STUDIES ON PLANKTONIC OSTRACODS OF THE NORTHERN INDIAN OCEAN

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This is to certify that this thesis is an authentic record of the work carried out by the candidate under my supervision and guidance and that no part thereof has been presented for any other degree.

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INTRODUCTION

The early marine expeditions have provided material that has made possible the establishment of the majority of species existing today. Claus (1873-1894) and Müller (1890-1912) published a series of papers on Ostracoda but limited their description to main diagnostic features. Later Skogsberg (1920, 1931), Angel (1968-1973) and Poulsen (1962-1973) have published more detailed information on their morphology.

Our information on the Indian Ocean halocyprid ostracods is mainly confined to Müller's (1906 a) work on "Valdivia" material and Poulsen's (1969, 1973) work on "Dana" material which had only a few stations in Indian Ocean area.

No attempt has hitherto been made for a comprehensive study that involves methodically collected samples from a wider area. The International Indian Ocean Expedition (1960-'65) provided samples from Indian Ocean which form the basis of this study.

During the period of this work, six months were spent in the British Museum (N.H.) and Institute of Oceanographic Sciences in U.K., and Zoological Museum and Fiskeri -og Havundersøgelser in Denmark, which enabled me to examine some of the type material.

In the present study the main objectives are; (1) Proper determination of the species of planktonic Ostracoda that occur in the area of investigation, (2) to explain the pattern of distribution, (3) to estimate their abundance and to some extent seasonal variation, and (4) to correlate their distribution with the physico-chemical factors of the environment.

The planktonic ostracods form one of the most important groups in tropical zooplankton. One of the main objectives of the Indian Ocean Expedition is the study of the qualitative and quantitative distribution of planktonic organisms in the Indian Ocean. Since the ostracods constitute a large portion of the zooplankton samples, the study has become particularly important.

Planktonic ostracods of the Indian Ocean have not been studied in detail although extensive studies have been made on them from other oceans, particularly Atlantic. With this view, the present study was undertaken, to throw some light on the systematics and distribution of planktonic ostracods in this region. This study provides information regarding the distribution of each species in the Northern Indian Ocean, especially in the Bay of Bengal which is the least explored, as far as planktonic ostracods are concerned. It may also furnish us with the data regarding the nature of ostracod production in this area, which directly reflects on the total productivity as they play an important role in the rapid recycling of organic substances, faecal pellets and even floculants. The distributional studies of this sort will also be helpful in evaluating their adaptation to physico-chemical and biological environment and to know more about their community structure and species diversity.

Historical

Von Linne (1746) in his "Fauna Suecia" gives a species called "*Monoculus antennis capillaceis multiplicibus*, *testa bivalvi*" which is the first superficial description of an ostracod. In the later part of 18th century a number of papers have been published which mention, among other things forms belonging to Ostracoda. During the earlier part of 19th century, a greater number of scientists studied Ostracoda, but with comparatively insignificant results.

Milne Edwards (1840) and Philippi (1840) for the first time, classified species, belonging to the sub-order Cypridiniformes and established the genus *Cypridina* and *Asterope*. Most of the other works were also purely taxonomic. Straus (1821) for the first time separated ostracods from other Entomostraca as an independent group for which he gave the name "Ostrapoda". Latreille in 1802 called this group "Ostrachoda" including ostracods in modern sense and cladocera.

He retained the same classification in his later works (1806 and 1810) but used a different name "Ostracoda". Thus the now generally accepted spelling came into use, which Stebbing (1910) calls it a great injustice. He wrote "Ostrapoda" Straus as a synonym for Ostracoda Latreille. The name "Ostrapoda" is evidently the right name for this group. But the name "Ostracoda" has been admitted into literature so completely and used in majority of works since the rules of nomenclature does not make it absolutely necessary to use the principle of priority.

From the middle of 19th century studies on ostracods gained considerable momentum. Numerous works on marine ostracods appeared, the most important of which are Baird (1850), Dana (1852), Sars (1865, 1887), Brady (1868, 1880), Claus (1873, 1874, 1876, 1891 and 1894), Brady and Norman (1889 and 1896) and Müller (1890, 1894, 1906a, 1906b, 1908 and 1912). After the work of Muller, study of marine ostracods entered into a barren period, till the beginning of 20th century with a few exceptions like Skogsberg (1920 and 1931) and Sars (1928). Skogsberg (1920) pointed out the inadequacies of the earlier descriptions as most of them are merely confusing. His descriptions were thorough and the terminology and the classification are widely accepted. Recently, expeditions like Discovery and Dana provided material for further studies (Iles, 1953 and 1961) and (Poulsen, 1962, 1965, 1969a, 1969b and 1973). Angel (1968a, 1968b, 1968c, 1969a, 1969b, 1969c, 1969d, 1970a, 1970b, 1970c, 1971, 1972 and 1973) and Deevey (1968a, 1968b, 1970 and 1974) have published a series of papers and re-described many species which were helpful to clear the existing confusion in taxonomy.

Work done in the Indian Ocean

Müller (1906a) is the first author who gave a somewhat detailed report on the ostracods of the Indian Ocean based on the material collected during the round the world cruise "Valdivia" (1898-1899). Cannon (1940) has given a list of planktonic ostracods collected during John Murray Expedition (1933-34). Recently Leveau (1966, 1967 and 1969), George (see appendices), Merylal James (1972, 1973) have published papers on planktonic ostracods. Poulsen's reports (1962, 1965, 1969a, 1973) on the "Dana" material are more exhaustive reports. Indian Ocean material of the Dana Expedition was mainly from the waters off Sumatra and very few stations in the central and western Indian Ocean. Till now no detailed report on planktonic ostracods of the Arabian Sea, which is the most productive area in the Indian Ocean, and of the Bay of Bengal have been published. Indian Ocean Expedition provides the most methodically collected samples from the Indian Ocean which forms the basis of the present study.

General Hydrography

The Indian Ocean is the only major ocean having a land locked northern boundary, lying approximately along the Tropic of Cancer, with the southern end open to the Antartic Ocean. It is almost an enclosed area with the African continent on the west and the Eastern Archipelago on the east. It is connected to the tropical Pacific through the Malacca Strait between Eastern Archipelago and Australia. Land mass of Asia closes the northern end of the Indian Ocean resulting in an oceanic system with at its closed end fed by large rivers of middle east and also from India and Pakistan flowing into the Arabian Sea and those of India, Bangladesh and Burma into the Bay of Bengal carrying fresh water and sediments. Although the Indian Ocean is about 74,917,000 km^2 and covers about 14 percent of the earth's surface, it is still the least known of the three major oceans.

A new phase of oceanographic research was initiated by the "Challenger" Expedition in 1873, organized for the first time to make complex oceanographic surveys. Until 1957, Indian Ocean exploration had been carried out independantly by national governments or private institutions. In that year, the idea for international cooperation and large scale oceanographic study was considered which resulted in the International Indian Ocean Expedition.

During the preparation of the atlas on the physical oceanography of the Indian Ocean a comprehensive analysis of its oceanographic conditions have been undertaken to interpret the structure and circulation of the Indian Ocean, which is in many ways different from the other oceans.

The surface water of the Arabian Sea generally occupies a layer from the surface to a depth of about 100 - 150 m. The average surface temperature ranges from 20°C to 30°C varying according to seasons. The highest surface temperature in the Indian Ocean excluding Red Sea and Persian Gulf is found in the northern parts of the Arabian Sea during summer. In winter, the surface temperature, here, drops down to 22°C. The summer monsoon causes upwelling and the flow of the relatively cool water of the Somali current along the African and Arabian coasts, which reduces the surface temperatures along these coasts. The salinity values are quite high in the Arabian Sea. In the surface layer it varies from 35.8 - 36.5‰ as a result of high temperature which causes evaporation.

The sub-surface water in the Arabian Sea, which is found immediately below the surface layer to a depth of about 400 m, is formed from the waters of the gulfs of Aden and Oman, and in the adjacent parts of the Arabian Sea, by mixing with the Red Sea and Persian Gulf waters with the surface water of the Arabian Sea. This water spreads through the entire northern part of the Indian Ocean and is bounded near the equator by a zone of upwelling South Indian Ocean Intermediate water. The temperature in the Arabian Sea sub-surface water varies from 10 to 19°C and the salinity ranges from 35 to greater than 36‰ which decreases with distance away from the formation sources near the Persian Gulf and Red Sea, which has a salinity of greater than 39‰.

The Intermediate water comes into the Arabian Sea at depths of 400 - 600 m and fills a layer up to 1500 m. The temperature ranges from 4 to 13°C and salinity 35 to 36.5‰ decreasing downwards.

The Arabian Sea deep water is formed as a result of mixing of Arabian Sea Intermediate water, South Indian Ocean Intermediate water and Indian Ocean bottom water. The temperature is higher than 2°C and salinity ranges from 34.68 to 34.78‰.

The Tropical sub-surface layer of minimum oxygen is most pronounced in the Arabian Sea. This layer is usually found in the northern part of the Arabian Sea at a depth of 75 m, but towards the equator it descends to a depth of 150 m. The layer of oxygen minimum is most pronounced off Bombay at a depth of 50 metres (Schott, 1935). The origin of this layer in the Arabian Sea is not fully understood but it is associated with the high salinity and high temperature (Gallagher, 1966) which according to many authors originate from Red Sea and Persian Gulf.

Another peculiarity of the sea is the reported existence of H_2S in the Intermediate waters over an extensive area (Bezrukov, 1961). However this needs further confirmation.

The surface water of the Bay of Bengal occupies a layer up to a depth of 100 to 150 metres. La Fond (1958) has divided the western part of the Bay into three distinct water masses, which migrate seasonally according to monsoon circulation. They are, northern dilute water, transition water and southern Bay of Bengal water. The range of temperature in the Bay of Bengal in the surface water is found in the northern part as 23°C to 29°C which is not as great as in the Arabian Sea. Minimum value for salinity is also found in the northern part to a monthly average of less than 20‰ and maximum value in the offshore water of Bay of Bengal does not usually exceed 34‰.

The sub-surface water of the Bay of Bengal is found below the surface waters as the rèsult of mixing between high salinity waters from the Arabian Sea and the north Indian Ocean deep water. The temperature ranges between 5 to 15°C and salinity 34.1 to 35‰.

The deep water spreads into the Bay of Bengal at depths greater than 1500 m. Arabian Sea Intermediate water and Indian Ocean Bottom water and Antartic Bottom water contribute to the formation of this water mass. The temperature is between 1.6°C and 2.8°C and salinity 34.68 to 34.78‰.

Wyrtki (1973) has delineated 3 distinct circulation systems for the Indian Ocean (1) The seasonally changing monsoon gyre, (2) The south hemispheric subtropical anti-cyclonic gyre and (3) The Antartic waters with Circumpolar Current. Since the last 2 systems are essentially similar to the corresponding systems in the other oceans and since the present study includes only Northern Indian Ocean, the seasonally changing monsoon gyre alone is discussed here.

Surface currents of the Northern Indian Ocean as a whole is initiated by the monsoon winds. During the SW monsoon the currents are easterly in a clockwise direction and during NE monsoon the currents are in a westerly and in a counter-clockwise direction. The easterly and westerly directions are direct monsoon currents and clockwise and counter-clockwise directions are set during transition periods (Gallagher, 1966).

The SW monsoon begins by April when the water starts flowing north along Somalia and by May, north of equator, water starts flowing east. In July Somali current comes to its peak, the countercurrent shifts north and together with the monsoon current forms a broad eastward flowing current. South Equatorial Current becomes stronger and most of its water turns north into Somali Current. Off Sumatra the monsoon current crosses the equator and turns into the South Equatorial Current. These 3 currents, South Equatorial Current, Somali Current and monsoon current form a strong gyre in the equatorial Indian Ocean.

During NE monsoon period, the circulation undergoes a complete change. The water movements to the north of Equator are from east to west, starting in November and ending in April with its peak in February. From November to January a strong branch of this current turns north and flows along the west coast of India carrying low salinity waters from the Bay of Bengal. The NE monsoon drift which is shallow having little influence below the thermocline depth turns south, off the coast of Somalia crosses the equator and forms the Equatorial Countercurrent which at its western origin draws water from the South Equatorial Current also. The countercurrent at its eastern end continues to the southeast or turn directly to the South Equatorial Current or some part of it returns to the monsoon drift (Wyrtki, 1973).

Connected with these seasonally changing monsoons are extensive areas of upwelling at Somali and Arabian coasts (Currie <u>et al</u>., 1973) and also along the eastern margins of Arabian Sea (Banse, 1968), making the Arabian Sea a very much fertile area during SW monsoon. Upwelling along the east coast of India according to many authors exists from March to May (Jayaraman, 1965). However, the high productive conditions observed in the waters, off west coast of India have not been encountered in the east coast.

Classification

Baird (1850) was the first to divide this group into families viz. Cypridae, Cytheridae and Cypridinidae. Dana (1852) divided Ostracoda into 2 families viz. Cypridae and Halocypridae, which are again subdivided into families. Family - Halocypridae comprises subfamilies Cypridininae and Halocyprinae. Halocyprinae comprises 2 genera, Halocypris and Conchoecia. The classification by Dana forms the basis of the present system of classification of Ostracoda.

Classification put forward by Sars (1865) is mainly based on that of Dana (1852). It is important in that the terms he used for the groups are widely used. He divides Ostracoda into 4 sections. Section I - Podocopa, comprising Cypridae and Cytheridae, Section II - Myodocopa comprising Cypridinidae and Conchoeciidae, Section III - Cladocopa comprising the family Polycopidae and Section IV - Platycopa comprising the family Cytherellidae.

Müller (1894) classified Ostracoda into 2 tribes: Tribus I - Myodocopa, comprising Cypridinidae, Halocypridae and Polycopidae and Tribus II - Podocopa, comprising Cypridae, Nesideidae, Cytheridae, Cytherellidae and Darwinulidae. Muller's system is a modified form of Sars' classification, where four sections, are united to form 2 tribes.

Claus' (1876) classification is of an entirely different pattern. He treated Cypridinidae, Halocypridae, Cypridae and Cytheridae as equivalent families.

The classification of Ostracoda by Skogsberg (1920) modified by Poulsen (1962, 1969a, 1973) is widely accepted. The order Ostracoda is divided into 5 suborders. Suborder I - Cypridiniformes, Suborder II - Halocypriformes, Suborder III - Polycopiformes, Suborder IV - Cypriformes and Suborder V - Cytherelliformes.

SUBORDER CYPRIDINIFORMES

Cypridiniformes is divided into 4 families namely Cypridinidae, Rutidermatidae, Sarsiellidae and Asteropidae. Family Cypridinidae is divided into 2 sub-families Cypridininae and Philomedinae.

The subfamily Cypridinidae Müller includes 19 genera:

Genus Gigantocypris Müller
Genus Macrocypridina Skogsberg
Genus Doloria Skogsberg
Genus Paradoloria Poulsen
Genus Skogsbergia Poulsen
Genus Vargula Skogsberg
Genus Paravargula Poulsen
Genus Bathyvargula Poulsen

Genus <u>Melavargula</u> Poulsen

Genus <u>Hadacypridina</u> Poulsen

Genus <u>Pterocypridina</u> Poulsen

Genus <u>Paracypridina</u> Poulsen

Genus <u>Siphonostra</u> Skogsberg

Genus <u>Amphisiphonostra</u> Poulsen

Genus <u>Cypridina</u> Milne Edwards*

Genus <u>Monopia</u> Claus

Genus <u>Cyprinoides</u> Brady

Genus <u>Codonocera</u> Brady

Genus <u>Azygocypridina</u> Sylvester-Brady

* Only <u>Cypridina</u> Milne Edwards is present in the Indian Ocean Expedition material.

SUBORDER HALOCYPRIFORMES

Suborder Halocypriformes comprises Family Thaumatocypridae and Halocyprididae. Family Thaumatocypridae has only the species <u>Thaumatocypris</u> <u>echinata</u> Müller.

Family Halocyprididae comprises 4 subfamilies:

1. Subfamily Archiconchoecinae

   Genus <u>Archiconchoecia</u> Müller

2. Subfamily Euconchoecinae

   Genus <u>Euconchoecia</u> Müller

   Genus <u>Bathyconchoecia</u> Deevey

3.	Subfamily	Halocyprinae
	Genus	_Halocypris_ Dana
	Genus	_Halocypria_ Claus
	Genus	_Fellia_ Poulsen
4.	Subfamily	Conchoecinae
	Genus	_Paraconchoecia_ Claus
	Genus	_Conchoecetta_ Claus
	Genus	_Microconchoecia_ Claus
	Genus	_Metaconchoecia_ Granata & Caporiacco
	Genus	_Orthoconchoecia_ Granata & Caporiacco
	Genus	_Gaussicia_ Poulsen
	Genus	_Platyconchoecia_ Poulsen
	Genus	_Spinoecia_ Poulsen
	Genus	_Conchoecia_ Dana
	Genus	_Loricoecia_ Poulsen
	Genus	_Pseudoconchoecia_ Claus
	Genus	_Mollicia_ Poulsen
	Genus	_Boroecia_ Poulsen
	Genus	_Paramollicia_ Poulsen
	Genus	_Conchoecissa_ Claus
	Genus	_Alacia_ Poulsen
	Genus	_Conchoecilla_ Claus

MATERIALS AND METHODS

The present study is based on the analysis of plankton samples collected during the International Indian Ocean Expedition (IIOE). Indian Ocean Biological Centre, Cochin was established in 1962 to receive the plankton samples and to sort them into various taxonomic categories. In the beginning of the IIOE, owing to lack of a standard gear, different types of nets have been used. When the Indian Ocean Standard Net (IOSN) was specially designed (Currie, 1963) all the participating vessels used the same. IOSN has a mouth area of one square metre and a total length of 5 metres. The straining surface is nylon gauge of mesh width 0.33 mm. Collections were taken in a vertical haul of 200 m to the surface. The major part of the samplings were made during 1962-'64. The station list has been published (IOBC, 1969). Alongwith the plankton samples temperature and salinity data from standard depths were also obtained. The temperature, and salinity ranges given under each species are the maximum and minimum observed from 200 m to 0 m (IOBC, 1971).

The zooplankton samples received at IOBC was subjected to the following treatment. The displacement volume was found out. The larger organisms and fish eggs and larvae were first removed from the total sample. Them the rest of the sample was sub-sampled either by Leas plankton fractionator (Wiborg, 1951) or by Folsom plankton splitter (Mc Ewen et al., 1954). Three to 5 ml was taken for sorting into various taxa. The sorted taxa preserved in 4% formalin was made available to specialists.

Out of the ostracod taxa thus made available, 712 samples collected from the Northern Indian Ocean forms the basis for the present study. The distribution of ostracods based on their numerical data has been published (IOBC, 1972 - See Appendix V). Besides dealing with the distribution pattern of the various species, short notes on the morphological peculiarities of the specimens in the collections are also given.

Eventhough there was standardisation in the collection method, there was no uniformity on fixation and preservation. The condition of the samples was not good in a few cases. It is observed that, preservation in formalin for a long period will cause the pigmentation to disappear.

For distribution and abundance studies, collections are compared on the basis of catch per unit standard haul, because the wire angle was not recorded in most cases and no flow meter was used to measure the volume of water filtered.

A few drawbacks of the collection method adopted are worth mentioning; (1) IOSN may tend to clog when the wire angle is high (Tranter and Smith, 1968), (2) there was no flow meter attached, (3) limitation of the depth of haul to 200 m making the day hauls incomplete for most of the migratory species and (4) the uneven distribution of stations.

In spite of the above drawbacks the IIOE is the first expedition to have such wide coverage for biogeographical studies.

The classification and terminology followed in this study is that of Skogsberg (1920) and Poulsen (1962, 1969a, and 1973).

The data for the 10 common species were subjected to statistical analysis using Students 't'. The abundance figures were converted to their log values for the purpose of analysis. The formula used for comparison of the means of the two seasons as well as day and night was:

$$t = \bar{x}_1 - \bar{x}_2 \;/\; S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

where n_1 and n_2 are number of observations, $\bar{x}_1$ and $\bar{x}_2$ are the means and S is the combined S.D. calculated by the formula $S^2 = \Sigma\, x_1 (x_1 - \bar{x}_1)^2 + \Sigma\, x_2 (x_2 - \bar{x}_2)^2 / n_1 + n_2 - 2$. The degrees of freedom of this 't' is $n_1 + n_2 - 2$. The values of mean, combined standard deviation, the 't' values and their respective degrees of freedom are given in the tables II - IV. Since the environmental conditions for Arabian Sea and Bay of Bengal are different, their values are treated separate. Only 10 of the more common species were thus studied. The other species did not provide enough representative samples for application of statistical methods worthwhile.

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SYSTEMATICS AND DISTRIBUTION

SUBORDER CYPRIDINIFORMES Skogsberg, 1920

FAMILY CYPRIDINIDAE Brady and Norman, 1896

Genus *Cypridina* *Milne* Edwards

Cypridina Milne Edwards, 1840.

Pyrocypris Müller, 1890, 1906b and 1912.

Cypridina Poulsen, 1962.

The diagnosis of this genus is given by Poulsen (1962). Only 2 species of this genus were encountered in IIOE material.

Key to the species (IIOE) of the genus *Cypridina*:

Rostrum rounded anteriorly, Second furcal claw separated from lamella - *acuminata*

Rostrum acute, second furcal claw united with lamella - *dentata*

Cypridina *acuminata* (G.W. Müller)
(Map XVII)

Pyrocypris *acuminata* Müller, 1906b and 1912.

Cypridina *acuminata* Poulsen, 1962.

Locality:- Station: Va 1768 - 20°00'N, 71°45'E - 21 specimens.

This species is distinguished by its well rounded rostrum. Detailed description is given by Poulsen (1962).

Distribution:- Reported earlier from the Indonesian Sea. In the present material this species was obtained only from a single station off Bombay, where the salinity was 35.6‰. No data on temperature was available.

Cypridina dentata G.W. Müller
(Map XX)

Pyrocypris dentata Müller, 1906b and 1912.

Cypridina dentata Poulsen, 1962.

Localities:- Numerous stations (See Table Ia).

Description is given by Poulsen (1962). The length of the carapace was 1.6 mm - 2 mm in the present material.

Poulsen observed one epipodial bristle on sixth limb for this species. Present material showed variation of having one or two bristles in different specimens or sometimes single specimen having one bristle on one side and two on the other side.

Müller (1890 and 1906b) has described a number of species belonging to his genus Pyrocypris, descriptions being incomplete and in many cases referring to classification and pigmentation of the carapace. These characters would be of little use when dealing with specimens preserved in formalin for a long time. This state of matters has created a little bit uncertainty in the identification of this species. However a careful examination of the present material does not show any marked disagreement with the description of C. dentata (Poulsen, 1962 and Muller, 1906b), eventhough the remote possibility ~~of~~ of some of it being C. chierchiae, an incompletely described species cannot be totally ruled out.

Distribution:- Poulsen (1962) reported this species from the southern Bay of Bengal and Malayan Archipelago. In the IIOE material it was found to be the most abundant planktonic ostracod in the Arabian Sea. In Bay of Bengal it was present only in a few stations. Statistical analysis showed significant (0.1% level) seasonal variations, being more abundant during NE monsoon period. Day and night variations were found to be not significant. Although this species was found to occur at a wide salinity range, they were abundant only in areas where salinity values exceeded 34‰. The maximum number of specimens, about 20,600/haul was encountered off Cochin (10°29'N and 75°31'E) where temperature and salinity of the surface layer varied from 14.3°C - 28.8°C and 34.9‰ - 35.8‰ respectively. Possible range in temperature 10.1°C - 30.4°C and salinity 30.1‰ - 37.4‰.

FAMILY HALOCYPRIDIDAE

Terminology and general morphology

Halocyprids are characterised by the presence of a bivalve shell having an antennal notch, seven pairs of appendages, and the presence of a frontal organ in most of the species.

Carapace:- In most cases a rostral incisur is present on the anterior edge. Valves of the carapace are joined together along the dorsal edge, which is almost straight in majority of cases. Other margins are rounded or straight.

Sculpture of the carapace in many cases are weak, especially in the preserved material. Selvage is present and runs slightly away from the margin and almost parallel to it, except on anterior margin where it comes closer and at the rostral incisur it runs on the margin itself. Close to the margin of the shell there are numerous glandular cells. A number of them are concentrated in large groups and open by a common pore. Müller (1906a) has conveniently described them as "Unsymmetrichen Drusen", "lateralen Eckdrusen" and "Dorsalen medialen Drusen", the location of which are characteristic in many species. Whether the secretion of the gland helps in inmobilizing the prey is yet to be determined with certainty.

Terminology used here is that of Müller (1906a). Gland groups are referred to as "asymmetric glands", "lateral glands" and "dorso-medial glands".

<u>First antenna</u>:- This limb is considered to be a sensory organ. Since it shows sexual dimorphism in majority of species it is quite possible that it has some secondary function.

Stem of the first antenna is considered as consisting of 5 to 6 or 7 segments (Poulsen, 1969a). The segmentation in many cases are indistinct. The number, shape and size of the bristles, present on this appendage varies considerably within the family. The thin walled, hyaline bare filaments, in most cases are shorter and rounded distally.

Bristles of the first antenna are termed 'a', 'b', 'c', 'd', 'e' bristles from proximal to distal position.

<u>Second antenna</u>:- This always shows sexual dimorphism, and is more developed in male. Protopodite is large and bare. Exopodite is almost same in both sexes. First segment is long and has a short bristle. Eight distal segments are short and provided with natatory bristles. Endopodite is comparatively short, with often 3 segments in male and 2 in female. First segment is provided with 2 short pointed bristles and second and third segments together carry 5 long bristles of which some are developed as sensory filaments. A clasping organ is present on the endopod of male.

The 2 bristles on the first joint are called 'a' and 'b' bristles. Two long bristles of the second joint are 'f' and 'g' bristles and small spine like bristles which in some cases absent are called 'c', 'd', and 'e' bristles. The three bristles of the end joint are 'h', 'i' and 'j' bristles.

<u>Mandible</u>:- Almost similar in both sexes. Protopodite-Pars incisiva of coxale is furnished with broad triangular processes. In addition 2 rows of teeth, which are called proximal and distal tooth list. Proximally of the tooth lists is a cushion like masticatory pad provided with spines or hairs. Basale endite with 6 broad teeth and 2 other tube bristles. The number and positions of the bristles are subject to variation. Epipodial appendage, if present, is small and verruciform process provided with a single bristle. Exopodite has also a single bristle except in <u>Platyconchoecia</u> on which it is somewhat leaf like. Endopod consists of 3 segments, bristles of which are subject to slight variation.

<u>Maxila</u>:- This appendage has no sexual dimorphism. Endite on the precoxale have from 6 to 10 bristles and coxale 12 to 18. These bristles are subject to slight variation and have great constancy within the species. Basale forms a lobe like part provided with a single bristle. Endopod with 2 segments. First segment with 4 to 6 bristles on the anterior edge and 2 to 4 on posterior edge. In addition there is a single

bristle on the inside of this segment. End segment with 5 or 6 bristles.

Fifth limb:- No sexual dimorphism present. Epipodial plate with marginal bristles arranged in 3 groups, with a slight variation in the number of bristles. Protopodite with traces of 2 endites. Exopodite has always 3 joints. First segment with slightly varying number of bristles. Ventrally, one long bristle dorsally and one or two laterally. Second segment always with 3 bristles.

Sixth limb:- With or without sexual dimorphism. Epipodial plate similar to that of the 5th limb with only slight variation. Endopodite with one or two bristles. Exopodite with the 3 proximal joints rather long with bristles. End segment with 3 bristles.

Seventh limb:- Exhibits no sexual dimorphism, consists of 3 articles, in some cases often fused into a single segment. End segment with 2 sub-equal bristles.

Copulatory limb:- This comparatively large organ is present in male and situated on the left side and is directed downward and forward. Near its posterior edge runs the vas deferens which opens almost at distal point.

<u>Furca</u>:- With no sexual dimorphism. Furcal lamellae are not clearly separated from the body. Strong or weak claws which slightly bent or straight are arranged on the lamellae. These claws gradually decrease in length posteriorly. Number of claws shows slight variation, 6 to 8 were observed on the species examined. Behind the furcal claws there is often an unpaired bristle.

<u>Frontal organ</u>:- With or without sexual dimorphism. In <u>Bathyconchoecia</u>, it is much reduced or absent.

FAMILY HALOCYPRIDIDAE

<u>Key to the subfamilies of Halocyprididae</u>

1. First antenna terminally with 5 bristles........... 2
1. " " more than 5 bristles........... 3
2. First segment of endopod of second antenna with processus mammillaris .... Conchoecinae
2. This segment without processus mammillaris.. Halocyprinae
3. First antenna, terminally with 6 sensory bristles.................................... Archiconchoecinae
3. This with more than 6 sensory bristles...... Euconchoecinae

SUBFAMILY ARCHICONCHOECINAE

Genus <u>Archioconchoecia</u> G.W. Müller

<u>Archiconchoecia</u> Müller, 1894, 1906a and 1912.

<u>Archiconchoecia</u> Poulsen, 1969a.

Poulsen (1969a) has given the diagnosis of the genus, based on A. cucullata and A. ventricosa. A. striata was not present in 'Dana' material. From the present studies it is clear that A. striata with its less developed rostrum, less number of bristles on appendages and 6 pairs of claws of furca stands separate within the genus.

Key to the species (IIOE) of Archiconchoecia

Furca with 6 pairs of claws .... A. striata

Furca with more than 6 pairs of claws and ventral margin concave.............. A. ventricosa

Archiconchoecia ventricosa G.W. Müller
(Map XVII)

Archiconchoecia ventricosa Müller, 1906a and 1912.

Archiconchoecia ventricosa Poulsen, 1969a.

Localities:- Stations Di 5267 - 06°44'N, 57°59'E - 1 specimen
Ar 37 - 06°26'N, 49°46'E - 1 specimen.

Only damaged specimens were available and hence no supplementary description is given here.

Distribution:- Reported earlier from the Indian, Atlantic and Pacific Oceans (Müller, 1906a; Poulsen, 1969). It was observed only at two stations from the equatorial region of the Arabian Sea. Salinity and temperature values for these stations ranged between 35.1‰ - 35.5‰ and 13.9°C - 27.8°C.

Archiconchoecia striata Muller

Description of this species has been given by George (in press - see appendix VII). Angel (per. comm.) feels that M. striata is neotenous and has two fewer juvenile stages than other halocyprids as evidenced by the lesser number of furcal claws.

SUBFAMILY EUCONCHOECINAE

Key to the genera of subfamily Euconchoecinae

First antenna with a group of 100-250 sensory filaments .... Bathyconchoecia

First antenna with about 20-30 sensory filaments .... Euconchoecia

Genus Euconchoecia G.W. Müller

Euconchoecia (Part) Müller, 1890, 1906a and 1912.

Euconchoecia (Part) Skogsberg, 1920.

Euconchoecia Poulsen, 1969a.

Most important diagnostic character is the presence of 20-25 sensory filaments on the first antenna. The genus includes 2 species, E. chierchiae and E. aculeata, both present in IIOE material.

Key to the species of genus Euconchoecia

Frontal organ longer than first antenna .... E. aculeata

Frontal organ not longer than first antenna..... E. chierchiae

Euconchoecia chierchiae, G.W. Müller
(Pl. VII, Fig. 24-25 and Map XVII)

Euconchoecia chierchiae Müller, 1890, 1906a and 1912.

Euconchoecia chierchiae Skogsberg, 1920.

Euconchoecia chierchiae Deevey, 1968a.

Euconchoecia chierchiae Poulsen, 1969a.

Localities:- See Table I.a

Detailed description of the species is given by Skogsberg (1920).

Carapace:- Length varies from 1.2 to 1.5 mm. Posterodorsal corner of right valve with moderately long spine and left one with a minute spine, the type reproduced by Skogsberg (1920, Fig. CXL VIII, 4) and rostrum broad and rounded.

Copulatory limb:- It is slightly different in shape to what is shown by Skogsberg (1920), anterior margin is straight and posterior margin convex.

Frontal organ:- Uniformly thin with a pointed end reaching the disto-dorsal boundary of the second segment.

Remarks:- Skogsberg (1920) did not include Müller (1906a), in his list of synonyms, because he doubted that Müller had combined and confused two closely related forms. More over, the shape of female specimens of Müller (1906) and Skogsberg (1920) are slightly different. In the present specimens, shape of the female, and the length of frontal organ are more similar to Muller's figures. Careful examination of the appendages of the present specimens do not show any remarkable difference to descriptions of Skogsberg (1920). Considering all these factors, E. chierchiae, Müller (1906a) is also included as a synonym.

Distribution:- Distributed over all the oceans (Müller, 1906a, Poulsen, 1969a). In the Arabian Sea, it was present mainly off Somali coast and in the Gulf of Aden. In the Bay of Bengal it occurred in the Malacca Strait, and also in Andaman Sea in large numbers (3056 specimens/haul) at random stations. Possible range in temperature 24°C - 29°C and salinity 32.4‰ - 33.8‰.

Euconchoecia aculeata (T. Scott)
(Pl. VII, Fig. 19-23 and Map XVIII)

Halocypris aculeata Scott, 1894.

Euconchoecia aculeata Müller, 1906a and 1912.

Euconchoecia aculeata Poulsen, 1969a.

Localities:- Numerous Stations. See Table Ia.

Description:-

Carapace:- Length 0.95 mm to 1.15 mm in male and 1.15 mm to 1.45 mm in female. Shape of the carapace is similar to that is shown by Müller (1906a).

The appendages are similar to *E. chierchiae*. But the frontal organ is longer over-reaching the stem of the first antenna.

Remarks:- Longer forms of female, which according to Müller (1906a) belonging to *E. aculeata* var. *elongata* were present in fair numbers. There are no morphological differences for considering it separately. Poulsen (1969a) observes, that it is possible for it to exist in the female sex only.

It is interesting to compare this situation with that of *S. parthenoda*. When Müller (1906a) created it he thought that it existed only in female form, and reproduce by parthenogenesis, which is evident from the name itself. Deevey (1969a) and Angel (1969d) described the males of *S. parthenoda* which is very close to *C. magna* with which many previous authors might have confused *S. parthenoda*.

The possibility of confusing males of *S. aculeata* var. *elongata* if present with any other species is very remote. I feel that it is the same species with a wider range of shell length or as Poulsen (per. comm.) has stated that it may be the result of post maturity moults.

Distribution:- This species was recorded from the Indian, Atlantic and Pacific Oceans (Muller, 1906a. Hartmann. 1959 and Poulsen, 1969a). It was found to be the most widely distributed and the most abundant halocyprid ostracod in the Northern Indian Ocean. Its wide range of tolerance in salinity seems to promote its distribution. The maximum number of 11,000/haul were observed in a station 13°03'N and 50°00'N where temperature and salinity values were 16.3 to 25.3°C and 35.5‰ to 36‰. Statistical analysis does not show any significant diurnal variations. Seasonal variations were significant (5% level) only in Bay of Bengal, more abundant during NE monsoon period. Possible range in temperature 10.2°C - 30.5°C and salinity 31.1‰ - 37.4‰.

Genus *Bathyconchoecia* Deevey

Bathyconchoecia Deevey, 1968a.

Bathyconchoecia Poulsen, 1969a.

Two species of *Bathyconchoecia* viz. *B. deeveyae* and *B. angeli* are present in IIOE material. Presence of large number of (100 - 300) sensory filaments on the first antenna is the most important diagnostic character of this genus.

George (1967) has reported the occurrence of *Grubea lacunosa* in the Arabian Sea. The genus name *Grubea* was given by mistake. Poulsen (per. comm.) intended to use this genus name at one time but abandoned the idea as Deevey (1968b) published the genus Bathyconchoecia. The specimen, belonging to probably B. lacunosa, are not good enough for taxonomic studies and hence left out in the present study.

Key to Bathyconchoecia species (modified from Poulsen, 1972)

1. Shell with long rostral, lateral, dorsal and posterior spines 2

1. Shell without much spines 3

2. Shell surface covered with fine 'hairs'.....septemspinosa

2. Shell surface without 'hairs' ....deeveyae

3. Right dorso-posterior shell corner with point or spine 4

3. Right dorso-posterior shell corner without point or spine 9

4. Each half of male rostrum bifid ....darcythompsoni

4. " " " " simple 5

5. Posterior glands open in notches or level with shell edge, ... 6

5. Glands open on rounded processes 7

6. Posterior carapace margin with denticles....sagittarius

6. No such denticles ....arctica*

7. Adult length > 4 mm ....darcythompsoni

7. " " < 4 mm 8

8. First segment of antenna 1 with ventrolateral bulge ....crosneri

8. No such bulge .... *subrufa*

9. Adult length > 4 mm 10

9. " " < 4 mm 11

10. Posterior carapace margin with denticles...*foveolata*

10. " " " smooth...........*baskiae*

11. Length of adults < 1.5 mm (1.0 - 1.5 mm) 12

11. " " > 1.5 mm (1.6 - 2.5 mm) 15

12. Both posterior dorsal corners of
carapace produced into blunt processes ....*nodosa*

12. No such processes 13

13. Posterior dorsal carapace corners
sharply right angled, height 55-60% length...*laqueata*

13. Posterior dorsal carapace corners
rounded height 70% of length 14

14. Rostrum barely bent ventrally,
shoulder vaults not prominent .... *latirostris*

14. Rostrum strongly bent ventrally,
shoulder vaults prominent .... *paulula*

15. Shell not strikingly sculptured,
though punctuation may be present.......... *galesta*

15. Shell with covering of vertical striations..*arctica**

15. Shell strikingly covered with polygonal
cells with pits.................................. 16

16. Shell sculpturing prolonged as a flange
along the posterior margin below the
gland openings........................... *kornickeri*

16. No such flange 17

17. Rostrum clearly bent ventrally .... <u>lacunosa</u>

17. " barely " " .... <u>angeli</u>

* <u>B. artica</u> has a minute spine and so is keyed out on both sides.

<u>Bathyconchoecia</u> <u>deeveyae</u>, Kornicker
(Map XVII)

<u>Bathyconchoecia</u> <u>deeveyae</u> Kornicker, 1969.

<u>Bathyconchoecia</u> <u>deeveyae</u> George, 1971.

<u>Locality</u>:- Station Co 62 - 10°39'N - 75°22'E - 1 specimen

The only male specimen obtained so far, is from IIOE material, the description of which is given by George (1971). (See appendix II).

<u>Bathyconchoecia</u> <u>angeli</u>, George
(Map XVII)

<u>Bathyconchoecia</u> <u>angeli</u> George (in press).

<u>Locality</u>:- Station Ki 519 - 06°36'N, 98°03'E - 1 specimen.

The description (see appendix VI) is based on a single female specimen.

SUBFAMILY HALOCYPRINAE Claus

Key to the genera of subfamily Halocyprinae

1. Carapace with spines or processes .... *Fellia*

1. Carapace without spines or processes.......... 2

2. Rostrum well developed........................ *Halocypria*

2. Rostrum low and flattened..................... *Halocypris*

Genus *Halocypria* Claus

Halocypria Claus, 1874 and 1891.

Halocypris (part) Müller, 1906a and 1912.

Halocypris (part) Skogsberg, 1931.

This genus includes only one species *H. globosa*.

Halocypria globosa Claus
(Map XVII)

Halocypria globosa Claus, 1874 and 1891.

Halocypris globosa Müller, 1906a and 1912.

Halocypris globosa Skogsberg, 1931.

Halocypris globosa Deevey, 1968a.

Halocypria globosa Poulsen, 1969a.

Localities:- Station Ar 47 - 08°53'N, 53°09'E - 80 specimens
Di 5267 - 06°44'N, 57°59'E - 2 "
Ki 360 - 09°14'N, 86°06'E - 10 "
Me 126 - 05°44'N, 49°30'E - 22 "

Description of Female:

Carapace:- Length 2.0 mm in all the adult specimens examined. Dorsal margin more or less straight, other margins rounded. Rostrum broad and pointed and bent ventrally.

First antenna:- Similar to the type described by Müller (1906a) with a longer dorsal bristle on the second segment.

Mandible:- Toothed edge of coxale with 10 teeth - anterior most tooth broad and flat, followed by 8 pointed teeth of which the distal ones are smaller; posterior-most tooth is bigger and pointed. Distal tooth list with 1 large and about 15 smaller one. Proximal tooth list is slightly narrower than the distal list with about 6 teeth of different size.

Furca:- Poulsen (1969a) described it having 7-8 claws. But all the adult specimens examined by me had 8 pairs of claws. Unpaired bristle present.

Frontal organ:- Proximal part is bent at an angle with the distal part as shown by Müller (1906a). Proximal part is straight and uniformly thick with a rounded end. This part has a weak suture, a little proximally of its middle.

Remarks:- Males of H. globosa are rare which is evident from the fact that Claus (1874, 1891) and Skogsberg (1931) described only females and Müller (1906a) had only one male. H. globosa as such is exceedingly rare in IIOE material and males were not observed.

<u>Distribution</u>:- Poulsen (1969) reported this species to be most frequent in the tropical parts of all the oceans. In the IIOE material this species was very rare, present in the equatorial region where the temperature and salinity ranges are 13.3°C - 29°C and 33.3‰ - 35.6‰.

