

intergovernmental oceanographic commission

information
paper

11

UNESCO/NS/IOC/INF - 67

FOREWORD

The International Indian Ocean Expedition has entered into its last year of ship operations and the second meeting of the International Co-ordination Group is scheduled to be held next June. The most important topic at this meeting will be the preparation and publication of IIOE atlases and data reports. To ensure success of the meeting, participants should have a sound knowledge of the work accomplished by various participating countries and of the progress achieved in the treatment and analysis of data. In this connection, the role of this information paper will not diminish, although information on ships' activities will perhaps be a less important part of its content.

The Office of Oceanography of Unesco would welcome information on various findings by the participating vessels and shore stations. The information received will be communicated to interested scientists through this bulletin.

unesco

Unesco Office of Oceanography
Paris, February 1965

IIOE INFORMATION PAPER No.11

1. Recent Activities of the IOC1.1 The Fifth Bureau and Consultative Council Meeting

The Bureau and the Consultative Council of IOC met at the UNESCO Headquarters from 7 to 11 December 1964. Among the various problems discussed at the meeting, the following are of particular interest to IIOE.

(a) IIOE Data Reports and Atlases

The Secretary informed the group that little response had been received from National Co-ordinators concerning means of consolidating and publishing IIOE data and cruise reports. It was the feeling of SCOR that individual scientists should volunteer to work on the IIOE atlases. The Secretary offered to write again to the various national co-ordinators (see para. 1.2 of this issue) stressing the need to locate such persons and the delegates for their part agreed to do what they could to assist in this matter on their return. The Chairman pointed out that progress had been made insofar as meteorological data was concerned and IOBC might be able to handle the biological data. However, experts should help by selecting appropriate physical and chemical characteristics for the purpose of charting. Delegates were urged to impress on their respective National Commissions for Unesco the importance of adequate financing through Unesco of the production of the IIOE atlases in 1967-68. At the last SCOR meeting, it was suggested that tables of contents be prepared for the first three to four volumes of the IIOE cruise and data reports composed of those data already in WDCs, and that a subscription be announced by Unesco on a volume basis. The Co-ordinating Group had suggested a tentative cost of \$20 per set, but the Secretary felt that it would be inadequate and that \$3 to \$5 should be charged per volume, the total cost to subscribers being higher but spread over a longer period of time. The Secretary was authorized by the Bureau to proceed with this effort.

(b) Fisheries aspects of IIOE

The Secretary informed the group of the present status of the Fisheries Subject Leader (FSL) for the IIOE and communicated the fact that SCOR had felt that with the termination of the observations programme in 1965, there would be little for the Fisheries Subject Leader for IIOE to do. Dr. Jackson (FAO) reported that, at the IPFC meeting, the work of the Fisheries Subject Leader for IIOE was discussed only briefly and no recommendations were made. He added that FAO was now establishing a Stock Assessment Unit which, in its capacity of Fisheries Data Centre, would work on the IIOE fisheries data. FAO felt that it could also take care of the preparation of charts based on fisheries data. The Bureau and Consultative Council took note of the work already accomplished by the Fisheries Subject Leader for the IIOE and that the tasks envisioned for him after the termination of the

field phase of the Expedition might in fact be better assumed by the FAO with its ACMRR Working Group on Fishermen's Charts and the IOBC, which will compile the charts on zooplankton, fish larvae and eggs. Meanwhile, the Bureau and Secretariat would continue their search for capable scientists to accept responsibility for compiling the IIOE atlases. Thus, the Bureau resolved that the work would continue but in a somewhat different manner than was previously envisioned in Resolution III-3.

The Chairman asked the FAO representative about the status of the secondment of a tuna larvae specialist to the IOBC, as recommended in Resolution III-3 of the Third Session of IOC, and was informed that Japan was now being approached for such an expert with apparently a good chance of success.

(c) IIOE Reprints

Two volumes are now in press and should be available in January. The first comprises papers on physical and chemical oceanography, marine geology and geophysics, the second is on biological results. These volumes, however, are not representative of all national efforts in the IIOE since some major countries have been slow in transmitting reprints, especially the USA and UK. Sufficient funds are provided under the Unesco budget to continue publishing IIOE collected reprints in 1965-66.

1.2 Questionnaire on Volunteer Scientists for the Preparation of Atlases

The Secretary of IOC has circulated a letter to the IIOE National Co-ordinators and Secretaries of National Committees on Oceanic Research whose countries are not participating in the IIOE, asking them to inform the Office of the names of scientists who are interested in the preparation of the IIOE Atlases. Scientists who are interested in such work have been advised to contact the IIOE National Co-ordinators or the Secretary of the National Committee of their respective countries.

1.3 Forthcoming Important Meetings

The last IOC Bureau and Consultative Council Meeting agreed the schedule of meetings to be convened under the auspices of IOC. The following is the tentative schedule of meetings which are particularly concerned with the IIOE :

Second IIOE International Co-ordinating Group Meeting 7-9 June 1965, Paris

Third IOBC Consultative Committee Meeting April 1965, Cochichewich

2. Recent Activities of SCOR

2.1 Seventh SCOR Meeting

SCOR met in Hamburg from November 30 to December 4, 1964. This was the first meeting of SCOR under the new Constitution and some 17 of the now 31 members attended. Among the various topics discussed at the meeting were some concerning the IIOE especially; these are:

- (a) Fisheries Subject Leader for IIOE
- (b) Exchange of Data
- (c) Data Reports
- (d) IIOE Atlases

The opinions of SCOR were reflected in the discussions at the meeting of the Bureau and Consultative Council. There is no need, therefore, to report them again.

The Executive Committee of SCOR met in Paris together with the IOC Bureau and the Consultative Council (see para. 1.1 of this issue).

2.2 New SCOR Officers

The last SCOR meeting elected the following new Executive members :

President:	Capt. Luis R.A. Capurro (Argentina)
Vice-Presidents:	Prof. V.G. Kort (USSR) Prof. T. Braruud (Norway)
Retiring President:	Dr. G.F. Humphrey (Australia)
Secretary:	Prof. W.S. Wooster (USA)

3. Indo-Pacific Fisheries Council of FAO

The Eleventh Session of the Council was held in Kuala Lumpur (Malaysia) from October 16 to 31, 1964. Problems concerning the IIOE were discussed at the Technical Committee during the session. The following is an extract from the Summary Report of the Session.

International Indian Ocean Expedition

The Council took note of the programme of work for the FSL of the IIOE as described in UNESCO/IOC/INF-53 and approved by the IOC in Resolution III-3 of its 1964 meeting.

The Council agreed that the compilation of the data described in UNESCO/IOC/INF-53, and the preparation of charts of such data, is required by the fishery programmes of the Indian Ocean, but the Council believed that much of such work rests with and is being carried out by various institutions, both inside and outside the Indian Ocean area. There may be a need, however, for the FSL to ensure the compilation of, and preparation of charts relating to some types of data which may not be dealt with otherwise. The Council was of the opinion that the need in the region is for an Officer who would work within the region to assist national research institutions in their planning and conduct of programmes of fisheries oceanography.

The Council noted, however, that FSL has been appointed by IOC and has been given terms of reference relating mostly to the preparation of charts.

The Council suggested to IOC that the terms of reference of the FSL should be revised in consultation with FAO so as to oriente the work of the FSL more closely to the regional needs and expressed a wish that FAO might find the means in 1965 or 1966 to place an Officer in the region to carry out such work indefinitely.

The Council also noted the desirability for charts of this nature in the future; charts which would show the seasonal and cyclical changes of oceanic conditions of importance to fisheries development where data permit.

Recommendation on the Indian Ocean

The Council recognized the growing need for animal protein in the human dietary requirements of the countries surrounding the Indian Ocean and was aware of the ability of the Indian Ocean Fishery resources, if rationally developed, to contribute substantially to the filling of those needs on a sustainable basis.

Further, the Council realized the need, in developing fishing industries, that the governments in those countries be able to take into account the seasonal and cyclical variability in fish availability and abundance arising from temporal changes in the environment as well as from increased fishing pressure in planning the rational development of those fisheries, since local conditions of fish abundance and availability may be strongly affected by climatic and oceanographic conditions arising in the far distance and not detectable locally. Recognizing the necessity for a regional ocean-wide, as well as national approach to these problems into which the results of national fishery development programmes can be fitted and can grow, the Council resolved to request FAO in consultation with other appropriate United Nations bodies, to examine the feasibility of designing and funding a programme of fishery oceanography for the Indian Ocean which would provide a regional background of knowledge and understanding of the ocean for the use of national fishery development programmes, which would make use of this sort of information arising from the International Indian Ocean Expedition and national fishery development work, and which would provide a long range programme incorporating both national and regional elements under which the rational development of the Indian Ocean fisheries could proceed expeditiously.

Surface Temperature Charts

The Council recognized the value to the rational development of the pelagic fisheries of synoptic knowledge of variations in the temperature regime over broad areas of ocean, and being aware of inferences that can be drawn concerning upwelling, superficial currents and other such oceanic processes useful in interpreting variations in fish distribution and behaviour from plottings of surface temperatures over broad area oceans, congratulated the International Meteorological Centre for the Indian Ocean on its preparation and publication of surface temperature charts for the Indian Ocean at regular and brief intervals, and hoped that this form of charting will be made a part of the permanent programme of IMC.

IOBC

Considering the potential importance to the developing fishing industries of the IPFC region of the plankton studies and data on the Indian Ocean organized in the IOBC, the Council hoped that the Centre would continue some similar international activities for an appropriate period after the end of the IIOE, and encouraged UNESCO, together with FAO and the Government of India, to seek ways and means of ensuring this.

4. Exchange of Information

4.1 National Newsletter

India. The Indian National Committee on Oceanic Research, CSIR, has issued the IIOE Newsletter of India, Vol. II No.2, in September 1964 and a copy has been received by this Office. It contains the report of scientific cruises of INS KISTNA, activities of IOBC, IMS and other IIOE participating countries, etc. The report of the IIOE Indian Programme is reproduced in the next sub-section.

4.2 Cruise Reports

(1) Australia

Summaries of the cruises of H.M.A.S. DIAMANTINA Dm 5/64 and GASCOYNE G5/64 have been received from the Australian National Co-ordinator. Extracts from the summaries are reproduced below and the Station Maps appear in Annex I. (For details of programmes, see No. 10, 2.2 p.11.)

H.M.A.S. DIAMANTINA Dm 5/64. 10 August - 10 September, 1964.

Scientific Personnel

B. Newell (Cruise Leader)
G. Dal Pont
J. Klye
J. Prothero
B. Scott

Itinerary

10/8/64	1300	Depart Fremantle
20/8/64	0800	Arrive Cocos Islands
21/8/64	0800	Depart Cocos Islands
25/8/64	0800	Arrive Singapore
29/8/64	0800	Depart Singapore
1/9/64	0700	Arrive Christmas Island
3/9/64	0400	Depart Christmas Island
10/9/64	0900	Arrive Fremantle

Programme

Stations

15 stations

Dm 5/210/64 - Dm 5/224/64

Bathythermograms	at 15 stations
Subsurface hydrology	15 stations
Primary production	10 stations
Zooplankton	14 stations

H.M.A.S. GASCOYNE G 5/64. 19-20 August, 1964.

