information paper

intergovernmental oceanographic commission

12

UNESCO/NS/IOC/INF-69

FOREWORD

As the reader will see from the last page of this Information Paper the second meeting of the International Co-ordinating Group for the IIOE will take place in Unesco, Paris, from 7 to 9 June this year. Problems which are going to be discussed during this meeting are listed in the Provisional Agenda given in Annex VI to this Information Paper. Among the items of the Agenda, the problems of the IIOE Atlases and Data Reports merit particular attention. It is more and more clear, particularly after the thorough planning for producing ICITA Atlases has been done, that the preparation and publishing of the IIOE Atlases is going to be a huge and complicated task. Apparently, in certain particular fields like meteorology and zooplankton, where specialized centres were created in the region of study, data and samples are already in the state which permits preparation of charts reflecting particular distributions or processes. In other fields longer periods of time are needed in order to assemble, analyse and interpret data and perhaps national scientific institutions themselves, in agreement with each other, or separately, will inevitably pioneer as they did in bathymetry in producing generalizing charts as soon as data are available. There are groups of scientists who consider that the IIOE Atlases should not be prepared in a rush but that they should gradually develop on the basis of regional maps prepared by interested scientific institutions. Undoubtedly other points of view could be expressed and the Secretariat of the IOC by reprinting the Provisional Agenda of the Coordinating Meeting in this issue would like to provoke early thinking on the problems involved in order to facilitate forthcoming discussion at the meeting.

unesco

Unesco Office of Oceanography
Paris, April 1965

WS/0465.92-AVS

IIOE INFORMATION PAPER No.12

1. Reports of Important Meetings.

1.1 The Third Regional Meeting of Marine Science Experts in East and South-East Asia.

The meeting was convened in Manila, by Unesco, jointly with its South-East Asia Science Co-operation Office, on February 3 to 6, 1965, at the invitation of the Government of the Philippines acting through its Unesco National Commission. The meeting discussed various problems relating to marine science activities in the region. The following is a summary of the discussion as far as it dealt with the International Indian Ocean Expedition.

It was pointed out that in international ocean-wide studies such as that of the Indian Ocean, smaller countries in the area might contribute to the accumulation of data relevant to large-scale problems if these countries' programmes are planned as a supplement to big expeditions. In the long run there would be some local benefit from better understanding of large-scale phenomena which are more often a target of studies by the larger participating nations. However, it might be more beneficial for the smaller countries to develop their own national programmes around well-defined local problems. This may give local scientists a better opportunity to utilise their own data for their own purposes, using data collected by other countries as background or supplementary information. Thus large co-operative expeditions might be of greater help to the development of national oceanographic programmes. Within the structure of the IIOE, India is building a strong national programme which is a good example for other countries to follow.

The International Co-ordinating Group agreed to terminate co-ordinated field activities of the IIOE in December 1965. Co-operation in the assessment of results will continue. Plankton identification sheets are being prepared and, so far, 14 additional workers in taxonomy have been trained in India.

1.2 The Third Session of the Advisory Committee on Marine Resources Research (ACMRR) of F.A.O.

The Third Session of ACMRR was held from March 1 to 8, 1965, at the F.A.O. The Committee has taken note of the Recommendation of IPFC respecting the Indian Ocean, adopted at its 11th Session (see this Information Paper, No.11, Section 3). The following is an extract from the report of the Committee.

"The Committee was made aware of that portion of the Special Fund Fishery Pre-development Survey at Aden under which F.A.O. was initiating analyses of hydrographic and biological data arising from the IIOE and other sources by competent ocean scientists as a preliminary phase of that project.

The Committee commends this initiative and calls the attention of the Director-General to the vast amount of such data that has been accumulated respecting the hydrology and biology of the Arabian Sea in particular and of the Bay of Bengal - Andaman Sea area as well, under the aegis of IIOE and through the efforts to develop research of the high seas by the countries of this region.

The Committee requests that the Director-General:

1. Implement the recommendation of IPFC in so far as he finds this to be practicable, and with such timing as will get this working up of data under way on a priority basis as soon as possible.

2. Examine the possibility of implementing a pre-development survey involving primarily analyses of fishery-useful hydrographic and biological data, in the same manner as is contemplated for the Gulf of Aden Special Fund Fishery Project arising from the International Indian Ocean Expedition for the Arabian Sea and its pendant gulfs as a unit.

3. Depending upon experience and success under (2) above, initiate similar activity respecting the Bay of Bengal - Andaman Sea area.

4. Urge participating nations, agencies, and laboratories involved in the IIOE to file their hydrographic, meteorological, and biological data in World Data Centres with all due speed so that these analyses of data for fishery developmental purposes in the Indian Ocean countries can proceed as expeditiously and competently as possible."

2. Exchange of Data and Information.

2.1 Cruise Reports.

Australia.

H.M.A.S. DIAMANTINA, Cruise Dm 1/62. February 12 - March 25, 1962.

Oceanographic Cruise Report No.14, Oceanographic Observations in the Indian Ocean 1962, H.M.A.S. DIAMANTINA Cruise Dm 1/62, was published by the Division of Fisheries and Oceanography, C.S.I.R.O., Australia, and a copy was received by this Office.

The Cruise commenced at Fremantle on February 12 and worked four lines of stations in the region off North-West Australia, to Darwin.

The Cruise left Darwin on March 2, worked a line of stations in the Banda and Java Seas to Singapore - thence south via Sunda Strait and worked a line of stations to the North-West Cape, from there to Fremantle on March 25 (see the Station Map in Annex 1). During the Cruise, bathythermograph casts were made at 29 stations and the following samples were collected:

sub-surface hydrology	42 stations
primary productions	42 stations
pigments	32 stations
zoo-plankton	23 stations
phytoplankton	39 stations

List of Scientists:

B. Newell (Cruise Leader 12.2.62 - 25.2.62)
D. Rochford (Cruise Leader 2.3.62 - 25.3.62)
F. Davies
N. Dyson
K. Fleming
C. Middleton
J. Stevenson (Division of Meteorological Physics)

The Report contains descriptions on methods of collections and analysis of samples, together with the data sheets and tables.

Germany. r/v METEOR

First Part of the Indian Ocean Expedition of German r/v METEOR

According to unofficial information the first half of the Expedition of r/v METEOR proved to be very successful. It was the first large cruise of the ship, but the amount of initial difficulties normal for a new vessel equipped with much new gear was surprisingly low. The interest of German scientists to participate in the Indian Ocean Expedition was so high that an extensive exchange of participants had to take place. At each port of call five to ten scientists were exchanged. This gave an opportunity to 50 scientists to participate in the Expedition, although only 25 berths for scientists were available on board. The scientist-in-charge for the main part of the six-months'-long Expedition was Professor Dietrich of the Institut für Meereskunde of Kiel University. For some parts of the cruise foreign visitors came aboard, among them Professor Tchernia, IIOE Disciplinary Leader in physical oceanography. The cruise programme and chart were published in the IIOE Information Papers Nos. 8 and 10, and the ship followed its schedule with only a few days delay.

R/v METEOR left Hamburg on October 29 and reached Port Said on November 17, after a brief call in Naples and after doing some hydrography and marine geology in the Mediterranean. For continuous recording in the surface water the following instruments were used:

Thermograph
Salinograph
Continuous turbidity recorder
Magnetometer with towed electrodes
Continuous recorder for radio activity.

Satisfactory results were obtained from trials with the "Bathysonde" for registration of temperature and electrical conductivity down to 2000m, with registration of vertical distribution of oxygen down to 400m; from a new deep sea echograph with extremely narrow beam for the registration of steep slopes of submarine vulcanoes and of narrow submarine trenches and folds.

The routine programme started in the Red Sea, where special interest was paid to geological and geophysical studies of its young tectonics and to the stratification of temperature, salinity, pH, oxygen, alkalinity and organic and inorganic components (silicate, nitrate, nitrite, phosphate, ammonia, calcium). It was obvious that the Mediterranean below 500m and the Red Sea below 250m are almost homogenous, whereas in the Atlantic and in the Indian Ocean narrow stratification of various parameters can be found down to several thousand meters. One exception to the homogeneity of the deep water in the Red Sea is the local mass of highly saline hot water found by DISCOVERY and later by METEOR at 2000m depth off Djidda (see IIOE Information Paper No. 11 and the next sub-section). The nutrient content in the surface water of the Red Sea is three to four times higher than in the North Atlantic, but at greater depths thin layers with very low O_2 content (0.4ml/l) were found and catches of mid-water fauna were accordingly poor. For the measurement of chlorophyll and seston the spectro-photometric analysis of chromatography gave very consistent results and a new method for measuring particulate organic carbon was successfully applied and gave readings of 20-40 µg/l in the deeper layers. For taking water samples for chemical and biochemical studies, newly-developed, metal-free water samplers of 3.5 litres capacity were used. For plankton studies and ichthyological work, Indian Ocean Standard nets, Heligoland larvae nets, closing nets, Gulf-III-samplers with closing device, Agassiz trawls, dredges and bottom trawls were provided. Special attention was paid to the diurnal movements of the scattering layers.

