

Brown Mussel *Perna indica* Fishery in Kanyakumari District, South East and West Coast of India

¹M. Dalin Mary, ²K. Saritha, ³M. Jansi and ²Jamila Patterson

¹St. Jude's College, Thoothoor, Tamil Nadu, India

²Suganthi Devadason Marine Research Institute, Tuticorin, Tamil Nadu, India

³ST Hindu College, Nagercoil, Tamil Nadu, India

Abstract: Mussel fishery takes place in Kanyakumari district from October to April. Two species of mussels, *Perna indica* and *P. viridis* are available in this region and among that *P. indica* is the most dominant species. Mussel fishery plays an important role in the livelihood of thousands of fisher folk. Mussel also serves as a good source of high quality protein and the fat content is also very low. In the present study, the quantity of mussels fished during two fishing seasons from 2010 to 2012 in ten coastal villages of Kanyakumari district were estimated. Mussel fishing was high in Enayam coastal area with 293.13 tons in 2010-2011 and 279.19 tons in 2011-2012 fishing season followed by Kadiapatinam with 256.88 tons in 2010-2011 and 252.25 tons in 2011-2012. The annual catch of mussels in Kanyakumari district was 1227.93 tons and 1131.75 tons during the fishing seasons of 2010-2011 and 2011-2012 respectively. Prices of the mussels have increased from Rs 3-10 /100 mussels to Rs. 100-200/100 mussels. The harvested mussels were transported by head load, trucks and auto rickshaws for marketing.

Key words: Mussel Fishery • Brown Mussel • *Perna indica* • Mussel Cost • Mussel Transportation

INTRODUCTION

Kanyakumari district is at the southern tip of the Indian peninsula spanning a total area of 68km, 58 km along the Western coast and 10 km along the Eastern coast. There are massive mussel beds on the rocky coastal waters [1] and mussel fishery is regularly carried out from September to March at many centers which have mussel beds in submerged or partially submerged rocks in the near shore waters [2]. The distribution of mussels is limited within a coastal stretch of about 150 km, roughly between Kanyakumari and Quilon. The major mussel fishing centers of the South West coast of India is from Kovalam to Pulinkudi coastal area in Trivandrum district of Kerala state and Enayam, Colachel and Kadiapatinam in Kanyakumari district of Tamil Nadu state [3]. Many consumers prefer the flesh of this bivalve species for its nutritive value. In India, two species of mussels are available, Asian green mussel, *P. viridis* and brown mussel *P. indica* but globally few more species have been reported, *P. perna*, Newzealand green lipped mussel, *P. canalicula*, *P. dentifera*, European mussel *P. nucleus*,

M. galloprovincialis and Black mussel *Choro-mytilus meridionalis* [4].

The most abundant mussel species in Kanyakumari district is brown mussel *P. indica*. Brown mussel *P. indica* is abundant on the rocky beaches of South West coast of India [5]. Mussel fishing is more in the rocky coastal areas and the price of mussels are varied in different coastal areas and faraway places. The people of the coastal villages and nearby towns consume the mussel meat. The aim of the work is to know the pattern of mussel fishing and quantity of mussels fished in two fishing seasons in the rocky coastal areas of Kanyakumari district.

MATERIALS AND METHODS

Information about mussel fishing was collected from ten major mussel fishing centers in Kanyakumari, Enayamputhenturai (Lat.8° 22'; Long.77° 22'), Enayam (Lat. 8°22'; Long. 77°19'), Midalam (Lat. 8°21'; Long. 77°22'), Kurumpanai (Lat. 8°18; Long 77°.27'), Vaniyakudi (Lat 8°.17; Long 77°.26'), Kodimunai (Lat 8°.17°; Long

77°.24'), Colachel (Lat 8°.17; Long 77°.24'), Kadiapatinam (Lat 8°.07'; Long: 77° 19'), Muttom (Lat 8°.13°; Long 77°.32'E) and Kanyakumari (Lat 8° 07' and Long 77° 54'). Data on total catch, catch per unit effort (CPUE) and species composition were collected during two mussel fishing seasons of October 2010 – April 2011 and October 2011 – April 2012. Methodology adopted was stratified multi-stage random sampling technique and CPUE [6]. The traders were also regularly surveyed through questionnaires and interviews to know the extent of exploitation of these mussels. Additional information was gathered by personal observation and enquiries with fishermen, mussel divers, mussel merchants and consumers. Multivariate cluster analysis was conducted with Biodiversity pro software [7].

