

## Meroplanktonic Stages of Anthozoa in the Indian Ocean

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The international collection of 1927 zooplankton samples lodged at the Indian Ocean Biological Centre (IOBC) forms the basis for the present study. The geographical names used in the present report follow those adopted by the International Hydrographic Bureau (IHB) (Sp. Publ. 23, 1953). An aliquot of the catch, equalling about 3 to 4 ml of the plankton irrespective of sample size, was fractionated either with a Lea's fractionator (WIBORG, 1955) or with a Folsom plankton splitter (MC EVEN, JOHNSON and FOLSON, 1954) and sorted. From this aliquot the catch per unit haul is estimated and this is used for comparison of collections. Abundance indicates population density, the term population being used not in the ecological sense but in a statistical sense. Biomass is used here to mean wet zooplankton displacement volume.

### I. Salient Features in the Distribution of Anthozoa Larvae

**Numerical abundance**—When compared to the copepods that constitute roughly 70% of the zooplankton, the percentage of *Anthozoa* larvae is negligible. From Table 1 it can be seen that 61% of standard samples and 33% of nonstandard samples contained anthozoan larvae.

Out of a possible total of 220 5° squares, collections are available from 170; of these, 39 squares (22% of total squares) were devoid of larvae; 79 squares (47%) contained only 1 to 3 larvae; 29 squares (17%) contained 4 to 6 larvae; 16 squares (10%) contained 7 to 9 larvae; 4 squares contained 10 to 12 larvae; one square contained 12 to 25 larvae and only 2 squares had more than 18 larvae. This extensive dispersal of anthozoan larvae by currents indicates a long life span or extended larval life for most species.

Numbers ranged from 0 to 190 per haul. The maximum average representation in a 5° square is 20, and that of a 10° zone of latitude 16. Of the 1065 samples which contained anthozoan larvae, only 71 samples had more than 20. The 71 samples had 2858 larvae, i.e. 40 per unit sample, while the other 994 samples had 4891 larvae, hence an average of 5 per sample. Most of the samples had about the same number of larvae.

Areas of greater larval abundance are (Fig. 1) a) along the West Australian coast. The sampling in this area was done along the longitude 110° E from 12° S to 32° S. Night hauls show a slightly bigger catch; b) between the Red Sea and the Gulf of Aden and off the Arabian coast; c) in the central and western Bay of Bengal, to the northwest and south of the Andaman and Nicobar Islands; d) along the Mozambique coast, east of 30° E and 30° S; e) the Malabar coast, the Laccadive Sea and SW of the Maldiv Islands; f) the coast of Kenya and Somalia, 5° S to 7° N.

In addition, isolated places in the north and central Indian Ocean, such as the SW coast of Sumatra, the southern tip of India, the northern and SW coasts of Ceylon, off Visakhapatnam 13° N and 80° E, and around the St. Brandon group of islands.

Outside these regions the average catch is much smaller, i.e. below 25%. The central south Indian Ocean is almost devoid of larvae except in the coastal areas. A gradual reduction is noticed from north to  $40^{\circ}$  S in the oceanic region. Larvae are more abundant in the neritic areas than in the oceanic areas. Minimum numbers have usually been recorded in areas far from land. An exception, however, is the area adjoining the Kerguelen Islands, represented by 9 larvae. There is a relation between numbers of larvae and proximity to land. The trend of distribution in general shows comparable high values towards the western and eastern sides of the Indian Ocean and along the coasts of India.

