

information
paper



Intergovernmental oceanographic commission

18

UNESCO/NS/IOC/INF - 118

FOREWORD

Relevant information which has been accumulated by the Office of Oceanography since the publication of the previous IIOE Information Paper is incorporated in this present issue - IIOE Information Paper No. 18. Most of this information concerns the preparation of IIOE Atlases and Data Reports, as these are the domains requiring internationally co-ordinated action following the termination of official ship operations.

Pertinent material for the IIOE Information Paper is becoming scarce and, so as to avoid delay in its dissemination, such information will now be printed separately upon receipt for immediate despatch. Consequently, this issue - IIOE Information Paper No. 18 - will be the last in the present form.

26 SEPT 1967

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Unesco Office of Oceanography
Paris, September 1967

IIOE INFORMATION PAPER NO. 18

1. Action taken by IOC

The seventh meeting of the Bureau and Consultative Council was held in Monaco, from 30 January to 2 February 1967.

Item 4 (c) - IIOE Atlases, Indian Ocean Biological Centre, and IIOE Data Reports - was an item of particular interest to the Expedition. The following is an extract from the summary report of the meeting.

Item 4 Co-operative Expeditions

...

(c) IIOE Atlases, Indian Ocean Biological Centre, and IIOE Data Reports

The discussion centred around the difficulties which atlas-makers encountered in attempting to adopt a certain common projection and scale for the most important charts of their atlases in order to ensure their intercomparability. The Vice-Chairman, Rear-Admiral Langeraar, proposed that, in future, for any co-operative study, a common projection and a common scale for the presentation of the final results in the form of atlases should be agreed in advance. It was also realised that, without knowing exactly what charts, and in which projections, are contained in the atlases presently under preparation, it is impossible to recommend which charts should preferably be re-plotted and repeated in other atlases for the purposes of intercomparison. The Bureau therefore recommended the following:

Rec. 7.15 ... The Bureau requested the Secretary to obtain from the Editors of the IIOE Atlases the tables of contents of ~~their~~ respective atlases with indications of the projections and scales used for each specific chart. This information should be presented to the Fifth Session of the IOC for consideration of the necessary steps to be taken to ensure the comparability of these atlases.

Rec. 7.16 ... The Bureau recommends that, in the future, the publication in the form of atlases of scientific data resulting from the co-operative expeditions of the IOC should be a subject of thorough discussion by the Commission during the initial planning stage, at which stage a proposal should be made concerning the projection or projections, scales, and the modality of presentation of the material in the planned atlases.

The Bureau and Consultative Council discussed very briefly the progress with publishing IIOE Data Reports by participating countries and the development of work on the International Collection at the IOBC. The Secretary informed the meeting that, so far, a number of national reports containing IIOE data have been received from the United States and the United Kingdom. All these reports were distributed to IIOE National Co-ordinators. The Secretary also indicated that a long-term agreement between Unesco and CSIR, India, was about to be signed* with respect to maintenance of the International Collection and Unesco's responsibility for distributing samples of this collection to scientists recommended by the Consultative Committee. The Bureau decided to stress the importance of this work in the following two recommendations:

Rec. 7.17 ... The Bureau urges the Member States who participated in the International Indian Ocean Expedition to report to the IOC Secretariat on the efforts they undertook to publish their national data collected within the framework of the Expedition and to make available to the IOC Secretariat copies of these publications for further distribution to all the other participating countries as recommended by Resolution IV-3 of the Commission.

Rec. 7.18 ... The Bureau believes that the great importance which the Indian Ocean Biological Centre has had in developing marine biology in the Indian Ocean region is due to the close collaboration which has been formed between Indian institutions, the Consultative Committee of the IOBC, and the Office of Oceanography of Unesco.

* It was signed on 10 February 1967

The Bureau recommends strongly that this collaboration continue, particularly by a member of the Office of Oceanography being present at all meetings of the Consultative Committee and by this Committee having added to its terms of reference the ability to recommend to the Director-General of Unesco which scientists should receive samples from the IOBC International Collection.

...

2. Recent action taken by SCOR

The Executive Committee of SCOR met at Jerusalem from 6 to 8 February 1967. In connection with relations with IBP, the problem of holding a symposium on the biological results of IIOE was discussed. A pertinent part of the Proceedings of the SCOR meeting is reproduced below.

IIOE Symposium.

The following resolution was adopted by the Second Meeting of the IBP/PM Sectional Committee (Paris, April 1966):

"The IBP/PM Committee notes widespread interest in the IBP/PM results of the International Indian Ocean Expeditions and realises that at present many of the results are not yet sufficiently advanced to permit a comprehensive presentation at the Second International Oceanographic Congress. The Committee would thus welcome consideration by SCOR and IOC/UNESCO of a symposium on the biological results of the International Indian Ocean Expedition and suggests early 1969 as an appropriate time. If this suggestion is acted upon favourably, the IBP/PM Committee would be pleased to participate and co-sponsor the symposium. Considering the applications of the results of the International Indian Ocean Expeditions for the development of fisheries of the region, the participation of FAO and the Indo-Pacific Fisheries Council in a symposium of this kind seems most desirable."

This proposal was considered by the ACMRR which recommended that its Secretariat maintain contact with IBP and other potential sponsoring organisations, and that FAO be advised to offer support for such a symposium in case it could be arranged for it to also include fishery resources appraisal as a special objective, and that UNESCO/IOC be informed accordingly and their co-sponsorship solicited.

The Executive Committee agreed that it would be appropriate to hold a symposium on the biological results of the International

Indian Ocean Expedition in early 1969, and welcomed the interest of UNESCO and FAO in making this possible. It was decided to request Dr. Humphrey to act on behalf of SCOR and in co-operation with other interested parties to develop more detailed plans for the organization of this symposium.

3. The fourth meeting of ACMRR

The meeting was held at FAO Headquarters, Rome, from 16 to 21 January 1967. Two agenda items were of particular interest to the Expedition. Pertinent parts of the summary report are reproduced below:

5.6.1 Symposium on the Biological Results of the IIOE

At the IBP/PM Sectional Committee Meeting (Paris, April 1966), the Sectional Committee resolved to take steps to initiate a Symposium some time in 1969 on the biological results of the International Indian Ocean Expedition, and requested suggestions on this proposal from SCOR and UNESCO/IOC, and also the support of FAO and IPFC. Consultations by correspondence followed among the organisations concerned. Noting the interesting plans for a symposium on the Indian Ocean being organised by NISI and INCOR to be held in New Delhi, March 1967, the Committee considered that advantage should be taken to discuss further the IBP proposal. The Committee was informed that UNESCO would not be able to consider supporting the IBP symposium before 1968/69, while SCOR had not yet had time to consider this suggestion. In discussing the proposal some members expressed the view that the proposed IBP symposium on the biological results of the IIOE should concentrate on a selected area, for example, the Arabian Sea. The Committee recommended that the Secretariat maintain contact with IBP and other potential sponsoring organisations, and that FAO be advised to offer support for such a symposium in case it could be arranged for it to also include fishery resources appraisal as a special objective, and that UNESCO/IOC be informed accordingly and their co-sponsorship solicited.

6.3.1 IIOE Fisheries Atlases

The Secretary informed the Committee that due to the sudden death, by accident, of Dr. H. Einarsson (working in the UNDP Special Fund Project in the Federation of South Arabia), it was necessary to reconsider the proposal made by ACMRR and transmitted by FAO to IOC for Dr. Einarsson to act as editor of the IIOE Fisheries Atlases. As a result of correspondence and direct consultations between Dr. Einarsson and the IOC Secretariat, two atlases are envisaged to cover (i) species of marine importance, and (ii) species of general zoological interest. The IOC Secretary reported on the progress of work on the other atlases.

The Committee heard with interest of the work of the IPFC in preparing, under the guidance of Dr. G. Kesteven, a manual on the fishery resources and present levels of exploitation in the Indo-Pacific region. The manual is to take the form of an annotated atlas with statistical tables.

The Committee then recommended that Dr. G. Kesteven (CSIRO, Australia) and Dr. F. H. Talbot (Australian National Museum) be nominated as editors of the IIOE Fisheries Atlases and jointly to prepare them. Subject to their agreement, the FAO Secretariat would pass to them the information left by the late Dr. Einarsson. The IOC Secretariat should be informed of this proposal and explain to the nominees the procedure for final confirmation by the Commission of nominated editors.

4. Indian Ocean Biological Centre

4.1 Long-term agreement between UNESCO and CSIR

A long-term agreement between UNESCO and the Council of Scientific and Industrial Research, India, regarding the International Collection at IOBC has been concluded recently. This agreement will remain in force until 31 December 1970. The agreement defines the responsibility of UNESCO and of CSIR for the handling of the International Collection at the Centre. On its part, UNESCO will maintain the Consultative Committee and shall appoint the International Curator or Chief Expert. The relevant terms of reference are given in Annex II and III of the IIOE Information Paper No. 14. Financial assistance for equipment and literature is also defined in the agreement. CSIR will assume responsibility for the safe custody of the International Collection and the administrative and technical responsibility for servicing; the necessary staff for this purpose and also for the sorting of further contributions to the International Collection beyond the IIOE programme will be supplied by CSIR. CSIR will co-operate with UNESCO in providing facilities and local help to visiting experts and students coming to work on the International Collection at the IOBC.

4.2 New membership to the Consultative Committee

Dr. V. N. Greze (USSR) has been appointed as a member of the Consultative Committee, replacing Dr. M. Vinogradov, who retired from the Committee on 31 October 1966 after three years of service.

4.3 The fifth meeting of the Consultative Committee

The Committee met in New Delhi on 28 February and 1 March 1967 and from 6 to 8 March at IOBC, Cochin. The members of the Committee participated also in the Symposium on the Indian Ocean (sponsored jointly by the National Institute of Sciences of India and the Indian National Committee on Oceanic Research), which was held from 2 to 4 March in New Delhi.

All members of the Committee, together with Dr. Brinton, International Curator; Dr. Panikkar, Director of NIO; Dr. Evstafiev; and Dr. Serène, participated.

The Committee adopted a number of recommendations, among which was the recommendation that, where several specialists express interest in a particular taxonomic group, one of them should be recognised as a "senior specialist" for that group to collaborate with the other specialists so as to ensure that the material in the group be handled to the best advantage. Senior specialists for taxonomic groups have been selected by the Committee. The report of the meeting appears as Annex I to this Information Paper.

5. National Newsletter

The Indian National Committee on Oceanic Research of CSIR, New Delhi, continues to publish the IIOE Newsletter. To date, the IOC Secretariat has received issues up to Volume IV, No. 1 (June, 1966). This publication contains news on the activities of oceanographic institutions in India, announcements and reports of important national and international meetings concerned with IIOE, reports on activities in oceanography abroad and abstracts of interesting publications.

The establishment of the National Institute of Oceanography was announced in Volume IV, No. 1 of this publication, and the announcement is reproduced below:

ANNOUNCEMENT

The Indian Ocean Expedition Directorate with its 3 Centres at Ernakulam (Cochin) has now merged into the newly established National Institute of Oceanography which has been set up under the CSIR with effect from 1st January 1966. All correspondence which was hitherto addressed as Director, Indian Ocean Expedition, may henceforward be addressed as: -

The Director	Telephone	Telegraphic
National Institute of Oceanography	Number:	Address:
CSIR, Rafi Marg	35657	OCEANOLOGY
New Delhi-1 (India)		NEW DELHI-1

Various Centres which have been functioning under the IOE Directorate (CSIR) have now been redesignated as follows: -

1. Planning & Data Division of NIO	73353	OCEANOLOGY
B-7 Hauz Khas Enclave		NEW DELHI-1
New Delhi-16		

2.a)	Indian Ocean Biological Centre of NIO Ravipuram Sannidhi Road Ernakulam-6 (South India)	Telephone Number: 3384	Telegraphic Address: OCEANOLOGY ERNAKULAM-6
b)	Indian Ocean Biological Centre of NIO University Oceanographic Laboratory Ernakulam-6 (South India)	3306	OCEANOLOGY ERNAKULAM-6
3.	Physical Oceanographic Division of NIO Karikkamuri Cross Road Ernakulam-1 (South India)	3538	GEOPHYSICS ERNAKULAM-1
4.	Biological Oceanographic Division of NIO 'Vijaya Alayam' Karikkamuri Cross Road Ernakulam-1 (South India)	814	GEOPHYSICS ERNAKULAM-1

6. Exchange of Data and Reports

6.1 Publication of IIOE Data

A circular letter was despatched to the IIOE National Co-ordinators reminding them of recommendation 7.17 of the recent Bureau and Consultative Council meeting (see section 1 of this issue), and asking information in this regard. To date the following information has been received in response to this circular:

<u>Country</u>	<u>Information</u>
Australia	Extract of a letter from Mrs. Brown, Acting Librarian, CSIRO (not as an answer to the circular): "We shall send you by surface mail 61 copies for each of the IIOE Cruise Reports. Ten copies of each will be sent off immediately and the rest will follow when further stocks are obtained from our stores."
Burma	Extract of a letter from Dr. Tun Yin, Director-General of Burma Meteorological Department: "I regret that this department has at present no IIOE data to offer for publication in the next issue of the IIOE Information Paper."

