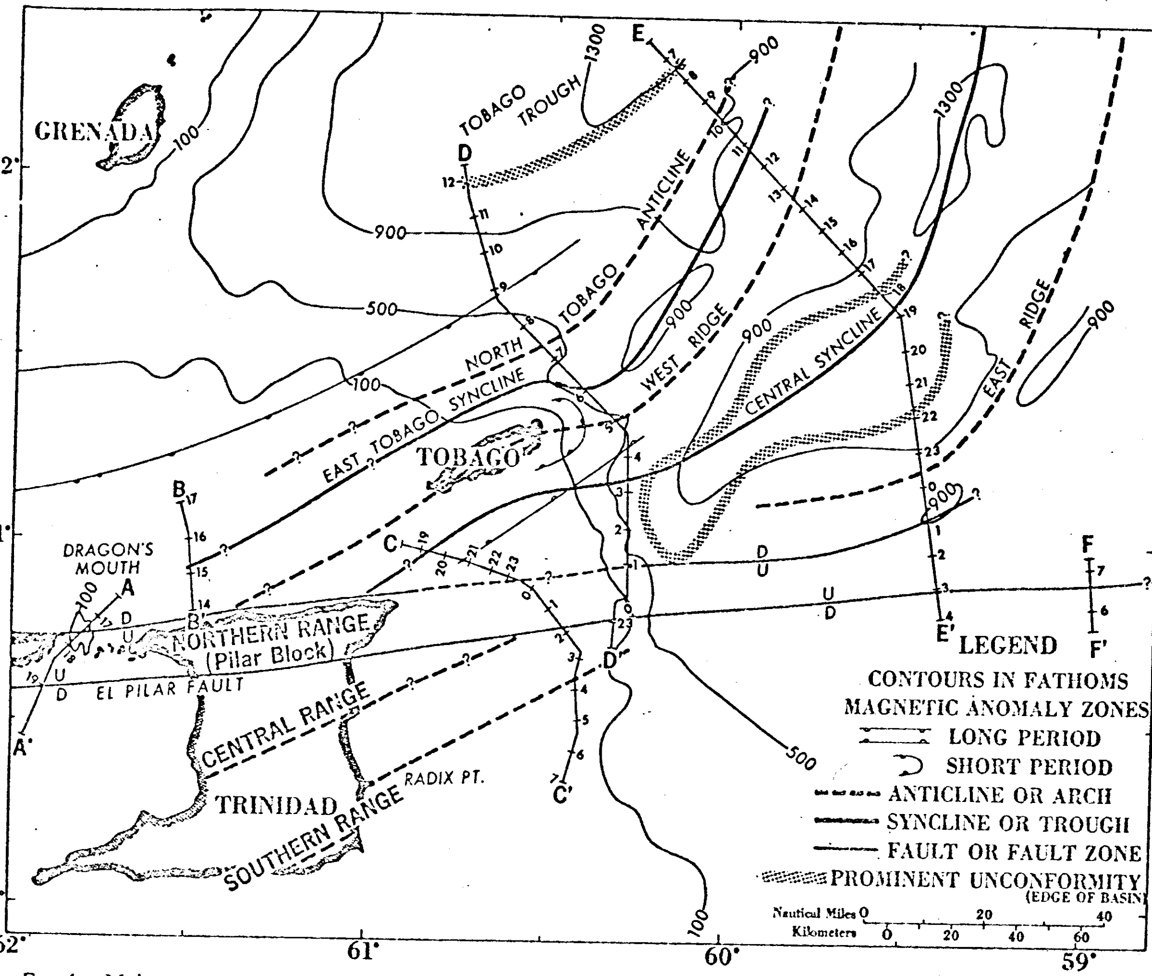

FIG. 1.—Major structural trends and location of representative traverses. Barbados anticlinorium is complex of structures lying east of Tobago Trough through East ridge.

the Caribbean, across the Lesser Antilles island arc, and in the Atlantic were summarized by Officer *et al.* (1959). Some of these velocity data were analyzed by Ewing *et al.* (1957) and later utilized in presenting a summary of the crustal section of the Caribbean area (Edgar, 1968). Higgins (1959) compared the offshore velocity data with similar velocities from geologic structures on Trinidad. Recently, Sykes and Ewing (1965) discussed the seismicity of the Caribbean for the period 1950–1964 and related its occurrence to boundaries between prominent structures.

The Caribbean plate and adjacent South American continent have been described as contrasting crustal blocks with great horizontal movements along major boundary faults. Diverse interpretations were made concerning the interaction between these crustal blocks and the boundary fault systems. Hess (1938) suggested that the Caribbean block was translated eastward 80–160 km (50–100 mi). However, Eardley (1954) summarized the earlier hypotheses and presented an argument for subsidence of the Caribbean basin. On the contrary, Rod (1956) implied that the overall displacement within the Caribbean area of more than 100 km (62 mi) was not unreasonable, based on an analysis of the supposed strike-slip fault system along northern Venezuela. In further support of strike-slip movement, Alberding (1957), applying the principle of wrench-fault tectonics of Moody and Hill (1956) to northern South America, concluded that during the Cre-

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Structural Relations Among Lesser Antilles, Venezuela, and Trinidad-Tobago[1]

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Abstract More than 2,500 n. mi (4,630 km) of seismic reflection profiling, gravity, magnetics, and bathymetric data were collected in the southeastern Caribbean by the ESSA Coast and Geodetic Survey ship *Discoverer* in 1968–1969.

A review of the structural geology of the southeastern Caribbean and the South American continent in conjunction with the ESSA data supports a relatively simplistic explanation for the geologic structure. The Barbados Ridge is a greatly fractured anticlinorium, supported by "basement" rocks, and consisting of two parallel arches with a central syncline. The Lesser Antilles volcanic arc, the Tobago trough, and the Barbados anticlinorium are traceable into the Venezuelan and Trinidadian shelves (South American continent).

An analogy between the Caribbean and Indonesian island arcs shows the validity of the concept of continuation of continental mobile belts into island arc systems. The mobile belt and the island arc system are analogous manifestations of orogeny in different crustal types. Evidence is against wrench faulting, with its implication of vast horizontal movements of individual blocks. The island arc structural belts and the mobile belts of the continent are interrelated, gradational, and interlocked.

Introduction

In 1968 the ESSA ship *Discoverer* began a continuing geophysical study of the southern Lesser Antilles, the Venezuelan and Trinidadian shelves, and the Barbados Ridge.

The primary purpose of this study is to determine the structural configuration of the Lesser Antilles island arc system and its relation to the South American continent. Previously, the senior writer and others conducted a similar study in the Andaman Sea during the International Indian Ocean Expedition in 1964 (Peter *et al.*, 1966; Weeks *et al.*, 1967). Similarities between the Andaman-Nicobar Islands and the Lesser Antilles led to a similar though expanded study of the Caribbean eastern margin.

This paper is a synthesis of the ESSA data presented in the preceding papers in this *Bulletin* by Lattimore *et al.* (1971) and Bassinger *et al.* (1971), and of the known structural geology of the island arc system and the northeastern part of the South American continent. A structural analogy between the Lesser Antilles and Indonesian arcs is presented.

The 1969 study area was bounded by long. 58°30′-63°W and lat. 10°-12°30′N. Within that area more than 2,500 n. mi (4,630 km) were covered by seismic reflection profiling, gravimeter, magnetometer, and echo sounding observations. Additional gravimetric, magnetic, and bathymetric data were collected along various transects of the area. Figure 1 shows bathymetry and track lines within the study area.

Structural Belts

An interpretative cross section across the Lesser Antilles island arc system from the Venezuela basin through the Aves Ridge, Lesser Antilles, Barbados anticlinorium, and intervening troughs (Grenada Trough, Tobago Trough, Central syncline) is shown in Figure 2. The vertical scale is exaggerated to show the structural features more clearly.

Venezuela Basin

The west end of the section (Fig. 2) starts in the eastern Venezuela basin, on the west flank of the Aves Ridge. According to Edgar (1968; Fig. 3 this report), there are about 2 km (1¼ mi) of sediments, of velocity less than 5 km/sec (3.1 mi/sec), within the central part of the Venezuela basin, thickening to about 5 km (3.1 mi) on the western flank of the Aves Ridge. Sediments are thinnest within the central part of the basin and thicken toward the flanks of the basin in all directions. Ewing *et al.* (1967) showed that the sediments of the Venezuela basin are flat and undisturbed, indicating a lack of deformation or tectonic activity within the block. The basin as a unit has had a relatively stable tectonic history with only minor deformation around the edges of the plate. It is seismically inactive. Ewing *et al.* (1967) concluded that stability of the Caribbean subbasins

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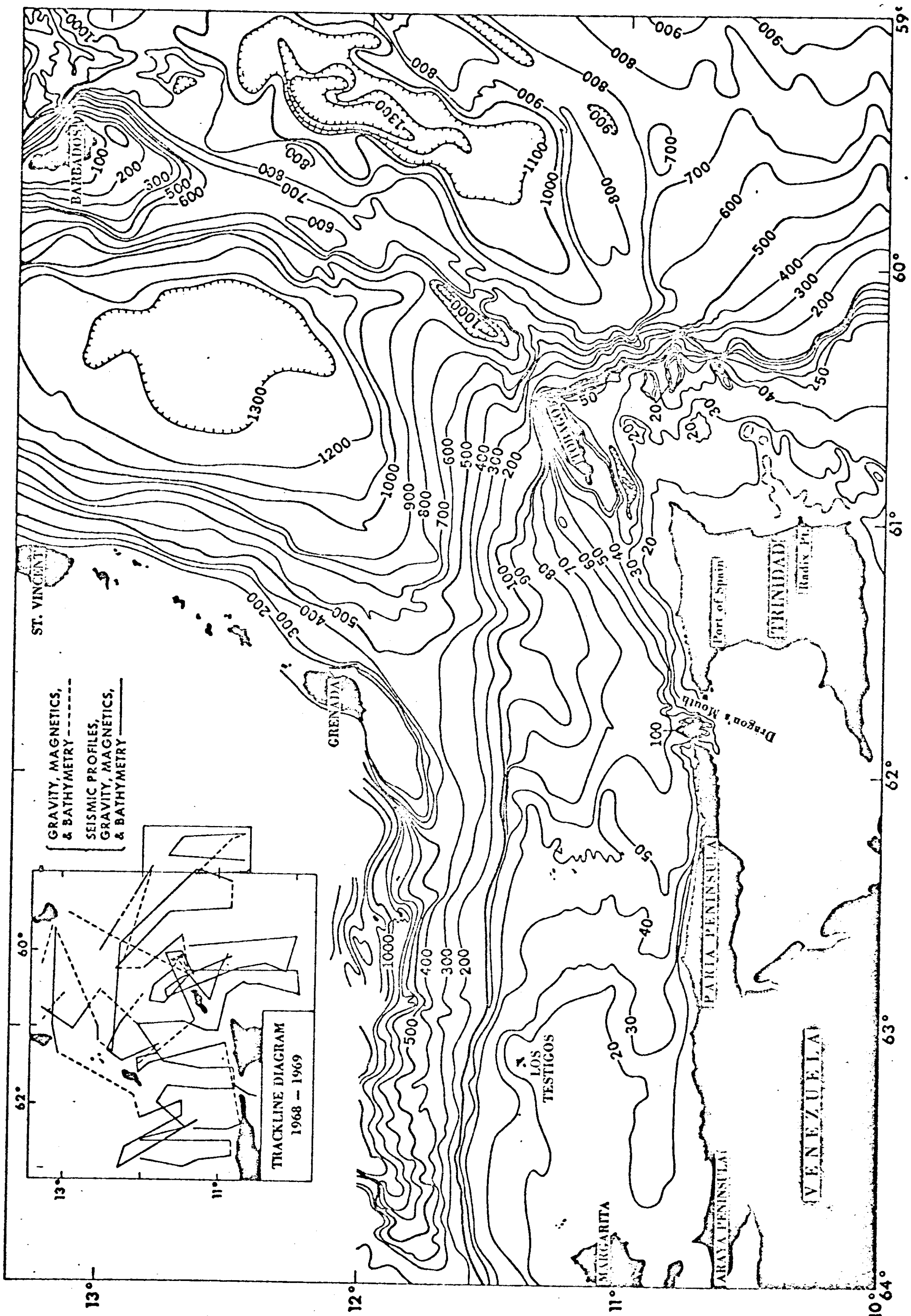


FIG. 1.—Bathymetry and trackline diagram. Contours in fm. Contour interval between 20 and 100 fm is 10 fm; below 100 fm, interval is 100 fm.

Physical Oceanography

1971-2

As part of CICAR Survey Month I in August, 1971, the Physical Oceanography Laboratory of AOML conducted a two-ship survey of the western Caribbean Sea and the eastern Gulf of Mexico. The objectives of this portion of CSM I were to investigate the dynamics and kinematics of the formation of the Yucatan Current and the distribution of various water masses in the area. To avoid Hurricane Chloe the work area was extended to the Gulf of Mexico.

In the western Caribbean Sea, the NOAA Ship RESEARCHER tracked sets of three and four parachute drogues along the paths indicated in Fig. 1. The approximate path of the drogues in the Gulf of Mexico is given in Fig. 2. Thirty-five Nansen stations and eighty STD stations were taken along these tracklines to provide the downstream density fields.

The NOAA Ship DISCOVERER occupied the Nansen and STD stations shown on Fig. 3 to obtain the distribution of cross-stream density and various chemical elements. Among these elements were oxygen, nitrate, nitrite, phosphate, silicate, copper, mercury, and pH. Current meters and deep sea tide gauges were implanted by the DISCOVERER on Rosalind Bank and Misterioso Bank at positions noted on Fig. 2. These experiments are discussed in the report of the CICAR Subject Leader for Tides (B. D. Zetler).

Preliminary results of the Lagrangian drifter study in the western Caribbean Sea were presented at the Fifty-Third Annual Meeting of the American Geophysical Union in Washington, D. C. The drogue tracks of Fig. 1 and the dynamic height fields of Fig. 4 summarize these results. Briefly, the greatest amount of flow through the Yucatan Strait enters the basin south of Misterioso Bank at velocities of 0.75 m/sec. The flow de-accelerates in an anticyclonic turn and, upon leaving this bend, accelerates in the vicinity of Cozumel Island. On the track-line closest to Cozumel, the drogue speeds more than doubled from 0.7 m/sec to 1.7 m/sec, within sixty km. Also, both the drogue and hydrographic data indicate a stagnation point in the flow east of Banco Chinchorro, with some transport turning to the south.

During September the DISCOVERER occupied STD and water sampling stations on CICAR standard section b, and deployed two deep sea tide gauge/current meter capsules near the semi-diurnal tide amphidromes in the eastern Caribbean. These capsules were recovered in October, and the results are described under the tide program.

During CICAR Survey Month II in April-May of 1972, a multi-institution study was conducted to investigate the upper 1000-m transport and water mass distribution into, within, and out of the eastern Gulf of Mexico. Participants included Nova University, Mexico, Texas A&M University, University of South Florida, and AOML.

While Dr. Richardson of Nova University deployed his transport meters by airplane in the Yucatan Strait, the R/V VIRGINIA KEY of AOML took a series of sections to obtain geostrophic transports for comparison. Fourteen transects were made between Isla Mujeres and Cabo San Antonio from 27 April to 29 May 1972, and 69 STD stations and 124 750-m XBT's were taken. Because of the consistent T-S relation in the Yucatan Strait, predetermined salinity values will be used with the XBT temperatures to increase the amount of available density data.

The R/V URIBE of Mexico and the R/V VIRGINIA KEY rendezvoused twice at Isla Mujeres, Mexico, during this study. The cooperation of the Mexican Navy and Dr. Emilsson at these meetings proved invaluable to the AOML vessel. The difficulties often encountered in setting up a temporary base of operation were eliminated. The loan of a cook from the URIBE enabled our personnel to channel their efforts towards scientific endeavors. Our attempts at cooperation involved the loan of some XBT's and a GEK cable and electrodes to the R/V URIBE.

1972-3

The primary thrust of AOML during this period will be in the Gulf of Mexico and the southern Sargasso Sea. A one-year study to determine the feasibility of using satellite data to monitor the Gulf of Mexico is scheduled to begin in July under the direction of Mr. George Maul of AOML. A six-day XBT, surface temperature, and chlorophyll survey will be made every thirty-six days to obtain ground truth data for satellite passes over the eastern Gulf of Mexico. Also planned is an STD/XBT section across the Yucatan Strait in an attempt to further correlate this flow with the down-stream circulation. The proposed tracklines are given in Fig. 5. The work to be done in the southern Sargasso Sea is part of the Mid-Ocean Dynamics Experiment (MODE). While not explicitly a CICAR activity, this work will improve knowledge of transient currents in the region which may affect transports through the Caribbean passages.

The National Data Buoy Center will have six buoys deployed in the Gulf of Mexico at the positions given in Fig. 5 during this period. Although this is primarily an engineering experiment, a valuable time-series of data including surface currents and temperature profiles will be obtained. Texas A&M University and AOML will be involved in the interpretation of these data which should greatly increase our knowledge of the time-scale of events in this basin.

To be discussed under the tide programs are the AOML Physical Oceanography Laboratory's deployment of a tide gauge in the Gulf of Mexico for two months and another in the eastern Caribbean Sea. Besides the tide data, near-bottom current information will also be obtained.

Sea-Air Interaction

1971-2

The Sea-Air Interaction Laboratory of AOML carried out in September and October of 1971, a study of the processes acting in the upper mixed layer of the ocean north of Puerto Rico. The best summary of this work is found in the cruise report prepared by Feodor Ostapoff, Chief Scientist on the DISCOVERER for this project, and that report is included in toto.

NOAA-Carib

1972-3

As a result of the requests of various of the CICAR nations during the previous meetings of the ICG for CICAR, NOAA's Atlantic Oceanographic and Meteorological Laboratories has scheduled for October-December of 1972 an at-sea education and training program for interested persons from Mexico, Jamaica, Puerto Rico, Trinidad and Tobago, Venezuela, and Colombia. Called NOAA-Carib, the project starts during CSM-III and is described in the attached article from the publication of NOAA's Environmental Data Service. Also attached is the tentative schedule for NOAA-Carib.

Interested persons from the CICAR countries to be visited should contact their National Coordinator: Mexico-Dr. Ayala Castanares, Jamaica-Dr. Robinson, Puerto Rico-Dr. Juhl, Trinidad and Tobago-Dr. Kenny, Venezuela-Dr. Atilano, Colombia-Captain Rairan.

Research plans for each country should be in the hands of the U. S. Coordinator for NOAA-Carob (Dr. H. B. Stewart, Jr., AOML, Miami, Florida) by early August for inclusion in the overall program.

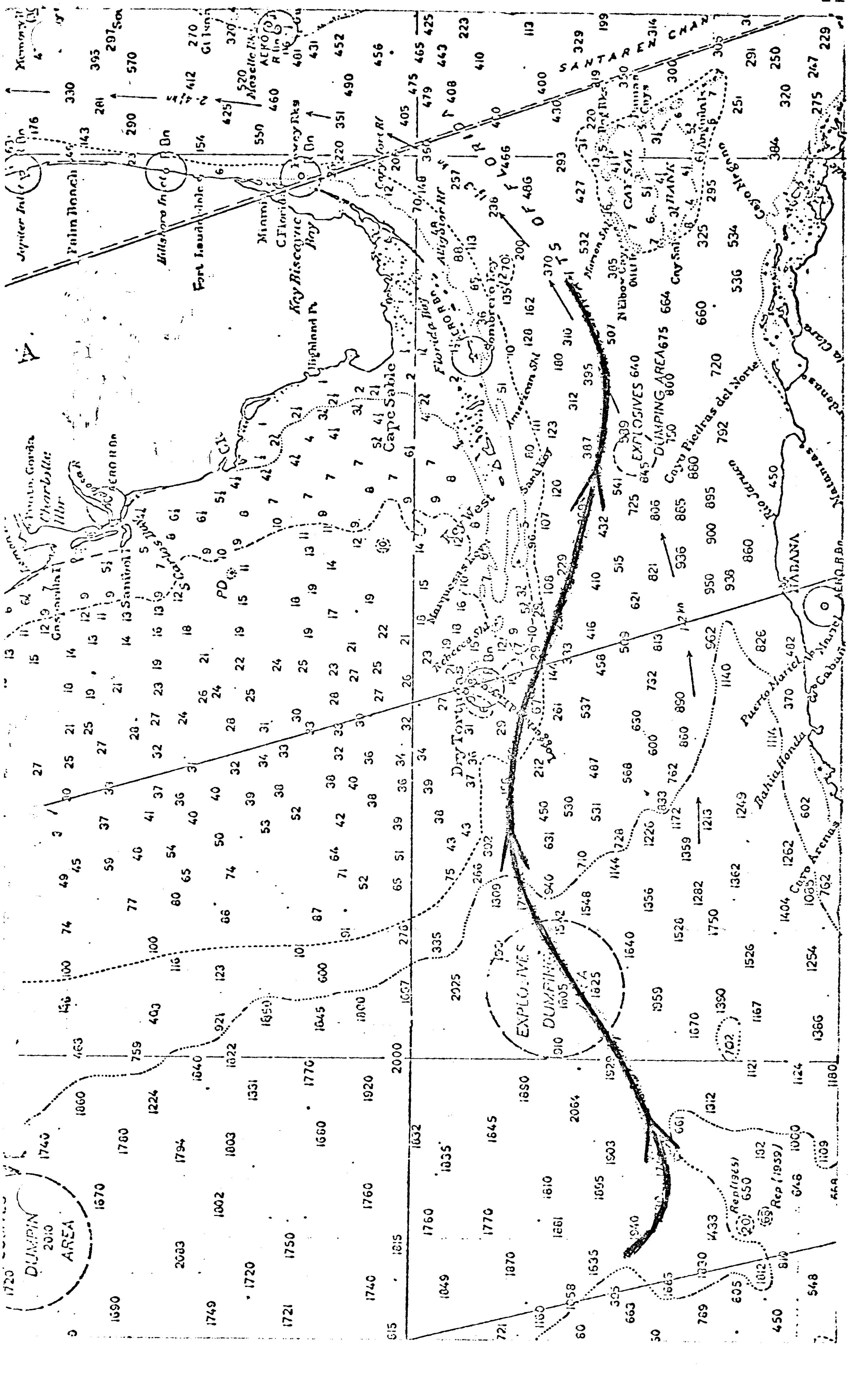


Fig. 2. The approximate drogue paths in the Gulf of Mexico.

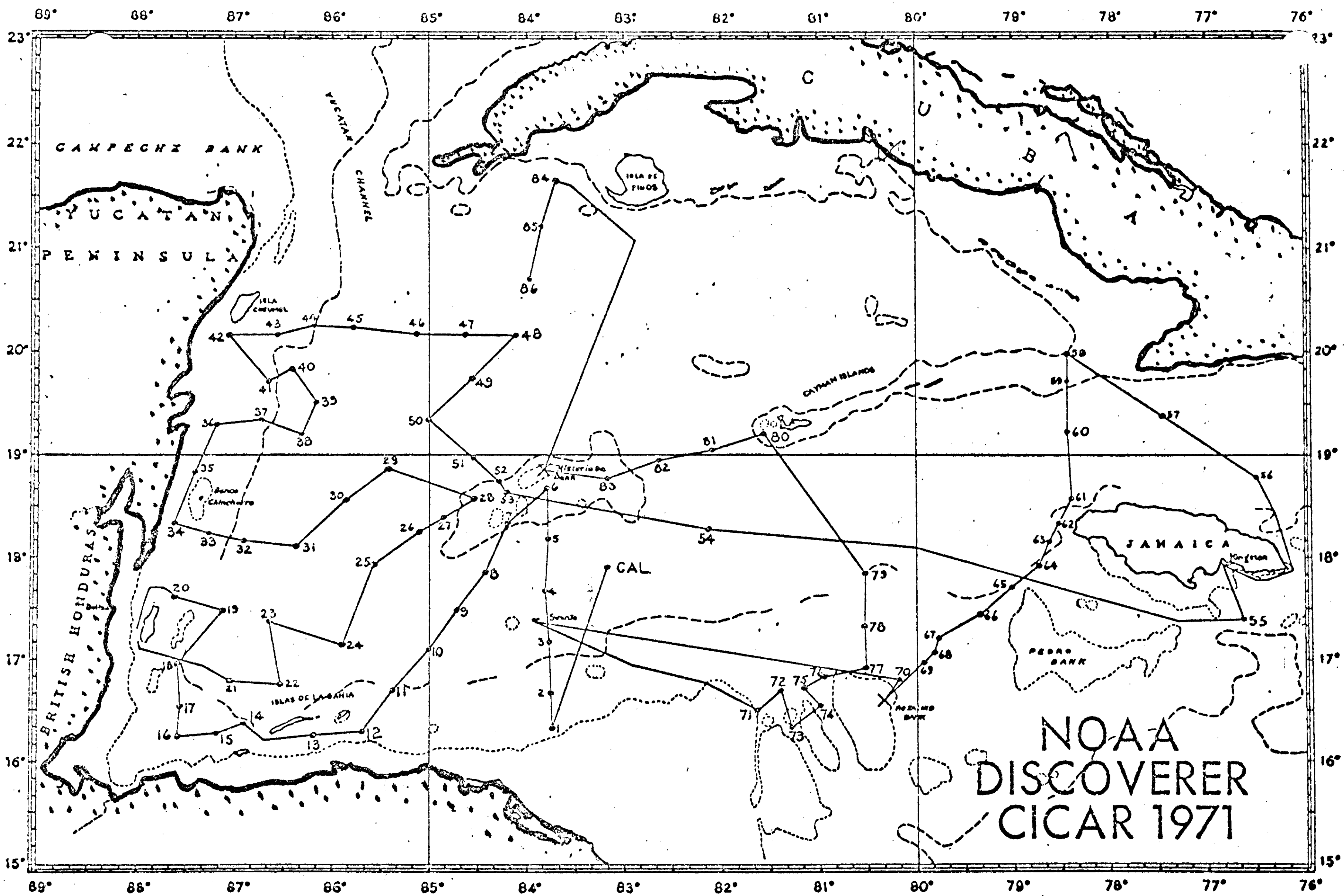


Fig. 3. The STD and Nansen station positions occupied by the DISCOVERER during CSM I.

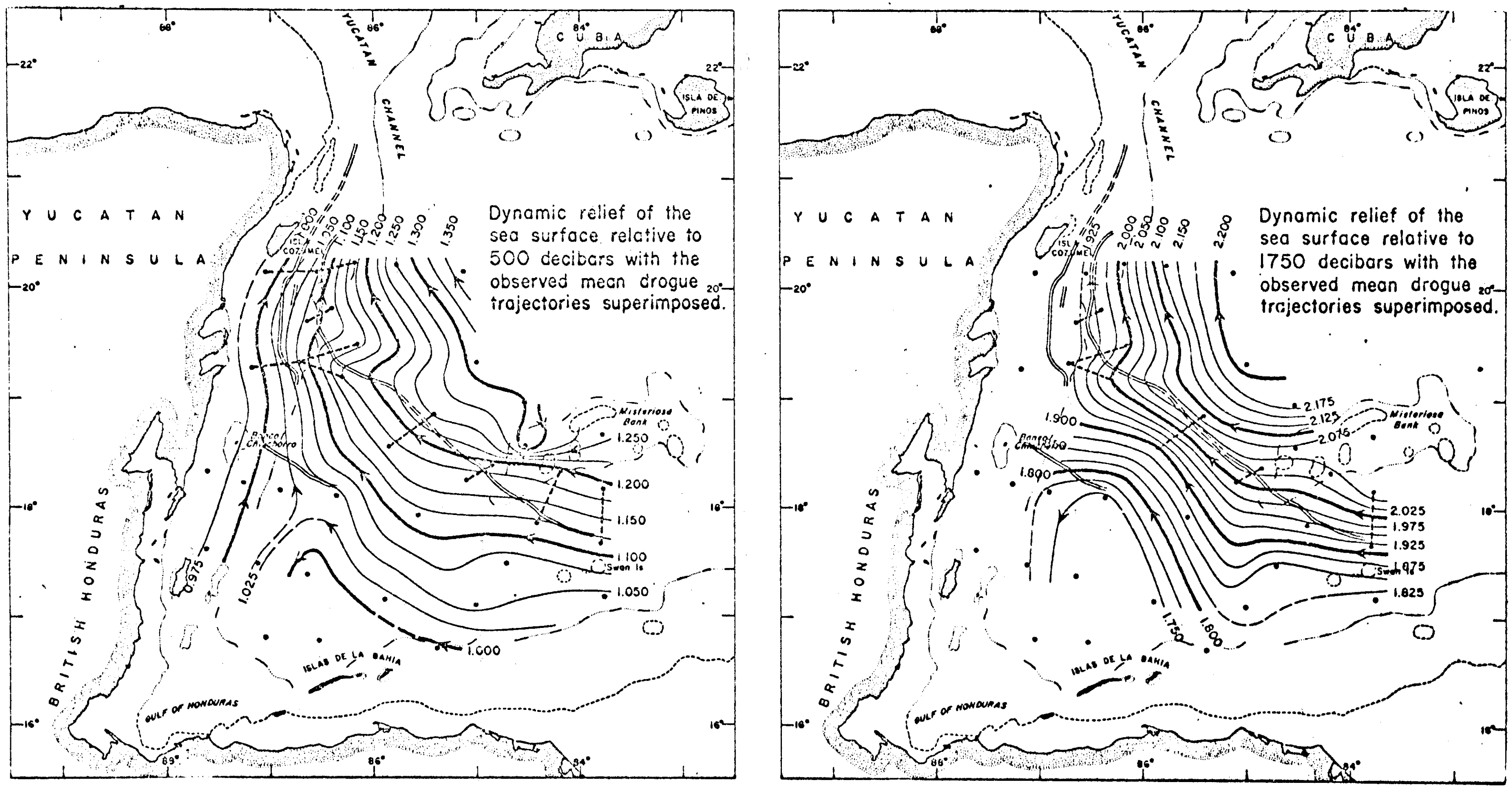


Fig. 4. The dynamic height field of the surface relative to 500 db and 1750 db as determined from the DISCOVERER CSM-I data.

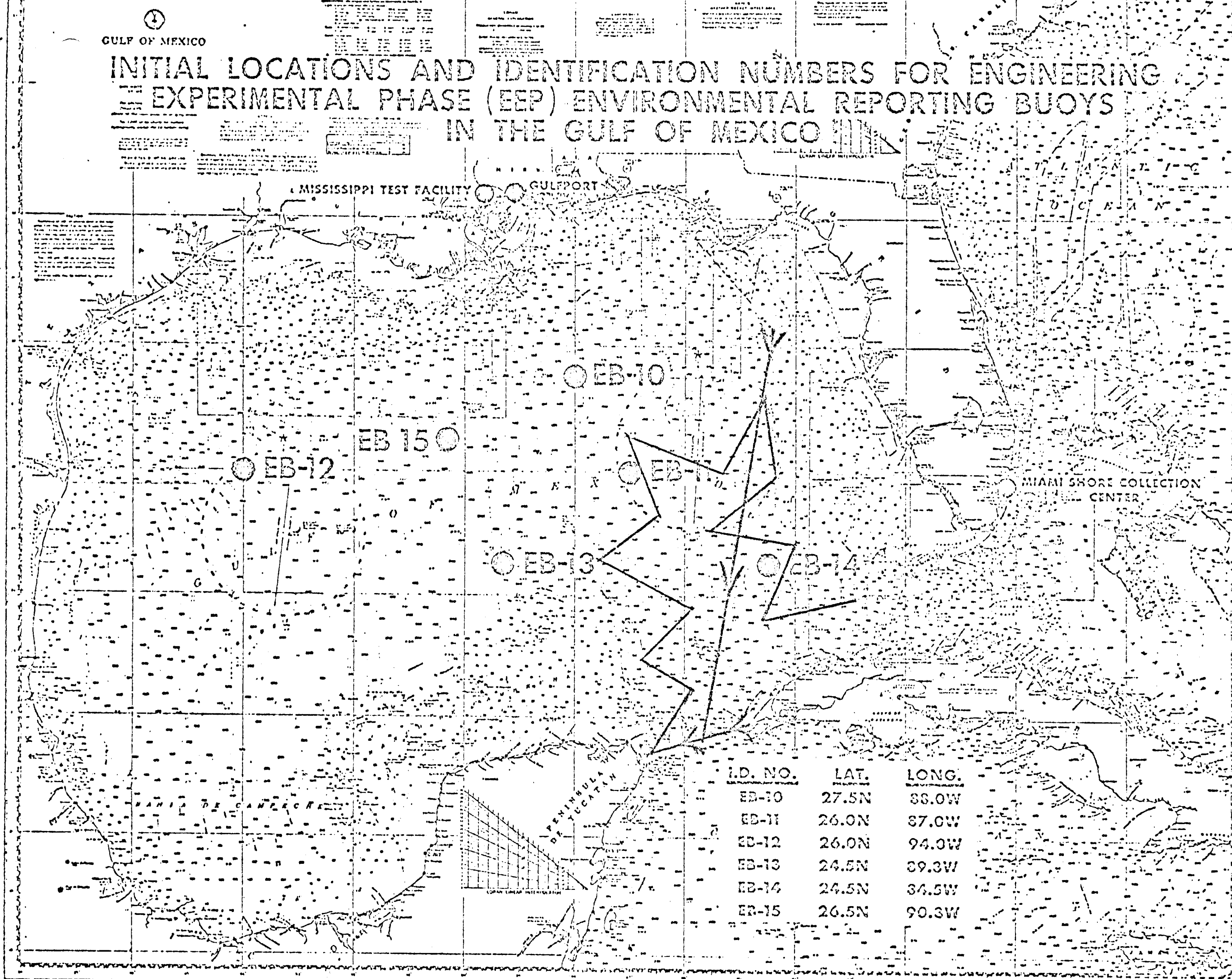


Fig. 5 - The approximate tracklines of the satellite groundtruth project; the actual

CRUISE REPORT ON CICAR PHASE II

The prime objective of this project, called Mixed Layer Project, is to study the total heat exchange across the air-sea interface on the diurnal and smaller time scales as inferred from the total heat budget of the oceanic mixed layer; and to study the vertical structure of the temperature, salinity, and current fields in the mixed layer of the ocean in relation to vertical heat transfer processes and mixing.

To achieve these objectives a number of instrumentation systems were utilized. Two MAMOS type buoys were deployed using 28 ft. parachutes at 30 meter depth. One buoy (#1) was instrumented with a quartz thermometer system recording temperatures at 1 minute intervals at 10, 20, 30, 40, and 50 meter depths on digital magnetic tape recorder. The other buoy (#2) recorded air temperature, sea surface temperature, humidity, and wind speed, also on digital magnetic tape.

The buoys were loaded on board the DISCOVERER on September 7 for transportation to the Coast Guard Base San Juan, Puerto Rico, which was used as a staging place by courtesy of the U. S. Coast Guard. The buoys were off-loaded at San Juan September 15.

On September 24, 1971 at 10:00 a.m. the DISCOVERER left for a position about 20 n.mi. north of San Juan to establish procedures for the current profiler method and to obtain test data tapes with 5 profiles (4 to 250 meters and one to nominally 1500 meters.) This was accomplished during the day and the following night. On September 25 8:00 A.M. the DISCOVERER tied up at the Coast Guard Base, San Juan where Dr. Duing of the University of Miami, acting as advisor, left the ship for Miami with the test tapes.

In view of tropical storm Janice and last minute calibrations on the buoy #2 sensor system, the departure for the project was scheduled for September 27, 1971. The DISCOVERER proceeded with the two MAMOS buoys in tow at a speed of about 8 knots toward 21°N, 64°W, a different position from the originally planned, necessitated by a request from the U. S. Navy.

On September 28, 10:00 A.M., buoy #1 was deployed without difficulties and in the afternoon buoy #2. At 8:00 P.M. the STD and hourly XBT program was initiated. The STD was held at 15 meter depth and every hour on the half hour it was lowered to first 50 meters, later 100 meters, and raised back to 15 meters. Once a day the cast was extended to 300 meters. At that time the current profiler program was also started, continued at 3 hourly intervals until October 11, resulting in about 92 current profile measurements. At the same time, a current meter suspended at 20 meter depth recorded the drift of the ship through the water. Twice a day it became necessary to steam the ship back to the buoys because of her further drift rate. This was accomplished without loss of data, except for the STD which had to be hauled aboard.

Other observations were made, specifically, while the ship adrift, a modified Eppley pyranometer was suspended at 20 meters to measure total radiations at that depth. This program commenced Oct. 3 and ended Oct. 11 with data recorded for two full days and 6 partial days. Profiles (6) of radiation were obtained using divers extending to 30 meters. Furthermore, continuous records of incoming solar radiation, reflected solar radiation and net radiation were obtained from a sensor system deployed on boom at the bow of the ship. At the same time an all-sky camera was recording cloud coverage every 20 seconds for the entire duration of the project.

Upper air data was obtained twice a day with a sub-program of 18 Omega sonde releases. Once every hour, radar scope pictures were photographed on the 50 mile scale at 0^o and 10^o elevation angle to record shower activities around the ship.

The reactivated SCARD system recorded continuously during the entire period the OMEGA signal on both frequencies for future use of re-navigation. The OMEGA radiosondes were also recorded on SCARD.

Finally, the ship's officers did a magnificent job in satellite navigation and buoy tracking resulting in extremely exciting data of local water movements.

On October 9, 2100 LT a current profile down to nominally 1500 meters was made and October 10, 0100 an STD cast to 2000 meters. On this day, two more 2000-meter STD casts were obtained, one 20 n.m. north of the current profile station and the other 20 n.m. south of it with a second deep current profile cast in between.

On October 11, the ship sailed a figure "eight" of 4 n.m. dimension while a rapid XBT program was executed with a spatial resolution of about 200 meters in order to delineate horizontal extent of step structures in the thermocline.

On October 12, two current meters were rigged at 10 meter spacings above the STD and lowered to 250 meters. Then, records of 5 minute duration were obtained at 5 meter intervals up to 125 meters. The process was repeated on the way down and again up. The purpose of these measurements is to investigate whether the step-like structure in the thermocline is associated with a similar structure in current velocity distribution.

On October 13, Buoy #1 and then buoy #2 were secured and taken into tow, which commenced about 1600 L.T. It soon became apparent that with the good towing condition the ship would arrive earlier in San Juan than expected. Ship and buoys arrived at the Coast Guard Base at San Juan on October 14, 1300 L.T.

The success of this operationally unusual and difficult project was possible only through the excellent cooperation of two agencies, the United States Coast Guard and the National Ocean Survey. The Coast Guard, Commander, Capt. Kobler of the base in San Juan and especially the Electronics Department provided all the help possible to outfit the buoys, to provide electronic shop space and crane service. Moreover, a small Coast Guard cutter made tow tests with one buoy prior to deployment to assure proper ballasting of the buoys.

The cooperation on the DISCOVERER was beyond praise. Ship's officers and crew were cooperating beyond the call of duty with a level of moral unexcelled. The response to the demands of the Chief Scientist, often on very short notice, was immediate and professional. Special praise should go to the Commanding Officer, Capt. Munson; the Operations Officer, Lt.Cdr. Allbritton; Mr. Guthrie and the Chief Engineer, Mr. R. Johnson.

Summary of data collection

1. STD data on 4 raw data tapes

2. About 578 XBT and surface temperatures and salinities

3. 92 current profiles

4. A total of 30 radiosondes and upper air wind plus 13 Omega sondes,

5. Hourly surface meteorological observations - a total of 393,

6. 2882 radar pictures

7. About 70,000 temperature readings from both buoys

8. Radiation data

Up-facing radiometer	16 days
Net radiometer	16 days
down-facing radiometer	14+ days
Radiation at 20 m. depth	2 full days
	6 partial days
Radiation profile in water	6 days
All sky camera	17 days

F. Ostapoff

Feodor Ostapoff
Chief Scientist

CICAR's NOAA-CARIB:

An Experiment in International Scientific Cooperation

BY HARRIS B. STEWART, JR., U.S. National Coordinator for CICAR

The Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR) is now in the third year of its field phase. CICAR is a 15-nation scientific inquiry into the marine biology, geology, and geophysics: physical oceanography; meteorology; and fisheries of the Caribbean Sea and its adjacent regions, including the Gulf of Mexico. Although all results are not in, it appears that a good deal of new information has been developed in all these areas.

One of the stated aims of the CICAR program and its sponsor, the Intergovernmental Oceanographic Commission of UNESCO, is to foster the education and training of marine scientists in the Latin American and Caribbean countries. Unlike the exploratory and scientific phases of CICAR which have moved along successfully, the international education and training phase has received a good deal of discussion, but the actual training of scientists on ships of other countries has been less than the initiators of CICAR had hoped for.

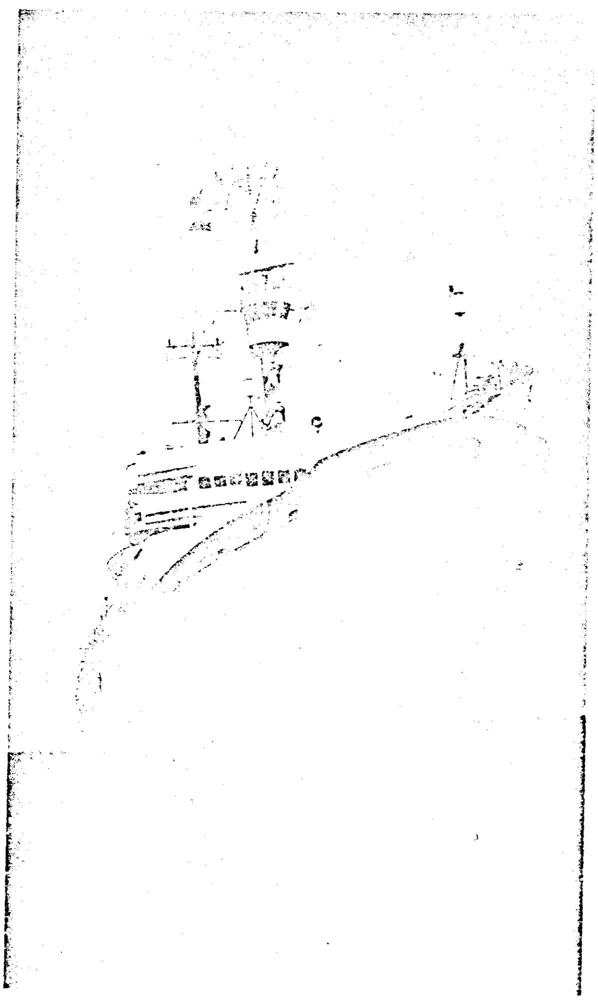
During the quasi-synoptic CICAR Survey Month-I in August of last year, ships of several countries worked together on a well coordinated program of physical and biological measurements; but generally Mexicans worked on the Mexican ship, Venezuelans on the Venezuelan ship, Americans on the United States ships, and so on.

There have been, of course, some exceptions. U.S. scientists have been on Mexican and Brazilian ships, Colombian oceanographers have been aboard U.S. ships and there are other examples. But since a research ship is usually full when it sails and its projects are planned well in advance by the persons who will be on board, there usually is neither bunk nor project time for investigators of other nations. Their status, therefore, is at best that of visitors or observers. And because only one or perhaps two bunks are available, the cooperating country usually sends a senior person, one who does not really need the training at sea.

At the CICAR International Coordination Group in Washington, D.C., in 1969, in Mexico City in 1970, and in Trinidad and Tobago in 1971, the needs of the Columbian, Venezuelan, Mexican, and Jamaican delegations, as well as those of the Trinidad, Tobago, and other delegations for assistance within the CICAR framework, became apparent. Their initial needs were for basic oceanographic equipment and the opportunity for their people to get scientific experience at sea as part of the education and training program of their own countries.

The U.S. Agency for International Development (AID) has provided financial support to assist the Organization of American States marine sciences

Above: Dr. Stewart on the DISCOVERER. Left: In a CICAR survey involving NOAA's DISCOVERER and OREGON II and the Mexican research vessel URIBE, plankton samples are gathered to study the distribution of the marine organisms. Opposite page: NOAA scientists demonstrate the use of "bongo" nets to Mexican oceanographers. Below: the NOAA ship DISCOVERER.



training centers in Colombia, Mexico, Argentina, and Venezuela. These centers train marine scientists, engineers, and technicians from many Latin American countries, with particular emphasis on marine sciences instrumentation. The work of these centers will assist in the intercalibration of marine sciences instrumentation and the standardization of data formats and reporting; it should improve the capabilities of many Latin American countries participating in the CICAR program.

In addition to the AID effort, the University of Rhode Island has provided some excess gear to the University of the West Indies in Trinidad, and the NOAA National Ocean Survey has loaned a shallow-water echo sounder to the Mexican Research Vessel, URIBE. These developments have helped, but the need for education and training at sea still remain unsatisfied.

It was primarily to meet this particular need that the National Oceanic and Atmospheric Administration (NOAA) conceived the idea of NOAA-CARIB. Although the CARIB part of the expedition title can be considered as being derived either from the name of the sea or (ι the ancestral inhabitants of the area, it also ds for Cicar Area Research and Instruction Breakthrough. Actually, the concept does represent a real breakthrough in the running of international cooperative expeditions.

continued

Briefly, the rationale is this: To work with the CICAR National Coordinators in several CICAR countries to develop joint research projects that would reflect the marine research interests of each of the countries concerned. Arrangements would be made to place six or eight scientists from CICAR country "X" aboard a United States oceanographic research ship to work with their United States counterparts in carrying out marine research projects of interest to country "X" as well as the United States.

At the end of the project (about 1 week), the ship would put into a major port of country "X" and make a 1-day training and demonstration cruise, on which she would carry as many students, faculty members, administrators, government officials, local press representatives, etc., as she could accomodate for 1 day. On this trip, scientists from country "X" who had been aboard for the previous week could act as instructors for the 1-day cruise participants. Not only would they speak their language, but they would also by then know the ship's capabilities, be more familiar with local training needs, and could tailor the teaching accordingly. If properly planned, such an operation could contribute valuable research information.

With this concept as the basic framework for NOAA-CARIB, shiptime aboard the NOAA ship DISCOVERER was allotted to the program by NOAA's Atlantic Oceanographic and Meteorological Laboratories in Miami, Fla. The scheduled time includes the 72 days between October 5, when the ship will sail from Miami, and December 15, 1972, when she will return. The present itinerary will take the DISCOVERER from Miami to Veracruz, Mexico; Kingston, Jamaica; San Juan, Puerto Rico; Port of Spain,* Trinidad; Cumana,* Venezuela;* Cartagena,* Colombia; and back to Miami. The plan is that some 7 to 10 scientists from each country will join the ship at the last port prior to the stop in their own country, and will carry out their own projects aboard enroute to their own port for the one-day trip. Several NOAA projects will also be carried out simultaneously.

Planning is already well underway for NOAA-CARIB, and the contacts in each of the six countries to be visited have been established. If marine scientists in any of these countries have projects that they would like to have considered, they should submit their plans to their local NOAA-CARIB representative. (Names and addresses are listed following this article).

The October-phase of the operation will coincide with CICAR Survey Month-III, a third quasi-synoptic survey, and, wherever possible, the standard CICAR sections that have been established throughout the region will be occupied for physical and biological observations.

NOAA-CARIB thus has two main goals: to provide opportunities for education and training at sea for CICAR country nationals and to contribute to the overall CICAR scientific program. A secondary objective is to provide, through scientist-to-scientist contacts, the mechanisms for continuing cooperative oceanographic activities in the Caribbean long after the formal CICAR program has terminated.

As the details of the various projects take shape, it is NOAA's intention to report them in this publication, so that all involved in Caribbean marine research will be kept informed.

Senior United States oceanographers who wish to participate in a teaching capacity aboard the DISCOVERER during one or more legs of NOAA-CARIB should have extensive experience at sea and preferably, but not necessarily, a working knowledge of Spanish. Limited positions are still available for marine fisheries specialists, marine biologists, physical oceanographers, marine geologists and geophysicists, and marine meteorologists who can pay their own way to and from the ship. Since marine chemistry is not taught at most universities in the CICAR area, it is not planned now to have any specialists in marine chemistry aboard. Those who are interested and can qualify should write directly to U.S. National Coordinator for CICAR, NOAA Atlantic Oceanographic and Meteorological Laboratories, 901 South Miami Avenue. Miami, Fla. 33130.

In Mexico, those who wish to propose scientific projects to be carried out aboard the DISCOVERER between Miami and Veracruz in early October of 1972 should submit their plans to Dr. Augustin Ayala Castanares, Instituto de Biologia, U.N.A.M., Apartado Postal 70-233, Mexico 20 DF, Mexico.

In Jamaica, proposed projects should be submitted to Dr. Edward Robinson, University of the West Indies, Department of Geology and Geography, Mona, Kingston, 7, Jamaica.

In Puerto Rico, proposals should be submitted to Dr. Rolf Juhl, Department of Agriculture, Santurce, Puerto Rico 00936.

In Trinidad and Tobago, proposals should be submitted to Dr. J. Kenny, Department of Biological Sciences, University of West Indies, Trinidad and Tobago.

In Venezuela, Dr. ~~Luis E. Herrara~~ is the NOAA-CARIB coordinator, and proposals should be addressed to ~~Dr. Herrara at Instituto Oceanografico, Cumana, Venezuela.~~

In Colombia, proposed projects aboard the DISCOVERER for late November and early December should be submitted to Capt. Juan Pablo Rairan Hernandez, Comision Colombiana de Oceanografia, Bogota, Colombia, Apartado Aereo 23466.

NOAA-CARIB will make a good wind-up cruise for the Cooperative Investigation of the Adjacent Regions and pave the way for future cooperation in marine science in the Caribbean.

Dr. Carlos Atilano
Projecto de Invest.
y Desarrollo Pesq.
Apartado 2578
Caracas, Venezuela

National Oceanic and Atmospheric Administration
Atlantic Oceanographic and Meteorological Laboratories
901 South Miami Avenue
Miami, Florida 33130

NOAA DISCOVERER

Tentative Schedule for NOAA-Carib

October 6 - December 16, 1972

Oct. 6	Depart Miami with Mexican scientists aboard
Oct. 7-9	Marine geology and geophysical studies in Abaco Canyon, Bahamas
Oct. 14	Arrive Veracruz, carry out Mexican work en route
Oct. 15	Open House aboard DISCOVERER
Oct. 16	One-day cruise for instruction and training
Oct. 17	Depart Veracruz for Montego Bay, Jamaica. STD stations in Yucatan Channel and water sampling for Battelle en route.
Oct. 21	Pick up Jamaican scientists at Montego Bay. Carry out coring, dredging, seismic profiles, current measurements as Jamaican program.
Oct. 26	Arrive Kingston, Jamaica
Oct. 27	One-day cruise for instruction and training
Oct. 28	Open House aboard DISCOVERER
Oct. 29	Liberty and seminars ashore
Oct. 30	Depart Kingston for San Juan, Puerto Rico
Nov. 1	Arrive San Juan, Puerto Rico
Nov. 2	Refuel and resupply
Nov. 3	Open House aboard DISCOVERER
Nov. 4-5	Liberty
Nov. 6	Depart San Juan, with Puerto Rican scientists aboard to carry out their program.

2.

Nov. 10 Arrive San Juan, one-day cruise for education and training

Nov. 11-12 Liberty and seminars ashore

Nov. 13 Depart San Juan for Port of Spain, Trinidad. Recover deep-sea tide gauge and current meter en route. Dutch ornithologist aboard. Others?

Nov. 16 Arrive Port of Spain

Nov. 17 Depart Port of Spain with Trinidad and Tobago scientists aboard to carry out their program.

Nov. 21 Arrive Port of Spain, one-day cruise for instruction and training

Nov. 22 Open House aboard DISCOVERER

Nov. 23 Liberty and seminars ashore

Nov. 24 Depart Port of Spain and arrive Cumana, Venezuela

Nov. 25 Depart Cumana with Venezuelan scientists aboard to carry out their program

Nov. 29 Arrive Caracas, Venezuela

Nov. 30 One-day cruise for education and training

Dec. 1 Open House aboard DISCOVERER

Dec. 2-3 Liberty and seminars ashore

Dec. 4 Depart Caracas for Cartagena, Colombia, with Colombian scientists aboard

Dec. 10 Arrive Cartagena, Colombia

Dec. 11 One-day cruise for education and training

Dec. 12 Open House aboard DISCOVERER

Dec. 13 Depart Cartagena for Miami with Colombian scientists and others (?) aboard

Dec. 16 Arrive Miami, Florida

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National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Fisheries Center
Virginia Key, Miami, Fla.

1971 CICAR DRIFT BOTTLE ACTIVITIES

The major release of drift bottles occurred during quasi synoptic oceanographic investigations in the Gulf of Mexico and western Caribbean. Bottles were also released from individual surveys in the eastern Caribbean and adjacent regions.

Prepared drift bottles were sent, upon request, to Colombia and Mexico. Organizations that released bottles include the (Florida) State University System Institute of Oceanography, Food and Agriculture Organization, NOAA's Atlantic Oceanographic and Meteorological Laboratory, and NOAA's Southeast Fisheries Center.

Figures 1 and 2 show the locations of CICAR drift bottle releases for 1971. Table 1 provides the results of 1971 drift bottle releases.

Table 1.--Drift bottle results for 1971 CICAR releases

	Eastern Gulf of Mexico		Western Gulf of Mexico		Western Caribbean		Eastern Caribbean	
Total No. released	2770		1320		1366		1284	
Total No. recovered	919		79		103		64	
Total Percent recovered	33--in 180 days		21--in 180 days		7.5--in 90 days		5--in 90 days	
Days adrift	No. recovered	% of total recoveries	No. recovered	% of total recoveries	No. recovered	% of total recoveries	No. recovered	% of total recoveries
0-10	313	34.0	0	0.0	4	.3	4	.3
11-20	57	6.2	18	6.4	6	.4	8	.6
21-30	136	14.8	26	9.3	7	.5	8	.6
31-40	67	7.3	55	19.7	8	.6	4	.3
41-50	46	5.0	47	16.8	19	1.4	5	.4
51-60	55	6.0	27	9.7	14	1.0	13	1.0
61-70	25	2.7	23	8.2	14	1.0	7	.5
71-80	19	2.1	9	3.2	23	1.7	10	.8
81-90	38	4.1	18	6.4	8	.6	5	.4
91-100	17	1.8	16	5.7				
101-110	14	1.5	2	0.7				
111-120	9	1.0	4	1.4				
121-130	11	1.2	5	1.8				
131-140	19	2.1	0	0.0				
141-150	14	1.5	4	1.4				
151-160	7	0.8	4	1.4				
161-170	8	0.9	1	0.4				
171-180	2	0.2	4	1.4				
> 180	38	4.1	15	5.4				
no date recorded	24	2.6	1	0.4				

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Figure 1.-- CICAR drift bottle release locations in the western Caribbean and Gulf of Mexico. July, August 1971.

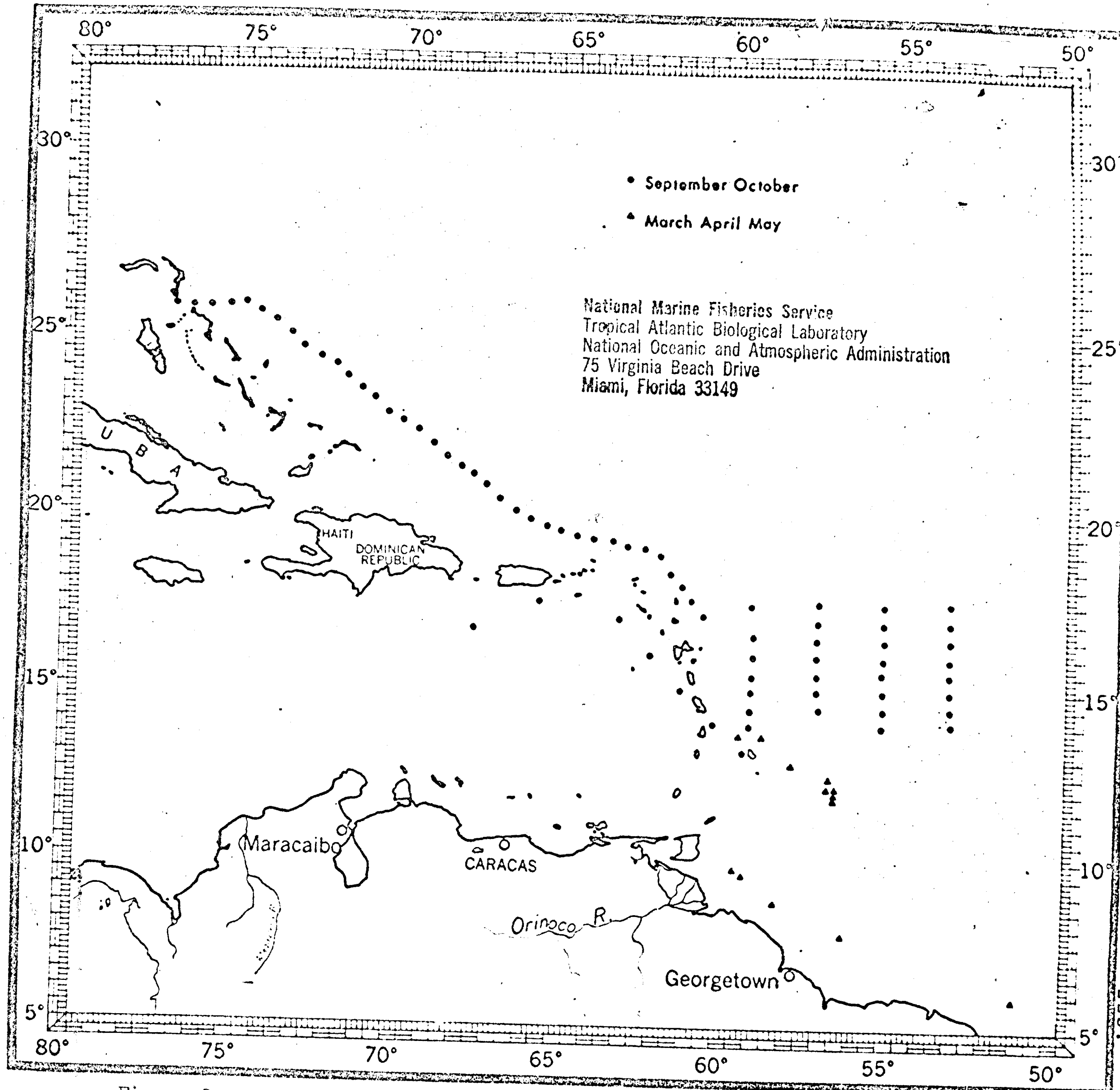

Figure 2.--CICAR drift bottle release locations in the eastern Caribbean and adjacent regions. Sept.-Oct. 1971; March-April-May 1971.

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

NOAA's Southeast Fisheries Center

Past Accomplishments - The objectives of CICAR and the MARMAP Program of the National Marine Fisheries Service provided an excellent opportunity to not only add to the U.S. contribution to the scientific data base of CICAR but also to test the presurvey activities of MARMAP Survey I -- Ichthyoplankton and environment.

The Southeast Fisheries Center gained considerable knowledge concerning sampling frequency and the performance of new equipment during the early EGMEX investigations. Beginning with CICAR Month I, the presurvey activities were expanded and two cruises were completed by the R/V Oregon II in the Gulf of Mexico in August and November 1971. The primary missions of the two cruises were (1) investigation of the distribution and abundance of ichthyoplankton (fish eggs, larvae, and juveniles), (2) investigation of the physical environment with particular emphasis devoted to currents and current boundary conditions.

Figure 3 (Aug. 1971) and Figure 4 (Nov. 1971) depict the isothermal topographies found during the cruises. Processing of biological samples and other physical data is in progress.

Future Plans 1972-73

MARMAP Survey I
(Ichthyoplankton-environmental surveys)

The Southeast Fisheries Center is responsible for MARMAP investigations in the Gulf of Mexico, Caribbean, and western tropical Atlantic. Figure 5 shows the transects that the Southeast Fisheries Center proposes to occupy to achieve uniform assessments and predictions of living marine resources. Due to the vastness of this area, collaborators and CICAR participants are requested to commit their organizations to occupy transects within their areas of interest.

Three cruises are scheduled within the next year (July 72, February 73, May 73). Figures 6, 7, and 8 show the transects with firm commitments and also depict transects for which commitments are being sought.

Guidelines for sampling procedures during the ichthyoplankton-environmental surveys are outlined below. Figure 9 is a flow chart showing avenues of distribution and processing of the physical and biological data.

MARMAP SURVEY I
Ichthyoplankton - Environmental Surveys

A. Standard Stations (Physical Oceanography)

1. STD
   (a) A standard STD lowering to 1000 m will be taken at each major station. In areas where 1000 m water depth is not available, the STD will be lowered to within "a safe distance" of the bottom ($\approx$85% water depth).

   (b) In the event the STD becomes inoperative, an XBT will be taken at each major station.

2. XBT - An XBT to 450 m (T-4 probe) and a surface temperature will be taken between major stations.

3. A calibration cast will be taken every three (3) days to assure proper performance and accuracy of the electronic STD.

Purpose - In behalf of the National Marine Fisheries Service Southeast Fisheries Center, the primary purpose of the STD and XBT observations is to define the current regime and related mechanisms responsible for the dispersal of fish eggs, larvae, and juveniles located within the surface layer. Therefore, the oceanographic data will be available to researchers interested in other facets such as vertical structures, subsurface circulation etc.

B. Standard Biological Station Sampling

1. Bongo net tow
   (a) Standard bongo array consisting of a depressor, 60 cm bongo with 505μ and 333μ nets, 20 cm bongo with 283μ and 165μ nets, time depth recorder.

   (b) Type of tow: double oblique to depth of 200 m.

   (c) Speed of towing winch 50 m/min deployment, 1 minute to reach equilibrium at depth, retrieve at 20 m/min, ¼-inch wire.

   (d) Vessel speed: 2 knots.

2. Neuston net tow
   (a) Standard surface tow with neuston net 2 m x 1 m with 1000μ mesh.

   (b) Type of tow: net at surface outside of wake of vessel towed for 10 min.

   (c) Ship's speed: 5 knots.

3. Midwater trawl

(a) Small MWT towed in same manner as bongo net.

Purpose:

Primary:

Bongo net 505 samples will be sorted for fish eggs and larvae for quantitative assessment purposes to determine the kinds and numbers present. From these data, calculations will be of the size of the spawning stock, the time of spawning, the area of spawning and the movements of the eggs, larvae and juveniles.

Neuston net tows will provide qualitative data on the times, areas, and movements of larvae and juveniles of tunas, billfish, dolphin and other fishes which inhabit the surface layer of the ocean.

Midwater trawl samples will be used to capture intermediate stages of fish juveniles necessary for identification of younger material. Data will also be provided for spawning times and areas.

Bongo 505, neuston, and MWT samples will also be surveyed for lobster larvae for determining spawning time, spawning areas, and abundance.

Secondary: Samples from smaller mesh bongos will be used for production measurements and invertebrate studies as will the plants and invertebrates from neuston and MWT samples. It is expected that the scientific community at large will so use these samples as it is unlikely that NMFS will be interested in these studies in the near future.

TABLE I. Cruises conducted between April 1971 and March 1972 for collecting fish eggs, larvae and juveniles.

Vessel & Cruise No.	Operating Agency	Date	Area Sampled	Gear Used	No. Samples	State of Processing Fish Eggs & Larvae
R/V Dan Braman SUS-7113	State of Florida	May 1971	Eastern Gulf of Mexico	Bongo Nets	86	Sorted, 50% identified
R/V Tursiops SUS-7114	State of Florida	May 1971	Eastern Gulf of Mexico	ICITA Nets	37	Sorted
R/V Gerda G-7117	University of Miami	June 1971	Eastern Gulf of Mexico	Bongo Nets	31	Sorted, 50% identified
R/V Dan Braman SUS-7120	State of Florida	August 1971	Eastern Gulf of Mexico	Bongo Nets	99	Sorted
R/V Tursiops SUS-7121	State of Florida	August 1971	Eastern Gulf of Mexico	Bongo Nets	51	Sorted
R/V Oregon II 7129	NMFS	August 1971	Eastern Gulf of Mexico	Bongo Nets Neuston Nets	41 60	Sorted Sorted & identified
R/V Gerda G-7127	University of Miami	November 1971	Eastern Gulf of Mexico	Neuston Nets	2	Sorted
R/V Tursiops SUS-7131	State of Florida	November 1971	Eastern Gulf of Mexico	Neuston Nets	33	Sorted
R/V Bellows SUS-7132	State of Florida	November 1971	Eastern Gulf of Mexico	Neuston Nets	31	Sorted
R/V Oregon II 7131	NMFS	November 1971	Eastern Gulf of Mexico and Southeastern Atlantic	Bongo Nets Neuston Nets	55 48	Partially sorted Sorted & identified
R/V Bellows SUS-7201	State of Florida	February 1972	Eastern Gulf of Mexico	Bongo Nets	17	No action
R/V Gerda G-7202	University of Miami	February 1972	Eastern Gulf of Mexico	Bongo Nets	15	No action

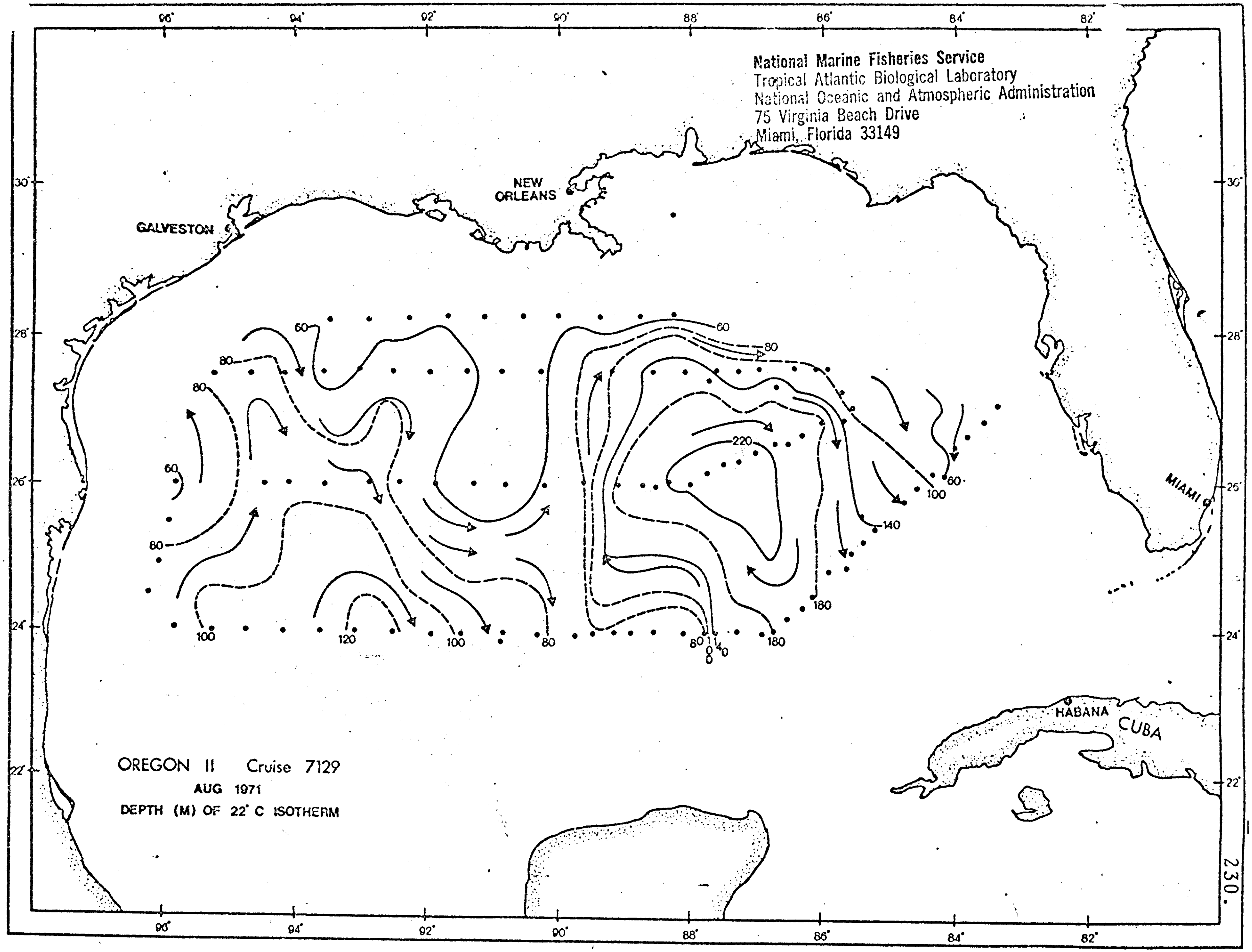

Figure 3.--Depth (M) of the 22°C isotherm. August 1971.