Genus <u>Halocypris</u> Dana

<u>Halocypris</u> Dana, 1852.

<u>Halocypris</u> Müller, 1890.

<u>Halocypris</u> Claus, 1891.

<u>Halocypris</u> <u>brevirostris</u> (Dana)
(Map XIX)

<u>Conchoecia</u> <u>brevirostris</u> & <u>C</u>. <u>inflata</u> Dana, 1849.

<u>Halocypris</u> <u>concha</u> & <u>H</u>. <u>pelagica</u> Claus, 1891.

<u>Halocypris inflata</u> Müller, 1906a, 1908 and 1912.

<u>Halocypris</u> <u>brevirostris</u> Skogsberg, 1920.

<u>Halocypris</u> <u>brevirostris</u> Deevey, 1968a.

<u>Halocypris</u> <u>brevirostris</u> Poulsen, 1969a.

<u>Localities</u>:- See Table Ia.

<u>Description</u>: In males, length varies from 1.4 - 1.5 mm; height about 70% of its length. In female, length varies from 1.4 - 1.6 mm with height more than 80%. Shape differs from <u>Halocypria</u> <u>globosa</u> in having a less developed rostrum.

This species has been described in detail by Skogsberg (1920).

Remarks:- Morphologically this species has close resemblance to H. globosa. Furcal lamellae has only 7 pairs of claws against 8 in H. globosa.

Distribution:- Reported earlier from all the tropical parts of all the oceans (Poulsen, 1969a). They were encountered in the western Arabian Sea and Bay of Bengal in the equatorial region. Statistical analysis failed to show any significant seasonal or diurnal variations. Possible range in temperature 11.9°C - 30.3°C and salinity 32.1‰ - 36.1‰.

SUBFAMILY CONCHOECINAE

Key to the genera of Conchoecinae (Adapted from Poulsen, 1973)

1. One or more sensory bristles of the 1st antenna deeply furcate .... Microconchoecia

1. None of the bristles of the 1st antenna furcate..... 2

2. Right asymmetric gland on antero-ventral shell corner .... Conchoecilla

2. This gland on or near the postero-ventral shell corner 3

3. Left asymmetric gland on rostrum or on first-third of dorsal margin .... Metaconchoecia

3. This gland near postero-dorsal shell corner or on posterior half of dorsal margin........ 4

4. A compound gland at middle of ventral margin... Gaussicia

4. No such gland present............................... 5

5. Expodite of mandible elongate, flat, leaf-like .... Platyconchoecia

5. Exopodite of mandible a small knob with a long bristle 6

6. Masticatory pad of mandible coxale a roughly triangular plate with an undivided, straight, ventral margin .... Paraconchoecia

6. This pad with a divided ventral, straight margin or with flaps 7

7. The straight ventral margin of this pad divided into an anterior and a posterior part, both with long, spine-like papillae.. Conchoecetta

7. Ventral part of masticatory pad consists of 2 or more partly overlying ridges or flaps with rounded margins 8

8. Basale of mandible short, less than 1/5 of total length of the mandible .... Pseudoconchoecia

8. Basale longer, more than 1/4 of the mandible........ 9

9. Shell of about the same height anteriorly and posteriorly; ventral margin slightly concave....... 10

9. Shell highest at the middle or posteriorly, ventral margin or convex.......................... 11

10. Shell with a more or less distinct concentric striation or with hardly any striation .... Conchoecia

10. Shell with a distinct striation anteriorly, the striae running parallel to the antero-ventral margin .... Mollicia

11. Lateral corner glands absent 12

11. Lateral corner glands present 13

12. Ventral margin of 1st endopodite segment of mandible with only one or two bristles .... Spinoecia

12. This margin with 3 or 4 bristles .... Orthoconchoecia

13. More than one lateral corner gland, either on both valves or only on one of the valves.... Alacia

13. Only one lateral corner gland on each valve....... 14

14. The right lateral gland opens on the right asymmetric gland .... Loricoecia

14. This gland opens dorsally of the right asymmetric gland 15

15. Shell sculpture strongly reticulate with a pattern of rectangles or posteriorly of round "scales"; dorso-posterior spines present on both valves .... Conchoecissa

15. Shell not with either strong reticulation or dorso-posterior spines 16

16. Dorso-posterior shell corners rounded, each with 3-4 small, pointed teeth .... Boroecia

16. Dorso-posterior corners rounded and bare or each with a short spine .... Paramollicia

Genus *Paraconchoecia* Claus

Paraconchoecia Claus, 1891.

Paraconchoecia Poulsen, 1973.

Paraconchoecia is differentiated from other genera by the shape of the masticatory pad of the mandibular endite, being an undivided triangular plate with a broad ventral margin. Shape of the carapace and frontal organ varies. Asymmetric glands open at the usual places, right one near the postero-ventral and left one near the postero-dorsal corner.

Six species occur in the present material *P. oblonga*, *P. echinata*, *P. elegens*, *P. discophora*, *P. procera* and *P. decipiens*.

Key to the species (IIOE) of Paraconchoecia

1. 'e' bristle of the first antenna with oval plate 2
1. " without............... 3
2. Female first antenna with dorsal bristle........ *discophora*
2. Female first antenna without.................... *elegens*
3. 'b' bristle of first antenna with a double comb of spines .... *echinata*
3. 'b' bristles with no comb 4
4. Posterior margin of the shell arched .... *procera*
4. Posterior margin sloping 5

5. Shoulder vaults less developed, carapace margin where the opening of the right asymmetric gland is located, distinct and almost triangular .... decipiens

5. Shoulder vaults well developed carapace margin where the opening of the right asymmetric gland is located less distinct.... oblonga

Paraconchoecia oblonga Claus
(Pl.I, Figs. 1-9 and Map I)

Paraconchoecia oblonga Claus, 1891.

Conchoecia oblonga Müller, 1906a and 1912.

Conchoecia oblonga Skogsberg, 1920.

Conchoecia oblonga Deevey, 1968a.

Parachoecia oblonga Poulsen, 1973.

Localities:- See Table Ia.

Description:

Carapace:- Dorsal margin more or less straight with well developed shoulder vaults. Dorso-posterior corner of the right valve developed into a small spine. Postero-ventral and antero-ventral corners rounded. Asymmetric glands open on the usual place. Length of adult male 1.45 mm and height 47% of length. Length of adult female 1.6 - 1.7 mm and height 43% of length.

First antenna:- Male - The 'e' bristle with a relative length of 49% armed with about 30 pairs of narrow and pointed spines, which becomes smaller distalwards. Two or 3 pairs of distally bent spines are present distally. The 'b' and 'd' bristles are slightly shorter than the 'e' bristle and their distal one-third are slightly bent at an angle with the remaining portion as in the case of 'e' bristle.

Female: The dorsal bristle of the second segment is as long as the stem itself. The 'e' bristle long and provided with hairs on the distal two-third part.

Second antenna:- Male - Clasping organ of the right second antenna is powerful and uniformly curved, left one small with its distal part bent at right angle to the proximal part.

Mandible:- Toothed edge of the coxale with 8 teeth. Distal tooth list with 2 long and about 14 smaller teeth. Proximal tooth list also with same number of teeth. Masticatory pad is undivided and provided with spines and hairs. Basale endite with 6 serrulated teeth.

Maxilla:- Anterior edge of the first endopodite segment with 5 and posterior edge with 3 bristles. End segment with 5 bristles of which 2 are claw-like.

<u>Copulatory limb</u>:- Uniformly narrow. Vas deferens runs near the ventral margin of the appendage and opens at the ventro-distal part which bears a transversely placed spine.

<u>Furca</u>:- With 8 pairs of claws. First pair is slender. Second to fifth are thick and curved with short spines. Last 3 pairs are smaller.

<u>Frontal organ</u>:- <u>Male</u> - Shaft reaches the distal end of the first antenna. Capitulum as long as the second segment of the first antenna and with small hairs proximally.

<u>Female</u>: Shaft reaches far beyond the first antenna and capitulum, provided with hairs, ends in a pointed tip.

<u>Remarks</u>:- Müller (1906a) shows a varying shapes of frontal organs for <u>P</u>. <u>oblonga</u>. Capitulum of the frontal organ of the present specimens agrees with Müller's Fig. 17 of Plate IX and figures of Skogsberg (1920) and Claus (1891). But differs from the capitulum shown by Poulsen (1973).

<u>Distribution</u>:- This species has been previously reported from Atlantic, Indian and Pacific Oceans (Poulsen, 1973). The present study shows its occurrence off Somali coast, south west of Ceylon, along the equatorial region. It was absent in the Northern Arabian Sea and Bay of Bengal. Examination of the hydrographic data of the areas of occurrence of this species shows a possible range in temperature from

11.5°C to 30°C and in salinity from 34.2‰ to 36.4‰.

<u>Paraconchoecia</u> <u>echinata</u> (Müller)
(Pl.I, Fig. 10-17 and Map I)

<u>Cochoecia</u> <u>echinata</u> Müller, 1906a and 1912.

<u>Paraconchoecia</u> <u>echinata</u> Poulsen, 1973.

<u>Localities</u>:- See Table I.[a]

<u>Description</u>:

<u>Carapace</u>:- Shape of the carapaces somewhat similar in both sexes. Posterior margin straight. Postero-dorsal corner of right valve with a small spine. Asymmetric glands present in the usual place. Dorsomedial glands present in both sexes. Parallel striations present near the ventral margin.

<u>First antenna</u>:- Relative length of the stem is 32% in male and 20% in female. <u>Male</u> - The 'e' bristle is also similar to that of <u>P</u>. <u>oblonga</u> but the number of spines is only about 15. The 2 pairs of distally bent spines of 'e' bristle very much pointed. The 'b' bristle with 10 - 12 short spines arranged like a comb plate.

<u>Second antenna</u>:- <u>Male</u> - Right clasping organ well developed with 2 small finger-like processes on its inner side proximally and the distal part is very much curved.

Mandible:- Pars incisiva of the coxale with about 10 teeth. Proximal and distal tooth list with 2 large and 14 - 18 small uniform and blunt teeth. Epipodial bristle spines like. Exopodite and the setation of the endopod similar to that of P. oblonga.

Maxilla, 5th, 6th and 7th limbs similar to other species of the genus.

Furca:- Furca differs from that of P. oblonga. Furcal claws of P. echinata are uniformly curved and with fine hairs. 4th pair is twice as long as the 5th pair. There is no unpaired bristle.

Copulatory limb:- Narrow with a broad middle portion and somewhat rounded tip.

Frontal organ:- Shaft reaches beyond the first antenna. In male, capitulum is separated from the shaft and bent, in female it is united. Capitulum is provided with hairs and with a rounded end in both sexes.

Remarks:- P. echinata is distinguished from other species by the shape of the frontal organ and copulatory limb, the presence of comb-like spines on 'b' bristle and the straight posterior margin.

Distribution:- Previously recorded from Atlantic, Indian and Pacific Oceans (Müller, 1906a; Poulsen, 1973). The distribution of this species closely resembles that of another member of the same genus, P. oblonga. It was found to occur along the equatorial belt, off Somali coast and off South-west of Ceylon, but was absent in the northern Arabian Sea and Bay of Bengal. Possible temperature range, 11.5°C - 28.7°C and salinity range 33.9‰ to 35.3‰.

Paraconchoecia elegens (Sars)
(Pl. I, Figs. 18-23 and Map II)

Conchoecia elegens Sars, 1865.

Paraconchoecia gracilis Claus, 1891.

Conchoecia elegens Müller, 1906a and 1912.

Conchoecia elegens Deevey, 1968a.

Paraconchoecia elegens Poulsen, 1973.

Localities:- See Table Ia.

Description:

Carapace:- Length 1.1 to 1.3 mm and 1.1 to 1.5 mm in male and female respectively. Elongated shape narrowing anteriorly very much similar to P. discophora.

Mandible:- Toothed edge of coxale with 11 teeth. Distal tooth list with 2 large and about 14 smaller teeth. Proximal tooth list with about 20 teeth, 2 or 3 posterior ones are larger.

Copulatory limb has a curved tip very much similar to the figure given by Deevey (1968a).

Descriptions are given by Claus (1891), Müller (1906a) and Skogsberg (1920).

Remarks:- This species closely resembles P. discophora. The important differences are discussed under P. discophora. P. elegens eventhough not as numerically abundant as many other species, has been reported by most of the previous authors and it is known to have a very wide distribution.

Distribution:- This species is widely distributed over all the three oceans. It is found to be present in the Arabian Sea and Bay of Bengal irrespective of seasons, but in the Bay of Bengal distribution is rather sporadic. It is more abundant along the Arabian coast and the mouth of Persian Gulf. The wider range of tolerance exhibited by the species could well explain its wide distribution. Temperature range 10.2°C - 30.5°C, salinity range 33.2‰ - 37.4‰.

__Paraconchoecia__ __discophora__ (Müller)
(Pl. I, Fig. 24-29 and Map I)

__Conchoecia__ __discophora__ Müller, 1906a and 1912.

__Conchoecia__ __discophora__ Deevey, 1968a.

__Paraconchoecia__ __discophora__ Poulsen, 1973.

__Locality__:- Station Di 5383 - 09°58'N, 67°32'E - 120 specimens.

__Description of male__:

Length 1.1 mm and height about 45% of carapace length. Shoulder vault well developed. A minute spine present on the postero-dorsal corner of right valve. Left asymmetric gland on the usual place, but the right one shifted more dorsalwards from the postero-ventral corner.

__First antenna__:- Length of stem 35% and 'e' bristle 39% of carapace length. The hyaline 'a' bristle as long as the stem and extended backwards. Distal half of the 'b' bristle with 2 rows of hairs. The 'e' bristle provided with an oval plate of hairs.

__Second antenna__:- Length of protopodite 60% and exopodite 26% of carapace length. Endopodite with curved subequal 'a' and 'b' bristles and thin and straight 'c' and 'd' bristles. The 'f' and 'g' bristles equal in length, strongly developed with their base slightly swollen. Right clasping organ curved more proximally, with a rounded end and with 8 or 9 furrows near the tip. Left one very small as in other species.

<u>Mandible</u>:- Pars incisiva of coxale, with 12 teeth, proximal and distal tooth lists, as in other species of the genus. Epipodite in the form of a verrucciform process. First endopodite ventrally with 3 bristles, one of them reaches beyond the end segment and dorsally a single bristle. Second segment with 2 long ventrally and one long and 2 short bristles dorsally. End segment with 7 bristles, 2 of them are claw-like.

<u>Maxilla</u>:- First endopodite segment with 6 bristles anteriorly and 3 posteriorly. Of the 5 bristles of the end segment, 2 are claw-like.

<u>Furca</u>:- With 8 pairs of claws gradually decreasing in size. Except the first pair, all the claws are bare. No unpaired bristle behind the claws.

<u>Copulatory organ</u>:- Resembles the copulatory organ of <u>P</u>. <u>elegens</u>. Length 3 times its breadth; tapering distalwards, it has a narrow rounded end.

<u>Female</u>: The female is similar in size and appearance to the female of <u>P</u>. <u>elegens</u>. Postero-dorsal corner of right valve showed variation, ending in either one, two or vary rarely without spines.

Second segment of first antenna with a short dorsal bristle; second antenna with straight 'a' and 'b' bristles. Capitulum of frontal organ reaches far beyond the stem of first antenna.

Remarks:- P. discophora is a very rare species and Poulsen (1973) even doubts its validity. However, P. discophora can be separated from P. elegens by the longer frontal organ and shape of the clasping organ, the tip of which is rounded in P. discophora and flattened in P. elegens. Dorsal bristle of first antenna in female was present in P. discophora and absent in P. elegens.

Distribution:- This species is reported to be exceedingly rare. Previous records include Müller (1906a) in Atlantic and Indian Oceans, Deevey (1968a) in Atlantic Ocean and Poulsen (1973) in Pacific Ocean. During the present study this species was encountered only at a single station, in the southern Arabian Sea where the temperature values range between 14.6°C - 29.4°C and salinity 34.8‰ - 35.9‰.

Paraconchoecia procera (Müller)
(Pl. II, Fig. 1-7 and Map III)

Conchoecia procera Müller, 1894.

Conchoecia procera Deevey, 1968a.

Conchoecia procera Angel, 1971.

Paraconchoecia procera Poulsen, 1973.

Localities:- See Table Ia.

Description:

Carapace:- Length 0.95 to 1.05 mm in male and 1.05 to 1.15 mm in female. Height about 47% of length. Dorsal margin almost straight and posterior margin smoothly rounded. Postero-dorsal corner of right valve with a small spine, opening of the right asymmetric gland very prominent.

First antenna:- Male - The 'a' bristle as long as the limb itself and 'c' bristle very short. The 'e' bristle slightly longer than 'b' and 'd' bristle provided with 16 to 17 pairs of spines, decreasing in length proximally and 2 distally pointing spinules in addition to it. Relative length of the stem is about 36%. In female, stem is shorter, only one-third of the frontal organ.

Second antenna:- The 'a' bristle of endopodite half as long as 'b' bristle, both provided with hairs. The more curved right clasping organ and the smaller left clasping organ with a pointed lip.

Mandible:- Toothed edge of coxale with 10 teeth. Distal tooth list with 2 large and 10 to 12 smaller teeth and proximal tooth list with 1 large and about 15 smaller teeth. First endopodite segment with one bristle on its ventral margin. Setation of the other segment is typical for the genus.

Maxilla:- First endopodite segment with 6 bristles on its anterior margin, 3 on its posterior margin and one laterally.

Fifth, sixth and seventh limbs are of the usual type.

Caudal furca:- Claws gradually decreasing in length and with fine hairs, unpaired bristle absent.

Frontal organ:- Male - Shaft is as long as the first antenna. Capitulum slightly bent downwards, with small hairs proximally.

Female:- The long capitulum, distal part of which is swollen and with a pointed end, is not well differentiated from the shaft.

Remarks:- Angel (1971a) described 2 new species *Paraconchoecia microprocera* and *P. macroprocera* and shows that Muller might have confused *P. procera* with these 2 closely related species. The present material is identified as *P. procera* taking into consideration the important factors, like size, shape of frontal organ and the armature of the 'e' bristle.

Distribution:- Reported earlier from Atlantic, Indian and Pacific Oceans (Müller, 1906a; Deevey, 1968a; Poulsen, 1973). This species was found to be distributed throughout the Arabian Sea and the Bay of Bengal as well as in the Red Sea. Its occurrence was noticed throughout the year. Statistical analysis of the data showed significant diurnal variations (significant at 5% level). This species also exhibited marked seasonal variation (significant at 0.1% level) in the Arabian Sea, being more abundant during SW monsoon. The wide range of tolerance of the species probably helps it to extend its range of distribution. Range in temperature 10.2°C - 30.5°C and in salinity 31.1‰ - 37.4‰.

<u>Paraconchoecia</u> <u>decipiens</u> (Müller)
(Pl.II, Figs. 8-14 and Map IV)

<u>Conchoecia</u> <u>decipiens</u> Müller, 1906a and 1912.

<u>Paraconchoecia</u> <u>decipiens</u> Poulsen, 1973.

<u>Localities</u>:- See Table Ib.

<u>Description</u>:

<u>Carapace</u>:- Length 1.15 - 1.3 mm in male and 1.35 - 1.6 mm in female. Height 50% of length. Shoulder vaults well developed. Dorsal half of the posterior margin somewhat straight, postero-ventral corner strongly rounded. Postero-dorsal corner of right valve with a small spine. Right asymmetric gland opens on the ventral margin more anteriorly than in the other species of the genus.

<u>First antenna</u>:- Similar to that of <u>P</u>. <u>procera</u>, 'e' bristle in male with about 30 rows of spines increasing in length proximally.

<u>Second antenna</u>:- <u>Male</u> - Endopodite of second antenna with straight and subequal 'e' and 'b' bristles. The 'g' bristle, 4 times as long as 'h', 'i' and 'j' bristle. Clasping organ more or less similar to that of <u>P. procera</u>, but the tip of right clasping organ is not as pointed as in <u>P. procera</u>.

<u>Mandible</u>:- Proximal tooth list with about 10 - 12 teeth. Ventral margin of the first endopodite segment with 2 bristles.

Other appendages are as in <u>P. procera</u>.

<u>Frontal organ</u>:- Shaft reaches level with the first antenna. Capitulum with more or less uniform thickness and with a rounded end. In female, even though the shaft and capitulum are fused together, the differentiation is more visible than in <u>P. procera</u>. Tip of capitulum is rounded in female also.

<u>Remarks</u>:- <u>P. decipiens</u> is very much similar to <u>P. procera</u> morphologically, but can be distinguished by the shape of the carapace, frontal organ and by the armature of 'e' bristle. The ventral margin of the first endopodite segment of mandible has a single long bristle in <u>P. procera</u> but 2 in <u>decipiens</u>.

<u>Distribution</u>:- Earlier records show its occurrence in the tropical parts of Indian and Pacific (Müller, 1906a; Poulsen, 1973). It is distributed throughout the Arabian Sea and the Bay of Bengal. The pattern of distribution is generally

similar to that of _P_. _elegens_. In the Arabian Sea the species exhibited seasonal variation, which was found to be significant at 1% level; more abundant during NE monsoon. Diurnal variation was also significant at 1% level. Possible range in temperature 10.2°C - 30.3°C and salinity 32.3‰ - 37.4‰.

Genus _Conchoecetta_ Claus

Conchoecetta Claus, 1891.

Conchoecetta Poulsen, 1973.

The genus Conchoecetta includes two species _C_. _acuminata_ and _C_. _giesbrechti_, characterised by an elongated shell with an acute dorsoposterior angle, hairs across the posterior part of shell, female first antenna with short dorsal bristle, 'e' bristle on male with 20 pairs of spines having broad base and pointed tip.

Key to the species of Conchoecetta

The 'h' bristle of 2nd antenna with a
bulbous basal part .... _giesbrechti_

This bristle without a bulbous basal part ...... _acuminata_

Conchoecetta acuminata Claus
(Pl. II, Fig. 21-26)

Conchoecetta acuminata Claus, 1891.

Conchoecia acuminata Müller, 1906a, 1912.

Conchoecia acuminata Skogsberg, 1920.

Conchoecia acuminata Deevey, 1968a.

Conchoecetta acuminata Poulsen, 1973.

Localities:- Stations - AB 30 - 12°17'N, 93°21'E - 120 specimens
AB 113 - 03°33'N, 69°54'E - 75 "

Description:

Carapace:- Length 2.0 to 2.2 mm in male and 2.4 to 2.8 mm in female. Height about 40% of length in male, only one-third of its length in female. In male posterior shell margin with a series of hairs. Postero-dorsal corner forms an acute angle. Asymmetric glands on the usual place.

First antenna:- Male - The 'e' bristle with about 20 pairs of spines having broad base and pointed tip. Female - Dorsal bristle of the 2nd segment comparatively short.

Second antenna:- Male - Process mammillaris is not pointed. Distal two-third part of right clasping organ curved and at right angle to proximal part and straight in left clasping organ. The 'h', 'i' and 'j' bristles with uniform thickness.

Mandible:- Masticatory pad divided into 2 clear parts each provided with more than 6 thick and long spines. Pars incisiva of coxale with 10 teeth. Distal tooth list with one large and 10 small teeth and proximal tooth list with 10 teeth of varying size and shape.

Maxilla:- Basal bristle present. First endopodite segment with 5 bristles anteriorly, 3 posteriorly and one laterally. This segment possesses 5 or 6 short and sharp spines distally.

Fifth and sixth limbs do not show variation from the usual pattern.

Seventh limb:- Of the 2 sub-equal bristles, the longer one has a few short spines proximally.

Furca:- Claws gradually decrease in length, but the last 3 pairs are very thin. Unpaired bristle present behind the claws.

Copulatory limb:- Shape is somewhat similar to that of P. decipiens and P. procera.

Frontal organ:- Male - Shaft reaches the end of first antenna. Capitulum with a square cut end and spines over the proximal half. Female - Long and slender with uniform thickness but with a narrow end.

Remarks:- C. acuminata resembles C. giesbrechti in the shape of the shell. The females of the former species is distinguished by the acute angle of dorso-posterior corner and the pointed rostrum. The important difference between these 2 species is that the base of the 'h' bristle of second antennal endopodite is thin walled in C. acuminata and with a bulbous base in C. giesbrechti. Frontal organ in male has a square cut end in C. acuminata whereas it is rounded in C. giesbrechti.

Distribution:- This species was previously recorded from all the three oceans (Müller, 1906a; Poulsen, 1973). The species was not common. The range of temperature 11.9 - 20°C and salinity 32.3‰ - 35.4‰.

Conchoecetta giesbrechti (Müller)
(Pl.II, Fig. 15-20 and Map V)

Conchoecia giesbrechti Müller, 1906a and 1912.

Conchoecetta giesbrechti Poulsen, 1973.

Localities:- See Table IB.

Distribution:

Carapace:- Length 1.7 to 2.00 mm in male and 2.1 to 2.2 mm in female. Shape of the carapace more or less similar to C. acuminata.

First antenna:- Male - The 'e' bristle with about 35 pairs of spines, 'b' and 'd' bristles with a few pairs of spines as in C. acuminata.

<u>Second antenna</u>:- The 'h' bristle of the endopod with bulbous proximal part.

<u>Frontal organ</u>:- <u>Male</u> - Frontal organ has a rounded end.

<u>Female</u>: - Frontal organ is similar to that of <u>C</u>. <u>acuminata</u>.

<u>Remarks</u>:- Poulsen (1973) describes <u>C</u>. <u>giesbrechti</u> with the 'b' and 'd' bristles of first antenna without any spinules. The present material shows their presence as in <u>C</u>. <u>acuminata</u>.

<u>Distribution</u>:- Müller (1906a) observed the species from the Atlantic, Indian and Pacific Oceans, so also Poulsen (1973). They were found distributed in the Arabian Sea and Bay of Bengal in large numbers. Seasonal variation was significant at 1% level in Bay of Bengal being more abundant during SW monsoon period. Diurnal variations were far more pronounced (significant at 0.1% level). They occurred in a wide range of salinity 32‰ - 37‰ and temperature 11.5°C - 30.4°C.

Genus <u>Microconchoecia</u> Claus

<u>Microconchoecia</u> Claus, 1891.

<u>Microconchoecia</u> <u>Poul</u>sen, 1973.

Small shell with conspicuous reticulations and striations, dorsally placed right asymmetric gland. First antenna in male with forked 'a' bristle and 'e' bristle having a single row of spines. In female 'a', 'b' and 'c' bristles are forked.

Masticatory pad of the mandible with a broad and straight ventral margin with 2 or 3 ridges.

Microconchoecia curta (Lubbock)
(Pl.III, Fig. 1-9 and Map VI)

Conchoecia curta Lubbock, 1860.

Microconchoecia clausii var similis Claus, 1891.

Conchoecia curta Müller, 1906a, 1912.

Conchoecia curta Skogsberg, 1920.

Conchoecia curta Deevey, 1968a.

Microconchoecia curta Poulsen, 1973.

Localities:- See Table IB.

Description:

Carapace:- Length 0.7 to 0.9 mm. Height two-third of its length. Postero-dorsal corner distinct. Postero-ventral corner rounded. Carapace reticulated. Right asymmetric gland opens on the posterior margin dorsally of the postero-ventral corner, left one on the usual place.

First antenna:- Male - The hyaline 'a' bristle is forked. The 'b', 'd' and 'e' bristles equally long. The 'e' bristle with 13 spinules. The 'b' and 'd' bristles with a few spines. Female - The dorsal bristle of the second segment only slightly shorter than this segment.

Second antenna:- **Male** - Protopodite about half as long as shell. Subequal 'a' and 'b' bristles very much curved. The 'g' bristle is longer than 'f' bristle and flattened distally. The 'h' bristle has a little swollen base of spinous nature. Right clasping organ curved with a broad base and narrow distal end.

Mandible:- Toothed edge of pars incisiva of coxale with 10-12 teeth. Distal tooth list with 2 large teeth, one of which is serrate and about 15 small teeth. Proximal tooth list with about 10-12 irregular teeth decreasing in size. Masticatory pad divided into 2 (or 3) ridges; 2 spines also present at its base. Two bristles of the 2nd endopodite segment comparatively long. Second and third segment with group of hairs.

Maxilla:- Basale without any bristle. First endopodite segment with with 6 anterior and 4 posterior bristles.

Copulatory limb:- It has a rounded end with the pointed appendage protruding out.

Furca:- Claws bare. Unpaired bristle absent.

Frontal organ:- Male - Shaft reaches about the distal end of the second segment of first antenna. Capitulum somewhat narrow at the middle and has a rounded end. Female - Not separated into shaft and capitulum and is only as long as the first antenna. It has a rounded end.

Remarks:- Only one species of the genus Microconchoecia is present in the present material. The unique feature of having forked bristle on the first antenna, makes Microconchoecia, a well defined genus.

Distribution:- Reported earlier from all the three oceans (Müller, 1906a; Poulsen, 1973). It was found off Somali and Arabian coast, off south west coast of India and southern Bay of Bengal. Most of the specimens were collected during the SW monsoon period, both from the Arabian Sea and Bay of Bengal eventhough statistical analysis failed to show any significant seasonal or diurnal variation. Possible range in temperature 11.5°C - 30.5°C and salinity 32‰ - 36.9‰.

Genus Metaconchoecia Granata & Caporiacco

Metaconchoecia Granata & Caporiacco, 1949.
Metaconchoecia Poulsen, 1973.

This genus comprises those species which Müller (1906a) included under his "Rotundata" group, characteristic features are, the location of left asymmetric gland antero-dorsally or on the rostrum, and the upper lip with weakly developed combs and narrow deep notch in between the combs.

Key to the species (IIOE) of Metaconchoecia

Right asymmetric gland opens close to the postero-dorsal corner .... rotundata

Right asymmetric gland opens more posteriorly.... kyrtophora

Metaconchoecia rotundata (Müller)
(Pl. III, Fig. 10-17 and Map VII)

Conchoecia rotundata Müller, 1890.

Conchoecia rotundata Deevey, 1968a.

Metaconchoecia rotundata Poulsen, 1973.

Localities:- See Table Ib.

Description:

Carapace:- Length 0.9 to 1.1 mm. Height 46% of length in male and 53% in female. Posterior and ventral margins and the corners rounded. Right asymmetric gland opens close to the postero-dorsal corner and the left one just behind the rostrum.

First antenna:- Male - The 'a' bristle curved proximally and only a little shorter than the limb. The 'b' and 'd' bristles shorter than 'e' bristle. The 'e' bristle furnished with 10-11 pairs of proximally pointing spines decreasing in length distally. The 'e' bristle is distinctly bent distally to its armature.

<u>Second antenna</u>:- <u>Male</u> - Protopodite about 50% of carapace length. The 'a' and 'b' bristles of endopodite are longer and less curved than in female. The 'c' and 'd' bristles extremely short. The 'f' and 'g' bristles 3 times as long as the irregularly curved 'h', 'i' and 'j' bristles and have their distal half a little flattened and hyaline. In female these 5 bristles are more or less of the same length.

<u>Mandible</u>:- Toothed edge of coxale with about 15 teeth with the anterior one flattened. Remaining teeth are rather small and of different shape and size. Distal tooth list with one large and about 20 small teeth. Proximal tooth list has 2 or 3 large teeth with smaller teeth in between them posteriorly and about 15 smaller ones.

<u>Maxilla</u>:- There is no basal bristle. Endopodite with 4 bristles anteriorly, three posteriorly and one laterally.

<u>Copulatory organ</u>:- Posterior margin is convex and the tip is obliquely rounded.

<u>Furca</u>:- Unpaired bristle present behind the furcal claws.

<u>Frontal organ</u>:- <u>Male</u> - Shaft ends level with the end of the first antenna. Capitulum is deep with its proximal 1/4 part, bent at an angle with the distal part. The tip is rounded. Hairs present, throughout ventrally and only few are present dorso-proximally. <u>Female</u> - Frontal organ is long

and straight, capitulum, has hairs ventrally and the distal end is slightly bent downwards and has a rounded tip.

Remarks:- What Müller (1906a) described as Conchoecia rotundata was later on found to consist of 3 different species. From it, Iles (1963) separated C. skogsbergi and C. teretivalvata. The present specimens are identified as M. rotundata considering mainly the armature of the 'e' bristle of first antenna and its relative length with 'b' and 'd' bristles. The differences between these 3 closely related species have been discussed by Deevey (1968a) and Poulsen (1973).

Distribution:- This species was previously reported from Atlantic and Pacific Oceans by Müller (1890), Skogsberg (1920), Poulsen (1973) and from Indian Ocean by George (1969). Distribution of this species was similar to that of P. procera. It was present in the entire Arabian Sea, Red Sea and in the Bay of Bengal. This species was found to establish itself on the comparatively low saline waters of the Bay of Bengal and reach high abundance as could be seen from their distribution within a wide range of salinity. It was recorded throughout the year. Statistical analysis failed to show any significant seasonal or diurnal variation. Possible range in temperature 10.1°C - 30.5°C and in salinity 31.1‰ - 37.4‰.

Metaeonchoecia kyrtophora (Müller)
(Pl. III, Fig. 18-26 and Map XVI)

Conchoecia kyrtophora Müller, 1906a, 1912.

Conchoecia kyrtophora Deevey, 1968a.

Metaconchoecia kyrtophora, Poulsen, 1973.

Localities:- Stations

AB 10	-16°36'N, 64°00'E	- 8	specimens
Co 45	-09°52'N, 75°39'E	- 3	"
Co 58	-10°29'N, 75°31'E	- 4	"
Co 62	-10°39'N, 75°22'E	-10	"
Di 5267	-06°44'N, 57°59'E	- 3	"
Di 5269	-03°59'N, 57°59'E	-18	"
Di 5404	-08°20'N, 57°59'E	- 2	"
Di 5560	-13°12'N, 50°19'E	- 8	"
Ki 531	-06°00'N, 96°00'E	-10	"

Description:

Carapace:- Length 0.75 - 0.8 mm. Height, greater posteriorly 57% of length in male and 60% in female. Antero-ventral and postero-ventral corners rounded. Postero-dorsal corner is distinct especially in male. Striations faintly visible. The left asymmetric gland opens just behind the rostrum and right asymmetric gland near the posterior shell fusion.

First antenna:- Male - The 'a' and 'c' bristles as in *M. rotundata*. The 'b' and 'd' bristles only a little shorter than 'c' bristle. The 'e' bristle with 7-8 spines with a blunt end.

Second antenna:- Right and left clasping organs with more or less the same size. The distal two-third portion is curved and forms a right angle with the proximal part. It has an obliquely pointed end and has furrows. Left one is curved proximally and with narrower distal end.

Frontal organ:- In male, shaft reaches the end of first antenna. Capitulum has swollen distal portion with a rounded end.

Remarks:- A careful study of the appendages clearly showed its close similarity with *M. rotundata*. Skogsberg (1920) considered "Roundata" group as a natural one. It appears that *Metaconchoecia* is one of the few well defined genera coming under Conchoecinae.

Distribution:- This species was recorded from Atlantic and Indian Oceans (Müller, 1906a) and it is considered to be a rare one. This species was found mostly in the southern Arabian Sea. It does not seem to withstand large fluctuations in salinity, as evidenced by its absence in the low saline waters of Bay of Bengal. Possible range in temperature 12.2°C - 29°C and salinity 33‰ - 36.5‰.

Genus *Orthoconchoecia* Granata & Caporiacco

Orthoconchoecia Granata & Caporiacco, 1949.

Orthoconchoecia Poulsen, 1973.

This genus includes species of Müller's (1906a) "Bispinosa" group. Granata and Caporiacco (1949) removed *Conchoecia gaussi* and *C. incisa* from it and proposed the genus name. Characteristic features are longer size, presence of pad on 'b' bristle of first antenna; exceptionally long 'c' bristle of endopodite of second antenna; 'h', 'i' and 'j' bristles with spinous shafts, masticatory pad of mandible with 3-4 semicircular flaps.

Key to the species (IIOE) of Orthoconchoecia

1. Postero-dorsal corner without spines......... *atlantica*
1. " " with spines 2
2. Shell with distinct striations, spines of 'e' bristle of first antenna at right angle to the bristle .... *striola*
2. Shell without distinct striations, spines of 'e' bristles slanting .... *bispinosa*

Orthoconchoecia striola (Müller)
(Pl. IV, Fig. 7-15 and Map VIII)

Conchoecia striata Müller, 1890.

Conchoecia striola Müller, 1906a, 1912.

Orthoconchoecia striola Poulsen, 1973.

Localities:- See Table IIb.

Description:

Carapace:- Length of male 2.0 to 2.2 mm and female 2.2 to 2.4 mm. Height about half of its length. In female height increases posteriorly. Antero-ventral and postero-ventral corners rounded. Postero-dorsal corner of both valves produced into broad spines. Shoulder vaults powerful. Longitudinal striations parallel to the margin, clearly visible. The asymmetric glands open in the usual places.

First antenna:- Male - The 'a' bristle swollen at its base and directed backwards. The 'b' bristle with a pad, level with the armature of 'e' bristle. Armature of 'e' bristle consists of about 15 straight, conical spines, The size and shape of spines not uniform.

Second antenna:- The 'c' bristle as long as the first endopodite segment. The 'h', 'i' and 'j' bristles with spines on their base, 'h' bristle with more spines. Both right and left clasping organs well developed and smoothly curved, the distal ends provided with furrows terminating in small spines.

Mandible:- Toothed edge of coxale with 11-12 teeth. Distal tooth list with 2 larger and 10-12 small teeth. Proximal tooth list with 3-4 large teeth followed by 13-14 small teeth.

Maxilla:- Basal seta present. First endopodite segment with 6 anterior, 3 posterior and one lateral bristle.

Copulatory limb:- Anterior margin almost straight and posterior margin slightly convex. Distal end rounded.

Caudal furca:- First pair of claws reaches level with the second pair. Fine hairs present on the furca. Unpaired bristle not present.

Remaining limbs agree with *O. bispinosa* (Poulsen, 1973).

Frontal organ:- Dorsal margin concave. Distal end square-cut or truncate, provided with hairs about 1/2 to 3/4 of its proximal portion. In female the distal end is rounded.

Remarks:- *O. striola* is very similar to *O. bispinosa* but can be distinguished by the following characters: Armature of 'e' bristle of first antenna with only 15 pairs of spines, smoothly curved clasping organs, shape of the frontal organ and the conspicuous striations of the shell.

Distribution:- This species has been reported from the Indian and Pacific Oceans (Müller, 1906a; Poulsen, 1973). In the Indian Ocean *O. striola* is a very common species, though it did not attain very high numbers. It was present off Somali and Arabian coast, in the equatorial region, east of Andaman Islands and at the mouth of Malacca Strait. They seem to prefer higher salinity. Possible range in temperature 11.5°C - 30.5°C and salinity 33.2‰ - 36.1‰.

Orthoconchoecia bispinosa (Claus)
(Pl. IV, Fig. 1-6 and Map XVI)

Conchoecia bispinosa Claus, 1891.

Conchoecia bispinosa Müller, 1906a and 1912.

Conchoecia bispinosa Skogsberg, 1920.

Orthoconchoecia bispinosa Granata and Caporiacco, 1949.

Conchoecia bispinosa Deevey, 1968a.

Conchoecia bispinosa Angel, 1970a.

Orthoconchoecia bispinosa Poulsen, 1973.

Localities:- Stations - AB 16 - 07°31'N, 96°11'E - 12 specimens
Ar 29 - 95°92'N, 53°01'E - 8 "
Ar 31 - 00°57'N, 62°19'E - 10 "
Di 5089 - 13°14'N, 50°15'E - 4 "
Di 5559 - 11°25'N, 52°42'E - 8 "

Description:- Length varies from 1.6 - 2.1 mm. This species is very much similar to O. striola differentiated by the presence of about 30 spines on 'e' bristle of first antenna, rounded end of male frontal organ and the less conspicuous striation of the carapace.

Distribution:- According to Müller (1906a) and Poulsen (1973), this species has a very wide distribution in all the three oceans. Surprisingly the IIOE samples contain only a few representatives. These were collected from the mouth of Malacca Strait and the Arabian Sea. A comparison of the pattern of distribution of a closely related species, O.striola with the present species suggest the possibility that this has been replaced by O. striola. Possible range in temperature

12.5°C - 30°C and salinity 32.9‰ - 36.4‰.

Orthoconchoecia atlantica (Lubbock)
(Pl.IV, Fig. 16-19 and Map IX)

Halocypris ~~atlantis~~ atlantica Lubbock, 1856.

Conchoecia atlantica Müller, 1906a and 1912.

Orthoconchoecia atlantica Granata & Caporiacco, 1949.

Conchoecia atlantica Deevey, 1968a.

Orthoconchoecia atlantica Poulsen, 1973.

Localities:- See Table Ib.

Description:

Carapace:- Length 3.2 to 4.5 mm. Females are larger in size than male. Height of carapace about half of its length. A large species, distinguished by the size and characteristic shape of carapace. Antero-ventral and postero-ventral corners rounded. Postero-dorsal corner distinct. Height of carapace increase posteriorly. Asymmetric glands in the usual place.

