information paper

intergovernmental oceanographic commission

13

UNESCO/NS/IOC/INF - 70

FOREWORD

In the Foreword to our issue number 10, we have already made an appeal for information on any national or international symposia planned in connexion with the IIOE results. Since that time, we have tried to retransmit the information thus obtained on pages of our Information Paper. However, we still do not succeed in giving much advance information on such symposia. To help readers to be informed in advance of any IIOE symposia, the Office of Oceanography, Unesco, should like to receive early announcements of such scientific discussions through National Co-ordinators. If names of lecturers and titles of papers to be presented could be sent along with these announcements, such information would be indeed of great assistance to all scientists working on the Indian Ocean problems.

unesco

Unesco Office of Oceanography
Paris, June 1965

WS/0665.49 - AVS

IIOE INFORMATION PAPER No.13

1. Third Meeting of the Consultative Committee of I.O.B.C.

The Consultative Committee, which has been established by S.C.O.R. and Unesco, consists now of the following members: Mr. R. Glover (U.K.) (Chairman); Professor Motoda (Japan); Professor Vinogradov (U.S.S.R.); Dr. McGowan (U.S.A.); Professor Krishnaswamy (India). All members of the Consultative Committee, except Professor Krishnaswamy, participated in the Third Meeting of the Committee, held in Cochin from 8-16 April 1965. Dr. Panikkar, Professor Krey, Dr. Serene, Dr. Prasad and Dr. Hempel participated on behalf of the Indian C.S.I.R., S.C.O.R. and Unesco.

The Committee reviewed the reports by Dr. Panikkar and his collaborators and by Mr. Vagn Hansen, former international curator at I.O.B.C. The Committee commended the excellent work done by Mr. Vagn Hansen, who left I.O.B.C. in February 1965. The supervision of the sorting work is now done by the assistant curator, Mr. Kasturirangan. A total of 1646 samples has been received by the Centre. Another 1000 samples are likely to arrive before the close of the IIOE. About 500 samples of the International Collection have been sorted. A full description of the sorting procedure is under preparation. The Consultative Committee formulated the scientific terms of reference for the new international curator, who will be appointed in due course. They also outlined the Constitution for the International Collection and they prepared plans for the future scientific work of the Centre, which will now start a new phase by compiling and mapping the results of the sorting into 78 large systematic groups. Special attention will be paid to a quick analysis of the fish eggs and larvae.

The full report of the Meeting of the Consultative Committee, together with the report by the Director of I.O.B.C., will be published in the next issue of the IIOE Information Paper.

2. National Newsletter - India.

Indian Newsletter on IIOE, Volume II, Number 3, has been received. It contains information on IIOE activities in India and in other countries, as well as on recent meetings of international bodies. An extract from a cruise report of Indian ships appears in the next section of this issue.

3. Exchange of Data and Information.

3.1 Cruise Reports.

Australia.

H.M.A.S. DIAMANTINA, Cruise Dm 2/62. July 16 - August 25 1962.

Oceanographic Cruise Report Number 15, Oceanographic Observations in the Indian Ocean in 1962, H.M.A.S. DIAMANTINA, Cruise Dm 2/62, was published by the Division of Fisheries and Oceanography, C.S.I.R.O., Australia, and a copy was received by this Office.

The Cruise commenced at Fremantle on July 16 and worked a series of stations north along the 100°E meridian; thence to Singapore via. Sunda Strait. The Cruise then returned and crossed the 100°E meridian around 10°S and worked a line of stations north near the 95°E meridian. It then returned to Singapore via. Strait of Malacca. Finally, a line of stations was worked south along 100°E and the Cruise terminated at Fremantle (see Station Map in Annex I). During the Cruise, bathythermograph casts were made at 57 stations and the following samples were made:

Surface hydrology	..... 57 stations
Subsurface hydrology	..... 49 stations
Primary production	..... 28 stations
Pigments	..... 28 stations
Zooplankton	..... 23 stations

The temperature-salinity-depth recorder was used at 14 stations.

List of Scientists:

B. Hamon (Cruise Leader)
K. Fleming
J. Klye
C. Middleton
J. Prothero
B. Scott

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

H.M.A.S. GASCOYNE, Cruise G 2/65. February 1 - February 9 1965.

A summary of the above Cruise has been received from the Australian National Co-ordinator. An extract is reproduced below and the Station Map appears in Annex I.

List of Scientists:

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

Itinerary:

February 1, 1965	1000	Departed Sydney
February 9, 1965	1230	Arrived Port Lincoln

Programme:

Subsurface ..... at 45 stations.

India

(Extract from Indian IIOE Newsletter, Volume II, Number 3)

I.N.S. KISTNA, Cruise 19. August 17 - August 27 1964.

The ship left Madras on August 17 1964 with a complement of 15 scientists under the leadership of Dr. N. K. Panikkar and reached Singapore on the 27th of the same month.

12 stations were occupied in the eastern Bay of Bengal and the Strait of Malacca, and the following samples were made:

Hydrographic casts	12 stations
BT lowerings	24 stations
IOS net hauls	12 stations
Vertical closing net hauls	9 stations
Submarine photometer observations	5 stations
Phytoplankton sampling for the euphatic zone	9 stations
Radio-sonde ascents	3 stations

Cruise 20. September 2 - 1964.

The 20th scientific Cruise of the ship commenced on September 2 1964, under the leadership of Dr. S. S. Srivasta. A total number of 18 stations were occupied in this Cruise; in the first three of these only BT lowerings were made, while in the rest the following samplings were made:

Hydrographic casts	15 stations
IOS net hauls	11 stations
Vertical closing net hauls	13 stations
Submarine photometer observations	7 stations
Phytoplankton sampling (filteration of large volume of water)	9 stations
Surface meteorological observations	18 stations
Radio-sonde ascents	4 stations

During these Cruises, the EDO echo sounder was run almost continuously and daily wave observation as well. In a few stations collections of water samples were made for geochemical studies.

