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BIVALVE RESOURCES OF MULKY ESTUARY, KARNATAKA

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Abstract: Mulki estuary was surveyed during 2006 to 2007 to assess the existing bivalve resources and the potential for exploitation. Clams form a major exploited resource of Mulky estuary. A survey was carried out to assess the bivalve resource and potential stock. The estuary harbours an estimated standing stock of 17813 t of bivalve; *Meretrix casta* is the dominant species (10409t) followed by *Paphia malabarica* (7404 t). An aspect of influence of physico chemical parameterson the distribution of bivalves has been detailed.

Keywords: Clam beds, Estuary, population density.

INTRODUCTION

The molluscs form an important fishery in India as it provides nutritious food and their importance in the economy of coastal fishermen coupled with the development of an export market for the frozen clam meat and the molluscan shell has many industrial uses as well (Narasimham,1991). Clams are bivalves, molluscs that burrow under the floor in aquatic habitat and there are over 15,000 different species of clams worldwide. As these animals are filter feeders, they are confined to microhabitats below mean high water and are usually only abundant in areas adjacent to open water (Khade, 2012). Several species of clams, found in the estuaries and backwaters of India, are exploited for their meat and shells. While some general accounts on the clams of India are available (Alagarswami and Narasimham 1973, and Laxmilatha & Appukuttan 2002, Laxmilatha 2006 and Boominathan *et al*. 2012) a comprehensive review of the work done on this group is wanting. To see the diversity of bivalves and their distribution in the estuary, the study was conducted carried out.

MATERIAL AND METHODS

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 sea throughout the year and is subjected to tidal influence to the tune of 1.86 m affecting the water to a length of 6.0 km in

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Mulki river. The bottom is generally sandy with muddy stretches in the deeper areas. In the present study, four stations were selected in the predetermined clambeds. (Fig.1). As there is tremendous demand for clam meat and shells, Mulki estuary was surveyed during 2006 to 2007 to assess the existing bivalve resources and the potential for exploitation. A pilot study was undertaken along the stretches of Mulki estuary and the adjoining estuary (Pavanje) to ascertain the availability and locate the clambeds by using Geographical Positioning System Instrument (Model Megallan GPS NAV DLX -10). The clam beds were selected on the based on their intensity of fishing along the stretches of Mulki estuary covering the areas from the mouth of the estuary to the upper reaches (Fig. 2)

Water and soil samples were collected for analyzing various hydrographical and sediment characteristics. The clam samples were hand picked at fortnightly intervals (August, 2007-July, 2008) from the selected locations during the 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 estimation of population biomass was made following standard procedures.

RESULTS AND DISCUSSION

The hydrographical parameters exhibited a wide variation at various locations selected (Table 1) and it was found to be that all the hydrographical parameters had a significant effect on the spatial and seasonal distribution of clams. The clams survival and growth in the clambeds are influenced by physical, chemical and biological interactions. The temperature, pH and salinity were in optimum range for better growth and survival of the clams and it indicated that pH is one of the most important parameter influencing on the growth and survival of clams in low saline region.

The dense and potential six clambeds were identified and located at the latitude and longitudes and is depicted in (Fig. 2). Clambeds at the confluence are located in shallower areas. Most of the beds are exposed to tidal currents and the sediments are characterized by having more of sand than clay and silt, within the sand, medium to fine sand dominated. Clambeds in Pavnaje estuary are submerged all the time and during the low tide the maximum depth will be around 2 to 2.6 ft. and these clam beds are surrounded by dense mangrove.

Six species of bivalves were reported from the Mulki estuary, *Meritrix casta; Meritrix meritrix; Paphia malabarica; Crassostrea madarsensis; Crasastrea gygas* and *Donax spp.* Among which, *M. casta, P. malabarica* were the dominant throughout the study period than any other organisms. Lagade (2013), reported five bivalves during his study on edible clams

in Bhatye estuary, Maharashtra. The population density of *M. casta* varied from zero to 281 no/m^2, it was most abundant at stations S1, S2 and S3 spatially and seasonally varied from 56 to 111 no/m^2 in monsoon season; 100.78 to 167.97 no/m^2 in the post monsoon season and 16 to 12 no/m^2 in premonsoon season. The mean population observed was 117.0 ± 30.64 no/m^2. The period from the later part of the monsoon season was found more productive for clam production in Mulki (Fig. 3). Results of the correlation coefficient indicated that a negative correlation with respect to clay, and a positive correlation with respect to chlorophyll, sand, coarse sand, very fine and sand was observed.