First antenna:- Male - The 'e' bristle longer than the carapace, provided with about 65-75 pairs of more or less uniform proximally pointing spines and just distal to it, 4 distally pointing slender spines and more distally 1 or 2 spines present. The 'd' bristle provided with 14-16 spines increasing in length distalwards, level with the distal half of the armature of 'e' bristle. At the same level 'b' bristle has 4-5 closely placed spines and more proximally 4-5 irregularly placed spines. The 'c' bristle is slender and half as long as 'b' bristle. The 'd' bristle is slightly longer than 'b' bristle and half as long as 'e' bristle. <u>Female</u> - The 'e' bristle with 12-15 spines posteriorly and very few anteriorly.

The surface of the stem in both male and female covered with minute spines and the distal end with longer spines.

<u>Second antenna</u>:- <u>Male</u> - Both 'a' and 'b' bristles provided with hairs. In some 'c' and 'd' bristles or one of them is long. The 'h', 'i' and 'j' bristles with shafts. Shaft of the 'h' bristle bulbous. Right clasping organ with 2 small processes on its inner side and with about 10 furrows and a bent papilla. Left clasping organ has no furrows but papilla present. <u>Female</u> - The 'h' bristle not bulbous. One or two bristles present at the 'c' - 'd' bristles position.

<u>Mandible</u>:- Toothed edge of coxale with 9 teeth. Tooth lists with a lesser number of teeth than other species of the genus. Distal list with about 12 and proximal list with about 15 teeth. Masticatory pad with 3-4 narrow round flaps. Epipodial bristle is long and spine-like. The bristles of the ventral margin of first endopodite segment are also comparatively longer.

Maxilla:- Of the 6 anterior bristles, 2 are extremely long.

Copulatory limb:- More or less straight organ with rounded end and triangular appendage.

Furca:- Unpaired bristle present behind the furcal claws.

Frontal organ:- Proximal part broader and covered with spines and the distal end is rounded in both male and female.

Discussion: The species of the genus are supposed to be characterised by long 'c' bristle and short 'd' bristle of second antenna. In females only one long bristle is present and the assumption is that it is 'c' bristle. A variation of this rule is observed in females of O. atlantica. In some female specimens both 'c' and 'd' bristles are long, of which 'd' bristle is longer. So it is quite probable that when one long bristle alone is present it may be 'd' bristle.

Distribution:- This species has been reported to be widely distributed in the Atlantic, Indian and Pacific Oceans (Müller, 1906a, Poulsen, 1973). The present study confirms the earlier observation (Poulsen, 1973), that this species is very abundant in the Indian Ocean. It occurred in the whole of the Arabian Sea and Bay of Bengal throughout the year. But the statistical analysis of the data did not show any significant seasonal and day and night variations. The very wide geographic distribution enjoyed by this species is perhaps not surprising as it is capable of tolerating a considerable range of salinity. Possible range in temperature 12.1°C - 30.4°C and salinity 31.1‰ - 36.7‰.

Genus *Platyconchoecia* Poulsen

Platyconchoecia Poulsen, 1973.

The genus is characterised by the leaf-like exopod of the mandible.

Platyconchoecia prosadena (Müller)
(Pl. V, Fig. 1-9 and Map XVI)

Conchoecia prosadena Müller, 1906a and 1912.

Platyconchoecia prosadena Poulsen, 1973.

Localities:- See Table ~~III~~ Ic.

Description:

Carapace:- Length of male 2.25 mm and female 2.5 mm. Height about half of its length. Antero-ventral and postero-ventral corners very much rounded. Right asymmetric gland opens on the ventral margin anteriorly of the postero-ventral corner on a distinct bulge. Lateral corner glands present.

First antenna:- Male 'e' bristle armed with about 10 pairs of spines distally and 10 spines in a single row proximally. Spines are proximally directed and placed at an acute angle with 'e' bristle.

<u>Second antenna</u>:- The 'h', 'i' and 'j' bristles with shafts. Right clasping organ is bent more than at right angle at its base and then curves smoothly ending in a slightly swollen, ridged rounded end. Two processes present on its inner side. The left clasping organ is straight beyond the angle.

<u>Mandible</u>:- Toothed edge of coxale with 9 teeth. Distal list with 2 large and about 12 smaller teeth. Proximal list with about 17 teeth, 2 large followed by 4 or 5 small teeth and then 2 large and the remaining smaller teeth. Exopod of the mandible is large and leaf-like with a pointed tip.

<u>Sixth limb</u>:- Endopod with one bristle, with swollen base.

<u>Copulatory limb</u>:- Long and slender with a narrow rounded end.

<u>Furca</u>:- Furcal claws suddenly decrease in length from fifth pair onward. The seventh and eight pairs are exceptionally thin. Unpaired bristle absent. Usually 8 claws are present on a lamella. But in a male specimen, 9 claws were observed.

<u>Frontal organ:</u>- Male capitulum with narrow middle part and with a rounded end. Female capitulum with pointed, down turned tip, provided with only a few hairs.

<u>Remarks</u>:- The genus <u>Platyconchoecia</u> comprises only one rare species viz. <u>P. prosadena</u>. The flattened exopodite of the mandible is a unique character along species of Conchoecine, making the genus a well defined one.

Distribution:- A rare species, reported earlier from the Indian, Atlantic and Pacific Oceans (Muller, 1906a; Poulsen, 1973). This species was mostly collected from the Bay of Bengal except for a few stations in the Arabian Sea. Probable range in temperature 12.1°C - 29.7°C and salinity 32.5‰ - 36.2‰.

Genus Spinoecia Poulsen

Spinoecia Poulsen, 1973.

Main distinguishing features are: the male 'e' bristle with a distal group of short stout spines and proximally thinner ones.

Key to the species (IIOE) of Spinoecia

Opening of the left asymmetric gland placed more anteriorly of the postero-dorsal corner on a distinct bump .... parthenoda

Opening of the left asymmetric gland in the usual place and bump absent .... porrecta

Spinoecia porrecta (Claus)

(Pl.V, Fig. 10-16 and Map X)

Conchoecia porrecta Claus, 1891.

Conchoecia porrecta Deevey, 1968a.

Conchoecia porrecta Angel, 1969c.

Spinoecia porrecta Poulsen, 1973.

Localities:- See Table Ib.

Description:

__Carapace__:- Length 1.25 mm in male; 1.3 - 1.7 mm in female. Height less than half of its length. Unsymmetric glands in the usual places.

__First antenna__:- The 'a' bristle reaches the end of the first segment. The 'b' bristle slightly shorter than 'd' bristle slightly shorter than 'e' bristle. The 'e' bristle armed with 10-11 pairs of broad but pointed spines followed proximally by about 25-30 pairs of alternating thinner spines.

__Second antenna__:- The 'b' bristle of endopod carries long hairs. The shafts of 'h', 'i' and 'j' bristles weakly developed. The right clasping organ is bent at right angle proximally and the distal portion smoothly curved.

Appendages are as described by Angel (1969c).

__Remarks__:- Angel (1969) has discussed about the confusion existing in earlier literature between the closely related __S__. __porrecta__ and __S__. __spinirostris__. Angel (1969c) describes __S__. __porrecta__ as having 14-15 pairs of larger spines and __S__. __spinirostris__ having 7-8 pairs, on 'e' bristle of first antenna. The present specimens carry about 10-11 pairs. Similarly 'b' bristle of endopodite of second antenna carries 2 bristles, which he considers as a character of __S__. __spinirostris__. The size of the present specimen is slightly smaller than what is reported by Angel (1969c) and Poulsen

(1973) but larger than what is given for S. spinirostris. The comparative length of 'a' bristle of first antenna seems to be a very relevant identifying character.

Distribution:- Earlier records are not reliable as many authors including Müller (1906a) considered S. porrecta and S. spinirostris as a single species as pointed out earlier. Angel (1969) and Deevey (1968a) have reported it from the Atlantic and Poulsen (1973) from the Pacific. This was found to be one of the most common species, in the Indian Ocean. It was present in the Arabian Sea and Bay of Bengal throughout the year, more abundant along the Somali and Arabian coasts. The abundance of this species seems to have a negative influence on another closely related species S. spinirostris. Like other common species of ostracods this species exhibits a wide range of tolerance to salinity. Significant (1% level) diurnal variations were obtained from statistical analysis but not so for seasonal variations. Possible range in temperature 10°C - 30°C and salinity 31.1‰ - 37‰.

Spinoecia parthenoda (Müller)
(Pl. V, Fig. 17-23 and Map XI)

Conchoecia parthenoda Müller, 1906a and 1912.

Conchoecia parthenoda Deevey, 1968a.

Conchoecia parthenoda Angel, 1969d.

Spinoecia parthenoda Poulsen, 1973.

Localities:- See Table ~~III~~ Ic.

Description:

Carapace:- Length 1.4 - 1.5 mm in male and 1.6 - 1.8 mm in female. Shape of male similar to other species of Muller's "Magna" group, but shape of female is different, the height increasing posteriorly and with very much rounded posterior margin. The right asymmetric gland opens on the usual place, left one anteriorly of the postero-dorsal corner on a distinct bulge.

First antenna:- The distal spines of 'e' bristle are not as broad as that of *S. porrecta*. Counting from distal end, the alternation of spines begins from 7th or 8th pair.

Second antenna:- Only 2 or 3 hairs present on the 'b' bristle. Right clasping organ is right angled at its base and smoothly curves to a swollen end with a pointed tip.

Other appendages are well described by Angel (1969d) and supplemented by Poulsen (1973).

Distribution:- Previously recorded from the Atlantic, Indian and Pacific Oceans (Müller, 1906a; Poulsen, 1973). Poulsen (1973) considers this species as a rare one in the Indian Ocean. But the IIOE material provided adequate number of specimens to consider this a fairly common species. It was present in the western Arabian Sea and southeastern Bay of Bengal. Possible range in temperature 11.5°C - 28.9°C and salinity 32.1‰ - 36.4‰.

Remarks:- Since Müller could not identify the males of *S. parthenoda* he placed it in his "Obtusata" group. Deevey (1968) described the male but placed it in the same "Obtusata" group. Angel (1968) felt that it belongs to "Magna" group as it is intermediate in many characters between *S. porrecta* and *C. magna*. However Poulsen (1973) put it along with *S. porrecta* in his new genus *Spinoecia*, but admits that *S. parthenoda* and *S. obtusata* stand apart from other species of the genus. In the present study *S. parthenoda* is retained in the genus *Spinoecia*, following the classification proposed by Poulsen (1973). The limited number of species in the IIOE material prevents me from attempting a revision of the classification.

Genus *Conchoecia* Dana

Conchoecia (part) Dana, 1849.

Conchoecia Poulsen, 1973.

This genus includes species included under Muller's "Magna" group except *Spinoecia spinirostris* and *S. porrecta*. A diagnosis of this genus is given by Poulsen (1973).

Conchoecia magna Claus
(Pl. VI, Fig. 1-8 and Map XII)

Conchoecia magna Claus, 1891.

Conchoecia magna, Müller, 1894.

Conchoeciamagna Deevey, 1968a.

Conchoecia magna Angel, 1969d.

Conchoecia magna Poulsen, 1973.

Localities:- See Table ~~III~~ Ic.

Description:

Carapace:- Size 1.5 - 1.6 mm for male and 1.6 - 1.8 mm for females. Height about half of its length. Postero-dorsal corner distinct. Antero-ventral and postero-ventral corners rounded. Ventral margin slightly concave. Posterior margin almost straight in male and rounded in female. Asymmetric glands in the usual places.

First antenna:- The 'a' bristle is curved proximally and the distal end reaches the distal part of the first segment. The 'b', 'd' and 'e' bristles are with more or less same length. Armature of the 'e' bristle with 13-14 pairs of spines and 15-16 alternating spines. In female, dorsal bristle of second segment long and hairy.

Second antenna:- The 'b' bristle of endopodite with short spines; longer hairs present only in male specimens. The 'h', 'i' and 'j' bristles with shafts. The right clasping organ with a basal part bent at right angles, the distal part again bent at right angles. The smaller left clasping organ is straight after the basal bent. Both right and left organs with ridged end and the left one very much pointed.

Mandible:- Toothed edge of coxale with 10 teeth. Distal list with 2 large teeth, of which second serrated, followed by 13-14 small teeth. Proximal list with a total of about 16 teeth, the 3 larger teeth have 2 smaller ones in between.

Copulatory limb:- Broad at middle, more convex anterior edge. The distal end rounded.

Frontal organ:- In male, distal part is bare and the end rounded. Dorso-proximally there are 5-6 spines and more spines are present and more ventrally spreading up to two-third of capitulum. In female, shaft and capitulum are not separated, the tip is pointed and turned downwards. Spines present on distal half of the ventral side, very much stronger than those present on the proximal part of the dorsal side.

Remarks:- Most of the species coming under this genus are somewhat similar in general shape but identified by their size, and armature of 'e' bristle of first antenna.

Distribution:- Reported earlier from all the three oceans (Müller, 1906a; Poulsen, 1973). The distribution of this species in the Indian Ocean is sporadic. It was present along the

Somali and Arabian coasts, mouth of Persian Gulf, Andaman Sea and southwest Bay of Bengal. It can be seen from the vertical distribution table of this species, given by Poulsen (1973) that it is more abundant in the depth of 350-1000 m, which probably provides an explanation for their scant occurrence in the IIOE material. Possible range in temperature 11.5°C - 30.1°C and salinity 32%o - 36.4%o.

Genus *Pseudooonchoecia* Claus

Pseudoconchoecia Claus, 1890.

Pseudoconchoecia Poulsen, 1973.

This genus includes 2 species *P. serrulata* and *P. concentrica* Only *P. concentrica* was available in IIOE material.

Pseudoconchoecia concentrica (Müller)
(Pl.VI, Fig. 9-17 and Map XIII)

Conchoecia concentrica Müller, 1906b, 1912.

Conchoecia pectinata, Leveau, 1966.

Conchoecia concentrica Deevey, 1968a, 1970.

Pseudoconchoecia concentrica Poulsen, 1969.

Localities:- See Table ~~III~~ Ic.

Description:

Carapace:- Length 1.3 - 1.5 mm. Height about 60% of length. Longitudinal striations present. The shoulder vaults more pronounced. Postero-dorsal corner of right valve produced into a small spine. Asymmetric glands as usual. Dorso-median glands present only in male at postero-dorsal corner of each valve.

<u>First antenna</u>:- <u>Male</u> - Armature of 'e' bristle consists of 35-45 pairs of proximally directed simple spines, of uniform length. In female 'e' bristle with short hairs ventrally on two-third of its distal part.

<u>Second antenna</u>:- The 'a', 'b', 'c' and 'd' bristles with short hairs. The 'c', 'd' and 'e' bristles absent in female.

Right clasping organ curves almost at 180°, with distinctly ridged end. Left one with basal bent at 90° and the distal part only slightly curved.

<u>Mandible</u>:- Toothed edge of coxale with 9 teeth. Distal tooth list with 2 large, second of which is serrated and 12-14 small teeth. Proximal list with 2 or 3 large and about 11-12 smaller teeth.

<u>Furca</u>:- Unpaired bristle present behind the claws.

<u>Copulatory limb</u>:- Very broad. Both anterior and posterior edges convex. The appendage is large. The distal end is rounded.

<u>Frontal organ</u>:- In male it is separated into shaft and capitulum. Capitulum down-turned. Thin walled and bare

distal part is bent a little forwards with a rounded end. Female frontal organ almost straight with a narrow and bare distal part and pointed tip.

Remarks:- The juveniles are characterised by the presence of 10-12 triangular plates on their shoulder vaults. The specimens described by Leveau (1966) as *Conchoecia pectinata* are probably immature stages of *P. concentrica*.

Distribution:- Earlier recorded from Atlantic, Indian and Pacific Oceans (Poulsen, 1973). This species though present in the Arabian Sea, was absent in the Bay of Bengal. This pattern of distribution seems to support the suggestion that it prefers high saline conditions. Possible range in temperature 10.2°C - 30.3°C and salinity 34.8‰ - 37.4‰.

Genus *Conchoecissa* Claus

Conchoecissa Claus, 1891.

Conchoecissa Poulsen, 1973.

Characterised by long processes on rostrum, postero-dorsal and postero-ventral corners of reticulated carapace. Only one species was present in IIOE material.

Conchoecissa imbricata (Brady)
(Pl. VI, Figs. 18-24 and Map XVI)

Halocypris imbricata Brady (part), 1880.

Conchoecissa armata Claus, 1891.

Conchoecia imbricata Müller, 1890, 1906a.

Comchoecia imbricata Deevey, 1968a.

Conchoecissa imbricata Poulsen, 1973.

Localities:-	Station Ar	11	- 00°03'S, 76°56'E	- 16	specimens
	Ar	19	- 00°03'S, 61°00'E	- 10	"
	Ar	68	- 00°55'N, 79°04'E	- 10	"
	Ar	71	- 00°30'S, 79°02'E	- 12	"
	Ar	72	- 00°56'S, 79°03'E	- 15	"
	Di	5269	- 03°59'N, 57°59'E	- 4	"
	Me	127	- 05°29'N, 50°02'E	- 7	"
	Me	129	- 05°05'N, 50°31'E	- 16	"

Distribution:

Carapace:- Length 2.2 mm in male and 2.2 - 2.4 mm in female. Rostrum long and symmetrical. Postero-dorsal corner of each valve produced with long processes of which left one is longer. Postero-ventral processes are short and blunt. Carapace is distinctly sculptured, in the form of rectangular blocks. Antero-ventral margin is more spinous.

First antenna:- Armature of male 'e' bristle consists of 11 pairs of pointed spines, the middle ones slightly alternating.

Second antenna:- Male - The 'a' and 'b' bristles are bare. One bristle ('c' or 'd') of 2nd endopodite segment is exceptionally long. Clasping organs resemble that of C. symmetrica

(Skogsberg, 1920). The 'f' bristle is sword-shaped distally. The 'h', 'i' and 'j' bristles with shafts and at the joint of the shaft 'h' bristle is swollen. In female 'h', 'i' and 'j' bristles with spines proximally.

Frontal organ:- Both male and female capitulum are long and slender. Capitulum is separated from shaft and with a rounded end. The proximal spines on ventral margin of female capitulum are larger.

The setation of appendages are about the type described for *C. symmetrica* (Skogsberg, 1920).

Remarks:- This species can be identified by the characteristic shape of having long processes. The presence of long processes are very rare among halocyprids.

Distribution:- Poulsen (1973) reported this as a common species in all the three oceans. But in the IIOE material it was found to be restricted to the equatorial belt. Their total absence in the Arabian Sea and Bay of Bengal defies explanation and is worthy of further consideration. Possible range in temperature 12.8°C - 28.7°C and salinity 34.3‰ - 35.6‰.

Genus Alacia Poulsen

Alacia Poulsen, 1973.

This genus includes species included under Muller's (1906a) 'Alata' group, characterised by the presence of two or more groups of lateral glands on the posterior margin.

Alacia alata (Müller)
(Pl. VII, Fig. 1-9 and Map XIV)

Conchoecia alata Müller, 1906a and 1912.

Alacia alata Poulsen, 1973.

Localities:- See Table ~~III~~ lc.

Description:

Carapace:- Length 1.8 - 2.00 mm in male and 2.00 - 2.4 mm in female. In male height is more or less uniform, about 56% of length. In female height increases posteriorly to about 61% of length. Shoulder vaults produced into wing-like expansions, laterally ending in apoint. Both right and left valves have postero-dorsal spines. Asymmetric glands in the usual places. Lateral glands present, one postero-dorsally and 2 postero-ventrally on both valves. Dorso-median glands present in male only.

First antenna:- Armature of male 'e' bristle consists of about 22 pairs of plates twisted in the form of a 'T'.

<u>Second antenna</u>:- <u>Male</u> - The 'a', 'b', 'c' and 'd' bristles bare, 'h', 'i' and 'j' bristles with shafts having spines. Right clasping organ uniformly curved and long. Left one more or less straight after the basal bent, the distal ends ridged and a small process present at the tip.

<u>Mandible</u>:- Toothed edge with 11 teeth. Distal tooth list with 2 large and 12-14 smaller teeth. Proximal list with 16-18 teeth of which 4-5 are larger.

<u>Copulatory limb</u>:- Anterior margin somewhat straight and posterior margin slightly convex, tapering to a narrow end.

<u>Furca</u>:- Posterior claw is bare. Unpaired bristle present, double the length of posterior claw.

<u>Frontal organ</u>:- Frontal organ of male with bare distal part and rounded end. Frontal organ of female also separated into shaft and capitulum. Distal part is very narrow with pointed tip, strong spines up to about 3/4 ventrally, only very few spines present dorsally and laterally.

<u>Remarks</u>:- Poulsen (1973) pointed out that <u>A</u>. <u>alata</u> Müller differs from <u>A</u>. <u>alata</u> <u>major</u> Rudjakov, 1962 and <u>A</u>. <u>alata</u> <u>minor</u> McHardy 1964 in having larger points or spines on the postero-dorsal corner and posterior points on wing-like shoulder vaults. But absence of spines on postero-dorsal corners and variation in the shape of female frontal organ have been observed in a few specimens.

Distribution:- This species has been recorded from the tropical zones of all oceans (Poulsen, 1973). Present study showed its occurrence in the Persian Gulf regions, off Arabian coast, south-west coast of India and west coast of Ceylon. This species was absent in Bay of Bengal. Possible range in temperature 13.3°C - 30.4°C and salinity 34.8‰ - 36.9‰.

Genus *Conchoecilla* Claus

Conchoecilla Claus, 1891.

Conchoecilla Poulsen, 1973.

This genus is characterised by elongated shell and location of the openings of right asymmetric gland below incisur and that of the left on posterior margin.

Conchoecilla daphnoides Claus
(Pl. VIII, Fig. 10-18 and Map XV)

Conchoecilla daphnoides Claus, 1891.

Conchoecia daphnoides Müller, 1906a and 1912.

Conchoecia diphnoides Skogsberg, 1931.

Conchoecia diphnoides Deevey, 1968a.

Conchoecilla daphnoides Poulsen, 1973.

Localities:- Many stations (See Table ~~III~~ Ic).

Description:

Carapace:- 2.3 mm in male and 3.5 - 4.3 mm in females (length). Distinctly striated. Dorsal margin almost straight. There are no definite antero-ventral and postero-ventral corners. Rostrum of male is normal, in female long, pointed and asymmetrical. The postero-dorsal corner is produced backward, longer in female. Right asymmetric glands open below rostral incisur and left postero-dorsally.

First antenna:- Male - The 'a' bristle is 'U' shaped. The 'b' bristle with about 10 spines situated at equal intervals and 'd' bristle with about 10 spines closely placed. The longer 'e' bristle with a knee bent having a few distally pointing spines and proximally it has about 45 pairs of equally long and slender closely placed spines.

Second antenna:- Both 'a' and 'b' bristles with hairs. The 'h', 'i' and 'j' bristles have shafts and are narrowed distally. They are bare in male and have small spines proximally in female. The 'c', 'd' and 'e' bristles absent in female. Left clasping organ somewhat straight distally often with a basal bent, but right one uniformly curved. The distal ends of both right and left organs swollen, indistinctly ridged and with small papillae.

<u>Mandible</u>:- The toothed edge of coxale with 9 distinct and 2 less prominent teeth. Distal tooth list with 2 large, one of which is serrated and about 14 smaller ones. Proximal tooth list with 3 large and about 18 smaller teeth.

<u>Copulatory limb</u>:- Posterior edge convex, distal end rounded. The appendage has a square cut tip.

<u>Furca</u>:- Unpaired bristle absent.

<u>Frontal organ</u>:- Male frontal organ with very small spines up to 2/3 of the ventral region and lesser laterally, absent dorsally. The distal end is rounded. Female frontal organ with apointed down-turned tip. Hairs present throughout the ventral margin decreasing laterally to 1/2 of dorsal margin.

<u>Remarks</u>:- Müller (1906a) described 2 varieties of <u>C</u>. <u>daphnoides</u> viz. var. <u>typica</u> and var. <u>minor</u>, subsequently synonomized by Skogsberg (1920), which is adopted in the present work. <u>C</u>. <u>daphnoides</u> of IIOE material belongs to the size grouping which Muller called as <u>C</u>. <u>daphnoides</u> <u>minor</u>.

<u>Distribution</u>:- Poulsen (1973) reported this to be one of the most common species of Conchoecinae in all the world oceans. Present investigation showed the occurrence of this species in the equatorial region, Andaman Sea and mouth of Malacca Strait in small numbers. Stray occurrences were

noticed in the Arabian Sea and Bay of Bengal. Poulsen (1973) examining the north-south distribution of this species considered it to be more abundant in the temperate and sub-tropical zone, than in the tropical zones. Possible range in temperature 11.9°C - 29.5°C and salinity 32.3‰ - 36‰.

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DISCUSSION

A comprehensive study of the planktonic ostracods of the Northern Indian Ocean based on the International Indian Ocean Expedition collections has been attempted with a view to study the species composition and pattern of distribution, to estimate their abundance and to correlate their distribution with the physico-chemical factors of the environment.

Ostracods form a major group of the plankton of the Indian Ocean, and numerically they are the third most abundant group, the first being copepods and second chaetognaths. Cypridina spp. are known to form swarms in the Arabian Sea. The author during the course of his investigations has observed (Tranter and George, 1972) a peak density of 2076 specimens/m^3 in the Laccadive Sea. An examination of the overall distribution of this group shows that the areas of their high abundance coincides with the areas of high plankton biomass, off Arabian coast, northern Arabian Sea and off south-west coast of India.

No attempt has been made to alter the classification put forward by Poulsen (1973) because of the limited number of species in the present material, eventhough the limitations of the system has been pointed out in the concerned discussion part. The new generic classification has many unresolved taxonomic problems.

Certain species like Conchoecia macrocheira, C. parvidentata and C. subarcuata, eventhough occurred rarely, have been left out from the present study, mainly owing to the absence of adult males. A few genera like Loricoecia, Mollicia, Boroecia and Paramollicia were not at all encountered in the present material. Many of these species are reported to occur in deeper waters and their absence in the present material may be more of a result of limited sampling depth rather than their being uncommon or absent from the area of investigation.

Of the 32 species belonging to 18 genera discussed, Euconchoecia aculeata was the most dominant species in the Northern Indian Ocean. However, for the Arabian Sea alone Cypridina dentata was the most abundant species. George et al. (1975) has reported that C. dentata occurs mainly in the neritic waters and off south-west coast of India. It was less common beyond the edge of the continental shelf. Euconchoecia aculeata occurs both in neritic and oceanic waters whereas all the other species occurred only in the oceanic waters.

The occurrence of juveniles and ripe females in most of the samples indicates that breeding is continuous in the tropical waters. Incidence of dense patches of juveniles in certain collections suggest that periods of heavy spawning are superimposed on what may be called continual spawning. Such peak spawning periods were observed for C. dentata off Cochin and in the Laccadives, where, of the large number of specimens collected about half of them were juveniles. The halocyprids which are comparatively less abundant, had their juveniles in about the same number as that of adults. The IIOE samples were collected from widely separated geographical locations and in different seasons of the year and hence they are of limited value for assessing the breeding periods of zooplankton organisms.

The species fall into 4 categories depending on zoo-geographical ranges:

1. Widely distributed species
2. Equatorial species
3. Species restricted to Arabian Sea
4. Patchy.

Widely distributed species

Paraconchoecia elegens, P. procera, P. decipiens, Conchoecella giesbrechti, Microconchoecia curta, Metaconchoecia rotundata, Orthoconchoecia atlantica, Spinoecia porrecta, Euconchoecia aculeata and Halocypris brevirostris belong to this group. Most of these species are found to tolerate salinity from 32‰ - 37‰. Orthoconchoecia striola and

Spinoecia parthenoda eventhough present off Arabian coast, and in Andaman Sea, were found more abundant in the equatorial region. These 2 species occurred only in salinities less than 36‰.

Equatorial species

Paraconchoecia oblonga, P. echinata, Conchoecissa imbricata and to some extent Conchoecilla daphnoides also can be put under this category. These species are already reported from the Atlantic and Pacific and known to have a wide zoogeographical range of distribution. The reason why they are absent in the Northern Arabian Sea may be assumed as their inability to withstand high salinity (>36‰).

Species restricted to Arabian Sea

Pseudoconchoecia concentrica, Alacia alata and Cypridina dentata were confined to Arabian Sea. P. concentrica has mainly been reported from tropical parts and Poulsen (1973) has recorded it in the Indian Ocean close to equator. A. alata is known to have a wide geographical range (Angel, 1969a). However these 2 species were found to occur mostly in the high saline conditions (34‰ - 37‰) in the Arabian Sea. Occurrence of Cypridina dentata in the Arabian Sea has already been discussed. Even with its tolerance to wide salinity (30.8% - 37.4‰) why they are not frequent in other parts of the ocean is worthy of further investigations. The large amount of fresh waters, bringing suspended matter from rivers perhaps make the Bay of Bengal very much turbid and unfavourable for it to thrive.

Patchy distribution

The distribution of Conchoecia magna, Platyconchoecia prosadena, Metaconchoecia kyrtophora and also to some extent Euconchoecia chierchiae may be considered as Patchy. The reasons for C. magna having patchy distribution is more because of it being mesoplanktonic. P. prosadena and M. kyrtophora are extremely rare species. E. chierchiae was earlier recorded close to the equator. In the IIOE material most of the stations where this species was present, are off Somali and Arabian coast, appearing with a localised distribution. E. chierchiae, unlike most of the species shows a preference to low salinity (32.4‰ - 33.8‰).

Seasonal variations

Statistical analysis showed significant seasonal variations for 5 species. In the Arabian Sea, Cypridina dentata was more abundant during NE monsoon period. The other 2 species that showed seasonal variation in the Arabian Sea are Paraconchoecia procera and P. decipiens, the former being more abundant during SW monsoon period and latter during the NE monsoon period. In the Bay of Bengal significant 't' values were obtained only for 2 species Euconchoecia aculeata being more abundant during NE monsoon and Conchoecetta giesbrechti during SW monsoon period. The reported abundance (George, 1969) of ostracods during the NE monsoon in the Indian Ocean could largely be the result of swarming of Cypridina dentata in the Arabian Sea and Euconchoecia aculeata in the Bay of Bengal.

Day and Night variations

Significant 't' values for day and night variations were obtained for Paraconchoecia procera, P. decipiens, Conchoecetta giesbrechti and Spinoecia porrecta. Because of the limitation of the depth of the present sample up to 200 m, it is not possible to draw any definite conclusions on their vertical movements, except for the species which do not migrate to deeper parts or which do appear in the upper zones at night for the sampling to be effective. George (1967) has reported the nocturnal abundance of ostracods in general. These 4 species could largely be responsible for the larger bulk of ostracods coming up to the surface at night.

Comparision of IIOE material with their distribution in the Atlantic and Pacific Oceans.

Poulsen (1973) has compared halocyprid species of the Indian, Atlantic and Pacific Oceans. Angel (1973) has summarised the occurrence of the ostracod species in all the world oceans and attributed the richness of Atlantic fauna to the disparity of the scientific effort employed. Comparison of the distribution of the 32 species, in the present collection from the Indian Ocean with their distribution in Atlantic and Pacific showed that only 2 species are Indo-Pacific viz. Paraconchoecia decipiens and Orthoconchoecia striola. Species of Bathyconchoecia cannot be taken into account, as they are bathypelagic and hence not easily sampled by plankton nets. Therefore their not being reported from any particular ocean cannot be considered as their total absence. Angel (1972) in his summary has included O. striola as belonging to these 3 oceans, probably taking into account the single record of O. striola by Müller (1906a) in the Atlantic Ocean, which could very well be a mistake (Poulsen, 1973). The fact that Skogsberg (1920), Angel (1969a), Deevey (1968a), Poulsen (1973) have not reported it from Atlantic shows its possible absence in the Atlantic Ocean. The case of Platyconchoecia prosadena is also doubtful, since it is a comparatively rare species, and so assumption of this sort may not be conclusive. Hence only *Paraconchoecia decipiens* and *Orthoconchoecia striola* are considered Indo-Pacific.

Ostracods in the Red Sea

No reliable data is available on the ostracod fauna of the Red Sea. During IIOE, only 2 samples were available from the Red Sea. Eventhough it is not possible to draw any conclusion on the ostracod fauna of the Red Sea based on these 2 samples, it is worthwhile to examine the species that were present. *Paraconchoecia elegens*, *P. procera*, *Metaconchoecia rotundata*, *Spinoecia porrecta*, *Pseudoconchoecia concentrica*, *Euconchoecia aculeata* and *Cypridina dentata* were encountered only in very few numbers. The hydrographic conditions prevailing in the Red Sea (salinity 36.6‰ - 40.5‰ and temperature 21.9°C - 29.5°C) down to 200 m depth, may not be congenial for all the species occurring in the Arabian Sea and Gulf of Aden. Investigations of Kimor (1973) indicate that most of the epiplankton of the Red Sea are dependant on recruitment of individuals for population maintenance from adjacent Gulf of Aden and Arabian Sea. The hot saline waters of the Red Sea and perhaps other physical and chemical factors are a barrier to the successful maintenance of many ostracod species. The few species which are able to withstand this particular environment might have maintained the population due to lack of competition and the availability of food as is evidenced by the copepod distribution in this area (IOBC, 1970).

Angel (1972) summarising the recent literature pointed out that apart from North Atlantic and Mediterranean, the oceanic coverage, with regard to planktonic ostracods is incomplete. The present study provides some information regarding the ostracods of the Northern Indian Ocean especially that of the Bay of Bengal, one of the least explored areas as far as ostracods are concerned.

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SUMMARY

1. A brief account of the historical aspects, general hydrography, classification and terminology of the planktonic ostracods of the Northern Indian Ocean is given.

2. The material dealt with here was collected during IIOE (1960-'65) from 200 m to 0 m using IOSN.

3. Poulsen's (1973) new generic classification has been adopted, but some of the limitations are mentioned.

4. 32 species have been identified from the samples, their number and locations are given in Ia - Ic, two of them belonging to Cypridinidae and the rest to Halocyprididae.

5. Systematics of the species has been discussed giving importance to diagnostic features and illustrations given (Plates I-VII). Comparison of the morphology of the species with one another and also their individual variations are discussed.

6. Distribution maps of the species have been prepared (Plates I-XX). Arabian Sea was found to have a rich ostracod fauna compared to Bay of Bengal or equatorial region of the Indian Ocean.

7. Based on their distribution, ostracods are categorised into four groups - widely distributed, equatorial, restricted to Arabian Sea and Patchy.

8. The reduction in the number of ostracod species in the Red Sea is attributed to the hot saline waters of the area.

9. Cypridina acuminata is restricted to the area off Bombay.

10. Cypridina dentata is found to be the most abundant species in the Arabian Sea. Considering the Northern Indian Ocean as a whole, Euconchoecia aculeata is the most frequent and dominant species. Other common species are Paraconchoecia procera and Metaconchoecia rotundata.

11. Except Paraconchoecia decipiens, Orthoconchoecia striola, Bathyconchoecia deeveyae and B. angeli, all other species reported here are common to Atlantic and Pacific Oceans.

12. The abundance in the distribution of ostracods correspond to that of other crustaceans and also to the areas of high productivity.

13. Statistical analysis of theé data using Students 't' test shows significant seasonal variations, for *Cypridina dentata*, *Euconchoecia aculeata*, *Paraconchoecia procera*, *P. decipiens* and *Conchoecetta giesbrechti* and day and night variations for *Paraconchoecia procera*, *P. decipiens*, *Conchoecetta giesbrechti* and *Spinoecia porrecta*.

14. Breeding, as deduced from the occurrence of juveniles and ripe females, in the samples is found to be continuous.

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TABLE - I a: Data concerning the stations and number of specimens obtained.

Name of Ship, Cruise No. & Station No.		Name of Species and No. of specimens: C.denta-ta	E.acu-leata	E.chier-chiae	H.brevi-rostris	P.echi-nata	P.ele gans	P.pro-cera
		1	2	3	4	5	6	7
Anton Bruun								
Cr.A. 1	12°00'N,45°51'E	-	1075	-	-	-	-	80
2	12°41'N,48°00'E	500	-	-	-	-	-	-
3	13°03'N,50°00'E	-	11000	-	-	-	-	-
4	13°34'N,52°01'E	385	885	-	5	-	-	-
5	14°03'N,54°00'E	8	128	-	-	-	40	-
6	14°35'N,56°00'E	350	895	10	15	-	65	95
7	15°05'N,58°00'E	10885	1075	-	-	-	-	25
8	15°35'N,60°00'E	622	403	-	-	-	-	33
9	15°02'N,62°00'E	25	20	-	-	-	10	200
10	16°36'N,64°00'E	9128	16	-	-	-	-	-
11	17°08'N,66°00'E	5575	180	-	-	-	-	110
12	17°36'N,68°00'E	-	850	-	-	-	-	-
13	18°09'N,70°00'E	1250	1250	-	-	-	-	-
Cr.1.14	07°27'N,49°21'E	-	-	-	40	-	-	50
15	07°27'N,95°18'E	-	-	-	10	-	-	30
16	07°31'N,96°11'E	-	-	-	25	-	-	80
17	07°40'N,97°09'E	-	-	-	40	-	-	80
19	08°29'N,97°59'E	-	4	-	-	-	-	-
21	09°54'N,97°42'E	-	-	4	-	-	-	-

TABLE - I a (Contd.)

Station No. Name of Ship & Cruise No.		1	2	3	4	5	6	7
Anton Bruun								
Cr.1. 24	10°36'N,95°39'E	-	-	-	25	-	-	62
25	10°41'N,94°40'E	-	-	-	25	-	20	24
26	10°39'N,93°49'E	-	-	-	10	-	-	50
27	10°37'N,92°59'E	-	38	-	-	-	35	30
28	11°49'N,92°53'E	-	-	3056	-	-	-	-
29	11°23'N,93°31'E	-	6	-	-	-	-	-
30	12°17'N,93°21'E	-	12	-	-	-	-	-
31	12°53'N,93°23'E	-	30	-	20	-	-	60
32	12°52'N,94°13'E	-	-	-	30	-	25	30
33	12°57'N,95°01'E	-	1656	-	10	-	-	82
34	12°50'N,95°56'E	-	-	-	-	-	-	78
39	14°42'N,96°47'E	360	10	-	-	-	-	10
41	15°04'N,95°51'E	1157	-	-	-	-	-	-
52	18°55'N,91°59'E	-	25	-	-	-	-	-
53	18°33'N,91°16'E	-	675	-	-	-	-	-
54	18°24'N,90°45'E	-	50	-	-	-	-	20
55	18°20'N,90°06'E	-	3	-	-	-	-	-
56	18°15'N,89°20'E	-	35	-	-	-	-	25
58	18°11'N,88°04'E	-	394	-	-	-	25	-
59	18°00'N,87°16'E	-	50	-	-	-	-	10
60	17°54'N,86°31'E	-	240	-	15	-	-	-
61	17°53'N,85°56'E	-	10	-	-	-	-	10

TABLE - I a (Contd.)

Station No. Name of Ship & Cruise No.		1	2	3	4	5	6	7
Anton Bruun								
Cr.1. 62	17°52'N,85°12'E	-	26	-	16	-	-	20
63	17°56'N,84°37'E	-	3610	-	-	-	-	6
65	17°30'N,83°47'E	-	-	-	-	-	-	35
66	17°07'N,84°33'E	-	756	-	2	-	10	63
67	16°30'N,85°32'E	-	30	-	-	-	-	120
68	15°59'N,86°14'E	-	450	-	25	-	-	-
69	15°47'N,87°05'E	-	339	-	-	-	-	155
70	15°17'N,87°50'E	-	123	-	-	-	-	83
71	14°53'N,88°40'E	-	68	-	-	-	-	27
72	14°23'N,89°23'E	-	136	-	-	-	-	51
73	14°02'N,90°08'E	-	56	-	-	-	-	-
74	13°36'N,90°48'E	-	20	-	-	-	-	6
75	13°16'N,91°34'E	-	56	-	-	-	-	-
76	12°56'N,92°10'E	-	280	-	-	-	-	-
77	13°50'N,92°17'E	-	82	-	40	-	-	41
78	14°15'N,91°50'E	-	206	-	-	-	-	90
79	14°58'N,91°17'E	--	60	-	-	-	-	-
80	15°43'N,90°58'E	-	16	-	-	-	-	50
81	16°25'N,90°43'E	-	125	-	-	-	-	-
83	17°48'N,89°43'E	-	195	-	-	-	-	-
84	18°30'N,89°18'E	-	20	-	20	-	-	25
85	19°16'N,88°56'E	-	30	-	25	-	30	30

TABLE - I a (Contd.)

