Population Density and Biomass of Organisms in the Mangrove Region of Akshi Creek, Alibag Taluka, Raigad District, Maharashtra

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Introduction

The investigation of the population density and biomass of the organisms in creeks and estuaries is useful for the environmentalists to get enough information about the life span of important resource fauna. It gives a lot of information about the inflow of the young ones, the fry, total biomass, maturity, spawning, breeding and fecundity of the organisms of that region. In the recent years, pollution has become the major hazard to the aquatic biodiversity, especially in rivers, ponds, lagoons, estuaries and creeks. The commercially important organisms show upward and downward movement for various purposes like feeding, spawning and breeding. If the environment is not comfortable and convenient, they do not migrate to that habitat. The crustaceans and fish are very sensitive to the changes in the hydrological parameters. They do not tolerate any slight change in the aquatic media. The varieties of organisms migrate towards the sea for further growth as they cannot live in the creeks, estuaries or the mangrove habitats. The juvenile prawns, *Sillago, Platycephalus* and *Gerres* spp are the prominent examples of the organisms which follow the migration towards the sea after the month of October to live there further.

The Akshi creek is not much affected by any type of pollutant due to the absence of industries near the area except a little oil leakage from the trawlers. It is necessary to work out the population density and the biomass of some commercially important species which are closely associated with the mangrove habitat. Mangroves form the best protective, nursery and spawning ground for most of the important species.

The density of the population is defined as the number of organisms in a particular area at a given time. An actual census of all the individuals in that area is referred to as the absolute density and is expressed as the number per unit area. The easiest method of measuring the absolute density is counting every individual animal. The reason for high density of the

biomass of a particular organism in a specific area of the creek lies in the abundance of the nutrients in the region. The mangroves possess the same characteristics and therefore attract the maximum number of organisms. The mangrove is the treasure house for many commercially important species like *Gelonia* spp. This species is commonly known as the mangrove clam which has high density only in the mudflats of mangroves. Patole (2010).The ecological factors are always directly correlated with the density and the biomass of the organisms. If these factors are undisturbed, they accelerate the comfortable growth of the species like the mangrove clam. The post-monsoon season was directly correlated with the density and the biomass of the Akshi creek.

The estuaries are the major components of the marine ecosystem due to the presence of high nutritional environment and the primary productivity. The majority of the marine organisms spend at least a part of their life in estuaries else they are bound to perish due to various reasons (Patole 2010, Hegishte 2006). Typically, the tropical estuaries and creeks are lined by mangrove wetlands that provide rich source of nutrients for marine waters. The unique characteristics of these marine ecosystems are the shallowness of the creeks, the relatively high temperature, high oxygen content, low wave energy and the semi-enclosed nature of the habitat. Decomposed material of the plant litter from August onwards is an important component of nutrient cycling in wetlands and it harbours a large number of diverse species.

A change in the environment may give advantage to some species for withstanding in the competition and they may exploit it to the maximum. Babu (1999), derived that the ability of the climatic or the physical parameters to control the community structure as the biological interaction like dispersion, competition and the feeding behavior is equally significant. Frequently, the competition and predation may go on simultaneously; leading to the large fluctuation in population biomass and low density.

The density and the biomass in Akshi creek varies from place to place. The density of organisms strictly depends on the nature of floor as well as sediments. If the sedimentation is well developed, then it supports large number of organisms like crabs, prawns and Uca. The muddy floor provides excellent nutrients as well as protection to their young ones. The fry and juveniles feed voraciously on the sediments and reach to maximum size within short span of time. The muddy benthic floor gives high yield of juvenile prawns in monsoon season. In the present investigation, it is noticed that the benthic floor of Akshi Creek is lined with thick sediments rich in nutrients, hence there is more stability in fauna. This study aims to co-relate seasonal fluctuations in environmental factors and biotic factors including spawning, growth rate and settlement of larvae.