P. malabarica was recorded at station S2 to S4 throughout the year except during monsoon season and in the pre-monsoon, high density was reported with 3.0 to 162 no/ m^2. Lower values were recorded during monsoon season and high populations were reported during late post monsoon season. The average number per sq. meter was found to be 46.0 to ± 25.99. Spatially, station S3 and S4 contributed higher populations throughout the study period. Seasonally, the densities varied from nil to 44 no/m^2 in monsoon season; 55 to 66 no/m^2 in post - monsoon and 29 to 67 no/m^2 in pre-monsoon with a standard deviation of 25.99 (Fig. 4). One way analysis of variance indicated significant variation with respect to all the physical and chemical parameters. Correlation indicated that at 0.0l level there was a positive correlation between clay, medium sand, fine sand, very fine sand. However, there was a negative correlation with respect to sand, coarse sand.

Clams were observed to be dominant in sandy substrates having more than 80% of fine sand. *M.casta* was found to prefer more of fine sand where as *P.malabarica* showed its preference to sandy clay substratum. Absense of *P.malabarica* at station S1 where there was less content of clay as compared to other stations (S2, S3, S4) was evident for this. Correlation studies have revealed that *M. casta* had a positive correlation with sand, clay coarse sand and very fine sand. However in case of *P. malabarica*, a negative correlation with sand and coarse sand, while positive correlation was observed with medium, fine and very fine sand.

Population biomass

The wet weight of *M.casta* ranged from 2.77 to 10.06 ± 4.64 g/m^2 and the dry weight varied from 0.1 to 5.70 ± 1.60 g/m^2 and in case of *P. malabarica* the biomass in terms of wet weight varied from nil to 19.39 ± 6.51 gm/m^2 and dry weight 1.20 to 11.75 ± 2.29. g/m^2. Highest wet weight biomass was reported in all the months except in the month of October and June in case of *M. Casta*, where as in *P. malabarica* except in the months of October and June. In terms of dry weight bio mass, *M. casta* was almost uniform except in the month of

September. The reason that could be attributed to reduction in the weight of gonads after breeding. In *P. malabarica*, the biomass in terms of dry weight varied from 5.89 to 9.62± 2.29 gms/m^2. Lower values were observed in the months of November, February and June. The low values could be attributed to the prolonged breeding season of the species and continuous exploitation of adult clams in both the species.

Meretrix casta and *Paphia malabarica* and are the exploited clams in the estuary. About 45 clam fishers in 7-8 canoes per day are engaged in the exploitation of *M. casta* and *P.malabarica* fishing is done by handpicking or with a scoop /bag net. Fishing is carried out for about 19 days in a month. The total annual production of *M. casta* was 192.46 t in 1999 with an average production of 16.04 t /month (Table 2). The total standing stock of the clams in the Mulki estuary is 17813 tons of which the estimated standing stock of *M. casta* is 10409 and *P. malabarica* is 7404 tons (Table 3). The present level of exploitation is low to moderate and therefore offers ample scope for further exploitation. Frequent surveys or continuous monitoring should be conducted to understand the change in stock sizes in relation to environmental and biological factors. Further, the continuous sand quarrying in the estuary could alter the bottom profile and the substratum and this would affect the seed settlement pattern and wipe out the whole population.

