Distribution of Benthos In Relation to Different Environmental Variables in Mulki Estuary

N.Sivashankar * Chethan N** and T.Ch.Jhansi Lakshmi Bai***

*College of Agriculture, Bheemarayanagudi, UAS Raichur, Karnataka
**Fisheries Research and Information Centre, Hebbal UAS Bangalore
***Department of Aquaculture, College of Fishery Science, SVV University, AndhraPradesh

Abstract:- **The distribution of benthos in relation to environmental variables was studied in Mulki estuary, Dakshina kannada, Karnataka. The study was carried out from August, 2007 to July, 2008 from the four different locations in the Mulki estuary. The hydrographical parameters had a significant effect on the distribution of clams between stations and months. Mollusca, polychaetes and crustaceans became the dominating groups in the benthic community and higher populations were observed during the premonsoon and post monsoon season. The mean population density of *M. Casta* and *P. malabarica* varied from 43 to 83 and 29 to 60 no/m^2 respectively, with pre and post monsoon recorded good numbers of spat population. The population studies, Length –weight and height-weight relationships indicated an isometric growth and Negative allometric between length on width, length on meat weight, shell on meat weight and wet weight on dry weight in *M.casta* and *P.malbarica.***

Key words: Estuary, variables, macrobenthos, monsoon

I. INTRODUCTION

Estuaries and backwaters in India occupy 1.44 million hectare water spread area (Anon., 2006). Both east and west coasts are interspersed with several estuaries and backwaters of varying length. Each one of them is different from another mainly due to river inflow tidal ingress and basin topography. Rao *et al.* (1989) estimated clams and oyster resources to be 6700 tonnes/yr. In the estuaries of Karnataka, the finfish and shellfish resources of Netravathi-Gurpur, Sita-swarna and Mulki estuaries were 2593 tonnes. Among the molluscan resources, clams are by far the most widely distributed and abundant and extensively exploited natural biological resources. Large quantities of clams are being exploited for food, as bait and are also being used for industrial purposes in manufacturing of cement, poultry feeds, lime extraction etc. Venerid clams are the most sought for in the clam fisheries of India viz., *Meretrix casta*, *Meretrix meretrix*, *Marcia opima*, and *Paphia malabarica*, which form 30.49 % of the total clam production in India of 14,052 tons (Rao *et al*., 1989). The brackish water clam *Meretrix casta* (Chemnitz) occurs commonly in almost all the estuaries along the estuaries in the both coasts of India. Studies on the ecology of this species are available in the works of Parulekar et al (1973) from Mondovi, Cumburjua and Zuari estuaries and Harakantra (1975a) from Kali estuaries. So far there is no information available on the distribution of seeds of *M.casta* and associated environmental and sediment properties in Mulki estuary. Therefore the present investigation was taken up to study the distribution of seed clams in relation to environmental variables.

II. MATERIAL AND METHODS

Location of sampling stations in the Mulki Estuary.

The confluence of the Mulki and Pavanje rivers with the Arabian Sea leads to the formation of Mulki estuary. The Mulki estuary (lat. 13° 4' N and long. 74° 17' E) is situated at about 45 km north of Mangalore. The estuary is connected to the Arabian sea throughout the year and is subjected to tidal influence to a length of 6.0 km in Mulki river and 6.6 km in Pavanje river (Reddy and Gopala 1982). The water samples were collected during the low tide period for determination of various physical and chemical parameters and transported to the laboratory for further analysis. The water quality parameters like temperature, pH, salinity, ammoniacal nitrogen and suspended solids were analysed. The clam species were collected at fortnight intervals from August, 2007 to July, 2008 from the four different locations in the Mulki estuary. The samples were collected during low tide by using a quadrant having an area of 0.16m^2, upto a depth of 10 cm and were used for further analysis. The

samples were hand picked and the mean value of biomass (wet weight) and population density was estimated (no./m^2).

