



International Indian Ocean Expedition

NEWSLETTER
INDIA



No. 4

March 1964



Collecting Plankton with Indian Ocean Standard Net.

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THE INDIAN NATIONAL COMMITTEE ON OCEANIC RESEARCH
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Indian Programme:

During the quarter, January to March, 1964 there were no cruises of INS KISTNA. As the ship had suffered some slight damage during her NOMAD operation in September 1963, she was taken to docks for repairs. The repairs have not yet been completed and it is expected that the ship will be ready towards the end of April 1964 to commence her 1964 cruises.

The *R. V. VARUNA* completed the post monsoon programmes by the end of 1963. Most of the time she was busily engaged in intensive fishery research programme and could spare little time for cruises connected with IIOE. The sections comprising about 20 stations were, however, completed as part of the IIOE programme in the post monsoon period.

In order to review the progress made in the 1962-63 cruises with special reference to the problems and difficulties that have arisen in the cruises of INS KISTNA, a meeting of the Cruise Leaders and the Naval Officers was convened by the Director of the Indian Programme at Bombay in the middle of March 1964. The purpose of the meeting was also to discuss the 1964 cruising programme and finalise the details. Among the points discussed, the most important were, the ratio of cruise time to shore time so that the maximum endurance of the ship could be taken advantage of, the additional facilities by way of

fitting up of new items of equipment and working facilities in the ship's laboratory etc. It was decided that in the early 1964 cruises, the effort will be concentrated in the Bay of Bengal and accordingly a cruise programme is being drawn up with extensive coverage of the east coast of India and the northern Bay of Bengal.

Processing of Data:

The preliminary processing of the Physical and Chemical Data collected during the 1963 pre-monsoon cruises is almost nearing completion. Accounts of the preliminary findings in 1962 cruises are being prepared in the form of reports by some of the participants in the early cruises. A team is being organized for monitoring the quality and accuracy of the incoming data with a view to their ultimate exchange both at the national as well as at the international level.

Indian Ocean Biological Centre, Ernakulam:

The report of the Curator on the development and activity of the centre indicating the position up to date is now available.

The input of samples has been considerable. On the 1st March 1964 the total number of samples received is 1079 and the break-up country-wise is as follows:

Country	Total No. of samples	Non-standard collections	% of Non-standard collections
Australia	206	16	7.8
India	275	117	42.5
Japan	68	0	0
England	44	0	0
South Africa	166	166	100
U.S.A.	270	0	0
U.S.S.R.	50	5	10
	1079	304	28.4

Samples taken by standard or non-standard nets have been considered to have equal scientific value; so far 249 samples have been processed.

According to the latest information received by the Curator at the Centre, approximately 1000 samples will be received from the following countries:

Country	Approx. No. of samples
Australia	150
Japan	94
Germany	230
South Africa	200
U.S.A.	300
U.K.	50

The Curator's report also contains full details regarding the procedure for sorting as adopted at the Centre.

The sorting is carried out in three steps according to schemes A, B & C.

Scheme A :

Dominance of plankton elements: The 2 or 3 important plankton groups are estimated visually.

Scheme B :

Volumetric composition of the plankton samples: The displacement volume of the total

sample is measured. Following this the displacement volumes are measured or computed of 9 groups of organisms.

Scheme C :

The sorting: After removing all larger organisms including fish eggs, fishes and cephalopods the remaining lot of organisms of nearabout same size is sub-sampled either with Lea's plankton divider or Folsom's plankton splitter, so that a sub-sample of 3-5 ml is left for sorting. The non-sorted fraction (minimum 10% of samples) will be kept as "archives." Of the 80 groups listed, 14 are identified but left in the residue; 5 are composite and 61 are sorted, counted and stored separately.

Rate of sorting:

Based on the studies made so far, the time taken for processing one sample according to the above procedure is 3 days.

Sorting on contract:

The contract sorting has been organized and supervised by the Curator. From Australia 200 samples have been received of which 25 have been sorted by two M.Sc. students of the University Oceanographic Laboratory, Ernakulam.

Meetings of Consultative Committee and Advisory Board of the IOBC Ernakulam

The Advisory Board for the Indian Ocean Biological Centre met at Ernakulam along with the 2nd meeting of the Consultative Committee of the Indian Ocean Biological Centre from March 18 to 27, 1964. Representatives from Smithsonian Institution, Washington, USA, UNESCO, and SCOR also attended the meeting. The following is the list of participants at the meeting :

1. Mr. R. S. Glover, U. K.—Chairman, Consultative Committee
2. Dr. M. E. Vinogradov, USSR—Member, Consultative Committee

3. Prof. Sigeru Motoda, Japan—Member, Consultative Committee
4. Dr. John A. McGowan, U.S.A.—Member, Consultative Committee
5. Dr. I. E. Wallen, USA—Representing Smithsonian Institution, Washington.
6. Dr. T. R. Parsons—UNESCO, Paris.
7. Dr. R. Serene—UNESCO/SEASCO, Djakarta
8. Dr. A. Evstafiev — UNESCO/SASCO, New Delhi.
9. Prof. J. Krey—SCOR
10. Dr. N. K. Panikkar—INCOR & SCOR Representative on the IOBC Advisory Board and Director, Indian Programme of IIOE.
11. Dr. R. Raghu Prasad—Member, IOBC Advisory Board & Chief Scientist-in-charge, IOBC.
12. Prof. P. N. Ganapati—Member, IOBC Advisory Board.
13. Dr. K. S. Pradhan—Member, IOBC Advisory Board representing Zoological Survey of India.
14. Dr. Vagn K. Hansen—Curator, IOBC.

The recommendations of the Consultative Committee are contained in a detailed report and is to be presented at the meeting of the Indian National Committee on Oceanic Research to be held in April 1964. These will be given in the next issue of the Newsletter.