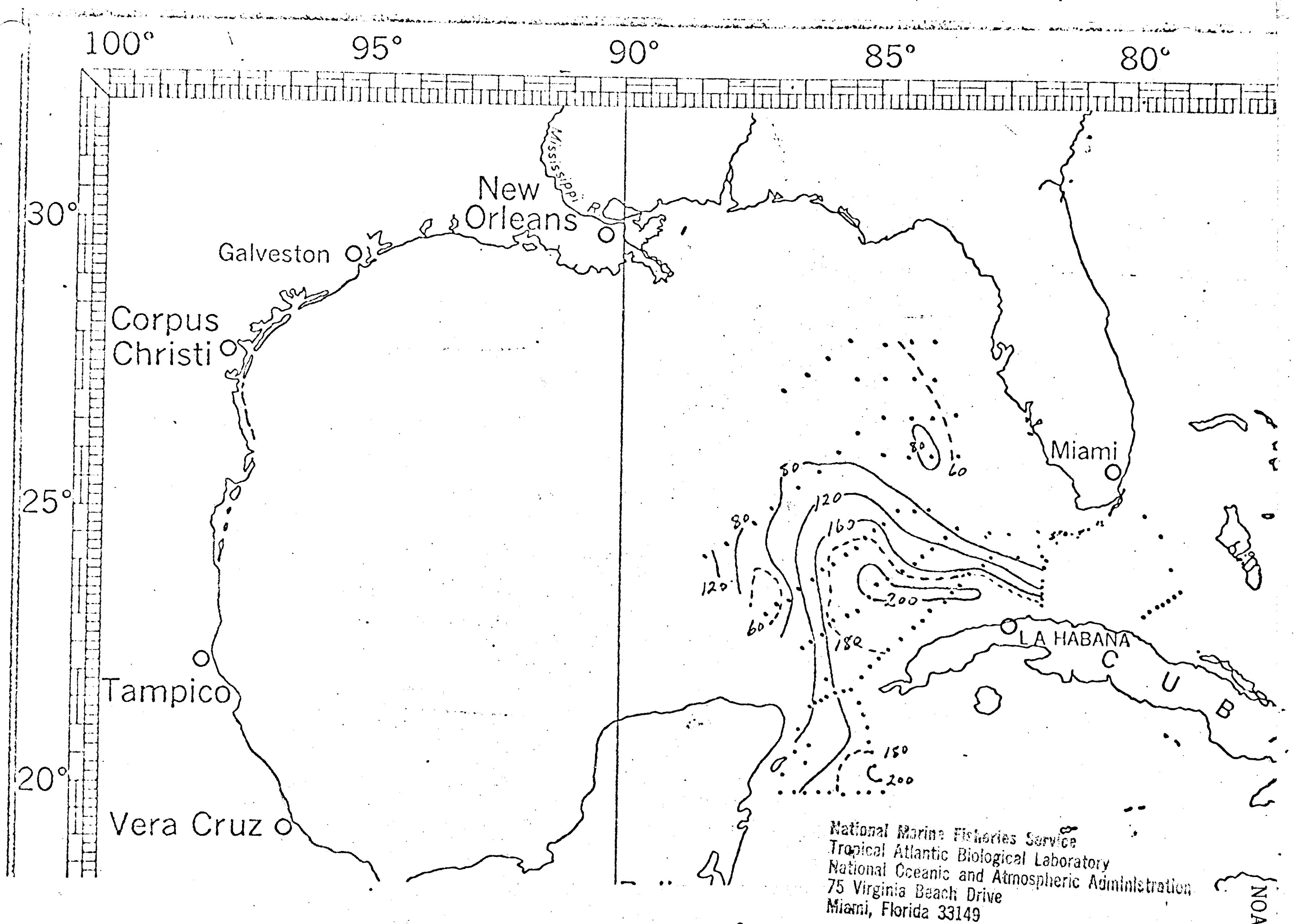

Figure 4.--Depth (M) of the 22°C isotherm. November 1971.

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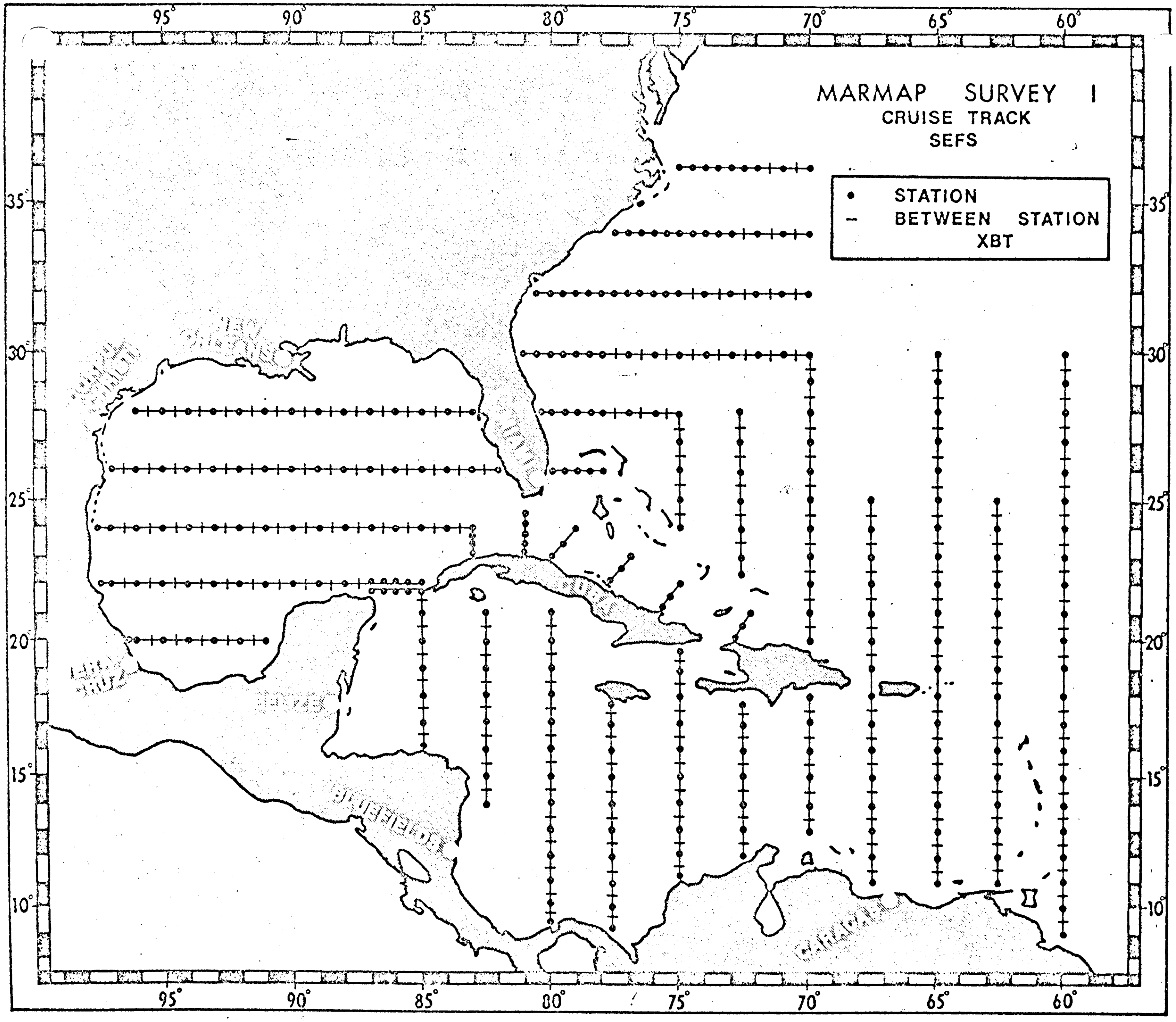

Figure 5.--Proposed transects to be occupied within the Southeast Fisheries Center's area of MARMAP responsibilities.

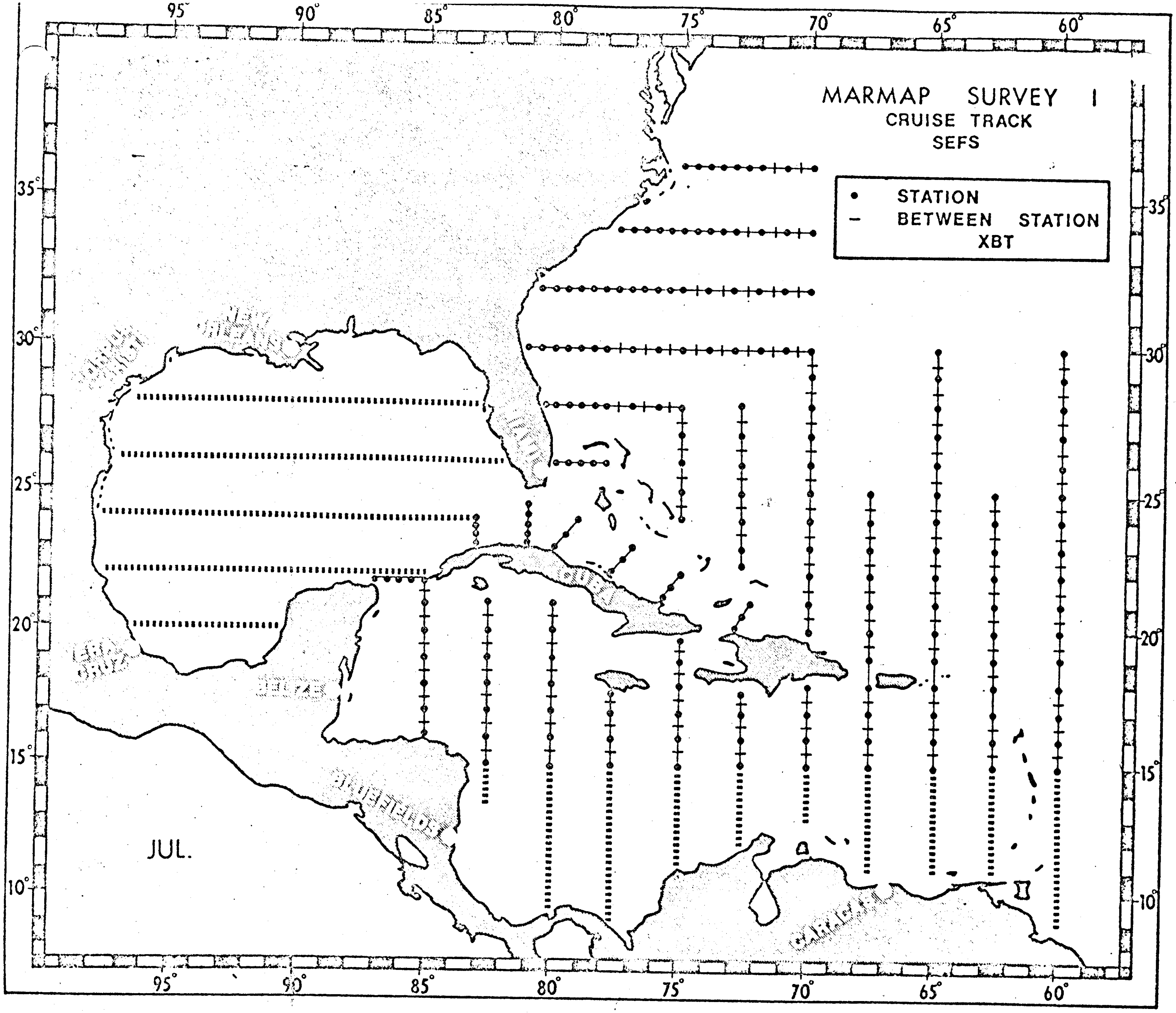

Figure 6.--Cruise track for July 1972. Dotted lines represent transects with firm commitments. Dashed lines depict transects for which participants will be sought.

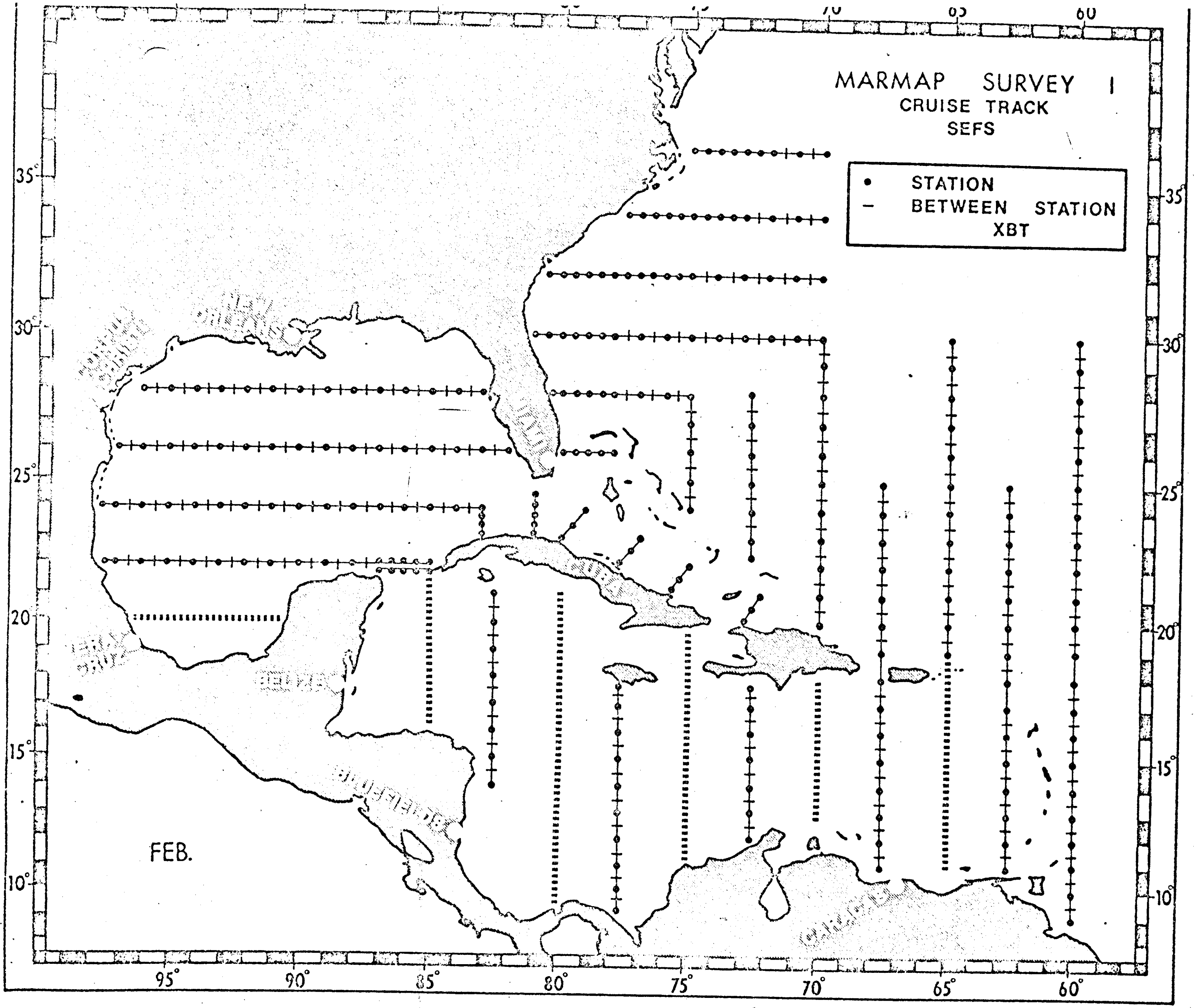

Figure 7.--Cruise track for February 1973. Dotted lines represent transects with firm commitments. Dashed lines depict transects for which participants will be sought.

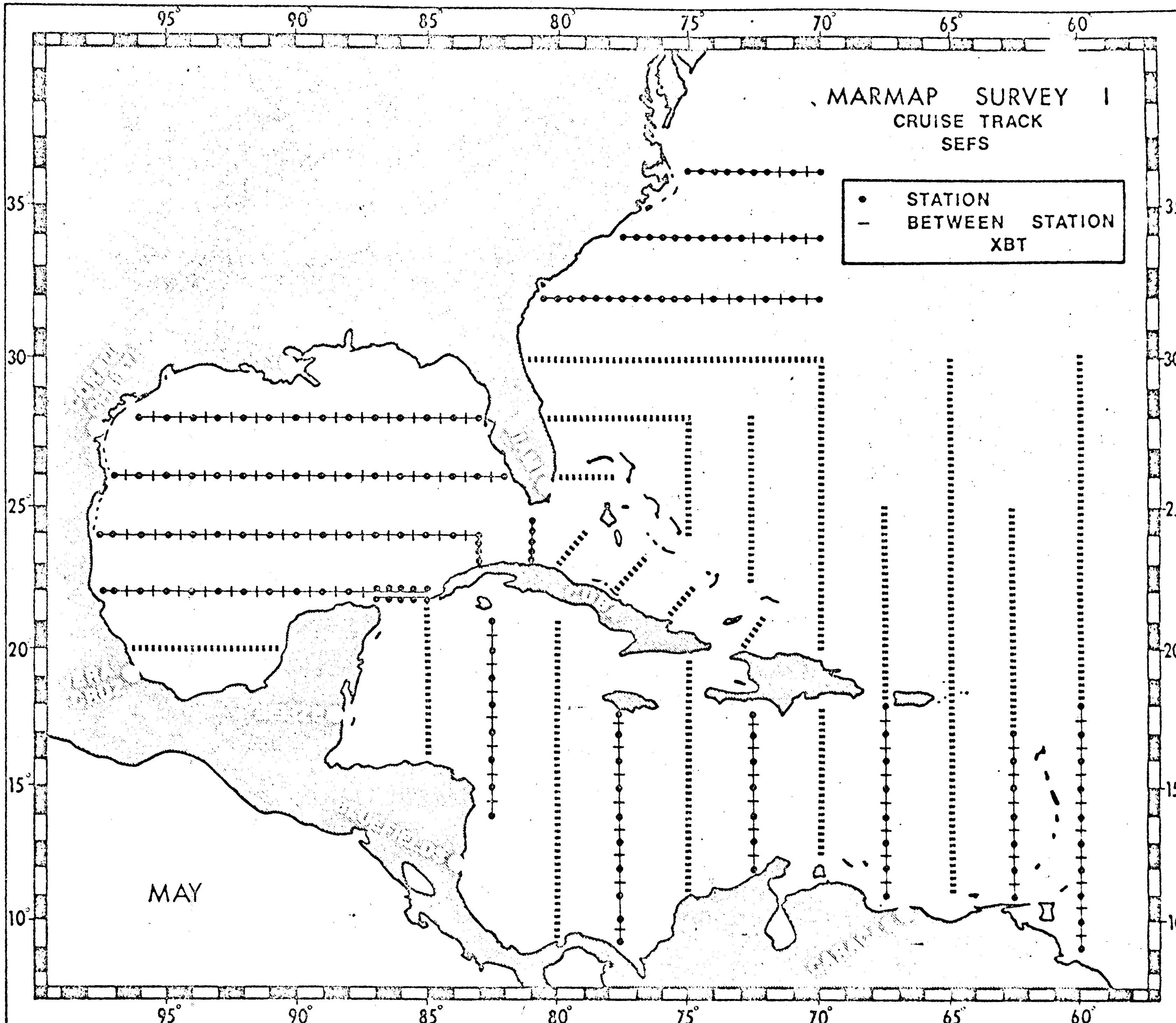

Figure 8.--Cruise track for May 1973. Dotted lines represent transects with firm commitments. Dashed lines depict transects for which participants will be sought.

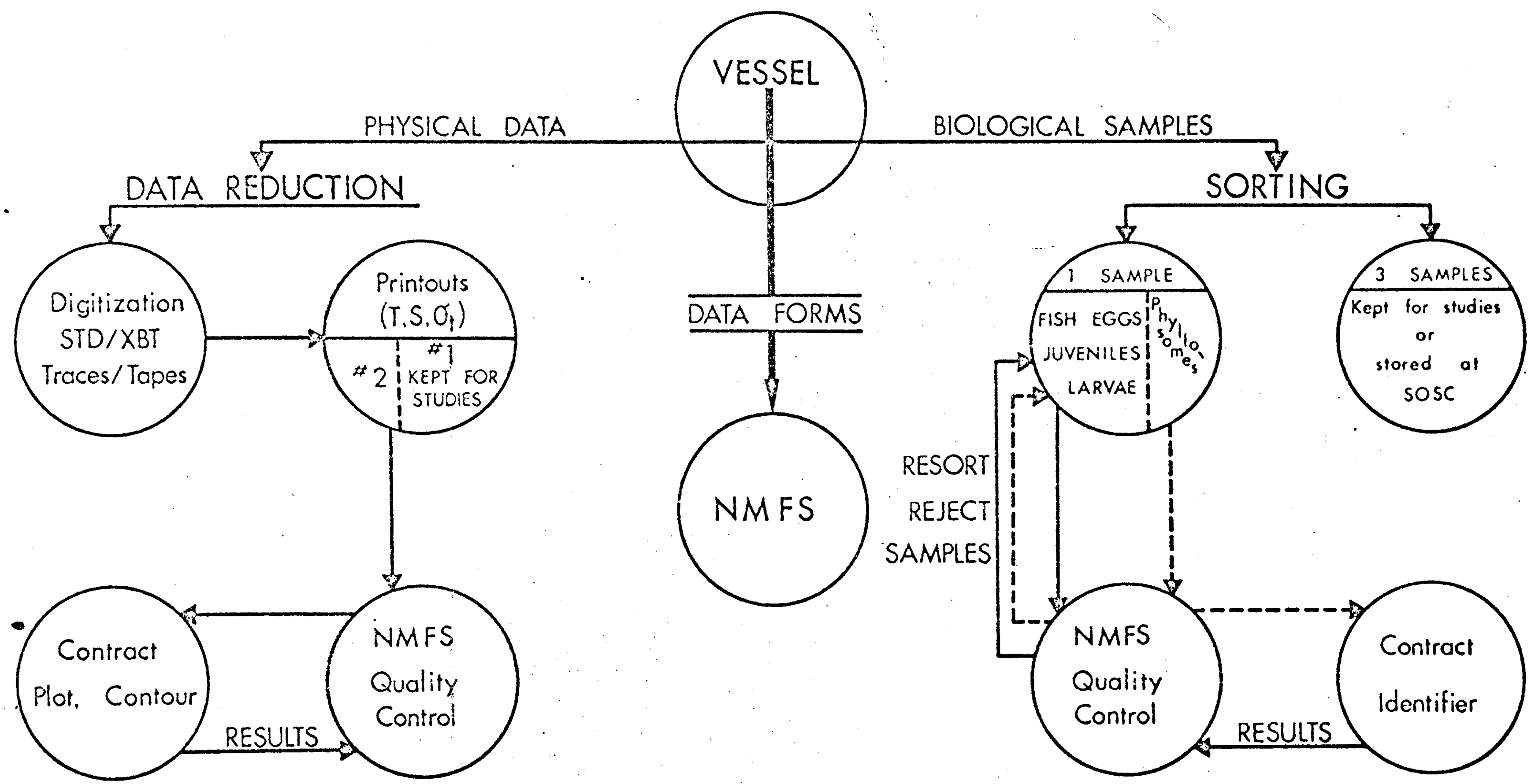

Figure 9.--Flow charts showing distribution and processing of physical and biological data.

United States Coast Guard

Washington, D. C.

1971

The U. S. Coast Guard Cutter ROCKAWAY participated in CICAR during her 1971 work in the southern Caribbean. The Chief Scientist for this primarily chemical oceanographic work in the Cariaco Trench and Gulf of Paria was Dr. Neil R. Andersen, Chief of the Applied Chemical Oceanography Branch of the Coast Guard Office of Research and Development (U. S. Coast Guard Headquarters, Washington, D. C.,20591). His report to the Commanding Officer of the USCGC ROCKAWAY is included in this report as the best summary of this work.

1972-3

So far as is known, the Coast Guard plans no work in the CICAR area during the rest of 1972 and 1973.

Statement of Chemical Oceanographic Operations in the Cariaco Trench and Gulf of Paria, July 1971.

The scientific party is involved in investigating environmental pollution; primarily petroleum and its degredation products and toxic heavy metals. One aspect of this research program is to take advantage of natural phenomena and use them as environmental laboratories for studying the fate and behavior of the particular pollutant under scrutiny. The Gulf of Peria is one such area with respect to our considerations on petroleum because of the natural oil seeps present. By conducting a multi-disciplinary investigation of the distribution of petroleum in the Gulf, as well as associated physical and chemical oceanographic parameters, we expect to be in a position to better understand what happens to oil when it is injected into the marine environment as well as the processes, such as the effect of having a large suspended sediment load, controlling its distribution.

Prior to the efforts put forth in the Gulf of Paria, an in-situ dissolved oxygen probe which was coupled to an STD, was tested for its operational characteristics and comparability with two other analytical determinations of dissolved oxygen in sea water. This investigation was conducted in the Cariaco Trench, a depression of about 1500 meters on the continental shelf of Venezuela, which is anoxic (i.e. no oxygen and high hydrogen sulfide content) below about 250 meters. It is this latter point which made the location particularly attractive because until now it was not clear what the consequences would be of inserting this system into an anerobic environment, a condition which one is likely to find when making measurements in polluted marine areas.

The results of the scientific investigations indicated above, will significantly aid in providing the necessary knowledge, whereby the U. S. Coast Guard can design pollution monitoring networks for use in their law enforcement responsibilities.

The total effort was one of a multi-disciplinary nature comprised of chemical, biological and geological considerations. The main body of the scientific team was made up of Dr. Neil R. Andersen, Chief Scientist, a chemical oceanographer; Mr. J. Richard Jadamec, a geochemist; LTJG T. C. Johnson, a marine geologist; ENS W. E. McGowan, a biologist; and ENS R. L. Foster, a chemist; all from the Office of Research and Development of U. S. Coast Guard Headquarters. The team was further supplemented by Dr. Andre Cobet, a microbiologist from the School of

Public Health of the University of California, Berkeley, and Dr. William G. MacIntyre, a chemist from the Virginia Institute of Marine Science. These scientists combined their efforts in making measurements and collecting samples from seven locations in the Gulf of Paria in addition to the operations in the Cariaco Trench.

The present state-of-the-art capabilities for conducting Chemical Oceanographic research for the most part do not allow for a total measurement program to be conducted on board the research vessel. As a result, the majority of effort expended in any such operation is that of collecting the appropriate environmental samples for further and later sophisticated analysis in the shore based laboratory. In other cases, such as with the microbiological investigations, it is simply not possible to have immediate results because cultures have to be grown in media prepared on the vessel. Therefore, a period of time from six months to a year will necessarily elapse before the results of the investigations will be obtained and published. The efforts put forth in achieving this goal included the following measurements and sample collections in the Gulf of Paria:

a. 86 water samples ranging in volume from two to twenty liters for hydrocarbon and toxic heavy metal content, and carbon isotope ratios.

b. 13 plankton samples for identification and hydrocarbon and toxic heavy metal analyses.

c. 15 core samples ranging from one foot to six feet in length for hydrocarbon and heavy metal content, sizing, clay mineral distribution and carbon-14 age determinations.

d. 21 suspended sediment samples for hydrocarbon content and compositional analyses.

e. 7 grab samples of sediment for benthic biota and geochemical analyses to complement those conducted on the core samples.

f. A variety of fish whose internal organs were surgically removed for later analyses of hydrocarbon and heavy metal content.

g. 30 water and sediment samples for fungi and bacteria identification and content.

In addition to the above indicated collection of samples, the following measurements were made:

a. 1165 analyses for nitrate, nitrite, ammonia, silicates, phosphates and hydrogen sulfide.

b. 65 determinations of dissolved oxygen.

c. 32 determinations of salinity.

d. 3 profiles of salinity and temperature determined in-situ.

e. Continuous analyses of surface water along the ship's track for low molecular weight hydrocarbons (i.e. C_1 through C_4.

As indicated previously, the significant conclusions from the research cruise are yet to come when all the data become available and are intercompared. However, the following are several observations and tentative conclusions which are presently possible:

a. For an area which is as prolific in natural oil seeps and as enclosed as the Gulf of Paria there is a remarkable absence of obvious oil on the surface waters. This could be the result of the rather large suspended sediment load in this water during the rainy season. Analyses of the core and grab samples will shed more light on this.

b. Dissolved oxygen levels in the bottom waters of the Gulf of Paria are rather low and appears to be at a level that further significant depletion would result in anerobic conditions setting in. A dissolved oxygen inversion was observed in the northern waters of the Gulf.

c. The bottom material reflect the above observation in that there appears to be an oxidizing surface sediment layer of about one inch, below which characteristics of a reducing environment were observed. There was, however, no obvious concentrations of sulfides in these sediments. Nevertheless, aside from samples obtained in the Bacas del Dragon and the Serpents Mouth, there appeared to be a paucity of benthic animals.

d. Levels of nutrients in the Gulf of Paria were surprisingly low. Silicates were relatively high in the southern part of this body of water. This is undoubtedly the result of the large amount of clay minerals being drained from the Orinoco River. These low levels of nutrients could be the result of either high biological productivity or the injection of nutrient depleted waters. The former does not appear to be the case inasmuch as the plankton samples collected did not indicate a great amount of productivity is present. These observations are very similar to those which are observed in the Amazon River Plume in the Equatorial Atlantic Ocean.

e. Core samples obtained in the Serpents Mouth contained obvious oil contamination, in agreement with the indications that that location is a natural seep area.

f. The Gulf of Paria is a highly stratified body of water during this time of the year, with the pycnocline at about 10 meters. This is obviously the result of the large volume of drainage during the rainy season and corroborates previous observations.

g. There is a zone on the bottom of the Gulf of Paria about one foot thick where there is a high concentration of suspended sediment (i.e. nephloid layer). This prevents any significal visual observations, either by camera or television, of the surface layer of the bottom.

Subsequent to departing the vessel in Port-of-Spain, operations will continue on the beaches of Trinidad. The results of this effort will be of considerable complementary value to the investigations conducted at sea.

It is with extreme pleasure that I find it appropriate to extend my personal thanks to CDR Ralph Judd, the officers and men of the USCGC ROCKAWAY for their splendid assistance rendered before and throughout this operation, not the last of which was the prevailing philosophy in conducting the planned research. I would consider it a pleasure to undertake future research cruises with these personnel.

Submitted to Commanding Officer,
USCGC ROCKAWAY on 19 July 1971,
Port-of-Spain, Trinidad, by

(Signed) Neil R. Andersen

Dr. Neil R. Andersen (Chief Scientist)
Chief, Applied Chemical Oceanography Branch
Division of Applied Sciences
Office of Research & Development
U. S. Coast Guard Headquarters
Washington, D. C. 20591

U. S. Geological Survey

1971-2

The U. S. Geological Survey, with support from the International Decade of Ocean Exploration of the National Science Foundation, using the UNITEDGEO I carried out four marine geological and geophysical studies in the CICAR area during 1971. The areas included 1) the Bay of Campeche, 2) East Margin of the Yucatan Peninsula, 3) Eastern Greater Antilles, and 4) Venezuela Continental Borderland. Preliminary reports on the results of these studies have been published by the Geological Survey particularly as a means of making copies of the acoustic-reflection profiles available to other geologists and geophysicists working in the Gulf and Caribbean area. It was impractical to include the entirety of each of these four reports in the present report to the Vth ICG for CICAR, so only the introductory material from each report is included here.

1972-3

Other than some possible nearshore geological work off Puerto Rico, the U. S. Geological Survey plans no additional work in the CICAR area during the remainder of 1972 and 1973.

INTERNATIONAL DECADE OF OCEAN EXPLORATION

U.S. GEOLOGICAL SURVEY

LEG 1, 1971 CRUISE, UNITEDGEO I

G. W. MOORE, CHIEF SCIENTIST

ACOUSTIC-REFLECTION PROFILES

BAY OF CAMPECHE

USGS-GD-72-002

1972

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INTRODUCTION

As part of a cooperative marine research program designated the International Decade of Ocean Exploration (IDOE), the United States Geological Survey is participating in an investigation of the geologic framework and resource potential of continental margins and small ocean basins in the Gulf of Mexico, Caribbean Sea, and west African continental shelf areas. These studies are funded through the National Science Foundation. Acoustic-reflection profiles of Leg 1, described in this report concern mainly a 200 X 250 kilometer project area in the Bay of Campeche in the southwestern part of the Gulf of Mexico (fig. 1). The cruise leg began at Corpus Christi, Texas and ended at Veracruz, Mexico. Other geophysical records collected during the cruise include magnetometry, gravimetry, and bathymetry.

Visiting scientists from the Institute of Geophysics of the National University of Mexico, the Oceanographic Commission of the Mexican Navy, and the Mexican Institute of Petroleum joined the research vessel UNITEDGEO I throughout the cruise in the Bay of Campeche. The cruise offered an excellent opportunity for scientific interchange between investigators from Mexico and the United States and permitted collaboration in the instrumentation, operational techniques, and interpretation of acoustic-reflection records aboard the research vessel.

SCIENTIFIC PARTY

U.S. Geological Survey

G. W. Moore, Chief Scientist
Erk Reimnitz, Geologist
A. R. Tagg, Geologist
S. C. Wolf, Geologist
B. D. Ruppel, Geophysicist
H. L. Krivoy, Geophysicist
J. W. Lee, Electronics Technician
F. A. Lybolt, Electronics Technician

Mexican Participants

Luis del Castillo G., Geophysicist, and M. A. Calderon V., Assistant Geophysicist, National University of Mexico, Institute of Geophysics

Gustavo Calderon R., Oceanographer, Oceanographic Commission of Mexico

Leonardo Garcia A., Assistant Geophysicist, Mexican Institute of Petroleum

SHIP SCHEDULE

A total of 19 days was spent at sea in the Gulf of Mexico during Leg 1, which began at Corpus Christi on May 27, 1971 and ended at Veracruz on June 17, 1971. In addition, information collected in the Bay of Campeche during a 1-day run out of Veracruz at the start of Leg 2 has been made a part of the data of Leg 1. The subbottom acoustic profiles obtained between Corpus Christi and Veracruz and within the project area at the southwest corner of the Bay of Campeche near Veracruz were run at an average ship speed of 8.3 knots.

Day 147 (27 May 1971)	Left Corpus Christi
Day 151 (31 May 1971)	Arrived Veracruz; main Mexican team boarded
Day 153 (2 June 1971)	Left Veracruz
Day 158 (7 June 1971)	Refraction (sonobuoy) station no. 1
Day 161 (10 June 1971)	Dredge station
Day 166 (15 June 1971)	Refraction (sonobuoy) station no. 2
Day 168 (17 June 1971)	Arrived Veracruz at end of Leg 1
Day 170 (19 June 1971)	Left Veracruz to begin Leg 2
Day 172 (21 June 1971)	End Bay of Campeche survey

OBJECTIVES OF INVESTIGATION

Scientific objectives of this cruise leg were: (1) to define the details of folding and faulting on the west side of the Bay of Campeche; (2) to study the extension into the bay of the Mexican volcanic belt and related volcanic lineaments; (3) to investigate the origin of a belt of salt domes that extends along the floor of the east side of the basin; and (4) to acquire new evidence that might bear on the origin of the Gulf of Mexico.

GEOLOGIC SETTING

The area bordering the Bay of Campeche has a Paleozoic granitic and metamorphic basement overlain by Upper Jurassic redbeds, salt, and gypsum (Viniegra, 1971). These rocks are in turn overlain by thin-bedded Cretaceous and Paleocene sedimentary rocks upon which a thick sequence of coastal-plain sediment was deposited aroung the margin of the bay.

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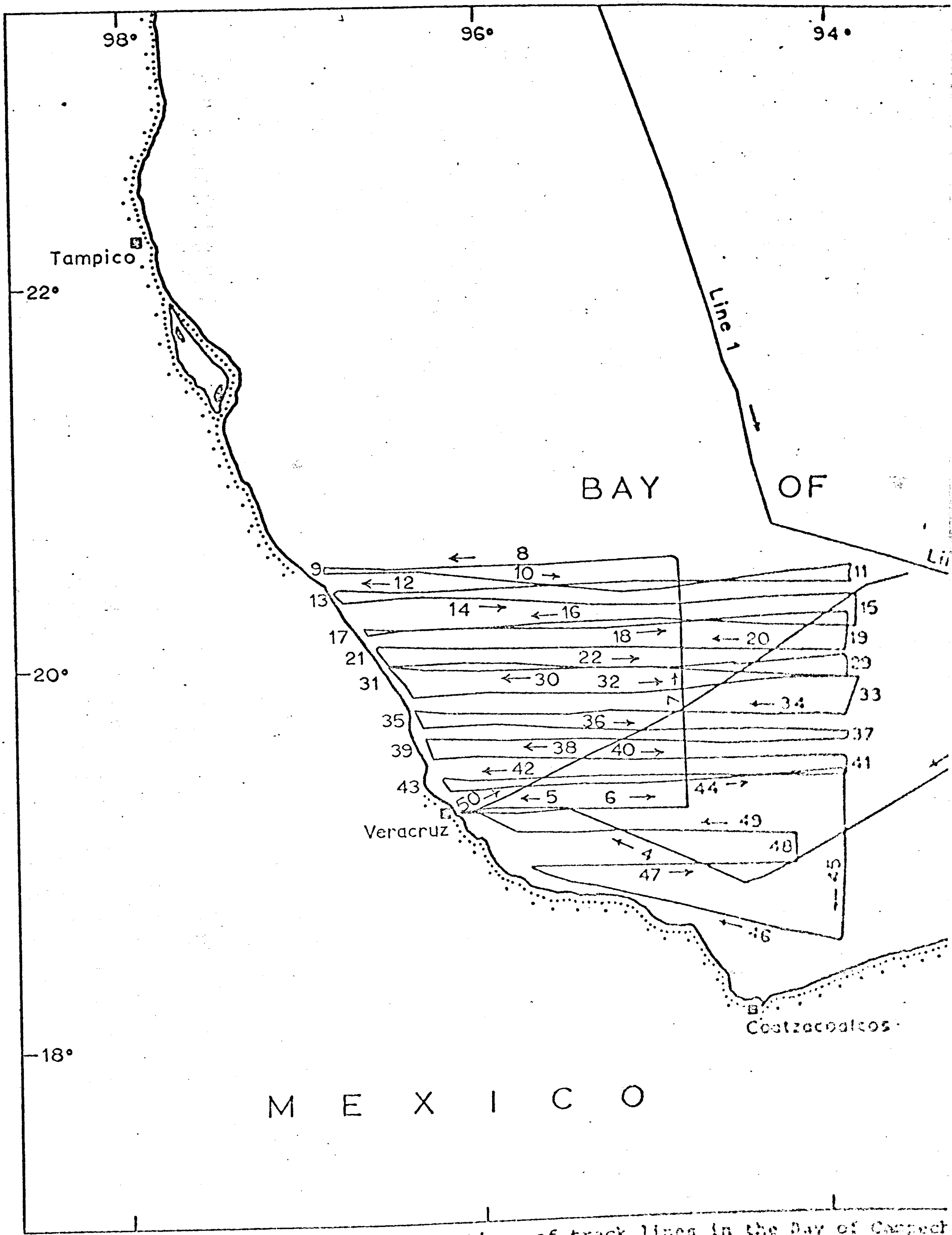

Figure 1.--Index map showing locations of track lines in the Bay of Campech

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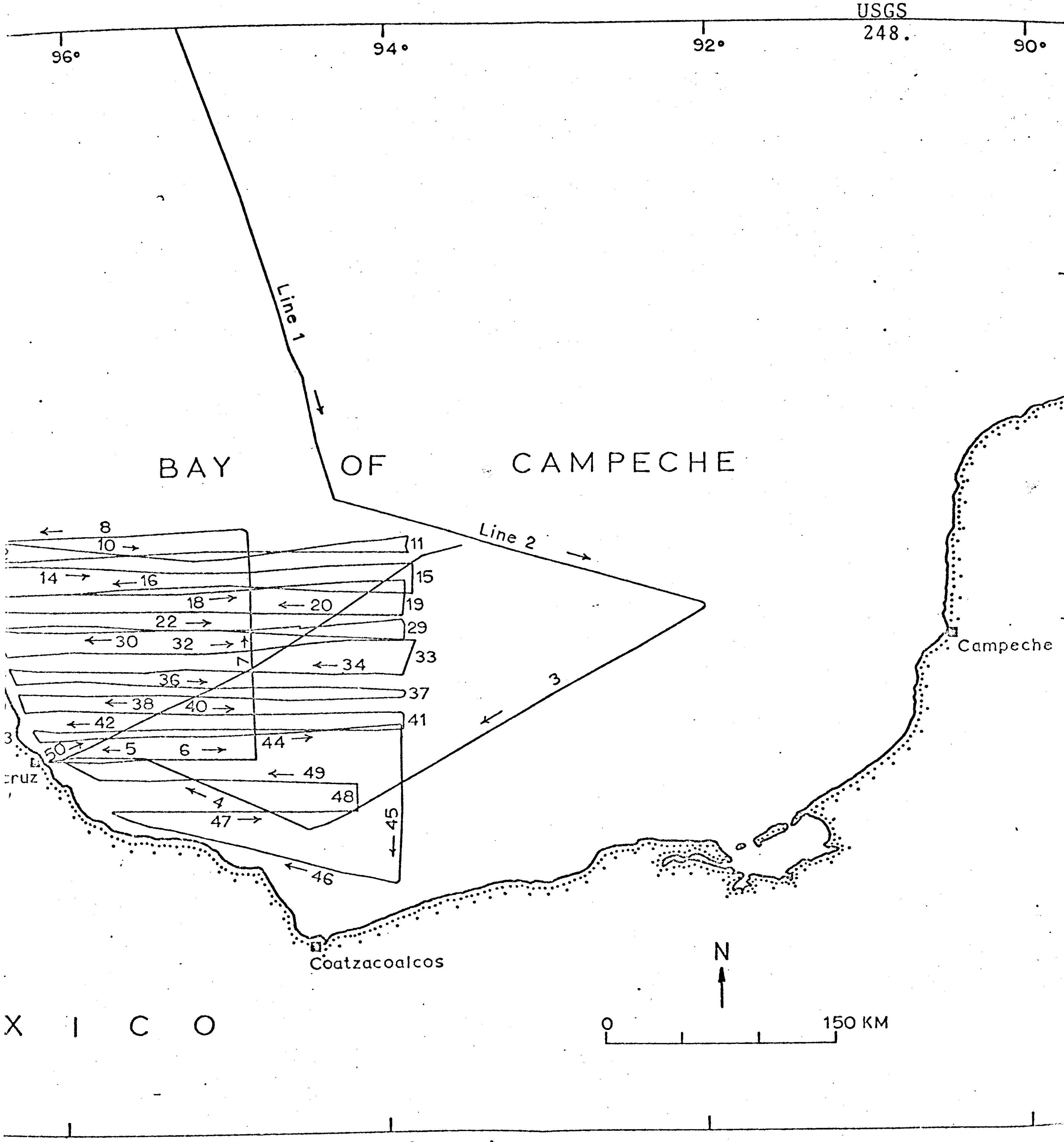

locations of track lines in the Bay of Campeche.

3

The continental slope and floor of the Bay of Campecehe are characterized by several structural features. The continental rise on the western side of the bay is marked by regularly spaced, north-trending folds that generally parallel the continental margin and occur at various depths from the slope to the abyssal plain (Bryant and others, 1968). The eastern half of the bay is a province of salt domes that appear as hills extending above the floor of the bay (Bergantino, 1971). The southern extent of this salt province lies in the oil-producing Isthmian Saline Basin of the south coastal plain. An area of nearly undisturbed sediment lies between the belt of folds in the western part of the bay and the region of salt domes in the eastern part. An additional structural feature is the late Cenozoic Mexican volcanic belt that extends almost 1,000 km eastward across Mexico to the western side of the Bay of Campeche and then turns south-eastward discontinuously toward Guatemala (Mooser, 1958).

The Deep Sea Drilling Project (DSDP) has contributed vital lithologic and paleontologic information in the project area. A hole in the northern part of the Bay of Campeche indicates the presence of a sequence of fine-grained pelagic sediment of Pliocene and Pleistocene age through most of the hole, which bottomed at 440 meters in sand turbidity-current deposits of late Miocene age (Worzel and others, 1970). Another DSDP hole farther to the north indicates that diapirs on the floor of the Gulf of Mexico contain salt (Burk and others, 1969). Comparison of acoustic characteristics in Leg 1 profiles with a profile through the northern DSDP hole suggests that the structures in the eastern part of the Bay of Campeche also contain salt. Seaward extension of the onshore salt-dome belt to the south provides an additional basis for inferring that salt constitutes the cores of the diapirs in the eastern part of the bay.

PRELIMINARY RESULTS

Approximately 7,000 km of geophysical lines were run, chiefly in the southwestern part of the Bay of Campeche, using a 220,000-joule sparker system. The north-trending belt of folds in the western part of the bay was surveyed in detain using an average track spacing of 9 km. Prominent fold axes and faults were correlated from track to track, and in many places young sea-floor sediment was found to be deformed (Moore and others, 1971).

The late Cenozoic Mexican volcanic belt apparently ends abruptly on the continental shelf of the bay. Evidence from the cruise suggests that the Mexican and Guatemalan belts join each other near the western shore of the Bay of Campeche.

Many profile records showing salt intrusion were obtained within the tectonic belt of domes in the eastern part of the Bay of Campeche. Incipient salt domes and anticlines were also noted outside the main tectonic belts during the cruise. They indicate that salt is present in some essentially undeformed parts of the basin as well as in the deformed parts. Scientific analysis of the cruise records is underway.

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OPERATIONAL DATA

Navigation

A satellite-navigation system, supplemented near the shore by radar, was used for positioning. To optimize the accuracy of interpolation between satellite fixes, all straight tracks were steered by automatic pilot.

The satellite system consisted of an ITT 4007 AB satellite-navigation receiver, a DEC PDP-8L computer, and an ITT teletypewriter. In a 23-hour test while at the dock in Veracruz, 10 satellite fixes were within about 120 m (380 ft.) of a plotted average. Precision of satellite fixes while underway is estimated at about 180 m (600 ft.).

The radar system was a Decca RM 329, with 25 kw of power and a range up to about 65 km (40 mi.). A 9-foot wave-guide antenna giving a beam width of less than 1° at the half-power points provided high azimuth resolution. Accuracy of radar fixes, where used as primary control near the shore, is estimated at about 400 m (1200 ft.). Plotting was done on E. Uchupi's map titled "Map showing relation of land and submarine topography, Mississippi delta to Bahia de Campeche", which was published in 1968 in the U.S. Geological Survey's Miscellaneous Geologic Investigations Series as Map I-512.

Time for navigation and scientific records is referred to Greenwich Mean Time (Z), and days are numbered consecutively from the first day of the year. Scientific clocks were adjusted according to WWV radio.

Acoustic-Reflection System

The acoustic-reflection profiles were obtained using a sparker system consisting of separate, van-mounted, self-contained 160- and 120-kilojoule units triggered from a single source. Maximum total usable power was about 220 kilojoules. The triggered discharge of large capacitors through 6 twin-electrode "ladders" trailed behind the ship created sparks that produced the low-frequency acoustic pulse. These pulses were reflected from the sea bottom and from subbottom surfaces and were received and preamplified by a 100-hydrophone streamer. They were then selectively filtered and recorded graphically on a Raytheon recorder. The sparker ladders were trailed about 70 m behind the navigation antenna; the center of the hydrostreamer was at about 180 m.

Organization of profile records.--The subbottom acoustic profiles at the back of this report are presented in numerical order at approximately 1/5th scale. Many are shown reversed in order to facilitate comparison of structural and sedimentary features from profile to profile. All east-west profiles have been assembled with the west end at the left; thus, the user views such profiles as though looking northward. The start and end of each line are indicated, as are time marks every hour. Day notations are listed consecutively from day one of the year 1971. The records in this report were made between days 147 and 172 (May 27 to June 21). Hour marks shown on the profiles are in GMT and correspond with those on the detailed track chart (Plate 1, pocket).

The subbottom profiles were chiefly run at a 12-second firing rate and alternately gated 6-second sweep. Brief periods at the beginning of line 1 and at sonobuoy stations on lines 18 and 44 had a 6-second firing rate and 6-second sweep. Line 50 was run at a 4-second firing rate and 4-second sweep. The vertical scale shown on the acoustic profiles is two-travel time in seconds. The sparker energy source was generally set at 220 kj, but 80 kj was used on line 50, 120 kj on lines 1 and 48-49, 160 kj on lines 22a and 28, 165 kj on line 18, 180 kj on lines 35 and 40-46, 190 kj on lines 4 and 5, and 215 kj on lines 15 and 16. The filter band pass was generally 125/20 hz but was 98/20 hz for the first 1-1/2 hours on line 1 and 125/16 hz on line 50. The average vertical exaggeration of the sea-floor profile is about 10:1; the range is between 9:1 and 13:1.

Depth Recorder

A 3.5 khz Edo acoustic-reflection system was used as an echo-sounder and shallow-penetration subbottom profiler. Twelve transducers mounted in a sea chest in the ship's hull emitted a pulse signal programmed by a Gifft graphic recorder that provided uncorrected water depths in seconds (two-way travel time). These water depths were transcribed at quarter-hour intervals and, in conjunction with navigation fixes, were computer-processed using corrections from Matthews' tables. Computer output was printed at one-hour intervals and includes the position of each station, the observed depth in seconds, and the corrected depth in meters (Table 1).

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INTERNATIONAL DECADE OF OCEAN EXPLORATION

U.S. GEOLOGICAL SURVEY

LEG 2, 1971 CRUISE, UNITEDGEO I

J. G. VEDDER, CHIEF SCIENTIST

ACOUSTIC REFLECTION PROFILES

EAST MARGIN, YUCATAN PENINSULA

USGS-GD-72-003

1972

USGS
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Illustrations

INTRODUCTION

As part of a cooperative marine research program designated the International Decade of Ocean Exploration (IDOE), the United States Geological Survey is participating in an investigation of the geologic framework and economic significance of continental margins and small ocean basins in the Gulf of Mexico, Caribbean Sea and West African continental shelf areas. These studies are funded through the National Science Foundation. Leg 1, completed June 22, 1971, concerned the southern part of the Bay of Campeche. Leg 2, described in this report, traversed the westernmost part of the Caribbean Sea from the Yucatan Channel southward to Glovers Reef off British Honduras (fig. 1). The area of Leg 2 lies at the western extremities of 3 major sea floor features, the Yucatan Basin, the Cayman Ridge and the Cayman Trough. Acoustic reflection, magnetic, and gravity data from the investigation will be studied in order to evaluate mineral resource potential and to analyze the structural framework as it relates to the hypothesis of global plate tectonics.

Scientists and observers from the Institute of Geophysics and Institute of Petroleum of the National University of Mexico and from the Mexican Navy joined the research vessel UNITEDGEO I, at the beginning of Leg 2 and remained aboard for two weeks. The cruise offered an excellent opportunity for the Mexican collaborators to observe the instrumentation, operational techniques, and interpretation of records aboard a marine research vessel.

SCIENTIFIC PARTY

U.S. Geological Survey

J. G. Vedder, Chief Scientist
W. P. Dillon, Geologist
A. E. Roberts, Geologist
B. D. Ruppel, Geophysicist
A. G. McHendrie, Geologist
P. E. Malin, Geophysicist
C. A. Rodeick, Physical Science Technician
H. R. Hill, Electronic Technician
R. A. Patrick, Electronic Technician

Mexican Participants

Lt. Alberto Vazquez de la Cerda, Mexican Navy
Alfredo Hernandez Andres, National University of Mexico, Institute of Petroleum
Jose Sandoval Ochoa, National University of Mexico, Institute of Geophysics

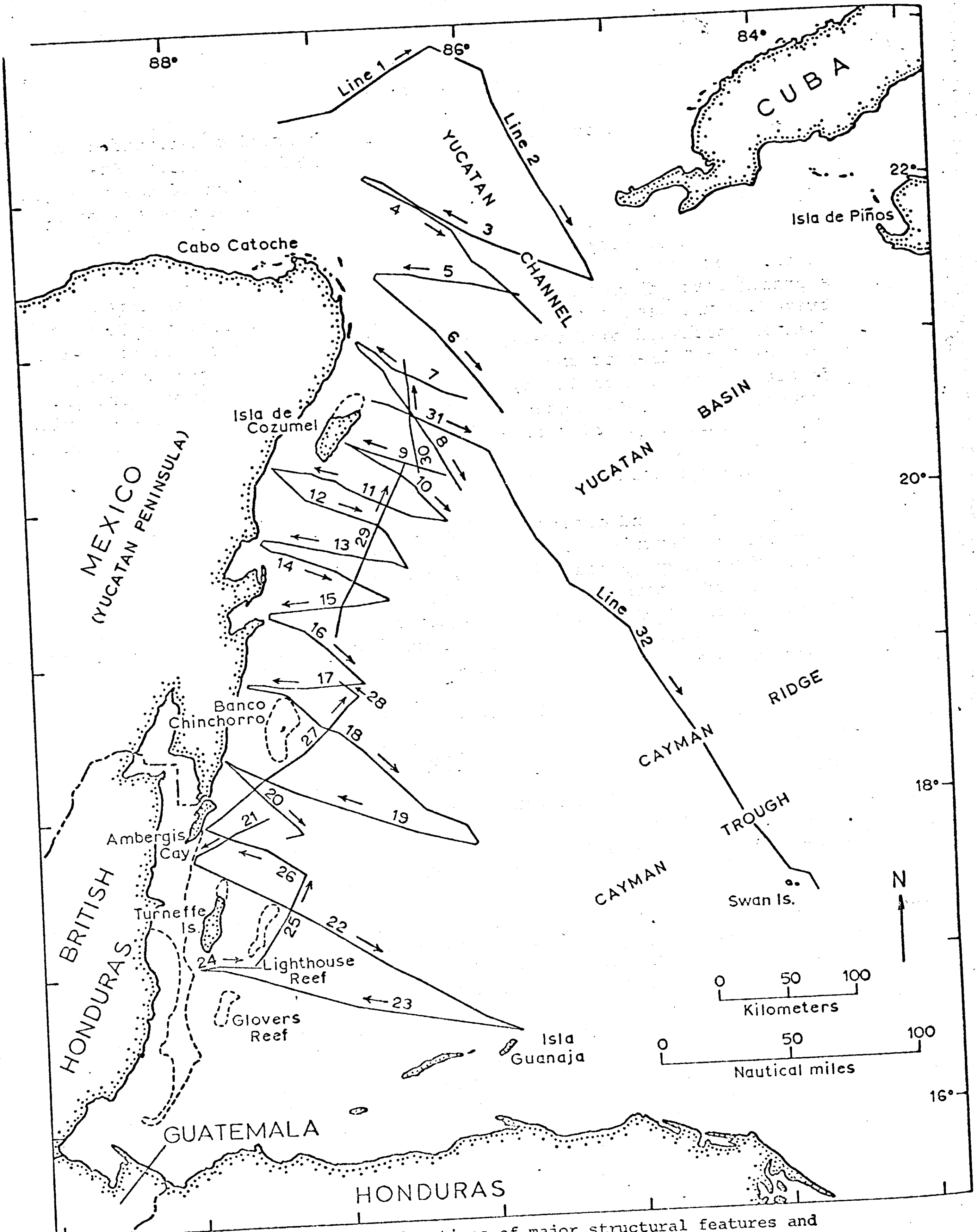

Figure 1.--Index map showing locations of major structural features and track lines along the east margin of the Yucatan Peninsula.

SHIP SCHEDULE

Leg 2, which covered a total of 25 days, included four days in transit from Veracruz, Mexico to the project area and 7 days from the project area to San Juan, Puerto Rico. Continuous acoustic reflection profiling, gravimetry, magnetometry, bathymetry and rock dredging were done within the project area.

Day 170	(June 19, 1971)	Left Veracruz with Mexican observers
Day 182	(July 1, 1971)	Reached southern point, Isla Guanaja
Day 186	(July 5, 1971)	Completed profile lines and dredge hauls; arrived Isla de Cozumel, debarked observers
Day 187	(July 6, 1971)	Departed Isla de Cozumel
Day 189	(July 8, 1971)	Off Swan Islands, secured seismic gear, continued gravity and magnetics
Day 191	(July 10, 1971)	Put into Kingston for fuel and water
Day 195	(July 14, 1971)	Arrived San Juan.

OBJECTIVES OF INVESTIGATION

The lack of offshore data in the area of Leg 2 of the USGS-IDOE cruise necessitated the assembly of detailed geophysical and geologic information in order to evaluate the resource potential and to resolve the tectonic framework of the continental margin. The first phase (1971) was primarily a geophysical reconnaissance designed to provide information that will help decipher the structural evolution of the continental margin east of the Yucatan Peninsula. A few dredge sites were selected as a possible means of determining the age and lithology of the rocks that form major surveyed features.

The primary scientific objectives of Leg 2 were: (1) to investigate the evolution of the continental margin east of the Yucatan Peninsula and its relation to concepts of continental margin development; (2) to explore the possibility of structural and stratigraphic links between western Cuba and the Yucatan Peninsula; (3) to study the western terminus of the Cayman Ridge and Trench system and to determine its influence on the structure of British Honduras and Guatemala; (4) to examine the Yucatan Basin in order to interpret the origin of this distinct sea floor feature in the northwestern Caribbean; (5) to learn more about the nature of interaction between the North American and Caribbean plates in this area.

GEOLOGIC SETTING

The geology of the offshore area from Cabo Catoche at the northern tip of the Yucatan Peninsula to Glovers Reef off British Honduras not only is very complex but also has received less study than most other areas in the circum-Caribbean region. Onshore work by Flores (1952), Dengo (1969), Dengo and Bohnenberger (1969) and Viniegra (1971) provides background information on the regional geology and structural setting of the eastern continental margin of the Yucatan Peninsula and northern Central America. Their work indicates that two orogenic cycles, one Paleozoic, the other Mesozoic, can be distinguished in the southern part of the area. The oldest rocks in the lower cycle are slightly to moderately metamorphosed and probably are mid-Paleozoic in age. These rocks are locally cut by granitic intrusives and are overlain by a greatly deformed clastic wedge of upper Paleozoic strata that are slightly metamorphosed at places (Kesler and others, 1970; Bateson and Hall, 1971). Baie (1970) has speculated that a remnant of this Paleozoic fold belt connects Cuba and the Yucatan Peninsula along the outer edge of the continental margin. In British Honduras, granitic rocks of Triassic age intrude the upper Paleozoic clastic rocks (Bateson and Hall, 1971).

The second orogenic cycle evolved during Late Jurassic and Early Cretaceous time with the deposition of a thin sequence of red beds followed by shallow-water marine sedimentation in elongate troughs. The Mesozoic clastic rocks are little deformed but locally were intruded by plutonic rocks during Late Cretaceous or early Tertiary time in southeastern Guatemala (Clemons and Long, 1971). In Late Cretaceous time, serpentinites also were injected along major east-trending fault zones in central Guatemala. Deposition of a thick succession of shallow water carbonates and evaporites began in mid-Cretaceous time and continued into Late Cretaceous and early Tertiary time. Very slightly deformed carbonate platform deposits compose the bulk of the late Tertiary strata on the Yucatan Peninsula.

PRELIMINARY RESULTS

More than 4,450 kilometers of track line were traversed within the project area using a continuous acoustic reflection profiling system, a ship-towed magnetometer, and a shipboard gravimeter.. Dredging at 10 sites selected on the basis of geophysical records provided critical information on the types of rocks and sediments that form major sea floor features. Accurate positioning was established by a satellite navigational system.

Cursory shipboard examination of the subbottom profiles indicates that the continental slope east of the Yucatan Peninsula is characterized by a steep gradient from near the shoreline to a depth of about 1,000 meters. Seaward from the narrow shelf, several elongate reefs, banks, and islands lie parallel to the coast and interrupt the slope. Farther basinward, the sea floor slopes gradually to depths of about 1,200 to 1,800 meters where another set of ridges, not evident on existing charts, projects above the regional gradient and also lies parallel to the coast. A relatively sharp declivity on the east side of this ridge system drops to the floor of the Yucatan Basin at a depth of about 4,000 meters. Dredge hauls of muscovite schist and marble from near the base of the slope in the Yucatan Channel and off Isla de Cozumel suggest that the two subparallel sets of ridges are belts of relatively resistant metamorphosed sedimentary rock bordering an elongate basin partially filled with sediments. The fill may be as thick as 1,800 meters in the borderland basin east of Isla de Cozumel where the sedimentary rocks and overlying unconsolidated deposits also are broadly folded and locally faulted. The outer ridges serve as depositional barriers to sedimentation in smaller troughs developed along the east edge of the ridge-basin system.

The basement ridges of the British Honduras-Yucatan continental margin probably should be considered tectonic dams (Emery, 1968); presumably they represent fault blocks formed during the large scale rifting that formed the continental margin in post-late Paleozoic to pre-late Mesozoic time. However, some recent activity also is indicated by extensional faults in the nearshore basin sediments. This relatively recent movement of the blocks may have resulted from activity on the nearby border of the North American and Caribbean lithospheric plates.

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INTERNATIONAL DECADE OF OCEAN EXPLORATION

U.S. GEOLOGICAL SURVEY

LEG 3, 1971 CRUISE, UNITEDGEO I

L. E. GARRISON, CHIEF SCIENTIST

ACOUSTIC-REFLECTION PROFILES

EASTERN GREATER ANTILLES

USGS-GD-72-004

1972

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INTRODUCTION

As part of a cooperative marine research program designated the Internataional Decade of Ocean Exploration (IDOE), the United States Geological Survey is participating in an investigation of the geologic framework and resource potential of continental margins and small ocean basins in the Gulf of Mexico, Caribbean Sea, and west African continental shelf areas. These studies are funded through the National Science Foundation. Legs 1 and 2, completed June 22 and July 8, respectively, were concerned with subbottom features of the Bay of Campeche and with the tectonic framework of the continental margin east of the Yucatan Peninsula. Leg 3, described in this report was conducted in the Antilles region of the northeastern Caribbean between July 17 and August 4, 1971.

This report presents the unedited records of the approximately 5840 km of acoustic reflection profiling made during Leg 3 (fig. 1). Magnetic and gravity data were collected also but are being reported elsewhere in conjunction with the results of the study.

SCIENTIFIC PARTY

<u>U.S. Geological Survey</u>

Louis E. Garrison, Chief Scientist
J. V. A. Trumbull, Geologist
M. S. Marlow, Geophysicist
R. G. Martin, Jr., Geologist
A. K. Cooper, Geophysicist
R. L. Immel, Geologist
R. A. Patrick, Electronics Technician
M. Hijmans, Electronics Technician

SHIP SCHEDULE

A total of 19 days was spent at sea in the eastern Greater Antilles during Leg 3 which began at San Juan, Puerto Rico, on July 17, 1971 and ended at St. Thomas, Virgin Islands, on August 4, 1971. Subbottom acoustic profiles were obtained over about 5840 km of track line in the project area. These records were made at an average ship's speed of 8.3 knots. One dredging station was occupied and three sonobuoy refraction profiles made.

Departure from San Juan was approximately 36 hours later than scheduled due to delays in filling out ship's crew list and loading ship's stores. The work schedule was as follows:

Day 198	(17 July 1971)	Departed San Juan. Began work in Mona Passage and Muertos Trough area.
Day 202	(21 July 1971)	Began work around Anegada Trough.
Day 203	(22 July 1971)	In St. Thomas (0730-1100) to pick up Dr. John Albers, Associate Chief Geologist, U.S. Geological Survey.
Day 205	(24 July 1971)	Returned to St. Thomas (0930-1300) to debark Dr. Albers. Resumed work in Anegada Trough.
Day 207	(26 July 1971)	Began Puerto Rico Trench crossings.
Day 213	(1 August 1971)	Began work on northern part of Aves Swell.
Day 216	(4 August 1971)	Terminated work off St. Thomas, picked up freight shipment there, and made for San Juan for generator repairs.
Day 217 - 219	(5-7 August 1971)	In port San Juan replacing generator unit and briefing the on-coming Leg 4 crew.

OBJECTIVES OF INVESTIGATION

Scientific objectives of this cruise leg were: (1) to investigate the zone of juncture between the south flank of the Antillean ridge and the north edgeof the Venezuelan Basin along the depressed Muertos Trough; (2) to examine structural deformation in the Anegada Trough where the Greater Antilles are joined by the Lesser Antilles and Aves Swell; and (3) to study the northeastern sector of the Puerto Rico Trench where predicted relative plate motion should be transitional between westward underthrusting of the Lesser Antilles and east-west strike-slip motion north of the Greater Antilles.

