# MEIOFAUNA FROM LAKSHADWEEP, INDIAN OCEAN

by

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## Résumé

**Méiofaune des Lakshadweep, Océan Indien.**

L'auteur donne les résultats d'une étude préliminaire de la méiofaune des sédiments coralliens des Lakshadweep. Une brève description de la topographie, des conditions physiques et du climat de ces îles peu connues est fournie. La méiofaune s'y montre suffisamment riche et variée, tous les groupes y étant représentés. Une estimation quantitative des divers groupes taxonomiques rencontrés est donnée. La densité totale des spécimens de la méiofaune oscille entre 26 et 1 440 animaux/100 cm³. Leur distribution dans l'habitat est la même que dans les autres plages du Monde.

Une liste de 158 espèces récoltées est donnée avec leur distribution géographique. Un fort pourcentage de la méiofaune des Lakshadweep n'est pas endémique : on trouve plusieurs genres et espèces largement répandus et cosmopolites. Tous sont nouveaux pour la méiofaune des Lakshadweep. De nouvelles études amèneront certainement à la découverte de nombreuses autres espèces. L'étude actuelle montre que plusieurs espèces de la méiofaune sont largement répandues et l'exploration de nouvelles zones indiquera à coup sûr des relations plus étroites.

La distribution de la méiofaune est discutée en relation avec la nature du substrat et l'âge des îles. Elle montre un développement phylogénétique propre, comme on le constate pour certaines autres îles océaniques.

## Introduction

The taxonomy, ecology and distribution of meiofauna inhabiting the intertidal and subtidal sediments have been sufficiently investigated in recent times on the continental margins of several parts of the world. On the other hand, very little is known of the meiofauna inhabiting the coralline sediments of the oceanic atolls located mostly in the circumtropical region. Our knowledge of the meiofauna is limited to the few investigations that were carried out on the atolls of Maldives (Gerlach, 1958, 1961, 1962, 1963, 1964; Ax, 1971) in the Indian Ocean and Tuamotu (Salvat and Renaud-Mornant, 1969; Renaud-Mornant, Salvat and Bossy, 1971) in the Pacific Ocean. Hitherto, nothing is known of the meiofauna of the Lakshadweep group of atolls located in the Arabian Sea close to the south-west coast of India. During a programme of the Zoological Survey of India in the winter from December 1979 to January 1980 to investigate the faunal resources of these atolls, collections of meiofauna were made from four of these islands, *viz.*, Minicoy, Kavaratti,

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Androth and Agatti. The fauna proved to be sufficiently rich in their density and diversity. The present paper reports the preliminary results of the qualitative and quantitative investigations made on the four islands.

## Area investigated

The Lakshadweep, formerly known as Laccadive Archipelago, comprise 27 islands in all and lie irregularly scattered in the South Arabian Sea between latitudes 8° and 12° N and longitudes 71° and 74° E. The islands are situated 200-300 km off and stretched along the south-west coast of India. They are atolls and submerged reefs of varied dimensions, their coral reefs enclosing islands and shallow water lagoons. All these atolls are open in their disposition, with surge channels constantly exchanging waters between the open sea and the lagoon. Correlated with the prevailing winds in this region, these surge channels are mostly oriented in the north-west and south-west direction. With the exception of one island (Androth), all are similar in their formation with their roughly crescent shaped ends disposed north-south and the lagoons contained on the west. All the islands are flat, only a few metres above sea level and have a total geographical area of 32 sq km. Fringed with extensive white coralline sandy beaches and coconut palms, these islands present scenes of surpassing beauty. Their soil is formed mostly from the fragmentation of coral lime stones and sedimentary rocks. There are no streams or hillocks on these islands. Vegetation mainly consists of dense coconut groves. Significant mangroves are absent. Coral species of the genera *Acropora, Porites* and *Pocillopora* dominate these reefs.

The islands slope abruptly on the eastern side, resulting in steep shelf close to the shore. Due to this, the shore profile of the leeward side is quite different from that of the windward side of the island. With the exception of one island (Agatti), the seaward beaches on the eastern side are steep, narrow, exposed to severe wave action and mostly rocky, composed of coarser elements as boulders. The waters inside the lagoon are relatively calm even during rough weather. The lagoon side beaches west of these islands are mostly sheltered and sandy, with occasional concentrations of seaweed. Inside the lagoon, coarser sediments with gravel generally occurred near the reef and finer sediments near the islands. The beach sands are mostly well sorted and the particle shape varies from subspherical to spherical. Compactness of these sands is generally low. The texture of the substrate varies from fine sand to coarse gravel. The sediments are devoid of any coral debris and generally poor in decayed organic detritus. The lagoon sands are exclusively of calcium carbonate, with very little silica. Grab collections of the bottom sediment made on the deeper parts of these lagoons indicated the presence of a relatively compact substratum, with a higher percentage of fine material as coralline powder, silt and organic detritus.

These islands have a warm and humid climate. The atmospheric temperature during the year varies between 17° C and 37° C. They get rain from the south-west monsoon from late May to early October

and north-west monsoon between November and January. The annual rainfall averages 1600 mm. The surface water values of temperature in this region are known to vary between 28° C and 31° C, while that of salinity between 34 and 37 permil (Jayraman *et al.* 1960; Patil and Ramamirtham 1963). Tropical cyclones and hurricanes are liable to occur between the two monsoons influencing growth and destruction of these coral reefs. A high tidal range is characteristic of these islands resulting in a wide exposure of intertidal zone at low tide, the springs ranging from 0.3 to 2.0 m.