Station No. Name of Ship & Cruise No.			1	2	3	4	5	6	7
Anton Bruun									
Cr.1.	86	20°04'N,88°24'E	-	339	-	-	-	-	165
	90	17°29'N,83°27'E	-	265	-	-	-	-	-
	91	17°14'N,83°47'E	-	396	-	-	-	-	60
	92	16°40'N,83°58'E	-	30	-	-	-	-	15
	93	15°58'N,84°27'E	-	20	-	-	--	-	-
	95	14°22'N,85°20'E	-	148	-	-	-	-	-
	96	13°43'N,85°47'E	-	276	-	-	-	-	46
	97	13°08'N,86°12'E	-	90	-	-	-	-	100
	98	13°03'N,85°21'E	-	450	-	-	-	-	150
	99	13°02'N,84°22'E	-	50	-	10	-	-	75
	100	13°04'N,83°10'E	-	-	-	2	-	-	'30
	101	13°09'N,82°22'E	-	43	-	2	-	-	25
	102	13°10'N,81°17'E	-	-	-	2	-	-	31
	103	13°17'N,80°64'E	-	48	-	10	-	-	48
Cr.2.	106	17°27'N,70°27'E	-	-	-	-	-	2	-
	107	15°40'N,70°07'E	2520	322	-	-	-	12	342
	108	13°50'N,70°07'E	-	-	-	-	-	-	24
	109	11°59'N,69°55'E	-	8	-	-	-	-	37
	110	09°56'N,70°06'E	-	31	-	3	-	-	94
	111	08°09'N,70°02'E	-	2	-	-	-	-	15
	112	05°48'N,70°03'E	-	-	-	7	1	-	-
	113	03°33'N,69°54'E	-	-	-	9	-	-	30

TABLE - I a (Contd.)

Station No. Name of Ship & Cruise No.		1	2	3	4	5	6	7
Anton Bruun								
Cr.2. 114	01°30'N,70°01'E	-	608	-	12	-	16	41
143	01°54'N,79°52'E	-	45	-	30	-	35	40
144	04°18'N,80°08'E	-	20	-	15	-	15	-
145	11°56'N,60°53'E	23	27	-	3	-	-	3
146	10°12'N,60°04'E	13	-	-	-	-	-	-
147	07°13'N,59°57'E	-	-	-	4	5	-	-
149	01°16'N,60°08'E	-	-	-	35	--	-	15
151	05°04'N,60°03'E	-	-	-	6	-	-	-
Cr.4A.168	05°52'N,52°56'E	-	-	-	-	-	-	40
170	12°04'N,51°31'E	-	-	-	-	20	40	-
171	13°11'N,51°28'E	-	-	-	10	-	-	50
172	14°44'N,51°02'E	-	-	-	4	-	45	12
174	16°27'N,54°39'E	-	160	-	-	-	-	26
175	17°26'N,56°29'E	-	7	-	-	-	13	-
176	16°29'N,57°09'E	-	10	-	-	-	-	-
177	15°18'N,57°43'E	-	4	-	-	-	28	52
178	14°21'N,58°18'E	4	8	-	-	-	-	40
179	13°12'N,58°58'E	4	80	-	-	-	56	-
180	12°15'N,59°42'E	-	-	-	8	-	--	16
182	15°58'N,62°33'E	-	5	-	-	-	-	75

TABLE - I a (Contd.)

Name of Ship, Station No. & Cruise No.			1	2	3	4	5	6	7
Anton Bruun									
Cr.4A.	183	23°43'N,66°21'E	5721	188	-	-	--	90	58
	184	23°33'N,65°50'E	8852	48	-	-	-	-	20
	185	20°39'N,64°41'E	15746	27	-	-	-	25	26
	186	21°31'N,64°06'E	2970	105	-	-	-	80	36
	187	22°23'N,63°32'E	-	10	-	-	-	-	90
	188	23°19'N,62°50'E	1240	126	-	-	-	-	246
	189	24°00'N,62°04'E	40	108	-	-	-	54	10
	190	24°48'N,61°37'E	1200	1008	-	-	-	228	136
	191	23°57'N,60°58'E	70	50	-	-	-	50	60
	192	23°08'N,60°32'E	930	6560	-	-	-	820	15
	193	22°48'N,59°34'E	400	280	-	-	-	640	50
	194	22°22'N,60°05'E	84	4512	-	-	-	348	-
	196	20°44'N,61°15'E	900	-	-	-	-	-	100
	197	20°02'N,62°00'E	48	647	-	-	-	90	-
	198	19°17'N,62°29'E	870	1150	-	-	-	30	-
	199	18°31'N,63°08'E	4060	198	-	-	-	-	-
	200	18°32'N,64°39'E	3475	75	-	-	-	-	350
Cr.5.	282	16°13'N,63°29'E	3820	44	-	-	-	-	80
	283	14°42'N,60°52'E	6805	575	-	-	-	20	115
	284	15°22'N,58°12'E	134	262	-	-	-	-	8
	285	14°22'N,54°18'E	120	272	-	8	-	-	136
	286	13°50'N,52°59'E	-	210	-	5	-	-	70

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		Position	1	2	3	4	5	6	7
Anton Bruun									
Cr.5.	287	13°11'N,50°22'E	50	125	5	-	-	-	60
	288	09°28'N,54°52'E	-	-	-	52	-	4	12
	289	07°10'N,55°05'E	-	-	-	7	-	-	46
	327	06°51'N,75°02'E	2	50	-	14	-	-	20
	328	18°02'N,65°08'E	2505	278	-	-	-	-	85
	329	15°36'N,64°59'E	4128	112	-	-	-	-	180
	330	13°36'N,65°03'E	1334	63	-	-	-	-	69
	331	11°28'N,65°04'E	1149	24	-	3	-	-	86
	332	10°01'N,65°01'E	11	-	-	2	-	2	5
	334	06°01'N,64°59'E	-	-	-	11	-	10	90
Argo									
Cr.Dodo	29	03°52'N,48°18'E	-	-	-	8	-	40	-
	32	05°11'N,49°44'E	-	-	380	-	-	150	-
	37	06°26'N,49°46'E	10	-	950	80	10	290	240
	40	07°05'N,49°39'E	-	-	20	49	80	30	50
	47	08°53'N,53°09'E	-	-	200	40	-	640	240
	51	11°08'N,53°02'E	-	-	240	-	-	25	20
	58	08°27'N,53°23'E	-	7	14	14	20	50	40
	67	05°02'N,55°06'E	-	-	-	45	-	44	980

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Argo									
Cr.Lusiad.	1	00°07'S,96°31'E	-	-	-	2	2	-	-
	5	00°00' ,88°56'E	-	-	-	10	-	-	-
	7	00°02'S,84°56'E	-	-	-	12	-	-	-
	8	00°01'S,82°52'E	-	-	-	5	-	-	5
	14	00°03'S,71°02'E	-	-	-	5	-	-	-
	16	00°02'N,66°56'E	-	-	-	40	38	-	-
	17	00°01'S,65°04'E	-	-	-	65	-	-	-
	18	00°03'N,62°41'E	-	-	-	20	-	-	-
	19	00°03'S,61°00'E	-	-	-	8	-	-	-
	20	00°00' ,59°01'E	-	-	-	10	-	-	-
	21	00°01'S,57°05'E	-	-	-	120	-	100	-
	26	00°08'S,46°52'E	-	-	-	65	-	-	65
	27	00°01'N,45°02'E	-	-	4	-	-	-	-
	28	00°01'N,45°25'E	-	-	-	25	-	-	-
	32	02°30'N,53°00'E	-	-	-	5	-	-	-
	33	02°00'N,52°58'E	-	-	-	10	-	-	-
	34	01°30'N,52°59'E	-	-	-	210	-	-	-
	35	01°00'N,53°00'E	-	-	-	75	-	65	-
	36	00°29'N,52°58'E	-	-	-	30	-	-	-
	37	00°00'N,53°00'E	-	-	-	15	-	-	-
	41	02°02'S,53°03'E	-	-	-	5	-	-	-
	42	02°30'S,53°00'E	-	-	-	13	-	-	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Argo								
Cr. Lusiad 43	03°00'S,53°00'E	-	-	-	350	-	-	-
44	03°56'S,52°59'E	-	-	-	50	-	-	-
45	05°00'S,52°00'E	-	-	-	14	-	-	-
46	04°07'S,62°10'E	-	-	-	60	-	-	-
47	03°00'S,62°20'E	-	-	-	25	-	-	12
48	02°29'S,62°20'E	-	-	-	101	10	2	-
49	02°00'S,62°20'E	-	-	-	50	-	-	-
50	01°28'S,62°20'E	-	-	-	28	30	-	-
51	00°57'S,62°19'E	-	-	-	33	-	-	-
52	00°28'S,62°19'E	-	-	-	42	45	-	40
53	00°05'N,62°20(E	-	-	-	45	-	-	-
54	00°29'N,62°19'E	-	-	-	25	30	25	-
55	01°02'N,62°20'E	-	-	-	12	-	--	-
56	01°32'N,62°20'E	-	-	-	-	-	4	8
57	02°05'N,62°15'E	-	-	-	24	-	-	-
58	02°31'N,62°20'E	-	-	-	10	-	-	30
59	03°06'N,62°19'E	-	-	-	4	-	-	-
61	05°02'N,62°20'E	-	-	-	8	-	-	-
62	04°51'N,79°04'E	-	-	-	28	-	-	-
64	02°55'N,78°58'E	-	-	-	10	-	-	-
65	02°26'N,78°56'E	-	-	-	25	-	-	-
66	01°54'N,79°01'E	-	-	-	10	-	-	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Argo									
Cr.Lusiad	68	00°55'N,79°04'E	-	-	-	28	-	-	-
	69	00°30'N,79°01'E	-	-	-	36	-	-	-
	70	00°02'N,79°04'E	-	-	-	33	-	-	-
	71	00°30'S,79°02'E	-	-	-	55	-	48	45
	72	00°56'S,79°03'E	-	-	-	25	-	-	-
	74	01°55S,78°54'E	-	-	-	60	-	-	-
	75	02°30'S,78°59'E	-	-	-	-	-	35	-
	76	03°00'S,79°01'E	-	-	-	25	30	-	-
	77	04°00'S,79°00'E	-	-	-	130	-	-	-
	79	00°01'N,88°56'E	-	-	-	12	-	-	-
	81	01°08'S,89°05'E	-	-	-	7	-	5	7
	84	03°03'S,89°03'E	-	-	-	18	-	-	16
	86	05°00'S,89°00'E	-	10	-	50	-	45	60
	91	01°30'N,89°00'E	-	-	-	80	-	-	-
	92	02°01'N,88°58'E	-	-	-	32	-	42	-
Conch									
	45	09°52'N,75°39'E	4920	117	-	13	-	187	88
	49	10°00'N,75°39'E	6640	60	-	-	-	36	59
	52	10°10'N,75°46'E	18750	100	-	-	-	10	50
	55	10°19'N,75°37'E	7300	48	-	-	-	8	72
	58	10°29'N,75°31'E	20600	120	-	-	-	12	168
	62	10°39'N,75°22'E	1703	-	-	-	-	13	36

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Discovery								
Cr.1. 5002	20°19'N,38°21'E	14	-	-	-	-	-	114
5009	15°10'N,52°32'E	-	112	-	4	-	-	216
5016	13°16'N,53°30'E	72	-	-	7	-	67	53
5017	12°56'N,53°44'E	80	60	-	-	-	-	106
5018	12°50'N,53°52'E	344	136	-	4	-	-	112
5026	16°31'N,54°08'E	10	670	-	-	-	-	60
5030	15°54'N,54°31'E	-	224	-	-	-	20	252
5031	15°26'N,54°46'E	2	50	4	10	-	19	57
5036	17°32'N,57°00'E	-	40	-	-	-	-	80
5037	17°28'N,57°03'E	-	133	-	-	-	67	233
5038	17°18'N,57°09'E	-	595	-	-	-	80	528
5039	17°09'N,57°15'E	-	445	-	5	-	25	255
5041	16°45'N,57°30'E	-	60	-	-	-	-	120
5047	19°11'N,57°55'E	5	220	-	-	-	-	20
5048	19°03'N,58°04'E	30	1590	-	-	-	90	270
5050	18°51'N,58°19'E	120	3173	-	-	-	-	253
5051	18°46'N,58°23'E	40	1653	-	-	-	53	333
5052	18°39'N,58°31'E	10	140	-	-	-	10	150
5053	18°20'N,58°59'E	-	670	-	10	-	-	270
5054	17°51'N,59°20'E	34	50	-	5	-	6	37
5055	17°33'N,59°45'E	13	40	-	-	-	-	14

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Discovery								
Cr.1. 5056	17°12'N,60°05'E	60	-	-	-	-	18	200
5057	16°45'N,60°31'E	305	34	-	-	-	-	24
5062	20°52'N,59°25'E	5	480	-	-	-	25	160
5063	20°43'N,59°36'E	26	253	-	-	-	200	427
5064	20°38'N,59°45'E	-	1400	-	-	-	10	300
5065	20°32'N,59°55'E	40	507	-	-	-	105	280
5066	20°26'N,60°03'E	20	410	-	-	-	-	300
5067	20°13'N,60°20'E	950	490	-	-	-	34	270
5068	19°58'N,60°48'E	820	10	-	-	-	90	320
5069	19°34'N,61°14'E	780	560	-	20	-	-	260
5089	13°14'N,50°14'E	-	40	-	-	-	35	136
5094	15°45'N,53°11'E	-	70	10	-	-	90	170
Cr.3. 5251	13°12'N,50°19'E	80	1750	80	-	-	30	150
5265	09°39'N,57°57'E	8	-	16	8	-	-	40
5267	06°44'N,57°59'E	-	-	-	7	-	9	46
5269	03°59'N,57°59'E	-	204	4	31	5	31	48
5380	10°03'N,70°37'E	-	-	-	-	-	78	-
5381	09°57'N,74°27'E	-	-	-	4	-	46	120
5383	09°58'N,67°32'E	566	-	-	-	-	-	4

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Discovery								
Cr.3. 5386	12°02'N,62°59'E	1526	82	-	-	-	-	192
5387	12°42'N,61°46'E	4482	30	-	-	-	-	46
5389	14°13'N,59°27'E	3663	250	-	10	-	4	-
5400	14°01'N,56°30'E	3000	114	-	16	-	-	202
5402	11°09'N,56°30'E	344	2	-	38	-	-	176
5404	08°20'N,57°59'E	50	-	-	15	-	-	98
5406	06°00'N,57°57'E	130	-	-	30	9	-	170
5555	10°45'N,51°28'E	-	150	-	-	-	40	-
5559	11°25'N,52°42'E	-	-	7	-	-	27	86
5561	11°38'N,52°57'E	-	-	26	-	-	-	-
5565	11°37'N,51°34'E	5	120	-	5	-	8	120
5566	13°12'N,50°19'E	--	17	-	3	-	-	30
Kistna								
Cr.15. 353	12°31'N,80°36'E	-	243	-	25	-	-	204
354	12°00'N,80°06'E	-	568	-	40	-	-	-
356	09°15'N,83°00'E	-	456	-	-	-	-	35
357	09°00'N,83°00'E	-	-	-	116	-	10	110
358	09°09'N,84°10'E	-	120	-	50	-	-	110
359	09°10'N,84°13'E	-	-	-	-	-	-	195
360	09°14'N,86°06'E	-	128	-	64	-	-	-
361	09°16'N,87°08'E	-	92	-	90	-	-	100

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Kistna								
Cr.15. 362	10°00'N,90°00'E	-	44	-	90	-	85	-
363	10°00'N,87°00'E	-	99	-	-	-	-	-
364	10°05'N,86°10'E	-	85	-	-	-	-	10
365	10°02'N,85°00'E	-	103	-	90	-	-	-
366	10°00'N,84°00'E	-	70	-	-	-	-	70
367	10°00'N,83°00'E	-	240	-	4	-	-	-
368	10°00'N,82°00'E	-	140	-	15	-	-	17
369	11°00'N,82°00'E	-	50	-	95	-	-	-
372	11°00'N,87°00'E	-	41	-	-	-	-	-
376	12°00'N,82°00'E	-	25	-	-	-	-	-
377	12°00'N,81°00'E	-	920	-	-	-	-	46
378	12°36'N,80°40'E	-	600	-	8	-	-	-
Cr.16. 383	13°00'N,81°00'E	-	188	-	9	-	-	10
384	13°00'N,82°00'E	-	6	-	-	-	-	-
385	13°00'N,83°00'E	-	145	-	-	-	-	-
386	13°00'N,84°00'E	-	177	-	25	-	-	-
387	13°00'N,85°00'E	-	459	-	2	-	-	-
388	13°00'N,86°00'E	-	75	-	-	-	-	50
390	14°04'N,87°52'E	-	111	-	-	-	-	120
391	14°05'N,86°50'E	-	125	-	-	-	10	50
392	14°04'N,85°45'E	-	330	-	-	-	-	-
393	14°07'N,85°45'E	-	25	-	2	-	-	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Kistna									
Cr.16.	394	14°10'N,84°20'E	-	86	-	-	-	-	86
	396	14°15'N,81°59'E	-	172	-	-	-	-	23
	397	14°16'N,80°58'E	-	120	-	50	-	-	33
	401	15°00'N,82°00'E	-	250	-	-	-	-	-
	402	15°00'N,83°00'E	-	10	-	-	-	-	-
	403	15°13'N,84°00'E	-	279	-	-	-	-	8
	405	15°00'N,88°00'E	1	657	-	5	-	-	25
	406	15°00'N,90°00'E	-	16	-	2	-	-	5
	407	16°00'N,88°00'E	-	57	-	25	-	-	-
	410	16°00'N,83°00'E	-	130	-	--	-	-	7
Cr.17.	427	20°40'N,89°12'E	-	134	-	-	--	10	49
	432	19°00'N,87°00'E	-	156	-	-	-	-	13
	433	19°00'N,88°00'E	-	66	-	-	-	-	60
	435	19°00'N,90°15'E	-	323	-	12	-	-	-
	436	18°55'N,91°00'E	-	272	-	-	-	-	-
	437	18°00'N,91°00'E	-	448	-	-	-	-	133
	438	18°00'N,90°00'E	-	260	-	-	-	8	35
	439	18°00'N,89°00'E	-	200	-	-	-	-	200
	440	18°04'N,88°00'E	-	720	-	-	-	-	-
	441	18°00'N,87°00'E	-	400	-	-	-	-	37
	443	18°00'N,85°00'E	-	2300	-	-	-	-	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Kistna									
Cr.19.	511	11°00'N,93°35'E	-	190	-	5	-	70	76
	512	11°00'N,95°00'E	-	230	-	66	-	-	-
	513	09°57'N,95°03'E	-	65	-	60	-	-	70
	514	09°00'N,95°00'E	39	-	-	32	-	-	-
	515	07°57'N,95°07'E	50	25	-	10	-	-	-
	516	06°56'N,95°07'E	-	100	-	25	-	-	50
	517	07°00'N,97°02'E	-	111	-	35	-	-	-
	518	07°07'N,98°21'E	-	55	-	16	-	-	-
	520	06°00'N,98°30'E	-	73	-	10	-	25	29
	521	06°95'N,98°59'E	-	157	-	5	-	-	-
	522	06°00'N,99°29'E	-	6	-	-	-	-	-
Cr.20.	526	03°00'N,100°45'E	1457	1407	-	-	-	-	-
	527	04°00'N,99°49'E	495	81	-	-	-	-	-
	528	05°00'N,98°00'E	1	-	-	-	-	-	-
	529	06°00'N,98°00'E	-	5	-	-	-	-	5
	530	05°57'N,96°56'E	-	150	-	-	-	15	-
	531	06°00'N,96°00'E	-	66	-	-	-	70	-
	532	06°00'N,95°00'E	-	192	-	-	-	-	31
	533	06°00'N,94°00'E	-	150	-	3	-	-	90
	536	07°00'N,92°00'E	3322	1020	-	4	-	-	255

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Kistna									
Cr.20.	538	08°47'N,92°56'E	90	400	-	-	-	-	-
	539	10°00'N,92°00'E	343	25	-	30	-	-	27
Cr.21.	541	17°00'N,84°55'E	-	360	-	-	-	-	-
	542	16°42'N,86°09'E	-	558	-	-	-	-	20
	543	16°00'N,87°00'E	-	330	-	-	-	-	-
	546	16°53'N,88°23'E	-	242	-	-	-	-	36
	549	18°90'N,90°00'E	-	330	-	-	-	-	2
	550	18°17'N,88°30'E	-	301	-	2	-	-	40
	551	18°54'N,88°37'E	-	49	-	1	-	-	-
	552	19°18'N,88°03'E	-	621	-	-	-	-	-
	553	19°37'N,87°19'E	-	109	-	-	-	-	15
	558	18°59'N,85°15'E	-	42	-	-	-	-	45
	559	18°52'N,85°30'E	-	2434	-	-	-	-	54
	560	18°36'N,86°00'E	-	430	-	-	-	-	135
	561	17°56'N,87°00'E	-	590	-	-	-	-	160
	562	17°28'N,86°00'E	-	450	-	-	-	-	45
	563	16°58'N,84°58'E	-	1039	-	2	-	-	-
	564	16°53'N,83°56'E	1	1728	-	-	-	-	19
	566	17°30'N,83°41'E	-	90	-	-	-	-	-
Cr.22.	570	16°00'N,84°02'E	-	700	-	-	-	-	46
	571	16°27'N,83°02'E	-	685	-	-	3	-	228
	572	16°31'N,82°53'E	-	364	-	-	-	-	120

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Kistna								
Cr.22. 573	16°30'N,82°23'E	4064	82	-	-	-	-	-
574	16°08'N,81°51'E	-	550	-	-	-	-	-
575	15°36'N,81°01'E	-	3520	-	-	-	-	-
578	15°05'N,80°24'E	-	565	-	-	-	-	-
579	15°00'N,81°01'E	-	1900	-	-	-	-	-
580	15°00'N,82°00'E	-	350	-	6	-	-	451
585	12°41'N,82°42'E	-	2238	-	-	-	-	-
586	12°39'N,81°54'E	-	700	-	5	-	-	-
587	12°49'N,80°51'E	-	2601	-	10	-	-	28
588	12°55'N,80°37'E	-	910	-	-	-	-	201
591	12°00'N,81°11'E	-	1539	-	-	-	-	35
594	11°01'N,80°12'E	-	1313	-	2	-	-	-
595	11°02'N,81°01'E	-	963	-	-	-	3	225
596	11°02'N,81°01'E	-	2376	-	-	-	-	-
597	11°02'N,82°59'E	-	20	-	-	-	-	20
600	09°34'N,82°58'E	-	860	-	60	-	-	121
603	07°58'N,82°55'E	-	120	-	2	-	-	-
605	07°00'N,82°12'E	-	250	-	-	-	-	110
607	06°00'N,81°30'E	183	3	-	15	-	-	2
609	06°09'N,79°50'E	-	315	-	2	-	-	26
611	06°59'N,78°40'E	-	262	-	-	-	-	-
612	07°28'N,77°53'E	20	80	-	-	-	-	20

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Kistna									
Cr.25.	645	17°24'N,71°22'E	1935	105	-	-	-	-	53
	646	17°13'N,70°49'E	9483	1053	-	-	-	-	-
	647	17°02'N,70°04'E	5148	50	-	-	-	-	10
	648	14°00'N,71°30'E	1360	-	-	-	-	-	20
	652	14°39'N,72°29'E	394	-	-	-	-	-	-
	660	12°38'N,74°21'E	-	20	-	-	-	-	30
	661	12°36'N,74°12'E	1125	62	-	-	-	-	-
	662	12°29'N,73°53'E	-	264	-	-	-	-	25
	663	12°15'N,73°25'E	2790	348	-	-	-	-	170
	664	10°00'N,73°30'E	3940	164	-	-	-	-	7
	666	10°13'N,75°39'E	8235	-	-	-	-	-	-
Cr.26.	677	09°11'N,75°54'E	1350	25	-	-	-	-	84
	680	07°12'N,78°34'E	35	293	-	-	-	11	117
	686	11°01'N,80°21'E	-	833	-	-	-	-	208
	687	11°00'N,80°13'E	-	924	-	3	-	-	60
	689	10°55'N,80°04'E	-	280	-	-	-	-	-
	702	12°59'N,82°09'E	-	98	-	5	-	-	98
	703	13°01'N,81°39'E	-	25	-	4	-	4	195
	704	13°03'N,81°08'E	-	-	-	-	-	-	580

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Kistna									
Cr.26.	705	13°05'N,80°35'E	-	1063	-	-	-	-	-
	706	13°06'N,80°31'E	-	930	-	-	-	-	-
	707	13°05'N,80°30'E	-	652	-	-	-	-	-
	716	15°04'N,82°10'E	-	735	-	-	-	-	37
	717	15°00'N,83°00'E	-	125	-	-	-	-	128
	718	15°02'N,84°07'E	-	300	-	-	-	-	150
	719	15°06'N,85°08'E	-	806	-	-	-	-	-
	721	14°58'N,86°49'E	-	828	-	-	-	-	78
	722	14°56'N,87°34'E	-	-	-	38	-	-	47
	723	15°00'N,89°00'E	-	912	-	-	-	-	-
	724	14°53'N,90°08'E	-	175	-	-	-	-	143
	725	16°00'N,90°00'E	-	-	-	-	-	-	9
	726	17°00'N,89°59'E	-	780	-	-	-	-	52
	727	18°04'N,90°06'E	-	666	-	-	-	-	58
	729	20°00'N,90°18'E	-	256	-	5	-	-	248
Meteor									
Cr.1.	53	12°22'N,43°57'E	-	2377	-	-	-	-	-
	62	12°36'N,43°16'E	-	2200	-	-	-	-	-
	73	16°37'N,41°09'E	2	3	-	-	-	2	24
	90	13°53'N,48°09'E	2	100	5	-	-	-	10
	91	13°28'N,48°18'E	-	630	20	-	-	10	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Meteor									
Cr.1.	92	13°09'N,48°24'E	-	115	-	-	-	-	15
	93	12°43'N,48°31'E	-	520	7	-	-	-	14
	94	12°14'N,48°42'E	1	240	-	-	-	20	-
	95	11°42'N,48°49'E	2	85	-	-	-	30	5
	96	11°19'N,49°00'E	-	120	-	-	-	-	-
	100	12°13'N,51°35'E	-	38	-	-	-	-	-
	101	12°13'N,41°48'E	250	250	-	-	-	-	-
	102	11°33'N,52°54'E	-	340	7	-	-	5	-
	103	11°27'N,53°04'E	2	86	10	-	-	-	-
	104	11°21'N,53°11'E	-	226	7	-	-	-	-
	105	11°06'N,53°28'E	-	44	20	-	-	-	-
	106	10°50'N,53°46'E	-	280	-	-	-	-	100
	107	10°37'N,54°03'E	-	-	-	-	10	-	18
	108	10°17'N,54°25'E	-	-	-	-	3	-	47
	114	08°00'N,51°12'E	-	-	8	-	-	-	6
	115	08°11'N,50°57'E	-	-	6	-	-	-	134
	116	08°26'N,50°32'E	-	-	-	-	-	-	5
	125	05°39'N,49°22'E	-	-	-	-	-	-	8
	126	05°44'N,49°30'E	-	-	10	4	-	-	32
	127	05°29'N,50°02'E	-	-	-	15	12	-	4
	129	05°05'N,50°31'E	-	-	-	-	2	-	6

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Meteor								
Cr.1. 180	05°12'N,66°03'E	-	-	2	-	-	16	89
181	07°24'N,70°50'E	-	-	-	4	-	20	10
182	08°45'N,73°37'E	-	107	-	-	-	-	5
183	08°43'N,73°58'E	11550	10	-	-	-	-	-
184	09°01'N,74°17'E	4906	12	-	-	-	-	12
185	09°09'N,74°35'E	2478	5	-	-	-	-	-
186	09°23'N,75°02'E	4862	6	-	-	-	-	20
187	09°34'N,75°16'E	3236	136	-	-	-	-	8
188	09°37'N,75°31'E	945	45	-	-	-	-	2
189	09°40'N,75°40'E	1933	44	-	-	-	-	-
194	14°34'N,73°25'E	927	-	-	-	-	-	-
195	14°25'N,73°13'E	4604	-	-	-	-	-	25
196	14°25'N,72°58'E	3112	-	-	-	-	-	-
197	14°18'N,72°44'E	2020	12	-	-	-	-	92
198	14°14'N,72°19'E	1396	36	-	-	-	-	25
199	14°03'N,72°00'E	2502	-	-	-	-	-	-
200	13°53'N,71°36'E	6108	48	-	-	-	-	25
201	13°40'N,71°09'E	5755	60	-	-	-	-	-
202	13°36'N,70°50'E	5889	4	-	-	-	-	10
205	16°19'N,68°52'E	3922	6	-	-	-	-	10
206	16°35'N,69°15'E	1308	-	-	-	-	-	12

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Meteor									
Cr.1.	208	17°11'N,70°10'E	2314	86	-	-	-	-	6
	209	17°23'N,70°34'E	6733	10	-	-	-	-	-
	210	17°40'N,70°57'E	3238	-	-	-	-	-	-
	211	17°43'N,71°04'E	2000	222	-	-	-	-	-
	213	19°32'N,71°07'E	872	-	-	-	-	-	-
	217	18°45'N,70°18'E	4838	78	-	-	-	-	6
	218	18°37'N,70°08'E	5048	144	-	-	-	-	12
	220	18°20'N,69°40'E	1372	236	-	-	-	-	44
	222	19°35'N,68°35'E	7066	620	-	-	-	-	80
	223	19°58'N,66°51'E	10160	225	-	-	-	-	75
	224	20°19'N,67°03'E	11355	470	-	-	-	140	300
	225	20°44'N,67°32'E	2688	4	-	-	-	-	48
	226	21°41'N,67°47'E	1480	55	-	-	-	35	160
	228	21°50'N,68°02'E	4268	73	-	-	-	-	-
Umitaka Maru									
Cr.23.	(1-1)	07°39'N,78°09'E	-	-	-	10	-	10	45
	(1-2)	06°04'N,77°46'E	-	264	-	10	-	12	114
Varuna									
Cr.30.	1765	20°00'N,72°30'E	389	-	-	-	-	-	-
	1766	20°00'N,72°15'E	76	2	-	-	-	-	-
	1768	20°00'N,71°45'E	28	-	-	-	-	-	-
	1769	20°00'N,71°31'E	23	-	-	-	-	-	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Varuna									
Cr.30.	1770	20°00'N,71°15'E	25	23	-	-	-	-	-
	1771	20°00'N,70°00'E	14	-	-	-	-	-	-
	1772	20°00'N,70°45'E	19	-	-	-	-	-	-
	1773	20°00'N,70°31'E	3650	-	-	-	-	-	-
	1774	20°00'N,70°17'E	5054	-	-	-	-	-	-
	1775	20°00'N,70°00'E	1030	-	-	-	-	-	-
	1776	20°00'N,69°45'E	1311	-	-	-	-	-	-
	1777	20°00'N,69°30'E	240	30	-	-	-	-	30
	1778	20°00'N,69°15'E	11962	-	-	-	-	-	745
	1779	20°56'N,68°53'E	360	100	-	-	-	-	20
	1781	21°16'N,69°13'E	1265	630	-	-	-	-	-
	1782	21°27'N,69°24'E	1400	140	-	-	-	-	-
	1783	21°36'N,69°34'E	35	5	-	-	-	-	-
	1784	20°52'N,70°21'E	44	-	-	-	-	-	-
	1785	20°45'N,70°15'E	16	-	-	-	-	-	-
	1786	20°37'N,70°10'E	28	-	-	-	-	-	-
	1787	20°29'N,70°04'E	15	12	-	-	-	-	-
	1788	20°20'N,69°59'E	16	-	-	-	-	-	-
	1789	20°14'N,69°55'E	372	-	-	-	-	-	-
	1790	20°20'N,70°31'E	600	65	-	-	-	-	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Varuna									
Cr.30.	1791	20°20'N,71°00'E	331	1000	-	-	-	-	-
	1792	20°20'N,71°30'E	210	69	-	-	-	-	-
	1793	20°20'N,72°00'E	9	-	-	-	-	-	-
	1794	20°19'N,72°29'E	7600	-	-	-	-	-	-
Cr.31.	1796	18°30'N,72°30'E	200	-	-	-	-	-	-
	1797	18°30'N,72°15'E	480	50	-	-	-	-	-
	1798	18°30'N,72°00'E	2525	25	-	-	-	-	24
	1799	18°30'N,71°45'E	578	-	-	-	-	-	-
	1800	18°30'N,71°30'E	540	-	-	-	-	-	-
	1801	18°30'N,71°15'E	233	15	-	-	-	-	-
	1802	18°30'N,71°00'E	200	-	-	-	-	-	-
	1803	18°30'N,70°45'E	820	-	-	-	-	-	-
	1804	18°30'N,70°26'E	4590	1532	-	-	-	-	-
	1805	18°30'N,70°14'E	4875	600	-	-	-	-	308
	1806	18°30'N,70°00'E	5784	-	-	-	-	-	25
	1807	17°00'N,71°30'E	1140	-	-	-	-	-	60
	1808	16°58'N,71°45'E	2000	-	-	-	-	-	40
	1809	16°55'N,72°00'E	3500	130	-	-	-	-	390
	1810	16°52'N,72°14'E	1070	535	-	-	-	-	-
	1811	16°49'N,72°29'E	4928	-	-	-	-	-	-
	1812	16°49'N,72°45'E	4040	-	-	-	-	-	-

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Varuna									
Cr.31.	1813	16°45'N,73°00'E	3604	-	-	-	-	-	-
	1814	16°40'N,73°12'E	59	-	-	-	-	-	-
	1815	15°50'N,73°32'E	738	-	-	-	-	-	-
	1816	15°46'N,73°22'E	1513	-	-	-	-	-	-
	1817	15°43'N,73°13'E	12270	-	-	-	-	-	-
Cr.104.	2003	09°00'N,76°28'E	1	-	-	-	-	-	-
	2004	09°00'N,76°22'E	2173	-	-	-	-	-	-
	2005	09°00'N,76°16'E	30	30	-	-	-	-	-
	2006	09°00'N,75°12'E	5760	100	-	8	-	-	80
	2007	09°00'N,75°20'E	900	-	-	-	-	-	15
	2008	09°04'N,74°40'E	1950	-	-	-	-	-	-
	2009	09°04'N,74°00'E	3140	-	-	-	-	-	60
	2010	09°03'N,73°20'E	2476	-	-	-	-	-	-
	2011	09°00'N,72°40'E	40	-	-	-	-	-	74
	2012	09°00'N,72°00'E	10	-	-	10	-	-	75
	2013	09°05'N,71°20'E	150	-	-	-	-	-	-
	2014	09°10'N,70°40'E	18	60	-	-	-	-	140
Cr.106.	2038	14°58'N,72°32'E	2250	200	-	-	-	-	-
	2039	15°00'N,73°05'E	1100	30	-	-	-	-	-
	2040	15°00'N,73°16'E	668	133	-	-	-	-	133
	2041	15°00'N,73°28'E	783	-	-	-	-	-	260

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Varuna									
Cr.106.	2042	15°00'N,73°40'E	42	-	-	-	-	-	-
	2044	14°48'N,74°02'E	649	-	-	-	-	-	-
Vitiaz									
Cr.35.	5247	05°35'N,79°56'E	-	-	-	7	6	45	33
	5248	05°28'N,78°33'E	-	270	-	-	-	-	80
	5249	05°05'N,77°07'E	-	-	-	-	10	-	80
Zulum									
	2	24°45'N,66°20'E	10	13	-	-	-	-	33
	3	24°42'N,66°04'E	931	40	-	-	-	73	-
	4	24°38'N,65°49'E	385	-	-	-	-	47	409
	5	23°58'N,66°09'E	-	68	-	-	-	-	36
	6	24°05'N,66°27'E	15	-	-	-	-	-	10
	7	24°13''N,66°47'E	3	-	-	-	-	-	-
	8	24°17'N,67°04'E	-	3	-	-	-	-	2
	10	23°44'N,67°24'E	25	51	-	-	-	9	4
	11	23°39'N,67°38'E	-	3	-	-	-	-	13
	12	23°26'N,67°28'E	2	-	-	-	-	-	-
	13	23°27'N,67°19'E	-	-	-	-	-	18	82
	14	23°28'N,67°09'E	-	1	-	-	-	5	19
	15	23°12'N,67°02'E	4	20	-	-	-	26	136

TABLE - I a (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Zulun								
16	23°10'N,67°10'E	5	12	-	-	-	68	428
18	22°53'N,66°49'E	150	40	-	-	-	32	115
19	22°41'N,67°03'E	9	-	-	-	-	-	160
20	22°11'N,67°41'E	-	-	-	-	-	-	100
21	22°28'N,67°59'E	4	-	-	-	-	-	-
22	23°29'N,67°25'E	30	-	-	-	-	-	9

TABLE - I b

Data concerning the stations and number of specimens obtained (Contd.)

