

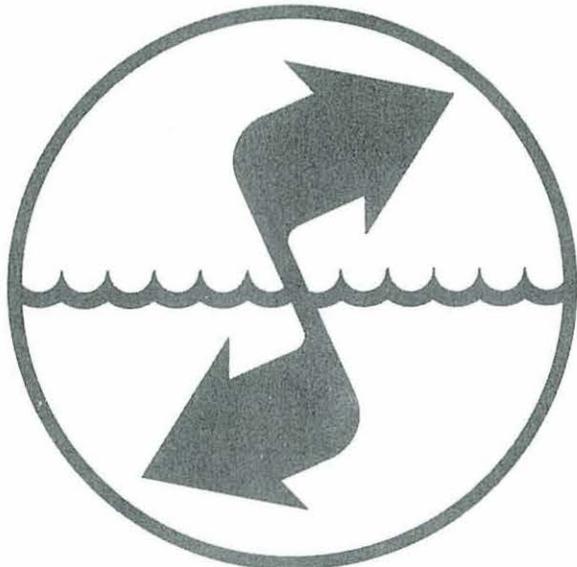
U.S. PROGRAM IN BIOLOGY
INTERNATIONAL INDIAN OCEAN EXPEDITION

NEWS BULLETIN NO. 4

NARRATIVE REPORT: ANTON BRUUN CRUISE 3

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Woods Hole Oceanographic Institution

INTERNATIONAL
INDIAN OCEAN
EXPEDITION



WOODS HOLE OCEANOGRAPHIC INSTITUTION

FEBRUARY 1964

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CRUISE III: R.V. ANTON BRUUN

I. Objectives and Cruise Description:

The primary purpose of Cruise III was to sample the deep-sea ichthyofauna in the western Indian Ocean, and to relate the distributions of species and biomass to the physicochemical and biological properties of the water masses sampled on a north-south transect. Midwater trawling stations were occupied at approximately 3-degree intervals from 12°N to 13°S and from 23°S to 44°S along the 60°E meridian.

At all but the last station, the permanent scientific staff completed the standard IIOE stations, including a hydrographic cast to 2000 m, chemical analyses of sea water, productivity measurements, and various plankton tows. Other special programs included regular measurements of bioluminescence in the scattering layers and of sunlight penetration, vertical sampling of yeasts in special sterile samplers, a study of the distribution of stomatopod crustaceans, and regular meteorological observations. The yeast sampling south of Mauritius and the photometer light measurements were incorporated into the hydrographic cast so that these three programs could be run simultaneously.

II. Itinerary (see Figure I):

Cruise III departed Bombay on August 8, 1963 and headed southwest picking up the 60th E meridian on August 13 where the first station was occupied. The ship then proceeded due south along 60°E occupying stations approximately every 3° of latitude for a total of 9 stations (HS 145-153) through August 25. The ship then proceeded southwest to Mauritius for refueling and provisioning.

Departing Mauritius on September 3, the BRUUN headed on a southeasterly cruise again picking up 60°E longitude on September 4 and thence proceeding south to approximately 44°S latitude, occupying an additional 8 stations. The ship then returned to Mauritius where Cruise III terminated on September 20.

III. Scientific Program (see Table I):

A. The basic program.

The basic hydrographic, chemical and biological program was carried out at each of the 17 stations occupied on Cruise III with the exception of the last station. The hydrographic cast was made to 2000 m on all stations except Station 151 where observations were extended to 4000 m. Standard depths sampled were 1, 25, 50, 75, 100, 125, 150, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1400, 1700, and 2000 meters. Measurements and determinations at each depth included temperature, salinity, dissolved oxygen, phosphate, nitrite, nitrate, and silicate.

Additional information on thermal structure was obtained with the bathythermograph at each station and at intervals of one hour between stations.

Primary productivity and phytoplankton pigments were also measured at 16 stations. Water samples for this purpose were collected with a plastic sampler at depths corresponding to the penetration of 100, 50, 25, 10, and 1% respectively of the incident radiation. Primary productivity was measured by the C^{14} technique, exposing water samples from the five above mentioned depths to sunlight in a simulated in situ incubator on deck for 24 hours and in an artificially illuminated incubator at 1000 foot candles in the laboratory for 4 hours.