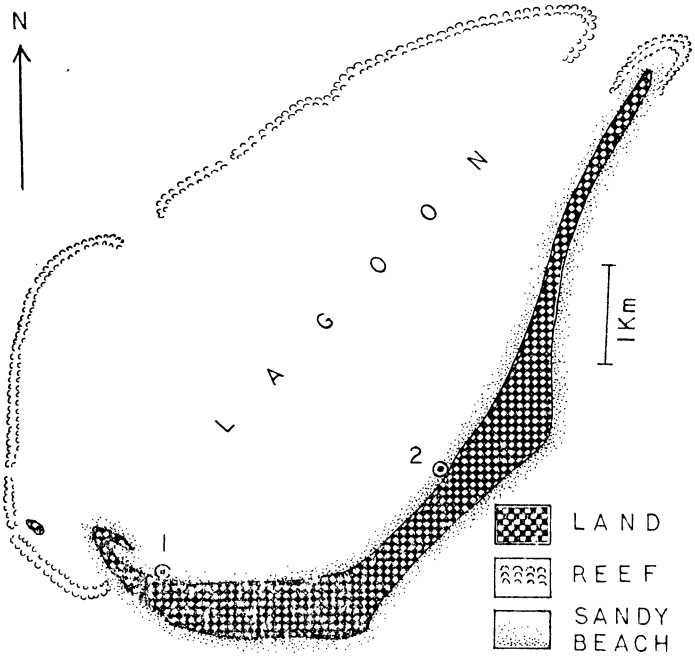


FIG. 1
Minicoy Atoll, showing collecting localities 1 - 2.

*Minicoy* (08° 17' N and 73° 04' E): it is the southern-most island of the Lakshadweep, located about 120 km from Maldives. The atoll is somewhat oval in outline, with its pointed end in the north-east direction. The position of the lagoon, island and reef areas are shown in Fig. 1. The island is crescent-shaped, measures more than 10 km in length and 0.8 km in maximum width, with an area of 4.4 sq km. The lagoon is large and about 15 m in maximum depth. About half-a-dozen surge channels of varied size open into the lagoon. The lagoon side of the island supports fine sheltered sandy beaches, which are relatively steep. The texture of the substrate is largely fine, with a higher percentage of organic content.

*Kavaratti* (10° 33' N and 72° 38' E): it is the capital of Lakshadweep and nearly occupies a central position of the archipelago. The island is narrow and arcuate, about 6 km long, 1.3 km wide at the north and

tapers down to the south-west (Fig. 2). It is 3.6 sq km in area. The lagoon is extensive, with a maximum depth of 3 m. Due to the shallower depths, wide sandy beaches are exposed at low tide with a low slope. The sands are mostly coarse and medium, with poor organic content.

*Androth* (10° 49' N and 73° 41' E): it is the eastern-most island of the group. Unlike other islands, it lies disposed in the east-west direction, with coral reef all around. It has no lagoon, as the island occupies the

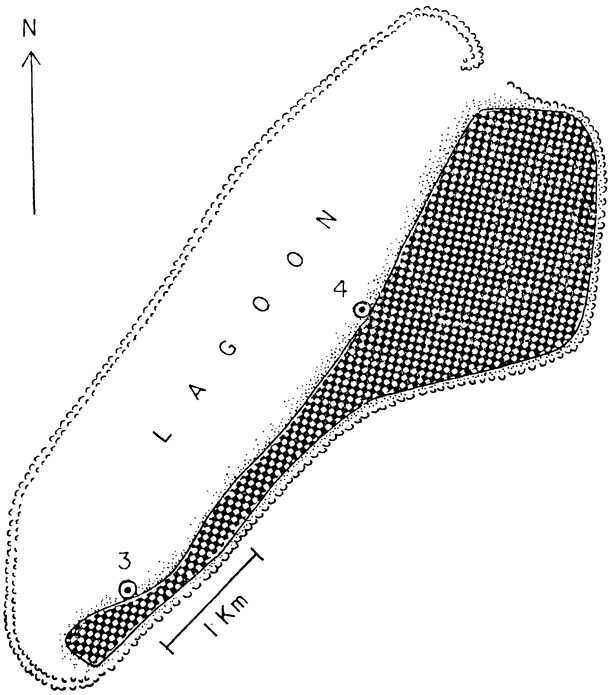


FIG. 2
Kavaratti Atoll, showing collecting localities 3 - 4.

whole of the atoll (Fig. 3). The island is about 6 km long, 1.8 km in maximum width and has an area of 4.8 sq km. Due to the absence of a lagoon, its sandy beaches are exposed on all sides. The beaches have a moderate slope, with a wide intertidal zone. The coralline sands are clean and mostly coarse in their texture.

*Agatti* (10° 51' N and 72° 11' E): it is the western-most island of the group. The island is somewhat club-shaped, with its broad part on the north and lies completely within and elliptical reef (Fig. 4). The island is about 5.8 km long, 0.7 km in maximum width and has an area of 2.7 sq km. The extensive lagoon on the west is 2-3 m deep. As an exception, there are no storm beaches on its east coast. On the leeward side of the island lies a wide belt of clean sand and the beach slopes gently down to the low water mark. The beach sands are mostly medium in their texture and poor in organic detritus.

## Material and methods

After a preliminary survey of the archipelago, 8 localities were selected on these 4 islands for the present faunal investigation (Figs. 1-4). The collection of intertidal meiofauna was made at low tide mostly near the half-tide level, where the fauna is usually well represented. Sand samples were dug out with a shovel to a depth of 30 cm below surface, transferred to field laboratory in open polythene jars and anaesthetized with a solution of $MgCl_2$ isotonic with sea water. The animals were extracted from the sediment by the usual decanting and seiving method. The fauna passing through a sieve of 1.0 mm in pore size and retained by a sieve of 62 μm, was collected,

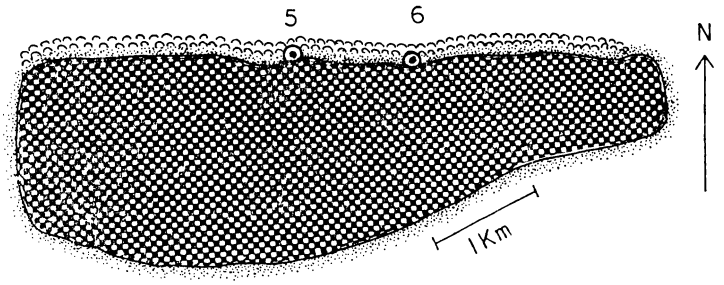


FIG. 3
Androth Atoll, showing collecting localities 5 - 6.

examined and preserved in 5 percent neutral sea water formalin or 70 percent alcohol. A quantitative estimation of meiofauna was made at the proximity of low, mid and high water levels of an intertidal transect. Using a metallic corer 30 cm in length and 20 sq cm in internal cross sectional area, sediment samples were collected to a depth of 30 cm below the surface. To ascertain the vertical distribution of meiofauna, the core was immediately cut into 5 cm thick segments and transferred to polythene vials. Meiofauna from these samples was collected by the method described above, sorted and counted. The abundance of meiofauna is expressed as the number of individuals per 100 $cm^3$. Each value represents the mean of two cores.