R.V. VARUNA.

The inorganic nutrient distribution studies were carried out in the Cruises of R.V. VARUNA during September - November 1963. The sampling stations and other particulars are given below:

Date	Cruise No.	Area	No. of Samples	Depths (Metres)	Details of the Analysis
6.9.63	100/V 37	Off Quilon	15	0-200	Phosphates; Silicate and Nitrates
20.9.63	100/V 38	Off Ratnagiri	34	"	"
25.10.63	103/V 40	Off Mangalore	48	"	"

1.11.63	104/V 41	Off Quilon	20	0-200	Phosphates; Silicate and Nitrates
4.12.63	106/V 43	Off Ratnagiri	46	"	Phosphates and Silicate only
18.12.63	107/V 44	Off Mangalore	20	"	"

U.S.A.

R.V. ANTON BRUUN, Cruise 3. August 8 - September 20 1963.

The final cruise report of R.V. ANTON BRUUN, Cruise 3, has been received by the Office. The contents of the report are similar to those of Cruise 2 (IIOE Information Paper Number 11).

R.V. ANTON BRUUN, Cruise 8. September 23 - November 9 1964.

A narrative report of the above Cruise has been received by the Office. The following is an extract from this report:

Area of Operation:

Mozambique Channel between Durban and Mombasa and the adjacent coastal waters of Africa, Madagascar, and the Comores Islands (see Station Map Annex 1).

Itinerary:

September 25, 1964	Depart Durban, South Africa
October 5, 1964	Arrive Beira, Mozambique
October 8, 1964	Depart Beira, Mozambique
October 24, 1964	Arrive Nossi Bé, Madagascar
October 24, 1964	Depart Nossi Bé, Madagascar
October 24, 1964	Arrive Diego Suarez, Madagascar
October 27, 1964	Depart Diego Suarez, Madagascar
October 28, 1964	Arrive Nossi Bé, Madagascar
October 29, 1964	Depart Nossi Bé, Madagascar
November 9, 1964	Arrive Mombasa, Kenya

Work Accomplished:

The following is the summary of works carried out during this Cruise:

Hydrographic casts	28 stations

Gulf of Mexico shrimp trawl	33 occasions
Okelman dredge	28 occasions
Menzies trawl	13 occasions
Rock dredge	6 occasions
Bottom snapper	1 occasion
Plankton net haul	12 occasions
2M plankton net haul	2 occasions
Anchor fishing	
Handline fishing	8 occasions
Deep line fishing	9 occasions
Flag line	1 occasion
Nightlite	5 occasions

Oceanographic Programme:

As on earlier cruises, the stations included measurement of temperature, salinity, dissolved oxygen, phosphate, nitrite, nitrate, silicate, particulate carbon, light penetration, phytoplankton pigments, primary productivity, IIOE standard zooplankton tows, and multiple depth vertical plankton hauls (Discovery NV-70 net). Nansen-bottle casts extended to or as near to the bottom as possible. Underway studies included meteorological observations, bathythermograph observations and continuous bathymetric recording.

Benthic Programme:

The main effort of Cruise 8 consisted of a bottom trawling programme in the Mozambique Channel and, to a greater extent, along the adjacent continental shelves. Sampling gear consisted of a Gulf-of-Mexico shrimp trawl (40 feet wide along the lead line), which was attached to the main trawl wire by means of a 60-foot bridle.

Supplementing the trawling operations, samples of smaller invertebrates and sediments were taken at frequent intervals with a variety of gear, including the Okelman dredge, Menzies trawl, rock dredge, and bottom snapper.

Nine lines, each consisting of about 50 baited hooks, and one fish trap were set on the bottom at depths ranging from 640 to 2150 meters. A total of seven sharks, two chimaeras, and one teleost, all adults and larger than had been expected, were taken by this means, suggesting that stronger gear, heavier anchors, greater floatation, etc. might have produced better results.

Indications of the presence of fishery resources available to trawling were found in two places. The largest catches with the shrimp trawl were made at Stations 396B and 396C, off Lourenco Marques, Mozambique, at a depth of 450 meters and consisted of a large proportion of market size shrimp (Hymenopeneus) and lobsters (Nephrops). A catch of very large peneid shrimps from Station 421G, off Formosa Bay, Kenya, in 240 meters suggests that the area may have an exploitable fishery. Trawl catches in other areas produced relatively small quantities of a quite diverse fauna and contained little of potential fishery interest.

Special Studies.

Physiological and biochemical studies of freshly-collected zooplankton were carried out during most of Cruise 8 (Durban - Nossi Bé). Collections were made at night from surface waters using a large (2 meter diameter) plankton net to obtain organisms in good condition. Principal emphasis was given to metabolic studies of euphausids and planktonic shrimp in relation to temperature and pressure. Effects of temperature on the respiration of pteropods, chaetognaths, and siphonophores and activity of euphausid lactate dehydrogenase were also studied.

A variety of fishes was collected by handlining in shallow water (20 to 60 meters), especially off Northwest Madagascar. Included in these efforts was the tagging and release of about 75 sharks. Numerous sonic indications of the presence of mid-water schools of fishes or invertebrates were observed over pinnacles and rough-bottom areas in the Mozambique Channel, but few surface schools were observed.

Rotenone collections of fishes were made at Chesterfield Island, off the Northwestern coast of Madagascar, and samples of invertebrates were collected there and on Banc du Castor, off Northern Madagascar, by SCUBA diving.