Indian Ocean Standard Net vertical plankton tows from 200 meters to the surface were also taken at 16 stations. Vertical microplankton tow from 200 meters to the surface was taken at 12 stations. Zooplankton samples were also collected using the pressure operated multiple depth, oblique plankton samplers (Be' nets) at 11 stations. Depth intervals sampled were 0-125 meters, 125-250 meters, 250-500 meters, 500-1000 meters, and 1000-2000 meters. The IOSN plankton tows have been deposited at the

International Biological Center at Cochin, India. The remaining plankton samples have been deposited at the Smithsonian Oceanographic Sorting Center, Washington, D.C. One-half hour surface and oblique zooplankton hauls using a 1 meter diameter, No. 0 mesh net were taken on 11 occasions at night at approximately 2100 hours. These special plankton tows were taken for the special interests of the participating scientists from the Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, and the University of Hawaii. They have been deposited with the B.C.F. Laboratory at Honolulu, Hawaii where they will receive preliminary sorting and where certain zooplankton and fish larva will be removed prior to their being forwarded to the Smithsonian Oceanographic Sorting Center for final disposition.

B. Midwater trawling.

A total of 28 midwater trawl hauls were taken at 17 stations with the 10' Isaacs-Kidd Midwater Trawl: 14 shallow tows averaging 700 m maximum depth and 14 deep tows averaging 1890 m maximum depth. Wherever possible, both a shallow and deep tow were taken at each station. Because of time limitations and various technical problems a few stations were necessarily shortened. Only one trawl haul was taken at stations 2, 5, 8, 9, and 11. When operational, a cod-end closing device (developed by Mr. Peter Foxton, National Institute of Oceanography, England) separated the catch of midwater fishes and invertebrates into two components: 1) for the shallow tows: one up-down sample between the surface and approximately 150 m, and one at-depth sample from about 150 m to the greatest depth trawled; 2) for the deep tows, one up-down sample between the surface and approximately 275 m, and an at-depth sample from about 275 m to greatest depth. During the course of the trawl haul, trigonometric wire-angle depth determinations were regularly made by multiplying the meters of

wire out by the cosine of the angle inscribed by the wire leaving the sheave on the starboard A-frame. A Woods Hole Oceanographic Institution Bourdon tube time-depth recorder (TDR) was usually clamped near the trawl as a check on the trigonometric depth determinations. When the Precision Graphic Depth Recorder was functioning, the position of the deep scattering layers were regularly observed. These depths were noted by time on the midwater trawl log sheet, and most of the records were saved. Wet displacement volumes of fishes and invertebrates for all samples were measured in a 1000 cc graduated cylinder and recorded on the trawl logs. Both fishes and invertebrates, after being sorted one from the other, were initially preserved and bottled according to depth sample in 10% buffered formalin. All were later packaged in polyethylene bags, canned, and shipped to the United States: most of the fishes to the Woods Hole Oceanographic Institution, the melamphuids (fishes) to the University of California at Santa Barbara, and the invertebrates to the Sorting Center at the U. S. National Museum.

The fishes were sorted at Woods Hole and (the melamphuids only) 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 physicochemically and biologically defined water masses. Materials from Cruise VI, a second midwater trawling venture on the ANTON BRUUN planned for the spring of 1964, will also be incorporated into these surveys.

Mr. Chen extracted and preserved testes or ovaries of most melamphuids for later histological study at the University of California. He will incorporate his findings into a general karyotaxonomic survey of the family.

C. Submarine light penetration and bathyluminescence.

Measurements were made of sunlight penetration to depths as great as 800 m and of bioluminescent flashing to depths as great as 3400 m using a sensitive photomultiplier-type photometer. During the first section of the cruise (Bombay-Mauritius) these studies were made at 9 stations with a total of 19 lowerings of the instrument.

On the second section, south of Mauritius, the light studies were made in conjunction with the standard hydrographic stations, using 4-conductor cable for the latter with the photometer at the bottom of the wire in lieu of a lead weight. By this means it was possible to include light measurements as a part of all the remaining hydrographic stations.

D. Marine yeast studies.

Sterile water samplers (Niskin samplers) were interspersed between Nansen bottles during hydrographic stations. Uncontaminated samples obtained in this manner were plated on special agar medium for the culture of marine yeasts. Information was thereby obtained on the geographical and depth distribution of these organisms, cultures of which were returned to the University of Miami for further study.