Scientific Personnel

D. Rochford (Cruise Leader)
F. Davies
N. Dyson
K. Fleming
J. Kaulback (Bureau of Mineral Resources)

Itinerary

19/8/64	1315	Departed Cairns
30/8/64	1100	Arrived Darwin

Programme

Stations

41 stations

G5/194/64 - G5/234/64

Subsurface hydrology at 41 stations

Between Stations 194 and 234 sediment samples were obtained for analysis by the Bureau of Mineral Resources, Canberra.

(2) India

The following is an extract from the Indian National Newsletter, Vol. II, No.2, and the Station Map appears in Annex I.

I.N.S. KISTNA. June - August, 1964.

The 1964 monsoon cruises of INS KISTNA commenced in the month of June from Madras and since then four cruises (XV, XVI, XVII and XVIII) were completed in the Bay of Bengal covering up to 91° long. The investigations in cruises XV to XVII were mainly related to physico-chemical and biological oceanography. Cruise XVIII was exclusively meant for geological work on the continental shelf although some geological collections were made in other cruises also. The meteorological group carried out surface observations and upper air studies in all the cruises except the last one. Radiosonde ascents were made

on all days during cruises XV, XVI and XVII but owing to the prevalent squally weather some of the ascents were not successful.

Physico-Chemical Observations: Nansen casts and BT lowerings were made in all the stations occupied during the cruises.

Chemical work on board mainly consisted of estimation of oxygen and salinity, the latter with Inductive Salinometer. Water samples for nutrient analysis were preserved in deep freeze on board the ship for subsequent analysis ashore.

A high salinity water with its core lying at 400 meters depth has been noticed during XV cruise in the southern Bay of Bengal. This may be due to the movements and sinking of water masses which are yet to be identified. During XVIII cruise observations were made to study the influx of fresh water from rivers, Krishna and Godavari and a northward drift of this water has been traced. It was also observed during cruise XV that offshore waters were fairly isothermal up to about 50 meters below which a sharp thermocline was noticed. The rather low temperature values nearshore indicate the possibility of upwelling in this region.

Biological: Vertical plankton hauls were regularly taken with Indian Ocean Standard Net (IOSN) and surface tows were made with other nets. During XV cruise, 22 vertical hauls were taken with IOSN from 200 meters to Surface. The samples were preserved and deposited at the Indian Ocean Biological Centre, Ernakulam, for sorting.

Geological: The bottom topography was obtained continuously by means of an Edo-echosounder and sediments collected by means of snapper and gravity corer. Submarine canyons were discovered in the continental slope off Pondicherry between $11^{\circ} 47'N$, $80^{\circ} 5'E$ and $11^{\circ} 30'N$, $79^{\circ} 58'E$. Two sections were made across the Swath of No-ground (Ganges Canyon) during XVII cruise and good profiles were obtained. Several core samples were also taken from the edges of Ganges Submarine canyon.

A series of submarine valleys have been located on the continental slope between the confluences of Krishna and Godavari rivers during the XVIII cruise. The detailed report on the findings is under preparation. In all, 113 core samples have been collected from 68 stations occupied during this cruise.

The period of each cruise, the track, total number of stations occupied and the number of scientists under various disciplines who participated in these cruises are given in the following tables.

TABLE I

Cruise No.	Period		Track	Cruise Leader	Total No Stations occupied
	From	To			
XV	8.6.64	20.6.64	Madras/Madras	Dr. V.V.R. Varadachari	37
XVI	23.6.64	4.7.64	Madras/Visakhapatnam	- do -	34
XVII	13.7.64	21.7.64	Visakhapatnam/Visakhapatnam	Shri R.Jayaraman	27
XVIII	2.8.64	9.8.64	Visakhapatnam/Madras	Dr.M. Subba Rao	68

TABLE II

Cruise Nos.	XV	XVI	XVII	XVIII
Physical Oceanographers	4	5	6	3
Geologists	1	2	2	9
Chemists	3	2	4	1
Biologists	2	2	2	-
Meteorologists	3	2	2	-
Total	13	13	16	13

(3) U.S.A.

R.V. ANTON BRUUN, Cruise 5. 26 January - 4 May, 1964.

A narrative report for the above cruise has been received. The following is an extract from the report and a Station Map appears in Annex I.

Itinerary

January 26	Departed Bombay
Jan.27 - Feb.12	Occupied stations from 17° 44'N, 69°11'E to 13°11'N, 50°22'E and along 55°E.
Feb.12 - Feb.15	Port Victoria, Seycelles Islands
Feb.22 - March 2	Port Louis, Mauritius Island; major ship repairs, refuel and replenish supply.
March 9	Ended series of stations along 55° E because of broken cam shaft.
March 14 - Mar.28	Port Louis; cam shaft repaired.

April 4	Stations along 75° E
April 7	Stop over St. Paul Island; collected sea birds and inshore fishes.
April 8	Stop over Amsterdam Island; collected sea birds, inshore fishes and marine invertebrates.
April 24 - 27	Gan Island
April 30	Completed the last station along 75° E
May 1	Cochin. Left the same day.
May 4	Arrived Bombay, completed cruise 5.

Purpose of Cruise and Results

To collect physical, chemical and biological data from the western and central Indian Ocean. The following works were carried out:

1. Hydrographic cast (usually down to 2,000 meters)... 46 sts. for temperature, salinity, oxygen, phosphate, nitrates, nitrites and silicates.
2. B.T. casts, at 3-hour intervals between stations.
3. Primary productivity studies (G 14) and pigment analysis (100%, 50%, 25%, 10% and 1% level) 46 sts.
4. Plankton sampling
 - IOS Net, vertical haul (200m - 0) 45 sts.
 - No.25 mesh net, vertical haul (200m - 0) 41 sts.
 - Bé multiple plankton sampler 0 - 125m, 125m - 250m, 250m - 500m, 500m - 1,000m, 1,000m - 2,000m 42 sts.
 - Oblique tows, $\frac{1}{2}$ -meter net 4 sts.
 - $\frac{1}{2}$ -hour surface zoo-plankton haul with 1-meter net at approx. 2100 local time 59 sts.
 - accompanied by $\frac{1}{2}$ -hour oblique hauls, from top of the thermocline to the surface 44 sts.
5. Long line fishing at 38 stations, a summary of catch is as follows:

105 yellowfin tuna	6 barracuda
54 bigeye tuna	112 lancetfish
83 albacore tuna	1 opah (moonfish)
3 skipjack tuna	4 mako shark
4 blue marlin	4 thresher shark
7 striped marlin	10 great blue shark
2 black marlin	4 silky shark
3 broadbill swordfish	11 whitetip shark
3 shortnosed spearfish	2 mackerel shark
8 sailfish	1 <u>Heptrachias perlo</u> (shark)
4 wahoo	1 unidentified shark
3 dolphin	(family Isuridae)

Length, weight and sex were determined and stomach contents, ovaries, blood samples, intestinal tract and gills (for internal parasites) and external parasites were saved for later detailed studies.

6. 10-foot Isaacs-Kidd midwater travel 2
7. Recording sea-birds observed during the cruise;
75 sea birds specimens were collected during stops at various islands.
8. Inshore fishes and marine invertebrates were collected at St. Paul and Amsterdam Islands.
9. Fish caught on trolling lines, rod-and-reels and hand lines include two species of Coryphaena, yellowfin tuna, skipjack tuna, black skipjack tuna, barracuda and whitetip sharks.
10. Routine weather observations, including aerological observation with radiosonde on 57 occasions.

Personnel

Chief Scientist: Richard S. Shomura (fishes)
Bureau of Commercial Fisheries

Visiting Scientists: Mary Belle Allen (nannoplankton physiology)
Kaiser Foundation Research Institute

Michael L. Coates (fishes)
Bureau of Commercial Fisheries

Peter Connors (meteorology)
U.S. Weather Bureau

Roger F. Cressey (parasitic copepods)
Boston University

Edward E. Gallaher (parasitic helminths)
Virginia Institute of Marine Science

Frank B. Gill (birds)
Smithsonian Institution

Sherril Kite (plankton physiology)
Woods Hole Oceanographic Institution

Edward J. Kuenzler (plankton physiology)
Woods Hole Oceanographic Institution

Michael M. Mullin (zooplankton ecology)
Woods Hole Oceanographic Institution

Royden Nakamura (fishes)
Bureau of Commercial Fisheries

C. Sankarankutty (guest scientist)
Indian Ocean Biological Centre
Cochin, India

Eric G. Silas (guest scientist)
Central Marine Fisheries Research Institute
Mandapam Camp, India

Marta Vannucci (medusae)
Instituto Oceanografico
Sao Paulo, Brazil

Fishermen-Technicians: 6 persons from the Bureau of Commercial Fisheries

Permanent Scientific Staff: 6 persons

4.4 Cruise Schedule

Information on R.V. ATLANTIS II's Cruise Plan, 1965, Voyage No.15, has been received by this Office, and is reproduced below. The scheduled track chart appears in Annex II.

The International Indian Ocean Expedition has involved many countries and many ships over a period of three years. In 1963 ATLANTIS II worked in the Indian Ocean, and in 1964 R.V. CHAIN of our Institution made a seismic and geological survey there. Now ATLANTIS II returns to study, among other phenomena, the NE monsoon of winter, which, with its opposing summer monsoon, is unique in the world oceans.

From Durban ATLANTIS II will survey eastward to Australia, then north through the Banda and China Seas to Japan. Two weeks will be spent in cooperation with Japanese oceanographers on an intensive survey of the lower reaches of the Kuroshio, a powerful western-boundary current very similar to the Atlantic's Gulf Stream. The northern sweep of this flow will be followed around the Aleutian arc and down the American coast to San Diego, California. This will be the first time a Woods Hole ship has circumnavigated the globe.

Sea and air are bound together by the most obvious and most subtle links, and scrupulous attention must be paid to air temperatures and winds, both by radio-sonde balloon and ship-borne instruments, as well as to probing the sea with sampling bottles and thermometers, the in-situ salinometer and the bathythermograph. Current measurements will be made with current meters, deep-floating Swallow buoys and parachute drogues.

Particular attention will be paid to the Somali Current. Continuous echo-sounding will chart the sea floor, while chemical and biological studies will add to the store of information of fisheries installations bordering on the Indian Ocean. Solar radiation, evaporation and precipitation will be measured; wave height and underwater sound velocities. Some 400 hydrographic stations, sampling from surface to bottom, will be spaced out over most of the cruise track, the water to be analysed for temperature, salinity, oxygen and phosphorous content. A towed magnetometer will record data on the earth's magnetic field.