<u>Country</u>	<u>Information</u>
Germany	<p>Extract of a letter from Professor J. Dietrich, National Co-ordinator:</p> <p>"In reply to your letter of 6 April 1967, I am referring to our</p> <p>'Meteor' Forschungsergebnisse, Reihe A - No.2</p> <p>in which all our chemical observations have been published by the authors Dietrich, Düing, Grasshoff and Koske in February 1967. In addition, all these data have been forwarded to the World Data Center A in Washington."</p>
South Africa	<p>Extract of a letter from Mr. G. H. Oosthuizen, Secretary, SANCOR:</p> <p>"It is not our intention to publish all the data obtained in this country during the IIOE in a single or series of Data Reports. All data obtained, have, however, been forwarded to the World Data Centres and will presumably be made available by the latter to all participating countries. Reprints of all papers on IIOE data, which have appeared in scientific journals, have already been forwarded to you for inclusion in the IIOE Collected Reprints."</p>

To date, no answer has been received from National Co-ordinators of the following countries:

* Ceylon	* Malaysia
* China	* Mauritius
France	Pakistan
India	Portugal
Indonesia	Tanzania
* Israel	Thailand
* Italy	United Kingdom
Japan	USA
* Madagascar	USSR

*

The National Co-ordinator has been nominated, but no cruise plan for IIOE has been announced.

6.2 Germany

The results of German participation in the IIOE are being published by Gebr. Bornträger, Berlin-Nikolassee, under the title of "'Meteor' Forschungsergebnisse". The publication consists of four series, i.e. Series A - General Reports, Physical and Chemical Oceanography; Series B - Meteorology and Aeronomy; C - Geology and Geophysics; D - Biology. Two issues of Series A have been published, the first one containing an extensive general report of the cruise of R.V. METEOR in the Indian Ocean and a special contribution on the hot bottom water in the Red Sea and on turbidity measurements in the Persian Gulf and the Gulf of Oman; the second issue gives the observed physical and chemical data obtained by R.V. METEOR in the Indian Ocean during her cruise 1964/65. The tables are based on the computations made by the National Oceanographic Data Center (NODC) in Washington. In addition to the normally communicated data, the tables contain four chemical parameters: alkalinity, ammonia, fluoride and calcium. The tables are accompanied by short descriptions on the technique employed for determination.

This publication is on sale through the publishers.

6.3 Japan

A 'General Report of the Participation of Japan in the International Indian Ocean Expedition' has been published by the National Committee for IIOE, the Science Council of Japan, as "Records of Oceanographic Works in Japan, Volume 8, No. 2 (New Series)" and distributed widely. The contents of this publication are as follows:

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In Chapter V, narrative reports on results are accompanied by 73 figures illustrating observation points, horizontal as well as vertical distribution of measured properties and 24 tables showing observational data.

6.4 South Africa

The Secretariat has received from the National Co-ordinator of South Africa a letter concerning the circulation of mean sea level data; this letter read as follows:

I refer to recommendation 2/4 of the second meeting of the International Co-ordination Group for the IIOE regarding the Tide Gauges in operation during the IIOE. We have approached our Naval Hydrographer in this connection and have now received the following reply from him:

"The Mean Sea Level Data collected from all tide gauges operated by the South African Navy have been regularly forwarded to the Director of the Permanent Service for Mean Sea Level since the commencement of observations in 1958. The date of despatch of data is generally in February or March of the year following that in which the observations have been made. The Director is also notified of the removal or installation of any tide gauges during the year under review, and he is provided with Forms PSCI(1) and PSC 1(2) for all gauges installed round the coast.

"In the case of gauges operated by the Railways and Harbours Administration the results from the Lea gauge in Table Bay only have been forwarded to the Director P.S.M.S.L. During the IIOE the South African Railways and Harbours Administration were also operating tide gauges in Durban and Port Elizabeth and East London and the records from these gauges are stored in the Hydrographic Office but have not been reduced owing to staff shortage.

"The Director, P.S.M.S.L., has been asked whether he would like M.S.L. results for South Africa and South West Africa to be sent to World Data Centre "A" as well as to his own office. I now await his reply."

6.5 United Kingdom

a) Admiralty Marine Science Publication No. 8, International Indian Ocean Expedition, Bathymetric and Magnetic Investigations, H.M.S. DALRYMPLE, 1961/2 and 1962/3, P.F. Barker.

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1. INTRODUCTION

- 1.1 Objectives
- 1.2 Narrative
- 1.3 Acknowledgements

2. NAVIGATION**3. BATHYMETRY****3.1 Instrumentation****3.2 Construction of Profile****4. MAGNETIC FIELD MEASUREMENTS****4.1 Instrumentation****4.2 Variations in Magnetic Field****4.3 The Heading Correction of the Ship****4.4 Reduction of Records****5. THE PROFILES****5.1 Summary of Treatment****5.2 Profile Description****REFERENCES****FIGURES**

1. Track Chart, N.W. Indian Ocean

2. Track Chart, Murray Ridge

3. Regional Field N.W. Indian Ocean (Bullard)

4. Regional Field Gulf of Oman (2nd order poly.)

5. Heading Correction (i) Aden

6. Heading Correction (ii) December 1962 and January 1963

7. Hourly Mean Values, Quetta

8. Key to slopes at 33°N

b) Admiralty Marine Science Publication, No. 9, International Indian Ocean Expedition, Bathymetric, Magnetic and Gravity Investigations, H.M.S. OWEN, 1962/3.

CONTENTS**Part One****1. Introduction****1.1 Objectives****1.2 Narrative****2. Navigation****2.1 On passage****2.2 Conduct of detailed surveys****3. Bathymetry**

- 4. Magnetic measurements
 - 4.1 Long profiles
 - 4.2 Detailed surveys
- 5. Gravity measurements
 - 5.1 Factors influencing accuracy of results
 - 5.2 Control of gravity measurements
 - 5.3 Data Reduction
 - 5.4 Construction of profiles and maps

Acknowledgements

References

Figures

Part Two

Explanation of profiles

30 1:1 million bathymetric, magnetic and gravity profiles.

The above publications were received from the National Co-ordinator of the U.K. and have been distributed by the IOC Secretariat among laboratories and institutes interested in marine geology, geophysics and bathymetry of the Indian Ocean (as in Annex V of IIOE Inf. Paper No. 8) and National Co-ordinators.

6.6 United States of America

- a) International Indian Ocean Expedition, USC&NS ship PIONEER - 1964. Volume 1. Cruise Narrative and Scientific Results, 11 February to 11 August 1964.

This volume contains reports of the scientific results in physical oceanography, geology and geophysics, biology, meteorology and SCUBA-diving investigations, together with tables showing the data, vertical profiles of parameters and charts showing the results.

- b) John G. Bruce, Jr.: Near Surface Currents off the Somali Coast in the Summer Monsoon, August 1964, Part II, Woods Hole Oceanographic Institution, Reference No. 65-66(a).

This publication contains charts showing current vectors at depths of 10, 50, 75, 100, 150 and 200 meters, and a table showing the data by R.V. ARGO, Cruise DODO VI). A description on observation methods of scientific results has been published - in 1965 - by the author under the same title as a WHOI publication, Reference No. 65-66.

c) A. F. Amos: Physical Oceanographic Observations in the Indian Ocean Using a Continuously Recording in-situ Salinity/Temperature/Depth Sensor, R.V. ROBERT D. CONRAD, Cruise 9 1965, Lamont Geological Observatory.

A description of the instrument, operating techniques, accompanied by nine figures and five tables are the contents of this publication. The results of measurements are presented in the form of tables showing the data (temperature, salinity, sigma T, anomalies of specific volume and dynamic height, and sound velocity) at standard depths, figures illustrating vertical profiles of temperature, salinity and sound velocity, and T.S. diagrams at the stations. A station map and a table indicating the station positions are attached.

National Co-ordinators have received a copy of each of the afore-listed publications from the IOC Secretariat. Interested scientists are advised to contact the National Co-ordinator of their country.

d) Selected IIOE Track Charts. National Oceanographic Data Center, Publication G-10.

This publication includes all IIOE cruises processed at NODC as of March 1966. The track charts have been prepared by using automatic processing and display techniques. The plotting programme is designed to connect stations in chronological sequence. As a result, lines between succeeding stations may cross over land areas; therefore, the connecting lines do not indicate the actual ship track between stations, but only the sequence in which stations were taken.

Another problem inherent in the use of this programme is that all stations must be included in an NODC reference identity number, even though several actual cruises may have been combined under one NODC reference number for ease in processing. Thus the computer does not distinguish between stations taken during different cruises of the same ship or of different ships. In order to demonstrate the direct use of the machine products, these charts have not been manually altered.

Examination of the resulting plots reveals that a number of possible errors in coding either time or position is readily discernible on the plots, whereas errors are not always apparent on machine print-outs of the data.

It is understood that all originators have received a copy and they are invited to examine the chart concerned and communicate necessary corrections, if any, should they not have already done so.

7. Preparation of IIOE Atlases

In compliance with recommendation 7.15, adopted by the Bureau and Consultative Council at their seventh meeting (see section 1 of this issue), editors of IIOE atlases were requested by a circular letter from the IOC Secretariat to give the Secretary the content tables of their respective atlases with information on the projection and scale used in the atlases. Extracts from their replies received to date are reproduced below:

CONTENTS OF THE ATLAS ON THE PHYSICAL AND CHEMICAL DATA (received from Prof. K. Wyrski)

PART I: Distribution of Physical and Chemical Properties

Data:

Temperature
Salinity
Density
Oxygen Content
Phosphate
Nitrate
Silicate

Horizontal maps combining data from all seasons:

bottom, 4000, 3000, 2000, 1500, 1000, 800, 600 and 400-meter depth.

Horizontal maps combining data for each of the four seasons:

300, 200 and 100 meter depth and at sea surface.

Vertical sections surface to bottom combining data from all season and four corresponding sections, 0 to 400 meters, combining data for each of the four seasons.

Seven north-south and seven east-west sections of this type will be selected.

Dynamic topographies:

Surface, 100, 200, 300, 400, 600, 800, 1000, and 1500 meters. The reference depth will be decided after the data have been studies. The topographies for 0, 100, 200 and 300 meter depth will be drawn for all four seasons.

It is estimated that Part I of the atlas will contain approximately 200 maps and sections. The total number will be decided after an inspection of the chemical data has been made. Some of the chemical properties may not have been observed with the necessary density to warrant their representation on all surfaces and sections.

PART II: Analytical Maps

Depth of the mixed layer by seasons.

Depth and intensity of the temperature gradient by seasons.

Topography of certain isothermal surfaces and surfaces of constant oxygen content.

Topography of selected density surfaces and distribution of properties on these surfaces.

Distribution of properties along core layers of water masses.

Horizontal and vertical extent of characteristic water masses.

Temperature-salinity diagrams for selected regions.

It is estimated that the atlas containing the analytical maps will consist of approximately 100 illustrations.

Map Projection

All the horizontal maps will be drawn on an equal-area sinosoidal projection covering the Indian Ocean from 30° N to 70° S and 20° to 150° E. A sample of this map is attached.* The machine-plotting of the data will be handled by a computer and the size of the original maps is 145 x 107 cm. The drafted maps will be of the same size and in this form they will be submitted to the printer. Reduction of these maps by about 1 : 3 is envisaged. The final printed maps will be approximately 60 x 40 cm. A scale of 1 : 25 million would make the equator 57.7 cm long on these maps. It is not felt that it is necessary at this point to decide about the actual scale, because it will also depend on the dimensions given by the press and the binder.

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A reduced copy of the map appears as fig. 8 (Annex III)

CONTENTS OF THE METEOROLOGICAL ATLAS
(received from Prof. C. Ramage)

Volume I. The Surface Climate of 1963 and 1964

Projection: Mercators
Scale: 1 : 40 million
Area: The Indian Ocean south to 45°S

CONTENTS

Introduction

General plan for the charts

Data sources

- (a) Ship observations
- (b) Mid-ocean island observations
- (c) Weather satellite observations

Error checking

- (a) Error identification
- (b) Error removal

Data processing and analysis

- (a) Averaging
- (b) Plotting and preliminary analysis
- (c) Centre-point plotting and computer analysis
- (d) Final analysis
- (e) Island stations

Availability of 1963 and 1964 data

References

Individual surface charts (24 months)

- (a) Background information (charts 1-24)
Plotted data: for each month, tracks and dates of research vessel cruises (with locations of radio-soundings) and of research aircraft flights (with locations of drop-soundings); tracks and dates of all tropical cyclonic systems; frequency of weather satellite photography for each 5-degree square; total number of ship observations made in each 5-degree square.
Analysis: Isopleths of the duration of civil twilight.