The following lectures were given by the members of the Consultative Committee at the Indian Ocean Biological Centre and these lectures were well attended:

1. Prof. S. Motoda—"Distribution of plankton in relation to current system."
2. Mr. R. S. Glover—"Spatial and temporal variations in marine plankton."
3. Dr. J. A. McGowan—"Plankton communities in the Sea."
4. Dr. M. E. Vinogradov—"Distribution of tropical plankton of different trophic levels."

International Meteorological Centre, Bombay

Detailed report on the International Meteorological Centre has been received from the India Meteorological Department.

The International Meteorological Centre commenced functioning in the Colaba Observatory Compound, Bombay from 1st January 1963, to serve as a base for meteorological activities connected with the International Indian Ocean Expedition. This Centre is a special division at Bombay of the Institute of Tropical Meteorology which has been set up with aid from the U.N. Special Fund. Earlier in August 1962 under a bilateral agreement between the Government of India and the United States a team of U.S. Scientists of the U.S. National Science Foundation headed by Prof. C. S. Ramage arrived in Bombay for collaboration in the activities at the Centre. The Centre consists of twelve scientific officers, and 100 members of staff of the India Meteorological Department. Dr. C. S. Ramage Scientific Director of International Indian Ocean Expedition Meteorology Programme and five other American Scientists work at the Centre. Dr. D. R. Jones, Chief of WMO Special Fund Mission joined the Centre in October, 1963.

The main activities of the Centre relate to research, principally into weather processes in the Indian Ocean and adjacent areas. The Centre also provides training in the application of modern methods of weather observations, current techniques of weather analysis and meteorological forecasting research. To support this activity, the International Meteorological Centre collects and processes meteorological data over the Indian Ocean region, prepares and analyses extended weather charts and interprets and describes weather processes. The International Meteorological Centre also provides, when required, forecasts for vessels participating in the Indian Ocean Expedition.

An efficient telecommunications unit was organised for obtaining data for extended area analysis. Data for India and neighbourhood are

drawn from the meteorological teleprinter channels of the India Meteorological Department. Basic data for U.S.S.R., Japan, China and South-west Pacific Ocean are obtained through the Northern Hemisphere Exchange Centre, New Delhi. The data from equatorial regions and the Southern Hemisphere are obtained by interception of RTT broadcasts from Singapore, Canberra, Nairobi and Pretoria, with the help of crystal controlled radio receivers generously provided by the U.S. National Science Foundation. The International Meteorological Centre also receives RTT broadcasts of Mauritius and W/T broadcasts of Saigon, Djakarta, Colombo and Karachi. Steady progress has been maintained in this unit to ensure increasing data availability for analysis and research through periodical assessments. A day's collection amounts to about 1200 surface observations, 450 upper air reports and about 400 ships reports besides numerous aircraft reports. Analysed charts received by facsimile from Moscow, Nairobi, Manila, Canberra and New Delhi, and Nephanalysis data received from TIROS Weather satellites help routine analysis. Daily map discussions are held at International Meteorological Centre resulting in free exchange of scientific ideas and information and formulation of research problems. A daily bulletin giving salient features of analysis of Indian Ocean charts is issued to the departmental offices.

In order to collect upper air data over significant regions of the vast Indian Ocean needed for understanding of weather processes and research, four heavily instrumented aircraft of the U.S. Weather Bureau Research Flight Facility and one of the Woods Hole Oceanographic Institution, performed seventyfour scientific missions, extending over 450 flying hours, during the period May 2, 1963 to July 15, 1963. During the second phase of operations, in February-March, 1964 two U. S. Weather Bureau aircraft and the Woods Hole aircraft performed 50 missions lasting 350 flight hours. The International Meteorological Centre coordinated and assisted the scientific missions of the research aircraft. The missions in the first and second phases of operation included

a probe into a near equatorial tropical storm in the Arabian Sea, Bay of Bengal and Arabian Sea monsoon probes, equatorial region and Southern Hemisphere flights, sea breeze profile traverses and special air-sea interaction measurements. Towards the latter objective a specially instrumented floating buoy "MENTOR" of the University of Washington made detailed measurements near sea surface at various locations in East Arabian Sea in co-ordination with low altitude aircraft flights.

The aircraft missions have resulted in a mine of well documented basic data for numerous meteorological, physical oceanographic and atmospheric circulation studies. Officers of the Meteorological Department as well as members of I.A.F. and Indian Navy participated in almost all the flights.

Concurrent with daily chart analysis, International Meteorological Centre has been engaged in investigational work relating to low latitude atmospheric circulations and weather processes. At a Seminar held on 1st August 1963 scientific papers relating to the following topics were presented:

- (i) Analysis of monthly mean resultant wind charts for Indian Ocean and adjoining continental areas.
- (ii) Monsoon definitions.
- (iii) Upper air circulations over Arabian Sea and Bay of Bengal during pre-monsoon and monsoon seasons.
- (iv) Equatorward extensions of troughs in upper westerlies.
- (v) Thunderstorms over Central India and South Peninsula.
- (iv) Land and Sea Breeze circulations

The proceedings of the Symposium have been brought out (in the form of a prepublished report) under the aegis of the National Science Foundation and the India Meteorological Department. Four of these papers are being published in the Indian Journal of Meteorology and Geophysics.

A detailed investigation has just been completed of the severe Arabian Sea cyclonic storm of May 1963, which was penetrated by the research aircraft with Indian meteorologists also on board.

A paper on the 'Analysis of Mean Resultant Winds for Standard Pressure Surfaces over the Indian Ocean and adjoining continental areas' by C. R. V. Raman and C. M. Dixit was presented at the Tropical Meteorology Symposium in New Zealand in November 1963.

Mean resultant wind charts for five standard isobaric levels for all the twelve months of the year have been completed and are being given limited distribution as a second pre-published report of the International Meteorological Centre.

At a Seminar held under the auspices of the Indian Aeronautical Society, four papers were presented by International Meteorological Centre Meteorologists relating to high level and supersonic aviation.

