

information
paper



intergovernmental oceanographic commission

16

UNESCO/NS/IOC/INF - 103

FOREWORD

The International Indian Ocean Expedition was terminated officially on 31 December, 1966 and scientists actively engaged in the processing and analysis of the data are invited to write to the Secretariat of the Intergovernmental Oceanographic Commission indicating existing gaps in coverage, suggesting additional studies etc., so that, if necessary, future co-operative research may be arranged.

IIOE INFORMATION PAPER NO. 16

1. Recent action by IOC

The Fourth Session of the Commission was held at Unesco House, Paris, from 3 to 12 November 1965. The International Indian Ocean Expedition was one of the items discussed at the Session.

The item was first discussed in the Ad Hoc Co-ordination Group for the IIOE, the composition and report of which was presented to the Commission in document IOC/INF-98 (see Annex I). The Ad Hoc Group reviewed various steps undertaken by the Secretariat to implement recommendations (IIOE Inf. Pap. No. 14, Annex I) of the Co-ordination Group which met in Unesco, Paris, in June 1965.

Discussion centred on the preparation of the IIOE atlases. Two conflicting interpretations of Recommendation 8 of the Co-ordination Group, one by the USSR delegation and another by the US delegation, were the main issue. The first interpretation was in favour of arranging international co-operation at all the stages in the preparation of an atlas, the other implying that an editor appointed by the Co-ordination Group might in some cases be the only author of an atlas, given full responsibility and the final decision in its composition and presentation. Finally, an interpretation comprising the essential elements of both the above views was agreed on and worded by the Ad Hoc Group. It was then incorporated in document IOC/INF-98. Further information with regard to the specific proposals and candidacies of editors, as well as some details on the financing of the whole activity, may be found in the afore-mentioned document.

The Commission discussed at its plenary meeting both the above-quoted documents and accepted them. It was understood that the interpretations provided in document INF/98, together with certain additional recommendations as given in Resolution IV-3 (Annex II) subsequently adopted by the Commission, clarified and in a certain measure rectified the recommendations of the International Co-ordination Group, as originally given in the summary report of its second meeting.

The additional recommendations resulted from discussion by the Commission on the problem of IIOE Data Reports. The Secretary reported that estimates of cost received from WDC-A were such that production of this series of IIOE data reports with Unesco financial support appeared highly unlikely. The US delegation suggested that comprehensive catalogues of all the IIOE holdings be prepared by both World Data Centres A and B. A further suggestion was put forward by the Secretary that countries participating in the IIOE publish their own series of data reports and that free copies be sent to all national co-ordinators.

A draft resolution summarising the above recommendations was prepared by Dr. G. Humphrey (Australia), rapporteur of the Ad Hoc Co-ordination Group, and was subsequently adopted by the Commission as Resolution IV-3 (see Annex II).

Dr. R. S. Glover, Chairman of the Consultative Committee for the Indian Ocean Biological Centre, then reviewed for the Commission the work accomplished so far by the Centre. He referred to document IOC/INF-79 (reproduced as Annex III of the IIOE Inf. Pap. No. 15) and particularly to the map showing gaps in the plankton collections in the Indian Ocean. A suggestion was made by one of the delegates that this map should make part of the revised version of the General Scientific Framework.

2. India's National Newsletter

Vol. II, No. 4 (March 1965), Vol. III, No. 1 (June 1965) and No. 2 (September 1965) of the Indian Newsletter on the IIOE were distributed at the Fourth Session of the IOC. These issues include reports on the Indian programme, activities of IOBC, IMC, extracts from reports of other countries, short reports of meetings relating to the Expedition, etc. An extract from the reports on the Indian programme is shown in section 4 of this issue.

3. Data Received by the WDC-A

The World Data Centre-A, Oceanography, has published Supplement No. 2, (data received during the period 1 July - 31 December 1964) and No. 3, (data received during the period 1 January-30 June 1965) for the Catalogue of Data in WDC-A. Necessary corrections and additions to the table "IIOE Data Received by WDC-A", which was given previously as Annex III of Information Paper No. 9, appear in Annex III of this issue. The WDC-A also prepared for distribution at the last IOC session the List of IIOE Cruise Data received by WDC-A, Oceanography, through to 15 October 1965; this information is incorporated in the Summary of IIOE Cruise Reports, the list not being reproduced in this Information Paper.

4. Exchange of Information4.1 Cruise ReportsAustralia

Summary of H.M.A.S. DIAMANTINA's Cruises Dm 2/65 and 3/65 has been received from the national co-ordinator; the following is an abstract of the summary and the station maps appear in Annex IV.

H.M.A.S. DIAMANTINA, Cruise Dm 2/65, 17-29 July, 1965

Scientific Personnel

R. G. Chittleborough
N. Dyson
J. Prothero
L. Thomas

Itinerary

17.7.65	0915	Departed Fremantle
29.7.65	0900	Arrived Fremantle

ProgrammeStations

43 stations Dm2/97/65-Dm2/139/65

subsurface hydrology at 34 stations
midwater trawling at 16 stations
zooplankton at 15 stations

Details of work carried out during the Cruise were published in Information Paper No. 15, section 1.2.

H.M.A.S. DIAMANTINA, Cruise Dm 3/65, 25 October - 5 November, 1965

Scientific Personnel

J. L. Bannister (Cruise Leader)
N. Dyson
J. W. Prothero
L. R. Thomas

Itinerary

25.10.65	0900	Departed Fremantle
5.11.65	1250	Arrived Fremantle

ProgrammeStations

47 stations	Dm3/140/65-Dm3/186/65	
	bathythermograms at	33 stations
	subsurface hydrology at	33 stations
	zooplankton at	18 stations
	micronekton at	18 stations

Details of the work of this Cruise appear in the next section of this issue.

India

The following is an extract from the IIOE Newsletters Vol. II, No. 4 and Vol. III, No. 2, issued by the Indian National Committee on Oceanic Research. Station maps are reproduced in Annex IV.

INS KISTNA, Cruise XXI (15-22 January 1965); Cruise XXII (28 January - 6 February 1965); and Cruise XXIII (14-17 February 1965).
(From Indian Newsletter Vol. II, No. 4)

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

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

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

While at station 542, position $16^{\circ}42'N$ and $86^{\circ}09'E$, formation and dissipation of four individual funnel type clouds were observed. During both the cruises the surface current was generally southerly to south-westerly. High wire angles, not consistent with the surface current and winds suggest sub-surface currents differing in direction from those at the surface. Surface temperature and salinity were generally found to increase from the coast towards the south. A slight inversion in temperature in the surface layer with more or less uniformly thick mixed layer was observed.

During XXI cruise in the north-western Bay of Bengal, observations revealed sub-surface salinity maximum at depths 400 to 600m and oxygen minimum at depths 300 to 400m. The range of temperature within these two layers is of the order of 12.0 to $9.5^{\circ}C$ with the salinity maximum being 35.05 to 35.30 ‰ and oxygen minimum 0.18 to 0.30 ml/l.

At 2000m depth the temperature is about $2.5^{\circ}C$ and salinity about 34.94 ‰.

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

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

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

INS KISTNA Cruises XXIV - XXVII (from Indian IIOE Newsletter Vol. III, No. 1)

XXIV Cruise (26 February - 9 March 1965)

The XXIV Cruise of INS KISTNA was undertaken exclusively for seismic studies under the leadership of Dr. D. Sreenivasan of the Indian Naval Physical Laboratory, Cochin, in the Gulf of Kutch and Gulf of Cambay, in collaboration with the German Research Vessel METEOR. The cruise commenced from Bombay along with METEOR on 26 February 1965 and, after the successful completion of the joint programme, KISTNA returned to Bombay on 9 March 1965, when METEOR sailed for Karachi according to her itinerary.

Five profiles in the Gulf of Cambay and four profiles in the Gulf of Kutch were completed. The length of the profiles varied between 30 and 60 km. During the operation, charges varying between 20 and 100 kg. were detonated from INS KISTNA and the recordings were made by scientists on board METEOR. Altogether 375 charges were fired in nine profiles whose records have given interesting results. A preliminary examination of the recorded data indicates refracted and reflected signals from the mantle (M-discontinuity). Dr. Guha of the Central Water and Power Research Station, Poona and Shri T.C.S. Rao of the Directorate of Scientific Research (Navy) were the Indian Scientists on board METEOR during these operations. The data recorded with the equipment they had are being processed.

XXV Cruise (22-28 March 1965)

The major objective of the XXV Cruise was to study the pre-monsoon hydrographic conditions of the waters along the west coast of India between Bombay and Cochin. INS KISTNA left Bombay with 19 scientists on board on 22 March 1965 and arrived at Cochin on 28 March, covering 34 stations in all. During this cruise observations were made under different disciplines as follows:

Meteorological: Observations on rainfall, wind, temperature, pressure, visibility, weather phenomena and clouds were taken at three hour intervals beginning from 1730 hours on 22 March 1965 to 0230 hours on 28 March 1965. Radiosonde ascents were made around 1630 hours to record the temperature, pressure and humidity at different levels in the atmosphere on all days from 23.3.65 to 27.3.65. The balloon went up to heights of 9.5, 9.8, 6.4, 9.8 and 18 km. on successive days.

Physical: Surface Water temperature and bathythermograph observations were obtained at all stations. Both shallow and deep bathythermograph lowerings were made at most of the stations. Nansen casts were made at all stations.

Observations on wave height, period, length and direction of the waves at 15 stations gave the following ranges for the various parameters:

Height: 1 to 3 feet
 Period: 1 to 4 seconds
 Length: 20 to 70 feet
 Direction: mainly N-W

Chemicals: Estimation of oxygen and salinity was made on board the ship for all the samples obtained on this cruise. Nutrient samples were kept in deep freeze for analysis in the shore laboratories. Samples from different depths were collected from 18 stations for the estimation of calcium and strontium contents in the Health Physics Division of the Atomic Energy Establishment, Bombay. Air samples were collected at ten stations for Radon studies in the laboratories of the Tata Institute of Fundamental Research, Bombay.

Biology: Vertical plankton hauls were made from 200 metres depth to surface at nine stations using Indian Ocean Standard Net. At five stations vertical hauls were also made from depths ranging from 100 to 50 metres.

Geological: The bottom topography was obtained almost continuously throughout the cruise using EDO echosounder. Sediment samples were collected from the bottom at 25 stations by means of corer and/or snapper. A few samples were obtained from beyond the edge of the shelf.

A preliminary analysis of the data collected during the cruise indicates that the waters off Bombay and Karwar are fairly isothermal or they have weak negative gradients up to a depth of about 75 metres. The thermocline is found below 100 metres. A fairly strong southerly current of about one knot was noticed at almost all the stations. The surface salinities were higher near-shore and they decreased slightly off-shore. Surface salinities for the near-shore stations gradually decreased from about 35.8‰ near Bombay to 34.8‰ near Cochin. High salinity water was found at a depth of about 100 metres beyond the continental shelf in all the sections of the cruise.

The oxygen values in the surface layers vary between 4.2 and 5 ml/litre. The values generally increase from 10 to 30 metres depth. The minimum oxygen zone exists at about 300 metres depth in deep stations and the minimum oxygen value is around 0.4 ml/litre. Between 800 and 1500 metres depth the oxygen content again increases from about 0.4 ml/litre to 1.6 ml/litre.

XXVI Cruise (1-8 April 1965)

The XXVI Cruise began from Cochin on 1 April 1965 with a complement of 15 scientists on board and after occupying 40 stations according to the itinerary terminated at Madras on 8 April 1965.

Ten stations were occupied off Pondicherry with a view to studying the canyons of that region in detail. Observations were taken under the different disciplines of oceanography, as has been done in the previous cruise.