Neither time nor facilities were available during the present survey to make any detailed investigation of the physico-chemical parameters of the environment. A graduated eye-piece was used to estimate the approximate limits of the texture of the substrate and expressed with the following terminology. Fine sand $< 250$ μm; medium sand 250-500 μm; coarse sand $> 500$ μm and gravel $> 1000$ μm. The amount of organic matter in these sediments is relatively estimated by visual observation based on personal experience. Some grab collections of the bottom sediment were made at random from the deeper parts of lagoon to ascertain the nature of the substratum and the composition of meiobenthos. A quantitative estimation of the meiobenthos could not be made due to difficulties in their sampling.

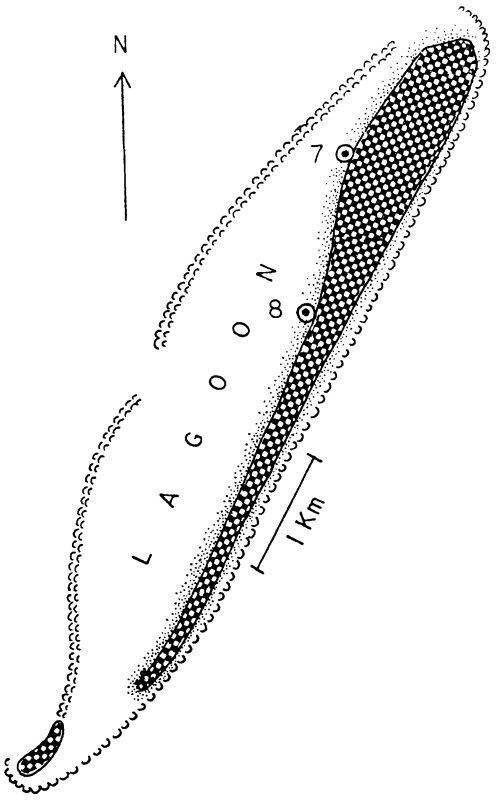


FIG. 4
Agatti Atoll, showing collecting localities 7 - 8.

## RESULTS

### Composition, density and distribution of meiofauna

Most of the meiofauna groups characteristic of the habitat were encountered on these islands. The results of a quantitative estimation of the meiofauna on the 4 islands showing the mean percentage abundance of the diverse groups are given in Table 1. Nematoda, Copepoda and Annelida constituted the major meiofauna groups comprising over 70 percent of the total numbers. Turbellaria and Gastrotricha were the next in importance, while the remaining groups occurred in much smaller numbers (Fig. 5A). The dominance of some meiofauna species was present, which was largely responsible for the higher total populations of the major meiofauna groups. Ciliates occurred in the habitat in sufficient numbers, but they are not included in the present study.

Qualitatively, the major groups of meiofauna are well represented on these islands, with a good number of genera and species.

TABLE 1

Percentage abundance of the diverse groups of meiofauna in the intertidal sediments on the 4 islands of Lakshadweep during the winter 1979-1980.

| Group | Minicoy | Kavaratti | Androth | Agatti | Mean |
|---|---|---|---|---|---|
| Hydrozoa | — | — | 0.5 | 1.5 | 0.5 |
| Turbellaria | 13.0 | 11.5 | 2.0 | 3.5 | 7.5 |
| Nemertina | — | — | 1.5 | 0.5 | 0.5 |
| Gastrotricha | 2.5 | 6.0 | 7.0 | 5.0 | 5.1 |
| Kinorhyncha | — | — | 1.5 | 0.5 | 0.5 |
| Nematoda | 51.0 | 23.5 | 12.5 | 17.0 | 26.0 |
| Archiannelida | 2.5 | 9.0 | 11.5 | 8.5 | 7.9 |
| Polychaeta | 4.0 | 14.0 | 15.0 | 11.5 | 11.1 |
| Oligochaeta | 1.5 | 3.5 | 1.5 | 2.5 | 2.2 |
| Ostracoda | 5.0 | 1.0 | 2.0 | 2.5 | 2.6 |
| Copepoda | 14.5 | 21.5 | 31.0 | 34.0 | 25.2 |
| Isopoda | — | 2.0 | 4.0 | 2.5 | 2.1 |
| Amphipoda | 0.5 | 1.0 | 2.5 | 2.0 | 1.5 |
| Cumacea | 2.0 | — | 1.0 | 0.5 | 0.9 |
| Insect larvae | 1.0 | 2.5 | 2.0 | 1.5 | 1.7 |
| Halacarida | — | — | 1.5 | 2.5 | 1.0 |
| Tardigrada | — | — | 1.5 | 0.5 | 0.5 |
| Mollusca | 2.5 | 4.5 | 1.0 | 3.0 | 2.7 |
| Holothuroidea | — | — | 0.5 | — | 0.1 |
| Tunicata | — | — | — | 0.5 | 0.1 |