GEOLOGIC SETTING

The eastern margin of the Caribbean lithosphere plate is marked by a zone of intermediate-depth earthquakes lying beneath the eastern Greater Antilles and curving southeastward along the Lesser Antilles arc (Sykes and Ewing, 1965). Exterior to the islands, the Puerto Rico trench is a strong topographic depression north of Puerto Rico but diminishes in relief southeastward as it follows the curve of the Antilles and disappears topographically near latitude 15°N. The pronounced gravity minimum associated with this feature, however, continues across the island of Barbados toward the South American continent. Evidence from first-motion earthquake studies (Molnar and Sykes, 1969) and from acoustic-reflection profiles (Chase and Bunce, 1969) suggests that the Atlantic sea floor is being thrust beneath the Lesser Antilles in a west-dipping zone of subduction.

The principal positive features in the northeastern Caribbean are the ridges of the Greater Antilles, the Lesser Antilles, and the Aves

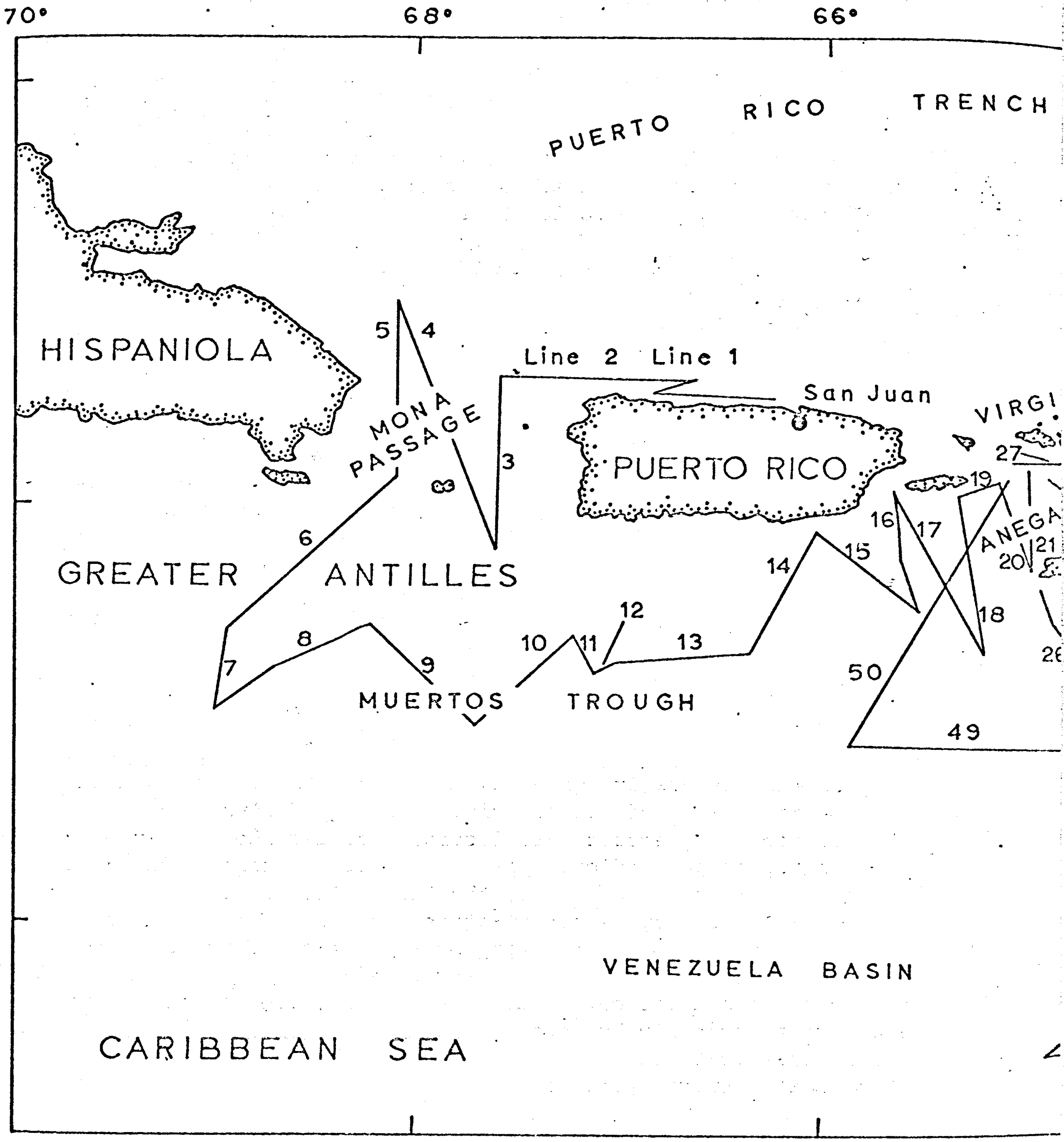
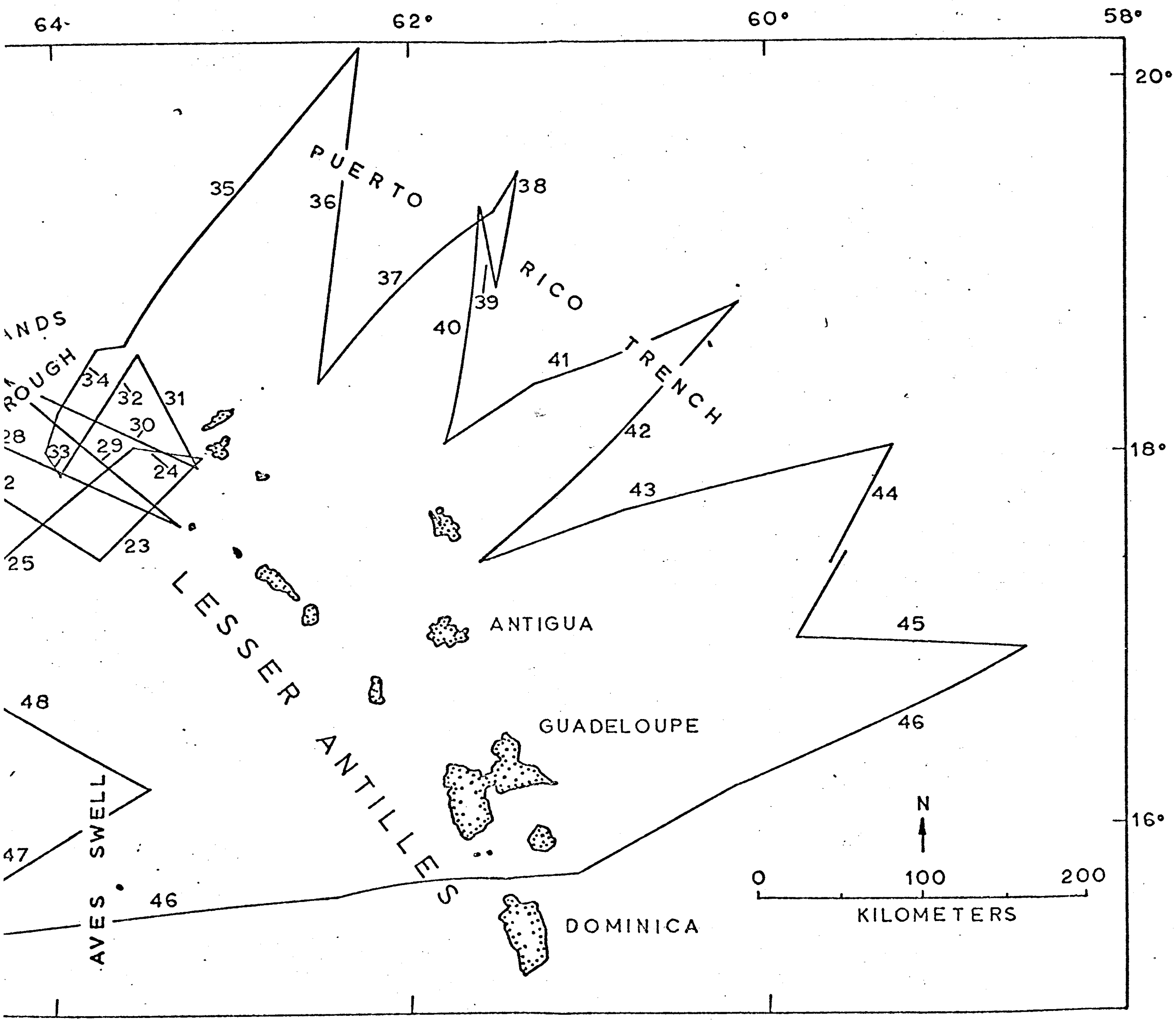


Figure 1.--Index map showing locations of major structural features and t



nes in the eastern Greater Antilles.

Swell. These structures are complicated by the separation from the Greater Antilles of the St. Croix ridge, and the division of the Lesser Antilles into inner and outer arcs. A narrow gap, the Anegada Trough, separates all of these features in the area of their convergence.

In the region south of the ridge of the Greater Antilles, seismic reflectors in the Venezuelan Basin, possibly as young as Oligocene in age, are depressed into a monoclinal feature called Muertos Trough (Martin and Garrison, 1971). Beneath this trough is the junction of Caribbean crust and Antillean structure. The junction has been described as a major strike-slip fault (Hess and Maxwell, 1953).

PRELIMINARY RESULTS

In the vicinity of Mona Passage and the Muertos Trough, about 986 km of geophysical track was run in order to examine the structural pattern of the Antillean ridge crest where it is cut by Mona Passage and to determine the structure of the Muertos Trough. The acoustic-reflection profiles that crossed Mona Passage (lines 3, 4, and 5) indicate widespread tensional faulting south of the ridge crest, whereas north of the crest the strata are relatively undisturbed. The profiles that crossed the Muertos Trough (lines 6-14) indicate that acoustic reflectors belonging to the Venezuela Basin continue northward beneath the Antillean ridge structure for a distance of at least 18 km with little or no internal deformation. Superficially at least, the overlap of ridge structure on depressed ocean floor resembles the structural relationships east of the Lesser Antilles where acoustic reflection profiles suggest that Atlantic crust is being thrust westward under the island arc (Chase and Bunce, 1969). Lines 35 to 46 of this report cross the latter area.

In the Anegada Trough area, about 1620 km of track was run to examine the interrelations of the principal positive features that converge in that region. The acoustic-reflection profiles show the great complexity of this region and indicate possible major faulting along the north flank of the St. Croix ridge. Thus, the Virgin Islands Basin to the north of St. Croix Island may be a down-dropped block. Normal faulting also appears to play a major role in the separation of the Lesser Antilles from the eastern tip of the Greater Antilles, but the faults are relatively short and discontinuous. As a whole, the region appears to be affected principally by tensional forces. Sediment thickness in the Virgin Islands Basin ranged from none at the northeastern end to almost 2 km in the central portion.

In the eastern segment of the Puerto Rico Trench (lines 35 through the eastern half of 46), approximately 2070 km of geophysical track was made as a series of near-normal crossings of the trench. Topographic relief across the trench axis diminishes markedly with the gradual disappearance of the outer ridge on the Atlantic floor to the north.

The entire central section of the trench (between 17° and 19°N) is barren of turbidite deposits, but both to the north and to the south of this section the trench axis contains up to 1.1 seconds of horizontally stratified material. The continuation of oceanic reflectors for several kilometers beneath the outer toe of the Antillean structure, as described by Chase and Bunce (1969), was seen in almost every crossing of 19°N. In the vicinity of 17°N, Atlantic sea-floor reflectors were recorded beneath the island-arc terrace as much as 52 km west of the trench axis.

The eastern margin of the Venezuela Basin, at its junction with the Aves Swell, was surveyed in greater detail than originally planned, because several dredge stations planned for the earlier part of Leg 3 were cancelled due to sea conditions and about 48 hours of extra time became available. The last few lines were modified to give two additional trench crossings, an extra line was carried south of Aves Island, and new lines were run near the Aves Swell.

Published acoustic-reflection profiles from the Venezuela Basin show a zone of strong reflectors (Horizon B"), which normally represent acoustic basement at a two-way travel time distance about 0.8 sec below the sea floor (Ewing and others, 1967). In recent deep-sea drillings, this zone was identified as basalt and dolerite of Coniacian age (Edgar and others, 1971b). Previous reflection profile data have yielded a mere indication that layered material may be present below B" (Edgar and others, 1971a), but the profiles from Leg 3 (lines 46-50) show a zone of prominent sub-B" reflectors in the northeast corner of the Venezuela Basin. The interval between Horizon B" and the zone of deeper reflectors is representing a two-way travel time that varies from 0.4 to 0.6 sec, thinning northwestward off the flank of Aves Swell.

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USGS
269.

INTERNATIONAL DECADE OF OCEAN EXPLORATION

U.S. GEOLOGICAL SURVEY

LEG 4, 1971 CRUISE, UNITEDGEO I

E. A. SILVER, SCHIEF SCIENTIST

ACOUSTIC-REFLECTION PROFILES

VENEZUELA CONTINENTAL BORDERLAND

USGS-GD-72-005

1972

TABLE OF CONTENTS

INTRODUCTION

As part of a cooperative marine research program designated the International Decade of Ocean Exploration (IDOE), the United States Geological Survey is participating in an investigation of the geologic framework and resource potential of continental margins and small ocean basins in the Gulf of Mexico, Caribbean Sea, and west African continental shelf areas. These studies are funded through the National Science Foundation. Legs 1-3, completed June 22, July 8, and August 4, respectively, were concerned with subbottom features and tectonic history of the Bay of Campeche, the continental margin east of the Yucatan Peninsula, and the Antilles region of the northeastern Caribbean Sea. Leg 4, described in this report, was conducted in the continental borderland area of Venezuela, including the Netherlands Antilles, between August 18 and October 1, 1971. The cruise leg began at San Juan, Puerto Rico, and ended at Port of Spain, Trinidad, after having run a total distance of 8,000 km (fig. 1). Other geophysical records collected during the cruise include magnetometry, gravimetry, and bathymetry.

Visiting scientists from the University of Amsterdam, the University of Utrecht, the Venezuelan Petroleum Corporation, and the Venezuelan Ministry of Mines and Hydrocarbons joined the research vessel UNITEDGEO I during separate phases of the cruise. The cruise offered an excellent opportunity for scientific interchange between investigators from the Netherlands, Venezuela, and the United States and permitted cooperative efforts both aboard the research vessel and during the geologic mapping of the islands of Aruba, Curacao and Bonaire.

SCIENTIFIC PARTY

U.S. Geological Survey

E. A. Silver, Chief Scientist
J. E. Case, Geophysicist
A. R. Tagg, Geologist
H. G. Greene, Geologist
J. P. Lockwood, Geologist
K. G. Blom, Geologist
P. R. Carlson, Geologist
H. L. Krivoy, Geologist
J. W. Lee, Electronics Technician
R. A. Patrick, Electronics Technician
H. R. Hill, Electronics Technician

Foreign Participants

H. G. MacGillavry, Geologist, University of Amsterdam
Rinus Wortel, Geophysicist, University of Utrecht
Jorge Navarro, Geologist, Venezuelan Ministerio de Minas e Hidrocarburos
Xavier Picard, Geologist, Venezuelan Ministerio de Minas e Hidrocarburos
Jose Albarracin Jimenez, Geological Engineer, Venezuelan Ministerio de Minas e Hidrocarburos
Nelson Aboud, Geological Enegineer, Venezuelan Ministerio de Minas e Hidrocarburos
Alvaro Acosta, Geologist, Corporacion Venezolano Petroleo
Enrique Vasques, Geologist, Corporacion Venezolano Petroleo

SHIP SCHEDULE

A total of 26 days was spent at sea in the central and southern Caribbean Sea during Leg 4. The departure from San Juan was approximately 10 days later than originally scheduled due to delays in filling out ship's crew list. Departure from Curacao was delayed an additional 15 days due to breakdown of various pieces of ship's equipment. Departure from the first port call at La Guaira was delayed another 2 days due in part to a passing hurricane and in part to breakdown of ship's generator. Departure from second La Guaira port call was delayed another one-half day due to breakdown of ship's equipment.

Days 230 (August 18, 1971)	Depart San Juan. Long profile across Carribbean passing west of Puerto Rico, through DSDP Site 146, and west of Curacao.
Days 233-248 (Aug 21 - Sep 5)	In Curacao repairing equipment and doing geological reconnaissance in Aruba, Curacao and Bonaire.
Days 248-256 (September 5-13)	Geophysical work on Venezuelan borderland between Aruba and Bonaire.
Days 256-259 (September 13-16)	In La Guaira repairing equipment and avoiding storm at sea.
Days 259-267 (September 16-24)	Geophysical work between Bonaire and Los Roques.
Days 267-268 (September 24-25)	In La Guaira
Days 268-274 (Sep 25 - Oct 1)	Geophysical work on Venezuelan borderland.

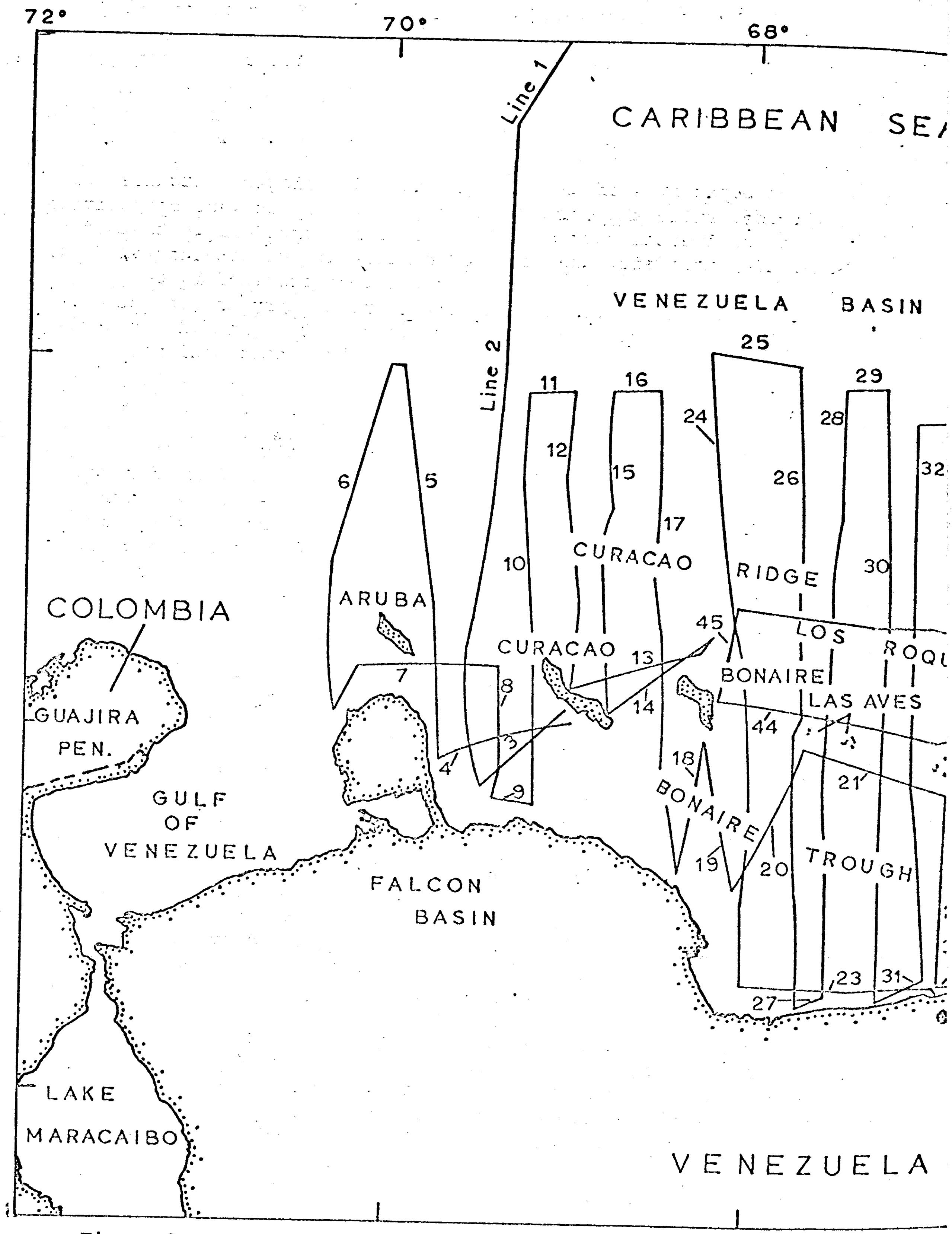
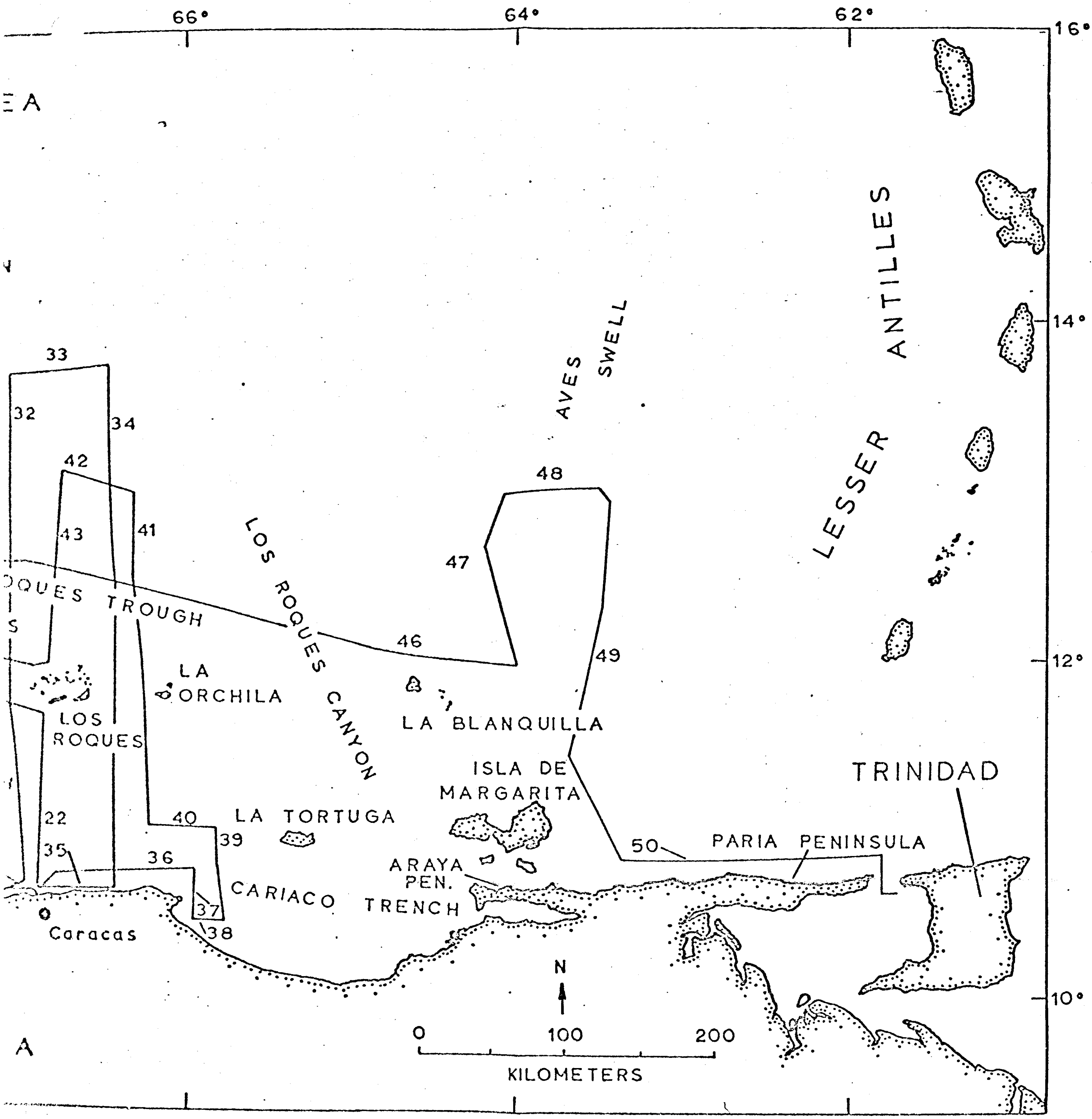


Figure 1.--Index map showing locations of structural features and track



:ack 'ines in the continental borderland of Venezuela.

D- - 274-286 (October 1-13)

In Port of Spain overhauling main engines and replacing deck generator that had shorted out near end of Leg 4.

OBJECTIVES OF INVESTIGATION

The objectives of the geophysical and geological studies were: (a) to determine the structure, crustal thickness, and composition of the continental margin, (b) to tie this structure to that of the Venezuelan mainland, the Leeward Antilles and to the central Caribbean area, where structural information has been provided by Deep Sea Drilling, (c) to determine the nature and history of the boundary between the Caribbean and South American plates, and (d) to outline areas of potential mineral resources on the continental margin.

Geologic Setting

The Venezuelan borderland and adjacent parts of northern South America make up a broadly arcuate structural zone that lies between the relatively stable Guyana Shield of Venezuela on the south and the Venezuelan Basin to the north (fig. 1). Parts of the structural zone in western Venezuela trend roughly NE-SW, but at the coast the zone turns eastward into the coast range area of Venezuela. The zone then parallels the coast and passes through Caracas, the Araya and Paria Peninsulas, and into northern Trinidad.

The structural zone was intensely deformed during Mesozoic and Cenozoic time. In the coast range area of Venezuela, the metamorphic grade tends to increase northward, although major southward thrusting of blueschist facies rocks complicates the pattern. In north central Venezuela, the pre-Upper Cretaceous rocks are metamorphosed to high-pressure glaucophane - bearing rocks of the greenschist facies (Shagam, 1960) and to lower-temperature moderate-pressure rocks (Winkler, 1965) of the lawsonite-pumpellyite facies (Piburn, 1968). The basement rocks of Aruba, Los Rogoes and La Orchila are metamorphosed to greenschist facies assemblages, but the rocks on Curacao and Bonaire are only weakly metamorphosed. The rock sequence on each island was intruded by dioritic or quartz dioritic masses in Late Cretaceous time, and possible ignembrites were erupted on Bonaire at that time also.

Upper Mesozoic intrusive rocks in the Netherlands Antilles form a basement complex composed largely of diabase (Schaub, 1948; Beets, 1966; Lagaay, 1969). Positive gravity and magnetic anomalies over the islands of Curacao, Bonaire and Aruba (Lagaay, 1969) are presumably associated with a diabase core or basaltic rocks on these islands. The Deep Sea Drilling Project cored Upper Cretaceous basaltic basement rocks in the Caribbean basin also (Edgar and others, 1971). The basement rocks in the Netherlands Antilles are overlain by strata containing ammonites of Late Cretaceous age (Beets, 1966). Lagoonal limestone terrace deposits of middle to late Cenozoic age cap many of the islands.

Field evidence for middle to late Cenozoic movement on faults suggests a complex interaction of compressional, extensional and lateral movement on the major fault zones. Rod (1956) discussed the transcurrent faults of northern South America and estimated about 33 km of post-Oligocene right-lateral movement on the northeast-trending Bocono fault. The east-trending El Pilar fault has strike slip displacement of 5 to 15 km (Metz, 1964), some of which is Holocene and right-lateral based on first motion studies (Molnar and Sykes, 1969). The east-trending Oca fault also has right-lateral movement and probably has not been active since the early Pleistocene (Vasquez, 1971).

In addition to the right-lateral movement on the Bocono, Oca and other faults in northern South America, large vertical offsets have also been measured. Bell (1971) suggests up to 40 km of N-S shortening in northern Venezuela, and published sections across the Cordillera Oriental suggest Cenozoic horizontal shortening of approximately 10 km (Hedberg, 1950; Campbell and Burgl, 1965; Julivert, 1970).

Preliminary Results

Approximately 8,000 km of survey lines were run during the geophysical cruise, and in addition the United States and Dutch scientists conducted a 10-day geological reconnaissance of the islands of Aruba, Curacao and Bonaire. Observations of pillow basalts were extended from the well-known exposures on Curacao to previously unknown occurrences on Aruba and Bonaire. A rich fossil-bearing chert horizon was discovered on Bonaire. The abundance of pillow basalt, diabase, chert and siliceous sedimentary rocks on the islands and the presence of positive gravity anomalies of as much as 100 mgals indicate that this island area is a raised segment of oceanic rocks.

The Curacao Ridge is a broad submarine upwarp that is highly deformed only on the north side west of Las Aves, but to the east of the island the entire ridge is deformed. The deformation is in sharp contrast to the eastward-thickening ponded turbidites north of the continental slope.

All profiles between Aruba and Las Aves show layer "B", the basaltic or diabasic layer under the sediments of the Venezuelan

Basement. This layer, which was cut by drilling in DSDP site 146 (Edgar and others, 1971), passes smoothly beneath the deformed deposits of the continental slope for several kilometers southward. East of Las Aves islands the sediment thickness beyond the continental slope approaches 4 km, and layer "B" could not be followed under the slope. In profiles from this region, however, and in other profiles to the west, the outermost deformed sediment of the Curacao Ridge is seen to be continuous with the undeformed layered strata to the north in the Venezuela Basin. In this basin, the thickness of the pelagic section is fairly uniform, but the section is reduced in thickness where it underlies horizontally bedded reflectors of possible turbidity-current origin in the trough north of the slope. The great increase in sediment thickness in the Venezuelan Basin north of La Orchila suggests that the pathway of sediment transport was through Los Roques Canyon.

A wide basin of deposition, the Bonaire Trough, lies between the island chain and the Venezuelan coast. A zone of deformation is seen on its south flank. A continuous reflector passes beneath the deformed zone in one profile.

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Department of the Navy

Naval Oceanographic Office

Suitland, Maryland

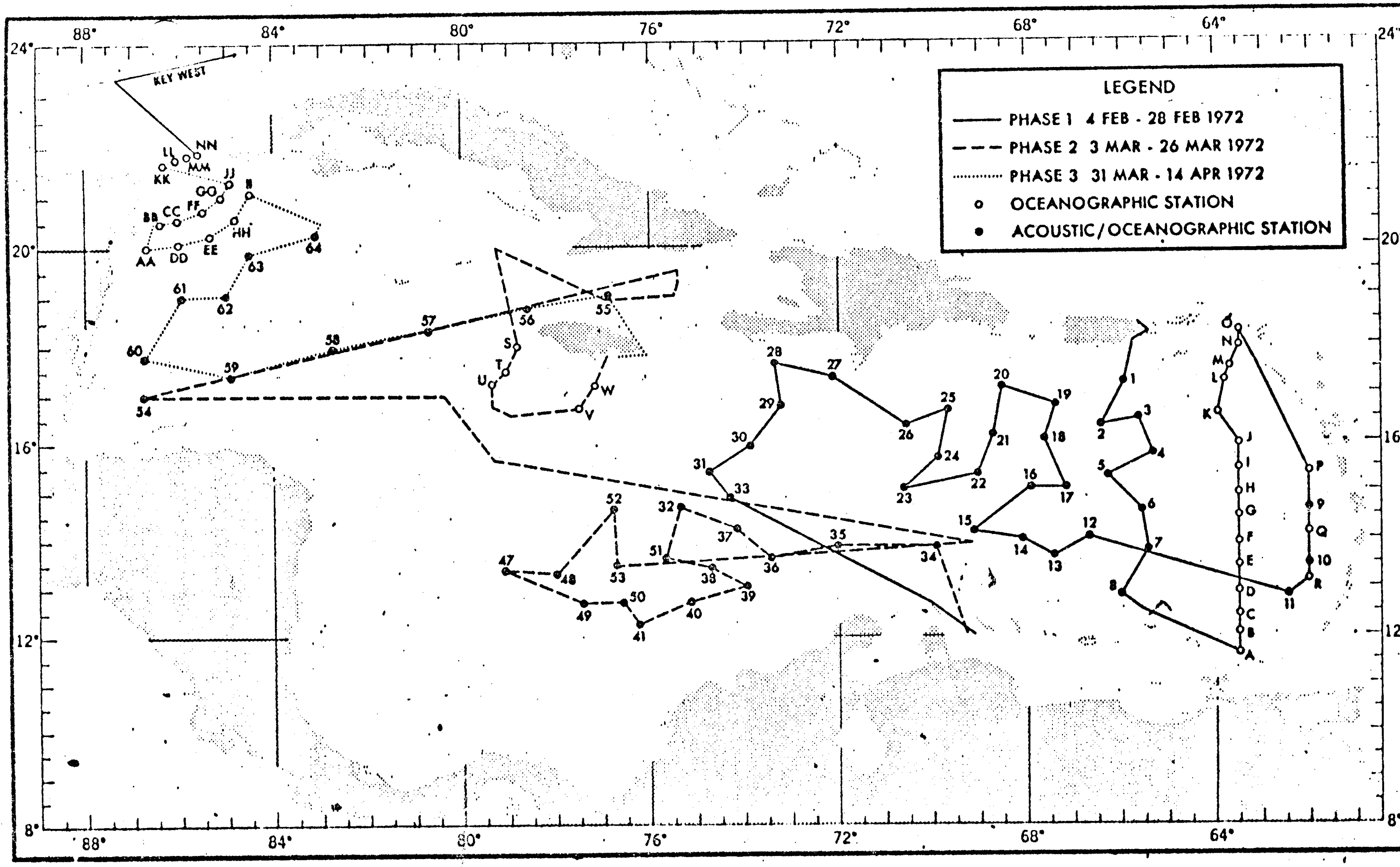
1971-2

The joint KANE/WILKES survey operations in the Caribbean Sea from early February to mid-April of 1972 were planned and executed to collect acoustic data principally. SV/STD data were collected on the acoustic stations. Expendable bathythermograph, bathymetric, magnetic, sea surface temperature, seismic reflection, and 3.5 kHz shallow sub-bottom profiling data were collected between acoustic stations. These data are being used to delineate the acoustic/physiographic province boundaries and to update bathymetric and magnetic charts of the area. The seismic data are being used in a study of sub-bottom unconformities. A preliminary analysis of the data from SV/STD stations and from expendable bathythermographs indicates that the distribution of the deep sound velocity minimum is affected by the topography of the Aves Swell Changes in surface duct character were affected by onset of seasonal heating and, near Venezuela, by fresh water run-off. Gross April boundaries of the East Gulf Loop Current were delineated using bi-hourly XBT data.

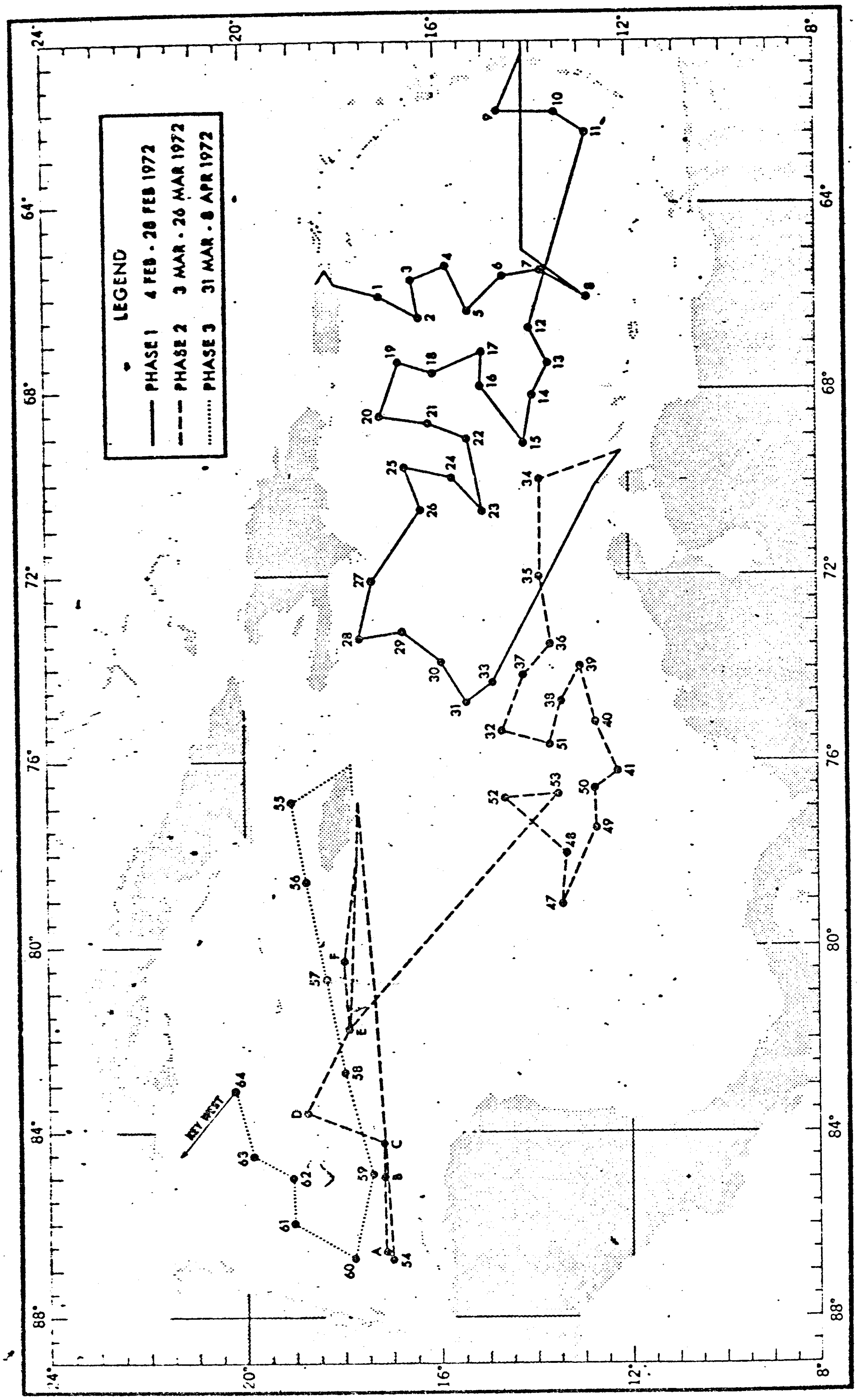
Track and stations locations are shown on the attached charts.

1972-3

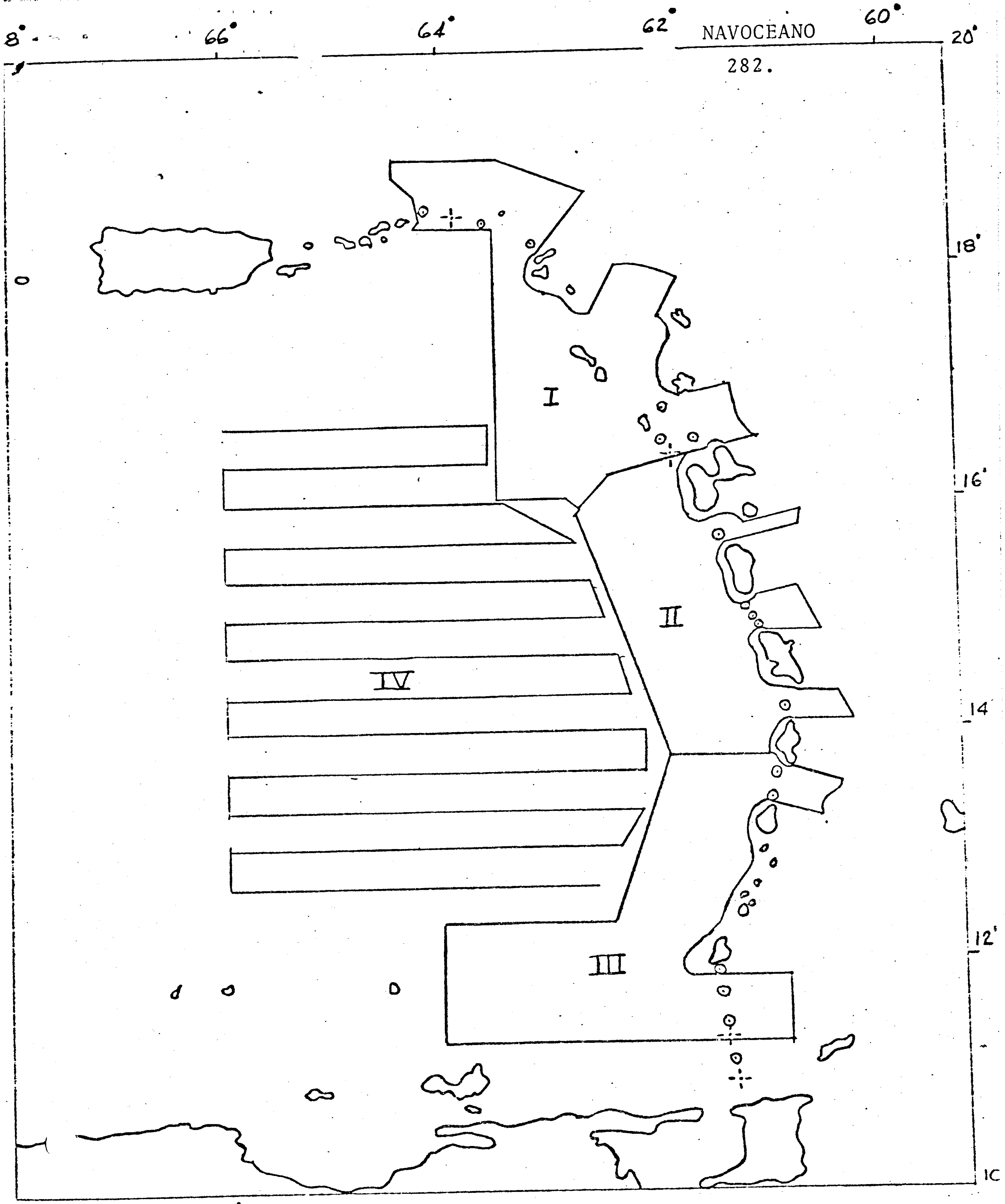
A geophysical/oceanographic survey in the Lesser Antilles, Caribbean Sea will be conducted from aboard USNS WILKES during June through September 1972. The survey will be accomplished in four area/phases, I-IV, as shown in the attached graphic. The objective of the survey is to provide bathymetric, seismic, magnetic, and water column measurements in and in the approaches to selected inter-island straits. Bathymetric (12 and 3.5 kHz), seismic, and magnetic measurements will be accomplished with 5 nautical mile track line spacing in areas I-III and 20 nautical mile spacing in area IV. Water column observations will be made with taut wire current meter array emplantments of 3-week duration and with sound velocity/salinity, temperature, depth (SV/STD) systems at the locations shown in the graphic. Hourly XBT measurements will be made on alternate track lines. All data will be DNP.



STATION LOCATIONS AND UNDERWAY TRACKS — USNS KANE (T-AGS 27)



ACOUSTIC STATIONS AND UNDERWAY TRACKS — USNS WILKES (T-AGS 33)



NAVOCEANO

282.

GEOPHYSICAL/OCEANOGRAPHIC SURVEY LESSER ANTILLES - CARIBBEAN SEA

JUNE - SEPTEMBER 1972

⊙ CURRENT AND SV/STD -¦- SV/STD

REPORT OF THE

NATIONAL OCEANOGRAPHIC DATA CENTER

NOAA ENVIRONMENTAL DATA SERVICE

NODC 283.

CICAR NEWS

Dearth of articles has prevented further publication of news from CICAR in the Environmental Data Service publication.

It is hoped that national coordinators or other interested individuals will take advantage of the opportunity still offered to disseminate news of their activities within the CICAR framework.

CICAR BIBLIOGRAPHY

Volume II Biology and Volume III Geology are now ready for printing and should be available in the fall of this year. Three copies of each volume will be sent to each National Coordinator and one copy to each Assistant International Coordinator, Subject Leader and correspondent. Additional copies can be obtained upon request. The deadline for insertion of new material was June 1971; by that time, a total of 3,496 references were obtained for Volume II with 3,280 references for Volume III.

NEWSLETTER

Recently Reported CICAR Cruises
(CICARDI forms received)

COUNTRY	VESSEL	DATED OF CRUISE	PROGRAM	AREA
Mexico	VIRGILIO URIBE	8/03/71 to 9/03/71	Descriptive oceanography current measurements, plankton, meteorology	Bahia de Campeche Yucatan Channel Caribbean Sea. MS 44,45,46,81,82
Mexico	VIRGILIO URIBE	2/12/72 to 2/26/72	Descriptive oceanography, current measurements, fisheries research, plankton, coral reefs	Yucatan Peninsula and Bahia de Campeche MS 45,46,81,82
Netherlands	H.Nl.M.S. LUYMES	2/22/72 to 3/01/72	Descriptive oceanography, plankton, meteorology	Information not available
Netherlands	H.Nl.M.S. LUYMES	3/13/72 to 3/29/72	Bathymetry, descriptive, oceanography, plankton, meteorology, geology	Information not available
U. K.	H.M.S. HECLA	4/09/72 to 4/23/72	Descriptive oceanography, geology and geophysics bathymetry	Lesser Antilles MS 42,43
U. S.	GERDA	11/10/71 to 11/10/71-	Descriptive oceanography, plankton, meteorology	Straits of Florida MS 81
U. S.	GERDA	2/01/72 to 2/08/72	Descriptive oceanography, plankton	Southeastern Gulf of Mexico MS 81

NODC
284.

PUBLICATIONS RECENTLY RECEIVED AT THE
NATIONAL OCEANOGRAPHIC DATA CENTER

"United Kingdom Programme", Revised September 1971
Natural Environmental Research Council Publications Series C N° 7
1972, 9 pages + chartlets -.English and Spanish

Informe preliminar sobre los cruceros oceanograficos efectuados in 1970 Reporte N°1
Direccion General de Faros e Hidrografia, Mexico, D.F. 1972
30 pages

Informe preliminar sobre los cruceros oceanograficos efectuados in 1971 Reporte N°2
Direccion General de Faros e Hidrografia, Mexico D.F., 75 pages

"The potential for fishery development in the Caribbean and Adjacent Seas" Clarence P. Idyll 16 pages
University of Rhode Island, International Center for Marine Resource Development Bulletin Number 1.

"Investigaciones conjuntas Cubano-Sovieticas"
Instituto National de la Pesca Cuba, Centro de Investigaciones pesqueras, Contribuciones No. 28, 29 & 30, La Habana Novembre 1970.

"MARINE RESEARCH IN THE CARIBBEAN"

Selected articles from the Russian-language pamphlet Akademiya Nauk Ukrainskoy SSR, Morskoy Gidrofizicheskiy Institut, Issledovaniya v Atlanticheskom Okeane, Ekspress-Informatsiya, No. 1, 1965 Kiev.

Contents

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(Continued)

Now available from:

U. S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22151

Recently available in English

LIST OF CICAR DATA RECEIVED AT NODC
AS OF MAY 15, 1972

Computer printout, for any and all of these cruises can be obtained upon request.

With very few exceptions all data referred to in this text have been processed and transmitted to WDC-A, Oceanography, and are now available thru the World Data Center System.

COUNTRY	SHIP	ORIGINATOR'S CRUISE NUMBER	CRUISE DATES	TYPE OF DATA	NUMBER OF OBSERVATIONS	GENERAL AREA	NODC IDENTIFICATION NUMBER
U.S.	BELLOWS	SUS 7201	February 1972	Station Data XBT Data	19 3	Eastern Gulf of Mexico, MS 81	311907
U.S.	DAN BRAMAN	SUS 7125	September 1971	Station Data	30	Northeastern Gulf of Mexico, MS 81	311852
U.S.	DISCOVERER	RP-2-70	May 1970	XBT Data	39	Straits of Florida, Yucatan Channel, Western Caribbean Sea, MS 81, 44, 45	40547
U.S.	ISLAND WATERS	1W-7001	May 1970	STD Data	24	Eastern Gulf of Mexico, MS 81,	318165
U.S.	ISLAND WATERS	1W-7004A	11 June 1970 to 16 June 1970	Station Data Volume Scattering Sea Surface Temperature Zooplankton Data Zooplankton Volume Data XBT Data	49 40 6 6 30	Eastern Gulf of Mexico, MS 81	311849 41394
U.S.	ISLAND WATERS	1W-7004B	17 June 1970 to 26 June 1970	Station Data Volume Scattering Sea Surface Temperature Zooplankton Data Zooplankton Volume Data	86 86 62 28 28	Eastern Gulf of Mexico, MS 81	311849
U.S.	J.E. PILLSBURY	JP 004	April 1970 to May 1970	STD	37	Northeastern Gulf of Mexico, MS 81	318185

COUNTRY	SHIP	ORIGINATOR'S CRUISE NUMBER	CRUISE DATES	TYPE OF DATA	NUMBER OF OBSERVATIONS	GENERAL AREA	NODC IDENTIFICATION NUMBER
Cuba	NA	NA	January 1970 to December 1970	Station Data	40	Yucatan Channel MS 45	CU0013
Mexico	VIRGILIO URIBE	12	October 1970 to November 1970	Station Data Transparency	53	Western Gulf of Mexico. Bahia de Campeche MS 82	57003
Netherlands	H.Nl.M.S. LUYMES	10	March 1970 to April 1970	Bathythermograph Data (Conventional and Digital)	92	Northeastern Coast of South America, MS 6, 43	
Netherlands	H.Nl.M.S. LUYMES	16	September 1970 to November 1970	Station Data	61	Northern Coast of South America off the Guianas, MS 6	023398
U.S.S.R.	ASKOLD	NA	June 1970	Station Data Water Transparency Water Color	25 12 5	Caribbean Sea MS 44, 45	90280
U.S.S.R.	AKADEMIK VERNADSKII	3	November 1970 to January 1971	Station Data pH	42 39	Caribbean Sea MS 44, 45	90281
U.S.	ALAMINOS	70-A-7	April 1970 to May 1971	Station Data STD Birdsightings	67 67 67	Yucatan Channel Western Caribbean Sea, MS 45	311654
U.S.	ALAMINOS	70-A-9	June 1970	Station Data STD	61	Gulf of Mexico MS 45, 81	318249
U.S.	ATLANTIS II	56	February 1970 to April 1970	Station Data Silicates Drift Bottle Observations	160 156 184	Western North Atlantic Lesser Antilles MS 79, 80, 43	311601
U.S.	BELLOWS	SUS 7127	September 1971	Station Data	29	Northeastern Gulf of Mexico, MS 81	311850

COUNTRY	SHIP	ORIGINATOR'S CRUISE NUMBER	CRUISE DATES	TYPE OF DATA	NUMBER OF OBSERVATIONS	GENERAL AREA	NODC IDENTIFICATION
U.S.	RESEARCHER	RP9	July 1971 to August 1971	Station Data	33	Straits of Florida	311898
				BT	262	Eastern Gulf of Mexico	
				XBT	393	Eastern Caribbean Sea, MS 45, 81	
U.S.	ROCKAWAY	RCC	July 1971 to August 1971	XBT	42	Off the Central part of the Northern Coast South America, MS 42	41744
				Station Data	42		318271
				Transparency	2		
U.S.	TURSIOPS	T7015	May 1970	Station Data	27	Eastern Gulf of Mexico, MS 81	318218
U.S.	TURSIOPS	SUS 7126	October 1970	Station Data	40	Northern Gulf of Mexico, MS 81	311851

Preliminary 1973 Ship Schedules

of

U.S.

University Oceanographic Laboratories

The recently formed University National Oceanographic Laboratory System (UNOLS) is a cooperative effort among U. S. universities engaged in oceanographic research supported by the Federal Government. A major UNOLS function is the insurance of maximum cooperative utilization of ship time at sea.

The April 1, 1972 "UNOLS Tentative Research Vessel Operating Schedule - 1973" summarizes ship schedules as planned at that time and includes numerous cruises in the CICAR area during 1973. The pertinent pages of that report follow and include CICAR-area cruises for the following vessels:

R/V ATLANTIS II - Woods Hole Oceanographic Institution

R/V TRIDENT - University of Rhode Island

R/V CONRAD - Lamont Geological Observatory

R/V EASTWARD - Duke University Marine Lab.

R/V GILLISS - University of Miami

R/V COLUMBUS ISELIN - University of Miami

R/V TURSIOPS - Florida State University

R/V ALAMINOS - Texas A&M University

Cruises in the CICAR area are indicated with a dot. It must be emphasized that the following schedules are all tentative and subject to change based on further developments during the year and subject also to requirements and contingencies of the operating institution.

For further information, contact the listed Chief Scientist directly.

LOA	210-ft
Scientists	25
Crew	30

R/V ATLANTIS II
Woods Hole Oceanographic Institution
Woods Hole, Masschusetts

TENTATIVE 1973 OPERATING SCHEDULE

Tentative Dates	Chief Scientist	Ports of Call	Area & Objectives
		Woods Hole	
12 Jan-31 May	K.O. Emery	Nouackchott	International Decade of Ocean Exploration (IDOE) Cruise Northwest Coast of Africa Geology and Geophysics
		Oporto	
1 Jun-30 Jun	Uchupi		Bay of Biscay - Geology & Geophysics
5 Jul-24 Jul	Deuser Williams		Eastern North Atlantic-Azores Marine Chemistry studies of Mediterranean Outflows
28 Jul-27 Aug	Heirtzler		Mid-Atlantic Ridge International Cooperative Expedition. Geology & Geophysics. Submersible Operations
1 Sept-29 Nov	Bowen et al		Western North Atlantic - Caribbean Sea Marine Chemistry, radioisotopes, physical oceanography
		Port au Spain	
4 Dec-21 Dec	Jannasch		Caribbean Sea - Carioca Trench. Benthic microbiology in anaerobic conditions
		Woods Hole	

LOA	180-ft.
Scientists	13
Crew	18

R/V TRIDENT
University of Rhode Island
Kingston, Rhode Island

TENTATIVE 1973 OPERATING SCHEDULE

Cruise #	Chief Scientist/ Co-Investigator	Area	Departure	Arrival	No. of Days
127	Swift	N.W. Atlantic	5 Jan 73 Narr., R.I.	19 Jan 73 San Juan	15
128	Kester/Betzer Carder, Lambert	Caribbean	22 Jan 73 San Juan	14 Feb 73 San Juan	24
129	Lambert/Richardson	Gulf Stream	17 Feb 73 San Juan	6 Mar 73 Narr., R.I.	18
	- - - - - - - - - - -UPKEEP- - - - - - - - - - - -		7 Mar 73	11 Mar 73	5
130	Sturges/Scarlet	28°N 68°W	12 Mar 73 Narr., R.I.	9 Apr 73 Bermuda	29
131	Duce	Sargasso	12 Apr 73 Bermuda	23 Apr 73 Bermuda	12
132	Sturges	23°N 68°W	26 Apr 73 Bermuda	20 May 73 Bermuda	25
133	Duce	N.W. Atlantic	23 May 73 Bermuda	30 May 73 Narr., R.I.	8
	- - - - - - - - - - -UPKEEP- - - - - - - - - - - -		31 May 73	12 June 73	13
134	Kennett/ Schilling	N. Atlantic	13 June 73 Narr., R.I.	2 July 73 Reykjavik	20
135	Schilling	Iceland	5 July 73 Reykjavik	24 July 73 Akureyri	20
136	Schilling	Iceland	27 July 73 Akureyri	15 Aug 73 Reykjavik	20
137	Schnitker	N. Atlantic	18 Aug 73 Reykjavik	2 Sept 73 St. John's	16
138	Webb	Grand Banks	5 Sept 73 St. John's	19 Sept 73 Narr., R.I.	15
	- - - - - - - - - - -UPKEEP- - - - - - - - - - - -		20 Sept 73	28 Sept 73	9
139	Lambert/ Richardson	N.W. Atlantic	29 Sept 73 Narr., R.I.	16 Oct 73 Bermuda	18
140	Smayda	Sargasso	19 Oct 73 Bermuda	4 Nov 73 Bermuda	17
141	Duce	Sargasso	7 Nov 73 Bermuda	24 Nov 73 Narr., R.I.	18
	- - - - -UPKEEP-----INSPECTION- - - - - - - - - -		25 Nov 73	4 Jan 74	40

LOA	208-ft
Scientists	22
Crew	21

R/V CONRAD
Columbia University
Lamont Doherty Geological Observatory
Palisades, New York

Tentative 1973 Operating Schedule

PORT	ARRIVAL/DEPARTURE		MAIN PURPOSE OF LEG:
BRIDGETOWN BARBADOS	ETD	3 July 1972	
			CARIBBEAN, ANEGADA PASSAGE MANGANESE STUDIES
ST. GEORGES BERMUDA	ETA / ETD	7 Aug / 10 Aug	
			BLAKE OUTER RIDGE AND CONTINENTAL MARGIN
KINGSTON JAMAICA	ETA / ETD	5 Sept / 8 Sept	
			WEST INDIAN TRENCH SYSTEM
PORT OF SPAIN TRINIDAD	ETA / ETD	9 Oct / 12 Oct	
			M.A.R. NEAR EQUATOR N.E. CONTINENTAL MARGIN S.A.
RECIFE BRAZIL	ETA / ETD	7 Nov / 10 Nov	
			MAGNETIC PATTERN, N. BRAZIL BASIN
RIO DE JANEIRO BRAZIL	ETA / ETD	28 Nov / 1 Dec	
			RIO GRANDE RIDGE & CONTINENTAL MARGIN
BUENOS AIRES ARGENTINA	ETA / ETD	29 Dec / 2 Jan 1973	
			ARGENTINE CONTINENTAL MARGIN
USHUAIA ARGENTINA	ETA / ETD	5 Feb / 8 Feb	
			FALKLAND PLATEAU & ARGENTINE BASIN
BAHIA BLANCA ARGENTINA	ETA / ETD	12 Mar / 15 Mar	
			MAGNETIC PATTERN EASTERN ARGENTINE BASIN
BUENOS AIRES	ETA	16 Apr	

Overhaul- six weeks scheduled. It is probable this can be shortened to one month, in which case the succeeding schedule will be advanced appropriately.

PORT	ARRIVAL/DEPARTURE		MAIN PURPOSE OF LEG:
BUENOS AIRES	ETD	25 May	
			RIO GRANDE RISE - M.A.R. JUNCTION
RIO DE JANEIRO BRAZIL	ETA / ETD	20 June / 23 June	
			M.A.R. - WALVIS RIDGE JUNCTION
LUANDA ANGOLA	ETA / ETD	23 July / 26 July	
			M.A.R. & E. BRAZIL BASIN
RECIFE BRAZIL	ETA / ETD	27 Aug / 30 Aug	
			N.E. BRAZIL MARGIN & SIERRA LEONE RISE
PORT OF SPAIN TRINIDAD	ETA / ETD	1 Oct / 4 Oct	
			CARIBBEAN MARGINS
COLON BALBOA PANAMA	ETA / ETD	31 Oct / 4 Nov	
			MAGNETIC PATTERN, EQUATORIAL PACIFIC
TAHITI PAPEETE	ETA / ETD	3 Dec / 6 Dec	
			MANIHIKI PLATEAU
SUVA FIJI	ETA	30 Dec	

LOA	118
Scientists	15
Crew	15

R/V EASTWARD
Duke University Marine Laboratory
Beaufort, North Carolina

Tentative 1973 Operating Schedule

Tentative Dates	Chief Scientist(s)	Port of Call	Area and Objectives
27 Dec-8 Jan	Sheridan (Univ of Del.)		Research Cruise-Geological Studies on the Continental Margin off Eastern No. America
8-9 Jan		Nassau	
10-20 Jan	Pilkey (Duke)		Geology 206, Geological Oceanography, Training Cruise
20-22 Jan		St. Croix	
22-30 Jan	Multer (Fairleigh-Dickinson Univ.) Pilkey (Duke)		Research Cruise-Geological Cruise in St. Croix Area of the Caribbean
30-31 Jan		St. Croix	
01-13 Feb	Watkins (Univ. N.C.)		Research Cruise - Geophysical investigation of the origin of the Venezuelan Basin
13-14 Feb		Curacao	
15-24 Feb	Paul (Florida State)		Predoctoral Cruise-Benthic Biomass in the Fosa de Cariaco, Venezuela
	Pierce (George Washington)		Research Cruise - Terrigenous phase of suspended sediment continental shelf, southeastern United States
24-26 Feb		Kingston, Jamaica	
26 Feb-5 Mar	Land (Univ of Texas)		Research Cruise-Deep transport & diagenesis of reef sediments, North Jamaica
	Bloom (Cornell Univ)		Training Cruise - Geological Oceanography 444
5-6 Mar		Kingston, Jamaica	
6-13 Mar	Goodbody (Univ of W.I.)		Training Cruise-Advanced Zoology Mar. Biology
	Robinson (Univ of W.I.)		Training Cruise-Advanced Geology Mar. Biology
13-16 Mar		Kingston, Jamaica	
16-30 Mar	Heezen (Columbia)		Training Cruise Geology W4948, Ocean Floor
30 Mar - 1 Apr		Keywest, Florida	
2-5 Apr	Pomeroy (Univ. Georgia)		Training Cruise -Marine Biology, Zoology 811
5-6 Apr		Miami, Florida	
6-11 Apr	Zingmark (Univ S.C.)		Training Cruise-Biology 728, Advanced Phycology
11-12 Apr		Charleston, S.C.	
12-17 Apr	Marshall (Old Dominion)		Training Cruise - Biology 419 Marine & Estaurine Plankton
	Kirby-Smith (Duke)		Research Cruise-Bench Mark Collections of Animals from the North Carolina Continental Shelf and Continental Slope
18-23 Apr		Beaufort, N.C.	
24-26 Apr	Litchfield (Rutgers)		Training Cruise-Marine Microbiology
27-30 Apr	Colwell (Georgetown)		Training Cruise-Marine Microbiology
1-4 May	Coull (Clark)		Training Cruise -Biological Oceanography
5-12 May	Musick/Grant (Virginia Inst.)		Training Cruise-Ichthyology, Advanced Problems in Marine Science
13 May		In port	
14-19 May	Zimmerman (Union College)		Research Cruise - Sedimentary processes on the east coast continental margin
20-31 May		Beaufort, N.C. (Availability Period)	

LOA	208-ft
Scientists	19
Crew	22

R/V GILLISS
University of Miami RSMAS
Miami, Florida

Tentative 1973 Operating Schedule

Cruises	Tentative Dates	TOTAL DAYS	Scientist	Ports of Call	Objectives and Areas
	SHIPYARD: 20 Nov. 1972 - 3 Jan. 1973				
GS-7301	Jan. 9 (T)-Jan. 24 (W)	16	Voss Staiger		Puerto Rico Trench. Study of systematics, geographic & vertical distribution and community structure of microorganisms, both pelagic and benthic.
GS-7302	Feb. 1 (Th)-Mar. 2 (F)	15 15	Emiliani Ball		Caribbean. (A) Recover 90' long globigerina ooze sections; and (B) Reflection magnetic and gravity surveys to supplement structural interpretations based on-shore work.
GS-7303	Mar. 9 (F)-Mar. 28 (W)	20	Grant Musick		Virginia Institute of Marine Science ship time request: Norfolk Canyon (off Virginia) and adjacent slope & shelf. Study of ecosystem structure and dynamics in Norfolk Canyon and adjacent slope.
GS-7304	Apr. 5 (Th)-Apr. 20 (F)	16	Robins Staiger	Freeport Nassau	Tongue of the Ocean. A quantitative analysis of the mid-water and benthic fish populations of the TOTO.
GS-7305	April 28 (St)-April 29 (S)	2	Corcoran		Education. Straits of Florida.
GS-7306	May 4 (F)-May 23 (W)	20	Grant Musick		Virginia Institute of Marine Science ship time request: Ditto Cruise GS7303.
GS-7307	May 30 (W)-June 10 (S)	12	Duing Mooers Perkins Kraus Geisler	Miami-Key West	Gulf of Mexico. Install an array of moored current meters and temperature recorders.
GS-7308	June 11 (M)-June 15 (F)	5	Daubin	Key West-Miami	Caribbean An acoustic propagation & ambient noise experiment drifting midwater using ACODAC Systems combined with free LORA-PROBES.
GS-7309	June 22.(F) - July 11 (W)	20	Ball		Bahamas Cruise to complete seismic program in the NE Bahamas (in conjunction with the R/V CALANUS).
GS-7310	July 31 (T)-Aug. 4 (M) InPort: Aug. 5-6	5 2	Daubin	Miami to San Juan	Caribbean. Ditto Cruise GS-7308.
GS-7311	Aug. 7 (T) - Sept. 5 (W) InPort: Sept. 6-7	10 20 2	Kraus Voss	San Juan to Monrovia	South and East Atlantic. (A) A multiship calibration and testing program in preparation of the GATE Experiment; collection of background climatological & oceanographic data in the eastern subtropical Atlantic for GATE. (B) Study the systematics, geographic and vertical distribution & community structure, of macroorganisms, both pelagic and benthic.

