

# intergovernmental oceanographic commission

information  
paper

# 5

UNESCO/NS/10C/INF - 46



## FOREWORD

Although the Expedition is at its highest activity point, the centre of gravity in the overall scope of tasks is starting to move more and more towards scientific evaluation of the results already obtained. To meet this new development oceanographers should be considering already what forms of exchange of information, data and opinions would appear most suitable for this new period. Should scientists and institutions work for some time on a purely individual basis without extensive exchange of views and findings or should they co-operate and exchange their views at an earlier stage for their common benefit? What meetings will be needed? What rôle should Unesco and IOC play after the actual field work is over? What should be our future plans?

The Office of Oceanography of Unesco would welcome suggestions and proposals in this connexion and is ready to publish opinions received in future issues of the Information Paper.

**unesco**

Unesco Office of Oceanography  
Paris, January 1964

IIOE INFORMATION PAPER  
No. 5

1. Recent activities of IOC

1.1 The Bureau and Consultative Committee of IOC met in Paris from 28 to 31 October 1963. A summary of discussions concerning the IIOE is as follows:

Coordination of the International Indian Ocean Expedition

The work of the two IIOE experts on plankton research and physical oceanography was reviewed by the Bureau. Following the advice of SCOR, it recommended that the reports of these experts be published in the next number of the IIOE Information Paper. (Annex I). SCOR was requested to re-examine the question of appointing an expert on geology and geophysics for the IIOE.

In the light of the recommendations of the previous Bureau Meeting in Moscow and remarks expressed in the letter of 28 October 1963 (para.2 of this Information Paper) addressed by SCOR's President to the Secretary of the Commission, the Bureau considered the problem of the agenda for the meeting of coordinators of the International Indian Ocean Expedition, scheduled for 22-24 January 1964.

The President of SCOR expressed the opinion that governmental representatives at the proposed meeting might be unable to discuss adequately all the items on the proposed agenda. The Bureau noted that the meeting would adopt its own agenda and suggested that the Secretary, as Chairman of the meeting, should keep in mind the scientific representation in guiding the discussions. The Bureau felt that, although the nominations already submitted by countries for attendance at this meeting indicated that its composition would be appropriate to its purpose scientifically, it would be useful to encourage governments to send scientists actively engaged in the work of the IIOE to this meeting. It was also felt that invitations to the meeting of the IIOE Coordinators should be extended to representatives of World Data Centers A and B and that governments participating in the IIOE should be encouraged to include in their delegations representatives of their national data centers if they feel the work of these centers is closely connected with the International Indian Ocean Expedition.

The Bureau reconfirmed its opinion, previously expressed in Moscow in May 1963, that during the meeting the main emphasis should be put on the problem of exchange of information and data.

The Bureau considered the problem of further installation of tide gauges in the Indian Ocean in connection with the IIOE and concluded that the general need for additional permanent and properly maintained tide gauges in this region should be reviewed at the Third Session of the Commission within the framework of the Permanent Service for Mean Sea Level Report on the World Distribution of Tide Gauges. Meanwhile, the Secretary should encourage and assist installation of tide gauges which might be required urgently in connection with expeditions already planned (particularly in the north-west part of the Indian Ocean) for the next few years if requests for such installations reach the IOC Secretariat.

The work of the Indian Ocean Biological Center and of the Fisheries Subject Leader, Mr. Hall, was discussed briefly on the suggestion of SCOR. The Bureau instructed the Secretary to invite both the Curator of the IOBC, Mr. Hansen, and the Fisheries Subject Leader to the meeting of IIOE Coordinators in January and to support the attendance of Mr. Hall to the ACMRR meeting in Rome in February. The conclusions of both these meetings should be used then by the Secretariat, in cooperation with FAO and ACMRR, to define more specifically the terms of reference of the Fisheries Subject Leader.

The Secretary was instructed to continue assisting the Indian Government and the Curator of the Indian Ocean Biological Center in the development of that Center. The Secretary and appropriate members of the Commission were requested to take the necessary steps to ensure full participation in the meeting of the IOBC Consultative Committee in March 1964.

The Bureau was informed of the difficulties East African oceanographers face in finding sources of funds for the repairs needed urgently by the East African Research Vessel "MANIHINE". The Bureau felt that unless the necessary funds are provided the important contribution of this vessel to the overall programme of the IIOE would be endangered, and instructed the Secretary to inform the appropriate authorities in the United Kingdom accordingly.

1.2 Following this development the IOC Secretariat has prepared and circulated among countries participating in the IIOE the following circular letter (CL.58 of 15 November 1963) transmitting the new Provisional Agenda for the meeting on the coordination of the IIOE:

"The problem of coordination of the International Indian Expedition was extensively discussed by the IOC Bureau at its recent meeting in Paris, from 28 - 31 October 1963, in connection with the forthcoming meeting of the International Coordination Group for the IIOE, to which your Government has already nominated its representative.

Since the Expedition has now entered its most active stage and since the problem of exchange of data and information related to the IIOE will be the main subject of discussion at the meeting, including such specific problems as operation of the Indian Ocean Biological Center, work of the Fisheries Subject Leader and of the International Coordinator for

Meteorology, it is highly desirable that scientists actively engaged in the work of the Expedition and representatives of national data centers, as well as of World Data Centers A and B, be present at the meeting. In this connection I have been instructed by the Bureau to ask all Governments participating in the Expedition to consider adding to their delegations a number of scientific advisers from among the scientists actively engaged in the IIOE work and related work of national data centers and WDCs A and B.

Therefore, I have the honour to extend the invitation to the above meeting (CL No.46 of 26 June 1963) previously restricted to national coordinators, to any persons falling into the categories indicated in the above paragraph. In the case of representatives of national data centers and WDC-A (USA) and B (USSR), the problem of their participation in the IIOE Coordination Meeting is fairly simple since the same people will be present at the IOC Working Group Meeting on Oceanographic Data Exchange (27 - 29 January 1964) in Paris. In all other cases, which for understandable reasons might present difficulties, prior extensive consultations of delegates with scientists representing all fields of research in the Indian Ocean might be an alternative to suggested reinforcement of delegations.

For your information I enclose a copy of the Provisional Agenda for the meeting, as revised by the IOC Bureau."

Provisional Agenda

1. Review of work accomplished to date.
2. Problems of exchange of IIOE data and information (plans and reports) between the participation.
3. Work of the IOC/Unesco appointed subject leaders:
  - a) Indian Ocean Biological Center (Curator, Mr. V. Hansen)
  - b) International Meteorological Programme (Coordinator, Professor C. Ramage)
  - c) Fisheries aspects (Subject Leader, Mr. D.N.F. Hall).
4. Review of plans for remainder of the Expedition and of more distant plans with regard to investigations of specific problems of the Indian Ocean.
5. Observations on reference stations and further plans for standardization and intercalibration work within the IIOE framework.
6. Processing, analysis and publication of results.
7. Other problems.

## 2. Recent actions of SCOR

The Executive Meeting of SCOR was held in Paris from 25-26 October and on 2 November 1963. The President of SCOR, Dr. G.F. Humphrey, addressed a letter dated 28 October 1963 to the Secretary of IOC containing brief comments of the discussions. The pertinent paragraphs of his letter are reproduced as follows:

### Extract of SCOR President's letter to IOC Secretary.

"The October-November SCOR Executive Meeting has already occupied October 25-26 and will commence again on November 2. The following brief comments on the discussions of the first two days contain some matters relevant to the Bureau - Consultative Committee meeting.

### Data Exchange

The question of data exchange does not seem to be satisfactorily resolved. Perhaps some members of SCOR should meet representatives of the WDCs. Perhaps this should be arranged for January 1964. Certainly representatives of the WDCs and perhaps other DCs should be invited to the IIOE Coordination Meeting. The only comment on whether the IBP marine sub-committee should act as adviser on biological data exchange was to the contrary.

### IIOE Coordination Meeting

Adverse criticism was expressed of this meeting. After a long discussion it was thought that either the agenda should be restricted to items within the competence of the government representatives likely to attend or that the meeting should be replaced by one for scientists in their individual capacities with an agenda such as 1. review recent work 2. outline present and expected problems, stating help needed.