In the Gulf of Aden and the Strait of Bab-el-Mandeb continuous registration of currents at various depths by anchored buoys and gradient current meter lowered from the vessel gave a good picture of the vertical distribution of speed and direction of currents. The meteorological station on board recorded the radiation and heat exchange between atmosphere and surface water.

After the initial phase of the Expedition in the Red Sea and the Gulf of Aden, the main part started with an intensive study of the Somali Current from mid-December to mid-January. The current, running in the upper 100 meters parallel to the coast, reaches a velocity of 1.5 m/sec. The vertical gradient of current velocity was followed from the surface to a depth of 200m.

The "Bathysonde" revealed a very complicated vertical structure with narrow layers of "Red Sea water" which could be traced even south of the Equator in 400 to 800m depth; but also in the cold deep sea water, steep gradients and inversions of temperature were found. In the western part of the Arabian Sea layers between 150 and 1000m depth are very poor in oxygen(1 ml/l). In surface waters nitrate seems to be the limiting factor for plankton development. The total amount of organic matter per surface area was increasing from north to south and is of the same order as in the North Atlantic. The horizontal and vertical distribtion of particulate organic carbon, of total organic carbon, of nannoplankton, seston, chlorophyll and albumen was determined in about 700 samples. Correlations with the results of microbiological studies were established. Samples of the macroplankton were taken according to the international schedule and on additional stations; work on the distribution of pelagic fish fry is underway. Geological studies on sedimentation and sediments in the Somali Basin were co-ordinated with biological studies of benthos. During these studies, various kinds of piston samplers, dredges and grabs were employed. The echosounder showed a sea-mount of 3000 meters elevation in the very flat Somali Basin at a depth of 5000m.

In the Somali region meteorological studies were intensified by permanent use of a long-range weather-radar and radio-sonde twice a day.

METEOR left Mombasa on January 21 and worked the last section along the African Coast before crossing the Western Indian Ocean to Cochin, S.India, which was reached on February 11. In contrast to the Somali studies, this part of the Expedition was favoured by the weather and work in the various fields of marine science was continued along the same lines that have been described for the earlier parts of the Expedition. The gradient current meter provided profiles of the currents at nine stations in the equatorial region. The equatorial undercurrent was found at 1°N with a velocity of 1.5 m/sec., but, in contrast to "Cromwell-type" currents in the Pacific and Atlantic, this current does not result in a lowering of surface temperatures or in an increase of nutrients on the surface. The oxygen content of the deeper layers of the tropical waters decreases from west to east, and off India values of 0.2 ml/l were found. 95 plankton samples were taken with an Indian Ocean Standard net and were delivered to the Indian Ocean Biological Centre in Cochin. The port call in Cochin was used for visits to that Centre and lectures to the staff were given by several biologists from METEOR.

The Expedition of METEOR continues with a survey of the waters off India, Pakistan and the Arabian Peninsula. METEOR is expected to return to Hamburg by mid-May.

United Kingdom.

R.R.S. DISCOVERY. Cruise 3, February 15 - September 28, 1964.

The Royal Society, London, has published a booklet entitled "International Indian Ocean Expedition, R.R.S. DISCOVERY, Cruise 3, Report on Oceanographic Work in the Western Indian Ocean, February 15 to September 28, 1964", which is prepared on behalf of the British National Committee for Oceanic Research. This booklet with four charts and six pictures contains a narrative report of the Cruise, a station list, and charts showing the stations.

The following is an extract of this report, and track charts are reproduced in Annex 1.

The Cruise consisted of the following nine legs:

1. Plymouth to Aden, February 15 to March 4, 1964.
2. Aden to Mauritius, March 7 to April 5, 1964.
3. Mauritius to Cochin, April 10 to May 8, 1964.
4. Cochin to Seychelles, May 12 to 16; May 19 to June 9, 1964.
5. Seychelles to Mauritius, June 12 to July 3, 1964.
6. Mauritius to Mombasa, July 9 to July 28, 1964.
7. Mombasa to Aden, August 2 to August 23, 1964.
8. Aden to Aden, August 26 to September 7, 1964.
9. Aden to Plymouth.

During the Cruise a total of 344 stations was occupied, out of which there were 306 stations with water sampling and current measurements and 275 stations with biological observations. Among them, SCOR/UNESCO Reference Stations No. 6, No. 8, and No. 12 (twice) were occupied. The following table gives the summary of stations.

Station Summary

Item	Leg								
	I	II	III	IV	V	VI	VII	VIII	IX
Water-sampling	9	60	51	49	43	38	43	10	6
Current-shear profiles	1	80	71	54	47	46	45	10	-
Neutrally-buoyant floats	-	11	14	-	6	2	6	2	-
Station where TSD was used	-	-	-	41	48	6	-	-	-
Vertical net hauls (NF70V)	-	24	16	22	14	18	42	8	3
Fine mesh net hauls	-	24	17	26	13	12	41	8	3
Chlorophyll profiles	-	22	20	25	12	15	53	8	3
Bacteriological sampling	-	21	22	-	-	-	-	-	-
Trawls	2	7	9	7	3	7	-	1	-
IOS-net hauls	-	15	15	12	16	15	22	1	-
Neuston net tows	1	38	32	28	17	18	65	64	-
Hand nets	1	3	-	-	1	-	-	-	-
No. of stations	12+	66	59	53	51	43	43	12	6+

+ three stations out of the Indian Ocean Region.

Except for a few hours when a repair was required, continuous echo-soundings were obtained. The usual surface weather observations, supplemented by continuous recording of dray and wet bulb temperature, total incident radiation and net radiation flux, were conducted throughout the Cruise. Radiosondes were released almost daily in the Indian Ocean region. The sea-surface thermograph was in continuous use and hourly bathythermograph casts were made along most of the tracks; in some cases more frequent observations were made, as research required.

During the leg VII, Mombasa to Aden, the ship worked with the U.S. r/v ARGO in the Somali Current, and in the leg IV, Cochin to Seychelles, a series of inter-calibration tests between the Australian and N.I.O. analytical methods were carried out. At station No. 5581 (37°38'.8 N, 5°59'.0 E), chemical observations were worked out for comparison with those of the German r/v METEOR.

Abnormally hot and salty water in the deep basins near 20° to 21°N of the Red Sea, which had been found by the ATLANTIS II, was repeatedly sampled and at the station 5580 (21°17'.2 N, 38°0'.5 E) extremely high temperatures and salinities (over 44°C, 270 ‰) were found in the lowest 150m in a small basin some 2200m deep. Chemical analysis of this water is continuing at Liverpool and N.I.O. First impressions are that it is unlikely to be volcanic in origin. More probably it may be due to solution of salt deposits on the sea floor.

Extensive current studies, with a direct reading current meter, neutrally-buoyant floats and dan-buoys, were worked out near the Equator. The equatorial undercurrent, with an eastward maximum velocity at 70m depth, centered on 1°S, was observed on 58°E. Its maximum speed exceeded 2 knots.

Cold upswelling water near the Somali coast was also studied.