Materials and Methods

The tenure of the present studies was from December 2008 to February 2010. The qualitative assessment of organisms was made from samples collected fortnightly with the help of a quadrate having m^2 area. Random sampling was done from twenty different locations keeping regular distances along transects traversing the inter-tidal zone in each study site. Before starting the investigation, comparison using different meshes was done and sieves of an aperture size 0.5 mm was used. The sediment was well covered with the estuarine water which allowed the animals to float and then the whole mass was sieved. The number of crabs was calculated by counting the holes in 1 square meter as suggested by Jones (1984). The onchidium and slugs were collected from one square meter area which was marked and average values were considered. All the other animals were computed using 1 square meter area for their density and biomass. The data was analyzed.

Results

The intertidal community in the Akshi Creek varies from place to place both qualitatively as well as quali-tatively on the mud flats of mangroves. The average percentage composition of population density (No/m^2) and biomass (gm/m^2) are presented in the Table 1 & 2, (fig. 1 & 2). The maximum biomass and the density of organisms were recorded at middle region (A2) of the creek. This is also noticed by Patole (2010), Babu (2000) and Hegishte (2006) in different estuaries. The highest mean biomass of mollusca was noticed as 42.18 % and that of polychaetes at 32.10 % whereas the population

Table 1. **Percentage composition of population density (No/m²) in Akshi creek**

Months	Mollusca % No/m²	Arthropoda % No/m²	Polychaeta % No/m2	Chordata % No7/m²	Others % No/m²
Dec-08	50.25	24.15	11.24	10.21	4.15
Jan-09	46.15	14.38	20.23	12.53	6.69
Feb-09	44.11	12.44	21.81	14.22	7.40
Mar-09	35.46	16.26	23.48	18.48	6.89
Apr-09	37.12	12.75	27.05	19.05	3.12
May-09	41.09	10.42	29.12	13.30	6.06
Jun-09	48.52	25.11	_	17.82	8.64
Jul-09	36.62	38.37	11.37	10.05	3.12
Aug-09	38.42	40.36	8-09	7.06	6.06
Sep-09	44.26	36.24	9.20	5.15	5.15
Oct-09	39.22	21.88	17.11	10.66	11.11
Nov-09	52.15	20.30	_	20.30	7.20
Dec-09	49.25	24.20	11.25	11.15	5.15
Jan-10	47.38	14.15	18.53	12.23	7.69
Feb-10	44.11	11.44	23.81	13.22	7.40

Percentage composition of biomass (gm/m²) in Akshi Creek
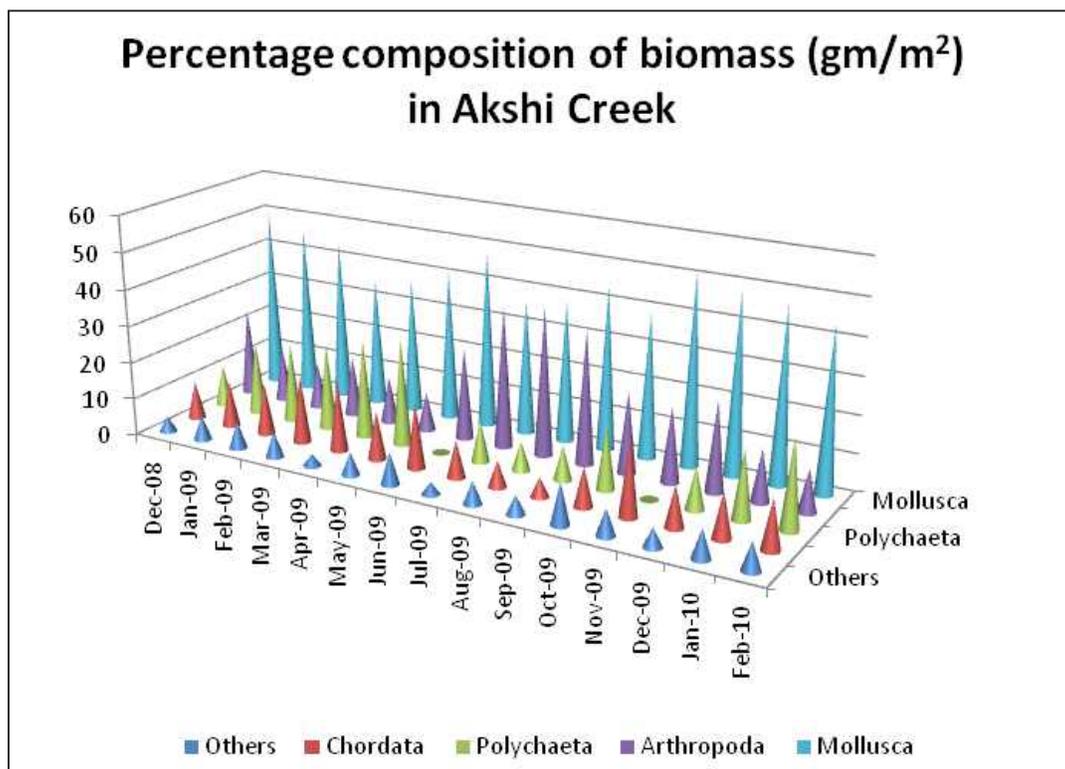
Table 2. **Percentage composition of biomass (gm/m^2) in Akshi Creek**