If the tentative agenda were retained it could be as in NS/9/88F with the following additions:

2. e.g. uninvestigated areas
3. e.g. primary production, chlorophyll and zooplankton biomass.
4. e.g. rapid interchange, charts of stations planned and finished. Status of 5-reprint proposal.
6. Future expeditions to the Indian Ocean to solve specific problems.
7. Long-term observations from islands.

In such a case, every effort should be made to see that delegations included scientists who have made cruises in the Indian Ocean or who have worked on Indian Ocean data or material. Two of the SCOR experts (as defined by Resolution 2 of IOC) presented reports, Professor Krey on plankton and Professor Tchernia on physical oceanography. These experts will be available for the Monday (and perhaps longer) of the Bureau meeting and should be encouraged to give their comments. SCOR

suggests IOC should publish the full reports of the experts (? IIOE newsletter).

I would be grateful if you would put these comments before the Bureau if you think they will help the meeting. This document has not been given to the SCOR Executive for approval; time did not allow such action. "

### 3. Exchange of Information

3.1 The Indian National Committee on Oceanic Research, Council of Scientific and Industrial Research, published an IIOE Newsletter for India (No.1 in June 1963 and No.2 in September 1963). These publications have been received by the Office of Oceanography. They contain information on the progress made in the Indian Programme of the Expedition as well as activities undertaken by other participating countries and international bodies.

The following are various Indian activities related to the IIOE as referred to in these issues:

#### From Indian Newsletter No.1

#### Cruising Programme of Indian Vessels

##### INS KISTNA:

The cruising programme of INS KISTNA is going on according to schedule. The first scientific cruise of INS KISTNA was inaugurated by Professor Humayun Kabir, Minister for Scientific Research and Cultural Affairs on October 9, 1962. Prior to the inauguration the ship had made one training cruise and some observations and collections were made in the northern part of the Arabian Sea including Gulf of Oman. Since inauguration seven cruises have been completed in all. In these cruises, a number of sections have been worked out in the Arabian Sea, parts of the Indian Ocean from Cape Comorin to the equator and Southern & Central Bay of Bengal including the Andaman Sea.

##### R.V. VARUNA:

R.V. VARUNA has done two equatorial crossings in connection with the International Indian Ocean Expedition Programme during September-October, 1962 and is currently doing her cruises near the east coast. Extensive physical oceanographic observations with special reference to temperature, salinity and oxygen have been made during these cruises. This vessel which has a deep echosounder has made soundings in an extensive area near the Laccadives and Maldives. Echo traces revealing fish concentrations have been confirmed by actual fishing, using various types of gear.

The data collected in the cruises have been quite voluminous; the processing is, therefore, still in the preliminary stage. Detailed processing and analysis would take considerable amount of time. It has however been arranged that significant findings be highlighted as early as possible.

From Indian Newsletter No.2

Indian Programme

INS KISTNA and RV VARUNA are now participating in the monsoon cruising programmes. These programmes were finalised in the month of June 1963.

The cruises of INS KISTNA commenced on July 18, 1963. The vessel has completed six cruises so far. In the first three cruises it was not possible strictly to adhere to the cruise plans because of very rough weather. In these cruises all the scientific disciplines mentioned in the Indian Scientific Programme were covered with the exception of geological and geophysical studies, as the equipment for these studies have not yet arrived. When the ship cruises in the Andamans-Nicobars region, it is proposed to carry out a few trial fishing for tuna and other related fishes using long lines. For this purpose, fishing technicians from the Government of Indian Offshore Fishing Stations and the Andamans Administration will be taken on board the ship and the scientists will have an opportunity to study the fish populations in a typically upwelling region.

The cruising programme of RV VARUNA commenced in late July and the area of operation for this vessel is limited to the continental shelf between Cape Comorin in the south and Ratnagiri in the north. The stations are, however, more closely spaced than in the case of INS KISTNA. The emphasis is on intensive studies over a limited area.

Data Processing

The processing of the data collected during the earlier cruises has made some progress. As the data collected relate to different scientific disciplines, the processing of data is now undertaken by different organizations specialising in the particular disciplines. The participating institutions in the country have been requested to send all processed data to the Director, Indian Programme of the Indian Ocean Expedition, with a view to establishing a data centre from which information could be disseminated to interested organizations within the country as well as outside. The data are to be entered in the standard cards so that exchange of data on an international basis could be facilitated.

Indian National Committee on Oceanic Research

1. The Indian National Committee on Oceanic Research met on August 1, 1963 to review the progress of the Indian participation in the International Indian Ocean Expedition. Prior to its meeting, the Working Groups in various disciplines met separately to assess the progress so far made under each discipline and examine reorientation in the programme if necessary. Their reports were also presented before the National Committee for further discussion.

The following are the salient points mentioned in the various Working Group reports:

Physical Oceanography -

- 1) Preliminary processing of the Physical Oceanography data for 1962 cruises have been completed.
- 2) Direct current measurement programme will be started as soon as the TSK - self-recording current meters, which are on order through UNESCO, are received.
- 3) Seismic exploration studies will be started by DSR (Navy) as soon as the sonobuoy and other accessories are ready. Some receivers have been obtained by the DSR (Navy) on loan from the New Zealand Government.

Meteorology -

- 1) Work relating to Instrumentation for the Shallow Water Observatory at Chilka lake is in progress at the Meteorological Office, Poona. The instruments will be first tested in a lake near Poona and then transferred to a suitable site in the Chilka lake area. The site has to be arranged with the help of the Government of Orissa.
- 2) Shore-based wave recorders are to be installed by the India Meteorological Department at Bombay, Mangalore and Visakhapatnam. The recorders are on order and as soon as they are received, the installation will be undertaken.
- 3) The Naval scientific group are to take up the work of installing a wave recorder at Mormagao (Goa).
- 4) The microseismic station originally proposed for Minicoy is to be set up at Trivandrum as Minicoy is considered to have no particular advantage and Trivandrum will be most suitable from several points of view.

Marine Geology and Geophysics -

- 1) Marine Geology programme will be started as soon as the medium type winch on order through UNESCO is received; gravity type corers and snappers will be used to obtain bottom samples.
- 2) Survey of India and the Directorate of Scientific Research (Navy) will undertake magnetic studies using the Precession magnetometer.
- 3) Echosounder with PDR will be used for bottom profile studies.



One of the important items of discussion at the National Committee was a long range plan for promoting oceanographic research in the country. There was unanimous agreement among the members for the establishment of a National Institute of Oceanography in the country.

A working group has been formed to plan out a comprehensive programme of work on "Coastal Problems and nearshore Oceanography" as part of the Indian participation in the International Indian Ocean Expedition. The group is to be headed by Dr. D.V. Joglekar, Adviser to the Central Board of Irrigation and Power and is to consist of members drawn from the various organizations interested in these problems.

### 3.2 Cruise Reports

(i) A cruise report of the fifth oceanographic cruise of "COMMANDANT ROBERT GIRAUD (France), from 19 December 1962 to 18 February 1963 has been published in "Cahiers Oceanographiques" (XVe annee, No.8, Sept.-Oct.1963). The abstract (original in French) of this report is given below:

On the way back to France, the COMMANDANT ROBERT GIRAUD (Scientific Leader, Mr. Manache, Director of Research of ORSTOM) made oceanographic observations in the Indian Ocean, the Gulf of Aden, the Red Sea and the Mediterranean Sea, as the French participation for IIOE.

The work carried out, of which the major object was detailed investigations of the hydrology of the region in winter, is tabulated as follows:

	<u>Indian Ocean</u>	<u>Gulf of Aden</u>	<u>Red Sea</u>	<u>Mediterranean Sea</u>	<u>Total</u>
Hydrological Stations	10	46	63	1	120
BT Station	10	46	63	1	120
Surface Station	-	-	-	24	24
GEK Measurements	19	29	27	19	94
Water samples	156	682	982	43	1863

The tracks and stations in the Indian Ocean, the Gulf of Aden and the Red Sea, which differ from those in "Indian Ocean - Oceanographic Cruise Tracks Scheduled" (U.S.N, H.O. 17.138C Sept. 1962), are illustrated in Figs. 1 and 2.

This was the fifth cruise of this vessel in the Indian Ocean since 1957. The first one was made in October 1957 under the IGY Programme and limited to the Mozambique Channel; the second and fourth were carried out in the summer monsoon season in 1960 and 1962, respectively, in the western part of the Indian Ocean from the Gulf of Aden to the latitude of 32°S; finally the third cruise took place from April to June 1961 in the Gulf of Aden, the Arabian Sea and the Persian Gulf.