- (b) Winds and sea-level pressure (charts 25-48)
Plotted data: for each month, mean resultant winds and steadiness; mean surface pressures;
Analysis: Steamlines, isobars.
- (c) Air and sea-surface temperatures (charts 49-72)
Plotted data: for each month, mean air temperatures; mean sea surface temperatures.
Analysis: Sea surface isotherms, isopleths of air temperature minus sea temperature.
- (d) Vapour pressure (charts 73-96)
Plotted data: for each month, mean vapour pressure (e_a); mean saturation vapour pressure at the temperature of the sea surface (e_s).
Analysis: Isopleths of e_a , $.98 (e_s - e_a)$.
- (e) Clouds and precipitation (charts 97-120)
Plotted data: for each month, mean cloudiness; percentage frequency of observations reporting precipitation; percentage frequency of observations reporting thunderstorm manifestations.
Analysis: Isonephhs; isotherms of the equivalent black-body temperature of the earth's emitting surface (July 1963 through December 1964).
- (f) Heat exchange at the sea surface (charts 121-144)
Plotted data: for each month, mean net radiation; mean transfer of latent heat; mean transfer of sensible heat (computed from standard meteorological observations).
Analysis: Isodiabatics of mean net radiation, mean equivalent heat exchange (latent plus sensible).

Volume II. Upper Air

Projection: Mercators

Scale: 1 : 40 million

Area: 20° E - 155° E; 45° N - 50° S

CONTENTS

Introduction

Data sources

- (a) Long-term rawinsonde and pilot balloon normals
- (b) IIOE collections
- (c) Winds measured from aircraft

General plan for the charts

Data processing and analysis

- (a) Constant pressure-level charts
Averaging; machine plotting; subjective analysis
- (b) Longitudinal cross-sections
Machine plotting and partial analysis; final
subjective analysis

Availability of data

References

Individual charts

- (a) Constant pressure-level charts
Plotted data: monthly mean resultant winds
and steadiness, monthly mean pressure heights,
temperatures and dew points entered on charts for
the standard pressure levels of 850, 700, 500, 300,
200, and 100 mb.
Analysis: Streamlines of the resultant wind
direction, isotachs.
- (b) Longitudinal cross-sections
Plotted data: monthly mean N-S and E-W
components of the wind and monthly mean
pressure-heights, potential temperatures,
and dew points for as many levels as possible
entered on meridional cross-section charts
for the longitudes 30°E, 73°E, 110°E, 140°E
between 45°N and 50°S.
Analysis: Isotachs of the zonal wind component,
isentropes.

CONTENTS OF THE ATLAS ON 'CHEMICAL BIOLOGY OF THE INDIAN OCEAN'
(received from Prof. J. Krey)

I. Total Indian Ocean	C ¹⁴	Cp	Chl a	Chl a+c	Seston	Phytopl.
a. Levels or layers						
0, 20, 50, 100 m	-	+	+	+	+	+
50 - 0 m	-	+	+	+	+	+
thermocline - 0 m	+	+	+	+	+	+
500 - 0 m	-	+	+	+	+	+
bottom - 0 m	-	-	-	-	+	-

	C ¹⁴	Cp	Chl a	Chl a+c	Seston	Phytopl.
b. Sections (5 per page) 500(100) - 0 m	20	10	20	20	+	+
						total pages: 14
c. Diagrams						
1. Annual variation	+	+	+	+	+	+
2. Vertical distribution (single stations)	50	20	50	50	20	10
						total pages: 25
II. Special Regions						
a. Arabian Sea	+	+	+	+	+	+
b. Gulf of Bengal	+	-	+	+	-	-
c. 110°E	+	+	+	-	-	-
d. SW Indian Ocean	+	+	+	+	-	-
						total pages: 32
III. open						7
						total pages: 100

Supplementary Transparent Charts from Other Parts of the Atlas
(in the same projection as the charts of the part 'Chem. Biology')

From:

I. <u>Meteorological part:</u>		<u>pages</u>
1. Radiation at sea surface	I - XII	2
2. Wind: direction and force at the sea surface	I - XII	2
II. <u>Physical oceanography's part:</u>		
1. Depth of mixed layer	I - XII	
total Indian Ocean		2
Arabian Sea		2
Gulf of Bengal		2

		<u>pages</u>
2. Temperature at surface	I - XII	1
3. Salinity at surface	I - XII	1
4. Salinity at 50 m	I - XII	1
5. Temperature at 50 m	I - XII	1
6. Surface current	I - XII	2
7. Oxygen concentration (surface and 50 m)	I - XII	2
8. PO ₄ - P - concentration (surface and 50 m)	I - XII	2

total: 20

Map Projection

The base map has an equal area projection and a scale of 1 : 15 million; a reduced copy of the map appears as fig. 1 to Annex III - "Progress-Report on the Atlas 'Chemical Biology - Indian Ocean'", prepared by Prof. J. Krey.

8. IIOE National Co-ordinators

A new list of IIOE National Co-ordinators has been prepared which compiles information received from IOC Member States in answer to an enquiry on Government representation to the IOC subsidiary bodies, including the International Co-ordination Group for IIOE. The list appears as Annex II to this issue.

9. Miscellaneous9.1 Cruises after IIOE

The following information on cruises in the Indian Ocean after the official closure of ship operations for IIOE has been received by this office:

Australia

H.M.A.S. DIAMANTINA Cruise Dm2/66, April 12 to April 29, 1966

Area:	South of Australia Fremantle-Port Lincoln-Adelaide-Fremantle	
Programme:	Surface hydrology	61 stations
	Subsurface hydrology	49 stations
	Bathymograph	37 stations

H.M.A.S. DIAMANTINA Cruise Dm3/66, May 9 to June 19, 1966

Area:	Eastern Indian Ocean, North of 32°S Fremantle-Christmas I.-Singapore-Cocos I- Penang-Fremantle	
Programme:	Bathymograph	6 stations
	Hydrology	59 stations
	Primary production	28 stations
	Pigments	29 stations
	Micronekton	17 stations

9.2 IIOE Collected Reprints, Vol. IV

The list of contents of Vol. IV appears as Annex IV to this issue. The volume is available for distribution.

9.3 Address of Professor C.S. Ramage

Professor C.S. Ramage, Scientific Director of the IIOE Meteorological Programme has requested us to announce his change in address; an extract of his letter is reproduced as follows:

'Although most people who correspond with me know now that I have moved from Bombay to Honolulu, a few do not. Would it be possible please, in the next issue of your IIOE Information Paper, to list my address:

Department of Geosciences
University of Hawaii
2525 Correa Road
Honolulu, Hawaii, USA 96822'.

9.4 Subject Index of IIOE Information Papers Nos. 1 to 18

The Subject Index is attached at the end of this issue and supersedes the former one which was attached to issue No. 10 of this Information Paper.

ANNEX I

REPORT OF THE FIFTH MEETING OF THE CONSULTATIVE COMMITTEE
FOR INDIAN OCEAN BIOLOGICAL CENTRE HELD FROM FEBRUARY 28
TO MARCH 8, 1967, AT NEW DELHI AND ERNAKULAM (INDIA).

The fifth meeting of the Consultative Committee for Indian Ocean Biological Centre was held from February 28 to March 8, 1967. The Conference was held in two parts, in Delhi from February 28 to March 4 and in Ernakulam from March 6 to 8. The first Session of the Consultative Committee was held at the India International Centre on February 28 at 2.30 p.m. The Session was presided over by Prof. J. Krey, Chairman of the Consultative Committee. (List of participants is enclosed Appendix V).*

1. WELCOME BY THE CHAIRMAN

The Chairman welcomed the members and invitees of the meeting. He said the background papers for the meeting had been circulated amongst the participants, and expressed his satisfaction that from these documents one can see that a great deal of progress has been made in sorting and sub-sorting of samples, and initiating the work of general properties atlas of the Indian Ocean. The agenda as proposed for the meeting was approved, and the details of the agenda items to be discussed at Delhi and Ernakulam were finalised. He asked the Director, IOBC, to give a brief report of the IOBC for the preceding year.

2. REVIEW OF THE PREVIOUS YEAR'S WORK BY THE DIRECTOR
AND THE CURATOR OF IOBC

(a) Report of the Director of the IOBC:

Dr. N. K. Panikkar, Director of the IOBC, briefly summarised his report (Appendix I). The Centre has proved its usefulness and in order to provide continuation of the work in progress at IOBC and its further expansion a five-year contract has been entered into between the CSIR of India and UNESCO (Appendix II). It was stated inter alia that: -

- (i) During the past years the Indian Ocean Biological Centre has made steady progress in the sorting of zooplankton collections and in the development of plankton research activities.
- (ii) The IOBC continued to be housed in one wing of the Oceanographic Laboratory of the Kerala University. These arrangements are temporary and with the acquisition of a site of 1.1 acres at Ernakulam, steps will be taken for the construction of a permanent building for the Centre.

* The appendices originally attached to this Report are omitted in this Annex.

- (iii) The laboratory facilities continued to grow and efforts are being made to supplement the existing literature through the CSIR and the co-operation of subject specialists. There was no special change in the scientific and ancillary staff; the present strength of scientific and ancillary personnel is 41, who are working under the guidance of Dr. Raghu Prasad, Chief Scientist-in-charge and the Curator. The equipment position continued to be the same; it was not possible to place any orders for specialised equipment during the preceding year.
- (iv) The sorting of the samples proceeded at a steady rate. A total of 2188 samples have been received at the IOBC; out of these, 1213 samples were sorted up to the beginning of the year 1966; during 1966, 336 samples have been sorted and in December 1966, 639 samples were unsorted.
- (v) The work at IOBC is entering the second phase of specialised studies. The more experienced personnel amongst the sorting assistants have progressed towards specialised studies of different groups. The work of the advanced sorters includes sub-sorting of selected groups, consultation of scientific and technical literature relevant to his group and planning the course of future research in his group.
- (b) Report of the Curator of IOBC (Appendix III):

Dr. E. Brinton, UNESCO, Curator for IOBC, gave his report for the period from January 1966 to February 1967.

During 1966, 343 samples were received at IOBC. These were from the following institutions: -

Division of Sea Fisheries, South Africa	- 194
Institute of Oceanology, USSR	- 29
CSIRO, Australia	- 88
Fisheries College, Shimonoseki, Japan	- 32

The IOBC collection now consists of 2144 samples and 90% of these are Indian Ocean Standard Net samples. The geographical distribution of these samples during two seasons of six months' period each (mid-April and mid-December are limits of the season) has good coverage. The mid-ocean area south of 20°S, continues to be sparsely covered. He also gave details of the processing of samples, sub-sorting, specialised studies of the staff and distribution of sorted material to the specialists and visits of specialists at IOBC.

The Handbook of IOBC collections has been compiled and it consists of a mimeographed list of collections with the pertinent data and keys appended. The early publication of the Handbook is essential for the full utilisation of the collections.

Regarding Atlas preparation, preliminary charts of "General Properties", i.e. total Copepoda, fish larvae, chaetognaths, etc. have been prepared, based on average densities for 5 Marsden Squares. The data for these charts come from the 1285 Standard Samples sorted so far.

When all samples from particular regions are processed, atlases for those regions could be prepared. For example, data for the Arabian Sea to the equator are now complete. The Bay of Bengal will be completed in two to three months.

The projection which has been adopted provisionally for use is the same sinusoidal equal-area projection which is in use for the IIOE physical data.

Dr. R. Prasad and Dr. Brinton presented the various biomass data and specialised group charts prepared at the IOBC.

3. ROUTINE SORTING AND SUB-SORTING OF THE INTERNATIONAL COLLECTIONS

The Chairman proposed for discussion routine sorting and sub-sorting of the international collections. Dr. Brinton gave a brief resumé of the sorting work, present and proposed. This was followed by discussions.

Dr. Pamikkar recalled the idea of Fellowships, raised in earlier years. The meeting authorised the Chairman to raise this point at the joint meeting of the Advisory Board and Consultative Committee, and to request the CSIR authorities to earmark four to six fellowships for tenure at the IOBC.

The Joint Meeting of the Indian Advisory Board and the UNESCO Consultative Committee for IOBC was held in the forenoon of the 1st March, 1967, in the CSIR Conference Room, under the Chairmanship of Dr. D. N. Wadia, Chairman, Indian National Committee on Oceanic Research (Report is enclosed - Appendix IV).

Dr. Brinton reviewed the "Progress to date in sorting and sub-sorting". In the course of this review, Dr. Brinton also referred to the visit of Dr. Ahlstrom and of his setting up a scheme of study of fish larvae, and of his report to UNESCO which was included as item 7 of the background papers circulated among Consultative Committee Members.

In the ensuing discussions, the dominating points were (a) that the work of basic sorting would be speeded up by the appointment of two year research fellows; (b) that these fellowships should be open for award also to scientists from other countries bordering on the Indian Ocean; (c) that Unesco may award one-year fellowships to students from other countries to come to IOBC for training in sorting; (d) that Unesco may provide fellowships to enable IOBC scientists to go abroad for specialised training.

Mr. Tranter expressed concern that Unesco did not act on the previous year's recommendation about the supply of specialised equipment to IOBC.

The following recommendations were formulated and adopted: -

(1) Equipment for sorting and research:

The Consultative Committee recommends that the Curator, guided by the UNESCO-CSIR contract, should request microscopes, camera lucidae and other necessary equipment from UNESCO to meet present and future needs and that priority of requirements should be indicated.