Scientific Personnel:

Chief Scientist:	Stewart Springer U.S. Fish & Wildlife Service Stanford University Stanford, California	Sharks
Participating Scientists:		
	B. E. Bell East African Marine Fisheries Research Organisation Zanzibar	Guest Scientist (Biological Oceanography)

Richard H. Benson U.S. National Museum Smithsonian Institution Washington, D.C.	Ostracods
Francis G. Carey Woods Hole Oceanographic Institution Woods Hole, Massachusetts	Plankton physiology
David Davies, Director Oceanographic Research Institute Durban, South Africa	Guest Scientist (Sharks)
Norberto Della Croce Instituto de Zoologia University of Genoa Genoa, Italy	Cladocerans-Penilia
Francis Dov Por Department of Zoology Hebrew University Jerusalem, Israel	Harpacticoids
Richard Gooding Biology Department Boston University Boston, Massachusetts	Copepods
Roy M. Johnson Life Science Division Arizona State University Tempe, Arizona	Bacteria
Leslie W. Knapp Smithsonian Oceanographic Sorting Centre Smithsonian Institution Washington, D.C.	Fishes
David Masch Woods Hole Oceanographic Institution Woods Hole, Massachusetts	Plankton physiology

Alain Sournia Centre d'Oceanographie et des Peches Nossi Bé, Madagascar	Primary production
James Sterling Virginia Institute of Marine Science Gloucester Point Virginia	Trematodes
John M. Teal Woods Hole Oceanographic Institution Woods Hole, Massachusetts	Plankton physiology
John H. Wallace Oceanographic Research Institute Durban, South Africa	Guest Scientist (Batoids)
Marvin L. Wass Virginia Institute of Marine Science Gloucester Point Virginia	Pagurids

Permanent Scientific Staff:

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

3.2 Cruise Plan.

Australia.

H.M.A.S. GASCOYNE, Cruise G5/65. March 29 - April 7 1965.

The Plan of the above Cruise has been received from the National Co-ordinator for IIOE. An extract is reproduced below and the track chart is identical to that of G2/65 (IIOE Information Paper Number II, Annex II).

Area of Operation:

From Adelaide through Investigator Strait to the continental shelf and

adjacent areas off Cape Catastrophe and the Investigator group of islands, Spencer Gulf, thence to Port Lincoln.

Objective:

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

Stations:

At position Stations listed and shown on chart.

Work at Stations:

Position Stations: Hydrological sampling to the bottom or 1500 m (whichever is less) for temperature, salinity, oxygen, and inorganic phosphate.

List of Scientists:

D. Vaux (Cruise Leader)
R. Bradley
L. Brown
F. Davies
J. Klye

Probable Itinerary:

March 29	Depart Adelaide
April 4	Arrive Port Lincoln
April 7	Depart Port Lincoln

Sampling and Observations:

Hydrology:

Position Stations: (1) In depths of 200 m or less. Nansen bottle sampling at 0, 10, 20, 30, 40, 50, 75, 100, 150, and 200 m.

(2) In depths greater than 200 m. Nansen bottle sampling at 0, 25, 50, 75, 100, 150, 200, 300, 500, 700, 900, 1100, 1300, and 1500 m.

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

Physics:

Echo sounding continuously
Meteorological reports on station

Laboratory Work:

Shipboard

Hydrology: Salinity, oxygen, and inorganic phosphate determinations.

3.3 IIOE Data Received by W.D.C.-A.

By copies of correspondence between W.D.C.-A, Oceanography, and IIOE participating countries, which have been received recently from the W.D.C.-A, Oceanography, the Secretariat was informed that the data of the following IIOE cruises has been received by the Centre.

Country	Ship	Cruise	Period	Remarks
France	NORSEL		March '59	does not appear in IIOE Cruise List
	COMMANDANT ROBERT GIRAUD	II	July-Sep.'59	
	COMMANDANT ROBERT-GIRAUD	III	April-June'61	
	COMMANDANT ROBERT-GIRAUD	V	Dec.'62-Feb.'63	

Japan	KOYO MARU		Nov.'62-Jan.'63
	KOYO MARU		Nov.'63-Jan.'64
	UMITAKA MARU		Nov.'60-Jan.'61
	UMITAKA MARU		Dec.'62-Jan.'63
	UMITAKA MARU		Dec.'63-Jan.'64
Portugal	ALMIRANTE LACERDA	1/64	April-May'64
U.K.	DISCOVERY	I	June-Aug.'63

Cruises, for which data has been received to date, are shown in Annex II of this issue of Information Paper.

4. Meteorological Programme.

An extract of "News from the Scientific Director's Office, Number 15, March 1965" is reproduced below.

The programme's two-year observation period ended on 31 December 1964. While data collection and processing continue, research results are emerging and special meetings are being planned for their presentation.

International Meteorological Centre.

Staff. Mr. C. R. V. Raman, Chief Research Forecaster at IMC since its establishment, was appointed Director, with effect from 2 December.

Mr. Francis P.W. Ho, U.N. computer expert on leave from the University of Hawaii, has begun work at IMC.

Lt. Col. F. R. Miller and Mr. J. R. Nicholson visited IMC during January. In the same month Mr. R. A. Smith, Electronic Technician, left Bombay for the United States. Fourteen local staff members of the U.S. Programme will continue to work at IMC during 1965.

The IBM 1620 computer successfully completed a trial computation of monthly mean resultant winds from aircraft observations. An expanded programme should produce information of value in the compilation of the IIOE atlases (see News Number 9).

The Geophysical Fluid Dynamics Laboratory of the U.S. Weather Bureau, under the direction of Dr. J. Smagorinsky, is preparing to test numerical methods of analysis and forecasting on a global scale. IMC has contributed by sending a set of rawinsonde error-checked punch cards for the Indian Ocean region to Washington. The cards comprise observations made at 00 and 12 GMT for the period 14-20 January 1964.