During these five cruises, the ship occupied 516 hydrological stations, spent 262 days at sea and navigated more than 57,000 miles. These cruises were based at the "Centre d'Océanographie et des Pêches" at Nosy-Be belonging to ORSTOM and directed by Mr. Menache, the former Director of the Centre. The activities in the field of physical oceanography were an essential part of the French contribution to the IIOE.

(ii) A narrative report of R.V. ANTON BRUUN (USA) Cruise 1 has been received by the Office. This cruise, the first of the U.S. Programme in Biology of IIOE, was carried out in the Bay of Bengal during the period 12 March - 10 May 1963.

The work done during this cruise is shown in the following table.

Stations for ANTON BRUUN Cruise 1

	Standard	Trawl	Dredge	Sediment	Surface samples for chemical productivity
Bombay - Phuket	5	5	0	0	26
Phuket - Chittagong	25	18	15	2	5
Chittagong - Visakhapatnam	21	10	4	12	0
Visakhapatnam - Visakhapatnam	23	0	7	14	3
Visakhapatnam - Madras	18	0	0	2	0
Total	92	33	26	30	34

The stations included measurements of temperature, salinity, dissolved oxygen, phosphate, nitrite, nitrate, silicate, primary productivity, phytoplankton, pigments and zooplankton tows. Sediment was sampled with mud snapper or Phleger corer. A "Gulf of Mexico" shrimp trawl was used to survey fish and shellfish resources.

(iii) Summary cruise report for R.S. AFRICANA II (South Africa) was received from the national coordinator. The cruise was made from 2 April to 20 April 1963, and the work done during the cruise is tabulated below:

1. Stations occupied

15 - A2386 - A2400 (for track see Fig.4)

2. Hydrology

Temperature observations	- 227
Salinity samples collected	- 227
Oxygen determinations	- 226
Phosphate (inorganic) determinations	- 151
Phosphate (total) determination	- 151
PH - determinations	- 2
Bathythermograph recordings	- 17
Transparency measurements	- 12
Drift cards released	- 500 at 25 localities

3. Biology

Zooplankton

N70V Samples	- 86
N113V "	- 9
N7V "	- 39
N100H "	- 13
N100B "	- 10
N200B "	- 7
Continuous plankton recorder samples	- 50

Phytoplankton

N50V Samples	- 11
Diatom samples from Nansen Pettersson bottle (0, 10, 30, 50, 100, 150 metre)	- 75

Productivity measurements

Samples collected at optical depths of 100%, 10%, 1% for C-14 measurements of phytoplankton production	- 19
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Experimental Fishing

Handlines and Japanese long lines were used  
at 7 stations. Scuba diving at Marion  
Island

Ornithology

Oceanic bird counts	- 26
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Botany

Collection of seaweed	- 1
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#### 4. Meteorology

Complete meteorological observations were made at six hourly intervals and at all stations. A thermograph and barograph were operated continuously.

#### 5. Echo-soundings

A deep sea echo sounder was in continuous operation throughout the trip.

#### 6. Wave recordings

An NIO wave recorder was operated at pre-arranged intervals throughout the cruise.

#### 7. Geology

Rock samples were collected by Scuba divers at Marion Island.

(iv) The Office of Oceanography received the Summary of Cruise for HMAS DIAMANTINA (Australia) Cruises DM 2/63 and DM 3/63. The plans for these cruises appeared in IIOE Information Paper No.4, page 9. The itineraries and programme carried out are tabulated below:

<u>Cruise</u>	<u>DM 2/63</u>	<u>DM 3/63</u>
Departed Fremantle	6/V/63	9/VII/63
Arrived Singapore	19/VI/63	26/VII/63
Departed Singapore	23/V/63	30/VII/63
Arrived Fremantle	3/VI/63	11/VIII/63
BT	34 stations	32 stations
Subsurface hydrology	34 "	33 "
Primary production	34 "	35 "
Pigments	34 "	35 "
Particulated carbon	34 "	28 "
Zooplankton	34 "	31 "
Midwater trawl	14 "	15 "

Reference stations No.1 ( $32^{\circ}\text{S}$ ,  $111^{\circ}50'\text{E}$ ) and No.2 ( $9^{\circ}\text{S}$ ,  $105^{\circ}\text{E}$ ) have been occupied by both cruises

(v) The Royal Society (London) has recently published the Cruise Report of RRS DISCOVERY (UK), Cruise I. She left Plymouth on July 1, 1963, and returned to Aden on August 20, 1963. The object of this cruise was to survey the region off the South Arabian Coast intending to delimit the area of upwelling and then to investigate its mechanism and the ensuing cycle of chemical and biological events. It was hoped also in the course of this work to collect as much information as possible which might be of use in the future to the development of any fisheries in this region.

The following works were carried out during the cruise.

At the station (95 oceanographic stations were occupied)

Water sampling at standard depths

Bathymograph lowering to 270 m

Current profile to 100 m, with attached temperature/  
salinity/depth probe

Chlorophyll measurement (0, 20, 40, 60, 80 and 100 m) \*

Vertical haul with 50 cm diameter phytoplankton net (100-0m)

Vertical haul with 70 cm diameter 200  $\mu$  mesh zooplankton  
net (50 - 0, 100 - 50, 200 - 100, 500 - 200, 1000 - 500 m)

Vertical haul with IOS net (200 - 0 m) \*

Bottom grab (0.1 m<sup>2</sup> spring grab) \*

A 15 min. tow with a neuston net at 5 kt.

\* these observations were made only at alternate stations

Bathymograph lowering, underway

Meteorology

Continuous recording of wet and dry bulb air temperature.

Four hourly surface observations.

Wave, daily

Echo soundings, continuous recording for most of the tracks.

Currents

70 vertical profiles of relative currents with direct-reading  
current meter, in most cases to 100 m, some to 200 m depth.

81 surface current vectors deduced from the discrepancy between  
dead reckoning and observed positions.

6 surface drogues were followed (periods 3 to 12 hours each).

6 neutrally buoyant floats, at depths between 75 and 360 m  
(for periods 14 to 65 hours each)

Chemistry

Routine analysis for salinity, dissolved oxygen, inorganic  
phosphate, nitrate and silicate.

Specialized analysis for ammonium nitrogen, albuminoid nitrogen,  
trace metals, permanganate oxidizable material in filtered  
water, ultra-violet absorption and volatile fraction of  
filtered water, at selected stations.

Surface water sampling for particulate carbon, nitrogen and  
phosphorus estimation.

Bacteria, up to 3500 m depth.

Ornithology

Entomology

Sonic scattering layers and fish shoals

This report in booklet form is available from the Royal Society, 6 Cornwall Terrace, Regent's Park, London, N.W.1., on request.

(vi) The Cruise Report of RRS DISCOVERY (UK) for the period 23 August to 12 September 1963 has been received by the Office. The main object of this cruise was geological and geophysical study of the ocean floor. An extensive programme was carried out in the Areas 4A (around 5°30'N, 62°E) and 4C (around 2°45'N, 60°E). Continuous magnetometer and echo-sounder records were obtained when underway. The stations occupied during the cruise are shown in the following table.

	Camera stations	Dredge stations (successful)	Coring stations (heat flow)	Water Bottle stations
Aden to 4A	-	-	-	1
4A	4	11(3)	5(2)	1
4C	4	6(3)	2(2)	2
4B to Mombasa	-	-	1(1)	-
Total	8	17(6)	8(5)	4

Besides the geological and geophysical work, 4 water bottle stations were occupied as shown in the table. Salinity, dissolved oxygen, nitrate and nitrite, ammonia and albuminoid nitrogen were measured. Dissolves and suspended trace materials (copper, lead, cobalt, nickel, manganese and zinc) will be analysed in a laboratory on land.

Ornithological observations were made during the cruise. Unexpectedly, land birds were also seen in the central Arabian Sea.

### 3.3 Cruise Plans

(i) From the National Coordinator the Office received the following cruise plans of HMAS DIAMANTINA (Australia) in the Indian Ocean.

DIAMANTINA Cruise DM 4/63. 20/VIII/63 - 26/VIII/63

Objectives:

To find the late larval stages of the W.A. crayfish (*Panulirus cygnus*) and to measure distribution and density;

To determine whether there are deep water prawns which breed near the edge of the continental shelf;

To detonate depth charges for crustal structure studies;

To sample sediments on the continental shelf.