Name of Ship, Cruise No. & Station No.			Name of Species and No. of specimens						
			P.deci-piens	C.gies-brechti	M.cur-ta	M.rotun-data	O.stri-ola	O.atlan-tica	S.porre-cta
			1	2	3	4	5	6	7
Anton Bruun									
Cr.A.	1	12°00'N,45°51'E	20	10	-	30	-	60	975
	3	13°03'N,50°00'E	-	-	-	-	-	240	270
	4	13°34'N,53°01'E	10	25	-	70	-	-	215
	5	14°03'N,54°00'E	8	-	36	32	-	132	56
	6	14°35'N,56°00'E	5	65	5	10	-	15	315
	7	15°05'N,58°00'E	10	30	-	-	-	-	130
	8	15°35'N,60°00'E	-	4	-	-	7	-	285
	9	15°05'N,62°00'E	40	100	-	30	10	5	250
	10	16°36'N,64°00'E	-	24	-	16	-	8	-
	11	17°08'N,66°00'E	-	-	-	10	-	-	-
	12	17°36'N,68°00'E	-	-	-	-	-	-	9
	13	18°09'N,70°00'E	-	15	-	10	-	-	17
Cr.1.	15	07°27'N,95°18'E	-	-	-	25	-	10	32
	14	07°27'N,94°21'E	-	50	-	100	45	50	-
	16	07°31'N,96°11'E	-	-	30	-	25	10	50
	17	07°40'N,97°09'E	12	43	-	76	28	-	39
	23	10°39'N,96°35'E	-	26	-	28	-	-	-
	24	10°36'N,95°39'E	10	51	-	128	-	-	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Anton Bruun									
Cr.1.	25	10°41'N,94°40'E	-	27	-	25	28	-	30
	26	10°39'N,93°49'E	-	48	-	16	-	-	50
	27	10°37'N,92°59'E	10	36	-	28	-	30	43
	30	12°17'N,93°21'E	-	16	10	12	-	-	17
	31	12°53'N,93°23'E	10	-	-	30	-	4	50
	32	12°52'N,94°13'E	28	-	-	-	25	10	26
	33	12°57'N,95°01'E	-	82	76	80	-	10	-
	34	12°50'N,95°56'E	-	15	-	160	2	-	-
	36	12°52'N,97°40'E	-	1	-	-	-	-	-
	37	13°28'N,97°19'E	-	2	-	-	-	-	2
	51	19°11'N,92°14'E	-	80	-	-	-	-	8
	52	18°55'N,91°59'E	-	-	-	-	-	-	10
	53	18°33'N,91°16'E	-	15	-	14	-	15	15
	54	18°24'N,90°45'E	-	20	-	23	-	-	25
	55	18°20'N,09°06'E	-	2	-	2	-	-	2
	56	18°15'N,89°20'E	-	35	-	45	-	-	-
	58	18°11'N,88°04'E	-	24	-	25	-	-	31
	59	18°00'N,87°16'E	-	10	-	9	-	4	8
	60	17°54'N,86°31'E	-	15	-	-	-	-	16
	61	17°53'N,86°56'E	-	50	-	32	-	10	55

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Anton Bruun									
Cr.1.	62	17°52'N,85°12'E	10	30	-	66	-	-	12
	63	17°56'N,84°37'E	1	6	-	3	-	30	12
	64	17°48'N,84°02'E	-	-	-	-	-	21	3
	65	17°30'N,83°47'E	-	50	-	-	-	50	-
	66	17°07'N,84°33'E	-	60	-	36	-	-	72
	67	16°30'N,85°32'E	15	10	-	120	-	-	5
	68	15°59'N,86°14'E	10	-	-	12	-	-	20
	69	15°47'N,87°05'E	-	33	-	134	-	-	30
	70	15°17'N,87°50'E	-	83	-	80	-	-	21
	71	14°53'N,88°40'E	25	28	-	68	-	10	30
	72	14°23'N,89°23'E	-	50	-	48	-	-	61
	73	14°02'N,90°08'E	-	-	-	57	-	20	62
	74	13°36'N,90°48'E	-	55	-	25	-	-	12
	75	13°16'N,91°34'E	-	56	-	50	-	-	16
	76	12°56'N,92°10'E	-	30	-	143	-	-	-
	77	13°50'N,92°17'E	-	40	-	38	-	-	-
	78	14°15'N,91°50'E	-	61	-	200	-	-	60
	79	14°58'N,91°17'E,	-	20	-	-	-	10	-
	80	14°43'N,90°58'E	-	32	-	80	-	-	-
	81	16°25'N,90°43'E	-	10	-	-	-	90	25
	82	17°06'N,90°17'E	-	80	-	-	-	-	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Anton Bruun									
Cr.1.	83	17°48'N,89°43'E	-	26	-	22	-	-	14
	84	18°30'N,89°18'E	-	20	-	12	-	-	18
	85	19°16'N,88°56'E	35	28	-	35	-	10	30
	86	20°04'N,88°24'E	10	113	-	320	-	10	105
	91	17°14'N,83°47'E	2	75	2	56	-	-	60
	92	16°40'N,83°58'E	-	15	-	20	-	-	120
	93	15°58'N,84°27'E	-	10	-	-	-	-	21
	95	14°22'N,85°20'E	-	10	8	30	-	-	74
	96	13°43'N,85°47'E	-	46	-	40	-	-	50
	97	13°08'N,86°12'E	-	37	-	123	-	-	10
	98	13°03'N,85°21'E	-	60	-	162	-	10	64
	99	13°02'N,84°22'E	10	-	10	63	-	-	37
	100	13°04'N,83°10'E	-	10	-	10	-	-	12
	101	13°09'N,82°22'E	-	-	24	8	-	-	4
	102	13°10'N,81°17'E	-	75	7	15	2	1	6
	103	13°17'N,80°44'E	10	96	-	24	-	-	160
Cr.2.	107	15°40'N,70°07'E	2	-	-	30	-	-	10
	108	13°50'N,70°07'E	-	10	-	-	-	19	13
	109	11°59'N,69°55'E	-	7	-	-	-	15	19

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Anton Bruun								
Cr.2. 110	09°46'N,70°06'E	-	11	2	40	-	-	10
111	08°09'N,70°02'E	-	70	-	-	3	4	-
112	05°48'N,70°03'E	-	-	-	2	5	6	-
113	03°33'N,69°54'E	-	27	-	32	-	10	-
114	01°30'N,70°01'E	-	20	16	40	-	-	45
143	01°54'N,79°52'E	30	35	32	40	-	35	44
144	04°18'N,80°08'E	14	12	15	16	-	-	23
145	11°56'N,60°53'E	-	-	-	2	-	-	50
147	07°13'N,59°57'E	4	6	-	-	5	4	46
149	01°16'N,60°08'E	2	20	2	15	-	-	18
151	05°04'S,60°03'E	2	-	-	-	2	-	-
Cr.4A.168	05°52'N,52°56'E	4	-	-	4	-	-	28
170	12°04'N,51°31'E	30	50	-	-	20	10	70
171	13°11'N,51°28'E	-	-	-	-	-	72	105
172	14°44'N,51°02'E	4	-	16	25	8	-	36
173	15°27'N,52°50'E	160	980	-	80	-	60	380
174	16°27'N,54°39'E	20	46	-	73	-	86	60
175	17°26'N,56°29'E	27	73	-	100	-	66	113
176	16°29'N,57°09'E	30	20	-	-	-	120	160

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Anton Bruun									
Cr.4A.	177	15°18'N,57°43'E	12	16	-	8	-	44	32
	178	14°21'N,58°18'E	-	84	-	28	-	12	80
	179	13°12'N,58°58'E	-	32	40	64	4	8	12
	180	12°15'N,59°42'E	-	-	-	4	-	-	38
	182	15°58'N,62°33'E	10	110	-	-	-	48	-
	183	23°43'N,62°21'E	-	2	-	16	-	-	-
	184	23°33'N,65°50'E	-	-	-	19	-	-	-
	185	20°39'N,64°41'E	-	-	-	13	-	-	7
	186	21°31'N,64°06'E	15	5	-	80	-	15	130
	187	22°23'N,63°32'E	-	40	-	-	-	-	110
	188	23°19'N,62°50'E	7	-	-	45	-	-	20
	189	24°00'N,62°04'E	4	30	-	-	-	4	-
	191	23°57'N,60°58'E	12	50	-	150	-	14	90
	192	23°08'N,60°32'E	10	25	-	5	-	5	10
	193	22°48'N,59°34'E	10	-	-	20	-	-	50
	194	22°22'N,60°05'E	-	25	-	24	-	-	8
	196	20°44'N,61°05'E	20	210	-	70	-	-	-
	197	20°02'N,62°00'E	20	213	-	60	-	7	67
	198	19°17'N,62°29'E	-	280	-	50	-	30	30
	199	18°31'N,63°08'E	-	2	-	50	-	-	2

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Anton Bruun									
Cr.5.	282	16°13'N,63°29'E	4	28	-	12	-	-	96
	283	15°42'N,60°52'E	10	50	-	20	-	-	55
	284	15°22'N,58°12'E	8	10	-	25	7	-	56
	285	14°22'N,54°18'E	-	116	-	28	-	-	120
	286	13°50'N,52°59'E	15	5	-	10	4	55	150
	287	13°11'N,50°22'E	20	10	5	-	-	10	165
	288	09°28'N,54°52'E	8	4	-	25	9	8	-
	289	07°10'N,55°05'E	7	-	-	10	-	-	10
	327	06°51'N,75°02'E	6	54	4	52	3	5	130
	328	18°02'N,65°08'E	-	-	-	13	-	-	5
	329	15°36'N,64°59'E	4	92	4	16	-	-	24
	330	13°36'N,65°03'E	-	14	-	3	-	-	6
	331	11°28'N,65°04'E	2	36	-	96	-	12	4
	332	10°01'N,65°01'E	2	20	-	2	-	1	10
	334	06°01'N,64°59'E	32	-	-	7	4	-	6
Argo									
Cr.Dodo.	29	03°52'N,48°18'E	8	-	-	8	25	16	24
	32	05°11'N,49°44'E	10	-	160	-	-	80	80
	37	06°26'N,49°46'E	60	-	180	10	90	22	60
	40	07°05'N,49°39'E	110	30	90	-	70	-	120
	47	08°53'N,53°09'E	-	-	80	-	-	-	120

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Argo									
Cr. Dodo	51	11°08'N,53°02'E	60	-	280	25	40	60	200
	58	08°27'N,53°23'E	60	-	140	7	33	15	-
	67	05°02'N,55°06'E	30	-	130	-	--	50	65
Cr.Lusiad.	1	00°07'S,96°31'E	-	-	-	-	-	2	-
	7	00°02'S,84°56'E	10	-	-	-	12	-	-
	8	00°01'N,82°52'E	5	-	-	-	-	5	-
	9	00°00' ,80°56'E	5	-	-	-	1	-	-
	10	00°01'N,78°59'E	-	-	-	-	25	-	-
	11	00°03'S,76°56'E	-	-	-	-	4	-	-
	12	00°01'S,74°59'E	3	-	-	-	-	-	-
	15	00°09'N,68°59'E	-	25	-	-	25	-	-
	16	00°02'N,66°56'E	-	35	-	-	-	-	-
	17	00°01'S,65°04'E	-	-	-	-	70	-	-
	18	00°03'N,62°41'E	-	15	-	-	-	-	-
	19	00°03'S,61°00'E	-	10	-	-	9	-	-
	20	00°00' ,59°01'E	-	-	-	-	-	-	15
	21	00°01'S,57°05'E	-	100	-	-	8	120	150
	22	00°03'N,55°03'E	-	-	-	-	45	50	-
	26	00°08'S,46°52'E	62	-	-	-	-	-	-
	27	00°01'N,45°02'E	-	20	-	-	-	-	-
	29	05°02'N,51°01'E	-	-	-	8	-	-	-
	32	02°30'N,53°00'E	-	-	-	-	11	-	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Argo								
Cr.Lusiad. 35	01°00'N,53°00'E	-	-	-	-	70	-	-
36	00°29'N,52°58'E	-	-	-	-	30	-	30
37	00°00' ,53°00'E	-	-	-	10	-	-	-
41	00°02'S,53°03'E	-	-	-	-	-	-	10
42	02°30'S,53°00'E	-	-	-	-	-	30	-
43	03°00'S,53°00'E	-	-	-	-	300	-	--
44	03°56'S,52°59'E	50	30	-	-	-	-	-
45	05°00'S,62°00'E	-	-	-	-	-	-	20
46	04°07'S,62°10'E	40	50	-	-	-	-	-
47	03°00'S,62°20'E	40	12	-	12	-	-	-
48	02°29'S,62°20'E	-	4	-	-	6	-	4
49	02°00'S,62°20'E	48	-	-	-	40	-	-
50	01°28'S,62°20'E	-	25	-	-	30	-	-
51	00°57'S,62°19'E	-	-	-	20	-	-	-
52	00°28'S,62°19'E	42	-	-	-	50	-	-
53	00°05'S,62°20'E	10	-	-	-	-	-	-
54	00°29'N,62°19'E	25	-	-	-	-	-	-
55	01°02'N,62°20'E	-	10	-	-	-	-	-
56	01°32'N,62°20'E	-	-	-	4	-	-	-
57	02°05'N,61°15'E	-	-	-	-	-	-	24
58	02°31'N,62°20'E	-	28	-	7	-	-	30

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Argo								
Cr.Lusiad 59	03°06'N,62°19'E	-	12	-	-	-	-	130
60	04°00'N,62°19'E	-	-	-	-	40	-	-
61	05°02'N,62°20'E	-	-	-	-	10	-	-
62	04°51'N,74°04'E	-	30	-	-	-	-	-
64	02°55'N,78°58'E	-	-	-	-	3	-	-
65	02°26'N,78°56'E	-	-	-	25	20	-	-
66	01°54'N,79°01'E	-	12	-	-	-	-	10
68	00°55'N,79°04'E	25	30	-	-	30	25	28
70	00°02'N,79°04'E	-	-	-	-	30	-	-
71	00°30'S,79°02'E	42	40	10	-	45	-	-
72	00°56'S,79°03'E	-	-	-	-	25	-	-
74	01°55'S,78°54'E	60	-	-	-	-	-	-
75	02°30'S,78°59'E	40	-	-	-	-	-	-
76	03°00'S,79°01'S	25	-	-	-	25	-	-
77	04°00'S,79°00'E	-	10	-	-	-	-	-
81	01°08'S,89°05'E	-	-	-	-	-	7	-
84	03°03'S,89°03'E	22	15	-	-	16	-	20
86	05°00'S,89°00'E	50	40	12	-	50	-	-
92	02°01'N,88°58'E	-	-	-	-	-	25	30
95	04°02'N,89°00'E	-	1	-	-	-	-	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Conch									
	45	09°52'N,75°39'E	65	90	115	197	-	30	-
	49	10°00'N,75°39'E	155	95	82	39	-	36	-
	52	10°10'N,75°46'E	75	20	55	70	-	35	-
	55	10°19'N,75°37'E	24	40	104	88	-	16	-
	58	10°29'N,75°31'E	48	64	76	220	-	12	-
	62	10°39'N,75°22'E	4	40	7	58	-	3	-
Discovery									
Cr.1.	5002	20°19'N,38°21'E	-	-	-	8	-	-	-
	5009	15°10'N,52°32'E	44	-	92	148	4	196	194
	5016	13°16'N,53°30'E	26	-	20	40	14	40	246
	5017	12°56'N,53°44'E	27	7	7	33	-	33	-
	5018	12°50'N,53°52'E	28	48	36	104	-	64	268
	5026	16°31'N,54°08'E	30	60	40	160	-	60	640
	5030	15°54'N,54°31'E	24	80	96	76	4	100	260
	5031	15°26'N,54°46'E	11	10	36	12	13	20	72
	5036	17°32'N,57°00'E	100	160	-	-	20	-	260
	5037	17°28'N,57°03'E	-	533	34	200	-	100	566
	5038	17°18'N,57°09'E	95	125	100	85	25	45	990
	5039	17°09'N,57°15'E	35	50	55	55	-	175	605
	5041	16°45'N,57°30'E	-	320	20	-	-	140	280
	5047	19°11'N,57°55'E	-	-	-	38	-	-	120

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Discovery									
Cr.1.	5048	19°03'N,58°04'E	20	140	10	40	-	70	120
	5050	18°51'N,58°19'E	-	120	26	80	15	-	133
	5051	18°46'N,58°23'E	26	146	40	132	-	26	266
	5052	18°39'N,58°31'E	-	100	80	90	-	50	220
	5053	18°20'N,58°59'E	30	140	-	60	10	130	320
	5054	17°51'N,59°20'E	3	25	2	40	-	--	55
	5055	17°33'N,59°45'E	-	346	-	10	-	-	20
	5056	17°12'N,60°05'E	-	20	-	70	--	20	-
	5057	16°45'N,60°31'E	-	40	-	23	-	-	-
	5062	20°52'N,59°25'E	20	260	-	140	-	60	520
	5063	20°43'N,59°36'E	120	14	13	66	-	13	693
	5064	20°38'N,59°45'E	20	330	10	60	10	10	540
	5065	20°32'N,59°55'E	27	533	14	200	-	66	226
	5066	20°26'N,60°03'E	30	1080	-	140	-	30	450
	5067	20°13'N,60°20'E	-	260	-	130	10	40	170
	5068	19°58'N,60°48'E	50	10	-	50	-	-	150
	5069	19°34'N,61°14'E	-	70	-	80	-	10	450
	5089	13°14'N,50°14'E	80	-	60	40	-	68	68
	5094	15°45'N,53°11'E	50	-	260	60	50	330	310

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Discovery								
Cr.3. 5251	13°12'N,50°19'E	90	-	120	20	-	40	890
5262	12°36'N,58°15'E	-	-	40	-	35	20	-
5265	09°39'N,57°57'E	16	1	92	72	5	8	52
5267	06°44'N,57°59'E	30	2	40	25	2	1	12
5269	03°59'N,57°59'E	35	3	72	38	10	11	-
5269	03°59'N,57°59'E	8	2	58	-	-	-	14
5371	08°31'N,67°27'E	3	36	15	30	-	16	3
5380	10°03'N,70°37'E	4	120	20	84	5	10	20
5381	09°57'N,74°27'E	-	3	10	56	2	30	13
5383	09°58'N,67°32'E	-	-	-	-	-	-	11
5386	12°02'N,62°59'E	13	-	-	-	-	13	18
5387	12°42'N,61°46'E	-	40	-	16	-	15	7
5389	14°13'N,59°27'E	50	53	200	83	-	52	83
5400	14°01'N,56°30'E	30	54	12	68	-	34	36
5402	11°09'N,56°30'E	14	4	8	48	5	54	38
5404	08°20'N,57°59'E	63	-	27	25	2	5	-
5406	06°00'N,57°58'E	40	20	70	40	-	-	50
5552	08°38'N,50°34'E	-	-	-	-	3	-	-
5555	10°45'N,51°28'E	-	20	40	90	-	-	60
5559	11°25'N,52°42'E	47	-	-	66	-	13	-
5561	11°38'N,52°57'E	30	-	20	-	-	40	27

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Discovery									
Cr.3.	5565	11°37'N,51°34'E	10	5	5	5	-	5	110
	5566	13°12'N,50°19'E	-	3	23	18	3	20	57
Kistna									
Cr.15.	353	12°31'N,80°36'E	10	95	15	80	-	12	81
	354	12°00'N,80°06'E	-	-	-	-	-	8	84
	356	09°15'N,83°00'E	-	342	-	114	-	55	50
	357	09°00'N,83°00'E	-	120	100	115	-	16	-
	358	09°09'N,84°10'E	10	100	95	102	-	40	116
	359	09°10'N,85°13'E	-	434	130	425	-	-	-
	360	09°14'N,86°06'E	-	384	-	192	-	60	72
	361	09°16'N,87°08'E	-	99	80	90	-	100	-
	362	10°00'N,90°00'E	-	44	132	85	10	40	103
	363	10°00'N,87°00'E	-	108	90	95	-	12	-
	364	10°05'N,86°10'E	4	80	78	75	-	-	92
	365	10°02'N,85°00'E	-	93	84	93	10	90	-
	366	10°00'N,84°00'E	75	68	-	65	-	70	82
	367	10°00'N,83°00'E	-	-	-	-	-	-	125
	368	10°00'N,82°00'E	-	87	-	70	-	-	16
	369	11°00'N,82°00'E	-	-	-	-	-	-	150
	372	11°00'N,87°00'E	-	-	-	-	-	-	38

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Kistna								
Cr.15. 377	12°00'N,81°00'E	3	-	-	-	-	10	5
378	12°36'N,80°40'E	-	-	-	-	-	-	45
Cr.16. 383	13°00'N,81°00'E	-	-	12	-	-	-	-
385	13°00'N,82°00'E	-	-	-	50	-	15	160
386	13°00'N,84°00'E	-	35	-	-	-	10	175
387	13°00'N,85°00'E	-	15	-	25	-	10	-
388	13°00'N,86°00'E	-	76	-	25	-	-	-
390	14°04'N,87°52'E	-	119	-	95	-	117	100
391	14°05'N,86°50'E	-	125	-	46	-	-	118
392	14°04'N,85°45'E	-	15	-	8	-	-	7
393	14°07'N,85°45'E	-	168	-	28	-	-	55
394	14°10'N,84°20'E	-	86	-	60	-	2	-
395	14°14'N,82°58'E	-	600	-	-	-	5	4
396	14°15'N,81°59'E	-	86	-	34	-	10	-
397	14°16'N,80°58'E	-	32	-	72	-	10	48
401	15°00'N,82°00'E	-	100	-	-	-	-	-
402	15°00'N,83°00'E	-	10	-	-	-	-	-
403	15°13'N,84°00'E	-	10	-	319	-	-	9
405	15°00'N,83°00'E	-	15	-	50	-	-	24
406	15°00'N,90°00'E	-	-	-	4	--	-	17
407	16°00'N,88°00'E	-	-	-	20	-	12	10

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Kistna									
Cr.16.	410	16°00'N,83°00'E	-	2	-	-	-	-	4
Cr.17.	427	20°40'N,89°12'E	-	134	-	-	-	-	-
	432	19°00'N,87°00'E	-	65	-	26	-	10	25
	433	19°00'N,88°00'E	-	61	-	50	-	15	67
	435	19°00'N,90°15'E	-	161	-	52	-	-	76
	436	18°55'N,91°00'E	-	34	-	30	-	-	-
	437	18°00'N,91°00'E	-	179	-	45	-	40	21
	438	18°00'N,90°00'E	-	25	-	32	-	10	-
	439	18°00'N,89°00'E	-	200	-	50	-	-	200
	440	18°00'N,87°00'E	-	-	-	40	-	12	38
	441	18°00'N,87°00'E	25	187	-	74	-	-	35
	443	18°00'N,85°00'E	-	125	-	112	-	-	-
Cr.19.	511	11°00'N,93°35'E	-	114	70	75	-	35	124
	512	11°00'N,95°00'E	-	60	45	65	-	-	88
	513	09°57'N,95°03'E	-	58	50	47	-	60	55
	514	09°00'N,95°00'E	-	34	30	38	-	-	34
	515	07°57'N,95°07'E	-	-	-	-	-	10	8
	516	06°56'N,95°07'E	-	250	45	-	-	50	70
	517	07°00'N,97°02'E	40	37	-	32	-	-	-
	518	07°07'N,92°21'E	-	20	-	-	-	-	15
	520	06°00'N,98°30'E	-	-	15	-	-	-	25

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Kistna								
Cr.20.528	05°00'N,98°00'E	-	-	-	-	-	1	-
530	05°57'N,96°56'E	-	-	-	20	5	-	60
531	06°00'N,96°00'E	-	-	60	-	-	80	58
532	06°00'N,95°00'E	-	40	30	66	-	-	-
533	06°00'N,94°00'E	-	-	60	80	-	-	78
536	07°00'N,92°00'E	-	52	-	225	-	-	25
538	08°47'N,92°56'E	-	-	-	-	-	4	87
539	10°00'N,92°00'E	-	22	-	-	-	-	20
Cr.21.541	17°00'N,84°55'E	-	40	-	-	-	-	-
542	16°42'N,86°09'E	-	80	-	20	-	-	-
543	16°00'N,87°00'E	-	35	-	150	-	31	60
546	16°53'N,88°23'E	-	8	-	36	-	6	37
549	18°00'N,90°00'E	-	2	-	3	-	-	-
550	18°17'N,89°30'E	-	20	-	17	-	5	16
551	18°54'N,88°37'E	-	6	-	49	-	5	24
552	19°18'N,88°03'E	-	20	-	18	-	--	23
553	19°37'N,87°19'E	-	35	-	15	-	-	15
558	18°59'N,85°15'E	18	60	-	-	-	-	-
559	18°52'N,85°30'E	10	81	-	50	-	4	51
560	18°36'N,86°00'E	-	146	-	150	-	-	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Kistna								
Cr.21.561	17°56'N,87°00'E	-	8	-	30	-	2	15
562	17°28'N,86°00'E	-	180	-	90	-	--	86
563	16°53'N,84°58'E	-	-	--	138	-	2	52
564	16°53'N,83°56'E	25	57	-	20	-	27	-
565	17°31'N,83°41'E	-	15	-	-	-	-	-
566	17°30'N,83°41'E	-	11	-	15	-	-	-
Cr.22.570	16°00'N,84°02'E	-	46	-	46	-	2	50
571	16°27'N,83°02'E	-	58	-	-	-	55	114
572	16°31'E,82°53'E	-	50	-	-	-	-	-
573	16°30'N,82°23'E	-	4	-	-	-	-	-
574	16°08'N,81°51'E	-	3	-	32	-	10	-
575	15°36'N,81°01'E	-	120	-	-	-	-	-
578	15°05'N,80°24'E	-	190	-	23	-	11	-
579	15°00'N,81°01'E	-	6	-	5	-	-	7
580	15°00'N,82°00'E	-	12	-	50	-	-	-
581	15°01'N,82°57'E	-	20	-	111	-	2	-
585	12°41'N,82°42'E	-	33	-	15	-	-	-
586	12°39'N,81°54'E	-	108	-	100	-	40	110
587	12°49'N,80°51'E	30	120	-	25	-	5	28
588	12°55'N,80°37'E	-	-	25	-	-	8	45
591	12°00'N,81°11'E	-	35	-	40	-	5	-
594	11°01'N,80°12'E	-	20	-	166	-	10	166

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Kistna									
Cr.22.	595	11°02'N,81°01'E	-	192	-	200	-	38	-
	596	11°02'N,82°01'E	-	26	-	32	-	-	130
	597	11°02'N,82°59'E	-	8	-	20	4	8	-
	600	09°34'N,82°58'E	10	-	-	112	-	10	-
	603	07°58'N,82°55'E	-	-	20	-	-	-	113
	605	07°00'N,82°12'E	96	100	50	55	-	5	100
	609	06°09'N,79°50'E	-	20	18	16	-	-	20
	611	06°59'N,78°40'E	-	-	45	-	50	52	-
	612	07°28'N,77°53'E	-	-	-	50	-	20	-
Cr.25.	645	17°24'N,71°22'E	-	-	-	50	-	-	-
	647	17°02'N,70°04'E	-	10	-	12	-	-	-
	648	14°00'N,71°30'E	10	20	-	-	-	-	-
	660	12°38'N,74°21'E	5	6	-	10	-	5	30
	661	12°36'N,74°12'E	-	25	-	12	-	-	22
	662	12°29'N,73°53'E	-	18	-	28	-	25	-
	663	12°15'N,73°25'E	-	10	-	150	-	-	-
	664	10°00'N,74°30'E	8	-	-	5	-	7	5
Cr.26.	677	10°14'N,75°43'E	-	-	32	-	-	-	50
	680	07°12'N,78°34'E	117	93	-	22	-	88	-
	686	11°01'N,80°21'E	-	186	150	175	-	83	185
	687	11°00'N,80°13'E	-	25	-	62	-	25	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Kistna								
Cr. 26. 689	10°55'N,80°04'E	-	98	-	-	-	-	70
702	12°59'N,82°09'E	-	212	98	-	-	98	-
703	13°01'N,81°39'E	-	150	4	206	-	-	50
704	13°03'N,81°08'E	-	580	-	580	-	580	-
705	13°05'N,80°35'E	-	400	-	212	-	225	400
706	13°06'N,80°31'E	-	-	-	9	-	-	-
707	13°05'N,80°30'E	-	-	-	-	-	-	4
716	15°04'N,82°10'E	-	94	-	45	-	2	40
717	15°00'N,83°00'E	-	90	-	100	-	126	134
718	15°02'N,84°07'E	-	15	7	75	-	-	-
719	15°06'N,85°08'E	-	326	161	150	-	20	80
721	14°58'N,86°49'E	-	83	-	85	-	1	82
722	14°56'N,87°34'E	42	45	-	-	-	-	67
723	15°00'N,89°00'E	-	60	-	66	-	30	50
724	14°53'N,90°08'E	-	145	-	125	-	35	71
725	16°00'N,90°00'E	-	9	-	-	-	-	-
726	17°00'N,89°59'E	-	104	-	-	-	10	50
727	18°04'N,90°06'E	-	5	-	-	-	-	88
729	20°00'N,90°18'E	-	226	-	240	-	5	250

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Meteor									
Cr.1.	53	12°22'N,43°57'E	-	-	12	25	-	5	46
	62	12°36'N,43°16'E	-	-	-	-	-	-	110
	73	16°37'N,41°09'E	-	-	-	8	-	-	6
	90	13°53'N,48°09'E	-	--	8	110	5	80	-
	91	13°28'N,48°18'E	10	-	-	-	2	40	60
	92	13°09'N,48°24'E	5	120	10	45	10	10	100
	93	12°43'N,48°31'E	7	7	13	120	7	113	93
	94	12°14'N,48°42'E	-	10	50	128	-	152	76
	95	11°42'N,48°49'E	5	-	25	210	-	105	40
	96	11°19'N,49°00'E	-	-	-	-	-	253	-
	100	12°13'N,51°35'E	-	-	-	-	-	3	-
	101	12°13'N,51°48'E	8	10	15	35	-	5	60
	102	11°33'N,52°54'E	-	20	-	40	-	-	13
	103	11°27'N,53°04'E	-	15	-	45	-	-	-
	104	11°21'N,53°11'E	-	20	-	-	-	47	20
	105	11°06'N,53°28'E	-	-	12	-	-	-	36
	106	10°50'N,53°46'E	12	8	-	28	-	24	112
	107	10°37'N,54°03'E	-	5	-	25	10	5	-
	108	10°17'N,54°25'E	13	-	-	3	5	17	32
	113	07°57'N,51°34'E	-	4	-	-	3	13	-
	114	08°00'N,51°12'E	-	-	-	-	-	10	28

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Meteor								
Cr. 1. 115	08°11'N,50°57'E	10	-	-	48	20	22	16
116	08°26'N,50°32'E	6	-	15	-	50	5	-
125	05°39'N,49°22'E	-	-	-	-	-	-	80
126	05°44'N,49°30'E	8	6	3	4	-	6	38
127	05°29'N,50°02'E	17	3	5	5	24	8	7
129	05°05'N,50°31'E	-	-	8	2	12	-	-
180	05°12'N,66°03'E	7	-	13	3	2	-	-
181	07°24'N,70°50'E	20	4	48	-	-	-	-
182	08°45'N,73°37'E	8	-	15	37	3	5	-
184	09°01'N,74°17'E	6	10	-	4	4	-	-
185	09°09'N,74°35'E	-	-	-	7	-	-	-
186	09°23'N,75°02'E	2	-	-	-	6	34	-
187	09°34'N,75°16'E	12	12	-	4	4	12	8
188	09°37'N,75°31'E	-	9	-	15	-	-	3
189	09°40'N,75°39'E	-	4	-	13	-	-	-
195	14°25'N,73°13'E	4	16	-	4	-	-	-
197	14°18'N,72°44'E	8	47	-	-	-	8	-
198	14°14'N,72°19'E	16	20	-	16	-	4	-
199	14°03'N,72°00'E	6	28	-	8	-	-	-
200	13°53'N,71°36'E	16	4	-	16	-	-	-
201	13°40'N,71°09'E	-	15	-	-	-	-	-
202	13°36'N,70°50'E	13	4	-	-	-	-	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Meteor									
Cr.1.	205	16°19'N,68°52'E	-	6	-	2	-	-	-
	206	16°35'N,69°15'E	-	-	-	4	-	--	-
	208	17°11'N,70°10'E	-	-	-	4	-	-	-
	209	17°23'N,70°34'E	-	-	-	8	-	-	-
	217	18°45'N,70°18'E	2	-	-	-	-	-	-
	218	18°37'N,70°08'E	-	4	-	20	-	-	-
	220	18°20'N,69°40'E	12	-	-	44	-	-	-
	222	19°35'N,68°35'E	-	4	-	53	-	-	-
	223	19°58'N,66°51'E	-	-	-	85	-	-	-
	224	20°19'N,67°[illegible]'E	5	-	-	40	-	-	-
	225	20°44'N,67°32'E	-	-	-	16	-	-	-
	226	21°41'N,67°47'E	-	-	-	20	-	-	-
Umitaka Maru									
Cr.23	(1-1)	07°39'N,78°09'E	5	-	150	30	40	148	65
	(1-2)	06°04'N,77°46'E	54	32	64	40	20	102	54
Varuna									
Cr.30.	1779	20°56'N,68°53'E	-	-	-	23	-	-	-
Cr.31.	1806	18°30'N,70°00'E	-	-	-	15	-	-	-
	1807	17°00'N,71°30'E	-	-	-	10	-	-	20
Cr.104.	2006	09°00'N,75°58'E	-	80	-	75	-	30	-

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.			1	2	3	4	5	6	7
Varuna									
Cr.104.	2007	09°00'N,75°20'E	-	10	-	12	-	8	-
	2008	09°04'N,74°40'E	-	10	-	-	-	-	-
	2009	09°04'N,74°00'E	-	68	-	62	-	-	-
	2010	09°03'N,73°20'E	-	50	-	48	-	-	-
	2011	09°00'N,74°20'E	-	75	-	-	-	38	-
	2012	09°00'N,72°00'E	-	30	16	30	-	-	-
	2013	09°05'N,71°20'E	-	80	-	69	-	-	-
	2014	09°10'N,70°40'E	-	52	-	50	-	-	-
Cr.106.	2038	14°58'N,72°32'E	-	12	-	-	-	-	-
	2039	15°00'N,73°05'E	-	25	-	30	-	-	-
	2040	15°00'N,73°16'E	-	120	-	100	-	60	-
	2041	15°00'N,73°28'E	-	15	-	-	-	14	-
Vitiaz									
Cr.35	5247	05°35'N,79°56'E	26	20	240	7	14	75	40
	5248	05°28'N,78°33'E	60	-	30	10	-	-	-
	5249	05°05'N,77°07'E	-	50	75	40	5	85	35

TABLE - I b (Contd.)

Name of Ship, Cruise No. & Station No.		1	2	3	4	5	6	7
Zulun								
2	24°45'N,66°20'E	-	-	-	-	-	-	13
3	24°42'N,66°04'E	2	-	-	22	-	-	20
4	24°38'N,65°49\E	-	-	-	13	-	-	7
5	23°58'N,66°09'E	-	-	-	4	-	-	8
13	23°27'N,67°19'E	-	-	-	-	-	-	2
15	23°12'N,67°02'E	-	-	-	8	-	-	12
18	22°53'N,66°49'E	-	-	-	-	-	-	6
20	22°11'N,67°41'E	-	-	-	11	-	-	-

TABLE - I c

Data concerning the stations and number of specimens obtained (Contd.)

Name of Ship & Station No.		Name of species and number of specimens						
		S.parthenoda	P.prosadena	C. magna	P.concentrica	A. alata	C.daphnoides	P.oblonga
		1	2	3	4	5	6	7
Anton Bruun								
1	12°00'N,45°51'E	5	2	225	5	-	-	-
3	13°03'N,50°00'E	-	-	30	-	-	-	-
4	13°34'N,52°01'E	-	-	90	10	5	-	-
5	14°03'N,54°00'E	-	-	112	-	92	-	-
6	14°35'N,56°00'E	-	-	10	10	25	-	-
7	15°05'N,58°00'E	-	-	25	-	-	-	-
9	15°05'N,62°00'E	-	-	-	30	35	-	-
10	16°36'N,64°00'E	-	-	-	8	-	-	-
11	17°08'N,66°00'E	-	-	-	25	-	-	-
13	18°09'N,70°00'E	-	-	-	27	-	-	-
14	07°27'N,94°21'E	50	-	45	-	-	50	-
15	07°27'N,95°18'E	-	-	-	-	-	20	-
16	07°31'N,96°11'E	10	-	56	-	-	20	-
17	07°40'N,97°09'E	20	-	-	-	-	40	-
18	07°41'N,97°59'E	5	-	-	-	-	-	-
23	10°39'N,96°35'E	-	1	-	-	-	5	-
24	10°36'N,95°39'E	10	-	25	-	-	-	-
25	10°41'N,94°40'E	27	-	-	-	-	25	-

TABLE - I e (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Anton Bruun								
26	10°39'N,93°49'E	-	-	30	-	-	20	-
27	10°37'N,92°59'E	30	-	-	-	-	8	-
30	12°17'N,93°21'E	-	-	10	-	-	-	-
31	12°53'N,93°23'E	-	-	-	-	-	4	-
32	12°52'N,94°13'E	34	-	-	-	-	26	-
33	12°57'N,95°01'E	-	-	25	-	-	10	-
34	12°50'N,95°56'E	15	-	50	-	-	50	-
53	18°33'N,91°16'E	-	1	-	-	-	-	-
64	17°48'N,84°02'E	-	2	-	-	-	-	-
71	14°53'N,88°40'E	-	1	-	-	-	-	-
74	13°36'N,90°48'E	-	4	-	-	-	-	-
106	17°27'N,70°27'E	-	-	-	4	-	-	-
107	15°40'N,70°07'E	-	-	-	12	-	-	-
112	05°48'N,70°03'E	1	-	10	-	-	-	-
113	03°33'N,69°54'E	-	-	-	4	-	-	-
114	01°30'N,70°01'E	16	-	-	-	-	-	-
143	01°54'N,79°52'E	25	1	-	-	-	-	-
144	04°18'N,80°08'E	-	-	-	-	-	15	-
151	05°04'N,60°03'E	10	-	-	-	-	-	-
168	05°52'N,52°56'E	16	-	-	8	-	-	-
170	12°04'N,51°31'E	10	-	40	-	-	-	-

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Anton Bruun								
172	14°44'N,51°02'E	24	-	-	-	-	-	-
173	15°27'N,52°50'E	40	-	340	-	250	-	-
174	16°27'N,54°39'E	-	-	65	-	-	-	-
175	17°26'N,56°29'E	-	-	178	-	45	-	-
176	16°29'N,57°09'E	-	-	40	-	-	-	-
177	15°18'N,57°43'E	8	-	12	-	30	-	-
178	14°21'N,58°18'E	4	-	16	-	-	-	-
179	13°12'N,58°58'E	-	-	72	-	116	-	-
180	12°15'N,59°42'E	4	-	16	6	-	-	-
182	15°58'N,62°33'E	-	-	-	5	-	-	-
183	23°43'N,66°21'E	-	-	-	14	-	-	-
185	20°39'N,64°41'E	-	-	-	26	-	-	-
186	21°31'N,64°06'E	-	-	-	55	-	-	-
187	22°23'N,63°32'E	-	-	-	10	-	-	-
188	23°19'N,62°50'E	-	-	-	7	-	-	-
190	24°48'N,61°37'E	-	-	-	24	-	-	-
191	23°57'N,60°58'E	-	-	40	-	45	-	-
192	23°08'N,60°32'E	-	-	-	10	-	-	-
193	22°48'N,59°34'E	-	-	-	20	-	-	-
196	22°44'N,61°15'E	-	-	-	20	35	-	-
197	20°02'N,62°00'E	-	-	15	12	13	-	-

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Anton Bruun								
198	19°17'N,62°29'E	-	-	-	50	80	-	-
199	18°31'N,63°08'E	-	-	-	4	-	-	-
200	18°32'N,64°39'E	-	-	-	5	-	-	-
283	15°42'N,60°52'E	-	-	-	20	-	-	-
284	15°22'N,58°12'E	-	-	-	4	-	-	-
285	14°22'N,54°18'E	-	-	-	72	-	-	-
286	13°50'N,52°59'E	10	-	35	45	-	-	-
287	13°11'N,50°22'E	-	-	-	35	-	-	-
288	09°28'N,54°52'E	-	-	48	-	-	-	-
289	07°10'N,55°05'E	4	-	30	-	44	3	8
329	15°36'N,64°59'E	-	-	-	24	-	-	-
330	13°36'N,65°03'E	-	-	-	7	-	-	-
331	11°28'N,65°04'E	2	-	-	28	-	-	-
Argo Dodo								
29	03°52'N,48°18'E	8	-	-	-	-	-	-
32	05°11'N,49°44'E	-	-	-	-	-	10	21
37	06°26'N,49°46'E	20	-	220	-	-	-	120
40	07°05'N,49°39'E	20	-	80	-	-	-	70
47	08°53'N,53°09'E	-	-	-	-	-	80	120
51	11°08'N,53°02'E	20	-	-	-	-	-	2
58	08°27'N,53°23'E	-	-	-	-	-	-	-
67	05°02'N,55°06'E	-	-	-	-	-	-	110

TABLE - I c (Contd.)