LOA	170-ft
Scientists	13
Crew	12

R/V COLUMBUS ISELIN
University of Miami RSMAS
Miami, Florida

Tentative 1973 Operating Schedule

Cruise	Tentative Dates	TOTAL DAYS	Scientist	Ports of Call	Objectives and Areas
CI-7211	Dec. 1 (F)-Dec. 16 (St)	16	Robins Staiger	Freeport Nassau	Tongue of the Ocean. A quantitative analysis of the midwater and benthic fish population of the TOTO.
	19 Dec 1972 - 10 Jan 1973	SHIPYARD			
CI-7301	Jan. 15 (M) - Jan 20 (St)	6	Perkins Duing Van Leer		NW Providence Channel. Tests of unattended cycling current profilers in deep water.
CI-7302	Jan. 24 (W) - Feb. 2 (F)	10	Mooers Duing Perkins Kraus Geisler	Miami to Key West	Gulf of Mexico Installation of moored current meters in the Eastern Gulf of Mexico.
CI-7303	Feb. 3 (S) - Feb. 11 (S)	9	Houde	Key West to Miami	Off Western Coast of Florida. Estimate abundance of eggs and larvae of commercial fishes off Western Fla.
CI-7304	Feb. 19 (M) - Mar. 2 (F)	12	Voss		Straits of Florida. The distribution, abundance and community structure of the fauna and flora of the continental shelf between Elliott Key and Ft. Pierce, Fla., in relation to environmental factors.
CI-7305	Mar. 7 (W) - Mar. 23 (F) Inport: Mar. 24-25-26	17 3	Zillioux	Miami to San Juan	Mona Passage and south to operate off the Mona escarpment along the islands in southern coast. Continue studies on the behaviour and physiology of vertically-migrating zooplankton.
CI-7306	Mar. 27 (T)-Mar. 31 (St) Inport: April 1	5 1	Bader	Puerto Rico to Belize	British Honduras. Marine Biology.
CI-7307	Apr. 2 (M) - Apr. 13 (F)	12	Ginsburg	Belize to Miami	British Honduras Study of geology of British Honduras reefs, emphasizing internal processes.
CI-7308	Apr. 20 (F) - May 4 (F)	15	Perkins Van Leer Duing		Blake Plateau. Current profiling in deep ocean.
CI-7309	May 9 (W) - May 17 (Th)	9	Houde	Miami to Key West	Off Western Coast of Fla. Estimate abundance of eggs and larvae of commercial fishes off Western Florida.
CI-7310	May 18 (F) - May 21 (M)	4	Owre	Key West to Maimi	Yucatan Channel and Straits of Florida. Sampling macrozooplankton to determine bulk transported by Florida Current.
CI-7311	May 24 (Th) - June 4 (M)	12	Voss		Straits of Florida. Ditto Cruise CI-7304.
CI-7312	June 9 (St) - June 18 (M) Inport: June 19	10 1	Betzer Carder	Miami to Tampa	University of South Florida ship time request: Gulf of Mexico, Yucatan Channel, and Florida Straits. Study the optical & chemical properties of suspended particulates of the Gulf of Mexico

R/V COLUMBUS ISELIN (Cont'd)

Cruises	Tentative Dates	TOTAL DAYS	Scientist	Ports of Call	Objectives and Areas
CI-7312	Continued				and to determine the effects of certain particle sources and sinks.
CI-7313	June 20 (W) - June 28 (TH) Inport: June 29-30	9 2	Houde	Tampa to Tampa	Off Western Coast of Florida. Ditto Cruise CI-7309.
CI-7314	July 1 (S) - July 10 T)	10	Duing	Tampa to Miami	Gulf of Mexico.
CI-7315	July 16 (M) - Aug. 1 (W)	17	Duing Van Leer Perkins		Sargasso Sea. Current profiling in deep ocean.
CI-7316	Aug. 6 (M) - Aug. 14 (T)	9	Houde		Off Western Coast of Florida. Ditto Cruise CI-7309.
CI-7317	Aug. 20 (M) - Sept. 12 (W)	24	Bunt	Jamaica (Discovery Bay)	Western Caribbean Metabolism of plankton communities, benthic productivity (coral reef and sediment) and micro-biology.
CI-7318	Sept. 18 (F) - Sept. 29 (S	12*	Voss		Straits of Florida. Ditto Cruise CI-7304.
~~CI-7319~~	~~Oct. 4 (Th) - Oct. 12 (F)~~ Inport: Oct. 13-14	~~9~~ 2	~~Houde~~	~~Miami to~~ Key West	Gulf of Mexico. Ditto CI-7309.
CI-7320	Oct. 15 (M) - Oct. 18 (Th)	4	Owre	Key West to Maimi	Yucatan Channel & Straits of Florida. Citto Cruise CI-7309.
CI-7321	Oct. 24 (W) - Nov. 8 (Th)	16	Duing		Straits of Florida. Current profiling in the Florida Current from anchored vessel
CI-7322	Nov. 13 (T) - Nov. 14 (W)	2	Voss		Straits of Florida. Education.

LOA	65-ft
Scientists	5
Crew	3

R/V TURSIOPS
Florida State University
Tallahassee, Florida

Tentative 1973 Operating Schedule

Dates	Cruise Number	Area	Chief Scientist	Project Description
5-7 June 1972	7213	N.W. Gulf Shelf	H. Kritzler, F.S.U.	Infauna Studies •
10-12 June	7214	Eastern Gulf	J. Calder, F.S.U.	Organic geochemistry - water & Sediments •
12-18 June	7215	Florida Keys	R. Livingston, F.S.U.	Reef Ecology, Fisheries Biology •
18-21 July	7216	N. Gulf	J. Calder, F.S.U.	Organic geochemistry - water & Sediments •
22-28 July	7217	Miss. Delta & Mobile Bay	W. Ahr, Texas A&M J. Hanor, L.S.U. R. Harriss, F.S.U.	Chemical sedimentation, fate of pollutants, organic carbon studies. •
11-14 August	7218	Eastern Gulf (Tampa Bay area)	P. LaRock, F.S.U.	Marine pollution studies, microbiology •
15-22 August	7219	Eastern Gulf & Gulf Stream	E. Zillioux, U. Miami	Plankton migration studies •
23 Aug. - 4 Sept.	7220	Bimini Bank	W. Herrinkind, F.S.U.	Lobster distribution & <u>in situ</u> behavior studies. •
5-11 September	7221	Florida Keys	R. Livingston, F.S.U.	Reef ecology, fisheries biology •
20-27 September	7222	Eastern Gulf	S. Collard, U. West Fla.	Macroplankton - water mass studies •
4-9 October	7223	N. Gulf	J. Calder, F.S.U.	Organic geochemistry •
10-19 October	7224	Miss. Delta & Mobile Bay	W. Ahr, Texas A&M J. Hanor, L.S.U. R. Harriss, R.S.U.	Chemical sedimentation, fate of pollutants, organic carbon studies •
20-22 October	7225	N. Gulf Shelf	R. Shipp, U. South Alabama	Fisheries Biology •
1-12 November	7226	Eastern Gulf	K. Warsh, F.S.U.	Physical oceanography •
16-20 November	7227	Eastern Gulf Shelf	C. Moore, L.S.U.	Marine geology Florida Shelf •
30 Nov. - 4 Dec.	7228	N. Gulf	J. Calder, F.S.U.	Organic geochemistry •
8-18 December	7229	N. Gulf (Middle grounds)	T. Hopkins, U. West Fla.	Plankton, benthic community studies •
19 Dec. - 15 Jan.	(1973)	DRY DOCK	& MAINTENANCE	
20-24 January	7301	N. Gulf	J. Calder, F.S.U.	Organic geochemistry •
1-14 February	7302	N. Gulf	T. Hopkins, U. West Fla.	Plankton, benthic community studies •
1-6 March	7303	N. Gulf	J. Calder, F.S.U.	Organic geochemistry •
7-16 March	7304	Miss.Delta & Mobile Bay	W. Ahr, Texas A&M J. Hanor, L.S.U. R. Harriss, F.S.U.	Chemical sedimentation, fate of pollutants, organic carbon studies •

LOA	180
SCIENTISTS	14
CREW	17

UNOLS
300.

R/V ALAMINOS
Texas A&M University
College Station, Texas

TENTATIVE 1973 OPERATING SCHEDULE

Tentative Dates	Chief Scientist(s)	Port of Call	Area and Objectives
10-11 January	Treadwell		Instrumental & Ship Shakedown Cruise
15-20 January	Treadwell		Student Cruise
23 Jan - 15 Feb.	Sackett		Chemistry of Gulf & Caribbean •
20 Feb - 1 Mar	Moore/Bouma		Geology of N.W. Gulf (UNOLS) (cooperative with Univ. of Wisconsin et al) •
5 Mar - 15 Mar			Physical Oceanography Gulf & N.W. Caribbean •
20 Mar - 15 Apr			Biological Oceanography Gulf & Caribbean •
20 Apr - 15 May			Biological Oceanography Gulf & Caribbean •
20 May - 20 July	Bouma/Bryant/Poag/ Rezak/Treadwell		Geology & Geophysics Gulf & Caribbean •
25 July - 15 Aug	Sackett		Chemistry of Gulf & Caribbean •
20 Aug - 1 Oct	Bauer, (Univ. N.C.)		Deep Sea physiology N.E. Caribbean (UNOLS) •
10 Oct - 15 Oct	Treadwell		Student Cruise
20 Oct - 1 Dec	Nowlin		Physical Oceanography Caribbean & Gulf •

Additional Information

1) The Gulf and Caribbean Fisheries Institute will hold its 25th Annual Meeting in Miami, Florida, November 26-30. Announcement of this meeting is included in this report.

2) Abstracts of three additional CICAR papers are also included.

ANNOUNCING

the

25th Annual Meeting

Gulf and Caribbean Fisheries Institute

November 26-30, 1972, Miami Beach, Florida

The 25th Annual Meeting of the Gulf and Caribbean Fisheries Institute will be held at the Playboy Plaza Hotel, on the ocean at 54th Street, Miami Beach, Florida, November 26-30, 1972. Convention rates have been arranged at $18.00 per day single and $22.00 per day double occupancy, European plan.

We will hold four daily sessions of the Institute this year. The first session will principally concern fisheries policy and the issue of territorial seas. In the remaining sessions, we are particularly interested in research that has practical application to the fisheries of this region. The areas of fisheries prediction, seafood technology and utilization of plant effluent would receive special consideration.

Anyone wishing to present papers during these sessions must first submit an abstract no longer than 300 words for review. These should be sent to the Executive Secretary by July 15 at the address shown below. Presentation time for all papers is strictly limited to 20 minutes, followed by a discussion period. Manuscripts will be published in the Institute's annual *Proceedings* and final copies must be submitted by November 1. This manuscript may be longer than the version presented orally.

The Gulf and Caribbean Fisheries Institute is a membership organization. Due to increased costs the Institute is compelled to increase its membership and registration fees this year. Formal action to raise these fees was taken in the Annual Executive Committee meeting November 17, 1971. Members of the fishing industry and associated businesses will pay a minimum membership fee of $30.00 per year. Technical members will pay $7.50 per year. In addition, a registration fee of $25.00 will be required for attendance at the Institute.

The International Game Fish Conference will hold their 15th Annual Meeting, December 1st and 2nd, immediately after the Gulf and Caribbean Fisheries Institute.

Executive Secretary
Gulf and Caribbean Fisheries Institute
10 Rickenbacker Causeway
Miami, Florida 33149

FIRST PAGE ONLY INCLUDED IN THIS REPORT

From: Norwegian Journal of Botany, Vol. 19, No. 1, 1972

Coccolithophorids from the Caribbean Sea

JAHN THRONDSEN

Throndsen, J. 1972. Coccolithophorids from the Caribbean Sea. *Norw. J. Bot. 19*, 51–60.

Light and scanning electron microscopical studies on preserved material from 6 stations in the Caribbean Sea (in May 1970) revealed the presence of at least 48 species. Scanning electron micrographs of *Acanthoica aculeata, Calyptrosphaera pirus, Syracosphaera prolongata* as well as *Sphaerocalyptra gracillima* (Kamptner) comb. nov. are presented with comments.

J. Throndsen, Institute of Marine Biology, section B, University of Oslo, Blindern, Oslo 3, Norway

The present report on coccolithophorids is based on material collected during the SCOR (Scientific Committee on Oceanic Research) Working Group 15 cruise on USC & GSS DISCOVERER through the western and middle part of the Caribbean Sea in May 1970. Several papers previously published include information on the coccolithophorid occurrence (see e.g. Hulburt 1963, 1966, 1968; Margalef & Bernáldez 1969) in this area, but additional information may be valuable. The present investigation revealed the presence of at least 48 different coccolithophorid taxa in the same season (and more than 27 at one of the localities), indicating that many of the numerically less important species have been ignored by the methods previously used.

MATERIAL AND METHODS

Water samples were collected by means of a Jitts water sampler from different depths down to about the 3 % light penetration level, on 6 stations (see map Fig. 1). Subsamples of 100 ml were preserved with formaldehyde neutralized by hexamethylen tetramine (giving a concentration of 0.4 % HCHO in the sample).

At the laboratory (Institute of Marine Biology, sect. B, University of Oslo), a concentration of 25 to 1 by centrifugation preceded the phytoplankton enumeration by the Utermöhl sedimentation method (Utermöhl 1932). Sedimentation chambers holding 2 ml (Throndsen 1970) were used, and the samples examined on a WILD M 40 (plankton microscope) by means of 20x and 40x phase contrast objectives, supplemented by a Leitz 90x water immersion bright field objective.

Interesting or dubious specimens were picked up by a micropipette method (Halldal, Markali & Næss 1954) and transferred to grids for electron microscopy. The grids were prepared for scanning electron microscopy and viewed in a Cambridge Stereoscan Microscope at the Electron Microscopical Unit for Biological Sciences, at the University of Oslo.

SPECIES RECORDED

The species observed could in most cases be identified as to species in the light microscope. A few identifications were verified by means of the scanning electron microscope, but some of the doubtful species were too small for the present transfer technique (see above) and are not included in the list of species given in Table I.

The number of coccolithophorid taxa met with in each of the samples examined varied from 12 to 27; usually it was 20–23. However, most of the species were very low in number,

THE GEOLOGICAL SOCIETY OF AMERICA, INC.
MEMOIR 130, 1971

Bathymetry, Geomagnetism, and Tectonics of the Caribbean Sea North of Colombia

DALE C. KRAUSE
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ABSTRACT

A bathymetric, magnetic, and seismic profiler survey of the Caribbean Sea north of Colombia revealed four natural geologic systems: (1) a Quaternary erosional system of continental shelf modification and submarine canyon formation; (2) a sedimentological system of seaward progradation of the continental shelf and slope and of turbidite deposition in basins; (3) a deformational system with a fold belt flanking the continent and faults marking the coast; and (4) the ocean-continent transition. The deformation system severely modifies the sedimentational system and is penecontemporaneous. The fold belt acts as a dam to a marginal, turbidite-filled basin. The east-west magnetic pattern of the Colombian basin contrasts with the less intense anomaly pattern paralleling and associated with the continental margin. The geological evidence indicates that the continent is decoupled from the Colombian basin, and that a relative east-west movement exists.

CONTENTS

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Heat Flow and Continuous Seismic Profiles in the Cayman Trough and Yucatan Basin

ABSTRACT

The average of 8 heat-flow measurements in the western half of the Cayman Trough is 2.07 ± 0.25 HFU, markedly higher than the averages of 1.46 ± 0.19 HFU ($n = 9$) and 1.38 ± 0.19 HFU ($n = 3$) obtained on the Yucatan Basin and Cayman Ridge, respectively. There is a tendency for the highest heat-flow values to be situated in the deepest areas of the trough. No systematic variation of heat flow with distance along the trough was observed. The existence of a long, narrow zone of uniformly high heat flow along the floor of the Cayman Trough, along with other geophysical data, suggest a tectonic origin for the trough by extension normal to the axis of the trough and/or by strike-slip faulting related to the eastward movement of the Caribbean lithospheric plate relative to the Atlantic plate. The mean heat flows through the Yucatan Basin and Cayman Ridge are nearly equal to the average world heat flow. Seismic profiler data and piston cores from the Cayman Trough and Ridge and in the Yucatan Basin show that the Cayman Trough is a geologically young feature, probably having originated since the early Tertiary, when the trough and adjacent ridge developed simultaneously. Subsequently, the western end of the trough has received terrigenous sediment from a source located near the Gulf of Honduras, rather than from the Yucatan Basin or Honduras. The central and eastern parts of the trough have been and remain isolated from any major sediment sources. Tectonic activity in the trough has been largely restricted to the margins, as evidenced by the location of the deepest basins, fault structures, and seismicity along the southern margin of the trough west of °3° W. and along the base of the Cayman R[illegible] east of 81° W.

INTRODUCTION

Statement of the Problem

The Cayman Trough is a young, elongate depression in the floor of the northwestern Caribbean Sea. It is well defined structurally by an extraordinarily thin crust (Ewing and others, 1960) and topographically by water depths of 7 km or more (Hersey and Rutstein, 1958). The occurrence of earthquakes, the presence of thin sediments, rugged topographic relief on the floor and walls of the trough, and the basic linearity and parallelism of geophysical and topographic features of the trough that extend over a distance of 1600 km, all suggest that the trough is a major, active tectonic feature of the Caribbean. The origin of the trough and the sense and magnitude of displacements along or across the trough are poorly understood and are of great interest because the history and dynamics of crustal plates in the eastern Pacific west of Central America (Molnar and Sykes, 1969) and in the Atlantic Ocean (Funnell and Smith, 1968) appear to be related intimately to tectonic movements in the Caribbean.

Continuous seismic profiler and bathymetric data were obtained along more than 2,600 km of track in the western Cayman Trough and in the Yucatan Basin. The locations of the seismic profile lines and of the 13 heat-flow measurements obtained as part of this survey are shown in Figure 1. The results of these measurements, their interpretation, and their relevance to the sedimentary and tectonic history of the western Caribbean are presented in the following sections.

Previous Investigations

Bathymetric Data. Maximum water depths in the Caribbean occur within the Cayman

Geological Society of America Bulletin, v. 83, p. 1241–1260, 9 figs., May 1972

GRADUATE SCHOOL OF OCEANOGRAPHY
NARRAGANSETT MARINE LABORATORY
UNIVERSITY OF RHODE ISLAND
KINGSTON, RHODE ISLAND

Particulate iron and the nepheloid layer in the western North Atlantic, Caribbean and Gulf of Mexico

Ref. No. 71-11

Deep Sea Research
Vol. 18, pp. 753-761
1971

by

Peter R. Betzer and Michael E. Q. Pilson

Approved for distribution John A. Knauss

Sponsored by Office of Naval Research

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December 1971

NOAA Technical Memorandum ERL AOML-22

Data From the NOAA Ship VIRGINIA KEY and the SUSIO Ship BELLOWS, Collected During CICAR Survey Month II

Robert L. Molinari
Physical Oceanography Laboratory

Atlantic Oceanographic and Meteorological Laboratories
Miami, Florida

August 1974

UNITED STATES
DEPARTMENT OF COMMERCE
Frederick B. Dent, Secretary

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

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CONTENTS

DATA FROM THE NOAA SHIP VIRGINIA KEY AND THE SUSIO SHIP BELLOWS, COLLECTED DURING CICAR SURVEY MONTH II

Robert L. Molinari

Data collected during May 1972 aboard the R/V Virginia Key and R/V Bellows are presented. The techniques used to reduce these data are also given. These cruises were part of a cooperative venture, CICAR, to map synoptically the circulation in the western Caribbean Sea and the Gulf of Mexico.

1. INTRODUCTION

This publication is the second in a series of reports presenting data collected during May 1972. The data were collected by the Atlantic Oceanographic and Meteorological Laboratories (AOML) of the National Oceanic and Atmospheric Administration, Nova University, the State University System Institute of Oceanography (SUSIO) of Florida, the Instituto de Geofísica of the Universidad Nacional Autónoma de México, and Texas A&M University (TAMU) as part of the Declared National Program, Cooperative Investigation of the Caribbean and Adjacent Regions (CICAR). May 1972 was designated CICAR Survey Month II to coordinate ship schedules so as to monitor simultaneously the currents of the Caribbean Sea and Gulf of Mexico.

Morrison, Merrell, and Nowlin (1973) presented the data collected aboard TAMU's Research Vessel (R/V) Alaminos. This memorandum lists the data collected aboard AOML's R/V Virginia Key and SUSIO's R/V Bellows. The Bellows data were collected and reduced under the supervision of Mr. M. Rinkel of SUSIO.

2. NAVIGATION

The *Virginia Key* was to monitor the mass transport through the Yucatan Channel. Reliable Loran-A signals are difficult to obtain in the Channel, and the majority of the accurate fixes was obtained by radar positioning at the Mexican and Cuban coastlines. Some sunline and celestial fixes were obtained in the central portion of the channel. Within 20 mi. of either coast, the fixes are accurate to within ±1 n.mi. In the central portion of the Channel, the positioning accuracy is approximately ±3 n.mi.

The *Bellows* collected density data in the eastern Gulf of Mexico. The ship was positioned by a Loran-A navigational system. Loran-A has a probable error of ±1 n.mi. in this portion of the Gulf of Mexico.

Figures 1 through 15 include the Salinity/Temperature/Depth (STD) and Expendable Bathythermograph (XBT) stations occupied by the *Virginia Key*. Although a standard section was devised for the AOML research vessel, navigational and instrumental difficulties encountered during the cruise made the occupation of the standard stations impossible. Figure 16 shows the *Bellows* STD and XBT station positions.

3. EXPENDABLE BATHYTHERMOGRAPH DATA

The XBT's were edited visually to eliminate the obviously bad traces. The AOML XBT's were further edited to find those without check-cycle tick marks. The check-cycle is initiated at the start of an XBT launch, and, if the system is properly activated, a tick mark is made on the chart paper. Although XBT's without ticks can be valid, tickless traces were compared with the preceeding and following profiles. The SUSIO XBT's were visually inspected to insure a valid calibration tick.

The Virginia Key XBT times, positions, and isotherm depths are listed in appendix 1, and the Bellows data in appendix 2. The XBT traces were forwarded to the National Oceanographic Data Center (NODC) for analysis and now are filed under NODC reference numbers 42490 (AOML XBT's) and 44057 (SUSIO XBT's).

4. DENSITY DATA

Temperature, salinity, and depth measurements were taken on both vessels with Plessey Corporation Model Number 9060 Salinity/Temperature/Depth (STD) meters. This meter is a self-contained unit which records internally and continuously on an analog chart.

The AOML STD data were reduced by the following procedure. Temperature and salinity values were visually determined from the downtrace at 20-m intervals. Only surface water samples were collected; and from these, surface temperature and salinity values were obtained. The surface temperature was read from a bucket thermometer. The salinity of the surface sample was determined on an inductive salinometer.

The surface temperature differences are within the accuracy of the measuring systems, and the average salinity difference is $0.05^{o}/oo$ for stations number 2 through 58. After station 59, the salinity difference is within the accuracy of the two systems. The temperature versus depth profiles of simultaneously obtained XBT and STD stations were compared. There were no consistent differences between the profiles considered.

The historical data set of hydrographical stations occupied in the Yucatan Channel was supplied by NODC. The mean Temperature-Salinity (T-S) curve for the Channel was determined from these data. Below 17°C, there is little variability in the T-S relation, and this relation is used to correct the deeper salinity values.

In particular, the value of the minimum salinity at the depth of the Antarctic Intermediate Water (AIW) exhibits little variability with time. Therefore, this minimum is compared to the average AIW minimum determined from the *Virginia Key* data, and the difference is found to approximate the surface salinity difference for stations 2 through 58. Therefore, 0.05°/oo was subtracted from the salinity values of these stations.

A T-S histogram was computed for the historical data collected in May and is given in figure 17. A similar computation was performed using the *Virginia Key* data, and the resulting histogram is given on figure 18. The similarity between the shapes of the two histograms and the mean T-S curves supports the validity of the calibration.

Appendix 3 lists in chronological order the *Virginia Key's* temperature and corrected salinity values at observed and standard depths. Also listed are sigma-t, specific volume, dynamic height, and transport function values at standard depths. On some stations, the STD temperature sensor did not function because of low battery power. The temperatures of stations 15 (from 0 to 100 m), 48 (from 0 to 60 m), and 50 (from 0 to 60 m) were determined by linear interpolation between the surface-water sample temperature and the first available temperature. The temperatures of stations 13, 16, and 71 were taken from XBT profiles obtained at the same location.

The SUSIO STD's were visually read at 20-m intervals to obtain temperature and salinity values. Two water samples were collected when the sensor reached the desired maximum depth. Water samples and temperature values, from reversing thermometers, were obtained just above the STD sensor and at the surface.

Differences between the surface sample and STD temperature and salinity values were computed and plotted as functions of time. The plots were visually inspected to identify intervals of constant calibration. Lines of best fit were determined for these intervals, and these constant values were added to the surface STD temperature and salinity values.

The reliability of the STD depth sensor was checked by comparing the thermometric depth, determined from the protected and unprotected thermometers, and the equivalent STD depth. A correction to the STD depth values was applied if necessary.

The temperature and salinity values determined from the bottom water samples were compared to the corresponding STD values. A correction factor versus depth was computed from these values. Appendix 4 lists the Bellows STD data.

Figure 19 presents the T-S histogram and average T-S values determined from the Bellows data. The mean salinity at 5°C is somewhat lower than the historical mean salinity. The Virginia Key data exhibit a similar feature. The original salinity-versus-depth curves suggest that at greater depths the instrument does not respond quickly to small salinity changes ($\leq 0.02^{o}/oo$). Although salinity variations exist at these depths, the STD records frequently exhibit isohaline layers below 700 m. This slow response of the STD is apparently the cause of the lower salinities at depth.

5. PRELIMINARY DATA PRESENTATION

Figures 1 through 15 also give vertical temperature sections drawn from the *Virginia Key* data. The station positions were projected north or south to place them on a standard section. The figures include the station locations and the necessary movements.

Figure 16 gives the contoured depth field of the 22°C isothermal surface during the *Bellows* cruise. The positions of the XBT and STD stations are also included.

6. ACKNOWLEDGMENTS

The author wishes to acknowledge the significant contributions of Captain G. Hood and Chief Mate T. Morrissey of the R/V *Virginia Key* throughout the field operation. The assistance of the Mexican Naval personnel on Isla Mujeres is also acknowledged. Messrs. M. Josselyn and D. Tidwell assisted in the data reduction; Messrs. R. Carrodus and D. Senn and Ms. O'Brien drafted the figures; and Mrs. G. Cary typed the text.

Funds for the collection and reduction of the R/V *Bellows* data were provided by NOAA/AOML Contract Number N22-156-72(G) to SUSIO. The assistance of Mr. M. Rinkel during the contract period is gratefully acknowledged.

7. REFERENCE

Morrison, J. M., W. J. Merrell, and W. D. Nowlin, Jr. (1973), The waters of the eastern Gulf of Mexico as observed during May 1972. 1. Data collected aboard the R/V Alaminos, *Texas A&M Research Foundation Reference 73-10-T*, 330 pp.

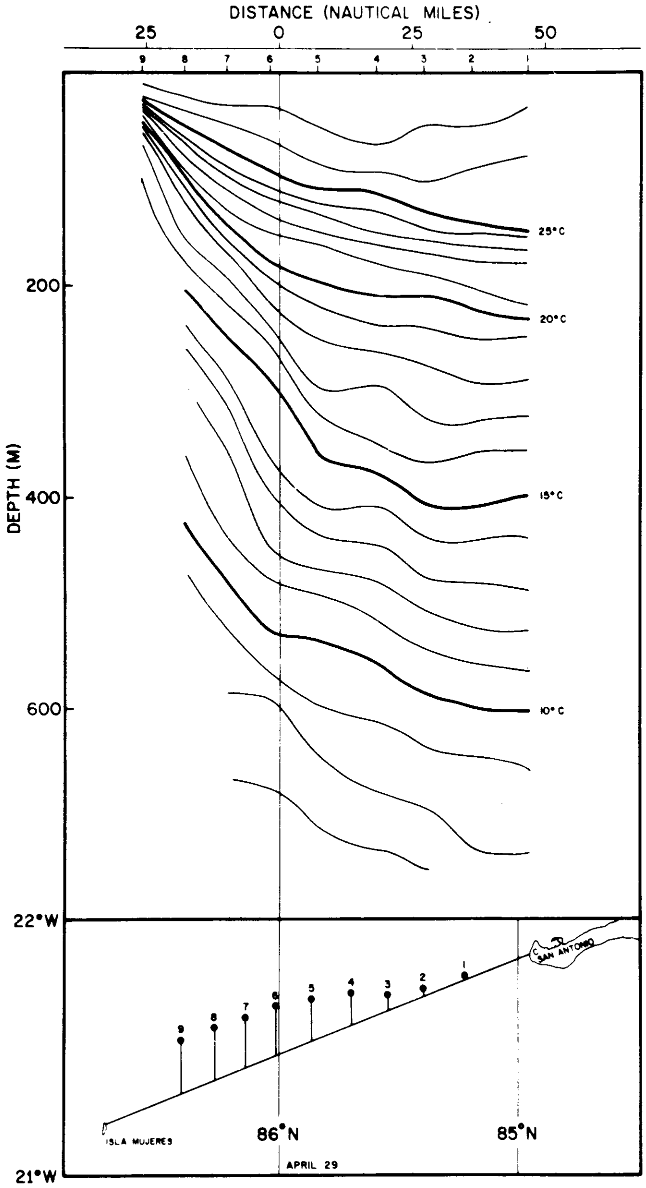

Figure 1. Lower panel. XBT (circles) and STD (squares) stations occupied on April 29 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

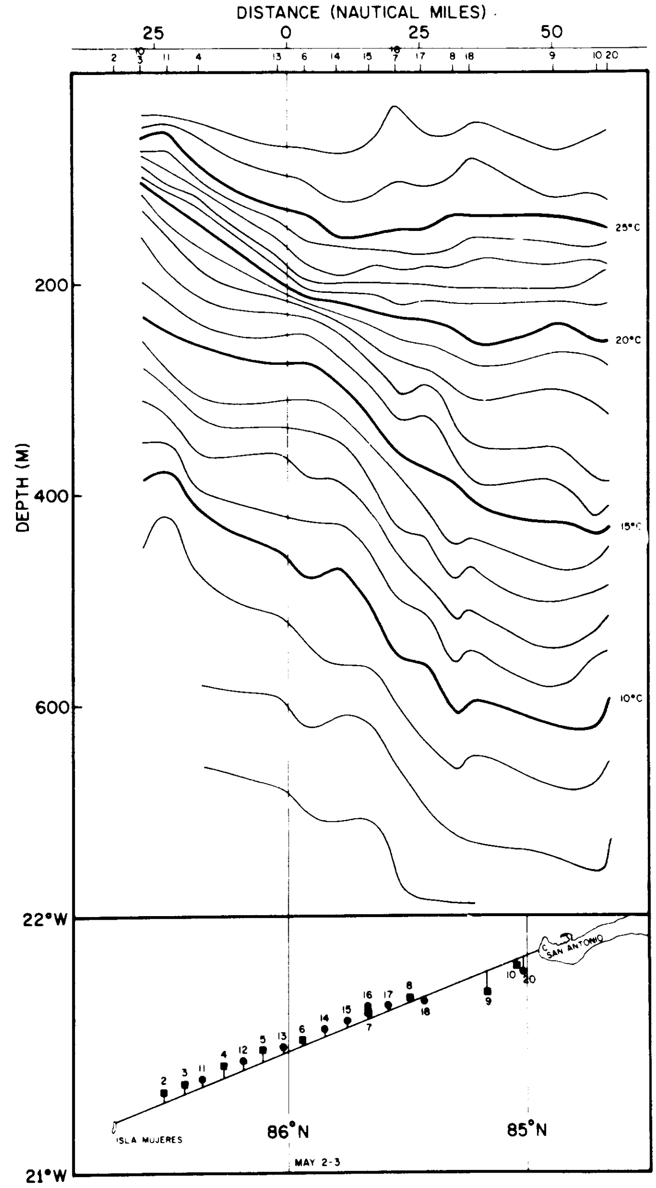

Figure 2. Lower panel. XBT (circles) and STD (squares) stations occupied on May 2-3 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

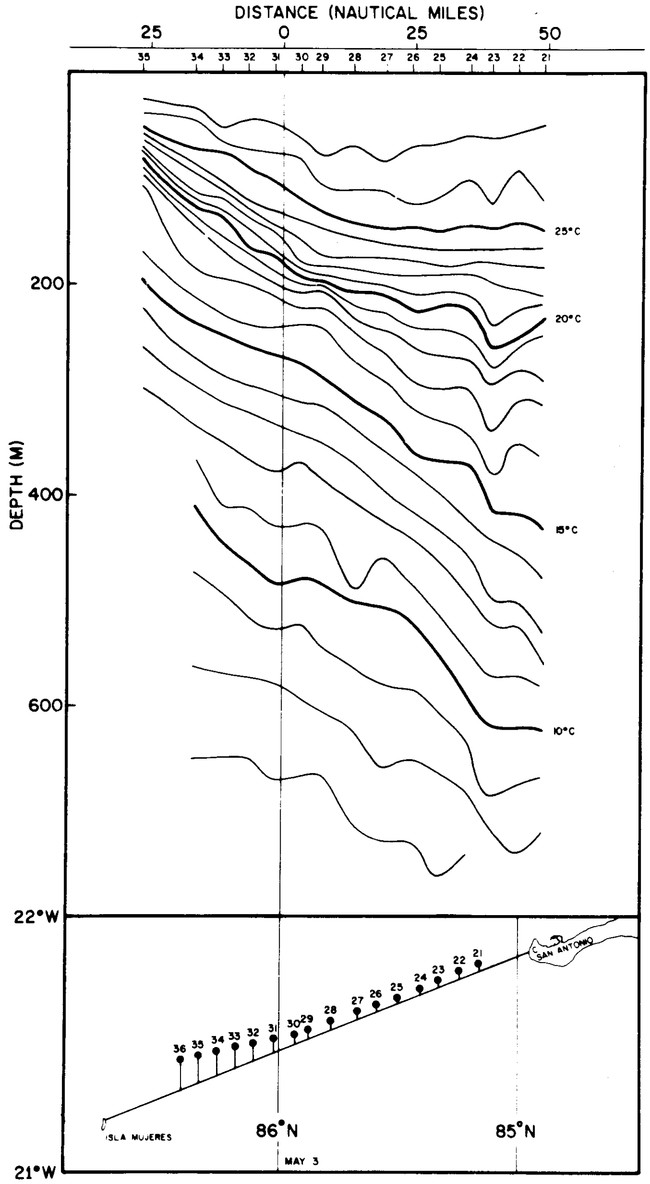

Figure 3. Lower panel. XBT (circles) and STD (squares) stations occupied on May 3 by the R/V <u>Virginia Key</u>. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

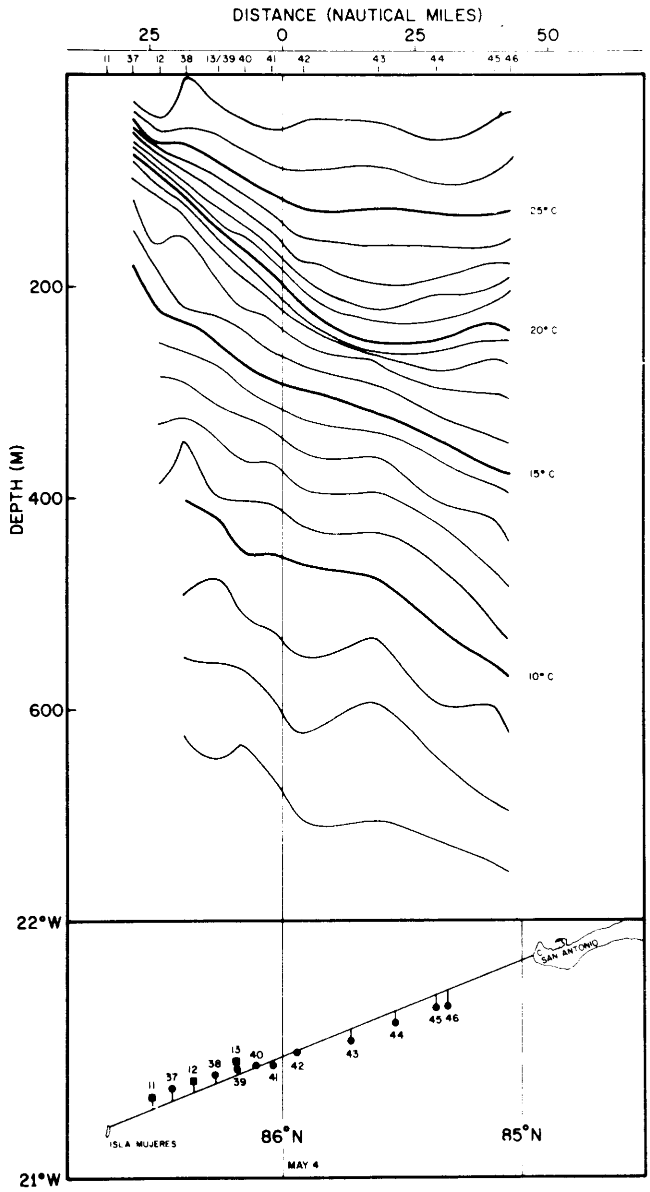

Figure 4. Lower panel. XBT (circles) and STD (squares) stations occupied on May 4 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

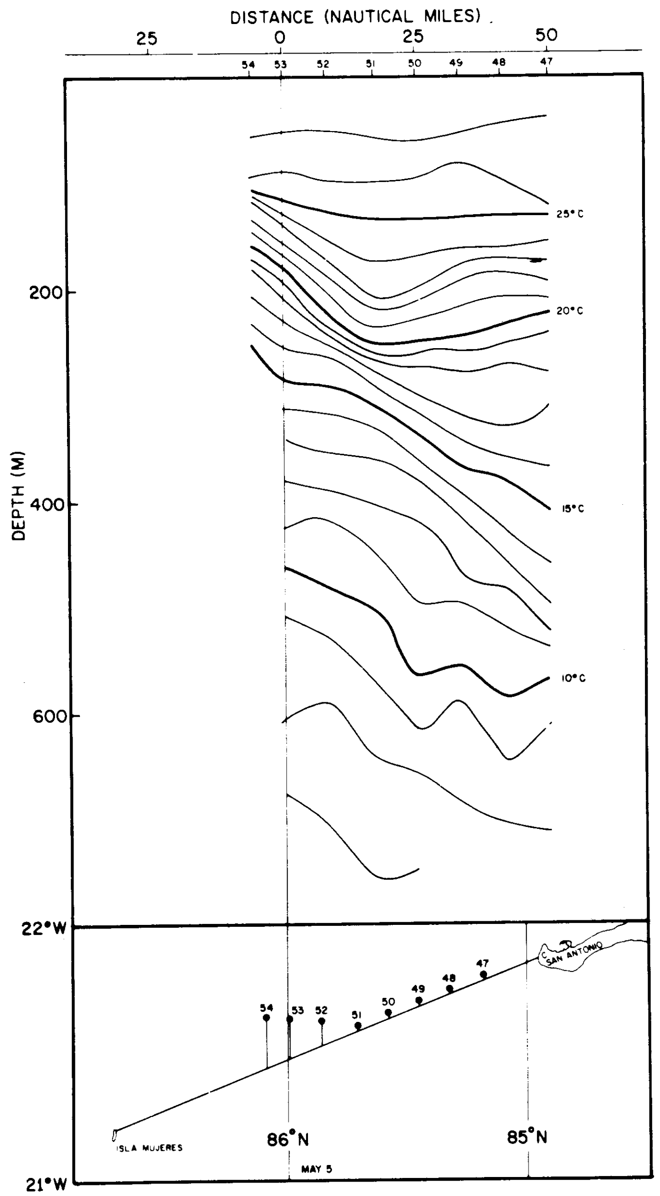

Figure 5. Lower panel. XBT (circles) and STD (squares) stations occupied on May 5 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

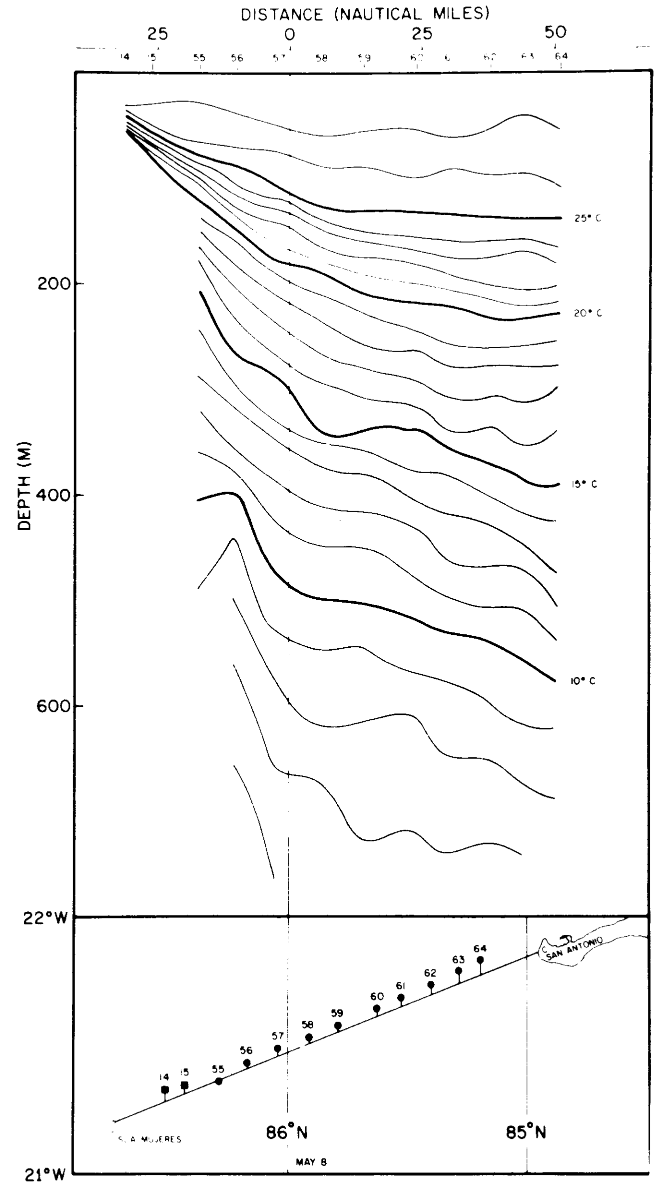

Figure 6. Lower panel. XBT (circles) and STD (squares) stations occupied on May 8 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

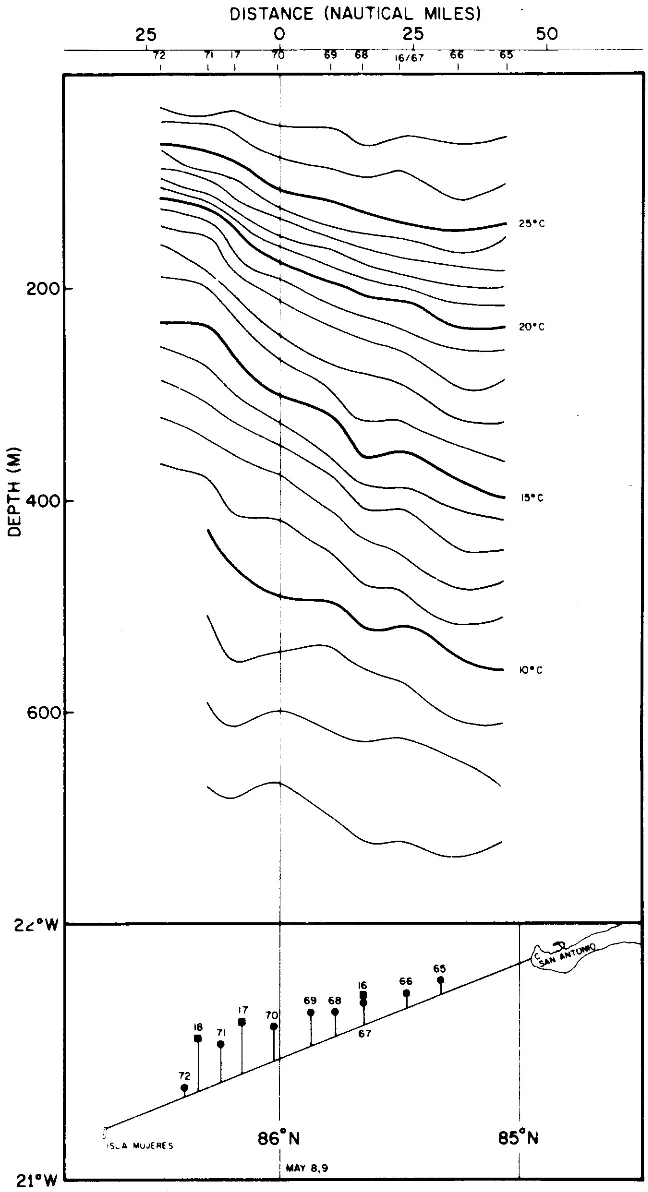

Figure 7. Lower panel. XBT (circles) and STD (squares) stations occupied on May 8-9 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

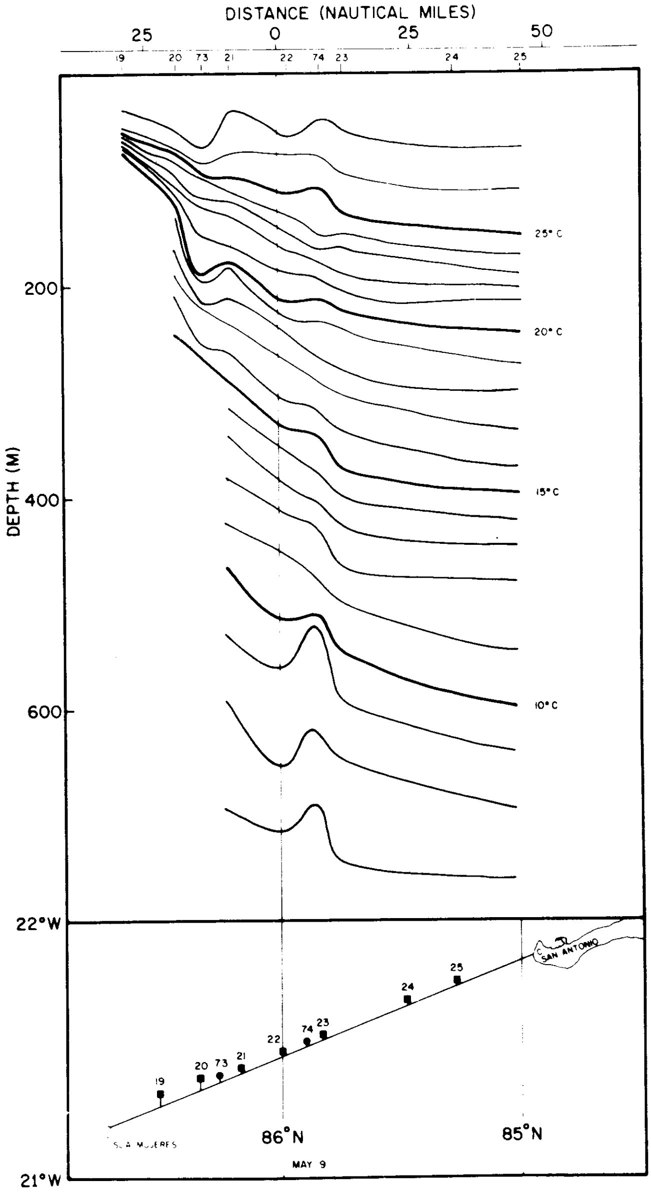

Figure 8. Lower panel. XBT (circles) and STD (squares) stations occupied on May 9 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

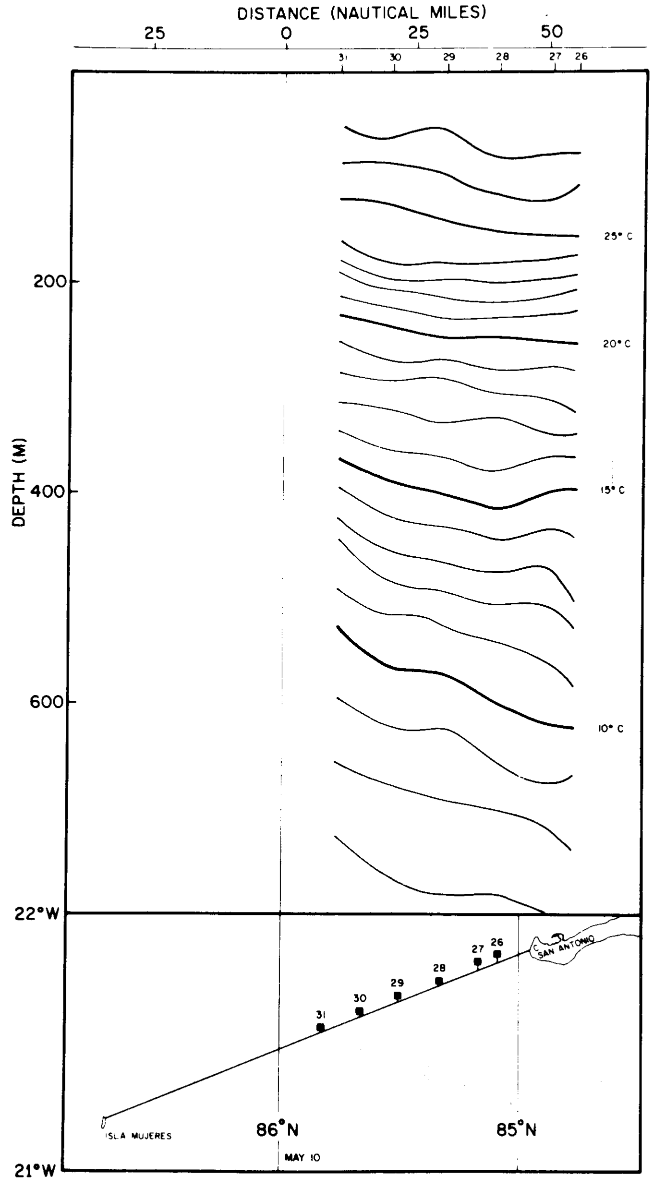

Figure 9. Lower panel. XBT (circles) and STD (squares) stations occupied on May 10 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

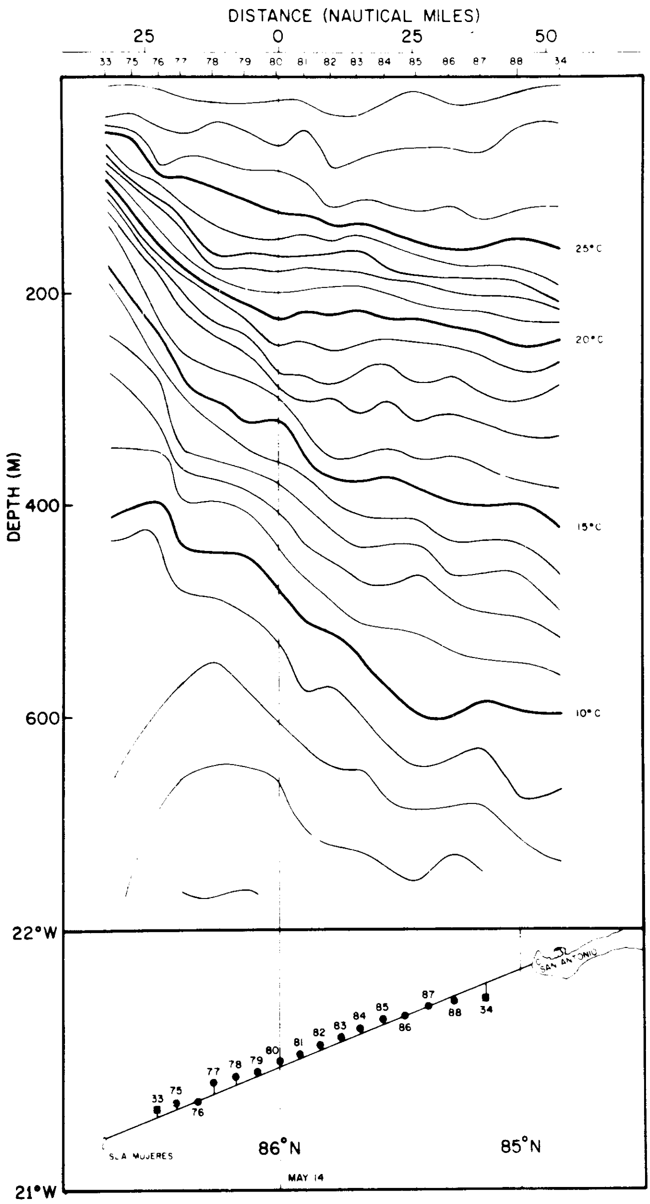

Figure 10. Lower panel. XBT (circles) and STD (squares) stations occupied on May 14 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

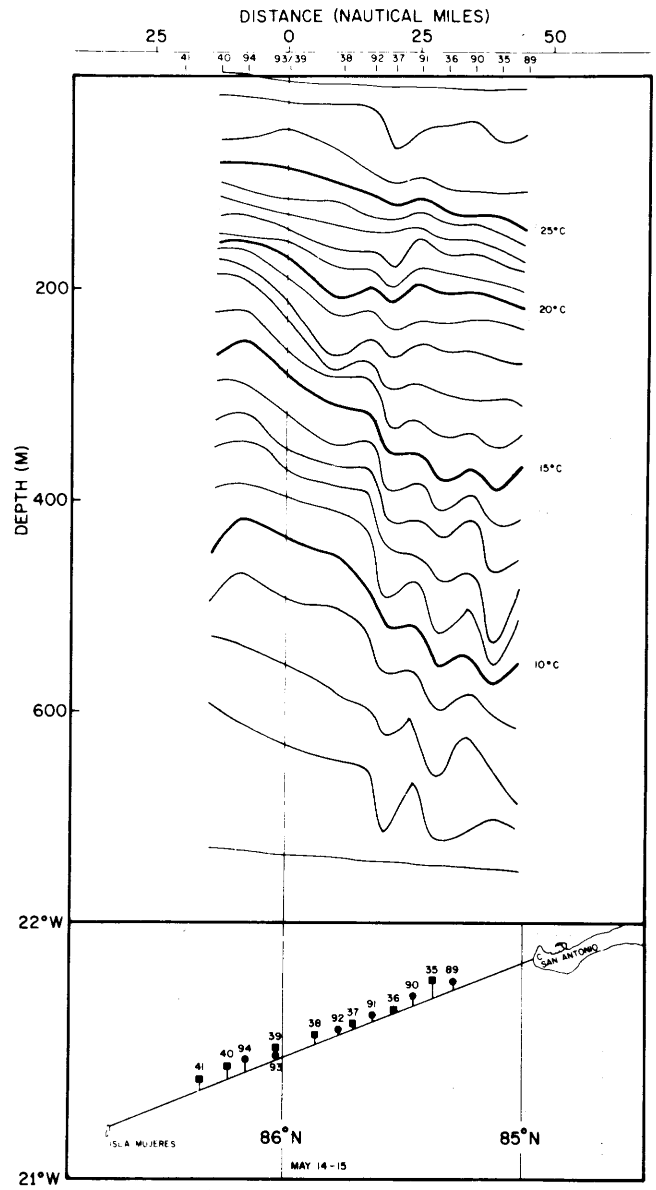

Figure 11. Lower panel. XBT (circles) and STD (squares) stations occupied on May 14-15 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

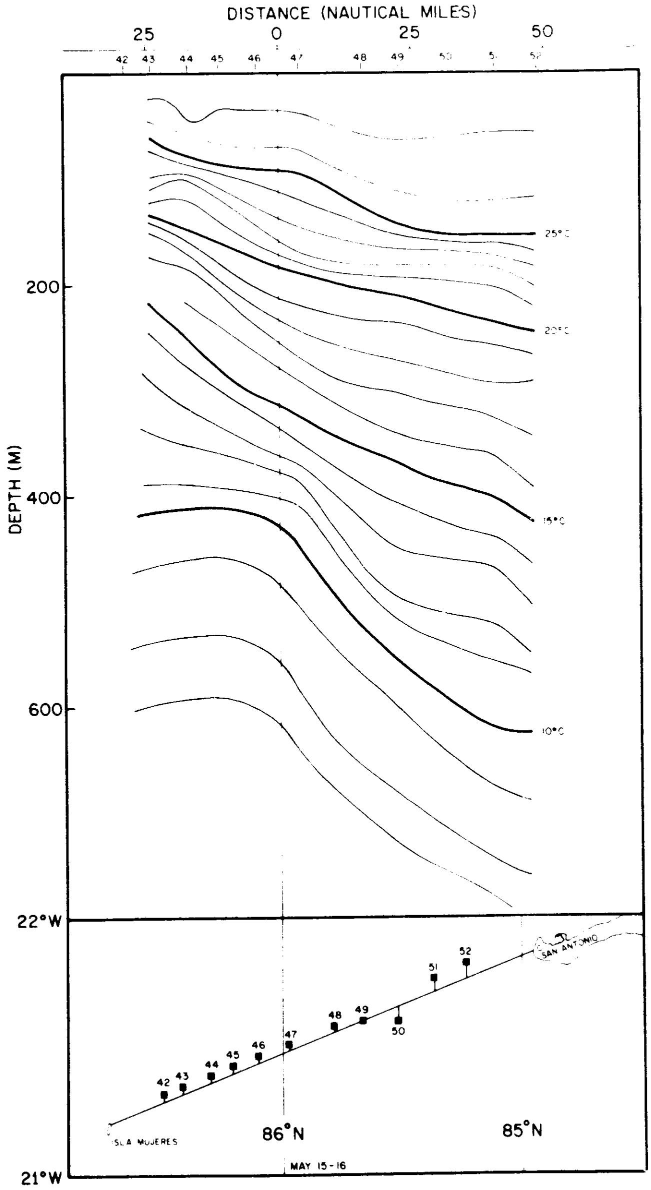

Figure 12. Lower panel. XBT (circles) and STD (squares) stations occupied on May 15-16 by the R/V <u>*Virginia Key*</u>*. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.*

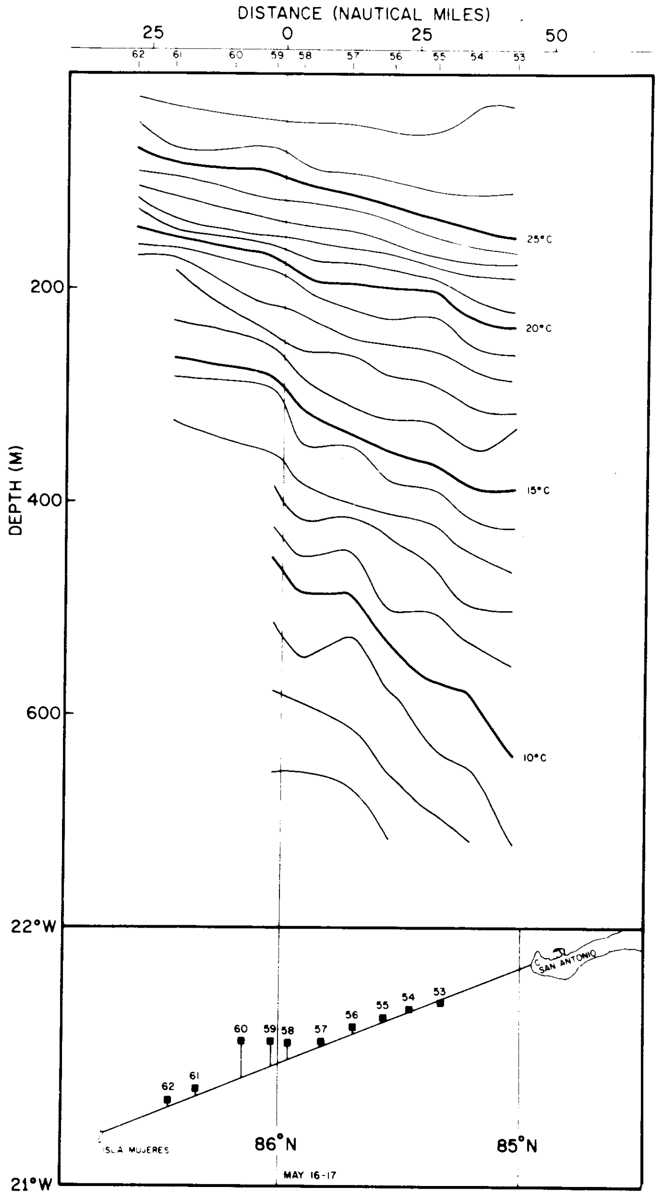

Figure 13. Lower panel. XBT (circles) and STD (squares) stations occupied on May 16-17 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

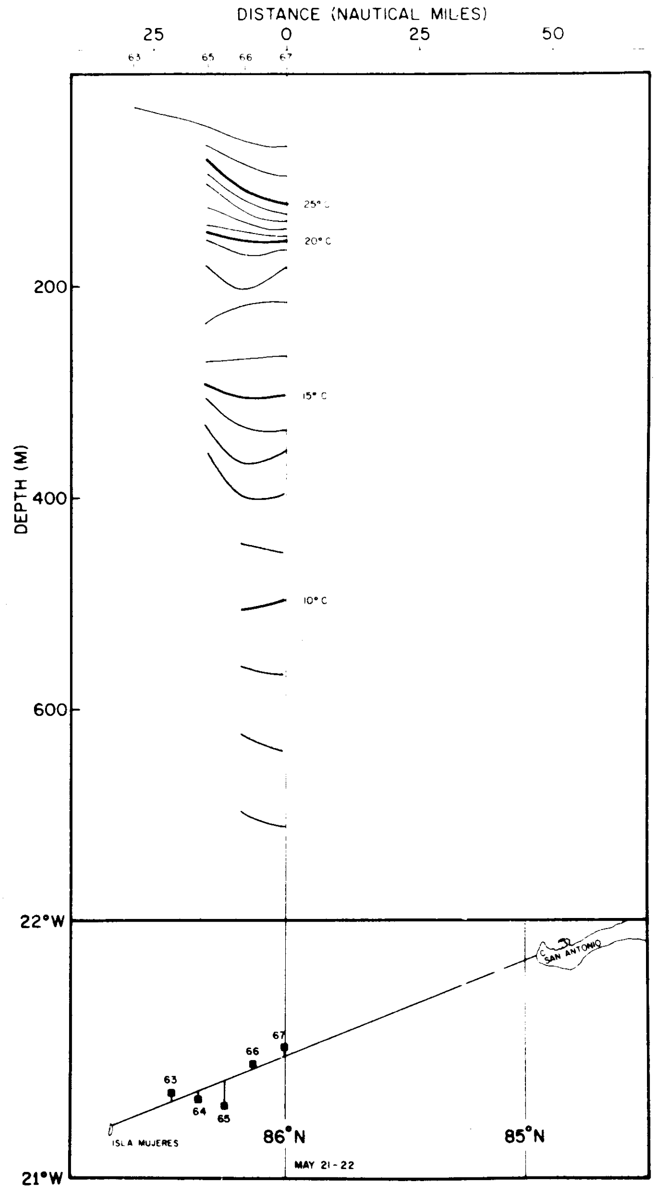

Figure 14. Lower panel. XBT (circles) and STD (squares) stations occupied on May 21-22 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

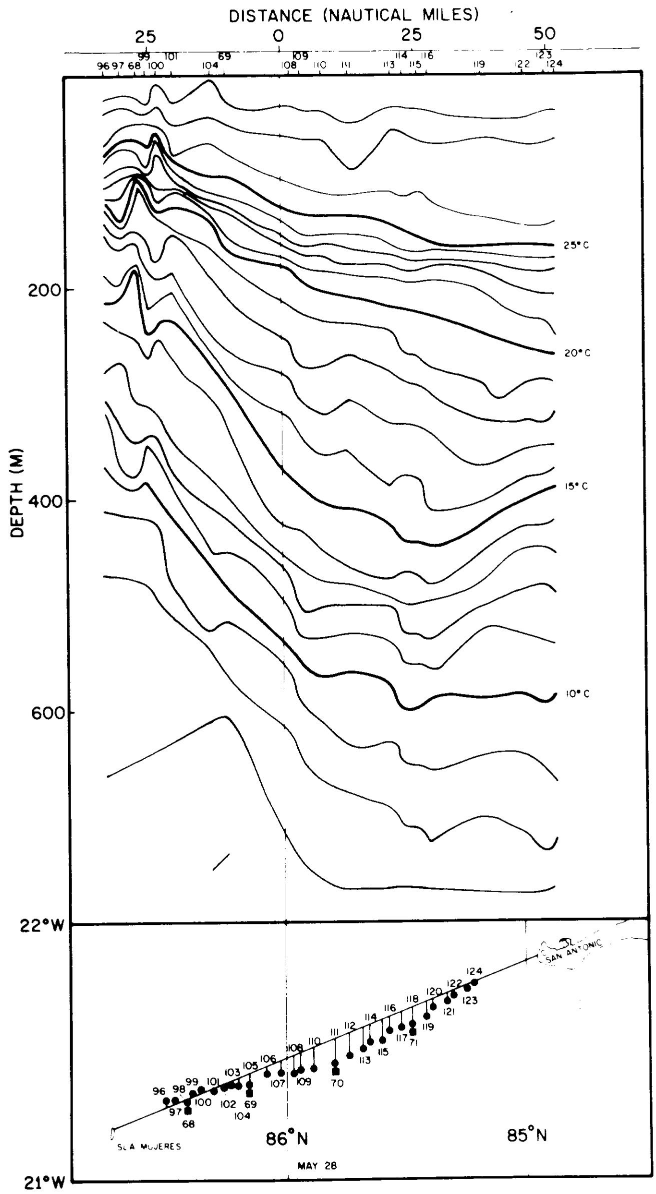

Figure 15. Lower panel. XBT (circles) and STD (squares) stations occupied on May 28 by the R/V Virginia Key. Upper panel. The vertical temperature section obtained after projecting the stations onto the standard section shown in the lower panel. The horizontal scales used on the two panels are different.