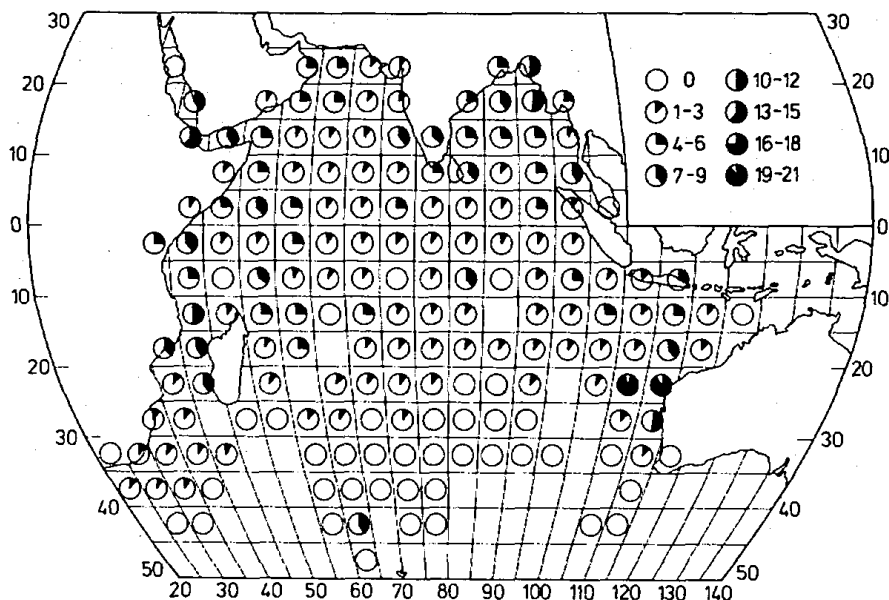


Fig. 1. Distribution of anthozoan larvae in the Indian Ocean  
No. of individuals under  $1 \text{ m}^2$ , averaged for  $5^{\circ}$  squares

Off the Gujarat coast between  $15^{\circ}$  N and  $24^{\circ}$  N in the mouth of the Gulf of Cambay and Kutch there were poor catches. Very low density areas were found along the South African coast between  $30^{\circ}$  S and  $40^{\circ}$  S,  $20^{\circ}$  E and  $40^{\circ}$  E. Collections made in this area in January, April, July and October produced negligible catches. Below  $30^{\circ}$  S along the west coast of Australia density is low. Anthozoan larvae were completely absent in between  $33^{\circ}$  S to  $46^{\circ}$  S and  $59^{\circ}$  E to  $114^{\circ}$  E where the "Patanela" collections were obtained.

The mean biomass of zooplankton in the Bay of Bengal is less (15.5 ml) than that in the Arabian Sea (19.2 ml per haul), yet the anthozoan population is higher. The Arabian Sea yielded 25% of the total larval collections. Similarly, though the mean plankton biomass value of the SE Indian Ocean is less (7.6 ml) than that of the SW Indian Ocean (9.5 ml), the anthozoan population has a higher density.

## II. Diurnal and Hourly Variation in the Catch of Anthozoan Larvae

Larvae are present in 61% of night hauls and in only 50% of day hauls (Table 1). The catch per night haul is 0-9 and per day haul 1-4 (Table 2), depending on area

Table 1. Occurrence of anthozoan larvae according to category of sample

Category of samples	Number of samples	% of total No. of samples	Larvae present No. of samples	%
Total	1927	100.00	1065	55
Standard	1548	81.00	943	61
Nonstandard	379	19.00	122	33
Day	1028	53.50	621	61
Night	892	46.50	444	50
SW monsoon	987	51.00	563	57
NE monsoon	939	49.00	502	54.5