List of Scientists:

Part of Cruise			
2 - 9	M.V. Angel	Biology	University of Bristol
1 - 9	R.S. Bailey	Ornithology	University of Oxford
1 - 9	D.G. Bishop	Electronics	N.I.O.+
4 - 6	R. Bowers	Electronics	N.I.O.+
1 - 9	P.G. Brewer	Chemistry	University of Liverpool
7 - 8	E.I. Butler	Chemistry	Marine Biological Association, Plymouth
1 - 3	H. Charnock	Physical oceanography	N.I.O.+
4 - 6	M.R. Clarke	Biology	N.I.O.+
1 - 9	J. Cox	Meteorology	Meteorological Office, Bracknell
6 - 9	J. Crease	Physical oceanography	N.I.O.+
3, 7, 8	R.I. Currie [a]	Biology	N.I.O.+
1 - 3	P.M. David	Biology	N.I.O.+

4 - 5	F. Davies	Chemistry	C.S.I.R.O., Cronulla
3 - 9	A.E. Fisher	Biology	N.I.O.+
6 - 9	P. Foxton	Biology	N.I.O.+
6 - 9	C.L. Gulliver	Physical oceanography	N.I.O.+
4 - 5	B.V. Hamon	Physical oceanography	C.S.I.R.O., Cronulla
2 - 9	P.J. Herring	Biology	University of Cambridge
7 - 9	F.H.F. Hinds	Physical oceanography	Hydrographic Department±
1 - 3	P.G.W. Jones	Chemistry	Fisheries Laboratory, Lowestoft
7	D.P. Keily	V.l.f. navigation	Massachusetts Institute of Technology
1 - 3	B. Kirtley (Miss)	Bacteriology	N.I.O.+
1 - 9	M.J. McCartney	Chemistry	N.I.O.+
1 - 3	J.A. Moorey	Electronics	N.I.O.+
1 - 6	R.G. Munns	Physical oceanography	Woods Hole Oceanographic Institution
2 - 5	R.A.G. Nesbitt	Soundings, physical oceanography	Hydrographic Department
7	A. Poling	V.l.f. navigation	U.S. Coast and Geodetic Survey
4 - 6	K.V. Ramam	Physical oceanography	Indian Naval Physical Laboratory, Cochin
4 - 5	D. J. Rochford	Chemistry	C.S.I.R.O., Cronulla
7 - 9	M.L. Somers	Electronics	N.I.O.+
1 - 3	A.R. Stubbs	Electronics	N.I.O.+
1 - 9	J.C. Swallow[b]	Physical oceanography	N.I.O.+
7	P. Tchernia	Physical oceanography	Laboratoire d'Oceanographie, Museum d'Histoire Naturelle, Paris
1 - 9	G. Topping	Chemistry	University of Liverpool

Edward Grey Institute of Field Ornithology, University of Oxford
\+ National Institute of Oceanography, Wormley, Surrey
± Hydrographic Department, Ministry of Defence: Navy

Note: a Principal scientist for parts 7 and 8
b Principal scientist for parts 1 to 6, and 9

U.S.A.

ANTON BRUUN.

Narrative reports for the cruises 6 and 7 have been received. The following is an extract from the reports. Station maps appear in Annex 1.

ANTON BRUUN. Cruise 6, May 15 - July 16, 1964.

Area of Operation: Western Central Indian Ocean, south along the 65°E meridian from 18°N to 40°S.

Itinerary:

May 15, 1964	Depart Bombay
May 17, 1964	Occupy Station 328
June 11, 1964	Arrive Mauritius
June 21, 1964	Depart Mauritius
July 5, 1964	Occupy Station 354
July 16, 1964	Arrive Durban

Objectives of Cruise and Preliminary Results.

The general objectives of this Cruise were to supply further materials and data essential to an understanding of the biology and ecology of the western Indian Ocean, and to take collections and observations at two-degree intervals along 65°E from 18°N to 40°S. One stations, however, was missed due to bad weather in the 2nd leg from 22°S to 40°S.

The following work was undertaken during the Cruise:

Hydrographic casts:..... 27 stations (up to 2,000m)

Analyses were made for temperature, salinity, dissolved oxygen, nitrate, nitrite, phosphate, silicate, and subsequent determination of dissolved organic carbon.

Primary productivity with C-14 technique, phyto-plankton pigments and particulate organic carbon ..... 28 stations (at 100, 50, 25, 10 and 1 % of the incident solar radiation)

Plankton sampling:

Microplankton (200m - 0m, vertical hauls)	21 stations
IOS - net (200m - 0m, vertical hauls)....	21 stations
NV-70 closing net (several intervals to the bottom).....	12 stations
Isaacs-Kidd midwater trawl	61 occasions

The capture of a leptocephalus, or larval stage of a deep sea eel, which is bright orange-red in colour in contrast to the absolute transparency of all other known eel larvae, is of obvious and unique zoological interest. The second exciting specimen is a metamorphosing eel, over a meter long, which on the one hand resembles the "giant leptocephalus" (caught years ago by the Danish DANA Expedition and subject since then to world-wide public interest), and on the other hand an adult nemichtyioid or snipe eel.

List of Scientists: (+ - Bombay to Mauritius only; ++ - Mauritius to Durban only)

Chief Scientist:
Giles W. Mead
Museum of Comparative Zoology, Harvard University; and Woods Hole Oceanographic Institution.

Participating Scientists:
E. Bertelsen++
Marinbiologisk Laboratorium, Denmark.

Donald W. Bourne
Woods Hole Oceanographic Institution; and M.C.Z., Harvard University.

Daniel M. Cohen
U.S. Bureau of Commercial Fisheries.

George D. Grice+
Woods Hole Oceanographic Institution

Richard L. Haedrich+
Woods Hole Oceanographic Institution; and M.C.Z., Harvard University.

C.P. Lee
U.S. Bureau of Commercial Fisheries.

Basil Nafpaktitis++
M.C.Z., Harvard University.

Jorgen Nielsen+
Universitetes Zoologiske Museum, Denmark.

Shigeru Yano
U.S. Bureau of Commercial Fisheries.

Permanent Scientific Staff:
Andrew Bakun - Chemical Oceanographer
Peter Connors - Meteorologist
Mark M. Jones - Chemical Oceanographer
Kevin G. Jones - Electronics Specialist
John R. Hall - Biological Oceanographer
Alan K. Pease - Physical Oceanographer
Bruce A. Rogers - Biological Oceanographer

ANTON BRUUN. Cruise 7, July 29 - September 10, 1964.

Area of Operation: Southwest Indian Ocean, east of South Africa and south of Madagascar.

Itinerary:

July 29, 1964	Depart Durban, Rep. South Africa
August 7, 1964	Arrive Tulear, Madagascar
August 10, 1964	Depart Tulear
August 20, 1964	Arrive Lourenco Marques, Mozambique
August 22, 1964	Depart Lourenco Marques
September 10, 1964	Arrive Durban

Objectives of Cruise and Procedures.

Cruise 7 of ANTON BRUUN was devoted primarily to benthic biology. Unlike cruises 1 and 4-B, in which the larger bottom fauna, including fishes, was studied by means of a Gulf-of-Mexico shrimp trawl, this Cruise concentrated upon invertebrate populations living both upon and within the sediments. A variety of gear was used successfully to sample the complete spectrum of benthic invertebrate fauna, from the largest forms to microscopic organisms.

(A) Basic Oceanographic Programme.

Eighteen hydrographic stations were taken by the permanent scientific party. Only these stations are shown on the station map (Annex 1). Each station consisted of the following measurements:

Double Nansen bottle cast to the bottom for
temperature, salinity, dissolved oxygen, phosphate, nitrite, nitrate and silicate.
Estimation coefficient of sunlight within the euphotic layer.

Water sampling at 100, 50, 25, 10 and 1% layers of incident radiation for
phytoplankton pigment and primary productivity and subsequent analysis ashore for particulate organic carbon.

Vertical plankton hauls with an IOS net (200m - 0m) and divided vertical hauls with an NV-70 discovery net (for several intervals, bottom to surface).

(B) Benthic Programme.

A total of 233 bottom samples were obtained from approximately 100 stations; most of these were intermediate in position between the previous and succeeding hydrographic stations. The equipment used on the Cruise included the following:

Trigger (gravity) corers used in tandem	60 occasions
Phleger corers	4 occasions
Bottom snapper	23 occasions (2 unsuccessful)

Campbell Grab (0.6m area)	53 occasions (4 unsuccessful)
Van Veen Grab	3 occasions (1 unsuccessful)
Menzies Trawl	18 occasions (1 unsuccessful)
Agassiz Trawl (with fine mesh at cod end)	39 occasions (5 unsuccessful)
Rock dredge	30 occasions (1 unsuccessful)
Naturalists dredge	1 occasion

(C) Shore Activities.

In addition to the oceanographic programme, extensive collecting was accomplished at the coral reef, mangrove swamp, and shore areas around Tulear and Lourenco Marques.

List of Scientists:

Chief Scientist:	Orville L. Bandy Department of Geology, University of Southern California.	Foraminifera
Participating Scientists:		
	Richard H. Benson U.S. National Museum, Washington, D.C.	Ostracods
	Kenneth Boss U.S. National Museum, Washington, D.C.	Mollusks
	Gordon Chapman Biology Department, University of Southern California.	Annelids
	Edward B. Cutler University of Rhode Island, Kingston, Rhode Island.	Sipunculids
	Ronald Echols Department of Geology, University of Southern California.	Foraminifera
	John Field University of Capetown, South Africa.	Guest Scientist
	Richard Gooding Boston University, Boston, Mass.	Parasitic Copepods

T. Peter Lowe U.S. National Museum, Washington, D.C.	Corals
Elizabeth Mitchell-Innis Oceanographic Research Institute, Durban, South Africa.	Guest Scientist
Lewis Roane U.S. Naval Air Station, Norfolk, Virginia.	Photography
Michael Webb Westville, Natal, South Africa.	Guest Scientist

Permanent Scientific Staff:

Andrew Bakun - Chemical Oceanographer
Peter Connors - Meteorologist
Mark M. Jones - Chemical Oceanographer
Kevin G. Jones - Electronics Specialist
John R. Hall - Biological Oceanographer
Alan K. Pease - Physical Oceanographer
Bruce A. Rogers - Biological Oceanographer
Shigeru Yano - Gear Specialist

ANTON BRUUN. Final Cruise Report of Cruises 4A and 4B.

