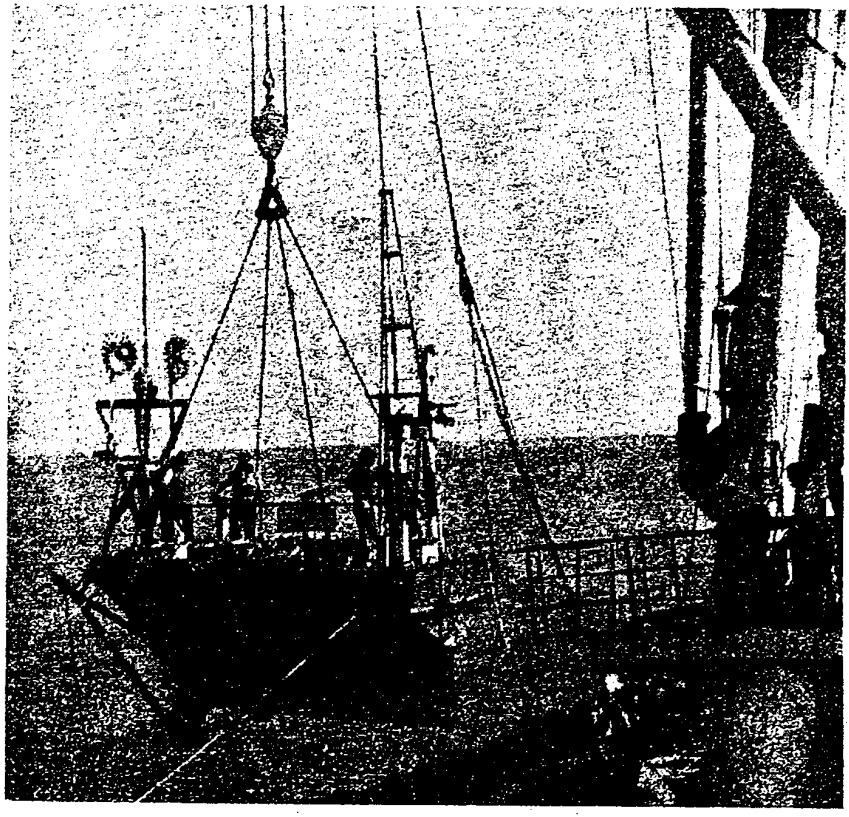
INTERNATIONAL INDIAN OCEAN EXPEDITION

NEWSLETTER

INDIA

Vol. II No. 2

September, 1964



'NOMAD' being lowered in the Bay of Bengal

Issued by

THE INDIAN NATIONAL COMMITTEE ON OCEANIC RESEARCH
COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH
NEW DELHI

THE NOMAD IN THE BAY OF BENGAL

(COVER PHOTO)

The NOMAD (Navy Oceanographic Meteorological Automatic Device) made available by the United States Government was anchored in South Bay of Bengal at Lat. 12.37°N, Long. 86.3°E on 24.4.64 by Lighthouse Tender M.V. SAGARDEEP belonging to the Department of Lighthouses and Lightships, Government of India. The sea is about 12000′ deep at the anchoring point. The photograph shows its launching under the supervision of Indian and U.S. Experts.

Regd. No. 7427/63

IN THIS ISSUE

1.	Nehru and Ocean Research	20
2.	Indian Programme : Scientific Cruises of *INS Kistna*	21
3.	Indian Ocean Biological Centre, Ernakulam	23
4.	International Meteorological Centre, Bombay	24
5.	Reports from other countries	24-28
6.	Extracts from Scientific papers	28-29
7.	Notes and News	29-33
8.	Third IOC Session in Paris	33-44
9.	Second meeting of the IOBC consultative committee	44-45
10.	INCOR Geological working group meeting	46
11.	Visitors	46
12.	Forthcoming meetings/Publications received	47

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NEWSLETTER

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Vol. II No. 2 SEPTEMBER, 1964

NEHRU AND OCEAN RESEARCH

(We reproduce below a letter written by Prof. Roger Revelle, Director, Scripps Institution of Oceanography, California to Dr. Hussain Zaheer, Director General of C.S.I.R. for the special number of "Science Reporter".)

July 29, 1964

Dear Professor Zaheer,

I have only today seen your letter of June 5, 1964 which somehow got delayed in our mail system. Because of this delay, I am afraid that what I write will be too late for your special issues. But because of my respect and admiration for your great leader, I want to say something about him.

I met Mr. Nehru only once, after the Pugwash meeting in Udaipur last January. He was at that time already ill yet his love of science and his joy in talking to scientists still persisted. He said very little himself, but listened quietly and with deep interest to our story of the meeting and its recommendations, particularly those dealing with the role of science in economic development.

My principal contact with Mr. Nehru was an indirect one stemming from my position as President of the Scientific Committee on Oceanic Research of the International Council of Scientific Unions. The major project of this Committee was, and still is, the International Indian Ocean Expedition, in which ships and scientists from some twenty countries are now carrying out a grand reconnaissance of the waters, the sea floor, and the biology of the Indian Ocean. Until a few years ago this was the least known of all the world's seas. By the end of the Expedition in 1965, the scientific groundwork will have been laid for attacking the problems of development of potential fisheries and mineral resources, for improvements in weather forecasting, and other theoretical and practical applications of the marine sciences.

Mr. Nehru played a great role in helping to launch this Expedition and, to ensure its success, Robert Snider, the Co-ordinator appointed by our Committee, met him on several occasions and received his wholehearted support. As a result, the Indian Ocean Meteorological Centre was established near Bombay, and the Indian Ocean Biological Centre was established near Cochin. The Meteorological Centre is providing a new level of insight into the interactions between the sea and the air, and the weather regimes over the entire Indian Ocean area. All the thousands of systematically collected plankton samples from the Expedition are being sorted and identified at the Biological Centre, in co-operation with leading specialists throughout the world.

Many other persons helped with both these enterprises, including, of course, your own Dr.

Panikkar, and they received support from the United Nations Special Fund and from UNESCO, but the inspiration and leadership came from Pandit Nehru. His imagination was captured not only by the broad scope and sweep of the plans for the Expedition, but also by the opportunities it gave for peaceful co-operation among scientists of many different countries. At the same time, he foresaw the importance for India itself of gaining greater scientific understanding of the ocean waters, the fishes, and the useful invertebrates off the coasts of your country. In this, as in all other scientific fields, he was eager to push ahead into the unknown.

In many ways, Mr. Nehru was the greatest man of our age. His name and fame will resound throughout the earth in ages to come. His love of science was only one facet of his complex, many-sided, and mysterious personality, yet his depth of understanding of science was perhaps unique among world leaders. All the scientists with whom he so generously shared his time came away starry-eyed. In his attitude toward science, Nehru was both intensely rational and sublimely mystical, concerned both with its elegance and beauty, and with its down to earth practical applications. His loss brought great sorrow to scientists and scholars throughout the world. We may never see his like again.

Sincerely,
ROGER REVELLE.

By Courtesy: Special number "Science Reporter" Council of Scientific & Industrial Research, New Delhi.

INDIAN PROGRAMME

Scientific Cruises of INS Kistna

The 1964 monsoon cruises of *INS Kistna* commenced in the month of June from Madras and since then four cruises (XV, XVI, XVII and XVIII) were completed in the Bay of Bengal covering up to 91° long. The investigations in cruises XV to XVII were mainly related to physico-chemical and biological oceanography. Cruise XVIII was exclusively meant for geological work on the continental shelf although some geological collections were made in other cruises also. The meteorological group carried out surface observations and upper air studies in all the cruises except the last one. Radiosonde ascents were made on all days during cruises XV, XVI and XVII but owing to the prevalent squally weather some of the ascents were not successful.

Physico-Chemical Observations: Nansen casts and BT lowerings were made in all the stations occupied during the cruises.

Chemical work on board mainly consisted of estimation of oxygen and salinity, the latter with Inductive Salinometer. Water samples for nutrient analysis were preserved in deep freeze on board the ship for subsequent analysis ashore.

A high salinity water with its core lying at 400 meters depth has been noticed during XV cruise in the southern Bay of Bengal. This may be due to the movements and sinking of water masses which are yet to be identified. During XVIII cruise observations were made to study the influx of fresh water from rivers, Krishna and Godavari and a northward drift of this water has been traced. It was also observed during cruise XV that offshore waters were fairly isothermal upto about 50 meters below which a sharp thermocline was noticed. The rather low temperature values nearshore indicate the possibility of upwelling in this region.

Biological: Vertical plankton hauls were regularly taken with Indian Ocean Standard Net (IOSN) and surface tows were made with other nets. During XV cruise, 22 vertical hauls were taken with IOSN from 200 metres to Surface. The samples were preserved and deposited at the Indian Ocean Biological Centre, Ernakulam for sorting.

Geological: The bottom topography was obtained continuously by means of an Edo-echosounder and sediments collected by means of snapper and gravity corer. Submarine canyons were discovered in the continental slope off Pondicherry between

Scientists on board INS Kistna getting the corer ready for lowering

11° 47'N, 80° 5'E and 11° 30'N, 79° 58'E. Two sections were made across the *Swatch of No-ground* (Ganges Canyon) during XVII cruise and good profiles were obtained. Several core samples were also taken from the edges of Ganges Submarine canyon.

A series of submarine valleys have been located on the continental slope between the confluences of Krishna and Godavari rivers during the XVIII Cruise. The detailed report on the findings is under preparation. In all, 113 core samples have been collected from 68 stations occupied during this cruise.

The period of each cruise, the track, total number of stations occupied and the number of scientists under various disciplines who participated in these cruises are given in the following tables.

TABLE I

Cruise No.	Period		Track	Cruise Leader	Total No. of Stations occupied
	From	To			
XV	8.6.64	20.6.64	Madras/Madras	Dr. V. V. R. Varadachari	37
XVI	23.6.64	4.7.64	Madras/Visakhapatnam	—do—	34
XVII	13.7.64	21.7.64	Visakhapatnam/Visakhapatnam	Shri R. Jayaraman	27
XVIII	2.8.64	9.8.64	Visakhapatnam/Madras	Dr. M. Subba Rao	68

TABLE II

Cruise Nos.	XV	XVI	XVII	XVIII
Physical Oceanographers	4	5	6	3
Geologists	1	2	2	9
Chemists	3	2	4	1
Biologists	2	2	2	—
Meteorologists	3	2	2	—
Total	13	13	16	13

INDIAN OCEAN BIOLOGICAL CENTRE (IOBC) ERNAKULAM

Progress report on the sorting of samples and related studies at the Centre has been received from the Curator. A total number of 139 samples have been received during the quarter ending 31st July, from different ships, as shown in the table III. 28 samples from the "*Anton Bruun*" Cruise No. 1 have been sorted. So far 103 samples received from Australia for contract sorting have been processed by six temporary contract sorters.