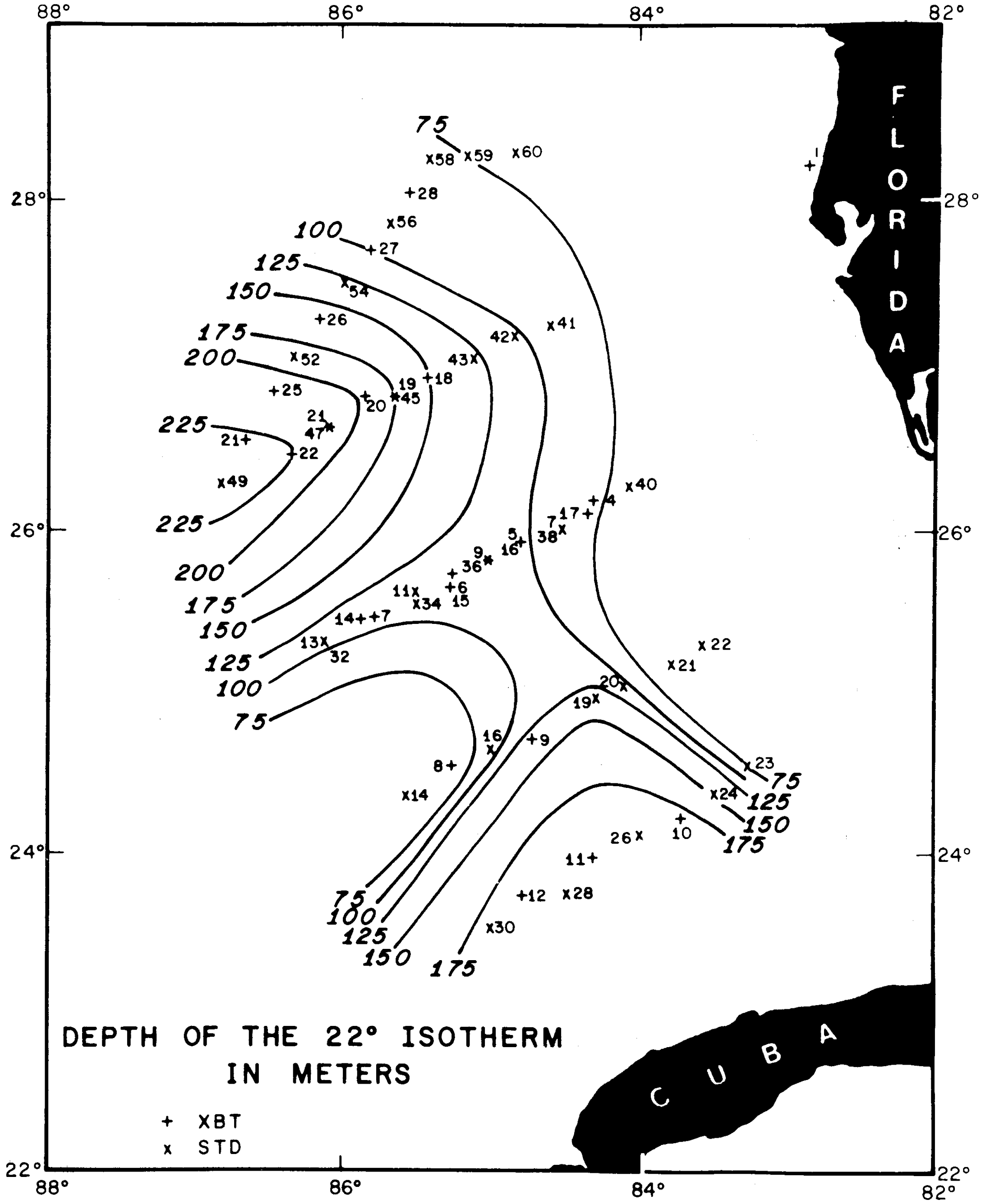

Figure 16. The positions of the XBT's (+) and STD's (X) occupied by the R/V <u>*Bellows*</u>*. Also shown is the contoured depth field (in meters) of the 22°C isothermal surface.*

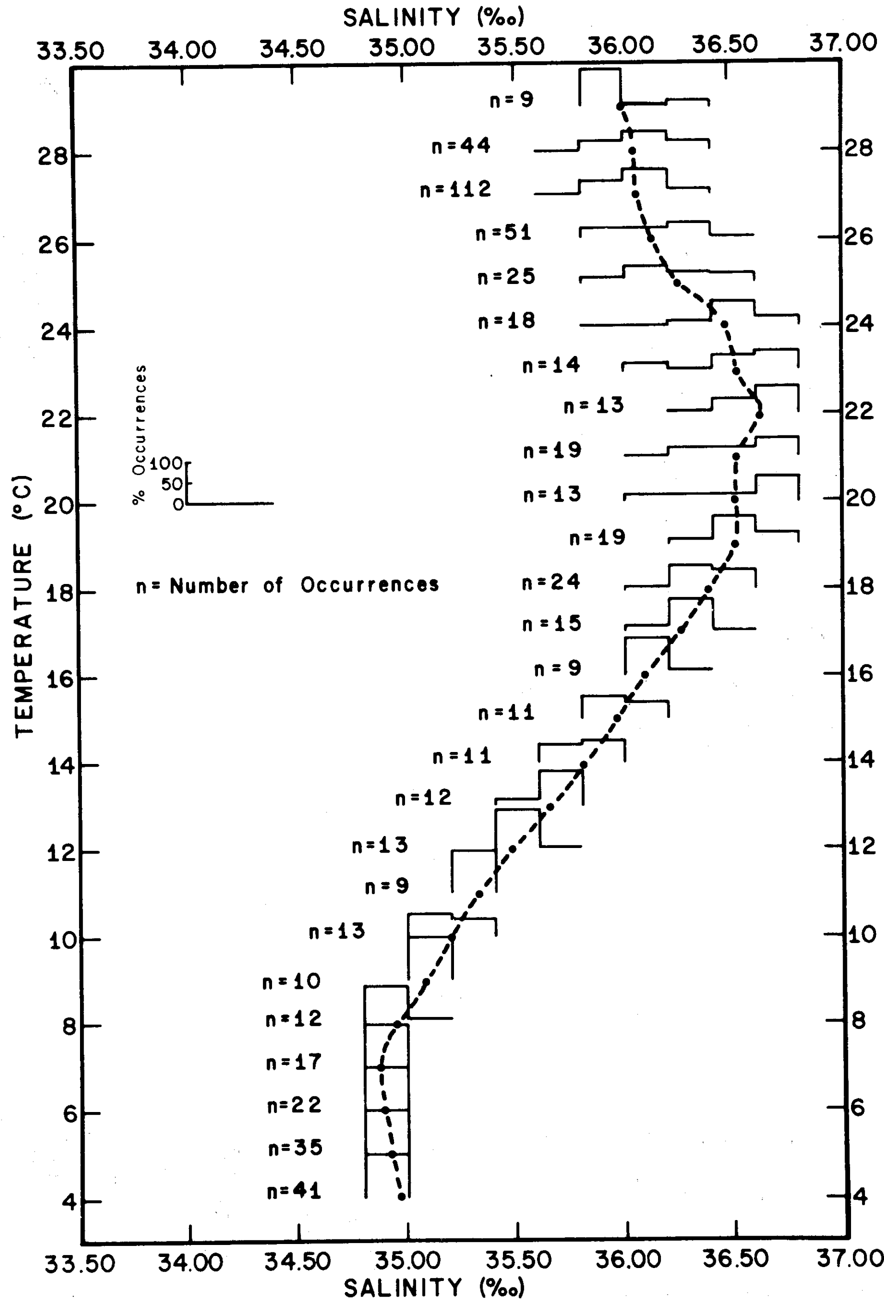

Figure 17. The T-S histogram computed from a portion of the historical data set available in the Yucatan Channel.

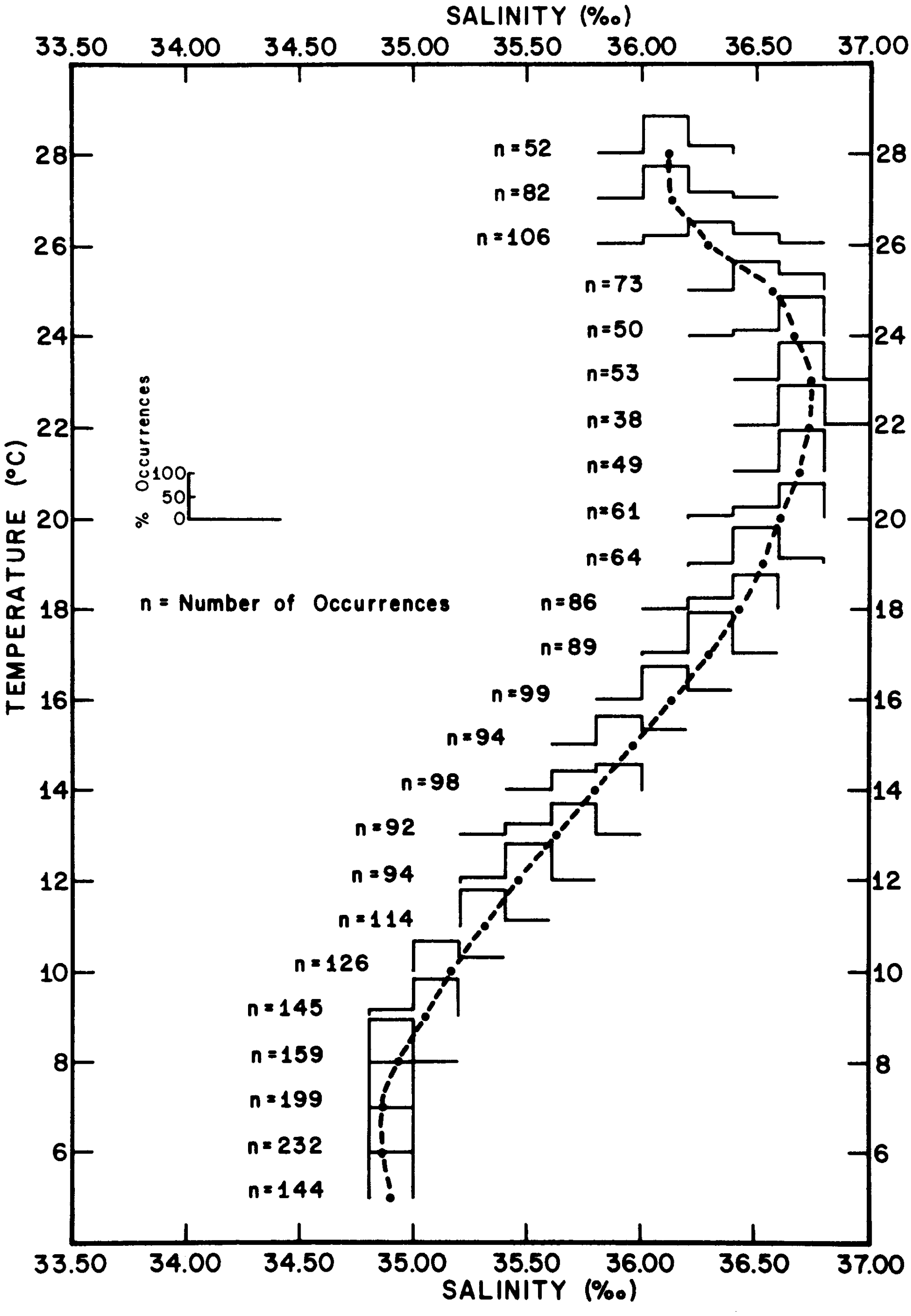

Figure 18. The T-S histogram computed from the STD data of the R/V Virginia Key.

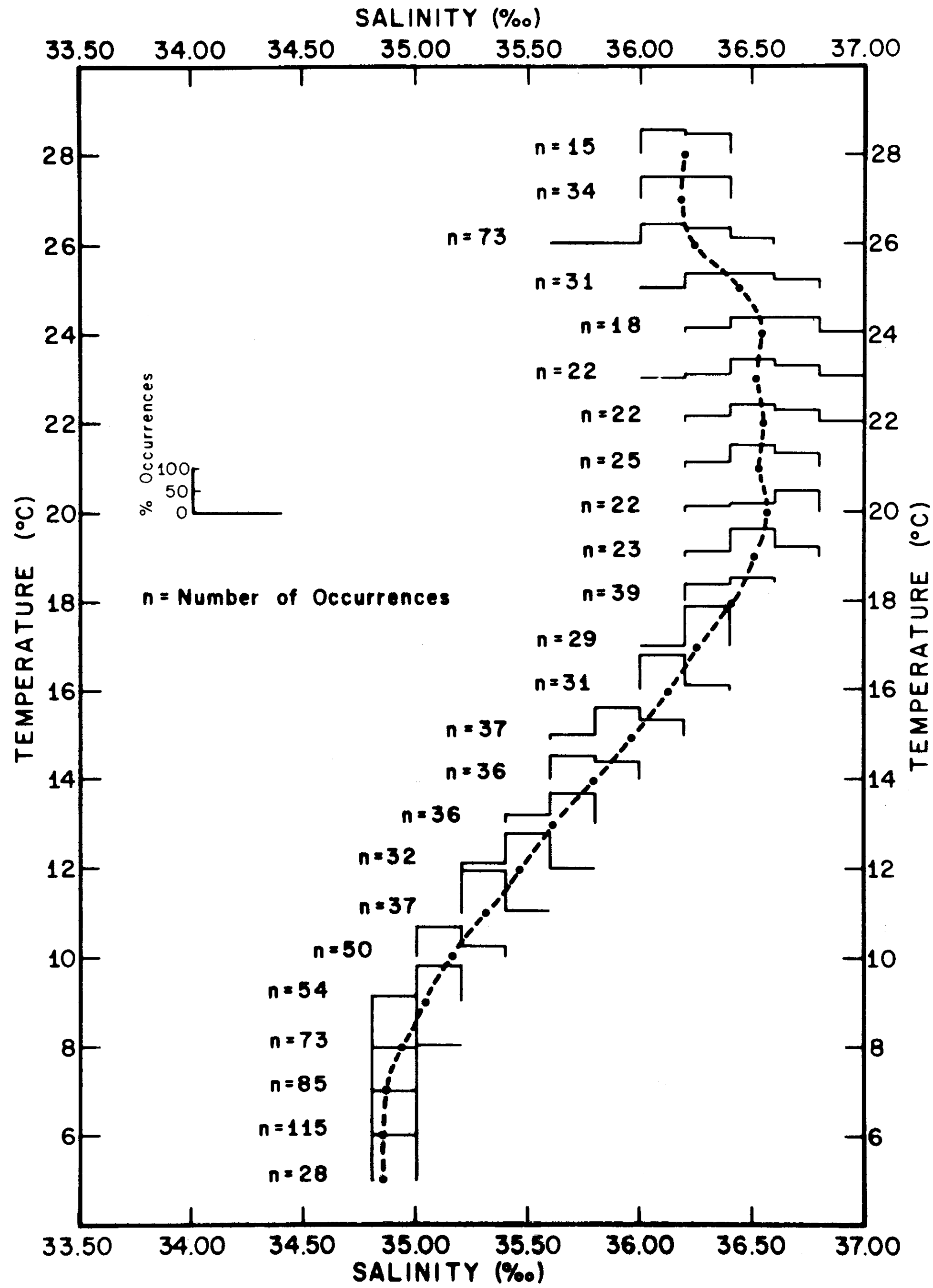

Figure 19. The T-S histogram computed from the STD data of the R/V ***Bellows.***

APPENDIX 1.

R/V VIRGINIA KEY XBT LISTING

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	1	2	3	4	5	6	7
DATE (GMT)	29-IV	29-IV	29-IV	29-IV	29-IV	29-IV	29-IV
TIME (GMT)	0645	0745	0845	0945	1045	1145	1245
LATITUDE °	21	21	21	21	21	21	21
'	47	44	42	42	41	40	37
LONGITUDE °	85	85	85	85	85	86	86
'	13	23	32	42	51	00	08
SURF T (C)	27.2	27.2	27.5	27.5	27.6	27.3	27.2
28							
27	33	52	49	67	51	30	33
26	80	90	106	93	87	59	49
25	150	140	130	113	110	94	71
24	156	151	149	129	123	107	88
23	160	164	158	150	132	120	98
22	170	180	170	165	148	136	109
21	210	202	190	178	160	152	128
20	233	222	208	210	197	178	139
19	250	251	240	238	220	193	158
18	290	290	274	263	252	217	172
17	326	331	327	295	300	238	192
16	357	358	370	347	323	261	217
15	398	409	407	377	360	287	249
14	430	442	440	407	408	360	284
13	480	481	477	445	436	399	312
12	527	525	511	480	467	450	358
11	566	559	547	520	490	485	447
10	604	600	587	559	534	528	483
9	661	648	639	613	599	570	526
8	730	738	696	679	643	592	588
7			754	734	715	677	669
6							

ISOTHERM DEPTHS (M)

SHIP P/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	8	9	10	11	12	13	14
DATE (GMT)	29-IV	29-IV	2-V	2-V	2-V	3-V	3-V
TIME (GMT)	1345	1445	1939	2105	2325	0157	0425
LATITUDE °	21	21	21	21	21	21	21
'	34	32	20	21	25	29	33
LONGITUDE °	86	86	86	86	86	86	85
'	16	24	26	21	00	01	50
SURF T (C)	26.9	27.1	27.4	27.4	27.5	27.6	27.4
28							
27		9	41	40		72	80
26	22	22	55	48		99	125
25	50	24	63	56		127	155
24	60	28	76	75		140	165
23	66	30	80	94		157	193
22	79	33	90	107		175	201
21	90	41	98	113		184	209
20	98	45	103	126		197	217
19	101	50	112	146		205	227
18	131	53	130	155		214	234
17	158	58	152	185		226	243
16	184	90	198	215		250	270
15	203		218	246		277	298
14	236		252	285		310	320
13	260		279	300		336	349
12	290		310	327		365	385
11	358		350	349		415	425
10	418		388	378		455	469
9	472		450	420		516	560
8						593	610
7						680	710
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	15	16	17	18	19	20	21
DATE (GMT)	3-V	3-V	3-V	3-V	3-V	3-V	3-V
TIME (GMT)	0458	0550	0726	0956	1248	1435	1530
LATITUDE °	21	21	21	21	21	21	21
'	35	37	38	40	40	45	48
LONGITUDE °	85	85	85	85	84	85	85
'	45	41	35	26	54	01	09
SURF T (C)	27.4	27.3	27.3	27.4	27.6	27.5	27.4
28							
27	69		58	49	68	58	50
26	120		112	82	126	123	120
25	153		148	138	146	149	148
24	168		173	157	170	163	166
23	184		185	179	189	184	184
22	200		200	203	199	190	209
21	209		215	221	229	220	219
20	225		234	262	257	255	231
19	240		258	281	291	280	249
18	259		280	312	320	327	291
17	275		295	349	362	388	313
16	300		325	386	392	416	363
15	324		375	411	426	430	430
14	355		409	440	446	450	479
13	385		440	469	510	488	531
12	415		482	509	547	516	560
11	458		510	548	587	549	581
10	512		560	597	630	595	622
9	565		635	650	685	654	667
8	620		700	730	720	730	719
7	710						
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	22	23	24	25	26	27	28
DATE (GMT)	3-V	3-V	3-V	3-V	3-V	3-V	3-V
TIME (GMT)	1605	1640	1710	1748	1810	1840	1910
LATITUDE °	21	21	21	21	21	21	21
'	47	45	42	40	38	36	34
LONGITUDE °	85	85	85	85	85	85	85
'	15	19	25	30	34	39	46
SURF T (C)	27.7	27.5	27.4	27.5	27.6	27.8	27.4
28							
27	58	63	59	69	69	82	68
26	92	125	100	118	125	112	110
25	130	149	144	150	145	148	140
24	165	169	167	169	163	160	154
23	184	183	179	183	178	175	175
22	203	201	191	191	192	191	185
21	225	240	210	207	209	200	198
20	250	262	223	220	227	210	208
19	260	280	248	241	240	226	220
18	279	298	269	270	264	241	234
17	310	339	297	300	293	265	249
16	350	381	342	330	321	291	275
15	415	413	368	368	359	325	312
14	453	443	428	400	378	360	341
13	500	500	459	436	418	399	369
12	523	525	500	465	441	431	410
11	570	572	548	508	480	459	490
10	619	621	586	549	519	504	503
9	676	687	630	603	582	581	560
8	739		680	664	650	659	620
7			739	764	728	730	710
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	29	30	31	32	33	34	35
DATE (GMT)	3-V	3-V	3-V	3-V	3-V	3-V	3-V
TIME (GMT)	1940	2010	2040	2110	2140	2210	2240
LATITUDE °	21	21	21	21	21	21	21
'	32	31	31	30	29	28	26
LONGITUDE°	85	85	86	86	86	86	86
'	51	55	01	06	11	15	20
SURF T (C)	27.4	27.8	27.7	27.8	27.7	27.8	27.6
28							
27	80	64	49	44	54	33	
26	109	80	76	73	68	45	
25	132	120	100	91	74	73	
24	146	138	129	122	101	90	
23	173	156	138	130	111	98	
22	184	180	150	139	119	114	
21	190	186	165	145	129	123	
20	195	192	172	166	134	128	
19	199	200	188	171	156	137	
18	205	210	198	185	171	148	
17	220	223	211	201	196	188	
16	241	240	241	240	228	212	
15	268	275	268	261	249	239	
14	314	313	302	298	289	268	
13	350	342	332	320	314	296	
12	388	370	380	363	350	331	
11	430	427	430	410	412	360	
10	484	480	485	462	445	410	
9	544	521	530	518	490	475	
8	606	594	578	575		562	
7	665	668	670	649		650	
6	750					740	

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	36	37	38	39	40	41	42
DATE (GMT)	3-V	4-V	4-V	4-V	4-V	4-V	4-V
TIME (GMT)	2310	1811	2001	2156	2228	2301	2350
LATITUDE °	21	21	21	21	21	21	21
'	25	20	23	24	25	26	28
LONGITUDE °	86	86	86	86	86	86	85
'	24	27	16	11	07	03	56
SURF T (C)	27.8	27.6	27.5	27.6	27.6	27.5	27.5
28							
27	26	33	11	40	51	60	50
26	40	42	60	79	80	94	98
25	52	49	71	88	109	118	135
24	54	59	90	105	125	139	163
23	62	61	100	121	138	155	186
22	70	70	111	132	150	169	200
21	75	73	115	146	159	179	212
20	78	83	122	152	171	191	225
19	83	91	130	163	182	205	237
18	91	106	139	177	200	219	248
17	103	120	160	201	230	239	260
16	169	152	230	233	248	271	280
15	194	185	240	259	280	295	302
14	222		270	282	306	319	330
13	261		298	319	331	341	360
12	300		332	350	372	370	398
11			359	408	410	412	432
10			409	425	460	460	472
9			500	483	520	529	558
8			559	565	566	589	630
7			630	656	640	663	712
6				752			

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	43	44	45	46	47	48	49
DATE (GMT)	5-V	5-V	5-V	5-V	5-V	5-V	5-V
TIME (GMT)	0130	0300	0435	0530	0706	0753	0838
LATITUDE °	21	21	21	21	21	21	21
'	31	35	39	39	47	44	41
LONGITUDE °	85	85	85	85	85	85	85
'	42	31	24	18	12	19	27
SURF T (C)	27.5	27.5	27.7	27.5	27.5	27.4	27.5
28							
27	50	70	48	41	40	46	56
26	91	109	100	85	123	97	80
25	133	139	140	132	134	132	138
24	168	172	169	162	157	160	160
23	207	198	185	185	174	172	177
22	228	213	207	197	194	186	192
21	240	240	225	212	210	210	219
20	262	257	240	248	224	235	245
19	269	272	259	260	240	251	260
18	275	289	274	282	280	272	281
17	282	303	310	315	310	330	319
16	300	328	350	356	370	360	342
15	325	350	378	385	411	380	371
14	347	370	395	402	460	424	389
13	368	408	425	448	499	455	414
12	402	428	475	490	526	480	470
11	441	469	525	541	542	519	497
10	482	529	563	575	571	588	555
9	539	600	603	630	610	650	590
8	600	650		700	715		688
7	710	730		760			
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	50	51	52	53	54	55	56
DATE (GMT)	5-V	5-V	5-V	5-V	5-V	8-V	8-V
TIME (GMT)	0930	1016	1102	1210	1255	0102	0155
LATITUDE °	21	21	21	21	21	21	21
'	39	36	37	37	38	22	25
LONGITUDE °	85	85	85	85	86	86	86
'	36	43	52	59	06	18	11
SURF T (C)	27.5	27.3	27.4	27.4	27.6	27.5	28.2
28							19
27	64	58	52	55	58	28	38
26	100	102	102	90	99	68	69
25	136	138	131	118	111	81	90
24	168	174	152	129	113	86	111
23	200	211	172	139	118	95	120
22	210	220	183	155	136	100	130
21	230	240	200	168	148	103	138
20	248	255	223	180	161	123	149
19	260	264	236	197	171	137	161
18	272	268	244	211	182	147	185
17	299	278	253	228	206	165	211
16	318	293	265	258	233	176	237
15	338	310	291	288	255	210	268
14	361	331	321	316		243	298
13	381	362	355	345		287	320
12	418	402	390	381		322	361
11	498	451	419	428		362	398
10	565	503	481	464		407	442
9	618	580	530	512		490	500
8	660	648	590	611			561
7	750	760	705	680			659
6				764			

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	57	58	59	60	61	62	63
DATE (GMT)	8-V	8-V	8-V	8-V	8-V	8-V	8-V
TIME (GMT)	0250	0350	0440	0528	0616	0708	0756
LATITUDE °	21	21	21	21	21	21	21
'	28	32	34	38	41	43	46
LONGITUDE °	86	85	85	85	85	85	85
'	03	55	48	39	32	25	18
SURF T (C)	28.0	28.0	28.0	27.9	27.7	27.8	27.7
28							
27	53	66	58	54	65	55	38
26	77	93	90	103	90	101	94
25	110	128	132	134	137	139	138
24	118	139	147	156	160	161	157
23	129	151	160	168	178	177	168
22	142	168	173	180	191	200	206
21	162	178	190	199	206	217	223
20	180	190	210	218	222	234	234
19	198	210	228	244	258	259	258
18	212	234	259	266	280	280	281
17	240	270	281	292	310	307	315
16	268	296	311	316	340	334	355
15	292	343	339	338	358	370	390
14	332	352	359	380	380	402	419
13	353	378	382	406	418	425	448
12	387	415	417	431	466	466	471
11	430	452	450	480	501	508	510
10	479	499	503	517	533	539	560
9	530	550	547	572	578	594	620
8	580	620	618	610	650	650	675
7	661	670	730	718	740	730	741
6	766						

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	64	65	66	67	68	69	70
DATE (GMT)	8-V	8-V	8-V	8-V	8-V	8-V	8-V
TIME (GMT)	0846	0948	1036	1310	1412	1453	1547
LATITUDE °	21	21	21	21	21	21	21
'	49	45	43	41	39	38	35
LONGITUDE °	85	85	85	85	85	85	86
'	12	20	27	39	45	52	01
SURF T (C)	27.8	27.5	28.2	27.9	28.0	28.0	28.0
28			30				
27	56	60	67	61	70	51	50
26	108	105	122	93	100	90	79
25	138	141	151	141	132	122	110
24	167	153	171	156	151	144	126
23	183	186	183	173	164	153	135
22	202	199	200	190	181	165	153
21	215	219	220	201	193	180	161
20	230	237	239	213	210	194	176
19	256	259	259	240	230	218	190
18	277	289	298	260	253	238	211
17	301	329	326	289	283	272	245
16	340	366	352	324	327	291	270
15	388	398	385	353	360	319	302
14	426	420	411	388	386	355	328
13	478	447	449	410	411	375	349
12	508	475	487	451	440	409	376
11	536	509	517	483	479	449	420
10	577	560	551	519	520	493	490
9	623	610	609	570	560	537	545
8	688	671	648	623	629	619	600
7		722	738	721	720	699	666
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	71	72	73	74	75	76	77
DATE (GMT)	8-V	9-V	9-V	10-V	14-V	14-V	14-V
TIME (GMT)	2008	0045	0255	0725	0135	0216	0300
LATITUDE °	21	21	21	21	21	21	21
'	31	21	24	31	19	21	25
LONGITUDE °	86	86	86	85	86	86	86
'	15	24	15	59	26	21	17
SURF T (C)	27.9	28.0	27.9	28.0	28.0	27.8	28.0
28							
27	43	33	26	45	38	50	55
26	51	48	50	80	49	86	77
25	76	69	53	111	58	95	95
24	95	73	58	157	89	99	120
23	99	90	61	169	100	114	130
22	115	100	75	180	104	121	135
21	120	109	89	194	110	140	165
20	127	120	100	215	129	161	175
19	138	129	103	235	136	171	184
18	154	144	122	268	140	178	198
17	179	163	130	290	158	183	224
16	200	193	160	319	181	228	260
15	238	235	196	343	210	242	288
14	276	257	219	375	227	266	300
13	310	289	260	403	260	282	350
12	343	328		428	299	328	370
11	380	369		478	350	354	400
10	430			510	406	400	445
9	509			522		437	485
8	590			620			572
7	672			690			660
6	749						765

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	78	79	80	81	82	83	84
DATE (GMT)	14-V	14-V	14-V	14-V	14-V	14-V	14-V
TIME (GMT)	0346	0430	0512	0554	0636	0718	0800
LATITUDE °	21	21	21	21	21	21	21
'	25	27	29	31	33	35	36
LONGITUDE °	86	86	86	85	85	85	85
'	11	06	00	55	50	45	40
SURF T (C)	28.2	28.2	28.1	28.3	28.5	28.1	28.0
28	25	28	30	28	39	38	
27	45	55	70	52	90	80	74
26	80	90	91	101	127	118	121
25	105	115	129	130	142	139	145
24	140	151	154	149	160	149	161
23	170	165	170	170	170	164	180
22	180	180	186	180	186	184	191
21	190	198	204	202	197	198	206
20	199	212	230	222	226	219	230
19	210	224	254	250	261	252	248
18	230	240	280	280	290	280	271
17	243	260	293	306	302	319	304
16	270	285	301	332	360	356	350
15	302	325	321	360	378	383	377
14	323	349	360	374	401	415	419
13	360	370	382	403	428	445	440
12	375	390	410	440	454	473	480
11	401	410	439	470	490	515	520
10	445	450	480	517	521	550	571
9	489	504	531	578	574	598	630
8	550	580	610	630	653	650	680
7	645	650	660	713	723	726	746
6	768	762					

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	85	86	87	88	89	90	91
DATE (GMT)	14-V	14-V	14-V	14-V	14-V	14-V	14-V
TIME (GMT)	0842	0924	1006	1048	1410	1612	1831
LATITUDE °	21	21	21	21	21	21	21
'	38	40	42	43	46	42	37
LONGITUDE °	85	85	85	85	85	85	85
'	34	29	23	17	18	28	37
SURF T (C)	28.2	28.2	28.3	28.2	28.2	28.0	28.4
28	18	32	28	21	31		30
27	71	69	76	50	74	61	71
26	130	123	138	128	128	127	116
25	158	165	163	153	163	149	133
24	172	180	180	184	178	157	148
23	188	190	193	194	194	172	162
22	195	204	207	211	202	186	172
21	215	219	221	232	222	208	199
20	228	237	241	258	238	222	216
19	250	256	263	282	257	247	250
18	290	283	301	307	290	278	270
17	316	319	330	340	330	322	308
16	360	358	371	380	357	354	344
15	388	400	404	402	385	387	373
14	416	438	436	438	436	412	401
13	441	469	468	470	474	436	438
12	468	491	504	510	501	486	470
11	524	539	551	553	530	522	495
10	600	605	589	600	569	562	536
9	650	642	631	680	633	598	579
8	641	727	685	720	728	642	623
7	758		746		768	720	687
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	92	93	94	95	96	97	98
DATE (GMT)	14-V	15-V	15-V	28-V	28-V	28-V	28-V
TIME (GMT)	2136	0110	0255	1844	1855	1909	1947
LATITUDE °	21	21	21	21	21	21	21
'	34	28	27	18	19	19	20
LONGITUDE °	85	86	86	86	86	86	86
'	47	02	08	30	28	25	23
SURF T (C)	28.4	28.3	28.2	28.5	28.3	.0	28.3
28	030	26	20	25	22	022	31
27	50	50	46	39	32	38	40
26	110	72	81	71	51	48	48
25	131	108	104	80	63	61	70
24	154	138	130	85	72	75	90
23	170	155	145	98	89	88	98
22	184	168	151	108	100	94	99
21	202	174	172	119	118	97	101
20	218	190	176	120	140	98	116
19	241	210	184	125	147	105	119
18	266	231	199	138	156	148	154
17	288	243	208	144	168	161	180
16	303	280	241	188	200	178	221
15	337	299	270	215	214	185	244
14	363	338	309	232	270	250	268
13	388	373	340	282	335	311	311
12	412	390	367	308	370	350	340
11	450	419	407	319	416	382	351
10	498	454	438	335			385
9	540	514	490				
8	612		555				
7	670		630				
6	760		750				

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	99	100	101	102	103	104	105
DATE (GMT)	28-V	28-V	28-V	28-V	28-V	28-V	28-V
TIME (GMT)	2000	2015	2030	2035	2045	2100	2228
LATITUDE °	21	21	21	21	21	21	21
'	20	21	22	22	23	23	25
LONGITUDE °	86	86	86	86	86	86	86
'	21	17	14	13	12	09	04
SURF T (C)	.0	.0	.0	28.0	.0	28.2	28.4
28	9	28			6	29	
27	31	49			39	49	
26	49	77			66	75	
25	54	82			98	94	
24	59	90			113	115	
23	76	101			121	123	
22	109	108			124	132	
21	122	110			131	156	
20	132	124			137	170	
19	138	146			163	179	
18	178	149			187	209	
17	195	187			242	262	
16	217	204			261	282	
15	236	231			270	296	
14	250	272			301	330	
13	320	348			377	399	
12	341	383			406	418	
11	423	395			455	451	
10		420			458	485	
9		490			527	516	
8		513			539	568	
7					610	606	
6					750	735	

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	106	107	108	109	110	111	112
DATE (GMT)	28-V	28-V	28-V	28-V	28-V	29-V	29-V
TIME (GMT)	2243	2258	2313	2328	2345	0114	0129
LATITUDE °	21	21	21	21	21	21	21
'	24	25	25	26	27	29	30
LONGITUDE°	86	85	85	85	85	85	85
'	01	58	55	52	48	44	41
SURF T (C)	28.6	28.7	28.4	28.3	28.3	28.4	28.3
28		28	34	33			29
27		58	62	60			50
26		100	106	110			109
25		128	132	135			139
24		143	152	151			159
23		156	164	160			170
22		165	171	170			181
21		174	185	186			194
20		183	197	205			220
19		215	225	233			242
18		249	276	277			281
17		285	308	323			332
16		320	341	359			390
15		380	386	408			426
14		430	429	447			478
13		460	467	480			493
12		470	508	499			503
11		510	532	532			538
10		538	555	568			576
9		565	599	613			630
8		620	650	668			690
7		727	747	760			765
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	113	114	115	116	117	118	119
DATE (GMT)	29-V	29-V	29-V	29-V	29-V	29-V	29-V
TIME (GMT)	0144	0159	0214	0229	0244	0405	0420
LATITUDE °	21	21	21	21	21	21	21
'	32	33	34	36	37	40	41
LONGITUDE °	85	85	85	85	85	85	85
'	39	36	33	31	29	24	22
SURF T (C)	28.3	28.3	28.3	28.3	28.2	.0	28.2
28	32	30	33			40	37
27	56	62	66			58	65
26	116	110	119			133	132
25	148	149	160			162	162
24	167	169	164			168	176
23	173	178	175			178	181
22	185	187	180			186	191
21	197	198	193			203	210
20	221	222	227			241	241
19	260	264	275			288	291
18	298	289	300			326	319
17	338	330	338			372	367
16	390	381	410			400	398
15	438	441	447			422	435
14	471	470	480			450	461
13	490	501	500			480	481
12	522	531	533			499	500
11	559	556	562			522	528
10	592	599	590			590	570
9	650	651	655			641	630
8	717	707	723			700	711
7	770						
6							

ISOTHERM DEPTHS (M)

SHIP R/V VIRGINIA KEY CRUISE VK 72-13

XBT NO.	120	121	122	123
DATE (GMT)	29-V	29-V	29-V	29-V
TIME (GMT)	0435	0449	0502	0517
LATITUDE °	21	21	21	21
'	42	43	45	47
LONGITUDE °	85	85	85	85
'	20	17	15	13
SURF T (C)	.0	28.1	.0	.0
28		40	33	33
27		66	63	60
26		140	142	137
25		160	161	162
24		174	176	173
23		187	190	183
22		203	210	208
21		231	231	248
20		260	262	265
19		292	288	291
18		325	329	320
17		353	351	350
16		380	379	372
15		402	395	389
14		427	427	423
13		447	448	455
12		486	481	490
11		530	536	536
10		585	595	586
9		640	655	670
8		717	735	721
7				
6				

APPENDIX 2.

R/V BELLOWS XBT LISTING

ISOTHERM DEPTHS (M)

SHIP R/V BELLOWS CRUISE B 7204

XBT NO.	1	4	5	6	7	8	9
DATE (GMT)	6-V	8-V	8-V	8-V	8-V	10-V	10-V
TIME (GMT)	1230	0239	0710	1120	1528	0510	1000
LATITUDE °	27	26	25	25	25	24	24
'	15	08	55	42	25	31	43
LONGITUDE °	84	84	84	85	85	85	84
'	36	17	47	16	50	16	43
SURF T (C)	26.2	26.8	26.1	26.1	27.1	26.5	27.7
28							
27					5		52
26	18	23	10	12	40	14	82
25		42	45	62	51	28	90
24		57	72	82	70	31	100
23		69	83	94	80	37	112
22		79	93	101	90	47	126
21		92	115	122	99	56	137
20		129	127	134	120	58	142
19		160	150	150	138	63	149
18		165	170	183	162	78	173
17			195	200	186	97	225
16			240	242	216	122	268
15			285	280	236	140	300
14			298	305	297	173	323
13			307	345	325	220	350
12			327	390	355	256	384
11			370	425	470	300	433
10			416	468	536	353	473
9			485	512	630	428	
8			580	583	730	528	
7			640	700		710	
6							

ISOTHERM DEPTHS (M)

SHIP R/V BELLOWS CRUISE B 7204

XBT NO.	10	11	12	14	15	16	17
DATE (GMT)	13-V	13-V	13-V	14-V	14-V	14-V	15-V
TIME (GMT)	0020	0519	1043	1030	1745	2235	0230
LATITUDE °	24	23	23	25	25	25	26
'	12	58	44	25	39	55	06
LONGITUDE °	83	84	84	85	85	84	84
'	44	18	47	50	16	47	19
SURF T (C)	27.6	27.6	28.0	26.3	27.0	27.1	26.7
28							
27	44	52	60			1	
26	73	96	87	35	62	23	20
25	115	146	125	93	78	68	38
24	146	160	146	100	102	76	64
23	172	173	154	109	115	87	77
22	184	187	171	133	140	113	89
21	193	203	182	161		140	106
20	200	220	200	175		154	120
19	219	236	228	190		170	144
18	246	268	270	210		200	164
17	277	290	301	231		217	
16	317	350	345	275		257	
15	345	378	381	308		288	
14	375	425	420	340		307	
13	397	464	475	375		324	
12	433	520	521	400		335	
11	466	569	550	443		344	
10	530	609	607	497		370	
9	620	660	690	627		430	
8	685	727		736		512	
7	760					625	
6							

ISOTHERM DEPTHS (M)

SHIP R/V BELLOWS CRUISE B 7204

XBT NO.	18	19	20	21	22	24	25
DATE (GMT)	16-V	17-V	17-V	17-V	17-V	17-V	17-V
TIME (GMT)	2120	0020	0255	0503	0912	1435	1705
LATITUDE °	26	26	26	26	26	26	26
'	55	49	44	38	28	32	51
LONGITUDE °	85	85	85	86	86	86	86
'	25	38	49	04	29	39	27
SURF T (C)	26.8	26.9	26.9	26.8	27.0	26.3	26.1
28							
27							
26	55	55	40	22	40	35	67
25	92	147	153	165	172	174	170
24	112	159	173	186	195	192	183
23	131	172	195	202	215	205	203
22	141	185	204	220	232	225	215
21	160	208	222	232	260	250	225
20	181	216	247	255	283	273	250
19	195	228	273	288	312	305	288
18	210	245	290	315	340	340	320
17	234	265	316	352	376	380	350
16	261	293	340	395	420	427	410
15	280	326	375	430	455	460	436
14	316	350	403	465	485	490	470
13	350	390	442	510	532	525	506
12	386	427	490	550	568	570	562
11	432	470	516	585	605	593	588
10	473	523	560	628	658	640	632
9	530	580	618	685	720	710	714
8	607	650	740	750			
7	700	750					
6							

ISOTHERM DEPTHS (M)

SHIP R/V BELLOWS CRUISE B 7204

XBT NO.	26	27	28
DATE (GMT)	17-V	18-V	18-V
TIME (GMT)	2210	0235	0640
LATITUDE °	27	27	28
'	17	40	03
LONGITUDE °	86	85	85
'	08	50	34
SURF T (C)	26.1	25.7	25.6
28			
27			
26	37		
25	125	48	36
24	150	58	50
23	162	68	60
22	170	85	78
21	212	105	96
20	232	117	104
19	313	128	115
18	372	143	137
17	415	160	148
16	468	187	172
15		216	197
14		243	227
13		278	252
12		307	297
11		355	340
10		403	388
9		463	450
8		535	
7		630	
6		750	

APPENDIX 3.

R/V VIRGINIA KEY STD LISTING

Z - Depth (m)

T - Temperature (°C)

(-9.9°C - no T - data)

S - Salinity (‰)

SIGT - Sigma-t

TANOM - Thermosteric anomaly

SVA - Specific volume anomaly

SVEL - Sound velocity (m/s)

DYNHGT - Dynamic height (dyn. m)

TRANS - Transport function

R/V VIRGINIA KEY VK 72-13 STD STATION 2
1816 GMT MAY 2 1972
21 19 N 86 31 W 201 M
SURFACE SAMPLE SALINITY 35.95
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.58	35.97	23.31	458.0	458.0	1541.78	.0000	0.
20	26.76	36.45	23.93	398.9	399.8	1540.74	.0858	9.
40	24.72	36.57	24.63	331.6	333.3	1536.57	.1591	33.
60	24.20	36.67	24.87	309.5	311.9	1535.72	.2236	71.
80	19.60	36.55	26.01	200.2	203.2	1524.53	.2751	121.
100	17.46	36.26	26.40	163.5	166.9	1517.71	.3121	180.
120	16.56	36.24	26.58	146.3	150.2	1515.56	.3438	246.
140	16.39	36.20	26.60	144.9	149.5	1515.27	.3738	317.
160	15.80	36.12	26.67	137.8	142.9	1513.70	.4030	395.
180	15.06	35.95	26.72	133.1	138.6	1511.34	.4312	478.

R/V VIRGINIA KEY VK 72-13 STD STATION 3
1930 GMT MAY 2 1972
21 20 N 86 26 W 457 M
SURFACE SAMPLE SALINITY 35.98
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.40	36.05	23.40	449.1	449.1	1541.63	.0000	0.
20	27.27	36.05	23.44	445.1	446.0	1541.67	.0895	9.
40	26.90	36.03	23.55	435.2	436.9	1541.15	.1778	36.
60	26.00	36.47	24.16	376.4	378.9	1539.81	.2594	79.
80	23.38	36.65	25.09	287.8	291.0	1534.01	.3264	138.
100	21.20	36.65	25.71	228.9	232.7	1528.73	.3788	208.
120	18.80	36.53	26.26	177.0	181.3	1522.35	.4202	288.
140	17.82	36.44	26.44	160.1	165.0	1519.76	.4548	376.
160	16.80	36.33	26.60	144.7	150.0	1516.96	.4863	470.
180	16.60	36.28	26.61	143.8	149.7	1516.63	.5163	570.
200	16.25	36.19	26.62	142.5	149.0	1515.79	.5461	676.
220	15.20	36.05	26.75	130.0	136.8	1512.72	.5747	789.

R/V VIRGINIA KEY VK 72-13 STD STATION 4
2142 GMT MAY 2 1972
21 24 N 86 17 W 951 M
SURFACE SAMPLE SALINITY 35.97
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.41	36.01	23.37	452.3	452.3	1541.62	.0000	0.
20	27.37	36.02	23.39	450.4	451.2	1541.87	.0904	9.
40	27.19	36.05	23.47	442.7	444.4	1541.82	.1799	36.
60	26.19	36.19	23.89	402.2	404.7	1540.00	.2648	81.
80	25.37	36.44	24.34	359.9	363.2	1538.64	.3416	141.
100	24.37	36.60	24.76	319.4	323.5	1536.72	.4103	216.
120	21.67	36.70	25.62	237.7	242.3	1530.33	.4669	304.
140	20.20	36.63	25.97	204.5	209.7	1526.66	.5121	402.
160	19.18	36.55	26.18	184.8	190.6	1524.08	.5521	508.
180	18.38	36.50	26.34	169.1	175.4	1522.08	.5887	622.
200	17.60	36.35	26.42	161.5	168.4	1520.00	.6231	744.
220	16.61	36.25	26.58	146.2	153.5	1517.27	.6553	871.
240	16.00	36.06	26.58	146.5	154.2	1515.54	.6860	1006.
260	15.06	35.95	26.71	134.4	142.3	1512.81	.7157	1146.
280	14.40	35.85	26.78	128.0	136.3	1510.93	.7435	1292.
300	14.12	35.81	26.80	125.2	133.9	1510.30	.7706	1443.
320	13.42	35.67	26.84	121.5	130.5	1508.18	.7970	1600.
360	12.05	35.48	26.97	109.5	118.8	1504.00	.8465	1929.
400	10.61	35.29	27.05	101.5	110.9	1500.10	.8930	2277.
440	9.52	35.13	27.15	92.1	101.4	1495.91	.9368	2643.
480	9.00	35.05	27.18	89.9	99.5	1494.53	.9773	3026.
520	8.62	35.04	27.23	84.9	94.9	1493.75	1.0161	3424.
560	8.20	34.95	27.22	85.4	95.7	1492.70	1.0553	3839.
600	7.78	34.94	27.28	80.2	90.7	1491.74	1.0925	4268.
640	7.20	34.88	27.32	76.6	87.1	1490.07	1.1281	4712.
680	6.62	34.85	27.37	71.3	81.6	1488.42	1.1620	5170.
720	6.30	34.86	27.42	66.5	76.9	1487.81	1.1938	5642.
760	6.00	34.87	27.47	62.0	72.6	1487.28	1.2234	6125.
800	5.60	34.89	27.51	58.1	68.9	1487.16	1.2519	6620.
840	5.62	34.92	27.56	53.8	64.8	1487.13	1.2787	7126.
880	5.59	34.93	27.57	52.7	64.2	1487.67	1.3044	7643.
920	5.41	34.93	27.59	50.6	62.2	1487.60	1.3295	8170.

R/V VIRGINIA KEY   VK 72-13   STD STATION   5
0 0 GMT   MAY 3 1972
21 27 N   86 06 W   1756 M
SURFACE SAMPLE SALINITY 35.99
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.42	35.96	23.33	456.2	456.2	1541.60	.0000	0.
20	27.36	35.95	23.34	455.1	455.9	1541.78	.0912	9.
40	27.28	35.97	23.38	451.2	452.9	1541.94	.1821	36.
60	26.82	36.05	23.59	431.3	433.9	1541.31	.2708	82.
80	26.15	36.26	23.96	396.0	399.3	1540.30	.3541	144.
100	25.30	36.55	24.44	349.9	354.1	1538.89	.4294	223.
120	24.20	36.67	24.87	309.5	314.4	1536.69	.4963	315.
140	22.80	36.74	25.33	265.3	270.8	1533.59	.5548	420.
160	21.50	36.73	25.69	231.0	237.2	1530.55	.6056	536.
180	20.60	36.57	25.82	219.1	225.8	1528.34	.6519	662.
200	18.30	36.45	26.32	170.8	177.8	1522.13	.6923	796.
220	17.10	36.33	26.53	151.5	158.9	1518.82	.7259	938.
240	16.70	36.27	26.58	146.8	154.7	1517.88	.7573	1087.
260	15.82	36.08	26.64	141.1	149.4	1515.32	.7877	1241.
280	15.10	35.95	26.70	135.2	143.8	1513.26	.8170	1402.
300	14.20	35.82	26.80	126.1	134.9	1510.57	.8449	1568.
320	13.58	35.67	26.81	124.6	133.7	1508.70	.8717	1739.
360	12.32	35.49	26.93	113.7	123.1	1504.93	.9239	2099.
400	11.33	35.33	26.99	107.6	117.4	1501.97	.9718	2478.
440	10.44	35.23	27.07	99.7	109.7	1499.35	1.0170	2876.
480	9.72	35.07	27.07	99.7	109.9	1497.20	1.0606	3291.
520	9.00	35.02	27.15	92.1	102.5	1495.14	1.1028	3724.
560	8.72	34.99	27.17	90.1	101.0	1494.70	1.1434	4173.
600	8.22	34.94	27.21	86.4	97.5	1493.41	1.1828	4639.
640	7.42	34.84	27.25	82.6	93.3	1490.87	1.2214	5119.
680	6.92	34.81	27.30	78.1	88.8	1489.53	1.2574	5615.
720	6.46	34.80	27.36	73.0	83.6	1488.36	1.2920	6125.
760	6.20	34.83	27.41	67.5	78.3	1488.02	1.3244	6648.
800	5.64	34.84	27.47	62.3	73.1	1487.25	1.3548	7184.
840	5.60	34.85	27.51	58.8	69.7	1486.95	1.3836	7732.

R/V VIRGINIA KEY VK 72-13 STD STATION 6
0230 GMT MAY 3 1972
21 31 N 85 57 W 1920 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.37	35.96	23.34	454.7	454.7	1541.49	.0000	0.
20	27.37	35.96	23.34	454.7	455.5	1541.81	.0910	9.
40	27.37	35.96	23.34	454.7	456.4	1542.13	.1822	36.
60	27.20	35.96	23.40	449.4	452.0	1542.08	.2730	82.
80	26.82	36.05	23.59	431.3	434.7	1541.63	.3617	145.
100	26.03	36.25	23.99	393.1	397.3	1540.34	.4449	226.
120	25.45	36.41	24.29	364.4	369.4	1539.45	.5216	323.
140	24.96	36.55	24.54	340.0	345.8	1538.74	.5931	434.
160	24.03	36.63	24.89	307.5	314.0	1536.88	.6591	559.
180	23.19	36.74	25.22	276.0	283.2	1535.22	.7188	697.
200	21.60	36.65	25.55	244.7	252.5	1531.91	.7724	846.
220	18.78	36.43	26.19	183.8	191.6	1523.80	.8168	1005.
240	16.37	36.15	26.56	148.1	155.9	1516.76	.8515	1172.
260	15.45	36.02	26.67	137.5	145.7	1514.11	.8817	1345.
280	14.65	35.95	26.75	130.0	138.5	1512.47	.9101	1525.
300	14.24	35.80	26.77	128.3	137.2	1510.67	.9376	1709.
320	13.08	35.67	26.79	126.6	135.7	1509.03	.9649	1900.
360	12.60	35.54	26.91	115.3	124.9	1505.93	1.0165	2296.
400	11.62	35.36	26.96	110.5	120.5	1503.01	1.0651	2712.
440	10.63	35.26	27.06	100.7	110.8	1500.06	1.1116	3148.
480	10.00	35.14	27.08	99.1	109.6	1498.30	1.1556	3601.
520	9.48	35.09	27.13	94.4	105.3	1496.99	1.1986	4072.
560	8.65	34.96	27.16	91.3	102.1	1494.40	1.2404	4560.
600	8.16	34.94	27.22	85.6	96.5	1493.18	1.2798	5064.
640	7.79	34.92	27.26	81.8	93.0	1492.39	1.3178	5584.
680	7.45	34.86	27.27	81.5	92.9	1491.65	1.3549	6118.
720	6.86	34.83	27.32	76.1	87.4	1490.05	1.3910	6667.
760	6.50	34.83	27.37	71.2	82.5	1489.21	1.4252	7231.
800	6.19	34.84	27.42	66.6	78.0	1488.65	1.4573	7807.
840	5.85	34.84	27.47	62.5	73.8	1487.94	1.4876	8396.
880	5.61	34.84	27.50	59.6	71.1	1487.63	1.5168	8997.
920	5.25	34.85	27.55	54.7	66.0	1486.83	1.5441	9609.
960	5.18	34.85	27.56	53.9	65.5	1487.20	1.5704	10232.
1000	5.00	34.86	27.59	51.2	62.9	1487.13	1.5958	10866.

R/V VIRGINIA KEY VK 72-13 STD STATION 7
0530 GMT MAY 5 1972
21 37 N 85 40 W 2195 M
SURFACE SAMPLE SALINITY 36.05
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.20	36.05	23.47	443.0	443.0	1541.19	.0000	0.
20	27.20	36.05	23.47	443.0	443.8	1541.51	.0887	9.
40	27.20	36.05	23.47	443.0	444.7	1541.84	.1775	35.
60	26.80	36.05	23.59	430.7	433.2	1541.27	.2653	80.
80	26.21	36.11	23.83	408.6	411.9	1540.30	.3498	141.
100	26.05	36.17	23.92	399.5	403.6	1540.31	.4314	219.
120	25.62	36.35	24.13	379.7	384.7	1540.26	.5102	314.
140	25.37	36.55	24.42	352.0	357.8	1539.71	.5845	423.
160	24.56	36.65	24.76	319.5	326.1	1538.04	.6528	547.
180	23.50	36.75	25.13	284.0	291.2	1536.00	.7146	684.
200	22.07	36.76	25.55	244.0	251.8	1532.71	.7689	832.
220	21.00	36.74	25.84	217.1	225.5	1530.20	.8166	990.
240	19.60	36.56	26.07	194.5	203.3	1526.55	.8595	1158.
260	18.72	36.48	26.24	178.7	187.9	1524.32	.8986	1334.
280	17.80	36.38	26.40	164.0	173.7	1521.89	.9348	1517.
300	17.22	36.25	26.44	160.0	170.1	1520.38	.9691	1708.
320	16.40	36.16	26.56	148.1	158.5	1518.14	1.0020	1905.
360	15.18	35.96	26.69	136.2	147.2	1514.81	1.0631	2318.
400	13.60	35.75	26.87	119.2	130.5	1510.14	1.1190	2754.
440	12.60	35.53	26.90	116.0	127.7	1507.21	1.1716	3213.
480	11.43	35.36	27.00	106.6	118.4	1503.54	1.2206	3691.
520	10.45	35.23	27.07	99.8	111.7	1500.67	1.2664	4189.
560	9.92	35.15	27.10	97.0	109.2	1499.31	1.3106	4704.
600	9.04	35.04	27.16	91.9	103.9	1496.75	1.3536	5237.
640	8.55	34.95	27.17	90.5	102.7	1495.30	1.3947	5787.
680	7.73	34.88	27.24	83.9	95.7	1492.75	1.4342	6352.
720	7.46	34.87	27.27	80.9	93.0	1492.35	1.4719	6934.
760	7.07	34.85	27.31	77.1	89.3	1491.47	1.5083	7530.
800	6.80	34.85	27.35	73.6	86.0	1491.06	1.5435	8140.
840	6.41	34.85	27.40	68.6	80.9	1490.18	1.5769	8764.
880	5.80	34.85	27.48	61.1	72.9	1488.40	1.6076	9401.
920	5.41	34.86	27.54	55.8	67.4	1487.50	1.6355	10050.
960	5.19	34.87	27.57	52.5	64.2	1487.27	1.6618	10709.

R/V VIRGINIA KEY VK 72-13 STD STATION 8
0812 GMT MAY 3 1972
21 40 N 85 30 W 1737 M
SURFACE SAMPLE SALINITY 36.00
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.40	36.02	23.38	451.3	451.3	1541.61	.0000	0.
20	27.40	36.05	23.40	449.1	450.0	1541.96	.0901	9.
40	27.35	36.05	23.42	447.6	449.3	1542.17	.1801	36.
60	26.99	36.05	23.53	436.5	439.1	1541.69	.2689	81.
80	26.07	36.06	23.83	408.0	411.3	1539.93	.3539	143.
100	26.00	36.15	23.92	399.4	403.6	1540.18	.4354	222.
120	25.50	36.33	24.21	371.7	376.6	1539.50	.5134	317.
140	24.90	36.60	24.60	334.7	340.4	1538.64	.5851	427.
160	24.38	36.71	24.84	311.8	318.3	1537.80	.6510	550.
180	23.32	36.75	25.19	278.9	286.1	1535.56	.7114	687.
200	22.38	36.75	25.46	253.1	261.0	1533.50	.7662	834.
220	21.01	36.72	25.82	218.8	227.2	1530.21	.8150	993.
240	20.20	36.65	25.98	203.1	212.0	1528.29	.8589	1160.
260	19.40	36.58	26.14	188.1	197.5	1526.34	.8998	1336.
280	18.62	36.55	26.32	171.2	181.1	1524.43	.9377	1520.
300	17.99	36.45	26.40	163.4	173.8	1522.84	.9732	1711.
320	17.57	36.42	26.48	155.8	166.7	1521.90	1.0073	1909.
360	16.35	36.15	26.57	147.7	159.3	1518.63	1.0724	2325.
400	14.72	35.92	26.76	129.4	141.4	1513.95	1.1323	2766.
440	14.19	35.82	26.80	125.9	138.7	1512.79	1.1884	3230.
480	13.10	35.58	26.84	121.9	135.0	1509.58	1.2426	3716.
520	12.00	35.45	26.96	110.8	124.0	1506.36	1.2934	4224.
560	11.01	35.26	26.99	107.2	120.4	1503.34	1.3419	4751.
600	10.19	35.15	27.06	101.4	114.7	1500.93	1.3884	5297.
640	9.47	35.06	27.11	96.5	109.8	1498.85	1.4338	5861.
680	8.61	35.00	27.17	90.7	104.0	1496.99	1.4763	6443.
720	8.20	34.90	27.19	89.1	102.2	1495.21	1.5182	7042.
760	7.50	34.84	27.24	83.7	96.5	1493.11	1.5578	7658.
800	6.90	34.84	27.33	75.6	88.2	1491.44	1.5945	8288.
840	6.50	34.84	27.38	70.5	82.9	1490.52	1.6288	8933.
880	5.90	34.86	27.48	61.6	73.6	1488.81	1.6606	9591.
920	5.75	34.89	27.52	57.5	69.8	1488.90	1.6895	10261.
960	5.43	34.92	27.58	51.5	63.7	1488.31	1.7162	10942.
1000	5.10	34.93	27.63	47.0	59.0	1487.64	1.7407	11633.

R/V VIRGINIA KEY VK 72-13 STD STATION 9
1048 GMT MAY 3 1972
21 40 N 85 10 W 1829 M
SURFACE SAMPLE SALINITY 35.96
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.22	35.95	23.38	450.8	450.8	1541.14	.0000	0.
20	27.22	35.95	23.38	450.8	451.6	1541.47	.0902	9.
40	27.20	36.02	23.44	445.1	446.8	1541.81	.1801	36.
60	26.95	36.03	23.54	436.1	438.7	1541.54	.2686	81.
80	26.50	36.17	23.78	413.0	416.4	1541.02	.3541	143.
100	26.39	36.36	23.96	396.0	400.2	1541.26	.4358	222.
120	25.40	36.62	24.46	347.8	352.8	1539.51	.5111	317.
140	24.94	36.65	24.63	332.2	338.0	1538.77	.5802	426.
160	24.15	36.75	24.94	302.3	308.8	1537.28	.6449	549.
180	23.20	36.76	25.23	274.9	282.1	1535.26	.7039	683.
200	22.45	36.76	25.44	255.1	263.0	1533.77	.7584	830.
220	21.00	36.74	25.84	217.1	225.5	1530.20	.8073	986.
240	20.06	36.65	26.04	198.0	206.9	1527.74	.8505	1152.
260	19.26	36.59	26.18	184.4	193.8	1526.01	.8906	1326.
280	18.60	36.52	26.30	172.9	182.8	1524.34	.9283	1508.
300	18.01	36.44	26.39	164.6	175.0	1522.89	.9640	1697.
320	17.58	36.38	26.45	158.9	169.8	1521.89	.9985	1893.
360	16.67	36.26	26.53	151.3	163.3	1520.31	1.0652	2306.
400	15.75	36.08	26.65	139.6	152.2	1517.36	1.1284	2745.
440	14.68	35.89	26.75	130.8	144.0	1514.43	1.1879	3208.
480	13.80	35.74	26.82	123.9	137.6	1512.07	1.2441	3695.
520	12.58	35.55	26.92	114.2	127.9	1508.45	1.2970	4203.
560	11.54	35.37	26.98	108.4	122.2	1505.32	1.3475	4732.
600	10.78	35.25	27.03	104.0	117.9	1503.16	1.3950	5281.
640	9.65	35.13	27.14	93.8	107.4	1499.53	1.4407	5848.
660	9.15	35.03	27.14	93.7	107.4	1498.28	1.4840	6433.
720	8.50	34.96	27.19	89.1	102.6	1496.42	1.5254	7035.
760	7.75	34.93	27.28	80.5	93.7	1494.19	1.5647	7653.
800	7.13	34.88	27.33	75.7	88.6	1492.39	1.6014	8286.
840	6.72	34.86	27.37	71.8	84.7	1491.41	1.6362	8934.
880	6.47	34.88	27.42	67.1	80.1	1491.10	1.6690	9595.
920	6.17	34.90	27.47	61.9	74.9	1490.59	1.6998	10269.
960	5.40	34.93	27.59	50.4	62.6	1488.20	1.7270	10954.

R/V VIRGINIA KEY VK 72-13 STD STATION 10
1330 GMT MAY 3 1972
21 50 N 85 05 W 1518 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.40	36.05	23.40	449.1	449.1	1541.63	.0000	0.
20	27.40	36.05	23.40	449.1	450.0	1541.96	.0899	9.
40	27.10	36.10	23.53	436.3	438.0	1541.66	.1787	36.
60	26.42	35.95	23.64	426.4	428.9	1540.31	.2654	80.
80	26.40	36.15	23.80	411.4	414.8	1540.77	.3498	142.
100	26.38	36.24	23.87	404.4	408.5	1541.13	.4321	220.
120	26.02	36.35	24.07	385.6	390.6	1540.72	.5120	314.
140	25.25	36.55	24.46	348.5	354.3	1539.42	.5865	424.
160	24.40	36.64	24.78	317.4	323.9	1537.79	.6543	548.
180	23.33	36.77	25.20	277.8	285.0	1535.60	.7152	685.
200	21.80	36.76	25.63	236.8	244.5	1532.01	.7682	834.
220	21.20	36.74	25.78	222.4	230.8	1530.74	.8157	992.
240	20.40	36.67	25.95	206.7	215.7	1528.85	.8603	1160.
260	19.95	36.65	26.05	196.7	206.4	1527.92	.9025	1336.
280	18.61	36.57	26.29	174.3	184.3	1524.99	.9416	1520.
300	18.50	36.55	26.35	168.3	178.9	1524.41	.9779	1712.
320	18.01	36.47	26.41	162.4	173.5	1523.24	1.0132	1911.
360	17.40	36.39	26.50	154.0	166.2	1522.02	1.0815	2330.
400	16.84	36.31	26.57	147.0	160.3	1520.91	1.1467	2776.
440	15.02	35.95	26.72	133.5	146.9	1515.58	1.2086	3247.
480	13.35	35.73	26.90	115.7	129.1	1510.58	1.2636	3742.
520	12.35	35.55	26.97	109.9	123.5	1507.67	1.3138	4257.
560	10.81	35.33	27.09	98.6	111.7	1502.72	1.3607	4792.
600	10.12	35.24	27.14	93.6	106.9	1500.79	1.4041	5345.
640	9.55	35.15	27.16	91.1	104.5	1499.26	1.4465	5916.
680	8.85	35.05	27.20	87.6	101.0	1497.20	1.4874	6502.
720	8.20	34.99	27.26	82.4	95.6	1495.33	1.5267	7105.
760	8.00	34.97	27.27	81.0	94.7	1495.20	1.5649	7724.
800	7.53	34.95	27.32	75.9	89.5	1494.02	1.6020	8357.
840	7.07	34.93	27.37	71.2	84.7	1492.87	1.6369	9005.
880	6.72	34.90	27.40	68.8	82.3	1492.11	1.6703	9666.
920	5.95	34.91	27.51	58.4	71.1	1489.73	1.7009	10341.
960	5.48	34.93	27.58	51.4	63.7	1488.52	1.7277	11026.

R/V VIRGINIA KEY VK 72-13 STD STATION 11
1730 GMT MAY 4 1972
21 18 N 86 33 W 91 M
SURFACE SAMPLE SALINITY 36.07
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.42	36.10	23.43	446.2	446.2	1541.72	.0000	0.
20	27.20	36.10	23.50	439.4	440.2	1541.56	.0886	9.
40	24.10	36.53	24.79	316.7	318.4	1535.03	.1645	34.
60	20.40	36.45	25.78	222.6	224.9	1525.75	.2188	73.

R/V VIRGINIA KEY VK 72-13 STD STATION 12
1842 GMT MAY 4 1972
21 22 N 86 22 W 457 M
SURFACE SAMPLE SALINITY 36.01
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.58	36.04	23.33	455.4	455.4	1542.02	.0000	0.
20	27.43	36.04	23.38	450.8	451.6	1542.02	.0907	9.
40	27.20	36.04	23.46	443.7	445.4	1541.83	.1804	36.
60	26.30	36.25	23.90	401.2	403.7	1540.31	.2653	81.
80	24.20	36.57	24.79	316.7	320.0	1535.96	.3377	141.
100	20.40	36.70	25.97	204.6	208.3	1526.62	.3905	214.
120	18.67	36.49	26.26	176.8	181.0	1521.94	.4294	296.
140	17.50	36.36	26.45	158.5	163.3	1518.75	.4639	385.
160	17.21	36.34	26.51	153.3	158.7	1518.19	.4961	481.
180	16.60	36.25	26.59	146.0	151.9	1516.60	.5271	584.
200	15.77	36.10	26.66	138.6	145.0	1514.23	.5568	692.
220	15.41	36.05	26.71	134.5	141.4	1513.38	.5855	806.
240	14.75	35.94	26.77	128.6	135.9	1511.50	.6132	926.
260	14.01	35.76	26.79	126.6	134.2	1509.25	.6402	1051.
280	13.40	35.67	26.85	121.1	129.0	1507.47	.6665	1182.
300	12.90	35.62	26.91	115.1	123.3	1506.07	.6917	1318.
320	12.19	35.48	26.94	112.1	120.4	1503.83	.7161	1459.
360	11.67	35.38	26.97	110.0	119.0	1502.57	.7639	1755.
400	10.88	35.26	27.02	104.9	114.4	1500.31	.8105	2070.

R/V VIRGINIA KEY VK 72-13 STD STATION 13
2036 GMT MAY 4 1972
21 25 N 86 11 W 1463 M
SURFACE SAMPLE SALINITY 36.08
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.70	36.14	23.37	452.0	452.0	1542.38	.0000	0.
20	27.60	36.12	23.39	450.3	451.1	1542.46	.0903	9.
40	27.00	35.96	23.46	443.3	445.0	1541.31	.1799	36.
60	26.10	36.17	23.91	401.0	403.5	1539.78	.2648	81.
80	25.50	36.35	24.23	370.2	373.5	1538.87	.3425	141.
100	24.40	36.65	24.79	316.7	320.7	1536.83	.4119	217.
120	23.10	36.73	25.24	274.3	279.1	1534.02	.4719	305.
140	21.70	36.73	25.63	236.3	241.7	1530.76	.5240	405.
160	19.10	36.55	26.20	182.9	188.6	1523.86	.5670	514.
180	17.80	36.45	26.45	158.9	165.2	1520.36	.6024	631.
200	17.20	36.32	26.50	154.5	161.2	1518.78	.6350	754.
220	16.20	36.24	26.67	137.8	144.9	1516.01	.6656	884.
240	15.70	36.13	26.70	134.9	142.5	1514.68	.6944	1020.
260	15.00	35.97	26.74	131.6	139.6	1512.64	.7226	1162.
280	14.20	35.91	26.86	119.5	127.7	1510.35	.7493	1309.
300	13.60	35.72	26.84	121.4	129.9	1508.50	.7751	1462.
320	13.00	35.60	26.88	118.5	127.2	1506.70	.8008	1619.
360	11.70	35.44	27.01	106.1	115.1	1502.75	.8484	1949.
400	11.12	35.34	27.04	103.2	112.8	1501.25	.8936	2298.
440	10.18	35.17	27.07	99.8	109.6	1498.35	.9383	2664.
480	9.22	35.05	27.14	93.3	103.1	1495.35	.9817	3048.
520	8.59	34.96	27.17	90.4	100.4	1493.54	1.0230	3449.
560	8.01	34.94	27.25	83.4	93.5	1491.97	1.0620	3866.
600	7.68	34.92	27.25	83.1	93.7	1492.09	1.0995	4299.
640	7.19	34.86	27.30	78.0	88.4	1490.01	1.1359	4746.
680	6.79	34.85	27.35	73.5	84.0	1489.08	1.1706	5207.
720	6.43	34.85	27.40	68.9	79.5	1488.32	1.2033	5682.
760	6.00	34.84	27.45	64.3	74.8	1487.24	1.2342	6169.
800	5.76	34.85	27.49	60.6	71.3	1486.95	1.2634	6669.
840	5.60	34.86	27.51	58.0	68.9	1486.97	1.2915	7180.
880	5.35	34.86	27.54	55.1	66.1	1486.61	1.3183	7702.
920	5.19	34.86	27.56	53.3	64.4	1486.61	1.3443	8235.
960	5.01	34.86	27.58	51.3	62.5	1486.53	1.3695	8777.

