



# International Indian Ocean Expedition

NEWSLETTER  
INDIA



Vol. II No. I

June 1964

OUR HOMAGE TO



*The late Prime Minister & the President of the Council of  
Scientific & Industrial Research — Shri Jawaharlal Nehru*

Issued by

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

# INTERNATIONAL INDIAN OCEAN EXPEDITION

## NEWSLETTER

### INDIA

Vol. II No. 1

JUNE, 1964

#### Oceanographic Institute in India:

The Board and Governing Body of the Council of Scientific and Industrial Research which met on March 23 and 24, 1964, unanimously approved the proposal for the setting up of a National Institute of Oceanography in India. The proposed Institute envisages a planned programme of research on the various aspects of geological, physical, chemical and biological oceanography with special reference to the Indian Ocean and the Indian coastal waters. The knowledge gained from these investigations would prove to be of significant applied value, in improving the utilisation of marine resources (food, chemicals, petroleum), in checking coastal erosions and in solving the many problems relating to marine transport and defence.

The Indian Programme of the International Indian Ocean Expedition has already established a nucleus, from which the Institute would be built up through stages of planned development. The valuable data collected during the various cruises, the equipment used by the Indian research centres which are functioning at present and the trained personnel available, will be utilised in this project.

The project envisages the establishment of units of research at suitable centres on the East and West coasts of India to deal with special problems; and the procurement of a well-equipped research

vessel. There would be broadly seven divisions of the Institute:

- i) *Data and Documentation Centre*—dealing with receiving, processing and exchanging oceanographic data;
- ii) *Physical and Dynamical Oceanography Division*—dealing with investigations in Physical Oceanography—special emphasis would be laid on the formation of monsoons;
- iii) *Coastal and Nearshore Oceanography Division*—dealing with problems of shore and sea-land interface. This Division would undertake investigations on coastal erosion, sedimentation, silting and such other problems, and seek methods of land stabilisation;
- iv) *Chemical Oceanography Division*—dealing with chemical and analytical problems. Special reference would be made to the analysis of trace elements and utilisation of marine chemicals in industry.
- v) *Biological Oceanography and Living Marine Resources Division*—dealing with living wealth of the sea; its assessment, utilisation and improvement;
- vi) *Geological Oceanography and related problems*—dealing with study of bottom contours, sediments, continental shelves; raw materials from the sea-bottom; and
- vii) *Oceanographic Instrumentation*—dealing with fabricating and designing oceanographic instruments.

## Indian Programme

### INS KISTNA

The INS KISTNA left Bombay on 20th May 1964 to undertake monsoon cruises of the year 1964. From May 22 to June 1, she has carried out seismic exploration studies in the Arabian Sea. Shri T. C. S. Rao of the Directorate of Scientific Research (Navy) was incharge of these studies. Scientists from the Indian Naval Physical Laboratory, Cochin, Central Water & Power Research Station, Poona, Atomic Minerals Division, Delhi and Indian Ocean Physical Oceanography Centre, Ernakulam collaborated in these studies. On the completion of

these studies the ship proceeded to Madras and started a series of cruises in the Bay of Bengal. In the first three cruises, detailed studies on the continental shelf along the east coast of India will be undertaken. It is also proposed to make detailed sections along the 'Swatch of No Ground'—the Ganges submarine canyon—during the 3rd and the 4th cruises (Cruises XVII & XVIII) in the current series. The fourth cruise will be in the mid Bay of Bengal, where one or two meridional sections will be worked.

With the fitting up of the medium duty winch, it is now proposed to undertake bottom sampling with the aid of gravity corers and snappers, along the continental shelf. The dredge and trawl will also be used.

The following is the proposed programme of monsoon cruises of INS KISTNA for 1964 :

Arrival	Place	Departure	Remarks
—	Bombay	20.5.64	
22.5.64	Cochin	1.6.64	for Seismic experiments.
4.6.64	Madras	8.6.64	Commence Cruise XV
20.6.64	Madras	23.6.64	Commence Cruise XVI
4.7.64	Visakhapatnam	13.7.64	Commence Cruise XVII
22.7.64	Calcutta	29.7.64	Commence Cruise XVIII
3.8.64	*Penang	7.8.64	Operational visit.
7.8.64	Langkawi	12.8.64	—
17.8.64	Madras		

\*Provisional.

The chart showing tracks of monsoon cruises is appended.

The undermentioned are the nominees for cruises XV and XVI

### Cruise Leader

1. Dr. V. V. R. Varadachari — Physical Oceanography

### Indian National Committee on Oceanic Research

2. Shri A. B. Wagh — Biology—Plankton.
3. Shri V. N. Sankaranarayanan — Salinometry, Phosphates and Silicates sampling.
4. Shri N. Jaganmohan Rao — Physical Oceanography.
5. Shri L. V. Gangadhara Rao — do-

### Directorate of Scientific Research (Navy)

- |                          |                    |
|--------------------------|--------------------|
| 6. Shri P. S. Srivastava | — Waves & Swell    |
| 7. Shri J. N. Garg       | — Chemistry—Oxygen |

### Zoological Survey of India

- |                        |           |
|------------------------|-----------|
| 8. Shri K. V. Rama Rao | — Biology |
| 9. Shri Prem Kumar     | — -do-    |

### Kerala University

- |                               |           |
|-------------------------------|-----------|
| 10. Shri A. N. P. Ummer Kutty | — Biology |
|-------------------------------|-----------|

### India Meteorological Department

- |                       |               |
|-----------------------|---------------|
| 11. Shri P. L. Raman  | — Meteorology |
| 12. Shri V. Natarajan | — -do-        |
| 13. Shri A. L. Jog    | — -do-        |

### Indian Ocean Physical Oceanography Centre (IOE)

- |                          |           |
|--------------------------|-----------|
| 14. Dr. M. G.A. P. Setty | — Geology |
|--------------------------|-----------|

*\*There has been changes in the Personnel since issuing this list.*

### Indian Ocean Biological Centre

Till March 1, 1964, 1079 plankton samples have been received of which 304 were taken with nets other than the Indian Ocean Standard Net. The positions of 937 samples have been plotted, and the positions of 123 samples are not yet available. The non-plotted samples, however, do not fill in the gaps in the following 3 areas, where none or only a few samples were taken:

- 1) South of 40°S from 20°E to 150°E;
- 2) 10°S to 40°S and 80°E to 105°E;
- 3) 5°S to 40°S and 40°E to 55°E.

Area 3 will, to a certain extent, be covered in future cruises by South African and U. S. Research Ships.

However every effort to collect zooplankton with the Indian Ocean Standard Nets will be made when vessels are operating in the areas mentioned.

In order to facilitate the work at the Centre, the participating ships and institutes are requested to send to the Curator two copies of the list of station numbers and number of samples. One should accompany the samples, and the other should be mailed to the Curator along with a list of positions of stations or a chart of station positions. It is

requested that the timings of operation may also be reported (GMT, local time etc.).

