

intergovernmental oceanographic commission

UNESCO/NS/IOC/INF-72

FOREWORD

Several meetings important for the future of IIOE have been held during the past few months. The main part of this issue is devoted to brief, but comprehensive, resumé of the results of these meetings. The final versions of the summary records are now under preparation and will be distributed in due course; therefore, only that of the third meeting of the IOBC Consultative Committee is annexed to this issue.

National Co-ordinators, participating institutions, and individual scientists, have been requested by these meetings to initiate and carry out various tasks; agreement on these is rather easy to reach at a meeting, but their accomplishment is sometimes more difficult, although this is quite indispensable to the success of the Expedition.

At the end of 1965 official ship operations for IIOE will terminate, but this should not imply the termination of the Expedition. The tasks of scientists will shift in emphasis and perhaps increase as data and findings resulting from the Expedition are processed. As a result of the recent series of decisive meetings, a new phase of the IIOE has started. Consequently, the objectives and tasks of this Information Paper will change in conformity with this transition.

The editor is prepared to assume new tasks, but this will only be possible with assistance from National Co-ordinators and any scientists who are in a position to supply relevant information with regard to organization of symposia on IIOE results, noteworthy results of investigations, new publications resulting from the Expedition, etc.

IIOE INFORMATION PAPER No.14

1. IOC Bureau and Consultative Council.

The fifth session of the IOC Bureau and Consultative Council was held in Rome from 14-18 June 1965. The problem of IIOE was one of the items on the Agenda, and the following is a brief summary of the discussion.

International Indian Ocean Expedition.

The IIOE Coordination Group met from 7-9 June 1965 in Paris and adopted a set of nine recommendations. Copies of these were made available to the Bureau and Consultative Council and it was suggested that sub-items a), b) and c) be discussed while following the recommendations. The Secretary pointed out that Recommendation 8 on Atlases in the distributed set was separated from the list of proposed editors, which list is to be included in the main body of the report of the Working Group. He also indicated that there was no time to discuss the future field work in the Indian Ocean after 1965 and that this item was referred to the fourth IOC session. The Bureau was informed that Unesco was taking steps to secure another Curator for the Indian Ocean Biological Centre. Further discussion centred on some of the recommendations of the International Coordination Group.

IIOE Cruise and Data Reports. The USSR delegate urged that all such reports should be published as soon as possible and expressed concern over the fact that only 30% of IIOE data was so far transmitted to World Data Centres. The Secretary replied that data from 66% of all IIOE cruises completed by the end of 1963 had been submitted to World Data Centres, but that the actual percentage of total data submitted was probably less. He also pointed out that Unesco support for publication of the IIOE Cruise and Data Reports and Atlases will be more readily available after publication of the ICITA Atlas.

Indian Ocean Biological Centre. In the discussion of the terms of reference for the Consultative Committee of the IOBC, various delegates expressed opinions on which version of the terms of reference should be included in the Report of the International Coordination Group. It was decided to print the terms of reference as referred to during that meeting in the main body of the Report and the terms of reference as finally adopted by Unesco as an annex.

IIOE Atlases. Delegates who participated in the meeting of the Coordination Group agreed that, when the present text of Recommendation 8 (IIOE Atlases) was adopted, an additional proposal was formulated orally and agreed on by the Coordination Group to provide for a more precise outline of the procedure for preparation of individual plans for each section by the proposed editors. There was, however, a difference of opinion as to whether it was resolved at that meeting to include this proposal in Recommendation 8 or in the main body of the Report. The Bureau and Consultative Council had certain difficulties in making decisions on recommendations of the Coordination Group, not being clear as to the final acceptance of some of these recommendations.

At the suggestion of the Bureau, the delegates of Australia and the United States, and the Secretary of IOC, who had presided the meeting of the Coordination Group, formulated the above additional proposal of the Group as follows:

1) "It was recommended at the 2nd meeting of the International Coordination Group for the IIOE that before editors are appointed they should have submitted specific official proposals for their Atlases. It was noted that Professors Ramage and Wyrteki had submitted specific proposals and it was recommended that these scientists should be appointed as editors for the meteorological and physical oceanographical Atlases respectively.

A list of Atlases and prospective editors was prepared at the meeting.

2) The Secretary was instructed to write to prospective editors asking them to submit proposals by the time of the fourth IOC session if they were interested and if they thought they could obtain financial support. Proposals for all the sections will then be discussed by the Commission at its fourth session."

The Bureau felt that, in the absence of a full report on the meeting of the Coordination Group, the subject should be fully discussed by the Commission at its fourth session. The Bureau instructed the Secretary to write to the National Coordinators and ascertain whether the above-quoted proposal should be included in the Report of the Group or in Recommendation 8.

The Bureau also noted that there was no unanimity of opinion on whether proposed editors should carry out the entire work on their sections themselves or if some other scientists, particularly those who offered their participation in answer to the Secretariat's questionnaire, would work jointly with editors on execution of certain parts of the job. It was felt that further discussion on this point would be needed during the fourth IOC session, or perhaps in the concurrent meeting of the Ad Hoc Coordination Group.

Therefore, the Bureau:

... Decided that the recommendations of the last meeting of the IIOE Coordination Group, when in final form, be transmitted to the Commission for consideration and approval.

2. SCOR Executive Committee.

The SCOR Executive Committee met in Rome from 10-12 June 1965. The following is a brief summary of the discussion relating to IIOE and IOBC.

Indian Ocean Biological Centre.

It was noted that the role of SCOR is to advise Unesco, operation of the Centre being a responsibility of Unesco and the Indian Government. The Executive Committee approved the terms of reference of the IOBC Consultative Committee adopted at the International Indian Ocean Expedition Coordination Meeting (Paris, 7-9 June 1965), and recommended that the Chairman of this Committee serve for two years; its members should normally serve for three years but not more than six years. It was also recommended that Professor J. Krey be appointed as the sixth member of the Committee.

International Indian Ocean Expedition.

At the IIOE Coordination Meeting referred to above, it was considered that the SCOR disciplinary experts provided an extremely valuable service, and that the importance of such work will further increase, despite the termination of IIOE field operations at the end of 1965. It was recommended that these scientists formulate suggestions for action by IOC, Unesco, SCOR, WMO and other interested international organisations, to ensure that the best use is made of data obtained through the cooperative efforts of countries which participated in the IIOE. The SCOR experts were also asked to serve as members of an editorial board for the IIOE Collected Reprints being published by Unesco.

A proposal had been made that SCOR participate in the publication of IIOE data reports, in order to obviate certain technical difficulties if Unesco alone were to be the publisher. However, it was decided that the World Data Centres for Oceanography would be more appropriate co-publishers.

3. The 2nd meeting of the International Coordination Group.

As already announced in No. 12 of this Information Paper, the 2nd meeting of the International Coordination Group took place at Unesco Headquarters from 7-9 June 1965. National Coordinators, or their alternates, from 11 IIOE participating countries (Australia, China, France, Germany, India, Japan, Madagascar, Thailand, U.S.S.R., U.K., U.S.A.) participated. Other participants were: Disciplinary Experts; Scientific Director of Meteorological Programme; Chairman of IOBC Consultative Committee; ex-Curator of IOBC; Members of IOC Bureau; SCOR Secretary; a Representative of FAO/ACMRR and the Secretariat of IOC.

The Agenda of the meeting was as follows:

1. Review of work accomplished to date.
2. Current situation with the exchange of IIOE data.
3. The IIOE Collected Reprints.
4. Cruise and Data Reports of the IIOE
 - a. Procedure for publishing a complete series
 - b. Tables of contents for the first two/three volumes.
5. Work of SCOR disciplinary experts and IOC/Unesco subject leaders.
6. Observations on reference stations.
Chances for their continuation after the official close of the IIOE.
7. IOBC and the future of the International Collection
 - a. Report of the Third Meeting of the Consultative Committee
 - b. Report of the International Curator, Mr. Vagn Hansen
 - c. International scientific team to work at the IOBC.

8. IIOE Atlases and charts; analysis of data.
 - a. General discussion
 - b. Meteorological Atlas
 - c. Environmental Atlas
 - d. Fish eggs, larvae, and zooplankton charts
 - e. Fisheries information and its presentation
 - f. Degree of data analysis for graphic presentation in Atlases
 - g. An Editorial Committee (or Committees) for Atlases
 - h. Financial aspects of Atlases.
9. IIOE Symposia.
10. Future field work outside the official IIOE framework.

Among various items discussed at the meeting, exchange of IIOE data and its acquisition by WDC, IIOE Collected Reprints, preparation and publication of Cruise and Data Report, IOBC and the future of the International Collection and preparation of IIOE Atlases were topics which were discussed particularly and at some length. The meeting adopted nine recommendations and submitted them to the Bureau and Consultative Council for their consideration (see item 1). These are reproduced in Annex I of this issue and cover important points agreed on at the meeting. A summary report of the meeting is now under preparation and will be distributed later.

4. Third Meeting of the Consultative Committee of IOBC.

The Report of the above meeting, which was held in Ernakulam and Munnar, South India, from 7-16 April 1965, appears in Annex II of this issue. This Report was submitted to the IIOE Coordination Group, to the IOC Bureau, and to SCOR (see items 1, 2 and 3).

The terms of reference of the Consultative Committee, as approved by Unesco, after consultation with the above meeting, are reproduced in Annex III.

5. National Newsletters and Reports.

5.1 India - IIOE Newsletter of India, Vol. II, No.4, issued by the Indian National Committee on Oceanic Research, CSIR, was published in March 1965, and was distributed at the 2nd meeting of the International Coordination Group for the IIOE. It contains information on India's Programme, IOBC, IMC, IBP, and the activities of other countries, etc. An extract from the "Indian Programme" appears in 6.1 of this issue, and contains a summary report of the Scientific Cruise of INS KISTNA and r.v. VARUNA.

5.2 Japan - The Report of the Working Group on the IIOE, Japanese National Committee on Oceanic Research of the Science Council of Japan (in Japanese), was published in March 1965. An English abstract of this report, printed in mimeography, was distributed at the last IIOE Coordination Group meeting by Professor Uda, National Coordinator for IIOE. He informed the meeting that a more elaborate summary report of the Japanese contribution to the IIOE is now being printed in English, as a volume of the "Oceanographic Works of Japan".

6. Exchange of Information and Data.

6.1 Cruise Reports.

Australia.

HMAS GASCOYNE Cruise G5/65 March 29-April 3, 1965.

The summary of the above cruise, the plan for which was reported in the last issue of this Information Paper, has been received from the National Coordinator for IIOE. The following is an extract from the report, and the station map appears in Annex IV.

Scientific Personnel.

D. Vaux (Cruise Leader)
R. Bradley
L. Brown
F. Davies
J. Klye

Itinerary.

29.3.65	1200	Departed Adelaide
3.4.65	1730	Arrived Port Lincoln

Programme.

Stations

49 stations G5/201/65 - G5/249/65

subsurface hydrology at 49 stations

Germany.

R.v. METEOR Second Part of the Indian Ocean Expedition of
German r.v. METEOR February 14-May 18, 1965.

In Information Paper No.12, the first part of the expedition (Hamburg to Cochin - October 29, 1964 to February 14, 1965) was described. The routine programme, as described there, for the work in the Gulf of Aden, Somali region, and western equatorial Indian Ocean, was continued up along the Indian and Pakistani coast to Karachi. After the call in Bombay, meteorological research by radiosondes was discontinued; physical and chemical oceanography was reduced in favour of geophysical investigations. A helicopter was taken on board METEOR and a seismic programme was started in cooperation with the INS KISTNA, which had been kindly arranged through Dr. Panikkar. Due to the excellent cooperation between the two ships, the Indian and German scientists obtained a great number of good seismograms. As a preliminary result, it can be said that the Moho discontinuity off the shelf area was found in a relatively low depth.

In the whole area investigated between Cochin and Karachi the oxygen content of the waters between 200 m and 900 m was extremely low with a minimum of only 0.04 ml/l, but nowhere H_2S occurred.

The phytoplankton of the water increased from south to north considerably. Bottom trawling in the region of the shelf in depths between 30 and 100 m yielded in good catches of sizeable fish. In comparison with the African coast, these hauls were poorer in species, but a few species appeared in great numbers.

On March 14, 1965, METEOR arrived at Karachi, where great interest was paid to the ship and her work. A symposium of Pakistani and German scientists was arranged. Professor Dr. W. Schott took up cooperation with Pakistani geologists in the Indus estuary. The scientific leadership of the METEOR expedition was now taken over from Professor Dr. G. Dietrich by Professor Dr. E. Seibold. The work of the marine botanists, micro-biologists, planktologists, physical and chemical oceanographers, was continued, but the main working group on board was from this time represented by marine geologists and geophysicists.

A close net of sections covered the Gulf of Oman across the continental slope with magnetic, gravimetric and seismic measurements and geological studies of the sediments. The in- and out-flow of water masses from the Persian Gulf proved to be similar to those in the Strait of Bab-el-Mandeb. The continuous recordings of temperature and transparency from surface to bottom showed a remarkable and complicated sandwich-like structure of the layering.

On March 23, METEOR met the American ATLANTIS II. Mr. A. Jokela (Woods Hole) came on board to work with freefall-corers in the Persian Gulf and in the Red Sea.

The narrow beam echo sounder showed a remarkably complicated structure of the bottom profile in the Persian Gulf. The micro topography of the bottom was investigated with a television camera connected with a photo camera. About 500 controlled photographs could be taken. The main aim of geology was to take samples; however, some typical properties of soil mechanics, as well as pH, alkalinity, SiO_2 and PO_4 content of the interstitial water, were determined on board. Additionally, x-ray photographs were taken from 80 samples. In contrast to the original plan, the expedition was restricted to the Iranian region of the Persian Gulf due to political reasons.

On April 23, 1965, the ship entered the port of Djibouti, where Dr. G. Böhnecke took over the scientific leadership. On the way to Hamburg the continuous routine measurements (echo sounder, magnetometer, gravimeter, surface temperature recorder, surface transparency recorder, meteorological data recorder, radioactivity recorder of surface water) were continued. On her return from the Arabian Sea METEOR investigated the second hot salty water hole (discovered by ATLANTIS II) in the central Red Sea. The echo sounder indicated the upper boundary of salty water by distinct signals. Records of the temperature from the surface to the bottom showed three different layers, 58.2°C were measured close to the bottom. The water seemed to be very turbid. Some bottom samples were taken.

METEOR returned to Hamburg on May 18, 1965. The whole distance of the six months' expedition was 24500 nautical miles. 385 stations were made.

India

INS KISTNA January-February 1965.

The following is an extract from the Indian IIOE Newsletter Vol.II, No.4:

Cruise XXI January 15-January 22, 1965.
Cruise XXII January 28-February 6, 1965.

INS KISTNA completed her scientific cruises XXI and XXII during January-February, 1965. The XXI cruise commenced from Visakhapatnam on 15.1.1965 and ended at the same port on 22.1.1965 and the XXII cruise began from Visakhapatnam on 28.1.1965 and completed at Cochin on 6.2.1965. During these cruises the vessel occupied stations along the western Bay of Bengal, around Ceylon and across Gulf of Mannar. A total number of seventy-four stations were occupied during these cruises with various activities mentioned below:-

Cruise No.	XXI	XXII
BT stations	4	10
Hydro stations over shelf	11	18
Hydro stations up to 1200 m.	11	14
Hydro stations 1200 and up to 2000 m.	3	3
IOSN Hauls 200-0 m.	15	20
IOSN Auxiliary hauls	3	6
Radio-sonde ascents	10	17

Besides, surface meteorological observations were made at intervals of three hours on all days.

Certain interesting underway observations were made during these cruises. At position $18^{\circ}15'N$ and $89^{\circ}40'E$ about ten miles south-east of station 550 a full-sized uprooted tree of 10m length heavily infested with barnacles and polychaetes was found drifting and subsequently hauled aboard for detailed examination.

While at station 542, position $16^{\circ}42'N$ and $86^{\circ}09'E$ formation and dissipation of four individual funnel type clouds were observed. During both the cruises the surface current was generally southerly to south-westerly.

High wire angles, not consistent with the surface current and winds suggest sub-surface currents differing in direction from those at the surface. Surface temperature and salinity were generally found to increase from the coast towards the south. A slight inversion in temperature in the surface layer with more or less uniformly thick mixed layer was observed.

During XXI cruise in the north-western Bay of Bengal, observations revealed sub-surface salinity maximum at depths 400 to 600m and oxygen minimum at depths 300 to 400m. The range of temperature within these two layers is of the order of 12.0 to 9.5°C with the salinity maximum being 35.05 to 35.30 o/oo and oxygen minimum 0.18 to 0.30 ml/l. At 2000m depth the temperature is about 2.5°C and salinity about 34.94 o/oo.