This publication contains tables for reduced oceanographic data, special chemical determinations, bathythermograph positions, biological logs for plankton and miscellaneous collections for Cruise 4A and biological collecting stations and physical and chemical determinations for Cruise 4B. It also contains methods and techniques with references. Narrative reports of these Cruises were published previously by the Woods Hole Oceanographic Institution, extracts from them appearing in the IIOE Information Paper, No. 8.

2.2 Cruise Plans.

Australia.

H.M.A.S. GASCOYNE, Cruise 2/65.

The plan of the above Cruise, scheduled to be undertaken south off Australia, has been received by this Office.

Dates:

February 1, 1965 - February 12, 1965 (11 days).

Area:

As shown on accompanying chart.

From Sydney to St. Vincent Gulf, the continental shelf and adjacent areas off Cape Catastrophe and the Investigator group of islands, Spencer Gulf, and then to Port Lincoln.

Objective:

To examine the chemical and physical environment during the South Australian tuna season.

Stations:

As shown on accompanying chart (Annex II).

Probable Itinerary:

Depart Sydney	February 1, 1965
At Port Lincoln	February 12, 1965

Sampling and Observations:

Hydrology:

Hydrological sampling to the bottom or 1500m (whichever is less) for temperature, salinity, oxygen, and inorganic phosphate. Transmission of grid square temperatures to VH5BA.

Physics:

Echo sounding continuously.
Meteorological reports on station.

Personnel:

T. R. Cowper (Cruise Leader)
R. Bradley
L. Brown
J. Klye
J. Prothero

2.3 Exchange of Data.

Supplement No. 1 for the Catalogue of Data in World Data Centre A, Oceanography, which contains data received during the period January 1 - June 30, 1964, has been received by the Office. Necessary corrections and additions to the table "IIOE Data Received by WDC -A", given previously in Annex III of Information Paper, No. 9, appear in Annex III of this issue.

3. List of Specialists.

The National Co-ordinator for the IIOE of South Africa has sent, as requested by Professor Zenkevich, a list of specialists on benthos, mid-water and deep fauna, and a copy of this was received by the Office. The list of South African specialists is reproduced in Annex IV.

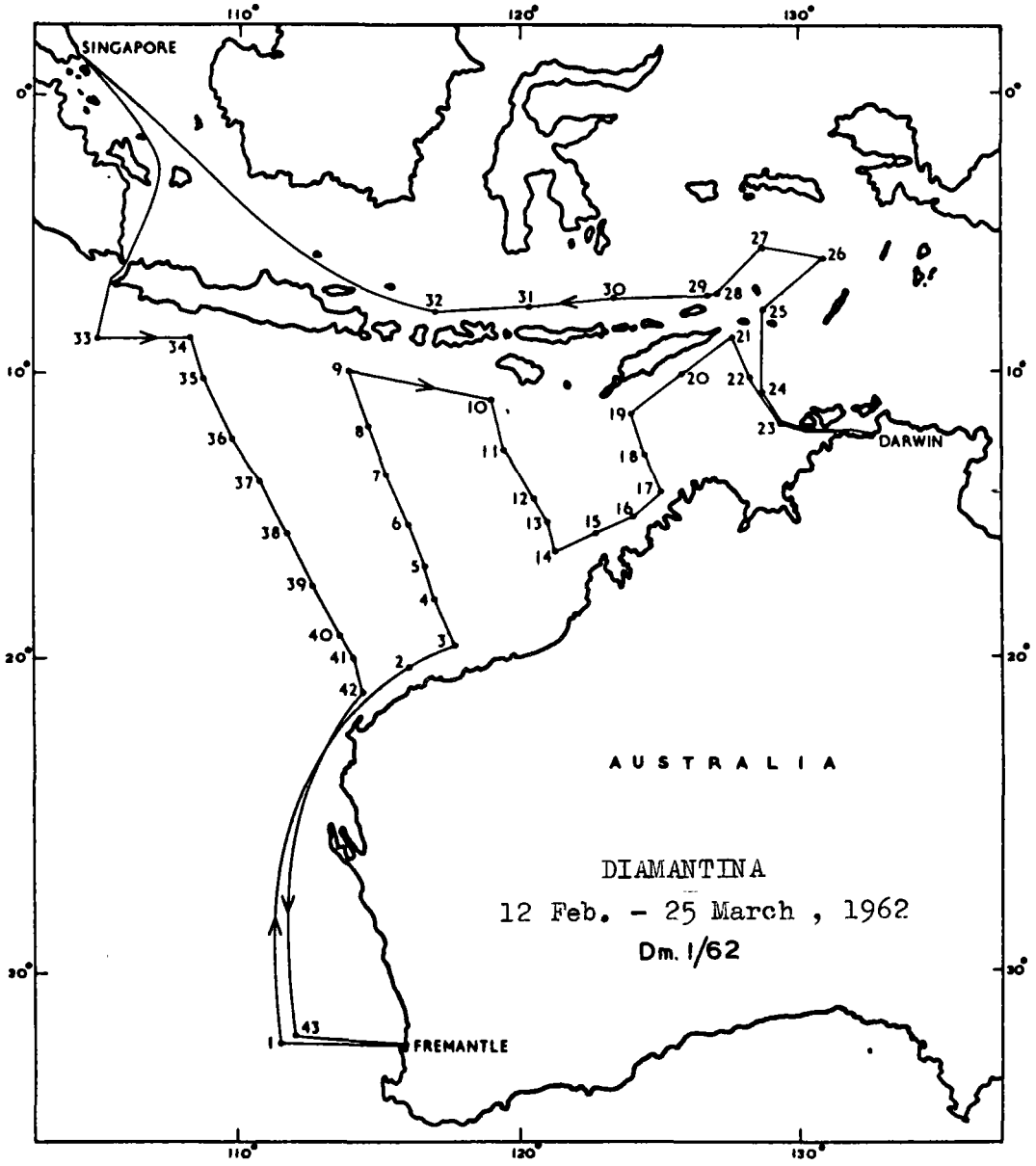
4. Observations at SCOR-Unesco Reference Stations.

A list of Reference Stations occupied during the U.S. cruises LUSIAD, ZEPHYRUS and DODO VI are given in Annex V of this issue.

5. The 2nd Meeting of the International Co-ordinating Group for the IIOE.

This Meeting will take place in Unesco, Paris, from June 7 - 9, 1965. Invitations to this Meeting were dispatched by the IOC Secretariat to the relevant governmental authorities and national co-ordinators on March 18 this year. The provisional Agenda of the Meeting is given in Annex VI.