IV. Personnel:

Chief Scientist:	Alfred Ebeling (fishes) - Yale University
Visiting Scientists:	Robert Gibbs, Jr. (fishes) - U. S. National Museum
	George Clarke (light studies - Harvard University
	Allan Bé (zooplankton) - Lamont Geological Observatory
	Sidney Townsley (stomatopod crustacea) - University of Hawaii
	Jack Fell (yeasts) - University of Miami

Tchaw-ren Chen (fishes) - Yale University

Peter Connors (meteorology) - U. S. Weather
Bureau

Shigeru Yano (fisherman) - B.C.F., Hawaii

Permanent Scientific Staff:

Andrew Bakun - Chemical Oceanographer

Don Fenner - Biological Oceanographer

Mark Jones - Chemical Oceanographer

Mahlon Kelly - Biological Oceanographer

Sidney McGuire - Physical Oceanographer

John Hall - Biological Oceanographer

Alan Pease - Physical Oceanographer

Bruce Rogers - Biological Oceanographer

TABLE I

SUMMARY OF ACTIVITIES, CRUISE III of R/V ANTON BRUUN

Date	Sta. No.	Tentative Position	Hydro-Cast	Vertical Plankton		Oblique Plankton	Night Plankton	I-K Trawl	Primary Production
				IOSN	Micro	Be	No. 0		
13-14 Aug	145	12°00'N 60°54'E	x	x			x	x	x
15 Aug.	146	10°09'N 59°55'E	x	x		x		x	x
16 Aug.	147	7°14'N 59°53'E	x	x	x	x		x	x
17 Aug.	148	4°12'N 60°08'E	x	x	x	x	x	x	x
19 Aug.	149	1°23'N 60°11'E	x	x	x	x		x	x
20 Aug.	150	1°58'S 60°06'E	x	x	x	x	x	x	x
22 Aug.	151	5°03'S 60°10'E	x	x		x	x	x	x
24 Aug.	152	7°31'S 59°56'E	x	x		x		x	x
25 Aug.	152A	10°23'S 60°08'E					x		
25 Aug.	153	12°09'S 58°35'E	x	x		x		x	x
28 Aug.	153A	16°40'S 56°54'E			x		x		
4 Sept.	154	23°00'S 59°46'E	x	x	x	x		x	x
5 Sept.	155	25°52'S 60°00'E	x	x	x		x	x	x
6 Sept.	156	28°54'S 60°01'E	x	x	x	x	x	x	x
7 Sept.	157	31°58'S 59°45'E	x	x	x			x	x
8 Sept.	157A	32°28'S 59°52'E					x		
9 Sept.	158	34°56'S 60°05'E	x	x	x	x		x	x
10 Sept.	159	38°01'S 59°53'E	x	x	x		x	x	x
12 Sept.	160	40°53'S 60°01'E	x	x	x		x	x	x
13 Sept.	160A	43°59'S 60°01'E						x	