III. RESULTS AND DISCUSSION

The atmospheric temperature varied from 25.1 to 32.2^{0}C with a mean of 29 ± 2.42 and the water temperature ranged from 29.54 to 30.11^{0}C. The maximum and minimum values were recorded in the months of May and August respectively. Warmer conditions prevailed during the pre monsoon season and cooler condition during the monsoon season. Higher pH values were reported during the post and pre monsoon and relatively lower values during the monsoon season with a variation from 7.84 to 8.10. Marked seasonal variations were observed in the salinity of water in the clam beds, higher saline conditions during the post and pre monsoon season and during the peak monsoon season, the salinity reduced rapidly due to the copious amount of fresh water running into the sea and low saline water were observed throughout the monsoon period. Building up of salinity was noticed during the post monsoon season. Dissolved oxygen in water varied from to a minimum of 3.10 mg/l to 6.10 mg/l and the suspended solids varied from 50.42 to 59.65 mg/l during the entire study period. Ammonia Nitrogen content varied between 6.12 and 7.11 µg-at/l and the fluctuations encountered throughout the period of investigation which can be attributed to the conversion of ammonia into other forms of Nitrogen, sea water influence and utilization by planketrs. In general aquatic animals are known to tolerate lower salinities, low dissolved oxygen concentration, if pH remains at higher side (Ringwood and Kepler 2002) and the lower values of pH reduces the tolerance of many of the organisms. Statistical analysis was made to observe the variation in the parameters selected and ANOVA studies indicated that all the hydrographical parameters had a significant effect on the distribution of clams between stations and months.

The seasonal and spatial variations in the qualitative and quantitative composition of the macrobenthos population were observed and the dominating communities inhabiting Mulki estuary were Mollusca, polychaetes and crustaceans. Generally the trend of higher populations were observed during the premonsoon and post monsoon season. The population density of macrobenthos varied between 228 and 915 no/m^2. Four species of polychaetes were recorded in Mulki estuary out of which *Seballaria* sp and *Dendroneries* were the most abundant. Relatively higher populations were recorded at stations S3 and S4. During pre-post monsoon seasons, polychaetes population density was high. Crustaceans were represented by amphipods, isopods, barnacles and crabs and among these, amphipods were the dominant group and formed a major component in the crustacean population and were found sporadically and no regular pattern was observed.

Molluscan population was represented by bivalves, and gastropods. Four species of bivalves were reported in Mulki estuary among which, *Meretrix casta and Paphia malabarica* were the most dominant. Bivalves contributed significantly to the macrobenthic population and *Meretrix casta* was the most dominant bivalve throughout the study period. The mean monthly population density varied from 15.36 to 195.83 no/m^2. At stations S1 to S3 *M.casta* recorded in good numbers and *Paphia malabrica* was the next abundant species recorded with the population density ranging from zero to 103.6 no/m^2. Maximum numbers were observed in the month of January while it was totally absent at station S1, which may be due to high wave action and salinity compared to the other stations which are located away from the confluence. Among the stations, S3 and S4 contributed the higher population of *P. malbarica* in the clam beds of Mulki estuary. Spat were observed throughout the study period and the population density varied from 28 to 179 no/m^2. Seasonally spats were abundant during pre-monsoon months while in the monsoon months the population was meagre. The mean population density of *M. Casta* and *P. malabarica* varied from 43 to 83 and 29 to 60 no/m^2 respectively, with pre and post monsoon recorded good numbers of spat population. The drastic reduction in the availability of *P malabarica* during monsoon season showing its non adaptation to the lower temperature. Temperature rather than salinity has been suggested to be the main factor limiting the distribution of temperate bivalves (Manzi and Castagna, 1989).

Gastropods were represented by four species and were recorded throughout the study period *Ceretridia fluventalis* was the dominant and spatialy station S1 recorded high numbers. The population density varied from 109 to 621 no/m^2. Analysis of variance indicated that there was no variation in the distribution of the gastropods between stations and months. Miscellaneous groups were represented by fish larvae, egg cases and algal plants and were reported occasionally during different months and seasons.