Months	Mollusca % gm/m^2	Arthropoda % gm/m^2	Polychaeta % gm/m^2	Chordata % gm/m^2	Others % gm/m^2
Dec-08	37.16	20.15	24.00	08.26	10.09
Jan-09	38.06	19.19	31.17	11.07	2.51
Feb-09	40.49	16.19	27.23	13.84	2.35
Mar-09	42.18	21.28	30.29	3.94	2.31
Apr-09	32.25	26.21	31.26	8.87	1.41
May-09	33.18	27.32	32.10	5.67	1.72
Jun-09	40.29	31.81	2.20	21.52	4.18
Jul-09	30.92	41.74	8.17	16.12	3.05
Aug-09	31.15	44.19	16.15	6.25	2.26
Sep-09	34.19	48.19	19.08	3.21	2.25
Oct-09	32.45	33.15	12.13	17.10	5.17
Nov-09	34.16	30.18	-	20.33	15.33
Dec-09	35.18	21.65	23.26	10.11	09.71
Jan-10	36.07	19.18	30.13	12.11	2.51
Feb-10	38.31	18.30	26.22	14.74	2.43
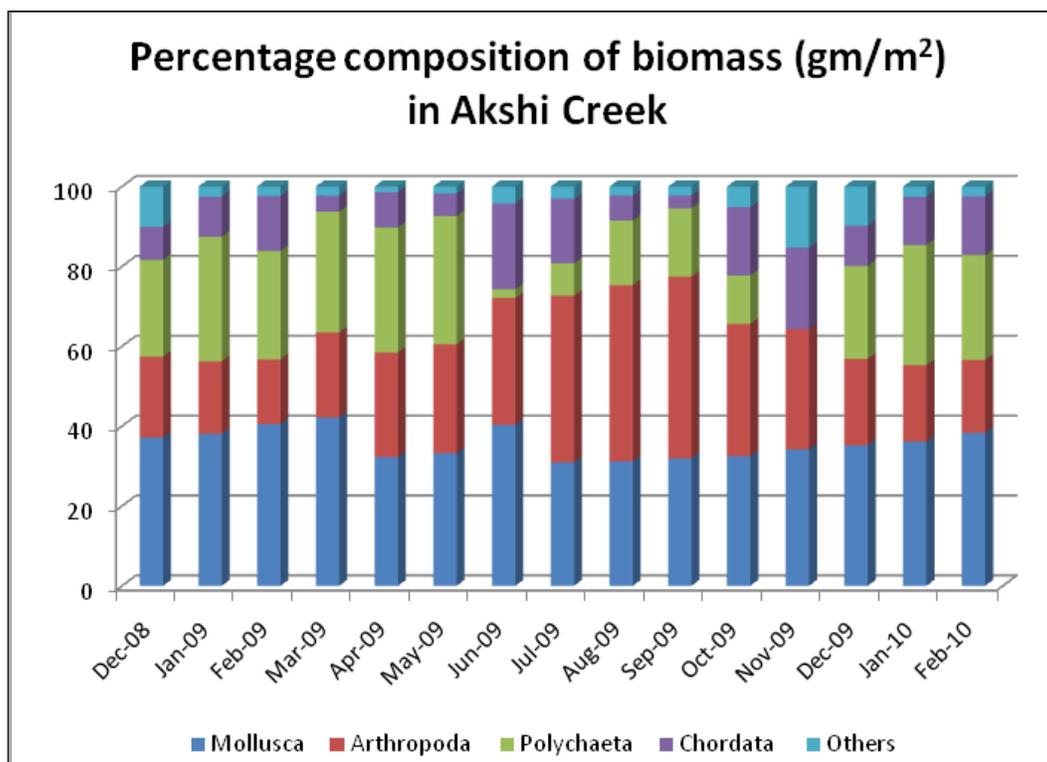
density was 52.15 % and 29.12%, respectively. It is clearly noticed that the biomass of mollusca was found varying between 30.92 % and 42.18 %. The lowest value was recorded in the month of July because of monsoon season. In monsoon, due to self-dilution of the body fluid, the sensitive molluscs were unable to adjust the fluctuating osmotic balance quickly hence their mortality was high. After the month of July, because of adjustment, the mortality rate of molluscs decreased gradually. As a result, density of molluscs increased. It is also understood that in the month of July, the salinity and temperature dropped down which made the condition adverse for the molluscs (Patole, 2010). The population density was at its peak in the month of November 2009, during post monsoon period and was at its lowest in the pre-monsoon period. It is clearly noticed by many research workers that the post-monsoon period is the most favourable time for the new inflow of molluscan species. The mangroves support high density of every type of molluscan species, especially, *Telescopium, Potamides, Natica, Nerita, Littorina* and *oysters*. The *Littorina* spp. and *Nerita* spp. are densely found on the trunks, pneumatophores as well as on stilt roots of mangrove plants. It is good harvesting place for variety of Molluscan species.