Dr. M. Krishnan Kutty joined the Biological Centre as Pool Officer on April 8, 1964. His subject of study will be 'Productivity of *infusoria* in relation to plankton algae and seston'.

### Extracts of Reports and Research Papers

#### JAPAN

The Japanese ship *Umitaka Maru* was cruising in the Indian Ocean from November 1963 to February 1964. Starting from Tokyo the ship called at Darwin, Broome, Geraldton, Fremantle and Penang, and then returned to Tokyo on February 17, 1964. The main observations made during this cruise in different disciplines are as under:

**Geophysics:** The measurements of earth's magnetic field showed the magnetic property of rocks on and beneath the ocean floor with various grades of local anomalies in some regions. Earth's gravity field was also measured.

**Physical Oceanography:** Ocean current, water temperature, B.T. and salinity were observed.

One hundred drift bottles were liberated at noon at each station (except 4 stations) and 200 bottles were liberated at station No. 7

**Chemical Oceanography:** Routine estimations of pH, dissolved oxygen, phosphate, nitrate and silicate were made.

**Submarine topography and geology:** Continuous echo-sounding was made and a topographic map was charted. A new Sea-Mount was discovered in the vicinity of 22° 12'S and 104° 40'E below a minimum depth of 1923 meters and has a diameter of about 13 nautical miles covering the area of less than 2000 meters. The Sea-Mount was tentatively named as 'Zenith Sea Mount'. Core-samplings of bottom sediments were collected seven times, and samplings of rocks, fossils, sediments and organic remains were taken with dredge at 23 points.

**Marine Biology:** Vertical hauls from 200 m depth were made at 28 points and zooplankton collected using Indian Ocean Standard Nets. Macroplankton was collected by larval net and the 'Umitaka's large square net' at 29 points in a total of 89 hauls. Half of the plankton samples collected through vertical hauls were deposited at the Indian Ocean Biological Centre, Cochin.

**Primary production:** The photosynthetic carbon assimilation *in situ* and under artificial light conditions was measured employing C<sup>14</sup> method. The sub-surface optical conditions were examined by a chemical method as also with 'Photovoltaic cell'.

**Measurement of radiation:** Measurement of solar radiation was continuously carried out by Robitzsch's Actinometer, and the intensity of underwater radiant illumination at each station was measured by means of the Murayama's A-type underwater illuminator.

**Maritime meteorology:** Maritime meteorological observations were made at intervals of three hours from October, 1963 to February 17, 1964. The data were sent to Australia, Malayasia, Philippines and Japan Meteorological Agency.

**Fishing operations:** Survey of long-line fishing grounds was carried out at each of the 5 stations along 120° E and at 5 stations along 100° E.

Morphological and anatomical studies were made on Tunas and Marlins caught on long-lines. Trawling ground survey was performed 6 times off Broome on January 1 & 2 and also 8 times off Snark Bay from 18 to 20 January. Catches were weighed and specimens tentatively identified on board the ship.

The other Japanese ships which took part in IIOE during October 1963 to February 1964 were:

- a) *Koyo-Maru*—area of operation was from 8°N to 10°S along 94°E and from 12°30'S to 21°30'S along 100°E line. It covered 13 stations along 94°E line, 7 stations along 100°E line and 1 reference station (32°S, 111°50'E).
- b) *Oshoro-Maru*—The cruise was mainly intended for the purpose of training cadets. However, oceanographic and fisheries investigations were made in the eastern Indian Ocean, south of Java Island. Two UNESCO Fellows from United Arab Republic participated in this cruise.
- c) *Kagoshima-Maru*—A programme of regular investigation was executed during the period November 26 1963 to January 9, 1964 between 8°N and 26°S, along 78°E and 86° E. A number of tuna-fishing experiments by long line were conducted during the northward cruise to Penang.

(IIOE—Newsletter of Japan—No. 5—March 1964)

## U.S.A.

The report in respect of cruise 3 of the U.S. Research Ship ANTON BRUUN has been received. The following is the brief summary of the report.

The ANTON BRUUN sailed from Bombay on August 8, 1963 and headed southwest to occupy the first station at the 60°E meridian on August 13, 1963. The ship then proceeded due south along 60°E occupying 9 stations situated at a distance of approximately 3° lat. from each other. The ship was diverted southwest to Mauritius for refuelling purposes. She left Mauritius and headed

on a southeasterly cruise picking up 60° E longitude on September 4. Thence she proceeded south to approximately 44°S Lat. occupying an additional 8 stations. ANTON BRUUN terminated her cruise 3 on September 20, 1963 at Mauritius.

The basic hydrographic, chemical and biological programme was carried out at each of the 16 stations (except the 17th). The hydrographic cast was made to 2000m on all stations except station 151 where observations were extended to 4000m. Besides hydrographic observations, routine measurements and estimations of sea water from surface to 2000m. were made. In addition BT lowerings were also recorded.

Primary productivity and phytoplankton pigments were measured at 16 stations with the water samples collected at depths corresponding to the penetration of 100%, 50%, 25%, 10% and 1% respectively of incident radiation. With the Indian Ocean Standard Net the plankton from 16 stations, micro-plankton from 12 stations were collected by vertical tows from 200m to the surface. Zooplankton samples were collected at 11 stations, using the pressure operated multiple depth oblique plankton samplers. The IOSN plankton samples have been deposited at the Indian Ocean Biological Centre at Ernakulam, India. The rest of the plankton samples have been deposited at the Smithsonian Oceanographic Sorting Centre, Washington, D.C.

A total of 28 midwater trawl hauls with the 10' Isaacs Kidd Midwater Trawl, 14 shallow tows averaging 700m depth and 14 deep tows averaging 1890m were taken at 17 stations. The fishes collected were sorted at Woods Hole and at the University of California at Santa Barbara. Later, specialists will identify individual specimens to species. Eventually, ecological surveys of the species-composition, diversity and biomass will be made relative to the physico-chemically and biologically defined water masses. Histological study of most melamphoids will be carried out by Mr. Chen at the University of California.

Measurements were made of sunlight penetration to depths as great as 800m and of biolumine-

scence flashing to depths as great as 3400m in both the sections using a sensitive photo-multiplier-type photometer.

Information on the geographic and depth distribution of marine yeasts were obtained by culturing the uncontaminated samples obtained by the use of sterile water samplers interspersed between Nansen bottles. These samples were sent to the University of Miami for further study.

(News Bulletin No 4 WHOI, Mass., Feb. 1964)

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## U.S.S.R.

### Vityaz

The report on the 33rd voyage of USSR Survey Vessel *VITYAZ* has now been made available.