Detailed traverses were made of the canyons off Pondicherry with continuous running of the echosounder to obtain the profiles of these canyons.

The surface current was southerly on the west coast, whereas on the east coast it was found to be northerly in direction and was quite strong (about two knots) between Pondicherry and Madras. The transparency of the water in the near-shore areas off Alleppey was very low according to observations recorded from 15 to 20 miles from the coast.

The surface salinity is in general higher near-shore and decreases outward from the coast at these places. A core of high salinity water appears off Alleppey beyond the continental shelf at a depth of about 75 metres. The oxygen values in the surface layers varied from 4.7 to 5.3 ml/litre. The decrease of oxygen starts at a depth of about 100 metres and the oxygen minimum exists at about 300 metres at the deep stations. The minimum values lie around 0.25 to 0.35 ml/litre. The oxygen content of the waters increase again between 800 and 1500 metres from 0.8 ml/litre to 1.10/litre.

The examination of the bottom sediments collected from cruises 25 and 26 show quite interesting features. The main characteristics of the sediments, as revealed by gross visual observation, are tabulated below:

Area	Depth	Nature of sediments	Colour
Off Bombay	-	Clayey with shell fragments	Greyish Black (nearshore) Greenish black (offshore)
-	bet. 40 and 90 m.	Sand with little clay and silt	-
Off Karwar	-	Clays	Greenish black (nearshore)
	55-65 m.	Coarse sand and pebbles	Brownish black (edge of shelf)
Off Mangalore	30-40 m.	Clays and silt up to edge of shelf	Greenish black Grass green
Off Cochin	30-120 m.	Silty sand or clayey	Black
	25 m.	Sticky mud	Black
Off Alleppey	up to 48 m.	Clay	Olive green
	beyond that	Coarse sand, silty sand with shell fragments	Olive green to greyish green
	on the slope	Fine to medium sand with shell fragments	-
Off Karaikkal	up to 28 m.	Medium to fine sand	-
	28-54 m.	Little clay	Brownish on the slope
	beyond that	Silty clays and sandy silts	-
Off Madras	middle of	Coarse sand with shell fragments	-
	edge of shelf	Sandy clay	Olivegreen
	nearshore	Medium to fine sand	-

Both XXV and XXVI cruises were under the leadership of Dr. V.V.R. Varadachari of the Indian Ocean Physical Oceanography Centre, Ernakulam.

XXVII Cruise (14-21 April 1965)

The XXVII scientific cruise of INS KISTNA commenced from Madras on 14 April 1965 and terminated at Calcutta on 21 April 1965. Fifteen scientists from different organisations participated in this cruise under the leadership of Shri R. Jayaraman of the Indian Ocean Expedition Directorate, Delhi. The details of work at the stations are:

Hydrographic casts	- 34
BT lowerings	- 32
IOSN samplings	- 32
Wave observations:	at all day stations
Surface Meteorological Observations:	during synoptic hours all days
Radiosonde ascents:	each day at 17 hours
Canyon traverses:	3 + 1

On the 26 April 1965, an informal seminar on the scientific problems of the Bay of Bengal was organised by the Indian National Committee on Oceanic Research, in collaboration with a few other scientific institutions at Calcutta, such as the Geological Survey of India, Zoological Survey of India and the Central Inland Fisheries Research Institute. The seminar was held at the Birla Industrial and Technological Museum (CSIR) in which a number of papers were presented.

INS KISTNA, Cruise XXVIII (29 April - 5 May 1965) (from Indian IOOE Newsletter, Vol. III, No. 1)

INS KISTNA commenced her XXVIII scientific cruise from Calcutta on 29 April 1965 with a complement of 12 scientists under the leadership of Dr. C.B. Murty of the Directorate of Scientific Research (Navy). In this cruise, 35 stations were occupied off the east coast of India between the mouth of Mahanadi and Visakhapatnam. Details of observations undertaken during this cruise are as follows:

BT station	- 14
Hydro-stations over shelf	- 10
Hydro-stations beyond shelf (max. 1200m deep)	- 11
Geological station	- 22
Radiosonde ascents	- 3
Surface Meteorological Observations	- every three hours beginning at 0230 hours.

Geological collections were made at all the shallow water stations and during the four sections occupied across the shelf between Gopalpur and Bhimilipatnam.

The sea surface temperatures were, in general, lower than the air temperatures over the shelf region, the maximum difference being 3.7°C at station 753 south of Gopalpur. 260 water samples were collected for salinity and oxygen determination which were carried out on board and about 130 water samples collected and preserved for nutrient analysis. In general salinity values showed a slight decrease in the surface layers up to 20 to 30m. except off Gopalpur where the depth of this layer of salinity decrease was only of the order of 5m. A sub-surface salinity maximum was observed at depth 300 to 500m.

The oxygen concentration in the surface layer down to 15m. was of the order of 4 to 5 ml/litre at 50m. The zone of oxygen minimum with concentration between 0.12 to 0.22 ml/litre was found at depth between 200 to 1000 m.

The cruise was completed at Visakhapatnam on 5 May 1965.

R.V. VARUNA (June-August, September-October 1965)
(from Indian IIOE Newsletter, Vol. II, No. 4)

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

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

R.V. VARUNA (January-March 1965)
(from Indian IIOE Newsletter, Vol. III, No. 1)

In the Arabian Sea R.V. VARUNA continued her work on the continental slope between Cape Comorin and Karwar, with special emphasis on exploratory fishing, but also collecting necessary basic oceanographic data.

A short cruise exclusively for oceanographic work was undertaken between Cape Comorin and Cochin during 4-8 February. The oceanographic cruise was continued up to Karwar till the 12th February, after which the vessel spent some time searching for fish shoals, off Karwar. As soon as some indication was obtained in the echosounder, bottom trawling was tried at positions $12^{\circ}50'N$, $74^{\circ}25'E$, $12^{\circ}40'N$, $74^{\circ}11'E$ and $12^{\circ}25'N$, $74^{\circ}14'E$, but the catches were not very encouraging. On the 12th afternoon huge shoals of dolphins were sighted and four of them were caught by harpooning. The vessel returned to Cochin on 15.2.1965.

During the quarter January-March 1965 VARUNA completed six cruises with a total steaming of 5,600 nautical miles, spending about 61 days at sea.

U.S.A.

ANTON BRUUN, Cruise 7 (29 July - 10 September 1964)
Cruise 8 (25 September - 9 November 1964) and
Cruise 9 (18 November - 28 December 1964)

This Office has received the Final Cruise Report for the above cruises (in two volumes). The content is more or less similar to that for her former cruises. Since extracts from narrative reports for cruises 7 and 8 have been published in No. 12 and No. 13 of this Information Paper respectively, just an abstract of the report on Cruise 9 appears below, and the cruise track is in Annex V.

Cruise 9 emphasised reef and shore collecting in some of the more remote island areas in the southwestern Indian Ocean. Specimens were obtained by SCUBA and free diving, rotenone poisoning, and collecting in the exposed intertidal zones of the reef and shore areas of Mombasa, Kenya, Latham Island south of Zanzibar, Grand Comore and Mayotta Islands, Aldabra and Farquhar Islands, St. Joseph's and D'Arros Islands in the Amirante Islands, and Mahe and Cerf Islands in the Seychelles. Although general collections were made at all these areas, certain groups received special attention because of specific interests among the scientific party. These included macroscopic algae, sea-grasses, mollusks, commensal and parasitic copepods, parasitic helminths, nemerteans, ostracods, lancelets, pontoniid shrimps, fishes and Ascothoracida, a parasitic group of barnacles found in certain cavities of zoantharians and echinoderms.

At most of the island stations, longline gear and a 200 ft. shark gill net were fished. Bottom trawling with a Gulf of Mexico shrimp trawl was impractical because of the many pinnacles and dome-shaped formations around the various islands. Towards the end of Cruise 9, a series of trawl hauls was made on the narrow continental shelf along the Somali coast.

Most of the Cruise 9 scientific party left the ship at Aden on December 20. The remaining members made a series of plankton collections in the Red Sea, and disembarked at Hurgada, U.A.R. to make shore collections.

The following table gives a summary of the work carried out during the cruise.

Bathythermograph cast	20 stations
Oblique haul with 75M3 plankton net	9 stations
Horizontal surface haul with 75M3 plankton net	7 stations

Vertical haul with NV-70 plankton net	6 stations
Trawling with Gulf of Mexico shrimp trawl	18 occasions
Dredging	13 occasions
Benthos sampling with snapper	2 occasions
Trolling	5 occasions
Dip net	2 occasions
Hand line	3 occasions
Flew on board	1 occasion
Reef and shore collection	8 occasions
Bottom long-line	9 occasions
Gill net	5 occasions
Long-line	2 occasions
Minnow trap	1 occasion

4.2 Cruise plans

Australia

H.M.A.S. DIAMANTINA, Cruise 3/65 (25 October - 5 November 1965)

The plan of the above cruise has been received from the Australian National Coordinator; the following is an extract from the plan. The track chart is not reproduced because it is similar to than shown in Annex IV.

Area

As shown on accompanying chart.

From Fremantle a series of traverses between latitudes 24° and 34° S. and to Fremantle

Objectives

To study the distribution and growth of the larval stages of the Western Australian crayfish (Panulirus cygnus)

To examine the hydrological conditions and circulation of water masses off the Western Australian coast

Stations

At the SCOR/UNESCO Reference Station 1 (32°S., 111°50'E. in 5000 m) and at Position Stations shown on chart

Work at Stations

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

Indian Ocean standard net haul from 200 m

Position Stations: Hydrological sampling to the bottom
 for temperature, salinity, oxygen, nitrate and
 inorganic phosphate

Indian Ocean standard net haul from 200 m

Oblique tow by midwater trawl from 200 m to
 surface. Simultaneous plankton net tow at
 surface

Personnel

J. Barnister (Cruise Leader)
 N. Dyson
 W. Prothero
 L. Thomas

Probable Itinerary

Depart Fremantle	October 25
Arrive Fremantle	November 6

Sampling and ObservationsHydrology:

Reference Station: (32°S., 111°50'E. in 5000 m)
 Nansen bottle sampling at 0,
 25, 50, 75, 100, 150, 200, 300,
 500, 700, 900, 1100, 1300 and
 1500 m and then at 500 m
 intervals to the bottom

Samples for temperature, salinity,
 oxygen, nitrate, and inorganic
 phosphate at all depths

Samples for particulate phosphate
 and total phosphorus at 0, 50, 100,
 200, 300, 500, 700, 900, 1100, 1300
 and 1500 m and then at 500 m inter-
 vals to the bottom

Position Stations (X and ⊗): Nansen bottle sampling to a maximum depth of 1500 m at the depths listed above.

Samples for temperature, salinity, oxygen, nitrate and inorganic phosphate at all depths.

Physics:

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

Zooplankton:

Indian Ocean Standard net haul from 200 m off the continental shelf (at Position Stations 0 and ⊗). Plankton net tow at surface for early stage larval crayfish during mid-water trawl tow.

Micronekton:

Oblique tow from 200 m to surface by midwater trawl off the continental shelf (at Position Stations 0 and ⊗).

Laboratory Work

Shipboard:

Hydrology:

Salinity, oxygen, inorganic phosphate and total phosphorus determinations.

Zooplankton:

Concentration and storage of samples.

Micronekton:

Concentration and storage of samples.

Perth:

Micronekton:

Examination of particular taxa.

Zooplankton:

Examination of particular taxa from surface tow.

Cochin (I.O.B.C.):

Zooplankton:

Taxonomic studies from Indian Ocean Standard net samples.

5. Meteorological Programme

News from the Scientific Director's Office, No. 17 (October 1965) has been received by this Office, and is reproduced below. The questionnaire form mentioned in the last section appears as Annex V.