Itinerary of ATLANTIS II includes Port Said, Aden, Bombay, Colombo, the Seychelles, Nossi Be, Durban, Fremantle, Manila, Kobe, Tokyo, San Diego and Panama.

ATLANTIS II is 210 feet overall, 44 feet wide, and draws 17 feet. Her displacement is 2300 tons. She has a cruising range of about 8000 miles, a speed of 12 knots, and accommodations for a crew of 30 and a scientific party of 25.

Her two 700 hp Skinner engines and her 300 kw generators are steam-driven, allowing very quiet operation during acoustical and seismic work.

A steam trawl winch and two electric hydrographic winches each carry 30,000 feet of wire, for lowering sampling bottles, cameras, velocimeters, dredges and coring gear. An hydraulic crane on the afterdeck handles the more cumbersome equipment. A bow thruster, in a tunnel below the water line, gives exceptional manoeuvrability while docking or on station at sea. By the time ATLANTIS II returns to Woods Hole in October she will have steamed nearly 50,000 miles.

Itinerary

<u>Port</u>	<u>Arrive</u>	<u>Depart</u>	<u>Agent</u>
Woods Hole, Mass.		20 Jan.	W.H.O.I.
Ceuta, Spanish Morocco	1 Feb.	2 Feb.	Jose Salama & Cia Gomez Marcelo No.14 POB No.54, Ceuta, Spanish Morocco
Port Said, Egypt, U.A.R.	8 Feb.	8 Feb.	Tanta Shipping Agency P.O. Box 328, Port Said, Egypt, UAR
Aden, Arabia	16 Feb.	19 Feb.	Halal Shipping Co.Ltd Aldrus Road, Crater, Aden, Arabia

<u>Port</u>	<u>Arrive</u>	<u>Depart</u>	<u>Agent</u>
Bombay, India	13 Mar.	16 Mar.	Lionel Edwards Ltd., 41 Nicol Road, Ballard Estate, P.O.Box 1000, Bombay, India
Colombo, Ceylon	5 Apr.	9 Apr.	J.D. McLaren & Co.(Ceylon)Ltd Hong-Kong & Shanghai Bank Bldg Prince Street, P.O. Box 806 Colombo, Ceylon
Mombasa, Kenya	26 Apr.	29 Apr.	Mitchell Cotts & Co.(EA) Ltd. Kinidini Road, P.O. Box 141, Mombasa, Kenya.
Nossi Bé, Madagascar	4 May	6 May	Nouvelle Compagnie Havraise Péninsulaire de Navigation, P.O. Box 1, Hellville, Nossi Bé, Madagascar
Diego Suarez, Madagascar	7 May	7 May	Nouvelle Compagnie Havraise Péninsulaire de Navigation P.O. Box 88, Diego Suarez, Madagascar
Victoria, Mahé Island, Seychelles Islands	25 May	28 May	Hunt Deltel Company P.O. Box 14, Port Victoria, Mahé Island, Seychelles Islands
Diego Suarez, Madagasscar	2 June	2 June	Same as above
Durban, Union of South Africa	22 June	27 June	Mitchell Cotts & Co.Ltd. 46/48 Point Road P.O. Box 1021 Durban, Union of South Africa
Fremantle, Australia	16 July	21 July	Burns, Philp & Co., Ltd. Fremantle, West Australia
Manila, Philippines	12 Aug.	14 Aug.	Columbian Philippines, Inc. P.O. Box 288 Davao City, Mindanao, Philippines
Kobe, Japan	20 Aug.	26 Aug.	Kobe Nissin Unyu Soko K.K. Marubeni - Iida Bldg. 57 Naniwamachi, Ikutaku P.O. Box 848 Kobe, Japan

<u>Port</u>	<u>Arrive</u>	<u>Depart</u>	<u>Agent</u>
Tokyo, Japan	19 Sept.	22 Sept.	Nissin Unyu Soko K.K. Room 333 Marunouchi Bldg. Central P.O.B. 1414 Tokyo, Japan
San Diego, California	12 Oct.	15 Oct.	Scripps Inst.of Oceanography P.O. Box 109 La Jolla, California 92038
Balboa, Canal Zone	26 Oct.	28 Oct.	Boyd Brothers Steamship Agencies, Inc. P.O. Box 2013 Balboa, Canal Zone
Woods Hole, Mass. U.S.A.	6 Nov.		W.H.O.I.

4.5 Exchange of Data

IIOE - Mean Sea Level Data

The following is an extract of a letter from Dr. J.R. Rossiter, Director of the Permanent Service for Mean Sea Level, addressed to the Secretary, dated 13 November 1963.

"There has been little improvement in the flow of mean sea level data from Indian Ocean stations into the Permanent Service for Mean Sea Level during the past year. Of the 38 gauges known to be in operation during 1963, only 11 have sent data for that year, only 2 for 1964. The Permanent Service processes the data for three of these stations.

The next M.S.L. publication of data will be in press in the spring of next year, and will contain data for the years 1962-64 inclusive. The present slow rate of data transmission suggests that the Indian Ocean data will not feature prominently in the publication, which would be a pity.

I suspect that this virtual breakdown in data exchange results from the fact that the organization of sea level data for the IIOE never received the same attention that other disciplines did. I suggest that some pointed remarks on the urgent need to process and despatch observations to us appear in the next issue of the IIOE Newsletter, if this is due shortly; this should be coupled with a request for the Permanent Service to be informed of stations set up since January 1963, and the information that the Service is prepared to process data if this cannot be done locally."

5. Meteorology

News from the Scientific Director's Office, IIOE Meteorology Programme No. 14, December 1964, has been received. The following is an extract from this newsletter.

"The past two months were marked by continued, productive activity.

International Meteorological Center

Staff

Mr. C.M. Dixit, awarded a fellowship under the U.N. Special Fund Project, is shortly leaving for the United States to study computer applications to meteorology.

Mr. V. Srinivasan attended the WMO Seminar on Satellite Information Utilization in Tokyo.

Mr. Arif A. Waqif of the University of Michigan returned to the United States in the third week of November after completing installation of the Michigan equipment at various stations in the Indian Ocean.

Processing of 1963 and 1964 data is proceeding smoothly although the gratifying and still increasing flow of aircraft weather reports may cause some delay in completing the project.

Experimental reception of facsimile nephanalyses re-transmitted from Moscow is proving satisfactory.

Work at IMC has been facilitated by the following pieces of equipment, bought under the U.N. Special Fund Grant:

Microfile camera
Verifax book copying unit
Antara "Streamliner" Ozalid Machine
16mm film projector
Epidiascope

Meteorological Rocket Programme

Since 18 August Sonmiani has successfully launched rockets on 19 August, 23 September, 21 October and 18 November and Thumba on 19 August, 5, 15 and 16 December. A report on preliminary findings will soon appear.

Carbon Dioxide Sampling (See News No.10)

From the airborne measurements he made during February and March this year, Dr. Bischof has concluded that the Indian sub-continent acts as a source of CO₂ during this season with the vertical distribution

off the coast accounted for by the sea breeze circulation. Within the near-equatorial convergence zone, however, the troposphere is well mixed by convection and the CO₂ content is therefore generally constant at all higher altitudes.

General

Microfilmed copies of synoptic charts for 27 August to 23 September analyzed at IMC have been sent to the U.S. National Aeronautics and Space Administration to assist in a study of meteorological data obtained from NIMBUS I.

Publications on IIOE Meteorology

Behrman, D., 1964: Web of Progress (Chapter 4). Paris, Unesco, 103 pp.

Raman, C.R.V., and Y. Ramanathan, 1964: Interaction between lower and upper tropical tropospheres. Nature, 204, 31-35.

Richardson, I.W., 1964: Research Flight Facility participation in International Indian Ocean Expedition. Mar. W. Log, 8, 155-157.

Suryanarayana, R., and F.R. Miller, 1964: Electronic computer aids research on Indian Ocean Expedition. Bull Amer. Meteor. Soc., 45, 644-647. "

6. Miscellaneous

6.1 Symposia, Conferences, etc. concerning the IIOE Results

- (1) Discussion Meeting on the IIOE. The Geology and Geophysics of the North-West Indian Ocean. 12 November 1964.

A meeting for discussion on some results of the International Indian Ocean Expedition was held by the Royal Society on 12 November 1964, under the organization of Dr. M.N. Hill, FRS. The meeting, featuring the geology and geophysics of the north-west Indian Ocean, took place at the Royal Society offices in London, and was attended by various scientists from the U.K. and U.S.A. taking an active part in these studies. The programme of the discussion as follows indicates the scope of the subjects covered, which were arranged in three groups:

Introduction by Dr. M.N. Hill, F.R.S. (Department of Geodesy and Geophysics, Cambridge University).

I. GULF OF ADEN, MURRAY RIDGE AND NORTHERN END OF THE CARLSBERG RIDGE

The Murray Ridge, by Mr. P. Barker (Imperial College, London)

The Owen fracture zone, by Dr. D.H. Matthews (Department of Geodesy and Geophysics, Cambridge University).

The Gulf of Aden, by Dr. A.S. Laughton (National Institute of Oceanography, Wormley).

Topographic and Magnetic structure of an area of the Carlsberg Ridge by Mr. F.J. Vine (Dept. of Geodesy and Geophysics, Cambridge Univ.)

Petrology of an area of the Carlsberg Ridge - by Dr. J. Cann (Dept. of Mineralogy and Petrology, Cambridge University).

II. THE SEYCHELLES BANK AND ITS ENVIRONS

The crustal structure of the Seychelles Bank - by Mr. D. Davies (Department of Geodesy and Geophysics, Cambridge University).

Marine sediments and bottom communities of the Seychelles - by Professor J.H. Taylor, F.R.S. (Department of Geology, King's College, London).

Preliminary Results of Chain Cruise No. 43 - by Miss Elizabeth T. Bunce (Woods Hole Oceanographic Institution, Massachusetts).

III. EAST AFRICA TO INDIA : GEOPHYSICAL MEASUREMENTS

A Physiographic diagram of the Indian Ocean - by Dr. B.C. Heezen (Lamont Geological Observatory, Columbia University).

Seismic refraction profiles - by Dr. M.N. Hill, F.R.S. (Department of Geodesy and Geophysics, Cambridge University).

Preliminary results of heat flow and magnetic measurements - by Dr. R.P. von Herzen (Office of Oceanography, UNESCO, Paris, and Scripps Institution of Oceanography, La Jolla, California).

Closing remarks - by Sir Edward Bullard, F.R.S. (Department of Geodesy and Geophysics, Cambridge University).

The papers presented are planned to be published as a group in the Proceedings of the Royal Society.

- (2) The Twenty-Second International Geological Congress, New Delhi, India.
Group Discussions on the Geological and Geophysical Results of the IIOE.

