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Venerid Clam fishery from Kalbadevi estuary, Maharashtra

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ABSTRACT

Venerid clam fishery from Kalbadevi estuary (Shirgaon creek and Sakarthar creek) is studied. Field survey was undertaken once a month during January 2015 to December 2016. Four species of clams namely *Katelysia opima*, *Paphia malabarica*, *Meritrix meritrix* and *Meritrix casta* dominated the catch in both the creeks. Species composition, length range, density and the corresponding biomass of bivalves are estimated from both the centers. About 100-200 collectors are involved in bivalve collection thus forming an alternative source of livelihood for villagers along Kalbadevi creek. The main market for these bivalves is Mumbai and Goa, where it is transported every alternate day. Women play an important role in income generation for the fishermen along this region engaging in various activities related to the fishery sector.

Keywords: Clam fishery, Kalbadevi estuary, Maharashtra

INTRODUCTION

Several species of clams belonging to a number of families constitute the clam resources and they are exploited all along the Indian coast (Narasimham, 1991). Maharashtra state with 720 km coastline is indented by 70 creeks, muddy bays, rocky inshore regions, estuaries and backwaters. The common edible shellfishes in these water bodies are clams, oysters and mussels which form subsistence level fishery of considerable local importance along the coast. Ranade (1964) reported bivalve resources of the state and estimated that, out of 70 creeks along the state's coastline from Thane to Ratnagiri district, 34 were productive, and about 3,600 persons were engaged in hand picking of bivalves. The most productive areas lie in Kalbadevi estuary and Bhatye creek of Ratnagiri district which accounted for more than half the total production in the state. According to Lagade *et al.* (2013), 1,100 t catch of commercially important clam species were recorded from Thane to Ratnagiri and the total average income generated by clam fishing was Rs.9, 17,280.

Bivalves are commercially exploited from various creeks in Maharashtra. Locally all clams are known as *Mule*, *Tasre* or *Shimpale*. Kalbadevi creek in Ratnagiri district, Maharashtra is a major bivalve collection centre. In Ratnagiri district, Kalbadevi, Sakhartar, Mirya, Shirgoan and Bhatye estuaries are excellent shellfish centres which abound in bivalve wealth. Clams are handpicked from the beds during low tide by local fishermen and usually the maximum collections are made on new moon and full moon days when the bivalve beds are fully exposed (Plate 1).

Some of the important studies over the years on clams from Maharashtra were by Rao *et.al* (1962), Subramanyam *et al.* (1949), Deshmukh (1972, 1979), Mane (1973a,b,c; 1975a,b), Nagabhushanam and Mane (1975b), Talikhedkar (1975), Talikhedkar *et al*. (1976), Dhamne and Mane (1976), Apte (1998), Mane (1981), Parulekar (1981), Dame (1996), Patil *et al*. (2002), Jaiswar and Kulkarni (2005), Sharma *et al.* (2005), Maske (2008), Mohite and Mohite (2009a,b), Mohite *et al.* (2009), Mohite (2010), Sundaram and Deshmukh (2011), Mohite and Mohite (2012), Khade and Mane (2012a,b), Taware and Muley (2013), Kurve *et al.* (2013) and Mohite and Sawant (2014).

Two major estuaries contribute towards the bivalve fishery of Ratnagiri, the Kalbadevi estuary which is towards the north of Ratnagiri city and the other Bhatye estuary which is towards the south of Ratnagiri city. Kalbadevi estuary is further divided in to two creeks, Shirgoan creek and Sakhartar creek. Clams are mainly exploited from Shirgoan creek while oysters are predominantly exploited from Sakhartar creek apart from other bivalves. The species composition of bivalves in these creeks differs according to the topography and other factors.

The river Kalbadevi flows from east to west and empties into the sea. Kalbadevi estuary is joined by the Shirgaon creek and Sakarthar creek. At high tides the depth of water generally is shallow and about one fathom at a point of about 1 km. from the river mouth. At low tides, the entire region is exposed. This area is rich with mangrove vegetation. The sandy muddy shore of this creek has various types of flora and fauna, including green filamentous algae, gastropods and molluscs (Mohite and Sawant, 2014). Kalbadevi estuary is an important bivalve fishing area in Ratnagiri. Edible oysters, clams and green mussels are fished with in Kalbadevi creek as well as in rocky inshore regions regularly.