The German R.V. METEOR visited Bombay from 22 to 25 February. During her Arabian Sea cruise 155 rawinsonde ascents were made, reaching on an average a height of 30 kilometers.

The U.S. R.V. ATLANTIS II revisited Bombay from 16 to 19 March.

Reports on Research.

The Proceedings of the Symposium on Tropical Meteorology have been distributed by the New Zealand Meteorological Service. The Symposium, held in Rotorua from 5-13 November 1963 included several papers on Indian Ocean meteorology.

At the Fourth Western National Meeting of the American Geophysical Union, held at Seattle between 28 and 30 December, F. I. Badgley and C. A. Paulson presented a paper, Energy Exchange at the Surface of the Indian Ocean, Winter, 1964, in which they discussed findings from the University of Washington's MENTOR programme (News Numbers 9 and 10).

A symposium on IIOE Meteorology will be held on the afternoon of 19 April during a combined American Geophysical Union - American Meteorological Society meeting in Washington, D.C. Seven or eight meteorologists will present papers.

The Government of India is organising a symposium which will be co-sponsored by WMO and UNESCO. The symposium, on the meteorological results of IIOE, will be held in Bombay from 22 to 26 July.

General.

Microfilming of the 1963 and 1964 synoptic charts analysed at IMC is almost complete. Co-operating meteorological services from the following countries have asked for duplicates of the microfilm set:

Mauritius
Pakistan
United Arab Republic
United Kingdom
Viet Nam

Other services which have provided data for the project are invited to make their requirements known to me (see News Number 2).

signed: C. S. Ramage
30 March 1965

5. List of Scientists.

A list of experts in marine biology in Pakistan was received from Commander S. R. Islam, National Co-ordinator for the IIOE, and is reproduced in Annex III.

6. Coming Meetings of Interest.

6.1 Unesco/WMO Symposium on the Meteorological Results of the International Indian Ocean Expedition.

The Symposium, jointly sponsored by Unesco and WMO, will be held in Bombay from July 22 - 26 1965. This is being organised jointly by the Indian Meteorological Department and the Indian National Committee for Oceanic Research. The programme for the Symposium will include the following subjects:

1. Air-sea interaction and interaction at ocean-continental boundary.
2. General circulation over the Indian Ocean.
3. Tropical cyclones.
4. Satellite meteorology.
5. Morphology of the monsoons and synoptic models for the tropics.
6. Monsoon forecasting.

6.2 Symposium "U.S. Programme in Biology, International Indian Ocean Expedition".

The above Symposium is to be organised under the Chairmanship of Dr. J. H. Ryther, Woods Hole Oceanographic Institution, on June 15 in Washington, during the course of Ocean Science and Ocean Engineering Conference and Exhibition, June 14-17, to be organised by the Marine Technology Society and the American Society of Limnology and Oceanography. The following is the programme of the Symposium.

Physical oceanographic conditions on the shelf near Karachi, November 1964 ... L. A. E. Doe, Bedford Institute of Oceanography.

Measurements of transparency and bioluminescence in the Indian Ocean ... G. L. Clarke, Harvard University and Woods Hole Oceanographic Institution.

Production and distribution of organic matter in the western Indian Ocean ... John H. Ryther and D. W. Menzel, Woods Hole Oceanographic Institution.

Nitrogen fixation in the Arabian Sea and Sargasso Sea ... R. C. Dugdale and John J. Goering, University of Alaska.

Structural composition of benthic communities ... H. L. Sanders, Woods Hole Oceanographic Institution.

Benthic life of the Mozambique Channel and Natal Deep between 1000 and 3000 FM ... O. Hartman, Allan Hancock Foundation and P. Field, University Capetown, and K. J. Boss, U.S. Bureau Commercial Fisheries.

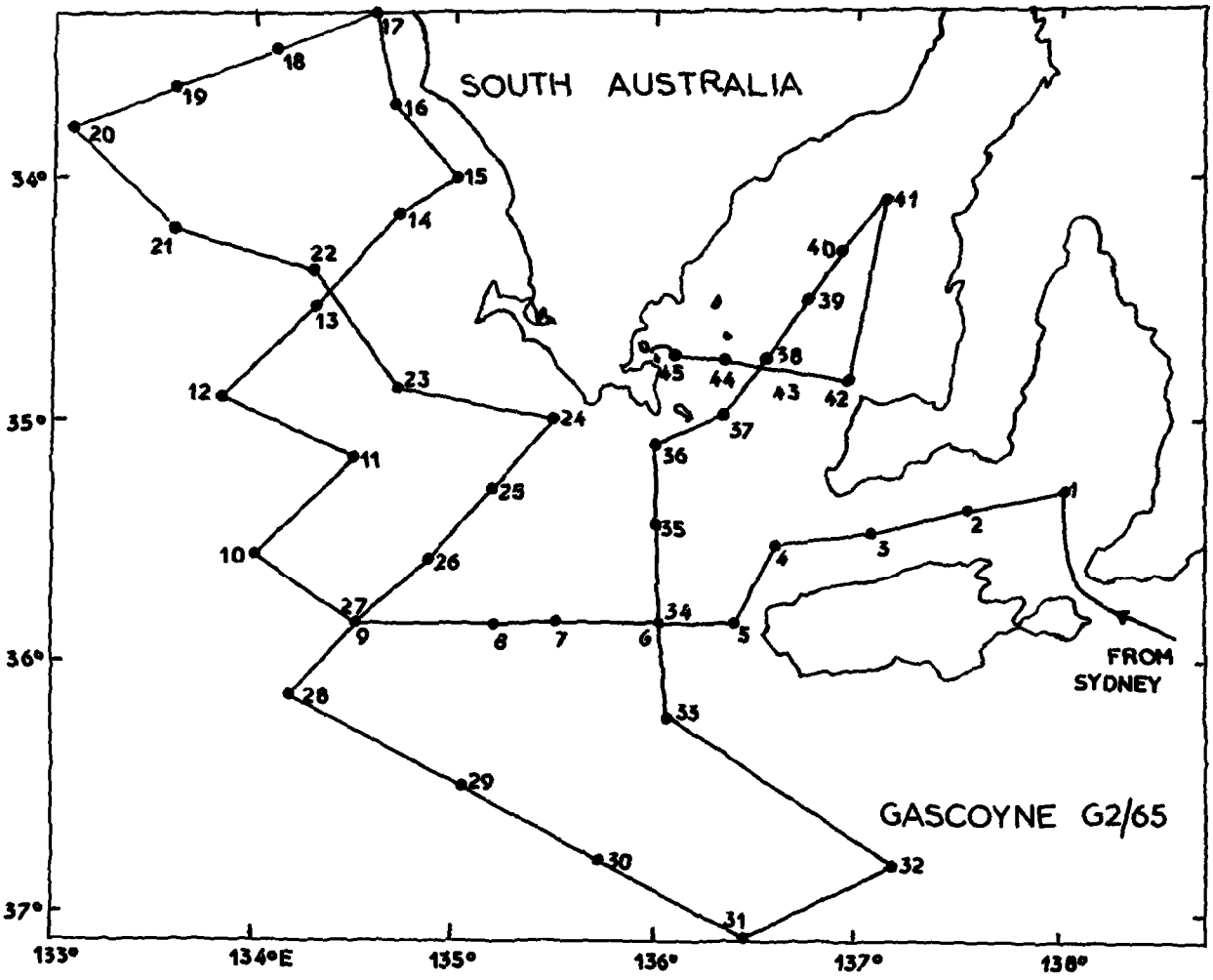
Preliminary results of the foraminiferal study, ANTON BRUNN Cruise 7 ... O. L. Bandy and R. J. Echols, Allan Hancock Foundation.