TABLE III

S. No.	Date	Name of the Ship	Cruise No.	Total No. of samples received	Station Nos.
1.	1.5.64	*Anton Bruun* (U. S.)	5	45	282-345
2.	9.5.64	*Discovery* (UK)	—	34	5006 and 4124-5371
3.	26.5.64	*Oshoro Maru* (Japan)	4	13	OS 1-13
4.	29.5.64	*Pioneer* (U. S.)	OPR-442 Leg V	19	2-23
5.	1.6.64	*Umitaka Maru* (Japan)	24	28	UM 5301-6328

During the quarter April-June, 20 stations have been operated for productivity studies; of these 18 were in the backwaters and the rest off Cochin.

The Curator, Dr. Vagn K. Hansen, attended the SCOR/UNESCO Working Group Meeting on Pigments (June 4-6) and the Third Session of the IOC at Paris (June 16-18). A report on the progress of sorting of plankton samples received from the participating ships was placed before the meeting. A map showing the coverage of IOSN samples by ships participating in the IIOE was also presented along with the report.

INTERNATIONAL METEOROLOGICAL CENTRE, BOMBAY

The International Meteorological Centre participating in the meteorology programme of the International Indian Ocean Expedition reached its peak of operation during the quarter ending June 30, 1964. The successful anchoring operations of the NOMAD was carried out under the supervision of Mr. Choudhury of the Light House Department, Mr. C. Ramaswamy, Deputy Director-General of Observatories, and Mr. R. A. Smith U. S. Electronics expert. The equipment is regularly transmitting meteorological observations six times daily from a location less frequented by merchant ships, but susceptible to cyclonic storm formation and from where there are no other means of obtaining weather information.

All computer programmes, data processing and research, have been checked and a new programme has been written for checking daily surface data of island stations in the Indian Ocean area. Surface ships, Rawin and Radiosonde observations are being checked, processed and printed out. Some special research programmes have been worked out to assist investigations at I. M. C. Card punching of data has been steadily in progress, over 3,00,000 cards have been punched.

Large volumes of manuscript data have been received at the Centre, and the plotting of the data on master charts has been intensified by two units of staff of India Meteorological Department and the U. S. Group.

The Second prepublished report of the International Meteorological Centre "Analysis of Monthly Mean Resultant Winds for Standard Pressure surfaces over the Indian Ocean and adjoining continental areas" by C. R. V. Raman and C. M. Dixit has been brought out and distributed to the Meteorological services who contributed the data. Salient features of large scale circulation over the Indian Ocean and its vicinity have been described in the report. Mean monthly resultant wind data for all available stations between 20°E and 155°E and 40°N and 50°S, analysed by stream lines for the levels 5,000 ft., 10,000 ft. and 30,000 ft. and 40,000 ft. are presented in the report.

A detailed study of the Arabian Sea Monsoon using intensive research aircraft data was completed by E. R. Miller and R. N. Krishnamoorthy. This study examines the applicability of mid-tropospheric (10,000-20,000 ft.) cyclone model to the Indian Summer Monsoon. A work pertaining to the evaporation loss from the Indian Ocean Surface for the month of January and June computed from mean and actual (1963) ships observations, was processed by the electronic computer at IMC and a comparison was made with the mean wind distribution over the Indian Ocean. Investigation on the possibility of circulation changes in upper levels following the precipitation in the lower levels was conducted and a paper entitled "Some aspects of the interaction between lower and upper tropical troposphères" by C. R. V. Raman and Y. Ramanathan has been completed. Besides, four papers were presented at the Technical Sessions of the Aeronautical Society of India.

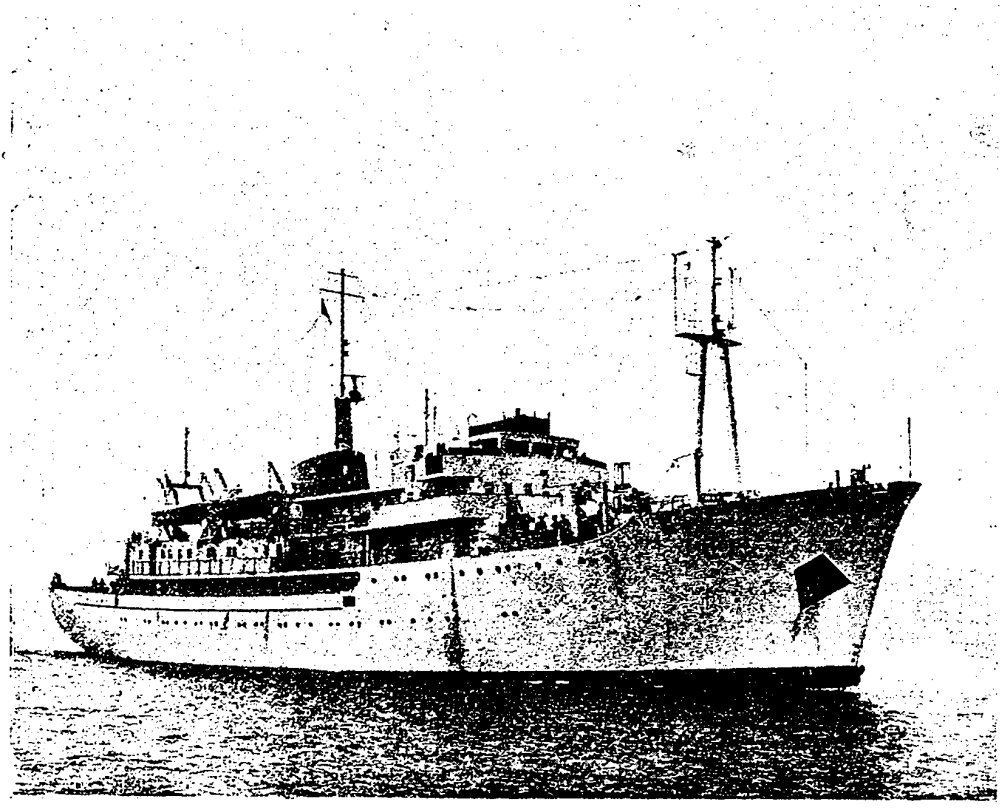
REPORTS FROM OTHER COUNTRIES: UNITED KINGDOM

Second Cruise of R R S Discovery

A short note on the preliminary findings of Royal Research Ship *Discovery* was published in IIOE Newsletter No. 3. A comprehensive report on the Second Cruise mainly concerned with the geological and geophysical work of the ship has been received from the Royal Society, London. Of the eighteen scientists on board thirteen were concerned with geology and geophysics and the rest of them were engaged in ocean chemistry, temperature measurements and ornithology.

The Cruise was undertaken between late August and early December, 1963, in four legs and the summary of different measurements carried out during the cruise is given in the following table.

Seismic Operations : The main objective of the Seismic investigation was the determination of the crustal structure beneath the gently sloping ocean floor between Lamu and Seychelles. The method



Royal Research Ship DISCOVERY of United Kingdom which Called at Cochin Port (8-12 May 1964) during her Cruise in Indian Ocean.

of operation conducted with the assistance of *H. M. S. Owen* has been referred earlier in Newsletter No. 3. Five attempts were made to obtain Seismic refraction profiles of the Sub-bottom, four on the Lamu—Seychelles line and one in the area 4D. In spite of the use of high signal-to-noise ratio technique the obvious sub-bottom refractions were not come across in any of the stations. It was concluded that the soundings were in areas without high contrast layer in shallow depths.

Eleven bottom seismic stations were occupied during the Second leg of the Cruise. The preliminary analysis of the Seismic exploration in one of the stations shows two distinct bottom layers of thickness 0.55 and 1.42 km. respectively.

Rock Dredge and Under-water Photography: Dredging at certain places during the first leg revealed volcanic rock having think film of manganese. Cobbles of altered lavas and manganese nodules were collected on the upper part of the eastern slope of Carlsberg ridge. Certain hitherto unknown metamorphic rock specimens have been

reported in this cruise.

Many of the photographs taken during the first leg showed sand ripples and scours. Good photographs of the accumulation of manganese nodules were obtained from where the dredging brought samples of them. Fauna included several sea pens, sea lilies, sea urchins, a crinoid, some gorgonians and about four different species of fish. Fifty remarkable photographs were obtained on the side of the Fred Mount. The long range photographs on the Fred Mount showed a few rock outcrops heavily coated with sediment, a dyke-like ridge and large areas of well developed ripple marks. All six stations made on Lamu-Seychelles line showed only mud disturbed by benthos. Another station in the area 4D showed rocky out crops and large boulders of abyssal hill.

Coring and Heat Flow : 32 stations were occupied during the cruise and almost all were successful. Cores from the central part of the Carlsberg ridge on the S. W. flanks showed the areas to be localised ponding of sediments. Between Mombasa and Seychelles, cores consisted of highly foraminiferal blue-grey terrigenous mud. Cores from area 4D, South of Seychelles bank consisted of highly calcareous pink foraminiferal clays interbedded with large proportion of graded turbidity deposits of

TABLE—I

Summary of cruise 2 of RRS DISCOVERY (23rd August to 4th December '63.)

Leg No.	1	2	3	4
Track	Aden to Mombasa	Mombasa to Mombasa	Mombasa to Aden	Aden to Plymouth
Duration of each leg.	23.8.63 to 12.9.63	14.9.63 to 23.10.63	26.9.63 to 14.11.63	16.11.63 to 4.12.63
	No. of Stations occupied			
Bottom seismics	—	11	2	—
Seismic reflection	—	5	—	—
Single ship refraction seismics	—	11	1	—
Two ship refraction seismics	—	4	3	—
Rock dredge	17	3	4	—
Under water camera	8	9	4	1
Core and Heat flow	7	12	7	6
Grab	—	1	5	—
Water bottles	2	9	1	1
Surface current	—	2	5	—
Indian Ocean Standard Net	—	2	—	—
Shore collection	—	1	—	1
Bathythermograph	110 observations were made till 9th October.			

mainly organic calcareous composition. Somali basin, South of socotra contained sandy layers, evidently the product of turbidity current deposition.