At the occasion of the last International Geological Congress, which was held at New Delhi, India, from 14 to 22 December 1964, group discussions on the IIOE results were organized. Unesco offered some scientists assistance to enable them to participate in the Congress. The group discussions were opened by Dr. D.N. Wadia, Chairman of the Indian National Committee on Oceanic Research, and the following is the list of speakers and their subjects submitted for the group discussions.

Group 1. : Crustal structures of the Indian Ocean

- | | |
|-----------------------------|--|
| B.C. Heezen & M. Tharp | Physiography Topography of the Indian Ocean Floor. |
| A.S. Laughton & D. Matthews | Crustal structure profile between Lamu (Kenya) and the Seychelles. |
| - do - | Structural trends in the Gulf of Aden. |
| - do - | Owen Fracture Zone. |
| - do - | The major geological features of the North-West Indian Ocean. |
| * E.S.W. Simpson | Submarine morphology and structure of the South-West Indian Ocean. |
| * I.M. Belousov | On the bottom topography of the North-Western Indian Ocean. |
| * G.B. Udintzev | Tectonics of the floor of the Seas and Oceans on the "Tectonic Map of Eurasia" |

Group 5. : Geophysical studies in the Indian Ocean

- | | |
|---------------------------------------|---|
| R.L. Fisher | Seismic refraction profiles in the Indian Ocean. |
| R.P. von Herzen & M.G. Langseth (Jr.) | Heat flow through the Indian Ocean Floor. |
| M. Caputo | Gravity surveys in the Indonesia Area and the Western Indian Ocean and their interpretations. |

Group 2. : Submarine Geology of the Indian Ocean

- | | |
|---|--|
| D.P. Dash | Reconnaissance Survey of the Murray Ridge. |
| * H. Niino | Results of the International Indian Ocean Expedition by Umitaka Maru, Tokyo University of Fisheries: A - Cocos Guyot, and B - Umitaka Sea Mount. |
| H.B. Stewart (Jr.)
R.S. Dietz & F.P. Shepard | The Ganges and Ceylonese Canyons in the Bay of Bengal. |
| T.C.S. Rao | Submarine valleys and hills near Madras on the East Coast of India. |
| A.S. Laughton & D. Matthews | Two detailed surveys of areas of the Carlsberg Ridge. |

Group 3. : Sediments and Sedimentation in the Indian Ocean

- | | | |
|---|--|--|
| * | H. Niino | Results of the International Indian Ocean Expedition by Umitaka Maru, Tokyo University of Fisheries: The collected samples by piston core sampler. |
| | G. Evans | The recent sediment facies of the Persian Gulf Region. |
| | M.P. Rao | Some aspects of sediments and sedimentation in the Bay of Bengal along the East Coast of India. |
| | E. Siebold | German investigations of the sediments of the Indian Ocean. |
| | J.P. Neprochnov,
V.M. Covylin &
M.F. Mikhno. | The results of seismic measurements of the earth crust and thickness of sediments in the Indian Ocean. |
| | P.L. Bezrukov | Sedimentation in the central and northern parts of the Indian Ocean. |

Group 4. : Islands in the Indian Ocean and Continental Margins of the Indian Ocean

- | | | |
|---|--------------------------------------|---|
| | M.G. Lewis &
J.D. Taylot | Marine sediments and bottom communities of the Seychelles. |
| * | R.E. Burns, G. Peter
& L.A. Weeks | A geophysical study of the Andaman - Nicobar Arc. |
| * | B.G.J. Upton &
W.J. Wadsworth | The geology of Rodriguez Island. |
| | L.A. Weeks | The island arc system in the Andaman Sea. |
| | A.S. Laughton &
D. Matthews | Geophysical studies of the sea floor around the Seychelles Islands. |
| | V.P. Kanaev | Bottom geomorphology of the North-Eastern Indian Ocean. |

* not submitted orally.

6.2 Interesting Findings

(1) USC & GS PIONEER

(a) Dr. H.B. Stewart, Jr. has informed us of the following results obtained during PIONEER's cruise in 1964. The full report was submitted at the 22nd International Geological Congress, an abstract of which is reproduced below.

"The Ganges and Ceylonese Canyons in the Bay of Bengal

Work by the U.S. Coast and Geodetic Survey Ship PIONEER in 1964 showed that seaward of the Swatch of No Ground (Ganges Submarine Canyon), the sloping flat-floored valley runs across the wide shelf and can be traced down the gentle continental slope of the Bay of Bengal. The valley decreases in relief and develops natural levees on both sides - valleys typical of the fan valleys seaward of submarine canyons elsewhere in the world. Typically, one side of the valley has terraces, perhaps due to slump blocks, whereas the other side is steep. The fan valley bifurcates at axial depths of about 900 fathoms, and in some cases the branches join farther downslope much like a braided river valley. The pattern of valleys becomes very complex about 200 miles from the coast, but lines across the Bay of Bengal down to 8 degs. N, show widely spaced channels from a few fathoms to as much as 40 fathoms below bordering natural levees. Cores from the axis of the valley on the shelf are predominantly silt and clay with some sand. Sub-bottom profiler records showed that the fan valley walls are in places underlain by blocks, perhaps due to slumping. The thick deltaic sediments are, in general, flat-flying but show some lenses.

Off the east coast of Ceylon, a continental slope of greater than 45 degs. was discovered. This is believed to be the steepest continental slope yet found anywhere in the world. It is incised by several very large submarine canyons. The canyon entering Trincomalee Bay was traced seaward as a gorge to depths of 10,000 feet and at 11,000 feet has a fan-valley continuation with natural levees. Farther south, three canyons, all off major rivers, have walls a mile or more in height.

A core obtained at 8,000 feet in one canyon showed fine salt underlain by clean sand with angular gravel and shell fragments. Sub-bottom profiler records indicate that there may be sedimentary beds along a portion of Trincomalee Canyon which dip toward the axis from both sides. "

(b) From the International Hydrographic Bulletin, November 1964.

"Among the PIONEER's 'finds' during the voyage, were:

- A continental shelf with a 45-degree slope - the steepest ever discovered in any ocean - off the coast of Ceylon.

- Several Indian Ocean submarine canyons, never before explored, larger than Arizona's Grand Canyon.
- 'Tennis-ball shaped' coral objects found on a submarine mountain east of the Andaman Islands in the Bay of Bengal.

The ship discovered massive undersea waves 275 feet high. Captain Brown noted that these waves were five times as high as those normally appearing on the surface. The ship was plowing through waters 60 miles off the northern tip of Sumatra when Ensign Paul W. Larsen, a Scuba diver, noticed unusual surface action. There were slick areas of the surface half a mile wide, then very disturbed strips about one-eighth of a mile wide. Each band stretched from horizon to horizon and some of the disturbed areas had breakers up to 7 feet high.

Oceanographers quickly checked instruments and soon plotted 270-foot high waves, some near surface, others extending down to 900 feet. They may be caused by tidal forces of the sun and moon alone, or by tidal pull in connection with a tugging oscillation between waters of the Andaman Sea and the Bay of Bengal, which come together in the area of the PIONEER's survey. "

(2) PNS ZULFIQUAR

A ship-board training course on Oceanography was organized in Pakistan by Unesco, and a one-week training cruise aboard PNS ZULFIQUAR was undertaken. Dr. L.A.E. Doe, Instructor of the Training Course, informed the Office on their findings during the training cruise. A pertinent part of his letter is reproduced below.

"A report summarizing the operation and tentative conclusions regarding the oceanography of the region has been drafted and is at present in the hands of Commander Islam, who will arrange for its duplication and distribution. From the physical point of view, two results were of particular interest. There is a very sharp decrease in the concentration of dissolved oxygen as one passes into the thermocline layer at depths ranging from some 20 - 60 metres. The decrease is so rapid and so marked that at depths of the order of 100 metres or less, the concentration is less than 1ml/litre. This incidentally answers the question of why bottom fishing was good in certain areas and completely unproductive in other areas on the shelf, since it was found that the productive areas were all shallow enough to be in the aerated zone while the unproductive areas were in the deficient zone. The second result was evidence of mild upwelling along this coast. The reasons for this upwelling are not immediately obvious, but the observation is worthy of a further investigation."

(3) High Saline Water in the Red Sea

In connection with the International Indian Ocean Expedition an increasing amount of oceanographic work has also been done in the Red Sea, which is one of the most interesting areas for submarine geology and offers also some unique hydrographical features. The British R.V. DISCOVERY detected on 11 September 1964 a small area of hot bottom water in great depth off Djidda. Two months later the German R.V. METEOR found there at 1975m depth bottom water of 44,8°C. The apparent salinity 319‰ is the highest salinity ever recorded in the sea. This local phenomenon was also characterized by high values of silicate and a p_H of 6.5 compared to 8.1 in mid-water layers. The layer of saline, warm bottom water is less than 45m thick.

6.3 Intercalibration and Standardization

(1) During the course of R.R.S. DISCOVERY's IIOE cruise from Cochin to Mauritius in May-June 1964, SCOR-UNESCO chemical intercalibration tests were organized. C.S.I.R.O. (Australia) equipment for inorganic phosphate and oxygen analyses was set up in the laboratory aboard for comparison with NIO chemical data. A report of the tests was published and distributed by the C.S.I.R.O. Division of Fisheries and Oceanography, Sydney. A limited number of copies is available, on request, from the Office of Oceanography, UNESCO, Paris.

(2) The report of SCOR-UNESCO Working Group 17 on Determination of Photosynthetic Pigments, which met from June 4-6, 1964, in Paris, was published and distributed. The report contains recommendations for techniques on pigment determination. Scientists participating in the pigments determination programme of IIOE may receive a copy from the Office of Oceanography, UNESCO, on request.