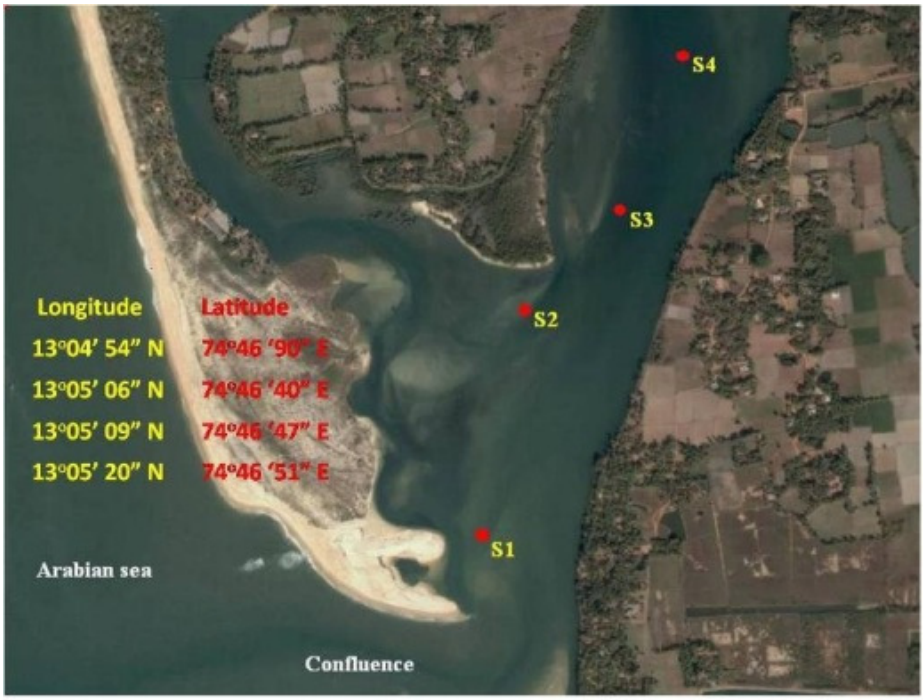
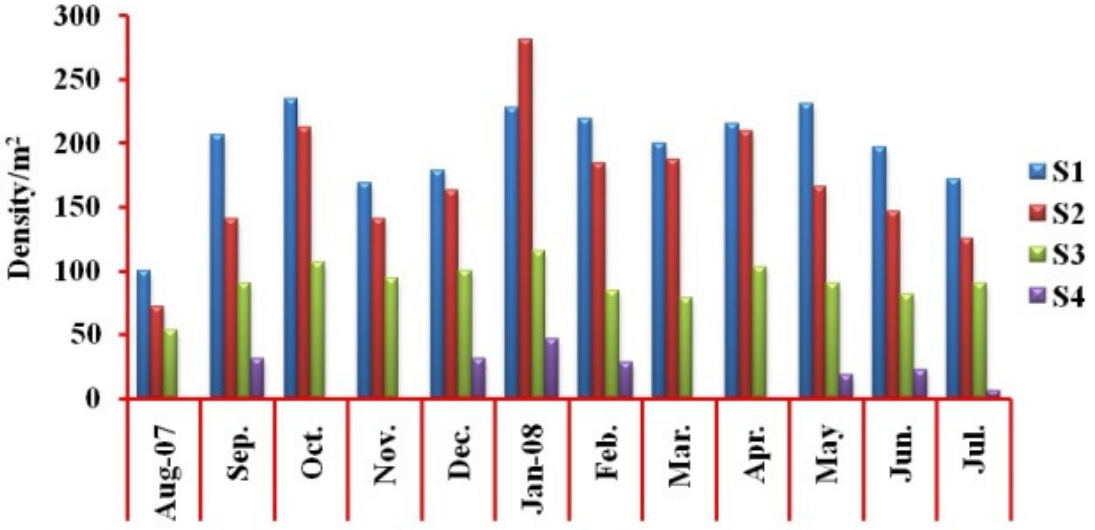


Fig. 1: Location of sampling stations in the Mulki Estuary

Fig. 2. Geographical positions of the identified clambeds in the Mulki and adjoining estuary



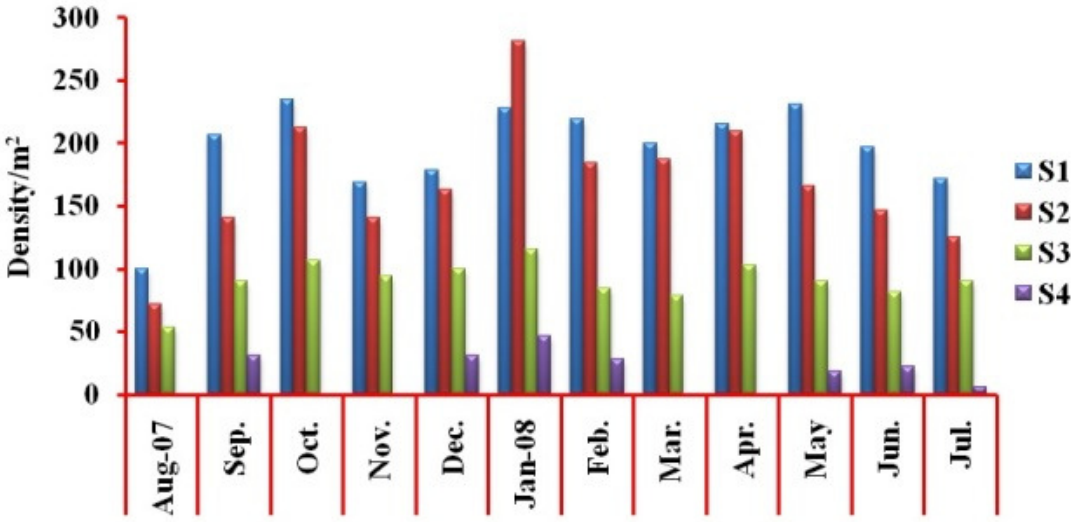


Fig.3. Population density distribution of *Meretrix casta* (no/m^2) at various stations in clambeds of Mulki estuary.