Heat flow values obtained around Seychelles appear to be lower than those near Kenya Coast, Seven heat flow stations were occupied between Mombasa and Seychelles. The values confirmed the previous work undertaken by British and American Scientists.

Chemical Work : Routine determinations like Salinity, Oxygen concentration, Nitrite, Nitrate and albuminous nitrogen concentrations were carried out throughout the cruise. Samples treated by a method of co-crystallisation were retained to be analysed at Liverpool for trace elements like copper, lead, cobalt, nickel, manganese, zinc, etc. During the first leg (Aden-Mombasa) northern most station was found to be richer in nutrients in the upper layers than the southerly stations which were completely devoid of available nitrogen above the thermocline.

The analysis of the samples collected during the second leg showed ammonia content to be of the order of 1μ/litre, concentration of both ammonia and albuminoid nitrogen to be erratic down the water column. A well-defined thermocline was also noticed causing complete depletion of nitrate in the Surface layers while below the discontinuity it increased rapidly to $>30\mu$g./litre at 1000 m.

Plankton Hauls : The volume of plankton was generally low except for the hauls taken in the vicinity of *Ile des Noeufs*. There seems to be no significance in volume at any Seismic line although the ones close to the African coast may have been slightly richer. Hauls in the open ocean have almost always been of the same type containing a few numbers of blue copepod and smaller numbers of blue decapod. Few fish have been caught because all the hauls have been taken in day-light.

Ornithological : Certain interesting ornithological observations were carried out during this cruise. Unexpectedly land birds were also seen in the Central Arabian Sea: a whimbrel, a swallow, and a curlew sandpiper whose destination was not known. Interesting species like red footed boobies, and oceanodroma, probably a species of sooty storm petrel were observed during the second leg. Small numbers of sooty terns, frigate birds red-footed boobies and one sooty storm petrel were also seen. A shore party landed on Bird island noticed that sooty terns were the only sea birds breeding in any number. Observation during the cruise is likely to throw a new light on the migratory habits of certain species of birds.

AUSTRALIA

Summary reports of HMAS *Diamantina's* Cruises, Dm 4/63, Dm 5/63, Dm 6/63 and Dm 1/64 have been received from C. S. I. R. O. Division of Fisheries and Oceanography. R. G. Chittleborough was the Scientific Leader for all the said cruises except Dm 5/63 which was led by D. Rochford. Number of stations covered during each cruise with various observations are given here in tabular form.

Cruise 3/64 of *Diamantina* has been planned between 4-5-64 and 15-6-64 (a) to study the development of upwelling south of Java (hydrology, primary production pigments and zooplankton) (b) to measure the non-particulate organic matter formed during photosynthesis, (c) to measure the productivity in rich dilute tropical waters with a high silt load using scintillation counting and to investigate long and short wave radiation. On her track from Fremantle to Bangkok the ship will cover SCOR/UNESCO reference station 1, upwelling region South of Java and SCOR/UNESCO reference station 2; departing Bangkok on May 26 she would arrive back at Fremantle via Singapore by the same track on June 15, 1964.

34 stations are expected to be worked out during this cruise lasting for 42 days and a total steaming of 6540 miles. The following scientists will be on board.

1. H. Jitts (Cruise Leader)

Station Summary (HMAS *Diamantina*)

Cruise	Dm4/63	Dm5/63	Dm6/63	Dm1/64
Bathy thermograph	—	14	—	—
Sub-Surface hydrology	3	33	13	47
Primary production	—	26	—	—
Pigments	—	26	—	—
Particulate carbon	—	12	—	—
Particulate phosphorous	—	1	—	—
Zooplankton	—	11	—	—
Sediment sampling	16	—	44	31
Bottom photography	2	—	7	8
Bottom dredging	3	—	8	—
Bottom trawling	2	—	9	—
Mid-water trawling	3	—	6	—
Depth charging	6	—	—	—

2. J. Klyre
3. C. Middleton
4. B. Scott
5. J. Stevenson (CSIRO Division of Meteorological Physics)
6. D. V. Subba Rao (From India, CSIRO Fellow)
7. Thai Scientist (Singapore-Bangkok-Singapore)

HMAS Gascoyne: Report on the completed cruise G 3/64 (Adelaide-Sydney) has been received. 45 stations have been worked out during the cruise undertaken between 5-3-1964 and 25-3-1964 under the leadership of B. Hamon.

GERMANY

Cruise plan of R/V METEOR

It has been reported earlier in Newsletter No. 4 that the newly—built German Research Vessel *Meteor* would be joining Indian Ocean Expedition during winter 1964. According to the detailed cruise plan available now, the vessel is expected to commence her maiden scientific cruise from Hamburg on 1-10-1964 and will arrive at Cochin on 13-1-1965.* About 53 scientists belonging to 13 different institutions would be participating in this cruise to conduct studies under various disciplines of oceanography : Physical, Chemical, Biological Oceanography, Meteorology, Geology and Geophysics. Emphasis has been given for geological studies of the west coast of India and the vessel is planning to occupy 22 geological stations between Cochin and Bombay during 16-1-65 to 25-1-65.

During this 22980 mile cruise lasting for about 195 days the vessel will occupy 167 stations in all. *Meteor* is scheduled to return to Kiel by the middle of March, 1965.

EXTRACTS FROM SCIENTIFIC PAPERS

Radioactivity and its relation to oceanic food chains

The Oceans receive a substantial share of the fall-out resulting from nuclear tests and drainage from continents. Certain of the fission products are accumulated by filter feeding zooplankton. Recently, investigation conducted off the Oregon coast to study the fall-out of neutron-induced radionuclides in oceanic food chains has brought interesting results.

*The latest information regarding the ship is that she is expected to touch Cochin in early February 1965.

The gamma ray spectra of marine organisms from different trophic levels have been compared to determine which radionuclides are passed through food chains and which are discriminated against. In this study the assignment of an organism to a particular trophic level is in most cases based on studies of stomach contents supplemented with references of earlier studies.

Comparisons of spectra of organisms from different trophic levels determined from stomach contents and literature show that Zr^{85}, Nb^{95} and Ce^{141} were concentrated by primary producers especially by herbivores, and not by carnivores. Cr^{51} was abundant only in filtered samples (primary producers). Mn^{54}, Co^{60} and Cs^{137} were found in only herbivores. Zn^{65} was found in every marine organism examined. It was concluded by the investigators that the abundance of Zr^{85}, Nb^{95} and Ce^{141} in particular may be useful in marine trophic level studies. Peaks due to these fission products are greatly reduced in spectra of predaceous animals as compared with spectra of herbivores. (Charls Osterberg, W. G. Pearcy, and Herbert Curl, Jr., Journal of Marine Research, Vol. 22, No. 1 Jan. 1964)

On the Vergence field in the North Indian Ocean

The divergence and convergence in the Sea are processes of vital importance to the physical oceanographer as well as marine biologist. They are closely related to the vertical movements of water known as upwelling and sinking (Sverdrup 1942). Studies on the convergence and divergence in the Indian Ocean are quite meagre.

The results of investigation on the diveregence and convergence of the surface waters in the North Indian Ocean for different months of the year are summarised here. The divergence is computed by a graphical method from the data on the surface currents and the pattern shows considerable seasonal and space variations. Several centres of strong divergence and convergence occur in the open ocean region in the equatorial parts of the Indian ocean throughout the year. But strong divergence and convergence also occur in the month of March. Similarly, on the Somali Coast strong divergence with central values exceeding 40 units ($1 \text{ unit} = 2 \times 10^{-7} \text{ Sec}^{-1}$) often occur.

The investigation shows that the monsoon months (June, July and August) are the months of intense divergence of surface currents in the North Indian Ocean. During this period the central values of some of the divergences and convergences exceed 60 units. The intense divergence during the monsoon months may be ascribed to the strong monsoon winds over the area. The divergence field indicates that along the east coast of India, upwelling may be prevalent during the period January to August while sinking may be prevalent during the remaining period of the year. This is in agreement with the earlier findings by the authors and others on upwelling on the East Coast of India as deduced from temperature structure etc. Along the West Coast of India the divergence is prevalent from January to May or June. Along the Somali Coast divergence is prevalent from March to August indicating upwelling.

Study of vergence field in relation to the troughs and ridges in the pressure field over the North Indian Ocean in different months shows that in general divergence occurs in the region of troughs and convergence in the region of ridges (V. V. R. Varadachari & G. S. Sharma—Bulletin of the National Geophysical Research Institute, Vol. 2 No. 1 March, 1964)

NOTES AND NEWS

Bottom Profiles of the Arabian sea Obtained from Echograms of R. V. VARUNA.

The echograms obtained by R. V. *Varuna* during her cruises along the West Coast of India between 7° and 17°N latitude are under detailed study at the Indian Ocean Physical Oceanography Centre. They are mostly records of white line echosounder and the ASDIC, during the September, October and November, 1963 cruises.

All the records were analysed after obtaining the connected information of the instruments used and the notes from the log book of *Varuna*. Two interesting features of the sea bed were recorded in the vicinity of Laccadives Minicoy ridge. One is a "Saucer shaped" rise near the Kalpeni and Kiltan islands. This may be a separate sea mount or an extension of the ridge itself. None of the earlier survey records indicate the exact location of this features with raised edges and depressions in the Central portion resembling Coral reef. The other feature is an isolated new sea-mount with rough bottom which has given crescent-shaped reflections from tne the sea near the Investigator bank. These two were traced and preserved as the original records are likely to fade. (V. S. Rama Raju, IOPOC. Ernakulam.)

M. S. DHANARAJATHA—Thailand's new Research Vessel

The Government of Thailand has received a newly built Fisheries Research Vessel named *DHANARAJATHA* from Japan as part of War reparation. The construction of this 45.50 metre vessel was completed by Niigata Engineering Co. Ltd., Tokyo, Japan in May, 1964. The vessel is fitted with most modernized oceanographic research equipment besides its riggings for stern trawling which is gaining attention all over the world. The basic specification of this vessel includes a moulded breadth of 8.70 metres, moulded depth of 4.20 metres, gross tonnage of 388.81 and the fish hold capacity 59 m^3.

The main engine, "a Niigata diesel" of 1000 BHP gives a service speed of 12.2 knots. *Dhanarajatha* has a unique position among the Fisheries Research Vessels of S. E. Asian region considering its size and equipment.