Table 2. Time and area of zooplankton sampling of 11 cruises in the Indian Ocean

Stn No.	Ship and Cruise	No. of hauls	Average catch per haul	% of hauls without larvae	Time hour	Period	Area
1.	"Diamantina" 1/65	19	1	47	19.00–24.00	18.4.65 to 12.5.65	7° N–32° S, 76° E–110° E
2.	"Kagoshima Maru" 3	31	2	35	19.30–21.00	26.11.63 to 9.1.64	5° N–24° S, 69° E–80° E
3.	"Diamantina" 1/64	11	1	64	20.00–23.00	1.2.64 to 17.2.64	21° S–33° S, 113° E–114° E
4.	"Anton Bruun" 2	38	2	22	06.12–14.10	23.5.63 to 17.7.63	17° N–37° S, 69° E–80° E
5.	"Anton Bruun" 5	45	3	44	08.00–12.45	29.1.64 to 30.4.64	16° N–42° S, 50° E–75° E
6.	"Anton Bruun" 6	23	1	60	08.10–19.00	17.5.64 to 12.7.64	18° N–37° S, 64° E–65° S
7.	"Umitaka Maru" 23, 24	28	1	80	Day	21.11.63 to 22.1.64	4° S–25° S, 99° E–112° E
8.	"Diamantina" 3/64 and 5/64	23	4	30	Day	5.5.64 to 15.5.64 11.8.64 to 8.9.64	9° S–32° S, 105° E–112° E
9.	"Koyo Maru" 14 and 16	47	2	40	Night	23.11.62 to 15.1.63 23.11.63 to 25.1.64	5° N–32° S, 94° E–110° E 8° N–22° S, 94° E–100° E
10.	"Patanela" Surface hauls	25	0	100	Night	6.12.64 to 21.2.65	33° S–46° S, 59° E–114° E
11.	"Pioneer"	40	9	31	Night	16.4.64 to 21.4.64	20° N–6° S, 81° E–102° E.

of catch and season and probably other factors that interfere with vertical migration, such as stratification of the water.

Hauls during "Diamantina" cruises 1/64 and 1/65 and "Kagoshima Maru" cruise 3, "Anton Bruun" cruises 2 and 5 indicate that the hour of collection is less important than the area of collection (Table 2).

Of the hauls having more than 20 larvae, 43 night hauls (1725 larvae) averaged 40 per haul, and 28 day hauls (1133 larvae) averaged 40 per haul. This probably shows some diurnal effect. The hauls made at 2000 to 2100 h, 0100 to 0600 h, 0800 to 1200 h, 1500 to 1800 h, and 2200 to 2300 h had fairly good catches, probably indicating an absence of hourly effect on larval catch. While one haul at 2100 h had 190 larvae, one haul at 0900 had 112, indicating patchiness. There was no relation of catch to plankton biomass.

### III. Effect of Structure of Water Column on Bathymetric Distribution of Larvae

On "Discovery" cruises 1 and 3, additional hauls were made at 62 stations from the thermocline to the surface (Table 3).

Table 3. Bathymetric distribution of zooplankton samples from "Discovery" cruises 1 and 3

Serial No.	"Discovery" Stn No.	Time of sampling	No. of samples 200-0 (m)	No. of samples from other depth ranges	Depth range (m)	Depth of thermocline (m)
1	5292	Night	10	2	70-0	125 Not clear
2	5307	Day	16	0	50-0	98 and 118 not clear
3	5310	Night	26	6	40-0	No therm.
4	5336	Day	7	0	45-0	100-125 not clear
5	5340	Day	8	1	40-0	75-95
6	5348	Day	8	0	50-0	75-85
7	5363	Night	10	0	70-0	
8	5381	Night	15	2	80-0	100
9	5429	Day	13	0	70-0	94
10	5488	Night	8	0	70-0	100
11	5502	Day	17	4	75-0	50
12	5505	Night	18	2	55-0	91
13	5516	Day	17	0	80-0	95
14	5267	Night	3	12	100-0	99
15	5367	Night	0	2	85-0	94
16	5491	Night	3	5	70-0	84
17	5514	Night	0	9	70-0	75
18	5515	Day	0	10	80-0	75
19	5520	Night	8	10	75-0	114
20	5521	Night	5	32	95-0	141

A comparison of hauls taken at the same station with the same net from 200 m to the surface and from a lesser depth to the surface, shows very clearly that the larvae are most abundant below the thermocline and are seldom found in the upper layer when a thermocline is present. When there is no thermocline, the larvae occur higher up ("Discovery" Stn 5310). Night also seems to influence upward movement of the larvae. On the other hand when the stations were in upwelling waters, larvae were commonly found in the upper layer.