The Ship covered 31,250 miles in 194 days (1960-61) during the voyage. The programme included oceanographic work in the northern Indian Ocean including the Arabian Sea, the Bay of Bengal and the Andaman Sea and also in the central part of the ocean (South to 40°S) in the vicinity of south western half of the Java trench. It is noteworthy that 65 specialists in the different scientific fields of oceanography, participated in this cruise. The highlights of the findings of the cruises are as follows:

#### i) *Geology:*

The bottom beyond the limits of continental shelf in the Arabian Sea is essentially an extensive accumulative plain. Underwater range 'Merccia' stretches from north east to the south west and is a continuation of one of the mountains on the right bank of river Indus. Connected with the range is a trench which possesses steep sides and a flat bottom with a depth down to 4230m. The ranges of Arabian, Indian and Central Indian Oceans have an exceptionally complex broken relief with numerous peaks as high as 2-2.5 km. A deep longitudinal valley, corresponding to the rift valley earlier discovered in the more southerly part of central Indian range is traced along the

axial part of Arabian, Indian and also the central Indian range. Immediately to the east of it, in the areas of the Chagos Archipelago there is a large trench (Chagos trench) about 5400m. deep similar to the other deep water ocean trenches, having steep sides and a flat bottom. The underwater range 'Afanasii Nikitin' 550 miles SSW of Ceylon, lies within the limits of the accumulative plain stretching from Bay of Bengal to the region of the northern part of the Indo-Australian basin at approximately 7°S. To the south of 7°S. the bottom of the Indo-Australian basin has a very complex broken structure with a volcanic relief predominating.

In the Bay of Bengal on the continental shelf and also in the region of the accumulative plain which occupies a large part of the floor of the Bay, are numerous underwater valleys, apparently formed by turbidity currents. In the southeastern part of the Bay an underwater range at a depth of about 2000-2500m has been traced to the Equator. A deep trench as well as an underwater range along the eastern side of Andaman Nicobar Island ridge was also observed.

The sediments over oceanic ranges and deep basins are distributed unevenly. Slow sedimentation rates explain the extremely wide distribution of rock crops. The presence of rock is confirmed by samples of rock and underwater photography. The changes in granular composition of bottom sediments observed from elevations to depressions are connected with changes in the hydrodynamic conditions. Underwater Photography showed ripplemarks formed by strong currents on the surface of underwater ranges. Changes in the composition of deep water sediments were particularly sharp at depths from 4200 to 5000m.

In the region of the accumulative plain of the Arabian Sea the depth of sediments was found to vary from north to south as also at depths ranging from 2.5 to 0.5 km. In the Bay of Bengal, in the part of Indo-Australian basin adjoining the bay, the thickness of sediments was found to be 3 km. and 2 km. respectively. In the central part of the ocean it varies from 400-100km.

## (ii) *Physical Oceanography:*

The temperature distribution in the Indian Ocean at the surface is found to vary from 26-28°C and at the bottom from 1.3 to 1.7°C. In the upper layer the temperature is found to be higher in the Bay of Bengal than in the Arabian Sea. The reverse is the case in the lower layers below 150m., owing to a pronounced density stratification resulting from excess of precipitation over evaporation.

In the Arabian Sea three layers of high salinity are traced; subsurface layer, strictly of an Arabian Sea origin; an intermediate layer formed in the Persian Gulf; and a deeper layer of Red Sea origin. The three layers get mixed and lose their individuality before they reach the Bay of Bengal. Reduced salinity is found in the surface layers of north-eastern and eastern Indian Ocean and in the deep bottom layers of entire northern Indian Ocean.

In the central Indian Ocean the following areas of convergence and divergence are well defined; the equatorial convergence (2-3° South), Southern equatorial divergence (8°S), tropical convergence (20°S) and sub-tropical divergence (29-33°S). An analysis of current measurement data and a map of dynamic topography shows that from November to the first 10 days of December, 1960, current system did not correspond to that for the winter monsoon in spite of the fact that prevailing winds were north westerly. In the Bay of Bengal from February to the beginning of March 1961 the currents were characteristic of winter monsoon. Current measurements at great depths (down to 5000m) showed considerable velocities over the entire deep ocean. A strong sub-surface current analogous to the Cromwell current in Pacific Ocean was observed on the Equator.

## iii) *Chemical Oceanography:*

In the north-eastern Arabian Sea an oxygen deficiency was observed from the surface down to the bottom. A complete absence of oxygen from the depth of 250m to the bottom (832m) was also observed. Smallest values of pH (7.64-7.67)

have also been observed in the Arabian Sea.

The maximum quantity of nitrite nitrogen observed in Arabian Sea is equal to 75 mg/m<sup>3</sup>, the highest value for all the oceans of the world. The second maximum of nitrites (in the layer from 150—300 down to 400—800m.) extends south and southeast to approximately 90°W.

In the Arabian Sea hydrogen sulphide is found in quantities of 0.02—0.10 ml/L in the layer with the least oxygen and a second nitrite maximum (from 150—250 down to 600—1000m). Hydrogen sulphide was also found in a layer in the north-western Bay of Bengal (0.02—0.06 ml/L). The presence of hydrogen sulphide seems to be one of the causes of periodic fish mortality in the sea. The distribution of all the chemical components studied, show a zonal distribution which reflects the effects of such dynamic factors as mixing, currents, zones of convergence and divergence etc.

#### iv) Biological

Large values of phytoplankton production was observed in the Andaman Sea (where a higher nitrate content was observed in the surface waters) and in the region of Somali Current where the primary production reached 300 mg/ cm<sup>2</sup>/ day. The reverse is the result in central part of the ocean. In the Andaman Sea luminescence water was observed due to blue green algae. Due to the development of phytoplankton in the Andaman Sea and Gulf of Aden, the phosphate contents were extremely low in surface waters. The Bay of Bengal was poor in phytoplankton but in the southern part of it there is an outburst of diatoms in the northern monsoon current.

The largest biomass of zooplankton was observed in the layer 0-100m in the Arabian Sea. In the Bay of Bengal the biomass was considerably lower while in the Andaman Sea it was somewhat higher than in the Bay of Bengal. Extreme low values of biomass of zooplankton occur in the anticyclonal zone to the south down to 38°S. Further south an increase in the biomass is again observed. The layer 200-500m is universally characterised by the low values for the biomass of

zooplankton, particularly in the Arabian Sea. Benthos biomass was highest in central Arabian Sea. A detailed picture of the distribution of both its total biomass and also the biomass of different groups was obtained.

In the tropical ocean zone a series of stations of deep water crustacea from the family *Ischnomesid*, which had earlier been considered to be distributed bipolar, was found.

A region rich in pelagic predatory fish, near the entrance of the Gulf of Aden was found to be of practical significance for development of marine fisheries. Many new, rare and little known deep water species of fish and a series of unknown types from the Indian Ocean were caught. A number of species of flying fish were recorded for the first time in the Indian Ocean. The distribution of young tuna, flying fish and other deep water fishes was of interest.

(P. L. Bezrukov—Deep Sea Research Vol. 10 Nos. 1-2)

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#### Sea Surface Currents of the Western part of the Indian Ocean.

During the 31st cruise of Soviet Research Ship VITYAZ in the western part of the Indian Ocean during February—March 1960 the author computed the sea surface currents by drift method. The data taken during cloudy weather and in places where there was no free drifting were eliminated. The author's findings are in agreement with the results obtained by I. M. Ovchinnikov by direct observation during the same cruise.