The vessel is expected to be commissioned for work in Indian Ocean from November this year, with programme for extensive tuna investigation in Andaman Sea (Source: Shri K. Gopinatha Pillai, Director of Fisheries, Kerala).

Tide Gauges and Radio Sonde Station in Malaysia

The Malaysian National Special Committee on Oceanographic Research has establishd three new tide gauges and a fourth is being set up. Preliminary work has been done on the establishment of Radio-sonde station at Singapore which is expected to commence operation this year. Photographs of radar-scopes which are to be taken four times a day at Kuala-Lumpur and Singapore will be sent to Dr. Ramage at the International Meteorological Centre Bombay. (International Marine Science Vol. II No. 2 April 1964)

Submarine Plateau Mapped in South Pacific

The American Research vessel *Argo* has recently mapped a submarine plateau about the size of Tarmania, in South Pacific, nearly 500 miles east of Samoa. According to Prof. H. W. Menard of Scripps Institution who was scientific leader on board when this submarine feature was studied, this plateau which is quite level now was once an island which got sheared off by waves in geologic ages.

The top of this "Guyot" is 1300 fathoms beneath the sea surface and its base lies 1300 fathoms deeper. This is the first time the dimensions of this plateau have been studied even though the fairly shallow nature of this area has been known since long. Most of the 'Guyots' especially in Pacific seem to be of Volcanic nature, but Prof. Menard said that it was hard for him to conceive a single volcano of the size of the plateau mapped. (Science Horizons, No. 47, June 1964)

Offshore Oil Survey with Soviet Aid

Scientists hold the view that oil reserves may be found in the Gulf of Kutch, Cambay, Bay of Bengal, and other parts in India. To verify the correctness of this, an offshore seismic survey was carried out earlier in the Gulf of Cambay around the Alibet Island. Now extensive seismic and

drilling operations have begun with the aid of Soviet Union along Coromandal coast. For this the Soviet Seismic ship "*Akademic Arkhangelsky*" equipped with special instruments arrived in India early in August 1964, and started deep drilling operations off Karaikkal in Madras. Along the Coromandal coast the survey is expected to continue for 3 months.

UNESCO Training Course in Advanced Marine Biology

An advanced marine biological training course was organised by UNESCO at Copenhagen, during April-May, 1964. Professors of the Copenhagen University and senior scientists of Danish marine science institutions were the instructors. The course was for a period of two months and comprised of lectures, group discussions, laboratory experiments, shipboard research training, and visits to institutions of marine scientific interest. Selected participants were given a supplementary period for specialisation in their concerned field.

There were 17 participants representing Columbia, Japan, India, Indonesia, Korea, Malaysia, Phillippines and Vietnam. The course and supplementary period of specialised study were quite useful to the participants and helped in aquainting themselves with latest methods and techniques in the field of theoretical and applied marine biology. Shri P. C. George, Shri P. V. R. Nair and Shri T. Tholasilingam participated in this course from India.

Marine Geological Work in Andhra University, Waltair

A number of problems of marine geological interest are being tackled at the Department of Geology, Andhra University, Waltair. This includes a study on the "Sedimentary environment and geomorphic evolution of Chilka Lake" undertaken by Shri Kolla Venkataratnam (INCOR Fellow). Laboratory analysis of about 520 sediment samples revealed a number of sedimentary environments in Chilka Lake.

The following problems are also being tackled by three CSIR Research fellows and one INCOR fellow

1. "The study of the Nizampatam Bay along the east coast of India" (N. Nageswara Rao)
2. "Visakhapatnam beach cyclic changes, (short term to long term) grain size variation, minerology and minor structure (Ch. Madhusudana Rao).
3. "Study of the sediments in the various environments of Krishna delta with regard to physical chemical and biological aspects (A. Seetha Ramaswamy).
4. "Beach Study of Bhimilipatnam area" (R. M. Kidwai—INCOR Fellow)

"RIVERS OF MUD"

U. S. Coast & Geodetic Survey Ship Pioneer's Discovery in Bay of Bengal

A score of huge channels carved out by "rivers of mud" have been reported at the bottom of the Bay of Bengal by the U. S. Coast and Geodetic Survey Vessel *Pioneer*. American Oceanographer Dr. Robert Dietz disclosed this in Washington on 25th July, 1964. He describes that these channels are of enormous dimension and the largest surveyed was about 4 miles wide and 300 ft. deep, 2 miles below the surface of the sea. Scientists estimate that it carries a volume of water 25 times larger than Mississippi river.

Possibly about once or twice each century this mud suddenly moves with compelling force from the shelves across the bottom of the sea. Dr. Dietz explains that the mud is deposited on the continental shelf by many rivers that flow into the Bay of Bengal. The force behind the sudden avalanches remains unknown and he describes it as a 'truly remarkable phenomena' of the sea. The mud rivers run along the bottom like a flood of mercury and the volume is so great that it fills the sea channels to overflowing and while doing so, building its own levels or walls just as the Mississippi river does on lands. The 27,000 miles cruise

of *Pioneer* ended at Oakland, California on August 11, 1964.

U.S. Programme for Marine Mining Research

The U.S. Bureau of Mines has drafted a 10 year programme for Marine Mining Research. The Bureau believes that it can discover techniques for taking rich and hitherto untapped material deposits from the Sea floor. Initial efforts will be to recover phosphorites off California Coast, and at a later stage scientists plan to move further offshore to attempt to mine such metals as platinum, titanium, chromium, iron and zirconium.

Bathythermograph Card Processor

In contrast to the large volumes of Bathythermograph data accumulating every day, no punched card system has been developed that preserves the temperature-depth relationship of the original trace and therefore analytical work becomes much handicapped. Against this background the "Bathythermograph aperture card" now being introduced into the Canadian Oceanographic Community has added much ease to the processing, preserving and storage of original bathythermograph trace.

It essentially duplicates LaFond's standardised method of processing bathythermograph data except that complete automation of the photographic process is achieved by a modified commercially available camera which transposes the bathythermograph record directly to an aperture frame punch card. The modification comprising a complex viewer assembly was developed by the National Research Council of Canada. The complete unit is referred to as a "bathythermograph card processor". The routine operation including the loading and positioning of the slide relative to the grid in the processor takes approximately 50 seconds.

Historical bathy-files can also be converted to the new system by simply replacing the present viewer assembly with another modification unit. A variety of such units will allow for a wide range of applications in the field of oceanographci data retrieval i.e. the storage of sub-marine photographs.

To take the full advantage of the system the peripheral equipment should include the following :

1. An aperture card producer for making low-cost copies of bathythermograph aperture card.
2. An IBM key-punch for punching pertinent environmental data on the card.
3. An IBM punch card sorter for sorting the bathythermograph files.
4. An aperture card "viewer-printer" which serves a dual role, the first for making photographic prints from the bathythermograph aperture card and second, when equipped with a high speed card feed attachment, for fast and sequential examination of the presorted cards.

The bathythermograph card processor is not necessarily confined to the laboratory but can be considered as a Sea-going microfilm devise. (Charles D. Sauer, Canadian Oceanographic Data Centre, Ottawa).

Hydraulically Actuated Safety Device

Premature actuation of the sampling device becomes a distinct hazard or at least time-consuming and inconvenient especially during rough weather. Against this background the new and simple mechanism described by P. L. Sacks of the Woods Hole Oceanographic Institution appears to be useful in preventing the malfunction of sampling devices. It consists of a heavy walled cylinder with a closed head to which is attached six head bolts and is sealed with a standard static O-ring seal. A piston is provided with a standard dynamic O-ring seal and is free to move nearly the full length of the cylinder when the air above it is compressed. There is an extension of the piston below the cylinder and for some distance through a mounting bar attached to the cylinder. The mounting bar holds the piston captive but only partially close the open end of the cylinder. When the piston is at the beginning of its stroke, a hole

through the mounting bar is in alignment with a hole through the piston extension, thus forming a double shear. The assembly is attached to a sampling device by means of two holes in the mounting bar.

A pin is inserted in the shear aligned by mounting bar and piston. The pin tends to resist this force until the load exceeds its strength. The shear strength of the pin will correspond to the depth of operation.

The reliability of this mechanism has been successfully tried on board the vessels of Woods Hole Oceanographic Institution and found useful to arm various piston corer designs (Journal of Marine Research Vol. 22 No. 1 Jan. 1964)

THIRD IOC SESSION IN PARIS
10-19 June 1964

The third Session of the Inter-governmental Oceanographic Commission finished its work on June 19 after its 9 days long discussions on important matters relating to the World Ocean Studies. The session was attended by 101 representatives from 35 member states of IOC and 30 representatives from interested international organisations. 51 countries are members of this Commission at present. 73 percent of the delegates were scientists and the remaining were officials from various governments. The following items were successfully dealt in detail by the Commission.

1. Exchange of Oceanographic data.
2. Preparation of the General Scientific Framework for the comprehensive study of world Oceans.
3. Comparative study of the Kuroshio and other international expeditions.
4. The International Biological Programme.

Resolutions Adopted by the Commission at its Third Session

Resolution III-1

General Scientific Framework

The Intergovernmental Oceanographic Commission

Recalling the urgent terms of Resolution 2 of the second session on the need to develop a general scientific framework for the Commission's Comprehensive Programme of World Ocean Study, including fishery oceanographic research, and

Noting with great appreciation the draft document ("Draft of a General Scientific Framework for World Ocean Study" prepared for the IOC by SCOR" Report on Fisheries Aspects of the General Scientific Framework for World Ocean Study ACMRR/2/WP5, IOC/III-INF. 50) submitted on behalf of SCOR and ACMRR, as providing an essential scientific basis for developing and furthering oceanographic research and its many practical applications;

Recognising that these documents require further and wider consideration than can be given to them during the present session, and should be supplemented with discussions of certain scientific problems and with programmes for carrying out the research, and

Being Deeply Concerned with the urgent need for speedy development of oceanographic research throughout the world and its applications for the benefit of mankind;

Considering that Member States have volunteered to translate both documents into the working languages of the Commission and also into other languages.

