Ecology of benthic macrofauna in Cuddalore-Uppanar backwater, southeast coast of India

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Benthic fauna were mainly represented by polychaetes, molluscs, crustaceans and ‘others’. Faunal diversity was more in st I than at the other station. Polychaetes were found dominant in st I whereas the dominance of crustaceans at st II was due to the tanaid *Apsides chilkensis* and accordingly lower faunal diversity than at st I. Highly significant correlation was observed between benthic fauna and organic carbon. Station II showed higher organic carbon content owing to the addition of organic substances from sewage outlets and wastes from coconut husk retting grounds.

Benthic organisms form an important component of the food web and are regarded as the efficient recyclers of nutrients. The potentiality of an aquatic ecosystem is determined by the benthic production which in turn is influenced by the physical and chemical factors. This study was carried out in Uppanar backwater to know the abundance and seasonal variation of macrobenthos in relation to physico-chemical parameters.

Materials and Methods

The present study was carried out in 2 stations of Uppanar backwater, Cuddalore (Fig.1) from October 1986 to September 1988. Sediment samples were taken by Peterson’s grab (0.08 m²) in a single haul, sieved through 0.5 mm mesh and the animals were sorted out and preserved. A portion of the fresh mud sample was transferred to a clean plastic bag, air dried and used for the granulometric analysis¹ and organic carbon². The species diversity³, species richness⁴ and evenness⁵ were calculated.

Results and Discussion

*Environmental parameters* — The variations in temperature, salinity and dissolved oxygen are presented in Fig.2. Changes in temperature had no profound influence on the distribution of benthic fauna (see Figs.3,4) as evidenced by the insignificant correlation between benthic fauna and temperature. The dissolved oxygen was on the higher side during most part of the year and showed significant negative correlation (1986-87: st I *P* < 0.05; 1987-88: st I and II *P* < 0.01) with benthic fauna as observed in Vellar estuary⁶. The increase in faunal abundance with increase in salinity indicated the adaptation of benthic organisms towards higher salinity.

*Species composition* — Forty species at st I and 44 species at st II were observed in the present study. The fauna were represented by:


![Fig. 1 - Location of sampling stations](image-url)
Molluscs - Bivalves: *Anadara granosa, A. rhombia*, *Katelysia opima, Meretrix meretrix, M. casta, Perna viridis, Tellina cuspis, Tellina nobilis* and *Solen* sp.

Gastropods: *Cerithidea fluviatilis, Nassa* sp., *N. dorsata, Natica* sp., *N. tigrina, Turetella attenuata* and *Umbonium vestiarium*.

Crustaceans: *Alpheus malabaricus, Apsuedes chilkensis, A. gymnopobia, Amphipod, Hermit crab (Clibanarius sp.) Isopod, Penaeus indicus, P. monodon* and *P. semisulcatus*.

The group 'others' was mainly constituted by fish larvae, sea anemone, polyclad, nemertines, nematode, star fish, brittle star, mysids and gobid fish.

The distribution and abundance of polychaetes like *Ancistroyclis constricta, Ceratonereis costae, Diopatra neapolitana, Heteromastus similis* and *Nephtys polybranchia* throughout the year may be due to their continuous breeding habits. A cyclic pattern in species distribution (near faunal depletion in monsoon followed by colonization in postmonsoon and growth and structural development in premonsoon season) was observed in the present study as reported in Goa estuaries.

**Population density** — The population density (Fig.3) was higher in st II than in st I. Seasonal variation showed minimum during monsoon due to low salinity and flushing of the soft bottom sediment as observed in Vellar estuary° and maximum during premonsoon season. The fluctuations observed in the numerical abundance of benthic fauna may be attributed to unstable nature of the bottom sediment and salinity.

The numerical abundance of macrobenthos observed in the present study was less when compared to 3512.m⁻² reported for Vellar estuary° and
4313 m\(^{-2}\) recorded in Coleroon estuary\(^9\). Statistical analysis showed significant positive correlation with organic carbon \((P<0.01)\). Analysis of variance showed significant differences in density between the 2 stations.

**Percentage composition of benthic fauna** — The percentage composition of polychaetes, crustaceans, molluscs and 'others' is presented in Fig.4. The polychaetes were abundant (33.3\%) in st I whereas the crustaceans (58.38\%) especially *Apseudes chilkensis* and *A. gymnophobia* dominated the benthic fauna in st II.

Species diversity, species richness and evenness — Diversity, richness and evenness values are presented in Fig.5. In general, diversity was higher at st I than that of st II. Station I showed high richness values and the seasonal variation showed minimum values during monsoon. The premonsoonal diversity minima in st II could be attributed to the dominance of single species, *Apseudes chilkensis* as noticed in the brackishwater impoundment of Hooghly-Matlah estuary\(^10\). The low diversity values during monsoon at st I could be due to the influence of heavy freshwater flow and subsequent changes in physico-chemical parameters.

**Sediment composition** — The percentage of sand, silt and clay in sediment at both stations is given in Fig.6. Higher sand percentage was observed in summer and the nature of the substratum was silty sand at both stations. The higher benthic population density was associated with silty-sand substratum at both stations. The higher biomass values associated with sandy substratum followed by silty bottom was reported in the estuarine complex of Goa\(^11\). In another study from the shelf region of west coast of India\(^12\) it was reported that the sedimentary type is a dominant criterion in the distribution of marine invertebrates.

**Organic carbon (OC)** — Seasonal variations in total OC are presented in Fig.3. Minimum and maximum values were observed during monsoon and premonsoon seasons respectively. Station II showed higher OC content than that of st I.

The high benthic faunal densities were found to be associated with rich OC content in the present study. The higher OC values recorded in the silty-sand
Fig. 6 Percentage composition of sediment

Station II showed a high numerical abundance of benthic fauna than st I. It may be inferred that high OC content and the optimum environmental conditions at st II were responsible for rich numerical abundance of benthos.

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References

Substratum might be due to the addition of organic substances from sewage outlets and wastes from the adjacent coconut husk retting grounds. The high OC content of 15.042 mgC.g⁻¹ noticed at st II was comparatively higher than that of 13.8 mgC.g⁻¹ recorded in Coleroon estuary⁹, but lower than the value of 23.18 mgC.g⁻¹ reported in Vellar estuary⁶.

In coastal waters of east coast of India OC content >6% in sediments was anoxic to bottom fauna¹³. However, in the present study, it was found to be lower than this limit and never reached the anoxic conditions.