Studies on clam resources from Kalbadevi estuary are by Mane (1974), Mane and Nagabhushanam (1979), Nagabhushanam and Mane (1975a), Mohite and Mohite (2008), Mohite *et al.* (2008), Mohite *et al.* (2009c), Kamble and Muley (2009) and Gangan *et al.* (2013). The present observations were carried out to add some more information towards the exploitation of clam resources from Kalbadevi estuary..

MATERIAL AND METHODS

In the present study, field survey was undertaken once a month during January 2015 to December 2016. The bivalves are generally exploited maximum during full moon and new moon days when the tide was extremely low and large intertidal area was exposed. Monthly samples were collected from the creek during the low tide days. Sampling was performed at harvesting site to study distribution and abundance of edible clams. The clams are found along the periphery of these creeks, buried in the sandy mud up to the depth of one meter. Visits to local markets were also made to ascertain the economic assessment of harvested edible clams.

The collected clams were brought to the laboratory for identification and biological analysis. Identification was done as per Narasimham (1991). The clams were identified (genus level) and the number of clams found per square meter (density) was recorded. Month wise species density of the stations and catch composition were also recorded. Shell length (SL) was measured using a digital caliper and total weight (TW) ($\pm$ 0.01 g) was determined using an electronic balance after the specimens were dried on blotting paper. The measurements were taken as described by CMFRI (1995).

For the study of population density, samples were collected from the intertidal zones of Kalbadevi (Sakhartar – Shirgoan) at randomly selected four stations by adopting quadrant method (measuring 1 sq. m) and the density was estimated by counting the number of animals in different quadrants. Four stations in each creek were fixed for this purpose and two quadrants from each station were selected during each field trip. The numbers of clams collected from each quadrant were averaged to estimate the animal density.

RESULTS AND DISCUSSION

Generally fishing in Kalbadevi estuary is done during low tide for the first eight days after the new moon or full moon phase. Calm water condition and sunny days are helpful and sometimes early morning hours are preferred. The local fishermen harvest the clams from the creeks and estuaries by handpicking and also by using the traditional gear 'Kurud net'. Fishers also use small non-mechanised boat *i.e*. 'Dingi' or dugout canoe for collection from shallow waters. An indigenous technique is by the use of wooden planks by children for collection of clams from marshy areas. The wooden planks are used to skate over the mud flats and children are involved in this activity because of their lesser body weight which facilitates easy skating over the mud. During monsoon months (June-August), due to the non-availability of fish because of the monsoon ban on trawling, fishermen tend to exploit bivalves more from intertidal area which are generally along the creeks, for their livelihood. Generally fishers collect about 80-100 kg/day from Kalbadevi creek depending upon availability.

The clams were in different stages of maturity throughout the year. Bivalves occurring from intertidal to sub-tidal areas, feed low in the food chain mainly on plankton and detritus, which are abundantly available in the natural waters circulated by the tides. Generally, algae are the main source of nutrition for bivalve filter feeder, but in coastal habitat, they feed on detritus, phytoplankton, benthic microflora, benthic algae and micro zooplankton (Dame, 1996). Clams are exploited for consumption and they are also used as a source of lime, as decorative articles, constituents for medical preparations and fertilizers. The shell is used for poultry feed and the flesh is used as feed for prawn brood stock in hatchery. Bivalves are affordable to even poor and they are equally rich in protein, glycogen and minerals like other sea food.

Sakhartar creek:

On an average in the year 2015-16 about 6 hand pickers and 3 hand-operated dredge nets are operated per month. Annually hand pickers make 50-60 efforts and collect about 845 kg of bivalves with a catch rate of 17 kg/effort. About 10-20 dredge nets are operated (efforts) annually collecting 914 kg of bivalves with an exploitation rate of 45.7 kg/effort. The creek contributed 25.8% of the bivalve production and the maximum density of bivalves was observed in January. The total approximate annual production from this creek is 1.7 t. Clam landings were dominated by the species *Katelysia opima* (40%), *Paphia malabarica* (25%), *Meritrix meritrix* (20%), *Meritrix casta* (9%) and other clam species (6%). The length range for *K. opima* in the fishery ranged from 15-40 mm, *P. malabarica* from 20-50 mm*, M. meritrix* from 15-35 mm and *M. casta* from 20-30 mm.