R/V VIRGINIA KEY   VK 72-13   STD STATION   14
2254 GMT   MAY 7 1972
21 18 N   86 31 W   146 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.73	36.12	23.35	454.3	454.3	1542.42	.0000	0.
20	27.40	36.13	23.46	443.4	444.2	1542.03	.0899	9.
40	26.90	36.17	23.65	425.2	426.8	1541.27	.1770	36.
60	19.00	36.25	25.99	202.2	204.3	1521.69	.2401	77.

R/V VIRGINIA KEY VK 72-13 STD STATION 15
2348 GMT MAY 7 1972
21 20 N 86 26 W 283 M
SURFACE SAMPLE SALINITY 36.05
SURFACE SAMPLE TEMPERATURE 27.6

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.60	36.05	23.34	455.3	455.3	1542.08	.0000	0.
20	25.90	36.14	23.95	397.2	398.0	1538.64	.0853	9.
40	24.20	36.22	24.52	341.9	343.5	1535.00	.1595	33.
60	22.50	36.67	25.36	262.1	264.5	1531.48	.2203	71.
80	20.80	36.74	25.89	211.9	215.0	1527.42	.2682	120.
100	19.10	36.60	26.24	179.2	182.9	1522.94	.3080	177.
120	17.38	36.36	26.48	155.7	159.8	1518.07	.3423	243.
140	16.20	36.23	26.66	138.5	143.1	1514.72	.3726	314.
160	15.25	36.08	26.77	128.9	133.9	1511.95	.4003	391.

R/V VIRGINIA KEY VK 72-13 STD STATION 16
1154 GMT MAY 8 1972
21 41 N 85 39 W 2103
SURFACE SAMPLE SALINITY 36.05
SURFACE SAMPLE TEMPERATURE 27.8

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.00	36.15	23.28	460.6	460.6	1543.04	.0000	0.
20	27.90	36.15	23.31	457.5	458.3	1543.15	.0919	9.
40	27.80	36.10	23.31	458.0	459.7	1543.21	.1837	37.
60	27.00	36.10	23.57	433.2	435.8	1541.76	.2732	82.
80	26.50	36.16	23.77	413.7	417.1	1541.01	.3585	146.
100	26.00	36.25	24.00	392.2	396.4	1540.27	.4399	225.
120	25.40	36.51	24.38	355.8	360.7	1539.42	.5156	321.
140	25.10	36.60	24.54	340.5	346.3	1539.11	.5863	431.
160	23.90	36.68	24.96	300.3	306.7	1536.61	.6516	555.
180	22.60	36.73	25.38	260.5	267.6	1533.72	.7090	691.
200	21.20	36.65	25.71	228.9	236.5	1530.33	.7594	838.
220	19.70	36.64	26.11	191.2	199.3	1526.58	.8030	994.
240	19.00	36.57	26.24	179.0	187.6	1524.88	.8417	1159.
260	18.00	36.44	26.39	164.4	173.4	1522.21	.8778	1331.
280	17.30	36.37	26.51	153.1	162.6	1520.41	.9114	1509.
300	16.80	36.33	26.60	144.7	154.6	1519.20	.9431	1695.
320	16.20	36.17	26.62	142.9	153.2	1517.55	.9739	1887.
360	14.70	35.95	26.79	126.8	137.7	1513.28	1.0320	2288.
400	13.20	35.75	26.95	111.3	122.4	1508.82	1.0850	2711.
440	12.20	35.55	27.00	107.1	118.5	1505.87	1.1336	3155.
480	11.10	35.37	27.06	100.6	112.1	1502.50	1.1808	3618.
520	9.90	35.21	27.15	92.3	103.6	1498.67	1.2241	4099.
560	9.20	35.08	27.17	90.8	102.2	1496.60	1.2650	4597.
600	8.40	34.97	27.21	86.8	98.1	1494.12	1.3044	5111.
640	7.70	34.94	27.29	79.0	90.2	1492.07	1.3420	5640.
680	7.50	34.91	27.30	78.5	90.0	1491.91	1.3778	6184.
720	7.00	34.90	27.36	72.5	84.0	1490.61	1.4131	6743.
760	6.50	34.86	27.40	69.0	80.3	1489.25	1.4459	7314.

R/V VIRGINIA KEY VK 72-13 STD STATION 17
1700 GMT MAY 8 1972
21 34 N 86 09 W 1737 M
SURFACE SAMPLE SALINITY 36.06
SURFACE SAMPLE TEMPERATURE 27.9

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.83	36.09	23.29	459.6	459.6	1542.62	.0000	0.
20	27.60	36.05	23.34	455.3	456.2	1542.40	.0916	9.
40	26.50	36.00	23.65	425.2	426.9	1540.22	.1799	36.
60	26.03	36.25	23.99	393.1	395.6	1539.69	.2621	81.
80	25.20	36.58	24.49	344.9	348.2	1538.36	.3365	140.
100	23.99	36.66	24.92	304.2	308.3	1535.84	.4022	214.
120	23.10	36.71	25.22	275.7	280.5	1534.00	.4610	301.
140	20.50	36.67	25.92	209.3	214.6	1527.51	.5106	398.
160	19.43	36.65	26.19	183.7	189.6	1524.87	.5510	504.
180	18.62	36.46	26.25	177.7	184.1	1522.73	.5883	618.
200	17.40	36.38	26.49	154.7	161.5	1519.43	.6229	739.
220	16.70	36.26	26.57	147.5	154.8	1517.55	.6545	867.
240	15.61	36.08	26.68	136.6	144.2	1514.35	.6844	1001.
260	15.25	36.05	26.74	131.1	139.1	1513.52	.7128	1140.
280	14.63	35.95	26.80	125.4	133.8	1511.77	.7401	1286.
300	14.15	35.85	26.83	122.9	131.6	1510.44	.7666	1436.
320	13.40	35.70	26.87	118.9	127.9	1508.15	.7926	1592.
360	12.08	35.52	27.00	107.1	116.4	1504.15	.8417	1919.
400	11.28	35.37	27.03	103.4	113.2	1501.78	.8873	2265.
440	10.25	35.25	27.12	95.0	104.9	1498.70	.9316	2629.
480	9.87	35.17	27.13	94.7	105.1	1497.87	.9735	3010.
520	9.58	35.16	27.17	90.8	101.8	1497.45	1.0148	3408.
560	8.95	35.03	27.17	90.6	101.7	1495.61	1.0551	3822.
600	8.20	34.95	27.22	85.4	96.4	1493.35	1.0941	4251.
640	7.58	34.92	27.29	78.9	89.8	1491.59	1.1312	4697.
680	7.02	34.88	27.34	74.2	85.1	1490.02	1.1665	5156.
720	6.57	34.87	27.40	69.1	80.0	1488.89	1.1996	5629.
760	6.19	34.85	27.43	65.9	76.7	1488.01	1.2309	6116.
800	5.79	34.85	27.48	61.0	71.7	1487.07	1.2606	6614.
840	5.57	34.85	27.51	58.4	69.3	1486.83	1.2886	7124.

R/V VIRGINIA KEY VK 72-13 STD STATION 18
2036 GMT MAY 8 1972
21 31 N 86 20 W 823 M
SURFACE SAMPLE SALINITY 36.08
SURFACE SAMPLE TEMPERATURE 28.0

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.00	36.12	23.26	462.8	462.8	1543.01	.0000	0.
20	27.38	36.12	23.46	443.5	444.3	1541.98	.0907	9.
40	27.03	36.13	23.58	432.0	433.7	1541.53	.1785	36.
60	26.06	36.40	24.09	383.2	385.8	1539.89	.2605	80.
80	23.18	36.50	25.04	293.1	296.3	1533.38	.3287	139.
100	20.20	36.55	25.91	210.3	214.0	1525.94	.3797	210.
120	19.90	36.55	25.99	202.7	207.2	1525.44	.4218	290.
140	17.40	36.35	26.47	156.9	161.7	1518.44	.4587	378.
160	16.60	36.27	26.60	144.5	149.8	1516.29	.4898	473.
180	16.18	36.23	26.67	137.6	143.5	1515.24	.5192	574.
200	15.79	36.15	26.70	135.4	141.8	1514.34	.5477	680.
220	15.32	36.07	26.74	131.1	138.0	1513.12	.5757	793.
240	14.47	35.94	26.83	122.8	130.0	1510.61	.6025	910.
260	13.69	35.81	26.85	120.6	128.1	1508.91	.6283	1034.
280	13.40	35.74	26.90	116.0	123.9	1507.55	.6535	1162.
300	12.78	35.66	26.97	109.9	118.0	1505.72	.6777	1295.
320	12.26	35.55	26.98	108.2	116.6	1504.15	.7011	1433.
360	11.40	35.42	27.05	102.2	111.1	1501.68	.7471	1722.
400	10.80	35.33	27.09	98.4	107.8	1500.11	.7910	2030.

R/V VIRGINIA KEY VK 72-13 STD STATION 19
0148 GMT MAY 9 1972
21 19 N 86 31 W 110 M
SURFACE SAMPLE SALINITY 36.11
SURFACE SAMPLE TEMPERATURE 27.8

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.78	36.15	23.35	453.7	453.7	1542.56	.0000	0.
20	27.50	36.20	23.48	441.5	442.3	1542.31	.0896	9.
40	26.99	36.20	23.65	425.8	427.4	1541.50	.1766	36.
60	25.52	36.45	24.30	363.6	366.1	1538.68	.2559	79.
80	19.85	36.35	25.85	216.0	218.9	1524.48	.3144	136.

R/V VIRGINIA KEY VK 72-13 STD STATION 20
0318 GMT MAY 9 1972
21 23 N 86 22 W 494 M
SURFACE SAMPLE SALINITY 36.14
SURFACE SAMPLE TEMPERATURE 27.4

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.38	36.09	23.44	445.6	445.6	1541.63	.0000	0.
20	27.38	36.08	23.43	446.4	447.2	1541.94	.0893	9.
40	26.42	36.14	23.78	412.8	414.4	1540.16	.1754	35.
60	25.92	36.18	23.97	394.9	397.4	1539.37	.2566	79.
80	24.61	36.43	24.56	338.5	341.8	1536.83	.3305	137.
100	22.86	36.65	25.24	273.4	277.4	1533.02	.3925	210.
120	21.10	36.63	25.73	227.7	232.3	1528.76	.4434	293.
140	19.07	36.47	26.14	187.9	193.0	1523.38	.4860	386.
160	18.27	36.43	26.32	171.5	177.1	1521.38	.5230	487.
180	17.20	36.28	26.47	157.4	163.5	1518.42	.5570	595.
200	16.61	36.17	26.52	152.0	158.6	1516.87	.5892	710.
220	15.66	36.05	26.65	139.9	146.8	1514.15	.6198	831.
240	15.21	35.96	26.68	136.8	144.2	1512.98	.6489	957.
260	14.76	35.94	26.77	128.8	136.7	1511.85	.6770	1090.
280	14.28	35.80	26.78	127.5	135.7	1510.23	.7042	1228.

R/V VIRGINIA KEY VK 72-13 STD STATION 21
0536 GMT MAY 9 1972
21 26 N 86 11 W 1646 M
SURFACE SAMPLE SALINITY 36.11
SURFACE SAMPLE TEMPERATURE 27.5

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.60	36.10	23.37	451.7	451.7	1542.12	.0000	0.
20	27.60	36.05	23.34	455.3	456.2	1542.40	.0908	9.
40	26.99	36.09	23.56	433.7	435.3	1541.40	.1799	36.
60	26.60	36.17	23.75	416.0	418.5	1540.92	.2653	81.
80	25.66	36.25	24.04	388.1	391.4	1539.62	.3463	142.
100	25.00	36.60	24.57	337.6	341.7	1538.23	.4196	218.
120	23.48	36.66	25.07	289.9	294.7	1534.91	.4833	309.
140	21.85	36.75	25.61	238.8	244.3	1531.16	.5372	411.
160	21.20	36.65	25.71	228.9	235.0	1529.69	.5851	523.
180	20.10	36.55	25.93	207.8	214.5	1526.96	.6300	645.
200	18.32	36.45	26.32	171.2	178.3	1522.19	.6693	774.
220	17.88	36.35	26.35	168.1	175.7	1521.14	.7047	912.
240	16.80	36.25	26.54	150.5	158.4	1518.16	.7381	1056.
260	16.12	36.06	26.55	149.2	157.5	1516.22	.7697	1207.
280	15.53	36.00	26.64	140.7	149.5	1514.66	.8004	1364.
300	14.43	35.86	26.78	127.8	136.7	1511.35	.8290	1527.
320	13.84	35.77	26.83	122.5	131.7	1509.67	.8559	1695.
360	12.75	35.55	26.89	117.4	127.1	1506.45	.9068	2048.
400	11.59	35.37	26.97	109.3	119.2	1502.92	.9558	2421.
440	10.60	35.27	27.04	102.8	113.1	1500.68	1.0016	2812.
480	9.82	35.14	27.11	96.1	106.5	1497.65	1.0463	3222.
520	9.20	35.05	27.14	93.0	103.6	1495.92	1.0890	3649.
560	8.48	34.96	27.19	88.8	99.4	1493.77	1.1296	4093.
600	7.95	34.92	27.24	84.0	94.8	1492.36	1.1681	4552.
640	7.58	34.88	27.26	81.8	92.8	1491.54	1.2055	5027.
680	7.20	34.86	27.30	78.1	89.2	1490.69	1.2418	5516.
720	6.61	34.84	27.37	71.9	82.8	1489.01	1.2765	6020.
760	6.23	34.84	27.42	67.1	78.0	1488.16	1.3087	6537.
800	5.99	34.85	27.46	63.4	74.5	1487.86	1.3389	7067.
840	5.60	34.85	27.51	58.8	69.7	1486.95	1.3679	7608.
880	5.42	34.85	27.53	56.7	67.8	1486.87	1.3954	8161.
920	5.27	34.86	27.55	54.2	65.5	1486.93	1.4222	8724.
960	5.07	34.86	27.58	52.0	63.3	1486.77	1.4480	9298.

R/V VIRGINIA KEY VK 72-13 STD STATION 22
0812 GMT MAY 9 1972
21 29 N 86 00 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE 27.7

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.66	36.13	23.38	451.4	451.4	1542.28	.0000	0.
20	27.69	36.12	23.36	453.1	453.9	1542.66	.0905	9.
40	27.48	36.05	23.37	451.6	453.3	1542.46	.1813	36.
60	27.18	36.04	23.46	443.1	445.6	1542.11	.2712	81.
80	26.04	36.25	23.98	393.4	396.8	1540.03	.3554	144.
100	25.46	36.47	24.35	358.6	362.8	1539.06	.4313	223.
120	24.96	36.56	24.57	337.6	342.5	1538.28	.5019	316.
140	23.79	36.65	24.97	299.3	305.0	1535.99	.5666	423.
160	22.60	36.69	25.35	263.4	269.7	1533.37	.6241	542.
180	21.69	36.70	25.61	238.2	245.1	1531.35	.6756	672.
200	20.70	36.66	25.86	215.2	222.7	1529.01	.7224	812.
220	19.99	36.58	25.99	202.8	211.0	1527.33	.7657	961.
240	18.57	36.38	26.20	182.3	190.8	1523.48	.8059	1118.
260	17.42	36.30	26.43	161.0	169.8	1520.38	.8420	1283.
280	16.77	36.24	26.54	150.5	159.8	1518.70	.8749	1454.
300	16.24	36.13	26.58	146.7	156.4	1517.31	.9065	1632.
320	15.83	36.05	26.61	143.5	153.7	1516.28	.9375	1817.
360	13.96	35.74	26.78	127.1	137.5	1510.67	.9951	2203.
400	12.62	35.54	26.91	115.7	126.3	1506.64	1.0479	2612.
440	11.45	35.31	26.95	111.2	122.0	1503.01	1.0971	3041.
480	10.71	35.25	27.04	102.8	113.9	1500.98	1.1438	3489.
520	9.99	35.15	27.09	98.2	109.5	1498.92	1.1891	3956.
560	9.12	35.01	27.13	94.7	106.0	1496.21	1.2322	4440.
600	8.41	34.95	27.19	88.5	99.7	1494.13	1.2733	4942.
640	8.14	34.91	27.20	87.5	99.1	1493.71	1.3131	5459.
680	7.57	34.85	27.24	83.9	95.5	1492.10	1.3520	5992.
720	7.00	34.82	27.30	78.5	89.9	1490.51	1.3890	6540.
760	6.53	34.82	27.36	72.4	83.7	1489.31	1.4235	7103.
800	6.17	34.82	27.41	67.9	79.2	1488.54	1.4561	7679.

R/V VIRGINIA KEY   VK 72-13   STD STATION   23
1036 GMT   MAY 9 1972
21 33 N   85 50 W   0 M
SURFACE SAMPLE SALINITY 36.13
SURFACE SAMPLE TEMPERATURE 27.7

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.70	36.15	23.38	451.3	451.3	1542.38	.0000	0.
20	27.70	36.14	23.37	452.0	452.8	1542.70	.0904	9.
40	27.52	36.09	23.39	450.0	451.7	1542.58	.1809	36.
60	26.60	36.14	23.66	424.3	426.8	1541.35	.2687	81.
80	26.50	36.25	23.84	407.3	410.6	1541.09	.3524	143.
100	25.94	36.33	24.08	384.7	388.9	1540.20	.4324	222.
120	25.38	36.46	24.35	358.8	363.7	1539.33	.5076	316.
140	24.90	36.55	24.56	338.3	344.0	1538.59	.5784	424.
160	23.23	36.70	25.17	280.0	286.4	1534.97	.6415	546.
180	22.52	36.77	25.43	255.5	262.6	1533.55	.6964	680.
200	21.40	36.70	25.70	230.5	238.2	1530.91	.7464	824.
220	20.35	36.65	25.94	206.9	215.1	1528.37	.7918	978.
240	19.15	36.51	26.15	187.0	195.6	1525.25	.8328	1141.
260	18.58	36.46	26.26	176.8	185.9	1523.91	.8710	1311.
280	18.07	36.44	26.37	166.0	175.8	1522.74	.9072	1489.
300	17.21	36.32	26.49	154.7	164.8	1520.42	.9412	1674.
320	16.50	36.14	26.52	151.7	162.2	1518.43	.9739	1865.
360	15.60	36.05	26.66	138.6	149.8	1516.21	1.0359	2267.
400	13.95	35.78	26.82	124.0	135.5	1511.32	1.0917	2693.
440	12.60	35.56	26.92	113.8	125.5	1507.24	1.1434	3140.
480	11.50	35.38	27.00	106.9	118.8	1503.91	1.1920	3607.
520	10.60	35.27	27.08	99.4	111.4	1501.26	1.2382	4093.
560	9.62	35.15	27.15	92.2	104.1	1498.23	1.2816	4597.
600	8.77	35.05	27.21	86.4	98.1	1495.61	1.3223	5118.
640	8.20	34.95	27.22	85.4	97.1	1493.99	1.3617	5655.
680	7.65	34.92	27.28	79.8	91.6	1492.50	1.3990	6207.
720	7.41	34.90	27.30	78.0	90.1	1492.20	1.4352	6774.
760	6.83	34.85	27.34	74.0	85.8	1490.53	1.4704	7355.
800	6.44	34.85	27.40	69.0	80.8	1489.65	1.5039	7950.
840	6.00	34.86	27.46	62.8	74.4	1488.56	1.5350	8558.

R/V VIRGINIA KEY VK 72-13 STD STATION 24
1312 GMT MAY 9 1972
21 41 N 85 29 W 2012 M
SURFACE SAMPLE SALINITY 36.03
SURFACE SAMPLE TEMPERATURE 27.9

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.80	36.06	23.28	460.8	460.8	1542.52	.0000	0.
20	27.80	36.15	23.35	454.4	455.2	1542.93	.0916	9.
40	27.52	36.18	23.46	443.5	445.2	1542.66	.1816	36.
60	26.44	36.29	23.89	402.6	405.1	1540.66	.2667	81.
80	26.20	36.34	24.00	391.8	395.1	1540.48	.3467	143.
100	25.83	36.37	24.14	378.6	382.7	1539.98	.4245	220.
120	25.77	36.44	24.21	371.7	376.7	1540.22	.5004	312.
140	25.40	36.55	24.41	352.9	358.7	1539.78	.5740	420.
160	25.05	36.63	24.58	336.9	343.5	1539.34	.6442	542.
180	24.30	36.69	24.85	310.9	318.2	1537.92	.7103	677.
200	22.80	36.75	25.34	264.6	272.5	1534.57	.7694	825.
220	21.10	36.69	25.77	223.4	231.7	1530.43	.8198	984.
240	19.90	36.65	26.06	195.5	204.3	1527.46	.8634	1152.
260	19.05	36.52	26.19	183.8	193.1	1525.30	.9032	1329.
280	18.30	36.46	26.33	170.0	179.9	1523.42	.9405	1513.
300	17.75	36.40	26.42	161.4	171.7	1522.09	.9756	1705.
320	16.96	36.28	26.52	151.9	162.6	1519.96	1.0091	1903.
360	15.88	36.10	26.64	141.0	152.4	1517.13	1.0718	2320.
400	14.33	35.90	26.83	122.9	134.7	1512.68	1.1303	2760.
440	13.15	35.70	26.92	114.0	126.2	1509.24	1.1829	3223.
480	12.20	35.51	26.96	110.0	122.5	1506.47	1.2324	3706.
520	10.95	35.34	27.07	100.2	112.6	1502.58	1.2792	4208.
560	9.80	35.16	27.13	94.3	106.4	1498.89	1.3234	4729.
600	9.00	35.07	27.19	88.4	100.4	1496.49	1.3657	5267.
640	8.35	35.00	27.24	83.9	95.8	1494.62	1.4050	5821.
680	7.97	34.98	27.28	79.9	92.1	1493.80	1.4425	6391.
720	7.48	34.91	27.30	78.2	90.4	1492.48	1.4788	6975.
760	6.90	34.88	27.36	72.7	84.6	1490.84	1.5136	7573.
800	6.60	34.88	27.40	68.8	80.9	1490.32	1.5467	8185.
840	6.08	34.89	27.48	61.5	73.3	1488.92	1.5782	8811.
880	5.85	34.91	27.52	57.2	69.2	1488.68	1.6067	9448.
920	5.59	34.93	27.57	52.7	64.7	1488.32	1.6330	10096.

R/V VIRGINIA KEY VK 72-13 STD STATION 25
1524 GMT MAY 9 1972
21 46 N 85 17 W 1463 M
SURFACE SAMPLE SALINITY 36.21
SURFACE SAMPLE TEMPERATURE 28.2

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.03	36.25	23.35	454.4	454.4	1543.19	.0000	0.
20	27.90	36.24	23.38	451.0	451.9	1543.22	.0906	9.
40	27.87	36.24	23.39	450.1	451.8	1543.48	.1810	36.
60	27.40	36.19	23.51	439.1	441.6	1542.73	.2703	81.
80	26.80	36.25	23.74	416.4	419.7	1541.77	.3565	144.
100	26.40	36.27	23.89	402.8	407.0	1541.20	.4391	224.
120	25.60	36.44	24.20	372.6	377.6	1540.29	.5176	319.
140	25.50	36.57	24.39	354.4	360.2	1540.03	.5914	430.
160	24.70	36.66	24.71	324.6	331.1	1538.53	.6605	555.
180	23.50	36.75	25.13	284.0	291.2	1536.00	.7227	694.
200	22.37	36.76	25.47	252.1	260.0	1533.48	.7779	844.
220	20.93	36.74	25.86	215.3	223.7	1530.02	.8262	1004.
240	20.25	36.67	25.99	202.9	211.8	1528.44	.8698	1174.
260	19.57	36.61	26.12	190.1	199.6	1526.84	.9109	1352.
280	18.78	36.54	26.27	175.8	185.8	1524.87	.9495	1538.
300	18.07	36.45	26.38	165.3	175.7	1523.07	.9856	1731.
320	17.55	36.40	26.47	156.7	167.7	1521.82	1.0199	1932.
360	16.40	36.23	26.62	143.0	154.7	1518.86	1.0845	2353.
400	14.80	36.00	26.80	125.3	137.3	1514.29	1.1440	2799.
440	13.21	35.74	26.94	112.3	124.5	1509.49	1.1970	3267.
480	12.00	35.53	27.02	104.9	117.2	1505.81	1.2457	3756.
520	11.39	35.43	27.06	101.3	114.0	1504.23	1.2923	4263.
560	10.80	35.35	27.10	96.9	110.0	1502.71	1.3372	4789.
600	9.88	35.17	27.12	94.9	107.9	1499.84	1.3810	5333.
640	9.04	35.10	27.21	86.8	99.7	1497.32	1.4223	5894.
680	8.19	35.01	27.27	80.8	93.3	1494.67	1.4608	6470.
720	7.32	34.92	27.33	75.3	87.2	1491.88	1.4977	7062.
760	7.00	34.92	27.38	71.0	83.1	1491.29	1.5316	7668.
800	6.60	34.92	27.43	65.8	77.9	1490.37	1.5638	8287.
840	6.20	34.92	27.48	60.8	72.8	1489.44	1.5941	8919.
880	5.96	34.93	27.52	57.1	69.2	1489.15	1.6223	9562.
920	5.85	34.95	27.55	54.2	66.8	1489.39	1.6494	10216.
960	5.50	34.95	27.60	50.1	62.5	1488.63	1.6752	10881.

R/V VIRGINIA KEY VK 72-13 STD STATION 26
1912 GMT MAY 9 1972
21 50 N 85 05 W 1097 M
SURFACE SAMPLE SALINITY 36.20
SURFACE SAMPLE TEMPERATURE 28.6

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.00	36.15	23.28	460.6	460.6	1543.04	.0000	0.
20	27.93	36.11	23.27	461.3	462.2	1543.18	.0923	9.
40	27.70	36.11	23.35	454.1	455.8	1543.00	.1841	37.
60	27.39	36.05	23.40	448.8	451.4	1542.58	.2748	83.
80	26.82	35.91	23.48	441.4	444.7	1541.51	.3644	147.
100	26.06	36.00	23.79	412.0	416.1	1540.18	.4505	228.
120	25.85	36.20	24.01	391.4	396.3	1540.20	.5317	326.
140	25.55	36.45	24.29	364.5	370.3	1540.04	.6084	440.
160	24.59	36.59	24.69	326.4	333.0	1538.21	.6787	569.
180	23.60	36.66	25.04	293.2	300.5	1536.17	.7421	711.
200	22.50	36.71	25.39	259.2	267.1	1533.77	.7988	865.
220	21.15	36.66	25.73	226.8	235.2	1530.53	.8491	1030.
240	20.52	36.64	25.89	212.0	221.0	1529.15	.8947	1204.
260	19.80	36.58	26.04	198.0	207.6	1527.45	.9375	1388.
280	19.15	36.50	26.15	187.7	197.8	1525.88	.9781	1579.
300	18.30	36.44	26.32	171.5	182.0	1523.73	1.0161	1779.
320	17.99	36.39	26.36	167.8	178.8	1523.10	1.0521	1985.
360	16.17	36.22	26.66	138.6	150.2	1518.15	1.1183	2420.
400	14.90	35.95	26.74	131.0	143.1	1514.55	1.1790	2879.
440	14.03	35.79	26.81	124.8	137.5	1512.23	1.2357	3362.
480	13.31	35.69	26.88	117.9	131.2	1510.41	1.2894	3867.
520	12.33	35.48	26.92	114.7	128.2	1507.52	1.3413	4394.
560	11.86	35.41	26.95	111.2	125.3	1506.48	1.3913	4940.
600	10.43	35.21	27.06	101.0	114.6	1501.87	1.4393	5506.
640	9.60	35.06	27.09	98.5	112.0	1499.33	1.4844	6091.
680	8.80	34.99	27.16	91.3	104.5	1496.93	1.5275	6694.
720	8.20	34.95	27.22	85.4	98.6	1495.28	1.5680	7313.
760	7.90	34.95	27.27	81.1	94.6	1494.79	1.6064	7948.
800	7.42	34.94	27.33	75.2	88.6	1493.59	1.6430	8598.
840	7.22	34.93	27.35	73.2	86.9	1493.45	1.6779	9262.
880	6.87	34.88	27.36	72.3	86.0	1492.67	1.7125	9940.
920	6.24	34.89	27.46	63.5	76.7	1490.86	1.7450	10632.

R/V VIRGINIA KEY   VK 72-13   STD STATION   27
2042 GMT   MAY 9 1972
21 49 N   85 10 W   0 M
SURFACE SAMPLE SALINITY 36.16
SURFACE SAMPLE TEMPERATURE 28.7

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.20	36.20	23.25	463.3	463.3	1543.52	.0000	0.
20	27.79	36.17	23.36	452.6	453.5	1542.92	.0917	9.
40	27.61	36.16	23.42	447.7	449.4	1542.84	.1820	37.
60	27.40	36.16	23.48	441.2	443.8	1542.70	.2713	82.
80	26.70	36.15	23.70	420.5	423.9	1541.45	.3581	145.
100	26.23	36.22	23.90	401.3	405.4	1540.77	.4410	225.
120	26.00	36.33	24.06	386.5	391.5	1540.66	.5207	321.
140	25.45	36.46	24.33	360.8	366.6	1539.82	.5965	433.
160	24.80	36.59	24.62	332.5	339.0	1538.71	.6670	559.
180	23.77	36.70	25.02	295.1	302.4	1536.63	.7312	699.
200	22.65	36.75	25.38	260.5	268.4	1534.19	.7883	851.
220	21.59	36.73	25.67	233.4	241.9	1531.76	.8393	1013.
240	20.60	36.65	25.88	213.3	222.3	1529.37	.8857	1186.
260	19.80	36.59	26.04	197.3	206.9	1527.46	.9286	1367.
280	18.95	36.53	26.22	180.6	190.7	1525.35	.9684	1557.
300	18.22	36.45	26.34	168.9	179.3	1523.50	1.0054	1754.
320	17.81	36.35	26.37	166.4	177.4	1522.54	1.0411	1959.
360	16.20	36.14	26.59	145.1	156.7	1518.16	1.1085	2389.
400	14.86	35.96	26.76	129.4	141.5	1514.44	1.1682	2845.
440	13.72	35.75	26.84	121.6	134.1	1511.18	1.2236	3323.
480	12.70	35.59	26.93	113.5	126.3	1508.26	1.2755	3823.
520	11.70	35.44	27.01	106.1	119.1	1505.32	1.3246	4343.
560	10.93	35.33	27.06	100.6	113.9	1503.14	1.3712	4882.
600	10.34	35.25	27.11	96.5	110.0	1501.59	1.4154	5440.
640	9.59	35.15	27.16	91.7	105.2	1499.41	1.4588	6015.
680	8.90	35.05	27.19	88.4	101.8	1497.38	1.5002	6606.
720	7.95	34.94	27.25	82.6	95.4	1494.32	1.5406	7215.
760	7.44	34.91	27.31	77.7	90.4	1492.98	1.5780	7838.
800	6.96	34.87	27.34	74.2	86.8	1491.71	1.6137	8477.
840	6.75	34.87	27.37	71.5	84.4	1491.54	1.6479	9129.
880	6.36	34.93	27.47	62.0	74.9	1490.74	1.6797	9795.
920	5.98	34.93	27.52	57.3	70.1	1489.88	1.7087	10472.

R/V VIRGINIA KEY VK 72-13 STD STATION 28
2242 GMT MAY 9 1972
21 45 N 85 19 W 1554 M
SURFACE SAMPLE SALINITY 36.01
SURFACE SAMPLE TEMPERATURE 28.6

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.43	36.05	23.06	481.3	481.3	1543.88	.0000	0.
20	27.60	36.01	23.31	458.2	459.1	1542.36	.0940	9.
40	27.26	36.05	23.45	444.8	446.5	1541.97	.1846	37.
60	27.19	36.23	23.60	429.7	432.3	1542.30	.2725	83.
80	26.78	36.17	23.69	421.5	424.9	1541.65	.3582	146.
100	26.41	36.27	23.88	403.1	407.3	1541.22	.4414	226.
120	25.88	36.45	24.19	374.3	379.3	1540.49	.5201	322.
140	25.40	36.57	24.42	351.4	357.2	1539.79	.5937	434.
160	24.59	36.66	24.74	321.4	327.9	1538.27	.6622	559.
180	23.99	36.72	24.97	299.9	307.2	1537.19	.7257	698.
200	22.81	36.76	25.34	264.1	272.0	1534.60	.7837	849.
220	21.90	36.76	25.60	239.5	248.0	1532.59	.8357	1011.
240	20.40	36.67	25.95	206.7	215.7	1528.85	.8820	1183.
260	19.77	36.65	26.10	192.2	201.8	1527.43	.9238	1363.
280	19.10	36.56	26.20	182.1	192.2	1525.80	.9632	1552.
300	18.22	36.45	26.34	168.9	179.3	1523.50	1.0003	1748.
320	17.23	36.43	26.57	147.2	158.0	1520.91	1.0341	1952.
360	16.40	36.21	26.60	144.4	156.1	1518.84	1.0973	2378.
400	15.45	36.05	26.70	135.3	147.8	1516.39	1.1583	2829.
440	14.15	35.84	26.82	123.6	136.4	1512.68	1.2151	3304.
480	12.81	35.63	26.94	112.7	125.6	1508.67	1.2677	3801.
520	11.60	35.43	27.02	105.0	117.9	1504.96	1.3163	4317.
560	10.57	35.28	27.09	98.2	111.0	1501.81	1.3621	4853.
600	10.00	35.17	27.10	96.8	109.9	1500.27	1.4061	5407.
640	9.20	35.12	27.20	87.8	100.8	1497.94	1.4476	5978.
680	8.59	35.02	27.22	85.9	98.9	1496.19	1.4876	6565.
720	7.81	34.95	27.28	79.8	92.5	1493.80	1.5257	7167.
760	7.13	34.88	27.33	75.7	88.0	1491.74	1.5624	7785.
800	6.80	34.87	27.36	72.1	84.5	1491.09	1.5969	8417.
840	6.40	34.87	27.42	67.0	79.3	1490.16	1.6296	9062.
880	5.99	34.89	27.49	60.4	72.6	1489.21	1.6597	9720.
920	5.77	34.93	27.55	54.8	67.1	1489.04	1.6873	10390.
960	5.23	34.94	27.62	47.8	59.6	1487.53	1.7125	11070.

R/V VIRGINIA KEY VK 72-13 STD STATION 29
0112 GMT MAY 10 1972
21 41 N 85 29 W 1829 M
SURFACE SAMPLE SALINITY 36.06
SURFACE SAMPLE TEMPERATURE 28.3

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.02	36.15	23.27	461.2	461.3	1543.08	.0000	0.
20	27.82	36.16	23.35	454.3	455.1	1542.98	.0916	9.
40	27.50	36.06	23.38	451.5	453.2	1542.51	.1825	37.
60	26.50	36.05	23.69	421.6	424.1	1540.59	.2702	82.
80	26.18	36.32	23.99	392.6	395.9	1540.42	.3522	144.
100	25.91	36.34	24.09	383.1	387.2	1540.14	.4305	222.
120	25.42	36.52	24.38	355.6	360.6	1539.47	.5053	316.
140	25.02	36.55	24.53	341.8	347.5	1538.88	.5761	424.
160	24.80	36.64	24.66	328.9	335.5	1538.75	.6444	546.
180	24.10	36.68	24.90	305.9	313.2	1537.42	.7093	682.
200	22.63	36.74	25.38	260.6	268.5	1534.13	.7675	829.
220	21.78	36.74	25.62	237.7	246.2	1532.26	.8189	988.
240	20.60	36.68	25.90	211.1	220.2	1529.40	.8656	1156.
260	19.65	36.58	26.08	194.3	203.8	1527.03	.9080	1334.
280	18.61	36.45	26.25	178.2	188.1	1524.30	.9472	1519.
300	17.70	36.38	26.42	161.7	172.0	1521.92	.9832	1712.
320	17.35	36.35	26.48	155.8	166.6	1521.19	1.0170	1912.
360	16.22	36.16	26.61	144.1	155.7	1518.24	1.0816	2332.
400	15.07	35.96	26.71	133.8	146.0	1515.10	1.1417	2777.
440	13.80	35.77	26.84	121.7	134.3	1511.46	1.1973	3245.
480	12.40	35.52	26.93	113.0	125.6	1507.16	1.2497	3734.
520	11.15	35.33	27.02	104.4	116.9	1503.27	1.2979	4244.
560	10.24	35.23	27.11	96.3	108.9	1500.57	1.3430	4772.
600	9.41	35.08	27.13	94.0	106.5	1498.01	1.3858	5318.
640	8.61	35.00	27.20	87.7	100.0	1495.59	1.4269	5880.
680	8.17	34.95	27.23	85.0	97.4	1494.52	1.4667	6459.
720	7.55	34.88	27.27	81.4	93.6	1492.71	1.5046	7054.
760	7.19	34.88	27.32	76.5	88.9	1491.97	1.5410	7663.
800	6.79	34.85	27.35	73.5	85.8	1491.02	1.5762	8286.
840	6.50	34.86	27.40	69.0	81.5	1490.55	1.6096	8923.
880	5.97	34.86	27.47	62.4	74.5	1489.09	1.6407	9573.
920	5.48	34.87	27.54	55.9	67.6	1487.79	1.6690	10235.
960	5.23	34.92	27.61	49.3	61.0	1487.50	1.6950	10908.

R/V VIRGINIA KEY VK 72-13 STD STATION 30
0324 GMT MAY 10 1972
21 37 N 85 40 W 2012 M
SURFACE SAMPLE SALINITY 36.18
SURFACE SAMPLE TEMPERATURE 28.0

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.00	36.15	23.28	460.6	460.6	1543.04	.0000	0.
20	27.83	36.16	23.34	454.6	455.4	1543.00	.0916	9.
40	27.48	36.17	23.47	443.0	444.7	1542.57	.1816	36.
60	27.00	36.18	23.63	427.5	430.0	1541.83	.2691	82.
80	26.18	36.35	24.02	390.4	393.8	1540.44	.3515	144.
100	25.59	36.45	24.28	365.7	369.8	1539.49	.4278	222.
120	25.24	36.56	24.47	347.5	352.4	1539.08	.5001	314.
140	24.75	36.57	24.62	332.5	338.2	1538.25	.5691	421.
160	24.60	36.65	24.73	322.4	328.9	1538.28	.6358	542.
180	24.10	36.73	24.94	302.3	309.6	1537.46	.6997	675.
200	22.41	36.76	25.46	253.2	261.1	1533.59	.7568	821.
220	21.14	36.70	25.77	223.7	232.1	1530.54	.8061	977.
240	20.23	36.65	25.98	203.8	212.8	1528.37	.8506	1143.
260	19.40	36.55	26.12	190.3	199.7	1526.31	.8918	1317.
280	18.70	36.50	26.26	176.8	186.7	1524.61	.9304	1499.
300	17.62	36.34	26.41	162.7	173.0	1521.65	.9664	1689.
320	17.00	36.26	26.50	154.3	164.9	1520.06	1.0002	1886.
360	16.00	36.10	26.61	143.6	155.1	1517.50	1.0642	2299.
400	14.60	35.90	26.77	128.4	140.4	1513.55	1.1244	2737.
440	13.59	35.72	26.85	121.2	133.6	1510.72	1.1790	3197.
480	12.08	35.46	26.95	111.5	123.8	1506.00	1.2314	3679.
520	10.69	35.31	27.06	101.4	113.7	1502.33	1.2798	4182.
560	10.19	35.17	27.07	100.0	112.4	1500.31	1.3250	4703.
600	9.38	35.10	27.15	92.1	104.5	1497.93	1.3684	5242.
640	8.86	35.01	27.18	89.8	102.3	1496.32	1.4095	5797.
680	7.95	34.94	27.25	82.6	94.7	1493.67	1.4487	6369.
720	7.51	34.86	27.26	82.4	94.5	1492.53	1.4860	6956.
760	6.99	34.86	27.33	75.3	87.4	1491.17	1.5222	7557.
800	6.41	34.86	27.41	67.9	79.6	1489.54	1.5555	8173.
840	6.10	34.87	27.46	63.3	75.1	1488.98	1.5867	8802.
880	5.72	34.87	27.51	58.7	70.3	1488.11	1.6160	9442.
920	5.45	34.89	27.56	54.0	65.7	1487.70	1.6431	10094.
960	5.30	34.91	27.59	50.8	62.7	1487.77	1.6686	10756.
1000	5.08	34.92	27.62	47.6	59.5	1487.54	1.6930	11429.

R/V VIRGINIA KEY VK 72-13 STD STATION 31
0542 GMT MAY 10 1972
21 34 N 85 49 W 2140 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE 27.9

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.96	36.15	23.29	460.0	460.0	1543.00	.0000	0.
20	27.81	36.15	23.34	454.7	455.5	1542.95	.0916	9.
40	27.38	36.06	23.41	447.8	449.5	1542.25	.1821	37.
60	26.08	35.95	23.75	416.2	418.7	1539.53	.2689	82.
80	26.02	36.17	23.93	398.6	401.9	1539.92	.3509	144.
100	25.60	36.44	24.26	366.7	370.8	1539.50	.4282	222.
120	25.01	36.53	24.51	342.9	347.8	1538.51	.5001	314.
140	24.62	36.65	24.72	323.0	328.7	1538.01	.5677	421.
160	23.78	36.65	24.98	299.0	305.5	1536.29	.6311	541.
180	22.79	36.68	25.29	269.3	276.5	1534.16	.6893	673.
200	21.40	36.70	25.70	230.5	238.2	1530.91	.7408	816.
220	20.61	36.64	25.87	214.3	222.5	1529.07	.7869	969.
240	19.60	36.55	26.07	195.2	204.0	1526.54	.8295	1130.
260	18.75	36.52	26.26	176.5	185.8	1524.45	.8685	1300.
280	18.19	36.44	26.34	168.9	178.6	1523.09	.9050	1478.
300	17.40	36.34	26.46	157.6	167.8	1521.00	.9396	1662.
320	16.64	36.25	26.53	151.4	162.0	1519.57	.9726	1853.
360	15.40	36.04	26.70	135.0	146.2	1515.58	1.0350	2255.
400	13.79	35.77	26.84	121.5	132.9	1510.79	1.0907	2680.
440	12.04	35.46	26.96	110.8	122.1	1505.22	1.1416	3127.
480	11.21	35.36	27.04	103.3	114.9	1502.87	1.1888	3593.
520	10.12	35.24	27.14	93.6	105.2	1499.50	1.2339	4078.
560	9.41	35.08	27.13	94.0	105.7	1497.37	1.2763	4580.
600	8.79	35.03	27.19	88.2	99.9	1495.66	1.3176	5099.
640	8.16	34.95	27.23	85.1	96.8	1493.91	1.3569	5633.
680	7.61	34.92	27.29	79.3	91.0	1492.35	1.3946	6184.
720	7.00	34.85	27.32	76.2	87.7	1490.55	1.4302	6749.
760	6.58	34.85	27.38	70.8	82.2	1489.55	1.4636	7328.
800	6.22	34.86	27.43	65.5	76.9	1488.79	1.4954	7919.
840	5.83	34.87	27.49	60.0	71.3	1487.90	1.5250	8524.
880	5.55	34.87	27.53	56.7	68.0	1487.42	1.5530	9139.
920	5.34	34.88	27.56	53.5	65.0	1487.24	1.5794	9766.
960	5.16	34.89	27.59	50.7	62.3	1487.17	1.6048	10403.

R/V VIRGINIA KEY   VK 72-13   STD STATION   33
0 48 GMT   MAY 14 1972
21 18 N   86 31 W   174 M
SURFACE SAMPLE SALINITY 36.12
SURFACE SAMPLE TEMPERATURE 28.0

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.80	36.13	23.33	455.8	455.6	1542.59	.0000	0.
20	27.62	36.14	23.40	449.5	450.3	1542.52	.0906	9.
40	26.62	36.23	23.79	412.3	414.0	1540.70	.1770	36.
60	24.40	36.67	24.81	315.2	317.7	1536.20	.2502	79.
80	22.00	36.58	25.44	255.1	258.2	1530.44	.3078	134.
100	20.00	36.35	25.81	219.7	223.4	1525.21	.3560	201.
120	18.30	36.30	26.21	181.7	185.9	1520.70	.3969	276.

R/V VIRGINIA KEY VK 72-13 STD STATION 34
1130 GMT MAY 14 1972
21 47 N 85 12 W 1372 M
SURFACE SAMPLE SALINITY 35.96
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.82	35.97	23.20	467.9	467.9	1542.49	.0000	0.
20	27.80	35.98	23.22	466.6	467.4	1542.78	.0935	9.
40	27.43	36.03	23.38	451.5	453.2	1542.33	.1856	37.
60	26.85	36.05	23.58	432.3	434.8	1541.38	.2744	83.
80	26.70	36.15	23.70	420.5	423.9	1541.45	.3603	147.
100	26.39	36.15	23.80	411.1	415.3	1541.07	.4442	227.
120	26.19	36.39	24.04	387.9	392.9	1541.15	.5250	324.
140	25.42	36.55	24.40	353.5	359.3	1539.82	.6002	437.
160	25.12	36.63	24.56	338.9	345.5	1539.51	.6707	564.
180	24.59	36.67	24.75	320.7	328.0	1538.60	.7380	705.
200	24.00	36.75	24.99	298.0	306.1	1537.56	.8015	859.
220	22.40	36.75	25.45	253.6	262.3	1533.87	.8583	1024.
240	20.62	36.71	25.92	209.5	218.5	1529.48	.9064	1201.
260	19.66	36.64	26.14	188.7	198.2	1526.95	.9480	1386.
280	18.58	36.53	26.31	171.7	181.6	1524.29	.9860	1580.
300	17.78	36.45	26.45	158.5	168.8	1522.22	1.0211	1781.
320	17.21	36.37	26.53	151.1	161.9	1520.79	1.0541	1988.
360	16.60	36.25	26.59	146.0	157.8	1519.49	1.1182	2423.
400	15.79	36.05	26.62	142.7	155.3	1517.45	1.1808	2882.
440	14.60	35.94	26.76	129.6	142.9	1514.87	1.2401	3367.
480	13.79	35.77	26.84	121.5	135.2	1512.07	1.2961	3874.
520	12.42	35.56	26.96	110.5	124.1	1507.92	1.3480	4403.
560	11.17	35.35	27.04	103.3	116.8	1504.01	1.3957	4952.
600	10.00	35.16	27.10	97.6	110.7	1500.26	1.4411	5519.
640	9.38	35.10	27.15	92.1	105.3	1498.57	1.4841	6104.
680	8.86	35.05	27.20	87.8	101.1	1497.24	1.5258	6706.
720	8.38	34.97	27.21	86.5	100.0	1495.98	1.5656	7325.
760	7.72	34.94	27.29	79.3	92.5	1494.09	1.6039	7959.

R/V VIRGINIA KEY VK 72-13 STD STATION 35
1442 GMT MAY 14 1972
21 44 N 85 23 W 1097 M
SURFACE SAMPLE SALINITY 36.05
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.03	36.10	23.23	465.2	465.2	1543.06	.0000	0.
20	28.02	36.10	23.24	464.8	465.7	1543.36	.0931	9.
40	27.30	36.05	23.43	446.1	447.7	1542.06	.1844	37.
60	27.24	36.12	23.50	439.2	441.7	1542.31	.2734	83.
80	26.82	36.15	23.66	424.2	427.5	1541.72	.3603	146.
100	26.60	36.21	23.78	413.2	417.3	1541.60	.4448	227.
120	26.24	36.31	23.97	395.1	400.1	1541.20	.5265	324.
140	25.50	36.55	24.38	355.8	361.6	1540.01	.6027	437.
160	24.60	36.70	24.77	318.8	325.3	1538.33	.6714	564.
180	23.00	36.82	25.33	265.0	272.2	1534.81	.7311	704.
200	21.70	36.77	25.67	233.4	241.1	1531.76	.7825	856.
220	20.57	36.75	25.96	205.3	213.6	1529.06	.8280	1017.
240	19.48	36.65	26.17	185.0	193.8	1526.30	.8687	1187.
260	18.72	36.60	26.33	170.0	179.3	1524.44	.9060	1364.
280	18.18	36.53	26.42	162.1	171.9	1523.14	.9411	1549.
300	17.60	36.46	26.51	153.5	163.8	1521.71	.9747	1740.
320	17.00	36.37	26.58	146.3	157.0	1520.16	1.0068	1938.
360	16.15	36.24	26.68	136.7	148.3	1518.11	1.0682	2353.
400	15.20	36.10	26.79	126.4	138.7	1515.66	1.1267	2793.
440	14.00	35.92	26.92	114.7	127.5	1512.28	1.1811	3254.
480	13.60	35.75	26.87	119.2	132.7	1511.43	1.2333	3737.
520	12.39	35.57	26.97	109.2	122.8	1507.83	1.2837	4241.
560	11.52	35.40	27.01	105.8	119.6	1505.29	1.3326	4764.
600	9.61	35.15	27.15	92.0	104.7	1498.83	1.3780	5306.
640	8.63	35.03	27.22	85.8	98.1	1495.71	1.4187	5866.
680	7.72	34.95	27.30	78.6	90.4	1492.81	1.4567	6441.
720	6.97	34.91	27.37	71.3	82.8	1490.51	1.4914	7030.
760	6.67	34.88	27.39	69.7	81.3	1489.94	1.5242	7634.

R/V VIRGINIA KEY VK 72-13 STD STATION 36
1648 GMT MAY 14 1972
21 39 N 85 33 W 1737 M
SURFACE SAMPLE SALINITY 36.12
SURFACE SAMPLE TEMPERATURE 28.2

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.13	36.15	23.24	464.7	464.7	1543.32	.0000	0.
20	28.00	36.16	23.29	459.9	460.8	1543.37	.0925	9.
40	27.56	36.14	23.42	447.6	449.3	1542.72	.1836	37.
60	27.20	36.13	23.53	437.2	439.8	1542.23	.2725	82.
80	26.79	36.15	23.67	423.2	426.6	1541.66	.3591	146.
100	26.62	36.19	23.76	415.2	419.4	1541.63	.4437	226.
120	26.26	36.35	23.99	392.8	397.8	1541.28	.5254	323.
140	25.60	36.47	24.29	364.5	370.3	1540.18	.6022	436.
160	24.00	36.73	24.97	299.5	306.0	1536.90	.6699	563.
180	22.62	36.77	25.40	258.2	265.3	1533.81	.7270	702.
200	21.40	36.79	25.76	224.0	231.7	1530.99	.7767	853.
220	20.30	36.73	26.02	199.8	208.1	1528.31	.8207	1013.
240	19.40	36.65	26.20	183.0	191.8	1526.08	.8607	1181.
260	18.75	36.58	26.31	172.2	181.4	1524.50	.8980	1357.
280	18.00	36.47	26.41	162.2	171.9	1522.56	.9333	1540.
300	17.56	36.45	26.50	153.8	164.1	1521.64	.9669	1730.
320	17.02	36.35	26.56	148.2	158.9	1520.20	.9992	1926.
360	16.00	36.16	26.66	139.2	150.7	1517.57	1.0608	2338.
400	15.00	35.99	26.75	130.2	142.4	1514.91	1.1198	2775.
440	13.70	35.75	26.85	121.2	133.7	1511.11	1.1753	3234.
480	12.40	35.56	26.96	110.1	122.7	1507.21	1.2262	3714.
520	11.24	35.38	27.05	102.3	114.9	1503.65	1.2742	4214.
560	10.50	35.27	27.09	97.7	110.5	1501.55	1.3195	4733.
600	9.50	35.11	27.14	93.2	105.8	1498.38	1.3627	5270.
640	8.60	35.03	27.23	85.3	97.6	1495.60	1.4031	5823.
680	7.99	34.95	27.26	82.4	94.6	1493.84	1.4413	6392.
720	7.22	34.92	27.35	73.9	85.8	1491.49	1.4776	6976.
760	6.64	34.87	27.39	70.0	81.6	1489.81	1.5115	7573.
800	6.22	34.87	27.44	64.7	76.2	1488.80	1.5430	8184.
840	5.70	34.91	27.54	55.4	66.6	1487.43	1.5714	8807.
880	5.42	34.93	27.59	50.7	61.9	1486.98	1.5972	9441.
920	5.29	34.93	27.61	49.2	60.6	1487.11	1.6217	10085.

R/V VIRGINIA KEY VK 72-13 STD STATION 37
1906 GMT MAY 14 1972
21 36 N 85 43 W 1920 M
SURFACE SAMPLE SALINITY 36.19
SURFACE SAMPLE TEMPERATURE 28.6

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.42	36.15	23.14	473.8	473.9	1543.95	.0000	0.
20	28.40	36.25	23.22	466.0	466.9	1544.31	.0941	9.
40	27.60	36.15	23.35	454.4	456.1	1543.25	.1864	37.
60	27.17	36.15	23.55	434.9	437.4	1542.18	.2757	84.
80	27.08	36.18	23.60	429.9	433.3	1542.33	.3628	148.
100	26.62	36.26	23.81	410.2	414.4	1541.69	.4476	229.
120	26.18	36.36	24.02	389.7	394.7	1541.10	.5285	326.
140	25.20	36.62	24.52	342.0	347.8	1539.36	.6027	439.
160	23.81	36.75	25.04	292.7	299.1	1536.45	.6674	566.
180	22.61	36.63	25.45	253.6	260.7	1533.83	.7234	705.
200	22.10	36.79	25.57	242.7	250.5	1532.81	.7745	855.
220	21.00	36.73	25.83	217.9	226.2	1530.20	.8222	1015.
240	19.70	36.67	26.13	189.0	197.8	1526.93	.8646	1183.
260	19.02	36.60	26.26	177.3	186.6	1525.29	.9030	1360.
280	18.22	36.48	26.37	166.7	176.5	1523.21	.9393	1544.
300	17.62	36.43	26.48	156.2	166.5	1521.74	.9736	1736.
320	16.90	36.35	26.59	145.5	156.1	1519.84	1.0059	1934.
360	15.82	36.10	26.65	139.7	151.1	1516.95	1.0662	2348.
400	14.36	35.92	26.84	122.0	133.8	1512.80	1.1223	2786.
440	12.99	35.67	26.93	113.2	125.2	1508.68	1.1741	3245.
480	11.60	35.45	27.03	103.6	115.5	1504.34	1.2221	3725.
520	10.30	35.27	27.13	94.4	106.1	1500.19	1.2673	4223.
560	9.57	35.15	27.16	91.4	103.2	1498.04	1.3091	4738.
600	8.60	35.04	27.23	84.6	96.1	1494.96	1.3490	5270.
640	8.00	34.97	27.27	81.0	92.6	1493.26	1.3868	5817.
680	7.60	34.95	27.31	76.9	88.6	1492.35	1.4231	6379.
720	7.12	34.92	27.36	72.6	84.3	1491.11	1.4577	6955.
760	6.70	34.90	27.40	68.6	80.2	1490.09	1.4908	7545.
800	6.22	34.91	27.47	61.7	73.2	1488.86	1.5213	8147.
840	5.69	34.94	27.57	53.1	64.3	1487.43	1.5487	8761.
880	5.42	34.95	27.61	49.2	60.4	1487.01	1.5732	9386.
920	5.19	34.95	27.63	46.6	57.8	1486.73	1.5968	10020.
960	5.06	34.95	27.65	45.1	56.6	1486.85	1.6198	10663.
1000	4.98	34.95	27.66	44.2	56.0	1487.17	1.6423	11316.

R/V VIRGINIA KEY   VK 72-13   STD STATION   38
2218   GMT   MAY 14   1972
21 32 N   85 53 W   1737 M
SURFACE SAMPLE SALINITY 36.13
SURFACE SAMPLE TEMPERATURE 28.7

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.35	36.15	23.17	471.6	471.6	1543.80	.0000	0.
20	28.10	36.13	23.23	465.2	466.1	1543.56	.0938	9.
40	27.30	36.15	23.51	438.9	440.6	1542.15	.1844	37.
60	26.75	36.18	23.71	419.9	422.4	1541.27	.2707	83.
80	26.40	36.25	23.87	404.2	407.6	1540.86	.3537	145.
100	25.60	36.35	24.20	373.2	377.3	1539.43	.4322	224.
120	25.00	36.61	24.58	336.9	341.8	1538.56	.5041	317.
140	24.00	36.75	24.99	298.0	303.7	1536.59	.5687	425.
160	23.10	36.80	25.29	269.2	275.6	1534.72	.6266	544.
180	22.40	36.80	25.49	250.0	257.1	1533.27	.6799	675.
200	21.10	36.70	25.78	222.6	230.3	1530.11	.7286	816.
220	20.40	36.68	25.95	206.0	214.2	1528.54	.7731	966.
240	19.59	36.56	26.08	194.2	203.0	1526.53	.8148	1125.
260	18.59	36.53	26.31	171.9	181.1	1524.00	.8532	1291.
280	18.27	36.45	26.33	170.1	179.9	1523.33	.8893	1466.
300	16.30	36.18	26.60	144.4	154.1	1517.54	.9227	1647.
320	15.40	36.06	26.72	133.5	143.5	1514.96	.9525	1834.
360	14.30	35.90	26.84	122.3	132.9	1511.94	1.0072	2226.
400	12.40	35.64	27.03	104.2	114.8	1506.02	1.0575	2640.
440	10.70	35.33	27.11	96.7	107.0	1500.40	1.1018	3072.
480	9.60	35.20	27.16	91.4	101.8	1497.65	1.1438	3521.
520	9.00	35.08	27.20	87.7	98.1	1495.21	1.1839	3986.
560	8.50	35.03	27.24	83.9	94.5	1493.93	1.2222	4468.
600	8.00	34.98	27.28	80.3	91.1	1492.62	1.2595	4964.
640	7.35	34.94	27.34	74.2	84.9	1490.73	1.2952	5475.
680	6.85	34.91	27.39	69.8	80.4	1489.40	1.3279	6000.
720	6.25	34.88	27.45	64.4	74.8	1487.64	1.3588	6537.
760	5.97	34.90	27.50	59.4	70.0	1487.20	1.3879	7086.
800	5.70	34.90	27.53	56.2	66.8	1486.77	1.4152	7647.
840	5.43	34.91	27.57	52.3	63.0	1486.35	1.4410	8218.
880	5.30	34.92	27.60	50.0	61.0	1486.48	1.4658	8800.
920	5.10	34.93	27.63	47.0	58.1	1486.34	1.4896	9391.
960	4.95	34.93	27.65	45.4	56.6	1486.37	1.5125	9991.
1000	4.85	34.93	27.66	44.3	55.7	1486.62	1.5349	10601.

R/V VIRGINIA KEY VK 72-13 STD STATION 39
0100 GMT MAY 15 1972
21 28 N 86 03 W 1554 M
SURFACE SAMPLE SALINITY 36.16
SURFACE SAMPLE TEMPERATURE 28.2

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.04	36.07	23.21	467.6	467.6	1543.06	.0000	0.
20	27.66	36.07	23.26	462.6	463.5	1543.03	.0931	9.
40	27.00	36.08	23.55	434.7	436.4	1541.42	.1831	37.
60	26.52	36.08	23.70	420.1	422.6	1540.66	.2690	82.
80	25.97	36.25	24.01	391.4	394.7	1539.87	.3507	144.
100	25.10	36.52	24.48	346.3	350.4	1538.40	.4252	222.
120	24.58	36.67	24.75	320.4	325.3	1537.61	.4928	314.
140	24.10	36.74	24.95	301.6	307.3	1536.83	.5560	418.
160	22.80	36.75	25.34	264.6	270.9	1533.93	.6139	535.
180	21.10	36.68	25.76	224.1	231.0	1529.77	.6641	663.
200	19.60	36.63	26.08	194.4	201.8	1526.53	.7073	800.
220	19.00	36.50	26.18	184.0	191.9	1524.49	.7467	946.
240	18.12	36.44	26.36	167.2	175.6	1522.24	.7835	1099.
260	16.90	36.25	26.51	152.7	161.4	1518.78	.8171	1259.
280	16.36	36.17	26.58	146.4	155.5	1517.39	.8488	1425.
300	15.20	35.96	26.68	136.6	145.8	1513.91	.8790	1598.
320	14.76	35.90	26.74	131.7	141.4	1512.77	.9077	1777.
360	13.55	35.74	26.87	118.9	129.1	1509.33	.9618	2151.
400	11.92	35.44	26.96	110.1	120.2	1504.15	1.0126	2546.
440	10.60	35.28	27.05	102.1	112.4	1500.69	1.0592	2960.
480	9.98	35.16	27.10	97.2	107.8	1498.26	1.1035	3393.
520	9.40	35.10	27.15	92.4	103.2	1496.71	1.1453	3843.
560	8.40	34.98	27.22	86.1	96.6	1493.49	1.1854	4309.
600	7.80	34.93	27.27	81.2	91.7	1491.80	1.2230	4791.
640	7.05	34.86	27.32	76.1	86.4	1489.46	1.2591	5287.
680	6.60	34.85	27.38	71.0	81.3	1488.34	1.2925	5797.

R/V VIRGINIA KEY   VK 72-13   STD STATION   40
0324 GMT   MAY 15 1972
21 24 N   86 13 W   805 M
SURFACE SAMPLE SALINITY 36.16
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.80	36.15	23.35	454.4	454.4	1542.60	.0000	0.
20	27.76	36.05	23.28	460.3	461.2	1542.75	.0916	9.
40	26.02	36.19	23.95	397.2	398.8	1539.29	.1776	36.
60	25.85	36.40	24.16	377.0	379.5	1539.40	.2554	79.
80	25.30	36.45	24.36	357.1	360.4	1538.49	.3294	138.
100	25.12	36.55	24.50	344.7	348.8	1538.47	.4003	211.
120	24.20	36.73	24.91	305.2	310.1	1536.74	.4662	297.
140	22.80	36.67	25.28	270.3	275.9	1533.54	.5248	397.
160	21.74	36.65	25.56	243.1	249.3	1531.11	.5773	507.
180	20.34	36.63	25.93	208.1	214.8	1527.69	.6237	627.
200	17.60	36.33	26.41	163.0	169.8	1519.97	.6622	755.
220	16.65	36.20	26.54	150.3	157.5	1517.28	.6949	891.
240	16.10	36.11	26.60	145.1	152.8	1515.89	.7259	1033.
260	15.60	36.05	26.66	138.6	146.7	1514.61	.7559	1181.
280	15.12	35.95	26.69	135.6	144.2	1513.32	.7850	1336.
300	14.70	35.85	26.71	134.1	143.1	1512.21	.8137	1495.
320	13.57	35.71	26.84	121.5	130.6	1508.72	.8411	1661.
360	12.43	35.55	26.95	111.4	120.9	1505.37	.8917	2008.
400	11.42	35.35	26.99	107.7	117.5	1502.31	.9388	2374.
440	10.58	35.26	27.07	99.8	110.0	1499.89	.9841	2758.
480	9.63	35.16	27.13	94.8	105.2	1497.71	1.0274	3161.
520	8.90	35.05	27.19	88.4	98.7	1494.81	1.0686	3580.

R/V VIRGINIA KEY   VK 72-13   STD STATION   41
0524 GMT   MAY 15 1972
21 21 N   86 22 W   421 M
SURFACE SAMPLE SALINITY 36.14
SURFACE SAMPLE TEMPERATURE 27.8

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.74	36.13	23.35	453.9	453.9	1542.45	.0000	0.
20	27.73	36.10	23.33	455.8	456.6	1542.73	.0911	9.
40	27.20	36.10	23.50	439.4	441.1	1541.88	.1808	36.
60	26.57	36.18	23.76	414.4	416.9	1540.86	.2666	81.
80	25.59	36.39	24.23	370.0	373.3	1539.11	.3456	142.
100	24.50	36.65	24.76	319.5	323.6	1537.07	.4153	218.
120	23.19	36.70	25.19	278.9	283.7	1534.22	.4761	308.
140	22.50	36.66	25.36	262.9	268.4	1532.76	.5313	408.
160	20.40	36.53	25.84	216.9	222.8	1527.44	.5804	519.
180	17.80	36.22	26.27	175.7	181.8	1520.13	.6209	640.
200	15.39	36.01	26.68	137.0	143.2	1512.95	.6534	767.
220	14.93	35.95	26.74	131.6	138.3	1511.76	.6815	900.
240	14.42	35.84	26.76	129.1	136.2	1510.34	.7090	1040.
260	14.05	35.61	26.82	123.8	131.3	1509.43	.7357	1184.
280	13.45	35.72	26.88	118.4	126.3	1507.69	.7615	1334.
300	13.17	35.67	26.89	116.6	124.9	1507.03	.7866	1489.
320	12.57	35.56	26.93	113.3	121.8	1505.21	.8113	1648.

R/V VIRGINIA KEY VK 72-13 STD STATION 42
0736 GMT MAY 15 1972
21 18 N 86 30 W 91 M
SURFACE SAMPLE SALINITY 36.15
SURFACE SAMPLE TEMPERATURE 27.6

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.60	36.15	23.41	448.1	448.1	1542.16	.0000	0.
20	27.55	36.15	23.43	446.6	447.4	1542.38	.0896	9.
40	26.80	36.50	23.93	398.4	400.1	1541.33	.1743	35.
60	21.22	36.44	25.55	244.6	246.9	1527.95	.2390	77.
80	20.80	36.43	25.65	234.4	237.4	1527.14	.2874	129.