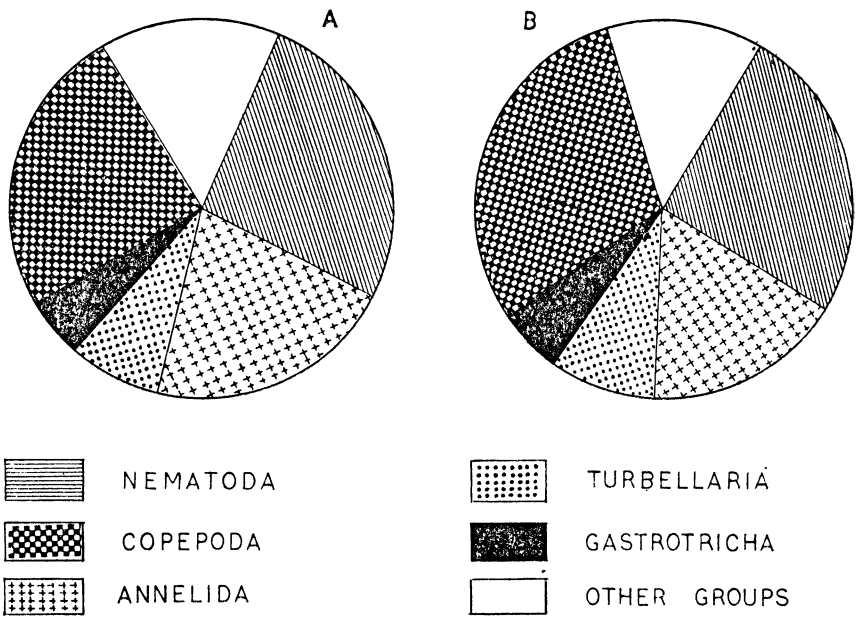


FIG. 5

Circle diagrams illustrating the percentage composition of the diverse groups of meiofauna of the Lakshadweep during the winter, 1979-80. A - Quantitative distribution. B - Qualitative distribution.

Copepoda, Nematoda, Annelida, Turbellaria and Gastrotricha, in the order of their abundance constituted nearly 87 percent of the total number of species encountered (Fig. 5B). The remaining groups are poorly represented by a small number of species.

Moderately dense populations of meiofauna inhabit the intertidal sediments of these islands. Their composition and abundance varied at different tidal levels, localities and from island to island, depending on the nature of the substratum. The sheltered situations generally supported the richest populations. The values of the total population densities recorded on the 4 islands upto a depth of 30 cm are given in Table 2. Their mean values ranged from 26 animals/100 $cm^3$ to 1440 animals/100 $cm^3$. Maximum concentration of the meiofauna was observed on the lower beach at the proximity of mid-water level and in the upper 10-20 cm of the sediment. Some meiofaunal submergence occurred towards high-water level due to decreased amount of water content in the upper layers of the sediment.

TABLE 2

Quantitative distribution of total meiofauna (nos./100$cm^3$) in the intertidal sediments on the 4 islands of Lakshadweep during the winter, 1979-1980.

| Island | Level | Depth in cm | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0-5 | 6-10 | 11-15 | 16-20 | 21-25 | 26-30 |
| Minocoy | HWL | 68 | 83 | 270 | 311 | 530 | 384 |
| | HWL | 480 | 662 | 1027 | 864 | 406 | 140 |
| | HWL | 360 | 704 | 934 | 546 | 212 | 96 |
| Kavaratti | HWL | 114 | 92 | 205 | 726 | 408 | 510 |
| | MTL | 604 | 923 | 1440 | 1130 | 514 | 217 |
| | MTL | 493 | 816 | 890 | 336 | 124 | 90 |
| Androth | MTL | 26 | 78 | 91 | 287 | 310 | 104 |
| | MTL | 282 | 610 | 1086 | 1213 | 504 | 348 |
| | LWL | 281 | 842 | 680 | 512 | 106 | 64 |
| Agatti | LWL | 52 | 69 | 114 | 216 | 370 | 88 |
| | LWL | 310 | 448 | 924 | 1160 | 625 | 540 |
| | LWL | 476 | 860 | 632 | 426 | 245 | 118 |

Many of the meiofauna groups were generally collected in larger numbers on the lower shore although their horizontal distribution extended towards the high-water level in reduced numbers. Nematodes, ostracods and copepods largely occurred in the upper sediment layers, while the gastrotrichs, kinorhynchs, polychaetes and isopods were more abundant in the lower layers. Other meiofauna groups did not indicate any clear pattern in their vertical distribution. The finer sediments generally supported larger populations of the smaller nematodes and copepods, while the larger archiannelids, polychaetes, oligochaetes, copepods, isopods and amphipods were more numerous in the coarser sediments.

Examination of the sediment samples collected on the lagoon floor of these atolls indicated a reduced meiobenthic diversity and a preponderance of individuals. These meiobenthic populations largely consisted of nematodes, while polychaetes, copepods and molluscan

larvae together constituted second in their overall abundance. Other groups, as Turbellaria, Gastrotricha, Archiannelida, Oligochaeta, Ostracoda and Amphipoda were poorly represented. The decreased diversity of species was particularly apparent for groups other than Nematoda, particularly the Turbellaria, Gastrotricha, Polychaeta and Copepoda. As already reported, a quantitative estimation of the meiobenthos could not be made during the present survey.

### List of meiofauna species

Of the material collected from these islands, altogether 158 species could be identified and reported in the present paper. Several species remain to be identified and described, including those reported here at the generic level. Further intensive collection of these islands is likely to reveal the existence of more known and unknown species. A preliminary list of the identified meiofauna species of the diverse groups showing the records of their distribution on the 4 islands and other glogal areas, is given in Table 3. The meiofauna reported in the present study are mostly confined to those collected from the intertidal sediments and excludes those from other habitats. The collection data of the individual species will be reported at the time of publishing the detailed reports on the concerned groups. The distribution of meiofauna on other glogal areas is briefly indicated in the table owing to their numerous records. All the genera and species recorded in the present study are new to meiofauna of Lakshadweep.