Name of Ship & Station No.	1	2	3	4	5	6	7
Argo Lusiad							
9 00°00' ,80°56'E	-	-	-	-	-	2	-
10 00°01'N,78°59'E	-	-	-	-	-	2	-
17 00°01'S,65°04'E	-	-	-	-	-	2	-
18 00°03'N,62°41'E	-	-	-	-	-	20	-
19 00°03'S,61°06'E	-	-	-	-	-	8	-
31 02°59'N,53°02'E	10	-	-	-	-	-	-
32 02°30'N,53°00'E	-	-	-	-	-	-	10
36 00°29'N,52°58'E	30	-	-	-	-	-	25
40 01°29'S,53°01'E	10	-	-	-	-	-	-
44 03°56'S,52°59'E	50	-	-	-	-	-	-
47 03°00'S,62°20'E	12	-	-	-	-	-	-
48 02°29'S,62°20'E	2	-	-	-	-	-	2
50 01°28'S,62°20'E	-	-	-	-	-	28	-
53 00°05'N,62°20'E	25	-	-	-	-	30	-
54 00°29'N,62°19'E	25	-	-	-	-	25	-
58 02°31'N,62°20'E	-	-	-	-	-	30	-
64 02°55'N,78°58'E	-	-	-	-	-	5	-
71 00°30'N,79°02'E	48	-	-	-	-	-	-
74 01°55'S,78°54'E	60	-	-	-	-	-	-
75 02°30'S,78°59'E	-	-	-	-	-	-	46
76 03°00'S,78°59'E	-	-	-	-	-	-	20
79 00°01'N,88°56'E	-	-	-	-	-	2	-
81 01°08'S,89°05'E	-	-	-	-	-	-	6

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Conch								
45	09°52'N,75°39'E	15	-	30	-	-	-	-
49	10°00'N,75°39'E	-	-	27	-	-	-	-
52	10°19'N,75°46'E	-	-	20	-	-	-	-
55	10°19'N,75°37'E	12	-	-	-	4	-	-
58	10°29'N,75°31'E	4	-	28	-	-	-	-
62	10°39'N,75°22'E	100	-	20	-	4	-	-
Discovery								
5002	20°19'N,38°21'E	-	-	-	10	-	-	-
5009	15°10'N,52°32'E	-	-	-	4	-	-	-
5017	12°56'N,53°44'E	-	-	-	-	7	-	-
5018	12°50'N,53°52'E	4	-	-	4	24	-	-
5019'	12°43'N,53°54'E	-	-	-	-	-	-	-
5026	16°31'N,54°08'E	-	-	20	-	-	-	-
5030	15°54'N,54°31'E	-	-	-	24	44	-	-
5031	15°26'N,54°46'E	3	-	25	5	21	-	-
5037	17°28'N,57°03'E	-	-	-	35	33	-	-
5038	17°18'N,57°09'E	5	-	-	10	120	-	-
5039	17°09'N,57°15'E	5	-	150	15	100	-	-
5041	16°45'N,57°30'E	-	-	-	40	-	-	-
5048	19°03'N,58°04'E	-	-	-	20	60	-	-
5050	18°51'N,58°19'E	-	-	170	40	80	-	-
5051	18°46'N,58°23'E	26	-	-	25	93	-	-
5052	18°39'N,58°31'E	-	-	-	60	130	-	-

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Discovery								
5053	18°20'N,58°59'E	-	--	-	70	-	-	-
5054	17°51'N,59°20'E	-	-	-	23	-	-	-
5055	17°33'N,59°45'E	-	-	-	22	-	-	-
5056	17°12'N,60°15'E	-	-	-	75	-	-	-
5057	16°45'E,60°31'E	-	-	-	20	-	-	-
5062	20°52'N,59°25'E	-	-	-	20	40	-	-
5063	20°43'N,59°36'E	-	-	-	15	240	-	-
5064	20°38'N,59°45'E	-	-	320	50	-	-	-
5065	20°32'N,59°55'E	-	-	-	40	40	-	-
5066	20°26'N,60°03'E	-	-	-	45	20	-	-
5067	20°13'N,60°20'E	-	-	-	40	20	-	-
5068	19°58'N,60°48'E	-	-	-	70	-	-	-
5069	19°34'N,61°14'E	-	-	-	160	-	-	-
5089	13°14'N,50°14'E	44	-	-	-	-	-	30
5094	15°45'N,53°11'E	20	-	140	-	-	-	-
5251	13°12'N,50°19'E	10	-	80	-	35	-	-
5265	09°39'N,57°57'E	4	-	-	-	-	-	-
5267	06°44'N,57°59'E	4	-	20	-	3	-	4
5269	03°59'N,57°59'E	17	-	-	-	-	2	56
5369	05°43'N,67°32'E	6	-	-	-	38	-	-
5380	14°13'N,59°27'E	-	-	-	-	40	-	-
5386	12°02'N,62°59'E	-	-	-	5	-	-	-

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Discovery								
5400	14°01'N,56°30'E	6	1	-	16	-	-	-
5402	11°09'N,56°30'E	-	-	-	12	-	-	-
5404	08°20'N,57°59'E	8	-	-	10	-	-	-
5406	06°00'N,57°57'E	10	1	-	-	-	-	10
5555	10°45'N,51°28'E	-	-	50	-	-	-	90
5559	11°25'N,52°42'E	46	-	-	-	38	7	31
5561	11°38'N,52°57'E	-	-	60	-	-	-	14
5565	11°37'N,51°34'E	-	-	-	-	-	-	10
5566	13°12'N,50°19'E	-	-	48	3	-	-	-
Kistna								
114	01°32'S,61°45'E	-	-	16	-	-	-	-
143	05°00'N,83°00'E	-	-	35	-	-	-	-
144	06°00'N,83°03'E	-	-	15	-	-	-	-
354	10°08'N,94°35'E	-	-	84	-	-	-	-
359	09°10'N,85°13'E	-	-	-	-	-	2	-
360	09°14'N,86°06'E	-	-	60	-	-	-	-
362	10°00'N,90°00'E	-	-	120	-	-	4	-
364	10°05'N,86°10'E	-	1	-	-	-	10	-
365	10°02'N,85°00'E	-	-	-	-	-	10	-
396	14°15'N,81°59'E	-	-	15	-	-	-	-
511	11°00'N,93°35'E	-	-	-	-	-	25	-

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Kistna								
512	11°00'N,95°00'E	-	-	-	-	-	4	-
513	09°57'N,95°03'E	-	-	60	-	-	2	-
514	09°00'N,95°00'E	-	-	34	-	-	30	-
530	05°57'N,96°56'E	-	-	-	-	-	5	-
531	06°00'N,96°00'E	-	-	66	-	-	70	-
532	06°00'N,95°00'E	-	-	30	-	-	30	-
533	06°00'N,94°00'E	-	-	60	-	-	-	-
538	08°47'N,92°56'E	-	-	50	-	-	-	-
562	17°28'N,86°00'E	-	3	-	-	-	-	-
570	16°00'N,84°02'E	-	-	10	-	-	-	-
586	12°39'N,81°54'E	-	2	-	-	-	-	-
595	11°02'N,81°01'E	-	1	-	-	-	-	-
596	11°02'N,82°01'E	-	1	-	-	-	-	-
597	11°02'N,82°59'E	-	-	4	-	-	-	-
600	09°34'N,82°58'E	-	-	60	-	-	-	-
605	07°00'N,82°12'E	-	4	-	-	-	-	-
611	06°59'N,78°40'E	-	-	-	-	12	-	-
664	10°00'N,74°30'E	-	1	-	--	-	-	-
680	07°12'N,78°34'E	-	-	-	-	52	-	-
717	15°00'N,83°00'E	-	-	-	-	120	-	-
Meteor								
53	12°22'N,43°57'E	-	-	-	-	4	-	-
91	13°28'N,48°18'E	-	-	-	-	10	-	-

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Meteor								
92	13°09'N,48°24'E	-	-	-	-	25	-	-
93	12°43'N,48°31'E	-	-	140	-	80	-	-
94	12°14'N,48°42'E	-	-	40	-	112	-	-
95	11°42'N,48°49'E	-	-	-	-	10	-	-
96	11°19'N,49°00'E	-	-	190	-	16	-	-
100	12°13'N,51°35'E	-	-	5	-	-	-	-
102	11°33'N,52°54'E	13	-	-	-	7	-	-
104	11°21'N,53°11'E	-	-	33	-	-	-	-
105	11°06'N,53°28'E	-	-	-	-	25	-	-
106	10°50'N,53°46'E	-	-	-	-	4	-	-
108	10°17'N,54°25'E	-	-	37	-	-	-	-
114	08°00'N,51°12'E	-	-	6	-	-	-	-
115	08°11'N,50°57'E	-	-	35	-	-	-	-
116	08°26'N,50°32'E	-	-	65	-	-	-	4
126	05°44'N,49°30'E	-	-	8	-	-	-	-
127	05°29'N,50°02'E	3	-	20	-	82	-	-
180	05°12'N,66°03'E	-	-	-	-	-	-	5
182	08°45'N,73°37'E	-	-	-	-	8	-	-
184	09°01'N,74°17'E	-	2	-	-	-	-	-
Umitaka Maru								
(1-1)	07°39'N,78°09'E	25	-	-	-	-	-	-
(1-2)	06°04'N,77°46'E	12	-	-	-	-	-	4

TABLE - I c (Contd.)

Name of Ship & Station No.		1	2	3	4	5	6	7
Varuna								
2007	09°00'N,72°20'E	-	-	-	-	2	-	-
2008	09°04'N,74°40'E	-	-	-	-	3	-	-
2014	09°10'N,70°40'E	-	-	-	-	5	-	-
Vitiaz								
5247	05°35'N,79°56'E	-	-	12	-	-	-	-
5248	05°28'N,78°33'E	20	-	-	-	-	10	10
5249	05°05'N,77°07'E	10	-	-	-	-	-	30
Zulun								
2	24°45'N, 66°20'E	-	-	-	7	-	-	-
3	24°42'N,66°04'E	-	-	-	220	-	-	-
4	24°38'N,65°49'E	-	-	-	385	-	-	-
5	23°58'N,66°09'E	-	--	-	92	-	-	-
6	24°05'N,66°27'E	-	-	-	4	-	-	-
7	24°13'N,66°47'E	-	-	-	3	-	-	-
10	23°44'N,67°24'E	-	--	-	4	-	-	-
12	23°26'N,67°28'E	-	-	-	2	-	-	-
13	23°27'N,67°19'E	-	-	-	15	-	-	-
14	23°28'N,67°09'E	-	-	-	70	-	-	-
15	23°12'N,67°02'E	-	-	-	56	-	-	-
16	23°10'N,67°10'E	-	-	-	60	-	-	-
18	22°53'N,66°49'E	-	-	-	12	-	-	-
19	22°41'N,67°03'E	-	-	-	8	-	-	-
20	22°11'N,67°41'E	-	-	-	2	-	-	-
21	22°28'N,67°59'E	-	-	-	8	-	-	-
22	23°29'N,67°25'E	-	-	-	2	-	-	-

TABLE - II

Comparison of 10 common species during SW and NE Monsoon periods in the Arabian Sea.

Species	SW monsoon average	NE monsoon average	Combined S.D.	t	d.f.
S. porrecta	1.7445	1.5914	0.6037	1.5948	157
O. atlantica	1.4416	1.2704	0.5039	1.8896	122
M. rotundata	1.4390	1.2458	0.5644	0.4332	185
M. curta	1.4356	1.3539	0.5340	0.6626	78
C. giesbrechti	1.5107	1.3448	0.5570	1.9025	163
P. decipens	1.2987	1.0625	0.4825	2.7986[b]	129
P. procera	1.8733	1.5851	0.5229	3.9221[c]	199
H. brevirostris	1.2159	0.9643	0.4781	1.8776	98
E. aculeata	1.9985	2.0163	0.7346	0.1594	181
C. dentata	2.3391	2.8805	1.0004	3.8261[c]	200

a - significant at 5% level
b - " 1% "
c - " 0.1 "

TABLE - III

Comparison of 10 common species during SW and NE Monsoon periods in the Bay of Bengal.

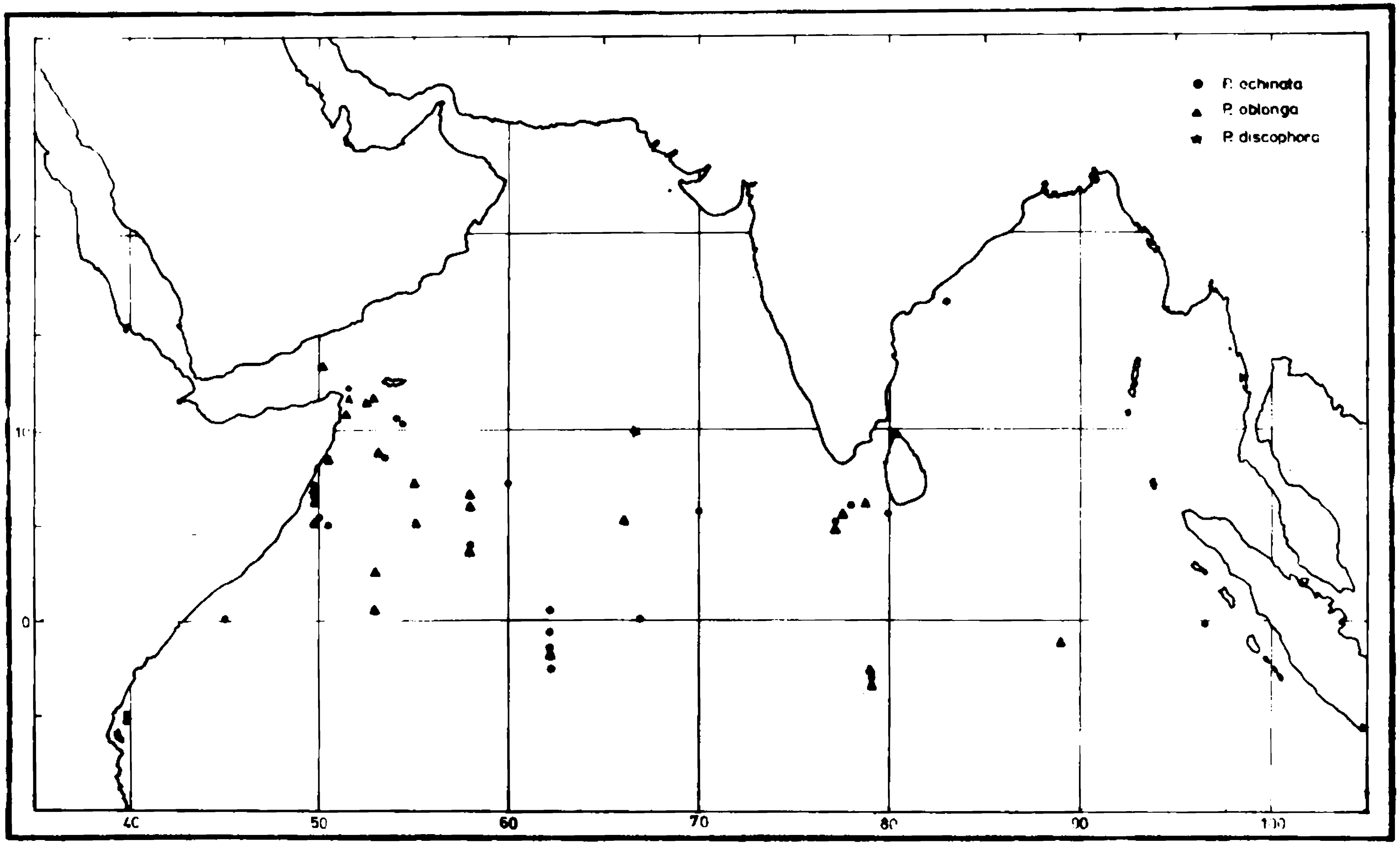
Species	SW monsoon average	NE monsoon average	Combined S.D.	t	d.f.
S. porrecta	1.6025	1.4842	0.4595	1.4533	132
O. atlantica	1.2199	1.1177	0.5468	1.1419	87
M. rotundata	1.7376	1.5927	0.4354	1.9581	139
M. curta	1.6464	1.5037	0.4707	0.7798	32
C. giesbrechti	1.7328	1.4843	0.5095	3.0268	154
P. decipens	1.1630	1.1640	0.4423	0.0065	32
P. procera	1.6446	1.6807	0.4549	0.4313	116
H. brevirostris	1.1654	0.9335	0.5244	1.8522	78
E. aculeata	2.1160	2.3563	0.6551	2.3722[a]	173
C. dentata	-	-	-	-	-

TABLE - IV

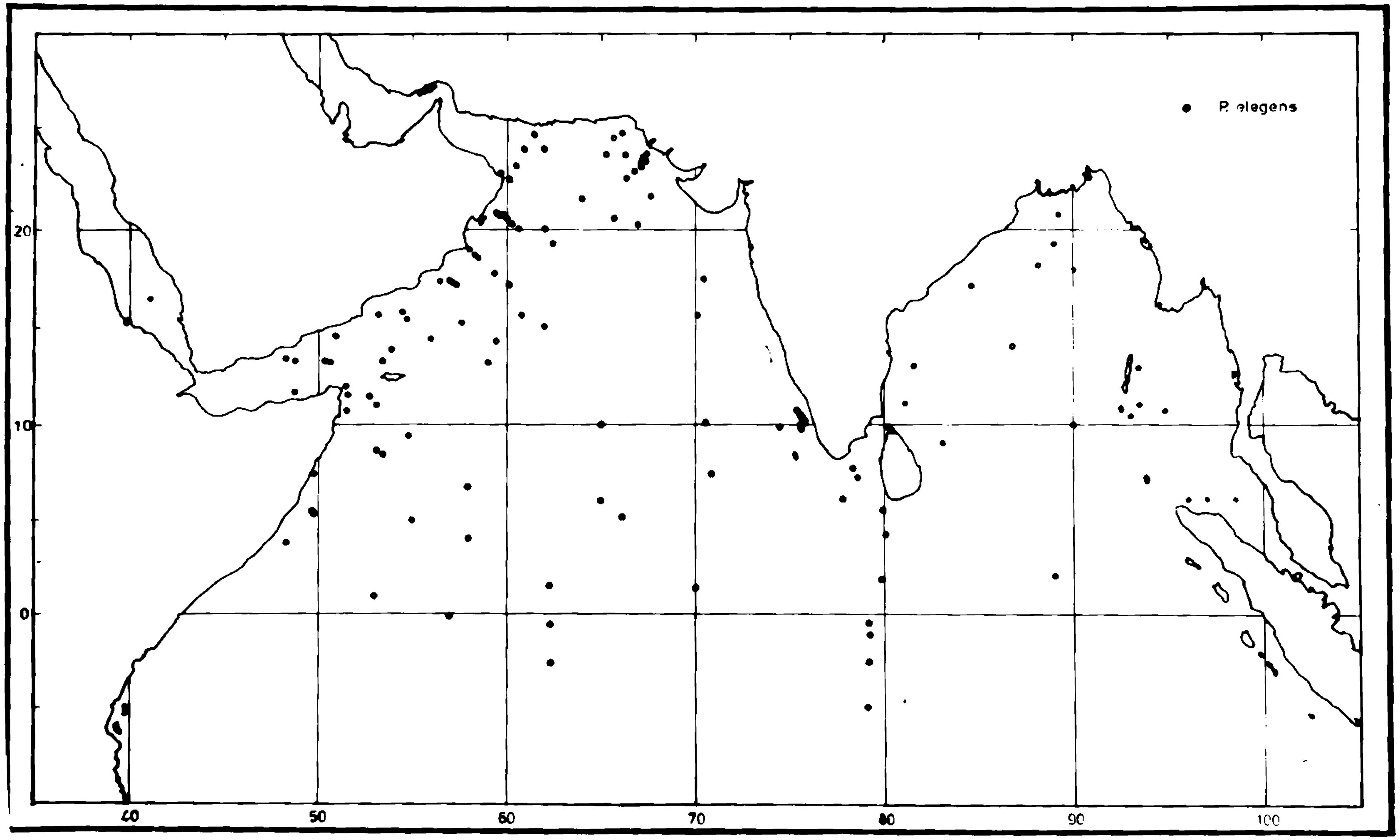
Comparision of 10 common species during day and night

Species	Day average	Night average	Combined SD SP	t	d.f.
S. porrecta	1.5321	1.7255	0.5395	3.0505[b]	291
O. atlantica	1.2630	1.2830	0.5332	0.2736	211
M. rotundata	1.4867	1.5647	0.4861	1.0584	315
M. curta	1.3878	1.5243	0.4332	1.6646	112
C. giesbrechti	0.5141	1.2880	0.5881	9.7591[c]	258
P. decipiens	1.0821	1.2880	0.4724	2.7976[b]	163
P. procera	1.5725	1.7242	0.5767	2.3815[a]	327
E. aculeata	2.0922	2.1297	0.7089	0.4954	353
C. dentata	2.7055	2.5430	1.0393	1.0972	197
H. brevirostris	1.1339	1.1448	0.4915	0.1485	178

MAP - I. Distribution of _Paraconchoecia_ _echinata_,
_P_. _oblonga_ and _P_. _discophora_.

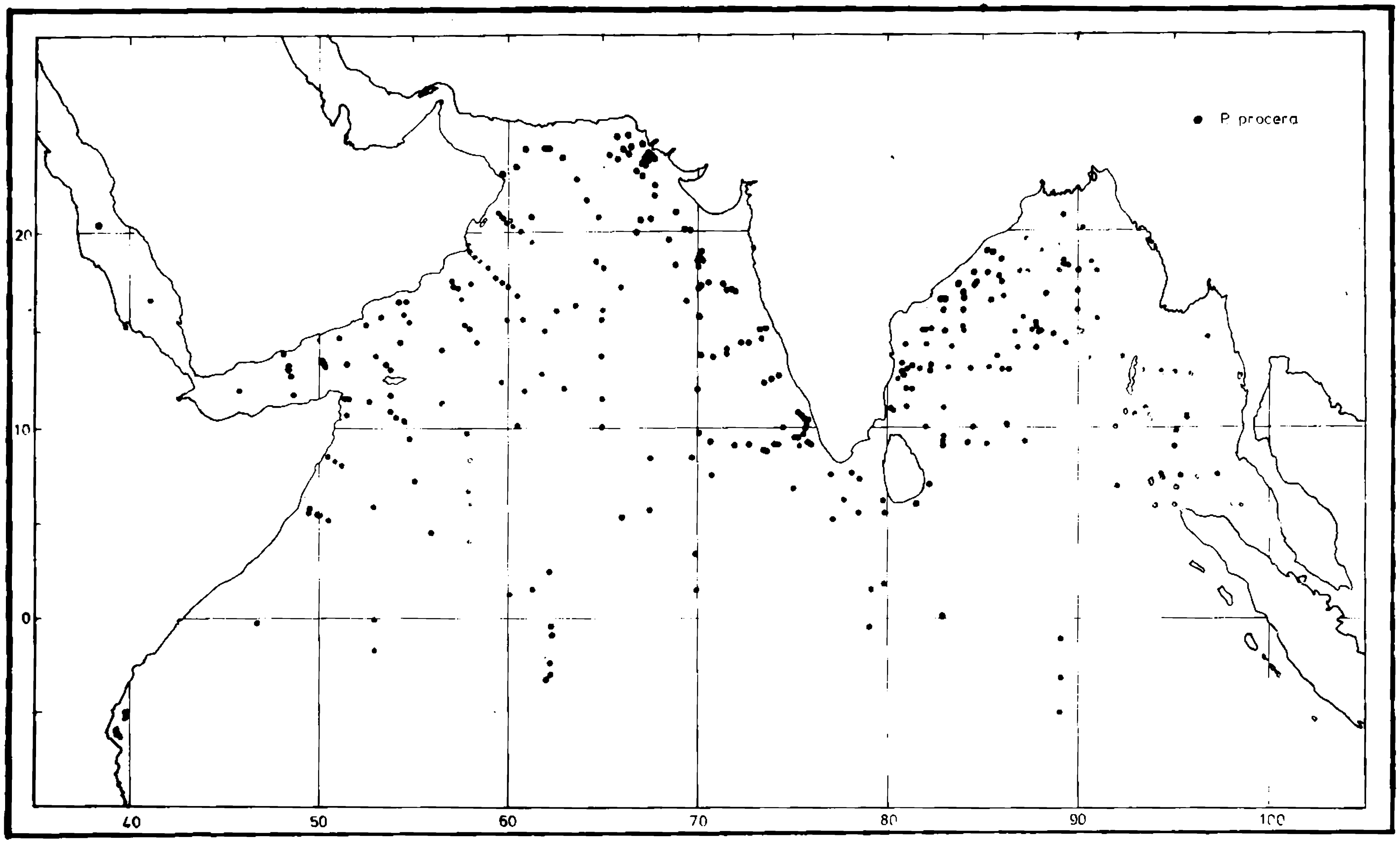

P. echinata
P. oblonga
P. discophora
40
50
60
70
80
90
100
0

MAP - II. Distribution of *Paraconchoecia* *elegens*.



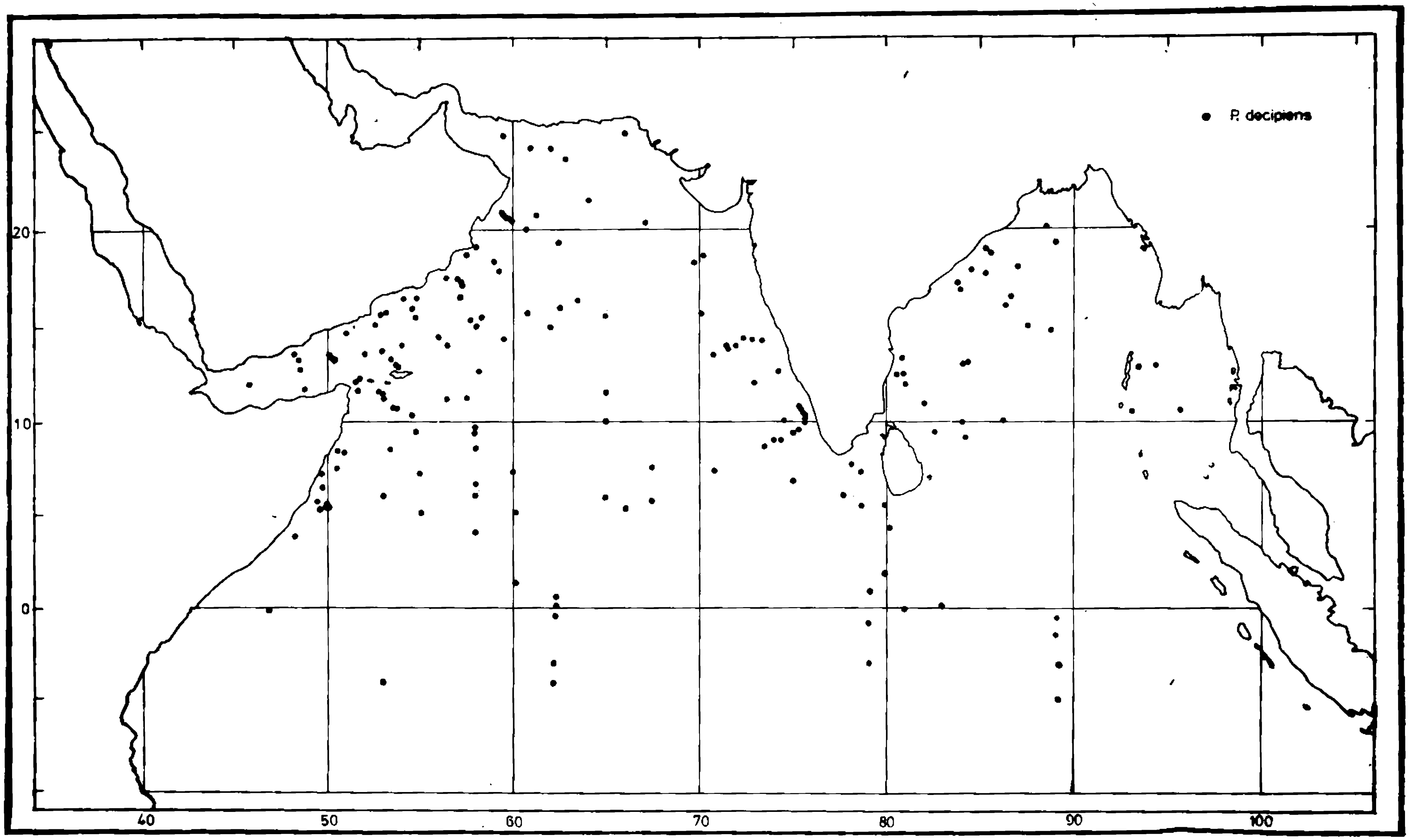
P. elegans
20
10
0
40
50
60
70
80
90
100

MAP - III. Distribution of *Paraconchoecia procera*.



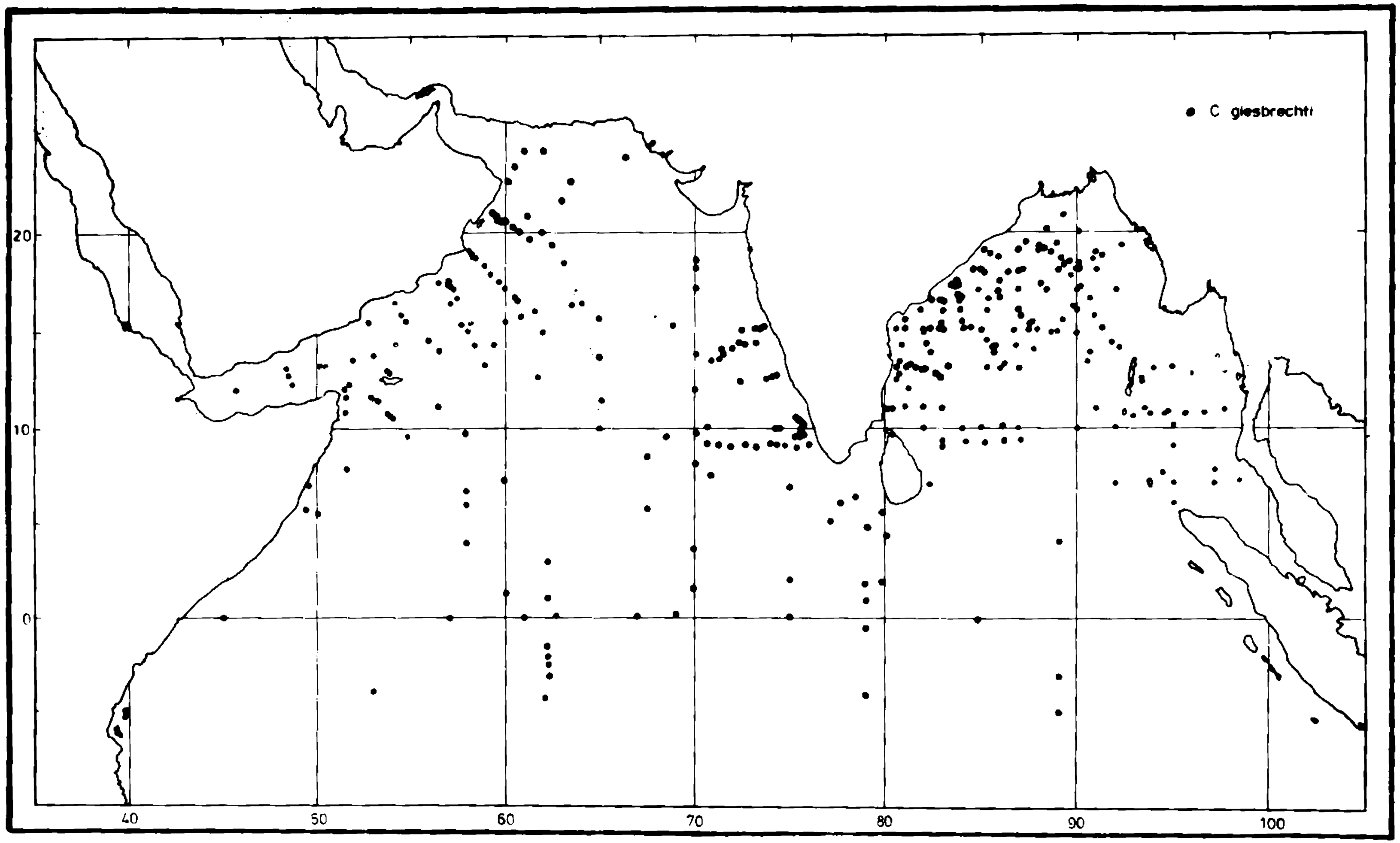
P procera
20
10
0
40
50
60
70
80
90
100

MAP - IV. Distribution of *Paraconchoecia decipiens*.



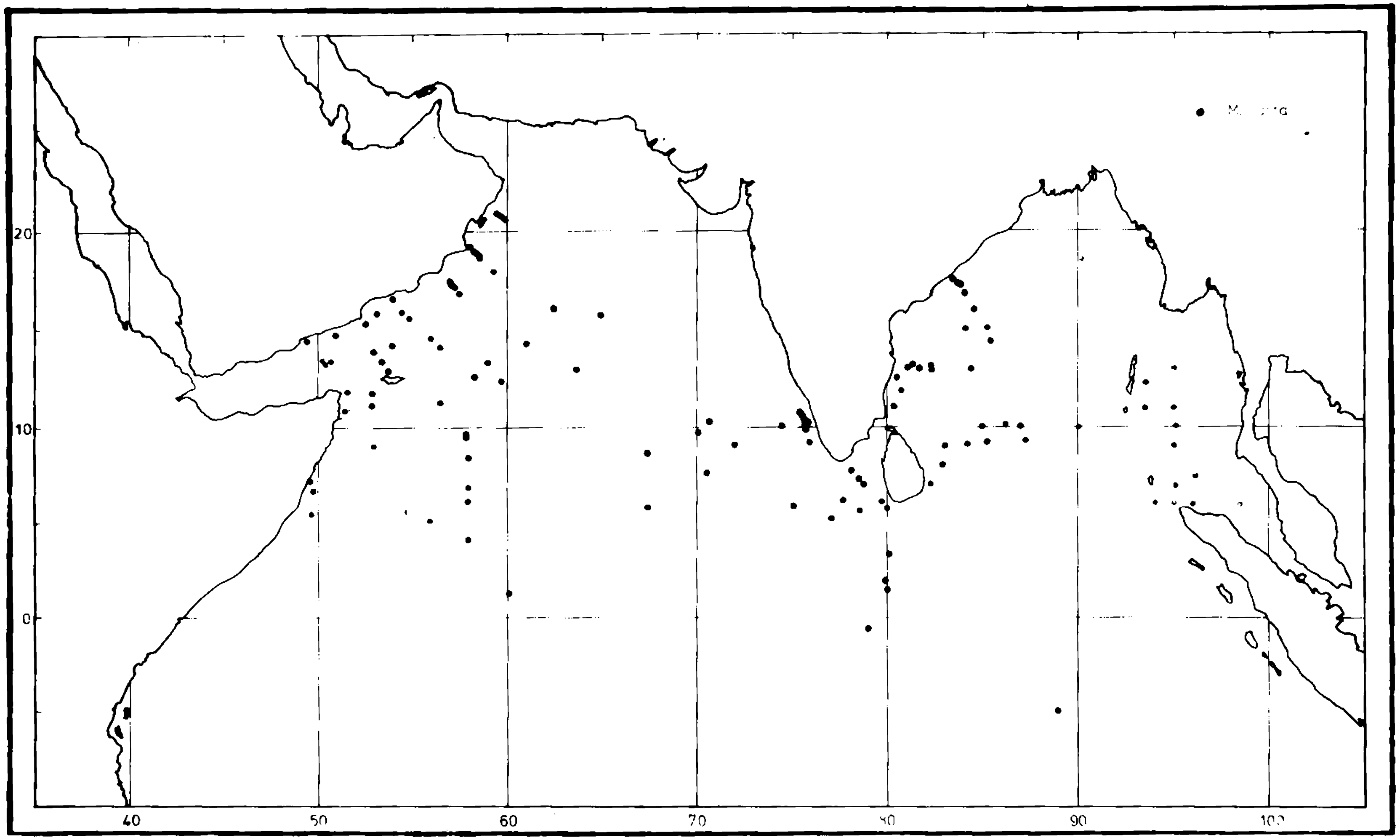
● P. decipiens
20
10
0
40
50
60
70
80
90
100

MAP - V. Distribution of <u>Conchoecetta</u> <u>giesbrechti</u>.



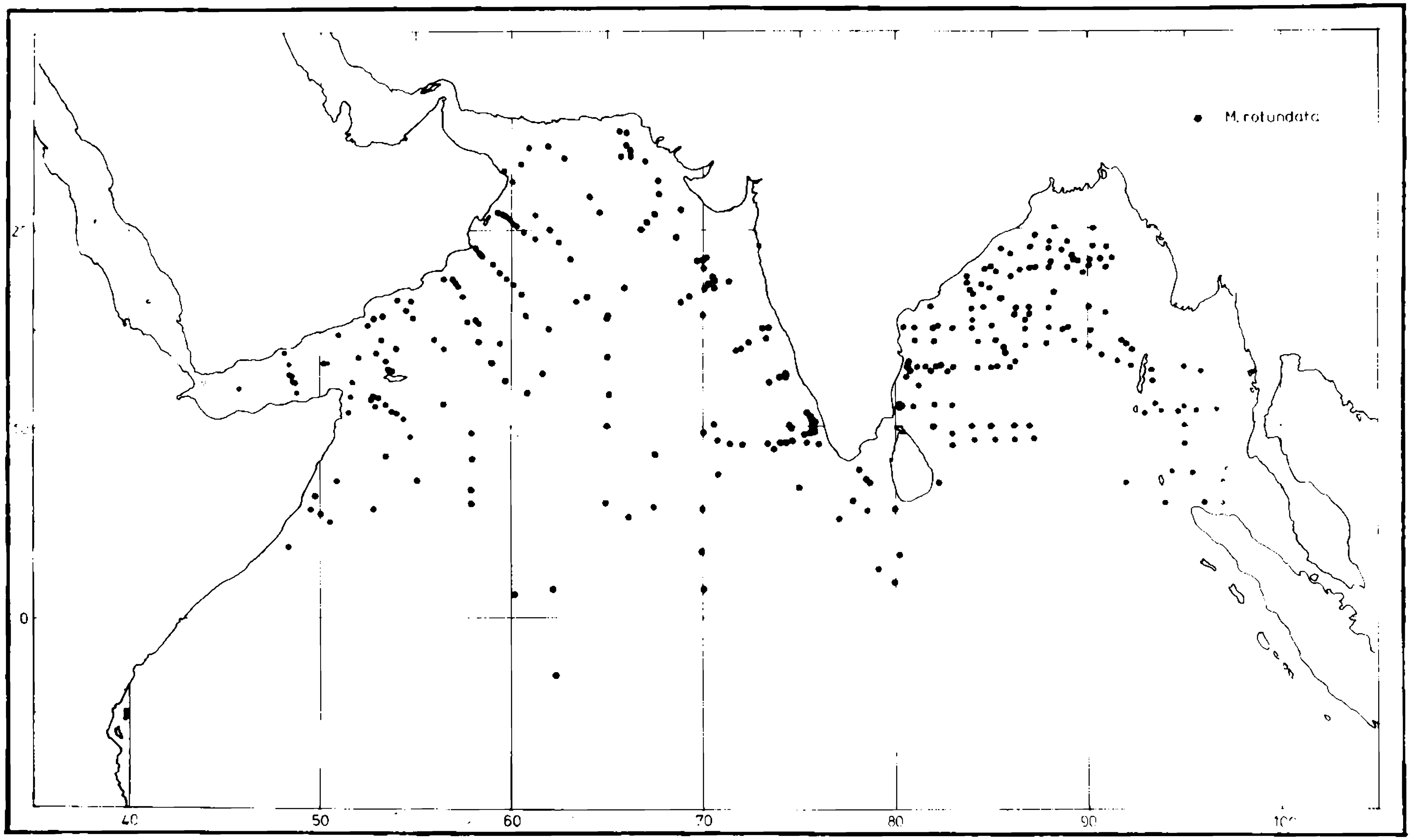
● C giesbrechti
20
10
0
40
50
60
70
80
90
100

MAP - VI. Distribution of Microconchoecia curta.



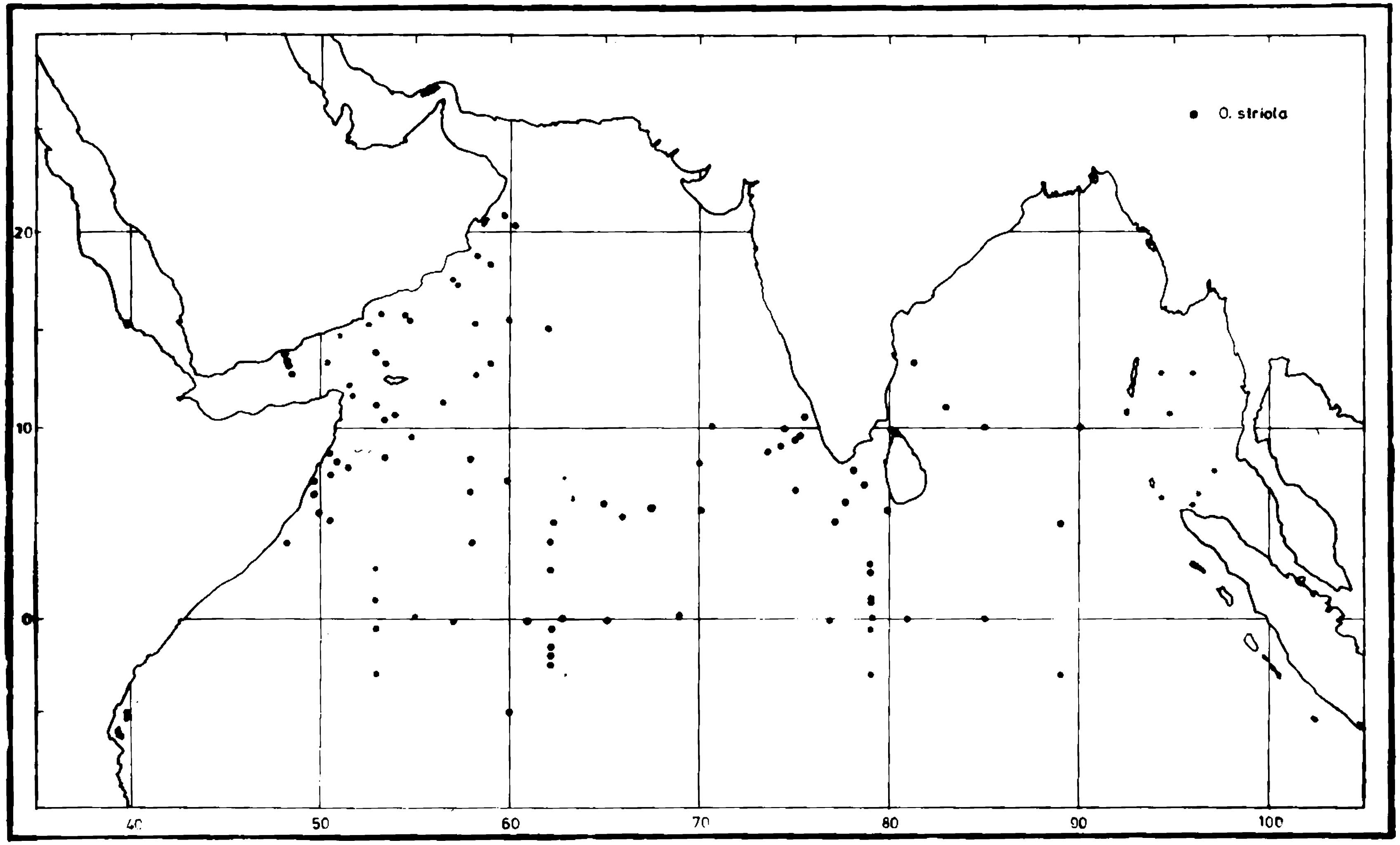
20
10
0
40
50
60
70
80
90

MAP - VII. Distribution of <u>Metaconchoecia</u> <u>rotundata</u>.