#### Work at Stations

##### Traverses:

Indian Ocean Standard net haul from 200 m.

Midwater trawl from 200 m to surface

Bottom photography at 80 fathoms

Bottom dredge and trawl and sediment sample at 80 fathoms

Surface and sub-surface temperature and salinity

##### Periodic Stations:

Depth charging

Sediment sampling by snapper grab or Barcoo sampler

DIAMANTINA Cruise DM 5/63, 4/IX/63 - 28/IX/63

#### Objectives:

To study the vertical distribution of organic phosphorus in relation to particulated matter;

To examine the vertical distribution of particulated matter in deep water;

To measure simulated in situ production;

To measure the amount of non-particulate organic matter formed during photosynthesis;

To collect plankton by means of IOS net vertical haul;

To test a new method of measuring relative productivity using scintillation counting in place of Geiger counting of  $C^{14}$ .

#### Work at stations

Hydrological sampling to the bottom, samplings for particulate phosphorus, particulate carbon, primary production, pigments and zooplankton by IOS net.

Two drift stations will be worked from 1100 to 1900 hours for the in situ measurement of primary production.

Surface sampling and bathymetric casts are required.

Reference stations No.1 and No.2 will be occupied.

DIAMANTINA Cruise DM 6/63, 2/X/63 - 15/X/63.

Objectives and work at stations are similar to cruise DM 4/63.

(ii) Japanese plan of the IIOE cruises in October 1963 - February 1964.

At the meeting of the Japanese National Committee on Oceanic Research (July 4, 1963) the Japanese plan for IIOE cruises in 1963/64 was discussed and agreed upon. The following is an abstract of the result of the meeting. (From Information Bulletin of Planktology in Japan, No.90, 1963, original Japanese).

Proposed itinerary

UMITAKA MARU

Departure from Tokyo	October 26, 1963
Call at Tateyama	October 27-30
Call at Darwin	November 14-17
Call at Broome	November 26-28
Call at Carnarvon (or Onslow)	December 12-14
Call at Fremantle	December 23-29
Call at Penang	January 22-25, 1964
Return to Tokyo	February 8

KOYO MARU

Departure from Shimonoseki	October 24, 1963
Call at Tokyo	October 26- November 5
Call at Hong Kong	November 11-16
Call at Penang	December 6-11
Call at Djakarta	December 30-January 4, 1964
Call at Fremantle	January 21-26
Call at Singapore	February 10-15
Return to Shimonoseki	February 26

KAGOSHIMA MARU

Departure from Kagoshima	November 10, 1963
Call at Singapore	November 12-23
Call at Colombo	December 23-27
Call at Fremantle	January 24-29, 1964
Return to Kagoshima	February 18

Observation stations

5 stations on 120°E	11°S-17°S	UMITAKA MARU
8 stations on 113°E	9°S-23°S	" "
9 stations on 106°E	8°S-25°S	" "
5 stations on 100°E	4°S-11°S	" "
7 stations on 100°E	12°30' S-21°30' S	KOYO MARU



Observation stations contd..

14 stations on  $94^{\circ}\text{E}$   $8^{\circ}\text{N}$ - $10^{\circ}\text{S}$  KOYO MARU  
1 station (Ref.sta.)  $9^{\circ}\text{S}$ ,  $105^{\circ}\text{E}$ , " "  
1 station (Ref.sta.)  $32^{\circ}\text{S}$ ,  $110^{\circ}50'\text{E}$  " "  
15 stations on  $86^{\circ}\text{E}$   $4^{\circ}30'\text{N}$ - $4^{\circ}30'\text{S}$  KAGOSHIMA MARU  
31 stations on  $78^{\circ}\text{E}$   $7^{\circ}30'\text{N}$ - $25^{\circ}30'\text{S}$  " "

Items of observations

Eye observation on sea birds, etc; meteorological observations, aerological observation (KOYO MARU only); precise depth recording; geomagnetic survey (UMITAKA MARU only); gravity measurement (UMITAKA MARU only); seismic observation (UMITAKA MARU only); cosmic ray measurement (UMITAKA MARU only); continuous recording of sea surface temperature; every 4 hour measurement of surface salinity (KOYO MARU only); BT cast, subsurface cast (temperature, salinity, oxygen, pH, inorganic P, total P, and sometimes Si,  $\text{NO}_3\text{-N}$ ); GEK tow; current measurement with two metres; continuous recording of solar radiation; underwater light intensity measurement; primary production measurement; chlorophyll a measurement; sampling of water for micro-plankton studies; zooplankton standard sampling; deep divided vertical hauls with fine mesh closing net; oblique haul with larva net; high-speed plankton sampling; Isaacs-Kidd mid-water trawling (KOYO MARU only); dredging; core sampling; trawling (UMITAKA MARU only) and long lining with commercial gear.

Reference Stations Nos. 1 and 2 will be occupied by the KOYO MARU.

The tracks of the above-mentioned cruises, if not reported previously, or different from those in "Indian Ocean - Oceanographic Cruise Tracks Scheduled" H.O. 17. 138C, are shown in the figures (Annex III).

(iii) From the Annual Report of the East Africa Marine Fisheries Research Organization, the Office was informed that RV MANIHINE will occupy the reference stations Nos. 8, 10, 11, 12 and 13. Ref.St. No.12 lies about 125 miles NE of the position quoted by IOC and will occupy the position of  $14^{\circ}11'\text{N}$ ,  $51^{\circ}49'\text{E}$  and is the deepest point in the vicinity. (For the programme of RV MANIHINE's cruise, see IIOE Information Paper No. 2 Supplement).

### 3.4 IIOE Cruises completed before 1 January 1963

The table in Annex II shows the IIOE cruises before 1 January 1963 compiled from the information received to date. There may be some inaccuracies in this table and any corrections and/or additions should be sent to the Office of Oceanography, Unesco.

## 4. Miscellaneous

### 4.1 IIOE vessels calling at Penang, Malaysia

The following is an extract from a letter dated 11 November 1963, from the Secretary of the National Special Committee on Oceanographic Research, Malaysia, addressed to the Secretary of IOC:

"The National Special Committee on Oceanographic Research, Malaysia, would be grateful if you would inform Commanding Officers of vessels calling in at Penang to contact Captain R.E. Gee, Director of Marine, Malaysia, Marine Headquarters at Penang as he would be pleased to liase and help whenever possible.

Your assistance on this matter would be greatly appreciated."

### 4.2 IIOE National Coordinators

After the issue of the IIOE Information Paper No.4, the Office received confirmation from the governments of the following National Coordinator (see IIOE Information Paper No.2, Annex B, No.3. p.4 and No.4, p.18).

INDIA

Dr. N.K. Panikkar

### 4.3 Exemption of light dues

Following is an extract of a letter from Dr. N.K. Panikkar (India) dated December 10, 1963.

" The Government of India, on the initiative of the Indian National Committee on Oceanic Research, has agreed to exempt the research vessels participating in the International Indian Ocean Expedition from the payment of light dues required under section 18 of the Indian Lighthouse Act, 1927 (17 of 1927). "

BRIEF SUMMARY OF THE MAIN INFORMATION RELATING TO THE  
RECENT PHYSICAL OCEANOGRAPHY CRUISES IN THE INDIAN OCEAN

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20 October 1963

Although neither the IOC nor myself receive much information on the observations carried out in the Indian Ocean, I shall report here the most important items I have managed to obtain. In so doing, I shall follow the division into four regions adopted by the coordination meetings held at Lourenço Marques in April and May 1962 for the Southwest of the Indian Ocean and at Wormley in July 1962 for the Northwest.

a) N.W. Region: This consists mainly of the Arabian Sea and its two annexes, i.e. the Red Sea and the Persian Gulf. It is the key region of the Indian Ocean in which water masses are formed which are a feature of the hydrological structure and the influence of which can be noticed far away to the south and to the east. It is also the region which is most strongly influenced by the monsoon. The strong, steady "and long-lasting" summer monsoon winds blowing from the S.W. across this semi-circular basin with its steep shores not only make the sea extremely agitated and rough but also give rise to a seasonal powerful western boundary current which, passing along the Somalia coast and Southern Arabia, produces strong upwellings.