## DISCUSSION

Due to lack adequate information on the composition, density and distribution of meiofauna inhabiting the intertidal sediments of atolls, it is difficult to make a close comparison of the present results obtained on Lakshadweep with those of the other areas. As elsewhere, the composition and density of the meeiofauna varied at different intertidal stations, localities and islands on these atolls. The texture of substrate with its effect on other parameters of the environment appeared to considerably influence the composition, density and distribution of meiofauna. In many of the world beaches investigated, the nematodes usually constituted a dominant element of the total meiofauna, while the copepods were the second in their overall abundance (McIntyre, 1969). The present investigation nearly indicated a similar composition, the nematodes dominating in the fine and sheltered areas with a higher percentage of organic detritus, while the copepods were well represented in clean and coarser sediments. The abundance of the other groups of meiofauna generally varied from area to area, making their comparison incongruous. The general preference of the meiofauna species larger in size to colonize the coarser sediments with adequate interstices is

TABLE 3

Alphabetical list of meiofauna species showing their distribution on Lakshadweep and other areas.

| Species | Minicoy | Kavaratti | Androth | Agatti | Other areas |
|---|---|---|---|---|---|
| HYDROZOA | | | | | |
| *Halammohydra* sp. | | | + | | |
| TURBELLARIA | | | | | |
| *Acanthomacrostomum gerlachi* Ax, 1971 | | + | + | + | India (Rao and Ganapati, 1968a), Maldives (Ax, 1971), Andamans (Rao, 1980). |
| *Coeloggnopora* sp. | + | + | | | |
| *Convoluta* sp. | | | | + | |
| *Gyratrix hermaphroditus* Ehrenberg, 1831 | | | + | | Cosmopolitan. |
| *Macrostomum* sp. | + | + | | + | |
| *Macrostomum* sp. | | + | | | |
| *Minona* sp. | + | | | | |
| *Nematoplana* sp. | + | + | | | |
| *Otoplana* sp. | | + | + | + | |
| *Promesostoma* sp. | + | | + | | |
| *Promesostoma* sp. | + | | | | |
| *Proxentes* sp. | + | | | | |
| *Utegla* sp. | | + | | | |
| NEMATODA | | | | | |
| *Anticoma acuminata* (Eberth, 1863) | | + | | | Cosmopolitan. |
| *Anticoma* sp. | + | | | | |
| *Chromodora* sp. | + | | | | |
| *Cytolaimium exile* Cobb, 1920 | | | | + | Eurytopic. |
| *Desmodora megalosoma* Steiner, 1918 | | + | | | Circumtropical. |
| *Desmodora* sp. | + | | | | |
| *Enoploides* sp. | | | + | | |
| *Halalaimus filum* Gerlach, 1962 | + | | | | Circumtropical. |
| *Halalaimus supercirrhatus* Gerlach, 1955 | + | + | | | Circumtropical. |
| *Halalaimus* sp. | + | | | | |
| *Halalaimus* sp. | | | | + | |
| *Haliplectus* sp. | | + | | | |
| *Linhomoeus* sp. | + | | | | |
| *Mesacanthion* sp. | | | + | | |
| *Metachromadora clavata* Gerlach, 1957 | | | | + | Circumtropical. |
| *Metacyatholaimus brevicollis* (Cobb, 1898) | + | | | | Circumtropical. |
| *Metepsilonema* sp. | + | + | + | + | |
| *Monoposthia costata* (Bastian, 1865) | | + | | | Cosmopolitan. |
| *Odontophora furcata* Wieser, 1956 | | | + | | Chile (Wieser, 1956), Maldives (Gerlach, 1962). |
| *Oncholaimus* sp. | | + | | | |
| *Paracyatholaimus duplicatus* Gerlach 1964 | + | | | | Maldives (Gerlach, 1964), India (Rao and Ganapati, 1968a). |
| *Platycoma africanum* (Gerlach, 1959) | | + | | + | Eurytopic (Indian Ocean). |
| *Procamacolaimus tubifer* Gerlach, 1953 | | | | + | Eurytopic (Indian Ocean). |
| *Rynchonema cinctum* Cobb, 1920 | + | | | | Eurytopic. |
| *Sabatieria hilarula* de Man, 1922 | + | | | | Eurytopic. |
| *Sabatieria* sp. | | + | | | |
| *Spirinia laevioides* Gerlach, 1963 | + | | | + | Maldives (Gerlach, 1963), India (Rao and Ganapati, 1968a). |
| *Synonchium obtusum* Cobb, 1920 | | + | | | Cosmopolitan (Tropical and warm temperate seas). |
| *Theristus* sp. | + | | | | |
| GASTROTRICHA | | | | | |
| *Acanthodasys aculeatus* Remane, 1927 | | + | | | Eurytopic (Indian and Atlantic Oceans). |
| *Aspidophorus marinus* Remane, 1926 | + | | | | Eurytopic. |