7. Recent Publication.

The Australian Journal of Science, Volume 27, Number 6, December 1964, contains an article entitled "The International Indian Ocean Expedition", by J. V. Leyendekkers of the Division of Fisheries and Oceanography, C.S.I.R.O. This article is based on papers presented during the ANZAAS Canberra Congress at the Symposium on the International Indian Ocean Expeditions. The papers were read by Captain A. H. Cooper, Royal Australian Navy; Mr. E. L. Deacon, C.S.I.R.O., Division of Meteorological Physics; Mr. H. Jitts; Dr. G. L. Kesteven; Mr. D. J. Rochford; and Mr. D. J. Tranter, C.S.I.R.O., Division of Fisheries and Oceanography.

The article contains the history of the development of IIOE programmes, problems to be studied by the Expedition, the interesting results obtained, and references.

ANNEX I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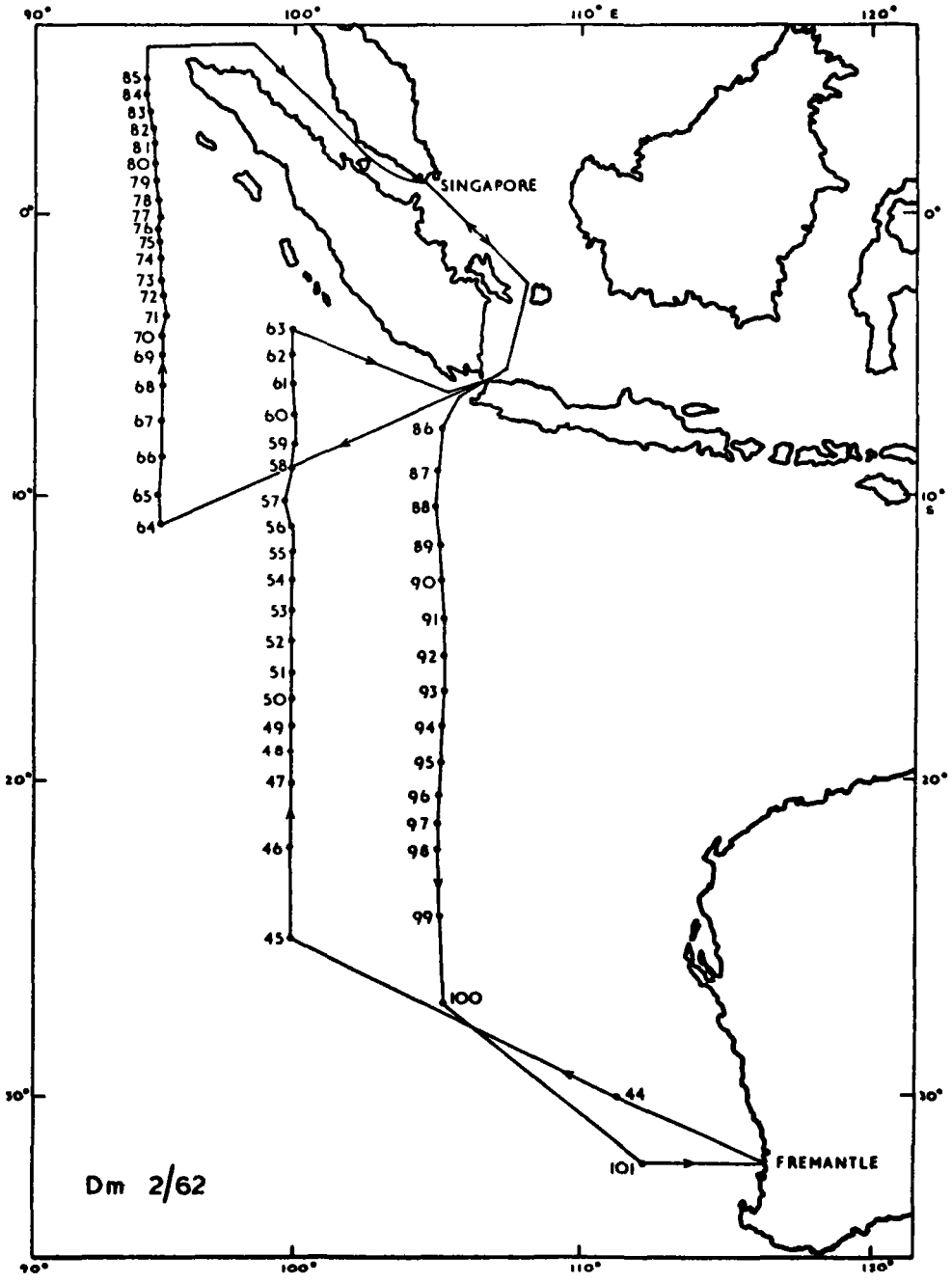
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SINGAPORE
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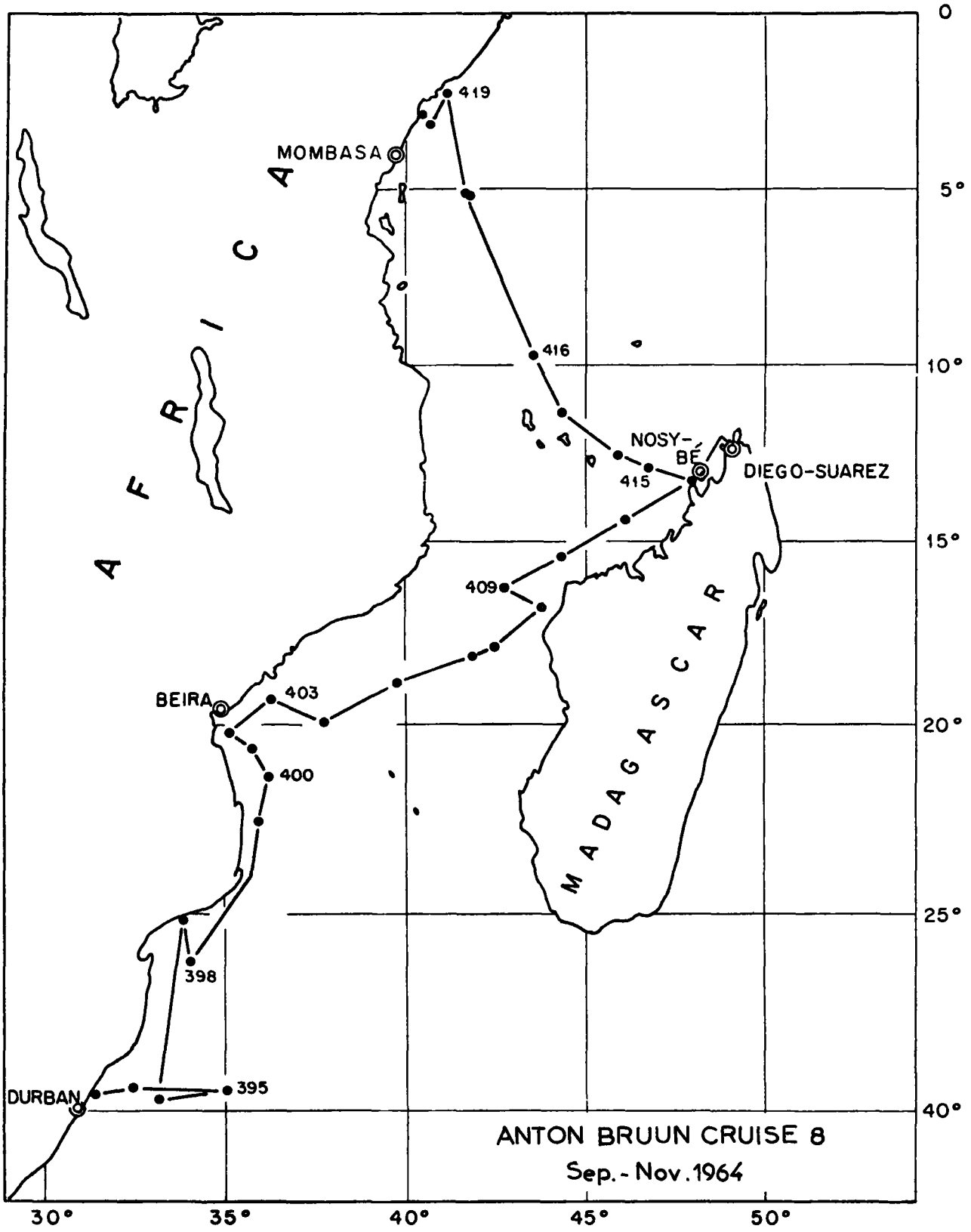
AFRICA
MADAGASCAR
MOMBASA
BEIRA
DURBAN
NOSY-BÉ
DIEGO-SUAREZ
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400
398
395
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30°
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45°
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ANTON BRUUN CRUISE 8
Sep. - Nov. 1964

ANNEX II

LIST OF IIOE CRUISES

Data received by WDC-A, Oceanography, as at 30 October, 1964.