"Papers presented at the Symposium in Bombay reflect the growing pace of research.

INTERNATIONAL METEOROLOGICAL CENTRE

IMC continues its daily collection and analysis of data from the Indian Ocean region and to check and process the main body of IIOE data for 1963 and 1964.

Besides participants in the Symposium, visitors included:

Mr. R. Frost:	of the United Kingdom Meteorological Office
Mr. Harvey Vogel:	of Texas Instruments
Mr. C.C. Reyes:	of the Philippine Weather Bureau

SYMPOSIUM ON THE METEOROLOGICAL RESULTS OF IIOE

The Symposium, sponsored by the Government of India, UNESCO and WMO and organised by the India Meteorological Department, was most successful. It was held in Bombay from 22-26 July in excellent accommodation provided by the Tata Institute for Fundamental Research. The Governor of Maharashtra opened the proceedings and during the next nineteen hours of sessions, forty-nine papers were presented. One hundred of the participants were from India and twenty from other countries. They visited the Institute of Tropical Meteorology and the Meteorological Office in Poona, were entertained by a superb performance of classical Indian dancing, and were awed by a spectacular display of the southwest monsoon which caused the worst floods in Bombay in fifteen years. Proceedings of the Symposium will be issued soon; information can be obtained from the Director of IMC.

PROGRESS ON IIOE METEOROLOGICAL ATLASES

To prepare preliminary numerical analyses of all surface marine and upper air meteorological data to be published in the IIOE Meteorological Atlases, computer programmes have been developed over the past six months at the University of Hawaii for processing and analysing IIOE meteorological data which have been punched on cards. The first programme checks surface marine and upper air observations and averages each observed parameter, the second prepares the data for analysis, and the third controls an electronic curve-plotter which draws isopleths of the analysed scalar quantity. Check runs are now being made of the analysis-curve plotter programmes with averaged surface marine observations for all months of 1963.

In sequence, the programmes:

1. Interpolate the scattered data to a regular five-degree grid using a five-point system.

Each value is weighted inversely according to distance from the required grid point. The presence of land masses is taken into account. (Data used so far have been fairly well distributed with no large sparse areas.)

2. Analyse data at the evenly-spaced grid points using a two-dimensional quadratic interpolation.
3. Determine isopoints over a fine mesh grid for use by the curve-plotter.
4. Direct the curve-plotter in drawing the isopleths.

Interpolation procedure for one parameter requires about five minutes on the IBM 7040, and the consequent analysis, covering the whole of the Indian Ocean, occupies the curve-plotter for eight minutes. As the programmes are made more efficient, these times will be reduced.

RADIATION DATA

During IIOE a variety of radiation measurements has been made from ships, aircraft, land stations, and satellites. Although most of the measurements were designed for special small-scale experiments, yet in combination they might provide valuable insights into the scale of ocean-atmosphere interaction. In order to determine whether this office can act effectively as collector, comparer, and distributor of radiation data, I should appreciate it if those of you who have radiation programmes could complete the attached questionnaire and return it to me (see Annex V).

Hopefully, we propose that the data should be sent to us in reduced form and that we should distribute them to users in the form of printouts, card decks, or data tapes. A set of the data would also be sent to World Data Centre A."

6. Miscellaneous Information

6.1 National Co-ordinator of USA

The Secretary of IOC has been informed that Dr. Joseph S. Creager has replaced Dr. Richard G. Bader as the National Co-ordinator of the United States of America. His address is:

Dr. Joseph S. Creager
Programme Director
Division of Environmental Science
National Science Foundation
Washington D.C. 20550
U.S.A.

6.2 Fourth Meeting of the Consultative Committee of IOBC

The meeting was held in New Delhi from 23-27 February and in Cochin from 28 February - 2 March 1966. The report of the meeting will be published in the next issue of this Information Paper.

6.3 IIOE Collected Reprints, Vol. III

The IIOE Collected Reprints, Vol. III, is now being printed. Its contents are reproduced as Annex VI. Selected marine institute and libraries will receive this volume in due course.

6.4 Summary of IIOE Cruise Reports

The summaries of IIOE cruises which were received by this Office have been reported in this Information Paper, with extracts from their contents. Since this material has been spread over the different issues of the Information Paper, the Secretariat has prepared a summary of it in the form of a table and this was despatched to national co-ordinators for their clearance. Although the clearance of a few has not yet been received, the summary is published in Annex VII, as a provisional one. Any corrections and additions will be published in a future issue of this Information Paper.

Distribution limited

UNESCO/IOC-IV/INF-98
10 November 1965
English only

UNITED NATIONS EDUCATIONAL
SCIENTIFIC AND CULTURAL ORGANISATION
INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
Fourth Session
Unesco, Paris, 3 - 12 November 1965
REPORT OF AD HOC IIOE COORDINATION GROUP

Documents

- | | |
|-----------------|--|
| IV-10 | Summary Report of Second Meeting of the International Coordination Group for the International Indian Ocean Expedition |
| IV-10 Addendum | - do- |
| INF-71 | A proposal for the Preparation of an IIOE Atlas of Physical and Chemical Oceanography |
| INF-79 | Indian Ocean Biological Centre. The Distribution of Plankton Samples in the International Collection |
| AVS/9/88D | 4 October, 1965. Preliminary proposal by Prof. Krey for Atlas on Chemical Biology |
| UNESCO/IOC/9/88 | Proposal by Prof. Krey for Atlas on Chemical Biology (now INF-94) |
| AVS/9/88A | 1 October 1965. Proposal by WDC-A on Printing Collected Data Reports |
| AVS/9/88D | 9 November 1965. Proposal by Dr. Udintsev for Atlas on Geology-Geophysics (now INF-95). |

Agenda

1. Consideration of Report of Second Meeting of IIOE Coordination Group, June 1965.
2. Suggestions for Editors and Advisory (Editorial) Committee members.
3. IIOE Data Reports.
4. IOBC.

.../

Participants

AUSTRALIA	G.F. Humphrey (Rapporteur)
FRANCE	P. Tchernia
FEDERAL REPUBLIC OF GERMANY	G. Dietrich
	A. Kotthaus
	J. Krey
	A. H. Meyl
JAPAN	D. Shoji
	K. Wadati
SOUTH AFRICA	C. G. Hide (Observer)
THAILAND	Cdr. Sarindu
UNITED KINGDOM/IOBC	R. S. Glover
UNITED STATES OF AMERICA	R. G. Bader
	W. M. Chapman (Observer)
	W. S. Wooster
USSR	V. G. Kort
UNESCO/IOC	K. N. Fedorov (Chairman)

1. In recommending the Report (UNESCO/IOC/IV-10) to the IOC for approval, discussion was mainly on Recommendation 8. The ad hoc group recommends that

1.1 The advisory board could also be called an Editorial Board.

1.2 International participation in the preparation of atlases should be a basic concept deciding the activities of each editor.

1.3 The only matters in which the editors have a final decision should be scientific matters.

1.4 The whole of Recommendation 8 should be interpreted as implying that each editor will seek the active participation not only of members of the editorial (advisory) board but also of other appropriate scientists in preparing parts of each atlas so that the work receives the full benefit of international co-operation.

2. The ad hoc group recommended that Editorial (Advisory) Boards be established for the two atlases (Meteorology and Physical Oceanography) for which recommendations for editors (Professor Ramage and Professor Wyrтки) have already been made (Recommendation 8 in Unesco/IOC/IV-10) and for the two atlases (Chemical Biology and Geology-Geophysics) for which the ad hoc group now recommends that Professor Krey and Dr. Udintsev be appointed as editors. The ad hoc group recommends that the boards be as small as possible and consist of scientists from the following countries under the chairmanship of the relevant editor.

<u>Professor Krey</u>	<u>Professor Ramage</u>	<u>Dr. Udintsev</u>	<u>Professor Wyrтки</u>
Australia	India	Federal Republic	Australia
Japan	U.K.	of Germany	Federal Republic of Germany
S. Africa	USSR	India	France
U.S.A.		U.K.	Japan
USSR		U.S.A.	USSR

The ad hoc group considered the question of the source of money for preparing atlases and interprets the relevant part of Recommendation 8 of UNESCO/IOC/IV-10 as meaning that the countries in which the editors work will pay all costs of preparation except the final printing; where there are authors from more than one country, the country of each author may pay the relevant costs or may arrange with the editor that his country pay part of the cost, e.g. where it is wished that the final charts for the printer are prepared in the editor's laboratory.

3. The ad hoc group discussed this item for only a few minutes.

4. There was no discussion on this item.

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Fourth Session

Resolution IV-3

RESOLUTION ON INDIAN OCEAN ATLASES AND DATA REPORTS

The Intergovernmental Oceanographic Commission,

Accepts and commends for further implementation the reports of the IIOE Coordination Group (UNESCO/IOC/IV-10) and of the Ad Hoc IIOE Coordination Group (UNESCO /IOC/IV-INF 98), and, taking into account additional recommendations by the Commission,

Resolves to accept the proposals of Professor Krey (University of Kiel), Professor Ramage (University of Hawaii), Dr. Udintsev (Institute of Oceanology, Moscow) and Professor Wyrski (University of Hawaii) to prepare atlases for Chemical Biology, Meteorology, Geology-Geophysics, and Physical Oceanography respectively, and further

Resolves to appoint under their respective chairmanships Editorial Boards consisting of scientists nominated by Australia, Japan, South Africa, USA and USSR for the atlas on Chemical Biology; by India, UK and USSR for the atlas on Meteorology; by the Federal Republic of Germany, India, UK and USA for the atlas on Geology-Geophysics; and by Australia, the Federal Republic of Germany, France, Japan and USSR for the atlas on Physical Oceanography, and

Recommends to Unesco that it provides funds for the appropriate travel of the editors and the members of the boards, and

Authorises the Bureau, in consultation with the IIOE Coordination Group, preferably by correspondence, to accept proposals for additional atlases, and further

Recommends that its members participating in the IIOE publish their own cruise and data reports and supply national coordinators of other participating countries with at least three copies of each series free of charge.