1. The three equatorial circulations are well established in the western part of the Indian Ocean during the northern hemisphere winter. They are North Equatorial Current, Equatorial Counter Current and the South Equatorial Current.
2. The current pattern as a whole is displaced to the south in comparison with the equatorial circulations in the Atlantic and Pacific Oceans.



3. The boundary between the North Equatorial Current and the Equatorial Counter Current lies to the south of the Equator at 68°E meridian (according to Ovchinnikov it lies at 3°S on 58°E and at 2°N on 86°E).
4. The Equatorial Counter Current widens as it flows farther and farther from the east coast of Africa.
5. The South Equatorial Current moving across the east coast of Madagascar divides into two branches; flowing north and south.
6. Near the West Coast of India, the surface current flows southward along the coast.

(V. S. Rama Raju—Bulletin of NGRI—Sept. 1963)



#### On the occurrence of fishes of the family Schindleriidae in the Indian Ocean

The family Schindleriidae with the genus *Schindleria* was created by Giltay to accommodate *Hemirhamphus praematurus* and *H. pietschmanni* described from the Pacific by Schindler who considered them to be sexually mature larval hemirhamphids. Bruun and Schultzy have subsequently recorded the collection of *S. praematurus* from the Pacific, and the latter has placed the family Schindleriidae in a sub-order Schindleriina. According to Bruun *Schindleria* could be considered as the lightest of all known vertebrates. In spite of the fact that the gobies *Pandaka pygmaea* and *Mistichthys luzonensis* are smaller they are heavier than *Schindleria*. All the previous records of *Schindleria* have been from the Pacific with *S. praematurus* from widely separated areas, viz. Hawaiian Islands, New Guinea, Tahiti, Samoa, Tasunan Sea; off Sydney and Grafson (Australia) and Bikini, while *S. pietschmanni* has been known only from the Hawaiian Islands.

A study of larval and juvenile fishes collected from the Laccadive Archipelago revealed the presence of specimens less than 20mm. in length resembling larval fishes but with mature gonads. These on further examination were identified to

be *Schindleria*. Both the species are represented in the collections and there are in all 81 specimens of *S. praematurus* ranging from 11.7—20.5mm. in total length and 8 specimens of *S. pietschmanni* ranging from 8.2—15.1mm in total length. As in the Pacific, the former appears to be comparatively more abundant and widely distributed in the Laccadive area. This is the first record of their occurrence in the Indian Ocean region and it is most likely that these should have a wider distribution than known hitherto. Their small size might have prevented their detection from among larval fishes. It is hoped that the participants of the International Indian Ocean Expedition will be on the look out for this interesting genus of fishes.

(S. Jones & M. Kumaran—  
Current Science Vol. 33 No. 5, March 5, 1964)



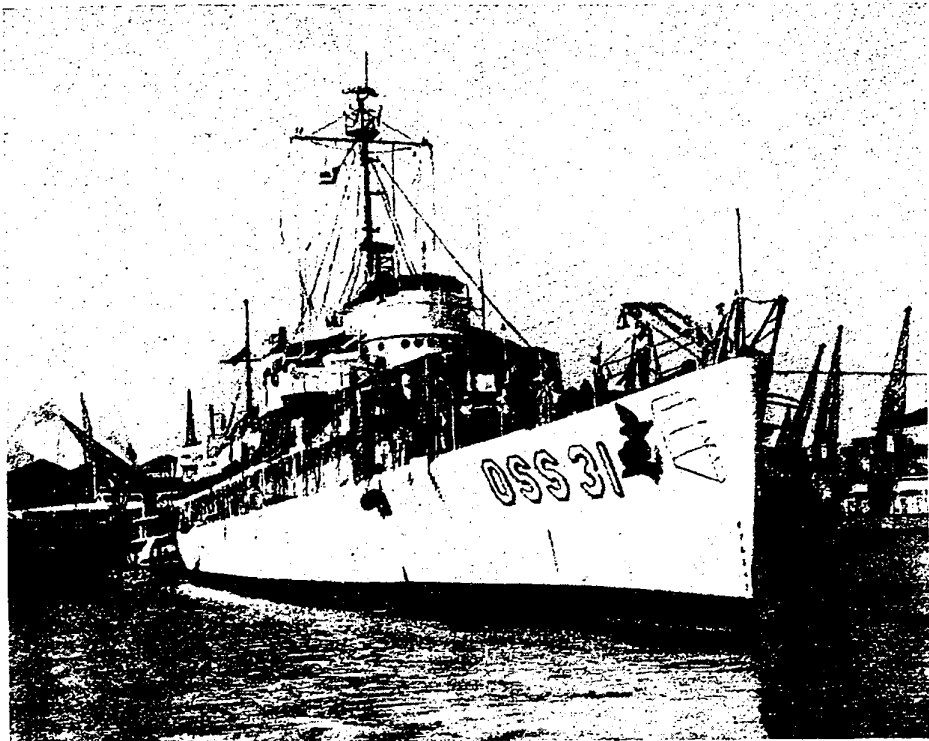
#### CRUISE PROGRAMMES OF FOREIGN SHIPS

##### RRS DISCOVERY—amended 1964 IIOE Programme

The amended 1964 IIOE Programme of RRS DISCOVERY as published in News letter No. 4 of January 1964 by the Royal Society is summarised below:

The ship during her programme will be visiting Seychelles, Mauritius, Mombasa and Aden. During her cruise she will be covering the north-south section between 58°E and 68°E and extending to 20°S. Work on equatorial current will be concentrated within these sections between 5°N and 15°S. In addition to the two visits already made in March and May to the South Arabian Coast, one more visit will be made in September on its homeward journey. The section 200 mile off shore from the Kuria Muria Islands will then be reoccupied.

Hydrographic sections and current measurements will be made in the Somali Current during August in co-operation with U.S. Research Vessel ARGO. Hydrographic stations will also be



*U.S. Coast & Geodetic Survey Ship 'Pioneer' which visited Calcutta from April 25 to May 2, 1964.*

worked on passage between areas specified above. In each part of the programme, an allowance of time has been made for current measurements, mid-water trawling, deep plankton hauls etc.

The ship is scheduled to leave Aden for England on 9th September, 1964.

Shri K. V. Sundararamam of Indian Naval Physical Laboratory, Cochin, is the Indian nominee on this cruise.

#### **Programme of U.S. Coast & Geodetic Survey Ship PIONEER**

The U.S. Coast & Geodetic Survey Ship PIONEER reached Calcutta on 25th April 1964 after completing the 4th leg of the cruise under the

IIOE Programme. Besides carrying out routine investigations (on physical, chemical and biological aspects) she will concentrate on the geological-geophysical investigations of the Malacca straits, Andaman Sea, and Bay of Bengal with special emphasis on detailed investigations of several submarine canyons. The detailed programme they intend to pursue during the Vth and VIth legs of the cruise starting from Calcutta and ending at Djakarta are as follows:

#### **Vth Leg:—Calcutta to Colombo**

During this leg, special emphasis would be laid on investigations of the Ganges Delta as also of Ganges and Trincomalee submarine canyons.