Around 19°30'N and 85°50'E off the coast south of Puri a canyon with depths increasing to about 200 fm from about 50 fm of flat shelf was traced by the Edogchosounder. The northern part of the continental shelf was found to be rather flat and wide around a depth 50 fm suddenly dipping to greater depths beyond 50 fm line. There were twenty scientists on board, including the Cruise Leader Dr. C. B. Murty of the Directorate of Scientific Research (Navy).

Cruise XXIII February 14-February 17, 1965.

Seismic Studies.

The XXIII cruise of INS KISTNA was undertaken for seismic study on an experimental basis in collaboration with INS KONKAN mainly for testing the various items of equipment for seismic exploration work prior to the joint programme with R.v. METEOR. B.T. data and bottom sediments have also been collected for a better understanding during the interpretation of seismic waves. During this cruise between 14.2.1965 and 17.2.1965 a track running from Cochin to Kalpeni Island was chosen. Three stations were fixed at different intervals for stationing the recording ship and in addition six stations at more or less equal intervals were selected within the continental shelf for collection of bottom sediments and B.T.

INS KISTNA carried ten scientists, led by Dr. Sreenivasan of the Indian Naval Physical Laboratory, Cochin, and there were two scientists on board INS KONKAN. Sediment samples from seven stations are deposited at Indian Ocean Physical Oceanography Centre, Ernakulam, for detailed analysis. The B.T. slides are being processed and the records of the seismic waves have been taken to Directorate of Scientific Research (Navy), Delhi, for study and interpretation.

R.v. VARUNA September-October, 1964.

R.v. VARUNA continued her programme mostly centred on exploring the fishing grounds off west coast, especially on the shelf between Cape Comorin and Mangalore. Physico-chemical and biological oceanographic data were regularly collected on all cruises by the scientists on board. Nansen casts, bathythermograph lowerings, echo-sounding and plankton hauls were taken and in addition surface meteorological observations were made. During the quarter June-August 1964 about 160 stations were worked out in spite of squally weather. Operations had to be suspended on certain occasions when the wind velocity ranged between 30 and 45 knots accompanied by high swells. A few plankton nets and trawl nets were badly damaged in these cruises.

During September-October 1964 the vessel covered 133 stations, making a total steaming of about 2250 miles. By the beginning of November VARUNA left for Bombay for dry docking and repairs.

U.S.A.

ANTON BRUUN

The final cruise report of the r.v. ANTON BRUUN Cruise 5, January 26-May 4, 1964, was published in March 1965; the contents of the report are similar to those for Cruise 2 (IIOE Information Paper No.11).

ARGO Dodo Expedition June 11-November 2, 1964.

The Secretariat received a summary report of n.v. ARGO's Dodo Expedition from Dr. R. L. Fisher (SIO). Attached charts are reproduced in Annex IV.

Expedition Dodo, the third and final field contribution to the IIOE by the Scripps Institution of Oceanography of the University of California, took place in the final eight months of 1964. R.v. ARGO, SIO's ship in the Indian Ocean on the 1960-61 MONSOON and 1962-63 LUSIAD (with r.v. HORIZON) expeditions, operated in the tropical and temperate Indian Ocean from June 11 (Port Darwin) to November 2 (Singapore). During this period ARGO logged 144 days and 24,000 miles within that area.

Her mission was to make detailed studies of areas found to be of special interest and importance by earlier investigations in the geological-geophysical and hydrographic fields. Meteorological observations by U.S. Weather Bureau personnel and a radiation-radiation flux programme set up by the University of Michigan meteorologists were carried out throughout the operation. As was the case in the earlier cruises, Dodo was supported in principal part by funds from the Office of Naval Research and the National Science Foundation (Grant G-22255).

From Port Darwin (June 15) to Mombasa (July 29), a scientific party of ten scientists and students, led by William R. Riedel, carried out a bottom sampling programme, generally between 10° and 20° South latitude across the Indian Ocean. The programme was designed to investigate the occurrence and distribution of Tertiary sediments exposed or near the sea floor near the southern boundary of the equatorial current system, and their relation to major and minor topographic features. Methods included precise echo-sounding (by PDR), piston and gravity coring, rock dredging and some bottom photography. Volcanic rocks were dredged from the "median ridge" south-east of Rodriguez and indurated sediments from the Amirante Ridge. Intermittent operation by the PDR between 70° E and arrival at Mombasa hindered operations, but the bottom sampling programme was successful. Sedimentary material is now stored and being studied at Scripps Institution.

Between Mombasa (August 4) and Port Louis (September 7), Warren S. Wooster of Scripps Institution and Henry Stommel of MIT conducted a study of the Somali Current in its August phase and made a meridional section of hydrographic casts near 55° E to supplement earlier observations. The former programme by ARGO was carried out in collaboration with John Swallow and scientists of the National Institute of Oceanography aboard R.R.V. DISCOVERY. The observational programme consisted of hydrographic casts, jogs (GEK), BT's, and standard plankton net tows (at most stations). Casts were made at or near SCOR-IOC Reference Stations 10 (0° , 55° E) and 11 (7° N, 52° E). Hydrographic data from all 86 stations were deposited with WDC-A in March last.

In September, at Port Louis, the physical oceanographers debarked and a geophysical team led by Victor Vacquier and Richard Von Herzen came aboard.

From September 11 to November 2 (Singapore), a programme of magnetic field observations and heat flow measurements was ARGO's chief mission. Coring of oriented samples for paleomagnetic study was a minor part of the programme. Stations were concentrated on traverses across the median ridge between latitudes 30°S and the Equator and across the Indonesian Trench off Sumatra. The former study paralleled the work of Vacquier, Von Herzen and others on the Mid-Atlantic Ridge and the East Pacific Rise; the latter supplemented and extended topographic, gravity, magnetic and heat flow measurements carried out by SIO on MONSOON and LUSIAD and by the USC&GS vessel PIONEER and other expeditions. A partial report of the findings was presented by Von Herzen at a Royal Society Symposium in London in November last and a paper (Richard P. Von Herzen and Victor Vacquier, "Heat flow on the Mid-Indian Ocean Ridge") is now in press in the Proceedings of that Society. Cores taken in conjunction with the temperature probe lowerings are under study at Scripps Institution, as are several dredge hauls from the median ridge and from the inner and outer reaches of the trench.

Scientific Personnel on Expedition Dodo.

Port Darwin to Mombasa

Riedel, W.R., Chief Scientist
Berger, W. H., SIO
Baltzer, F. J., University of Paris
Crouch, J.E., SIO
Heath, G.R., SIO
Hohnhaus, G.W., SIO
Randle, P.C., U.S. Weather Bureau
Roehrig, C.J., SIO
Thompson, J.D., SIO
Walsh, T.J., SIO

Port Louis to Colombo

Vacquier, V., Chief Scientist
Dixon, F.S., SIO
Harrison, C.G.A., SIO
Newhouse, D.A., SIO
Randle, P.C., U.S. Weather Bureau

Mombasa to Port Louis

Wooster, W.S., Chief Scientist
Bruce, John, Woods Hole
Ferreira, S.M., SIO
Gilman, P., MIT
Hendershott, M., SIO
Hires, R., Johns Hopkins
Holland, W.R., SIO
Mantyla, A.W., SIO
Rakestraw, N.W., SIO
Randle, P.C., U.S. Weather Bureau
Stewart, R. H., SIO
Stommel, H., MIT
Warren, Bruce, Woods Hole
Wirth, David, SIO
Chow Tsaihwa J., SIO

Colombo to Singapore

Vacquier, V., Chief Scientist
Dixon, F.S., SIO
Harrison, C.G.A., SIO
Hilde, T.W.C., SIO
Newhouse, D.A., SIO

Sclater, J.C., Univ. of Cambridge, England
Silverman, Max, SIO
Taylor, P.T., Stanford University
Warren, R.E., SIO
Von Herzen, R.P., Unesco

Randle, P.C., U.S. Weather Bureau
Sclater, J.C., Univ. of Cambridge
Silverman, Max, SIO
Taylor, P.T., Stanford Univ.
Warren, R.E., SIO

6.2 Cruise Plans.

Australia.

HMAS DIAMANTINA Cruise 1/65 April 17-June 7, 1965.

A cruise plan for HMAS DIAMANTINA, Cruise 1/65, has been received from the Australian National Coordinator; an extract is reproduced below, and a track chart appears in Annex V.

AREA.

As shown on accompanying chart.
From Fremantle to SCOR-Unesco Reference Station 1
and to the Cocos-Keeling Islands.
From the Cocos-Keeling Islands to Colombo, Ceylon.
From Colombo to Port Louis, Mauritius.
From Port Louis to SCOR-Unesco Reference Station 1
and to Fremantle.

OBJECTIVES.

To investigate the possible source region of oxygen-rich water which has been detected flowing as a current at 300m and to examine the possible intensification of this westward movement between the Chagos Archipelago and the Maldive Islands.

To investigate the path of Red Sea water east of 70°E meridian to complement the observations of DISCOVERY and VITYAZ.

To investigate the westward movement of Banda Intermediate water beyond 90°E by high precision salinity measurements.

To investigate the northward movement of Antarctic Intermediate water in the Central South Indian Ocean.

To compare the deep chemical results at two stations, 10°30'S, 70°E, and 20°S, 61°E, with results obtained by r.v. ATLANTIS II about the same time.

STATIONS.

At Reference, Time and Position Stations shown on chart.

WORK AT STATIONS.

Reference Station: (32°S, 111°50'E in 5000m)
Hydrological sampling to the bottom for temperature, salinity, oxygen, nitrate, inorganic phosphate, particulate phosphate and total phosphorus.

Sampling to 150m for primary production and pigments.

Zooplankton sampling to 200m by Indian Ocean Standard net.

Time Stations: (X) (0800-1100 hours S.M.T.)
Hydrological sampling to the bottom for temperature, salinity, oxygen, nitrate, inorganic phosphate, particulate phosphate and total phosphorus.

Sampling to 150m for primary production and pigments. Sampling and photometry to 1% surface light for simulated in situ production.

Time Stations: (O) (2200-0030 hours S.M.T.)
Hydrological sampling to 2000m for temperature, salinity, oxygen, nitrate, inorganic phosphate, particulate phosphate and total phosphorus.

Zooplankton sampling to 200m by Indian Ocean Standard net.

Oblique tow by midwater trawl from 200m to surface from 2000-2200 hours S.M.T. between Fremantle and 20°S, and 90°E and Fremantle.

Time Stations: (•)

(0300-0430, and 1400-1530 hours S.M.T.). Hydrological sampling to 1000m for temperature, salinity and oxygen.

Position Stations: (△)

Hydrological sampling to the bottom for temperature, salinity, oxygen, nitrate, inorganic phosphate, particulate phosphate and total phosphorus.

Sampling to 150m for primary production and pigments. Sampling and photometry to 1% surface light for simulated in situ production.

PERSONNEL.

D. Rochford (Druise Leader)
F. Davies
N. Dyson
J. Klye
J. Prothero
B. Scott

PROBABLE ITINERARY.

Depart Fremantle	0900	April 17
Arrive Reference Station	0100	" 18
Depart Reference Station	0500	" 18
Arrive first Time Station	2000	" 18
Arrive Cocos-Keeling Islands	1500	" 24
Depart Cocos-Keeling Islands	0800	" 26
Arrive Colombo	0900	May 3
Depart Colombo	1000	" 6
Arrive Port Louis	0900	" 19
Depart Port Louis	1200	" 24
Arrive Fremantle	-	June 7

SAMPLING AND OBSERVATIONS.

Hydrology:

A. Nansen bottle sampling to the bottom.

1. South of 20°S: 0, 25, 50, 75, 100, 150, 200, 300, 500, 700, 900, 1100, 1300, and 1500m and then at 500m intervals to the bottom.
2. 20°S to 12°S: As for one with additional samples at 125, 250, and 400m.
3. North of 12°S: 0, 25, 50, 70, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1500m and then at 500m intervals to the bottom.

Samples for temperature, salinity, oxygen, nitrate and inorganic phosphate at all depths. Samples for particulate phosphate and total phosphorus at 0, 50, 100, 200, 300, 500, 700, 900, 1100, 1300 and 1500m and then at 500m intervals to the bottom.

B. Nansen bottle sampling to 2000m.

Depths: As for A but limited to 2000m.
Samples: As for A.

C. Nansen bottle sampling to 1000m.

Depths: As for A but limited to 1000m.
Samples: For temperature, salinity and oxygen only.

Physics:

Bathythermograph cast to 274m.
Echo sounding continuously.
Meteorological reports on station.

Zooplankton:

Indian Ocean Standard net haul from 200m at Time Station (O) and Reference Station.

Micronekton:

Oblique tow by midwater trawl from 200m to surface preceding Time Station (0) on track between Fremantle and 20°S, and 90°E and Fremantle.

Primary Production:

Twin 6 litre samples at 0, 25, 50, 75, 100 and 150m for incubation at 1100 foot candles in fluorescent light bath. Samples at six light depths for incubation in a simulated in situ bath on deck.

Biochemistry:

5 litre samples at 0, 25, 50, 75, 100, and 150m and samples at six light depths for pigment determination.

LABORATORY WORK.

Shipboard:

<u>Hydrology</u>	Salinity, oxygen, inorganic phosphate, particulate phosphate and total phosphorus determinations.
<u>Zooplankton</u>	Concentration and storage of samples.
<u>Micronekton</u>	Concentration and storage of samples.
<u>Primary Production</u>	Incubation in simulated <u>in situ</u> and fluorescent baths; filtration and Geiger counting of samples.
<u>Biochemistry</u>	Filtration and drying of samples over silica gel. Storage of filters over silica gel in the refrigerator.

Cronulla:

<u>Hydrology</u>	Determination of nitrate by strychnidine method.
<u>Biochemistry</u>	Spectrophotometric measurement.

Perth:

Micronekton Examination of particular taxa.

Cochin (IOBC)

Zooplankton Taxonomic studies.

7. Observations at Reference Stations.

On her Cruise 3, RRS DISCOVERY occupied the following SCOR/Unesco Reference Stations:

SCOR/Unesco Station 12	8 March 1964
	27/28 August 1964
" " " 6	19/20 May 1964
" " " 8	23 May 1964

In addition to the above a few selected stations were worked for comparison with METEOR, ARGO and ATLANTIS II measurements.

8. Meteorology Programme.

Extracts of News from the Scientific Director's Office,
No.16, July 1965.

The programme's emphasis continues to shift from data processing to research.

INTERNATIONAL METEOROLOGICAL CENTRE.

Staff. Mr. D. R. Jones, Chief of the WMO/Special Fund Mission, left India on June 8. His place as Chief of Mission is being taken by Mr. Francis P.W. Ho.

The data collection and daily map analysis programme is being continued during 1965 on a slightly reduced scale. However, the intensive checking and processing applied to the 1963 and 1964 data to prepare them for research and atlas compilation will not be extended to 1965 data.

Duplicate decks of punch cards are being despatched from IMC to the University of Hawaii where they will be transferred to magnetic tape.

To illustrate the volume of data available from the Indian Ocean region, IMC distributed to cooperating countries copies of kinematically analysed charts for seven levels from the surface through 100 mb for 12 GMT 7 July 1963.

SECOND MEETING OF THE IIOE COORDINATION GROUP, Paris 7-9 June, 1965.

At this meeting it was decided that the United States, in addition to preparing the IIOE meteorological Atlases, would also be responsible for the physical and chemical oceanography Atlas. The fact that this will also be prepared at the University of Hawaii will mean considerable gain in efficiency for both projects, which will share a large and sophisticated automatic curve plotter designed to minimise subjective hand analysis of data.

I informed the meeting of the IIOE Meteorological Monograph Series which will be published by the East-West Centre Press at the University of Hawaii under the sponsorship of the U.S. National Science Foundation. The first monograph will appear toward the end of this year. I should be happy to answer enquiries from potential contributors to the series.

After the meeting I visited the French Meteorological Service headquarters for most profitable discussions on IIOE topics.

REPORTS ON IIOE METEOROLOGICAL RESEARCH.

At a symposium on "Problems of Tropical Meteorology", held in New Delhi on 23 and 24 March, 1965, lectures were given by:

D. R. Jones: Usefulness of kinematic analysis in equatorial and tropical regions of the world with special reference to flow patterns representative of active and weak monsoon.

C.R.V. Raman: Interaction between lower and upper tropical troposphere, and

Some broadscale features of the general circulation over the Indian Ocean and the adjoining tropical region.

At a session on the afternoon of 19 April during a combined American Geophysical Union-American Meteorological Society meeting in Washington, D.C., the following papers were presented:

- F. I. Badgley: Energy exchange at the ocean's surface.
- A. F. Bunker: Preliminary analysis of large-scale air-sea interaction over the Indian Ocean.
- J. A. Colon: Some aspects of the equatorial circulations and cyclone formation in the northern Indian Ocean.
- C. M. Dixit: A synoptic study of typical active monsoon and "break" conditions over India during June-July, 1964.
- D. J. Portman: Measurements to determine the heat and water vapour exchange at the air-sea interface.
- C. S. Ramage: The summer atmospheric circulation over the western Arabian Sea.