(2) Fellowships at the IOBC:

- 2.1 - The Consultative Committee recommends that CSIR allocate 4 to 6 two-year fellowships to the IOBC to expedite the programmes of basic sorting, sub-sorting, and research, these fellowships to be made available to candidates from the Indian Ocean region.
- 2.2 - The Consultative Committee recommends that UNESCO allocate one-year fellowships to students from the Indian Ocean region who wish to be trained at the IOBC in the systematics of tropical zooplankton.
- 2.3 - The Consultative Committee recommends that UNESCO allocate 2 to 3 fellowships each year to scientists at the IOBC for specialist training at other laboratories and that UNESCO encourage bilateral arrangements between India and other countries to the same end.

4. SPECIAL ANALYSES OF THE INTERNATIONAL COLLECTIONS BY TAXONOMISTS

The Chairman invited the comments of Dr. Brinton, Curator, regarding the analysis of international collections by taxonomists. Dr. Brinton briefly reviewed the progress.

- (i) Decapoda are being ~~sub-sorted~~ sorted to family, and, in some cases, to genus. Two of the staff are doing this work under the direction of Mr. Krishna Menon. This sub-sorting is proceeding well, and more than half the samples are subsorted.
- (ii) Larval fishes are now being sub-sorted to family, and, in some cases, to genus. The procedure of sorting the fish fraction to order has been replaced by the more detailed sorting started by K. J. Peter and developed in consultation with visiting scientists. Four of the staff are presently engaged in this sub-sorting.
- (iii) Planktonic polychaetes and anthozoan larvae are being subsorted and examined by two of the staff in preparation for their engaging in the taxonomic study in collaboration with, or under the guidance of, recognised specialists.

- (iv) Sub-sorting of Amphipoda has been put off, pending a possible visit by Dr. Gruner after October, 1967.
- (v) Euphausiacea are being studied and identified by one of the staff and the Curator (Dr. Brinton).
- (vi) The cosmatoous pteropods and Heteropoda are being studied by two of the staff, under guidance (by correspondence) from Dr. J.A. McGowan.
- (vii) Ostracoda are being identified by one of the staff, with guidance from Drs. McKenzie and Iles.
- (viii) Preliminary study of Chaetognatha has been started by one of the staff. It is expected that this person will work in collaboration with one or two recognised specialists.
- (ix) Mackerel larvae are being identified by one of the staff.
- (x) Sub-sorting and the preliminary study of Polychaetes and anthozoans have been started, as has been mentioned above.
- (xi) Studies of decapod larvae, with Penaeids and Pandalids to be given priority, can soon be started by the Decapod Group. Available outside specialists for this diverse group are scarce. We are fortunate to have the guidance of Mr. Krishna Menon, a recognised authority, particularly on Penaeids. Dr. Williamson's proposed visit has been put off, pending the availability of travel funds.

Visit of experts during 1966

The scientists and the taxonomists who visited IOBC for specialised taxonomic studies and delivered lectures have been dealt with under the item no. 2(a) - Report of the Director, IOBC.

Preparation of the handbook on the International Collections

The Consultative Committee recommends that the Curator should finish the Handbook within the next month and submit it for publication by CSIR.

The Consultative Committee recommends that a second volume of the Handbook be prepared listing the environmental data relating to the International Collections.

Distribution of material to institutions and individuals and liaison with other institutions and individuals engaged in the analysis of plankton from the Indian Ocean.

The Consultative Committee recommends that the Curator should invite specialists to correspond with senior sorters at the IOBC to ensure the best possible standard of sub-sorting.

5. SELECTION OF TAXONOMIC SPECIALISTS

Selection of specialists for particular groups:

The Consultative Committee recommends that where several specialists express their interest in a particular taxonomic group one of these should be recognised by the Curator as "Senior Specialist" for that group and should be vested with the authority, in correspondence with the Curator, to collaborate with the others to ensure that the material in that group will be handled to the best advantage.

The Consultative Committee recommended the following scientists for specialised studies: -

- 5.1 Stomatopod Larvae: Senior specialist; K. H. Alikunhi
Possible collaboration with Reger
- 5.2 Foraminifera: Senior specialists;
Possible collaboration with Asano
- 5.3 Amphipoda: Senior specialist; Gruner
Collaboration with Vinogradov
Possible collaboration with Bowman and others
- 5.4 Polychaeta: Senior specialist; Tebble
Collaborators; George Peter, larval polychaete
specialist to be sought
- 5.5 Chaetognatha: Senior specialist; T.S.S. Rao
Collaboration with Mrs. Nair (specialist sub-sorter),
Alvarino and Tokioka
- 5.6 Cephalopoda: Chief specialist; Taki
Collaborator; Okutani
- 5.7 Sergestidae: Senior specialist; Tirmizhi
- 5.8 Siphonophora: Senior specialist; Mrs. Daniel
Collaboration with Dr. Daniel
- 5.9 Anthozoan Larvae: Panikkar and Balachandra Menon
- 5.10 Tornaria: Burdon Jones
- 5.11 Cirripede Larvae
- 5.12 Cyphonautes Larvae: Cook
- 5.13 Amphioxus Larvae: Wickstead
- 5.14 Copepoda: Senior specialist; Fleminger

- 5.14.1 The Consultative Committee requests Dr. Fleminger to draw up a plan of action for the Copepods, bearing in mind all available copepod specialists, and to submit this to the members of the Consultative Committee for approval
- 5.15 Peneidae: Krishna Menon
- 5.16 Other Decapod Larvae: Chief specialist; Williamson
- 5.17 Fish Larvae
- 5.17.1 Ahlstrom report: Consultative Committee recommends that the report be not published in present form but that the author be asked to edit it with a view to publication by UNESCO in the IIOE Newsletter giving more emphasis to the factual aspects of the report rather than to recommendations
- 5.17.2 Literature: Consultative Committee recommends that Ahlstrom be asked to compile a list of the literature essential for fish larvae identification; that K. J. Peter, the Senior specialist sorter, be asked to determine which of these references are available at the IOBC; and that UNESCO be asked to obtain the remainder through Dr. Ahlstrom
- 5.17.3 Overseas training for specialist sub-sorters of fish larvae
- The Consultative Committee recommends that arrangements be made for K. J. Peter to visit the laboratory of Professor Rass (Moscow) on his return from Copenhagen with the special purpose of training in the systematics of Scombroid larvae
- 5.17.4 Senior specialist: Rass
- The Consultative Committee recommends that Professor Rass be asked to prepare a plan of action for co-ordinating the study of the fish eggs and larvae component of the collections, and that he be asked to visit the IOBC as soon as possible
- 5.18 Salps and Doliolids: Senior specialist; Tokioka
Collaborators; Berner, trainee specialist - possibly Nagabhushanam
- 5.19 Cubomedusae: Ralph
- 5.20 Scyphomedusae: Thiele (if available)
- 5.21 Euphausiacea: The Consultative Committee agrees that further decisions on the selection of specialists may be made between meetings upon the recommendation of the Curator and majority decision of the Consultative Committee

The Consultative Committee confirms that when Dr. Brinton, the Senior specialist, returns to his home laboratory the euphausiid material may be transferred to the care of that laboratory for the duration of the study

6. PROGRESS IN PREPARATION OF IOOE ATLAS
AND THE PROBLEMS THEREOF

6.1 'General Properties' Atlas:

The Consultative Committee recommends that the 'General Properties' Atlas being produced under the direction of Dr. Brinton and Dr. Panikkar should acknowledge also the individual work of other collaborators

6.2 'Species' Atlas:

The Consultative Committee recommends that the Atlas of Species should appear in loose leaf form for later re-assembly, since the data relating to species will become available at varying intervals over a period of years

7. OTHER ITEMS WITH THE PERMISSION OF THE CHAIRMAN:

(a) Preservation of plankton samples:

Following a reference to the Committee on the state of preservation of samples at the IOBC, the Consultative Committee recommended that the Curator investigate the merits of replacing the formalin in which calcareous material is fixed with alcohol or other suitable preservative.

The Consultative Committee recommends that a member of the IOBC staff be encouraged to develop an experimental interest in the problems of plankton preservation.

(b) Care and safety of the International Collections:

The Consultative Committee recommends that CSIR provide an air-conditioned room to house the sub-sorted material and reference collections, and appoint a 'Collection Tender' whose sole responsibility is the safety and condition of the collections.

(c) Publicity and promotion of the IOBC:

The Consultative Committee recommended that UNESCO distribute a pamphlet prepared by the Curator in consultation with CSIR, advertising the facilities and opportunities available at the IOBC for visiting research workers.

(d) Data arising from the International Collections:

The Consultative Committee recommended that the Curator should lodge all data arising from the International Collections with World Data Centres, by way of NODC India, as soon as scientists entrusted with each phase of the work can make their data available for general circulation.

(e) Arrangements for 6th Consultative Committee Meeting, 1968:

The Consultative Committee recommends that the next meeting be held entirely at Ernakulam, commencing February 22, the members assembling at Bombay on February 21.

(f) The Consultative Committee also discussed the consideration of taxonomic specialists and in this connection took note of the suggestion of Dr. Panikkar that the CSIR could invite Prof. Rass of Moscow to work at IOBC and evaluate the fish larvae at IOBC.

The Committee further recommended that Prof. Rass be invited to prepare a plan of action for co-ordinating the studies of the fish eggs and larvae component of the collections and that he be asked to visit IOBC as soon as possible.

(g) Regular discussions:

The Consultative Committee recommended that regular weekly or fortnightly discussions or seminars be held to promote scientific interest among the staff.

Dr. Krishnaswamy stressed the need to encourage the senior-most of the sorters to do advanced studies of individual species, as well as on taxonomic work, with the supervision and approval of the Director, IOBC.

(h) Species Monographs:

The Consultative Committee recommends that senior sorters be allowed to specialise in biological studies on individual species, as well as on taxonomic work, with the supervision and approval of the Director of IOBC.

Keeping in view the experience of partly bad preservation of the material in the international collections of the Indian Ocean Biological Centre the Committee concludes that in future expeditions greater care should be given to the methodology of collection, handling and storage of plankton samples.

(i) Curatorship:

The Consultative Committee recommends that UNESCO take steps to ensure that the position of Curator of the international collection is not left vacant after Dr. Brinton's departure.

(j) Agreement between CSIR (India) and UNESCO regarding IOBC:

Although not a regular item of the agenda, there was considerable discussion and exchange of views on the contract between CSIR and UNESCO on the IOBC. The general feeling of the members was that it was a satisfactory contract. The members of the Committee required clarification on many aspects of the contract and the position from the point of view of UNESCO, CSIR, the Director and Curator was explained respectively by Dr. Evstafiev, Dr. Panikkar and Dr. Brinton. The Chairman summed up the discussion and concluded that any further additions or changes to the contract could be made in the light of experience gained in the working of the IOBC, emanating as recommendations of the Consultative Committee, to be considered by UNESCO and CSIR at the appropriate time.

ANNEX II
31 May 1967

IIOE NATIONAL CO-ORDINATORS

<u>Country</u>	<u>Co-ordinator</u>	<u>Address</u>
Australia	Dr. G. F. Humphrey	CSIRO Marine Laboratory, Box 21, Cronulla, Sydney, New South Wales
Burma	The Chairman, (Director-General, Meteorological Dept.)	National Committee for IIOE, Meteorological Department, Rangoon
Ceylon	Dr. V. Basnayake	Ceylon Association for the Advancement of Science, 55 Maitland Place, Colombo 7
China	Dr. V.C. Juan	President, Chinese National Committee on Oceanic Research, c/o College of Science, National Taiwan University, Taipei
France	Mr. P. Tchernia	Physical Oceanographic Laboratory, Natural History Museum, 43 rue Cuvier, Paris 5
Germany	Professor Dr. G. Dietrich	Institut für Meereskunde, Hohenbergstrasse 2, Kiel
India	Dr. N. K. Panikkar	Indian National Committee on Oceanic Research CSIR, Rafi Marg, New Delhi 3
Indonesia	Commodore Wardiman	National Committee on Oceanic Research, Gunung Sahari 87, Djakarta
Israel	The Chairman	National Committee on Oceanic Research, Box 5192, Jerusalem
Italy	Professor Carlo Morelli	President, Experimental Geophysical Observatory Trieste
Japan	Professor M. Uda	Tokyo University of Fisheries, Konan 4-5-7, Minato-ku, Tokyo
Madagascar	Mr. Ramanisarivo	Director of Meteorology, Box 1254, Tananarive
Malaysia	Dr. Soong Min Kong	Director of Fisheries, Fisheries Division, Ministry of Agriculture & Co-operatives, Swettenham Road, Kuala Lumpur
Mauritius	Mr. G. Bunwaree	Principal Assistant Secretary, Ministry of Industry, Commerce and External Communications, Port Louis

<u>Country</u>	<u>Co-ordinator</u>	<u>Address</u>
Pakistan	Mr. Qadir Mohiuddin	Oceanographer, Marine Fisheries Department, Government of Pakistan, Karachi
Portugal	Mr. Manuel Antunes da Mota	National Committee for Oceanographic Research, Instituto Hidrografico, Rua do Arsenal, Porta H 10, Lisboa 2
South Africa	The Head (Mr. G. H. Oosthuisen)	Science Co-operation Division, CSIR, Box 395, Pretoria
Tanzania	The Director	East African Marine Fisheries Research Organisation, Box 668, Zanzibar
Thailand	Captain Wirat Sarindu	National Marine Science Committee, National Research Council, Paholyodhin Road, Bangkok
United Kingdom	Mr. G. E. Hemmen	The Royal Society, 6 Cornwall Terrace, Regents Park, London N.W.1
USA	Mr. John V. Byrne	National Science Foundation, Washington D.C. 20550
USSR	Professor P. L. Bezrukov	Institute of Oceanology, 1 Sadovaya Street, Lublino, Moscow Zh-387

ANNEX III

Progress-Report on the Atlas 'Chemical Biology - Indian Ocean'

Activities to produce here the part of the Indian Ocean atlas 'chemical biology' started with a grant from the 'Deutsche Forschungsgemeinschaft' in the first part of July 1966. The first action was to find qualified collaborators and satisfying lab facilities. Under the conditions of our university, this was not very easy, so that the real start of activities was set to 1 November 1966. Since that time, we have followed mainly three major fields of activity -

- 1) first collection of material
- 2) revision of methods
- 3) first drafting of charts -

but before doing so we had to decide, at least preliminarily, an adequate projection and scale of the master chart. We decided upon an equal area projection 1 : 15 mill: following the example of the Russian topographical chart of the Indian Ocean. This projection is given in fig. 1. In order to explain this special kind of chart with curved parallels one must imagine that one looks from the sun just to the Indian Ocean. In this way we get rather less distortion of those parts of the ocean south of 50° S. This is very valuable, because we have from a good number of cruises (also outside IIOE) many stations with biological observation concerning the field of this atlas. In order to demonstrate the superiority of this projection an example concerning the average of concentration of particulate carbon and seston is given in fig. 2.