The population density of different polychaete species during different months of study period is shown in fig 2. The highest density was noticed in the middle and end (A3) of the creek in post-monsoon and pre-monsoon periods. The density was fluctuating from month to month and reduced drastically in June due to self-dilution of body fluids. The polycheates are unable to adjust to the ionic balance quickly therefore, their mortality is on a high scale. The biomass was recorded highest in pre-monsoon and then declined gradually. The egrate birds prefer the polychaetes over other food during low tides. The egrates are densely observed in the mud flat region for their feeding preferences. They are selective feeders and feed voraciously on polychaetes which are present in muddy grounds in large quantities. This is also noticed in Mochemad estuary by Patole (2010).

The crustaceans are densely found in the mangrove habitat for their protection as well as for feeding purposes. The population density and biomass were recorded high throughout all the seasons. *Scylla serrata* is a commercially important crab species which make their homes in the mangrove habitat as well as in the sea grasses available in the inter tidal zone. If such places are properly utilized for the aquaculture purpose, it will definitely help in supporting the economy of the country. The other largely populated species is Paeneus indicus (white prawn) available plenty in monsoon but most of them return to sea in post-monsoon period. The population density of different crustacean species was recorded highest in the month of September and lowest in the month of May. The season-wise density was at its peak in monsoon and decreased in pre-monsoon. It is clearly understood that in monsoon, maximum number of crustaceans take shelter at this safe habitat to avoid self-dilution and to get plenty of food. After monsoon, the intertidal region is exposed more due to which the harvesting also increases. Due to heavy demand of crustaceans in the market, local fishermen try to harvest this species maximum to support their livelihood. The same opinion is given by many research workers, like Hegishte (2006), Yeragi (2002) and Patwardhan (1990). The biomass was recorded highest in the month of September (48.19%) and lowest in the month of February (16.19 %).