Lt. Col. F. R. Miller presented an invited paper - Data processing and dissemination on the International Indian Ocean Expedition - at a WMO/IUGG Symposium on Meteorological Data Processing, held in Brussels from 2-5 July.

PUBLICATIONS ON IIOE METEOROLOGY (III).

- Dixit, C. M., and J. R. Nicholson, 1964: The sea breeze at and near Bombay. Ind. J. Meteor. and Geophys., 15, 603-608.
- Frost, R., and P. M. Stephenson, 1965: Mean streamlines and isotachs at standard pressure levels over the Indian and west Pacific Oceans and adjacent land areas. Geophys. Mem., 109, 24 pp.
- Leyendekkers, J. V., 1964: The International Indian Ocean Expedition. Aust. J. Sci., 27, 153-161.
- Sadler, J. C., 1965: The feasibility of global tropical analysis. Bull. Amer. Meteor. Soc., 46, 118-130.

GENERAL

Microfilmed sets (each of 20 rolls) of IMC analysed synoptic charts are being mailed this week to cooperating meteorological services who requested them (see News No. 15).

The sets comprise daily charts for 00 and 12 GMT for the two years -1963, -1964, at the following levels: surface, 850 mb, 700 mb, 500 mb, 300 mb, 200 mb, and 100 mb.

Other organisations may obtain sets for the following prices (plus postage):

- | | | |
|---------------------------------------|---|----------|
| 1. Full set of 20 rolls | : | \$120.00 |
| 2. Three-roll set of 500 mb analyses: | | \$ 22.50 |
| 3. Three-roll set of 200 mb analyses: | | \$ 22.50 |

9. National Coordinator.

Madagascar.

Mr. M. Angot, the former National Coordinator of Madagascar, has informed the Secretariat that he has been replaced, from May 15, 1965, by Mr. Ramanisarivo, Directeur de la Météorologie Nationale Malgache. The address of the new National Coordinator is:

Mr. Ramanisarivo,
Directeur de la Météorologie Nationale
Malgache,
B. P. 1254 Tananarive,
Madagascar.

10. List of Scientists.

Professor L. A. Zenkevich has prepared the list of specialists who are studying the bottom fauna and flora of the Indian Ocean. The list is reproduced in Annex V.

11. New Publication.

"Recueil des Travaux de la Station Marine d'Endoume - Marseille, Special Number, Supplement No.2" has been published (1964) as a contribution to "La Station Marine de Tuléar (Republique Malgache)" for IIOE. It contains the following papers:

P. Vasseur: Contribution à l'étude bionomique des peuplements sciaphiles infralittoraux de substrat dur dans les récifs de Tuléar, Madagascar. pp 1-77.

M. Pichon: Contribution à l'étude de la répartition des
Madréporaires sur le récif de Tuléar, Madagascar. pp 79-203.

R. Plante: Contribution à l'étude des peuplements de hauts
niveaux sur substrats solides non récifaux dans la région de
Tuléar, Madagascar. pp 205-315.

RECOMMENDATIONS OF THE SECOND MEETING OF THE INTERNATIONAL
COORDINATION GROUP FOR THE INTERNATIONAL INDIAN OCEAN EXPEDITION

(Paris, 7 - 9 June, 1965)

RECOMMENDATION 1

The Coordination Group, having reviewed the work in the Indian Ocean accomplished to date, recognised that requests for additional observations, water samples or other material, may arise from different institutions and recommended that the IIOE Information Paper, as being the most appropriate vehicle, should be used for bringing such requests to the attention of organisations operating, or about to operate, in the Indian Ocean area.

RECOMMENDATION 2

IIOE Data Exchange

The Coordination Group, having considered the summary of the current status of the IIOE data exchange, took note of the progress made in exchanging data of cruises accomplished by the end of 1963 and, particularly, the speedy direct exchange of bathymetric data between scientists and institutions concerned. The Group recommended that:

1) National Coordinators should make further efforts to ensure that deadlines established by the Group at its first meeting be met and that all kinds of exchangeable data be submitted as expeditiously as possible.

2) World Data Centres should modify their system of assessing their acquisitions in that not only cruises and stations be given as indicators, but also that the amount of the various kinds of exchangeable data acquired be established.

3) The Secretariat should find out which particular kinds of exchangeable data have not so far been exchanged with respect to those cruises for which certain oceanographic data have already been sent to World Data Centres.

4) The Secretary should find out, with the aid of the Permanent Service for Mean Sea Level, those Indian Ocean tide gauges which were operating during the IIOE and for which sea level data have not yet been sent to the PSMSL. It would be useful to establish exactly on which dates the last data for each gauge were submitted and what has happened to the tide gauges since these dates.

The Secretary will then write to the National Coordinators concerned and will take any further steps required to provide necessary assistance and ensure steady progress in sea level data exchange.

5) National Coordinators should arrange that the FAO Fisheries Data Centre receives all the relevant material (fisheries data and information) as set out in IOC Resolution III-3 and in the ACMRR Recommendations.

RECOMMENDATION 3

The IIOE Collected Reprints

Having considered the information provided on this problem by the IOC Secretary, the International Coordination Group recommended:

1) That National Coordinators be requested to furnish to the IOC Secretariat each year a list of scientific papers based on results of the IIOE and published by scientists of that country. Following this, five copies of each paper should be furnished to the Unesco Office of Oceanography which, for bibliographic purposes, will furnish a complete list of such papers to FAO.

2) That from these papers a selection be made of scientific papers dealing with oceanography, meteorology, or fisheries biology.

3) That the papers selected should be reproduced in the Collected Reprints, other papers being listed by title and author's abstract or summary.

4) That where the International Coordinator has any question about the inclusion of a given paper he refer the paper to the appropriate member of an editorial board consisting of the SCOR disciplinary experts, the scientific coordinator for meteorology, and a fishery expert to be nominated by FAO.

5) That the Unesco Office of Oceanography, in cooperation with the FAO Fisheries Biology Branch, arrange to furnish upon request copies of papers not included in the Collected Reprints to libraries of marine laboratories or other institutional recipients of the Collected Reprints.

6) That the IIOE Collected Reprints be distributed to the libraries of marine and other appropriate laboratories throughout the world. Distribution to individuals was not considered necessary or desirable.

7) That consideration be given to the eventual preparation of a comprehensive annotated bibliography of papers resulting from the IIOE.

RECOMMENDATION 4

IIOE Cruise and Data Reports

The Coordination Group, having considered and reviewed the problem concerning the preparation and publication of IIOE Data Reports, recommends the following:

- 1) That the data reports be prepared and published in chronological order. It appears that sufficient data is available to initiate preparation for the years 1959 through 1961. All those nations or institutions that have not submitted data for cruises conducted during this period should be strongly encouraged to do so at the earliest possible time.
- 2) The contents of the volumes should consist of data that can be reasonably tabulated and which are consistent with the IOC "Manual on International Oceanographic Data Exchange"; in addition, information on accuracy, precision, methods, etc., should be included.
- 3) The Secretariat should contact World Data Centres A and B to determine if these centres are interested in preparing and printing the IIOE Data Reports.
- 4) An estimate of the cost of preparation and printing should be obtained from the World Data Centres which are interested and these centres should be requested to submit a proposal to the Secretariat for doing this work. The proposal should include suggested contents, format and mode of presentation, etc.
- 5) Unesco should be responsible for the distribution of the Data Reports and should explore on the basis of the estimated cost of production the costs of such distribution and any other overhead costs associated with handling distribution and sales, submitting an estimate to the IOC Secretariat.
- 6) The Data Reports should not bear a copyright.
- 7) The National Coordinators should act as an editorial and advisory board to the Secretariat until it is deemed necessary to have a smaller, specially appointed board of editors. All correspondence from the Secretariat to the National Coordinators on this subject shall have a time limit for reply. If no reply is received, it shall be assumed that the specific National Coordinator concurs with the plan put forth.

RECOMMENDATION 5

Disciplinary Experts of SCOR and the Scientific Director of the IIOE Meteorological Programme

The International Coordination Group, having discussed the reports of the SCOR Disciplinary Experts, Professors Krey, Zenkevich, Tchernia and Fisher, and of the Scientific Director of the IIOE Meteorological Programme, Professor Ramage, considers that these experts are providing to scientists, institutions and laboratories participating in the IIOE, an extremely valuable service, each in their own way, either through advice on planning field work, by compiling information showing the actual coverage of the Indian Ocean in each particular discipline, or by supplying scientists with lists of individuals actively engaged in scientific studies of the Indian Ocean within each particular discipline. The Group considers the importance of such work will further increase, in spite of the close of the IIOE field operations by the end of 1965.

Because the Disciplinary Experts and the Scientific Director of the IIOE Meteorological Programme have considerable knowledge of the state of research on the Indian Ocean, the International Coordination Group recommends that these scientists formulate suggestions for action by IOC, Unesco, SCOR, WMO, and other interested international organisations, to ensure that the best use is made of data obtained through the cooperative efforts of countries which participated in the IIOE. In this way, participating and other laboratories would be helped to formulate future research programmes on the Indian Ocean.

RECOMMENDATION 6

Observations on reference stations

The Coordination Group agreed unanimously that observations on reference stations should be continued on a voluntary basis for as long a period of time as possible. The Group also recommended that in any presentation of the IIOE results those coming from the reference stations should be singled out. For example, a volume of station-diagrams for reference stations might be envisaged as a part of the Cruise and Data Reports series or the IIOE Atlases.

RECOMMENDATION 7

Indian Ocean Biological Centre

Following a very full discussion of the draft report of the Consultative Committee of the Indian Ocean Biological Centre, the Coordination Group recommended that the Indian Council of Scientific

and Industrial Research be approached with a view to assuring the continuity of the Centre and its staff after the end of the IIOE in order to provide:

- a) a repository for the International Collections;
- b) a permanent service for workers engaged on tropical studies, particularly in the resolution of taxonomic problems;
- c) a centre for research on the plankton of the Indian Ocean;
- d) training, both for Indian recruits to marine biology and for workers from other countries who wish to specialise in tropical marine plankton.

The Group welcomed the proposal of the Indian CSIR to build a permanent laboratory to house the Centre in Cochin and recommended that the Unesco Office of Oceanography should continue to support the Centre in the future through the provision of funds for a Curator and equipment, as well as training courses, visits of specialists to work at the Centre and for the scientific development through the provision of fellowships to members of the permanent staff. The Group further recommended that national support be encouraged in order to enable taxonomists and others to collaborate in the biogeographical study of the plankton of the Indian Ocean and especially in the recruitment of international teams to work at the Centre for various periods on specific aspects of the International Collections.

The Group endorsed the recommendation of the Consultative Committee that sampling with the Indian Ocean Standard Net should be continued after the end of the IIOE and that the samples should be sent to the Centre for sorting. The principal objectives would be to fill geographical gaps in the sampling during the IIOE, especially in the Southern Indian Ocean, and to build up a time-series of observations for ecological studies of the plankton in the Indian Ocean.

The Group recommended that libraries and individuals should be asked to donate duplicate volumes and papers to the Centre and to provide photo-copies of identification keys and other works on taxonomy and biogeography. It welcomed the offer by the National Coordinator of the USSR to provide on request Russian identification keys in translation.

The Group recommended that duplicate copies of the completed sorting sheets be stored in the Office of Oceanography.

RECOMMENDATION 8

IIOE Atlases

The Coordination Group recommended that the project of IIOE Atlases should be divided into a number of subject sections. For each section an Editor should be appointed by IOC in consultation with SCOR. The IOC has to ensure that the home country of the Editor is willing to provide the salary of the Editor, along with the funds and technical assistance which are needed for the preparation of an Atlas. No decision with regard to the financing of the printing of the Atlases can be made at present.

The Editor would have the final decision in matters of presentation in the Atlases. He should be assisted in his work by an advisory board consisting of a small number of scientists who worked during the IIOE in that discipline. Much of this advice could be obtained by correspondence, but the Editor will probably need to visit laboratories and perhaps the advisory board might be convened for detailed consultation. It is recommended that Unesco provide funds for such travel.

RECOMMENDATION 9

IIOE Symposia

The Coordination Group recommends that all National Coordinators communicate to the IOC Secretariat in advance information on all the symposia, national or international, which are going to be held in their countries. This information will then be widely disseminated through the IIOE Information Paper and the International Marine Science Bulletin published by Unesco.

...

Annex II

Paris 3 June 1965

REPORT OF THE THIRD MEETING OF THE CONSULTATIVE COMMITTEE
FOR THE INDIAN OCEAN BIOLOGICAL CENTRE

PARTICIPANTS

The third meeting of the Consultative Committee was held in Ernakulam and Munnar, South India, during the period 7-16 April 1965. A list of participants is given below:

Mr. R. S. Glover, Chairman	- Consultative Committee.
Dr. M. E. Vinogradov	- Consultative Committee.
Professor S. Motoda	- Consultative Committee.
Dr. J. A. McGowan	- Consultative Committee.
Professor J. Krey	- SCOR.
Dr. N. K. Panikkar	- Director of IOBC, Advisory Board for IOBC, INCOR, CSIR.
Dr. R. R. Prasad	- Chief Scientist in charge.
Dr. S. Z Qasim	- Assistant Director of the Indian Marine IBP Laboratory, Head of Office of IOBC.
Mr. L. R. Kasturirangan	- Acting Assistant Curator, IOBC.
Dr. K. K. Tiwari	- Advisory Board for IOBC.
Mr. C. S. Nayar	- Secretary, Indian National Commission for Unesco.
Dr. A. Y. Evstafiev	- Unesco, Chief of Mission for India, Advisory Board for IOBC.
Dr. R. Serene	- Unesco - SEASCO, Singapore.
Dr. G. Hempel	- Unesco, Office of Oceanography.

On Friday, 17 April, members of the Consultative Committee discussed the work of the Centre with Dr. S. Hussain Zaheer, Director General of CSIR.

LECTURES AND SEMINARS

In accordance with the usual practice, members of the Consultative Committee gave lectures and seminars:

Thursday, 8 April. A symposium on "The trophic chain in the sea" was held in the Oceanographic Laboratory of the University of Kerala; it was attended by staff and students of the University, representatives of the Indo-Norwegian Project, the Central Marine Fisheries Laboratory and the staff of the IOBC. Lectures were given as follows:

- | | | |
|----------------------|---|--|
| Mr. R. S. Glover | - | Introductory Lecture: the use of models in studies of food chains. |
| Dr. S. Z. Qasim | - | The Indian marine IBP. |
| Dr. G. Hempel | - | The food and feeding of larval fish. |
| Dr. M. E. Vinogradov | - | The feeding of deep-sea plankton. |
| Professor J. Krey | - | Recent results of the METEOR expedition with reference to trophic relationships in the Indian Ocean. |

Thursday, 15 April. Three lectures were given to the staff of IOBC:

- | | | |
|---------------------|---|---|
| Professor J. Krey | - | Comments on the use of the Indian Ocean Standard Net. |
| Professor S. Motoda | - | The estimation of primary and secondary production. |
| Dr. J. A. McGowan | - | Species interaction and patch permanence. |

Thursday, 15 April. Group seminars were held in which members of the Committee jointed the sorting staff of IOBC. The group leaders were Mr. Glover, Dr. McGowan, Professor Krey and Dr. Tiwari.

SUMMARY OF DISCUSSIONS

On behalf of the CSIR of India, Dr. Panikkar welcomed the participants to Ernakulam.

In his reply, the Chairman expressed his pleasure that the Committee would have the benefit of the attendance of Dr. Tiwari (responsible for the marine section of the Zoological Survey of India) and of Dr. Qasim (Director of the new marine IBP Laboratory in Ernakulam). Collaboration between these organisations and the IOBC is highly desirable. The Chairman regretted the absence of Professor Krishnaswamy, whose advice as the first Indian member of the Committee would have been invaluable. It was unfortunate, also, that three other participants were unable to attend the first half of the meetings: Dr. Prasad through pressure of other work, and Professor Motoda and Dr. McGowan because of strikes of airline personnel and other travel difficulties.

The Chairman reminded the participants that the International Curator had completed his period of duty in Ernakulam and that Mr. Kasturirangan had performed the duties of Acting Assistant Curator during the previous two months.

The Committee wishes, unanimously, to place on record its sincere appreciation of the work of Mr. Vagn Kr. Hansen as the first Unesco Curator at the Centre (April, 1963 to March, 1965). In training the staff and setting up the administrative and scientific machinery for processing the samples, he has established a most promising growing point for future development.

The Committee received two reports: ■

The Indian Ocean Biological Centre. Report to the Consultative Committee. By Dr. N. K. Panikkar, Director, Indian Programme International Indian Ocean Expedition, CSIR, New Delhi.

Curator's Report on Activity at IOBC, April 1964 to March 1965. By Mr. Vagn Kr. Hansen and Mr. L.R. Kasturirangan.

1. Terms of reference and membership of the Consultative Committee. ■ ■

The Committee does not wish to recommend any changes in the five terms of reference listed in the Report of the second meeting of the Consultative Committee (IIOE Information Paper No.7, pp 1 and 2).