Biomass of *M.casta* varied from 0.26 to 17.5 g/m^2 (wet weight) and 0.10 to 5.70 g/m^2 (dry weight). Significant variations were observed between station. In *P.malabarica* the wet weight varied from 6.51 to 11.31 g/m^2. Post monsoon and pre monsoon seasons recorded higher values. Dry weight values '*b*' variedfrom1.20 to 7.36g/m^2 and variations were uniform though out the study period. In the size wise variation, maximum of 24.42 % of *M.casta* were represented by17- 19 mm class followed by 20-022 mm class. In *P.malabarica* 30.30 % represented by 20-22 mm class and less than 5 % of the population was represented by larger sized animals. The knowledge of the changes in meat content of the bivalves is also important for the culturist, as they greatly affect the meat yield and financial returns (Rajapandian and Rajan, 1987). In population studies, Length –weight and height-weight relationships indicated an isometrics growth in *M.casta* and *P.malbarica.* Negative allometric were noticed between length on width, length on meat weight, shell on meat weight and wet weight on dry weight.

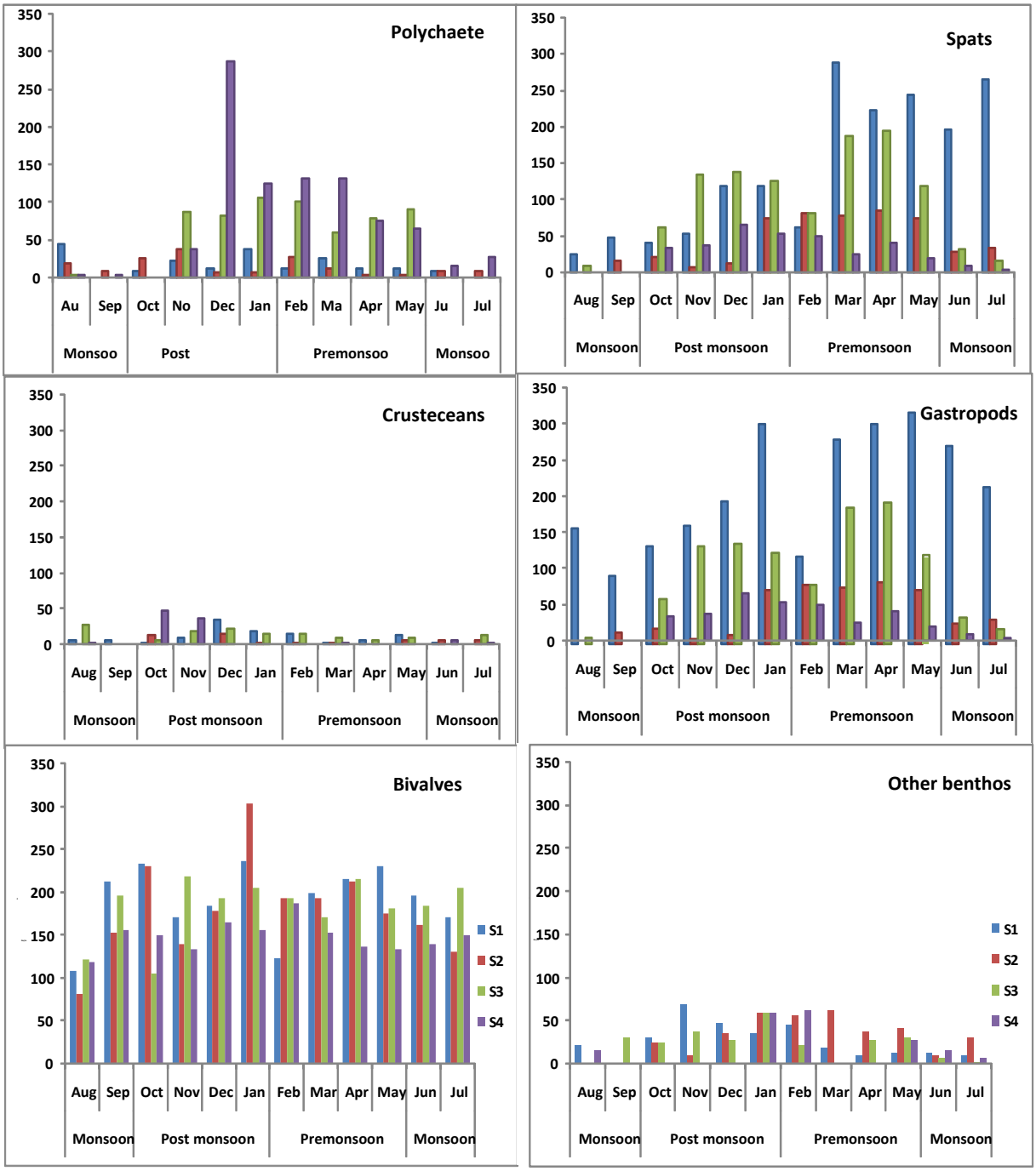

Fig. 1. Monthly distribution of different groups of macrobenthos (no/m^2) at different stations in the clambeds in Mulki estuary.

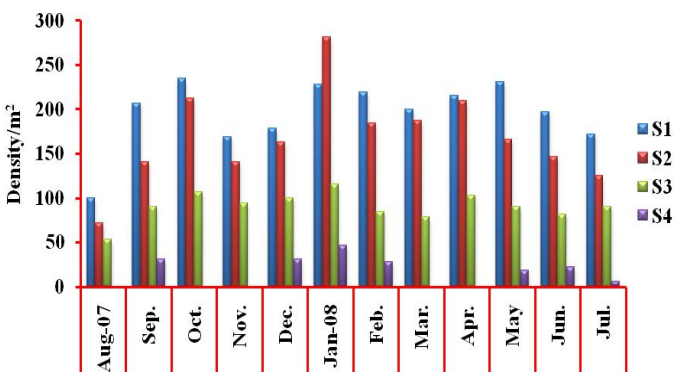

Fig. 2. Distribution of pulation density distribution of *Meretrix casta* (no/m^2) at various stations in clambeds of Mulki estuary.

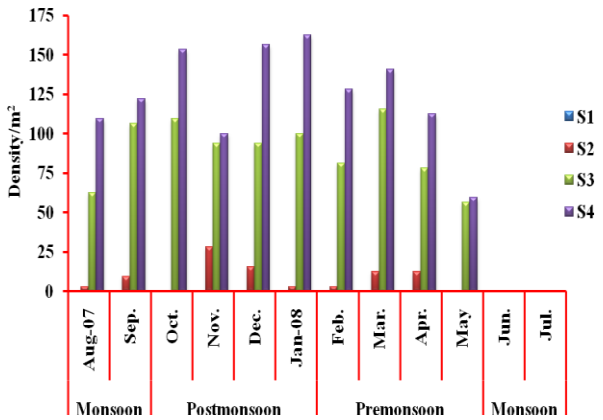

Fig.3. Distribution of population density distribution of *Pahpia malabarica* (no/m^2) at various stations in clambeds of Mulki estuary.

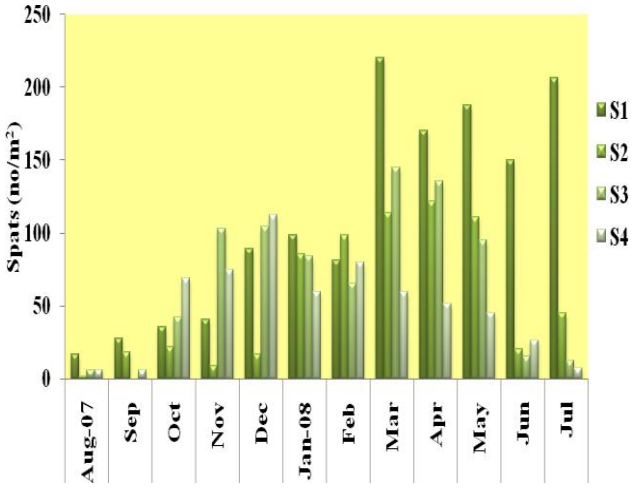

Fig.4: Distribution of total spats (no/m^2) at different stations in the clambeds in Mulki