Investigation is under progress on a further set of problems for presentation at a future seminar.

Yet another important phase of the International Meteorological Centre research programme is the processing of meteorological data by an IBM 1620 Electronic Computer. The Computer and ancillary equipment for sorting, printing and reproduction at a total cost of 12.25 lakhs of rupees, provided to India through United Nations Special Fund grant, have been installed in International Meteorological Centre in a set of rooms specially reconverted and airconditioned for the purpose. The Computer is being used to provide rapid and detailed processing and checking of meteorological data, to compute derived meteorological parameters for serving as auxiliary or diagnostic aids to researchers and to provide training in rapid processing and analysis of large amounts of meteorological data. Scientific Officers of the meteorological department underwent two courses of training in Computer programming and operations conducted by IBM Bombay. Programmes written and tested by Indian members under the guidance of and in collaboration with Lt. Col. F. R. Miller, U.S. Computer expert at the Centre include checking and averaging of ships weather reports, checking and listing of upper air data, computations of vorticity and divergence fields as well as statistical parameters.

A card punching unit organised at International

Meteorological Centre has already transformed a large volume of manuscript data (ship and rawinsonde) to punch cards for work with the computer. So far, 2.1 lakhs cards have been punched and 80% of them verified.

A significant and important analytical aid over large oceanic areas has resulted with the installation at International Meteorological Centre of Automatic Satellite Picture Taking Ground Equipment (A.P.T.), provided by U.S. National Science Foundation to the U.S. Meteorology Programme. A course of training in APT reception and interpretation was conducted by Lt. Col. J. S. Sadler of the U.S. HIOE group from Hawaii for the benefit of Indian meteorologists and technicians. Satellite pictures of parts of South Asia and adjoining Indian Ocean area are being received from TIROS VIII in orbit. Attempts are being made to interpret and disseminate useful information provided by this unit, the first of its kind in South Asia.

Increased liaison with AIR INDIA, Bombay and arrangements made with RAF at Singapore, Gan and Aden have resulted in regular availability at International Meteorological Centre of numerous over-ocean aircraft reports. These have significantly contributed to daily upper analysis at International Meteorological Centre and are benefiting research, besides enriching the data file.

In October-November 1963, a course of training was organised and conducted in connection with the UNESCO Oceanographic Fellowship Programme. A trainee from Indonesia and officers of the India Meteorological Department participated in the course. The training covered theoretical and practical aspects of kinematic analysis, ocean-air interaction, interpretation of mean resultant wind charts, application of statistics to reach and familiarization with International Meteorological Centre operations.

A fortnightly seminar on subjects having a direct bearing on low latitude meteorology is conducted at International Meteorological Centre. So far 15 Seminars have been held.

The co-operating meteorological services and

International airlines are sending published copies of weather data, hard copies of synoptic broadcasts as well as copies of post-flight reports. A back plotting unit, organised at International Meteorological Centre completes master charts by incorporating these data. Some charts for selected synoptic situations, thus completed have been re-analysed.

Steady progress is being maintained in micro-filming of basic data receptions published and manuscript 'hard' copies of broadcasts.

The meteorology programme of the IIOE has resulted in Meteorological services in the countries surrounding the Indian Ocean accelerating their developmental plans such as expansion of networks, improvements in data dissemination arrangements etc. Mention may be made of commissioning of upper air stations at Diego Garcia and Seychelles, two islands in the near equatorial Indian Ocean.

As an additional aid to research groups, a Central Library was organised by the Indian Meteorological Department in the Colaba observatory compound. Existing holdings of books and publications at the various meteorological offices in Bombay were amalgamated and considerably enhanced during the year. A qualified Librarian was provided by the U.S. Group of participants.

A large number of distinguished Indian and foreign visitors have visited the Centre from the time of its inception.

The Chief of the WMO Special Fund Mission, Mr. Jones, is significantly assisting the International Meteorological Centre by arranging for the acquisition of important equipment like Micro-file Camera, Micro-film reader etc. included in the Plan of Operations.

Reports from other countries:

JAPAN

During the cruise of the Japanese ship "Umitaka Maru" from November 1962 to January 1963 the following items of observations

concerned with the study of primary production and chlorophyll were carried out:

- a) Continuous recording of solar radiation energy by means of Robitzech self-recording radiation meter.
- b) Secchi disc reading.
- c) Measurement of underwater light intensity at stations.
- d) C^{14} primary production measured by tank method; sample water was taken from 0, 10, 25, 50, 75, 100 and 125 m depth.
- e) C^{14} primary production measurement by *in situ* method; bottles containing sample from 7 depths (ref. to d) were suspended at the depths of sampling respectively. This work was done at 9 to 20 stations.
- f) Chlorophyll measurements; sample water was taken from 0, 10, 25, 50, 100, 125, 150 and 200 m depths. Filters were treated with steam and preserved, for later study.

According to the personal communication from Mr. K. Takesue, on the "Koyo Maru" primary production was determined by tank methods at 23 stations and by *in situ* method at 13 stations. The simulated *in situ* method was also employed at some stations tentatively. Sample water was taken from the 6 optical depths, i.e. 100%, 50%, 20%, 10%, 5%, and 1% which were indirectly decided on the basis of Secchi disc readings.

Zooplankton sampling accomplished on the "Umitaka Maru" and the "Oshoro Maru" in the Indian Ocean.

The "Umitaka Maru" of Tokyo University of Fisheries, and the "Koyo Maru" of Shimono-seki University of Fisheries, participated in the IIOE programme on their training cruises in the Indian Ocean from October 1962 to February 1963. The "Oshoro Maru" of the Faculty of Fisheries, Hokkaido University, also carried out samplings of zooplankton by standard method in the Indian Ocean during the training cruise made in the same period. On the two ships "Umitaka Maru" and "Koyo Maru" vertical haul, mostly duplicate hauls, with Indian Ocean Standard Net

were made at every station. The former ship covered 20 stations and the latter 40 stations and the same number of samples will be sent to Indian Ocean Biological Centre, Ernakulam. Other types of nets were also used for samplings. More details are available in "Information Bulletin of Planktology in Japan" No. 9-1963-.