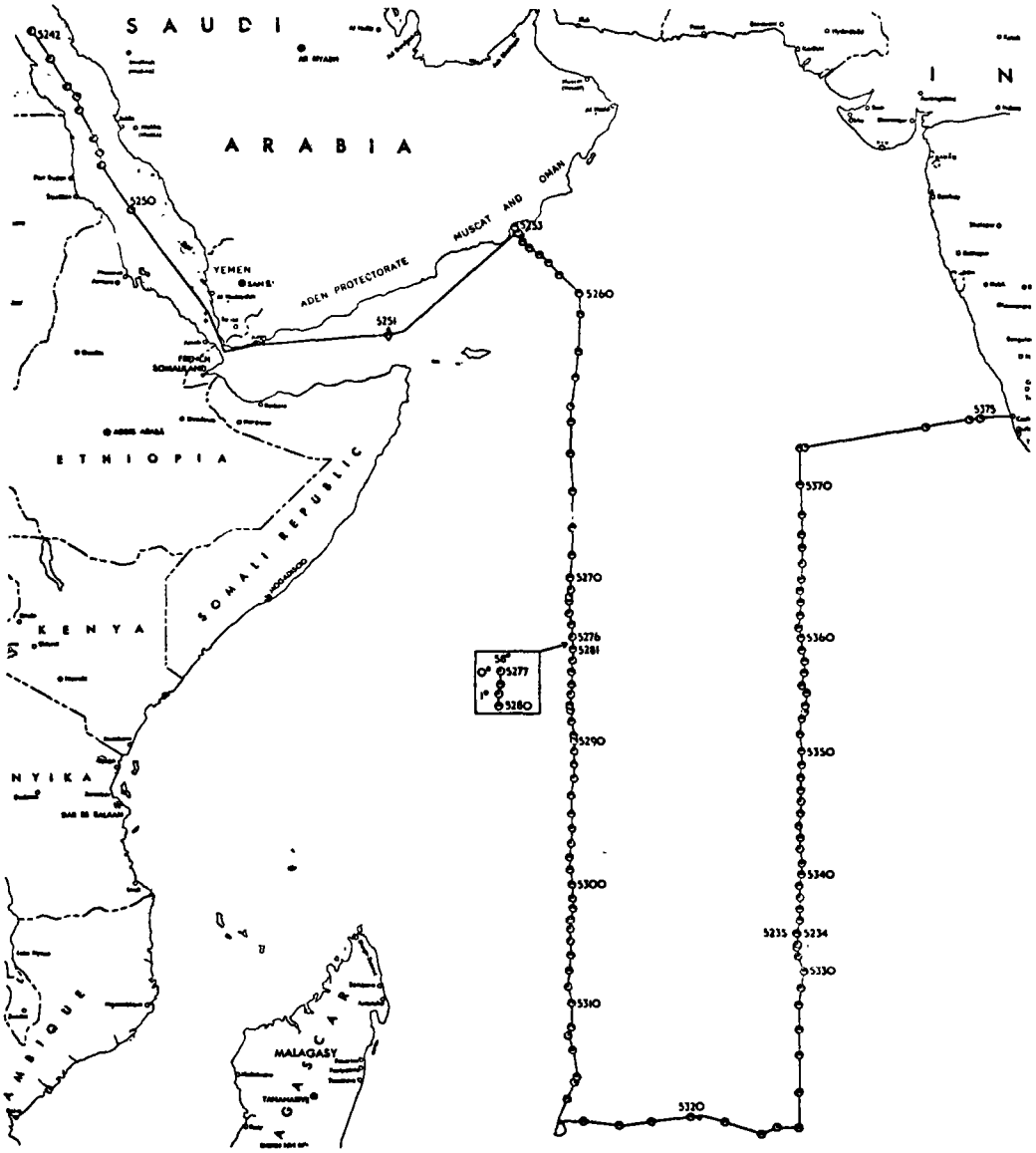
ANNEX I



DIAMANTINA

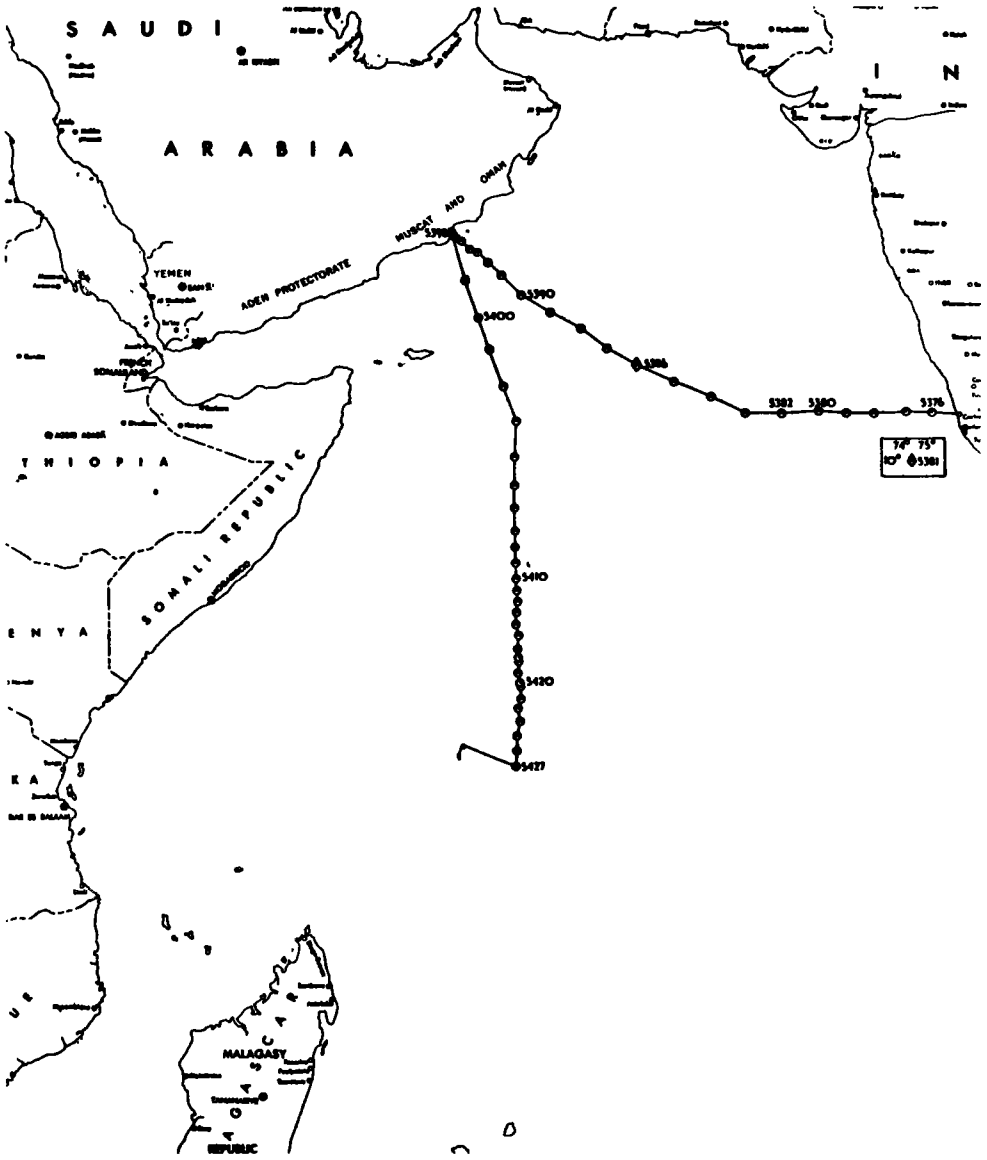
12 Feb. - 25 March , 1962

Dm. 1/62



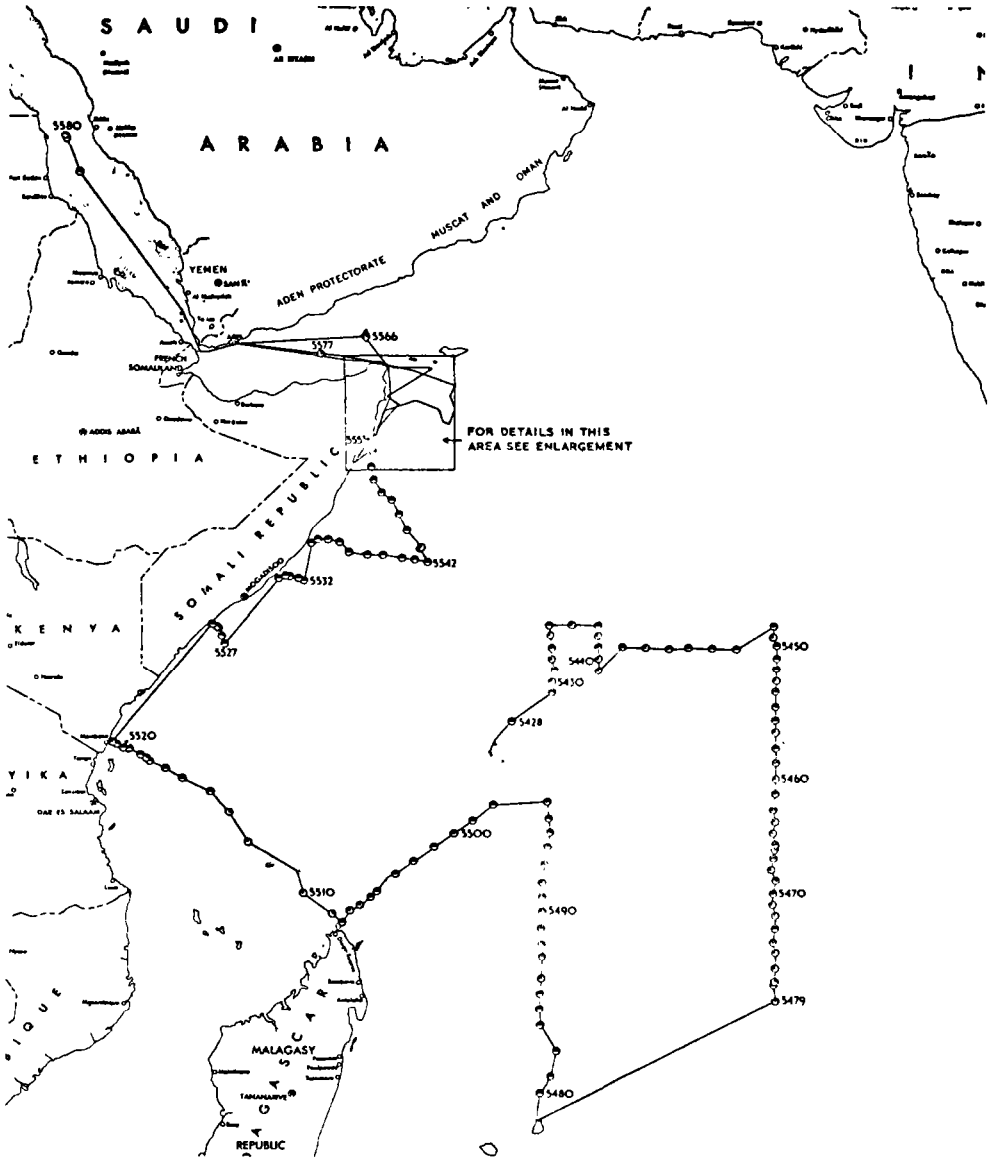
DISCOVERY Cruise 3