Sediment cores, dredge samples, electrosonic profiles, bottom photographs and such other investigations will be undertaken. In shallow depths, divers will investigate canyon heads using SCUBA gear.

From Calcutta the ship will proceed to Ganges Delta to investigate its physical profile. Thence she will engage herself in the investigations of the southward extension of the Ganges Canyon, (21°N, 89°E) and the canyon north-east of Trincomalee coast. During this leg, it might be possible to further investigate the Krishna, Mahadevan, and Andhra submarine canyons (17°54' N 84°16'E to 17°44'N, 84°02'E)

An Indian scientist Lt. Col. K. L. Khosla of Survey of India, Dehradun is aboard to participate in the Cruise between Calcutta & Colombo.

#### Leg VI—Colombo—Djakarta

If the Ganges Canyon happens to extend southward beyond the Trincomalee coast, investigations will be made until its terminus is reached otherwise the ship will proceed to 5°N, 84°E to occupy the 17 stations (between 5°N to 5°S along 84°E, 88°E and 92°E) to undertake investigations on temperature, salinity, dissolved oxygen and phosphate content. She will then proceed to 0°-90°E, the standard station designated by the International Indian Ocean Expedition. Thence she will move to 0° 30'S, 92°E to study detailed structures of the thermocline in this region. A series of 36 bottles will be employed between surface and 1200 m in this area (between 2°N and 2°S). 'Pioneer' will then proceed towards the north westward extension of the Java Trench (5°S 92°E) for investigation of bottom profiles.

The following is the cruise programme of the different countries participating in the International Indian Ocean Expedition for the year 1964-65 according to information so far available:

Sl. No.	Name of the Country	Ship	Months & year	Planned Programme
1.	U.S.A.	R/V ARGO	July—October 1964	Emphasis will be on detailed stratigraphic, geochemical, heat flow development and continuous underway water magnetometer readings in the central and eastern Indian Ocean under W.R. Riedel.
2.	"	R/V CONRAD	3 months in 1963-64	The programme will be carried out under the principal investigator Dr. Maurice Ewing in the southern Indian Ocean south of 30°S.
3.	"	R/V CHAIN	March—June 1964	Conduct underway observations in the Red Sea under the direction of Dr. J. B. Hersey—Reconnaissance of Zebirget Island, dredging for rock samples and core sediments, study of bottom by photographs, heat flow measurements in the portion of Somali Abyssal Plain, detailed study of Seychelles-Mauritius Ridge and Vema Trench, investigation of the relationship

- between Madagascar and the Seychelles-Mauritius Ridge, investigation with dredging and photography of a small trench to the south west of the Almirante Islands.
4.     "       R/V CHAIN     Sept—March 1964-65   Geophysics and sub-marine geology (Cape Agulhas to Laccadives, Chagos to India, India to Suez) besides physical and chemical oceanography.
  5.     "       R/V ATLANTIS    Feb—July 1965       Physical and chemical studies in Red Sea Agulhas Currents under the chief direction of Dr. A. R. Miller besides geophysics and submarine geology.
  6.     "       ANTON BRUUN    Feb 11—Mar. 28     Japanese longline fishing gear in the water between Bombay, Victoria, Seychelles, Port Louis, Cochin.
    - April 9—June 1    Isaacs-Kidd midwater trawl in the water between Bombay, Port Louis, Durban.
    - June 12—July 26   Menzies trawl, Campbell Grab, Piston corer in the water between Durban Lourenco Marques, Tulear, Madagascar.
    - Aug 6—Sept 25    Gulf of Mexico Shrimp trawl, dredges in the water between Durban, Beira, Mozambique Zanzibar, Tamatave.
    - Oct 3—Oct 12     Gulf of Mexico Shrimp trawl, midwater trawl in the water between Tamatave and Port de Galetes.
  7.    U.S.A.     TE VEGA         March—May '64      Biological work. Colombo-Mauritius with stops along the Maldives, Chagos island, Cochin.
    - June—Sept '64    Biological work. Mauritius-Zanzibar with stops along the Comoro Islands and north-western coast of Madagascar.
  8.    U.S.S.R.   R/V VITYAZ       She will be operating in the Indian Ocean during September, 1964 to February 1965. This will be mainly a geophysical & geological cruise but some other studies including Indian Ocean Standard Net tows will be undertaken.
  9.    GERMANY    METEOR II        Details not yet available.

## INCOR Meeting

The tenth meeting of the Indian National Committee on Oceanic Research was held at New Delhi on 3rd April 1964 under the Chairmanship of Dr. D. N. Wadia. The following members and invitees were present:

### Members

1. Dr. K. R. Ramanathan
  2. Dr. D. Lal
  3. Capt. N. S. Tyabji
  4. Dr. S. S. Srivastava
  5. Capt. S. Rajendra I.N.
  6. Capt. Gautam Singh I.N.
  7. Shri C. Ramaswamy
  8. Dr. N. K. Panikkar—Member Secretary
- Other participants
9. Shri K. G. Krishnamurthy
  10. Shri O. P. Mohla
  11. Lt. Cdr. A. S. Balakrishnan
  12. Shri R. Jayaraman
  13. Shri T. C. S. Rao
  14. Dr. V. S. Nair
  15. Shri N. R. Adyanthaya

The Chairman in his introductory remarks expressed satisfaction at the all round progress made in the Indian participation of the Expedition.

The highlights of the discussion at the meeting were the following:

1. The decision to make use of the Beam Transmission facilities of the All India Radio for fixing position of ships.
2. A suggestion for intensive study of Air-sea interactions by Dr. K. R. Ramanathan, at Thumba near Trivandrum, or some other convenient site.
3. The decision to constitute a Committee consisting of Mr. C. Ramaswamy, Capt. Gautam Singh and the Director—General of Lighthouses & Light ships, to speed up the NOMAD mooring programme for 1964-65 that has been delayed due to refit of INS KISTNA.
4. The discussion of draft report of Coordinators and Data Exchange Working group meetings of the Intergovernmental Oceanographic

Commission at Paris and of the Indian National Committee on Oceanic Research Progress Report 1962-63 presented at the meeting of the National Co-ordinators.

5. Oceanographic Data Centre which is being organised under the Directorate of Indian Ocean Expedition, CSIR in order to facilitate Data Exchange with World Data Centres A & B at Washington and Moscow.
6. Notes outlining the programmes of various countries.
7. The desirability of a meeting of Telecommunication and Maritime authorities with Oceanographers and Fishery Scientists at the National level. At the meeting of Telecommunication experts, Meteorologists and Oceanographers held in Paris in September 1963, India was represented by the Wireless Adviser to the Indian High Commission in U.K.
8. Report of the Indian Ocean Biological Centre:

The Consultative Committee of Indian Ocean Biological Centre met at Ernakulam from 18 to 28 March, 1964 to review the progress of the Centre. The Indian National Committee Advisory Board for Indian Ocean Biological Centre has expressed satisfaction at the progress and plans of the Centre.