IONO DATA RECEIVED BY WDC A DURING
THE PERIOD: 1 JULY 1964 - 30 JUNE 1965

ANNEX III

Country Institution Catalogue No. Ship	Period	Region	Type of Observation					Biological	Meteor- ological	Surface	Remarks		
			No. of Stations	Serial and Computed Data	Sts	Currents	Bottom Topo- graphy					Bottom Sedi- ments	
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
102. AUSTRALIA 102.1 Commonwealth Scientific and Industrial Research Organisation													
102.1 G-11 DIAMANTINA (Dm 1/62) (1108)	16.I.-12. XI.1962	NE Indian Ocean	36	T, S, σ_t , P(morg), P(total), N M ₁ , σ_t	500 Max.- 1299			D		Productiv- ity-47	Ta, Tw, Wd, Cld, Vis, Bar	Waves	AODC O.C.R. 20 Provisional data
102.1 G-12 DIAMANTINA (Dm 1/63) (1108)	30.III.- 27.IV.1963	NE Indian Ocean	36	T, S, σ_t , O ₂ , P(morg), P(total), N	400-500 to 5600 Max.- 5623			D		Pigments- -35 Productiv- ity-75	Ta, Tw, Wd, Cld, Vis, Bar	Waves	AODC O.C.R. 23 Provisional data
102.1 G-13 DIAMANTINA (Dm 2/63) (1108)	7.V.-2.VI 1963	NE Indian Ocean	33	T, S, σ_t , O ₂ , P(morg), P(total), N	400-500 to 4900 Max.- 5109			D		Pigments- -34, Productiv- ity-53	Ta, Tw, Wd, Cld, Vis, Bar	Waves	AODC O.C.R. 24 Provisional data
102.1 G-14 DIAMANTINA (Dm 3/63) (1108)	10.VII.- 10.VIII. 1963	NE Indian Ocean	32	T, S, σ_t , O ₂ , P(morg), P(total), N	400-500 3800- 4800 Max.- 5391			D		Pigments- -35, Productiv- ity-50	Ta, Tw, Wd, Cld, Vis, Bar	Waves	AODC O.C.R. 25 Provisional data

Country Institution Catalogue No. Ship	Period	Region	Serial and Computed Data			Type of Observation				Biological	Meteor- ological	Surface	Remarks
			No. of Stas.	Date	Sample Depths	BTs	Currents	Bottom Topog- raphy	Bottom Sediments				
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
102.1 G-15 DIAMANTINA (Im 5/65) (1108)	5-28.IX. 1963	NE Indian Ocean								Productiv- ity-34			AODC O.C.R. Provisional data
102.1 I-7 GASCOYNE (G 1/62) (1108)										Productiv- ity-54			
102.1 I-6 GASCOYNE (G 1/63) (1108)	18.I.-16. II. 1963	NE Indian Ocean	31	T, S, σ_t , H _{inorg} , H _{total} , N, σ_t	500, 4900 Max.- 5885			D		Pigments- -55, Productiv- ity-11	Ta, Tw, Wd, Cld, Bar	Waves	AODC O.C.R. 21 Provisional data
102.1 I-9 GASCOYNE (G 2/63) (1108)	4-8.III. 1963	Great Australian Bight	40	T, S, σ_t , H _{inorg} , O ₂	less than 100 Max.- 1500			D			Ta, Tw, Wd, Cld, Bar	Waves	AODC O.C.R. Provisional data
124. JAPAN 124.2 Hokkaido University													
124.2 A-8 HOKUSEI MARU (Cruise 11) (1108)	14-27.XII. 1961	NE Indian Ocean	16	T, Cl, S, σ_t , ΔD	700- 1000 Max.- 1000					Fishery obs-13	Wd, W, Ta	Col, Transp, Waves	Data in pub. rep. 2 "Data ...Fishing" No. 7, 1963

3.

Country Institution Catalogue No. Ship	Period	Region	Serial and Computed Data				BTs	Type of Observation						Remarks
			No. of Stas.	Data	Sample Depths	Currents		Bottom Topog- raphy	Bottom Sediments	Biological	Meteor- ological	Surface		
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12	
124.2 B-8 OSORO MARU (Cruise 1) (110E)	12.XII. 1962-19. I.1963	NE Indian Ocean; Eastern China, Philippine, Moluccas, Banda, Savu, Java, and South China Seas	72	T, Cl, S, O, AD	1200- 1100 Max.- 1196					Plankton- -129, Fishery obs-28	Wd, W, Ta	Waves, Col, Transp	Data in pub. rep.: "Data ... 80.3" (The Faculty of Fisheries, Hokkaido Univ., Japan, March 1964)	
137. UNION OF SOVIET SOCIALIST REPUBLICS 137.1 Academy of Sciences of the USSR; Arctic & Antarctic Research Institute, Head Board of the North Sea Route, and Institute of Oceanology	7.X.1960- 19.IV.1961	Mediterranean Sea - Eastern Basin; Gulf of Aden; NW, SW, SE, NE Indian Oceans; Bay of Bengal; Red, Arabian, Laccadive, Burma, Java, South China, Sulu, Celebes, Philippines, & Japan Seas	201	T, S, O, pH, Alk, P, Si, NO ₂ -N	1900- 2100 Max.- 6334	T-40		D, P, Photo- -6	Core- -118, Surface- -118				Bathymetric data in pub. rep.: "Data on Sea Bottom Relief" Collected during the 33rd Cruise of the Institute of Oceanology of the Academy of Science of USSR VIITAZ 1960-1961" (Acad. Sci. USSR Inst. Oceanology, Moscow 1963)	
137.1 B-7 VIITAZ (Cruise 33) (110E)														

Country Institution Catalogue No. Ship	Period	Region	Type of Observation					Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface	Remarks
			No. of Stas.	Serial and Computed Data	BTs	Currents	Sample Depths						
1	2	3	14a	14b	5	6	4c	7	8	9	10	11	12
137.1 B-9 VITYAZ (Cruise 35) (1108)	23.VI.-24. XI.1962	Japan, Eastern China, Philippine, South China, & Laocadive Seas; Bay of Bengal; NE, NW Indian Oceans; Malacca Strait	119	T, S, O, O ₂ , pH, Alk, P, Si, NO ₂ -N	T-115		1800- 2500 Max.- 5815	D, P	Surface- -11, Core- -162 Field Description				Bottom sediment information and photographs in pub. rep.: "Investigations in the Indian Ocean (33rd Cruise of R/V VITYAZ)" (Transactions of Institute of Oceanology Vol. 64, Acad. Sci. USSR 1963)
137.5 P-1 NEVELSKOI (1108)	2-30.V. 1962	Gulf of Aden, Bay of Bengal, NE Indian Ocean	23	T, O ₁ , S, O _t	T-47		2000 Max.- 2000	D	Old, Vis, Wd, Ta, Hum, Bar	T, Col, Transp, Waves			Pathymetric data in pub rep.: "Data on Sea Bottom Relief Collected during the 35th Cruise of Oceano- logy of the Academy of Science of the USSR "VITYAZ" 1962" (Acad. Sci. USSR, Inst. Oceano- logy, Moscow 1964.)

Country Institution Catalogue No. Ship	Period	Region	Type of Observation								Biological	Meteor- ological	Surface	Remarks
			No. of Stas.	Serial and Computed Data	BTs	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Sample Depths					
1	2	3	4a	4b	5	6	7	8	9	10	11	12		
139. UNITED STATES OF AMERICA														
139.1 Woods Hole Oceanographic Institution														
139.1 E-1 ANTON BRUN (Cruise A) (IIOE)	24.II.-4. III.1963	Gulf of Aden, Arabian Sea	13	T, S, O ₂ , PO ₄ -P, NO ₃ -N, NO ₂ -N, SiO ₃ -Si	1300 Max. - 1396		D		Productiv- ity-13, Plankton- -13	Wd	Transp	Data in pub. rep.: "U.S. Programme in Biology International Indian Ocean Expedition, Report No. 1, ANTON BRUN Cruise A, Aden- Bombay, February- March 1963, (WHOI, undated) NODC 31199		
139.1 E-2 ANTON BRUN (Cruise 1) (IIOE)	13.III.-9. V.1963	Bay of Bengal; Arabian, Laccadive Seas	92	T, S, O ₂ , PO ₄ -P, NO ₃ -N, NO ₂ -N, SiO ₃ Si, Chl.a, C ₁₄	900- 1000 Max. - 3096	B ^m	D		Plankton, Fishery obs	Wd, Sol. Rad.	T, S, PO ₄ -P, NO ₃ -N, NO ₂ -N, SiO ₃ -Si, Chl.a, C ₁₄	Data in pub. reps.: "U.S. Programme in Biology, International Indian Ocean Expedition, News Bulletin No. 2, Narrative Report ANTON BRUN Cruise 1" (WHOI, July 1963) U.S. Pro. in Biol. IIOE, Final Cruise Report ANTON BRUN Cruise 1, Vol. 1, Oceano- graphic Data, Vol. 2 Bathythermograph Positions, Station Lists for Biolo- gical Collections (WHOI, July 1964)		

Country Institution Catalogue No. Ship	Period	Region	Serial and Computed Data					Type of Observation					Surface	Remarks
			No. of Stas.	Data	Sample Depths	BTs	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteo- logical			
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12	
139.1 E-3 ANTON BRUHN (Cruise 2) (1108)	22.V.-23 VII.1964	Arabian Sea, NW Indian Ocean	39	T, S, O ₂ , PO ₄ -P, NO ₃ -N, NO ₂ -N, Max.- SiO ₂ -Si, Chl. a, b, C _{chl}	1900- 2000 Max.- 14091	B ^m				Productiv- ity-39, Plankton- -39, Fishery obs	Sol. Rad.		Data in pub. reps.: "U.S. Programme in Biology, International Indian Ocean Expedition News Bulletin No. 3, Narrative Report ANTON BRUHN Cruise 2" (WHOI, Jan. 1964). "U.S. Prog. in Biol., 1108, Final Cruise Report ANTON BRUHN Cruise 2, Oceanographic Data, Bathythermo- graph Positions, Station Lists for Biological Collections" (WHOI, July 1964) NODC 31199	
139.3 U.S. Naval Oceanographic Office														
139.3 D-2 SERRANO (1108)	19.II.-27. III.1963	Burma and Laccadive Seas; Bay of Bengal; NE Indian Ocean	63	T, S, O ₂ , δ, ΔD, V _s , O ₂ , PO ₄ -P, SiO ₂ -Si, pH ₄	50- 100, to 3800 Max.- 3890			D			W, Cld, Wd, Bar, Ta, Tw, Vis	Waves	NODC 31090	

DATA from SHORE AND FIXED STATIONS													
Country Institution Catalogue No. Station	Period	Region Latitude Longitude	Sea Level	Waves	Type of Observation								Remarks
					Serial & Computed Data		BTs	Currents	Biological	Meteor- ological	Surface		
					No. of Stas.	Sample Depth							
1	2	3	4	5	6a	6c	7	8	9	10	11	12	
236. SOUTH AFRICA 236.3 Division of Sea Fisheries, Oceanographic Research Institute, Durban	17.V.1961-25. III.1964	NW Indian Ocean, Fixed Station 29°54'S 31°07'E (Off Durban)			47	T, S, O ₂ , PO ₄ -P, pH, O ₂ , S, AD	25- 85 Max.- 90		Productiv- ity-46		T, S, pH		

Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data		BTs	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface		
			No. of Stas	Data									
												Sample Depth	
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
102. AUSTRALIA													
102.1 Commonwealth Scientific and In- dustrial Research Organisation													
102.1 G-7 DIAMANTINA (DM 3/61) (IIOE)													
102.1 G-8 DIAMANTINA (DM 1/62) (IIOE)													
102.1 G-9 DIAMANTINA (DM 2/62) (IIOE)													

Add:
ADAdd:
TranspAdd:
Data in pub. rep.:
"Oceanographical Cruise
Report No. 11"
(C.S.I.R.O. Austr. Oceanogr.
Cruise Report No. 11, 1964)Add:
PlanktonAdd:
Data in pub. rep.:
"Oceanographical Cruise
Report No. 14"
(C.S.I.R.O. Austr. Oceanogr.
Cruise Report No. 14, 1964)Add:
Data in pub. rep.:
"Oceanographical Cruise
Report No. 15"
(C.S.I.R.O. Austr. Oceanogr.
Cruise Report No. 15, 1964)

Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data		B's	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface		
			No. of Stas	Data									
												Sample Depths	
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
113. FRANCE													
113.7 Muséum National d'Histoire Naturelle													
113.7 D-1 NORSEL (IIOE)	28.II.- 10.III. 1959	NE Indian Ocean, Bay of Bengal	15	T, S, σ_t , PT	1900- 2500 Max.- 4427						Wd, Ta	Waves	
113.7 E-1 COMMANDANT ROBERT- GIRAUD (R.G.II) (IIOE)	4.VII.- 16.IX. 1960	NW Indian Ocean, Mozambi- que Channel	119	T, S, σ_t	1700- 2800 Max.- 4435			D			Wd, Ta, Hum, Cld	Waves	
113.7 E-2 COMMANDANT ROBERT- GIRAUD (R.G.III) (IIOE)	21.IV.- 1.VI. 1961	Arabian & Red Seas, of Gulfs of Oman, Iran, & Aden	98	T, S, σ_t	60- 3000 Max.- 3470			D			Wd, Ta, Hum, Cld	Waves	

Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data		E's	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface		
			No. of Stas	Data									
												Sample Depths	
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
113.7 E-3 COMMANDANT ROBERT- GIRAUD (R.G.V) (IIOE)	25.XII. 1962- 12.II. 1963	Arabian & Red Seas, Gulf of Aden, & Med. Sea- Eastern Basin	120	T, S, σ_t	100- 1000 Max.- 2245			D		Wd, Ta, Hum, Cld	Waves		
124.2 Hokkaido University	13.XII. 1963- 6.I. 1964	NE Indian Ocean	31	T, S	40-80, 1200- 1400 Max.- 1494					Wd, Bar, Ta, Tw, W, Cld; Vis	Col, Transp, Waves		Provisional data
124.4 Tokyo University of Fisheries	12.XI. 1960- 12.I. 1961	Banda & Timor Seas, NE & SE Indian Oceans	59	T, S, O_2 , PO_4 -P, SiO_3 - Si, pH	2600 Max.- 3890			D		Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp, Waves		Provisional data

Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data		BTs	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface		
			No. of Stas	Data								Sample Depths	
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
124.4 A-6 UMITAKA MARU (1st Cruise of IIOE)	19.XII. 1962-7. 1.1963	NW Indian Ocean	20	T, S, O ₂ , PO ₄ -P, SiO ₃ -Si, pH	2500- 2700 Max.- 2868			D			Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp, Waves	Provisional data
124.4 A-7 UMITAKA MARU (2nd Cruise of IIOE)	21.XI. 1963- 22.I. 1964	NE Indi- an Ocean	30	T, S, O ₂ , PO ₄ -P, NO ₂ -N, NO ₃ -N, SiO ₃ -Si, pH	2700- 3000 Max.- 3290			D			Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp, Waves	Provisional data
124.7 Kagoshima University													
124.7 A-2 KAGOSHIMA MARU (Cruise 63.3) (IIOE)	26.XI. 1963- 26.I. 1964	NE & NW Indian Oceans	46	T, S, O ₂ , PO ₄ -P, P(to- tal), NO ₂ -N, NO ₃ -N, SiO ₃ -Si, pH	3600- 4200 Max.- 4442			D			Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp, Waves	Provisional data

Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data		BTs	Currents	Bottom Topography	Bottom Sediments	Biological	Meteor- ological	Surface		
			No. of Stas	Data Sample Depths									
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
124.16 Fisheries College, Shimonoseki	22.XI.1962 -25.I.1963	NE Indian Ocean	26	T, S, O ₂ , PO ₄ -P, P(total), SiO ₃ -Si, pH, NO ₃ -N	2900- 3100 Max.- 3198			D			Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp Waves	Provisional data
124.16 A-2 KOYO MARU (Cruise 16) (IIOE)	23.XI.1963 -25.I.1964	NE Indian Ocean Bay of Bengal	22	T, S, O ₂ , PO ₄ -P, P(total), SiO ₃ -Si, pH	1300- 6000 Max.- 6053			D			Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp Waves	Provisional data

Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data			Bfts	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface	
			No. of Stas	Data	Sample Depths								
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
133. PORTUGAL													
133.1 <u>Ministério da Marinha</u>													
133.1 A-1 ALMIRANTE LACERDA (AL 1/64) (IIOE)	11.IV.- 8.V. 1964	Mozambi- que Channel	45	T, S, O ₂ , SiO ₃ -Si ₃	2500 Max.- 3000	D					Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp., Waves	Provisional data
133.1 A-2 ALMIRANTE LACERDA (AL 2/64) (IIOE)	7-30. IX. 1964	Mozambi- que Channel	45	T, S, O ₂ , PO ₄ -P, NO ₃ -N, SiO ₃ -Si ₃	2000, 2500 Max.- 2500	D					Wd, Bar, Ta, Tw, W, Cld, Vis	Col, Transp., Waves	Provisional data
136. REPUBLIC OF SOUTH AFRICA													
136.1 <u>Division of Sea Fisheries, Oceanographic Research Institute, Durban</u>													
136.1 A-3 AFRICANA II													

Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks	
			Serial and Computed Data		B's	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface			
			No. of Stas	Data										
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12	
138. UNITED KINGDOM 138.5 <u>National Institute of Oceanography</u> 138.5 B-1 DISCOVERY (Cruise 1) (IIOE)	25.VI.- 18.VIII. 1963	Arabian Sea, Gulf of Aden	72	T, S, O ₂ , PO ₄ , -P, NO ₂ -N, NO ₃ -N, SiO ₂ -Si	50, 900, 3400 Max.- 3952			D		Wd, Bar, Ta, Tw, W, Cld, Vis	Waves		Provisional data	
139. UNITED STATES OF AMERICA 139.1 <u>Woods Hole Oceanographic Institution</u> 139.1 D-4 CHAIN (Cruise 43) (IIOE)	15.II.- 21.VIII 1964	EE & NW Atlantic & NW Indian Oceans; Med. Sea -Eastern & West- ern Bas- ins; Strait of Gibral- tar; Gulfs of Suez & Aden; Red,						P1- 149	Surface- 27 field descrip- tion					Bathymetric data in pub. rep. "Track Charts, Bathymetry, and Location of Observations, CHAIN Cruise No. 43, North Atlantic Ocean, Mediterra- nean Sea, Red Sea, Indian Ocean, February 15, 1964 - August 21, 1964" (W.H.O.I. Ref. No. 64-51, December 1964)

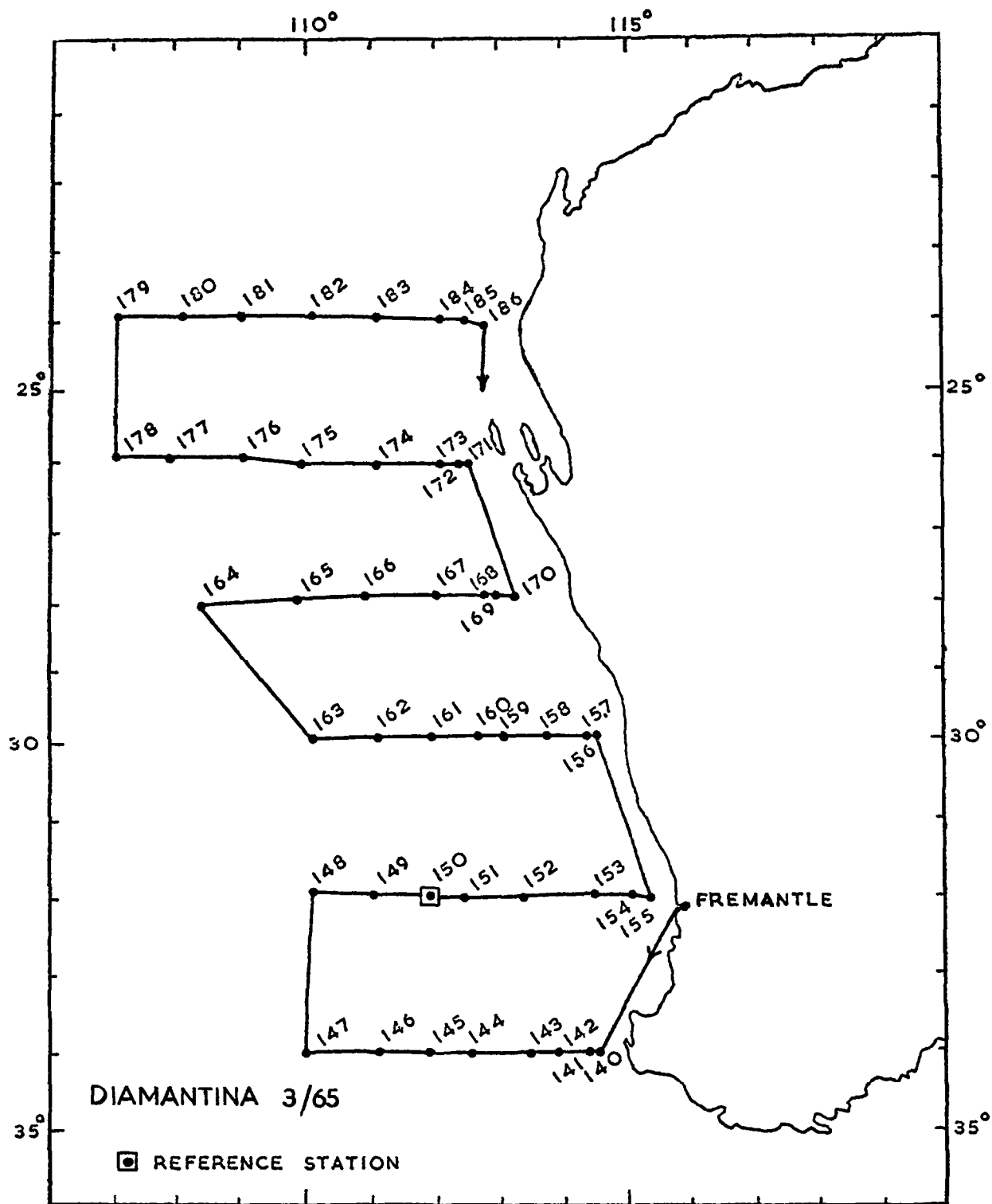
Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data		BTs	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface		
			No. of Stas	Data								Sample Depths	
139.1 E-4 ANTON BRUUN (Cruise 3) (IIOE)	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
	8.VIII -20.IX 1963	Alboran, Balearic, Ligurian Tyrren- ian, Ionian & Arabian Seas	16	T, S, O ₂ , PO ₄ -P, NO ₃ -N, NO ₂ -N, SiO ₃ -Si, Chl.a, C ₁₄	1900 Max.- 4287	B ^m				Productiv- ity-16, Plankton- 16, Fishery obs -22		T	Data in pub. reps.: "U.S. Program in Biology, International Indian Ocean Expedition News Bulletin No. 4, Narrative Report: ANTON BRUUN Cruise 3" (WHOI, February 1964) "U.S. Prog. in Biol., IIOE, Final Cruise Report: ANTON BRUUN Cruise 3, Oceanographic Data, Bathymograph Positions, Station Lists for Biological Collections" (WHOI, January 1965) NODC 31372.
139.1 E-5 ANTON BRUUN (Cruise 4A) (IIOE)	25.IX. -8.XI. 1963	Gulfs of Aden and Oman Arabian Sea, NW Indian Ocean	40	T, S, O ₂ , PO ₄ -P, NO ₃ -N, NO ₂ -N, SiO ₃ -Si, Chl a, C ₁₄	1900 -2000 Max.- 3872	B ^m				Productiv- ity-40, Plankton- 43 Fishery obs.		T	Special Chemical Determinatio- ns include: Dissolved organic carbon, Particulate carbon, Particulate phosphorus, Dissolved organic nitrogen, Particulate nitrogen & Particulate iron. Data in pub. reps.: "U.S. Program in Biology, International Indian Ocean Expedition News Bulletin No. 5, Narrative Report:

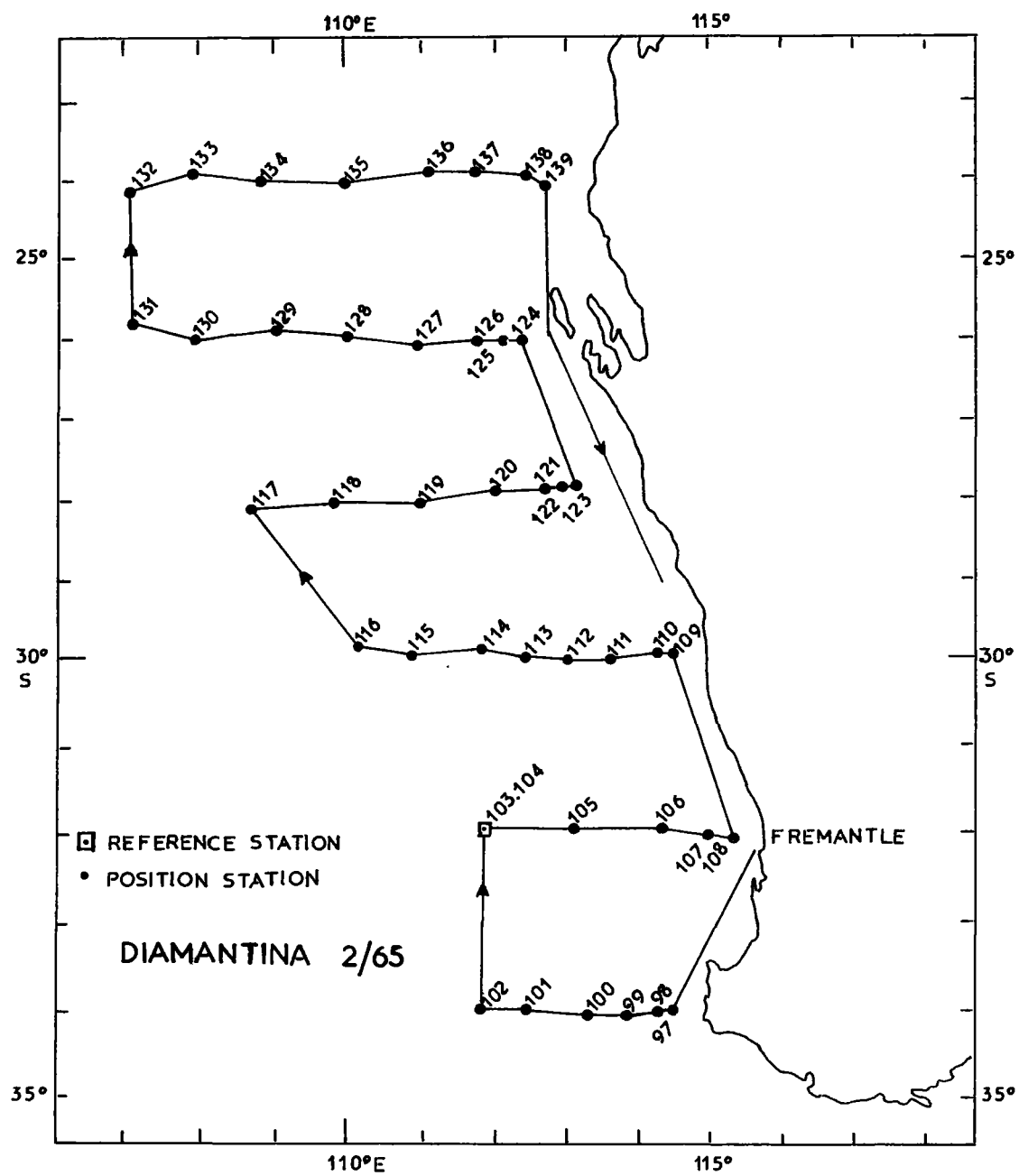
Country Institution Catalogue No Ship	Period	Region	Type of Observation										Remarks
			Serial and Computed Data		BTs	Currents	Bottom Topog- raphy	Bottom Sedi- ments	Biological	Meteor- ological	Surface		
			No. of Stas	Data								Sample Depths	
1	2	3	4a	4b	4c	5	6	7	8	9	10	11	12
139.1 E-6 ANTON BRUUN (Cruise 4B) (IIOE)	12.XI.- 10.XII. 1963	Arabian Sea, Gulfs of Oman & Iran				B*		D	Surface- field description	Fishery obs		T [*] S [*] PO [*] O ₂ [*]	ANTON BRUUN Cruise 4A" (WHOI, March 1964) "U.S. Prog. in Biol., IIOE, Final Cruise Report: ANTON BRUUN Cruises 4A and 4B, Oceanographic Data, Bathymograph Positions, Station Lists for Biological Collections" (WHOI, January 1965) * at surface and bottom * at bottom Data in pub. reps.: "U.S. Program in Biology, International Indian Ocean Expedition News Bulletin No. 6, Narrative Report: ANTON BRUUN Cruise 4B" (WHOI, April 1964) "U.S. Prog. in Biol. IIOE Final Report ANTON BRUUN Cruises 4A and 4B, Oceanographic Data, Bathymograph Positions, Station Lists for Biological Collections" (WHOI, January 1965)
139.1 E-7 ANTON BRUUN (Cruise 5) (IIOE)	27.I.- 5.V. 1963	Arabian & Laccadive Seas Gulf of Aden; NW Indian Ocean	46	T, S, O, PO ₄ -P, NO ₃ -N, NO ₂ -N, SiO ₃ -Si	1900 Max.- 1998	B*		D		Chl.a, C ₁₄ , Prod, * Plankton, * Fishery obs	Wd	T, Transp	Data in pub. reps.: "U.S. Program in Biology, IIOE, New Bulletin No. 7, Narrative Report: ANTON BRUUN Cruise 5" (WHOI, Oct. 1964) "U.S. Prog. Biol., IIOE, Final Cruise Report ANTON BRUUN Cruise 5, Oceanographic Data, Bathymograph Positions, Station Lists for Biological Collections" (WHOI, March 1965)

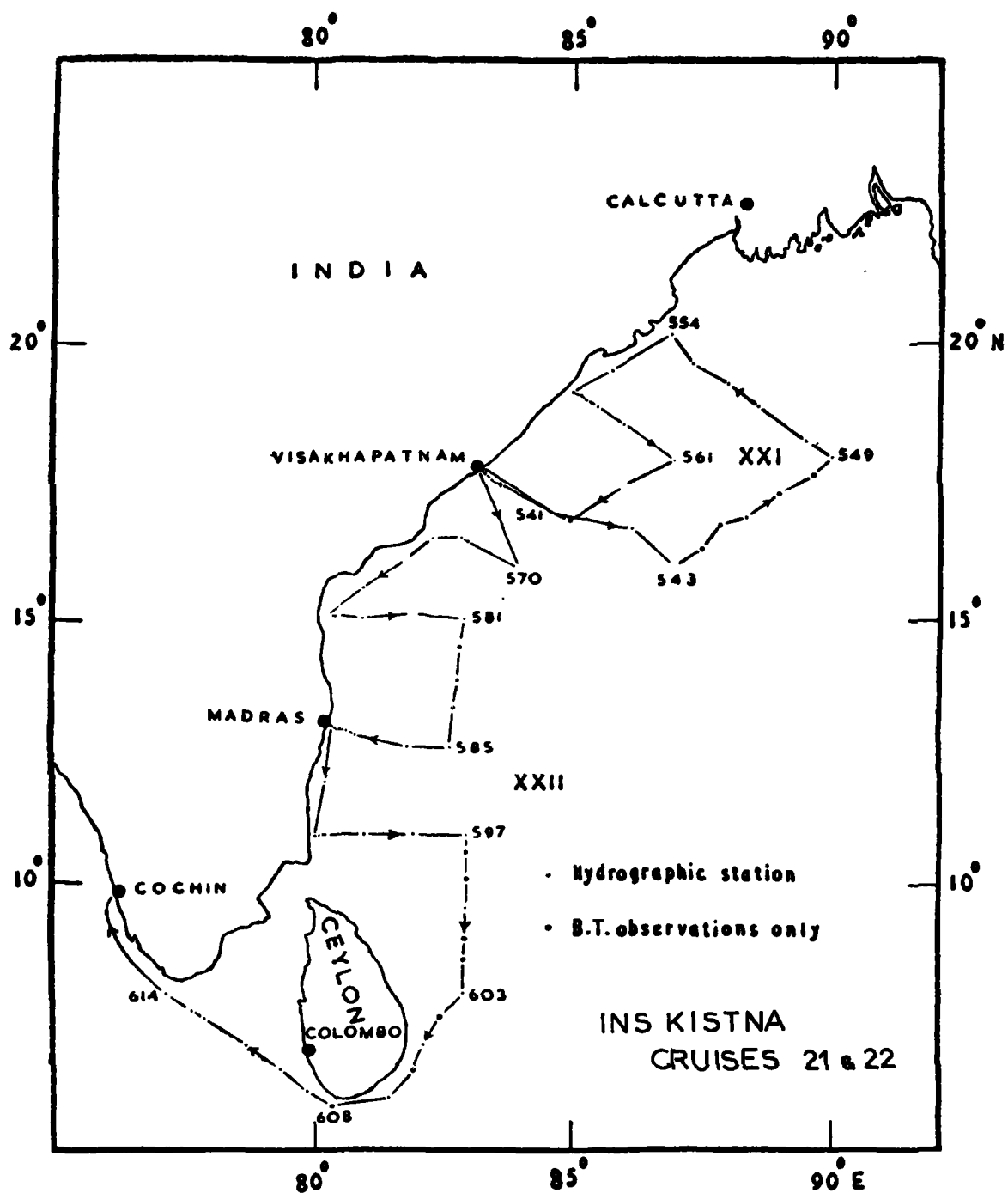
*Data collected, but not available at the Center.

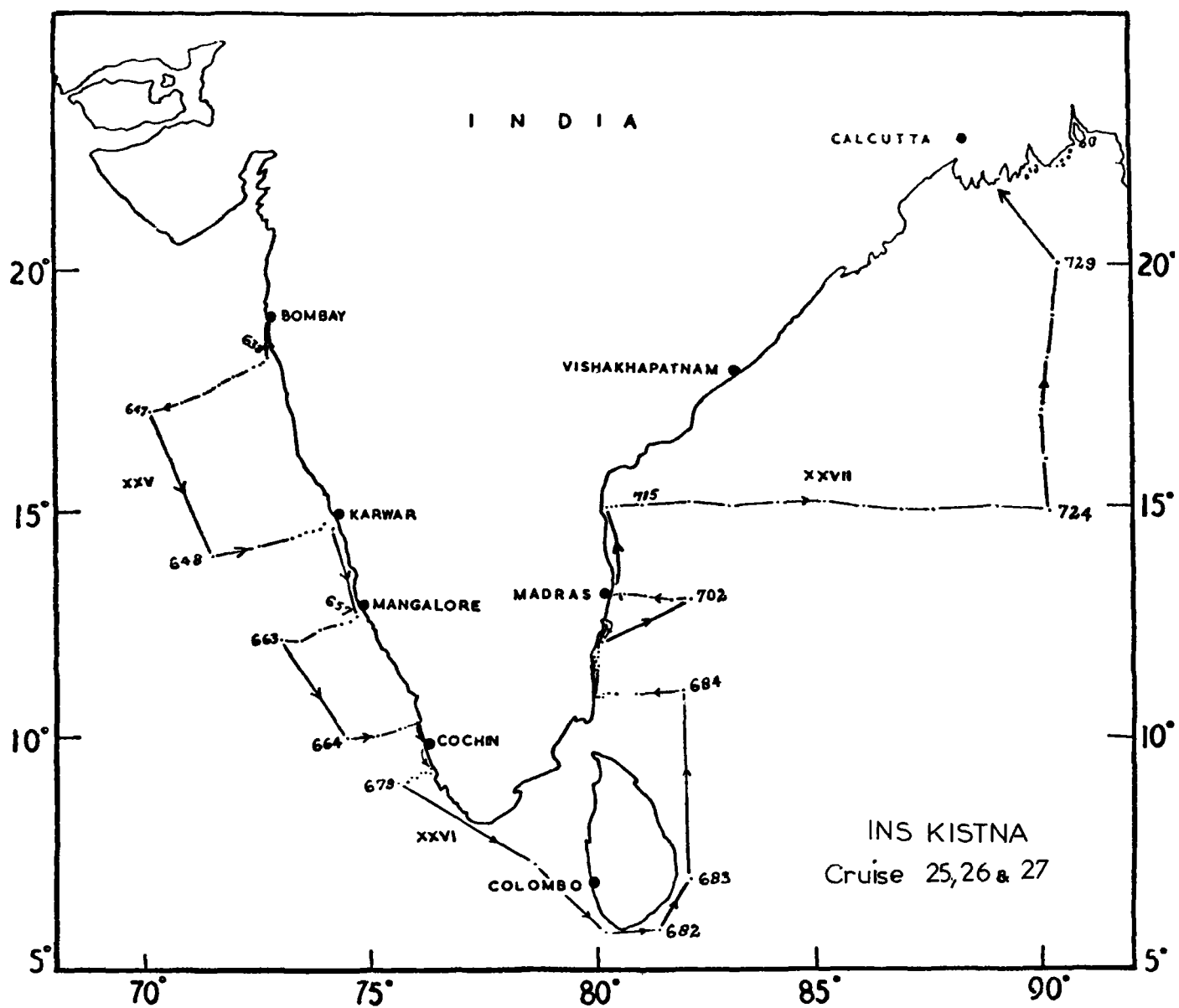
* Data collected, but not
available at the Center.