"Koyo Maru" sailed to the Indian Ocean on a cruise lasting from November 1962 to February 1963; She occupied 23 stations on the line from 5°N to 20°S along 94°E. Plankton work performed is briefly as follows:—

1. Highspeed plankton sampler V type (Motoda 1959-61): one-hour tow was insufficient. Considerable amount of samples was obtained by two hour tow.
2. Indian Ocean Standard Net (Currie 1962-Motoda 1962 a); two samples were collected by duplicate vertical hauls (0-200 m) at each station at night. Performance of flow meter, R.G.S. mounted on the net was good except in rough sea. Special care was needed in lowering the net to avoid occurrence of kinks in the wire cable. Although 4 mm. wire cable was used on this cruise, it is desirable to use 6 mm. wire or tapered wire cable. 160 cm. conical horizontal net (Motoda 1962. 1962 b): The net was towed horizontally running out the wire cable as long as 500 m. for one hour. Many animals were caught.
3. 80 cm. Juday type vertical closing net (Motoda 1962 a): The net was hauled separately for 0-200 m., 200-500 m., 500-1000 m., 1000-2000 m. and 2000-3000 m. depth. Samples taken with this net were usually very small in amount. It happened sometimes that 'Portugese man-of-war' and other jelly fish were entangled on the wire cable, disturbing the sliding of the messenger weight.
4. Midwater trawl: Large and small types of Isaacs-Kidd midwater trawl were used. Samples were comparatively monotonous, composed of mylophides, Jelly fish, fish-larvae, euphausiids and pteropods.

U. S. A.

The office of the Indian Ocean Expedition has received the U.S. IIOE News Bulletin No. 3 published from Woods Hole Oceanographic Institute, Massachusetts. This bulletin gives a narrative report of *Anton Bruun* cruise 2 which started on May 22, 1963 from Bombay and terminated at the same place on July 23, 1963. A brief summary is given below:

This cruise was undertaken as part of the joint cooperative programme for IIOE between the U.S. Fish and Wild Life Services. Its primary objective was to sample and assess the abundance of pelagic fishes on two north-west transects (70° and 80°E Longitude) between India and South Indian Ocean. The other purpose was to study the distribution of physical, chemical and biological properties throughout the different water masses encountered in the western Indian Ocean. The ship covered 39 stations along 70°E and 80°E from 17°N to 37°S. The following observations were made:

A hydrographic cast, usually to 2000 meters, was taken at each of the 39 stations. Measurements were made of temperature, salinity, dissolved oxygen, phosphate, nitrate, nitrite and silicate. Ammonia could not be measured. A deep hydrographic station to the bottom (4087 meters) was taken at 04°19'N latitude, 80°05'E longitude. Additional data were obtained with the bathythermograph at each station at hourly interval in calm conditions and two hourly intervals in rough seas.

Primary productivity and phytoplankton pigments were measured at 39 stations by C¹⁴ technique. Water samples for this purpose were collected with a plastic sampler from the depths to which 100%, 50%, 25%, 10% and 1% of the incident radiation penetrated.

Indian Ocean standard Net vertical plankton and microplankton tows from 200 meters to the surface were taken on 38 and 32 stations respectively. Zooplankton samples were also collected using the pressure operated multiple depth, oblique plankton samples (Be' nets) on 31 stations between 0-2000 meters. Some special plankton tows were taken

on 48 occasions using 1 meter diameter No. 6 net for the special interests of participating scientists.

Longline fishing for pelagic fishes were carried out on 33 stations. Fishes of 20 varieties were caught. Data collected from these fishes included length, weight & sex. The stomach contents, ovaries, blow samples and intestinal tracts were preserved for further examination.

A few scientists on board carried out their independent investigations on different subjects.

The Indian participants in this cruise were Mahadev Parab of Deep Sea Fishing Station, Bombay and K.N. Sankoli of Department of Fisheries, Maharashtra State, Bombay. The Chief scientist on board was S. Shomura of U.S. Bureau of Commercial Fisheries, Washington, U.S.A.

France

The French Vessel "Commandant Robert Giraud" during her cruise from December 19, 1962 to February 18, 1963 made oceanographic observations in the Indian Ocean, the Gulf of Aden, the Red Sea, and the Mediterranean Sea. The work carried out, of which the major object was detailed investigations of the hydrology of the region in winter, is tabulated as follows:

	<i>Indian Gulf of Red Medi-</i>				
	<i>Ocean</i>	<i>Aden</i>	<i>Sea terra</i>	<i>near</i>	<i>Total</i>
				<i>Sea</i>	
Hydrological stations	10	46	63	1	120
BT Stations	10	46	63	1	120
Surface-station	—	—	—	24	24
GEK Measurement	19	29	27	19	94
Water Samples	156	682	982	43	1863

This was the fifth cruise of this vessel in the Indian Ocean since 1957. The first one was made in October 1957 under the IGY programme and limited to the Mozambique channel; the second and fourth were carried out in the summer monsoon season in 1960 and 1962 respectively, in the western part of the Indian Ocean from the Gulf of Aden to the latitude of 32°S; the third cruise took

place from April to June 1961 in the Gulf of Aden, the Arabian Sea and the Persian Gulf.

During these five cruises, the ship occupied 516 hydrological stations, spent 262 days at sea and navigated more than 57,000 miles. These cruises were based at the "Centre d'Océanographie et des Pêches" at Nosy-Be belonging to ORSTOM and directed by Mr. Menache, the former Director of the Centre. The activities in the field of Physical Oceanography were an essential part of the French contribution to the IIOE.