■ An extended version of Dr. Panikkar's report will be published by CSIR. An account of the activity of the Curator and of the history and general programme of the Centre with regard to the International Collections will also be published in due course.

■ ■ The final version of the terms of reference of the Consultative Committee, as decided by Unesco, June 1965, is given as Annex III of this Information Paper.

It is recognised that the "present and future scientific activities of the centre" (the fourth term of reference) will be centred around the International Collections.

The Committee recommends that its members shall serve for up to five years and that the chairman shall be elected to hold office for two years. It is recommended that the vacant place on the Committee shall be filled, bringing the number of members to the maximum of six, which was proposed at the second meeting and approved by SCOR and IOC.

2. Staff of the Centre.

The Committee is disappointed by the failure to confirm the appointment of Dr. Prasad as the full-time Assistant Director. The Committee repeats the strong view, expressed at last year's meeting, that it is essential to make a full-time appointment in the near future, and, in any case, before the new Curator takes up his duties.

It is also considered to be essential that the Indian authorities shall appoint a Curator or Deputy Curator as the counterpart of the International Curator. It is recommended that the Indian Curator shall visit institutions engaged on related studies outside India, and, especially, laboratories with experience in the collection and processing of large numbers of plankton samples.

The Committee welcomes the appointment of Dr. S. Z. Qasim (Assistant Director of the Indian Marine IBP Laboratory) as part-time Assistant Director of IOBC and Head of the Office of the Centre. This appointment will facilitate a close liaison between the IOBC and the IBP Laboratory.

It is noted that the number of sorters increased from 11 at the time of the second meeting (in March 1964) to 13 in April 1965. The Committee was informed that five additional sorters have been appointed and will join the staff in the near future. (At the second meeting in March 1964, the Consultative Committee had recommended a staff of 20 sorters.)

It is suggested that consideration be given to the possibility of promoting the three senior sorters in recognition of their long and valuable service and the part they are playing in the training and supervision of junior staff.

It is also suggested that the possibility should be explored of sending one or two senior sorters to the Danish Advanced Course in Marine Biology, coupled with periods of instruction in data handling and processing at the Oceanographic Laboratory, Edinburgh, and elsewhere.

The Committee recommends that - for work on the International Collections - six new Research Fellowships be created (three senior and three junior) and expresses the hope that members of the sorting staff will be eligible to apply for some of these posts.

The Committee welcomes the appointment of a librarian who will soon assume responsibility for the library of the three marine science laboratories in Ernakulam (IOBC, IBP and the Physical Oceanographic Laboratory).

The Committee recommends that a new post of draughtsman be created to help with the preparation of charts and other illustrations.

3. Buildings and equipment.

Although the buildings and equipment are adequate for the present stage of development, it is clear that more space and additional apparatus will be needed in the near future as the work progresses. In particular there will be a requirement for research rooms and equipment for visiting workers.

The Committee recommends that Unesco shall continue to provide equipment which cannot be obtained in India and, further, that the Office of Oceanography shall allocate a minimum of \$500 per annum for the purchase of consumable stores and small items of equipment not available in India, at the discretion of the International Curator.

Working conditions in the sorting room have been improved by the installation of additional fans. It is suggested that additional air-conditioners and de-humidifiers will be necessary in rooms containing sensitive equipment.

It is recommended that a photographic dark room be provided and that it shall be especially well equipped for photo-copying. This will be valuable for making copies of books, papers and identification keys and it will be essential for the preparation of duplicate copies of plankton analyses, charts and other data.

It is suggested that the Centre is rapidly reaching the stage at which simple workshop facilities will be needed for the maintenance and repair of equipment for such tasks as the manufacture of special boxes for the safe transport of plankton samples overseas.

It is noted that negotiations have been started for the purpose of 1.1 acres of land at Ernakulam. The Committee welcomes the proposal to build a laboratory on this site to house the IBP Laboratory, the Physical Oceanographic Laboratory and the IOBC.

4. Sorting methods.

It is emphasised that a standard basis of sorting is essential throughout the International Collections and, therefore, no changes should be made at present in the sorting procedure laid down by Mr. Hansen and endorsed at the second meeting of the Consultative Committee. (During informal discussions, the sorting staff suggested some additions to the procedure, particularly the possibility of making estimates of volume or dry weight of the sorted categories. The staff were requested to draft schemes for such amendments for submission to the new International Curator.)

5. Receipt of material for sorting.

With the exception of the Australian samples mentioned in the Second Report of the Committee, no material has been received for "contract sorting".

Although the general response to the request for standard samples has been satisfactory, there are many disappointing gaps in the collections because of the absence of standard samples from some participating countries.

There are large regions of the Indian Ocean in which sampling during the IIOE is either lacking or quite inadequate. Even in the better-sampled areas, there has been insufficient repetition of sampling to permit an analysis of seasonal variation.

It is agreed that National Coordinators shall be asked to remind their colleagues of these gaps in the Collections and to seek ways of filling them, either by providing material from existing national collection or by undertaking special sampling in the future. It is hoped that these requirements will be borne in mind after the IIOE whenever research ships pass through the poorly sampled areas and that, whenever possible, standard samples will be taken and despatched to the Centre for sorting. It is hoped that samples taken by Russian vessels with the Juday net during the early phases of the IIOE will be made available to fill gaps in the southern part of the Indian Ocean.

In general, the condition of the material sent to the Centre is satisfactory, but there are a few cases of inadequate preservation. Also, picric acid has been used occasionally as a colouring agent to check that preservative has been added. The Committee approves the use of a temporary dye as a visual check, but points out that picric acid damages delicate specimens.

6. Data processing and station lists.

Although the sorting of the samples of the IIOE is unlikely to be finished before 1968 (at the present rate of 50 samples per month) the Committee think it is essential that processing and distribution of basic data shall be started immediately with three objectives:

- (a) to provide donors of material with information about the composition of the samples in terms of the standard sorting categories.
- (b) to provide taxonomists with details of the numbers and distribution of samples available for their studies.
- (c) to provide fundamental information for the development of research projects within the Centre.

There was some discussion, in which members of the sorting staff took part, of ways in which these objectives might be realised. It is suggested that a geographical form of representation based on Marsden squares may be the most suitable form of presentation. It was agreed that the staff of the Centre will make tests of alternative methods before the new Unesco Curator takes up his duties. It was also agreed that, in addition to receiving routine data, donors of material will be kept informed about outstanding discoveries made from their material.

It is considered essential that a standard chart shall be used for biological, physical and chemical data from the IIOE. The Committee requests the assistance of Unesco and IOC in reaching an early agreement and suggests that supplies of charts should be made available, preferably free of charge, to participants in the Expedition.

The Committee recommends that a basic station list of material in the Centre shall be compiled as soon as possible and that it shall be brought up to date periodically. It is suggested that the Station List should be published as a Unesco Technical Report.

The Committee recommends that a careful appraisal should be made of the requirements for storage of data and the need for duplication of records as a precaution against accidental loss or damage.

7. Library and identification keys.

The Committee wishes to record its gratitude to all the donors of books and papers and to the University of Kerala for permission to use the library of the Oceanographic Laboratory. The library of the IOBC has been further improved through purchases made by CSIR. Many valuable and complete series, including most of the great expedition reports, are now available to the staff and visiting workers (see Annex 1).

Nevertheless, it is hoped that libraries and individuals will continue to send their duplicates and other spares to augment the library of the Centre. The Committee also asks laboratories and individuals to send copies of identification keys which have been prepared for internal use but not yet published. It is hoped that the Unesco Office of Oceanography will be able to assist in securing such material, for example from S. America and West Africa, and in obtaining English translations of keys.

8. Collaboration with the Zoological Survey of India.

The Committee hopes that there will be a mutual exchange of information on current and future research between IOBC and the ZSI. Holotypes from the International Collection will be deposited in the Indian Museum at Calcutta.

The Committee hopes that the staff of ZSI will be able to collaborate in the analysis of the material. The Zoological Survey could render particularly valuable services in providing library facilities for visitors working on the material of the International Collections and in the preparation of identification keys for plankton in the Indian Ocean. The Committee asked Dr. Tiwari to explore the possibilities of initiating such work in the ZSI.

9. Future Development of the Centre and the International Collections.

The Committee recognises the prime importance of assessing the potential natural resources of the Indian Ocean. It is emphasised, however, that such assessments will be dependent on the establishment of a sound basis of fundamental knowledge. Initially this foundation must be largely biogeographical and taxonomic. For this the Centre is in a unique position by reason of the International Collections, taken from a very wide area of the Indian Ocean.

The second stage of development will be the analysis of seasonal, annual and spatial variations in the abundance and composition of the plankton. For this it will be necessary to augment the International Collections with samples collected throughout the year. Consideration should be given, therefore, to the possibility of developing a long-term sampling programme.

In view of the magnitude of the problem, it is clearly desirable that such a programme shall be developed in collaboration with other institutes, inside and outside India. The recent German cruises in the Indian Ocean have shown the potential value of the Continuous Plankton Recorder in these waters and it is suggested that a more extensive feasibility trial should be started.

These biogeographical studies will raise many questions, demanding special ecological research, both in the field and the laboratory. It is highly desirable, therefore, that the Centre shall collaborate closely with other institutes engaged in related problems. Liaison with the IBP marine laboratory, the Central Marine Fisheries Laboratory, the University Oceanographic Laboratory and the Physical Oceanographic Laboratory (all in Ernakulam) would be especially valuable and it is assumed that there will be a very close association with the proposed new Indian National Institute of Oceanography. Members of the Committee pointed out that the plankton cannot be studied in isolation and there is an excellent opportunity to cover the whole spectrum of biological oceanography by an integration of research in Cochin.

Through their discussions, members of the Committee emphasised the potential value of the IOBC along three lines:

- (a) In providing a service for workers engaged on tropical studies everywhere, particularly in the resolution of taxonomic problems.
- (b) As a centre for research on the plankton of the Indian Ocean.
- (c) As a training centre, both for Indian recruits to marine biology and for workers from other countries who wish to specialise on tropical problems.

The Committee suggests that the IOBC could provide a service through its function as a sorting centre, by the provision of laboratory and library facilities for research and as a taxonomic data centre for the Indian Ocean. A profitable research activity would be the study and development of new methods of handling biogeographical data.

The urgent need to understand the ecology of tropical waters is recognised throughout the world, both for fundamental science and resource development. It is essential that laboratories of high standing shall be set up to train scientists from the temperate as well as tropical zones. Such training should be carried out in centres of active research and it is hoped that national and international organisations will follow the lead provided by Unesco in supporting the parallel development of research and training in the IOBC.

Organisations elsewhere may wish to set up plankton sorting centres for which the IOBC could serve as a model. The Committee took note of a recent recommendation of the 3rd Regional Meeting of Marine Science Experts in East and South East Asia in the following terms:-

"Recognising the valuable work undertaken at the Indian Ocean Biological Centre (IOBC);

Recognising the efficiency of the methods and techniques employed in plankton sorting at this Centre;

Considering the need in the near future of a similar establishment in the countries concerned with the Cooperative Study of the Kuroshio;

Desires Unesco to request Mr. Vagn Hansen, present Curator of the Centre, to prepare, possibly as part of his final report to Unesco, a comprehensive description of the system, methods and techniques of sorting work at the IOBC."

The Committee suggests that this need should be met through the publication by Unesco of a booklet describing the International Collections and their analysis at IOBC.

10. Taxonomic and biogeographical analysis of the International Collections.

The International Curator has prepared lists of experts who might be able to cooperate in the taxonomic and biogeographical analysis of the International Collections. However, with a few exceptions, it is impossible to issue material to specialists at this stage; the total work which will be needed to analyse each of the sorted categories is not known. Only two-thirds of the expected number of samples have been received in the Centre and only one quarter have been processed. The Committee asked the Assistant Curator to make a forecast, based on the samples sorted so far, of the expected order of magnitude of the total number of specimens in each of the 80 categories of the sorted material. As soon as these predictions are available, the Committee will approach individual experts and National Coordinators, soliciting their cooperation in the analysis of the material. Specialists will be requested to provide certain minimum information which will enable a quantitative biogeographical treatment of the results.

Although it will be necessary to distribute material to specialists working elsewhere, the Committee believes that, whenever possible, the work should be done in the Centre where activities can be coordinated with the biogeographical objective in view.

It is hoped that senior and junior scientists will work together in the Centre so that the twin objectives of training and research will be ensured. In other laboratories, also, young workers should have the opportunity to study the International Collections, providing that they are properly supervised and guided.

The Committee feels that priority should be given to the study of larval fish. Apart from their basic scientific interest, they should provide a useful first approximation to the distribution and abundance of potential resource stocks. It is recommended, therefore, that an attempt should be made to gather an international team of experts to work in the Centre for, say, three to six months. For example, it might be possible to assemble a group of specialists on tuna larvae with experience of the Atlantic and Pacific to join the experts already in Ernakulam. The members of such a group could also provide training of the highest standard for members of staff and visitors to IOBC. The Committee requests the assistance of the Office of Oceanography of Unesco in seeking the advice of prominent biologists on the development of such schemes, especially for the Clupeidae and Scombridae. It is hoped that international and national agencies will be prepared to sponsor such projects for these as well as other groups of meroplanktonic larvae and, especially, the decapods.

11. Other research activities.

The Committee urges strongly that the sorting staff should undertake research activities under the guidance of senior officers, visiting workers and the curators. A valuable preliminary activity would be the finer sorting of some of the standard groups. For example, group 46 (Copepoda) could be sub-divided into Calanoida, Harpacticoida and Cyclopoida, and finer sub-divisions may be possible (for example, Oithonidae, Corycaeidae and Oncaeidae). A group which might repay detailed study is the anguilliformes, but for this it will be necessary to invite an expert to work in Ernakulam.

The Committee feels strongly that an immediate start should be made to plot distributions. The first stage will be the charting of displacement volumes of the samples and the numbers of organisms in each of the sorted categories. It is expected that these charts will have considerable scientific value and they will serve, also, as valuable guides for further work on the Collections. The Committee points to the need for similar rough charts of physical and chemical variables including current systems.

It is suggested that the Collections might provide good material for a study of the relationship between size and dry weight of organisms in all stages of development over a wide area.

Apart from the value of this work in the study of energy and trophic relationships, it is likely that the size/weight conversion factors will be useful in other laboratories working on the Indian Ocean. The Centre possesses an analytical balance which is suitable for this work, but it will be necessary to construct an air-conditioned and "dry" balance room.

Among other research topics, it is suggested that it might be possible to investigate the differences between sampling by night and day, using the International Collections. The Centre might also undertake a general examination of sub-sampling methods in plankton studies.

The Committee considered, briefly, the question of the kind of gear which should be used by the Centre and associated institutions in future work. As the International Collections are based on sampling with the Indian Ocean Standard Net, there is a strong argument for the continuation of sampling with this net. However, insufficient work has been done on the sampling characteristics of the IOSN and its comparison with alternative samplers. The Committee recommends that the attention of the SCOR working groups on intercalibration and zooplankton methods should be drawn to the need for a well-designed and thorough programme of research on the sampling characteristics of the IOSN and alternative nets, including high-speed samplers. Pending such a study, the Committee suggests that the IOSN should be retained as the preferred sampler for augmenting the International Collections.

12. Constitution of the International Collections.

With many of the above points in mind, the Committee prepared a draft Constitution for the International Collections; see Annex 1. It was agreed that a booklet will be prepared, incorporating the Constitution and summarising the aims of the Centre and the obligations of participants in the programme. This booklet will be given to visiting workers and to specialists who apply for material from the Collections.

13. International Curator

The Committee discussed applications for the vacant post of Curator and requests the Office of Oceanography of Unesco to take all necessary steps to ensure that the new Curator is appointed by 1 June and will take up his duties not later than September 1965.

Draft terms of reference for the Curator were prepared; see Annex 2.

14. The fourth meeting of the Consultative Committee.

It is proposed that the next meeting shall be held at the end of February 1966, and that the first two or three days shall be spent in New Delhi where officials of CSIR and other governmental agencies can be consulted. Members of the Committee and other participants would then conclude the meeting during four or five days in Ernakulam.

Scientific Aspects of the Constitution for the International
Collections at IOBC

The International Collections consist of plankton samples taken from the research ships of various countries participating in the International Indian Ocean Expedition. Most of the samples were taken in the upper 200m with the Indian Ocean Standard Net, according to a standard procedure. It is envisaged that the Collections will be augmented by further samples taken after the end of the IIOE.