R/V VIRGINIA KEY VK 72-13 STD STATION 43
0848 GMT MAY 15 1972
21 20 N 86 25 W 329 M
SURFACE SAMPLE SALINITY 36.12
SURFACE SAMPLE TEMPERATURE 27.3

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.80	36.11	23.32	457.2	457.2	1542.57	.0000	0.
20	27.77	36.10	23.32	457.0	457.9	1542.62	.0915	9.
40	26.51	36.20	23.80	411.2	412.8	1540.42	.1786	36.
60	25.60	36.35	24.20	373.2	375.7	1538.78	.2574	80.
80	23.96	36.68	24.94	302.0	305.2	1535.46	.3255	138.
100	23.40	36.72	25.14	283.3	287.3	1534.44	.3848	209.
120	21.98	36.63	25.48	251.0	255.7	1531.08	.4391	291.
140	19.95	36.66	26.06	196.0	201.2	1526.00	.4848	384.
160	16.90	36.54	26.74	131.6	137.0	1517.46	.5186	484.
180	16.14	36.23	26.68	137.2	143.0	1515.18	.5466	591.
200	15.30	36.15	26.81	124.8	131.1	1512.81	.5740	703.
220	15.05	35.99	26.74	131.4	138.2	1512.21	.6009	820.
240	14.40	35.88	26.80	125.8	132.9	1510.32	.6280	943.
260	13.60	35.80	26.91	115.5	122.9	1507.95	.6536	1071.

R/V VIRGINIA KEY VK 72-13 STD STATION 44
1006 GMT MAY 15 1972
21 23 N 86 18 W 530 M
SURFACE SAMPLE SALINITY 36.12
SURFACE SAMPLE TEMPERATURE 27.4

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.75	36.14	23.35	453.5	453.5	1542.49	.0000	0.
20	27.70	36.15	23.38	451.3	452.1	1542.71	.0906	9.
40	27.53	36.16	23.44	445.3	447.0	1542.67	.1805	36.
60	27.39	36.17	23.49	440.2	442.7	1542.69	.2694	81.
80	25.66	36.17	24.06	386.1	389.4	1538.94	.3527	143.
100	23.10	36.66	25.18	279.3	283.3	1533.64	.4199	221.
120	21.10	36.65	25.74	226.3	230.8	1528.78	.4713	310.
140	20.53	36.62	25.87	213.7	218.9	1527.55	.5163	409.
160	18.93	36.45	26.16	186.0	191.7	1523.28	.5574	516.
180	17.60	36.35	26.42	161.5	167.7	1519.67	.5933	631.
200	16.50	36.18	26.56	148.8	155.4	1516.54	.6256	753.
220	16.03	36.15	26.64	140.6	147.7	1515.40	.6559	881.
240	15.60	36.11	26.71	134.2	141.8	1514.35	.6849	1015.
260	14.60	35.94	26.80	125.5	133.3	1511.34	.7124	1155.
280	14.08	35.86	26.85	120.7	128.9	1509.90	.7386	1300.
300	13.40	35.76	26.92	114.5	123.0	1507.89	.7638	1450.
320	13.00	35.65	26.91	114.8	123.6	1506.76	.7885	1605.
360	12.10	35.51	26.98	108.2	117.5	1504.20	.8366	1930.
400	10.96	35.32	27.05	101.9	111.4	1500.66	.8815	2274.
440	10.25	35.24	27.11	95.8	105.7	1498.69	.9246	2635.

R/V VIRGINIA KEY VK 72-13 STD STATION 45
1136 GMT MAY 15 1972
21 25 N 86 12 W 1280 M
SURFACE SAMPLE SALINITY 36.19
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.98	36.18	23.31	457.8	457.8	1543.02	.0000	0.
20	27.98	36.15	23.29	460.0	460.8	1543.32	.0919	9.
40	26.58	36.13	23.72	418.3	420.0	1540.52	.1800	36.
60	25.80	36.43	24.20	373.3	375.8	1539.31	.2595	80.
80	25.00	36.54	24.52	341.9	345.2	1537.85	.3316	139.
100	24.39	36.65	24.79	316.4	320.4	1536.81	.3982	212.
120	23.10	36.65	25.17	280.0	284.8	1533.95	.4587	298.
140	21.98	36.68	25.52	247.4	252.8	1531.44	.5125	395.
160	20.90	36.55	25.72	228.3	234.3	1528.80	.5612	503.
180	19.00	36.42	26.12	189.8	196.3	1523.78	.6043	619.
200	16.18	36.15	26.61	143.9	150.4	1515.54	.6389	743.
220	15.80	36.07	26.63	141.4	148.4	1514.61	.6688	874.
240	15.12	35.97	26.71	134.2	141.5	1512.70	.6978	1011.
260	14.63	35.93	26.79	126.8	134.7	1511.43	.7254	1153.
280	14.54	35.90	26.78	127.2	135.5	1511.43	.7525	1301.
300	13.80	35.74	26.86	119.9	128.4	1508.53	.7789	1454.
320	13.02	35.65	26.91	115.2	124.0	1506.83	.8041	1612.
360	11.80	35.40	26.96	110.8	119.9	1503.04	.8539	1944.
400	10.60	35.25	27.06	100.9	110.1	1499.30	.8999	2295.
440	10.08	35.17	27.09	98.1	107.9	1497.99	.9433	2664.
480	9.57	35.10	27.12	95.1	105.2	1496.69	.9862	3050.
520	8.90	35.12	27.25	83.2	93.6	1494.90	1.0270	3452.
560	8.34	34.95	27.20	87.4	97.9	1493.23	1.0662	3871.
600	7.78	34.88	27.23	84.6	95.1	1491.66	1.1048	4305.
640	7.10	34.85	27.31	77.5	87.9	1489.64	1.1413	4754.
680	6.80	34.84	27.34	74.3	84.9	1489.11	1.1759	5218.
720	6.12	34.84	27.43	65.7	75.9	1487.07	1.2085	5695.
760	5.83	34.85	27.48	61.5	71.8	1486.58	1.2381	6184.

R/V VIRGINIA KEY   VK 72-13   STD STATION   46
1324 GMT   MAY 15 1972
21 27 N   86 06 W   1646 M
SURFACE SAMPLE SALINITY 36.06
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.00	36.15	23.28	460.6	460.6	1543.04	.0000	0.
20	28.00	36.15	23.28	460.6	461.5	1543.36	.0922	9.
40	26.62	36.07	23.67	423.8	425.5	1540.55	.1809	37.
60	26.10	36.24	23.96	396.0	398.4	1539.84	.2633	81.
80	25.50	36.49	24.33	360.1	363.5	1538.99	.3395	141.
100	24.66	36.65	24.73	322.4	326.5	1537.31	.4085	216.
120	24.19	36.67	24.87	309.2	314.1	1536.66	.4725	304.
140	22.60	36.71	25.31	267.4	273.0	1533.57	.5313	405.
160	21.92	36.70	25.55	244.3	250.5	1531.63	.5836	516.
180	20.30	36.61	25.93	208.5	215.2	1527.56	.6302	637.
200	18.40	36.43	26.28	174.6	181.7	1522.40	.6699	767.
220	16.65	36.25	26.57	147.1	154.4	1517.39	.7035	905.
240	16.60	36.17	26.52	151.8	159.7	1517.48	.7349	1049.
260	15.60	36.12	26.72	133.5	141.7	1514.68	.7650	1199.
280	15.00	35.95	26.72	133.1	141.7	1512.94	.7933	1354.
300	14.30	35.84	26.79	126.6	135.5	1510.91	.8211	1516.
320	13.70	35.72	26.82	123.4	132.5	1509.15	.8479	1683.
360	12.05	35.49	26.98	108.8	118.0	1504.01	.8981	2032.
400	11.12	35.35	27.04	102.4	112.1	1501.26	.9434	2400.
440	10.36	35.20	27.06	100.9	110.9	1499.10	.9877	2787.
480	9.66	35.09	27.11	96.3	106.5	1496.79	1.0310	3190.
520	8.64	35.03	27.19	88.9	99.2	1494.56	1.0720	3611.
560	8.20	34.94	27.22	86.1	96.4	1492.69	1.1112	4048.
600	7.80	34.90	27.25	83.4	93.9	1491.76	1.1492	4500.
640	7.22	34.85	27.29	79.2	89.6	1490.11	1.1863	4967.
680	6.62	34.81	27.34	74.3	84.5	1488.36	1.2215	5449.
720	6.15	34.81	27.40	68.4	78.5	1487.15	1.2542	5944.
760	5.95	34.82	27.44	65.2	75.6	1487.02	1.2849	6452.
800	5.53	34.85	27.51	57.9	68.2	1486.02	1.3137	6971.
840	5.25	34.85	27.55	54.7	65.0	1485.54	1.3404	7502.
880	5.12	34.85	27.56	53.3	63.8	1485.66	1.3662	8044.

R/V VIRGINIA KEY VK 72-13 STD STATION 47
1530 GMT MAY 15 1972
21 30 N 85 58 W 1829 M
SURFACE SAMPLE SALINITY 36.13
SURFACE SAMPLE TEMPERATURE 28.3

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.11	36.07	23.18	469.8	469.8	1543.21	.0000	0.
20	28.02	36.07	23.21	467.0	467.8	1543.34	.0938	9.
40	27.03	36.15	23.60	430.6	432.3	1541.55	.1838	37.
60	26.50	36.20	23.80	410.9	413.4	1540.72	.2683	82.
80	25.80	36.35	24.13	379.1	382.4	1539.57	.3479	144.
100	24.93	36.58	24.58	337.0	341.1	1538.04	.4203	221.
120	24.20	36.67	24.87	309.5	314.4	1536.69	.4858	311.
140	23.31	36.75	25.19	278.7	284.3	1534.89	.5457	415.
160	22.77	36.75	25.35	263.7	270.1	1533.85	.6011	529.
180	21.06	36.69	25.78	222.3	229.2	1529.68	.6510	654.
200	19.67	36.60	26.09	193.3	200.7	1526.14	.6940	789.
220	19.05	36.58	26.23	179.5	187.4	1524.71	.7328	932.
240	18.46	36.45	26.30	173.2	181.6	1523.06	.7697	1082.
260	17.33	36.36	26.50	154.6	163.4	1520.17	.8042	1239.
280	16.70	36.24	26.55	148.9	158.2	1518.49	.8364	1403.
300	15.66	36.12	26.67	137.8	147.3	1515.94	.8669	1574.
320	15.15	35.96	26.70	135.5	145.4	1514.07	.8962	1750.
360	13.57	35.77	26.89	117.1	127.3	1509.42	.9509	2120.
400	11.43	35.40	27.03	104.2	114.1	1502.40	.9992	2510.
440	10.10	35.21	27.12	95.5	105.3	1498.11	1.0428	2918.
480	9.66	35.08	27.10	97.0	107.2	1496.78	1.0848	3344.
520	8.75	35.04	27.21	86.8	97.0	1494.23	1.1251	3786.
560	8.21	34.98	27.25	83.3	93.7	1492.78	1.1636	4244.
600	7.44	34.90	27.30	78.4	88.5	1490.38	1.2004	4716.
640	6.93	34.86	27.34	74.5	84.7	1488.99	1.2351	5204.
680	6.42	34.83	27.38	70.2	80.2	1487.60	1.2679	5704.
720	6.17	34.85	27.43	65.6	75.9	1487.28	1.2994	6218.
760	5.90	34.85	27.47	62.3	72.7	1486.86	1.3289	6743.
800	5.65	34.85	27.50	59.3	69.8	1486.50	1.3574	7281.
840	5.39	34.86	27.54	55.6	66.1	1486.12	1.3847	7829.

R/V VIRGINIA KEY VK 72-13 STD STATION 48
1800 GMT MAY 15 1972
21 34 N 85 48 W 1920 M
SURFACE SAMPLE SALINITY 36.08
SURFACE SAMPLE TEMPERATURE 28.4

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.30	36.07	23.12	475.8	475.8	1543.62	.0000	0.
20	27.90	36.10	23.28	461.1	461.9	1543.10	.0938	9.
40	27.50	36.09	23.40	449.4	451.0	1542.54	.1851	37.
60	27.10	36.10	23.53	436.3	438.8	1541.98	.2741	83.
80	26.66	36.17	23.73	417.9	421.2	1541.38	.3601	147.
100	26.21	36.33	23.99	392.8	396.9	1540.82	.4419	227.
120	25.32	36.55	24.43	350.5	355.5	1539.26	.5171	323.
140	24.10	36.68	24.90	305.9	311.6	1536.77	.5838	433.
160	22.68	36.75	25.37	261.3	267.6	1533.62	.6418	555.
180	21.20	36.71	25.76	224.5	231.4	1530.07	.6917	689.
200	19.92	36.63	26.04	197.4	204.8	1526.86	.7353	831.
220	19.22	36.55	26.17	185.8	193.8	1525.16	.7751	982.
240	18.63	36.53	26.30	172.9	181.4	1523.79	.8127	1141.
260	18.40	36.48	26.32	171.0	180.1	1523.41	.8488	1307.
280	18.00	36.43	26.38	165.1	174.8	1522.53	.8843	1481.
300	17.38	36.32	26.45	158.6	168.8	1520.92	.9187	1661.
320	16.61	36.23	26.57	147.7	158.2	1518.85	.9514	1848.
360	14.65	35.94	26.79	126.5	137.3	1513.11	1.0124	2241.
400	13.38	35.64	26.83	122.9	134.1	1509.29	1.0668	2657.
440	11.70	35.43	27.00	106.8	117.8	1504.02	1.1170	3094.
480	10.60	35.26	27.07	100.2	111.2	1500.60	1.1622	3550.
520	9.40	35.08	27.13	93.9	104.7	1496.69	1.2057	4023.
560	8.61	35.00	27.20	87.7	98.5	1494.30	1.2462	4514.
600	8.20	34.95	27.22	85.4	96.4	1493.34	1.2852	5020.
640	7.58	34.90	27.28	80.3	91.3	1491.56	1.3224	5542.
680	7.00	34.83	27.31	77.7	88.5	1489.87	1.3582	6078.
720	6.50	34.85	27.39	69.7	80.5	1488.59	1.3917	6628.
760	6.00	34.86	27.46	62.8	73.3	1487.27	1.4224	7191.
800	5.75	34.86	27.49	59.8	70.5	1486.92	1.4510	7765.
840	5.48	34.86	27.53	56.6	67.3	1486.48	1.4785	8351.
880	5.36	34.86	27.54	55.2	66.2	1486.64	1.5052	8948.

R/V VIRGINIA KEY   VK 72-13   STD STATION   49
2006 GMT   MAY 15 1972
21 36 N   85 40 W   1920 M
SURFACE SAMPLE SALINITY 36.14
SURFACE SAMPLE TEMPERATURE 28.3

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.05	36.13	23.25	463.6	463.6	1543.13	.0000	0.
20	27.81	36.11	23.31	457.6	458.4	1542.91	.0922	9.
40	27.60	36.11	23.38	451.0	452.7	1542.78	.1833	37.
60	27.07	36.15	23.58	431.8	434.3	1541.96	.2720	82.
80	26.83	36.18	23.68	422.3	425.7	1541.77	.3580	145.
100	26.23	36.33	23.98	393.4	397.5	1540.87	.4403	225.
120	25.85	36.46	24.20	372.7	377.7	1540.43	.5179	321.
140	25.27	36.58	24.47	346.9	352.7	1539.50	.5909	432.
160	23.72	36.73	25.05	291.6	298.0	1536.21	.6560	557.
180	22.46	36.73	25.44	255.1	262.2	1533.21	.7120	693.
200	20.61	36.67	25.89	212.1	219.6	1528.77	.7602	841.
220	19.70	36.63	26.10	191.9	200.0	1526.57	.8021	997.
240	18.94	36.52	26.22	181.1	189.7	1524.66	.8411	1161.
260	18.38	36.45	26.30	172.7	181.8	1523.32	.8783	1333.
280	17.96	36.40	26.39	164.9	174.6	1522.21	.9139	1512.
300	17.11	36.27	26.48	156.1	166.1	1520.07	.9480	1698.
320	16.77	36.21	26.51	152.7	163.3	1519.32	.9809	1891.
360	15.24	35.95	26.67	138.2	149.2	1514.98	1.0441	2296.
400	14.22	35.78	26.76	129.4	141.1	1512.19	1.1025	2726.
440	13.21	35.62	26.85	121.1	133.2	1509.35	1.1573	3178.
480	12.38	35.50	26.92	114.1	126.7	1507.07	1.2090	3651.
520	11.06	35.26	26.99	108.0	120.4	1502.87	1.2586	4145.
560	9.86	35.11	27.09	98.0	110.0	1498.83	1.3045	4658.
600	8.97	35.03	27.17	90.9	102.9	1496.33	1.3465	5188.
640	8.53	34.99	27.20	87.3	99.4	1495.28	1.3870	5735.
680	7.99	34.94	27.25	83.1	95.3	1493.83	1.4261	6297.
720	7.49	34.87	27.27	81.3	93.5	1492.47	1.4640	6875.
760	6.65	34.85	27.37	71.7	83.2	1489.82	1.4997	7468.
800	6.39	34.85	27.40	68.4	80.1	1489.45	1.5326	8075.
840	5.90	34.85	27.47	62.3	73.8	1488.15	1.5632	8694.
880	5.58	34.86	27.52	57.8	69.2	1487.53	1.5921	9325.
920	5.17	34.86	27.57	53.1	64.2	1486.52	1.6187	9967.

R/V VIRGINIA KEY VK 72-13 STD STATION 50
2218 GMT MAY 15 1972
21 37 N 85 31 W 1554 M
SURFACE SAMPLE SALINITY 36.11
SURFACE SAMPLE TEMPERATURE 28.2

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.20	36.15	23.21	466.9	466.9	1543.47	.0000	0.
20	27.90	36.15	23.31	457.5	458.3	1543.15	.0925	9.
40	27.50	36.15	23.44	445.0	446.7	1542.59	.1830	37.
60	27.10	36.16	23.58	432.0	434.5	1542.04	.2712	82.
80	26.82	36.19	23.69	421.3	424.6	1541.76	.3571	145.
100	26.40	36.26	23.88	403.5	407.7	1541.19	.4403	225.
120	26.04	36.40	24.10	382.7	387.6	1540.81	.5198	321.
140	25.40	36.55	24.41	352.9	358.7	1539.78	.5945	432.
160	24.55	36.71	24.79	316.6	323.2	1538.21	.6627	558.
180	22.60	36.75	25.34	264.6	271.7	1534.25	.7221	696.
200	21.24	36.75	25.73	222.7	230.4	1530.53	.7724	846.
220	20.35	36.69	25.97	204.0	212.2	1528.41	.8166	1005.
240	19.50	36.63	26.15	186.9	195.7	1526.34	.8574	1172.
260	18.94	36.56	26.25	178.2	187.5	1525.02	.8957	1347.
280	18.33	36.48	26.34	169.3	179.1	1523.53	.9324	1530.
300	17.90	36.44	26.42	162.0	172.4	1522.57	.9675	1720.
320	17.20	36.36	26.53	151.6	162.3	1520.75	1.0010	1917.
360	16.60	36.26	26.59	145.2	157.1	1519.50	1.0648	2330.
400	15.50	36.05	26.69	136.4	148.9	1516.55	1.1260	2769.
440	14.23	35.82	26.79	126.7	139.5	1512.91	1.1836	3231.
480	12.65	35.59	26.90	116.4	129.3	1508.76	1.2370	3715.
520	12.00	35.45	26.96	110.8	124.0	1506.36	1.2873	4220.
560	11.00	35.33	27.05	101.8	115.1	1503.39	1.3349	4744.
600	10.22	35.22	27.10	96.8	110.1	1501.13	1.3802	5287.
640	9.39	35.09	27.14	93.0	106.2	1498.60	1.4239	5848.
680	8.60	35.03	27.23	85.3	98.4	1496.24	1.4649	6426.
720	7.92	34.92	27.24	83.6	96.4	1494.18	1.5039	7020.
760	7.37	34.87	27.28	79.7	92.3	1492.65	1.5411	7629.
800	7.00	34.88	27.34	74.0	86.7	1491.88	1.5770	8253.
840	6.22	34.88	27.45	64.0	76.0	1489.47	1.6101	8890.
880	5.65	34.89	27.51	58.7	70.7	1488.65	1.6394	9540.
920	5.57	34.90	27.55	54.7	66.6	1488.20	1.6667	10201.
960	5.30	34.90	27.58	51.5	63.4	1487.76	1.6926	10873.

R/V VIRGINIA KEY VK 72-13 STD STATION 51
0 36 GMT MAY 16 1972
21 46 N 85 22 W 0 M
SURFACE SAMPLE SALINITY 36.12
SURFACE SAMPLE TEMPERATURE 28.2

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.20	36.13	23.20	468.3	468.3	1543.45	.0000	0.
20	28.14	36.12	23.21	467.2	468.0	1543.64	.0936	9.
40	27.60	36.10	23.37	451.7	453.4	1542.77	.1858	37.
60	26.92	36.14	23.62	427.9	430.4	1541.62	.2742	83.
80	26.44	36.22	23.84	407.6	410.9	1540.93	.3583	147.
100	26.35	36.23	23.87	404.2	408.3	1541.05	.4402	226.
120	26.05	36.26	23.99	393.0	398.0	1540.71	.5209	323.
140	25.63	36.45	24.26	366.9	372.7	1540.23	.5979	434.
160	24.30	36.58	24.77	318.8	325.3	1537.50	.6677	561.
180	22.60	36.75	25.39	259.1	266.2	1533.74	.7269	700.
200	21.20	36.76	25.80	220.9	228.6	1530.43	.7764	851.
220	20.50	36.71	25.95	206.4	214.7	1528.83	.8207	1010.
240	19.60	36.65	26.09	193.0	201.8	1527.19	.8623	1179.
260	18.99	36.57	26.24	178.7	188.1	1525.17	.9013	1355.
280	18.41	36.54	26.37	166.9	176.7	1523.82	.9378	1539.
300	17.92	36.45	26.42	161.8	172.1	1522.63	.9727	1730.
320	17.20	36.33	26.50	153.8	164.5	1520.72	1.0064	1928.
360	16.02	36.15	26.64	140.4	151.9	1517.62	1.0696	2343.
400	15.06	35.97	26.72	132.9	145.1	1515.08	1.1286	2783.
440	14.03	35.83	26.84	121.9	134.6	1512.28	1.1845	3246.
480	12.65	35.62	26.96	110.4	123.2	1508.12	1.2353	3730.
520	12.00	35.51	27.00	106.4	119.7	1506.43	1.2842	4234.
560	10.90	35.31	27.05	101.6	114.8	1503.01	1.3316	4757.
600	10.26	35.23	27.11	96.7	110.1	1501.28	1.3767	5299.
640	9.80	35.15	27.12	95.1	108.8	1500.17	1.4207	5858.
680	8.85	35.02	27.18	89.8	103.2	1497.16	1.4631	6435.
720	8.48	34.95	27.18	89.5	103.0	1496.33	1.5044	7029.
760	7.44	34.89	27.29	79.2	91.9	1492.95	1.5431	7638.
800	7.12	34.86	27.31	77.1	89.9	1492.32	1.5796	8263.
840	6.79	34.85	27.35	73.5	86.4	1491.67	1.6146	8902.
880	6.34	34.85	27.41	67.7	80.5	1490.55	1.6475	9554.
920	5.84	34.86	27.48	60.9	73.2	1489.22	1.6782	10219.
960	5.38	34.88	27.56	54.0	66.0	1488.05	1.7061	10896.
1000	5.07	34.90	27.61	49.0	60.8	1487.47	1.7316	11584.

R/V VIRGINIA KEY VK 72-13 STD STATION 52
0230 GMT MAY 16 1972
21 48 N 85 12 W 1463 M
SURFACE SAMPLE SALINITY 36.10
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.08	36.12	23.23	465.3	465.3	1543.19	.0000	0.
20	28.07	36.09	23.21	467.1	468.0	1543.46	.0933	9.
40	27.46	36.13	23.44	445.2	446.9	1542.49	.1848	37.
60	26.96	36.13	23.60	429.9	432.4	1541.70	.2728	83.
80	26.62	36.16	23.73	417.4	420.7	1541.28	.3581	146.
100	26.37	36.24	23.87	404.1	408.2	1541.11	.4410	226.
120	26.00	36.37	24.09	383.6	388.6	1540.70	.5206	322.
140	25.63	36.53	24.32	361.1	366.9	1540.30	.5962	434.
160	24.75	36.65	24.68	326.7	333.3	1538.64	.6662	560.
180	23.38	36.74	25.16	281.3	288.5	1535.70	.7284	699.
200	22.27	36.75	25.50	248.8	256.6	1533.09	.7829	851.
220	21.20	36.70	25.75	225.3	233.7	1530.70	.8319	1012.
240	20.38	36.67	25.95	206.2	215.2	1528.79	.8768	1183.
260	19.40	36.60	26.16	186.6	196.1	1526.35	.9179	1362.
280	18.50	36.46	26.28	174.8	184.7	1524.00	.9560	1550.
300	17.88	36.44	26.43	161.1	171.4	1522.45	.9916	1745.
320	17.58	36.38	26.45	158.9	169.8	1521.89	1.0258	1946.
360	16.73	36.24	26.54	150.8	162.6	1520.02	1.0921	2370.
400	15.92	36.06	26.60	144.8	157.5	1517.86	1.1556	2820.
440	14.60	35.87	26.75	130.6	143.7	1514.16	1.2159	3294.
480	13.72	35.75	26.84	121.6	135.2	1511.82	1.2723	3792.
520	12.72	35.57	26.91	115.4	129.2	1508.94	1.3253	4311.
560	11.44	35.37	27.00	106.6	120.3	1504.98	1.3760	4852.
600	10.52	35.23	27.06	101.0	114.7	1502.21	1.4230	5411.
640	9.65	35.11	27.12	95.6	109.2	1499.57	1.4681	5990.
680	9.19	35.03	27.13	94.3	108.1	1498.43	1.5113	6586.
720	8.58	34.96	27.17	90.2	103.9	1496.72	1.5533	7199.
760	7.99	34.90	27.22	86.1	99.6	1495.06	1.5936	7828.
800	7.17	34.86	27.31	77.7	90.7	1492.51	1.6315	8473.
840	6.64	34.84	27.36	72.3	85.0	1491.07	1.6663	9133.
880	6.38	34.85	27.41	68.2	81.1	1490.71	1.6992	9806.
920	6.21	34.85	27.43	66.1	79.2	1490.68	1.7312	10492.
960	6.01	34.85	27.45	63.7	76.9	1490.54	1.7624	11191.

R/V VIRGINIA KEY VK 72-13 STD STATION 53
0448 GMT MAY 16 1972
21 45 N 85 20 W 1006 M
SURFACE SAMPLE SALINITY 36.01
SURFACE SAMPLE TEMPERATURE 28.2

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.06	36.03	23.16	471.7	471.8	1543.11	.0000	0.
20	28.00	36.00	23.17	471.4	472.2	1543.23	.0944	9.
40	27.03	35.94	23.44	445.7	447.3	1541.36	.1864	38.
60	26.48	35.98	23.64	426.1	428.6	1540.48	.2739	84.
80	26.27	36.03	23.75	416.2	419.5	1540.37	.3588	147.
100	26.18	36.15	23.86	404.8	409.0	1540.59	.4416	227.
120	25.94	36.35	24.09	383.3	388.2	1540.54	.5213	323.
140	25.63	36.44	24.26	367.6	373.4	1540.22	.5975	435.
160	24.77	36.56	24.61	333.8	340.3	1538.61	.6688	562.
180	23.42	36.75	25.16	281.7	288.9	1535.80	.7318	702.
200	21.80	36.77	25.64	236.1	243.8	1532.02	.7851	853.
220	21.40	36.75	25.73	226.9	235.4	1531.27	.8330	1015.
240	19.90	36.67	26.08	194.0	202.9	1527.48	.8768	1186.
260	19.20	36.57	26.19	183.9	193.3	1525.77	.9164	1366.
280	18.40	36.46	26.31	172.4	182.3	1523.71	.9540	1553.
300	17.60	36.35	26.42	161.5	171.8	1521.60	.9894	1747.
320	17.01	36.31	26.53	150.9	161.6	1520.13	1.0227	1948.
360	15.98	36.10	26.62	143.2	154.6	1517.44	1.0866	2370.
400	14.67	35.92	26.77	128.4	140.4	1513.79	1.1461	2817.
440	13.75	35.75	26.84	122.2	134.7	1511.28	1.2007	3286.
480	12.70	35.55	26.90	116.4	129.3	1508.21	1.2536	3777.
520	11.61	35.40	26.99	107.4	120.3	1504.96	1.3034	4289.
560	10.93	35.33	27.06	100.6	113.9	1503.14	1.3507	4819.
600	10.40	35.22	27.07	99.7	113.3	1501.77	1.3965	5369.
640	9.99	35.16	27.10	97.4	111.4	1500.87	1.4413	5936.
680	9.60	35.10	27.12	95.6	109.9	1500.02	1.4852	6522.
720	9.05	35.02	27.15	92.9	107.2	1498.55	1.5284	7124.
760	7.80	34.92	27.26	81.9	95.2	1494.37	1.5687	7744.
800	7.25	34.86	27.29	78.8	91.9	1492.82	1.6059	8379.
840	6.70	34.85	27.36	72.3	85.1	1491.32	1.6412	9028.
880	6.07	34.85	27.45	64.4	76.7	1489.48	1.6730	9691.
920	5.83	34.86	27.48	60.7	73.1	1489.18	1.7030	10367.
960	5.75	34.86	27.49	59.8	72.5	1489.51	1.7322	11054.
1000	5.30	34.90	27.58	51.5	63.9	1488.41	1.7597	11752.

R/V VIRGINIA KEY VK 72-13 STD STATION 54
0648 GMT MAY 16 1972
21 42 N 85 27 W 1646 M
SURFACE SAMPLE SALINITY 35.96
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.00	35.96	23.14	474.3	474.3	1542.87	.0000	0.
20	27.60	35.92	23.24	464.7	465.5	1542.28	.0940	9.
40	26.95	35.95	23.47	442.5	444.2	1541.19	.1849	37.
60	26.75	35.99	23.56	433.5	436.0	1541.10	.2730	83.
80	26.52	36.05	23.68	422.2	425.6	1540.95	.3591	146.
100	26.26	36.22	23.89	402.2	406.3	1540.84	.4423	226.
120	26.00	36.37	24.09	383.6	388.6	1540.70	.5218	323.
140	25.50	36.54	24.37	356.6	362.3	1540.00	.5969	435.
160	24.40	36.59	24.74	321.0	327.5	1537.75	.6659	561.
180	22.82	36.74	25.32	265.8	273.0	1534.29	.7259	700.
200	21.60	36.75	25.68	232.2	239.9	1531.48	.7772	851.
220	20.76	36.68	25.85	215.8	224.1	1529.56	.8236	1011.
240	19.60	36.62	26.12	190.1	198.9	1526.61	.8659	1180.
260	18.90	36.54	26.24	178.7	188.0	1524.89	.9046	1357.
280	18.00	36.42	26.38	165.8	175.5	1522.52	.9410	1541.
300	17.50	36.35	26.45	159.2	169.4	1521.31	.9755	1733.
320	16.92	36.27	26.52	151.7	162.4	1519.83	1.0087	1931.
360	15.90	36.13	26.66	139.2	150.7	1517.23	1.0713	2347.
400	14.60	35.86	26.74	131.3	143.3	1513.50	1.1305	2788.
440	13.40	35.65	26.83	122.6	134.8	1510.01	1.1860	3251.
460	12.50	35.54	26.93	113.4	126.1	1507.52	1.2375	3736.
520	11.30	35.35	27.01	105.6	118.2	1503.82	1.2870	4241.
560	10.45	35.22	27.06	100.6	113.3	1501.31	1.3332	4765.
600	9.76	35.15	27.13	94.7	107.6	1499.45	1.3772	5307.
640	9.22	35.05	27.14	93.3	106.3	1497.92	1.4193	5866.
680	8.50	34.96	27.19	89.1	101.9	1495.78	1.4605	6442.
720	8.02	34.93	27.24	84.3	97.2	1494.57	1.5008	7035.
760	7.56	34.88	27.27	81.6	94.5	1493.40	1.5391	7643.
800	7.25	34.86	27.29	78.8	91.9	1492.82	1.5762	8266.
840	7.00	34.85	27.32	76.2	89.5	1492.49	1.6126	8904.
880	6.22	34.85	27.43	66.2	78.8	1490.07	1.6464	9556.
920	5.82	34.86	27.49	60.6	73.0	1489.14	1.6766	10220.
960	5.23	34.87	27.57	53.0	64.7	1487.43	1.7045	10897.
1000	5.08	34.92	27.62	47.6	59.5	1487.54	1.7294	11583.

R/V VIRGINIA KEY VK 72-13 STD STATION 55
0854 GMT MAY 16 1972
21 39 N 85 34 W 1646 M
SURFACE SAMPLE SALINITY 36.10
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.05	36.08	23.21	467.2	467.2	1543.09	.0000	0.
20	28.04	36.08	23.21	466.9	467.8	1543.39	.0935	9.
40	27.44	36.00	23.35	454.0	455.7	1542.33	.1858	37.
60	27.00	36.04	23.52	437.6	440.1	1541.71	.2754	83.
80	26.62	36.05	23.65	425.3	428.6	1541.18	.3623	147.
100	26.08	36.16	23.90	401.1	405.2	1540.37	.4457	228.
120	25.96	36.36	24.09	383.1	388.1	1540.59	.5250	325.
140	25.00	36.53	24.52	342.6	348.4	1538.81	.5987	437.
160	23.80	36.65	24.97	299.6	306.0	1536.34	.6641	564.
180	22.58	36.70	25.36	262.2	269.2	1533.65	.7216	702.
200	20.35	36.62	25.92	209.1	216.5	1528.02	.7702	851.
220	19.34	36.55	26.13	188.8	196.8	1525.50	.8115	1010.
240	18.71	36.51	26.27	176.3	184.8	1524.00	.8497	1176.
260	18.00	36.41	26.37	166.6	175.6	1522.19	.8857	1349.
280	17.25	36.34	26.50	154.2	163.6	1520.24	.9196	1530.
300	16.93	36.26	26.51	152.7	162.7	1519.52	.9523	1717.
320	16.30	36.19	26.61	143.7	154.0	1517.87	.9839	1911.
360	15.28	35.95	26.66	139.0	150.1	1515.11	1.0445	2316.
400	13.78	35.74	26.82	123.5	134.9	1510.72	1.1009	2746.
440	12.63	35.52	26.89	117.3	129.0	1507.30	1.1533	3196.
480	11.68	35.40	26.98	108.7	120.6	1504.56	1.2029	3668.
520	10.77	35.26	27.04	103.0	115.2	1501.85	1.2503	4158.
560	10.19	35.16	27.06	100.7	113.1	1500.30	1.2961	4668.
600	9.50	35.07	27.11	96.2	108.7	1498.33	1.3402	5195.
640	8.90	34.99	27.15	92.8	105.4	1496.66	1.3829	5740.
680	8.21	34.91	27.19	88.5	101.0	1494.62	1.4237	6301.
720	7.75	34.85	27.21	86.4	98.9	1493.44	1.4633	6879.
760	7.33	34.85	27.27	80.6	93.2	1492.47	1.5016	7472.
800	7.09	34.84	27.30	78.2	91.0	1492.18	1.5383	8080.
840	6.50	34.83	27.37	71.2	83.7	1490.50	1.5732	8702.
880	5.90	34.84	27.46	63.1	75.0	1488.79	1.6049	9338.
920	5.59	34.85	27.51	58.6	70.5	1488.21	1.6341	9985.
960	5.12	34.86	27.57	52.5	64.0	1486.97	1.6610	10645.
1000	4.90	34.87	27.61	49.3	60.8	1486.74	1.6860	11314.

R/V VIRGINIA KEY VK 72-13 STD STATION 56
1054 GMT MAY 16 1972
21 36 N 85 42 W 1920 M
SURFACE SAMPLE SALINITY 36.11
SURFACE SAMPLE TEMPERATURE 28.0

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.00	36.13	23.27	462.1	462.1	1543.02	.0000	0.
20	28.00	36.10	23.24	464.2	465.1	1543.32	.0927	9.
40	27.50	36.06	23.38	451.5	453.2	1542.51	.1845	37.
60	27.00	36.07	23.54	435.4	437.9	1541.73	.2737	83.
80	26.60	36.15	23.73	417.5	420.8	1541.23	.3595	146.
100	26.20	36.26	23.94	397.5	401.7	1540.74	.4418	226.
120	25.40	36.45	24.33	360.1	365.0	1539.37	.5184	322.
140	24.37	36.57	24.74	321.6	327.2	1537.34	.5877	433.
160	23.08	36.72	25.26	272.2	278.6	1534.41	.6483	556.
180	21.44	36.73	25.71	229.4	236.3	1530.72	.6997	691.
200	20.56	36.68	25.93	208.6	216.1	1528.49	.7450	836.
220	19.28	36.63	26.21	181.5	189.5	1525.40	.7855	989.
240	18.87	36.55	26.26	177.2	185.8	1524.49	.8231	1150.
260	17.86	36.48	26.46	158.2	167.2	1521.84	.8584	1318.
280	17.36	36.35	26.48	156.0	165.5	1520.57	.8916	1493.
300	16.60	36.23	26.57	147.4	157.3	1518.50	.9239	1674.
320	16.20	36.15	26.60	144.4	154.7	1517.53	.9551	1862.
360	14.90	35.95	26.74	131.0	141.9	1513.91	1.0143	2256.
400	13.58	35.75	26.87	118.8	130.1	1510.08	1.0687	2673.
440	11.99	35.45	26.96	110.6	121.8	1505.04	1.1194	3111.
480	11.56	35.41	27.01	105.8	117.7	1504.15	1.1669	3568.
520	10.39	35.22	27.07	99.6	111.3	1500.45	1.2128	4044.
560	9.64	35.13	27.13	94.0	105.9	1498.27	1.2562	4538.
600	8.82	35.02	27.18	89.4	101.1	1495.76	1.2974	5049.
640	8.26	34.95	27.22	86.3	98.1	1494.21	1.3376	5576.
680	7.80	34.92	27.26	81.9	93.9	1493.08	1.3759	6118.
720	7.00	34.83	27.31	77.7	89.1	1490.52	1.4123	6676.
760	6.42	34.85	27.40	68.7	79.9	1488.92	1.4464	7248.
800	6.18	34.85	27.43	65.7	77.1	1488.62	1.4775	7833.
840	6.10	34.85	27.44	64.8	76.5	1488.95	1.5082	8430.
880	5.54	34.86	27.52	57.3	68.6	1487.37	1.5373	9039.
920	5.39	34.86	27.54	55.6	67.1	1487.42	1.5643	9659.
960	5.16	34.86	27.57	53.0	64.5	1487.13	1.5906	10290.
1000	4.81	34.86	27.61	49.1	60.4	1486.36	1.6157	10932.

R/V VIRGINIA KEY VK 72-13 STD STATION 57
1330 GMT MAY 16 1972
21 33 N 85 50 W 1920 M
SURFACE SAMPLE SALINITY 36.05
SURFACE SAMPLE TEMPERATURE 28.1

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.08	36.08	23.20	468.2	468.2	1543.15	.0000	0.
20	28.08	36.07	23.19	468.9	469.7	1543.47	.0938	9.
40	27.57	36.13	23.41	448.6	450.3	1542.73	.1858	37.
60	26.80	36.15	23.67	423.6	426.1	1541.36	.2734	83.
80	26.50	36.25	23.84	407.3	410.6	1541.09	.3571	146.
100	25.90	36.40	24.14	378.5	382.6	1540.17	.4364	226.
120	24.85	36.58	24.60	334.7	339.6	1538.18	.5087	320.
140	23.50	36.76	25.14	283.2	288.9	1535.37	.5715	428.
160	22.40	36.76	25.46	252.9	259.2	1532.92	.6263	548.
180	21.25	36.75	25.78	223.0	229.9	1530.23	.6752	678.
200	20.02	36.67	26.05	197.1	204.5	1527.17	.7186	818.
220	19.22	36.60	26.20	182.2	190.2	1525.21	.7581	965.
240	18.56	36.52	26.31	171.9	180.4	1523.58	.7952	1121.
260	17.40	36.36	26.48	156.2	165.0	1520.38	.8297	1283.
280	16.64	36.25	26.58	146.9	156.1	1518.32	.8618	1452.
300	16.45	36.23	26.61	144.1	153.9	1518.05	.8928	1628.
320	15.60	36.02	26.64	140.8	150.8	1515.54	.9233	1809.
360	13.78	35.75	26.83	122.8	133.0	1510.09	.9806	2190.
400	13.10	35.55	26.82	124.1	135.0	1508.26	1.0336	2593.
440	11.22	35.39	27.06	101.2	111.9	1502.30	1.0822	3016.
480	10.38	35.23	27.08	98.7	109.5	1499.78	1.1269	3458.
520	9.24	35.05	27.14	93.6	104.2	1496.06	1.1697	3918.
560	8.62	34.98	27.18	89.4	100.1	1494.32	1.2100	4394.
600	8.20	34.95	27.22	85.4	96.4	1493.34	1.2493	4885.
640	7.80	34.86	27.21	86.4	97.6	1492.35	1.2876	5393.
680	6.85	34.86	27.35	73.5	84.1	1489.33	1.3235	5915.
720	6.60	34.85	27.38	71.0	81.9	1488.98	1.3566	6451.
760	6.20	34.85	27.43	66.0	76.8	1488.05	1.3881	7000.
800	6.00	34.85	27.46	63.5	74.6	1487.90	1.4184	7562.
840	5.65	34.85	27.50	59.3	70.4	1487.15	1.4475	8135.
880	5.41	34.85	27.53	56.5	67.6	1486.83	1.4753	8719.
920	5.20	34.85	27.55	54.2	65.3	1486.63	1.5021	9315.

R/V VIRGINIA KEY VK 72-13 STD STATION 58
2218 GMT MAY 16 1972
21 32 N 85 58 W 1737 M
SURFACE SAMPLE SALINITY 36.05
SURFACE SAMPLE TEMPERATURE 28.6

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.62	36.05	23.00	487.4	487.4	1544.29	.0000	0.
20	28.21	36.10	23.17	470.8	471.7	1543.77	.0959	10.
40	27.42	36.13	23.45	444.0	445.7	1542.40	.1876	38.
60	26.80	36.22	23.72	418.5	421.0	1541.42	.2743	84.
80	26.40	36.36	23.95	396.3	399.7	1540.96	.3564	147.
100	25.40	36.55	24.41	352.9	357.0	1539.13	.4321	226.
120	24.40	36.75	24.87	309.5	314.4	1537.24	.4992	319.
140	23.35	36.77	25.19	278.3	283.9	1535.00	.5590	425.
160	22.21	36.76	25.51	247.8	254.1	1532.43	.6128	542.
180	20.79	36.73	25.89	212.4	219.2	1528.99	.6602	669.
200	19.50	36.63	26.15	186.9	194.2	1525.69	.7015	806.
220	18.30	36.53	26.39	165.0	172.7	1522.52	.7382	950.
240	17.72	36.43	26.45	158.5	166.8	1521.07	.7722	1101.
260	17.20	36.35	26.52	152.3	161.1	1519.78	.8049	1258.
280	16.38	36.25	26.64	141.1	150.2	1517.53	.8361	1422.
300	15.60	36.13	26.73	132.7	142.2	1515.33	.8653	1593.
320	14.61	36.02	26.82	124.0	133.7	1513.06	.8929	1768.
360	13.88	35.83	26.87	118.9	129.3	1510.51	.9458	2136.
400	12.59	35.63	26.98	108.5	119.2	1506.65	.9957	2525.
440	11.40	35.43	27.05	101.5	112.3	1502.98	1.0423	2932.
480	10.20	35.17	27.07	100.1	110.8	1499.06	1.0868	3358.
520	9.45	35.13	27.17	91.0	101.8	1496.94	1.1293	3801.
560	8.78	35.03	27.20	88.0	99.0	1494.98	1.1698	4261.
600	7.94	34.94	27.26	82.4	93.1	1492.34	1.2077	4737.
640	7.18	34.88	27.32	76.4	86.8	1489.99	1.2435	5227.
680	6.76	34.85	27.35	73.1	83.6	1488.96	1.2777	5731.
720	6.40	34.85	27.40	68.5	79.1	1488.19	1.3102	6249.
760	6.00	34.85	27.46	63.5	74.1	1487.26	1.3408	6779.
800	5.61	34.85	27.50	58.9	69.3	1486.34	1.3694	7321.

R/V VIRGINIA KEY   VK 72-13   STD STATION   59
0 54 GMT   MAY 17 1972
21 32 N   86 03 W   0 M
SURFACE SAMPLE SALINITY 36.17
SURFACE SAMPLE TEMPERATURE 28.3

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.22	36.20	23.25	463.9	463.9	1543.56	.0000	0.
20	28.01	36.20	23.31	457.3	458.2	1543.43	.0922	9.
40	27.39	36.17	23.49	440.2	441.9	1542.37	.1822	37.
60	26.60	36.21	23.78	413.2	415.7	1540.96	.2680	82.
80	25.80	36.50	24.25	368.3	371.6	1539.70	.3467	143.
100	24.92	36.64	24.62	332.4	336.5	1538.07	.4175	220.
120	24.19	36.70	24.89	307.0	311.9	1536.69	.4824	310.
140	23.35	36.75	25.18	279.8	285.4	1534.99	.5421	412.
160	21.60	36.70	25.64	235.8	242.0	1530.79	.5948	526.
180	19.66	36.60	26.09	193.1	199.7	1525.79	.6390	649.
200	18.46	36.52	26.34	169.5	176.6	1522.65	.6766	781.
220	18.05	36.46	26.39	164.1	171.8	1521.74	.7115	919.
240	17.54	36.40	26.47	156.5	164.7	1520.51	.7451	1065.
260	16.00	36.15	26.65	140.0	148.3	1515.95	.7764	1217.
280	15.20	36.04	26.75	130.7	139.4	1513.67	.8052	1375.
300	14.42	35.90	26.81	124.7	133.6	1511.36	.8325	1539.
320	13.52	35.78	26.91	115.4	124.5	1508.63	.8583	1708.
360	12.98	35.68	26.94	112.2	122.1	1507.37	.9086	2062.
400	11.60	35.44	27.03	104.3	114.3	1503.04	.9556	2435.
440	10.58	35.27	27.08	99.1	109.2	1499.90	1.0008	2826.
480	9.47	35.13	27.16	91.3	101.4	1496.37	1.0426	3235.
520	8.96	35.07	27.20	87.8	98.2	1495.05	1.0825	3660.
560	8.40	34.98	27.22	86.1	96.6	1493.49	1.1220	4101.
600	7.76	34.90	27.25	82.8	93.3	1491.61	1.1601	4557.
640	7.20	34.89	27.32	75.9	86.4	1490.08	1.1957	5028.
680	6.68	34.87	27.38	70.5	81.0	1488.68	1.2293	5513.
720	6.38	34.83	27.39	69.7	80.3	1488.09	1.2617	6012.
760	6.00	34.83	27.44	65.0	75.5	1487.23	1.2929	6523.

R/V VIRGINIA KEY VK 72-13 STD STATION 60
0306 GMT MAY 17 1972
21 32 N 86 09 W 0 M
SURFACE SAMPLE SALINITY 36.16
SURFACE SAMPLE TEMPERATURE 28.0

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.98	36.20	23.32	456.4	456.4	1543.04	.0000	0.
20	27.84	36.18	23.36	453.5	454.3	1543.04	.0911	9.
40	27.28	36.22	23.57	433.2	434.9	1542.17	.1800	36.
60	26.67	36.31	23.83	408.1	410.6	1541.20	.2645	81.
80	25.98	36.40	24.12	380.9	384.2	1540.03	.3440	142.
100	24.40	36.58	24.74	321.7	325.8	1536.77	.4150	217.
120	22.71	36.73	25.35	263.5	268.3	1533.04	.4744	306.
140	21.50	36.73	25.69	231.0	236.4	1530.23	.5249	406.
160	19.80	36.60	26.05	196.6	202.5	1525.86	.5688	516.
180	19.19	36.53	26.16	186.5	193.0	1524.41	.6083	633.
200	17.85	36.39	26.39	164.5	171.4	1520.77	.6448	759.
220	16.48	36.23	26.60	144.7	152.0	1516.85	.6771	891.
240	16.37	36.15	26.56	148.1	155.9	1516.76	.7079	1029.
260	15.40	36.04	26.70	135.0	143.1	1513.98	.7378	1174.
280	14.70	36.00	26.83	123.2	131.6	1512.05	.7653	1324.
300	14.00	35.82	26.84	122.0	130.7	1509.92	.7915	1480.
320	13.63	35.78	26.89	117.6	126.7	1508.99	.8173	1641.
360	12.80	35.63	26.94	112.5	122.2	1506.71	.8671	1978.
400	11.60	35.43	27.02	105.0	115.0	1503.03	.9146	2334.
440	10.42	35.24	27.09	98.6	108.6	1499.29	.9595	2709.
480	9.37	35.10	27.16	91.9	101.9	1495.96	1.0012	3101.
520	8.79	35.03	27.19	88.2	98.4	1494.37	1.0409	3510.
560	8.10	34.96	27.25	83.2	93.4	1492.33	1.0791	3934.
600	7.48	34.89	27.28	79.7	89.9	1490.52	1.1161	4373.
640	7.00	34.89	27.35	73.2	83.5	1489.31	1.1508	4826.
680	6.65	34.86	27.38	70.9	81.3	1488.55	1.1833	5293.
720	6.30	34.84	27.41	68.0	78.4	1487.79	1.2151	5773.
760	5.97	34.83	27.44	64.7	75.1	1487.11	1.2456	6265.

R/V VIRGINIA KEY VK 72-13 STD STATION 61
0606 GMT MAY 17 1972
21 22 N 86 20 W 0 M
SURFACE SAMPLE SALINITY 36.14
SURFACE SAMPLE TEMPERATURE 27.9

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.81	36.19	23.37	451.8	451.8	1542.66	.0000	0.
20	27.80	36.18	23.37	452.2	453.1	1542.95	.0905	9.
40	26.99	36.20	23.65	425.8	427.4	1541.50	.1785	36.
60	26.60	36.28	23.83	408.1	410.6	1541.02	.2623	80.
80	25.76	36.40	24.18	374.9	378.2	1539.56	.3412	140.
100	24.20	36.60	24.81	314.5	318.6	1536.30	.4109	216.
120	22.98	36.71	25.26	272.4	277.2	1533.70	.4705	304.
140	22.16	36.70	25.48	250.8	256.2	1531.92	.5238	403.
160	19.30	36.56	26.15	187.1	192.9	1524.43	.5687	512.
180	18.24	36.43	26.32	170.8	177.1	1521.61	.6057	630.
200	16.66	36.28	26.59	145.1	151.8	1517.13	.6386	754.
220	16.43	36.20	26.59	145.8	153.0	1516.67	.6691	885.
240	15.82	36.12	26.67	138.2	145.9	1515.04	.6990	1022.
260	15.40	36.08	26.73	132.1	140.2	1514.02	.7276	1165.
280	14.57	35.90	26.78	127.8	136.2	1511.52	.7552	1313.
300	13.60	35.83	26.93	113.3	121.9	1508.63	.7810	1466.
320	13.28	35.71	26.90	115.8	124.8	1507.76	.8057	1625.
360	12.20	35.52	26.97	109.3	118.7	1504.56	.8539	1957.

R/V VIRGINIA KEY VK 72-13 STD STATION 62
0330 GMT MAY 17 1972
21 19 N 86 27 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE 27.8

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.60	36.15	23.35	454.4	454.4	1542.60	.0000	0.
20	27.30	36.16	23.52	438.1	439.0	1541.84	.0893	9.
40	26.40	36.30	23.91	400.6	402.3	1540.26	.1735	35.
60	25.70	36.45	24.24	368.9	371.4	1539.10	.2508	78.
80	24.72	36.62	24.67	328.0	331.3	1537.25	.3211	135.
100	23.80	36.70	25.01	296.0	300.0	1535.41	.3843	205.
120	22.20	36.70	25.47	251.8	256.5	1531.71	.4399	288.
140	20.45	36.60	25.88	213.1	218.3	1527.31	.4874	381.
160	19.57	36.48	26.02	199.5	205.4	1525.11	.5298	482.
180	17.53	36.40	26.48	156.3	162.4	1519.52	.5666	592.

R/V VIRGINIA KEY   VK 72-13   STD STATION 63
2106 GMT   MAY 21 1972
21 19 N   86 30 W   0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE 27.5

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.80	36.22	23.40	449.3	449.3	1542.66	.0000	0.
20	27.78	36.21	23.40	449.4	450.3	1542.94	.0900	9.
40	26.80	36.30	23.78	412.8	414.5	1541.16	.1764	36.

R/V VIRGINIA KEY VK 72-13 STD STATION 64
2206 GMT MAY 21 1972
21 18 N 86 22 W 0 M
SURFACE SAMPLE SALINITY 36.19
SURFACE SAMPLE TEMPERATURE 27.5

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	-9.90	36.19	.00	.0	.0	.00	.0000	0.
20	-9.90	36.19	.00	.0	.0	.00	.0000	0.
40	-9.90	36.30	.00	.0	.0	.00	.0000	0.

R/V VIRGINIA KEY VK 72-13 STD STATION 65
2324 GMT MAY 21 1972
21 17 N 86 15 W 0 M
SURFACE SAMPLE SALINITY 36.22
SURFACE SAMPLE TEMPERATURE 27.5

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.70	36.25	23.45	444.1	444.1	1542.47	.0000	0.
20	27.73	36.22	23.42	447.2	448.0	1542.84	.0892	9.
40	27.43	36.22	23.52	437.8	439.5	1542.50	.1780	36.
60	26.50	36.21	23.81	410.1	412.6	1540.73	.2632	80.
80	25.48	36.45	24.31	362.4	365.7	1538.91	.3410	140.
100	23.63	36.70	25.06	291.2	295.2	1534.99	.4071	215.
120	22.30	36.74	25.47	251.7	256.4	1532.00	.4623	302.
140	21.80	36.76	25.63	236.8	242.2	1531.04	.5121	399.
160	18.60	36.55	26.33	170.7	176.4	1522.44	.5540	506.
180	18.03	36.47	26.41	162.9	169.2	1521.05	.5886	620.
200	17.61	36.42	26.47	156.7	163.6	1520.09	.6218	741.
220	17.32	36.40	26.53	151.4	158.9	1519.54	.6541	869.
240	17.05	36.35	26.56	148.9	156.9	1519.01	.6857	1003.
260	16.60	36.25	26.59	146.0	154.5	1517.88	.7168	1143.
280	15.70	36.19	26.75	130.5	139.4	1515.39	.7462	1289.
300	14.81	35.99	26.79	126.2	135.3	1512.71	.7737	1441.
320	13.40	35.78	26.93	113.0	122.1	1508.23	.7994	1599.
360	12.27	35.54	26.97	109.1	118.5	1504.82	.8476	1928.
400	11.48	35.45	27.06	101.4	111.3	1502.64	.8932	2276.
440	11.09	35.39	27.08	99.0	109.6	1501.85	.9374	2643.

R/V VIRGINIA KEY   VK 72-13   STD STATION   66
0224 GMT   MAY 22 1972
21 27 N   86 08 W   0 M
SURFACE SAMPLE SALINITY 36.20
SURFACE SAMPLE TEMPERATURE 27.5

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.65	36.22	23.45	444.7	444.7	1542.34	.0000	0.
20	27.73	36.21	23.41	447.9	448.7	1542.83	.0893	9.
40	27.75	36.21	23.41	448.5	450.2	1543.20	.1792	36.
60	27.61	36.12	23.39	450.6	453.2	1543.13	.2696	81.
80	26.25	36.31	23.96	395.4	398.8	1540.57	.3548	143.
100	25.70	36.47	24.26	367.5	371.6	1539.76	.4318	222.
120	24.20	36.70	24.89	307.3	312.2	1536.71	.5002	315.
140	22.58	36.71	25.37	261.4	267.0	1533.01	.5581	421.
160	20.00	36.60	26.00	201.6	207.6	1526.41	.6056	537.
180	18.78	36.54	26.27	175.8	182.2	1523.26	.6445	662.
200	18.32	36.46	26.33	170.5	177.6	1522.20	.6805	795.
220	17.52	36.34	26.43	160.4	167.9	1520.07	.7151	934.
240	16.48	36.23	26.60	144.7	152.6	1517.17	.7471	1080.
260	16.24	36.17	26.61	143.8	152.2	1516.70	.7776	1233.
280	15.70	36.04	26.63	141.5	150.3	1515.23	.8078	1391.
300	15.17	35.98	26.71	134.5	143.7	1513.83	.8372	1556.
320	14.80	35.89	26.72	133.3	143.0	1512.89	.8659	1726.
360	13.37	35.64	26.83	122.7	132.8	1508.62	.9212	2084.
400	12.15	35.43	26.91	115.0	125.3	1504.92	.9727	2463.
440	11.12	35.32	27.02	104.7	115.2	1501.87	1.0199	2861.
480	10.58	35.25	27.06	100.6	111.6	1500.52	1.0652	3278.
520	9.60	35.12	27.10	97.3	108.5	1498.20	1.1091	3713.
560	9.03	35.04	27.16	91.1	102.3	1495.92	1.1518	4165.
600	8.41	34.95	27.19	88.5	99.7	1494.14	1.1920	4634.
640	7.85	34.90	27.24	84.1	95.4	1492.60	1.2306	5119.
680	7.40	34.89	27.30	78.6	90.0	1491.50	1.2675	5618.
720	6.64	34.83	27.36	73.0	83.9	1489.11	1.3026	6133.
760	6.40	34.86	27.41	67.7	78.9	1488.86	1.3350	6660.
800	5.98	34.89	27.49	60.3	71.4	1487.88	1.3646	7200.
840	5.48	34.89	27.55	54.4	65.1	1486.52	1.3921	7752.
880	5.23	34.91	27.60	50.0	60.8	1486.19	1.4175	8313.
920	5.09	34.92	27.62	47.7	58.7	1486.28	1.4416	8885.
960	4.92	34.92	27.64	45.8	56.9	1486.24	1.4647	9467.
1000	4.80	34.93	27.66	43.7	55.1	1486.41	1.4872	10057.

R/V VIRGINIA KEY VK 72-13 STD STATION 67
0424 GMT MAY 22 1972
21 30 N 86 00 W 0 M
SURFACE SAMPLE SALINITY 36.21
SURFACE SAMPLE TEMPERATURE 27.8

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.73	36.20	23.41	448.6	448.6	1542.49	.0000	0.
20	27.73	36.19	23.40	449.3	450.2	1542.81	.0899	9.
40	27.79	36.19	23.38	451.2	452.9	1543.27	.1802	36.
60	27.38	36.14	23.47	442.1	444.6	1542.64	.2699	81.
80	26.80	36.14	23.66	424.3	427.6	1541.67	.3571	144.
100	26.00	36.31	24.04	387.9	392.1	1540.32	.4391	223.
120	25.37	36.50	24.38	355.6	360.6	1539.34	.5144	319.
140	23.53	36.66	25.06	291.3	296.9	1535.36	.5801	428.
160	20.21	36.60	25.94	206.9	212.9	1526.98	.6311	549.
180	18.35	36.53	26.37	166.2	172.5	1522.03	.6697	679.
200	17.38	36.34	26.47	157.2	164.0	1519.34	.7033	817.
220	17.00	36.31	26.54	150.6	158.0	1518.50	.7355	961.
240	16.43	36.22	26.60	144.4	152.2	1517.01	.7665	1111.
260	16.15	36.15	26.61	143.3	151.6	1516.41	.7969	1267.
280	15.80	36.12	26.67	137.8	146.7	1515.62	.8267	1429.
300	15.20	36.02	26.73	132.2	141.5	1513.97	.8556	1598.
320	14.61	35.94	26.80	125.7	135.3	1512.34	.8832	1772.
360	12.99	35.68	26.94	112.4	122.3	1507.40	.9352	2135.
400	12.00	35.50	27.00	107.1	117.4	1504.49	.9834	2519.
440	11.19	35.38	27.06	101.5	112.1	1502.19	1.0295	2922.
480	10.40	35.25	27.10	97.5	108.4	1499.88	1.0738	3342.
520	9.59	35.13	27.14	93.2	104.2	1497.45	1.1165	3781.
560	9.09	35.07	27.18	89.8	101.1	1496.18	1.1568	4235.
600	8.72	35.03	27.21	87.1	98.8	1495.40	1.1970	4706.
640	8.03	34.95	27.25	83.0	94.5	1493.35	1.2358	5193.
680	7.45	34.90	27.30	78.6	90.0	1491.71	1.2726	5694.
720	6.90	34.85	27.34	74.9	86.2	1490.16	1.3078	6210.
760	6.60	34.86	27.38	70.3	81.7	1489.64	1.3415	6740.
800	6.27	34.84	27.41	67.6	79.1	1488.96	1.3737	7283.
840	5.97	34.88	27.48	60.9	72.5	1488.47	1.4039	7839.
880	5.63	34.90	27.54	55.4	66.9	1487.79	1.4317	8406.
920	5.27	34.90	27.59	51.2	62.6	1486.99	1.4576	8984.
960	5.11	34.91	27.61	48.7	60.2	1487.00	1.4821	9572.
1000	4.92	34.93	27.65	45.0	56.7	1486.90	1.5054	10170.

R/V VIRGINIA KEY VK 72-13 STD STATION 68
1906 GMT MAY 28 1972
21 19 N 86 25 W 0 M
SURFACE SAMPLE SALINITY 36.18
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.11	36.23	23.30	458.3	458.3	1543.35	.0000	0.
20	27.83	36.25	23.41	448.1	449.0	1543.08	.0907	9.
40	27.00	36.32	23.73	417.4	419.1	1541.63	.1775	36.
60	25.03	36.64	24.59	335.6	338.1	1537.69	.2533	79.
80	24.19	36.75	24.93	303.4	306.7	1536.08	.3177	136.
100	23.10	36.80	25.29	269.2	273.2	1533.76	.3757	205.
120	19.00	36.56	26.23	179.7	184.0	1522.94	.4215	285.
140	18.50	36.54	26.34	169.0	174.0	1521.82	.4573	373.
160	17.80	36.45	26.45	158.9	164.5	1520.04	.4911	468.
180	16.66	36.31	26.62	143.0	148.9	1516.84	.5224	569.
200	16.35	36.30	26.68	136.8	143.3	1516.21	.5517	677.
220	14.80	36.02	26.82	123.8	130.5	1511.42	.5790	790.
240	14.53	35.96	26.83	122.6	129.8	1510.82	.6051	908.
260	14.19	35.90	26.86	120.0	127.7	1509.98	.6308	1032.
280	13.80	35.84	26.90	116.6	124.6	1508.97	.6561	1160.
300	13.18	35.84	27.02	104.4	112.7	1507.25	.6798	1294.
320	12.65	35.59	26.94	112.6	121.1	1505.52	.7032	1432.
360	11.30	35.49	27.12	95.3	104.1	1501.42	.7485	1723.

R/V VIRGINIA KEY   VK 72-13   STD STATION   69
2100 GMT   MAY 28 1972
21 23 N   86 09 W   0 M
SURFACE SAMPLE SALINITY 36.19
SURFACE SAMPLE TEMPERATURE 28.4

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.21	36.23	23.27	461.5	461.5	1543.56	.0000	0.
20	27.82	36.20	23.38	451.4	452.3	1543.02	.0914	9.
40	26.90	36.24	23.70	420.1	421.8	1541.34	.1788	36.
60	26.00	36.41	24.12	380.7	383.2	1539.76	.2593	80.
80	25.20	36.60	24.51	343.4	346.7	1538.38	.3323	139.
100	24.30	36.67	24.84	312.4	316.4	1536.61	.3986	212.
120	23.01	36.72	25.25	272.5	277.3	1533.79	.4580	298.
140	21.21	36.77	25.80	220.5	225.8	1529.50	.5083	394.
160	20.80	36.77	25.91	209.8	215.9	1528.73	.5525	501.
180	18.80	36.72	26.40	163.2	169.7	1523.49	.5910	615.
200	17.84	36.52	26.49	154.8	161.7	1520.86	.6242	736.
220	17.68	36.47	26.49	154.7	162.3	1520.67	.6566	864.
240	17.58	36.45	26.50	153.8	162.0	1520.68	.6890	999.
260	17.00	36.34	26.56	148.5	157.2	1519.17	.7209	1140.
280	15.70	36.25	26.79	126.1	135.0	1515.45	.7501	1287.
300	14.75	36.02	26.83	122.8	131.8	1512.55	.7768	1440.
320	14.17	35.90	26.86	119.6	129.0	1510.88	.8029	1598.
360	13.62	35.80	26.90	115.9	126.1	1509.62	.8541	1929.
400	13.00	35.70	26.95	111.2	122.1	1508.10	.9039	2281.
440	11.40	35.48	27.09	97.8	108.6	1503.04	.9495	2652.
480	9.78	35.19	27.16	91.8	102.2	1497.57	.9913	3040.
520	8.85	35.09	27.23	84.7	94.9	1494.67	1.0312	3445.
560	8.00	34.97	27.27	81.0	91.2	1491.97	1.0682	3864.
600	6.92	34.89	27.36	72.2	81.7	1488.35	1.1030	4299.
640	6.27	34.84	27.41	67.6	76.9	1486.37	1.1347	4746.

R/V VIRGINIA KEY   VK 72-13   STD STATION   70
2348 GMT   MAY 28 1972
21 27 N   85 48 W   0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE 28.4

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.33	36.00	23.06	481.8	481.8	1543.62	.0000	0.
20	28.17	36.01	23.12	476.0	476.9	1543.61	.0959	10.
40	27.37	36.04	23.40	448.9	450.6	1542.21	.1886	38.
60	26.66	36.05	23.66	424.7	427.2	1540.81	.2764	85.
80	26.20	36.08	23.81	410.5	413.8	1540.25	.3605	148.
100	25.83	36.18	24.00	392.2	396.3	1539.81	.4415	228.
120	25.42	36.48	24.35	358.5	363.5	1539.44	.5175	324.
140	24.59	36.75	24.81	314.9	320.7	1538.02	.5859	435.
160	23.44	36.80	25.19	278.7	285.1	1535.57	.6465	558.
180	22.00	36.82	25.62	237.8	244.8	1532.26	.6995	692.
200	20.35	36.72	26.00	201.8	209.3	1528.11	.7449	837.
220	19.66	36.61	26.11	190.9	198.9	1526.28	.7857	990.
240	18.60	36.58	26.30	173.4	181.9	1524.32	.8238	1151.
260	18.06	36.50	26.42	161.4	170.5	1522.45	.8590	1319.
280	17.74	36.42	26.44	159.7	169.4	1521.76	.8930	1494.
300	17.22	36.39	26.54	149.9	160.0	1520.52	.9260	1676.
320	16.70	36.30	26.60	144.6	155.1	1519.19	.9575	1865.
360	15.60	36.14	26.69	136.3	147.7	1516.93	1.0188	2260.
400	15.08	36.05	26.78	127.5	139.7	1515.23	1.0761	2679.
440	14.80	35.91	26.73	131.8	145.1	1514.84	1.1324	3121.
480	13.02	35.69	26.94	112.3	125.4	1509.44	1.1875	3585.
520	11.26	35.40	27.05	101.6	114.2	1503.81	1.2358	4070.
560	10.16	35.23	27.13	94.0	106.4	1500.06	1.2799	4573.
600	9.36	35.15	27.19	88.4	100.8	1497.99	1.3212	5093.
640	8.62	35.08	27.23	84.9	97.5	1496.48	1.3613	5630.
680	7.90	34.99	27.30	78.1	90.2	1493.55	1.3999	6182.
720	7.43	34.96	27.35	73.8	86.0	1492.36	1.4348	6749.
760	7.07	34.94	27.38	70.4	82.7	1491.59	1.4689	7330.
800	6.60	34.90	27.42	67.3	79.4	1490.34	1.5019	7924.
840	6.20	34.90	27.47	62.2	74.3	1489.41	1.5326	8531.
880	5.82	34.90	27.52	57.6	69.5	1488.55	1.5614	9150.
920	5.42	34.91	27.58	52.2	63.8	1487.60	1.5880	9780.
960	5.18	34.94	27.63	47.2	58.9	1487.32	1.6125	10420.