South Africa

R. S. Africana II: Details of the work done during the third cruise of this vessel between April 2, to April 20 1963 are tabulated below:—

1. <i>Stations occupied</i>	15—A2386—A2400
2. <i>Hydrology</i>	
Temperature observations	227
Salinity samples collected	227
Oxygen determinations	226
Phosphate (inorganic) determinations	151
Phosphate (Total) determinations	151
pH determinations	2
Bathythermograph recordings	17
Transparency measurements	12
Drift cards released	500 at 25 localities.
3. <i>Biology:</i>	
(a) <i>Zooplankton</i>	
N70V samples	86
N113V samples	9
N7V "	39
N100H "	13
N100B "	10
N200B "	7
Continuous plankton recorder samples	50
(b) <i>Phytoplankton</i>	
N50V samples	11
Diatom sample from Nansen	
Petterson bottle (0, 10, 30, 50, 100, 150 meters)	75
<i>Productivity measurements</i>	
Samples collected at optical depths of 100%, 10%, 1% for C ¹⁴ measurements of phytoplankton production	19

Experimental Fishing:

Handlines and Japanese longlines were used at 7 stations. Scuba diving at Marion Island.

Ornithology:

Oceanic Birds counted 26

Botany:

Collection of sea weed 1

4. Meteorology

Complete meteorological observations were made at six hourly intervals and at all stations. A thermograph and barograph were operated continuously.

5. Echosoundings:

A deep sea echo sounder was in continuous operation throughout the trip.

6. Wave recordings:

An NIO Wave recorder was operated at pre-arranged intervals throughout the cruise.

7. Geology:

Rock samples were collected by Scuba divers at Marion Island.

Australia

The itineraries and programme of HMAS Diamantina during the cruises DM/2/63 and DM/3/63 are tabulated below:—

Cruise	DM/2/63	DM/3/63
Departed Fremantle	6.V. 63	9.VII. 63
Arrived Singapore	19.V. 63	26.VII. 63
Departed Singapore	23.V. 63	30.VII. 63
Arrived Fremantle	3.VI. 63	13.VIII.63
BT	34 Stations	32 Stations
Sub-surface hydrology	34 „	33 „
Primary Production	34 „	35 „
Pigments	34 „	35 „
Particulated Carbon	34 „	28 „
Zooplankton	34 „	31 „
Midwater trawl	14 „	15 „

Reference stations No. 1 (32°S, 111° 50'E) and No. 2 (9°S, 105°E) have been occupied by both cruises.

Extracts from Scientific papers and reports

Andhra, Mahadevan and Krishna submarine canyons and other features of the continental slope off the east coast of India.

During the course of cruise of the U.S. Research Vessel *Anton Bruun* the echo sounding profiles revealed the presence of six hitherto unknown canyons. The sea-floor topographic data, which led to the discovery of the six canyons consisted of four profiles of the bottom off the east coast of India obtained by echo-sounders.

The three largest canyons of the six revealed by the expedition were given identifying names as

- 1) Andhra Canyon
- 2) Mahadevan Canyon and
- 3) Krishna Canyon

The three smaller canyons have not been named and need additional surveying to delineate their characteristics.

The sea-floor topographic data recorded consisted of four profiles of the bottom off the east coast of India. The details regarding the profiles are also discussed in the paper.

The shape of the Canyon walls shows the typical V shaped profile found in canyons cut into continental slopes. Their narrow bottoms indicate that they are not being filled with sediment. It is not known whether they extend up to the break in slope or whether they cut across the shelf. The soundings on published navigation charts are so widely spaced that it is not possible to contour canyons with existing soundings. It is known from the work of R.F. Dill off Baja California and southern California that canyons are often a focal point of fish concentrations. The canyons of the east coast of India therefore deserve future investigation to determine if such is also the case in the Indian Ocean (E.C. LaFond—Journal of Indian Geophysical Union—Vol. I No. 1 January, 1964).

Oceanographic studies at the Tata Institute of Fundamental Research

The Geophysics Research Group of the Tata Institute of Fundamental Research is at present

carrying out an intensive research programme in the field of chemical oceanography. The studies are principally directed towards development of new methods for the study of three aspects of marine phenomena, (i) distribution of trace elements, (ii) rates of large scale mixing and movement of water and, (iii) the chronology and composition of deep sea sediments.

Tata Institute's interest in oceanographic studies started in 1955, when it was realizing that the cosmic ray produced radio-nuclide, Be^{10} , (half-life, 2.5×10^6 yrs.) could be used for determining accurately the chronology of deep sea sediments upto periods of Ca. 5×10^6 yrs. B.P. After the discovery of this isotope in a Pacific deep sea sediment, several measurements of this isotope were made in other sediment cores. Subsequently, another isotope, Si^{32} , (half-life, 500 yrs.) also of natural origin, produced continually on the earth by cosmic rays, was discovered as a result of investigations of Prof. D. Lal of Tata Institute of Fundamental Research and Prof. E.D. Goldberg of Scripps Institute of Oceanography. Several measurements of this isotope have now been made by the Geophysics Research Group in Ocean sediments, and surface waters of the Indian, Pacific and Atlantic oceans and other water bodies.

These studies have led to some important inferences regarding the rates of sedimentation prevailing in contrasting regions of very rapid and ultra-slow accumulation. The measurements of specific activity of Si^{32} in surface waters of major water bodies, made by counting the activity of Si^{32} in coastal siliceous sponges, have led to an evaluation of the mean time of overturn of the Atlantic and Pacific oceans, and general characteristics of mixing of water in the Arctic and Antarctic regions.

A programme to study the rates of influx of extra terrestrial dust in the past few million years is now underway. The approach is to measure the concentrations of the radio-nuclides, and to measure the concentrations of the Mn^{55} , Ni^{59} and Al^{26} which are produced in the dust by cosmic ray bombardment during its interplanetary travel. It is hoped that these investigations will, besides pro-

viding rates of influx of cosmic dust, also throw some light on the history of dust prior to its incidence on the earth.