The primary aim of research on the International Collections will be the investigation of the distribution and abundance of the plankton in the Indian Ocean and the factors governing secondary production. This investigation will of necessity be based on taxonomic studies. The Consultative Committee of IOBC will invite experts to collaborate in the study of the material which will be pre-sorted by the staff of IOBC according to a standard procedure. Work on the various systematic groups may be done either at IOBC or in other scientific institutions to which material will be lent. Although the study will be primarily biogeographical and taxonomic, material will also be released for related studies. Any loan of material is subject to the following rules and conditions:

- (1) Samples will normally be lent to institutions only, rather than to individuals. Requests for samples should be made to the Curator of IOBC in a approved form containing a description of the proposed research project and naming the scientist who will be responsible for the material and the work which may be carried out by himself or by others under his supervision and guidance.
- (2) On receipt of the samples, the institution should give an estimate of the time needed for working up the samples. Every half-year a progress report should be given. Whenever the study is likely to last for more than two years, the Curator of the IOBC may ask that fractions of the samples already studied be returned to the Centre. The Consultative Committee will review the progress reports each year and reserve the right to withdraw the material in the case of undue delay or unsatisfactory treatment of the samples.
- (3) Institutions interested in a specific systematic group should be willing to work up all the samples of that group as collected during the IIOE and delivered to the International Collections. In general, team work on a national or international basis would be appreciated, as it may ensure speedier results, appropriate checking, and further training in taxonomy and systematics.

- (4) After the material has been studied, it should be returned, properly labelled, to the IOBC, where it will be kept for further studies and as a reference collection. If the institution wishes to retain specimens, it should apply for permission to the IOBC. The final report should contain the following information for each sample: number of specimens of each species; the size, sex and developmental stage of each specimen with notes on morphological anomalies and infestations.
- (5) In the case of new species, all type material should generally be given to IOBC, which will deliver the holotype to the Zoological Survey of India (Indian Museum). The Consultative Committee will formulate rules for the deposition of paratypes. One or more paratypes will be retained in IOBC and will normally not be lent outside the Centre.
- (6) Publication of the results should be given in one of the four official Unesco languages, or should contain a summary in one of these languages. The source of the material should be acknowledged and, if possible, five reprints should be delivered to the IOBC.

Advice on the scientific terms of reference of the Curator
at the IOBC

The Curator shall advise the Director of the IOBC and inform the Consultative Committee on matters regarding the International Collections. He shall train suitable counterparts in the conduct of work on the Collections. He shall execute the instructions of the Consultative Committee on the treatment, loan and further examination of the material in the Collections. In particular, he shall

- (1) supervise and provide training in sorting, cataloguing, data processing and evaluation of the International Collections in accordance with the procedure and programme approved by the Consultative Committee.
- (2) conduct taxonomic and biogeographical studies on the International Collections either independently or together with assistants or research fellows appointed by CSIR.
- (3) correspond with institutions and individuals regarding plankton samples for the IOBC and matters relating to the library, identification keys, etc.
- (4) provide scientific assistance to visiting scientists working on the International Collections.
- (5) assist such international working groups and training courses on plankton as may be sponsored by Unesco and held in the region.
- (6) prepare a booklet on the International Collections and the IOBC in consultation with the Director of IOBC and the Consultative Committee.
- (7) advise national and international institutions with respect to the establishment of similar sorting and taxonomic centres elsewhere.
- (8) maintain scientific contact and collaborate with other institutions and individuals engaged in marine research in the Indian Ocean region.

- (9) prepare an annual report on the current work and scientific results of the International Collections for submission to all countries which provide plankton samples. The Curator shall also find means of informing the donor directly of any outstanding results derived from samples collected by him.

In order to maintain technical efficiency of the sorting and other activities related to the International Collections and to ensure general continuity, it is understood that the Indian authorities will appoint a Deputy Curator.

Annex III

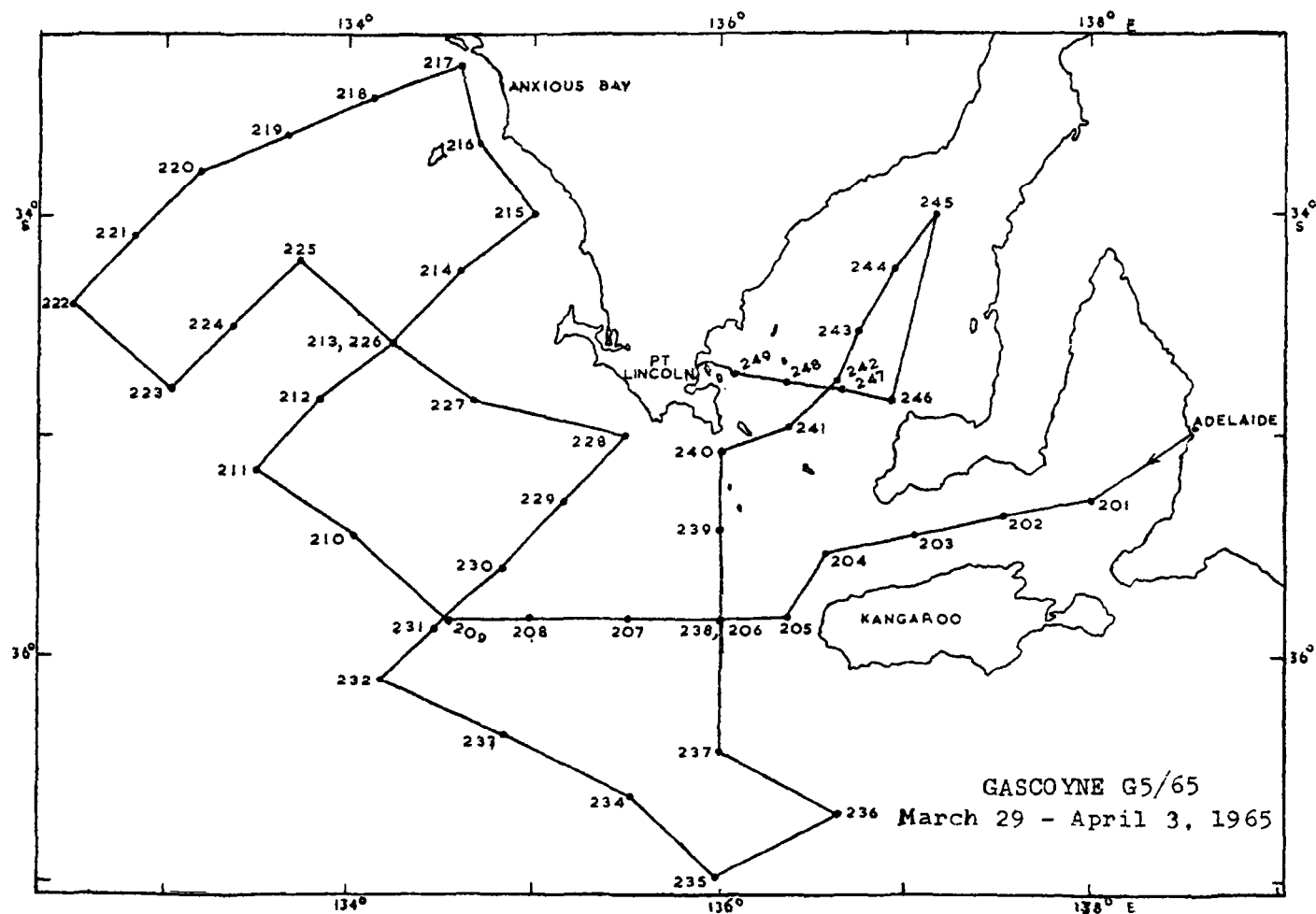
Terms of Reference of the Consultative Committee for the IOBC, as approved by Unesco

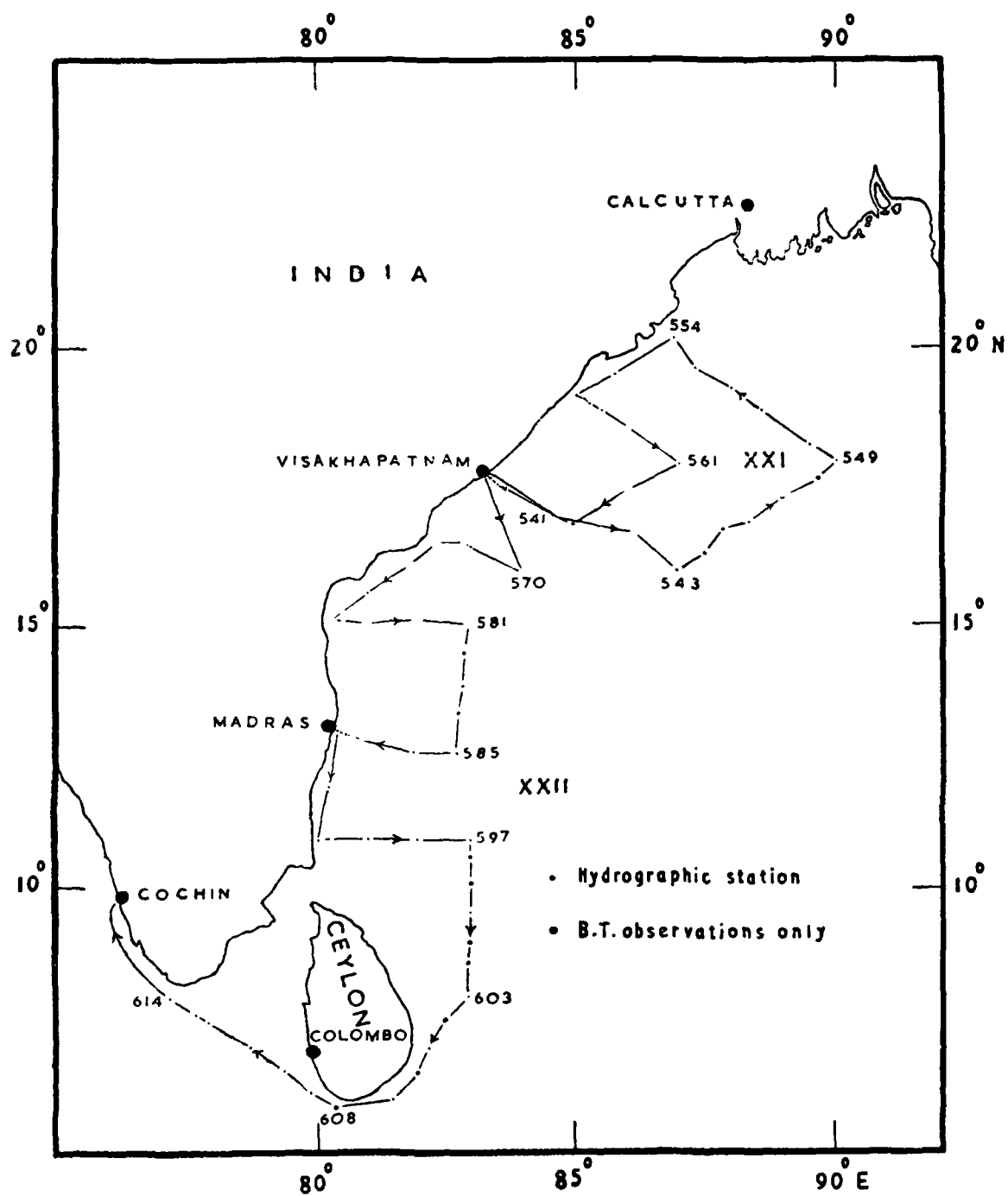
The Consultative Committee for the Indian Ocean Biological Centre shall consist of up to six members who should be experts on plankton, chosen by Unesco on the advice of SCOR. The Committee shall have the following functions:

1. To assume responsibility through the Curator for the treatment, loan, and further examination of the samples constituting the International Collection.¶
 2. To work out a general procedure for the maintenance of the International Collection.
 3. To advise with regard to the presentation of data resulting from the examination of samples received by the Centre.
 4. To have its members give lectures and seminars to the scientific and technical staff of Indian marine science institutions.
-

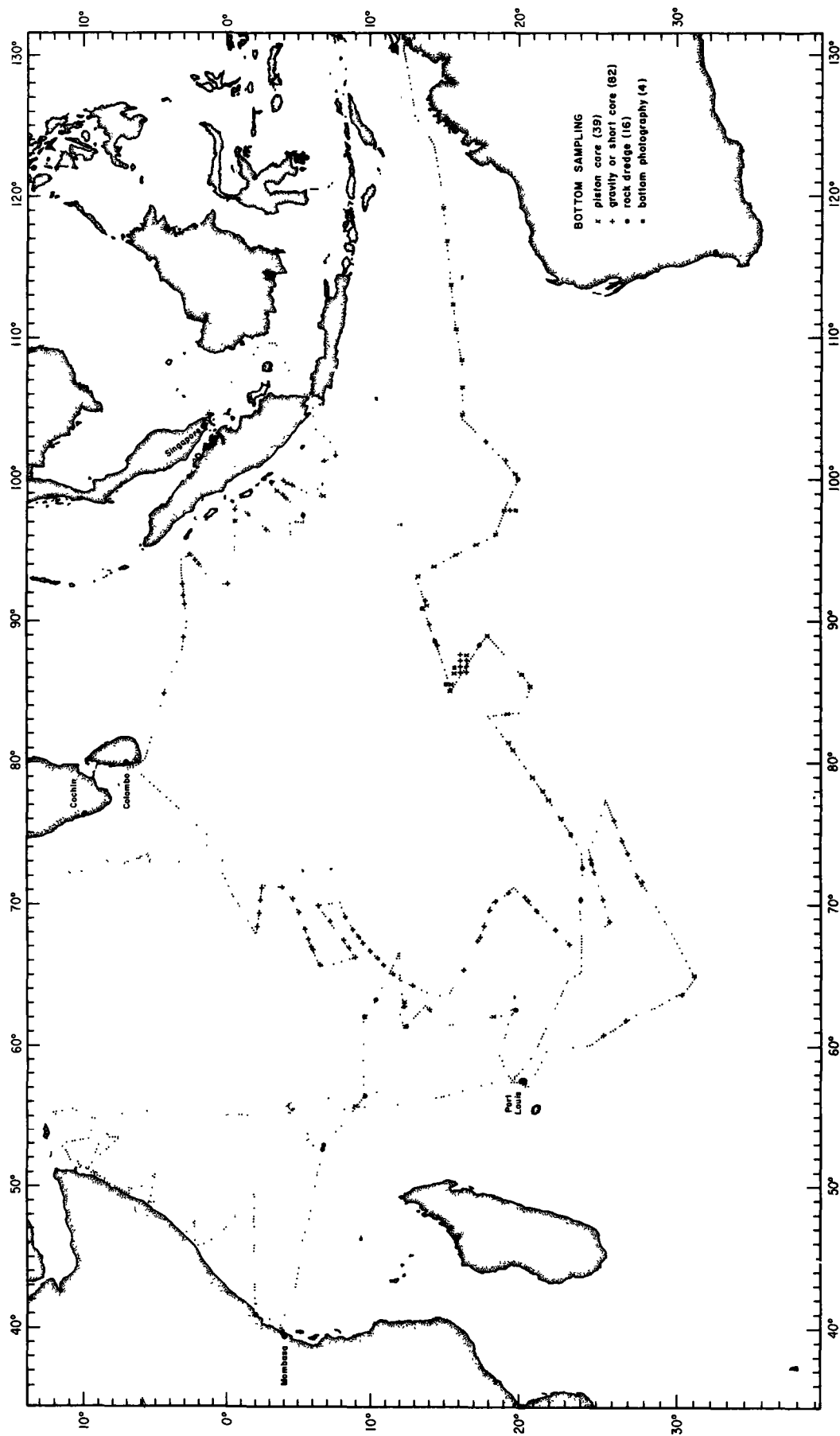
¶ The International Collection is defined as all those plankton samples sent to IOBC by any country during the period and from the area of the IIOE. The International Collection does not include, however, samples sent for contract sorting.