The biomass of chordata was recorded maximum in June (21.52 %) and lowest in the month of May (05.67 %). The biomass of some other groups of animals like porifera and coelenterata was found varying from 1.41 % to 15.33 %.

This investigation is very useful to find out the present status of important biodiversity of fauna living in creeks and estuaries in relation to their quantity and mass. It will definitely solve many problems in relation to local fishery potentiality. This investigation also provides the valuable information regarding the adverse effect of the pollutants on the distribution, spawning and survival rate of commercially important species like *Scylla* spp., *Gelonia* spp. and *Paeneus* spp.

Discussion

The present study reveals information on higher biomass, population density and diversity at middle zone of the creek due to thick forest of *Sonnertia* spp. and *Rhizophora* spp., slow current and low tidal energy.

The variation in biomass was attributed to topography, orientation, velocity of current and pollution gradient. The lower biomass in monsoon season and gradual rise of reproduction up to pre-monsoon season was due to elimination of marine fauna due to low salinity regime. Patole (2010) has also expressed the same opinion about Mochemad estuary. Whenever there are lagoons associated with the creeks or estuaries, they get filled with high biomass in monsoon season. During the rainy season, the fauna in the main stream are unable to perform normal activities because of the speedy water current hence they try to take shelter in the mangrove habitat. Babu (2000) also observed the same condition in Mithbav and Uran creeks. NIO (1991) recorded the biomass of macrobenthic community from Bassein creek, low biomass of 1.28 to 5.68 gm/m^2. The higher biomass of A2 station was due to sheltered thick mangrove swamp, nutritional load, sandy clay and muddy ground for easy burrowing which favours the high rate of settlement of fauna, especially crabs, prawns and many others. Wells (1983) reported higher biomass in *Avicennia marina* than in *Rhizophora stylosa*. He further reported greater biomass was present in the area at margins but neither diversity nor abundance in the forest area. In the present investigation, the higher population density and biomass in mangrove vegetation of Akshi Creek was noticed than in the open spaces of the same creek.

The presence of crustaceans, molluscans and polychaetes in different densities and species composition in diverse ecological niches is mainly due to their high degree of adaptability to a wide range of environmental parameters. Parulekar and Verlencar (1984) noticed that the polychaetes constituted a dominant faunal group in a sandy estuarine intertidal benthic community in Goa. Patole (2010) reported many species from Mochemad estuary inhabiting at the intertidal zones at different depths.

From the co-relation analysis, the salinity displayed both significantly positive and significantly negative relationships with the biomass and with the population density of different phyla of animals. The abundance of gastropod shells throughout all the seasons at all the stations is indicating that they are euryhaline in nature. Most of the polychaetes were scarce in monsoon due to their narrow range of tolerance. These animals are unable to adjust their salt balance in low saline medium. In monsoon, the bivalve like *Meretrix* spp. is always found dead in the first week of monsoon. But their larvae as well as juveniles remain safe in the sand.

The tolerance in monsoon season as compared to pre-monsoon season is always high, therefore, larvae and juveniles survive but adults cannot survive in this adverse condition. The salt balance in the body fluid needs to be adjusted quickly to prevent their mass mortality. The density and biomass is also dependent on rainfall in the creek. Every marine organism has some tolerance of hydrological variations. If this balance is not maintained, it leads to mortality. The mangrove environment adjusts the ecological niche of most of the important species, therefore, they remain in vicinity of such environment. Gastropoda is the main group which always prefers the mud flat environment of mangroves.

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