Strongly Recommends that sufficient copies in the working languages of the IOC are published without delay as part of UNESCO's Oceanographic Programme, for wide distribution through the appropriate national bodies, together with intergovernmental and international bodies and the organisers of the International Biological Programme (IBP), for immediate consideration and in particular as possible basis for national programmes and other memoranda and

Requests the Secretariat to ask individual scientists, national scientific committees and other national agencies, FAO, WMO, IAEA, other appropriate UN, intergovernmental, and international agencies, and the organisers of the IBP, to provide by February 1965 comments and suggestions for improvement of the present draft docu-

ments and such scientific discussions and proposals for research programmes as they consider desirable to be added, for transmission by the Secretariat to the working group of SCOR together with the working group of the ACMRR and representatives of other groups, and further

Recommends that the combined working groups plan to meet in April 1965, so as to be able to provide the secretariat with a collated report on these matters no later than July 1965, for subsequent circulation to the members of the Commission before its next session; these reports should be the basis for preparing the second stage of the Commission's Comprehensive Programme of World Ocean Study as a further development of international research programme in oceans and seas already approved by the Commission.

Resolution III-2

International Indian Ocean Expedition

The Intergovernmantal Oceanographic Commission

Approves the Report of the Meeting of the International Co-ordination Group for the International Indian Ocean Expedition (See Annex. IV) as a basis for the future guide-lines for co-ordination of the Expedition.

Authorises the Secretary to take immediate action as recommended on this report.

Takes note with appreciation of the preliminary report of the SCOR Working Group on Atlases.

Authorises the Secretary to make available the report to National Co-ordinators.

Invites SCOR to provide further advice as would be needed in course of the preparation of atlases incorporating the results of the Expedition.

Resolves

1. That the next meeting of this Co-ordination Group be convened before the next session of IOC.
2. That an invitation to this meeting be extended to national co-ordinators, to representatives from interested international organisations and to scientists actively participating in the scientific work of the expedition and,
3. That this group be charged with the task of working out and reporting to the Commission on the future work in the Indian Ocean after the termination of the present field work of the Expedition. It will particularly study the problems relating to the exchange of data, publication of atlases and results of observations for the Indian Ocean and other problems concerning the Co-ordination of the Expedition.

Resolution III-3

Fisheries Aspects of the IIOE

The Intergovernmental Oceanographic Commission

Having considered the recommendations contained in the Report by the Subject Leader for the Fisheries Aspects of the International Indian Ocean Expedition (SLF), the conclusions of the *ad hoc* working group on the subject and the value of the IOBC regarding the studies of tuna larvae

Suggests that the Secretariat of FAO explores the possibility of arranging the secondment to the IOBC for about one year of a specialist in tuna larvae from the Nankai Regional Fisheries Research Laboratory or from the Inter-American Tropical Tuna Commission,

Recognising that the collection of fisheries data would be improved by the existence of a specialised data centre, and that the proper storage and retrieval of fisheries data will become increasingly important to international and regional co-operative research.

Being informed that FAO is prepared to establish in accordance with 2nd session of ACMRR recommendations a fishery data centre, initially for the purposes of storing IIOE Fisheries data.

Commends FAO for having agreed to initiate this valuable project, and

Recommends that the FAO data centre should: (i) store fisheries data (ii) organise, keep up to date and distribute a catalogue of deposited data (iii)

furnish data under request and at cost, and

Urges Governments, National and Regional Bodies to assist FAO in the development of the Fisheries Data Centre.

Noting further the conclusions of the *ad hoc* Working Group on the follow-up of the fisheries aspects of the IIOE and the possible impact of the IIOE as a whole, and particularly of the fisheries research carried out during the Expedition on the development of fisheries in the area,

Adopts the recommendation of the *ad hoc* Working Group on the dissemination of fisheries data of immediate use in chart form and its early evaluation, and also,

Adopts the recommendations of the *ad hoc* Working Group on the submission of National Reports, and the speedy dissemination of the fisheries information they contain.

Noting the usefulness of the IPFC Sessions as a forum for the discussion of fisheries matters,

Recommends that full advantage be taken of the next Session of IPFC (Kuala—Lumpur, October 1964) for the discussion of the SLF Report and the Report of the *ad hoc* Working Group, and

Noting the invitation transmitted by the FAO representative that observers will be welcomed.

Requests the Bureau of IOC to nominate observers to that meeting.

Appreciating that, for the Expedition in its present stage of development, the SLF system is an appropriate method for dealing with the follow-up of the fisheries aspects of the IIOE, and

Appreciating the desirability that the SLF should work in close co-operation with FAO and regional and national institutions concerned in the operation of the centre for the fisheries data of the IIOE and that one of his main duties should be the preparation of the fisheries charts.

Requests UNESCO and FAO to seek means for the continuation of the work of the SLF by providing financial support either themselves or through other agencies likely to be interested in this project.

Resolution III-4

International Co-operative Investigations of the Tropical Atlantic

The Intergovernmental Oceanographic Commission

Considering the fact that the survey aspects of the ICITA and the Guinean Trawling Survey are now completed, and

Noting that the various data reports for EQ UALANTS I, II and III and GTS are either published or nearing completion

Adopts the plan for preparation of the ICITA atlases recommended in the report of the ICG and

Commends active participation by interested Member States,

Instructs the International Co-ordinator for the ICITA and the Secretary to co-ordinate and support this participation,

Invites UNESCO, WHO, and CCTA to join with the Commission in supporting the preparation of the ICITA atlases; and

Noting Resolution 19 of the Second Session of the ACMRR and past deliberations of the ICG.

Recognising the desirability of a symposium to review the results of both the ICITA and the GTS,

Decides to sponsor a symposium in West Africa during early December 1965 and

Invites UNESCO, FAO and CCTA to join with the Commission in sponsoring the symposium, and further,

Authorises the International Co-ordinator of the ICITA and the Secretary of the Commission to make the necessary arrangements

Noting the excellent spirit of collaboration among the Member States represented on the Co-ordinating Group for the ICITA as evidenced by the results of the ICITA, and

Noting the recommendation for continuation of the Co-ordination Group contained in its report.

Authorises the continuation of the International Co-ordination Group for the purpose of facilitating informal collabora ion among Member-States interested in oceanorgraphic research in the

Tropical Atlantic Ocean, such Group to be known as the *Ad Hoc* Co-ordination Group for the Tropical Atlantic after the final publication of the ICITA atlases.

Resolution III-5

Co-operative Study of the Kuroshio and Adjacent Regions

The Intergovernmental Oceanographic Commission

Having considered the Report of the Marine Experts Meeting on the Kuroshio Region for the Co-operative Study of the Kuroshio and Adjacent Region

Considering the great importance of such a study from the Oceanographic and fisheries view points as well as its significance for the development of marine sciences in the region,

Adopts the Co-operative Study of the Kuroshio as an official programme.

Commends to its Member States their active participation

Considering Resolution 21 of the Second Session of the Advisory Committee on Marine Resourses Research,

Instructs the Secretary to approach FAO with the suggetion that on the occasion of the next meeting of the Indo-Pacific Fisheries Council, scheduled to be held in October 1964 the detailed planning of the fisheries aspects of the Co-operative Study of the Kuroshio should be discussed by fisheries experts, and further

Instructs the Secretary to take the proper action to ensure that experts from countries participating in the Co-operative Study of the Kuroshio be well represented at the above meeting for the purpose of dealing with details of the fisheries aspects of the CSK

Requests UNESCO, in collaboration with FAO and other interested organiztions to support this programme and to commend to their members active participation therein and further

Establishes an International Co-ordination Group which will be composed of national co-ordinators nominated by participating Member States and, to meetings of which, representatives of interested organizations shall be invited as observers. The Chairman elected by the group, under the responsibility of the Secretaty of the Commission., will serve as International Co-ordinator with the functions described in the Report of the Meeting of Marine Science Experts referred to above.

Requests the secretary together with the interim International Co-ordinator to convene the first meeting of this Group as early as possible.

Draws special attention of the Co-ordinating group to the necessity of including into the preliminary phase of the GSK the following activities:

1. Analyses of existing data to determine the principal characteristics of time and space changes in the Kuroshio system.
2. Preliminary field studies in key areas to provide additional information essential to eventual design of the large-scale multi-ship field programme.
3. Field and laboratory tests of methods and equipment with the goal of achieving standardization and intercalibration prior to commencement of the large-scale field programme.
4. Training of personnel
5. Strengthening of shore and ship facilities and the accumulation of essential equipment.
6. Design of a field programme to sample in the most effective way the principal characteristics of time and space changes in the Kuroshio system.

Resolution III-6

General Bathymetric Charts of the Oceans

Recalling and reaffirming Resolution 8 of the second session of the Commission,

Urges countries participating in the GEBCO scheme sponsored by IHB to keep up to date the 1/1 million plotting sheets of the areas for which they have accepted responsibility, so that these may be readily available when called for by the compiling authority.

Requests Member States, participating in International Co-operative Expeditions and Declared National Programmes, to forward bathymetric data, preferably in the form of plotting sheets, to the International Hydrographic Bureau in accordance with the Provisional Guide for the Exchange of Oceanographic Data, approved at the present session of the Commission and to ask their relevant non-governmental agencies to do likewise.

Further requests the Secretary to draw the attention of International organizations and agencies, such as FAO, I.C.E.S. etc., to the contents of this resolution.

Resolution III-7

Tide Gauges

The Intergovernmental Oceanographic Commission

Having studied the report UNESCO/IOC/III-9, prepared for the Commission by the Permanent Service for Mean Sea Level, and believing that a greater knowledge of sea level is vital to both Oceanographic and Meteorological research,

Requests member states i) to study the existing network of permanent tide gauges, shown in the above report; ii) to inform the Permanent Service for Mean Sea Level, through the Secretariat of the Commission, of any errors in the "Index of Gauges" and also to report details of any additional gauges as and when established; and iii) to consider the possibility of filling gaps in the net-work and to report findings to the Secretariat of the Commission,

Recommends further that member states arrange for close liaison to be maintained between agencies operating tide gauges and scientists working in the field of sea level studies to ensure that research requirements are considered when new gauges are installed and in the processing of sea level records,

Recommends that a Symposium on Tide Gauge Instrumentation be held in Paris in May, 1965 jointly by UNESCO and IAPO and that standardization of presentation of data for automatic processing and the need for offshore Oceanographic Buoys and Platforms to be fitted with Tide Gauges where practical, be discussed,

Considers that the installation of gauges and the presentation of data should take into account all uses to which sea-level data are put, both scientifically such as in the theoretical relationship between coastal levels and those in the open sea and for such practical purposes as tidal prediction, port operation, coastal engineering, tsunami warning, etc.