Reference to the seasonal charts drawn up by the N.O.D.C. show almost no hydrological observations for the summer period. The line of stations occupied by the Soviet ship "OB" dates from the beginning of June 1956 and is therefore outside the real summer monsoon season which runs from the end of June to the end of August. Much further east, the short leg of DISCOVERY II stations, which are the only marks on the white background of the chart for the whole northern region of the Indian Ocean, unfortunately belong to an exceptional series of stations, the salinities of which are given as doubtful.

Summer monsoon sea conditions are such that all oceanographic ships had, until recent years, taken great care to avoid that region during the summer. Consequently, although summer is, from many points of view, the crucial period for the region, we had no research data either for the hydrological structure and its variations, or for the dynamical study of the seasonal western boundary current.

It was only when the International Indian Ocean Expedition began its work that certain oceanographic groups undertook the task of making systematic hydrological observations of that region in summer:

- French oceanographic cruises on board the ROBERT GIRAUD along the Somalia coast and in the Gulf of Aden during the summer of 1960 and 1962 (see IIOE Information Paper No.4, p.1).
- Cruise of British oceanographers on board the DISCOVERY in July-August 1963 along the southern coast of Arabia for a physical and biological study of upwelling under the leadership of Drs. R. Currie and J. Swallow.
- Cruise of American oceanographers on board the ATLANTIS II in the Arabian Sea along three tracks, covering principally the latitudes 10° N, 15° N and 20° N in August 1963 under the leadership of Dr. R.A. Miller.

The total observations carried out is still far below the total of what would be necessary to study this key region in summer, but these preliminary observations are already extremely useful.

Since I had opportunities in the past to work in this region only in May and November, i.e. in the inter-monsoon periods, I considered it necessary to go there and find out for myself how things go in summer. Therefore I participated in the cruise of ATLANTIS II between Aden and Bombay in August 1963 and came back with the simple conclusion that only powerful ships equipped with the most up-to-date technical equipment can expect to carry out systematic work in that region in summer.

Before leaving this region, mention should be made of the work carried out by the ROBERT GIRAUD in the Gulf of Aden and in the Red Sea in December 1962 and January 1963, and the systematic work carried out at different times of the year by Indian frigates in the Bombay-Laccadive-Maldives region down to the Equator (see IIOE Information Paper No.4, Annex III, p.3).

b) S.W. Region: The area of the Mozambique channel was investigated by the ROBERT GIRAUD in July, August and September 1960 and 1961. The area off the east coast of South Africa is being studied by cruises on the NATAL and AFRICANA which have been taking place regularly at different times of the year since 1962 and a report of which is included in IIOE Information Paper No.4, Annex I. Our South African colleagues are sending us regular rounded information on their cruise projects and on their observations.

c) N.E. Region: After its thirty-first (September 1959 to March 1960) and thirty-third (October 1960 to March 1961) cruises, which were devoted to observations in the N.E. and N.W. regions of the Indian Ocean, the VITYAZ carried out its 35th cruise during the summer monsoon period (June to November 1962). A report will be found in IIOE Information Paper No.4 (pp. 4-8 and map. Annex III, p.1). Towards the west this cruise did not go beyond the meridian marking the extremity of the Indian peninsula, while on the S.E. it extended to Fremantle (latitude about 32°S).

The axes of  $78^{\circ}$  E and  $94^{\circ}$  E covered by the VITYAZ in summer 1962 were from  $7^{\circ}30'$  N to  $25^{\circ}$  S and from  $5^{\circ}$  N to  $20^{\circ}$  S, and were re-examined by the Japanese ships UMITAKA MARU and KOYO MARU in the winter of 1962-63.

Mention should also be made of the very recent observations of the American ship ANTON BRUUN in the Gulf of Bengal area. This ship, after occupying 13 hydrological stations between Aden and Bombay in February and March 1963, carried out a biological cruise between 12 March and 10 May 1963, during which it occupied a network of stations mainly in the northern area of the Bay of Bengal. Unfortunately, these stations, as is too often the case in biological cruises, do not go beyond 1200 metres.

d) S.E. Region: Since August 1959 Australia has been carrying out regular observations in the S.E. region of the Indian Ocean. The main axis of this activity is on the line  $110^{\circ}$  E between  $32^{\circ}$  S and  $10^{\circ}$  S, but cruises at the two main seasons have been carried out in the region between Northern Australia and Indonesia and in the Great Australian Bight. Some cruises have extended north to Singapore and west to  $85^{\circ}$  E.

We are receiving regular information on the progress of these projects and have just received the complete numerical values of the observations carried out on board the frigate DIAMANTINA in February and March 1961.

Although less spectacular than large-scale expeditions, the regular activity of Australia and South Africa, repeated over a definite region at every season for several years in succession is nevertheless extremely useful. We are certain that the efforts now being made by Australia in that part of the Indian Ocean for so long neglected will be a significant contribution to the knowledge of that ocean.

e) Equatorial Region: Mention must still be made of an activity which covers the N.E. and N.W. quadrants, the purpose of which is to explore more thoroughly the equatorial zone of the Indian Ocean in order to find the equatorial undercurrent discovered by Cromwell in the Pacific, which has also been traced in the Atlantic.

This project was conceived and carried out on board the ARGO of the Scripps Institute by two experts who have studied the Cromwell current in the Pacific : Drs. J. Knauss and B. Taft. It consisted of:

- 1) a S.W. monsoon cruise (June to September 1962)
  - 2) a N.E. monsoon cruise (January to May 1963)
- During the S.W. monsoon, nothing similar to the Pacific undercurrent was discovered.
  - During the N.E. monsoon, only a very weak current was discovered, not anywhere as marked and constant as in the Pacific and Atlantic.

These simple statements are only preliminary results. Our colleagues should be given time to study their observations thoroughly and to repeat some of them in order to give a specific answer to this important question.

I have no definite information on the hydrological work carried out in the south of the Indian Ocean by the U.S. ships VEMA, ARGO and CONRAD, which have made geophysical research cruises in that area. VEMA has made 30 hydrological stations southward of  $20^{\circ}$  S between  $20^{\circ}$  E and  $105^{\circ}$  E.

It is not yet possible to calculate the total of the hydrological stations occupied by ships participating in the IIOE since January 1961, but it is very likely that the number exceeds that for the period between 1900 and 1961. When these observations have been studied, we shall certainly have made some progress; but the study of the Indian Ocean will not be terminated nevertheless. We have not yet finished even with the North Atlantic in spite of all the observations and studies of which it has been the object.

But I believe that, thanks to the International Indian Ocean Expedition, the Indian Ocean will be no longer the "forlorn" ocean. Some of the leading experts in physical oceanography seem now to be interested in its specific problems and this, in my opinion, is one of the first outstanding results of our enterprise.