9. Report of the International Meteorological Centre:—

Shri Ramaswamy reported on the following:

Organization of an efficient telecommunication system; collaboration with the U.S. Research Flight Facility Aircrafts flight programmes; and installation of an IBM 1620 Computer. It was stressed that the processing and publication of the meteorological data obtained should be done by the Indian Meteorological Department.

10. The unanimous decision of the Governing Body of the CSIR to set up a National

Oceanographic Institute in India.

The proposal has been included in the Fourth Five Year Plan of the C.S.I.R. The Indian National Committee on Oceanic Research would function as the Planning Committee for the proposed Institute. A Working Party of the Committee has been constituted to draw up priorities and plan phases of development. The Working Party consists of

1. Dr. N. K. Panikkar (Convener)
2. Dr. S. S. Srivastava
3. Shri C. Ramaswamy
4. Dr. D. Lal.

Shri R. Jayaraman will act as the Secretary to the Working Party.

The preliminary notes on the proposal have been circulated among members of the Indian National Committee on Oceanic Research to enable them study the same and send their comments before the end of May.

11. The constitution of a sub-committee to examine the suitability of locations chosen for installation of wave recorders. The sub-committee consists of Capt. S. Rajendra, Shri C. Ramaswamy and Dr. S. S. Srivastava.
12. The need for implementation of the Kort—Revelle-Deacon scheme for the General Scientific Framework for World Ocean study.

The copies of the scheme has already been circulated to the members of the Indian National Committee for examination and comments.

13. Symposia to be held at the conclusion of the Expedition.

i. Symposium on Air-Sea Interaction to be organised by the Meteorological Group.

Dr. K. R. Ramanathan has suggested that the symposium should not merely be confined to Air-Sea Interaction but the entire Meteorological data including the upper air studies in view of the fact that this is the first time that extensive meteorological data over the entire Indian Ocean region have been collected. The Indian National Committee has been requested to secure appropriate action by the Govt. of India in organising this seminar, which is to be sponsored by WMO under UNEPTA Regional Project.

ii. Symposium on the Marine Geological results of International Indian Ocean Expedition to be organised in connection with 22nd International Geological Congress to be held in India.

iii. Symposium on Oceanic Research to be organised by Indian National Committee towards the end of 1965. The National Institute of Sciences, India has been approached for collaboration in this symposium. It was proposed to hold this during January— March 1966 in view of the conclusion of the International Indian Ocean Expedition on December 31, 1965, and the World Oceanographic Congress to be held in Moscow during July-August 1966.

### THIRD SESSION OF THE INTER-GOVERNMENTAL OCEANOGRAPHIC COMMISSION

The Third Session of the Commission met at Unesco Headquarters in Paris from 10-19th June, 1964 under the Chairmanship of Dr. W. M. Cameron of Canada.

Of the fifty-one member-countries thirty five were represented at the meetings which were also attended by representatives of several Intergovernmental Organisations. Important decisions taken pertain to several international cooperative investigations in the field of Oceanography, particularly work on the Indian Ocean Expedition, the Tropical Atlantic and the Kuroshio in the

Pacific. Report on a General Scientific Framework for World Ocean Study was one of the major documents considered by the Commission, which recommended its world-wide circulation to elicit comments and further development of specific programmes.

The Commission elected Dr. N. K. Panikkar (India) as President for the ensuing period, with Prof. H. Lacombe (France) and Dr. K. Suguwara (Japan) as Vice-Presidents. Details of the resolutions and recommendations made by the Commission will be included in the next Newsletter.

### MARINE SCIENCE SEMINAR AT CALCUTTA

The U.S. Coast and Geodetic Survey Ship PIONEER, while cruising in the Indian Ocean, visited Calcutta from April 25 to May 2, 1964. During her stay there a Seminar on "Marine Science" was held on April 29 & 30, 1964, sponsored jointly by the Indian National Committee on Oceanic Research, Calcutta University and the United States Information Service, Calcutta. 58 participants from different organizations and Universities attended the Seminar and a number of papers were presented on the different aspects:

#### OCEANOGRAPHY—(General)

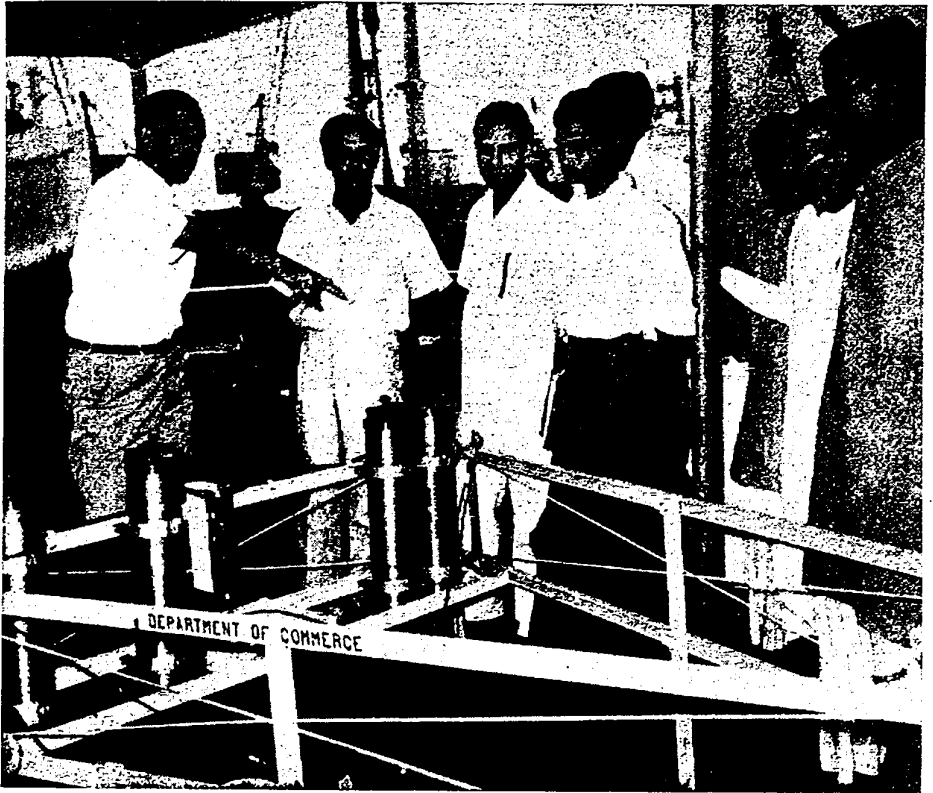
- |                        |   |
|------------------------|---|
| Dr. N. K. Panikkar     | —"India's role in the International Indian Ocean Expedition."<br>(Chairman's address) |
| Dr. Harris B. Stewart  | —"Scientific Programme of PIONEER."   |
| Dr. Francis P. Shepard | —"Submarine Canyons."   |
| Dr. R. Ramanadham      | —"Air Flow Studies Over the Ocean Surface of Waltair."                                |
| Mr. R. Jayaraman       | —"Swatch-of-no Ground".   |
| Dr. D. P. Kharkar      | —"Marine Investigations Based on Cosmic Ray Produced Isotopes."                       |
| Mr. C. Sreekumaran     | —"Natural Radio-activity in Marine Sediments."  |