| Species | Minicoy | Kavaratti | Androth | Agatti | Other areas |
|---|---|---|---|---|---|
| *Chaetonotus atrox* Wilke, 1954 | + | | | | Eurytopic (Indian and Atlantic Oceans). |
| *Chaetonotus* sp. | + | + | | + | |
| *Chaetonotus* sp. | | | + | | |
| *Dactylopodola indica* (Rao and Ganapati, 1968) | | | | + | India (Rao and Ganapati, 1968b) Andamans (Rao, 1980). |
| *Macrodasys* sp. | | | + | | |
| *Paraturbanella* sp. | | + | + | | |
| *Pseudostomella indica* Rao, 1970 | | | | + | India (Rao, 1970). |
| *Tetranchyroderma* sp. | + | + | | + | |
| *Tetranchyroderma* sp. | | + | | | |
| *Thaumastoderma heideri* Remane, 1926 | | | + | | Eurytopic (Indian and Atlantic Oceans). |
| *Turbanella* sp. | | | | + | |
| *Urodasys viviparus* Wilke, 1954 | | | + | | Eurytopic (Indian and Atlantic Oceans). |
| *Xenotrichula velox* Remane, 1927 | | + | | | Eurytopic (Indian and Atlantic Oceans). |
| *Xenotrichula* sp. | | | + | | |
| KINORHYNCHA | | | | | |
| *Cateria gerlachi* Higgins, 1968 | | | + | | India (Higgins, 1968), Andamans (Rao, 1980). |
| *Echinoderes* sp. | | | | + | |
| NEMERTINA | | | | | |
| *Ototyphlonemertes* sp. | | | + | | |
| ARCHIANNELIDA | | | | | |
| *Dinophilus* sp. | + | | | | |
| *Diurodrilus benazzii* Gerlach, 1952 | | | | + | Mediterranean (Gerlach, 1952), India (Rao and Ganapati, 1968a), Andamans (Rao, 1980). |
| *Nerilla antennata* Schmidt, 1863 | | + | | + | Cosmopolitan ? |
| *Nerillidium* sp. | | + | | | |
| *Polygordius madrasensis* Aiyar and Alikunhi, 1944 | | | + | | India (Aiyar and Alikunhi, 1944), South Africa (Jouin, 1975), Andamans (Rao, 1980). |
| *Polygordius uroviridis* Aiyar and Alikunhi, 1944 | | | + | | India (Aiyar and Alikunhi, 1944), South Africa (Jouin, 1975). |
| *Protodrilus indicus* Aiyar and Alikunhi, 1944 | + | + | + | + | India (Aiyar and Alikunhi, 1944), Andamans (Rao, 1980), Malaysia (Renaud-Mornant and Serène, 1967), New Caledonia (Jouin, 1970). |
| *Protodrilus pierantonii* Aiyar and Alikunhi, 1944 | | | + | | India (Aiyar and Alikunhi, 1944), Andamans (Rao, 1980), Galapagos (Westheide, 1977b). |
| *Protodrilus* sp. | + | + | | | |
| *Protodrilus* sp. | | | | + | |
| *Saccocirrus krusadensis* Alikunhi, 1948 | | | + | | India (Alikunhi, 1948a), South Africa (Jouin, 1975) Andamans (Rao, 1980), Australia (Brown, 1981), Pacific Ocean (Jouin, 1975). |
| *Saccocirrus minor* Aiyar and Alikunhi, 1944 | | | + | + | India (Aiyar and Alikunhi, 1944), Andamans (Rao, 1980), Malaysia (Renaud-Mornant and Serene, 1967). |
| *Saccocirrus orientalis* Alikunhi, 1946 | | + | | | India (Alikunhi, 1946), South Africa (Jouin, 1975), Andamans (Rao, 1980). |
| *Saccocirrus* sp. | | | | + | |
| POLYCHAETA | | | | | |
| *Autolytus* sp. | | | + | | |
| *Brania subterranea* (Hartmann-Schröder, 1956) | | | | + | Cosmopolitan (Tropical and warm temperate seas). |
| *Brania* sp. | | + | + | | |
| *Ceratonereis* sp. | | | + | | |

| Species | Minicoy | Kavaratti | Androth | Agatti | Other areas |
|---|---|---|---|---|---|
| *Eusyllis homocirrata* Hartmann-Schröder, 1958 | | | + | | Circumtropical. |
| *Exogone* sp. | | | | + | |
| *Exogone* sp. | + | | + | | |
| *Goniadides aciculata* Hartmann-Schröder, 1960 | | + | | | Red Sea (Hartmann-Schroder, 1960), India (Rao, and Ganapati, 1968a), Andamans (Rao, 1980). |
| *Hesionides arenaria* Friedrich, 1937 | | + | | + | Cosmopolitan. |
| *Hesionides gohari* Hartmann-Schröder, 1960 | + | + | + | | Tropical and temperate in Atlantic and Indian Oceans. |
| *Hesionides minima* Westheide and Rao, 1977 | | | + | | India (Westheide and Rao, 1977). |
| *Hesionides* sp. | + | | | | |
| *Langerhansia cornuta* (Rathke, 1843) | | + | | + | Eurytopic (Indian and Atlantic Oceans). |
| *Microphthalmus uroflmbriatus* Alikunhi, 1948 | | | + | | India (Alikunhi, 1948b), Red Sea (Hartmann-Schröder, 1960), South Africa (Berrisford, 1969), Andamans (Rao, 1980). |
| *Parasphaerosyllis indica* Monro, 1937 | | + | | | Circumtropical. |
| *Petitia amphophthalma* Siewing, 1956 | | | | + | (Cosmopolitan (Tropical and warm temperate seas). |
| *Pisione africana* Day, 1963 | | + | | | South Africa (Day, 1963), Ivory Coast (Laubier, 1967), Tuamotu (Renaud-Mornant, Salvat and Bossy, 1971). |
| *Pisione complexa* Alikunhi, 1947 | | + | + | + | India (Alikunhi, 1947). |
| *Pisione gopalai* (Alikunhi, 1941) | | | + | | India (Alikunhi, 1941). |
| *Pisionidens indica* (Aiyar and Alikunhi, 1940) | + | + | + | + | Circumtropical. |
| *Pseudonereis variegata* (Grube, 1856) | | | | + | Circumtropical. |
| *Schroederella* sp. | | + | | | |
| *Streptosyllis* sp. | | | + | | |
| *Sphaerosyllis* sp. | | + | | | |
| *Syllis gracilis* Grube, 1840 | | | + | | Cosmopolitan (tropical and temperate seas). |
| *Typosyllis variegata* (Grube, 1860) | | | + | + | Cosmopolitan (tropical and temperate seas). |
| *Typosyllis* sp. | + | | | | |
| OLIGOCHAETA | | | | | |
| *Enchytraeus* sp. | | + | | | |
| *Marionina* sp. | + | + | + | + | |
| *Marionina* sp. | + | | | | |
| OSTRACODA | | | | | |
| *Cythereis* sp. | + | + | | + | |
| *Polycope* sp. | | | + | | |
| COPEPODA | | | | | |
| *Ameira parvula* (Claus, 1866) | + | + | | + | Cosmopolitan. |
| *Ameira* sp. | | + | | | |
| *Amphiascus* sp. | | | + | | |
| *Arenopontia indica* Rao, 1967 | | + | + | + | India (Rao, 1967), Andamans (Rao, 1980). |
| *Arenopontia subterranea* Kunz, 1937 | | | | + | Eurytopic. |
| *Arenopontia* sp. | + | | | | |
| *Apodopsyllus camptus* Wells, 1971 | | + | | | India (Wells, 1971), Andamans (Rao, 1980). |
| *Apodopsyllus* sp. | | | | + | |
| *Arenosetella germanica* Kunz, 1937 | | | + | | Eurytopic. |
| *Arenosetella* sp. | | | | + | |
| *Cyclopina* sp. | + | | | | |
| *Ectinosoma melaniceps* Boeck, 1864 | | | + | + | Cosmopolitan. |
| *Ectinosoma* sp. | | + | | | |
| *Enhydrosoma* sp. | + | | | | |