R/V VIRGINIA KEY   VK 72-13   STD STATION   71
0242 GMT   MAY 29 1972
21 37 N   85 29 W   0 M
SURFACE SAMPLE SALINITY 36.00
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.60	36.07	23.02	485.3	485.3	1544.26	.0000	0.
20	28.40	36.07	23.09	479.0	479.8	1544.16	.0965	10.
40	27.80	35.99	23.23	465.9	467.6	1543.11	.1912	38.
60	26.90	36.02	23.54	435.9	438.5	1541.46	.2819	86.
80	26.60	36.12	23.71	419.6	423.0	1541.20	.3680	151.
100	26.30	36.12	23.80	410.6	414.7	1540.84	.4518	233.
120	25.90	36.30	24.07	385.7	390.6	1540.40	.5323	331.
140	25.80	36.60	24.32	361.1	366.9	1540.75	.6081	445.
160	25.00	36.70	24.65	330.4	337.0	1539.28	.6785	574.
180	23.50	36.78	25.16	281.8	289.0	1536.03	.7411	716.
200	21.20	36.75	25.79	221.6	229.3	1530.42	.7929	869.
220	20.80	36.71	25.87	214.1	222.4	1529.64	.8381	1032.
240	20.40	36.68	25.95	206.0	215.0	1528.86	.8818	1204.
260	20.10	36.62	25.99	202.7	212.3	1528.31	.9245	1385.
280	19.70	36.61	26.09	193.4	203.6	1527.52	.9661	1574.
300	19.40	36.49	26.07	194.6	205.5	1526.90	1.0070	1771.
320	18.50	36.37	26.21	181.4	192.6	1524.56	1.0468	1977.
360	18.00	36.33	26.31	172.4	184.8	1523.72	1.1214	2410.
400	17.60	36.09	26.22	180.4	193.9	1522.95	1.1959	2874.
440	16.50	35.95	26.38	165.6	179.8	1520.16	1.2684	3367.
480	14.70	35.72	26.61	143.6	157.9	1514.95	1.3350	3888.
520	13.80	35.51	26.64	140.7	155.4	1512.45	1.3966	4434.
560	11.80	35.28	26.86	119.7	133.6	1506.11	1.4561	5005.
600	10.70	35.20	27.00	106.3	120.1	1502.81	1.5069	5597.
640	10.20	35.09	27.01	106.0	120.1	1501.54	1.5545	6210.
680	9.50	35.01	27.06	100.6	114.7	1499.54	1.6015	6841.
720	9.10	34.96	27.09	98.1	112.5	1498.65	1.6471	7491.

APPENDIX 4.

R/V BELLOWS STD LISTING

Z - Depth (m)

T - Temperature (°C)

(-9.9°C - no T - data)

S - Salinity (^{o}/oo)

SIGT - Sigma-t

TANOM - Thermosteric anomaly

SVA - Specific volume anomaly

SVEL - Sound velocity (m/s)

DYNHGT - Dynamic height (dyn. m)

TRANS - Transport function

R/V BELLOWS B 7204 STD STATION 7
0448 GMT MAY 9 1972
26 00 N 84 29 W 210 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.60	36.24	23.80	411.0	411.0	1540.01	.0000	0.
20	26.55	36.26	23.83	408.1	408.9	1540.24	.0820	8.
40	25.90	36.34	24.10	382.8	384.5	1539.14	.1613	33.
60	24.10	36.45	24.73	322.5	324.9	1535.29	.2323	72.
80	22.60	36.34	25.08	288.7	291.8	1531.77	.2939	125.
100	21.23	36.36	25.48	250.6	254.4	1528.54	.3486	189.
120	20.30	36.35	25.73	227.3	231.8	1526.35	.3972	263.
140	19.40	36.43	26.03	198.9	204.0	1524.27	.4408	347.
160	18.49	36.36	26.21	181.9	187.5	1521.95	.4799	439.
180	17.65	36.28	26.36	167.8	174.0	1519.75	.5161	539.

R/V BELLOWS B 7204 STD STATION 9
0900 GMT MAY 9 1972
25 47 N 85 01 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.10	36.18	23.91	400.3	400.3	1538.82	.0000	0.
20	25.82	36.19	24.01	391.2	392.0	1538.50	.0792	8.
40	25.67	36.23	24.08	383.9	385.5	1538.51	.1570	32.
60	25.05	36.35	24.37	357.0	359.5	1537.48	.2315	70.
80	24.08	36.48	24.76	319.8	323.0	1535.59	.2997	124.
100	21.90	36.33	25.27	270.5	274.4	1530.28	.3595	189.
120	21.21	36.46	25.57	242.9	247.4	1528.90	.4117	267.
140	19.50	36.38	25.96	205.1	210.1	1524.50	.4574	353.
160	18.70	36.38	26.17	185.5	191.1	1522.57	.4975	449.
180	17.99	36.32	26.30	172.9	179.1	1520.79	.5346	552.
200	17.10	36.22	26.44	159.5	166.2	1518.39	.5691	663.
220	16.36	36.18	26.59	145.7	152.9	1516.44	.6010	780.
240	15.89	36.09	26.63	141.9	149.6	1515.23	.6312	903.
260	15.10	36.00	26.74	131.6	139.5	1512.99	.6602	1032.
280	14.70	35.87	26.73	132.7	141.1	1511.91	.6882	1167.
300	14.00	35.81	26.83	122.8	131.5	1509.91	.7155	1307.
320	13.62	35.73	26.85	121.0	130.1	1508.90	.7416	1453.
360	12.92	35.60	26.89	117.0	126.7	1507.08	.7933	1760.
400	11.69	35.39	26.97	109.6	119.6	1503.30	.8425	2087.
440	10.73	35.22	27.01	105.3	115.5	1500.37	.8895	2434.
480	9.88	35.14	27.10	97.1	107.5	1497.87	.9340	2798.
520	9.14	35.02	27.13	94.3	104.8	1495.66	.9765	3180.
560	8.44	34.98	27.21	86.7	97.3	1493.64	1.0166	3579.
600	7.92	34.91	27.24	84.4	95.0	1492.23	1.0552	3994.
640	7.48	34.88	27.28	80.5	91.3	1491.15	1.0924	4423.
680	6.96	34.85	27.32	76.0	86.7	1489.83	1.1282	4867.
720	6.68	34.84	27.36	72.8	83.8	1489.29	1.1623	5325.
760	6.34	34.84	27.40	68.5	79.5	1488.59	1.1948	5797.
800	6.10	34.84	27.43	65.5	76.7	1488.29	1.2260	6281.
840	5.83	34.84	27.47	62.2	73.5	1487.86	1.2561	6778.
880	5.70	34.85	27.49	59.9	71.5	1488.01	1.2852	7286.
920	5.49	34.85	27.52	57.5	69.2	1487.81	1.3132	7806.
960	5.31	34.85	27.54	55.4	67.3	1487.73	1.3407	8336.

R/V BELLOWS B 7204 STD STATION 11
1254 GMT MAY 9 1972
25 33 N 85 32 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.10	36.19	23.92	399.5	399.6	1538.83	.0000	0.
20	25.85	36.21	24.01	390.7	391.5	1538.59	.0791	8.
40	25.70	36.21	24.06	386.2	387.9	1538.56	.1570	32.
60	24.50	36.33	24.52	342.6	345.0	1536.15	.2303	70.
80	23.44	36.35	24.85	311.1	314.3	1533.89	.2963	123.
100	21.80	36.37	25.33	265.0	268.8	1530.05	.3546	188.
120	20.45	36.36	25.70	230.4	234.9	1526.77	.4049	264.
140	19.50	36.37	25.96	205.8	210.9	1524.49	.4495	349.
160	18.49	36.39	26.23	179.7	185.3	1521.98	.4891	443.
180	17.63	36.32	26.39	164.4	170.6	1519.73	.5247	545.
200	16.90	36.23	26.50	154.2	160.9	1517.80	.5579	653.
220	16.10	36.09	26.58	146.5	153.6	1515.55	.5893	768.
240	15.40	36.04	26.70	135.0	142.5	1513.66	.6189	888.
260	14.88	35.95	26.75	130.6	138.5	1512.24	.6470	1015.
280	14.41	35.87	26.79	126.7	135.0	1510.98	.6744	1147.
300	13.94	35.77	26.81	124.5	133.2	1509.67	.7012	1285.
320	13.63	35.69	26.82	124.2	133.2	1508.89	.7278	1428.
360	12.20	35.47	26.93	113.0	122.3	1504.50	.7788	1729.
400	11.29	35.33	27.00	106.9	116.6	1501.83	.8260	2050.
440	10.27	35.20	27.08	99.1	108.9	1498.71	.8696	2389.
480	9.83	35.14	27.11	96.3	106.7	1497.69	.9128	2746.
520	9.17	35.03	27.13	94.0	104.6	1495.78	.9550	3119.
560	8.60	34.97	27.18	89.8	100.5	1494.23	.9959	3510.
600	8.32	34.94	27.20	87.9	99.0	1493.79	1.0356	3916.
640	7.70	34.90	27.26	82.0	93.1	1492.03	1.0743	4338.
680	7.10	34.85	27.31	77.5	88.5	1490.29	1.1107	4775.
720	6.82	34.84	27.34	74.6	85.8	1489.83	1.1455	5226.
760	6.48	34.83	27.38	71.0	82.2	1489.13	1.1791	5691.
800	6.09	34.83	27.43	66.1	77.3	1488.24	1.2110	6169.
840	5.79	34.84	27.47	61.7	73.0	1487.70	1.2410	6660.
880	5.53	34.84	27.51	58.7	70.0	1487.31	1.2696	7162.
920	5.45	34.84	27.52	57.8	69.4	1487.64	1.2975	7675.

R/V BELLOWS B 7204 STD STATION 13
1730 GMT MAY 9 1972
25 17 N 86 08 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.20	.00	.00	.0	.0	.00	.0000	*
20	26.64	.00	.00	.0	.0	.00	.0000	*
40	25.93	.00	.00	.0	.0	.00	.0000	*
60	23.04	.00	.00	.0	.0	.00	.0000	*
80	21.30	.00	.00	.0	.0	.00	.0000	*
100	20.50	.00	.00	.0	.0	.00	.0000	*
120	19.55	.00	.00	.0	.0	.00	.0000	*
140	18.37	.00	.00	.0	.0	.00	.0000	*
160	17.70	.00	.00	.0	.0	.00	.0000	*
180	16.72	.00	.00	.0	.0	.00	.0000	*
200	15.90	.00	.00	.0	.0	.00	.0000	*
220	14.92	.00	.00	.0	.0	.00	.0000	*
240	14.10	.00	.00	.0	.0	.00	.0000	*
260	13.10	.00	.00	.0	.0	.00	.0000	*
280	12.47	.00	.00	.0	.0	.00	.0000	*
300	11.90	.00	.00	.0	.0	.00	.0000	*
320	11.17	.00	.00	.0	.0	.00	.0000	*
360	10.17	.00	.00	.0	.0	.00	.0000	*
400	9.63	.00	.00	.0	.0	.00	.0000	*
440	9.10	.00	.00	.0	.0	.00	.0000	*
480	8.50	.00	.00	.0	.0	.00	.0000	*
520	7.70	.00	.00	.0	.0	.00	.0000	*
560	7.24	.00	.00	.0	.0	.00	.0000	*
600	6.90	.00	.00	.0	.0	.00	.0000	*
640	6.70	.00	.00	.0	.0	.00	.0000	*
680	6.35	.00	.00	.0	.0	.00	.0000	*
720	6.02	.00	.00	.0	.0	.00	.0000	*
760	5.79	.00	.00	.0	.0	.00	.0000	*
800	5.55	.00	.00	.0	.0	.00	.0000	*
840	5.40	.00	.00	.0	.0	.00	.0000	*
880	5.20	.00	.00	.0	.0	.00	.0000	*
920	5.10	.00	.00	.0	.0	.00	.0000	*

R/V BELLOWS B 7204 STD STATION 14
0154 GMT MAY 10 1972
24 23 N 85 35 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.75	36.36	23.84	406.9	406.9	1540.46	.0000	0.
20	25.87	36.40	24.15	377.6	378.4	1538.80	.0785	8.
40	24.30	36.43	24.65	329.6	331.3	1535.43	.1495	31.
60	20.08	36.39	25.82	218.9	221.1	1524.83	.2047	66.
80	18.10	36.32	26.28	175.5	178.3	1519.50	.2447	111.
100	16.82	36.15	26.46	158.2	161.5	1515.87	.2786	163.
120	15.30	35.95	26.65	139.4	143.2	1511.32	.3091	222.
140	14.24	35.80	26.77	128.3	132.5	1508.11	.3367	287.
160	13.24	35.67	26.88	118.0	122.5	1505.02	.3622	357.
180	12.56	35.56	26.93	113.1	117.9	1502.94	.3862	431.
200	11.90	35.44	26.97	109.7	114.8	1500.87	.4095	511.
220	11.30	35.34	27.00	106.3	111.7	1498.99	.4321	595.
240	10.55	35.24	27.06	100.8	106.3	1496.55	.4539	684.
260	10.11	35.24	27.14	93.5	99.3	1495.29	.4745	777.
280	9.75	35.14	27.12	95.0	101.1	1494.19	.4945	874.
300	9.43	35.05	27.11	96.6	102.9	1493.23	.5149	974.
320	9.10	35.05	27.16	91.4	97.9	1492.33	.5350	1079.
360	8.30	34.95	27.21	86.9	93.6	1489.86	.5733	1301.
400	8.00	34.92	27.23	84.8	92.0	1489.33	.6105	1538.
440	7.54	34.89	27.28	80.5	88.1	1488.18	.6466	1789.
480	7.10	34.86	27.32	76.8	84.6	1487.08	.6811	2055.
520	6.84	34.87	27.36	72.6	80.8	1486.72	.7140	2334.
560	6.63	34.86	27.38	70.7	79.2	1486.53	.7459	2626.
600	6.38	34.86	27.41	67.5	76.3	1486.19	.7770	2931.
640	6.03	34.85	27.45	63.9	72.8	1485.44	.8067	3247.
680	5.70	34.84	27.49	60.7	69.7	1484.75	.8351	3576.
720	5.50	34.84	27.51	58.3	67.6	1484.59	.8626	3915.
760	5.30	34.84	27.53	56.0	65.5	1484.43	.8891	4266.
800	5.16	34.85	27.56	53.7	63.4	1484.53	.9149	4626.
840	5.05	34.85	27.57	52.5	62.4	1484.73	.9401	4998.
880	4.90	34.87	27.61	49.3	59.5	1484.79	.9647	5378.

R/V BELLOWS B 7204 STD STATION 16
0718 GMT MAY 10 1972
24 37 N 84 59 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.56	36.21	23.47	442.6	442.6	1542.13	.0000	0.
20	27.50	36.21	23.49	440.7	441.6	1542.32	.0884	9.
40	26.37	36.28	23.90	401.2	402.9	1540.17	.1729	35.
60	23.30	36.41	24.93	302.9	305.3	1533.27	.2437	77.
80	21.40	36.56	25.59	240.6	243.7	1528.85	.2986	131.
100	19.68	36.63	26.11	191.4	195.1	1524.59	.3425	195.
120	18.80	36.55	26.27	175.5	179.9	1522.37	.3800	267.
140	18.07	36.46	26.39	164.6	169.5	1520.51	.4149	347.
160	17.22	36.35	26.51	152.8	158.2	1518.23	.4477	433.
180	16.36	36.20	26.60	144.3	150.1	1515.82	.4785	526.
200	15.74	36.10	26.67	137.9	144.3	1514.13	.5079	624.
220	15.14	36.03	26.75	130.2	137.0	1512.51	.5361	729.
240	14.48	35.88	26.78	127.4	134.6	1510.57	.5632	839.
260	13.83	35.77	26.84	122.3	129.8	1508.67	.5896	954.
280	13.13	35.67	26.90	115.9	123.6	1506.58	.6150	1074.
300	12.80	35.62	26.93	113.2	121.3	1505.74	.6395	1200.
320	12.05	35.50	26.99	108.0	116.3	1503.38	.6632	1330.
360	11.14	35.35	27.04	102.8	111.5	1500.69	.7092	1605.
400	10.00	35.19	27.12	95.4	104.2	1497.08	.7524	1897.
440	9.30	35.05	27.13	94.5	103.6	1495.00	.7938	2206.
480	8.73	35.05	27.22	85.8	95.2	1493.53	.8336	2532.
520	8.30	34.99	27.24	83.9	93.6	1492.49	.8715	2873.
560	7.80	34.94	27.28	80.4	90.3	1491.17	.9084	3229.
600	7.33	34.90	27.31	76.9	86.9	1489.96	.9442	3599.
640	7.08	34.90	27.35	73.6	83.9	1489.64	.9784	3984.
680	6.65	34.86	27.38	70.9	81.3	1488.55	1.0117	4382.
720	6.24	34.85	27.42	66.5	76.8	1487.57	1.0432	4793.
760	5.97	34.85	27.46	63.2	73.7	1487.14	1.0734	5216.
800	5.73	34.85	27.49	60.3	70.9	1486.83	1.1022	5651.
840	5.54	34.85	27.51	58.1	68.9	1486.71	1.1302	6098.

R/V BELLOWS B 7204 STD STATION 19
1442 GMT MAY 10 1972
24 55 N 84 16 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.99	36.16	23.29	459.6	459.6	1543.03	.0000	0.
20	27.62	36.16	23.41	448.0	448.9	1542.54	.0908	9.
40	27.47	36.16	23.46	443.4	445.1	1542.54	.1802	36.
60	27.29	36.18	23.53	436.4	438.9	1542.48	.2687	81.
80	26.19	36.22	23.91	400.1	403.4	1540.35	.3529	143.
100	26.00	36.29	24.03	389.4	393.5	1540.30	.4326	222.
120	24.75	36.62	24.66	328.9	333.8	1537.97	.5053	316.
140	22.35	36.75	25.47	252.3	257.8	1532.46	.5645	423.
160	21.75	36.73	25.62	237.6	243.8	1531.21	.6146	540.
180	20.37	36.60	25.90	211.0	217.8	1527.74	.6608	668.
200	18.95	36.52	26.21	181.4	188.5	1524.05	.7014	804.
220	18.26	36.47	26.35	168.4	176.1	1522.35	.7379	948.
240	17.43	36.25	26.39	164.9	173.0	1520.04	.7728	1099.
260	16.38	36.12	26.54	150.5	159.0	1517.08	.8060	1257.
280	15.79	36.02	26.60	144.9	153.7	1515.49	.8373	1421.
300	15.15	35.95	26.69	136.3	145.5	1513.74	.8672	1592.
320	14.75	35.90	26.74	131.5	141.2	1512.74	.8958	1768.

R/V BELLOWS B 7204 STD STATION 20
1700 GMT MAY 10 1972
25 00 N 84 04 W 138 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.03	36.15	23.27	461.6	461.6	1543.10	.0000	0.
20	27.38	36.16	23.49	440.6	441.5	1542.01	.0903	9.
40	27.35	36.20	23.53	436.8	438.5	1542.31	.1783	36.
60	27.03	36.25	23.67	423.4	425.9	1541.96	.2647	80.
80	25.90	36.32	24.08	384.2	387.6	1539.77	.3461	141.
100	25.18	36.62	24.53	341.4	345.5	1538.67	.4194	218.
120	23.90	36.64	24.93	303.1	308.0	1535.93	.4847	308.

R/V BELLOWS B 7204 STD STATION 21
1936 GMT MAY 10 1972
25 08 N 83 47 W 100 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.02	36.15	23.27	461.2	461.3	1543.08	.0000	0.
20	27.00	36.20	23.64	426.1	426.9	1541.20	.0888	9.
40	26.70	36.22	23.75	415.5	417.2	1540.87	.1732	35.
60	26.65	36.23	23.78	413.2	415.8	1541.09	.2565	78.
80	25.65	36.49	24.29	364.6	367.9	1539.34	.3349	137.

R/V BELLOWS B 7204 STD STATION 22
2142 GMT MAY 10 1972
25 17 N 83 35 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.92	36.20	23.34	454.5	454.5	1542.91	.0000	0.
20	26.83	36.22	23.71	419.4	420.3	1540.84	.0875	9.
40	26.78	36.22	23.73	417.9	419.6	1541.05	.1715	35.
60	26.15	36.33	24.01	391.0	393.5	1540.04	.2528	77.

R/V BELLOWS B 7204 STD STATION 23
1842 GMT MAY 12 1972
24 30 N 83 18 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.65	36.32	23.84	406.8	406.8	1540.19	.0000	0.
20	25.45	36.32	24.22	370.9	371.7	1537.76	.0779	8.
40	21.33	36.32	25.43	256.1	257.7	1527.81	.1408	30.

R/V BELLOWS B 7204 STD STATION 24
2100 GMT MAY 12 1972
24 22 N 83 30 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVFL	DYNHGT	TRANS
0	27.55	36.18	23.45	444.4	444.4	1542.08	.0000	0.
20	27.27	36.18	23.54	435.8	436.6	1541.79	.0881	9.
40	27.09	36.17	23.59	431.0	432.7	1541.70	.1750	35.
60	26.99	36.17	23.62	427.9	430.4	1541.80	.2613	79.
80	26.74	36.18	23.71	419.6	422.9	1541.57	.3467	140.
100	26.60	36.20	23.77	413.9	418.1	1541.60	.4308	217.
120	26.10	36.30	24.00	391.6	396.6	1540.86	.5122	312.
140	23.35	36.72	25.15	281.9	287.5	1534.96	.5807	421.
160	20.30	36.62	25.93	207.8	213.8	1527.24	.6308	542.
180	18.41	36.43	26.28	174.9	181.2	1522.10	.6703	672.
200	16.40	36.13	26.54	150.2	156.8	1516.19	.7041	810.
220	14.88	35.93	26.73	132.0	138.7	1511.58	.7336	953.
240	14.23	35.89	26.84	121.6	128.6	1509.78	.7604	1103.
260	13.98	35.82	26.84	121.6	129.2	1509.21	.7862	1257.
280	13.05	35.57	26.84	121.7	129.3	1506.19	.8120	1417.
300	12.09	35.33	26.85	121.3	129.0	1502.99	.8378	1582.
320	10.65	35.30	27.09	98.1	105.5	1498.26	.8613	1752.
360	9.61	35.13	27.14	93.5	101.2	1494.95	.9022	2105.
400	8.52	34.99	27.21	87.1	94.8	1491.38	.9412	2474.
440	7.87	34.92	27.25	82.9	90.8	1489.47	.9783	2858.
480	7.62	34.91	27.28	80.2	88.5	1489.15	1.0142	3256.

R/V BELLOWS B 7204 STD STATION 26
0236 GMT MAY 13 1972
24 06 N 83 59 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.63	36.19	23.43	446.2	446.2	1542.27	.0000	0.
20	27.63	36.19	23.43	446.2	447.1	1542.59	.0893	9.
40	27.50	36.15	23.44	445.0	446.7	1542.59	.1787	36.
60	27.37	36.15	23.49	441.0	443.6	1542.63	.2677	80.
80	26.65	36.14	23.71	419.7	423.1	1541.33	.3544	143.
100	26.15	36.23	23.93	398.2	402.3	1540.59	.4369	222.
120	25.80	36.40	24.17	375.5	380.5	1540.26	.5152	317.
140	24.75	36.60	24.65	330.3	336.1	1538.28	.5869	427.
160	23.65	36.72	25.07	290.3	296.8	1536.03	.6502	551.
180	22.55	36.79	25.44	254.8	261.9	1533.65	.7060	686.
200	20.85	36.72	25.86	214.7	222.3	1529.46	.7544	833.
220	19.80	36.67	26.11	191.5	199.6	1526.88	.7966	988.
240	19.10	36.57	26.21	181.4	190.1	1525.16	.8356	1151.
260	18.35	36.49	26.34	169.1	178.2	1523.27	.8724	1322.
280	17.73	36.42	26.44	159.5	169.1	1521.73	.9072	1500.
300	17.10	36.30	26.50	153.7	163.7	1520.07	.9404	1684.
320	16.68	36.27	26.58	146.3	156.9	1519.10	.9725	1876.
360	15.65	36.13	26.71	133.8	145.1	1516.45	1.0340	2277.
400	14.70	35.94	26.78	127.6	139.6	1513.91	1.0909	2702.
440	14.76	35.78	26.64	140.9	154.1	1514.63	1.1483	3150.
480	12.77	35.56	26.89	117.0	129.9	1508.46	1.2026	3620.
520	11.76	35.43	26.98	108.3	121.3	1505.58	1.2526	4111.
560	10.95	35.30	27.04	103.2	116.4	1503.18	1.3001	4622.
600	10.18	35.18	27.08	99.1	112.3	1500.93	1.3458	5151.
640	9.53	35.07	27.11	96.7	110.0	1499.09	1.3905	5698.
680	8.65	34.99	27.19	89.1	102.1	1496.38	1.4330	6263.
720	8.25	34.95	27.22	86.1	99.4	1495.47	1.4735	6845.
760	7.75	34.89	27.24	83.5	96.6	1494.14	1.5126	7442.
800	7.05	34.87	27.33	75.4	88.2	1492.06	1.5497	8054.
840	6.66	34.85	27.37	71.8	84.5	1491.16	1.5842	8681.
880	6.27	34.84	27.41	67.6	80.2	1490.26	1.6171	9322.
920	6.03	34.84	27.44	64.6	77.4	1489.96	1.6488	9975.
960	5.78	34.84	27.48	61.6	74.4	1489.61	1.6793	10640.

R/V BELLOWS B 7204 STD STATION 28
0730 GMT MAY 13 1972
23 45 N 84 30 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.95	36.22	23.35	454.0	454.0	1542.99	.0000	0.
20	27.95	36.22	23.35	454.0	454.9	1543.32	.0909	9.
40	27.83	36.19	23.37	452.4	454.1	1543.35	.1818	36.
60	26.60	36.15	23.73	417.5	420.0	1540.90	.2692	81.
80	26.08	36.26	23.98	393.9	397.2	1540.14	.3509	143.
100	25.85	36.46	24.20	372.7	376.8	1540.10	.4283	221.
120	25.35	36.60	24.46	347.8	352.8	1539.38	.5013	314.
140	24.61	36.70	24.76	319.1	324.8	1538.03	.5691	421.
160	23.65	36.80	25.13	284.6	291.0	1536.09	.6306	541.
180	22.27	36.82	25.54	245.1	252.1	1532.96	.6850	673.
200	21.34	36.77	25.77	223.9	231.6	1530.81	.7333	815.
220	20.15	36.72	26.05	196.7	204.9	1527.89	.7770	966.
240	19.40	36.61	26.16	185.9	194.6	1526.04	.8169	1125.
260	18.38	36.48	26.33	170.5	179.6	1523.35	.8544	1292.
280	17.55	36.39	26.46	157.5	167.0	1521.17	.8890	1467.
300	16.94	36.32	26.56	148.6	158.6	1519.61	.9216	1648.
320	16.53	36.22	26.58	146.6	157.1	1518.60	.9532	1835.
360	15.71	36.12	26.69	135.8	147.2	1516.63	1.0136	2229.
400	14.46	35.88	26.79	127.0	138.8	1513.08	1.0714	2646.
440	13.21	35.67	26.89	117.4	129.6	1509.41	1.1257	3085.
480	12.56	35.48	26.87	118.9	131.6	1507.66	1.1767	3546.
520	11.54	35.36	26.97	109.1	121.9	1504.67	1.2268	4026.
560	10.76	35.28	27.06	101.4	114.4	1502.48	1.2740	4527.
600	9.99	35.15	27.09	98.2	111.2	1500.21	1.3187	5045.
640	9.37	35.04	27.11	96.4	109.5	1498.46	1.3623	5581.
680	8.80	35.03	27.19	88.3	101.6	1496.99	1.4046	6135.
720	8.31	34.95	27.21	87.0	100.3	1495.70	1.4445	6705.
760	7.77	34.92	27.27	81.5	94.8	1494.26	1.4834	7290.
800	7.25	34.87	27.30	78.1	91.1	1492.84	1.5208	7891.
840	6.79	34.84	27.34	74.2	87.1	1491.66	1.5564	8507.
880	6.35	34.82	27.39	70.1	82.8	1490.55	1.5903	9136.
920	6.08	34.82	27.42	66.7	79.5	1490.13	1.6229	9779.
960	5.89	34.83	27.45	63.7	76.7	1490.03	1.6540	10434.

R/V BELLOWS B 7204 STD STATION 30
1348 GMT MAY 13 1972
23 31 N 85 00 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	28.15	36.28	23.33	456.0	456.0	1543.48	.0000	0.
20	28.15	36.28	23.33	456.0	456.9	1543.80	.0913	9.
40	27.68	36.25	23.46	443.4	445.1	1543.08	.1815	36.
60	27.17	36.22	23.60	429.8	432.4	1542.25	.2692	81.
80	26.27	36.24	23.90	401.1	404.4	1540.55	.3529	144.
100	25.85	36.42	24.17	375.5	379.7	1540.07	.4313	222.
120	25.15	36.62	24.54	340.5	345.5	1538.92	.5038	316.
140	24.19	36.73	24.91	304.9	310.6	1537.04	.5694	423.
160	22.40	36.75	25.45	253.6	259.9	1532.91	.6265	543.
180	21.31	36.72	25.74	226.7	233.6	1530.37	.6759	673.
200	20.32	36.70	25.99	202.5	210.0	1528.01	.7202	812.
220	19.35	36.60	26.17	185.4	193.4	1525.57	.7605	960.
240	18.30	36.45	26.32	170.8	179.2	1522.77	.7978	1116.
260	17.52	36.38	26.46	157.5	166.4	1520.75	.8324	1279.
280	16.82	36.26	26.54	150.2	159.5	1518.87	.8649	1449.
300	16.50	36.22	26.59	145.9	155.7	1518.19	.8965	1625.
320	16.05	36.18	26.66	138.9	149.1	1517.10	.9270	1808.
360	15.45	36.04	26.69	136.1	147.3	1515.74	.9862	2190.
400	14.75	35.90	26.74	131.5	143.5	1514.03	1.0441	2596.
440	13.92	35.76	26.81	124.8	137.5	1511.84	1.1007	3025.
480	13.15	35.62	26.86	119.9	133.1	1509.80	1.1549	3476.
520	11.40	35.32	26.97	109.6	122.2	1504.13	1.2057	3949.
560	10.50	35.23	27.06	100.7	113.4	1501.50	1.2535	4441.
600	9.80	35.14	27.11	95.8	108.7	1499.51	1.2983	4951.
640	9.37	35.09	27.15	92.7	105.9	1498.53	1.3415	5479.
680	9.02	35.03	27.16	91.7	105.2	1497.81	1.3837	6024.
720	8.75	35.01	27.19	89.1	103.0	1497.42	1.4254	6586.
760	8.05	34.91	27.22	86.2	99.9	1495.31	1.4662	7164.
800	7.71	34.88	27.24	83.6	97.4	1494.62	1.5057	7759.
840	7.31	34.87	27.29	78.9	92.7	1493.72	1.5436	8369.
880	6.88	34.86	27.35	73.9	87.6	1492.69	1.5796	8993.
920	6.45	34.83	27.38	70.6	84.1	1491.61	1.6140	9632.

R/V BELLOWS B 7204 STD STATION 32
0536 GMT MAY 14 1972
25 17 N 86 09 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.47	36.14	23.77	414.3	414.3	1539.63	.0000	0.
20	26.35	36.12	23.79	412.1	412.9	1539.66	.0827	8.
40	26.34	36.12	23.79	411.8	413.5	1539.96	.1654	33.
60	25.94	36.12	23.92	399.8	402.3	1539.36	.2469	74.
80	25.79	36.22	24.04	388.2	391.5	1539.43	.3263	132.
100	25.14	36.43	24.40	353.9	358.0	1538.41	.4013	204.
120	23.35	36.43	24.94	302.8	307.6	1534.39	.4678	291.
140	22.47	36.75	25.43	255.5	261.1	1532.76	.5247	391.
160	20.98	36.66	25.78	222.4	228.5	1529.11	.5736	500.
180	19.32	36.43	26.05	197.0	203.5	1524.69	.6168	619.
200	17.77	36.34	26.37	166.2	173.1	1520.48	.6545	747.
220	17.18	36.25	26.45	159.1	166.5	1518.98	.6885	881.
240	16.35	36.16	26.58	147.0	154.8	1516.71	.7206	1022.
260	15.72	36.00	26.60	144.8	153.0	1514.93	.7514	1169.
280	15.30	35.89	26.61	143.8	152.5	1513.82	.7819	1322.
300	14.54	35.80	26.71	134.5	143.4	1511.64	.8115	1482.
320	13.94	35.79	26.83	123.0	132.3	1510.01	.8391	1647.
360	12.81	35.60	26.91	114.9	124.6	1506.71	.8909	1993.
400	11.75	35.44	27.00	107.0	117.1	1503.56	.9393	2359.
440	10.93	35.32	27.06	101.4	111.8	1501.20	.9852	2744.
480	10.08	35.19	27.11	96.7	107.3	1498.66	1.0294	3147.
520	9.32	35.09	27.16	91.9	102.6	1496.41	1.0718	3567.
560	8.59	34.99	27.20	88.2	98.9	1494.22	1.1123	4004.
600	8.08	34.94	27.23	84.4	95.3	1492.88	1.1509	4457.
640	7.66	34.92	27.28	80.0	91.0	1491.90	1.1880	4924.
680	7.12	34.87	27.32	76.3	87.3	1490.39	1.2237	5407.
720	6.74	34.86	27.37	72.1	83.1	1489.55	1.2577	5903.
760	6.38	34.85	27.41	68.2	79.3	1488.76	1.2902	6413.
800	6.11	34.85	27.44	64.9	76.1	1488.34	1.3213	6935.
840	5.79	34.85	27.48	61.0	72.3	1487.71	1.3510	7470.

R/V BELLOWS B 7204 STD STATION 34
1400 GMT MAY 14 1972
25 33 N 85 32 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPFRATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.55	36.07	23.69	421.7	421.7	1539.75	.0000	0.
20	26.45	36.07	23.72	418.7	419.5	1539.84	.0841	8.
40	26.35	36.12	23.79	412.1	413.8	1539.98	.1675	34.
60	26.15	36.22	23.93	398.9	401.4	1539.94	.2490	75.
80	25.57	36.41	24.25	368.0	371.3	1539.08	.3262	133.
100	24.73	36.49	24.57	337.7	341.8	1537.49	.3975	205.
120	23.15	36.64	25.15	282.1	286.9	1534.07	.4604	291.
140	21.66	36.43	25.41	257.4	262.8	1530.44	.5154	388.
160	20.40	36.51	25.82	218.3	224.3	1527.42	.5641	496.
180	19.80	36.64	26.08	193.7	200.3	1526.21	.6065	613.
200	18.77	36.55	26.28	174.8	182.0	1523.57	.6448	739.
220	18.15	36.52	26.42	162.1	169.8	1522.08	.6800	871.
240	17.68	36.42	26.46	158.3	166.6	1520.94	.7136	1010.
260	16.74	36.26	26.56	148.4	157.0	1518.31	.7460	1156.
280	16.68	36.18	26.51	152.9	162.1	1518.37	.7779	1309.
300	15.83	36.09	26.64	140.6	150.2	1516.01	.8091	1467.
320	14.75	35.98	26.80	125.7	135.3	1512.83	.8376	1632.
360	13.65	35.82	26.91	115.0	125.3	1509.74	.8895	1978.
400	12.83	35.67	26.96	110.1	120.9	1507.50	.9407	2344.
440	12.15	35.54	27.00	106.9	118.3	1505.70	.9885	2730.
480	11.32	35.35	27.01	105.9	117.6	1503.25	1.0356	3134.
520	10.37	35.16	27.03	103.7	115.4	1500.30	1.0815	3558.
560	9.25	35.05	27.14	93.8	105.2	1496.75	1.1249	3999.
600	8.12	34.92	27.21	86.5	97.4	1493.00	1.1652	4457.
640	7.41	34.91	27.31	77.3	88.0	1490.92	1.2017	4931.
680	6.87	34.88	27.36	72.3	82.9	1489.43	1.2360	5418.
720	6.54	34.87	27.40	68.8	79.6	1488.77	1.2684	5919.
760	6.15	34.85	27.44	65.4	76.1	1487.85	1.2994	6433.
800	5.95	34.85	27.46	62.9	73.9	1487.71	1.3293	6959.
840	5.75	34.85	27.49	60.5	71.7	1487.55	1.3583	7496.

R/V BELLOWS B 7204 STD STATION 36
1948 GMT MAY 14 1972
25 49 N 85 01 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.84	36.24	23.72	418.3	418.3	1540.55	.0000	0.
20	26.08	36.40	24.08	383.8	384.7	1539.29	.0803	8.
40	25.63	36.42	24.24	369.0	370.7	1538.59	.1558	32.
60	24.54	36.45	24.60	335.1	337.5	1536.35	.2267	70.
80	23.41	36.58	25.03	293.7	296.9	1534.02	.2901	122.
100	22.61	36.64	25.31	267.3	271.2	1532.38	.3469	185.
120	21.60	36.65	25.60	239.4	244.0	1530.10	.3984	260.
140	20.25	36.52	25.87	213.8	219.0	1526.70	.4447	344.
160	19.35	36.46	26.06	195.5	201.3	1524.48	.4868	437.
180	18.28	36.44	26.32	171.0	177.3	1521.74	.5246	538.
200	17.53	36.36	26.45	159.2	166.0	1519.80	.5590	647.
220	16.66	36.20	26.53	151.0	158.2	1517.37	.5914	762.
240	15.95	36.12	26.64	141.1	148.7	1515.44	.6221	883.
260	15.21	36.01	26.72	133.1	141.2	1513.35	.6511	1010.
280	14.24	35.88	26.83	122.5	130.7	1510.44	.6783	1143.
300	13.70	35.78	26.87	119.0	127.5	1508.90	.7041	1282.
320	13.04	35.66	26.91	114.9	123.6	1506.91	.7292	1425.
360	11.95	35.45	26.97	109.9	119.1	1503.62	.7779	1726.
400	11.09	35.32	27.03	104.1	113.7	1501.12	.8242	2047.
440	10.54	35.26	27.08	99.1	109.3	1499.75	.8690	2386.
480	9.80	35.15	27.12	95.1	105.4	1497.60	.9129	2742.
520	9.34	35.08	27.14	92.9	103.7	1496.47	.9541	3115.
560	8.35	34.95	27.20	87.6	98.0	1493.27	.9953	3505.
600	7.94	34.93	27.25	83.2	93.9	1492.33	1.0332	3911.
640	7.54	34.91	27.29	79.0	90.0	1491.43	1.0699	4332.
680	7.01	34.86	27.33	75.6	86.4	1489.96	1.1055	4767.
720	6.65	34.85	27.37	71.7	82.6	1489.18	1.1392	5216.
760	6.35	34.84	27.40	68.6	79.7	1488.63	1.1716	5678.
800	6.03	34.84	27.44	64.6	75.8	1488.01	1.2026	6153.
840	5.85	34.84	27.47	62.5	73.8	1487.94	1.2325	6640.
880	5.67	34.85	27.50	59.6	71.1	1487.88	1.2616	7139.
920	5.52	34.85	27.52	57.8	69.6	1487.93	1.2897	7649.
960	5.35	34.85	27.54	55.9	67.8	1487.90	1.3171	8171.

R/V BELLOWS B 7204 STD STATION 38
0 24 GMT MAY 15 1972
26 00 N 84 29 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.94	36.22	23.68	422.8	422.8	1540.76	.0000	0.
20	26.35	36.22	23.86	404.9	405.7	1539.75	.0829	8.
40	25.65	36.33	24.17	376.1	377.7	1538.55	.1612	33.
60	24.04	36.39	24.70	325.1	327.5	1535.09	.2317	72.
80	22.65	36.42	25.13	284.3	287.4	1531.97	.2932	124.
100	21.98	36.42	25.32	266.1	270.0	1530.57	.3490	189.
120	20.93	36.60	25.75	225.4	230.0	1528.28	.3990	263.
140	19.71	36.42	25.94	207.4	212.5	1525.12	.4432	348.
160	19.12	36.42	26.09	192.8	198.5	1523.79	.4843	440.
180	18.44	36.41	26.26	177.0	183.4	1522.17	.5225	541.

R/V BELLOWS B 7204 STD STATION 40
0412 GMT MAY 15 1972
26 16 N 84 02 W 140 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.45	36.36	23.94	397.8	397.8	1539.78	.0000	0.
20	26.05	36.36	24.06	385.8	386.7	1539.18	.0785	8.
40	24.67	36.35	24.48	346.0	347.7	1536.25	.1519	31.
60	23.13	36.40	24.98	298.9	301.3	1532.84	.2168	68.
80	21.21	36.43	25.54	245.0	248.1	1528.23	.2717	117.
100	20.15	36.52	25.90	211.2	214.9	1525.78	.3180	176.
120	19.20	36.54	26.16	186.0	190.4	1523.49	.3585	243.

R/V BELLOWS B 7204 STD STATION 41
1212 GMT MAY 16 1972
27 15 N 84 37 W 180 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	25.93	36.30	24.06	386.6	386.6	1538.53	.0000	0.
20	25.73	36.36	24.16	376.3	377.1	1538.44	.0764	8.
40	25.31	36.43	24.35	358.9	360.5	1537.85	.1501	30.
60	23.67	36.39	24.81	314.7	317.1	1534.18	.2179	67.
80	22.05	36.36	25.26	272.4	275.5	1530.37	.2772	117.
100	21.46	36.38	25.43	255.7	259.6	1529.22	.3307	177.
120	20.60	36.42	25.70	229.9	234.4	1527.23	.3801	248.
140	18.49	36.42	26.25	177.5	182.4	1521.68	.4217	329.
160	17.78	36.40	26.42	162.1	167.6	1519.93	.4568	416.

R/V BELLOWS B 7204 STD STATION 42
1430 GMT MAY 16 1972
27 10 N 84 51 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.15	36.12	23.85	406.1	406.1	1538.68	.0000	0.
20	25.94	36.32	24.07	385.4	386.3	1538.90	.0792	8.
40	25.53	36.52	24.35	358.9	360.5	1538.44	.1539	31.
60	23.75	36.45	24.83	312.6	315.0	1534.43	.2215	69.
80	22.80	36.42	25.09	288.4	291.5	1532.35	.2821	119.
100	22.05	36.41	25.29	268.7	272.6	1530.74	.3385	181.
120	21.60	36.40	25.41	257.5	262.1	1529.88	.3920	254.
140	20.90	36.40	25.60	239.1	244.4	1528.34	.4427	338.
160	19.57	36.39	25.95	206.1	211.9	1525.03	.4883	431.
180	18.12	36.38	26.32	171.6	177.9	1521.22	.5273	532.
200	17.00	36.29	26.52	152.1	158.8	1518.16	.5609	641.
220	16.35	36.14	26.56	148.4	155.6	1516.37	.5924	757.
240	15.71	36.09	26.67	138.0	145.6	1514.67	.6225	878.

R/V BELLOWS B 7204 STD STATION 43
1712 GMT MAY 16 1972
27 02 N 85 08 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.58	36.31	23.86	405.4	405.4	1540.03	.0000	0.
20	26.17	36.48	24.12	380.8	381.6	1539.56	.0787	8.
40	25.78	36.50	24.30	363.4	365.1	1539.05	.1534	31.
60	25.47	36.51	24.36	357.8	360.3	1538.61	.2259	69.
80	23.59	36.46	24.89	307.4	310.6	1534.36	.2930	121.
100	22.76	36.47	25.13	284.2	288.2	1532.66	.3529	185.
120	22.05	36.45	25.31	267.3	272.0	1531.08	.4089	262.
140	21.39	36.42	25.49	250.5	255.8	1529.67	.4617	349.
160	20.05	36.43	25.86	215.2	221.1	1526.39	.5094	446.
180	18.50	36.43	26.24	178.5	184.8	1522.54	.5499	552.
200	17.54	36.33	26.42	161.6	168.4	1519.80	.5853	665.
220	16.65	36.22	26.55	149.3	156.5	1517.36	.6178	786.
240	15.92	36.12	26.64	140.4	148.1	1515.35	.6482	912.
260	15.25	36.01	26.71	134.0	142.0	1513.48	.6772	1045.
280	14.57	35.88	26.76	129.3	137.6	1511.50	.7052	1183.
300	13.75	35.77	26.85	120.7	129.3	1509.05	.7319	1327.
320	13.21	35.69	26.90	115.9	124.8	1507.51	.7573	1476.
360	12.10	35.50	26.98	108.9	118.2	1504.19	.8057	1788.
400	10.85	35.27	27.03	103.7	113.1	1500.22	.8516	2120.
440	10.22	35.24	27.12	95.3	105.1	1498.58	.8949	2469.
480	9.58	35.16	27.17	90.8	101.0	1496.61	.9365	2836.
520	8.65	35.02	27.21	86.8	96.9	1493.84	.9762	3218.
560	8.29	34.98	27.23	84.5	94.9	1493.08	1.0145	3616.
600	7.75	34.93	27.28	80.5	91.0	1491.61	1.0518	4030.
640	7.16	34.87	27.31	76.9	87.3	1489.90	1.0873	4457.
680	6.76	34.85	27.35	73.1	83.6	1488.97	1.1212	4899.
720	6.35	34.85	27.41	67.8	78.4	1488.00	1.1536	5354.
760	6.09	34.84	27.44	65.4	76.0	1487.60	1.1843	5822.
800	5.83	34.85	27.48	61.5	72.3	1487.23	1.2140	6301.
840	5.60	34.86	27.51	58.0	68.9	1486.97	1.2423	6793.
880	5.54	34.86	27.52	57.3	68.6	1487.38	1.2697	7295.
920	5.49	34.90	27.56	53.7	65.5	1487.88	1.2969	7809.

R/V BELLOWS B 7204 STD STATION 45
0 18 GMT MAY 17 1972
26 49 N 85 38 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	27.06	36.09	23.53	436.4	436.4	1540.96	.0000	0.
20	26.59	36.01	23.63	427.2	428.1	1540.11	.0864	9.
40	26.42	36.12	23.77	414.2	415.9	1540.14	.1708	34.
60	26.25	36.12	23.82	409.1	411.6	1540.08	.2536	77.
80	26.17	36.11	23.84	407.4	410.7	1540.21	.3358	136.
100	26.07	36.12	23.88	403.7	407.8	1540.31	.4177	211.
120	25.72	36.15	24.01	391.1	396.0	1539.85	.4981	303.
140	25.44	36.41	24.29	364.1	369.9	1539.75	.5747	410.
160	24.35	36.64	24.80	315.9	322.5	1537.67	.6439	532.
180	23.15	36.71	25.21	277.1	284.3	1535.10	.7046	667.
200	21.73	36.75	25.64	235.6	243.4	1531.82	.7573	813.
220	20.73	36.56	25.77	223.2	231.4	1529.32	.8048	969.
240	18.80	36.48	26.22	180.6	189.2	1524.23	.8469	1134.
260	17.66	36.34	26.39	164.1	173.0	1521.18	.8831	1307.
280	16.66	36.23	26.56	148.8	158.0	1518.36	.9162	1487.
300	15.86	36.12	26.65	139.5	149.1	1516.19	.9469	1673.
320	15.21	36.02	26.73	132.4	142.3	1514.32	.9760	1866.
360	13.99	35.82	26.84	121.8	132.3	1510.85	1.0314	2267.
400	13.00	35.67	26.93	113.4	124.3	1508.07	1.0829	2690.
440	12.06	35.50	26.98	108.2	119.5	1505.34	1.1316	3133.
480	11.17	35.37	27.05	101.8	113.4	1502.75	1.1785	3595.
520	10.45	35.24	27.08	99.1	110.9	1500.69	1.2230	4076.
560	9.60	35.11	27.12	94.8	106.7	1498.10	1.2662	4574.
600	9.00	35.02	27.15	92.1	104.1	1496.43	1.3077	5088.
640	8.55	35.02	27.23	85.3	97.6	1495.40	1.3477	5619.
680	7.92	34.94	27.26	82.1	94.2	1493.56	1.3862	6166.
720	7.52	34.90	27.29	79.5	91.7	1492.62	1.4236	6728.
760	7.15	34.88	27.32	76.0	88.3	1491.82	1.4595	7305.
800	6.75	34.86	27.36	72.2	84.5	1490.88	1.4938	7896.
840	6.50	34.85	27.39	69.7	82.2	1490.53	1.5272	8500.
880	6.16	34.85	27.43	65.5	77.9	1489.84	1.5590	9117.

R/V BELLOWS B 7204 STD STATION 47
0500 GMT MAY 17 1972
26 58 N 86 04 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATUPE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.75	36.05	23.61	429.2	429.2	1540.18	.0000	0.
20	26.32	36.12	23.80	411.2	412.0	1539.59	.0841	8.
40	26.19	36.12	23.84	407.3	408.9	1539.62	.1662	33.
60	25.95	36.11	23.91	400.8	403.3	1539.38	.2474	75.
80	25.77	36.12	23.97	394.8	398.1	1539.29	.3276	132.
100	25.71	36.13	24.00	392.3	396.4	1539.49	.4070	206.
120	25.55	36.13	24.05	387.5	392.4	1539.44	.4859	295.
140	25.39	36.14	24.10	382.1	387.8	1539.39	.5639	400.
160	25.41	36.36	24.26	366.9	373.4	1539.96	.6401	520.
180	24.81	36.61	24.64	331.3	338.7	1539.08	.7113	656.
200	23.78	36.76	25.06	291.1	299.2	1537.03	.7751	804.
220	22.60	36.80	25.43	255.5	264.2	1534.43	.8314	965.
240	21.34	36.79	25.78	222.4	231.6	1531.47	.8810	1136.
260	20.27	36.74	26.03	198.3	208.1	1528.88	.9249	1317.
280	19.57	36.70	26.19	183.6	193.9	1527.24	.9651	1506.
300	19.07	36.61	26.25	177.8	188.6	1526.08	1.0034	1703.
320	18.37	36.52	26.36	167.4	178.6	1524.33	1.0401	1907.
360	17.15	36.36	26.54	150.4	162.5	1521.24	1.1082	2337.
400	16.22	36.22	26.65	139.7	152.6	1519.94	1.1712	2793.
440	15.19	36.03	26.74	131.3	144.8	1516.20	1.2300	3273.
480	14.14	35.83	26.82	124.1	138.1	1513.28	1.2867	3776.
520	13.26	35.67	26.88	118.4	132.7	1510.86	1.3416	4302.
560	12.55	35.55	26.93	113.6	128.4	1508.99	1.3940	4849.
600	11.58	35.37	26.97	109.1	123.9	1506.11	1.4443	5417.
640	10.58	35.23	27.05	102.0	116.7	1503.07	1.4914	6004.
680	9.64	35.13	27.13	94.0	108.3	1500.21	1.5358	6610.
720	8.95	35.03	27.17	90.6	104.8	1498.19	1.5779	7232.
760	8.35	34.95	27.20	87.6	101.7	1496.49	1.6186	7872.
800	7.67	34.93	27.29	79.4	93.1	1494.53	1.6577	8527.
840	7.35	34.91	27.32	76.4	90.4	1493.92	1.6946	9198.
880	7.01	34.90	27.36	72.6	86.6	1493.24	1.7299	9883.
920	6.54	34.86	27.39	69.5	83.2	1492.00	1.7640	10581.
960	6.24	34.86	27.43	65.7	79.4	1491.47	1.7965	11294.

R/V BELLOWS B 7204 STD STATION 49
1154 GMT MAY 17 1972
26 19 N 86 49 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPFRATURE

Z	T	S	SIGT	TANOM	SVA	SVFL	DYNHGT	TRANS
0	26.58	36.12	23.72	419.0	419.0	1539.86	.0000	0.
20	26.58	36.12	23.72	419.0	419.9	1540.18	.0839	8.
40	26.19	36.12	23.84	407.3	408.9	1539.62	.1668	33.
60	25.87	36.12	23.94	397.7	400.2	1539.20	.2477	75.
80	25.79	36.13	23.97	394.6	397.9	1539.35	.3275	132.
100	25.75	36.13	23.98	393.4	397.6	1539.58	.4070	206.
120	25.73	36.12	23.98	393.6	398.5	1539.85	.4867	295.
140	25.55	36.15	24.06	386.1	391.8	1539.78	.5657	400.
160	25.43	36.26	24.18	374.6	381.2	1539.92	.6430	521.
180	25.11	36.52	24.48	346.5	353.9	1539.71	.7165	657.
200	24.19	36.67	24.87	309.2	317.3	1537.96	.7836	807.
220	22.87	36.76	25.32	265.8	274.5	1535.08	.8428	970.
240	21.68	36.75	25.66	234.3	243.6	1532.33	.8946	1144.
260	20.67	36.73	25.92	209.3	219.1	1529.96	.9409	1327.
280	19.95	36.67	26.07	195.3	205.6	1528.26	.9834	1520.
300	19.01	36.60	26.26	177.0	187.8	1525.90	1.0227	1720.
320	18.47	36.53	26.34	169.0	180.3	1524.62	1.0595	1928.
360	17.52	36.38	26.46	157.5	169.7	1522.36	1.1301	2367.
400	16.70	36.27	26.58	146.8	159.9	1520.45	1.1962	2832.
440	15.95	36.12	26.64	141.1	155.0	1518.66	1.2588	3323.
480	14.83	35.99	26.79	126.6	141.1	1515.66	1.3184	3839.
520	13.95	35.76	26.80	125.4	140.3	1513.23	1.3750	4377.
560	13.15	35.63	26.87	119.2	134.5	1511.09	1.4301	4938.
600	12.13	35.49	26.96	110.2	125.6	1508.14	1.4819	5521.
640	11.24	35.35	27.02	104.5	119.9	1505.54	1.5308	6123.
680	10.18	35.18	27.08	99.1	114.1	1502.22	1.5777	6745.
720	9.12	35.05	27.16	91.7	106.2	1498.84	1.6224	7385.
760	8.54	34.99	27.20	87.4	101.8	1497.26	1.6639	8043.
800	7.75	34.92	27.27	81.2	95.1	1494.82	1.7034	8716.
840	7.32	34.90	27.32	76.8	90.6	1493.79	1.7405	9405.
880	6.81	34.82	27.32	76.0	89.5	1492.35	1.7763	10108.
920	6.35	34.85	27.41	67.8	81.2	1491.24	1.8100	10826.
960	6.09	34.86	27.45	63.9	77.3	1490.87	1.8416	11556.

R/V BELLOWS B 7204 STD STATION 52
1842 GMT MAY 17 1972
27 04 N 96 18 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.13	35.72	23.56	434.3	434.3	1538.46	.0000	0.
20	26.33	36.13	23.80	410.8	411.6	1539.62	.0846	8.
40	26.15	36.13	23.86	405.4	407.0	1539.53	.1664	34.
60	25.99	36.12	23.90	401.3	403.8	1539.48	.2475	75.
80	25.98	36.12	23.91	401.0	404.3	1539.78	.3283	133.
100	25.95	36.15	23.94	397.9	402.1	1540.06	.4090	206.
120	25.68	36.22	24.07	384.9	389.8	1539.82	.4882	296.
140	25.36	36.43	24.33	360.3	366.1	1539.58	.5638	401.
160	24.55	36.65	24.74	321.0	327.5	1538.16	.6331	521.
180	23.25	36.75	25.21	277.0	284.2	1535.38	.6943	654.
200	21.75	36.77	25.65	234.7	242.5	1531.89	.7470	798.
220	20.39	36.74	26.00	201.4	209.7	1528.56	.7922	952.
240	19.55	36.67	26.17	185.3	194.1	1526.51	.8325	1114.
260	18.75	36.61	26.33	170.0	179.3	1524.53	.8699	1284.
280	18.20	36.52	26.40	163.3	173.1	1523.19	.9051	1462.
300	17.74	36.45	26.46	157.5	167.9	1522.11	.9392	1646.
320	17.05	36.33	26.54	150.3	161.0	1520.27	.9721	1837.
360	15.99	36.12	26.63	141.9	153.4	1517.49	1.0354	2239.
400	14.66	35.91	26.76	129.3	141.3	1513.81	1.0937	2665.
440	13.35	35.70	26.88	117.9	130.2	1509.91	1.1481	3113.
480	12.75	35.61	26.93	113.0	125.9	1508.45	1.1995	3583.
520	12.03	35.49	26.98	108.4	121.7	1506.51	1.2497	4073.
560	10.77	35.30	27.07	100.1	113.2	1502.54	1.2962	4582.
600	9.93	35.16	27.12	95.0	108.0	1500.03	1.3408	5110.
640	9.15	35.05	27.15	92.2	105.1	1497.66	1.3834	5654.
680	8.52	35.01	27.22	85.6	98.5	1495.92	1.4237	6216.
720	8.16	34.95	27.23	84.8	97.9	1495.13	1.4629	6793.
760	7.67	34.91	27.27	80.8	93.9	1493.86	1.5016	7386.
800	7.19	34.87	27.31	77.3	90.2	1492.61	1.5384	7994.
840	6.89	34.87	27.35	73.3	86.4	1492.09	1.5734	8617.
880	6.53	34.85	27.39	70.1	83.2	1491.30	1.6073	9253.
920	6.16	34.85	27.43	65.5	78.5	1490.49	1.6396	9902.
960	5.91	34.85	27.47	62.4	75.5	1490.14	1.6703	10564.

R/V BELLOWS R 7204 STD STATION 54
0 0 GMT MAY 18 1972
27 30 N 85 59 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	26.31	36.32	23.95	396.5	396.5	1539.42	.0000	0.
20	26.31	36.32	23.95	396.5	397.3	1539.75	.0794	8.
40	26.02	36.42	24.12	380.6	382.3	1539.49	.1573	32.
60	25.42	36.55	24.40	353.5	356.0	1538.53	.2312	70.
80	24.35	36.48	24.68	327.5	330.7	1536.24	.2998	124.
100	22.97	36.36	24.99	297.4	301.3	1533.05	.3630	190.
120	21.74	36.42	25.39	259.7	264.4	1530.26	.4196	268.
140	21.03	36.44	25.60	239.6	244.9	1528.73	.4705	357.
160	19.61	36.42	25.97	204.9	210.7	1525.16	.5161	456.
180	18.37	36.36	26.24	179.0	185.3	1521.92	.5557	563.
200	17.18	36.25	26.45	159.1	165.8	1518.66	.5908	678.
220	16.35	36.17	26.56	146.2	153.4	1516.40	.6227	799.
240	15.42	36.09	26.74	131.8	139.3	1513.77	.6520	926.
260	14.95	35.99	26.76	129.1	137.1	1512.51	.6796	1060.
280	14.37	35.85	26.78	127.3	135.6	1510.83	.7069	1198.
300	13.66	35.72	26.83	123.0	131.5	1508.77	.7336	1342.
320	13.15	35.67	26.90	116.2	125.1	1507.28	.7593	1492.
360	12.11	35.49	26.97	109.9	119.2	1504.21	.8082	1805.
400	11.05	35.33	27.04	102.7	112.3	1500.99	.8543	2138.
440	10.33	35.22	27.09	98.6	108.5	1498.95	.8978	2488.
480	9.56	35.14	27.16	92.0	102.1	1496.71	.9397	2856.
520	8.94	35.03	27.17	90.5	100.8	1494.93	.9802	3240.
560	8.46	34.99	27.21	86.5	97.2	1493.81	1.0200	3640.
600	8.13	34.94	27.23	85.1	96.1	1493.07	1.0585	4056.
640	7.54	34.89	27.28	80.5	91.4	1491.40	1.0958	4486.
680	7.08	34.88	27.33	75.0	86.0	1490.25	1.1313	4932.
720	6.74	34.85	27.36	72.8	83.9	1489.53	1.1653	5391.
760	6.34	34.84	27.40	68.5	79.5	1488.59	1.1980	5864.
800	6.02	34.85	27.45	63.8	74.9	1487.99	1.2289	6349.
840	5.81	34.85	27.48	61.2	72.5	1487.80	1.2584	6847.
880	5.58	34.86	27.52	57.8	69.2	1487.54	1.2867	7356.

R/V BELLOWS B 7204 STD STATION 56
0418 GMT MAY 18 1972
27 52 N 85 42 W 0 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	25.45	36.09	24.05	387.5	387.5	1537.23	.0000	0.
20	25.55	36.34	24.20	372.4	373.2	1538.01	.0761	8.
40	24.45	36.43	24.61	333.9	335.6	1535.80	.1470	30.
60	22.68	36.45	25.14	282.9	285.3	1531.75	.2090	66.
80	21.71	36.47	25.43	255.3	258.4	1529.59	.2634	113.
100	20.66	36.49	25.74	226.4	230.2	1527.14	.3123	170.
120	18.95	36.47	26.17	185.0	189.3	1522.72	.3542	237.
140	17.63	36.36	26.42	161.5	166.3	1519.13	.3898	311.
160	16.55	36.22	26.57	147.0	152.3	1516.09	.4216	393.
180	15.58	36.12	26.72	133.0	138.7	1513.34	.4507	480.
200	15.04	35.99	26.74	131.0	137.2	1511.83	.4783	573.
220	14.44	35.89	26.80	125.9	132.4	1510.14	.5053	671.
240	13.65	35.79	26.89	117.2	124.1	1507.79	.5309	775.
260	13.24	35.69	26.90	116.5	123.8	1506.64	.5557	883.
280	12.52	35.57	26.95	111.6	119.0	1504.42	.5800	997.
300	11.90	35.48	27.00	106.8	114.4	1502.52	.6034	1115.
320	11.71	35.41	26.98	108.5	116.5	1502.11	.6264	1238.
360	10.71	35.31	27.09	98.3	106.8	1499.13	.6712	1498.
400	9.87	35.15	27.11	96.2	104.9	1496.56	.7137	1775.
440	9.28	35.10	27.17	90.5	99.6	1494.99	.7547	2069.
480	8.67	35.00	27.19	88.6	97.9	1493.24	.7944	2378.
520	8.16	34.94	27.22	85.6	95.1	1491.89	.8327	2704.
560	7.71	34.91	27.27	81.4	91.2	1490.79	.8699	3044.
600	7.25	34.88	27.31	77.3	87.2	1489.62	.9056	3400.
640	6.87	34.87	27.36	73.0	83.1	1488.78	.9395	3769.
680	6.48	34.85	27.39	69.5	79.6	1487.67	.9722	4151.
720	6.15	34.84	27.43	66.1	76.3	1487.20	1.0034	4546.
760	5.94	34.84	27.46	63.6	74.0	1487.01	1.0333	4953.
800	5.71	34.84	27.48	60.8	71.4	1486.73	1.0623	5373.
840	5.38	34.85	27.53	56.2	66.7	1486.07	1.0900	5803.

R/V BELLOWS B 7204 STD STATION 58
0824 GMT MAY 18 1972
28 15 N 85 25 W 274 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	25.38	36.26	24.20	373.2	373.2	1537.21	.0000	0.
20	25.74	36.51	24.27	365.8	366.6	1539.60	.0740	7.
40	25.48	36.52	24.36	357.4	359.1	1538.32	.1466	29.
60	23.20	36.45	24.99	297.2	299.6	1533.06	.2124	65.
80	22.01	36.44	25.33	265.5	268.6	1530.34	.2692	114.
100	20.75	36.49	25.71	228.7	232.5	1527.38	.3194	172.
120	19.23	36.46	26.09	192.6	196.9	1523.50	.3623	241.
140	17.65	36.37	26.42	161.3	166.1	1519.20	.3986	317.
160	16.73	36.23	26.54	150.4	155.7	1516.65	.4308	400.
180	15.85	36.15	26.68	136.7	142.4	1514.20	.4606	489.
200	15.08	36.03	26.77	128.9	135.1	1512.00	.4883	584.
220	14.57	35.95	26.82	124.1	130.8	1510.62	.5149	684.

R/V BELLOWS B 7204 STD STATION 59
1030 GMT MAY 18 1972
28 15 N 85 09 W 182 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPERATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	25.49	36.35	24.23	369.9	369.9	1537.55	.0000	0.
20	25.49	36.35	24.23	369.9	370.8	1537.88	.0741	7.
40	25.16	36.49	24.44	350.2	351.8	1537.54	.1463	29.
60	22.95	36.43	25.05	291.8	294.1	1532.41	.2109	65.
80	21.79	36.44	25.39	259.6	262.7	1529.77	.2666	113.
100	20.73	36.44	25.68	231.8	235.6	1527.28	.3164	171.
120	18.99	36.43	26.13	188.9	193.2	1522.79	.3593	239.
140	17.96	36.41	26.37	166.1	171.0	1520.20	.3957	314.
160	17.17	36.29	26.48	156.0	161.4	1519.02	.4290	397.

R/V BELLOWS B 7204 STD STATION 60
1230 GMT MAY 18 1972
28 15 N 84 51 W 91 M
SURFACE SAMPLE SALINITY
SURFACE SAMPLE TEMPFRATURE

Z	T	S	SIGT	TANOM	SVA	SVEL	DYNHGT	TRANS
0	25.22	36.34	24.31	362.7	362.7	1536.91	.0000	0.
20	25.00	36.30	24.34	359.2	360.0	1536.68	.0723	7.
40	23.19	36.14	24.76	319.3	320.9	1532.43	.1404	28.
60	22.32	36.38	25.19	278.2	280.5	1530.76	.2005	63.
80	20.81	36.40	25.63	236.8	239.8	1527.14	.2525	108.