Questionnaire used for the survey of mussel fishery

- Name of the fisherman
- Major occupation
- Other occupations if any
- Types of fishing
- Types of craft used
- Types of gear used
- Mussel collection season
- Number of mussel collected / day
- Number of trips per day
- Number of days of mussel collection per month
- Size of the mussel collected
- Mussel collection method
- Mussel collection equipment
- Number of people in a craft
- Specific mussel collection area – distance from the coast and depth
- Timing of mussel collection.
- Mussel cleaning and marketing
- Cost of mussels
- Method of transportation – Trucks /Auto rickshaw/ load on head
- Marketing

RESULTS

Survey and Pattern of Mussel Fishery: Mussel fishing is done as part time occupation by the fishermen during off season, but during the peak season most of them are engaged in full time mussel fishing. It is carried out using traditional fishing gear known as catamarans. In the rocky beaches of Kanyakumari district, rocks are found to be at visible distance of about 400 m from the shore. Normally

mussel beds within a depth of 5 - 30 feet are exploited. Some rocks are found immersed during high tide and exposed during low tide. Fisher folk wear flippers in their legs for smooth swimming and wear a snorkel to see the underwater resources clearly. They carry a scalpel which is locally known as “Aruvakatti” and a bag net locally known as “Katcha vali” while going for mussel fishing. They use the scalpel to scrape the mussels attached on the rocks and keep the fished mussels in the bag nets until they bring it to the boat. Both the fishermen in the catamaran dive alternatively.

Skin diving method is one of the age old methods and it is followed by fisher folk to fish mussels attached on the rocks. Mussel fishing is carried out every year from October to April. But in some coastal areas mussel fishing starts from November based on their village regulation. Mussel fishing begins during November in Midalam, Colachel, Kurumpanai, Kodimunai Vaniyakudi, Muttom and Kanyakumari. But in Enayam, Enayamputhenthurai and Kadiapatinam mussel fishing starts in October. The mussel catch is high during the month of November to January since the sea appears to be calm during these months making it favorable for the collection of mussels. During the spawning season of mussels in the months of May to September the fishermen go for other fishing.

Mussel fishing is carried out from 6.00 AM to 9.30 AM. The fishermen in the traditional boat (Catamaran) tie a bag net in a thick rope and give the bag net to the fisherman who skin dive for mussel fishing and keep other end of the rope in his hand. The fisherman skin dive and scrape the mussels on the rocks using the scalpel and collect them in the bag net. Once it is filled the drops the bag from his hand and the fishermen in the boat feel the weight and pull the bag net and collect the mussels in a big bag net in the boat. The fisherman comes out of the water and gets the empty bag and dives in to collect more mussels. According to the capacity of the fisherman, he normally fish for an hour and come back to the shore in the same boat for selling the mussels. The number of mussels collected per day in one catamaran varies 500 to 2000 at different stations. After fishing the fishermen bring their catch to the shore and the fisherwomen help in cleaning and segregating the mussels according to their size.

Generally mussel fishing season commences in October and ends in April in Kanyakumari district. During the study period of 2010 - 2012, the mussel fishing season commenced by the middle or end of October in

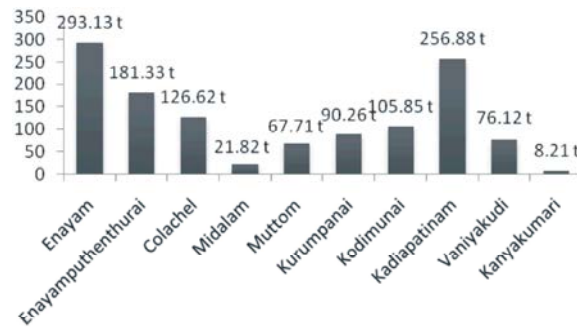


Fig. 1: Brown Mussel harvest in the fishing season of 2010 -2011 in Kanyakumari District