Asks member states who may have surplus gauges that they are willing to loan or present to other countries, to inform the Secretariat of the Commission so that this information may be promulgated in "International Marine Science."

Resolution III-8

Tsunami Warning System

1. *Desiring* to encourage the improvement of a system for providing international advance warning of the arrival of destructive seismic sea waves (tsunami) by combining the efforts of the various organizations concerned.
2. *Noting* the previous actions and resolutions of this Commission and those of the World Meteorological Organization (WMO), the International Union of Geodesy and Geophysics (IUGG), and the UNESCO Intergovernmental meeting on Seismology and Earthquake Engineering, but feeling that further careful study and research are required,
3. *Recognising* further the recent and proposed future expansion of the present tsunami warning system in the Pacific brought about by the close co-operation of the Hydrometeorological Service of the USSR, the Japanese Meteorogical agency, and the United States Coast and Geodetic Survey together with the eleven other nations of the Pacific Basin co-operating in this system.
4. *Recommends* that Member States of the Commission in the Pacific area who are not part of the present Tsunami Warning System establish adequate internal communications

and operate seismic and tidal stations, and integrate their system with that currently in operation.

5. *Recommends* further that all Member States encourage and promote research on the nature, causes, and effects of tsunami, support the development of improved tsunami measuring equipment and methods for warning of locally generated tsunami and provide for the wide dissemination of the results of such research and development.
6. *Requests* that these Member States presently operating Ocean Weather ship Stations (Weather Ships) investigate the possibility of utilising these ships as platforms for measuring the passage of a tsunami. The availability of these ships for lowering tsunami detectors on demand would encourage the development of such detectors and would improve the existing Tsunami Warning System in the Pacific. The member states concerned are further requested to communicate the results of such investigations in writing to the IOC Secretariat prior to the next session of the IOC.
7. *Requests* the Secretariat of the IOC to arrange for the convening of a meeting preferably in Hono'ulu in early 1965, to discuss the international aspects of the Tsunami Warning System with a view towards securing the best possible international co-operation in all phases of the Tsunami Warning System, viz. tidal and seismic monitoring stations, internal and international communications, and the issuance and dissemination of warnings. Invitations shall be extended to all the IOC Member States in the Pacific with specific invitation to the U.S. Coast and Geodetic Survey, the Japan Meteorological Agency, the Hydrometeorogical Service of USSR, United Nations Educational Scientific and Cultural Organisation (UNESCO) World Meteorological Organization (WMO), the Tsunami Committee of the International Union of Geodesy and Geophysics (IUGG), the International Telecommunication Union, and such other national or international bodies as may express interest.

Resolution III-9

International Biological Programme

The Intergovernmental Oceanographic Commission,

Noting the steps taken by ICSU and IUBS to organise an International Biological Programme, entitled the Biological Basis of Productivity and Human Welfare, and especially the plans being prepared for a section concerned with the productivity of marine communities,

Noting also that the IBP sub-committee concerned with planning this section has included representatives of the two officially designated advisory bodies of the Commission (SCOR and ACMRR),

Recognising that the plans for the IBP envisage the integration of research undertaken by individual scientists, institutions, national agencies and regional and international bodies, in laboratory and field programmes, extending over a world range of environmental conditions,

Acknowledging the contribution which such a programme in marine productivity could make to the Commission's programme of world ocean study,

Acknowledging also that the IBP may be a valuable means of generating national interest in marine science in various countries,

Observing the urgent need to study marine ecological conditions which have been and are being increasingly modified by man's activities, some of which may seriously affect marine productivity and human welfare,

Noting also that the ICSU special committee for the International Biological Programme will be meeting in Paris during July, 1964 further to developing the IBP, including its marine section,

Calls attention (1) to chapter VII of the draft GSF, especially the description of necessary field and laboratory research on the food web in the sea, the biological chemistry of sea water, and the roles of heterotrophs, phytoplankton and zooplankton in organic production; (2) to the sections in chapter III on pollution and in chapter

V on CO_2 and contaminants—lead, pesticides, detergents, radionucleides—being introduced at low but increasing levels of concentration in the oceans through the activities of man; (3) to those portions of chapter III and the ACMRR document which relate to the evaluation of harvestable organisms in the sea.

Welcomes the steps already taken, and

Commends the concepts of IBP to member governments for their consideration en-courargement and adequate support, and looks forward for proposals for further development of the programme.

Recommends that the secretariat of IOC provide such assistance as is in its power to further the objectives of this programme, and specially recommends that UNESCO help with arrangements for gathering and disseminating information on programmes and on work being done by different scientists in these fields, and that UNESCO be prepared on the request of SCIBP to assist with the co-ordination and integration of the IBP.

Recommends that representatives of SCOR, ACMRR and of the IOC Secretariat should be associated with SCIBP.

Resolution III-10

Development of co-operative Oceanographic Programmes.

The Intergovernmental Oceanographic Commission,

Being aware of the fact that the scientific interests and initiative of various countries and international organizations often lead to proposals of the IOC for the development of co-operative oceanographic programmes of a regional nature,

Having received the report of the Secretary on such proposals as the Antarctic Oceanographic programme (SCAR), the Co-operative Study of the South Mediterranean (meeting of Directors of North African Marine Institutions, Algiers, 3-6 June 1964) and some others,

Being further aware that other proposals of such nature may appear during the interim period between sessions,

Authorises the Secretary to follow and report to IOC members and interested organizations the development of such proposals with a view to assisting countries concerned through Unesco and through cooperation with other international organisations in formulating scientific programmes of proposed co-operative investigations, in arranging associated programmes of training and data exchange.

Authorises the Bureau where appropriate to undertake the following provisional steps to approve such programmes on the basis of their scientific merit, to commend such programmes to members of the IOC and to create international co-ordinating groups with their chairmen acting as international co-ordinators subject to approval by a subsequent session of the Commission.

Resolution III-11

Exchange of Oceanographic Data

The Intergovernmental Oceanographic Commission,

Desiring to foster the full and expeditious exchange of oceanographic data,

Recognising that this desire is closely related to the intention of IOC Members to co-operate in joint scientific study of the oceans,

Recognising further that this intention expresses itself either in participation of IOC Members in *International cooperative expeditions* or in *declaring publicly their own national* oceanographic programmes with a view to exchanging data resulting therefrom,

Recognising the special interest of Members in the organisation and operation of World Data Centres and specialised and regional centres for the collection and exchange of oceanographic data, in accordance with the principles of equality of rights and mutual assistance,

Resolves

1. to approve the new text of the Provisional Guide for Exchange of Oceanographic Data as prepared by the IOC Working Group in co-operation with SCOR,
2. to submit it for inclusion into the General CIG Guide to International Data Exchange through the World Data Centres, and
3. to keep it under constant review by the Commission's working group in co-operation and consultation with SCOR and ACMRR.

Recommends that all scientific data originating from "declared national oceanographic programmes" and "international co-operative oceanographic expeditions" (as defined in the above Provisional Guide), comprising results of observations and measurements by ships and recording stations outside territorial waters, as well as sea level observations, be exchanged by the methods and under the definitions and specifications prescribed in the above Provisional Guide for Exchange of Oceanographic Data, commencing with 1 January, 1960,

Recommends that in view of the great scientific value of long time-series records, mean sea level observations should be reported back to the time of establishment of the gauge wherever practicable,

Resolves that upon acceptance by CIG, the principal documents regulating the exchange of oceanographic data between Members will be the present resolution, the Provisional Guide for Exchange of Oceanographic Data approved herein, the introduction and general sections of the CIG Guide to International Data Exchange, and associated recommendations of the Commission's Working Group on Oceanographic Data Exchange,

Instructs the Secretary to prepare and distribute widely a Manual on International Oceanographic Data Exchange which will include the documents mentioned in the preceding paragraph, lists of national and specialized oceanographic data centres together with their addresses, methods, of operation and services and facilities available, and such other information as will be useful in facilitating the full and expeditious exchange of oceanographic data,

Recommends that the Commission, through its Secretary, communicate the present resolution and associated documents to the CIG, at the same time indicating its desire to be represented on that body.

Resolution III-12

Marking and Identification of Oceanographic Stations

The Intergovernmental Oceanographic Commission,

Considering the necessity of adopting a uniform system of rules on the marking and identification of oceanographic stations,

Recalling that Resolution 18 of its Second Session requested the Secretary of the Commission to inform the Maritime Safety Commission of the Intergovernmental Maritime Consultative Organisation of the I.O.C. suggestion concerning the marking, identification and any other safety aspects of fixed oceanographic stations,

Having considered with appreciation Document UNESCO IOC/III-13 containing the conclusions developed by the Maritime Safety Committee of IMCC together with the IOC Secretariat and subsequently approved by the Assembly of IMCO at its Third Session,

Recommends that all Member States adopt and implement these conclusions,

Notes that these conclusions may require Amendment from time to time, and

Requests Member States to report to the Commission on their experience in applying them.

Resolution III-13

Fixed Oceanographic Stations

The Intergovernmental Oceanographic Commission

A

Recalling that the third meeting of the Bureau suggested a meeting of users of fixed oceanographic Stations be called in 1964 to discuss

planning of systems of stations serving both oceanographic and meteorological purposes,

Requests the Secretariat to hold discussions with the Secretariat of the World Meteorological Organization with a view to forming a combined Working Group from the two organizations to prepare a proposed world Network of Oceanographic Stations, taking into account the existing network and also the proposed cooperative programmes of the Commission,

Requests that the report of this combined Working Group be passed to the Working Group on Communications at the earliest time to assist them in their discussions on frequency allocations,

Further requests member countries to inform the Secretariat of any errors in the publication "Fixed Oceanographic Stations of the World 1963" and its accompanying charts, to continue to forward any new information or alterations to the lists therein for existing stations and to report the installation of new stations, as recommended in Item 1 of the report of the first meeting of the Working Group on Fixed Oceanographic Stations.

B

Having considered with appreciation document UNESCO/IOC/INF 60, entitled "Report of the Director-General of the United Nations Educational, Scientific and Cultural Organization in consultation with the Secretary-General of the Intergovernmental Maritime Consultative Organization on the Legal Status of Oceanographic Research Stations",

Recognising that there are many varied aspects of the legal status of fixed oceanographic stations,

Requests the Secretariat to reproduce and distribute to all members of the Commission reports from Member States received pursuant to Resolution 1.82 adopted by the Commission at its Second Session,

Further Requests the Secretariat to raise the question of the legal status of fixed oceanographic stations with the Secretariat of WMO, in consultation with IMCO, with a view to including this matter as an agenda item of the proposed combined IOC-WMO Working Group and to report thereon to the next session of the Commission.