Red Sea to Cochin: 29 February to 7 May 1964



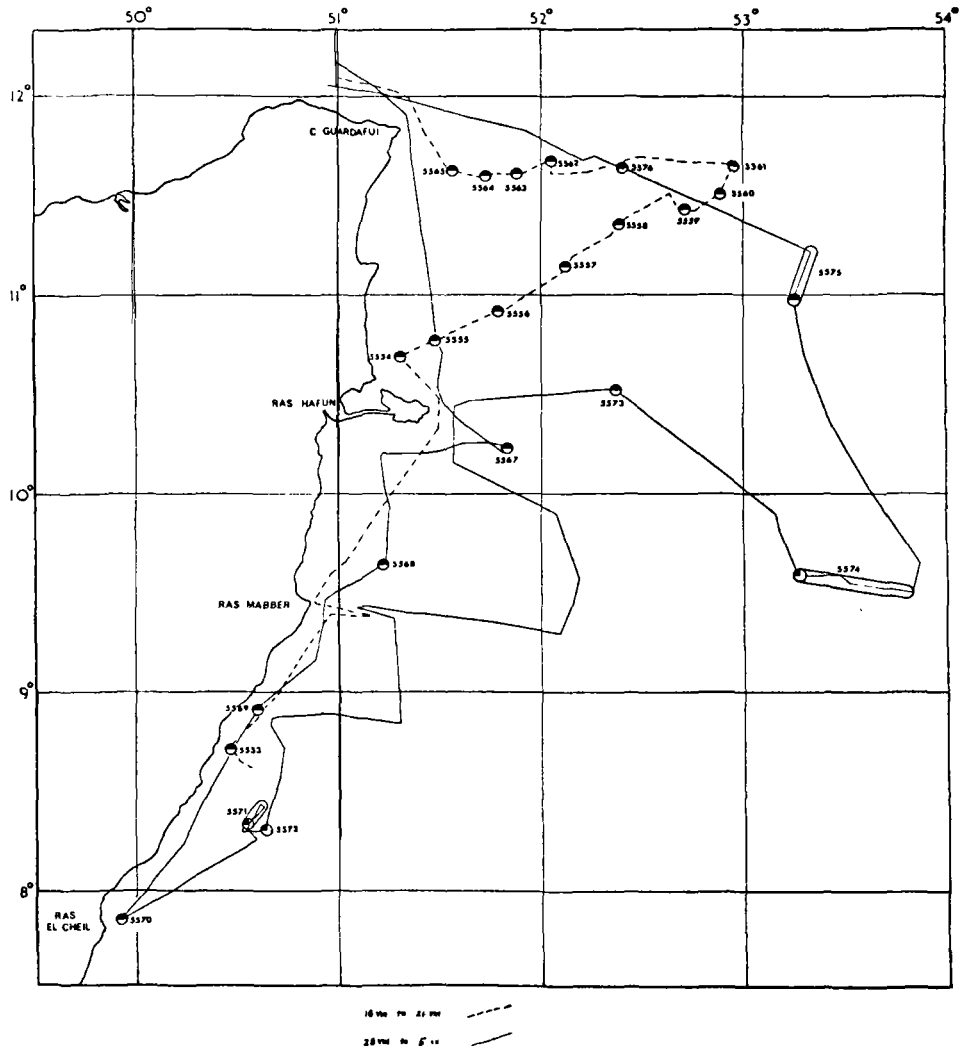
DISCOVERY Cruise 3

Cochin to Seychelles: 12 May to 8 June 1964



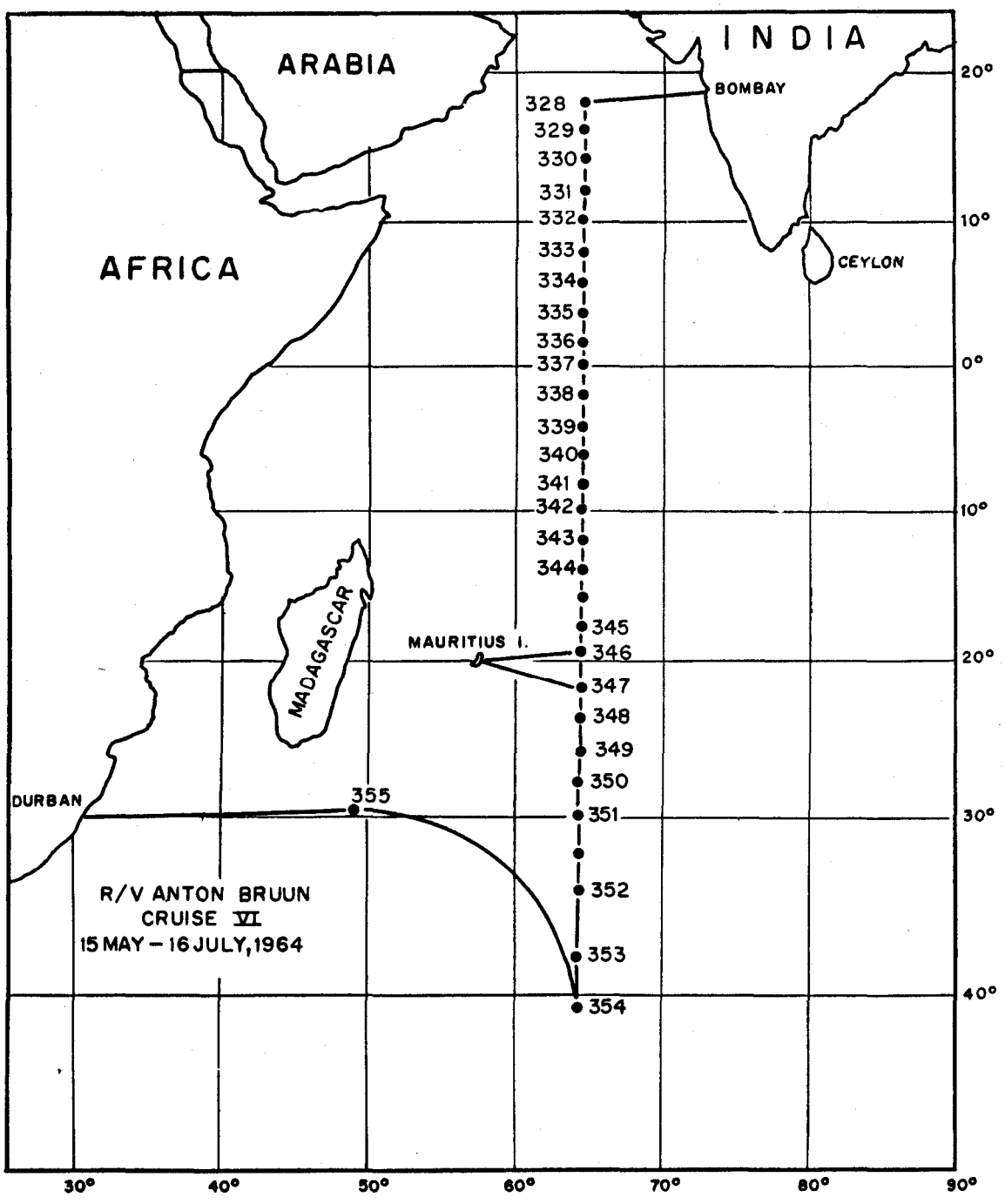
Seychelles to Red Sea: 12 June to 11 September 1964