It is highly desirable to restrict the number of projections of the five atlases under preparation as far as possible; but this is not absolutely necessary, if a limited number of charts from other projects is made available as transparent, loose leaf sheets.

In the first main field of activity - the collection of material - we received a good number of data reports and we obtained from National Co-ordinators the names of scientists in charge for the different fields of this atlas.

From preliminary and from definite publications of cruise data, we outlined the different station charts mainly for the open ocean. Presently the collection of material is continued on the basis of direct contact with National Co-ordinators. This is necessary, because we are not sure that all data of interest have been reported to World Data Centres A and B.

The second main field - revision of methods - is a most difficult task: in our field obviously very few research ships used the same methods.

It is very unfortunate that before starting the IIOE no agreement about methods to be applied in the field of chemical biology was accepted by all participants. So we are now forced to compare and revise all methods applied in the IIOE in our field.

First of all we started with comparison of the methods to determine particulate carbon. The results were not too bad. We continued with the different chlorophyll determination methods. These gave rather big differences and we are forced to follow a number of problems in this field intensely. This is also the case in the field of C_{14} - determinations. We look forward to close collaboration with the respective working groups of SCOR. Other fields - as, for example, protein and seston determination - have not yet been touched.

After this revision, the definite results can be used to draw definite charts. In order to get a first idea about the rough distribution of different observations, we have drawn a good deal of preliminary drafts. Mainly there are charts of distribution of chlorophyll a (e.g. 50-0 m - fig. 3 - surface layer, C_{14} productivity). There are also drafts for the concentration of the particulate carbon and seston. They show altogether a wide scale distribution.

These examples raised the question as to how these different patterns of distribution are connected with thickness of the surface layer. A respective chart has also been drawn (fig. 4, 4a). These charts are completed by diagrams which give an idea on proportion of chlorophyll and of particulate carbon in the surface layer of different selected cruises of Australian and US research vessels (fig. 5, 6).

From many points of view it would be advisable to draw not only average charts for the total area and year, but also to give special charts for different seasons. A meeting of editors may help to find out uniform seasons in all necessary cases.