Resolution III-14

Development of National Programmes

The Intergovernmental Oceanographic Commission

Recognises the urgent necessity for mutual assistance between its Member States in developing their national programmes in order to study the oceans as a whole more thoroughly;

Is aware of the need for pointing out to both the developing and the developed countries how they can serve their own interests by contributing to marine research, and at the same time serve the common welfare,

Recommends, in order to encourage development of national marine science programmes by Member States and helpful inter-comparisons among different nations, that each country which so desires prepare a report for consideration by its fellow members on the Commission, including information on the present situation and future needs for:

1. Scientific and technical manpower in the marine sciences, and the possibilities of careers in these sciences.
2. Facilities, ships, laboratories, equipment, libraries.
3. On-going research and development effort in different fields of marine sciences.
4. University participation in marine research and in education of marine scientists, fellowships for foreign students.
5. Means for training marine scientists and technicians.
6. Problems outlined in the General Scientific Framework for World Ocean Study which could be attacked within the limitations of national resources of scientific manpower and money.
7. Regular observations of oceanic parameters (for example, tides nearshore temperatures, standard hydrographic sections,

time series from weather ships, etc.) which are being carried out or could be undertaken.

8. Governmental and scientific organisations for co-ordinating and fostering marine research.

9. Such other matters concerning the marine sciences as the Member State may consider appropriate.

Suggests that each Member-State consider requesting the IOC to appoint a visiting committee to review its programme and facilities for marine research and to present its studies and advice to officials responsible for scientific development within the country, and in other ways to stimulate the proper growth of the national programme in marine sciences, and

Decides that a Working Group on Mutual Assistance be established to carry out the following tasks, among others:

1. Encourage sister-relationships between universities and government agencies in advanced countries on the one hand and developing countries on the other.

2. Obtain and arrange for dissemination of information on the availability of reliable, easily operated and relatively inexpensive oceanographic instruments and on standard methods and procedures.

3. Study and advise on curricula and methods for educating marine scientists and technicians.

4. Help Member States to obtain needed financial and technical assistance for development of marine sciences.

5. Arrange for places on research vessels for the training of marine scientists and technicians of developing countries.

6. Encourage regional collaboration between institutions working in neighbouring areas.

Resolution III-15

The Consultative Council and Proposed Changes in the States

The Intergovernmental Oceanographic Commission.

I

Recalling the actions of the First and Second Sessions in creating and continuing the Consultative Committee in order that it advise the Bureau in the development of the programme of the Commission,

Recognising the contributions that the representatives on the Consultative Committee have made in the development of the programme of the Commission through participation in Bureau meetings and through acting as a steering committee with the Bureau at sessions,

Desiring to give more formal status to the role heretofore played by the Consultative Committee,

Requests the General Conference to consider the following changes in Resolution 2.31:

Article 6: to add new paragraphs as follows:

"3. During the course of each session and after electing the members of its Bureau, the Commission shall designate certain Member States which will appoint representatives to a Consultative Council. The Bureau shall seek the advice of the Consultative Council on all matters, it considers substantial between sessions prior to taking action on such matters and shall serve with the Consultative Council as a steering committee at sessions."

4. The representatives on the Consultative Council, and their alternates and advisers, may attend all meetings of the Bureau, except executive sessions. The Consultative Council may not meet except with the Bureau and shall have no officers."

5. The Member States designated in accordance with paragraph 3 above shall hold office from the end of the session during which they have been designated until the end of

the next session. No Member State which is represented on the Bureau shall be designated to the Consultative Council at the same time."

Decides as an interim measure to establish a Consultative Council to serve until the election of officers at the next session. Member States in numbers decided by the Commission shall be selected for representation on the Consultative Council at this session after the election of officers. The representatives, alternates, and advisors on the Consultative Council shall have the right to attend all meetings of the Bureau, except executive sessions, and shall serve with the Bureau as a steering committee at the next session. The Bureau shall take no decisions on matters which it considers substantial without previously seeking the advice of the said representatives. Members of the Consultative Council may be consulted through correspondence if the Bureau is to take action through correspondence instead of meeting. Expenses of the representatives, alternates, and experts shall be the responsibility of the governments they represent. No Member represented on the Bureau shall be selected for the Consultative Council. The Consultative Council shall have no officers and shall not meet except with the Bureau. Further it

Instructs the Secretary to include consideration of the Consultative Council on the agenda for the next session, and to prepare for consideration at that session necessary amendments to the Provisional Rules of Procedure in accordance with the action of the General Conference in amending the Statutes.

II

Considering that the experience of the Commission has shown the desirability of certain other changes in the Statutes of the Commission,

Requests the General Conference to consider the following further changes in the Resolution 2.31:

Article 3, *paragraph* 1: to replace the word "annually" by "every two years."

Article 6, *paragraph* 1: to delete the word "annual" wherever it occurs in that paragraph.

Resolution III-16

Second World Oceanographic Congress

The Intergovernmental Oceanographic Commission,

Having reviewed the Project of the Unesco Programme and Budget for Marine Sciences for 1965-66 as well as the development of preparations for the Second World Oceanographic Congress,

Takes note with appreciation of Unesco's readiness to support financially the organization of this Congress in the USSR in the spring of 1966,

Expresses its satisfaction at the creation by the USSR Academy of Sciences of the National Arrangements Committee for the Congress, and

Requests the Director-General of UNESCO in collaboration with other intergovernmental Organizations which are ready to sponsor the Congress and, with the National Arrangements Committee, to organise the Second World Oceanographic Congress in April 1966, in the USSR.

Resolution III-17

Ocean-Atmosphere Interchange

The Intergovernmental Oceanographic Commission,

Having in mind the need to understand and eventually to predict changes of water conditions from time to time and from place to place in the ocean, and

Recognising the intimate dynamic relationship between the atmosphere and the ocean and the probable effect of global forces and events on the balance of heat and transport of water in the ocean,

Realising the high desirability of studying on a world-wide basis the processes by which energy

and water are transported, and

Being aware of these resolutions of the Fourth World Meteorological Congress in 1963, viz:

Resolution 22—Development Plan for world-wide net works of meteorological stations and telecommunications.

Resolution 26—Meteorological aspects of international oceanographic projects.

Resolution 35—International arrangements for marine climatological summaries and for data collection for the marine section of a World Climatic Atlas,

Welcomes the initiative already taken by WMO in these matters, and

Invites WMO, in making its comments on and suggested additions to the draft documents for the general scientific framework to give special attention to studies of ocean-wide and world-wide inter-relations between the sea and the atmosphere, and to suggest programmes for such studies.

At the closing Session Commission elected unanimously Dr. N. K. Panikkar (India) as President, Professor Lacombe (France) and Dr. K. Sugawara (Japan) as Vice-Presidents of the new Bureau.

Besides, eleven countries were designated to be represented on the Consultative Council. They are Argentina, Australia, Brazil, Canada, Federal Republic of Germany, Poland, the United Arab Republic, the United Kingdom, the Ukrainian SSR, USA and USSR.

REPORT OF THE SECOND MEETING OF THE CONSULTATIVE COMMITTEE FOR THE INDIAN OCEAN BIOLOGICAL CENTRE.

The Second meeting of the Consultative Committee for the Indian Ocean Biological Centre was held at Ernakulam, South India, March 18-27, 1964. Representatives of UNESCO, Indian National Committee Advisory Board for IOBC, SCOR and National Observers took part in the meeting. The suggestions made by SCOR participants were discussed and agreed upon. These are summarised here.

The Consultative Committee for IOBC shall consist of at least four plankton experts nominated by UNESCO on the advice of SCOR and the Committee shall elect a Chairman from among themselves. The Committee shall have the following functions :

1. To assume responsibility through the Curator for the loan and examination of sorted samples by specialists throughout the world.
2. To work out a general procedure for maintenance of international collections.
3. To advise with regard to the presentation of data resulting from the examination of samples received by the Centre.
4. To advise with regard to the present and future activities of the Centre.
5. To maintain adequate collaboration between the Centre and national and international organizations studying Indian Ocean.

A report on the administrative aspects of the Centre and a report on the scientific work were given to the meeting by Dr. Panikkar and Dr. Hansen. Members expressed their strong approval of the progress which has been made during the past one year. Specific discussions were held on the following subjects:

1. *Staff* : Committee considered the strengthening of the staff in order to complete all the sorting of IOSN samples within the stipulated period and also to allow a small margin of man-power sufficient to allow research activities by those sorters who showed aptitude.
2. *Procedure for sorting of plankton samples* : A working group was set up to examine the scheme described by the Curator and on the suggested modifications a revised scheme is under preparation at the Centre.
3. *Preparation of Station lists* : The Committee agreed to the proposal of the Curator that the station lists should be deferred until a large number of samples have been sorted. Necessity for standard format for reporting stations information was also considered.
4. *Plankton identification* : Committee felt the great need for identification sheets at the Centre. Scientists were requested to send

copies of identification sheets employed in their laboratories. Committee was informed of the publication of "A Key for the identification of more common Copepoda of Indian Coastal Waters" by L. R. Kasturirangan and the proof of a paper entitled "A bibliography of plankton of the Indian Ocean" by R. Raghu Prasad was also shown to the members. The importance of both these contributions was noted by the participants. The Committee was informed that as a general rule Indian Scientific publications would accept papers on Indian Ocean and publish them with little delay so as to disseminate Indian Ocean Information.