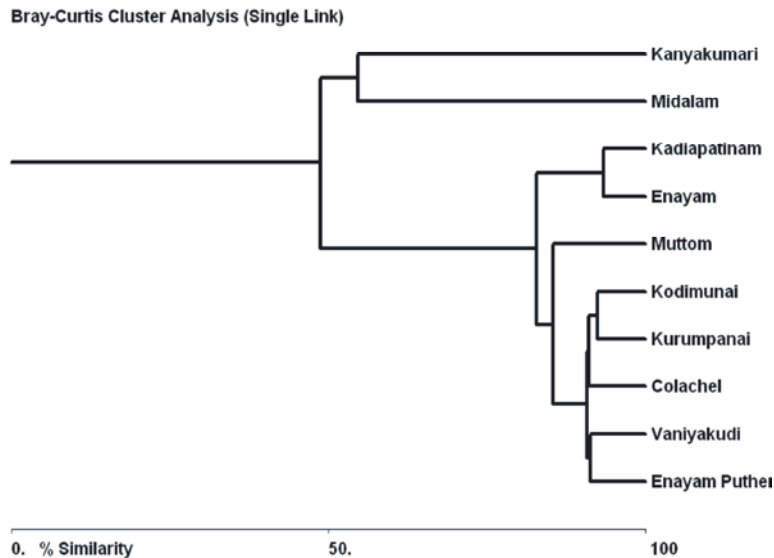


Fig. 2: Cluster analysis based on the variation in the population of brown mussel harvested

Enayam, Enayamputhenthurai and Kadiapatnam and ended in April (7 months) whereas it commenced by November in other stations such as Midalam, Kodimunai, Kurumpanai, Vaniyakudi, Colachel, Muttom and Kanyakumari and the mussel fishing lasted for five months only i.e., November to March. Peak landings of brown mussel in Kanyakumari district were recorded in November to January in both mussels fishing seasons of 2010-2012.

Total mussel catch observed in two fishing seasons of 2010 – 2011 are presented in Fig. 1. A total of 1227.93 tones of mussels were harvested during the fishing season of 2010-2011 in the fishing villages of Kanyakumari district. The mussel fishing was high in Enayam with 293.13 tons followed by Kadiapatnam (256.88 tons) and Enayamputhenthurai (181.33 tons). In two stations such as Midalam and Kanyakumari coast mussel fishing was observed to be very low and it was 21.82 tons and 8.21 tons respectively. The results of the multivariate cluster analysis of the present study during

2010 to 2011 have been summarized in Table 1 and Fig. 2. The similarity of harvest mussel was found to be highest between Enayam and Kadiapatnam (93.4092) followed by Kurumpanai and Kodimunai (92.4161), Enayamputhenthurai and Vaniyakudi (91.2755), Colachel and Kurumpanai (91.06551), Colachel and Vaniyakudi (90.81259), Muttom and Kurumpanai (83.3649) and Enayamputhenthurai and Kadiapatnam (82.763).

Total brown mussel *P. indica* fished during the fishing season of October to April of 2011 to 2012 was collected from all stations of Kanyakumari district and the results are presented in Fig. 3. A total of 1131.75 tons of mussels were harvested during this period. Brown mussel fished in Enayam was high with 279.19 tons followed by Kadiapatnam with 252.25 tons during the fishing season of 2011-2012.

The lowest percentage of mussels was fished in Midalam and Kanyakumari with 20.06 and 6.86 tons in each station. Mussel fishing is moderately good in Enayamputhenthurai, Colachel, Kodimunai, Kurumpanai

Table 1: Summary of multivariate cluster Analysis based on the variation in the population of mussel Harvested in the fishing season of 2010-2011 at different stations.