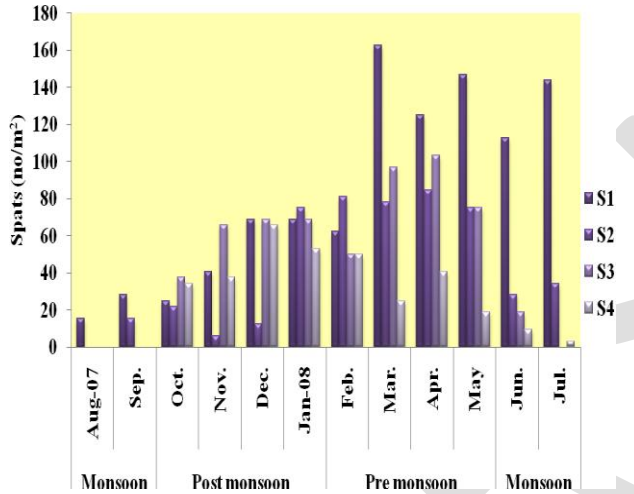

Fig.5. Distribution of spats of *Meretrix casta* (no/m^2) at different stations in the clam beds in Mulki estuary.

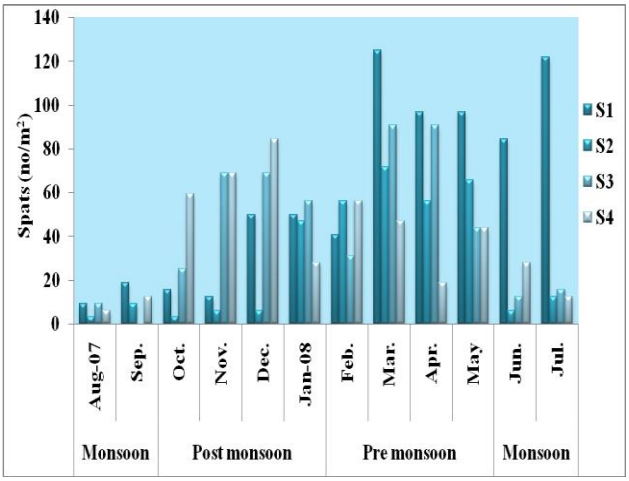

Fig.6. Distribution of spats of *Paphia malabarica* (no/m^2) at different stations in the clambeds in Mulki estuary.

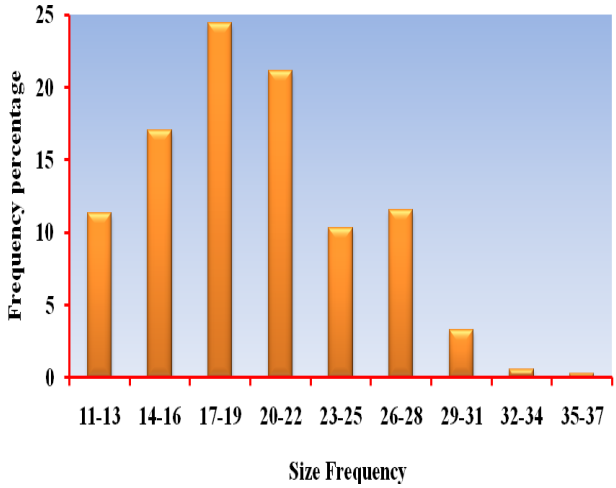

Fig. 7 Percentage frequency distribution of *Meretrix casta* in the clambeds of Mulki estuary.