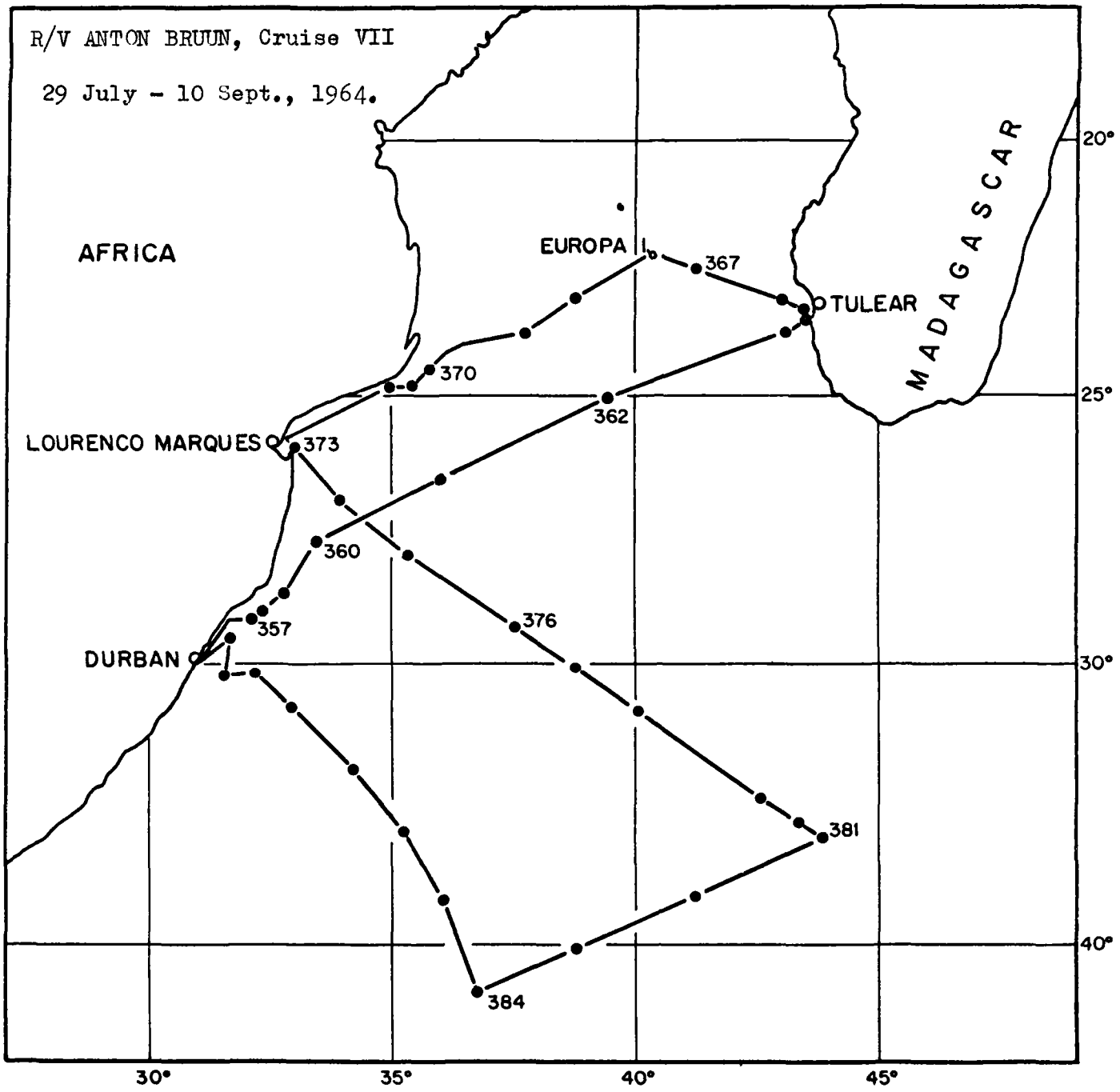
DISCOVERY Cruise 3

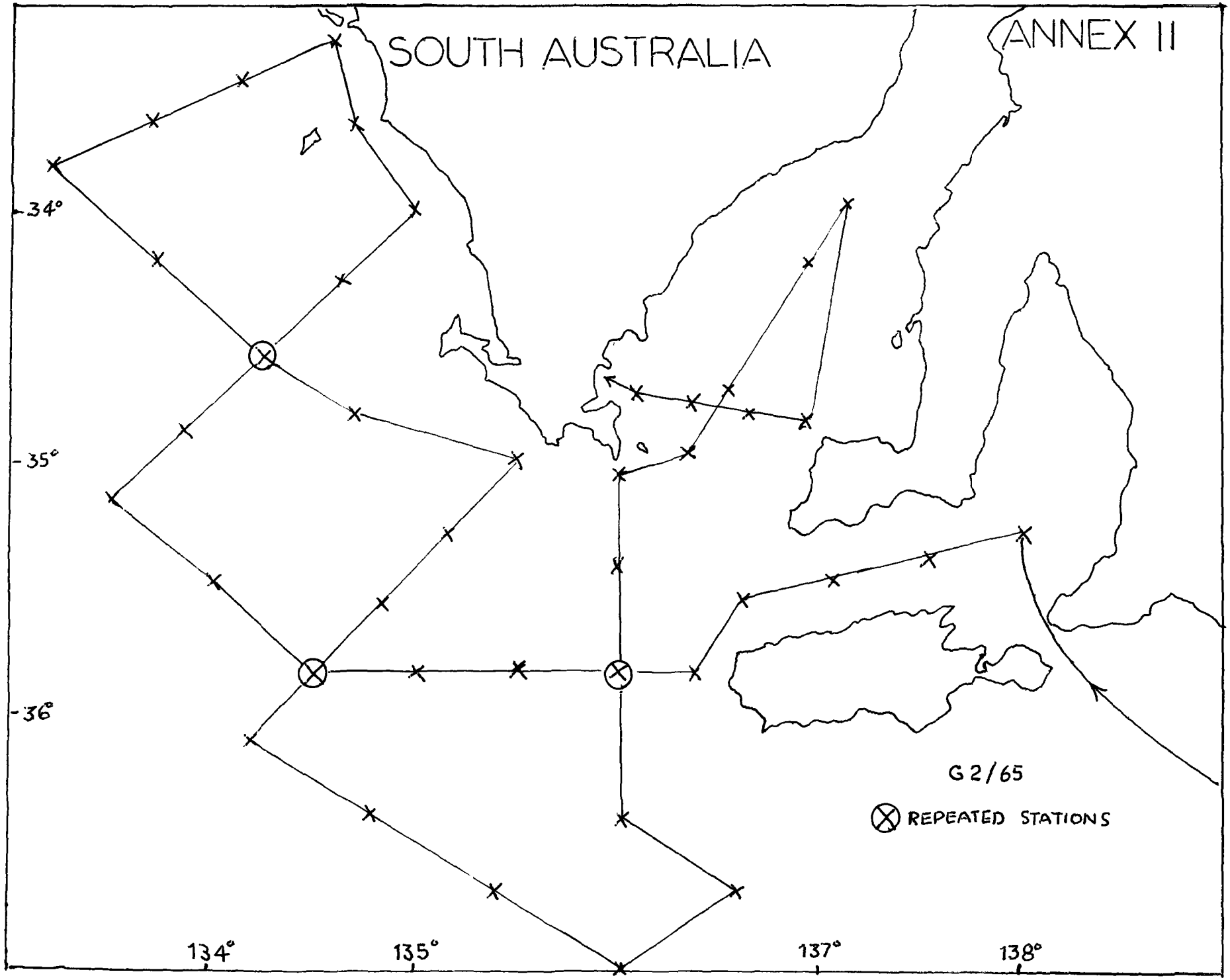


DISCOVERY Cruise 3

Cape Guardafui area: 18 August to 4 September 1964


ARABIA
INDIA
AFRICA
BOMBAY
CEYLON
MADAGASCAR
MAURITIUS I.
DURBAN
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
20°
10°
0°
10°
20°
30°
40°
30°
40°
50°
60°
70°
80°
90°
R/V ANTON BRUUN
CRUISE VI
15 MAY – 16 JULY, 1964


R/V ANTON BRUUN, Cruise VII
29 July - 10 Sept., 1964.
AFRICA
MADAGASCAR
EUROPA I.
TULEAR
LOURENCO MARQUES
DURBAN
367
370
362
373
360
357
376
381
384
20°
25°
30°
40°
30°
35°
40°
45°