#### PHYSICAL OCEANOGRAPHY & METEOROLOGY

- |   |   |
|---|---|
| Dr. K. R. Ramanathan                    | —"International Meteorological Centre."<br>(Chairman's address)   |
| Dr. R. Ramanadham and Collaborators     | —"Limnological Studies of the Chilka Lake."<br>"Storm Tides at Visakhapatnam."<br>"Some Observations of Currents in the Littoral Zone off the Waltair Beach." |
| Dr. J. S. Sastry                        | —"The Mechanisms of Sediment Transport in and around the Bombay Harbour Region."  |
| Dr. F. R. Miller & Mr. R. Suryanarayana | —"Energy Exchange Across Sea-Atmosphere Interface around India."  |

#### MARINE PRODUCTIVITY & RELATED ASPECTS

- |   |   |
|---|---|
| Dr. B. S. Bhimachar & Mr. V. R. Pantulu | —"Hydrology and Biology of some Indian Estuaries and Brackish Water Lakes." |
|---|---|



*Dr. Stewart, Chief Scientist, on U. S. Ship "Pioneer," explaining the working of the underwater camera.*

Dr. R. Viswanathan & Others

—“Distribution of inorganic Phosphates in Northern Indian Ocean.”

Dr. A. A. Ramasastry

—“Salinity Maximum below the Tropical Discontinuity Layer in the South-eastern Arabian Sea.”

Dr. K. K. Tiwari

—“Geographical distribution of the Marine and Estuarine representatives of the Family Palaemonidae (Crustacea: Decapoda: Caridea) with special reference to the Subfamily Pontoninae.”

### GEOLOGY & GEOPHYSICS

Dr. M. S. Krishnan

—“The Structure of the Eastern Bay of Bengal.”  
(Chairman's address)



- |   |  |
|---|--|
| Dr. B. Sundararama Rao                  | —“Geophysical Investigations for Ground water around Visakhapatnam.”   |
| Mr. L. N. Kailasam                      | —“Some aspects of Geophysical Exploration off the Madras Coast.”   |
| Dr. M. Poornachandra Rao                | —“A Resume of Marine Geological Studies at Andhra University.”   |
| Mr. H. N. Siddique                      | —“The Significance of Heavy Minerals of Balasore Sand Dunes in Deciphering Sediment Transport along Orissa Coast.” |
| Mr. K. Venkataratnam                    | —“Studies on Sediments of Chilka Lake, a Marine Lagoon along the East Coast of India.”                             |
| Mr. A. K. Chatterjee and Mr. S. C. Pant | —“Recent Micro-Faunal Study and its implication in the Evolution of Andaman Group of Islands.”                     |
| Dr. B. Sundararama Rao                  | —“Field Application of Modified Tripotential Method.”  |
| Shri. P. S. Srivastava                  | —“A Resume on Cruises of INS KISTNA in the Arabian Sea.”   |

### GEOLOGY GEOPHYSICS AFTERNOON SESSION

- |                        |  |
|------------------------|--|
| Dr. Robert S. Dietz    | —“Some Problems on the Permanence of Ocean Basins” (Chairman’s address)        |
| Dr. B. Sundararama Rao | —“Investigation of Magnetic Properties of Basalts and Charnokites.”            |
| Dr. M. Subba Rao       | —“Investigation of Magnetic Parameters of Magnetities at high and low Fields.” |
| Dr. B. Sundararama Rao | —“Studies on the Kakinada Bay on the East Coast of India.”                     |
| Mr. T. C. S. Rao       | —“Electrical Resistivity Soundings in a Part of Godavari Valley.”              |
|                        | —“Crustal Structure of the Ocean Bottoms.”                                     |

During the visit of PIONEER to Calcutta, the visiting Scientists were able to make contacts with Scientific Institutions and Indian Scientists through hospitality arrangements made by the local Hospitality Committee for the INCOR at Calcutta under the Chairmanship of the Vice-Chancellor, Calcutta University.

### NEWS

#### NOMAD Launched

The NOMAD was successfully anchored on April 24, 1964 by M. V. SAGARDEEP of the Department of Lighthouses and Light ships at 12°37'N and 86°30'E in the Bay of Bengal. It was first launched in September 1963 but due to some trouble it was brought back for repairs. This will transmit accurate data of atmospheric pressure, air temperature, sea water temperature and direction and speed of wind and therefore

warn us of impending storms and cyclones.

#### Department of Oceanography in the University of Karachi

The University of Karachi has decided to set up a Department of Oceanography to conduct research in marine fisheries at an estimated cost equivalent to about \$146,800. The scheme will be submitted for consideration before a development committee. According to the scheme the main laboratory will be opened at the University

Campus and a station will be set up on the sea coast.

(NODC Washington, Newsletter No. 2-64, 29 Feb. 1964)

### **Argentina to have a National Oceanographic Institute**

The Biological and Chemical branches of the Marine Biological Institute of Argentina are already well organised. Now a Physical Oceanography Branch for training and research is being added. In the near future it is planned to add a geological and later geophysical branch. The final aim is to transform the Marine Biological Institute into the National Oceanographic Institute of Argentina.

(NODC Washington, Newsletter No. 2-64, 29 Feb. 1964)

### **Miscellaneous:**

The Federal support (comprising of USN, NSF, Bureau of Commercial Fisheries, Weather Bureau and Coast & Geodetic Survey) of the U.S. participation in the International Indian Ocean Expedition for the fiscal year 1964 & 1965 amounts to \$6,068,000 and 3,904,000 respectively.

(Reports of U.S. Participation in IIOE)

The Academic Council of the Andhra University (India) has recognized the B.Sc. Degree awarded by the Academy of Ministry of Agriculture, Bagor, Indonesia as equivalent to the B.Sc. degree of that University for the purpose of admission to the M.Sc. Degree course in Meteorology and Oceanography, conducted by the Andhra University.

Shri H. N. Siddique, Assistant Geologist in the Geological Survey of India, Calcutta has been awarded a fellowship in the field of Marine Geology by UNESCO through the Indian National Committee on Oceanic Research. The fellowship commenced from 1st May 1964 and

is tenable for 10 months. His place of work will be the Oceanographic Institute of the Academy of Sciences, USSR.

Mr. Ramakantha Sarma, Director and Mr. William Ake Bergland, Cameraman of the United Nations Film Division who arrived at Calcutta on April 25 by U.S. Coast & Geodetic Survey Ship PIONEER visited Indian Ocean Biological Centre, Cochin and Thumba Equatorial Rocket Launching Station during the second week of May for taking footage for a United Nations Film entitled "The Count Down Under."