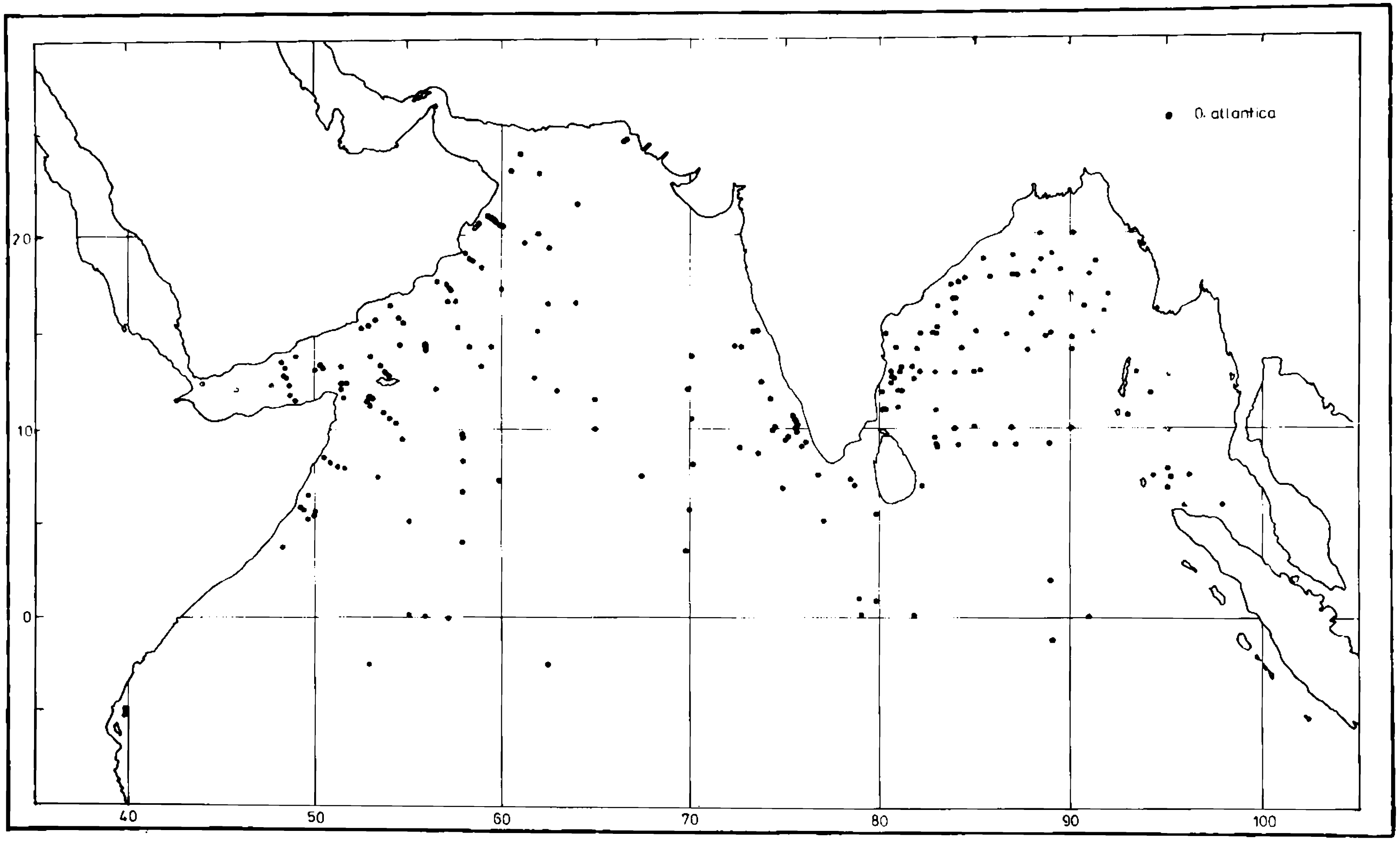


M. rotundata
40
50
60
70
80
90
0

MAP - VIII. Distribution of *Orthoconchoecia striola*.

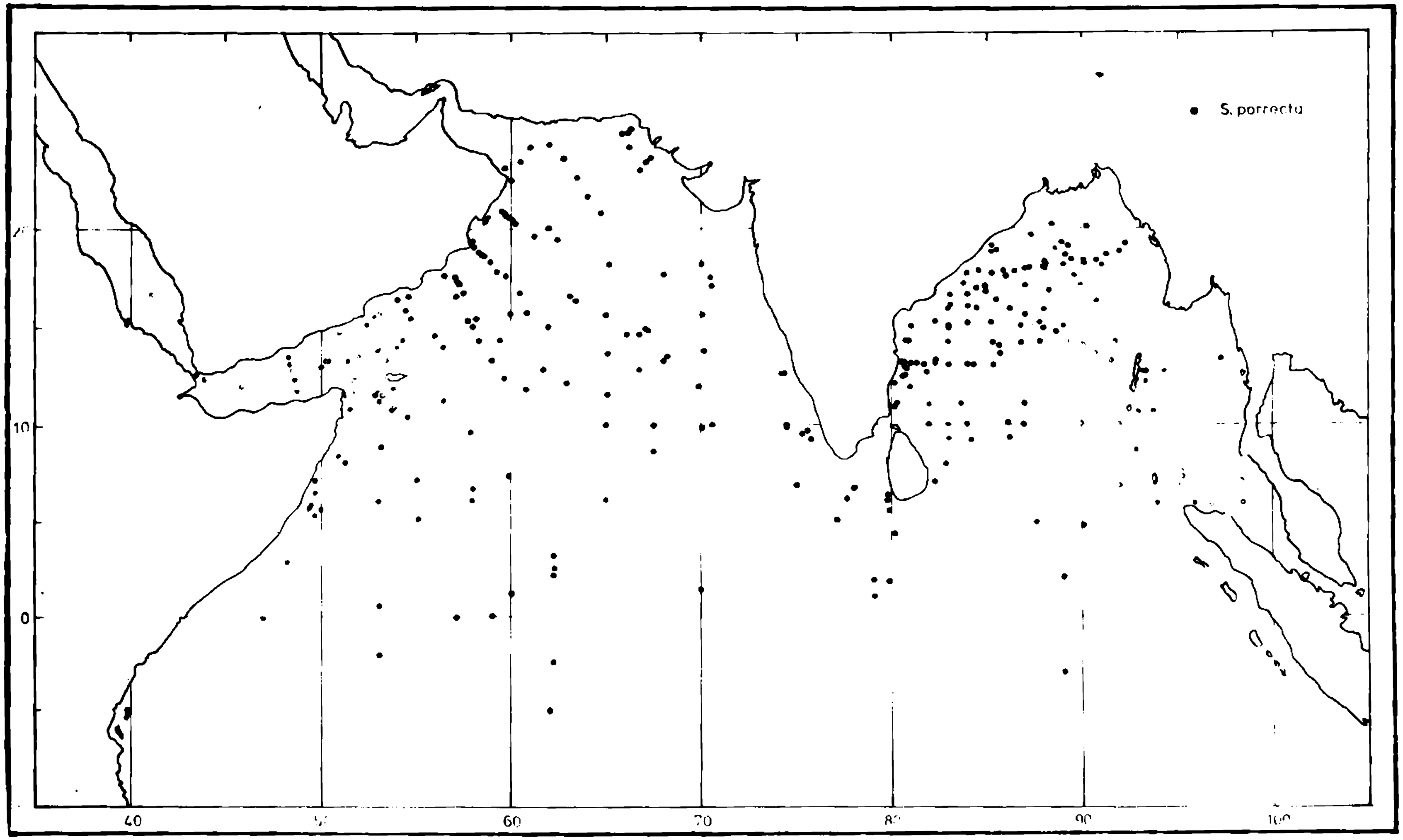

O. striola
20
10
0
40
50
60
70
80
90
100

MAP - IX. Distribution of _Orthoconchoecia_ _atlantica_.



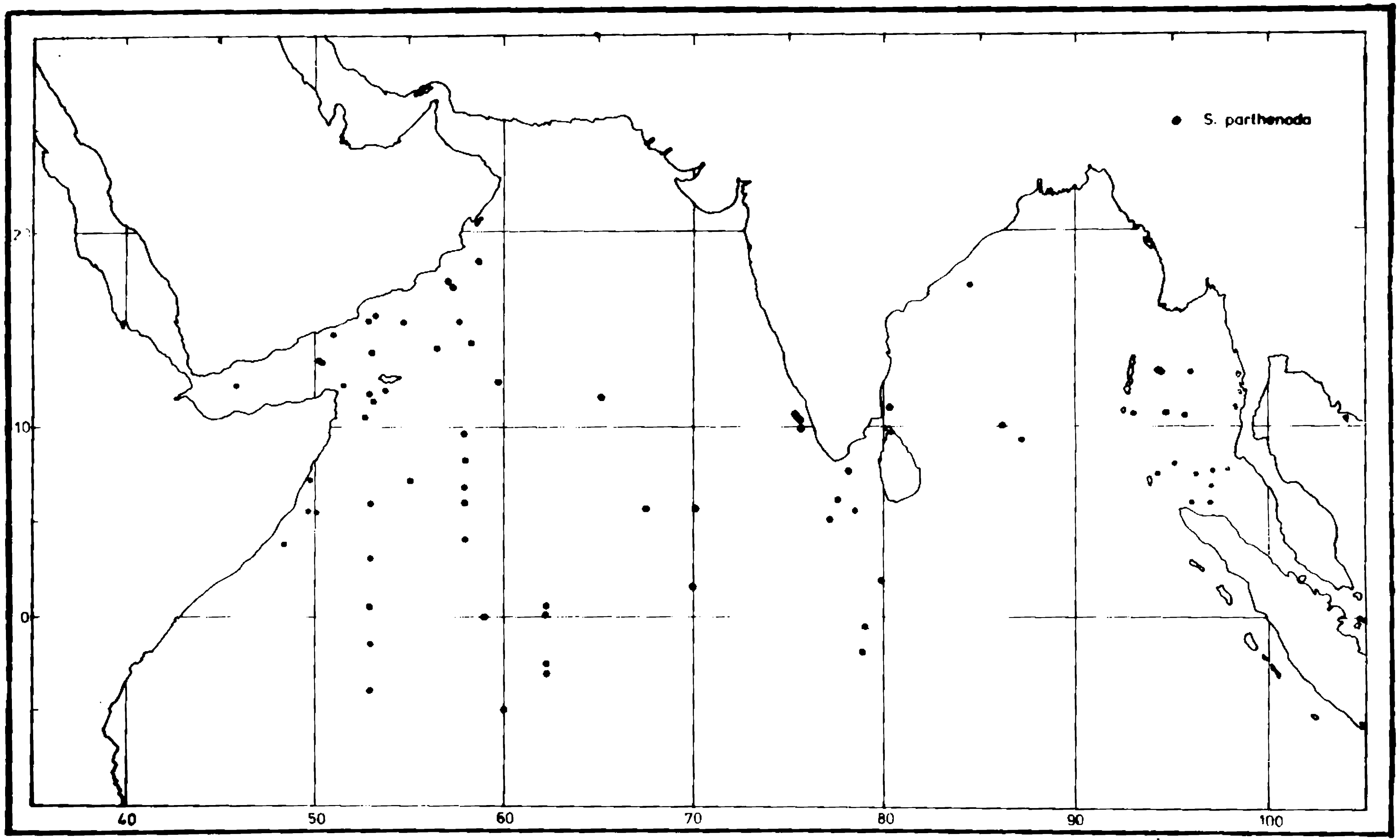
O. atlantica
20
10
0
40
50
60
70
80
90
100

MAP - X. Distribution of *Spinoecia porrecta*.

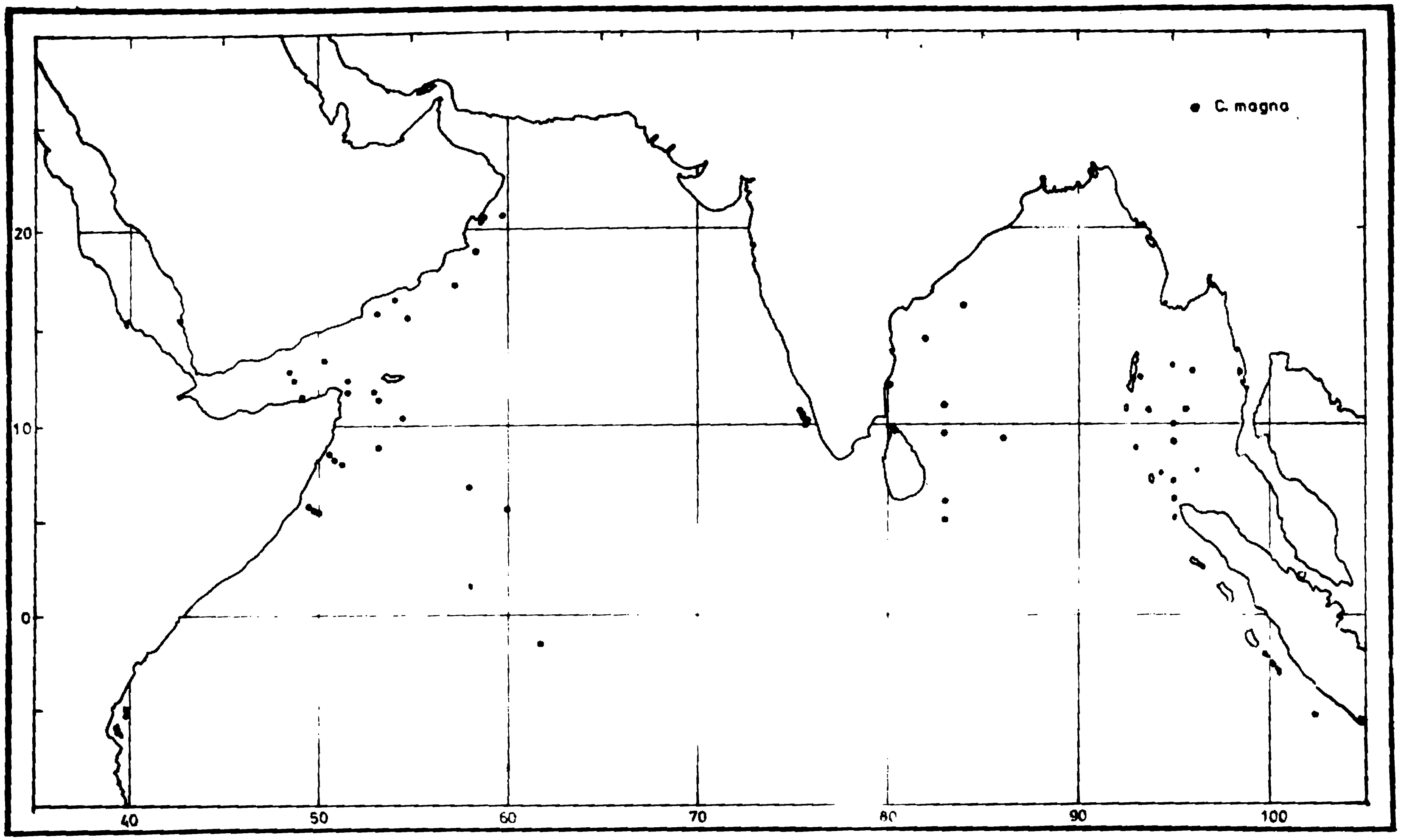


S. porrecta
10
0
40
60
70

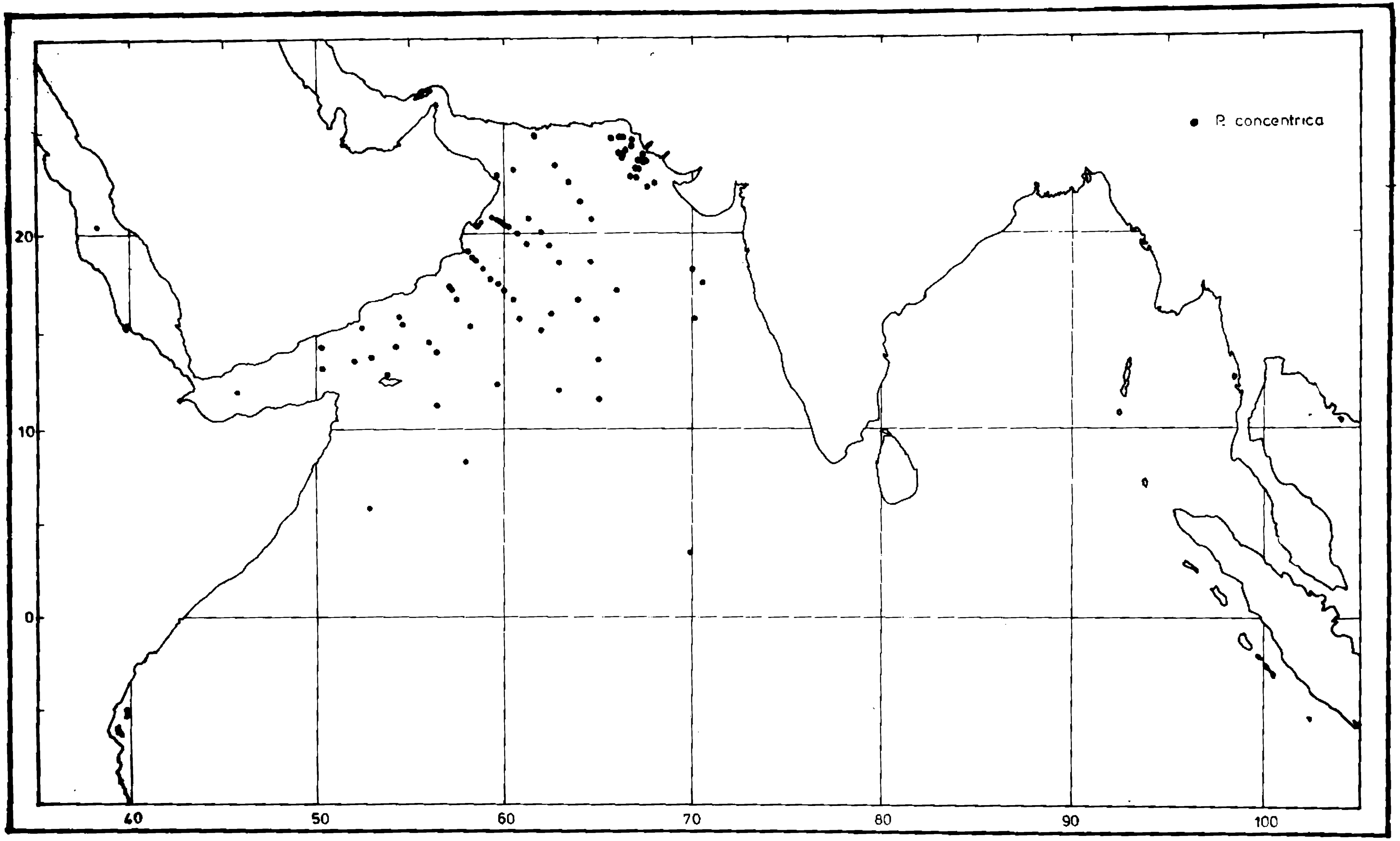
MAP - XI. Distribution of _Spinoecia parthenoda_.


S. parthenoda
10
0
40
50
60
70
80
90
100

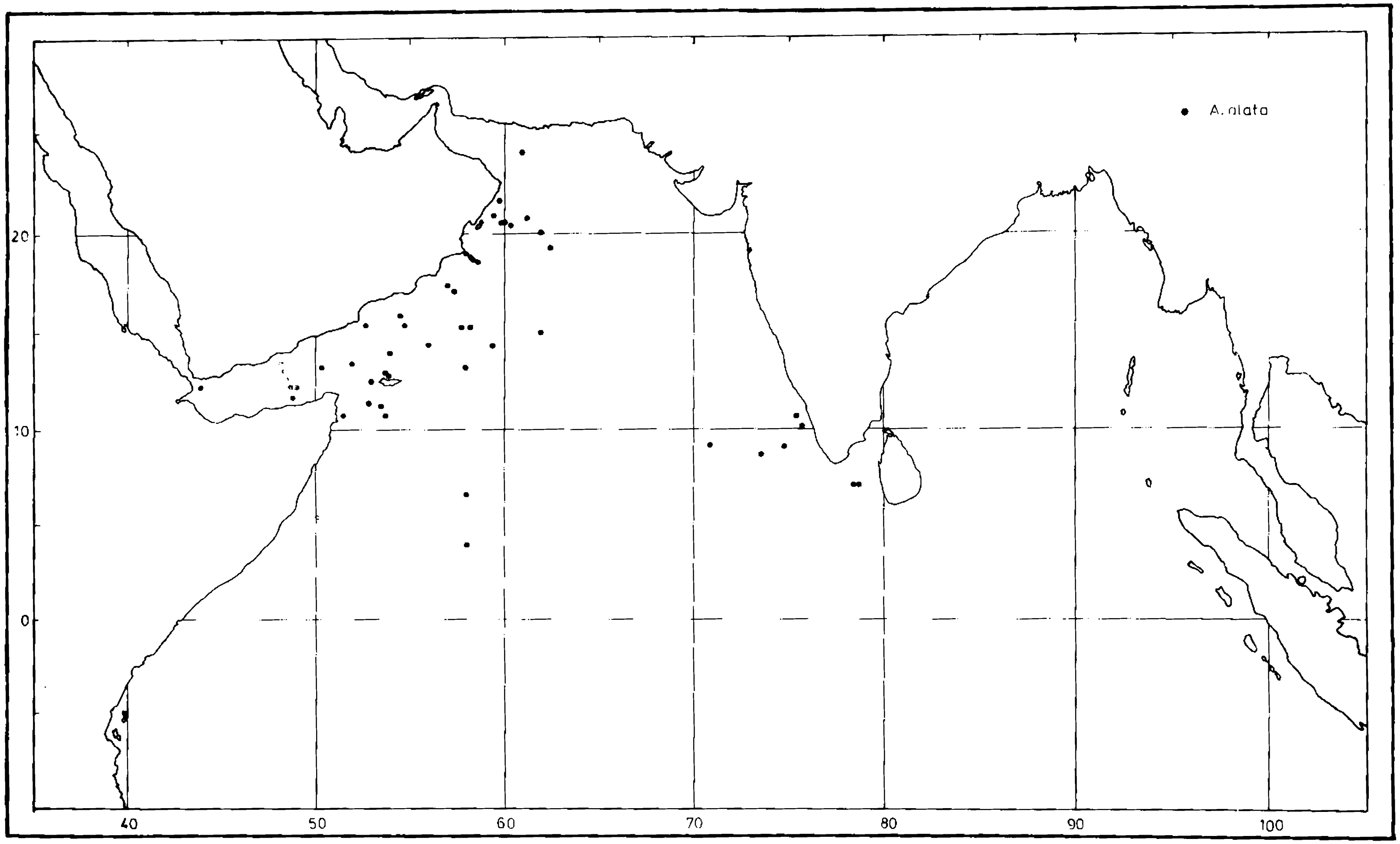
MAP - XII. Distribution of *Conchoecia magna*.


C. magna
20
10
0
40
50
60
70
80
90
100

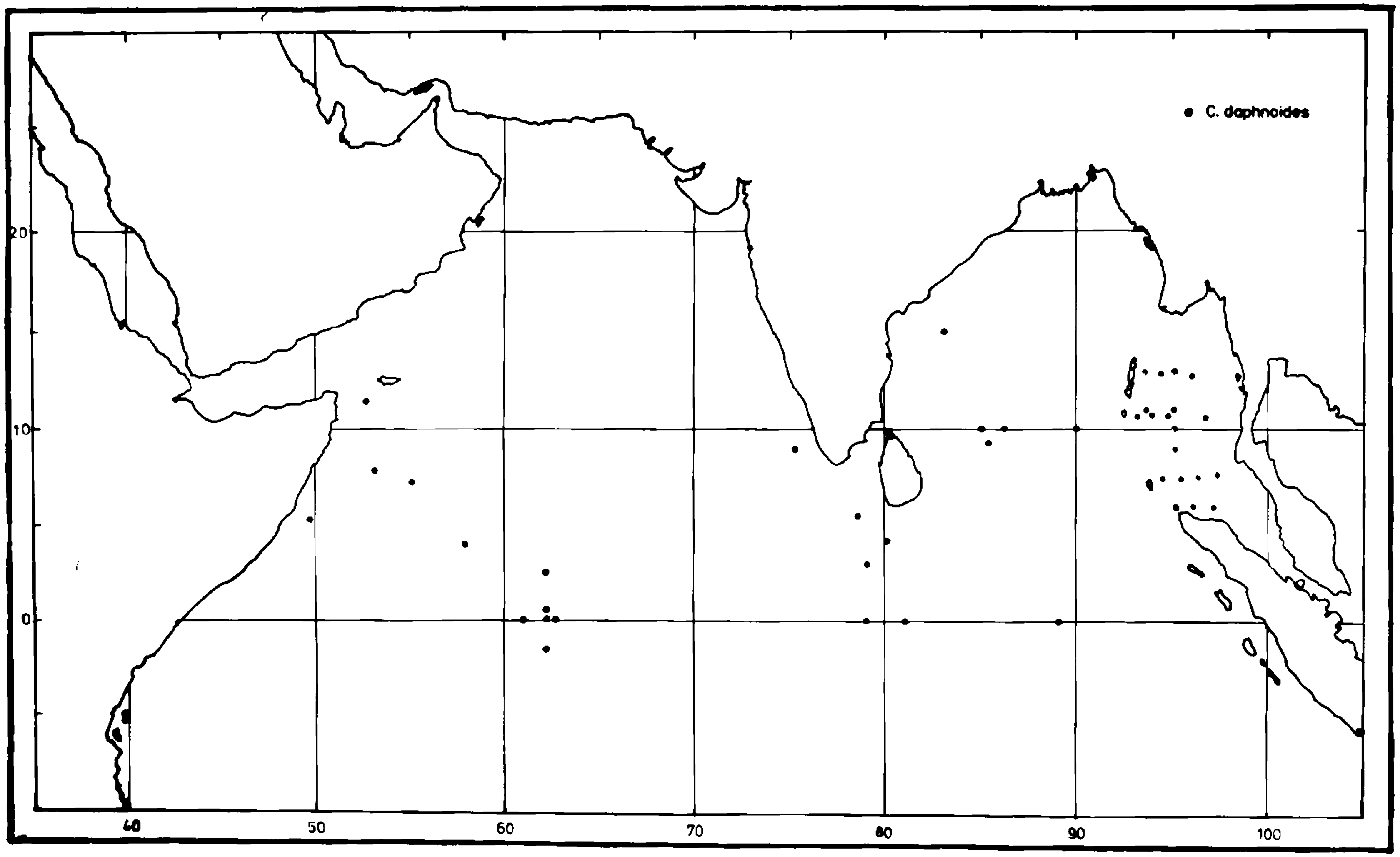
MAP - XIII. **Distribution of <u>Pseudoconchoecia</u> <u>concentrica</u>.**


P. concentrica
20
10
0
40
50
60
70
80
90
100

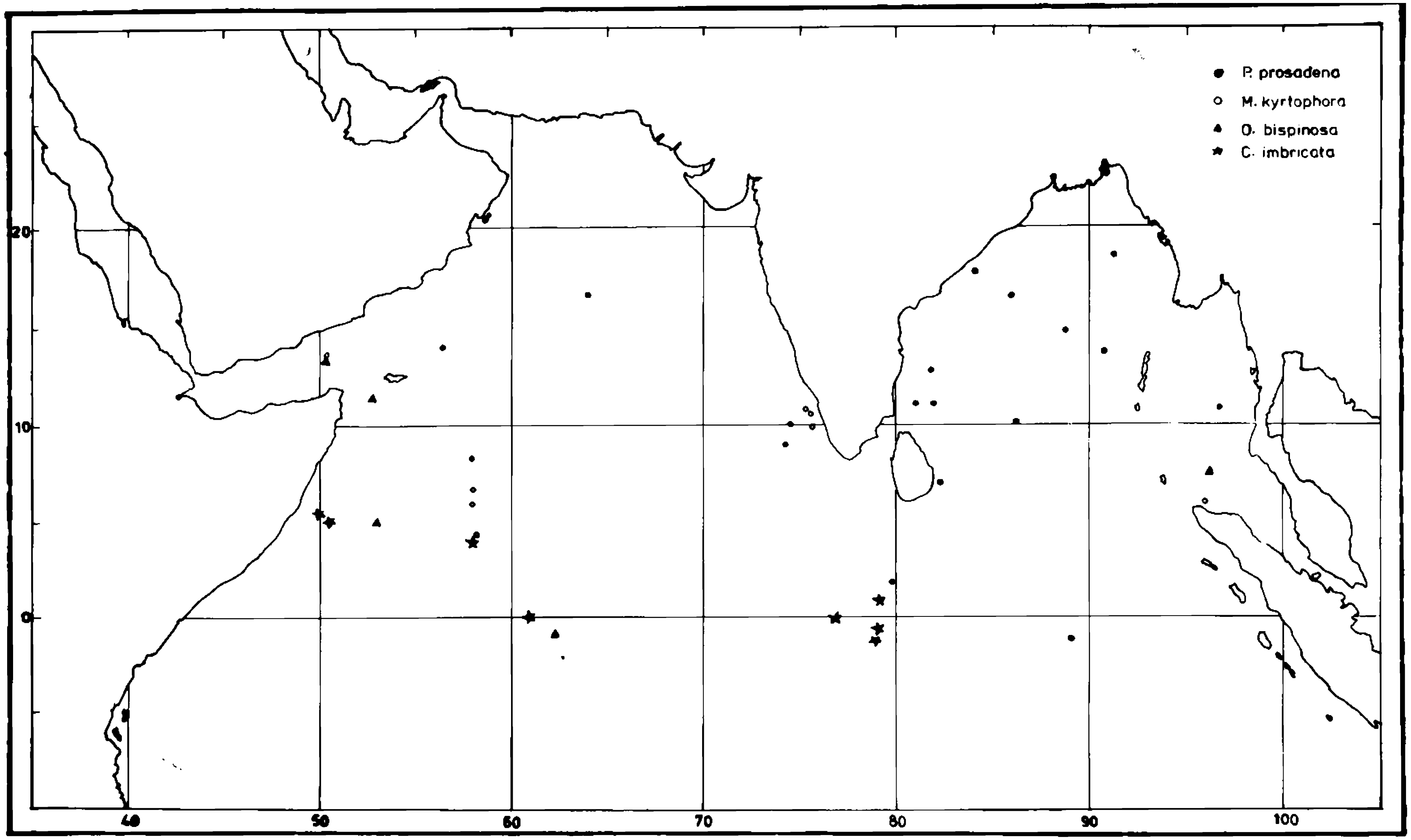
MAP - XIV. Distribution of *Alacia alata*.


A. alata
20
10
0
40
50
60
70
80
90
100

MAP - XV. Distribution of *Conchoecilla daphnoides*.

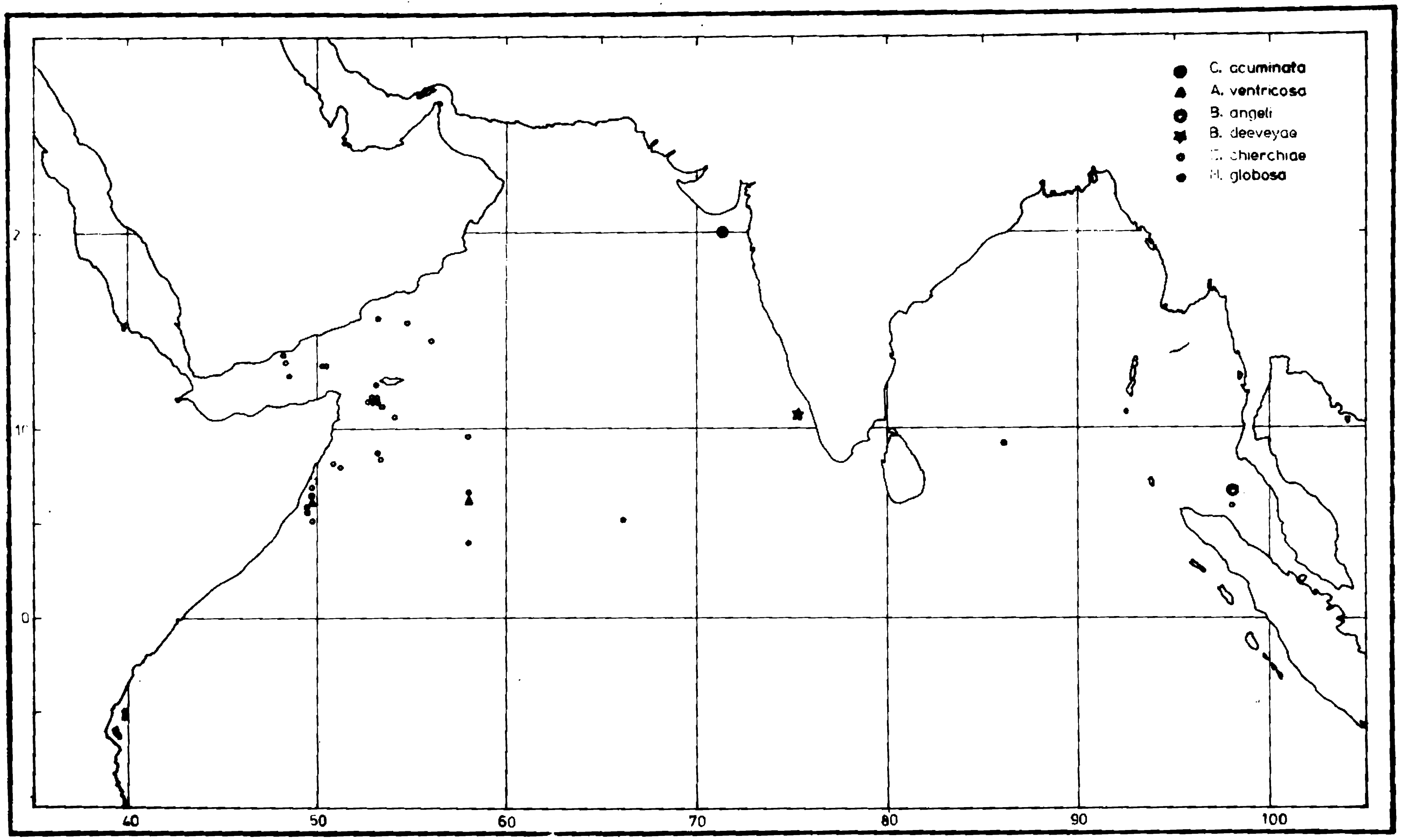

C. daphnoides
20
10
0
40
50
60
70
80
90
100

MAP - XVI. Distribution of *Platyconchoecia prosadena*, *Metaconchoecia kyrlophora*, *Orthoconchoecia bispinosa* and *Conchoecissa imbricata*.

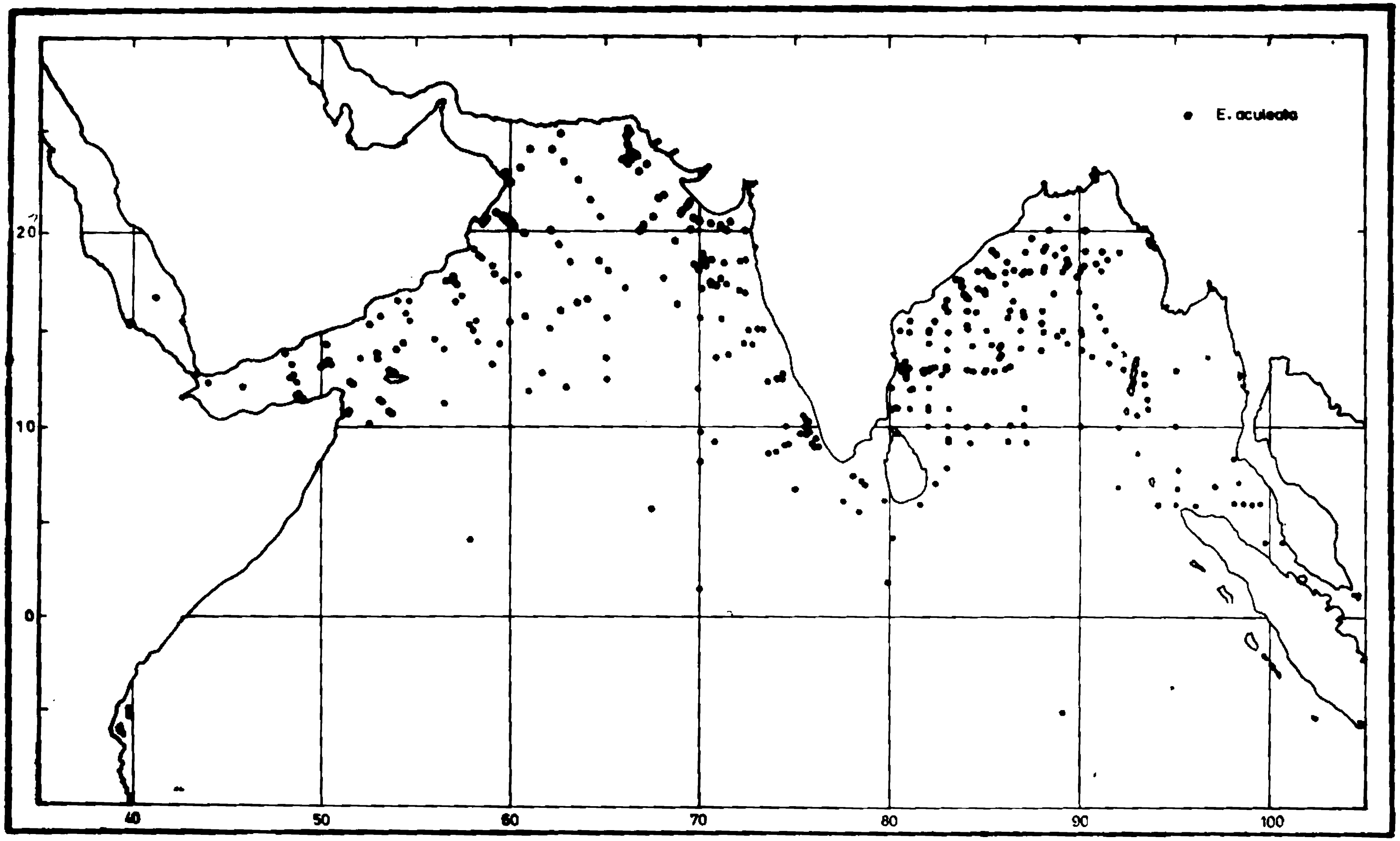


P. prosadena
M. kyrtophora
O. bispinosa
C. imbricata
20
10
0
40
50
60
70
80
90
100

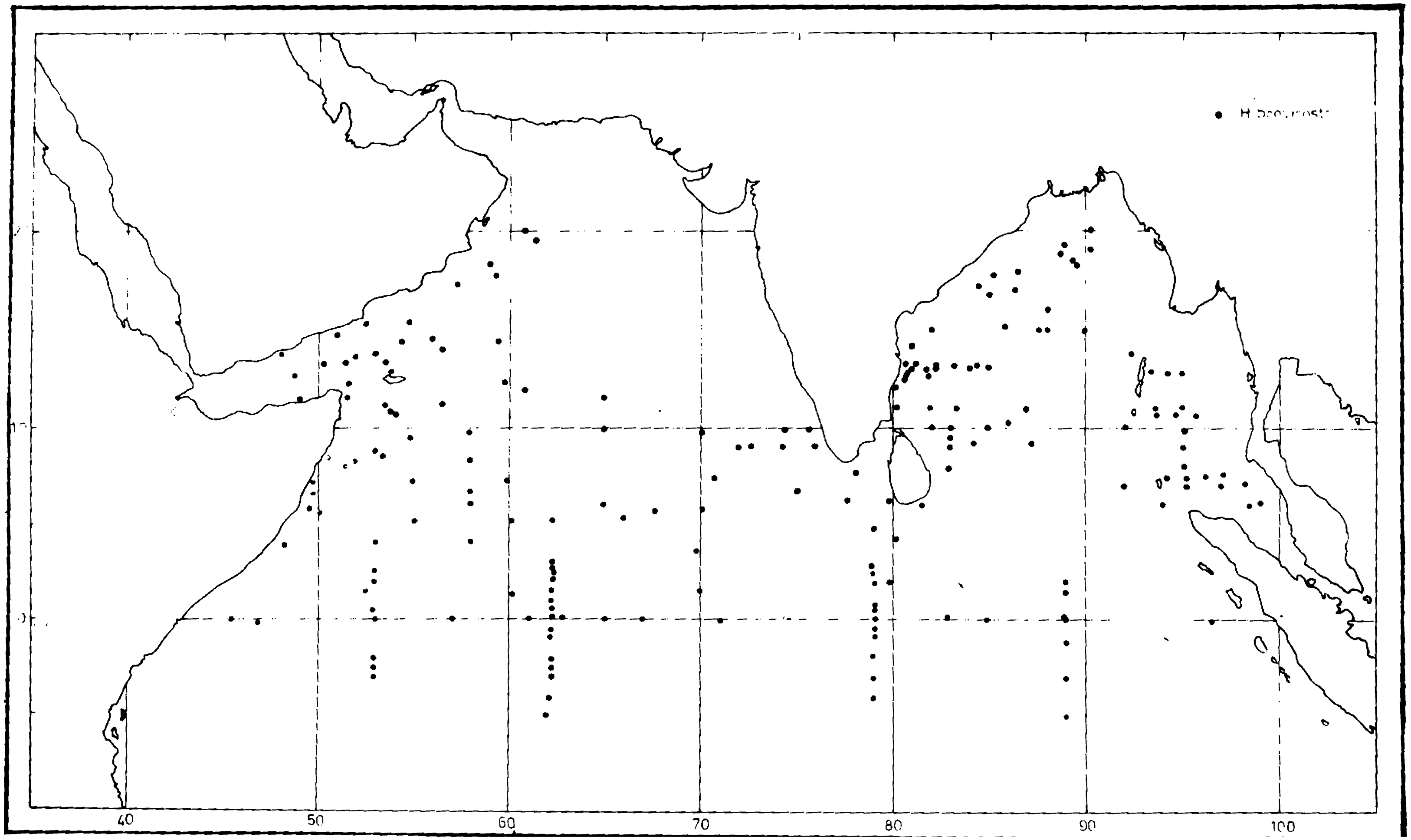
MAP - XVII. Distribution of *Cypridina acuminata*, *Archiconchoecia ventricosa*, *Bathyconchoecia angeli*, *B. deeveyae*, *Euconchoecia chierchiae* and *Halocypria globosa*.


