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CLUSTER FORMATION OF ZOOPLANKTON AND ITS RELATION TO SEASONAL VARIATION

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The survey of zooplankton was carried out in Plak Bay near to Mandapam. Regular fortnightly sample collections were made for two years from November 1993 to October 1995. A total of 81species of zooplankton were observed during the study period. The abundance and distribution pattern of each and every species show direct relation to seasonal effect. The results also affirm significant cluster formation during the study period.

INTRODUCTION

The regular and periodic climatic changes synchronised with season is ultimately reflected in the environmental parameters, which inturn to have a direct or indirect control over the planktonic population. thus cause changes in composition, density and distribution pattern. A preliminary account of the plankton of the inshore waters of Bay of Bengal at Madras city has described by Jayaraman (1954). More detailed investigation in the same area was reported by Ramamurthy (1953). Prasad (1954) described the characteristics of marine plankton at an inshore station in the Gulf of Mannar based on regular plankton samples. Further, the methods of collection and enumeration of the various components were described by Prasad *et al.* (1952).

The abundance and distribution of a species of zooplankton in a place strictly depends on biohydrographical feature, the most important factors limiting the distribution of a particular species being temperature and salinity. The study of zooplankton an aspect of biological oceanography, is vital because of their significant role in the food web of aquatic environment.

A general account of zooplankton distribution in the near shore water of Goa was recorded by Rajagopal (1981) and Goswami (1982). Copepods occupy a strategic position in the pelagic food-web. Being the principal phytoplankton grazers in aquatic ecosystem, they play a leading role in converting the plant material into animal tissue. Hence, the fate of energy transfer from producers to higher trophic level (consumers) primarily depend on them. In general, copepods constitute a dominant proportion among zooplankton community in all types of marine biotopes. Also, a few species of copepod are used as indicator organisms for assessing the water quality, including pollution stress.

Thus, the present investigation furnishes a comparative account of the changes in the planktonic group formation in relation with seasonal variation and the general interrelationships were discussed.

MATERIALS AND METHODS

The survey of zooplankton was carried out in the Palk bay near Mandapam (S. India). Regular fortnightly sample collections were made for two years from November 1993 to October 1995. The plankton samples were made at the above chosen station. The mean depth of water at the above station was 10 - 12 meters. The plankton collections were made for fifteen minutes subsurface hauls using a 50 cm mouth diameter net made of bolting silk cloth (No.14, net, mesh size 60μ) by a slow moving mechanised trawling boat. The volume of filtered water was calcula-