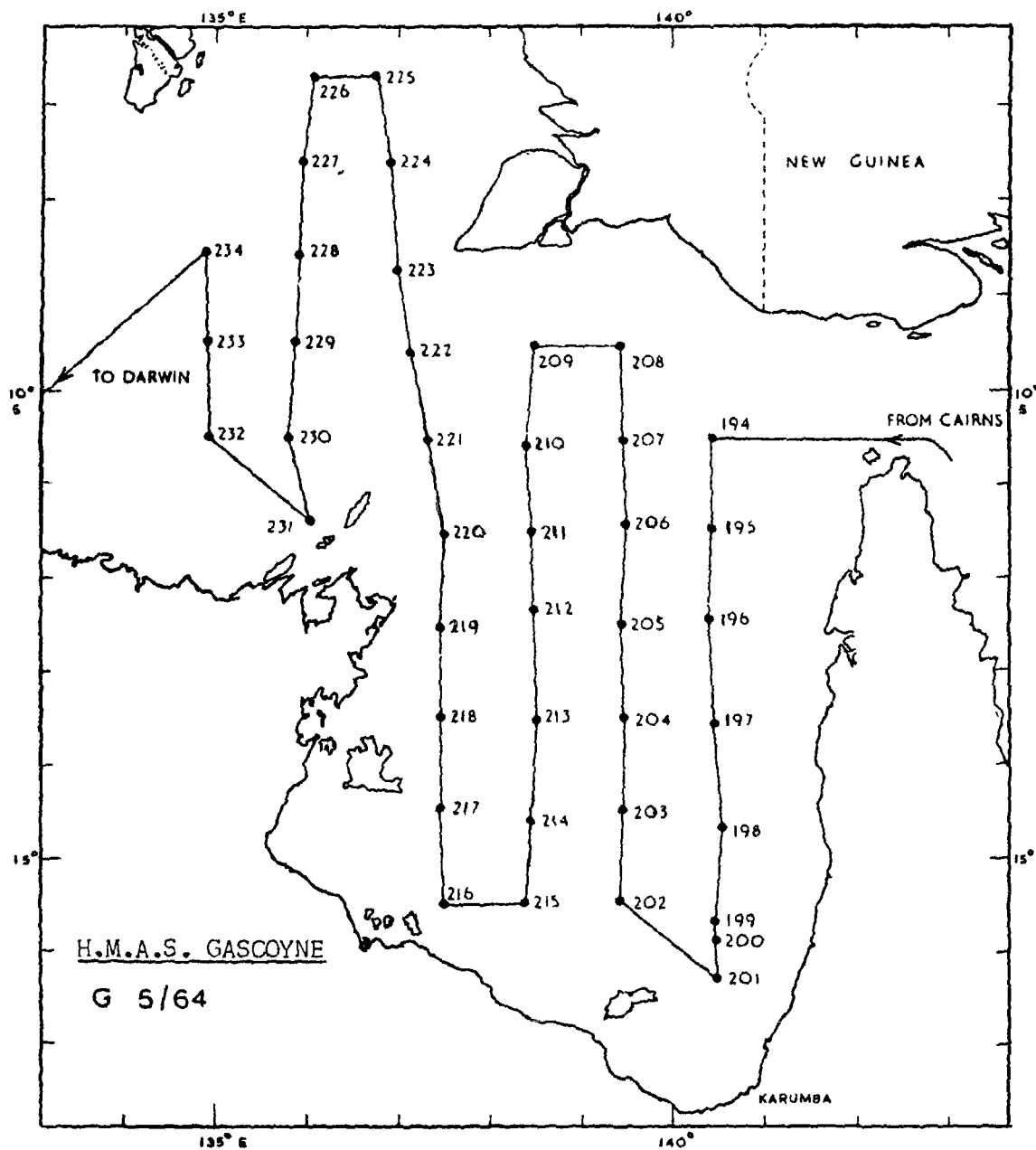
6.4 Lists of Specialists

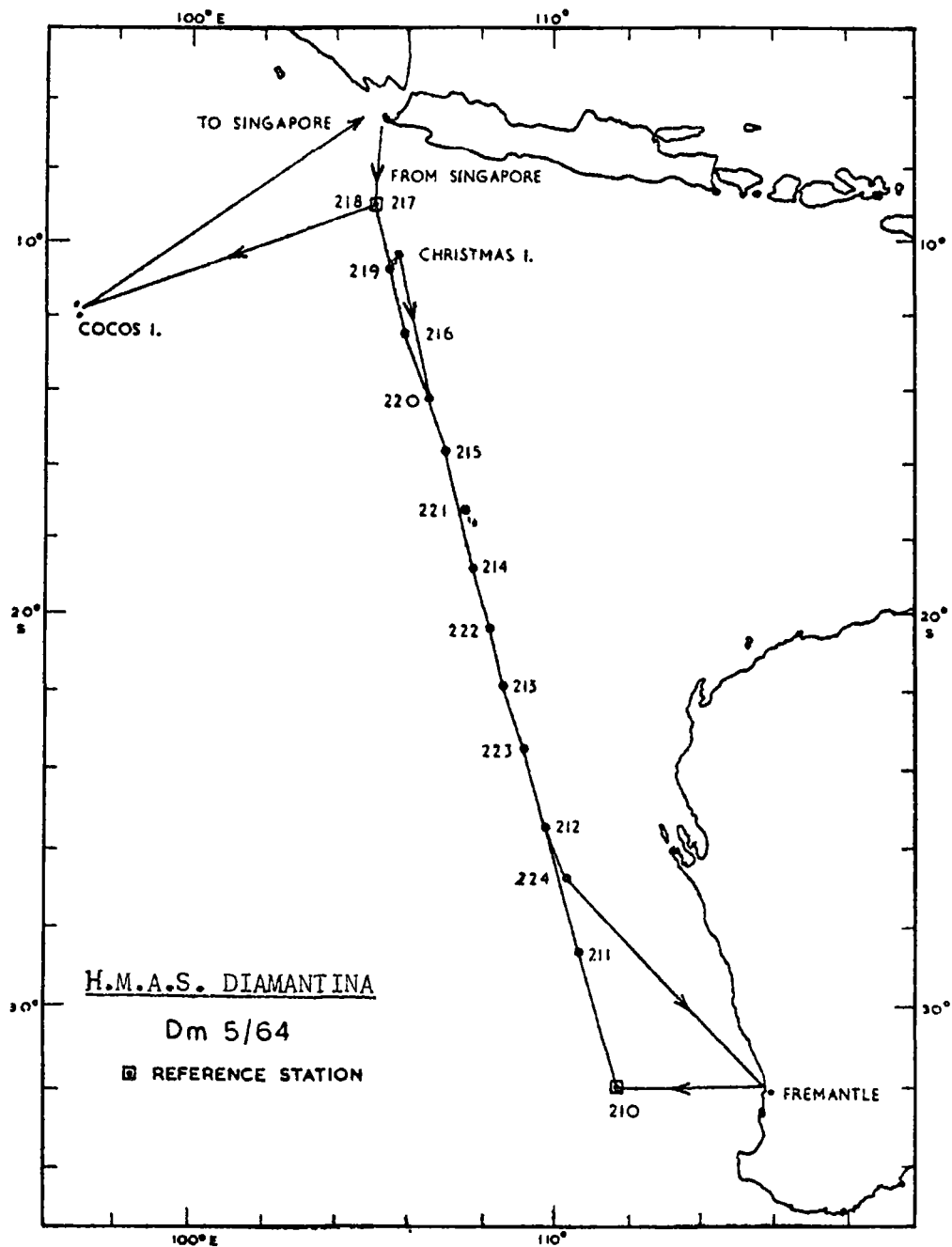
The following lists of Specialists have been received by the Office and are reproduced in Annex III.

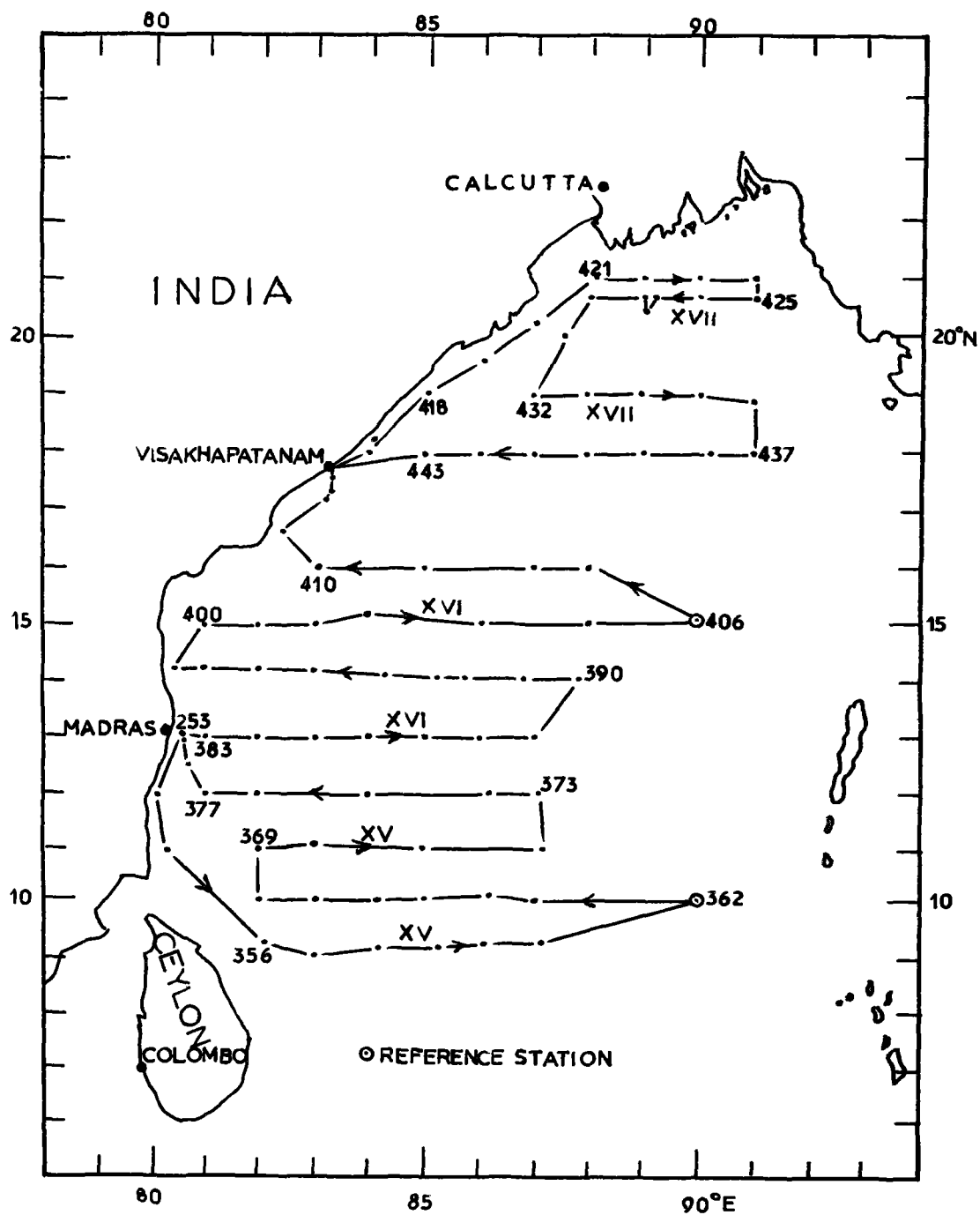
1. A preliminary list of specialists in Japan working on taxonomy of marine algae, invertebrates and fish.
2. A list of United Kingdom specialists interested in working on benthic plants and animals from the Indian Ocean.