C. acuminata
A. ventricosa
B. angeli
B. deeveyae
chierchiae
globosa
2
0
40
50
60
70
80
90
100

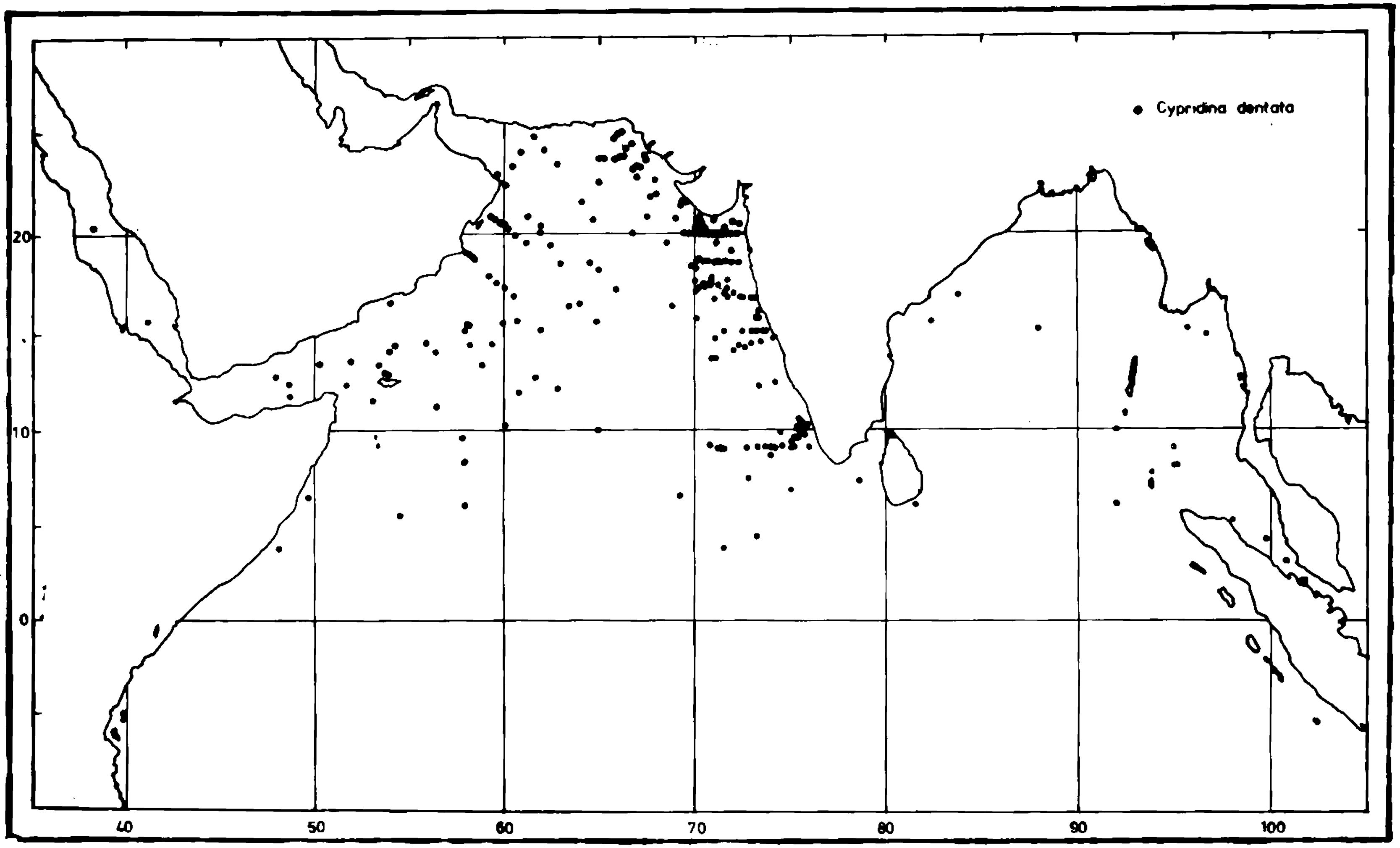
MAP - XVIII. Distribution of <u>Euconchoecia</u> <u>aculeata</u>.


E. aculeata
20
10
0
40
50
60
70
80
90
100

MAP - XIX. Distribution of <u>Halocypris</u> <u>brevirostris</u>.


40
50
60
70
80
90
100

MAP - XX. Distribution of <u>Cypridina</u> <u>dentata</u>.


Cypridina dentata
20
10
0
40
50
60
70
80
90
100

EXPLANATION TO PLATE

P L A T E I

Paraconchoecia oblonga (Figs. 1 - 9)

1. Male - carapace, lateral view
2. Female - carapace, lateral view
3. Male - frontal organ
4. Female - frontal organ
5. Male - armature of 'e' bristle of first antenna
6. " right clasping organ
7. " left clasping organ
8. " copulatory limb
9. " furca

Paraconchoecia echinata (Figs. 10 - 17)

10. Male - carapace, lateral view
11. Female - carapace, lateral view
12. Male-frontal organ
13. Female - frontal organ
14. Male - armature of 'b' bristle of first antenna
15. " tooth-lists of mandible
16. " copulatory limb
17. " right clasping organ

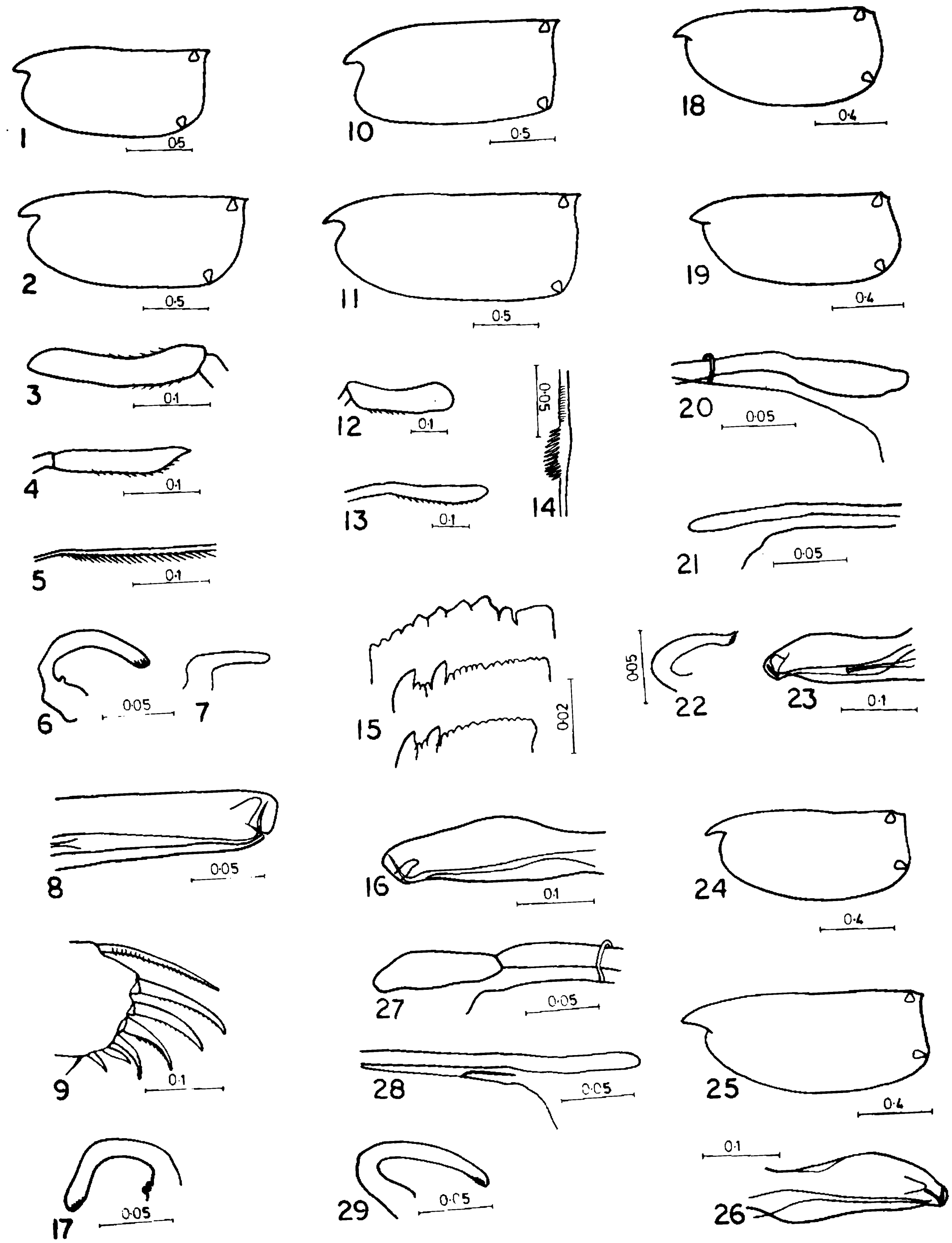
PLATE I (Contd.)

<u>Paraconchoecia</u> <u>elegens</u> (Figs. 18 - 23)

18. Male - carapace, lateral view
19. Female - carapace, lateral view
20. Male - frontal organ
21. Female - frontal organ
22. Male - right clasping organ
23. " copulatory limb

<u>Paraconchoecia</u> <u>discophora</u> (Figs. 24 - 29)

24. Male - carapace, lateral view
25. Female - carapace, lateral view
26. Male - copulatory limb
27. Male - frontal organ
28. Female - frontal organ
29. Male - right clasping organ.



1
0·5
10
0·5
18
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2
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11
0·5
19
0·4
3
0·1
12
0·1
14
0·05
20
0·05
4
0·1
13
0·1
5
0·1
21
0·05
6
0·05
7
15
0·02
22
0·05
23
0·1
8
0·05
16
0·1
24
0·4
9
0·1
27
0·05
28
0·05
25
0·4
17
0·05
29
0·05
26
0·1

EXPLANATION TO PLATE

P L A T E II

<u>Paraconchoecia</u> <u>procera</u> (Figs. 1 - 7)

1. Male - carapace, lateral view
2. Female - carapace, lateral view
3. Male - frontal organ
4. Female - frontal organ
5. Male - armature of 'e' bristle of first antenna
6. " copulatory limb
7. " left and right clasping organs

<u>Paraconchoecia</u> <u>decipiens</u> (Figs. 8 - 14)

8. Male - carapace, lateral view
9. Female - carapace, lateral view
10. Male - frontal organ
11. " armature of 'e' bristle of first antenna
12. Female - frontal organ
13. Male - copulatory limb
14. " left and right clasping organs

PLATE II (Contd.)

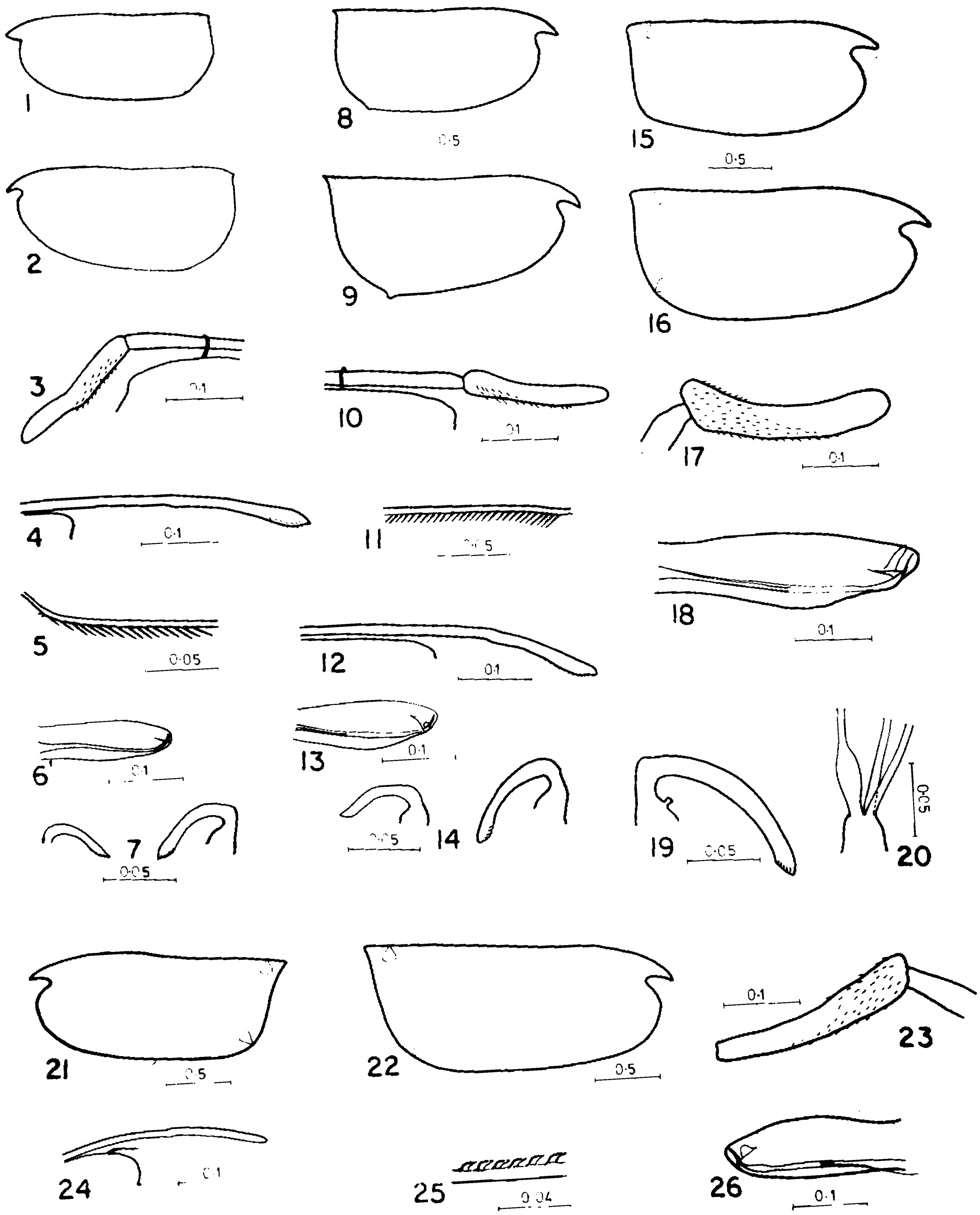
<u>Conchoecetta giesbrechti</u> (Figs. 15 - 20)

15. Male - carapace, lateral view
16. Female - carapace, lateral view
17. Male - frontal organ
18. " copulatory limb
19. " right clasping organ
20. " 'h', 'i' and 'j' bristles of second antenna

<u>Conchoecetta acuminata</u> (Figs. 21 - 26)

21. Male - carapace, lateral view
22. Female - carapace, lateral view
23. Male - frontal organ
24. Female - frontal organ
25. Male - armature of 'e' bristle of first antenna
26. " copulatory limb.

.....



1
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15
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16
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0·1
10
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17
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4
0·1
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18
0·1
5
0·05
12
0·1
6
0·1
13
0·1
7
0·05
14
0·05
19
0·05
20
0·05
21
0·5
22
0·5
23
0·1
24
0·1
25
0·04
26
0·1

EXPLANATION TO PLATE

P L A T E III

Microconchoecia curta (Figs. 1 - 9)

1. Male - carapace, lateral view
2. Female - carapace, lateral view
3. Male - 'a' bristle of first antenna
4. " armature of 'e' bristle of first antenna
5. " frontal organ
6. Female - frontal organ
7. Male - endopod of right second antenna
8. " tooth-lists of mandible
9. " copulatory limb

Metaconchoecia rotundata (Figs. 10 - 17)

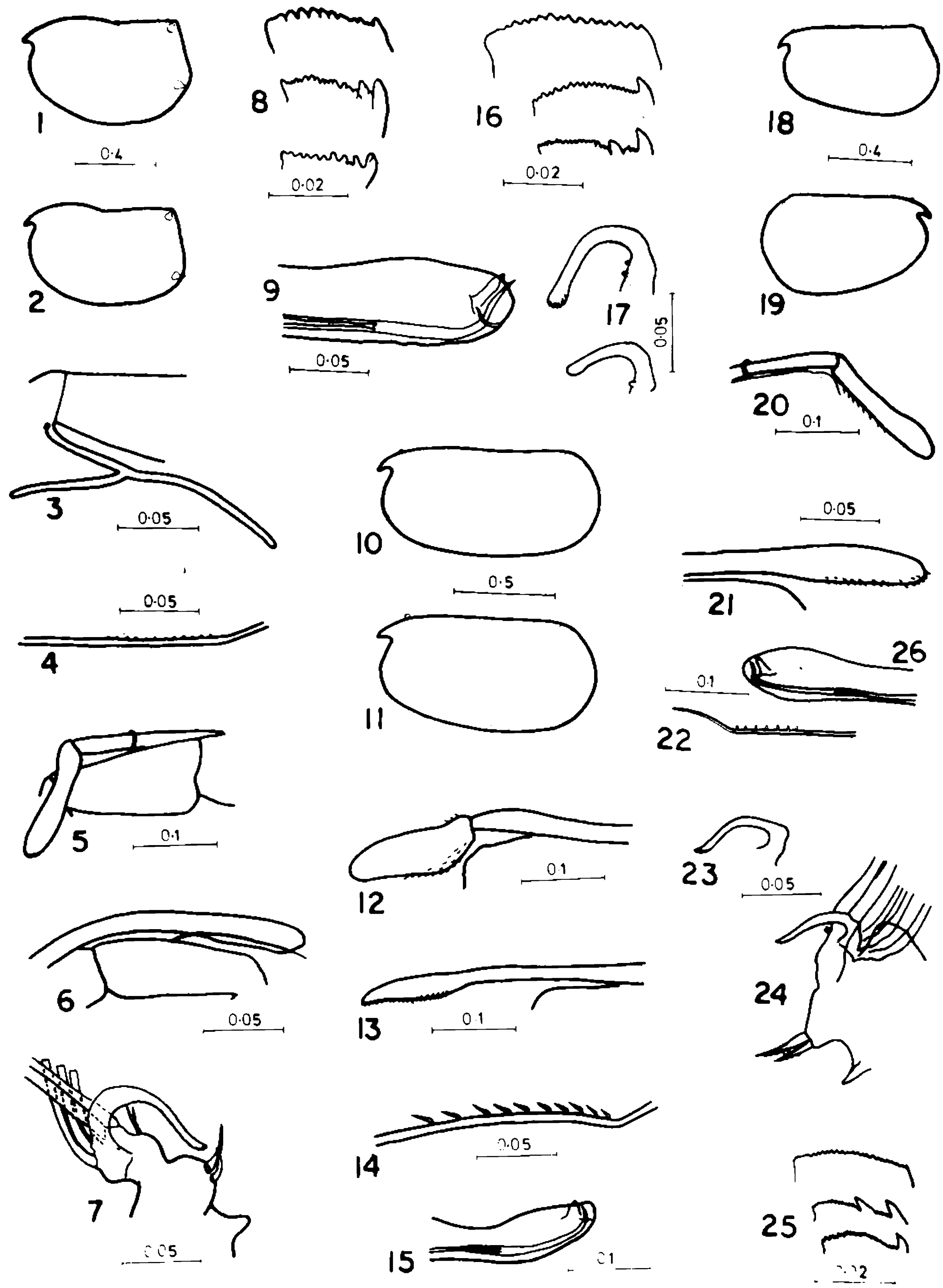
10. Male - carapace, lateral view
11. Female - carapace, lateral view
12. Male - frontal organ
13. Female - frontal organ
14. Male - armature of 'e' bristle of first antenna
15. " copulatory limb
16. " tooth-lists of mandible
17. " right and left clasping organs

PLATE III (Contd.)

Metaconchoecia kyrtophora (Figs. 18 - 26)

18. Male - carapace, lateral view
19. Female - carapace, lateral view
20. Male - frontal organ
21. Female - frontal organ
22. Male - armature of 'e' bristle of first antenna
23. " right clasping organ
24. " endopod of left second antenna
25. " tooth-lists of mandible
26. " copulatory limb.

......


1
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0·02
16
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18
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2
9
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17
0·05
19
3
0·05
20
0·1
10
0·5
0·05
21
4
0·05
11
26
0·1
22
5
0·1
12
0·1
23
0·05
24
6
0·05
13
0·1
7
14
0·05
25
15

EXPLANATION TO PLATE

PLATE IV

Orthoconchoecia bispinosa (Figs. 1 - 6)

1. Male - carapace, lateral view
2. Female - carapace, lateral view
3. Male - armature of 'e' bristle of first antenna
4. " frontal organ
5. Female - frontal organ
6. Male - endopod of left second antenna

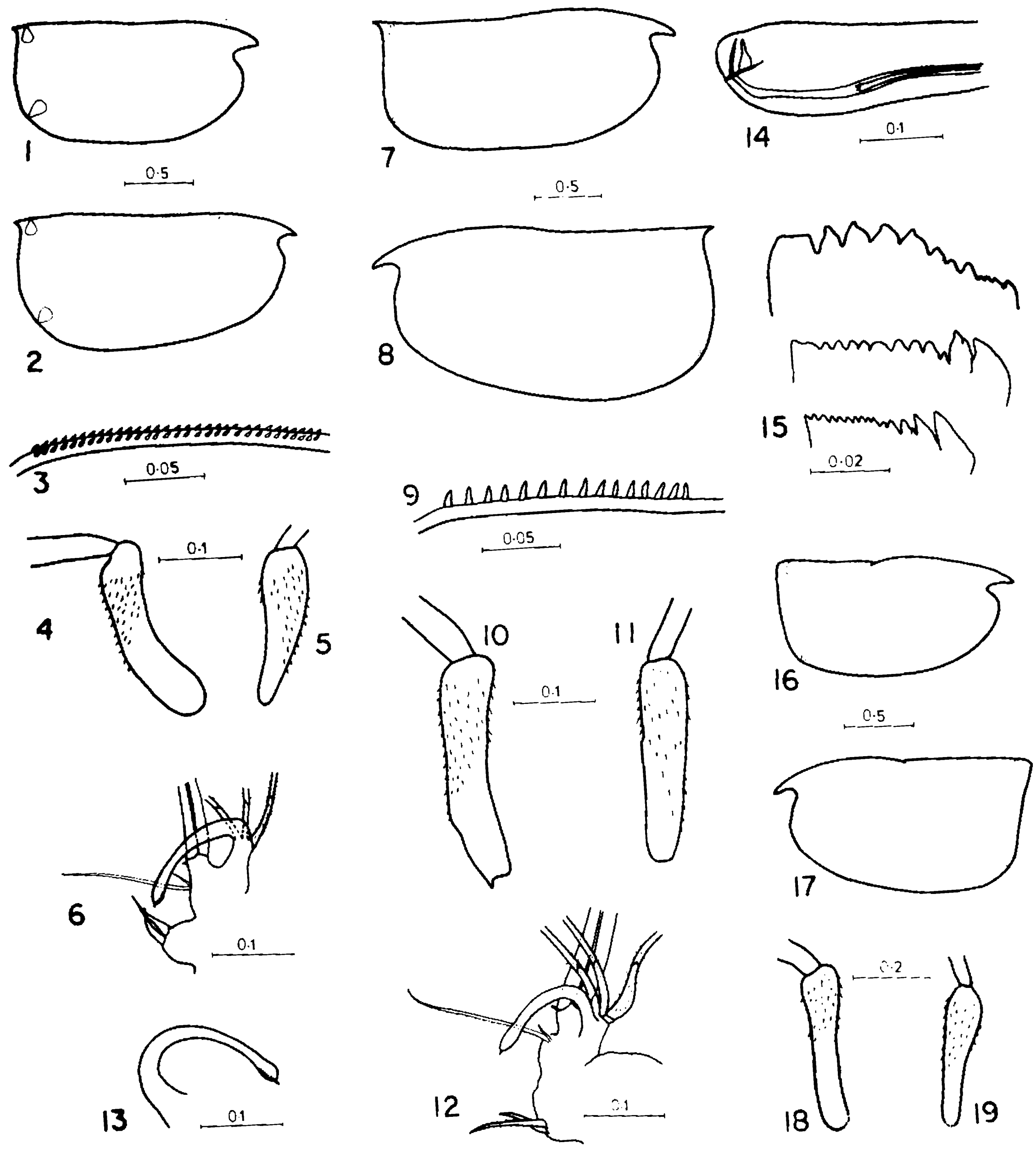
Orthoconchoecia striola (Figs. 7 - 15)

7. Male - carapace, lateral view
8. Female - carapace, lateral view
9. Male - armature of 'e' bristle of first antenna
10. " frontal organ
11. Female - frontal organ
12. Male - endopod of left second antenna
13. " right clasping organ
14. " copulatory limb
15. " tooth-lists of mandible.

Orthoconchoecia atlantica (Figs. 16 - 19)

16. Male - carapace, lateral view
17. Female - carapace, lateral view
18. Male - frontal organ
19. Female - frontal organ.

.....



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8
9
0·05
10
0·1
11
12
0·1
14
0·1
15
0·02
16
0·5
17
18
0·2
19

EXPLANATION TO PLATE

PLATE V

Platyconchoecia prosadena (Figs. 1 - 9)

1. Male - carapace, lateral view
2. Female - carapace, lateral view
3. Male - frontal organ
4. Female - frontal organ
5. Male - armature of 'e' bristle of first antenna
6. " right clasping organ
7. " mandible
8. " tooth-lists of mandible
9. " copulatory limb.

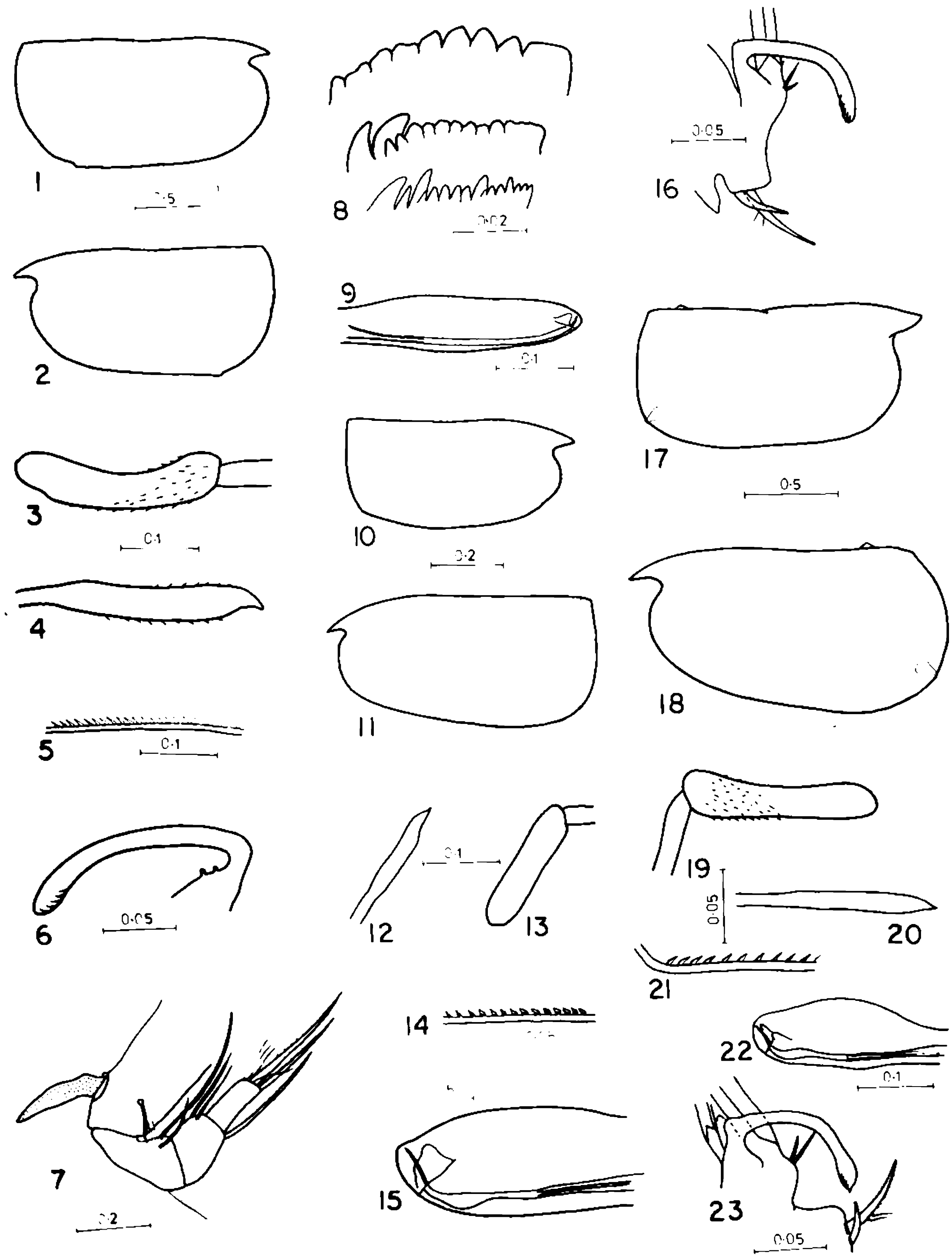
Spinoecia porrecta (Figs. 10 - 16)

10. Male - carapace, lateral view
11. Female - carapace, lateral view
12. " frontal organ
13. Male - frontal organ
14. " armature of 'e' bristle of first antenna
15. " copulatory limb
16. " endopod of right second antenna

Spinoecia parthenoda (Figs. 17 - 23)

17. Male - carapace, lateral view
18. Female - carapace, lateral view
19. Male - frontal organ
20. Female - frontal organ
21. Male - armature of 'e' bristle of first antenna
22. " copulatory limb
23. " endopod of right second antenna

.....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6
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12
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19
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20
21
7
0·2
14
15
22
0·1
23
0·05

EXPLANATION TO PLATE

P L A T E VI

Conchoecia magna (Figs. 1 - 8)

1. Male - carapace, lateral view
2. Female - carapace, lateral view
3. Female - frontal organ
4. Male - frontal organ
5. " armature of 'e' bristle of first antenna
6. " copulatory limb
7. " endopod of right second antenna
8. " tooth-lists of mandible

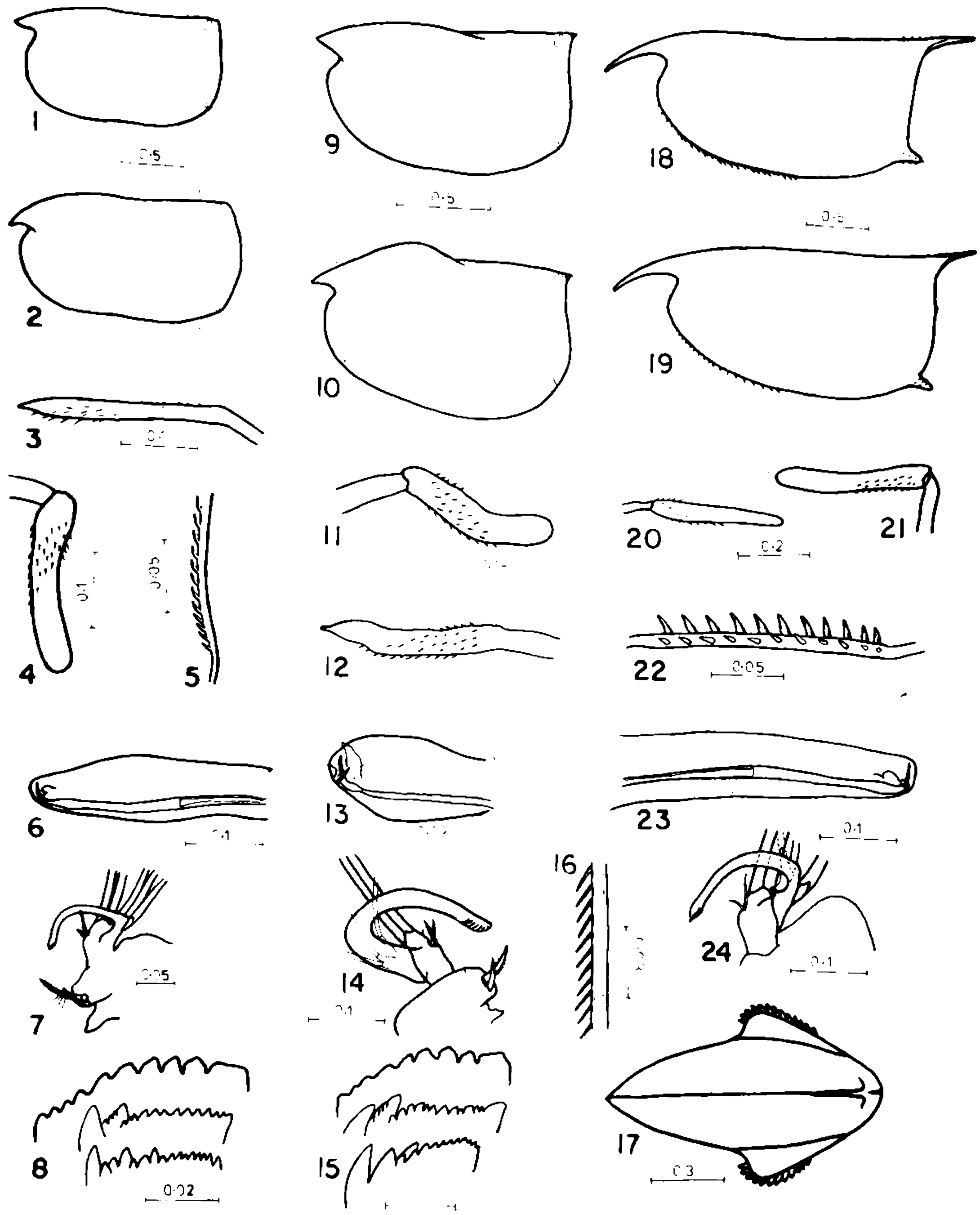
Pseudoconchoecia concentrica (Figs. 9 - 17)

9. Male - carapace, lateral view
10. Female - carapace, lateral view
11. Male - frontal organ
12. Female - frontal organ
13. Male - copulatory limb
14. " endopod of right second antenna
15. " tooth-lists of mandible
16. " armature of 'e' bristle of first antenna
17. Ventral view of carapace of juvenile.

Conchoecissa conbricata (Figs. 18 - 24)

18. Male - carapace, lateral view
19. Female - carapace, lateral view
20. " - frontal organ
21. Male - frontal organ
22. " armature of 'e' bristle of first antenna
23. " copulatory limb
24. " endopod of right second antenna.

......



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23
24
0·5
0·1
0·05
0·2
0·02
0·3

EXPLANATION TO PLATE

PLATE VII

Alacia alata (Figs. 1 - 9)

1. Male - carapace, lateral view
2. Female - carapace, lateral view
3. Male - frontal organ
4. Female - frontal organ
5. Male - armature of 'e' bristle of first antenna
6. " endopod of left second antenna
7. " right clasping organ
8. " copulatory limb
9. " tooth-lists of mandible.

Conchoecilla daphnoides (Figs. 10 - 18)

10. Male - carapace, lateral view
11. Female - carapace, lateral view
12. Male - frontal organ
13. Female - frontal organ
14. Male - endopod of right second antenna
15. " left clasping organ
16. " armature of 'e' bristle of first antenna
17. " copulatory limb
18. " tooth-lists of mandible.

Euconchoecia aculeata (Figs. 19 - 23)

19. Male - carapace, lateral view
20. Female - carapace, lateral view
21. Male - copulatory limb
22. " frontal organ
23. " endopod of right second antenna.

Euconchoecia chierchiae (Figs. 24 & 25)

24. Male - carapace, lateral view
25. Female - carapace, lateral view.

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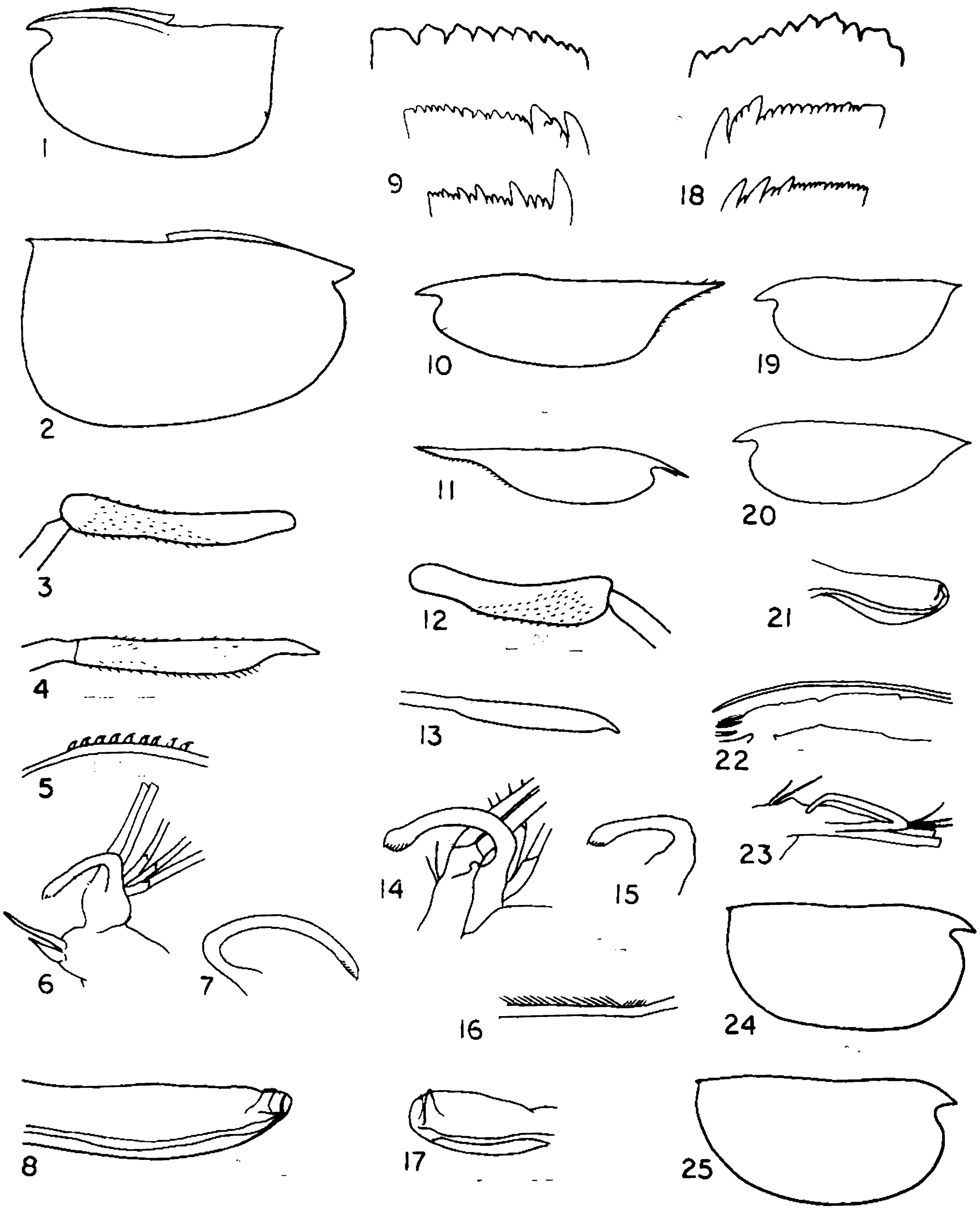
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(PUBLISHED PAPERS)

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APPENDIX - II.	-	On the occurrence of *Bathyconchoecia deeveyae* Kornicker (Ostracoda, Halocyprididae) in the Indian Ocean. Crustaceana, **21**: 141-144.
APPENDIX - III.	-	Zooplankton abundance at Kavaratti and Kalpeni atolls in the Laccadives. Mar. biol. Ass. India, Proc. Symp. Corals and Coral Reefs, 239-256.
APPENDIX - IV.	-	Distribution of certain planktonic crustaceans and Insect Halobates in the Indian Ocean. Ind. J. mar. Sci., **2**: 116-121.
APPENDIX - V.	-	Distribution of Ostracoda in the Indian Ocean. IIOE Plankton Atlas, **3**.
APPENDIX - VI.	-	*Bathyconchoecia angeli* sp. nov. a new halocyprid ostracod from the Malacca Strait, Indian Ocean. Crustaceana. (Accepted for publication on 18-11-1974).
APPENDIX - VII.	-	Redescription of *Archiconchoecia striata* Muller (Halocyprididae, Ostracoda) and its distribution in the Northern Indian Ocean. Crustaceana. (Accepted for publication on 8-8-1975).
APPENDIX - VIII.	-	Distribution of planktonic ostracods along the south west coast of India. Ind. J. mar. Sci., **4**: 201-202.

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