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# ANNEX II

## SHIP SCHEDULE FOR IIOE (before 1963)

COUNTRY	SHIP	PERIOD	DISCIPLINES AND ITEMS OF OBSERVATION	REPORT	TRACK
Australia	Diamantines	1/X-19/XI/59	Dol-5, 7, 8; Psl, 2g, 4, 5.	1	(1a)
	ditto	1/II-14/III/60	ditto	1	(1a)
	ditto	11/VII-26/IX/60	ditto	1	(1a)
	ditto	16/X-15/XI/60	Dol-5, 7, 8.	1	(1a)
	ditto	14/II-10/III/61	Dol-5, 7; Psl, 2f, g, 4, 5.	1	(1a)
	ditto	1/V-12/VI/61	ditto	1	(1a)
	ditto	20/VII-26/VIII/61	Dol-5, 7, 8; Psl, 2, f, g, 4, 5; Ph2.	1	(1a)
	ditto	12/II-25/III/62	Dol-5, 7, 8; Psl, 2g, 4, 5; Mt3.	1	(1b)
	ditto	16/VII-22/VIII/62	Dol-5, 7, 8; Psl, 2, a, 4, 5.	1	(1b)
	ditto	24/X-6/XI/62	Dol-5, 7, 8; Psl, 2, a, b, g, 4, 5.	1	(1b)
	ditto	15/X-13/XI/62	ditto	1	(1b)
	Gascoyne	21/II-15/III/62	Dol-5, 8; Psl, 2g, 4, 5; Mt3.	1	(1b)
	ditto	18/VI-13/VII/62	Dol-5, 7, 8; Psl, 2g, Abl, 2.	1	(1b)
	ditto	3/VIII-13/VIII/62	Dol-5, 7, 8; Psl, 2g, Abl, 2.	1	(1b)
	ditto	19/VIII-16/IX/62	Dol-5, 8; Psl, 2a, f, g, 4, 5; Mt3.	1	(1b)
	ditto	30/IX-12/X/62	Dol-5, 7, 8; Cml.	1	(1b)
France	R. Giraud	15/IV-17/VI/61	Do, Cm, Ps.	1	(1a)
	ditto	3/VII-10/X/62	Dol, 2, 3, 7, 8; Cml, 4.	1	(1b)
India	Bangada	VIII-IX/62	Fr.	1	(3)
	Conch	IX-XII/62	Dol, 2, 3, 4, 8; Psl, 2a, Abl, Gg2.	1	(1)
	Kistna	24/IX-6/XII/62	Dol-8; Psl, 2a, 4; Abl, Ph1, Fr1, 2; Gg1, 2, 4-7.	1	(2)
	Varuna	VI-VIII/62	Do; Ps; Fr.	1	(2)
Japan	Umi taka-Maru	XII/60-I/61	Dol-6; Psl, 2; Fr1, 2.	1	(1a)
Pakistan	Zulfiquar	XII/61-IV/62	Dol-5, 8; Cm; Psl, 2; Ch, 2, 3; Fr6; Gg1, 6; Mt1, 3.	1	(1)
	ditto	X/62-XII/62	Dol-8; Cm; Psl, 2, 4; Ch1-3; Gg1; Mt1-3	2	(1)
	Madagar	/62	Dol-8; Cm; Psl, 2, 4, 6; Abl, Ch3, Fr1, 2; Gg1, 2; Mt1-3.	2	(3)

COUNTRY	SHIP	PERIOD	DISCIPLINES AND ITEMS OF OBSERVATION	REPORT TRACK
South Africa	Africana II	VI-VII/61	Do1,2,4,5,7,8;Ps1,2,4,8;Fr1,6;Gg1,Mtl,2.	1 (1a)
	ditto	VI-VII/62	Do1,2,4,5,7,8;Ps1,2,4;Ch3;Fr1,6;Gg1,Mtl.	1 (1)
	Natal	2-24/IV/62	Do1-4,6-8;Ps1,2;Ch4;Fr6;Gg1.	1 (1)
	ditto	7-24/V/62	Do1,2,7,8;Gg1,4,6.	1 (1)
	ditto	4-22/VI/62	ditto	1 (1)
	ditto	2-24/VII/62	Do1-8;Ps1,2;Ch4;Fr6;Gg1.	1 (1)
	ditto	6-30/VIII/62	Do1,2,7,8;Cm3;Ps2b;Ch4;Fr1;Mt2.	1 (1)
	ditto	1-22/X/62	Do1-8;Ps1,2,4,5;Ch4;Fr6;Gg1.	1 (1)
	ditto	5-22/XI/62	Do1,2;Ps2b;Ab1;Fr6;Gg1,6.	1 (1)
	J.D.Gilchrist other vessels		Fr.	2 (3)
U.K.	A. Queen	VIII/62	Mt3.	2 (3)
	Dalrymple Owen	IX/61-III/62 8/XI/61-4/V/62	Do7;Gg1,2b,3,7;Mtl. Do1,3,7;Gg2b,6,7;Mtl.	1 (3) 1 (3)
U.S.A.	Argo*	19/X/60-22/I/61	Do;Ps1,2b,d;Ab1,2;Ch3,4;Gg1,2a,4-7.	1 (1a)
	ditto*	28/VI/62-28/V/63	Do;Cm;Ch4;Gg1,4-7.	2 (1)
	Atlantis	VI-VII/58	Gg.	2 (1a)
	East Wind	V/61	Do.	2 (1)
	Horizon	16/IX-23/XII/62	Do;Gg1,4,5.(with Argo)	2 (1)
	Requisite	1-III/61	Do.	2 (1a)
	Serrano	III-VI/61	Do;Cm;Gg.	2 (1a)
	ditto	XI-XII/61	ditto	2 (1a)
	Vema	14/IV-1/VI/63	Do1-4,7,8;Ab1,2;Ch4;Gg1,4.	2 (1a)
	ditto	17/VI/59-24/II/60	Do1-4,7,8;Ps1,2;Ab1,2;Ph1;Ch4;Gg1,4,5,7.	1 (1a)
	ditto	31/V-1/VIII/62	Do1-4,7,8;Ps1,2;Ab1,2;Ph1;Ch4;Gg1,4-7;Ph2;Ab1.	2 (2)
	Vityaz	13/59-III/60	Do1-8;Ps1,2,5;Cm;Ab1;Ph2;Fr2;Gg1,2a,4;Mtl-3.	1 (1a)
U.S.S.R.	ditto	X/60-IV/61	ditto	1 (1a)
	ditto	23/VI-23/VI/62	Do1-8;Cm;Ps1,2,5;Ab1,2;Ph2;Ch4;Fr1,2;Gg1,2a,4;Mtl-3.	1 (3)

Foot Note:

\*This Argo's cruise is a correction for Annex II of IIOE INFORMATION PAPER No.4.  
 In the Column "Report": "1" = Cruise report has been received  
 "2" = Cruise report has not been received.  
 Symbols in the column "Disciplines and Items of Observations" and "Track" are the same as in the  
 table SHIP SCHEDULES FOR IIOE (1963-1965). IIOE INFORMATION PAPER No.4, Annex II.