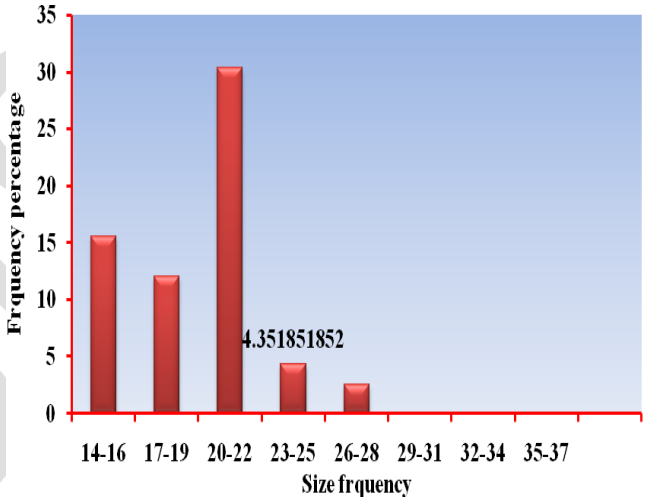

Fig.8 Percentage frequency distribution of *Paphia malabarica* in the clambeds of Mulki estuary.

Table 1. Allometric relations for *Meretrix casta* in Mulki estuary

Relationship	Regression equations	Allometry	Correlation(r)
Length (X) on width (Y)	y = 0.994x + (- 2.91)	Negative	0.996
Length (X) on Meat weight (Y)	y =- 0.025 + 0.908x	Negative	0.917
Height(X) on weight(Y)	y = 1.136 + 4.689x	Isometric	0.967
Shell on weight (X) Meat weight	y = - 0.075+ 0.203x	Negative	0.947
Wet weight (X) on Dry weight	y = 0.002+ 0.049x	Negative	0.938

Table 2. Allometric relations for *Paphia malabarica* in Mulki estuary

Relationship	Regression equations	Allometry	Correlation(r)
Length (X) on width (Y)	y = 0.746+ 0.984x	Negative	0.989
Length (X) on Meat weight (Y)	y = 0.112+ 1.124x	Negative	0.928
Height(X) on weight(Y)	y = 4.580+ 5.327x	Isometric	0.910
Shell on weight (X) Meat weight	y = 0.213+ 0.194x	Negative	0.95
Wet weight (X) on Dry weight	y = - 0.004 + 0.110x	Negative	0.950

REFERENCES

[1]. ANNON, 2006. Handbook of Aquaculture and Fisheries.(Ed).S.Ayyappan, ICAR, NewDelhi

[2]. HARKANTRA, S.N., 1975 a. Benthos of the Kali Estuary, Karwar. *Mahasagar Bull. Natl. Inst. Oceanogr*., 8 (1)&(2): 53-58.

[3]. MANZI, J.J. and CASTAGNA. M., 1989. Clam mariculture in North America developments in aquaculture and fisheries science. 19. Elsevier publication, Newyork, pp 461.

[4]. PARULEKAR, A.H., DWIVEDI, S. N. and DHARGALKAR, A.K., 1973. Ecology of clam beds in Madovi Cumderjia canal and Zuari estuary system of Goa. *Indian*

[5]. RAJAPANDIAN, M.E and C.T. Rajan, 1987. Biological aspects of oysters. *In*. Oyster culture – status and prospects (*Ed*) K. Nagappan Nayar and S, Mahadevan. *Bull. Cent. Mar. Fish. Res. Inst*., 38: 30-39.

[6]. RAO, G.S., KURIAKOS, P.S., RAMACHANDRAN, N., MEIYAPPAN, M.M., ACHARY, P.K., NAGARAJAN, P. and SHIVANNA, H.S., 1989. Atlas of clam resources of Karnataka. *CMFRI Special Publication*. 46: 66.

[7]. REDDY AND GOPALA, A.K., 1982. Studies on the plankton of Mulky estuary in relation to hdydrography. M.F.Sc Thesis, Univ.Agil. Sci. Bangalore, pp.248.

[8]. RINGWOOD, A.H.,KEPPLER, C.J. 2002. Water Quality Variation and Clam Growth: Is pH Really a Non-issue in Estuaries? .*Estuaries* 25(5): 901-907.