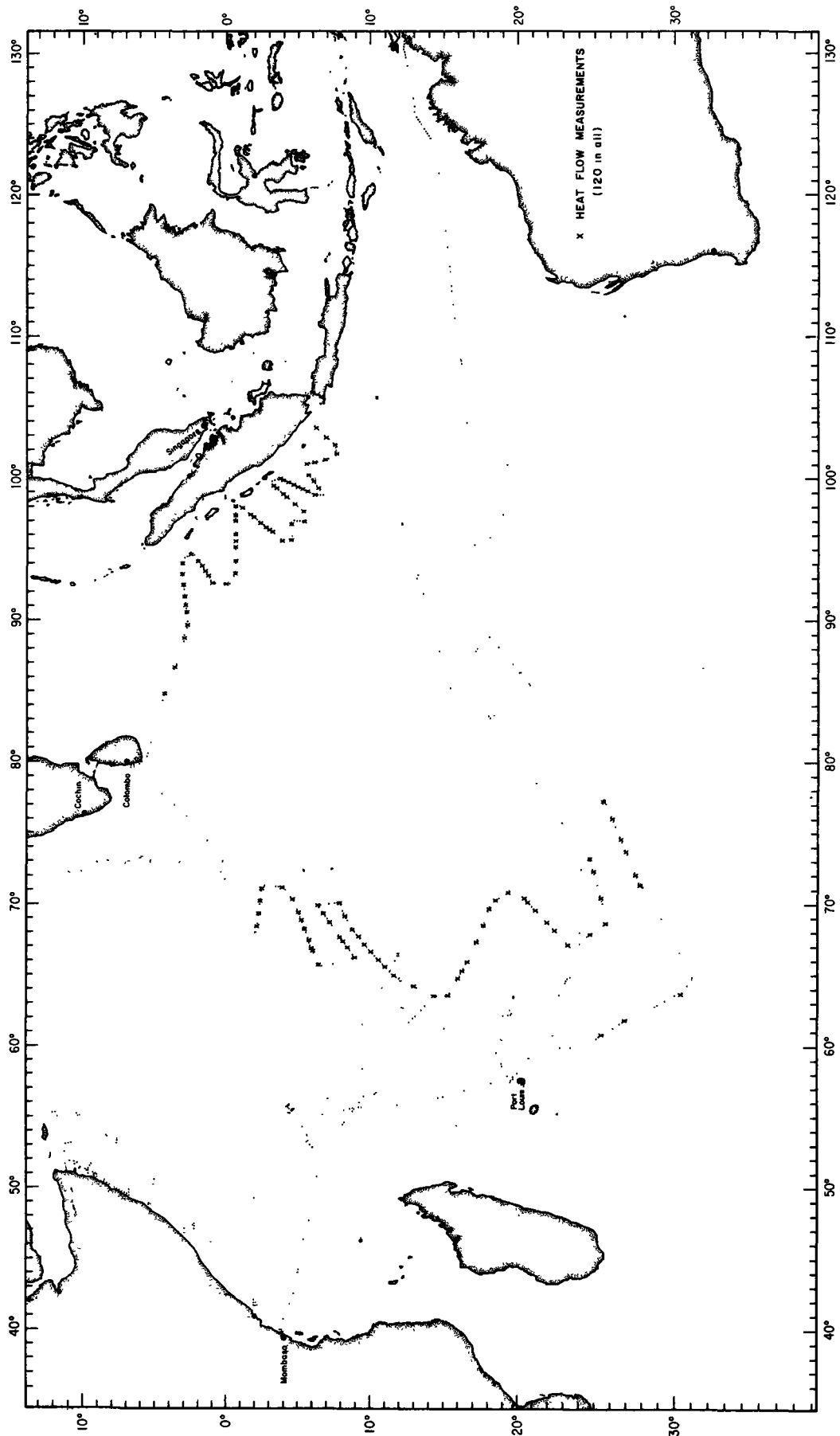
ANNEX IV

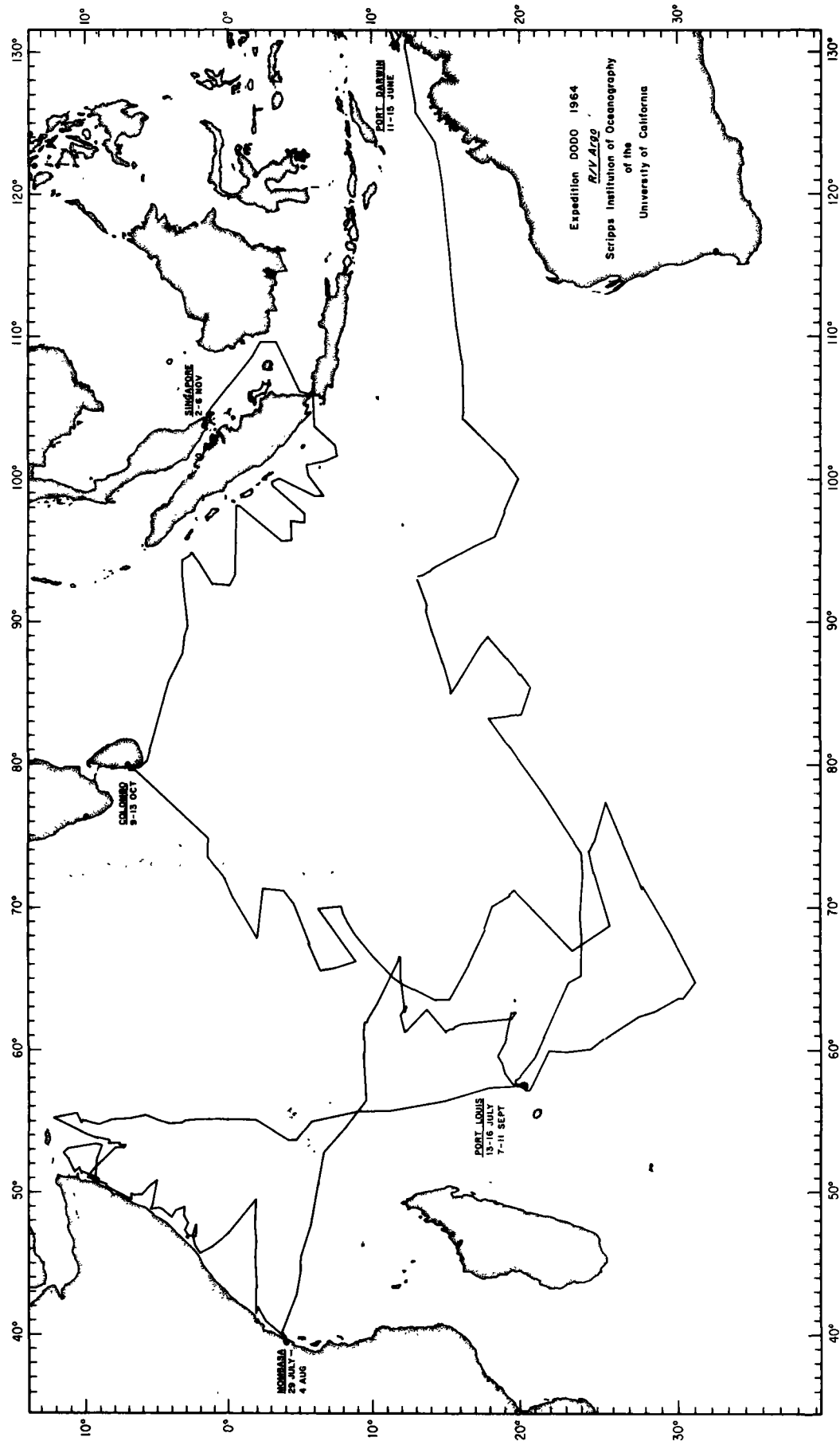


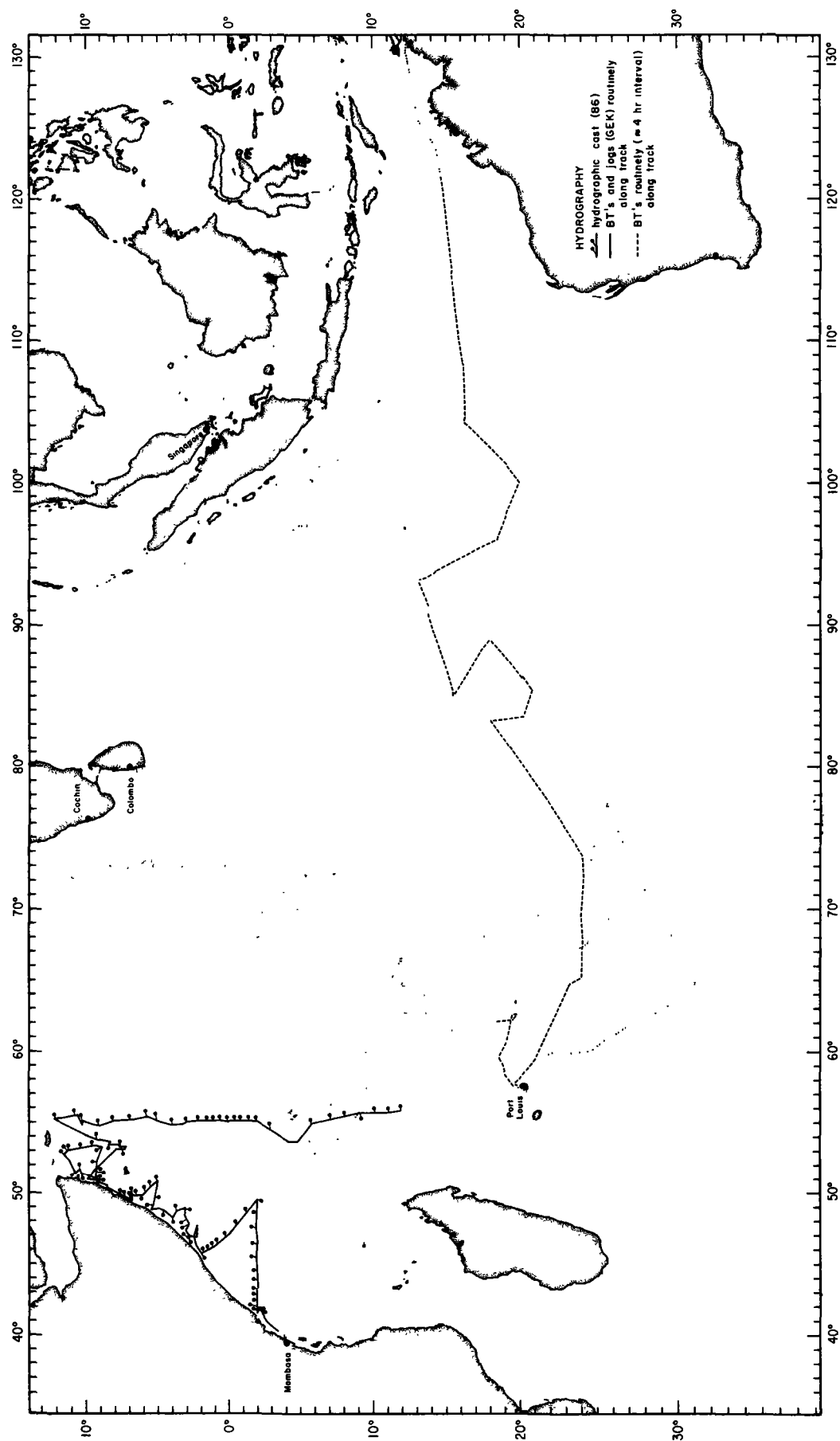


XXI & XXII Cruises of INS Kistna (Jan.-Feb.1965), track with station positions

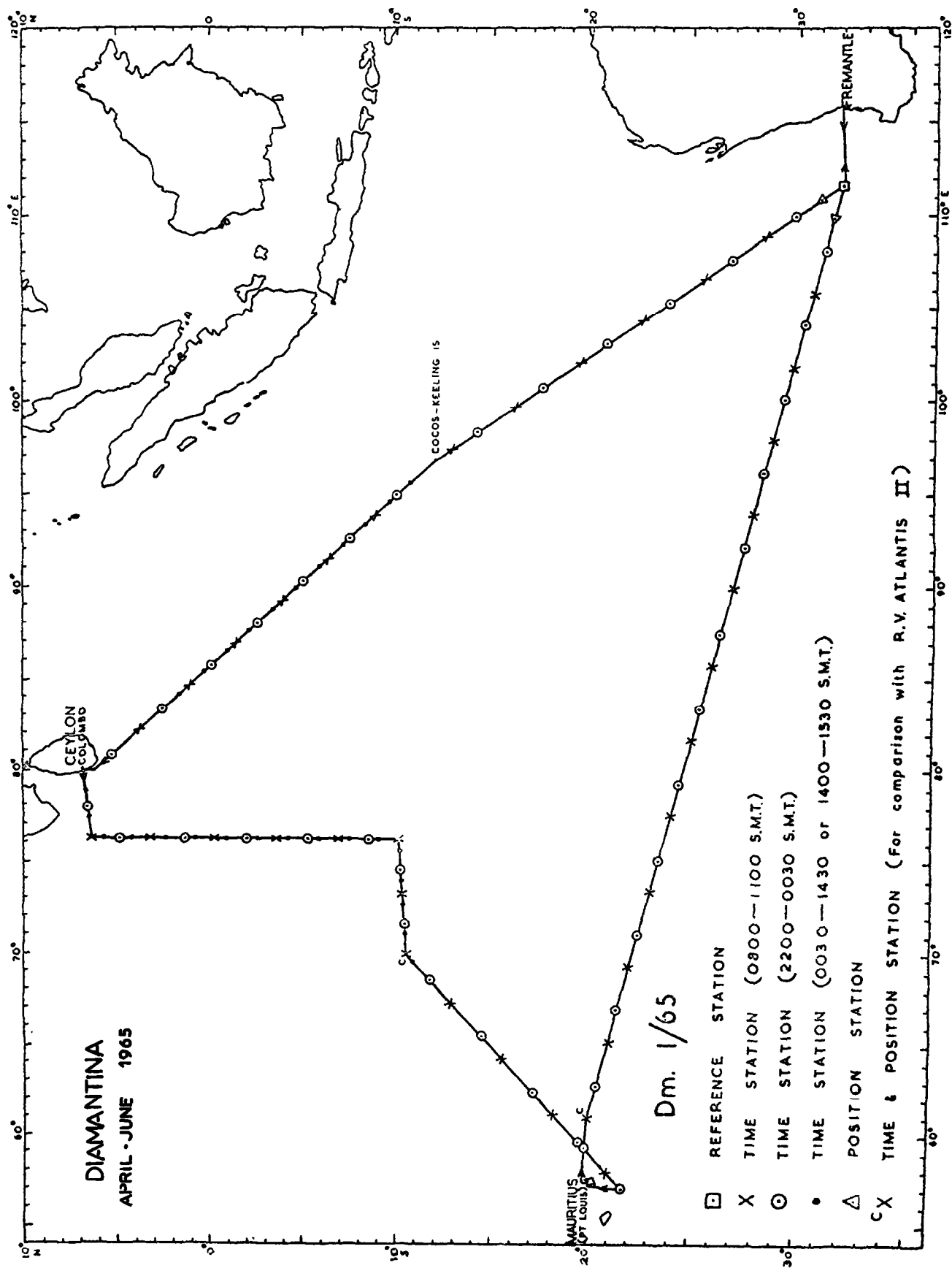








ANNEX V



LIST
OF SPECIALISTS WHO ARE STUDYING THE BOTTOM FAUNA AND FLORA
OF THE INDIAN OCEAN

prepared by Professor L.A. Zenkevitch

1965

	<u>Pages</u>
1. Algae	1-4
2. Protozoa	5
3. Spongia	6
4. Coelenterata	7-8
5. Vermes	9-10
6. Crustacea	11-15
7. Mollusca	16-19
8. Echinodermata	20
9. Other animal groups	21-22
10. General ecology	23-26
Biochemistry	
Physiology	

Aleem, A.A.	Oceanography Dept. Fac. Sci. Univ. Alexandria, Alexandria EGYPT (UAR).	Sea Grasses
Arasaki, Seibin	Fac. Agric. Univ. Tokyo, Tokyo, JAPAN.	Rhodophyceae (Porphyra)
Aziz, Khwaja M.S.	Department Bot. Duke Univ., Durham, North Carolina, U.S.A.	Algae (Acrochaetium)
Chasse, C.	Station biologique Roscoff, FRANCE.	Algues marine (Taxonomie)
Colinvaux, L.N.	Dept. Zoology, Yale University, New Haven, Connecticut, U.S.A.	Chlorophyceae Halimeda
Fucuhara, Eiji	Hokkaido Reg. Fish. Res. Lab., Yoichi, Hokkaido, JAPAN.	Rhodophyceae, (Porphyra)
Funubashi, Setsuo	Fac. Sci., Hokkaido University, Sapporo, JAPAN.	Rhodophyceae Chlorophyceae Phaeophyceae
Hackett, Harold	Dept. Botan., Duke University, Durham, North Carolina, U.S.A.	Systematics- Ecology of Algae
Hasegawa, Yochio	Hokkaido Reg. Fish. Res. Lab. Yoichi, Hokkaido, JAPAN.	Rhodophyceae Phaeophyceae (Laminaria)
Hirano, Minoru	Dept. Lib. Arts, Kyoto Univ., Kyoto, JAPAN.	Chlorophyceae Antarctic Algae
Hirose, Hiroyuki	Fac. Sci. Kobe Univ., Mikage, JAPAN.	Algae (Cyano-, Phaeo-, Rhodophy- ceae)
Chihara, Mitsuo	JAPAN.	Rhodophyceae Chlorophyceae
Inagaki, Kan-ichi	Hokkaido Gakugei University, Iwamisawa School, Iwamisawa, JAPAN.	Phaeophyceae (Chordariales)
Iwamoto, Kozo	Tokyo Univ. Fish., Tokyo, JAPAN.	Chlorophyceae Phaeophyceae (Ectocarpus)