6.5 IIOE Collected Reprints, Vol. II

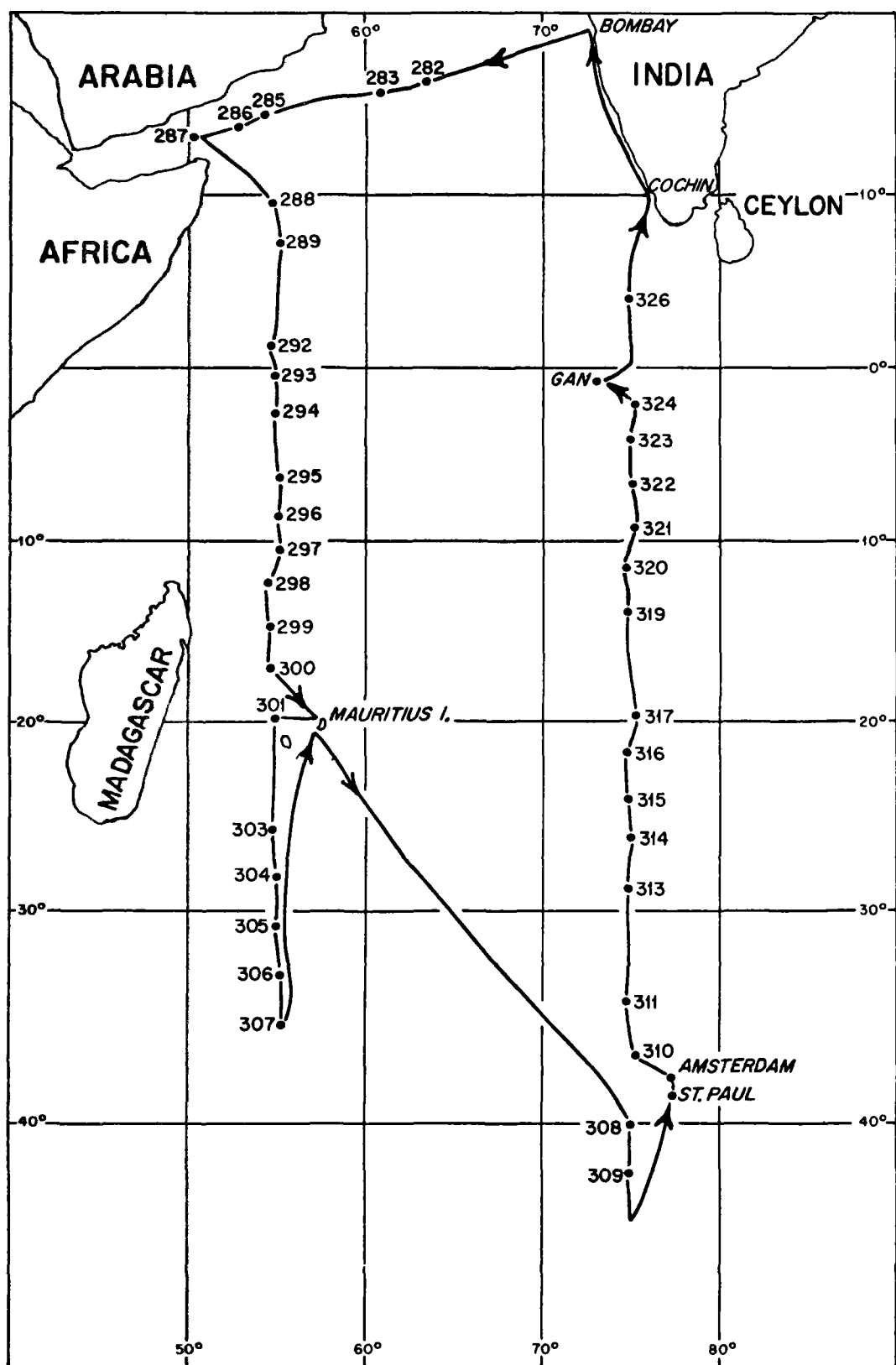
The contents of the above volume appears in Annex IV, which is now in press.



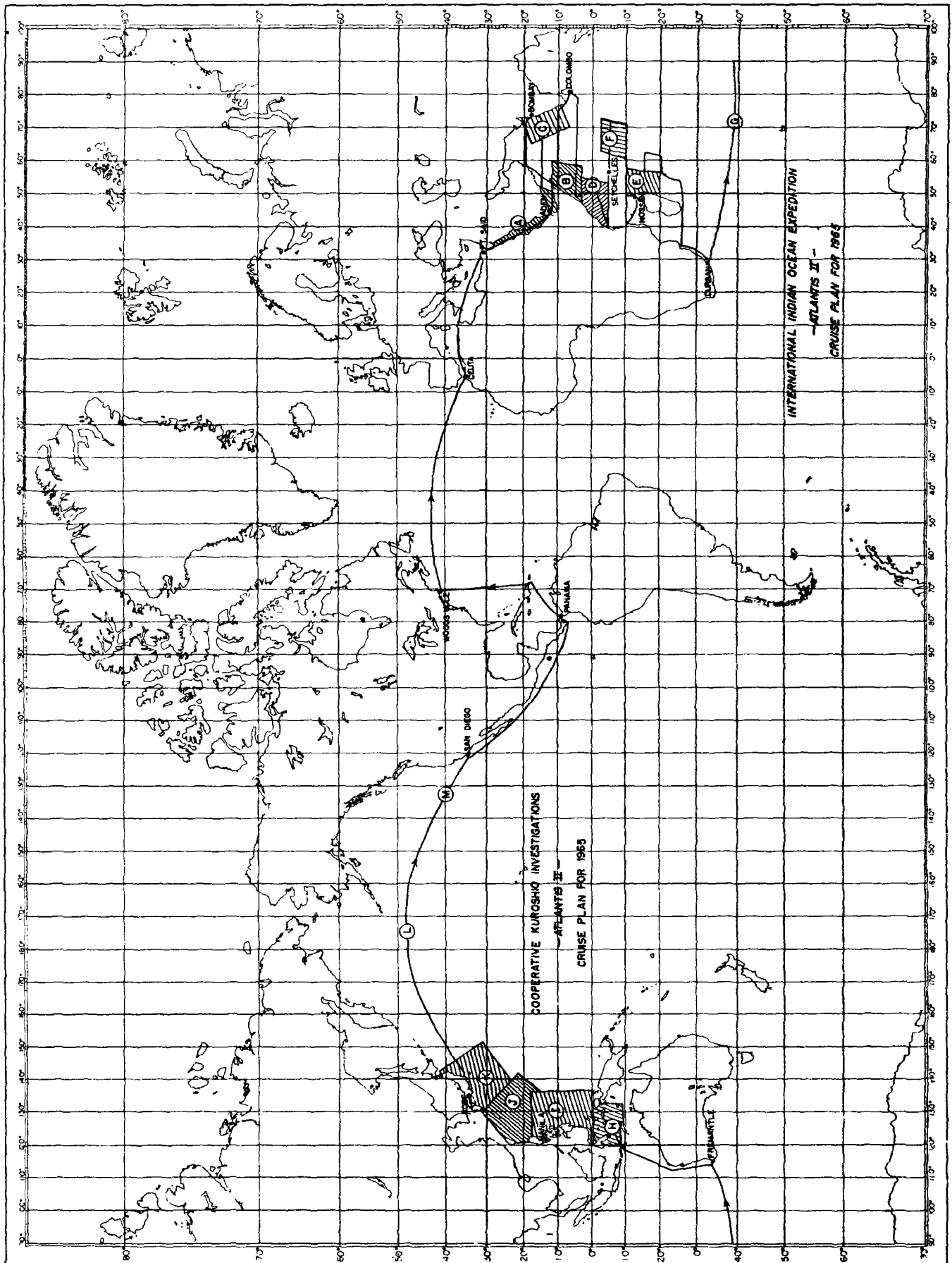




INS KISTNA Cruise XV XVI & XVII
June - July 1964



RV ANTON BRUUN Cruise 5 Jan.-May 1964



ANNEX III

A PRELIMINARY LIST OF SPECIALISTS IN JAPAN
WORKING ON TAXONOMY OF MARINE ALGAE,
INVERTEBRATES AND FISH

The list was compiled for information to the institutions which have taken biological samples during the IIOE of Japan. Although this is only tentative compilation, not complete, and it is not sure among the specialists listed who would willingly participate in the works on the Indian Ocean materials, the list will assist the institution to consider whom they can ask to examine their samples. Co-operation of Dr. J. Tokida, Dr. M. Yamada, Dr. S. Okada and Mr. Kiyu Kobayashi in compilation of this list is greatly appreciated.

October 27, 1964 S. Motoda

I. MARINE ALGAE

Abé, Tohru Hidemiti	Hosei University, Tokyo	Dinoflagellata
Arasaki, Seibin	Fac. Agr., Univ. Tokyo, Tokyo	Rhodophyceae (Porphyra)
Asaoka, Osamu	Nagasaki Mar. Obs., Nagasaki	Bacillariophyceae (distribution)
Chihara, Mitsuo		Rhodophyceae, Chlorophyceae
Fukuhara, Eiichi	Hokkaido Reg. Fish. Res. Lab., Yoichi, Hokkaido	Rhodophyceae (Porphyra)
Funabasbi, Setsuo	Fac. Sci. Hokkaido Univ., Sapporo	Rhodophyceae, Chlorophyceae, Phaeophyceae
Fujiyama, Kazue Mrs.	Akenohoshi Girls Coll., Fukuyama	Rhodophyceae
Hasegawa, Yoshis	Hokkaido Reg. Fish. Res. Lab., Yoichi, Hokkaido	Rhodophyceae, Phaeophyceae (Laminaria)
Hirano, Minoru	Dept. Lib. Arts., Kyoto Univ., Kyoto	Bacillariophyceae, Chlorophyceae, Antarctic algae
Hirose, Hiroyuki	Fac. Sci. Kobe Univ., Mikage	Cyanophyceae, Phaeophyceae, Rhodophyceae, Chlorophyceae
Honjo, S.	Fac. Sci. Hokkaido Univ., Sapporo	Coccolithophora
Iizuka, Atsushi	Hokkaido Reg. Fish. Res. Lab., Yoichi, Hokkaido	Dinoflagellata

ANNEX III (Contd.)