A new technique for an *in situ* extraction of a host of trace elements from sea water has been developed. The basis of the technique is absorption of the elements on ferric hydroxide. A matrix of finely dispersed ferric hydroxide gel, using fibrous jute or spongin as the framework, is constructed through which water can flow freely; this matrix is towed through sea water permitting an *in situ* extraction of elements from large quantities of sea water.

Using this technique, four elements, Si, Al, Ti, and Be, which are present in concentrations ranging from Ca. 10^{-4} to 10^{-9} gms./litre of sea water, have been extracted from an equivalent of few hundreds of tons of coastal sea water at Bombay and Mandapam, India. The radioactivity of Be^7 and Si^{32} have also been measured in the beryllium and silicon extracts. The results show that each gm. of matrix can extract elements from about 10 litres of sea water.

The technique discriminates against the more abundant cations, e.g. Na, Mg, Ca, K and should prove valuable for the extraction from oceans and rivers of several trace elements, e.g. Sc, Cr, Zr, Cb, rare earths, Th and Pa, which can be absorbed on ferric hydroxide precipitate.

(D. Lal, 1963 unpublished.)

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Conference on distribution of specimens at Washington.

The full report on the Conference on "On distribution of specimens" held under the aegis of Smithsonian Institution, Washington, D.C. on December 5-6, 1963 have been received from Dr. R. Raghu Prasad one of the two participants from India.

The report is given below:

After a welcome speech from Dr. I.E. Wallen, Assistant Director of Oceanography, Museum of Natural History, there were discussions on: (1) the ownership of collections (2) responsibility

of ownership (3) selection of experts & screening of requests for specimens (4) publication of availability of specimens and (5) deposition of specimens. Then the following sub-committees were constituted with the Chairman indicated against each.

- | | |
|-------------------|-------------------|
| 1. Algae | Dr. H. Humm |
| 2. Fishes | Dr. D. Cohen |
| 3. Invertebrates | Dr. F. M. Bayer |
| 4. Plankton | Dr. A. Fleminger |
| 5. Administrators | Dr. H. Friedmann. |

The sub-committee I recommended to constitute a five men Advisory Committee to decide about the experts to handle the algae material. One set of material is to be deposited in the Smithsonian Institution if the expert happens to be other than a citizen of United States and also the type specimen later is to be returned to United States. It was stressed to give special attention to smaller forms of algae attached to larger algae.

The sub-committee II endorsed the views of sub-committee on algae regarding fishes.

Sub-Committee III drew attention towards avoiding the collection of material unless specifically asked for. It recommended that (1) the sorting centre should act as liaison between various expeditions, institutions and individual scientists (2) sorting centre should not undertake routine determination or identification but should encourage training in research and curatorial work and (3) that the specimens be deposited in any recognised institution in USA or in foreign Institutions who can make the material available to U.S. workers. This sub-committee was not in favour of standardization of techniques for collection of materials.

Sub-Committee IV recommended the following:

1. Fine mesh net for collection of phytoplankton and protozoans & coarse net for zooplanktons. Samples to be preserved in 5% saline formalin
2. Need for the estimation of biomass.
3. Taking photo micrograph of the plankton community.
4. Permanent mounts of phytoplankton to be returned along with the residual samples after study.

5. Sorting centre should undertake research on the types of sub-samplers and sub-sampling to be done when larger forms are sorted.
6. Only aliquots should be sent to experts. The whole sample can only be sent by permission of Advisory Committee.
7. Microplankton should be handled as invertebrates.
8. History of the sample should be maintained by the Centre.
9. Type specimens to be deposited in United States.
10. Planktonic group will study the fish eggs and larvae but any request for these should be referred to Fish Group. Similar will be the procedure for invertebrates.

The sub-committee V stressed the immediate distribution of material to experts for study to avoid the accumulation of material in the sorting centre. Its another recommendation was to have permanent establishments and staff to process data at as many places as possible and preferably near Universities to facilitate training in graduate work. For running such establishments, it was discussed to approach government for Federal subsidy.

In the general discussion it was emphasized by all, that the experts should be selected on the basis of scientific standing, without regard to nationality. It was agreed that sorting should be done according to families or groups and priority should be assigned according to requests received. Issuing of periodical newsletter from the Centre was suggested. Publication of Atlases was ruled out and instead publication of a series of geographical distribution charts was suggested.

* * *

Meetings of International Coordination and Data Exchange Working groups at Paris.

Meetings of the International Coordination Group for the IIOE and the working group for Data Exchange were held at the Office of the UNESCO, Paris, from 22-24 and 27-30 January, 1964 respectively. The meetings were attended

by Dr. N.K. Panikkar and Mr. R. Jayaraman from India. In these meetings, the main discussions centred round the progress of the expedition to-date, programme for the remaining part of the expedition, work of the Indian Ocean Biological Centre, International Meteorological Centre, and problems relating to Data processing and exchange, establishment of National Oceanographic Data Centre etc. The discussions also included analysis of data and arrangements for the publication of the results.

* * *

Studies on Energy transfer between Indian Ocean & atmosphere:

Five American scientists of the University of Washington are to conduct a month-long research in the Indian Ocean on the transfer of energy between the ocean and the atmosphere, it was officially learnt in Bombay on February 7.

The team of five scientists, headed by Dr. Franklin Badgley will sail aboard the research tug "Ocean" on a cruise, which will take them approximately 20 miles west. The project forms part of the U.S. Meteorology programme of the International Indian Ocean Expedition. The subject of the transfer of energy between ocean and atmosphere has hitherto not received much attention from meteorologists and oceanographers. A unique assembly of instruments, put together as a buoy which the scientists will use, is the 'Mentor' (Measurement of Energy Transfer in Oceanic Regions). The 'Mentor' is being employed for research in the Indian Ocean for the first time. The "Ocean" a tug chartered by the U.S. National Science Foundation from L. Smith International Towing Company, Rotterdam, is claimed to be eminently suited for the project. The 'Mentor' will be connected to the tug's compact laboratory by cables.