Kamura, Shirtoku	Fac. Lit. Sci. Ryukyu Univ. Naha, Ryukyu, JAPAN.	Rhodophyceae Phaeophyceae Chlorophyceae
Kawabata, Seisaku	Hokkaido Gakugei Univ. Iwamisama, Hokkaido, JAPAN.	Rhodophyceae
Katada, Minoru	Tokyo Univ. Fish. Tokyo, JAPAN.	Rhodophyceae (Porphyra)
Kida, Washiro	Fac. Fish. Prefect. Univ. Mie Tsu, JAPAN.	Chlorophyceae (Monostroma)
Kuroki, Munenao	Tohoku Reg. Fish. Res. Lab. Shiogama, JAPAN.	Rhodophyceae (Porphyra) Phaeophyceae (Undaria)
Lawson, George W.	Botany Dept., University College of Ghana, Legon, GHANA.	Systematics-Ecology of Algae
Masaki, Tomitaro	Fac. Fish, Hokkaido Univ. Hokkaido, JAPAN.	Rhodophyceae (Corallinaceae)
Mc Laughlin, John J.	Haskins Laboratory, 305 East 43rd St., New York 17, New York, U.S.A.	Physiology of Algae
Mikami, Hideo	Sapporo Minami High School, Sapporo, JAPAN.	Rhodophyceae
Miura, Akio	Tokyo Univ. Fish., Tokyo, JAPAN.	Rhodophyceae (Porphyra)
Nakamura, Yoshiteru	Inst. Algol. Hokkaido Univ. Muroran, JAPAN.	Rhodophyceae Phaeophyceae, Chlorophyceae
Nakazawa, Shingo	Fac. Lit. Sci. Yamagata Univ. Yamagata, JAPAN.	Phaeophyceae
Nizamuddin, M.	Dept. Zoology Karachi University, Univ. Campus, Country Club Road, Karachi, PAKISTAN	Taxonomy of Marine Algae
Nodo, Kozo	Fac. Sci. Niigata University, Niigata, JAPAN.	Rhodo-, Phaeo-, Chloro- phyceae
Norris, Richard	U.S. National Museum Smithsonian Institution, Washington D.C., U.S.A.	Algae
Nozawa, Shuji	Fac. Fish. Kagoshima Univ., Kagoshima, JAPAN.	Rhodophyceae, Phaeo- phyceae, Rhodophyceae

Ogata, Eiji	Shimonoseki Univ. Fish Shimonoseki, JAPAN.	Rhodophyceae
Ohmi, Hikoei	Fac. Fish. Hokkaido Univ., Hakodate, JAPAN.	Rhodophyceae (Gracilariaceae)
Okada, Kiichi	Fac. Fish. Nagasaki Univ. Nagasaki, JAPAN.	Cyanophyceae Chlorophyceae
Papenfuss, George F.	Dept. Botany, Univ. California, Berkeley 4, California, U.S.A.	Algae
Saito, Jo	Fac. Fish. Hokkaido Univ., JAPAN.	Rhodophyceae (Laurencia)
Saito, Yunosuke	Exp. Stat. Univ. Tokyo, Shinamaiko, Aichi, JAPAN.	Phaeophyceae (Undaria)
Sakai, Yoshio	Wakkanai Fish. Exp. Stat. Wakkanai, Hokkaido, JAPAN.	Chlorophyceae
Sawada, Takeo	Exp. Stat. Kyushu Univ. Tsuyazaki Fukuoka, JAPAN.	Rhodo-, Chloro-, Phaeophyceae
Scagel, Robert F.	Institute Oceanography, University of British Columbia, Vancouver 8, B.C., CANADA.	Systematics-Ecology of Algae
Segi, Toshio	Fac. Fish. Prefect. Univ. Mie Tsu, JAPAN.	Rhodo-, Phaeo-, Chlorophyceae
Sudo, Shunzo	Tokai Reg. Fish. Res. Lab. Tokyo, JAPAN	Rhodophyceae
Tahara, Masato	648 Ninimiya, Kanagawa, JAPAN	Phaeophyceae
Tahamatsu, Masshiko	Oura, Ouranodatemura, Kamikita- gun, Aomori, JAPAN.	Rhodo-, Phaeo-, Rhodophyceae
Tanaka, Takeshi	Fac. Fish. Kagoshima Univ., Kagoshima, JAPAN.	Rhodophyceae Phaeophyceae
Tatewaki, Masakazu	Inst. Algol., Hokkaido Univ., Muroran, JAPAN.	Chlorophyceae
Taylor, Sylvia	Dept. Bot. Duke University, Durham, North Carolina, U.S.A.	Algae

Tokida, Jun	Fac. Fish. Hokkaido Univ. Hakodate, JAPAN.	Rhodo-, Phaeo-, Chlorophyceae
Tsubota, Hirishi	Fac. Sci., Kobe Univ., Mikage, JAPAN.	Chlorophyceae
Ueda, Samuro	Tokyo Univ. Fish, Tokyo, JAPAN.	Rhodophyceae
Umezaki, Isami	Fac. Agric. Kyoto Univ., Maizuru, JAPAN.	Cyanophyceae
Vozzhinskaya, V.B.	Institute of Oceanology Ac.Sci. USSR, Moscow J-387, Sadovaya 1, USSR.	Phaeophyceae (Sargassaceae)
Watanabe, Atsushi	Inst. Appl. Microbiol. Univ. Tokyo, Tokyo, JAPAN.	Cyanophyceae Chlorophyceae
Yabu, Hirochi	Fac. Fish. Hokkaido Univ., Hakodate, JAPAN.	Rhodophyceae Phaeophyceae
Yamada, Yukio	Fac. Sci. Hokkaido Univ., Sapporo, JAPAN.	Rhodophyceae Phaeophyceae
Yamazaki, Hirochi	Pref. Fish. Exp. Sta. Shizuoka Shimoda, JAPAN.	Rhodophyceae

Bandy, Orville L.	Department of Geology, University of Southern California, Los Angeles, California, U.S.A.	Foraminifera
Berger, Jacques	Department of Zoology, University of Illinois, Urbana, Illinois, U.S.A.	Protozoa, Commensal ciliates
Echols, Ronald	Department of Geology, University of Southern California, Los Angeles, California U.S.A.	Foraminifera
Hay, William	School of Mineral Science, Stanford University, California, U.S.A.	Coccolithophoridae
Morishima, Masao	Fac. Sci. Kyoto Univ., Kyoto, Japan.	Foraminifera (fossil)
Saidova, Kh.M.	Institute of Oceanology, Acad. Sci. USSR, Sadovaya 1, Lublino, Moscow, USSR.	Foraminifera
Sarajini, R.		Foraminifera of bottom sediment
Takayanagy, Yokichi	Fac. Sci. Tohoku Univ., Sendai, Japan.	Foraminifera (fossil)
Thompson, Jesse C.Jr.	Department of Biology, Hampden-Sydney College, Hampden-Sydney, Virginia, U.S.A.	Protozoa Ciliates
Uchio, Takayasu	Fac. Technol. Univ. Tokyo, Tokyo, Japan.	Foraminifera (fossil)

Clemens, W.A.	Department of Zoology, University of British Columbia, Vancouver 8, B.C., Canada.	Spongia
Koltun, V.M.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Spongia
Rutzler, Klaus	I. Zoologisches Institut, Universitat Wien, Dr. Karl Inger-Ring I, Wien I, Austria.	Spongia
Vacelet, T.	Station Marine d'Endoume, rue Batterie des Lions, Marseille 7 ème, France.	Spongia Taxonomie
Tanita, Seji	Japan Sea Reg. Fish. Res. Lab., Niigata, Japan.	Spongia
Wells, Harry W.		Sponges

Cutress, Charles E.	Division of Marine Invertebrates, U.S. Nat. Museum, Smithsonian Institution, Washington 25, D.C., U.S.A.	Anemones
Goreau, Thomas F.	Physiology Department, University College of the West Indies, Mona, Kingston, Brit. West Indies.	Corals
Lowe, T. Peter	U.S.A. National Museum, Washington, D.C., U.S.A.	Corals
Naumov, D.V.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Hydroidea
Pasternak, F.A.	Institute of Oceanologi, Acad. Sci. USSR, Sadovaya I, Lublino, Moscow, J-387, USSR.	Anthipataria Pennatularia Madreporaria
Picard, J.	Station Marine d'Endoume, rue Batterie des Lions, Marseille 7 ème, France.	Hydroidea
Pichon, Michel	Centre d'Océanographic et des Pêches, B.P. 68, Nosi Be, Republique Malgache.	Scleractinia
Rees, W.J.	Department of Zoology, British Museum (Natural History), Cromwell Road, London S.W.7, U.K.	Hydromedusae
Squires, Donald F.	Division of Marine Invertebrates, U.S. National Museum, Washington 25, D.C., U.S.A.	Corals (Ahermatypic forms)

Stepanjanz, S.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Hydroidea
Tixier-Durivault, A.	Laboratoire de Malacologie, Museum National d'Histoire Naturelle, 55 rue de Buffon, Paris 6 ème, France.	Alcionaries
Yamada, Mayumi	Fac. Sci. Hokkaido Univ., Sapporo, Japan.	Hydrozoa

Banse, Karl	Institute für Meereskunde der Universität Kiel, Hohenbergstrasse 2, Kiel, Germany.	Polychaeta
Chapman, Gordon	Biology Department, University of Southern California, Los Angeles, California, U.S.A.	Annelidae
Chekanovskaya, O.V.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Oligochaeta
Hartman, Olga	Department of Biology, University of Southern California, University Park, Los Angeles 7, California, U.S.A.	Polychaeta
Imajima, Minoru	Nat. Sci. Mus. Tokyo, Tokyo, Japan.	Polychaeta
Iwata, Fumio	Fac. Sci. Hokkaido Univ., Sapporo, Japan.	Nemertini
Ingles, W.G.	Department of Zoology, British Museum (Natural History), Cromwell Road, London S.W.7, U.K.	Nematodes
Jagersten, Gosta	Zoologiska Institutionen, Uppsala Universitets, Uppsala, Sweden.	Myzostomida Archianellida
Kato, Kojiro	Fac. Lit. Sci. Saltama Univ., Uzawa, Japan.	Turbellaria
Kirkegaard, Jørgen B.	Zoological Museum, København, Denmark.	Polychaeta

Kirstener, Ernst (Austria)	Universidad de Oriente, Instituto Oceanografico, Cumana, Venezuela.	Nemertina
Knight-Jones, E.W.	Department of Zoology, University College of Swansea, Singleton Park, Swansea, Glamorgan, Wales, U.K.	Serpulidae Piscicolidae
Korotkevitch, V.S.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Nemertini
Levenstein, R.J.	Institute of Oceanology, Acad. Sci. USSR, Sadovaya I, Lublino, Moscow, J-387, Moscow, USSR.	Polychaeta
Murina, V.V.	Institute of the Biology of the South Seas of the Ukr. SSR, Sebastopol, USSR.	Sipunculoidea
Prudhoe, S.	Department of Zoology, British Museum (Natural History), Cromwell Road, London S.W.7, U.K.	Turbellaria Trematoda Cestoda Plathelminthes
Simpson, Margaret	.	Polychaeta
Ushakov, P.V.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Polychaeta
Wieser, Wolfgang	Schrieberweg 43, Viena 19, Austria.	Nematodes
Zenkevitch, L.A.	Institute of Oceanology, Acad. Sci. USSR, Sadovaya I, Lublino, Moscow, USSR.	Echiuroidea

CRUSTACEA

Banner, Albert H.	Department of Zoology, University of Hawaii, Honolulu, 14, Hawaii, U.S.A.	Alpheidae (coral islands)
Barnard, I.L.	Beaudette Foundation for Biological Research, R.F.D. I, Box 482, Solvang, California, U.S.A.	Amphipoda (abyssal)
Benson, Richard H.	Division of Invertebrate Paleontology, Department of Paleobiology, United States National Mus. Smithsonian Institution, Washington 25, D.C., U.S.A.	Ostracoda
Birstein, J.A.	Moscow University, Leninskie Gori, Moscow, U.S.S.R.	Isopoda
Bovbjerg, Richard V.		Penaeidae Pontoniinae Stomatopoda
Brattström, Hans	Biological Station, University of Bergen, Espegrend, Norway.	Cirripedia Ascothoracica
Bruce, Alexander J.	Fisheries Research Station, Island Road, Aberdeen, Hong Kong.	Pontoniid shrimps
Butler, Terrance H.	Pacific Biological Station, Nanaimo, B.C., Canada.	Caridean shrimp (Oplophoridae, Pasiphaeidae, Pandalidae)
Chislenko, L.	Zoological Institute, Acad. Sci. USSR Universitetskaya nab. I, Leningrad, USSR.	Harpacticoidea
Crosnier, A.	Centre d'Océanographie et des Pêches, B.P. 1086, Pointe Noire, République du Congo.	Brachyura
de Freitas, A.J.	Instituto de Investigacao Cientifica de Mocambique, C. Postal 1780, Lourenco Marques. Mozambique.	Peneaidae

Gamo, Shigeo	Jokogama Nat. Univ. Kamakura, Japan.	Cumacea
Garth, John S.	Allan Hancock Foundation, University of Southern California, Los Angeles 7, California, U.S.A.	Brachyura
Gooding, R.U.	Department of Biology, Boston University, Boston, Massachusetts, U.S.A.	Copepods, form associated with invertebrates.
Gurjanova, E.F.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Amphipoda
Haefner, Paul A.		Brachyura
Hanai, Tetsuro	University of Tokyo Geological Institute, Hongo, Tokyo, Japan	Ostracoda
Harding, J.	British Museum of Natural History, Cromwell Road, London, S.W.7. U.K.	Cirripedia
Hay, William W.	see Protozoa	Ostracoda
Hessler, Robert R.	Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, U.S.A.	Cephalocaridae
Holthuis, L.B.	Ryk Museum of Nat. History, Leiden, Holland.	Decapoda Stomatopoda
Hulings, Neil C.	Department of Biology and Geology, Texas Christian University, Fort Worth, Texas, U.S.A.	Ostracoda
Ii, Naoyoshi	Hikone Municipal Office, Hikone, Japan.	Mysidacea
Irfe, Haruhiko	Fac. Fish, Nagasaki Univ. Nagasaki, Japan.	Amphipoda
Iwasa, Masao	Fac. Biol. Seikei Univ., Tokyo, Japan.	Amphipoda
Kaufmann, Reinhard		Pedunculate cirripedes

Kobyakova, L. I.	Leningrad University, Leningrad, U.S.S.R.	Decapoda
Kornicker, Louis J.	Division of Marine Invertebrates, U.S. National Museum, Smithsonian Institution, Washington 25, D.C., U.S.A.	Ostracoda Myodocopa
Kubo, Itsuto	Tokyo Univ. Fish. Tokyo, Japan.	Decapoda Macrura
Kusakin, O.G.	Leningrad University, Leningrad, USSR.	Isopoda (ecology)
Lasiewsky, Robert	Department of Zoology, University of California, Los Angeles 24, California, U.S.A.	Crabs (physiology)
Lomakina, N.B.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I Leningrad, USSR.	Cumacea
Maddocks, Rosalie F.	Department of Geology, University of Kansas, Lawrence, Kansas, U.S.A.	Ostracoda
Manning, Raymond B.	Division of Marine Invertebrates, Smithsonian Institution, U.S. National Museum, Washington, 25, D.C., U.S.A.	Stomatopoda (adult)
McHardy, Robert A.	Institute of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada.	Ostracoda
Miyake, Sadayoshi	Fac. Agric. Kyushu Univ. Fukuoka, Japan.	Anomura
Nagata, Kizo	Inland Sea Reg. Fish. Res. Lab., Hiroshima, Japan.	Amphipoda (Gammaridea)
Pasternak, R.K.	Moscow University, Leninskie Gori, Moscow, U.S.S.R.	Tanaidacea
Por, Francis D.	Department of Zoology, Hebrew University, Jerusalem, Israel.	Copepoda Harpacticoida
Rudjakov, J.A.	Institute of Oceanology, Acad. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Ostracoda

Sakai, Tsune	Yokogama Nat. Univ. Kamakura, Japan.	Brachyura
Sanders, Howard	Woods Hole Oceanographic Inst. Woods Hole, Massachusetts, U.S.A.	Cephalocarida
Starobogatov, J.I.	see Mollusca	Decapoda
Steel, Donald H.	Department of Biology, Memorial University of Newfoundland, St. John's, Newfoundland, Canada.	Amphipoda
Stock, Jan H.	Zoologisch Museum, Plantage Middenlaan 53, Amsterdam, Netherlands.	Copepoda
Swain, Frederick M.	University of Minnesota, Institute of Technology, School of Earth Sciences, Department of Geology and Geophysics, Minneapolis, Minn. 55455, U.S.A.	Ostracoda
Townsley, Sidney J.	University of Hawaii, Honolulu, Hawaii, U.S.A.	Stomatopoda, Gall crab, Hapalo- carcinidae
Tirmizi, N.	Department of Zoology, Karachi University, University Campus, Country Club Road, Karachi, Pakistan.	Shrimps and Prawns
Tsurita, Arai	Shimonoeki Univ. Fish. Shimonoeki, Japan.	Amphipoda
Tulkki, Paavo	Zoological Institute, University of Turku, Turku, Finland.	Crustacea living among littoral algae
Utinomi, Huzio	Seto Mar. Biol. Lab. Shirahama, Wakayama, Japan	Cirripedia
Vagin, V.L.	University of Kasan, Kasan, USSR.	Ascothoracidae
Vinogradov, L.G.	All-Union Res. Inst. of Marine Fisheries and Oceanography, Krasnoselskaja 17, Moscow, USSR.	Decapoda