Ichihara, Minoru	Osaka Municipal Univ., Osaka	Bacillariophyceae (fossil)
Inagaki, Kan-ichi	Hokkaido Gakugei Univ. Iwamisawa School, Iwamisawa, Hokkaido	Phaeophyceae (Chordariales)
Ishijima, Wataru	Rikkyo Univ., Tokyo	Corallinaceae (fossil)
Iwamoto, Kozo	Tokyo Univ. Fish., Tokyo	Chlorophyceae, Phaeophyceae (Ectocarpus)
Kamura, Shintoku	Fac. Lit. & Sci., Ryukyu Univ., Naha, Ryukyu	Rhodophyceae, Phaeophyceae, Chlorophyceae
Kanaya, Taro	Fac. Sci. Tohoku Univ., Sendai	Bacillariophyceae (fossil)
Karchji Kohei	Hakodate Mar. Obs., Hakodate	Bacillariophyceae (distribution)
Katada, Minoru	Tokyo Univ. Fish., Tokyo	Rhodophyceae (Porphyra) Phaeophyceae (Hizikia)
Kawamura, Teruyoshi	Fac. Fish. Hokkaido Univ.,	Bacillariophyceae (distribution)
Kawabata, Seisaku	Hokkaido Gakugei Univ. Iwamisawa School, Iwamisawa, Hokkaido	Rhodophyceae
Kida, Washiro	Fac. Fish. Prefect. Univ. Mie, Tsu	Chlorophyceae (monostroma)
Kokubo, Seiji	114-4 Chome, Yoshikicho, Omiya	Bacillariophyceae
Konishi, Kenji	Fac. Sci. Kanazawa Univ., Kanasawa	Bacillariophyceae, Corallinaceae (fossil)
Kurocki, Munenao	Tohoku Reg. Fis. Res. Lab.,	Rhodophyceae (Porphyra) Phaeophyceae (Undaria)
Marumo, Ryuzo	Ocean Res. Inst. Univ. Tokyo, Tokyo	Bacillariophyceae (distribution)
Masaki, Tomitaro	Fac. Fish. Hokkaido Univ.	Rhodophyceae, Corallinaceae
Mikami, Hideo	Sapporo Minami High School, Sapporo	Rhodophyceae
Miura, Akio	Tokyo Univ. Fish., Tokyo	Rhodophyceae (Porphyra)
Nakamura, Yoshiteru	Inst. Algol. Hokkaido Univ., Muroran	Rhodophyceae, Phaeophyceae, Chlorophyceae
Nakazawa, Shingo	Fac. Lit. Sci. Yamagata Univ., Yamagata	Phaeophyceae
Noda, Kozo	Fac. Sci. Niigata Univ., Niigata	Rhodophyceae, Phaeophyceae, Chlorophyceae

ANNEX III (Contd.)

Nozawa, Shuji	Fac.Fish. Kagoshima Univ., Kagoshima	Rhodophyceae, Phaeophyceae, Chlorophyceae Rhodophyceae
Nozawa, Yuriko Mrs.	c/o Dr. S. Nozawa, Kagoshima	
Ogata, Eiji	Shimonoseki Univ.Fish., Shimonoseki	Rhodolphyceae
Ohmi, Hikoei	Fac.Fish. Hokkaido Univ., Hakodate	Rhodophyceae (Gracillariaceae)
Ohwada, Mamoru	Maizuru Mar.Obs., Maizuru	Bacillariophyceae (distribution)
Okada, Kiichi	Fac.Fish. Nagasaki Univ., Nagasaki	Cyanophyceae, Chloro phyceae
Okuno, Haruo	Textile Univ., Kyoto	Bacillariophyceae (electron microcopy)
Oshite, Kei	Hokkaido Gakugei Univ., Hakodate School, Hakodate	Bacillariophyceae (fossil)
Saito, Jo	Fac.Fish. Hokkaido Univ.	Rhodophyceae (Laurencia)
Saito, Yunosuke	Exp.Sta.Univ. Tokyo, Shinmaiko, Aichi	Phaeophyceae (Undaria)
Sakai, Yoshio	Wakkanai Fish Exp.Sta., Wakkanai, Hokkaido	Chlorophyceae
Sawada, Takeo	Exp.Sta. Kyushu Univ., Tsuya- zaki, Fukuoka	Rhodophyceae, Phaeophyceae Chlophyceae
Segi, Toshio	Fac.Fish.Prefect.Univ. Mie, Tsu	Rhodophyceae (Polysiphonia, Gelidium), Phaeophyceae, Chlorophyceae
Sudo, Shunzo	Tokai Reg. Fish.Res.Lab., Tokyo	Rhodophyceae (Porphyra)
Tahara, Masato	648 Ninomiya, Kanagawa	Phaeophyceae (Fuciales)
Takamatsu, Masashiko	Oura, Ouranodatemura, Kamikitagun, Aomori	Rhodophyceae, Phaeophyceae, Chlorophyceae
Takano, Hideaki	Tokai Reg.Fish.Res.Lab., Tokyo	Bacillariophyceae
Tanaka, Takeshi	Fac.Fish. Kagoshima Univ., Kagoshima	Rhodophyceae, Phaeophyceae, Chlorophyceae
Tatewaki, Masakazu	Inst.Algol.Hokkaido Univ., Muroran	Chlorophyceae (Monostroma)
Tokida, Jun	Fac.Fish.Hokkaido Univ., Hokodate	Rhodophyceae, Phaeophyceae, Chlorophyceae
Tsubata, Bunryu	Fish-Culture Exp.Sta., Ominato, Aomori	Bacillariophyceae (distribution)

ANNEX III (Contd.)

Tsubota, Hiroshi	Fac.Sci.Kobe Univ., Mikage	Chlorophyceae
Tsumura, Kohei	Fac.Biol. Yokohama Municipal Univ., Yokohama	Bacillariophyceae
Ueda, Samuro	Tokyo Univ.Fish., Tokyo	Rhodophyceae
Umezaki, Isamu	Fac.Agr. Kyoto Univ., Maizuru	Cyanophyceae
Uyeno, Fukuzo	Fac.Fish.Prefect. Univ. Mie, Tsu	Bacillariophyceae (distribution)
Watanabe, Atsushi	Inst.Appl.Microbiol.Univ.Tokyo, Tokyo	Cyanophyceae, Chlorophyceae
Yabu, Hiroshi	Fac.Fish.Hokkaido Univ., Hakodate	Rhodophyceae, Phaeophyceae, Chlorophyceae
Yamada, Yukio	Fac.Sci.Hokkaido Univ., Sapporo	Rhodophyceae, Phaeophyceae, Chlorophyceae
Yamazaki, Hiroshi	Prof.Fish.Exp.Sta. Shizuoka, Shimoda	Rhodophyceae

Additions:

Nemoto, Takahisa	Whale Res.Inst., Tokyo	Bacillariophyceae (Pennales)
Tamura, Tadashi	Fac.Fish.Hokkaido Univ., Hakodate	Bacillariophyceae (distribution)

II. MARINE INVERTEBRATES

Anraku, Masateru	Seikai Reg.Fish.Res.Lab., Nagasaki	Copepoda (distribution)
Asano, Kiyoshi	Fac.Sci.Tohoku Univ., Sendai	Foraminifera (fossil)
Baba, Kikutaro	Fac.Biol. Osaka Gakugei Univ., Osaka	Nudibranchia
Chiba, Takuo	Shimonoseki Univ.Fish., Shimonoseki	Copepoda
Fukase, Shigeru	Nagasaki Mar.Obs., Nagasaki	Copepoda
Furuhashi, Kenzo	Japan Meteorol. Agency, Tokyo	Copepoda, Tunicata (distribution)
Gamo, Shigeo	Yokohama Nat.Univ., Kamakura	Cumacea
Habe, Tadashige	Nat.Sci.Mus., Tokyo	Gastropoda, Pelecypoda ^a Scaphoda
Hada, Yoshine	Suzugamine Women's Coll., Hiroshima	Foraminifera, Tintinninea, Rotatoria
Hanai, Tetsuro	Fac.Sci.Univ.Tokyo, Tokyo	Ostracoda
Hatai, Katora	Fac.Sci. Tohoku Univ., Sendai	Branchiopoda (fossil)
Hayasaka, Shozo	Fac.Sci. Tohoku Univ., Sendai	Mollusca (fossil)
Hayashi, Ryoji	Fac.Sci. Toyama Univ., Toyama	Asteroidea
Honjo, Koji	Tokai Reg.Fish Res.Lab., Tokyo	Copepoda, Euphausiacea (distribution)
Horikoshi, Masuyo	Ocean Res.Inst., Univ. Tokyo, Tokyo	Neogastropoda
Ii, Naoyoshi	Hikone Municipal Office, Hikone	Mysidacea
Imajima, Minoru	Nat.Sci.Mus., Tokyo	Polychaeta
Irie, Haruhiko	Fac.Fish. Nagasaki Univ., Nagasaki	Amphipoda
Iwasa, Masao	Fac.Biol. Seikei Univ., Tokyo	Amphipoda
Iwata, Fumio	Fac.Sci. Hokkaido Univ., Sapporo	Nemertini
Kato, Kojiro	Fac.Lit.Sci. Saitama Univ., Urawa	Turbellaria
Kitou, Masataka	Japan Met.Agency, Tokyo	Copepoda, Chaetognatha (distribution)
Kubo, Itsuo	Tokyo Univ. Fish., Tokyo	Macrura

ANNEX III (Contd.)

Kuroda, Tokubei	Fac.Sci.Kyoto Univ., Kyoto	Gastropoda, Pelecypoda, Scaphopoda, Amphineura Foraminifera (fossil)
Kuwano, Yukio	Inst.Nat.Resources, Tokyo	Bryozoa
Mawatari, Shizuo	Inst.Nat.Resources, Tokyo	
Masuda, Koichiro	Tohoku Univ. Kawauchi School, Sendai	Pelecypoda (Pectinidae, Veneridae)
Minoda, Takashi	Fac.Fish. Hokkaido Univ., Hakodate	Copepoda (distribution)
Mizuno, Atsuyuki	Inst.Geol. Survey, Ichigata- Kawadacho, Shinjukuku, Tokyo	Pelecypoda (Taxodonta, Teleodonta)
Motoda, Sigeru	Fac.Fish. Hokkaido Univ., Hakodate	Copepoda (distribution)
Miyake, Sadayoshi	Fac.Agr., Kyushu Univ., Fukuoka	Anomura
Morishima, Masao	Fac.Sci. Kyoto Univ., Kyoto	Foraminifera (fossil)
Murakami, Akio	Inland Sea Reg.Fish.Res.Lab., Hiroshima	Chaetognatha
Murakami, Shiro	Inland Sea Reg.Fish.Res.Lab., Hiroshima	Ophiuroidea
Nagata, Kizo	Inland Sea Reg.Fish.Res. Lab., Hiroshima	Amphipoda (Gammaridea)
Nakai, Zinziro	Dept.Oceanogr. Tokai Univ., Shimizu	Copepoda, Euphausiacea, Radiolaria (Challengeridae)
Nagaseko, Kojiro	Dept.Geol.Osaka Univ., Toyonaka, Osaka	Radiolaria (fossil)
Nemoto, Takahisa	Whale Res. Inst., Tokyo	Euphausiacea
Odaka, Tamio	Fac.Sci. Tohoku Univ., Sendai	Mollusca (fossil)
Okada, Yaichiro	Inst.Fish. Tokai Univ., Shizuoka	Bryozoa
Okutani, Takashi	Tokaid Reg.Fish.Res.Lab., Tokyo	Heteropoda, Pteropoda
Oyama, Katsura	Inst.Geol.Survey, Ichigaya- Kawadacho, Shinjukuku, Tokyo	Gastropoda (Stenoglossa), Pelecypoda (Anisomyaria)
Omori, Makoto	Ocean Res.Inst., Univ.Tokyo, Tokyo	Copepoda (distribution)

ANNEX III (Contd.)