The British ship RRS DISCOVERY touched Cochin on May 9, 1964 and left on May 15, 1964. During her stay the Hospitality Committee set up by the Indian National Committee on Oceanic Research with the Vice-Chancellor, Kerala University as its Chairman, entertained the visiting scientists and took them around to various institutions.

The U.S. Research Ship "Anton Bruun" on completion of her number of cruises in the Indian Ocean as a part of her U.S. Programme in Biology, arrived at Bombay on May 11, 1964. On that occasion a farewell dinner was arranged by the local Hospitality Committee of the Indian National Committee on Oceanic Research. Prior to that Dr. S. H. Zaheer, Director-General, CSIR visited the Research Ship and was taken round by Dr. Chin, Assistant Director of the U.S. Biology Programme, Dr. T.S.S. Rao, Liaison Officer and Dr. Panikkar, Director of the Indian Programme.

The U.S. Research Vessel TE VEGA which is a 135' two masted Schooner, visited Cochin on 2.4.64 and left on 15.4.64. The ship is mainly carrying out biological and physiological studies, collections and observations in and around island groups and shallow water areas of the Indian

Ocean. During her halt at Cochin, the local Hospitality Committee of INCOR gave a reception in honour of the visiting scientists on board this ship.



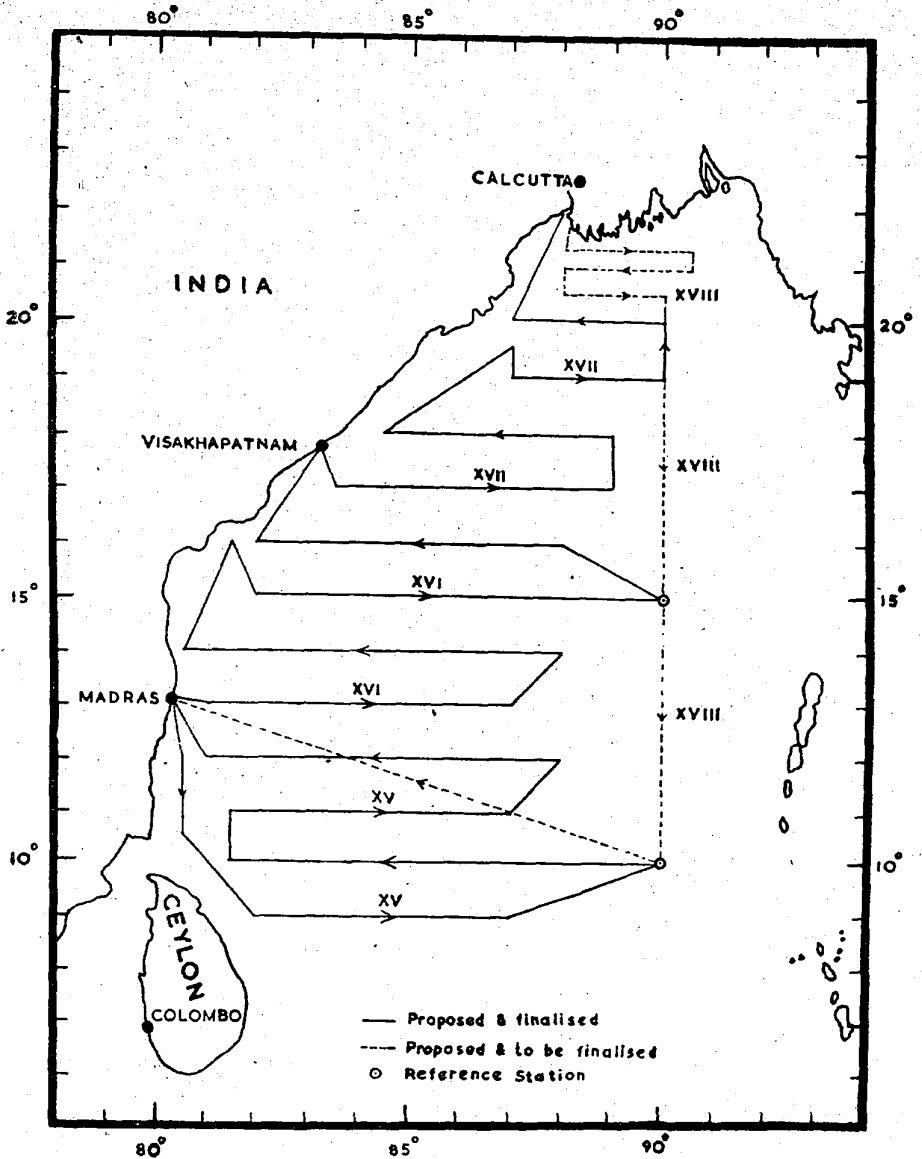
#### VISITORS:

The following persons visited the Indian Ocean Biological Centre and Indian Ocean Physical Oceanography Centre, Ernakulam:

1. Scientists aboard U.S. Research Vessel "TE VEGA". (Dr. Dixiele Ray Chief Scientist & party).
2. Dr. S. Krishnaswamy of Madras University.
3. Mr. Day of FAO's Office, New Delhi.
4. Mr. Griffin, FAO Expert (Marine Engineer)
5. Dr. T. S. Satyanarayana Rao, Liaison Officer, U.S. Programme in Biology, Bombay.
6. Dr. Edward Chin, Woods Hole Oceanographic Institute, Massachusetts, USA.
7. Mr. R. Crice, U.S.A.
8. Mr. Bruce Rogers aboard R/V Anton Bruun.
9. Miss Sherril Kite aboard R/V Anton Bruun
10. Mr. Rochford from CSIRO Australia.
11. Mr. B. Hamon -do-
12. Mr. F. Davies, -do-
13. Scientists aboard U.K. Research Vessel 'Discovery' (Dr. J. Swallow, Chief Scientist, Dr. R. I. Currie, Chief Biologist—and party of 15 other scientists).

#### Publications Received:

1. Research & Industry (CSIR) Vol. 9 No. 2 Feb. 1964.
2. Journal of Scientific and Industrial Research (CSIR) Vol. 23 No. 3 March 1964.
3. Indian Journal of Pure & Applied Physics (CSIR) Vol. 2 No. 3, March, 1964.
4. Limnology and Oceanography (USA)—Vol. 9 No. 1, January, 1964.
5. Information Newsletter of Industrial Liaison and Extension Services (CSIR) Vol. 3 No. 1, Jan-March, 1964.
6. Bulletin of the National Geophysical Research Institute, Hyderabad. Vol. 1 No. 3 September, 1963. Vol. 1 No. 4 December, 1963.
7. NODC Newsletter, Washington No. 1-64, 31 January, 1964.
8. The Seahorse published by Hydro Products Company, California, Vol. 1 No. 1.
9. Recommended Interim Procedures for Measurements in Biological Oceanography of the National Academy of Sciences, USA.
10. News Bulletin No. 5 of the U.S. Programme in Biology (Narrative Report—Anton Bruun Cruise 4A).
11. IOC—Information Paper No. 6.



Track Chart of INS Kistna for 1964 Monsoon Cruises.