Wass, Marvin L.	Virginia Institute of Marine Sciences, Gloucester Point, Virginia, U.S.A.	Paguridae
Wells, Harry W.		Pinnotheridae crabs
Wells, J.B.J.	Nat. History Department, Marischal College, Aberdeen Univ., Aberdeen, Scotland, U.K.	Crustacea meiobenthic Harpacticida
Joubert, L.	Oceanographic Res. Inst. P.O. Box 736, Durban, Republic of South Africa.	Penaeidae (Decapoda)
Zarenkov, N.A.	Moscow University, Leninskie Gori, Moscow, USSR.	Decapoda
Zevina, G.B.	Inst. of Oceanology, Acad. Sci, USSR, Lublino, Sadovaya I, Moscow, USSR.	Cirripedia
Zullo, V.A.	Marine Biolog. Lab. Woods Hole, Massachusetts, U.S.A.	Cirripedia

Abbott, R. Tucker	Department of Molluscs, Academy of Natural Sciences of Philadelphia, 19th and the Parkway, Philadelphia, Pennsylvania, U.S.A.	Mollusca
Aldrich, Frederick A.	Department of Limnology, Academy of Natural Sciences, Philadelphia 3, Penn., U.S.A.	Pelecypoda Unionidae
Allen, J.A.	Doke Marine Laboratory, University of Newcastle-upon-Tyne, Cullercoats, North Shields, Northumberland, U.K.	Bivalvia
Baba, Kikutaro	Fac. Biol. Osaka Gakugei Universitet, Osaka, Japan.	Nudibranchia
Barsanova, N.G.	Institute of Oceanology of the Academy of Sciences of the USSR, Lublino, Sadovaya I, USSR.	Trochidae
Boss, Kenneth J.	Ichthyological Laboratory, Bureau of Commercial Fisheries, U.S. National Museum, Washington 25, D.C., U.S.A.	Molluscs
Chamberlin, T. Lockwood	509 Franklin Street, Alexandria, Va., U.S.A.	Bivalvia
Filatova, Z.A.	Institute of Oceanology, Acad. Sci. USSR. Lublino, Sadovaya I, Moscow J-387, USSR.	Bivalvia
Foster, Richard	Museum of Comparative Zoology Harvard University, Boston, Massachusetts, U.S.A.	Mollusca
Galkin, Y. I.	Murmansk, Marine Biological Institute, Acad. Sci. USSR, Dalnie Zelentzi, USSR.	Mollusca

Golikov, A.N.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Gastropoda
Habe, Ioshine	Suzugamine Women's Coll., Niroshima, Japan.	Gastropoda Pelecypoda Scaphopoda
Haefner, Paul A. Tr.	see Crustacea	Cephalopoda
Horoicoshi, Masuyo	Ocean. Res. Institut, University Tokyo, Tokyo, Japan.	Neogastropoda
Jakovleva, A.M.	Tshernovtsi Medical Institut. Tshernovtsi, USSR.	Amphineura
Kohu, Alan T.	Department of Biological Sciences, Florida State University, Tallahassee, Fla., U.S.A.	Gastropoda (gen. Conus)
Kuroda, Tokurei	Fac. Sci., Kyoto University, Kyoto, Japan.	Gastropoda Pelecypoda Scaphopoda Amphineura
Lassig, Julius		Bivalvia
Lemche, Henning	Zoologisk Museum, Kristalgade 27, Kopenhagen K, Denmark.	Opisthobranchia
Lus, V.J.	Institute of Oceanology, Acad. Sci. USSR, Lublino, Sadovaya I, Moscow J-387, USSR.	Gastropoda
Macnea, W.	Department of Zoology, Witwatersrand University, Johannesburg, Rep. of South Africa.	Nudibranchia Tectibranchia

Mars, P.	Laboratoire de Biologie Animale, Faculte des Sciences, Place Victor Hugo, Marseille 1er, France.	Molluscs Taxonomy
Masuda, Koichiro	Tochoku Univ., Kawauchi School, Sendai, Japan.	Pelecypoda Pectinidae Veneridae
Minitchev, Y.S.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab I, Leningrad, USSR.	Opisthobranchia
Mizuno, Atsuvuki	Inst. Geol. Survey, Ichigata-Kawadacho, Shinjukaku, Tokio, Japan.	Pelecypoda Taxodonta Teleodonta
Moskalev, L.I.	Institute of Oceanology, Acad. Sci. USSR, Lublino, Sadovaya 1, Moscow, USSR.	Patellacea
Odaka, Tamio	Fac. Sci. Tohoku Univ. Sendai, Japan.	Mollusca (fossil)
Orr, Virginia	Acad. Nat. Sci. of Philadelphia, 19th and the Parkway, Philadelphia, Pennsylvania, USSR.	Mollusca
Oyama, Katsura	Inst. Geol. Survey, Ichigaga-Kawudacho, Shinjukuku, Tokyo, Japan.	Gastropoda Stenoglossa Bivalvia Anisomyaria
Parker, Robert H.	Marine Biological Laboratory, Woods Hole, Massachusetts, U.S.A.	Mollusca (deep-sea)
Ranjha, A.R.	Zoological Survey of Pakistan, Fish Harbour, West Wharf, Karachi, Pakistan.	Mollusca

Robertson, Robert	Acad. Nat. Sci. of Philadelphia, 19th and the Parkway, Philadelphia, Penn., U.S.A.	Mollusca
Rosewater, Joseph	Division of Molluscs, U.S. National Museum, Washington 25, D.C., U.S.A.	Mollusca
Russell, Henry D.	Boston University, Boston 15, Mass., U.S.A.	Mollusca of coral reefs
Skarlato, O.A.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Mollusca
Starobogatov, J.I.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab. I, Leningrad, USSR.	Mollusca
Taki, Iwao	Fac. Fish. Animal. Husb. Hiroshima Univ., Fukuyama, Japan.	Cephalopoda Nautiloidea Amphineura
Townsley, Sidney J.	see Crustacea	Cephalopoda
Vicente, N.	Lab. de Biologie Animale, Fac. des Sci., Place Victor Hugo, Marseille 1er, France.	Opisthobranchia Molluscs Taxonomy
Vokes, Harold E.	Department of Geology, Tulane University, New Orleans, Louisiana, U.S.A.	Mollusca
Voss, G.	Marine Laboratory, Rickenbacker Causeway, Miami, Florida, U.S.A.	Cephalopoda

ECHINODERMATA

Aldrich, Frederick A.	see Mollusca.	Asteroidea
Baranova, Z. I.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab I, Leningrad, USSR.	Echinodermata
Belyaev, G.M.	Institute of Oceanology, Acad. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Echinodermata (deep-sea)
Cherbonnier, G.	Laboratoire de Malacologie, Museum National d'Histoire Naturelle, 55 rue de Buffon, Paris 6 ème, France.	Holothuroidea
Clark, A.M.	British Museum of Natural History, Cromwell Road, London S.W.7, U.K.	Asteroidea Ophiuroidea Crinoidea
Grusov, E.N.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab I, Leningrad, USSR.	Asteroidea
Harrison, Gladys	Woods Hole Oceanographic Institute, Woods Hole, Massachusetts, U.S.A.	Echinoderms (physiology)
Hayashi, Ryoji	Fac. Sci. Toyama Univ., Toyama, Japan.	Asteroidea
Murakami, Shiro	Inland Sea Reg. Fish Res. Lab., Hiroshima, Japan.	Ophiuroidea
Ziesenhenné, Fred. C.	University of Southern California, Los Angeles, California, U.S.A.	Asteroidea Ophiuroidea Echinoidea

Androsova, E.I.	Zoological Institute, Acad. Sci. USSR, Universitetskaya nab I, USSR.	Bryozoa
Cook J.A.Z.	Dept. Zool. Univ. Museum, Oxford, U.K.	Pycnogonida
Cutler, Edward B.	Biolog. Dept. Lynchburg College, Lynchburg, Virginia, USA.	Pogonophora
Higgins, Robert P.	Dept. Biolog. Wake Forest College, Winston-Salem, N.C., U.S.A.	Kinirhynchs
Howard, Robert S.	Dept. Biolog. Sci. Univ. Delamare, Newark, Del., USA.	Intertidal Bryozoa
Ivanov, A.V.	Zoolog. Instit. Ac. Sci. USSR, Universitetskaya nab I, Leningrad, USSR.	Pogonophora
Jägersten, Gösta	Zoolog. Inst. University of Uppsala, Uppsala, Sweden .	Metazoa Myzostomida Pogonophora
Lozina-Lozinsky V.V.	Zoolog. Inst. Ac. Sci. USSR, Universitetskaya nab I, USSR.	Pycnogonidae
Mawatari, Shizuo	Inst. Natural Resources, Tokyo, Japan.	Bryozoa
Millar, R.H.	Marine Station, Millport, Scotland, U.K.	Ascidia
Okada, Yaichiro	Inst. Fish. Tokai Univ., Shizuoka, Japan.	Bryozoa
Pierce, E. Lowe	Dept. Biol. Univ. of Florida, Gainesville, Florida, USA.	Acrania
Rogich, Mary Dora	25 Prospect Street, Apt. I-K, New Rochelle, N.Y., U.S.A.	Bryozoa

Soule, John D.	University of South California, Los Angeles 7, California, U.S.A.	Bryozoa
Stock, Jan H.	see Crustacea	Pycnogonidae
Tokioka, Takasi	Seto Mar. Biol. Lab. Shirahanca, Wakayama, Japan.	Tunicata
Toriumi, Chu	Asamushi Mar. Biol. Sta. Asamushi, Aomori, Japan.	Bryozoa
Turpaeva, E.P.	Inst. Oceanol. Ac. Sci. USSR, Lublino, Sadovaya 1, Moscow, USSR.	Pycnogonodae Ecology
Vasseur P.	Station Marine de Tulear, B.P. 141, Tulear, Republique Malgache.	Ascidia, Bionomie, Benthique, Ecology.
Vinogradova N.G.	Inst. Oceanol. Ac. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Ascidia
Webb, J.E.	Dept. Zool. Westfield Col., London , U.K.	Acrania
Webb, M.	University College, Salisbury Island, Durban, Rep. of South Africa.	Pogonophora
Zezina, O.N.	Inst. Oceanol. Ac. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Brachiopoda
Zinn, Donald J.	Univ. Rhode Island, Dept. Zool., Kingston, R.I., USA.	Ascidia

GENERAL ECOLOGY

Baerends, G.P.	Zoologisch Laboratorium, Rijksstraat weg 78 Haren (Gron.) Netherlands.	Coral reef animals coral reef
Bennett, Isobel	University of Sydney, Sydney, N.S.W., Australia.	Intertidal ecology coral reef
Bovbjerg, Richard V.		Littoral fauna
Buscemi, Philip A.		Zoogeography
Cieresz, Leon	Dept. Chemistry, University Oklahoma, Norman, Oklahoma, U.S.A.	Biochemistry (invertebrates)
Derijard R.	Station Marine de Tulear, B.P. 141 Tulear, Republique Malgache.	Bionomie Benthique Ecologie, Littoral, Mangrove
Dolgopolskaya M.A.	Institute Biology South Seas of USSR, Sebastopol, USSR.	Ecology
Gordeev, O.M.	Inst. Biol. South Seas USSR, Sebastopol, USSR.	Ecology
Graufin, Arden R.	Dept. Zool. University of Utah, Salt Lake, Utah, USA.	Bottom fauna of island or coastal streams
Gilat (Gottlieb) Eliezer		Ecology of benthic animals communities
Greze, I.I.	Inst. Biol. South Seas USSR, Sebastopol, USSR.	Ecology
Gross, Warren	Division of Life Sciences, University of California, Riverside, California, USA.	Physiology: crabs
Grusov, E.N.	see Echinodermata	Methods of investigation
Gurjanova, E.F.	see Crustacea	Ecology, littoral
Ingle, Robert M.	Tallahassee, Fla., USA .	Invertebrates of commercial value.

Jacquotte R.	Station Marine de Tulear, B.P., 141 Tulear, Republique Malgache.	Bionomie Benthique Ecology
Kiselyova, M.I.	Inst. Biology South Seas USSR, Sebastopol, USSR.	Ecology
Kristensen, Ingvar		Shore fauna of coral reef
Kuznetzov, A.P.	Institute of Oceanol. Ac. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Ecology
Ledoyer, M.	Station Marine d'Endoume, rue Batterie des Lions, Marseille 7 ème, France.	Bionomie Benthique Ecology
McIntyre, A.D.	Dept. Agric. Fish. for Scotland, Marine Laboratory, P.O. Box 101, Victoria Road, Torry, Aberdeen, Scotland, U.K.	Macro- and meiso- benthos of the Arabian Sea
Makkaveeva, E.B.	Inst. Biol. South Seas USSR, Sebastopol, USSR.	Ecology
Marshall, Nelson		Ecology coral reef
Mokyevesky, O.B.	Inst. Oceanol., Ac. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Intertidal Ecology coral reef
Molinier, Roger	Laboratoire de Biologie Vegetale, Faculte des Sciences, Place Victor Hugo, Marseille 1er, France.	Phanerogames marines Taxonomie Physiologie
Neiman, A.A.	All-Union Research Institute of Marine Fisheries and Oceanography, Krasnoselskaya, 17, Moscow, USSR.	Ecology
Nessis, K.N.	Polar Research Institute of Marine Fisheries and Oceanography, Murmansk, USSR.	Ecology

Odum, Eugene P.	Dept. of Zoology, University of Georgia, Athens, Georgia, U.S.A.	Coral reef (coral-algae)
Peres, J.M.	Station Marine d'Endoume et Centre d'Océanographie, Fac. Sci., Marseille, Rue de la Batterie des Lions, Marseille 7 ème, France.	Benthic fauna
Qadri, M.A.H.	Dean, Faculty of Science, Karachi University, Univ. Campus, Country Club Road, Karachi, Pakistan.	Zoogeography
Parker, Robert H.	see Mollusca.	Ecology
Picard J.	see Coelenterata.	Bionomie Benthique Ecologie
Pichon Mireille	Centre d'Océanographie et des Pêches, B.P., Nosy Be, République Malgache.	Bionomie Benthique Ecologie, Littoral
Pierce, E. Lowe	Dept. Biol. Univ. Florida, Gainesville, Florida, USA.	Coral reef
Plante, R.	Centre d'Océanographie O.R.S.T.O.M. 24 rue Bayard, Paris 8 ème, France.	Bionomie Benthique Ecology, Littoral
Reys, J.P.	Station Marine d'Endoume, rue Batterie des Lions, Marseille 7 ème, France.	Etudes Benthiques Quantitative
Savilov, A.I.	Inst. Oceanol. Ac. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Pleuston
Schelema, Rudolf S.		Littoral fauna
Socolova, M.N.	Inst. Oceanol. Ac. Sc. USSR, Moscow, Lublino, Sadovaya I, USSR.	Tropical investigation

Tufail, M.	Dept. Zoology, Karachi University, University Campus, Country Club Road, Karachi, Pakistan.	Shore Ecology
Vilenkyn, B.J.	Inst. Biol. South Seas, USSR, Sebastopol, USSR.	Ecology
Vinogradova, N.G.	Inst. Oceanol. Ac. Sci. USSR, Lublino, Sadovaya I, Moscow, USSR.	Zoogeography
Zenkevitch, L.A.	see other animal groups	Quantitative distribution of the bottom fauna
Banse, Karl	see Vermes	Primary productivity
Belyaev, G.M.	see Echinodermata	Quantitative distribution of benthos

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intergovernmental oceanographic commission

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FOREWORD

During the Fourth Session of the Intergovernmental Oceanographic Commission, which took place in Paris from 3 to 12 November 1965, the ad hoc Co-ordination Group for the IIOE met to discuss the preparation of the IIOE Atlases. Following the recommendations of this ad hoc Group, the Commission approved the proposals presented for Atlases by Dr. C. Ramage (Meteorology of the Indian Ocean), Dr. K. Wyrski (Physical and Chemical Oceanography of the Indian Ocean) Dr. G.B. Udintsev (Geology and Geophysics of the Indian Ocean) and Dr. J. Krey (Chemical Biology of the Indian Ocean). The authors of these proposals were officially appointed as Chairmen of the respective Editorial Boards established by the Commission. Full information on the Commission's work in connexion with the IIOE will be given in the next issue of this Information Paper.

Even now, this and the following issues of the Information Paper will be printed after the official close of the expedition. The IIOE symbol - two arrows on a background of sea and sky - which so many of our readers have become accustomed to see on the pennants of their research ships, will now reappear on the volumes of data reports and scientific publications.

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Unesco Office of Oceanography
Paris, December 1965