The density of *K. opima* ranged from 3-7 no./ m^2 and the biomass ranged from 118.5 to 276.6 $g.m^2$. *P. malabarica* ranged from 1-4 no./ m^2 and the biomass ranged from 10.4 to 42.5 $g.m^2$. *M. meritrix* ranged from 1-3 no./ m^2 and the biomass ranged from 17.2 to 51.8 $g.m^2$. *M. casta* 2 no./ m^2 and the biomass 33 $g.m^2$

Shirgoan creek:

On an average in the year 2015-16 about 12 hand pickers and six hand-operated dredge nets were operated per month. Annually hand pickers make 140-150 efforts and collect about 1,659 kg of bivalves with a catch rate of 12 kg/effort. About 60-70 dredge nets were operated (efforts) annually collecting 2,633 kg of bivalves with an exploitation rate of 37.6 kg/effort. The creek contributed 74.2% of the bivalve production and the maximum density of bivalves was observed in April. The total approximate annual production from this creek is 4.2 t. Clam landings were dominated by the species *P. malabarica* (41%) followed by *M. meritrix* (20%), *K. opima* (20%), *M. casta* (10%) and other clam species (4%). The length range for *P. malabarica* in the fishery ranged from 20-60 mm, *M. meritrix* from 20-45 mm*, K. opima* from 15-20 mm and *M. casta* from 20-30 mm.

The density of *P. malabarica* ranged from 3-9 no./ m^2 and the biomass ranged from 31.9 to 95.7 $g.m^2$. *M. meritrix* ranged from 2-8 no./ m^2 and the biomass ranged from 34.5 to 138.2 $g.m^2$. *K. opima* ranged from 2-4 no./ m^2 and the biomass ranged from 79 to 158 $g.m^2$. *M. casta* ranged from 1-3 no./ m^2 and the biomass ranged from 15.5 to 49.6 $g.m^2$.

According to Mohite and Mohite (2008), maximum average density was observed in November and better catch/effort was observed during March, April, June, August and October-December. Apart from the above mentioned clams from Kalbadevi estuary the other species of bivalves recorded from Kalbadevi estuary recorded during the study period are clams such as *Polymedosa erosa, Anadara granosa, Gafrarium*

divaricata, Dosinia cretacea, Dosinia gibba, Mussels such as *Perna veridis* and oyster species such as *Saccostrea cucullata, Crassostrea gryphoides* and *Crassostrea madrasensis*. Nagabhushanam and Mane (1978) reported *K. opima* from Kaldbadevi estuary and Mane and Nagabhushanam (1979) reported the clam *Paphia laterisulca* at Kalbadevi Estuary. According to Mohite and Mohite (2008) and Mohite *et al.* (2009), *P. malabarica* with vast beds formed about 80% of the total clams landed in Kalbadevi estuary.

Figure 1: ???

Figure 2: ??

Figure 3 : ???

Khade and Mane (2012) reported 12 bivalve species from Ratnagiri while Mohite and Mohite (2012) reported species such as *P. malabarica, K. opima, M. meretrix, M. casta* and *A. granosa*. Gangan *et al*. (2013) recorded species such as *P. malabarica, M. casta, M. meretrix, K. opima, P. erosa, A. granosa, Tapus radiatus, Soletellina diphos* and *Villorita cyprinoides* from South Konkan coast of Maharashtra.

The collected clams are stored by the local fishermen by a unique practice. These clams are kept in meshed polythene net bags (Plate 2) each with 50-60 kg of collected clams in live condition completely immersed in water (in the creek itself). When the demand for bivalves increases in the local market they are removed and sold. These bags are mostly placed head to head in the creek and tied with a centre rope and an indicator flag is fixed for easy location. About 100-200 collectors are involved in bivalve collection thus forming an alternative source of livelihood for villagers along Kalbadevi creek. The main market for these bivalves is Mumbai and Goa, where it is transported every alternate day. However the fishermen are of the opinion that the spat fall is decreasing over the years, which may be due to developmental activities, boat movements, destruction of bed, climate change etc. Hence judicious exploitation and conservation of this clam resource is required to ensure sustainable fishery.