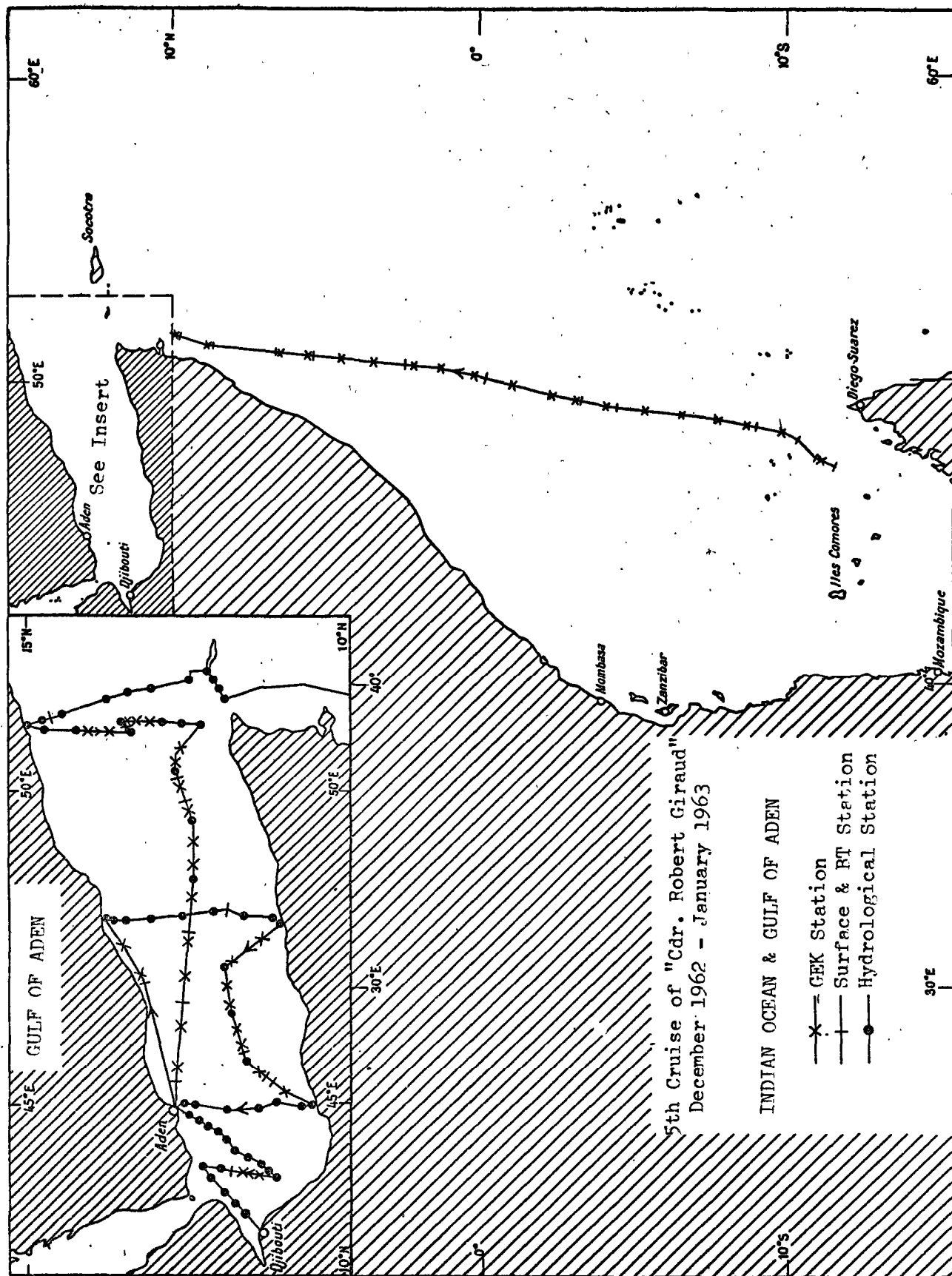
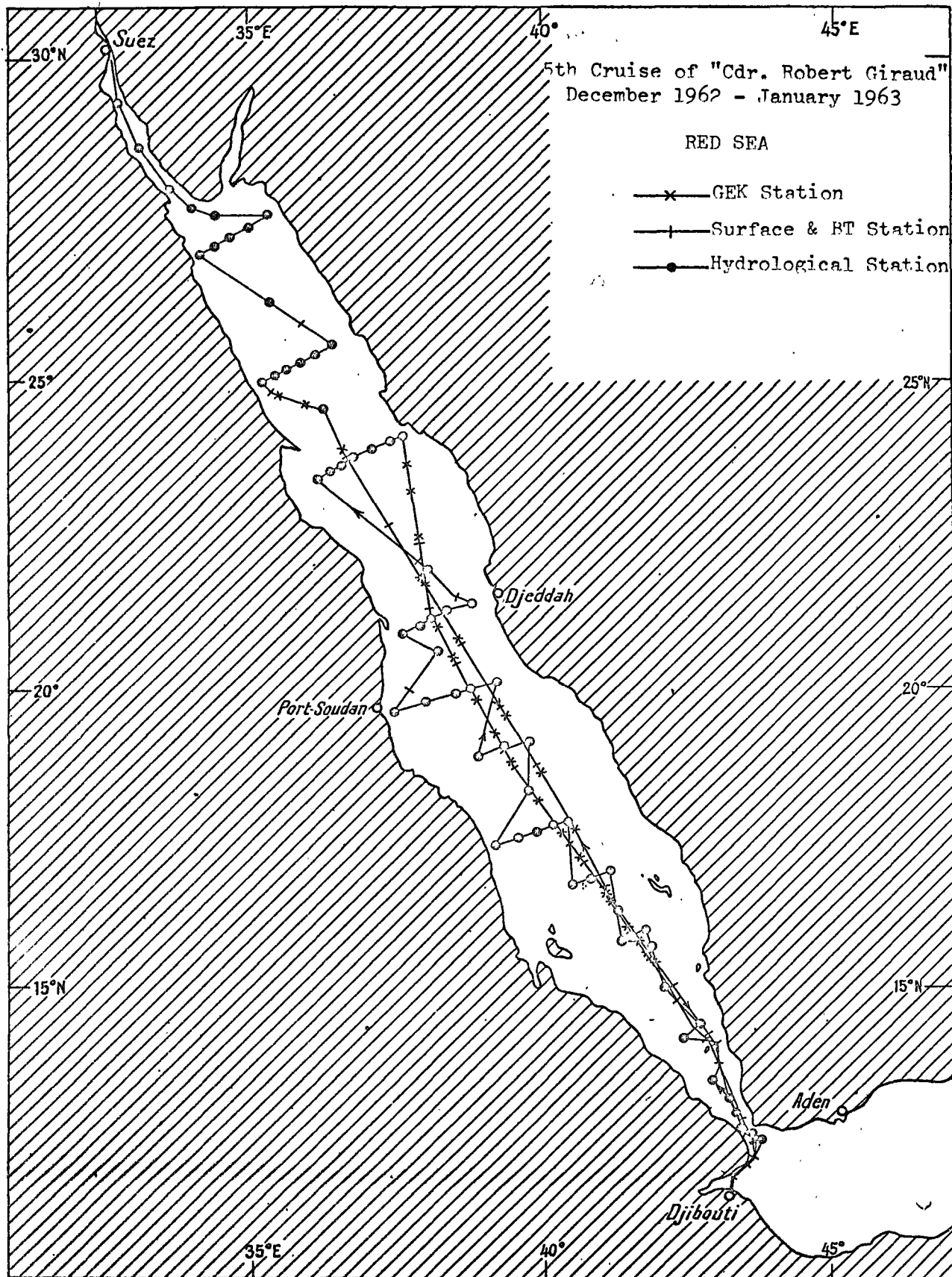