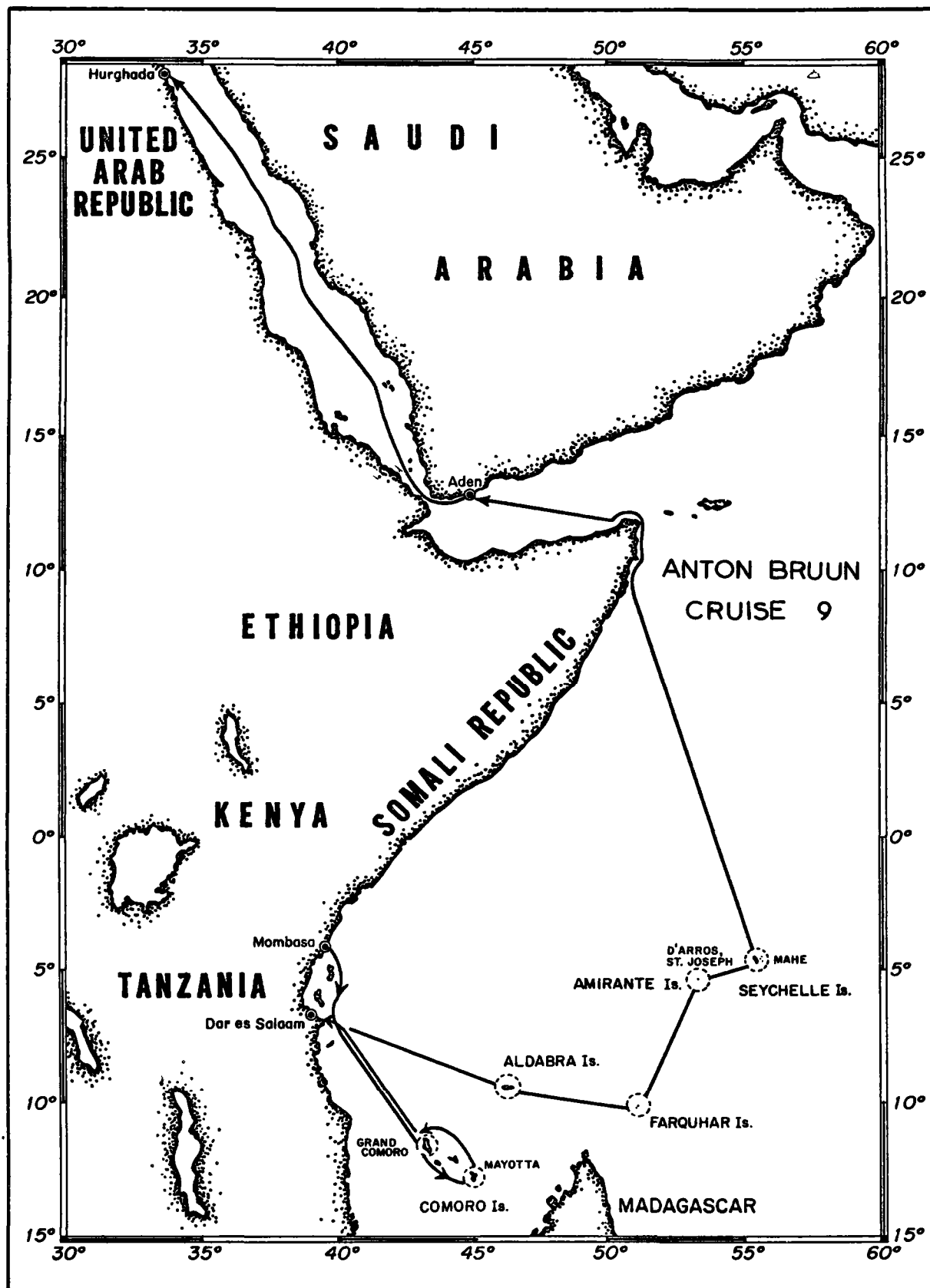
ANNEX IV

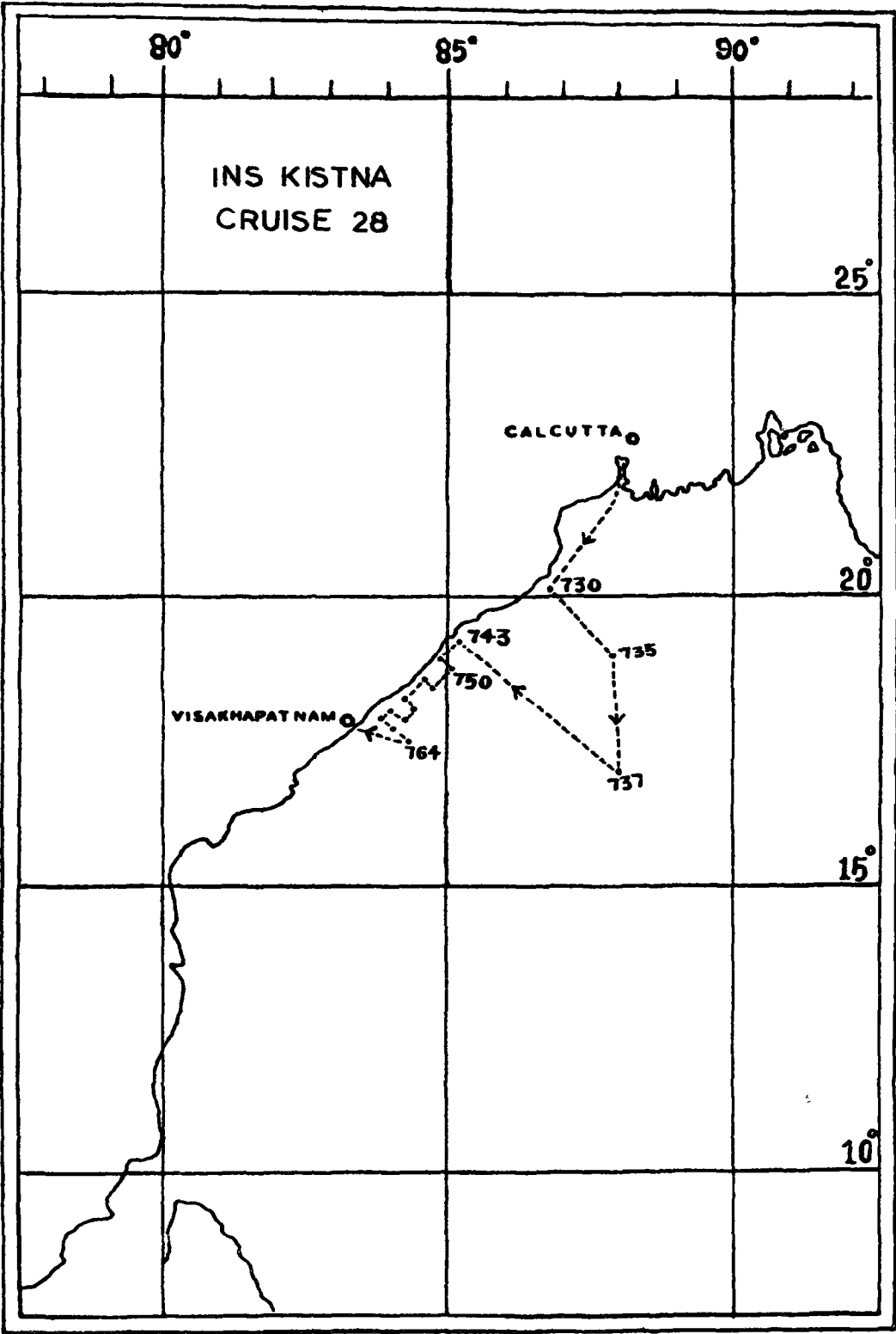












IIOE RADIATION DATA

Organization Name _____

Country _____

Instrument Location	Name					
	Latitude					
	Longitude					
	Altitude					
Index No. (if regular met. station)						
Research Vessel?						
Type of Instrument						
Period of Record						
Method of Reduction	Discrete values?					
	Interval between values					
	Average values?					
	Averaging period					
Date by which data will be available?						
Radiation Values Available	Diffuse sky rad.					
	Direct solar rad.					
	Totl. sun & sky rad.					
	Terrestrial rad.					
Long-short-wave balance						
Remarks						

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SUMMARY OF IIOE CRUISE REPORTSGeneral

1. Numerals in the 3rd to 28th columns indicate the number of stations where the work corresponding to the column heading has been undertaken. In cases where the number is not known, an 'x' is marked.

2. Numerals in brackets indicate the number of samples collected and not the actual number of stations.

3. Numerals between arrows indicate that the number is for work covered by the arrows.

4. Underlining indicates that the data, even if only a part of them, have been received by the WDC-A by 30 June 1965.

Occasionally some discrepancies have been found between the number of stations in a summary report and the number in the "Catalogue of Data in WDC-A"; the number in the summary report is shown in the table in these cases.

Country/ship/cruise

1. The name of a country underlined indicates that clearance or corrections have been received from the national coordinator.

2. The name of ship appears only once - in the first line - even though the ship may have engaged in several cruises for the IIOE.

3. Numerals after the name of a ship indicate the cruise number.

Period

1. No uniform rule exists in indicating the period, and this especially relates to ships coming from countries outside the Indian Ocean. The date of departure from the home port and return there is generally indicated unless the national coordinator or the operating institute has suggested differently.

Hydrol. St. (serial)

Stations where serial observations for subsurface layers have been undertaken irrespective of the number of sampling layers and the maximum depth; e.g. a hydrological cast is made in connection with experimental fishing operations. The station is listed in this column as well as in that of "experimental fisheries".

Hydrol. St. (surface)

Stations where water samples have been taken from the surface for determination of salinity, dissolved nutrient salts, etc. Surface hydrological observations made at the site of serial hydrological stations are also listed here, if the national coordinator concerned has requested that this be done.

continued..

1. Temperature measurements against depth with bathythermograph or other devices, including those at a hydrological station.

2. /3h indicates that BT casts were made at every three-hour intervals while the ship was underway, as well as at hydrological stations.

STD

Measurements of temperature and salinity against depth with continuous in-situ salinity-temperature-depth measuring device.

Current

1. Measurements of current.

2. Different techniques are indicated by the following signs:

G: with GEK; numerals indicate the number of jogs.