| Species | Minicoy | Kavaratti | Androth | Agatti | Other areas |
|---|---|---|---|---|---|
| *Halectinosoma* sp. | | | + | | |
| *Haloschizopera tenuipes* Noodt, 1964 | | | | + | Red Sea (Noodt, 1964). |
| *Harpacticus gracilus* Claus, 1863 | + | + | | + | Cosmopolitan. |
| *Hastigerella* sp. | | | + | | |
| *Kliopsyllus psammophilus* (Noodt, 1964) | | | | + | Red Sea (Noodt, 1964), Malaysia (Renaud-Mornant and Serène, 1967), India (Rao, 1980). |
| *Kliopsyllus* sp. | + | + | + | + | |
| *Laophonte cornuta* Philippi, 1840 | | + | | | Cosmopolitan. |
| *Leptastacus* sp. | + | | | | |
| *Leptopsyllus* sp. | + | + | + | + | |
| *Longipedia weberi* A. Scott, 1909 | | | + | | Eurytopic (Indian Ocean). |
| *Nitocra affinis* Gurney, 1927 | | | | + | Tropical and warm temperate seas. |
| *Noodtiella intermedia* Wells, 1967 | | + | | | Mozambique (Wells, 1967), Andamans (Rao, 1980). |
| *Paralaophonte* sp. | | + | + | | |
| *Paraleptomesochra minima* Wells, 1967 | | | | + | Mozambique (Wells, 1967), Andamans (Rao, 1980). |
| *Paramesochra longicauda* Nicholls, 1945 | | | | + | Eurytopic. |
| *Paramesochra* sp. | + | + | + | + | |
| *Phyllopodopsyllus longicaudatus* A. Scott, 1909 | | | | + | Cosmopolitan. |
| *Porcellidium* sp. | + | | | | |
| *Psammastacus spinicaudatus* Rao and Ganapati, 1969 | | | + | | India (Rao and Ganapati, 1969), Andamans (Rao, 1980). |
| *Sicameira langi* Rao, 1972 | | + | | | India (Rao, 1972b), Andamans (Rao, 1980). |
| *Stenhelia* sp. | | | | + | |
| *Tisbe furcata* (Baird, 1837) | + | + | + | | Cosmopolitan. |
| ISOPODA | | | | | |
| *Angeliera* sp. | | + | + | + | |
| *Microcerberus anfindicus* Messana, Argano and Baldari, 1978 | | + | | | Somalia and Malidves (Messana, Argano and Baldari, 1978). |
| *Microcerberus predatoris* (Gnanamuthu, 1954) | | | + | | India (Gnanamuthu, 1954). |
| AMPHIPODA | | | | | |
| *Bogidiella* sp. | | + | + | | |
| *Melita* sp. | | | | + | |
| TARDIGRADA | | | | | |
| *Batillipes mirus* Richters, 1909 | | | | + | Eurytopic. |
| *Parastygarctus higginsi* Renaud-Debyser, 1965 | | | + | | Madagascar (Renaud - Debyser, 1965), Malaysia (Renaud-Mornant and Serène, 1967), Andamans (Rao, 1980). |
| HALACARIDA | | | | | |
| *Copidognathus* sp. | | + | + | + | |
| *Halacarus anomalus* Trouessart, 1894 | | + | + | + | Eurytopic. |
| *Halacarus* sp. | | | | + | |
| MOLLUSCA | | | | | |
| *Caecum glabrum* (Montagu, 1849) | | | + | | Eurvtopic. |
| *Pseudovermis indicus* Salvini-Plawen and Rao, 1973 | | | + | + | India (Salvini-Plawen and Rao, 1973), Andamans (Rao, 1980). |
| *Unela* sp. | | | + | | |
| HOLOTHUROIDEA | | | | | |
| *Leptosynapta* sp. | | | + | | |

well known. Due to the relatively sheltered habitat of the lagoon side on these islands, there was also a predominance of the detritus feeders, while the predator species were very few.

The quantitative distribution of meiofauna in the intertidal sediments of these islands shows nearly the same pattern as reported on other world beaches, the richest populations inhabiting the sheltered areas and detritus sands with adequate interstices. The available data indicate that the densities of meiofauna populations recorded on these atolls are considerably lower than those of the other global areas. The relatively sheltered beaches on these islands with greater stability and adequate partical size should have supported denser populations of the meiofauna. When compared with the situations having nearly similar biotopes, the present values closely approach those recorded on the Bimini Island, Bahamas (Renaud - Debyser, 1963). As the environmental parameters were not studied in the present work, the paucity of meiofauna in these intertidal sediments could not possibly be explained. However, the poor organic detritus of the coralline sands is likely to be one of the important factors influencing their abundance. The horizontal and vertical distribution pattern of the total meiofauna in the habitat can also most closely be compared with that known on the Bimini Island (*loc. cit.*). However, as the present data were collected only during December and January following intense monsoon on these islands, these results are subject to seasonal variation in the abundance and vertical distribution of the meiofauna.