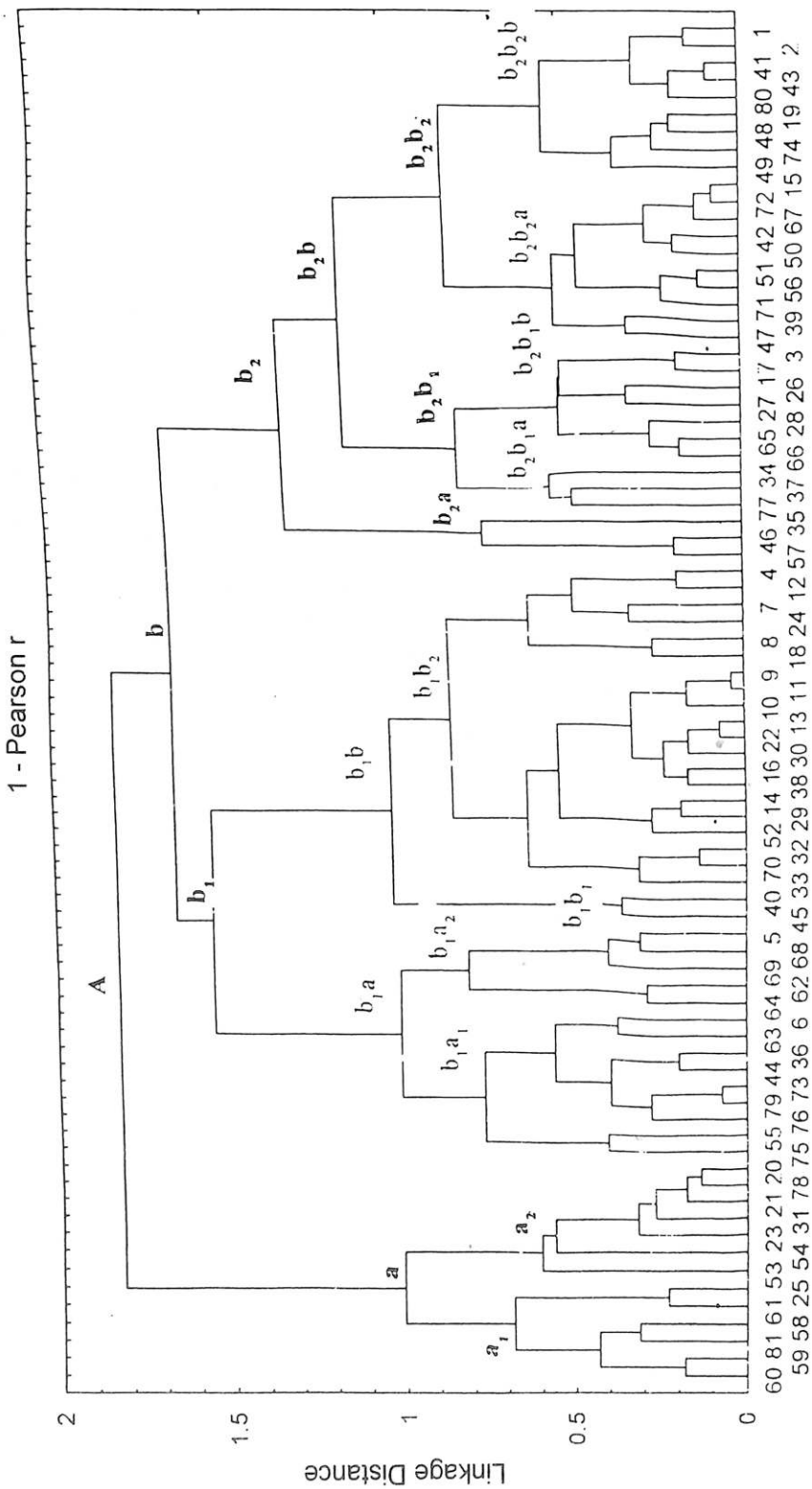

Fig. 1 : Tree diagram for 81 variables

Cluster Analysis

Major Group A

a

a_1 (Post monsoon)

60 *Lucifer typus*
59 *L.hanseni*
81 *Rhincalanus* sp.
58 *Mysid* sp.
61 *L.reynaudi*
25 *Sagitta enflata*

a_2 (Post monsoon - summer)

53 *Pseudodiaptomus* sp
54 *Sapphirina* sp.
23 *Pleurobrachia globosa*
31 *Krohnitta pacifica*
21 *Bougainvillia fulva*
78 *Paracalanus parvus*
20 *Cytaeis tetrastyla*

b_1a_1 (Monsoon)

75 *Corycaeus affinis*
55 *Scolecithrix* sp.
76 *Labidocera* sp.
79 *Neocalanus* sp.
73 *Canthocalanus pauper*
44 *Eucalanus* sp.
36 *Acrocalanus gibber*
63 *O.fusiformis*
6 *T.gracilis*

b_1a_2 (Monsoon)

64 *Doliolum* sp.
62 *O.dioica*
69 *Gastropod veliger*
68 *Bivalve veliger*
5 *Cyttarocylis* sp.

b_1b, b_1b_1 (Summer/pre/post monsoon)

45 *Euchaeta* sp.
40 *Candacia* sp.

b_1b_2 (Summer)