M: with current meter.

N: subsurface current measurements with neutrally buoyant float.

F: with surface drogue.

D: release of drift cards or bottles.

B: an anchored buoy is placed as a reference for current measurement.
or for suspending a recording current meter (s).

R: current determination by a discrepancy between an actual ship position
and that of dead-reckoning.

Physical studies

1. Studies of physical property of sea-water which is not generally included in descriptive oceanography.

2. Different studies are indicated by the following signs:

T: measurement of optical property, except transparency with Secchi disc and colour with standard colour scale.

S: measurement of sound velocity.

Chemical studies

1. Studies of chemical property of sea-water, which is not included in descriptive oceanography.

2. Different studies are indicated by the following signs:

R: Radioactivity of sea-water and isotopes.

T: Water sampling for determination of dissolved trace element (s).

C: Particulate carbon compounds.

P: Particulate phosphorus compounds.

Phytoplankton

Sampling of phytoplankton with a fine-mesh net or water sampler.

IOS-net

Collection of zoo-plankton by vertical haul of an Indian Ocean Standard Net.

continued..

3.

Zooplankton sampling (exc. IOS net)

1. Collection of zooplankton samples, excluding those collected with IOS net vertical haul.

2. Different techniques are indicated by the following signs:

- C: Sampling with Clarke-Bumpus plankton net.
- V: Vertical haul, either with a closing or open net.
- Q: Oblique haul, either with a closing or open net.
- H: Horizontal haul, either at the surface or subsurface (s).
- U: Underway sampling with a high-speed plankton sampler or a plankton recorder.
- L: Larva-net.

Midwater trawl

Towing an Isaacs-Kidd mid-water trawl or a similar instrument.

DSL

Catches from a deep scattering layer.

Pigments

Measurement of chlorophyll.

Primary productivity

Measurements of primary productivity of sea-water with carbon-14 technique, either in-situ, simulated in-situ and/or tank methods. Surface and subsurface irradiance measurements associated with this study are not listed in other columns.

Marine bacteriology

Sampling of sea-water (W) or sediments (S) for bacteriological studies.

Visual observations

1. Recording on living animals during the voyage.
2. Kind of animal is indicated by the following signs:

- M: mammals
- B: birds
- F: fishes
- E: insects

Benthos sampling

1. Sampling of benthic animals; apparatus employed is indicated by the following signs:

- G: Grab
- D: Biological dredge
- T: Trawl

continued..

Bottom photography

No distinction is made for its main purpose, biology or geology.

Sedimentology

Bottom sampling with various devices:

- C: coring with piston corer, gravity corer
- S: with bottom snapper or grab for geological purposes
- R: with rock-dredge

Seismic study

Seismic reflexion or refraction study; numerals preceded by P indicate number of profiles studied.

Heat flow

Measurement of heat flow in sediments.

Bathymetry

'C' indicates the continuous recording of echo-sounder.

Gravity and Magnetism

'G' and 'M' indicate continuous recording of gravity and earth magnetism respectively.

Synoptic Wx obs.

Surface weather observation at the synoptic hours or more frequently. /3h indicates the three-hourly observation.

Upper air obs.

Radio-sonde and/or rawin-sonde ascent; 'd' indicates once a day.

Air-sea interaction

Other maritime meteorological studies

- R: Continuous recording of surface radiations.
- W: Measurements of wind profile near the sea surface.
- H: Measurement of humidity profile near the sea surface.
- Wa: Wave measurement with instruments.

Experimental fisheries

Fishing operation for research with a fishing gear more or less commonly used for pelagic fisheries.

- T: Trawl
- ST: Shrimp trawl
- L: Long-line fishing including deep line
- G: Fishing with gill net

Fish collections Collections of fish samples with various methods.

[illegible]

[illegible]

COUNTRY/Ship/ Cruise No.	Period	ser	sur	BT	STP	our	ph	ch	phyte	IOS	soo	mid	DSL	plg	pr-p	hac	Via	ben	photo	sed	eds	heat	bath	gray	syn	upp	air	exp	fish	Remarks
Norcel.	22/2-10/1/59	15																												
GERMANY																														
Motor	1 29/10/60-18/5/65	292	192	M,B	T-75	G-14	P	83	210	L	19	1678	666	100																
INDIA																														
Kistna	0 23/9-10/10/62	32	23																											
	1 13-21/10/62	28	26																											
	2 3-11/11/62	19	19																											
	3 19-26/11/62	22	22																											
	4 17-30/1/63	22	22																											
	5 5-15/2/63	22	22																											
	6 21/2-9/3/63	35	35																											
	7 11-30/3/63	14	14																											
	8 18-20/6/63	25	22																											
	9 1-15/7/63	22	22																											
	10 17-22/7/63	13	12																											
	11 25-31/7/63	24	21																											
	12 7-13/8/63	11	11																											
	13 19-27/8/63	23	23																											
	14 2-18/9/63	38	38																											
	15 8-20/6/64	37	37																											

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COUNTRY/Ship/ Cruise No.	Period	ser	sur	Bt	STD	cur	ph	oh	phyto	IOS	soo	mid	DSL	pig	pr.p	bac	vis	ben	photo	sed	seis	heat	bath	grav	syn	upp	air	exp	fish	Remarks	
Madeira	30/11-3/12/63	8																													
PORTUGAL																															
Alm. Lacerda 1/64	11/4-21/5/64	15	15	122	M-4					39							MBF						CD	7h							
2/64	7/9-1/10/64	15	15	124						44							MBF						CD	7h							
SOUTH AFRICA																															
Africana II	25/7/6-20/8/61	32			D-32				17	32	24		16				EMF						CD			26	Wa	T-1	1	hand lines	
263	15/6-11/7/62	23					R-6	12		23	9		16				EMF						CD	7h	15	Wa	L-22	22			
273	2-20/4/63	15	17		D-25	T-12		15	9	15	5	9					EM						CD				Wa	T-7	1	scuba divers	
285	11-29/3/64	21	8	38	D-21	T-20	21	18	19	14							EMF						CD				Wa	L-10	1	hand line	
John D. Gable	30/31/5-3/6/61	4	4		C-2												B														
33	11-23/7/61	13	5					5	V-10								B	D-5													
34	17-26/8/61	2	2					1	V-1								B	G-3													dredge
37	4-12/12/61	1			1												B														
38	3-14/2/62	32	12			7			V-10								B-1	D-11													
146	30/11-10/12/62	19						3	V-6								B	D-6													
																		G-13													

dredge

COUNTRY/Ship/ Cruise No.	Period	ser	sur	BT	STD	our	ph	oh	phyto	IOS	zoo	mid	DSL	pig	pr.p	bac	vis	bon	photo	sed	seis	heat	bath	grav	syn	upp	air	exp	fish	Remarks
Natal	1 2-24/4/62	37	145				R-23	26	V-101 H-37								B			C-3	CD									
	2 7-24/5/62		34																	C-4	8	C	G							
	3 4-22/6/62		23																	C-6	9	C	G							
	4 2-24/7/62	27	81				R-23	28	V-99 H-37								B					C								
	5 6-30/8/62		68			F-8						8					B					C								
	6 1-22/10/62	35	36	72				24	36	V-66		9	3							C-10		C	G							
M/N	5-22/11/62		108								5																			
	7 7-30/1/63	37	59	96			R-6	24	37	V-68		24	21									CD								
	8 11/2-8/3/63		68				R-5				6						B			C-8		C								
	22-24/7/63	7																				CD								
Ol/10	10-22/8/64	16						14		V-24 H-5																				
A. Queen																														
TANZANIA																														
Manihine	11/1-20/3/65																													
THAILAND																														
Oceanographic Vessel																														
U.K.																														
Dalrymple	8/10/61-10/3/62																													
	13/10/62-8/1/63		/3h																											

COUNTRY/Ship/ Cruise No.	Period	ser	sur	BT	STD	our	ph	oh	phyto	IOS	200	mid	DSL	plg	pr.p	bac	vis	ben	photo	sed	seis	heat	bath	grav	syn	upp	air	exp	fish	Remarks		
Discovery	1 11/16-20/8/63	72	/Th	M-70 F-6 N-6 R-81	C-x P-x	64	144	V-71 H-2 Q-3 U-69	9	x	30	x	20	MBFE	G18	C	/Th	Wa R	x													
	2 23/8-11/12/63	26	110	F-6	T-28		3	H-3						B	22	C-33 S-26 P-11 R-26	33	C	M	/Th	d	R										
	3 15/2-28/9/64	306	/Th	M-351 N-41 C	C-x P-x	149	94	V-150 H-2 B-3 U-183	38	x	112		13	MBFE				R														half hourly BT tow near equator and Arabian coast radiop-sonde AMSP 4 & 5 magnetic measure- ment on a buoy # AMSP 9 with Discovery AMSP in prepara- tion +
Owen	31/10/61-13/5/62		/Th																													
	21/10/62-30/5/63		/Th																													
	29/9/63-27/6/64		/Th																													
U.S.A.																																
Anton Bruun A																																
	1 12/3-10/5/63	92	/Th		x	75	82	Q-89 H-51	13	90	90	90	x	B	D-26		C															
	2 22/5-23/7/63	39	/Th			32	38	Q-51 H-18		32	32	32			D-2		C															
	3 8/8-20/9/63	17	/Th			12	16	Q-18 H-18		16	15	x	16	17			C															
	4-A 25/9-8/11/63	40	/Th			40	40	Q-10		40		40					C															
	4-B 12/11-10/12/63	0	/Th					H-17							D-17		C															x shore collections
	5 26/1-4/5/64	46	/Th			41	45	Q-28 H-22		47	2	47		B			C															x shore collections
	6 15/2-16/7/64	27	124			28	21	V-12		28	61	x	28				C															x shore collections

half hourly BT
tow near equator
and Arabian coast
radiop-sonde
AMSP 4 & 5
magnetic measure-
ment on a buoy
AMSP 9
with Discovery
AMSP in prepara-
tion +

x shore collections
x shore collections
shore collections

COUNTRY/Ship/ Cruise No.	Period	ser	sur	BT	STD	our	ph	oh	phyto	IOS	zoo	mid	DSL	pig	pr-p	bae	vis	ben	photo	sed	seis	heat	bath	grav	syn	upp	air	exp	fish	Remarks		
Anton Bruun (continued)	7	29/7-10/9/64	27	/34				15	30	V-15 Q-9	25	36	36				MB	G-56 T-57 D-1	18	C-64 S-23 R-30			C		x						shore collections	
	8	23/9-9/11/64	23	/34			28	28	V-28 R-14			28	28				D-28			S-6 R-13			C		x						15 shore collections	
	9	18/11-28/12/64		20						V-4 Q-9 R-7							Q-2 D-13														5 extensive shore collections	
Argo	Monsoon	24/9/60-13/4/61	27	618			R-29 T-18	49		V-18	13						7			C-54 R-6		16	33	C	GM							
Lusitad II		1/7-21/9/62	27	x			x	x																								
Lusitad III		4/10-23/12/62	30																	C-67		x	x	C	GM						with Horizon	
Lusitad IV & VI		1/1-29/5/63	108																	C-19				C								
Dodo		11/6-13/7/64		/Th														4		C-43 R-6				C		x						
Dodo		16/7-7/9/64	86	x																C-5 R-7		120		GM	x							
Dodo		11/9-2/11/64																		C-73 R-3												
Atlantis II	8	10/7-12/9/63																														
	15	8/2-12/8/65																														
Chain	43	19/64-1/3/65																														
		15/2/-21/8/64																														
Conrad	8	6/1-2/3/65																														
East Wind		31/3-25/4/61	21																			16		C								

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