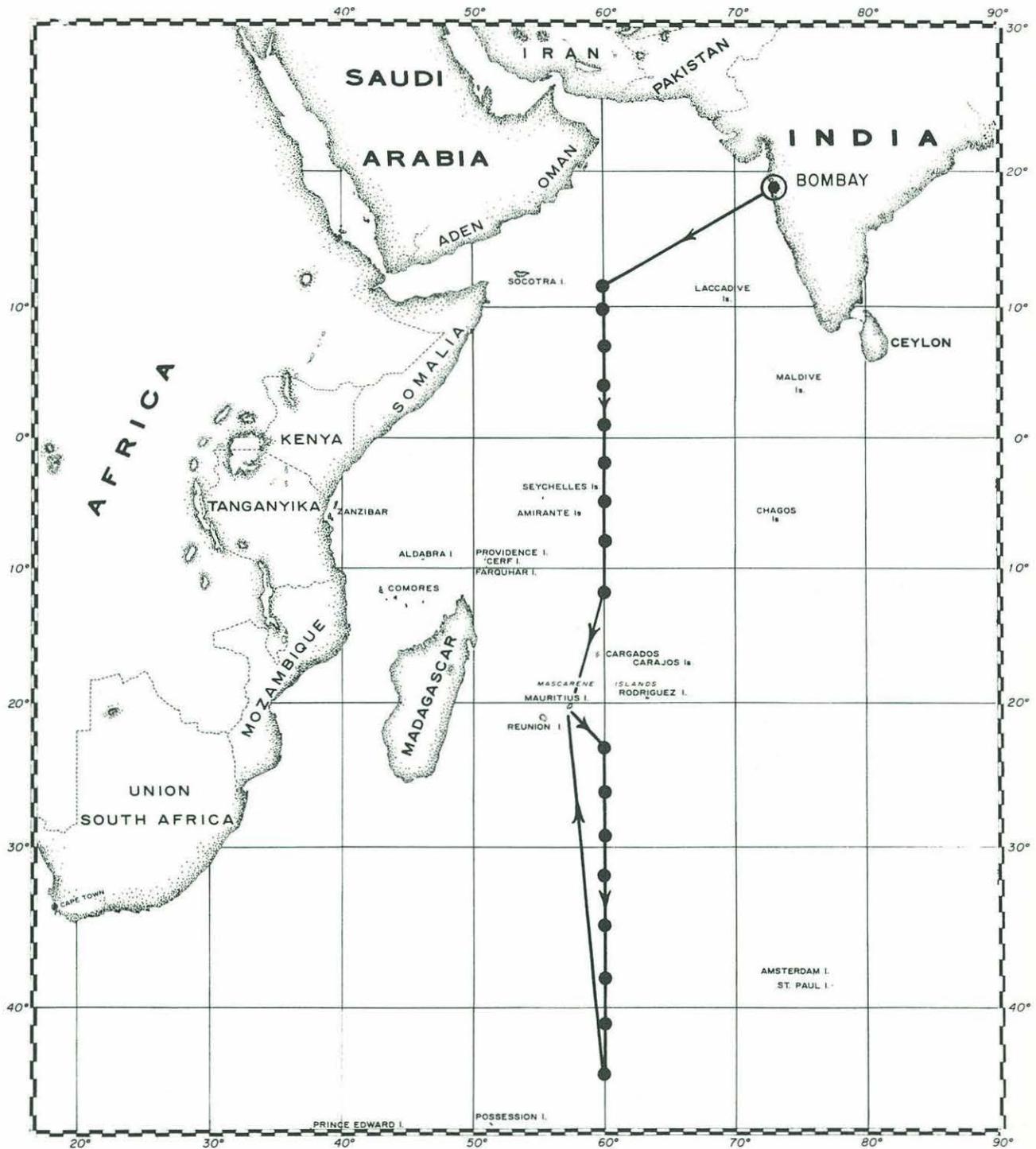
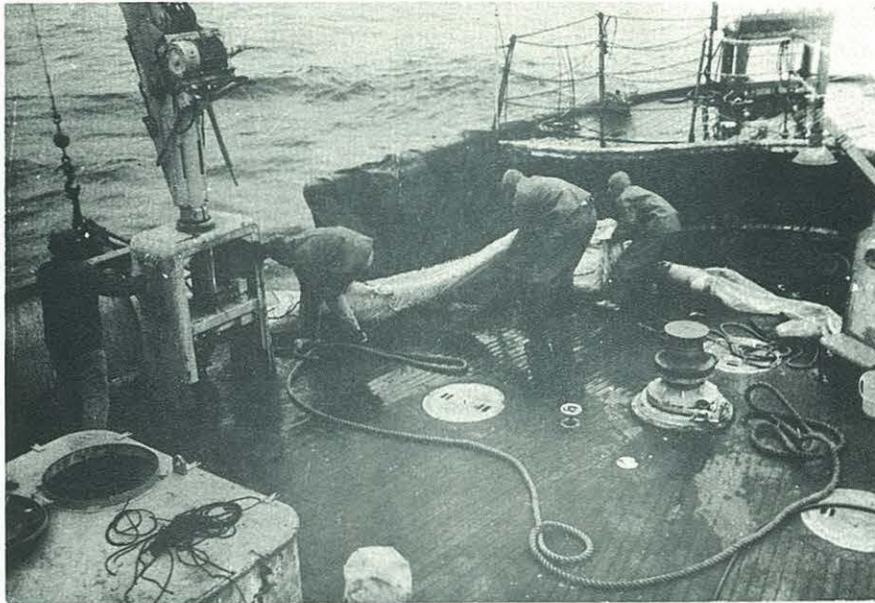