5. *Atlases* : The Committee hoped that maps of all physical, chemical and biological parameters of the IIOE would be presented on the same projection and scale. It was realised that one of the ultimate objectives of the IIOE is the publication of Biological Atlases and that IOBC will play a major role in this effort.
6. *International aspects of the work of the Centre* :
   a) *Contract Sorting* : The Committee recommended that the Centre should be encouraged to undertake sorting for other Institutions on a contract and payment basis. However, such contract work should not interfere with the sorting of IOSN samples.
   b) *Consultative Committee* : International Consultative Committee should continue in existence after the termination of IIOE and it was recommended that its membership should be increased to six.
   c) *Training and Visits by specialists* : The Committee recommended that specialists, should be invited to the Centre to undertake specific research projects and to assist in training and advising the staff at the Centre. It was also planned to send students from other countries to the Centre to be trained and to assist in sorting.
   d) *Distribution of samples to taxonomic experts*: The Committee recommended that the Curator should prepare a summary of the sorted material for examination by specialists. The final list of the specialists to whom the fractions of the sorted material are to be sent should be decided by the Curator in agreement with the Consultative Committee. It was decided to give priority in the examination of sorted samples to those scientists who had previous experience of Indian Ocean material or to those who are willing to work at the Centre.
   e) *Request to National Co-ordinators* : The Committee recommended the following to be brought to the attention of National Co-ordinators then scheduled to meet at Paris.
      a) That IIOE participants to make collections with IOSN and to send them to the centre and to adhere to all times to the procedure for collection and preservation of those samples.
      b) that national Co-ordinators should keep the centre informed of the names and activities of the scientists in their countries who were working on IIOE samples.
7. *Library, Equipment and Information* : The Committee recommended first priority in the purchase of books and equipments which are of immediate importance to sorters. A newsletter would be helpful in keeping scientists in other countries and international organisations informed about the progress and needs of IOBC. Discussions would be held between Dr. Panikkar, the Curator, the Consultative Committee and UNESCO as to the method of preparing and circulating such a newsletter.
8. *Future Plans* : Dr. Panikkar informed the Committee that after the IIOE the Centre would form part of a Biological Division of an Institute of Oceanography; however, the new developments would not prejudice the centre's responsibility to continue the maintainance of international collections. The members welcomed these proposals and also strongly recommended that the Centre be continued as a regional service both for sorting and training after the completion of immediate objective.

INCOR GEOLOGICAL WORKING GROUP MEETING

The Working group on Marine Geology and Geophysics (INCOR) met at the Council of Scientific & Industrial Research New Delhi on 23rd May, 1964 under the Chairmanship of Dr. D. N. Wadia to review the progress of work in that field. Chairman observed that Geological work in general was lagging behind for want of equipment and trained personnel. Summing up the progress made in implementing the various recommendations of the working group in its earlier meetings Dr. Panikkar said that Bathymetry and Echo-sounding were regularly being made on *INS Kistna's* cruises. He expressed hope to carry out trial experiments on geological composition, and configuration of the ocean bottom with available equipment. Regarding geochemical studies he said that some work was being carried out at the Tata Institute of Fundamental Research by Dr. Lal, who obtained a few samples from Scripps Institution of Oceanography, and at present working on them; his team would be in a position to work on samples taken by Indian ships in future. It was disclosed before the meeting that the Director, IOE had exploratory talks with authorities of German R/V *Metreor* regarding the collaboration in geophysical work when she comes to Indian waters in 1965.

He also stated that seismic refraction studies had been started from *INS Kistna* on the continental shelf off Cochin and magnetic studies would be taken up on receipt of the precession magnetometer. Dr. Panikkar pointed out the necessity for a strong team to work on the geological composition and configuration of the ocean bottom.

The working group authorised the Director, IOE to negotiate with German authorities for obtaining the equipment on loan and for collaboration programme. Further it was agreed that seismic refraction studies might be continued by the Naval Research Group and that magnetic studies might be done by the Survey of India. It was agreed that two cruises of *INS Kistna* should be reserved for intensive geological studies.

Discussion on the Results of Kistna's Cruises at Visakhapatnam

An informal discussion on the results of the 15th and 16th Cruises of *INS Kistna* by the participating scientists and Naval Officers took place at the naval base, Visakhapatnam on 6th July, 1964.

Commodore Mehra opened the discussions in which Dr. Varadachari, Scientific Leader of the Cruise briefly outlined the results of the Cruises XV and XVI. Scientists under various disciplines of Oceanography actively participated in the discussions which ended with a vote of thanks by Commander Maitra.

* * *

VISITORS :

Dr. Jackson, the new Director of Fisheries Division, FAO, Rome, Mr. J. A. Tubb, Regional Fisheries Officer, Bangkok visited Delhi towards the end of July, 1964. Apart from discussions at the Ministry of Food and Agriculture Dr. Jackson and Mr. Tubb held discussions with Chairman, INCOR, and the Director, Indian Ocean Expedition and other persons connected with Indian Programme of Indian Ocean Expedition. The following persons visited Indian Ocean Biological Centre, Cochin during the quarter ending July 30, 1964.

1. Dr. G. N. Subba Rao, F. A. O. Assistant Regional Fisheries Officer for Asia, and Far East, Bangkok, Thailand (also visited Indian Ocean Expedition Data Centre at Delhi.)
2. Dr. Carrter Brood, Assistant Professor in Zoology, Ohio University, USA.
3. Mr. R. I. Anderson, Journalist, Tremont, Australia.
4. Dr. J. Birkland, Professor of Microbiology, Ohio State University, USA.

Shri B. P. Sinha, former Chief Justice of

Supreme Court of India visited *INS Kistna* at Visakhapatnam on 5-7-1964.

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FORTHCOMING MEETINGS (November, 1964—January, 1965)

1. Special Committee on Oceanic Research (SCOR) November 30—December 4, 1964, Hamburg.
2. Bureau of the Intergovernmental Oceanographic Commission—7-11 December, 1964, Paris.
3. Consultative Committee for Indian Ocean Biological Centre—22-29 (tentative) January, 1965, Ernakulam.

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PUBLICATIONS RECEIVED

1. National Metallurgical Laboratory Technical Journal (Jamshedpur) Vol. VI, No. 1, Feb. and No. 2, May 1964.
2. International Marine Science (UNESCO) Vol. II, No. 2, April 1964
3. IIOE-IOC Information Paper No. 7, May 1964.
4. I.U.G.G. Chronicle No. 52, January 1964
5. R.R.S. Discovery Cruise Report—Royal Society, London.
6. Pacific Science Information Bulletin, Hawaii, Vol. No. 16, No. 1, Feb. 1964.
7. C.S.I.R. News Vol. 14, Nos. 12, 13, 14 and 15.
8. Indian Journal of Pure and Applied Physics CSIR, New Delhi, Vol. 2, No. 6, June 1964.
9. ISI Bulletin (New Delhi), Vol. 16
   No. 1, Jan. 1964
   No. 2, Feb. 1964
   No. 5, May 1964
   No. 6, June 1964
10. Journal of Scientific and Industrial Research (CSIR) Vol. 23, No. 6, June 1964.
11. NODC Washington Accountrement dated 30.6.64.
12. The Sea Horse—(Hydro-Products California) Vol. I, No. 2, May 1964.
13. UNESCO Bulletin (New Delhi) No. 16, June 1964

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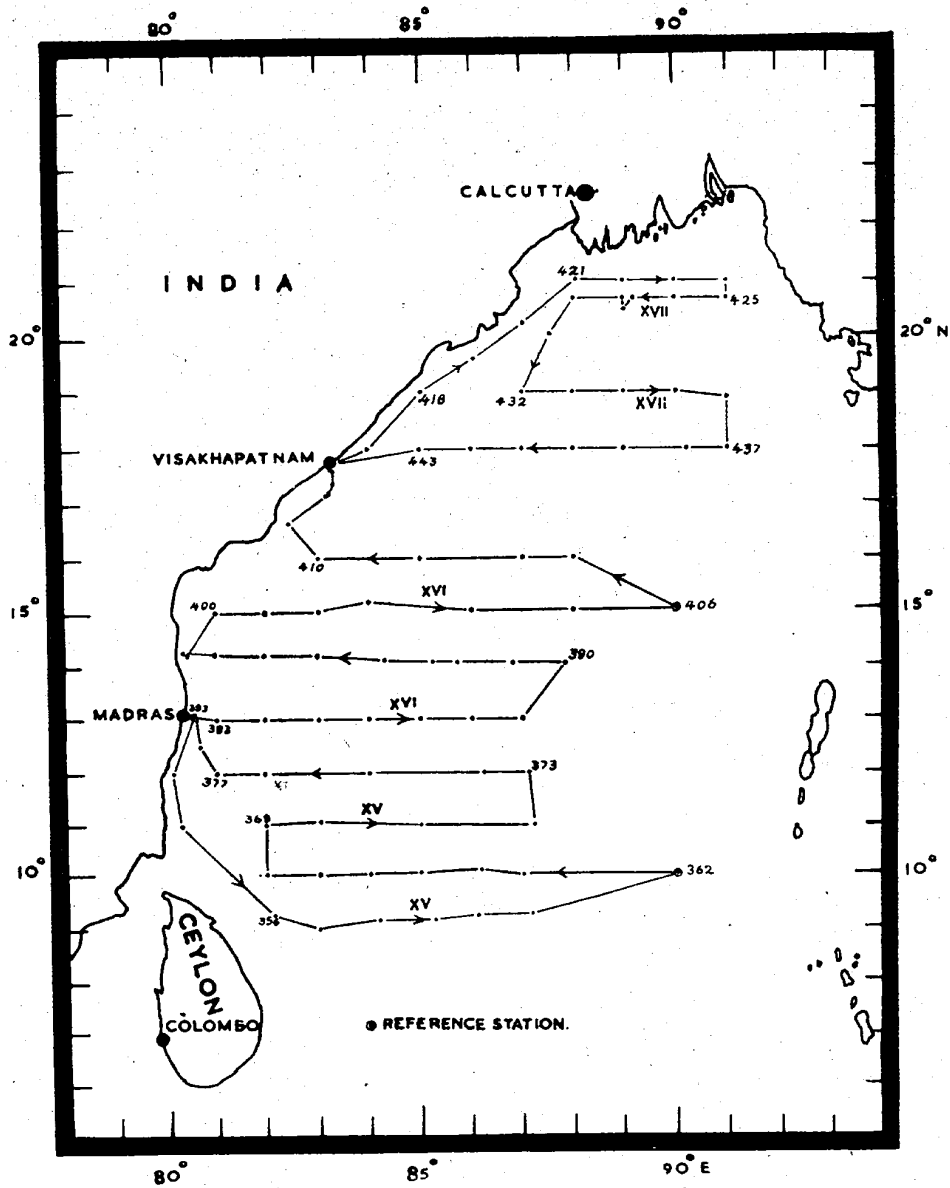
Correction

In last Newsletter Vol. II No. 1, June 1964 on page 6 Col. 1 last line—the depth of the sediment in central part of the Indian Ocean is printed as 400-100 Km. This may be read as 400-100m, instead of Km. The error is regretted.



Track and station positions of INS KISTNA for the Cruises XV, XVI and XVII Completed during June-July 1964.