Saisho, Toshiro	Fac.Fish. Kogoshima Univ., Kagoshima	Decapoda larvae
Sakai, Tsune	Yokohama Nat.Univ., Kamakura	Brachyura
Shiino, Sueo	Fac.Fish.Prefect.Univ. Mie, Tsu	Parasitic Copepoda
Takayanagi, Yokichi	Fac.Sci. Tohoku Univ., Sendai	Foraminifera (fossil)
Taki, Iwao	Fac.Fish. Animal Hub., Hiroshima University, Fukuyame	Cephalopoda (Decapoda, Nautiloidea), Amphineura Copepoda
Tanaka, Otohiko	Fac.Agr. Kyushu Univ., Fukuoka	Porifera
Tanita, Senji	Japan Sea Reg.Fish.Res.Lab., Niigata	Chaetognatha, Tunicata
Tokioka, Takasi	Seto Mar.Biol. Lab., Shirahama, Wakayama	Bryozoa
Toriumi, Chu	Asamushi Mar.Biol.Sta., Asamushi, Aomori	Copepoda, Amphipoda
Tsuruta, Arai	Shimonoseki Univ.Fish., Shimo-Shimonoseki	Medusae
Uchida, Toru	Fac.Sci. Hokkaido Univ., Sapporo	Foraminifera (fossil)
Uchio, Takayasu	Fac.Technol. Univ. Tokyo, Tokyo	Cladocera
Ueno, Masuzo	Otsu Hydrobiol. Sta., Otsu	Cirripedia
Utinomi, Huzio	Seto Mar.Biol.Lab., Shirahama, Wakayama	Hydrozoa
Yamada, Mayumi	Fac.Sci. Hoddaido Univ., Sapporo	Copepoda
Yamada, Tetsuo	Fac.Fish. Nagasaki Univ., Nagasaki	Copepoda (distribution)
Yamazi, Isamu	Nat.Sci.Mus., Tokyo	

ANNEX III (Contd.)

III. MARINE FISH

Abe, Tokiharu	Tokai Reg.Fish.Res.Lab., Tokyo	Percida, Tetradontida, etc.
Amaoka, Kunio	Fac.Agr. Kyoto Univ., Maizuru	Pleuronectida
Aoyagi, Hyoji	1-52-1, Todorokicho, Setagayaku, Tokyo	Coral fish
Asano, Hirotoshi	Fac.Agr. Kinki Univ., Fuse, Osaka	Congridae
Eikita, Toyoji	Kita 5, Nishi 20, Sapporo	Pleuronectida, etc.
Imai, Sadahiko	Fac.Fish. Kagoshima Univ., Kagoshima	Exocoetina
Ishiyama, Reizo	Shimonoseki Univ. Fish., Shimonoseki	Rajiida
Iwai, Tamotsu	Fac.Agr. Kyoto Univ., Maizuru	
Kamohara, Toshiji	Dept.Lit.Sci. Kochi Univ., Kochi	
Katayama, Masao	Fac.Educ. Yamaguchi Univ., Yamaguchi	Percida
Kishida, Shuzo	Fac.Agr. Kyoto Univ., Maizuru	Bembropidae
Kobayashi, Kiyu	Fac.Fish. Hokkaido Univ., Hakodate	Cottida, Fish larvae
Matsubara, Kiyomatsu	Fac.Agr. Kyoto Univ., Maizuru	Cottida, etc.
Matsui, Isao	Shimonoseki Univ. Fish., Shimonoseki	Anguillida
Mito, Satoshi	Inland Sea Reg.Fish.Res.Lab., Hiroshima	Fish larvae
Ochiai, Akira	Fac.Agr.Kyoto Univ., Maizuru	Pleuronectida
Okada, Shun	Fac.Fish. Hokkaido Univ., Hakodate	Lamnida, etc.
Okada, Yaichiro	Inst.Fish. Tokai Univ., Shimizu	
Okamura, Osamu	Fac.Agr. Kyoto Univ., Maizuru	Coryphaenoididae
Oshima, Masamitsu	180 Nakanecho, Meguroku, Tokyo	
Takagi, Kazunori	Tokyo Univ. Fish., Tokyo	Gobiina
Tanaka, Shigeo	234 Mure, Mitaka, Tokyo	
Tomiyama, Ichiro	Mar.Biol.Sta.Univ. Tokyo, Misaki, Miura, Kanagawa	Gobiina

ANNEX III (Contd).

Tsukahara, Hiroshi	Fac.Agr. Kyushu Univ., Fukuoka	Cottida
Uchida, Keitaro	41-25 Higashi-Wakakusa, Fukuoka	Fish larvae
Ueno, Tatsuji	Hokkaido Reg.Fish.Res. Lab., Yoichi, Hokkaido	Cyclopterina
Ueyanagi, Shoji	Nankai Reg.Fish.Res.Lab., Kochi	Tuna larvae
Yabe, Hiroshi	Fisheries Agency, Tokyo	Scombrina
Watanabe, Masao	3-48 Yoyogi, Shibuyaku, Tokyo	Cottida

LIST OF UNITED KINGDOM SPECIALISTS INTERESTED IN WORKING
ON BENTHIC PLANTS AND ANIMALS FROM THE INDIAN OCEAN

- | | |
|---|--|
| Dr. J.A. Allen,
Dove Marine Laboratory,
University of Newcastle-upon-Tyne,
Cullercoats,
North Shields,
Northumberland. | - Interested in working on bivalve molluscs. |
| Miss A.M. Clark,
Department of Zoology,
British Museum (Natural History),
Cromwell Road,
London, S.W.7. | - Would like to study unstalked crinoids, possibly also asteroids. |
| Dr. J.A.L. Cooke,
Department of Zoology,
University Museum,
Oxford. | - Interested in working on pycnogonida. |
| Dr. W.G. Inglis,
Department of Zoology,
British Museum (Natural History),
Cromwell Road,
London, S.W.7. | - Would be interested in working on free-living marine nematodes. |
| Prof. E.W. Knight-Jones,
Department of Zoology,
University College of Swansea,
Singleton Park,
Swansea,
Glamorgan,
Wales. | - Would be interested in working on piscicolidae (marine leeches) and serpulidae (tube worms), but suggests that Dr. P.H.D.H. de Silva, Colombo Museum might also be interested in these groups in which case is probably better situated for working on Indian Ocean benthos. |
| Mr. A.D. McIntyre,
Dept. of Agriculture and
Fisheries for Scotland,
Marine Laboratory,
P.O. Box 101,
Victoria Road,
Torry, Aberdeen,
Scotland. | - Currently working on macro- and meiobenthos of the Arabian sea. |
| Dr. P.J. Miller,
Dept. of Zoology,
The University,
Glasgow, W.2.,
Scotland. | - Interested in working on gobioid fishes (Teleostei-Gobioides). |

ANNEX III (Contd.)

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| Dr. R.H. Millar,
Scottish Marine Biological Assn.,
Marine Station,
Millport,
Isle of Cumbrae,
Scotland. | - Interested in aecidia |
| Mr. S. Pruchoe,
Department of Zoology,
British Museum (Natural History),
Cromwell Road,
London, S.W.7. | - Would be interested in
Platyhelminthes;
Turbellaria, Trematoda and
Cestoda. |
| Mr. E.I.S. Rees,
Marine Science Laboratories,
Monai Bridge, Anglesey,
N. Wales. | - Would be interested in 'Batfishes'
family Ogcephalidae genus
<u>Dibranchus</u> . |
| Dr. W.J. Rees,
Department of Zoology,
British Museum (Natural History),
Cromwell Road,
London, S.W.7. | - Interested in Coelenterates:
Hydromedusae. |
| Dr. J.B.J. Wells,
Natural History Department,
Mariachal College,
Aberdeen University,
Aberdeen, Scotland. | - Would like to study any samples of
meibenthic crustacea, main interest
is in Copepoda, particularly
Harpacticoida. |
| Mr. P.J.P. Whitehead,
Department of Zoology,
British Museum (Natural History),
Cromwell Road,
London, S.W.7. | - Would be interested in benthic
fishes. |

LIST OF REPRINTS

Second Volume of the IIOE Collected Reprints

MARINE BIOLOGY

Reprint No.

- 78 WILLMANN, Carl. Zwei neue Milben aus dem Kustengrundwasser des Roten Meeres (Ergebnisse Nr. 2 der Reise von A. Remane und E. Schultz nach dem Roten Meer). Kieler Meeresforschungen, Bd.XV, Heft 1, S.97-104, 1959.
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- 82 BANSE, Karl. Fabricia acusets n. sp., Fabriola ghardaqa n. sp., Oriopsis armandi (Claparede) aus dem Roten Meer (Sabe-lidae, Polychaeta). Kieler Meeresforschungen, Bd. XV, Heft 1, S.113-116, 1959.
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- 86 STRENKZKE , Karl. Selenoribates foveiventris n. gen., n. sp. aus der unterirdischen Feuchtzone der Küste des Roten Meeres (Acarina: Oribatei) (Ergebnisse Nr.9 der Reise von A. Remane und E. Schultz nach dem Roten Meer). Kieler Meeresforschungen, Bd. XVII, Heft 1, S.89-93, 1961.
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- 88 FILATOVA, Z.A. Some new data on two-leaved molluscs of Java Trench Ibid. Vol. I, No.1, pp. 133-135, 1961. (in Russian).
- 89 LEVENSTEIN, R.Y. New data on polychaeta of Java Trench. Ibid. pp. 136-139, 1961. (In Russian).
- 90 VINOGRADOV, M.E., VORONINA, N.M. Distribution of some widespread species of copepodes in the Indian Ocean. Dokl.Acad. Nauk. SSSR, Vol.140, No.1, pp. 219-222, 1961. (In Russian).
- 91 VINOGRADOV, M.E. VORONINA, N.M., SUKHANOVA, I.N. Horizontal distribution of tropical plankton and its relation to certain features of the environment in the open part of the ocean. Okeanologia, Vol.I, No.2, pp. 283-293, 1961. (In Russian).
- 92 BELAEV, G.M., VINOGRADOVIA, M.G. Quantitative distribution of bottom fauna in the northern half of the Indian Ocean. Dokl. Acad.Nauk SSSR, Vol.138, No.5, pp. 1191-1194, 1961. (In Russian).
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- 103 VINOGRADOV, M.E. On the quantitative distribution of deep-water plankton in the northern part of the Indian Ocean. Okeanologia, Vol.2, No.4, pp. 577-592, 1962. (in Russian).
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- 108 TOKIOKA, Takasi. The Outline of the Investigations made on Chaetognaths of the Indian Ocean. Inform.Bull.Planktol.Jap. No.8, pp.5-11, 1962.
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- 117 BARNARD, K.H. Deep-Sea Mollusca from the Region South of Madagascar Division of Sea Fishers Investigational Report No.44, "Commerce & Industry", 1963.
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