FIG.1



inf. 8

FIG.2

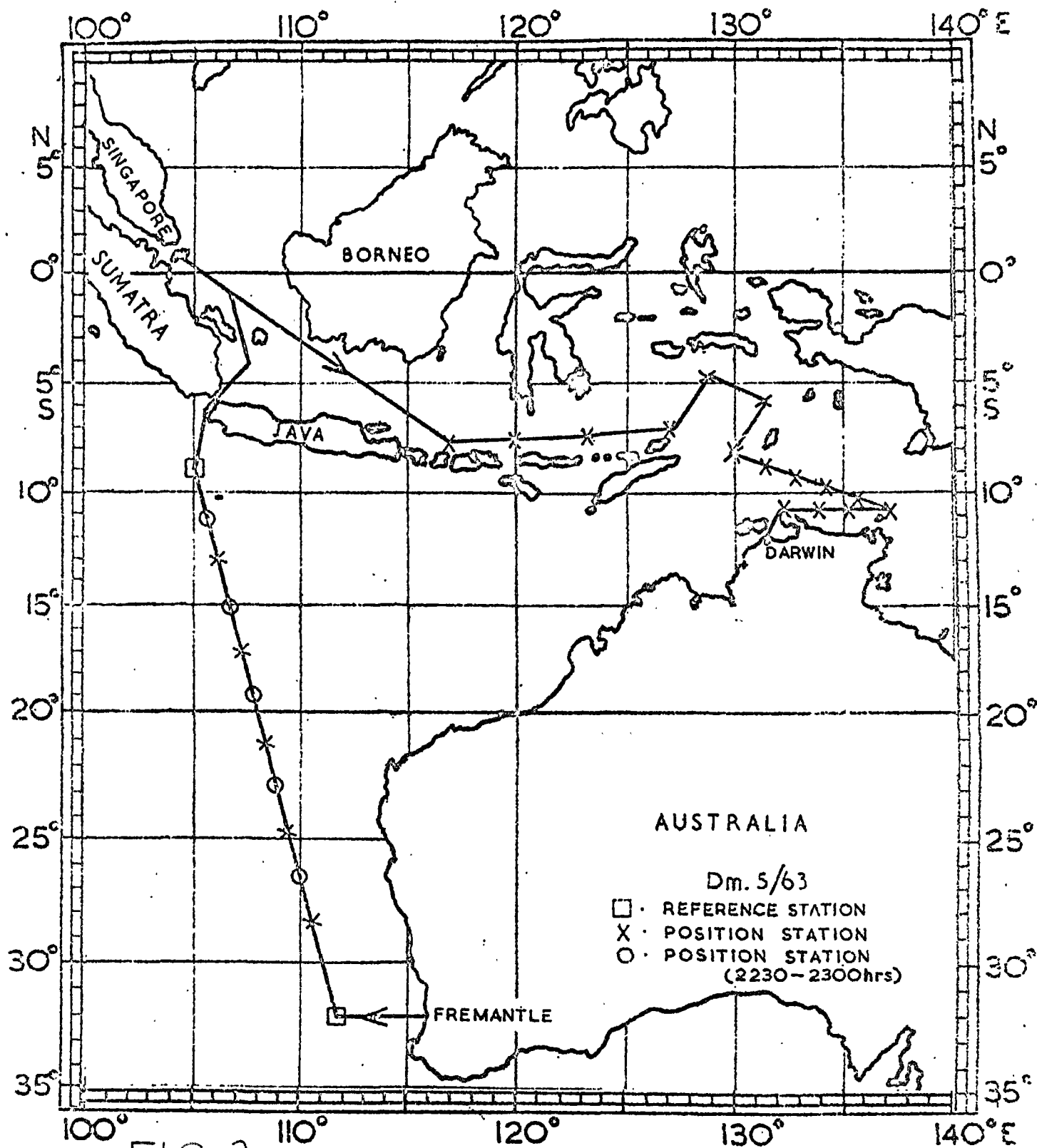
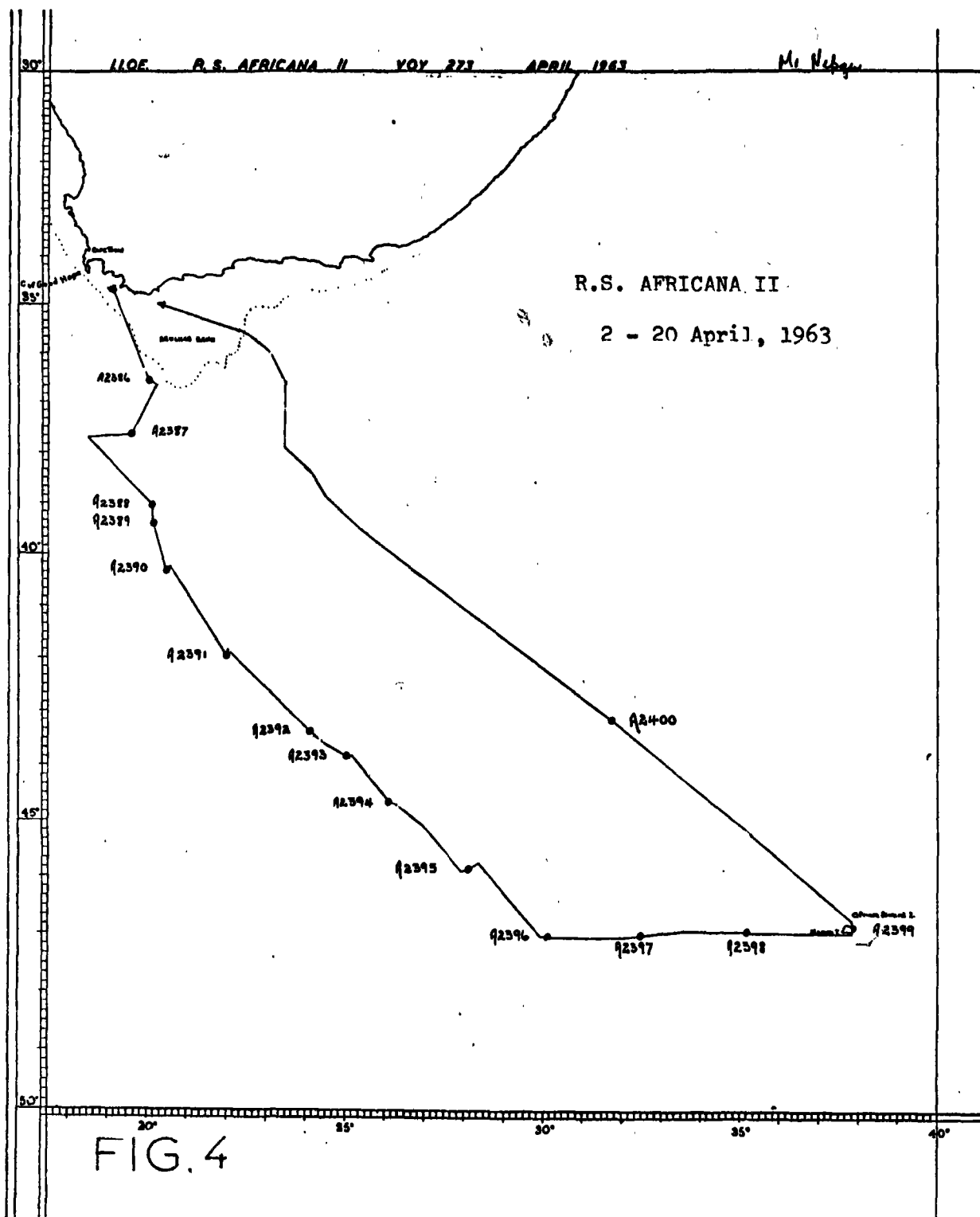


FIG. 3



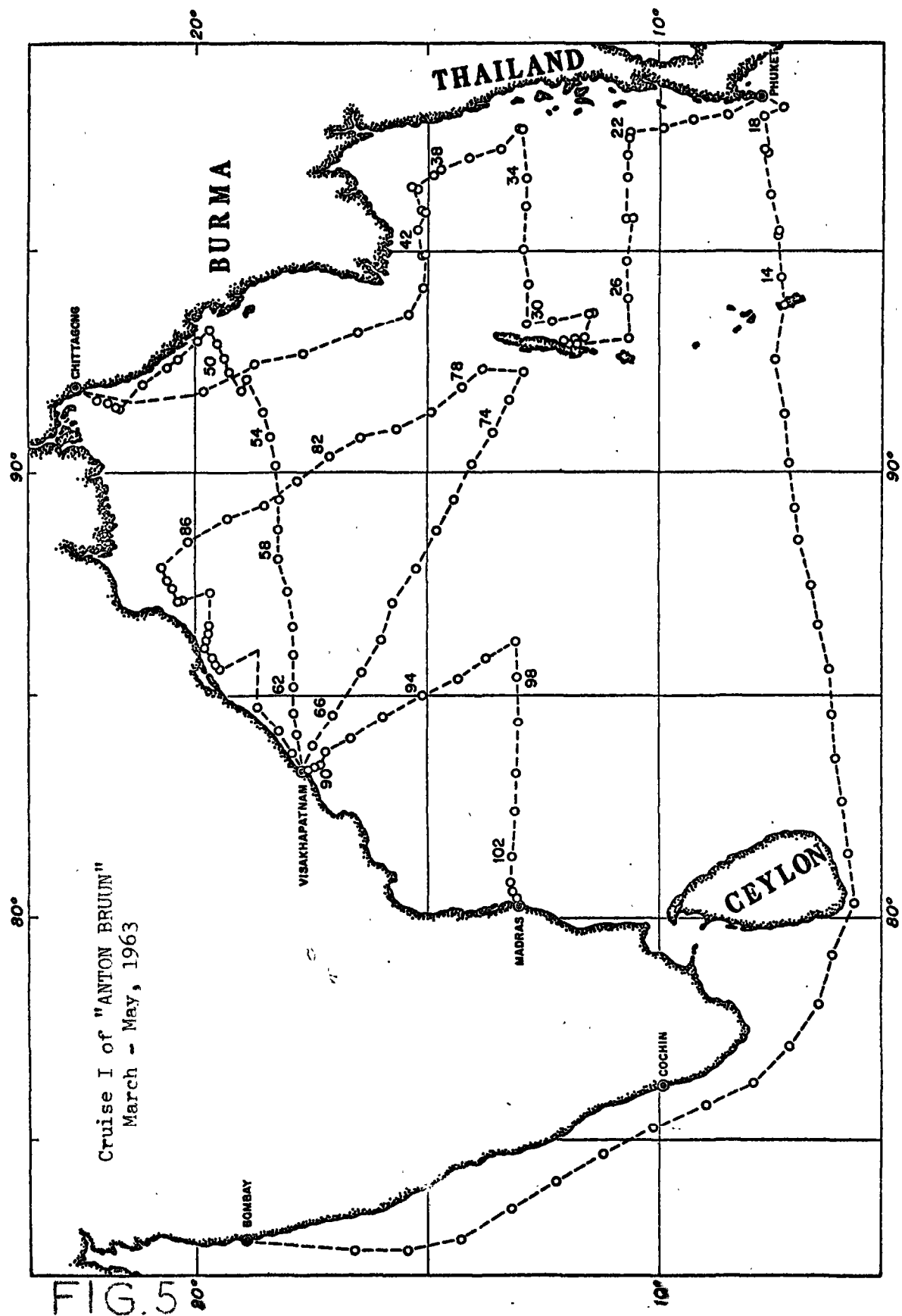


FIG.5