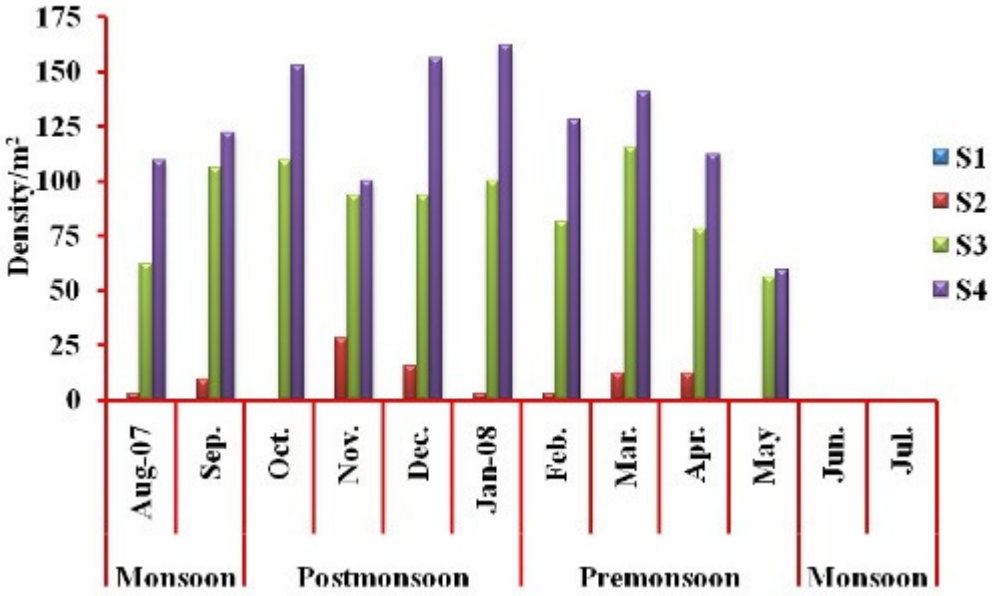


Fig.4. Population density distribution of *Pahpia malabarica* (no/m^2) at various stations in clambeds of Mulki estuary

Table 1: Ecological features observed in the clam beds in Mulky estuary

Parameter	Mean	Standard deviation
Hydrographical parameters		
Air Temperature(^{0}C)	29	±2.42
Water Temperature(^{0}C)	29.84	±1.84
Water pH	7.98	±0.56
Salinity($^0/_{00}$)	22.57	±14.76
Dissolved Oxygen (ml/lt)	4.62	±0.57
Ammonia-nitrogen(µg atom/lit)	6.67	±4.59
Organic Carbon(%)	1.34	±0.36
Chlorophyll a (mg/lt)	0.37	±0.20
Total Plankton(units/m^3)	$12317x10^{-3}$	$\pm 26030\ x10^{-3}$
Suspended solids (mg/lt)	55.39	±49.93
Sediment temperature (^{0}C)	29.81	±1.65
Sediment pH	7.76	±0.55
Organic carbon (^{0}C)	1.34	±0.36
Sand(%)	89.57	±3.26
Silt(%)	3.98	±0.74
Caly(%)	6.45	±3.05
Ver coarse sand(%)	3.29	±1.62
Coarse sand(%)	14.91	±5.10
Medium sand(%)	21.62	±3.92
Fine sand(%)	52.42	±9.78
Ver fine sand(%)	7.77	±6.10

Table 2: Total annual production of *Meretrix casta* in Mulki estuary

Station	Area	Density/m^2	Size range in mm	Estimated stock(kgs)	Total estimated stock in the estuary(t)
1	675 sq.mtrs	195	11-34	4290	10409.25
2	480 sqmtrs	169		1729	
3	270 sq mtrs	90		5320	
4	800 sq mtrs	15		2540	

Table 3: Total annual production of *Paphia malabarica* in Mulki estuary

Station	Area	Density/m^2	Size range in mm	Estimated stock(kgs)	Total estimated stock in the estuary(t)
1	675 sq.mtrs	0	11-43	0	7404.00
2	480 sqmtrs	7		1041	
3	270 sq mtrs	75		6277	
4	800 sq mtrs	103		2554	

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