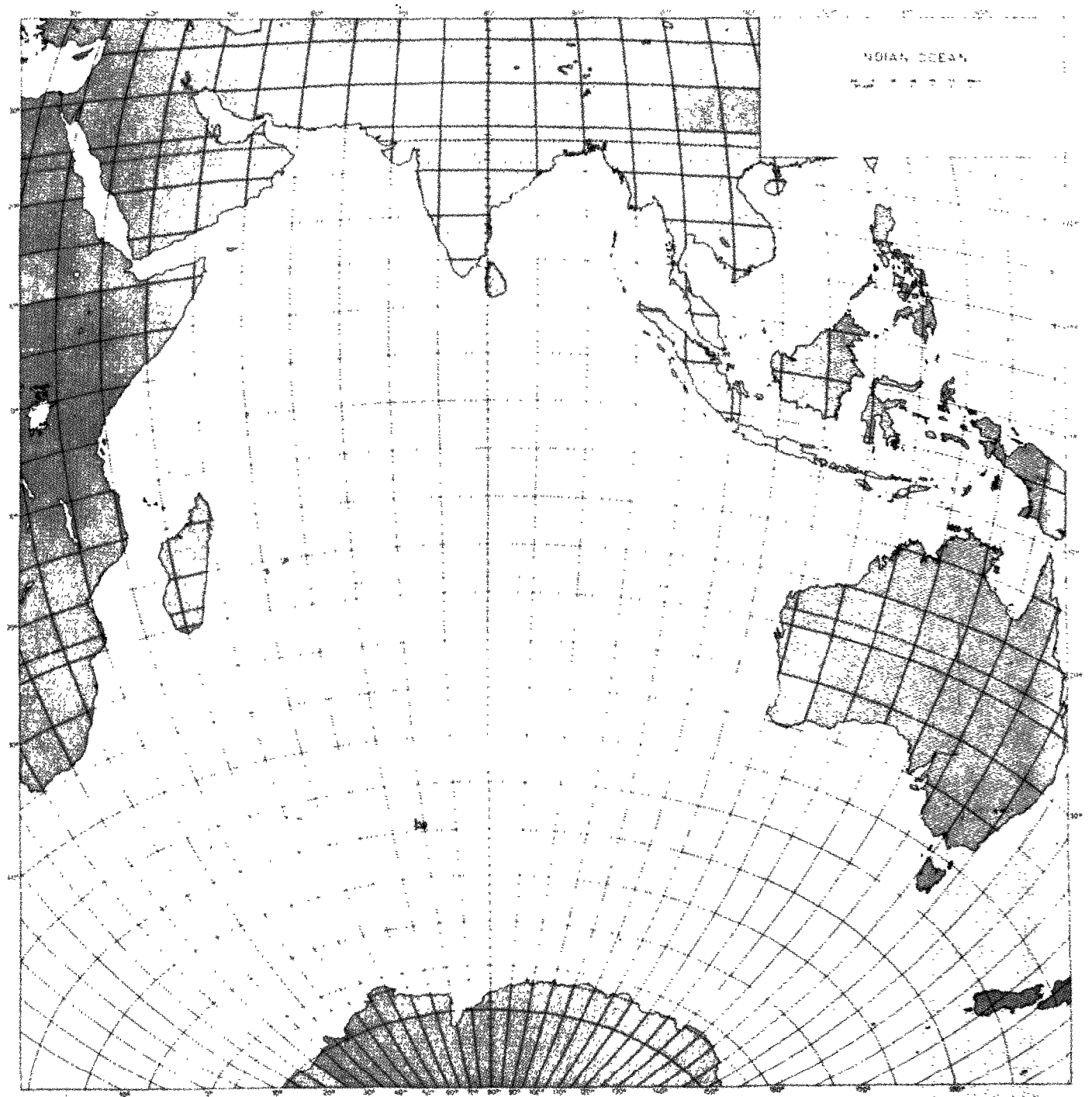


Fig. 1

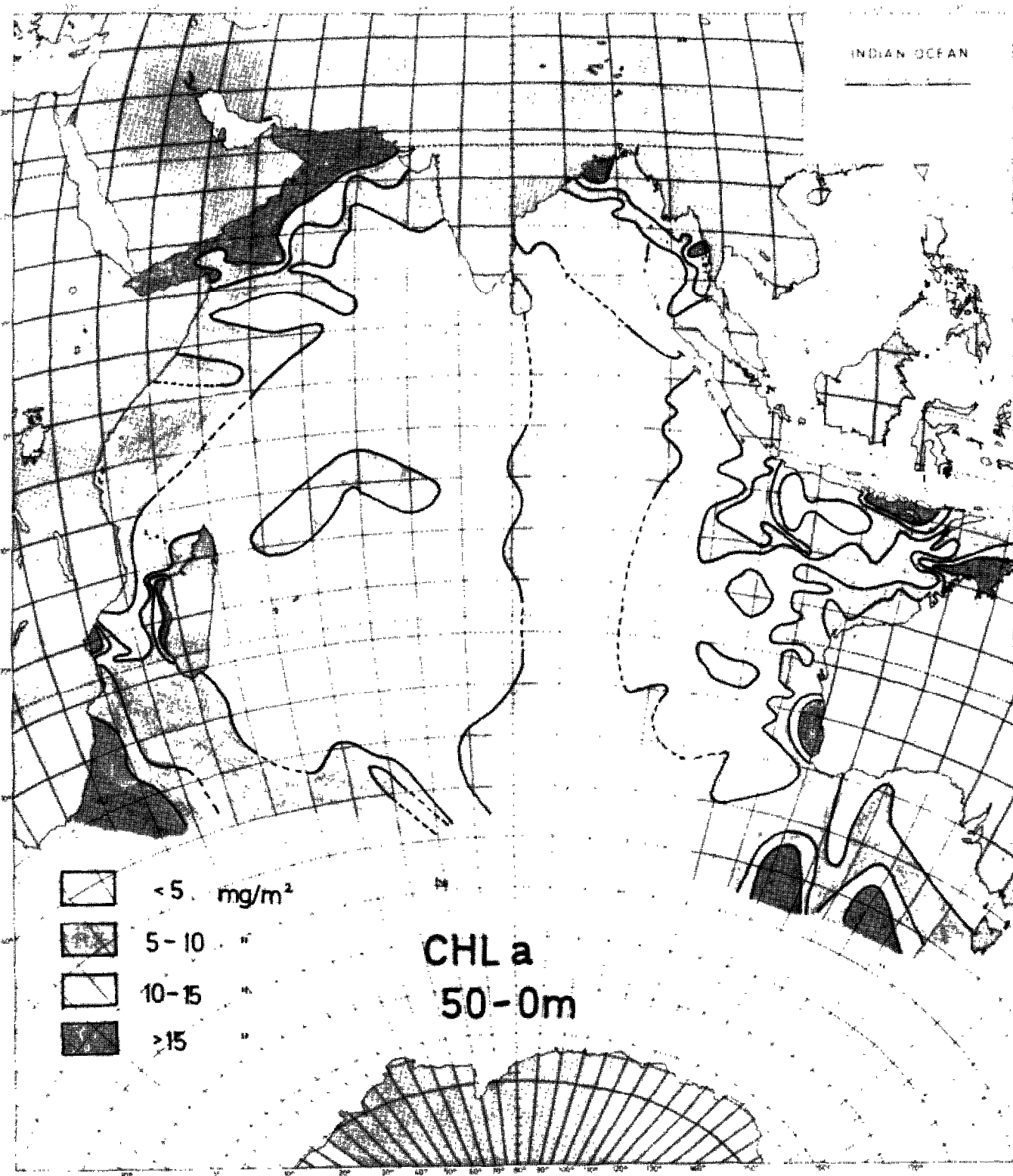


Fig. 3

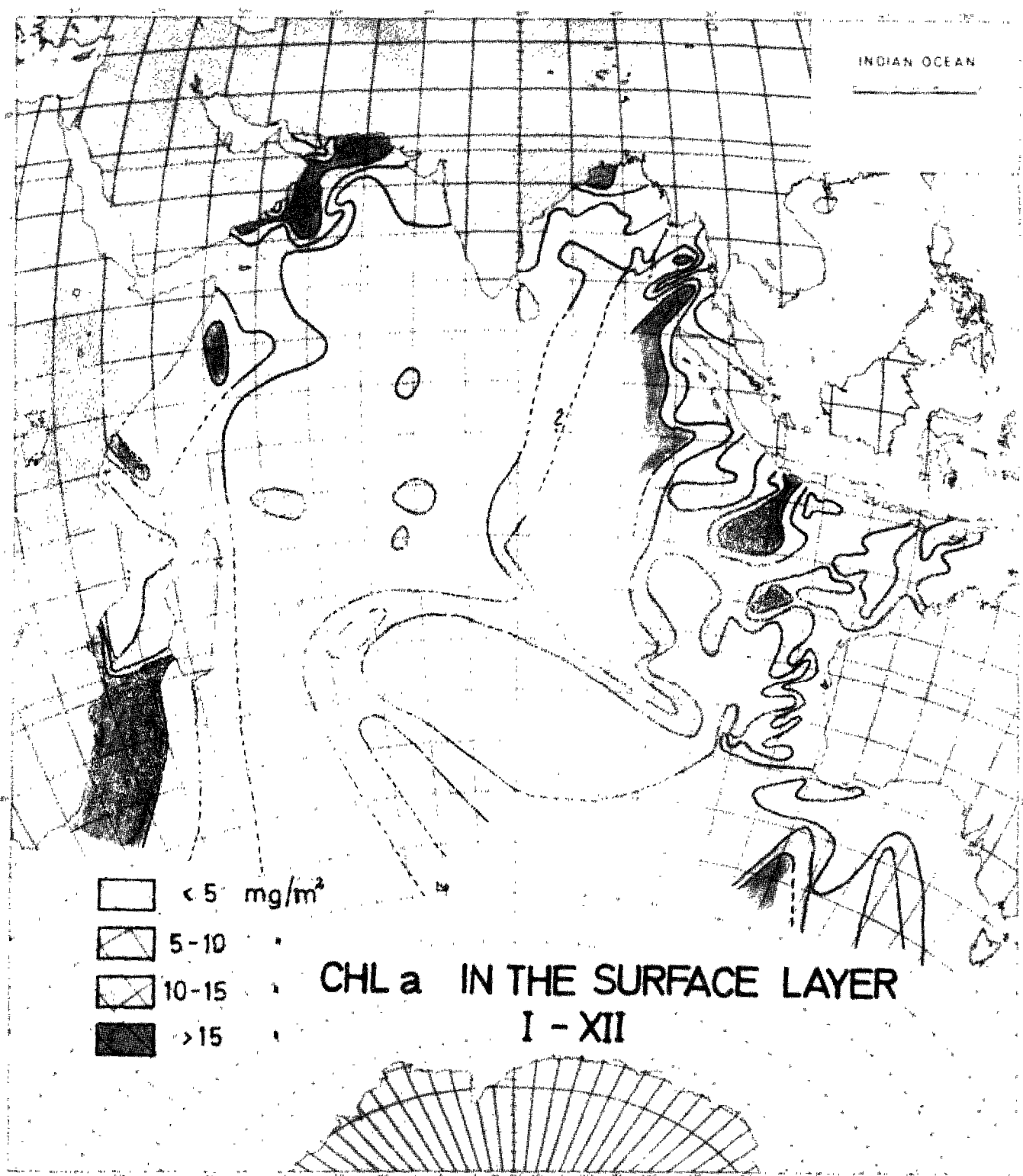


Fig. 4

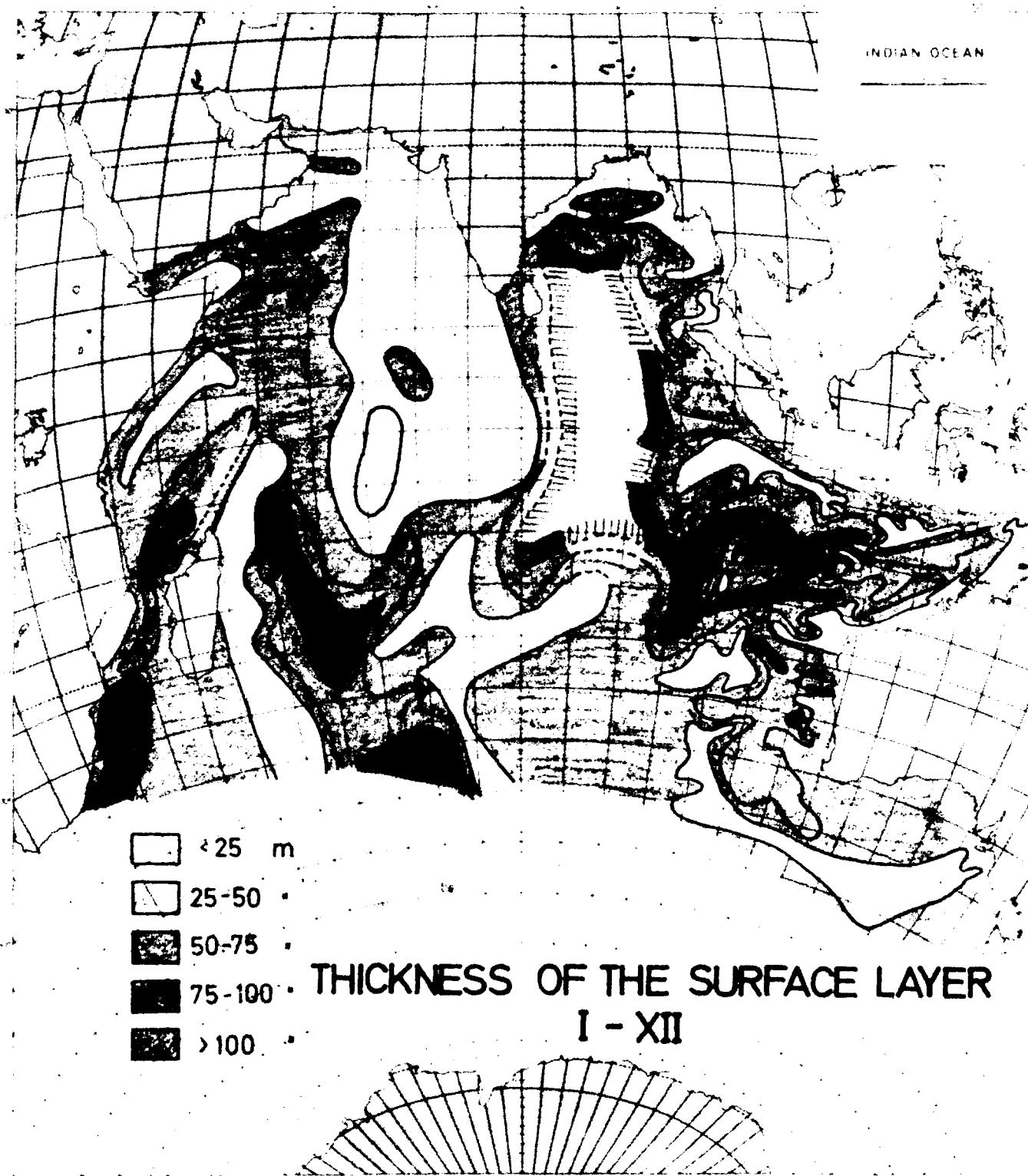
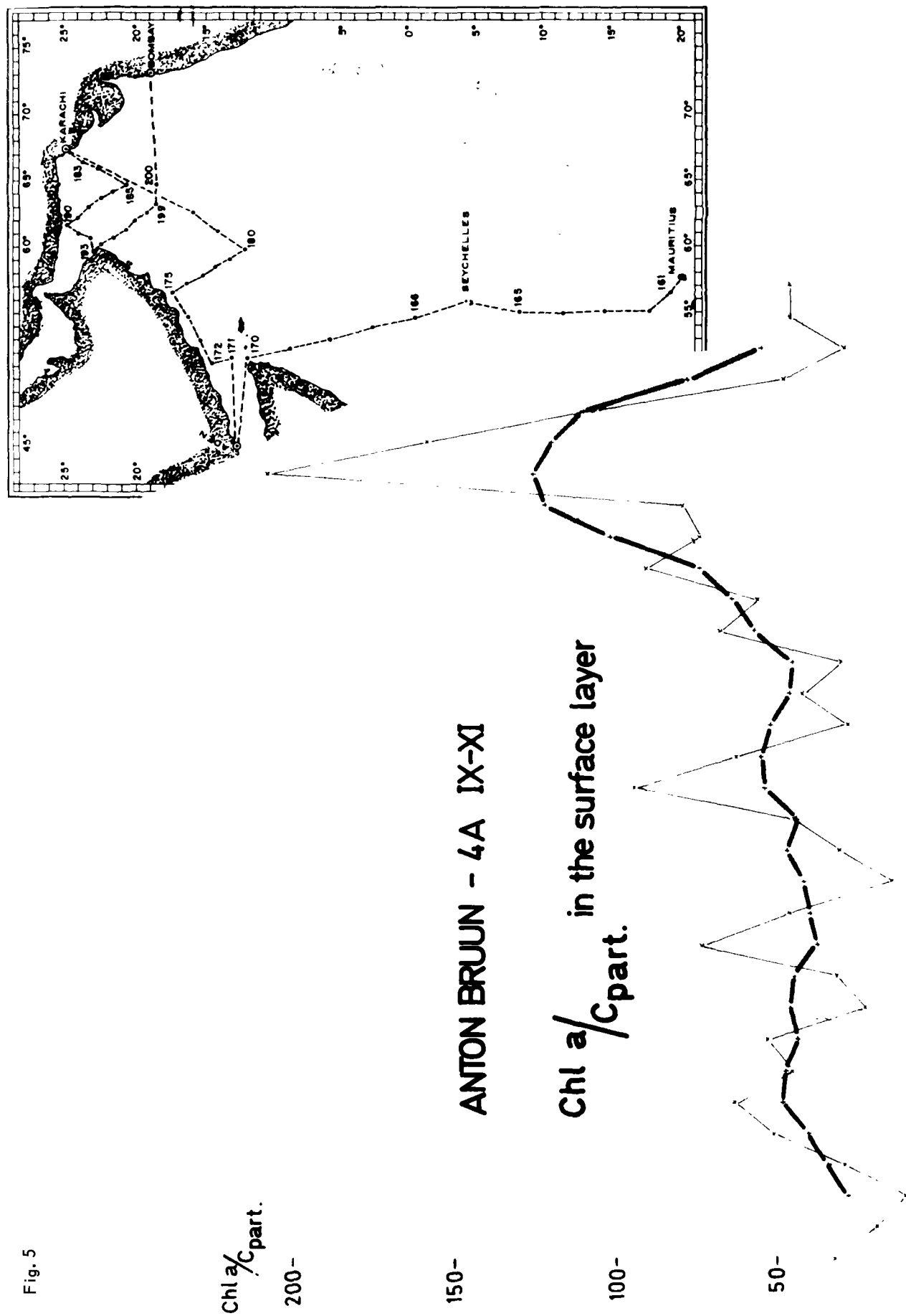


Fig. 4a

Fig. 5



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Fig. 6

GASCOYNE 1/63 I-II CHL a/C part.