During the month-long cruise, the scientists would study the influence of the ocean on the atmosphere and vice-versa and the way in which energy is transferred between the two. It is known that the motions of the atmosphere such as winds,

rains and weather generally are largely caused by energy from the surface of the earth. The scientists plan to make 13 different kinds of observations using the fine instruments in the float. These will be conveyed through the cables to the oscilloscope in the ship's laboratory and will be recorded on magnetic tape, to be decoded at the Washington University and made available to meteorologists around the world.

Tentative plans for SIO's 1964 Indian Ocean Expedition (DODO):

R. V. ARGO of Scripps Institution of Oceanography will be joining in Indian Ocean Expedition from April 8, to December 23, 1964 in 10 legs as detailed below. DODO is designed to elucidate MONSOON and LUSIAD, which were in many respects, reconnaissance cruises. In addition to the work given below—the other investigations to be carried are: BT measurements, plankton hauls, and shipboard meteorological measurements.

- Leg. I: 8-28 April. San Diego to Honolulu. Scientific Leader A. Raff (for V. Vacquier). Magnetic surveys of seamounts, and possible gravity measurements.
- Leg. II: 30 April-8 May. Honolulu to Honolulu. Scientific Leader V. Vacquier. Five seamounts will be dredged, SW of the Hawaiian Islands, for magnetic and petrological investigations.
- Leg. III: 10-27 May. Honolulu to Kwajalein. Scientific Leader W. Riedel or deputy. A topographic survey to investigate the possible westward extension of the Molokai Fracture Zone, and an intensive piston coring programme.
- Leg. IV: 29 May to 12 June—Kwajalein to Darwin. Scientific Leader not yet decided.
Possibility gravity measurements. Opportunity for other underway work.
- Leg V: 15 June-13 July. Darwin to Mauritius. 16 July-31 July. Mauritius to Mombasa.

Scientific Leader W. Riedel.
Piston coring, bottom photography,
dredging.

Leg. VI: 4 August-7 September—Mombasa to
Mauritius. Scientific Leader H.
Stommel or W. Wooster. Hydro-
graphic Survey of the Somali Current.

Leg. VII: 10 September-9 October—Mauritius
to Djakarta or Penang.
12 Oct-29th Oct. Djakarta or Penang
to Colombo.

Scientific Leader—R. Von Herzen.
Heat flow & coring.

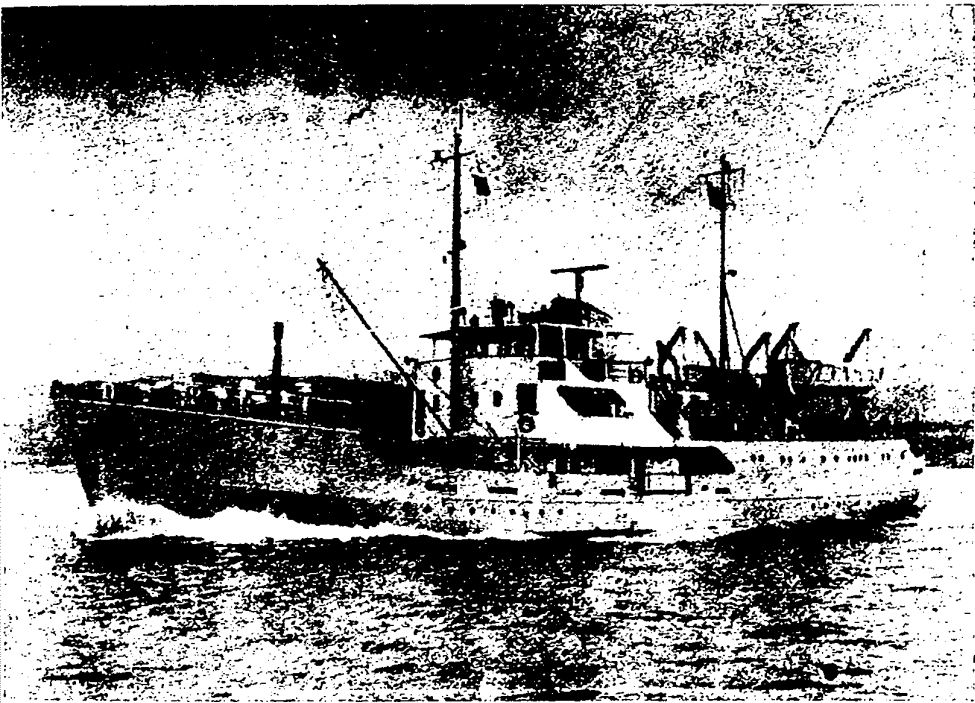
Leg. VIII: 2nd Nov. 20 Nov. 1964—Colombo to
Manila

Scientific Leader—J. Faughn.
Hydrographic & Bathymetric work,
south China Sea.

Leg. IX: 22 Nov. to 1 Dec. Manila to Gaun—
Scientific Leader C. Zobell.
Bacteriological investigations of trench
sediments

Leg. X: 3 Dec.-23 Dec. Gaun to San Diego
Scientific Leader not yet decided.
Opportunity for underway work.

W. Riedel is co-ordinating the cruises when he
is on campus. When Riedel is off Campus, R.P.
Von Herzen will act as Co-ordinator.



'Anusandhani'

New German Vessel

The New West German Research Vessel "Meteor II" fitted with modern equipment for oceanographic purposes will join IIOE during the ensuing winter. The work will be concentrated mainly in the Arabian Sea.

Built at a cost of 1.5 crores D.M., the Ship's overall length is 82 meters, beam 13.5 meters and a gross tonnage of 2500 tons. The area of the main deck is 108 Sq. meters. This floating Research Laboratory is staffed with 79 persons in all consisting of crew, technician and scientists.

The Meteor II is equipped with a scientific library, a photographic laboratory, instrumentation room, automatic measuring devices, television camera and a suitable temperature control and other apparatus to carry out geophysical, bacteriological, meteorological work etc. She is also provided with a space for landing Helicopters and so constructed that any scientific work can be carried out unhampered—even in rough weather conditions.