SOUTH AUSTRALIA
ANNEX II
-34°
-35°
-36°
134°
135°
137°
138°
G 2/65
REPEATED STATIONS

SHIP PROGRAMS

Country Catalogue Number Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data			BTs	Currents	Bottom Topography	Bottom Sediments	Biological	Meteorological	Surface	
			No. of Stas.	Data	Sample Depths								
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
102. AUSTRALIA													
102.1 G-7 DIAMANTINA (Cruise Dm 3/61) (IIOE)			Add: 48	Add: T, S, σ_t, O_2, P_{inorg}, P_{total}, N	Add: 100-300, 1500 Max.-4703			Add: D		Add: Productivity -42	Add: Ta, Tw, Wd, Cld, Vis, Bar	Add: Waves	
102.1 G-8 DIAMANTINA (Cruise Dm 1/62) (IIOE)			Add: 42	Add: T, S, O_2, P_{inorg}, P_{total}, Ni, σ_t	Add: to 6300 Max.-6379			Add: D			Add: Ta, Tw, Wd, Vis, Bar	Add: Waves	
102.1 G-9 DIAMANTINA (Cruise Dm 2/62) (IIOE)			Add: 49	Add: T, S, O_2, P_{inorg}, P_{total}, Ni, σ_t	Add: 2300-2500 Max.-5390			Add: D		Add: Productivity -29	Add: Ta, Tw, Wd, Cld, Vis, Bar	Add: Waves	
102.1 I-7 GASCOYNE (Cruise G 4/62) (IIOE)			Add: 35	Add: T, S, O_2, P_{inorg}, P_{total}, Ni, σ_t	Add: 200 Max.-5472			Add: D			Add: Ta, Tw, Wd, Cld, Bar, Vis	Add: Waves	
120. INDONESIA													
120.1 B-1 R. I. JALANIDHI (Cruise 1) (IIOE)				Add: σ_t, D, Vs									Correct: NODC 42796 JA
120.1 B-2 R. I. JALANIDHI (Cruise 2) (IIOE)				Add: σ_t, D, Vs									Correct: NODC 42796 JA
120.1 B-3 R. I. JALANIDHI (Cruise 3) (IIOE)				Add: σ_t, D, Vs									Correct: NODC 42796 JA
120. 1 B-4 R. I. JALANIDHI (Cruise 4) (IIOE)				Add: σ_t, D, Vs									Correct: NODC 42796 JA

136. SOUTH AFRICA														
136.1 A-2 AFRICANA II											Add : Productivity-16			
136.1 A-3 AFRICANA II (Cruise 251) (IIOE)			Corr: 32	Add : σ_t, D, Vs							Add : Productivity-16			
136.1 A-4 AFRICANA II (Cruise 273) (IIOE)			Corr: 15								Add : Productivity-9			
136.1 A-5 AFRICANA II (Cruise 285) (IIOE)				Add : σ_t, D, Vs										
136.3 A-4 NATAL											Add : Plankton -109			Add : Data in pub. rep. : "Data Report No. 2, Hydrographic & Plankton Data Collected in the South West Indian Ocean During the SCOR International Indian Ocean Expedition 1962-1963" (Univ. of Cape Town, Inst. of Oceanogr. 1964)
136.3 A-5 NATAL											Add : Plankton -37			Add : Data in pub. rep. : "Data Report No. 2, _____ 1962-1963" (Univ. of Cape Town, 1964)

ANNEX IV

LIST OF SPECIALISTS ON BENTHOS, MID-WATER, AND DEEP FAUNA

(South Africa)

Pogonophora.	Dr. M. Webb, University College, Salisbury Island, DURBAN. Republic of South Africa.
Galeoidea, Squaloides, Notidanoidea.	Miss J. d'Aubrey, Oceanographic Research Institute, P.O. Box 736, DURBAN. Republic of South Africa.
Skates, Rays, Chimaeras, Pristiophoroidea, Squatinoidea, etc.	Mr. J. H. Wallace, Oceanographic Research Institute, P.O. Box 736, DURBAN. Republic of South Africa.
Galeoidea (Scylliorhinidae, Iriakidae).	Mr. Stewart Springer, Division of Systematic Biology, C.S. Fish & Wildlife Service, Stanford University, PALO ALTO. California, U.S.A.
Penaeidea.	Miss L. Joubert, Oceanographic Research Institute, P.O. Box 736, DURBAN. Republic of South Africa.
Penaeidea.	Mr. A. J. de Freitas, Instituto de Investigacao Cientifica de Mocambique, C. Postal 1780, Lourenco Marques.
Benthic Fauna.	Professor J. M. Peres, Station Marine D'Endoume et Centre d'Oceanographie, Faculte des Sciences de Marseille, Rue de la Batterie-des Lions, MARSEILLE 7. France.

Annex V

Observations on Reference Stations

Sta. No	Cruise	Date	Actual Lat.	Actual Long.	Hydrogr. Cast	O_2	PO_4-P	SiO_3-Si	NO_2-N
			SCOR-Unesco Reference Station No.4. Position: Latitude 0°. Longitude 90°E						
Argo, 4S	Lusiad	3.7.62	00°02'S	91°02'E	1128	done	done	done	done
Argo, 4D	Lusiad	3.7.62	00°02'S	91°02'E	4114	done	done	done	done
Argo, 5	Lusiad	4.7.62	00°00'	88°56'E	1194	done	done	done	done
Argo, 61	Lusiad	8.4.63	00°06'.5S	89°31'.5E	1169	done	done	none	done
Argo, 81	Lusiad	27.4.63	00°00'	89°00'E	1135	done	done	none	done
			SCOR-Unesco Reference Station No.5. Position: Latitude 0°. Longitude 80°E						
Argo, 10S	Lusiad	8.7.62	00°01'N	78°59'E	978	done	done	done	done
Argo, 10D	Lusiad	8.7.62	00°01'N	78°59'E	4515	done	done	done	done
Argo, 70	Lusiad	2.9.62	00°02'N	79°04'E	1158	done	done	none	done
Argo, 57	Lusiad	5.4.63	00°04'.5N	78°59'E	1121	done	done	none	done
Argo, 58	Lusiad	5.4.63	00°00'	81°05'E	1103				
			SCOR-Unesco Reference Station No.10. Position: Latitude 0°. Longitude 55°E						
Argo, 22	Lusiad	18.7.62	00°03'N	55°03'E	1169	done	done	done	done
Argo, 44	Lusiad	27.3.63	00°05'.5N	55°02'E	1147	done	done	none	done
Argo, 74	Dodo VI	31.8.64	00°01'N	55°00'E	2877	done	done	done	done

Sta. No	Cruise	Date	Actual Lat.	Actual Long.	Hydrogr. Cast	O_2	PO_4-P	SiO_3-Si	NO_2-N
		SCOR-Unesco Reference Station No.11. Position: Latitude 7°N. Longitude 52°E							
Argo, 56	Dodo VI	24.8.64	07°22'N	53°07	5061	done	done	done	done
		SCOR-Unesco Reference Station No.12. Position: Latitude 13°N. Longitude 50°E							
Horizon, 74	Zephyrus	21.9.62	13°16'.5	49°15'E	2159	none	none	none	none
		SCOR-Unesco Reference Station No.13. Position: Latitude 8°S. Longitude 44°E							
Argo, 1D	Lusiad	19.5.63	07°56'S	44°02'E	3829	done	none	none	none
Argo, 1S	Lusiad	19.5.63	07°56'S	44°02'E	793	done	none	none	none
		SCOR-Unesco Reference Station No.14. Postion: Latitude 18°S. Longitude 41°E							
Argo, 2D	Lusiad	22.5.63	18°01'S	40°51'E	2330	done	none	none	none
Argo, 2S	Lusiad	22.5.63	18°01'S	40°51'E	589	done	none	none	none
		SCOR-Unesco Reference Station No.14. Position: Latitude 31°30'S. Longitude 34°30'E							
Argo, 3	Lusiad	26.5.63	32°00'S	35°21'E	1388	done	none	none	none

INTERNATIONAL COORDINATING GROUP FOR THE INTERNATIONAL INDIAN OCEAN EXPEDITION

Provisional Agenda

Second Meeting, 7-9 June 1965, Paris

1. Review of work accomplished to date.
2. Current situation with the exchange of IIOE data.
3. The IIOE Collected Reprints. (The first volume will be available prior to the meeting)
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 Editorial Committees for Atlases
    h. Financial aspects of atlases

AVS/9/88F
12 March 1965