CHL a/C part.
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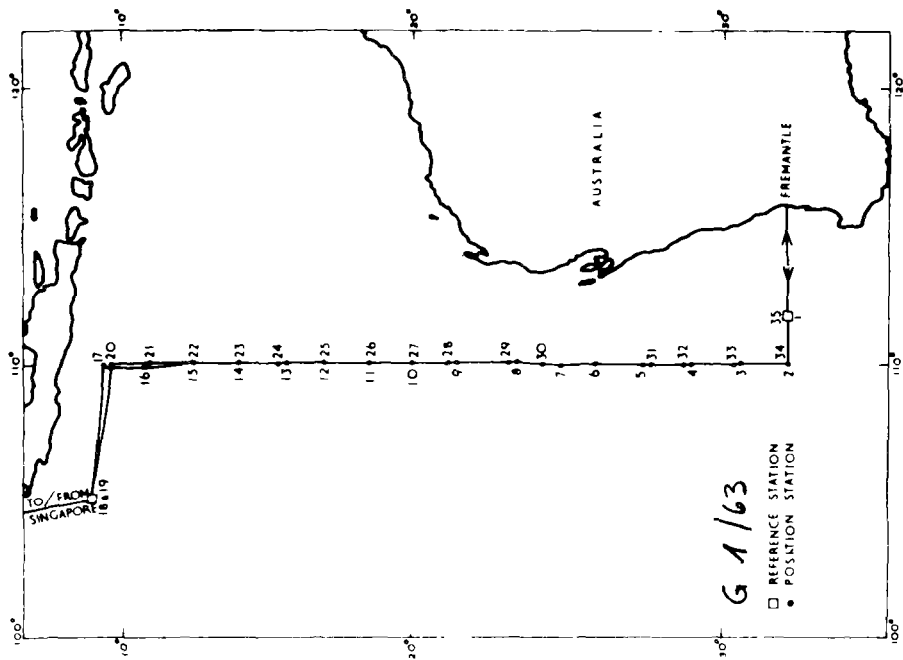
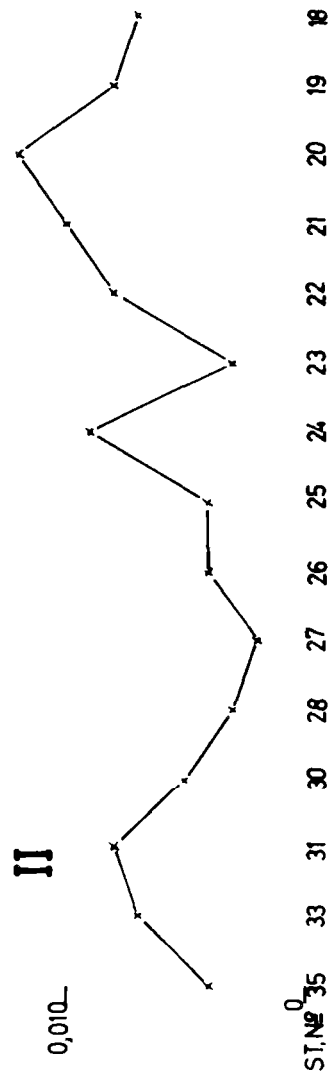
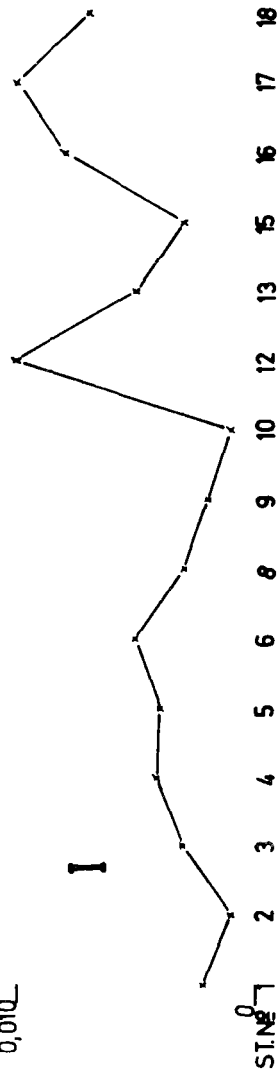
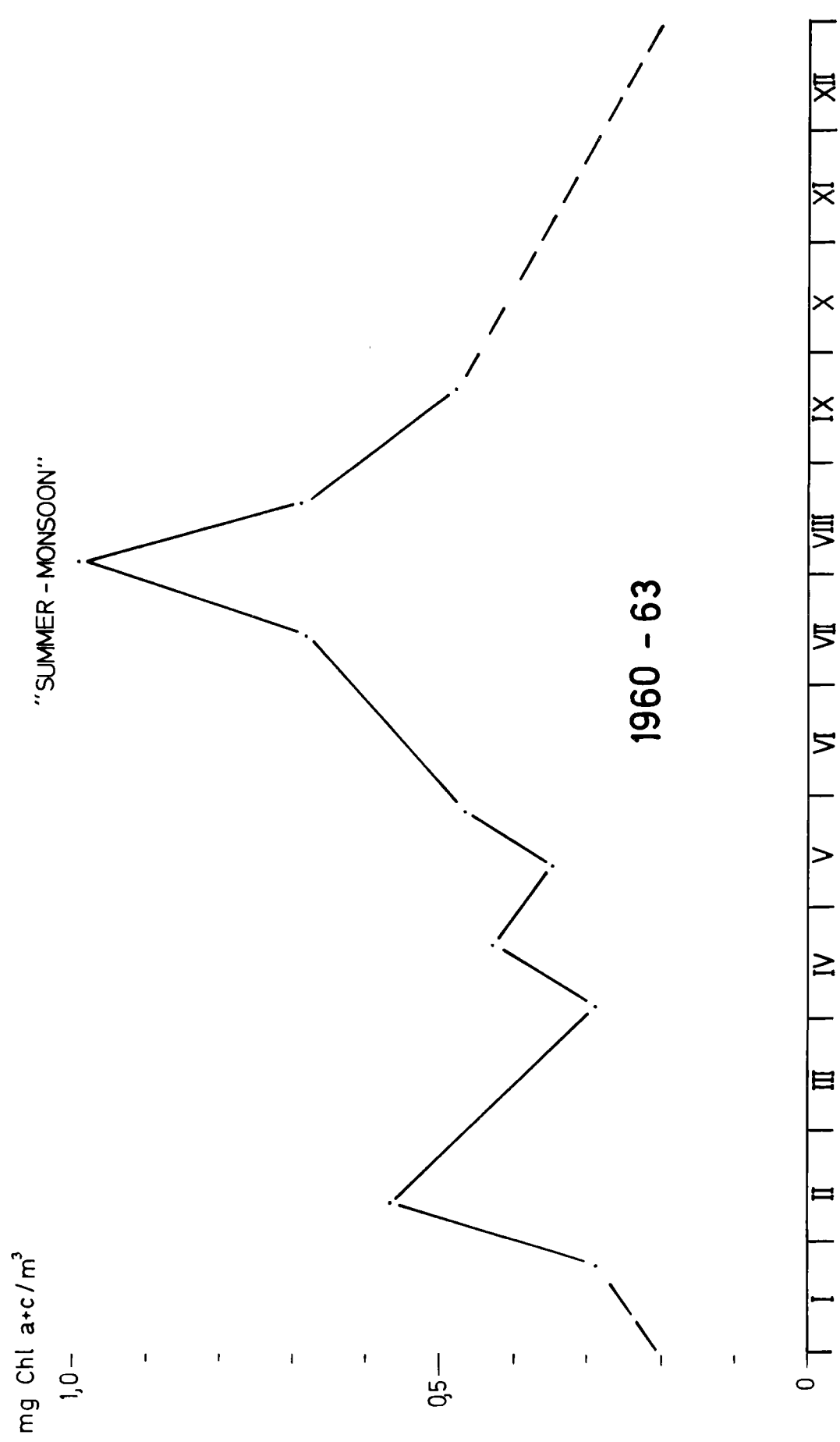


Fig. 7 **Average Chlorophyll a + Chlorophyll c on 15°30' S, 110° E**
0 - 50 m in mg / m³



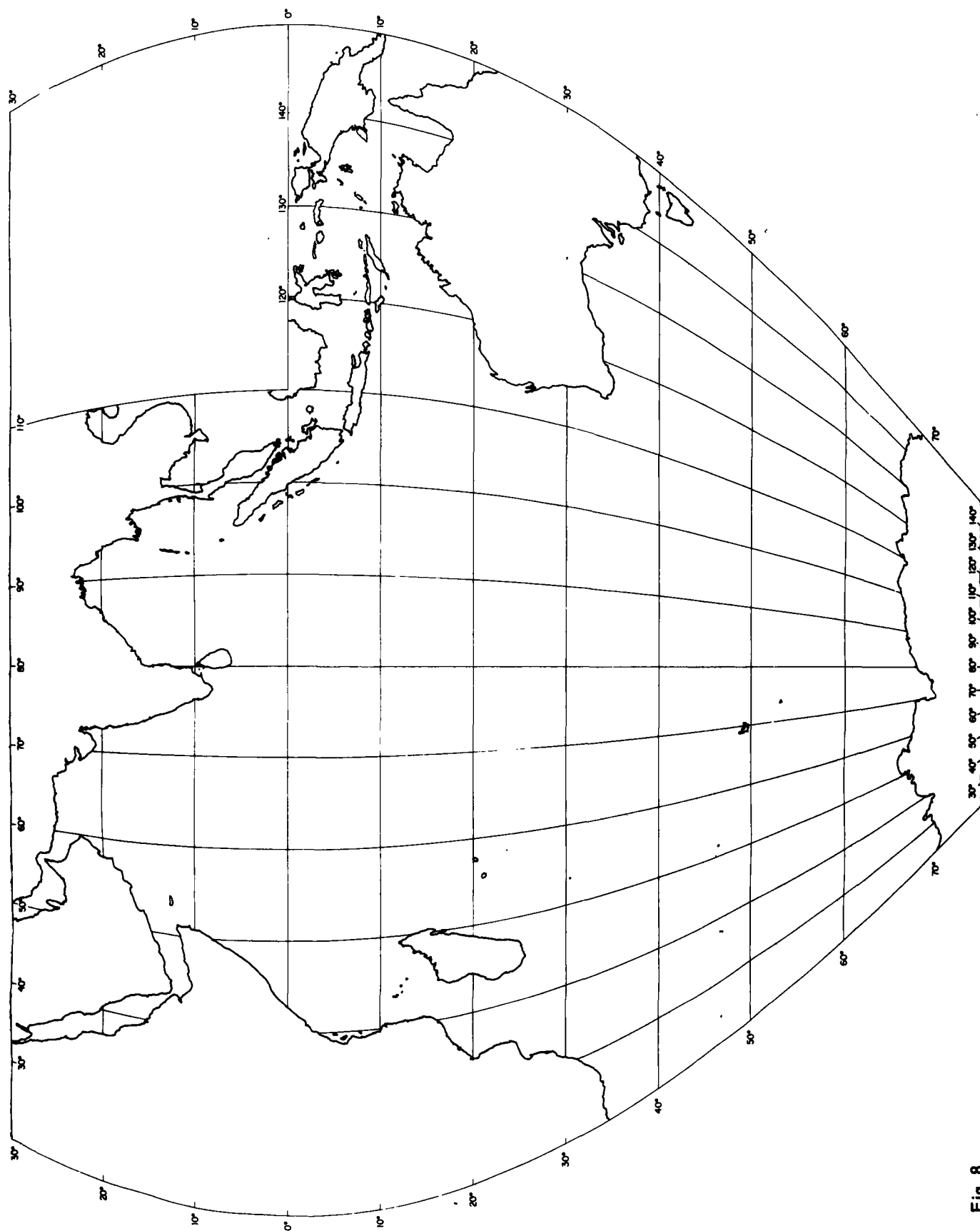


Fig. 8

Data-Sheet (IOE-Atlas, Chemical Biology)

Reference		Ship Code		Latitude	Longitude	Marsden-sq.	Station Time (GMT)			Local Time	Depth to Bottom	Max. Depth of Samples	Originator's		IOE Atlas Chem. Biology
Identity Number	Country Code	Institution Code	Ship Code	Deg.	Min.	Deg.	Min.	Month	Day	Hour	Year	Hour	1	10	
													Cruise No.	Station No.	
Phytoplankton:															
Photometric Depth (m)		Transparency/Secchi Disk (m)		Total Radiation Cal/cm²		Depth Range (m)	Sampling Device Code No.	Net		Volume of Water filtered	Displacement of phytoplankton (measured)	No. of Cells (1000/l)	Cell Volume (calculated)	Vol. under 1 m² Sea Surf.	Discussed Water Colour, Dimension of Patches
100	50	25	10	1%				Mesh Ap.	Mouth Diam.	Length					
C 14 Productivity															
Pigments		Chlorophyll		Carotenoides (Astacin etc.)		in situ		simulated in situ		art. const. light		Protein (Albumen)		Carbon	
Messenger Time	Real Depth (Corrected)	a mg/m³	b mg/m³	c mg/m³	MSPU/m³	mgC/h/m³	gC/m³	mgC/h/m³	gC/m³	h/m³	gC/m³	mgC/m³	mg/m³	total mg/m³	total mg/m³

Fig. 9

Collected reprints of the IIOE

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Part I. Marine biology

205. WOOD, E. J. F. Check list of dinoflagellates recorded from the Indian Ocean. Commonwealth of Australia, CSIRO, Division of Fisheries and Oceanography, 1963, (Report no. 28) 3
206. DURAIRATNAM, M. Studies on the seasonal cycle of sea surface temperatures, salinities and phytoplankton in Puttalam Lagoon, Dutch Bay and Portugal Bay along the west coast of Ceylon. *Bull. fish. res. Stn., Ceylon*, vol. 16, no. 1, 1963, p. 9-24 63
207. SAIJO, Yatsuka ; KAWASHIMA, Takuji. Primary production in the Antarctic Ocean. *J. oceanogr. Soc. Japan*, vol. 19, no. 4, 1964, p. 190-196 80
208. SAIJO, Yatsuka. Size distribution of photosynthesizing phytoplankton in the Indian Ocean. *J. oceanogr. Soc. Japan*, vol. 19, no. 4, 1964, p. 187-189 87
209. GRUA, Paul. Premières données sur les biomasses de l'herbier à *Macrocystis pyrifera* de la Baie du Morbihan (Archipel Kerguelen). *La terre et la vie*, no. 2, 1964, p. 215-220 91
210. GRUA, Paul. Plongées aux Iles Saint-Paul et Nouvelle Amsterdam. Plongées en eaux froides. In : R. Carrick (ed.), *Biologie antarctique*. Paris, Hermann, 1964, p. 279-282 99
211. GRUA, Paul. Le cycle sexuel et l'évolution des soies ovigères des femelles de *Jasus Paulensis* (Palinuridae). In : R. Carrick (ed.), *Biologie antarctique*. Paris, Hermann, 1964, p. 471-480 103
212. GRUA, Paul. Océanographie biologique. Sur la structure des peuplements de *Macrocystis pyrifera* (L.) C. Ag. observés en plongée à Kerguelon et Crozet. *C.R. Acad. Sc. Paris*, vol. 259, groupe 11, 1964, p. 1541-1543 113
213. DELÉPINE, R. ; GRUA, P. La végétation infra-littorale de la Baie du Morbihan (Kerguelen). *Bull. Soc. Phycol. de France*, no. 10, 1964, p. 14 116
214. KIRSTENER, Ernst. *Ptychodera flava* (Enteropneusta) von Tanikely, Madagaskar. *Zoologischer Anzeiger* (Leipzig), Bd. 175, Heft 4-6, 1965, S. 371-377 117
215. CROCE, N. Della ; HOLTHUIS, L. B. Swarming of *Charybdis (Goniohellenus) edwardsi* Leene & Buitendijk in the Indian Ocean (Crustacea Decapoda, Portunidae). *Boll. Mus. Ist. Biol. Univ. Genova*, vol. XXXIII, no. 199, 1964-1965, p. 33-38 125
216. SAIJO, Yatsuka ; TAKESUE, Kaoru. Further studies on the size distribution of photosynthesizing phytoplankton in the Indian Ocean. *J. oceanogr. Soc. Japan*, vol. 20, no. 6, 1965, p. 264-271 132
217. DURAIRATNAM, M. Some planktonic diatoms from the Indian Ocean. *Bull. fish. res. Stn., Ceylon*, vol. 17, no. 2, 1964, p. 159-168 141
218. ROBERTSON, Robert. Coelenterate-associated prosobranch gastropods. *Annual reports for 1965 of the American Malacological Union*, p. 6-8 152
219. CUTLER, Edward B. Sipunculids of Madagascar. *Océanographie*, vol. III, no. 2, 1965, p. 51-63 (Cahiers ORSTROM) 155
220. HUMES, Arthur G. ; HO, Ju-Shey. New species of the genus *Anthessius* (copepoda, cyclopoida) associated with mollusks in Madagascar. *Océanographie*, vol. III, no. 2, 1965, p. 79-113 (Cahiers ORSTROM) 169
221. HUMES, Arthur G. New species of *Hamicyclops* (copepoda, cyclopoida) from Madagascar. *Bull. Mus. comp. Zool.*, vol. 134, no. 6, 1965, p. 159-259 205
222. MEAD, Giles W. ; DE FALLA, J. E. New oceanic cheilodipterid fishes from the Indian Ocean. *Bull. Mus. comp. Zool.*, vol. 134, no. 7, 1965, p. 261-274 307
223. KIRSTEINER, Ernst. Über das Vorkommen von Nemertinen in einem tropischen Korallenriff ; 4. Hoplonemertini monostilifera. *Zool. Jb. Syst.*, Bd. 92, 1965, S. 289-326 321