33 *Autolytus* sp.
70 *Diphyes* sp.
32 *Tomopteris* sp.
52 *Pseudocalanus* sp.
29 *S.pacifica*
14 *Eutima curva*
38 *A.clausi*
16 *Rhopilema esculentum*
30 *S.bedoti*
22 *Phialucium* virens
13 *Obelia medusae*
10 *T.tocantinensis*
11 *T.nordquisti*
9 *T.mortensenii*
18 *Physalia* sp.
8 *T.butschlii*
24 *Beroe* sp.
7 *Leprotintinnus* sp.
12 *Eutintinnus* sp.
4 *T.radix*

b_2, b_2a (Summer and premonsoon)

57 *Undinula* sp.
46 *Eurytemora* sp.

b_2b, b_2b_1 (Summer and premonsoon)

35 *Penilia avirostris*
77 *Oithona* sp.
37 *A.spinicauda*
34 *Evadne tergestina*
66 *Cyclosalpa* sp.
65 *Salpa fusiformis*
28 *S.tenuis*
27 *S.robusta*
17 *Porpita pacifica*
3 *T.dadayi*

b_2b_2, b_2b_2a (Summer and premonsoon)

47 *Lucicutia flavicornis*
39 *A. pacifica*
71 *Muggiaea atlantica*
56 *Temora stylifera*
51 *Nannocalanus* sp.
50 *Macrosetella gracilis*
42 *Calonopia thompsoni*
67 *Thalia* sp.
72 *A.erythraea*
15 *Aequorea parva*

b_2b_2b (Premonsoon)

49 *Microcalanus*
74 *Centropages* sp.
48 *Metacalanus*
19 *Carybdea rastonii*
80 *Pleuromamma gracilis*
43 *Copilia* sp.
41 *Calocalanus* sp.
2 *Acanthometra* sp.
1 *Globigerina* sp.

ted with the help of flowmeter fitted in the ring.

RESULTS

A total of 81 species of zooplankton was recorded during the study period. Among which 12 species of Protozoa, 14 species of coelenterata, 2 species from each group of ctenophora, cladocera, polychaets and molluscs, 32 species from copepods, 4 species from decapods, 7 species from chaetognatha and 6 species from tunicates were identified. All the species occurrence and abundance vary season to season and also formed the cluster.

The cluster analysis of zooplankton formed by mainly two groups and many sub groups of different levels (Fig. 1). Each sub-groups behaved differently. Generally all the species of the sub-groups were linked with the related species and form a dominant group of species demarking the season. The formation of each group includes maximum population or minimum population or sporadic population or seasonal population for the concerned season. Thus clearly indicates the group formation in the respective seasons.

In the study area Palk Bay (near Mandapam) the self association of zooplankton species was mainly grouped into two **a** and **b**. The group **a** was comparatively small and this group was sub-grouped into $\mathbf{a}_1$ and $\mathbf{a}_2$ whereas the group **b** was a larger group, divided into $\mathbf{b}_1$ and $\mathbf{b}_2$. The $\mathbf{b}_1$ was further categorised into $\mathbf{b}_1\mathbf{a}$ and $\mathbf{b}_1\mathbf{b}$ and again these $\mathbf{b}_1\mathbf{a}$ group was classified into $\mathbf{b}_1\mathbf{a}_1$ and $\mathbf{b}_1\mathbf{a}_2$, identically $\mathbf{b}_1\mathbf{b}$ into $\mathbf{b}_1\mathbf{b}_1$ and $\mathbf{b}_1\mathbf{b}_2$. The sub-group $\mathbf{b}_2$ was divided into $\mathbf{b}_2\mathbf{a}$ and $\mathbf{b}_2\mathbf{b}$. The $\mathbf{b}_2\mathbf{b}$ group was again divided into $\mathbf{b}_2\mathbf{b}_1$ and $\mathbf{b}_2\mathbf{b}_2$. The group $\mathbf{b}_2\mathbf{b}_1$ again segregated into $\mathbf{b}_2\mathbf{b}_1\mathbf{a}$ and $\mathbf{b}_2\mathbf{b}_1\mathbf{b}$, similarly $\mathbf{b}_2\mathbf{b}_2$ grouped into $\mathbf{b}_2\mathbf{b}_2\mathbf{a}$ and $\mathbf{b}_2\mathbf{b}_2\mathbf{b}$. The linkage pattern for these sub-groups are presented (Fig.1).