The meat is separated by shucking, that is the removal of the meat from the shells either manually or by immersing the live organisms in boiling water or by steam cooking until the shells gape or open. Women sell the separated meat in the local market (Plate 3). If the meat is not separated they are taken to the market in wet gunny bags and sold to the local agents. Women play an important role in income generation for the fishermen along this region engaging in various activities related to the fishery sector. The market price is better for large and medium sized bivalves. The price depends on the availability of the commodity.

Mumbai, Ratnagiri and Malvan are the important marketing centres for clams. Large sized clams are filled in gunny bags and loaded in trucks from Ratnagiri and they reach Mumbai early morning at about 5.00 am and by 6.00 am they reach New Ferry Wharf, Fish landing centre. The demand is so huge that by 7.30 am the entire load is sold. Bivalves arrive in the city weekly thrice on alternate days. Each gunny bag contains about 25 kg of bivalves and in peak season about 100-125 such gunny bags are unloaded. Each gunny bad coast Rs.1,000 at the landing centre.

According to Dame (1996) bivalves are a 'key stone' species. A number of attributes of bivalves have led to their use as 'monitors', 'sentinels' or 'indicators' of environmental stress (Widdows and Donkin, 1992; Smaal and Widdows, 1994). Increasing urbanization and industrialization has caused detrimental changes in the coastal marine environment. Owing to indiscriminate discharge of untreated domestic sewage and industrial effluents, creeks in particular, have become highly polluted. Girkar (2003) reported the value of sulphide in the sediment at Kalbadevi estuary. Despite pollution, quite a few mollusks thrive in the coastal waters and some are noticed in the rocky sub-tidal regions. In the estuarine environment, there are great fluctuations in the salinity and temperature owing to tidal oscillations and river discharge. Salinity along with water temperature is the primary factor in determining the stratification of estuary. The depth and the shape of the estuary, volume of the freshwater inflow also influences the salinity of the estuary. The studies on the environmental factors like salinity and temperature have revealed a close relationship of these factors with the reproductive cycle of clams (Mohite and Mohite, 2012). Commercially exploited bivalve resources have been declining worldwide owing to different anthropogenic activities involving mining, sand extraction, overfishing and industrial pollution

The coast of Maharashtra has a huge potential as far as bivalves are concerned, hence, further studies on the quantity of bivalves exploited, species composition, fishing techniques, seasonal availability, species diversity and biology on bivalves needs to be carried out from Maharashtra. Further sediment profile and other studies need to be carried out from different creeks. Environmental data such as temperature, pH, DO, which is more or less stable in the creek, needs to be monitored. Salinity fluctuates drastically along these creeks in Maharashtra and therefore salinity studies which is a very important parameter in a creek environment needs to be carried out over a period of time. A proper assessment of bivalve resource of different areas is very essential. Molluscs generally breed almost throughout the year but peak season for all the species seems to be during monsoon and the juveniles are abundant in post monsoon season hence fishery or collection should be completely stopped during this period. According to Mohite and Mohite

(2008) the annual catch of clams from Shirgaon for year 2005-06 was 44.93 t with high catches during August, October and December which reduced to 4.2 t in 2013. There is very less information on the clam resources from this region regarding the annual production, seasonal variations in landings and biological characteristics of the exploited species. Studies on these aspects will be helpful for proper management, judicious exploitation and conservation ensuring sustainable fishery. Additional information on the life cycle and history is necessary to determine the short-term and long-term effects of commercial harvesting, which will help in proper management of its fishery, and conserving the diverse muddy ecosystems, in which it inhabits. Finally studies on the market potential both within and outside the country to ensure the marketing of bivalves and bivalve products. The need of the hour is to form a clam fishermen welfare society in Maharashtra to support this fishery, provide financial assistance to the fishermen and also assist in the disposal of the catch.

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