New Hydrographic Vessel for Hooghly Estuary.

The 650 ton Research Vessel "Anusandhani" has been built at a cost of Rs. 56 lakhs for the Hydraulic Study Department, Calcutta Port Commissioners to undertake comprehensive study and collection of data of the Hooghly and the estuary of Hooghly. The vessel has an overall length of 171 ft, beam 32 ft. 6 in. and working draft 11 ft. 6 in.

The vessel is fully equipped for carrying out hydrographic survey throughout the year, measuring current velocities, rates of transport of sediment, wind, wave actions and also for taking samples from the bottom of the sea-bed. Its laboratory is suited well for carrying out chemical analysis of water, analysis of suspended and bed materials and geological studies or river bed materials. She is fitted with twin Mirreles National Diesel engines which give a speed of

11½ knots. For slower work, an auxiliary engine has been installed which enables her to operate economically for long periods at speeds below 5 knots. To obtain a satisfactory control over the full range of speed she has been fitted with a special kort Rudder round her single propeller and this has proved to be very effective. The ship can accommodate seven scientists besides, 56 officers and crew.

Miscellaneous

A seminar on Salt & by-products was held at the Central Salt & Marine Chemical Research Institute, Bhavanagar on 10 & 11 March 1964 in connection with the decenary celebrations of the Institute. A number of organizations from different parts of the country including Indian Ocean Expedition participated in the Seminar and contributed scientific and technical papers.

The Tenth meeting of the Indian National Committee on Oceanic Research will be held on 3rd April 1964 at New Delhi to discuss the progress in Indian Programme of the International Indian Ocean Expedition. The agenda items will include the 1964-65 cruising programmes, the proposed National Institute of Oceanography, the coordination of the IIOE programmes of different countries and problems relating to Data Exchange.

Mention was made in Newsletter No. 3 about the publication of a booklet entitled "A Key to the identification of more common planktonic Copepoda of the Indian Coastal Waters" by L. R. Kasturirangan. The publication is priced at Rs. 7.00 or \$ 2.00 or 14 sh. per copy. Arrangements are being made for the sales and distribution of this publication through the Publications and Information Directorate, Hillside Road, New Delhi-12. Another publication entitled "Bibliography of Plankton of the Indian Ocean"

by Dr. R. Raghu Prasad is in press and is expected to be issued shortly.

♦ ♦ ♦

Visitors

Dr. K. N. Fedorov, Director, Office of Oceanography UNESCO, Paris and Secretary, Intergovernmental Oceanographic Commission visited Indian Ocean Biological Centre, Ernakulam, International Meteorological Centre, Bombay and the Office of the Indian Ocean Expedition, New Delhi. He also held discussions with Dr. D.N. Wadia, Chairman, Indian National Committee on Oceanic Research and Dr. N.K. Panikkar, Director, Indian Programme of IIOE at New Delhi.

♦ ♦ ♦

Mr. R.S. Glover of Oceanographic Laboratory, Edinburgh and Dr. Vinogradov of the Institute of Oceanology, Moscow, USSR, both members of the Consultative Committee for the Indian Ocean Biological Centre were at Ernakulam from 18 to 28 March 1964 attending the Consultative Committee meeting. Later they visited New Delhi to continue the discussions with Dr. D.N. Wadia, Chairman, INCOR and Dr. N.K. Panikkar.

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The procedure for sub-sampling of Plankton at IOBC is being explained by the Curator to Dr. Fedorov.

Dr. S.H. Zaheer, Director-General of Council of Scientific & Industrial Research visited the Indian Ocean Biological Centre and Indian Ocean Physical Oceanography Centre at Ernakulam on Jan. 1, 1964. He was accompanied by Dr. N.K. Panikkar who took him round the laboratories and explained the work in progress.



Dr. Hansen showing plankton samples to Dr. Zaheer at IOBC.

Publications Received

1. CSIR News—Vol. 13 No. 23
Vol. 14 No. 1 & 2
2. ISI Bulletin—Vol. 15 No. 6 Nov.—Dec. 1963
3. Annual Report of the Department of Fisheries, Bombay 1961-62
4. Reprint on—Noise Production by Marine Life by V. Narayana Pillai. Published in Defence Science Journal Vol. 13 No. 2—April 1963
5. Information Bulletin on Planktology in Japan, No. 8—Sept., 1962; No. 9—April 1963; No. 10—Sept., 1963
6. IIOE—Intergovernmental Oceanographic Commission Information Paper No. 4—Sept. 1963; No. 5—Jan. 1964
7. International Marine Science Vol. II No. 1—January 1964

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| 8. NODC Newsletter, Washington USA, No. 12—December 1963 | No. 3—Feb. 1964 |
| 9. World Data Centre—A—Oceanography—Catalogue of Data 1-7-57 to 31-12-63 | 13. IIOE—Newsletter of Japan No. 4—Dec. 1963 |
| 10. Oceanographic Cruise Report Nos. 8 and 9 (HMAS Gascoyne & Diamantina) | 14. Science Reporter Vol. 1, No. 1—Jan. 1964; No. 2—Feb. 1964 |
| 11. Information Newsletter of Industrial Liaison & Extension Services (CSIR)—Vol. 2 No. 4 Oct.-Nov. 1963 | 15. UNESCO (New Delhi) Bulletin No. 15—Sept. 1963 |
| 12. IIOE—News Bulletin of WHOI, Washington, | 16. Indian Journal of Experimental Biology (CSIR) Vol. 2, No. 1—Jan. 1964 |
| | 17. Indian Journal of Pure & Applied Physics (CSIR) Vol. 2, No. 1 & 2—Jan. 1964 |

FORM IV

(As required under Rule 8)

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I, N. K. Panikkar, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date 27/2/64.

Sd. N. K. PANIKKAR.
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