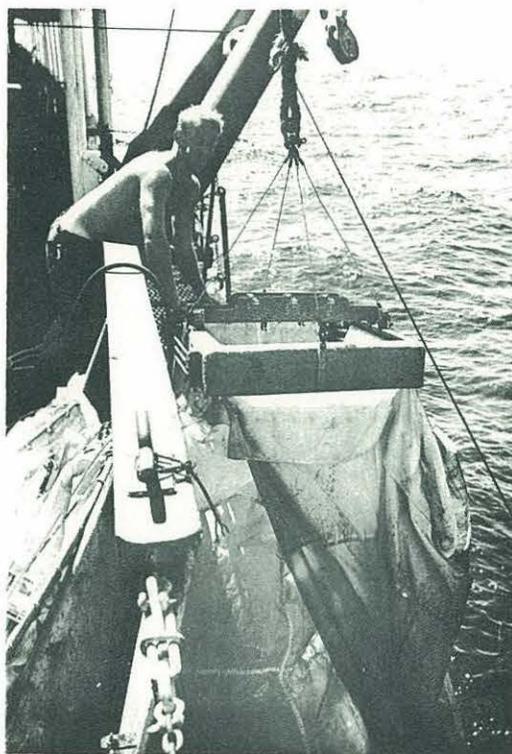
FIGURE 1



Placing Isaacs-Kidd midwater trawl overboard preparatory to lowering.



Retrieving I-K midwater trawl.



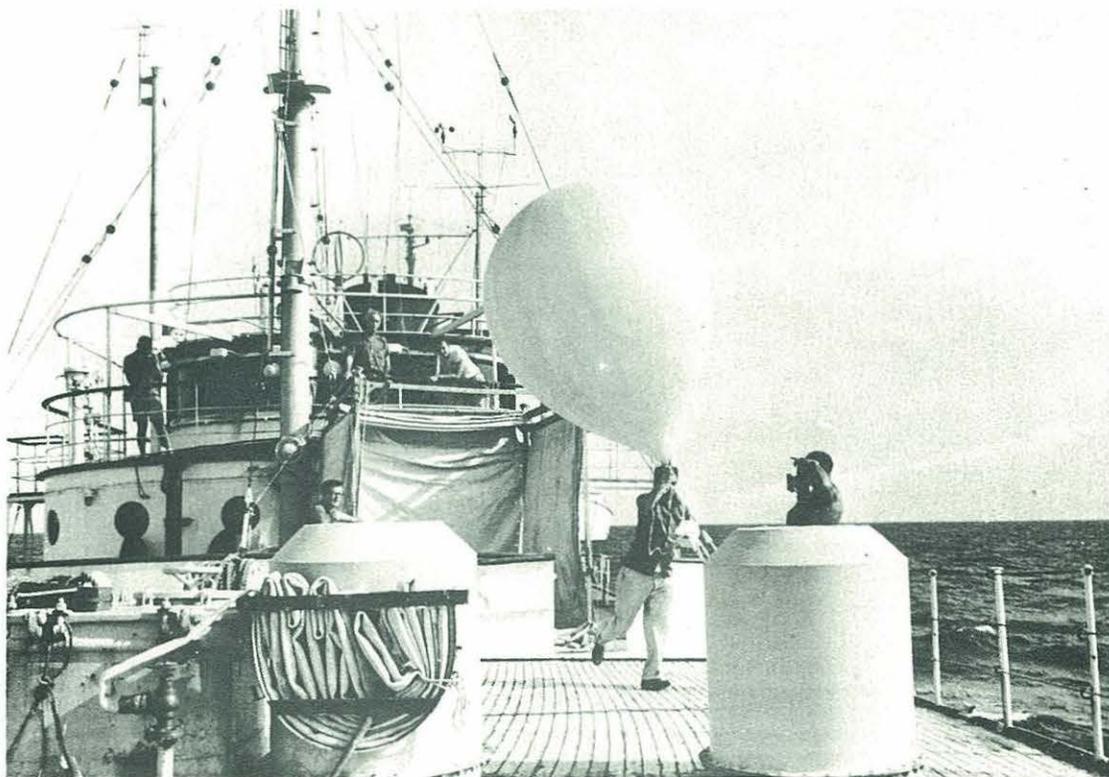
Lowering B₆ multiple plankton sampler (Rogers).



Lowering bathyphotometer (Clarke, Kelly).



Culturing marine yeasts (Fell).



Launching radiosonde (Connors).