224. DECKER, A. de. Observations on the ecology and distribution of copepoda in the marine plankton of South Africa. Cape Town, Republic of South Africa, Department of Commerce and Industries, Division of Sea Fisheries, 1964, 33 p. (Investigational report no. 49) 359
225. DECKER, A. de; MOMBECK, F. J. A preliminary report on the planktonic copepoda. Cape Town, Republic of South Africa, Department of Commerce and Industries, Division of Sea Fisheries, 1964, 41 p. (Investigational report no. 51). 391
226. GRINDLEY, J. R.; PENRITH, M. J. Notes on the bathypelagic fauna of the seas around South Africa. *Zoologica Africana*, vol. 1, no. 2, 1965, p. 275-295 433
227. MEAD, Giles W.; RUBINOFF, Ira. *Avocettinops yanoi*, a new nemichthyid eel from the southern Indian Ocean. *Breviora* (Museum of Comparative Zoology), no. 241, 1966, 6 p. 457
228. MULLIN, Michael M. Selective feeding by calanoid copepods from the Indian Ocean. In: H. Barnes (ed.), *Some contemporary studies in marine science*. London. Allen & Unwin Ltd., 1966, p. 545-554 463
229. БОГОРОВ, В. Г.; БОРДОВСКИЙ, О. К.; ВИНОВАДОВ, М. Е. Биогеохимия океанического планктона. Распределение некоторых химических компонентов планктона в Индийском океане. *Океанология*, т. VI, вып. 2, 1966, стр. 314-325. 474
- BOGOROV, B. G.; BORDOVSKIY, O. K.; VINOGRADOV, M. E. Biogeochemistry of the oceanic plankton. The distribution of some chemical components of the plankton of the Indian Ocean. *Okeanologia*, vol. VI, no. 2, 1966, p. 314-325. 474
230. HUMES, Arthur G. *Pseudanthessius procurrens* n.sp., a cyclopoid copepod associated with a cidarid echinoid in Madagascar. *Breviora* (Museum of Comparative Zoology), no. 246, 1966, 14 p. 487

Part II. Marine chemistry

231. SUBBA RAO, D. V. The measurement of total carbon dioxide in dilute tropical waters. *Aust. J. mar. freshw. Res.*, vol. 16, 1965, p. 273-280 503
232. THOMMERET, Jean; THOMMERET, Yolande; GALLIOT, Jean. Teneur en radiocarbone des eaux profondes et superficielles du nord de l'océan Indien (mer d'Oman). *Bull. Inst. océanogr. Monaco*, vol. 65, no. 1, 1965, 8 p. (IAEA, Radioactivity in the sea. Publication no. 18) 511
233. FRAGA, F. Distribution of particulate and dissolved nitrogen in the western Indian Ocean. *Deep-sea Res.*, vol. 13, 1966, p. 413-425 519
234. ROCHFORD, D. J. Source regions of oxygen maxima in intermediate depths of the Arabian Sea. *Aust. J. mar. freshw. Res.*, vol. 17, 1966, p. 1-30 533
235. MOSTERT, S. A. Distribution of inorganic phosphate and dissolved oxygen in the south-west Indian Ocean. Cape Town, Republic of South Africa, Department of Commerce and Industries, Division of Sea Fisheries, 1966, 23 p. (Investigational report no. 54) 563

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236. HAMON, B. V. Geostrophic currents in the south-eastern Indian Ocean. *Aust. J. mar. freshw. Res.*, vol. 16, 1965, p. 255-271 591
237. SOURNIA, Alain. Mesure de l'absorption de l'ultraviolet dans les eaux côtières de Noosi-Bé (Madagascar). *Bull. Inst. océanogr. Monaco*, vol. 65, no. 1, 1965, 12 p. 609
238. SWALLOW, J. C. The Somali current. Some observations made aboard R.R.S. *Discovery* during August 1964. *Mar. Obs., London*, July 1965, p. 125-130 621
239. ROCHFORD, D. J. Distribution of Banda Intermediate water in the Indian Ocean. *Aust. J. mar. freshw. Res.*, vol. 17, 1966, p. 61-76 627
240. RAMAGE, C. S. The summer atmospheric circulation over the Arabian Sea. *J. atmosph. Sci.*, vol. 23, no. 2, 1966, p. 144-150 643
241. VISSER, G. A.; VAN NIEKERK, M. M. Ocean currents and water masses at 1,000, 1,500 and 3,000 metres in the south-west Indian Ocean. Cape Town, Republic of South Africa, Department of Commerce and Industries, Division of Sea Fisheries, 1965, 46 p. (Investigational report no. 52). 651
242. ORREN, M. J. Hydrology of the south-west Indian Ocean. Cape Town, Republic of South Africa, Department of Commerce and Industries, Division of Sea Fisheries, 1966, 35 p. (Investigational report no. 55) 697

Part IV. Marine geology and geophysics

243. LAFOND, E. C. Andhra, Mahadevan and Krishna submarine canyons and other features of the continental slope off the east coast of India. *J. Indian geophys. Un.*, vol. 1, no. 1, 1964, p. 25-32 739
244. ALLAN, T. D.; CHARNOCK, H.; MORELLI, C. Magnetic, gravity and depth surveys in the Mediterranean and Red Sea. *Nature, Lond.*, vol. 204, no. 4, 1965, p. 1245-1248 751
245. КАНАЕВ, В. Ф.; МАРОВА, Н. А. Батиметрическая карта Северной части Индийского океана. *Океанологические исследования*, № 13, 1964, стр. 157-162. 759
- KANAEV, V. F.; MAROVA, N. A. Bathymetric chart of the northern part of the Indian Ocean. *Okeanol. issled.*, no. 13, 1964, p. 157-162 759
246. КАНАЕВ, В. Ф. Индийский океан. Новая географическая карта. *Океанология*, т. V, вып. 4, 1965, стр. 760-762. 768
- KANAEV, V. F. The Indian Ocean. A new geographical map. *Okeanologia*, vol. V, no. 4, 1965, p. 760-762 768
247. DAVIES, D.; FRANCIS, T. J. G. The crustal structure of the Seychelles Bank. *Deep-sea Res.*, vol. II, 1964, p. 921-927 773
248. FRANCIS, T. J. G.; SHOR, G. G. Seismic refraction measurements in the north-west Indian Ocean. *J. geophys. Res.*, vol. 71, no. 2, 1966, p. 427-449 781

249. ENGEL, C. G.; FISHER, R. L.; ENGEL, A. E. G. Igneous rocks of the Indian Ocean floor. *Science*, vol. 150, no. 3, 696, 1965, p. 605-610 805
250. БЕЗРУКОВ, П. Л.; КРЫЛОВ, А. Я.; ЧЕРНЫШЕВА, В. Н. Петрография и абсолютный возраст базальтов со дна Индийского океана. *Океанология*, т. VI, вып. 2, 1966, стр. 261-266. 811
BEZRUKOV, P. L.; KRYLOV, A. Ya.; CHERNYSHEVA, V. I. Petrography and the absolute age of the Indian Ocean floor basalts. *Okeanologia*, vol. VI, no. 2, 1966, p. 261-266 811
251. ГОРБУНОВА, З. Н. Распределение глинистых минералов в осадках Индийского океана. *Океанология*, т. VI, вып. 2, 1966, стр. 267-275. 817
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252. BIRCH, F. S.; HALUNEN JR., A. J. Heat-flow measurements in the Atlantic Ocean, Indian Ocean, Mediterranean Sea and Red Sea. *J. geophys. Res.*, vol. 71, no. 2, 1966, p. 583-586 827
253. BOWIN, C. O.; VOGT, P. R. Magnetic lineation between Carlsberg Ridge and Seychelles Bank, Indian Ocean. *J. geophys. Res.*, vol. 71, no. 10, 1966, p. 2625-2630 831
254. SCHOTT, W.; STACKELBERG, U. von. Über rezente Sedimentation im Indischen Ozean, ihre Bedeutung für die Entstehung kohlenwasserstoffhaltiger Sedimente. *Erdöl und Kohle-Erdgas-Petrochemie*, 18 Jahrgang, Nr. 12, 1965, S. 945-950 837
255. BUNGENSTOCK, H.; CLOSS, H.; HINZ, K. Seismische Untersuchungen im nördlichen Teil des Arabischen Meeres (Golf von Oman). *Erdöl und Kohle-Erdgas-Petrochemie*, 19 Jahrgang, Nr. 4, 1966, S. 237-243 843
- Part V. Papers presented by title or an abstract only
- 256-259. *Israel South Red Sea Expedition, 1962. Reports nos. 1-4*. Haifa, Department of Fisheries, Sea Fisheries Research Station, 1964. (Bulletin no. 35). [Titles only] 853
256. OREN, O. H. Hydrography of Dahlak Archipelago (Red Sea)
257. GOREAU, T. On the predation of coral by the spiny starfish *Acanthaster Planci* (L.) in the southern Red Sea
258. STOCK, J. H. Report on the Pycnogonida of the Israel South Red Sea Expedition
259. HODGFIN, J. H.; YARON, Z. A collection of reptiles from the Dahlak Archipelago
- 260-267. *Israel South Red Sea Expedition, 1962. Reports nos. 5-12*. Haifa, Department of Fisheries, Sea Fisheries Research Station, 1965. (Bulletin no. 38). [Titles only] 854
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261. COSTA, Michael. *Andrégamus* N. Gen., a new genus of mesostigmatic mites associated with terrestrial hermit crabs
262. DAY, J. H. Some polychaeta from the Israel South Red Sea Expedition, 1962
263. STOCK, J. H.; NIJSSEN, H. *Eriopisa Longiramus* N.Sp., a new subterranean amphipod from a Red Sea island
264. WAINWRIGHT, Stephen A. Reef communities visited by the Israel South Red Sea Expedition, 1962.
265. NIR, Yaacov; ROGERS, Allen S. Entedebir Island—Dahlak Archipelago
266. KOHN, Alan J. *Conus* (mollusca, gastropoda) collected by the Israel South Red Sea Expedition, 1962, with notes on collections from the Gulf of Aqaba and the Sinai Peninsula
267. STEINITZ, H. Comments on geographical names on the expedition's map
- 268-272. *Israel South Red Sea Expedition, 1962. Reports nos. 13-17*. Haifa, Department of Fisheries, Sea Fisheries Research Station, 1965. (Bulletin no. 40). [Titles only] 855
268. LÉVI, Claude. Spongiaires récoltés par l'Expédition Israélienne dans le Sud de la Mer Rouge en 1962
269. VERSEVELDT, J. Report on the Octocorallia (Stolonifera and Alcyonacea) of the Israel South Red Sea Expedition 1962, with notes on other collections from the Red Sea
270. HUMES, A. G.; STOCK, J. H. Three new species of Anthesius (Copepoda, Cyclopoida, Mycicolidae) associated with Tridacna from the Red Sea and Madagascar
271. SCHILDER, F. A. Cypraeidae
272. STEPHEN, A. C. Echiura and Sipuncula from the Israel South Red Sea Expedition
273. Records of oceanographic works in Japan. General report of the participation of Japan in the International Indian Ocean Expedition. Vol 8, no. 2 (new series February 1966). Published by the Science Council of Japan [Title only] 856
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288. McDOWELL, S. A preliminary report on the Tintinnida of the Indian Ocean from the collections of Cruise 2 of the *Anson Bruun*, June to August 1963. *Second International Conference on Protozoology. London, August 1965.* (Excerpta Medica International Congress series no. 91) [Abstract]. . 867

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