The observed pattern of the decreased diversity of species and the increase in the abundance of meiobenthos individuals in the bottom sediments of these lagoons has also been reported earlier on the Maturei Vavao atoll, where diversity of species decreased with increasing depth of the lagoon (Renaud-Mornant, Salvat and Bossy, 1971).

A zoogeographical comparison of the meiofauna of Lakshadweep is difficult at this stage, as several species are yet to be reported for these islands and the Indian Ocean coasts are still very incompletely investigated. However, an analysis of the list of meiofauna species presented in Table 3 is of considerable distributional significance, as the character of its fauna is to be based on its endemic element. The composition and abundance of the genera and species of these islands are nearly the same as known on other explored areas of the world. None of the genera are endemic, all being widely distributed in the tropical and temperate regions. Many of the known species recorded in the present survey are dominated by eurytopic forms being largely circumtropical or cosmopolitan in their distribution. Many of the species reported here at the generic level are likely to be new species and are to be treated as uncertain endemics for the present. The close examination of the material showed that a considerable percentage of the meiofauna species of Lakshadweep is new to science, although they presented only little morphological variation compared with the known species. Many of the oceanic islands are expected to exhibit a higher degree of endemicity due to their isolation, but the increasing investigations in recent years on different global areas are progressively limiting the

endemic species to a small number. Thus, the zoogeographical ranges of the meiofauna species will continue to increase as more and more areas are explored, resulting in closer faunal relationships. However, it is not possible at present to estimate the exact amount of endemism for these islands, but the available data suggests that the meiofauna of Lakshadweep exhibits a nearly similar amount of endemism known on the other oceanic islands, as Galapagos (Ax and Schmidt, 1973; Westheide, 1977a) and Andamans (Rao, 1980). Thus, the Lakshadweep meiofauna appears to have only a limited phylogenetic development of its own restricted to the formation of endemic species.

Recent studies in the Indian Ocean indicated a worldwide distribution of many meiofauna genera and species (Rao, 1980). The limited data available in this region suggests a closer relationship of the Laskshadweep meiofauna with nearby areas of the Western Indian Ocean, such as Red Sea, South Africa, Madagascar, Maldives and India, showing the distribution of many species in common. A close comparison of the meiofauna of Lakshadweep with that of the adjacent Indian subcontinent shows a general similarity in the composition of fauna between them. Several species recorded on the continent are now discovered on these islands and of the 79 known species listed here, about 70 species are common to both these areas. The Lakshadweep meiofauna also shows some closer affinities with the fauna of adjacent Maldives located on the south.

The Lakshadweep were geologically thought to be very young, but recent researches have indicated their formation as a result of coral growth over the continuation of the Aravalli system of mountain range of Rajasthan and Gujarat on the Indian mainland from late tertiary times (Mukundan, 1979). The Lakshadweep—Maldive and Chagos submarine ridge—is also known to have a great influence on the circulation of water masses in this part of the Indian Ocean. Much of the uniformity of the Indian and Lakshadweep meiofauna recorded in the present study is probably due to the common ancestry acquired in the past geological ages. This may possibly be explained in terms of the continental drift hypothesis (Rao, 1972a, 1980; Sterrer, 1973). Had there been land connections between them in the recent geological ages, the Indian faunal element would have probably constituted a more prominent element in the Lakshadweep fauna and a much more faunal similarity would have existed. Thus, the amount of endemism present in these islands probably indicates the period of their isolation from the Indian mainland. In this connection, it is also relevant to consider the various means of meiofaunal dispersal by drifting ways as suggested by Gerlach (1977) to explain their present pattern of distribution. While explaining the great meiofaunal uniformity of the Galapagos Islands, Westheide (1977a) concluded that it was due to the dispersal both by plate tectonics and some other means across the open oceans. As the Indian Ocean constitutes a biological link between the Atlantic and Pacific Oceans, the increasing knowledge on the distribution of meiofauna on its areas will possibly help a lot in constructing the mechanism of their worldwide distribution.

The continental margins are generally known to support a higher density and diversity of meiofauna due to the presence of vast stretches of sandy beaches for the colonization of the fauna. Thus, certain areas on the adjacent Indian subcontinent are richer both in the number of species and their abundance (Rao and Ganapati, 1968a; McIntyre, 1968) than that of the Lakshadweep. Atolls, because of their isolation and small size, offering limited stretches of the sandy habitat, are generally thought to harbour poor populations of the meiofauna. But, although these islands are small in size, the presence of relatively sheltered and stable coralline sandy beaches with adequate coarse particle size, offered a suitable substratum for the colonization of dense and diverse groups of meiofauna. Thus, the atolls of Lakshadweep proved nearly as rich in meiofauna as that of some of the continental margins. A further survey of the deeper parts of these lagoons and the remaining islands of the archipelago is necessary for a better understanding of the composition and distribution of the meiofauna of Lakshadweep.

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## Summary

The paper reports the results of a preliminary survey of the meiofauna inhabiting the coralline sediments of Lakshadweep. A brief description of the topography, physical conditions and climate of these little known islands is given. The meiofauna of the area proved to be sufficiently rich and varied. All the typical meiofauna groups are present. A quantitative estimate of the diverse taxonomic groups encountered is given. The density of total meiofauna individuals in these intertidal sediments ranged from 26 animals/100cm$^3$ to 1440 animals/100cm$^3$. The distribution of meiofauna in the habitat nearly followed the same pattern known on other world beaches. A list of 158 species collected on these islands is given along with their known geographical distribution. A high percentage of the Lakshadweep meiofauna is not endemic. Several genera and species regarded as widespread and cosmopolitan were recorded. All the genera and species recorded in the present survey are new to the meiofauna of Lakshadweep. Many more species are likely to be discovered with a further survey of these islands. The present study supports the forthcoming evidence that several meiofauna species are widely distributed and any future investigations of the unexplored areas are quite likely to indicate a closer meiofaunal relationship. The distribution of meiofauna is discussed in relation to the nature of the substratum and the age of these islands. The Lakshadweep meiofauna appears to exhibit only a limited phylogenetic development of its own, as known for certain other oceanic islands.

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