COUNTRY & SHIP	PERIOD	TYPES OF DATA RECEIVED
AUSTRALIA		
x Diamantina	11/X-19/XI/59	Dol, 5, 8; Psl, 2g, 4, 5
x - do -	2/11-23/111/60	Dol, 5, 8; Psl, 2g, 4, 5
x - do -	11/VII-26/IX/60	Dol, 5, 8; Psl, 2g, 4, 5
x - do -	16/X-15/XI/60	Dol, 5, 8
x - do -	14/11-10/III/61	Dol, 5; Psl, 2f, g, 4, 5
x - do -	1/V-12/VI/61	Dol, 5; Psl, 2f, g, 4, 5
x - do -	20/VII-26/VIII/61	Dol, 5, 8; Psl, 2f, g, 4, 5
x - do -	12/II-25/III/62	Dol, 5, 8; Psl, 2g, 4, 5
x - do -	16/VII-25/VIII/62	Dol, 5, 8; Psl, 2a, 4, 5
x - do -	24/IX-6/X/62	Dol, 5, 8; Psl, 2a, b, g, 4, 5
x - do -	15/X-13/XI/62	Ps 4, 5
x - do -	28/III-27/IV/63	Ps 4, 5
x - do -	6/V-6/VI/63	Ps 4, 5
x - do -	9/VII-9/VIII/63	Ps 4, 5
- do -	20-23 & 27-29/VIII/63	
x - do -	4-28/IX/63	
- do -	5-12/X/63	
- do -	28/1-6/11 & 14-18/II/64	
- do -	24/III-21/IV/64	
- do -	4/V-15/VI/64	
- do -	20-29/VII/64	
- do -	10/VIII-7/IX/64	
- do -	5/-20/X/64	
Gascoyne	21/II-15/III/61	
- do -	4-5/VI, 18/VI-12/VII/62	
- do -	3-13/VIII/62	
x - do -	19/VIII-16/IX/62	Dol, 5, 8; Psl, 2a, b, f, g, 4, 5
x - do -	17/I-17/II/63	Dol, 5, 8; Ps
x - do -	4-9/III/63	Dol, 5, 8
- do -	13/1-6/11/64	
- do -		

x cruises received.

COUNTRY & SHIP	PERIOD	TYPES OF DATA RECEIVED
Gascoyne	21-26/11/64	
- do -	5-25/III/64	
EAST AFRICA		
Manihine	11/I-20/III/64	
FRANCE		
* R. Giraud	1/VII-27/IX/60	- - - - - - - -
* - do -	4/IV-16/VI/61	- - - - - - - -
- do -	3/VII-10/X/62	
* - do -	19/XII/62-18/II/63	- - - - - - - -
* Norcel	III/59	- - - - - - - - (15 sta.)
GERMANY		
Meteor	29/X/64-12/V/65	
INDIA		
Kistna	23/IX-4/X/62	
- do -	13-21/X/62	
- do -	3-14/XI/62	
- do -	26/XI-6/XII/62	
- do -	17-29/I/63	
- do -	5-15/II/63	
- do -	21-28/II/63	
- do-	14-20/III/63	
- do -	18-24/VI/63	
- do -	1-15/VII/63	
- do -	17-22/VII/63	
- do -	25-31/VIII/63	
- do -	7-13/VIII/63	
- do -	19-27/VIII/63	
- do-	2-18/IX/63	
- do -	22/V-17/VIII/64	
Varuna	IX-X/62	

* cruises received

- - - - - - details are not known

COUNTRY & SHIP	PERIOD	TYPES OF DATA RECEIVED
Varuna	X-XII/62	
- do -	VI-IX/63	
- do -	IX-XII/63	
- do -	Programme not ready yet	
Bangada	- do -	
Conchi	- do -	
INDONESIA		
*Jalanidhi	1-7/IV/63	Dol-5
* - do -	6-26/VI/63	Dol-5
* - do -	-	Dol-5
JAPAN		
Hokusei-Maru	5/XI/61-1/II/62	
Kagoshima-Maru	12/VII-1/IX/61	
- do -	5/VII-29/VIII/62	
- do -	10/XI/63-18/II/64	
Keiten-Maru	22/V-4/VII/61	
- do -	10/V-7/VIII/62	
- do -	5/V-2/VIII/62	
*Koyo-Maru	24/X/62-18/II/63	- - - - - - - -
* - do -	25/X/63-18/II/64	- - - - - - - -
*Oshoro-Maru	17/XI/62-12/II/63	Do; Ps; Fr.
- do -	11/XI/63-9/II/64	
*Umitaka-Maru	12/XI/60-12/I/61	- - - - - - - -
* - do -	28/X/61-16/III/62	- - - - - - - -
* - do -	29/X/62-11/II/63	- - - - - - - -
- do -	XI/63-II/64	
PAKISTAN		
Zulfiquar	XII/61-IV/62	

* cruises received
- - - - - - - details not known

COUNTRY & SHIP	PERIOD	TYPES OF DATA RECEIVED
Zulfiquar	18-22/X/62	
- do -	2-5/XII/62	
- do -	I-V/63	
- do -	X/63-11/64	
- do -	1964	
Madagar	1962	
- do -	I-IV/63	
- do -	X-XII/63	
PORTUGAL		
※Lacerda	11/IV-28/V/64	- - - - - - - -
- do -	7/IX-1/X/64	
SOUTH AFRICA		
※Africana II	7/VI-20/VII/61	Dol, 4, 5, 8
※※ - do -	15/VI-14/VII/62	Dol-5, 8
※※ - do -	2-20/IV/63	Dol-5, 8
※Natal	2-24/IV/62	Dol-4, 8
※※ - do -	7-24/V/62	Dol, 8
※※ - do -	4-22/VI/62	- do -
※※ - do -	2-24/VII/62	Dol, 8
※※ - do -	6-30/VIII/62	Dol, 8
※※ - do -	1-22/X/62	Dol, 8
- do -	5-22/XI/62	
※※ - do -	7-29/I/63	Dol, 8; Psl, 2a, 4, 5
- do -	11/II-8/III/63	
- do -	10-28/VIII/64	
- do -	2/IX-1/X/64	
- do -	5/X-28/X/64	
- do -	9/XI-7/XII/64	