DISCUSSION

Monsoon played a major role in the distribution and abundance of zooplankton population in tropical water. The study area Palk Bay (near Mandapam) are much influenced by the northeast monsoon.

In the present study area, the cluster analysis reveals that formed by many groups, the sub-group $\mathbf{a}_1$ mainly formed by post monsoon dominant species. The members of $\mathbf{a}_2$ group were available during post monsoon to summer whereas in the case of $\mathbf{b}_1\mathbf{a}_1$ and $\mathbf{b}_1\mathbf{a}_2$ were aggregated by monsoon dominated species. The $\mathbf{b}_1\mathbf{b}_2$ group formed by summer dominant species. The $\mathbf{b}_2$ group divided into $\mathbf{b}_2\mathbf{a}$ and $\mathbf{b}_2\mathbf{b}$. Both the group of species were present during summers and premonsoon months. The group $\mathbf{b}_2\mathbf{b}$ again divided into $\mathbf{b}_2\mathbf{b}_1$ and $\mathbf{b}_2\mathbf{b}_2$. The former one extends summer to premonsoon and latter one was a premonsoon species.

The cluster analysis clearly indicates that the following species are functional species, specifically behave like an organiser and formed separate group with respect of season. The dominant contribution of *Tomopteris* sp., *Diphyes* sp., *Muggiawa atlantica*, *S. pacifica*, *A. centrua*, *Alciopa* sp., *T. nordquisti*, *Pleurobranchia globosa* and *Beroe* sp. were constituted a group during summer (*i.e.* hypersaline species). In summer and premonsoon seasons some species like *Oithona* sp., *Obelia medusae*, *Aequorea parva*, *Porpita* sp., *Calanopia thompsoni*, *A. spinicauda* and *T. dadayi* (*i.e.* moderate saline species), culminate this season and amenably congregate the other species. The monsoon season was conquered by *Oikopleura diocia*, *T. gracilis*, *Canthocalanus* sp., *Cyttarocylis* sp. and *Gastropod veliger* (*i.e.* hyposaline species) which play a major role in aggregating other friendly species. But prominent functional species *S. enflata* perform the grouping of related species during monsoon. Hence the dominant occurrence of these functional species indicates the specific season, in otherwords the parameters remain unique to that particular season. Further, these functional species of particular group maintained good relationship with

other widely tolerant or seasonal species, which may represent the year throughout or in particular seasons. Thus maintaining a copious secondary productivity in these areas. These results much more coincide with the natural survey of zooplankton and their relation with seasons during the study period.

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REFERENCES

GOSWAMI, S.C. 1982. Distribution and diversity of copepods in the Mandovi - Zuari estuarine systems in Goa. *Indian J. Mar. Sci.* **11**(4) : 292 - 294.

JAYARAMAN, R. 1954. Seasonal variations in salinity, dissolved oxygen and nutrient slats in the inshore waters of the Gulf of Mannar and Palk Bay near Mandapam. *Indian J. Fish.* **1**(1) : 345 - 364.

PRASAD, R.R. 1954. The characteristics of marine palnkton at an inshore station in the Gulf of Mannar near Mandapam. *Indian J. Fish.* **1**(1) : 1 - 35.

PRASAD, R.R., BAPAT, S.V. & TAMPI, P.R.S. 1952. Observations on the distribution of plankton at six inshore stations in the Gulf of Mannar. *J. Zool. Soc. India.* **4** : 141 - 151.

RAJAGOPAL, M.D. 1981. Plankton studies in estuarine and near shore regions of Mandovi - Zuari. *Indian J. Mar. Sci.* **10**(2) : 112 - 115.

RAMAMURTHY, S. 1953. Hydrobiological studies in the Madras coastal waters. *J. Mad. Univ.* **23**(B)2 : 136 - 148.