※ cruises received
- - - - - - - - details not known

COUNTRY & SHIP	PERIOD	TYPES OF DATA RECEIVED
⁎Lady Theresa	Monthly since 1960	- - - - - - - -
J. D. Gilchrist	-	
A. Queen	VIII/62	
THAILAND		
Oceanogr. V.II	XII/62-I/63	
U.K.		
Dalrymple	8/X/61-10/III/62	
- do -	13/X/62-8/IV/63	
⁎ Discovery	14/VI-20/VIII/63	- - - - - - - -
- do -	23/VIII-22/XI/63	
- do -	28/II-14/IX/64	
⁎ Owen	31/X/61-13/V/62	Do7; Gg6, 7
- do -	21/X/62-30/V/63	
- do -	29/IX/63-27/VI/64	
U.S.A.		
⁎ A. Bruun	12/III-7/V/63	Do1-5; Ps1, 2a, d; Fr1-3
⁎ - do -	22/V-23/VII/63	Do1-5; Ps1, 2a, d, 4, 5; Fr1, 2, 3
- do -	8/VIII-20/IX/63	
- do -	25/IX-1/XII/63	
- do -	1/I-28/III/64	
- do -	9/IV-1/VI/64	
- do -	12/VI-26/VII/64	
- do -	6/VIII-25/IX/64	
- do -	3/X-25/XI/64	
⁎ Argo	19/X/60-22/I/61	Do1-4
⁎ - do -	28/VI-29/IX/62	Do1
⁎ - do -	4/X-23/XII/62	Do1,4
- do -	1/I-12/II/63	
⁎ - do -	16/II-15/V/63	Do1,5

⁎ cruises received
- - - - - - - details not known

COUNTRY & SHIP	PERIOD	TYPES OF DATA RECEIVED
x Argo	18/V-29/V/63	Dol, 4
- do -	15/VII-31/VII/64	
- do -	4/VIII-7/IX/64	
- do -	10/IX-6/X/64	
Atlantis II	1/VII-19/XII/63	
- do -	II-VI/65	
Chain	IX/64-III/65	
x Conrad	6/I-2/III/64	Ab 2 (location only)
x East Wind	V/61	Do.
x Horizon	4/X-23/XII/62	Dol
x Pioneer	11/II-23/IX/64	Dol
x Requisite	I-III/61	Do.
x Serrano	III-VI/61	Do.
- do -	XI-XII/61	
- do -	I-II/63	
S. F. Baird	VII-X/64	
Te Vega	X-XII/63	
- do -	II-IV/64	
- do -	VI-IX/64	
x Vema	27/XII/59-31/III/60	Dol; Ab 2; Ggl (location only for Ab & Gg)
x - do -	31/V-1/VIII/62	Ab 2; Ggl (location only)
x - do -	10/VII-14/IX/63	Ab 2; Ggl (location only)
U.S.S.R.		
x Vityaz	IX/59-III/60	Dol-8; Psl-3, 5; Abl; Ggl, 2
x - do -	X/60-IV/61	- do -
x - do -	23/VI-23/XI/62	- do -
- do -	IX/64-II/65	

x cruises received

COUNTRY & SHIP	PERIOD	TYPES OF DATA RECEIVED
Acad. Y. M. Shokalski	VII/60	
Vorobyev	X/61-II/62	
- do -	VI-X/62	
- do -	IV/63-II/64	
- do -	VI-X/64	
Orlik	XI/62-III/63	
- do -	XI/63-IV/64	

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ANNEX III

List of Experts in Marine Biology in Pakistan

S. No.	Name	Address	Subject
1.	Dr. S.M. Haq	Department of Zoology, Karachi University, University Campus, Country Club Road, Karachi.	Plankton
2.	Dr. Nizamuddin	"	Taxanomy of Marine Algae
3.	Dr. M. Tufail	"	Shore Ecology
4.	Dr. Mrs. N. Tirmizi	"	Taxanomy of Shrimps and Prawns
5.	Prof. M.A.H. Qadri	Dean, Faculty of Science, Karachi University, University Campus, Country Club Road, Karachi.	Zoogeography
6.	Dr. M. R. Qureshi	Director of Marine Fisheries, Fish Harbour, West Wharf, Karachi.	Fishes
7.	Dr. A.R. Ranjha	Director, Zoological Survey of Pakistan, Fish Harbour, West Wharf, Karachi	Mollusca

LEGEND

Do	Descriptive oceanography
1	Temperature with reversing thermometer
2	Temperature with BT
3	Salinity
4	Oxygen
5	Naturient salts
6	pH
7	Bathymetry
8	Surface weather observation at the station
Cm	Current measurement
1	With GEK
2	With current meter
3	With Swallow float or drogue
4	With drift-bottle
Ps	Plankton study
1	Phyto-plankton
2	Zoo-plankton
a	Indian Ocean Standard Net
b	Isaacs-Kidd midwater trawl
c	Vertical haul with closing net
d	Oblique haul
e	Horizontal haul
f	High-speed surface sampler
g	Clarke-Bumpus sampler
3	Larva net
4	Pigments
5	Primary production, standing crops
6	Micro-biology
7	Marine bacteria
8	DSL
Ab	Biological study in deep layer
1	Benthic sample
2	Bottom photography
Ph	Physical study
1	Sound velocity
2	Turbidity
Ch	Chemical study
1	H_2S
2	CO_2
3	Trace elements
4	Radio-activity & isotops
Fr	Fisheries research
1	Experimental fishing
2	Fish sampling
3	Bionomics
4	Gear experiment
5	Tagging
6	Visual observation
Gg	Geology and Geophysics
1	Coring
2	Sediment sampling
a	Dredging
b	Grabbing
3	Sparker
4	Seismic study
5	Heat flow
6	Gravity
7	Magnetism
8	Drilling
9	others (specify)
Mt	Meteorology
1	Synoptic observation
2	Upper-air observation
3	Radiation & energy exchange
4	Wave recording