Step	Clusters	Distance	Similarity	Joined 1	Joined 2					
1	9	6.590787	93.40921	2	8					
2	8	7.583894	92.41611	6	7					
3	7	8.724457	91.27554	1	9					
4	6	8.934485	91.06551	3	6					
5	5	9.187406	90.81259	3	9					
6	4	14.63512	85.36488	5	6					
7	3	17.23703	82.76297	1	8					
8	2	45.32135	54.67865	4	10					
9	1	51.25656	48.74344	1	4					
Similarity Matrix	Enayam puthenthurai	Enayam	Colachel	Midalam	Muttom	Kurumpanai	Kodimunai	Kadiapatnam	Vaniyakudi	Kanyakumari
Enayam puthenthurai	*	76.4398	82.2306	21.4803	54.3739	66.7915	73.7134	82.763	91.2755	8.6625
Enayam	*	*	60.3312	13.8562	37.5291	47.3507	53.0603	93.4092	68.3656	5.449
Colachel	*	*	*	29.3991	69.6856	83.5928	91.0655	66.0339	90.8126	12.1783
Midalam	*	*	*	*	48.7434	38.7062	34.1819	15.6584	25.0718	54.6786
Muttom	*	*	*	*	*	85.3649	78.0249	41.7203	61.5685	21.628
Kurumpanai	*	*	*	*	*	*	92.4161	52.2858	74.7855	16.563
Kodimunai	*	*	*	*	*	*	*	58.363	82.0257	14.3959
Kadiapatnam	*	*	*	*	*	*	*	*	74.4231	6.1941
Vaniyakudi	*	*	*	*	*	*	*	*	*	10.2337
Kanyakumari	*	*	*	*	*	*	*	*	*	*

Table 2: Summary of multivariate cluster analysis based on the variation in the population of mussel harvested in the fishing season of 2011-2012 at different stations

Step	Clusters	Distance	Similarity	Joined 1	Joined 2					
1	9	1.055685	98.94431	3	7					
2	8	5.066268	94.93373	2	8					
3	7	6.362609	93.63739	6	7					
4	6	10.69879	89.30121	1	9					
5	5	16.8704	83.1296	3	9					
6	4	17.80502	82.19498	1	8					
7	3	32.61673	67.38327	4	5					
8	2	37.59583	62.40417	1	4					
9	1	49.03417	50.96583	1	10					
Similarity Matrix	Enayam Puthenthurai	Enayam	Colachel	Midalam	Muttom	Kurumpanai	Kodimunai	Kadiapatnam	Vaniyakudi	Kanyakumari
Enayam Puthenthurai	*	77.3332	72.9196	20.4631	36.6438	66.1851	71.9441	82.195	89.3012	7.503
Enayam	*	*	53.1298	13.4076	24.7793	47.5393	52.3101	94.9337	67.4244	4.7966
Colachel	*	*	*	33.1433	56.2113	92.5867	98.9443	57.1793	83.1296	12.7214
Midalam	*	*	*	*	67.3833	37.4568	33.7313	14.7332	24.7593	50.9658
Muttom	*	*	*	*	*	62.4042	57.0685	27.0661	43.5137	29.6073
Kurumpanai	*	*	*	*	*	*	93.6374	51.3115	76.0162	14.6097
Kodimunai	*	*	*	*	*	*	*	56.321	82.1058	12.9752
Kadiapatnam	*	*	*	*	*	*	*	*	72.029	5.2951
Vaniyakudi	*	*	*	*	*	*	*	*	*	9.218
Kanyakumari	*	*	*	*	*	*	*	*	*	*

and Vaniyakudi. In the other stations mussel fishing was very low. When comparing both fishing season fishing was low in all the stations in 2011-2012 than 2010-2011. The results multivariate cluster analysis of the present study has been summarized in Table 2 and Fig. 4. The similarity of harvest of mussel was found to be

highest between Colachel and Kodimunai (98.94431) followed by Enayam and Kadiapatnam (94.9337), Kurumpanai and Kodimunai (93.6374), Enayam puthenthurai and Vaniyakudi (89.3012), Colachel and Vaniyakudi (83.1296) and Enayam puthenthurai and Kadiapatnam (82.195).

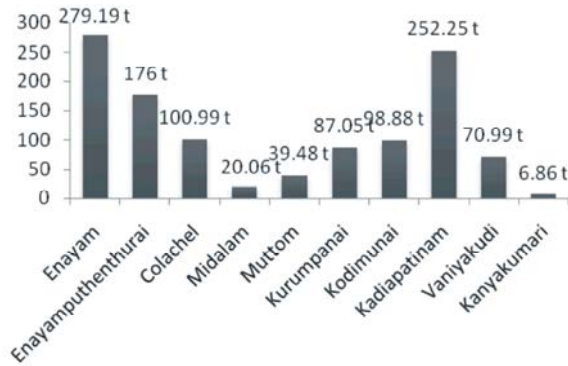


Fig. 3: Brown Mussel harvest in the fishing season of 2011 -2012 in Kanyakumari District

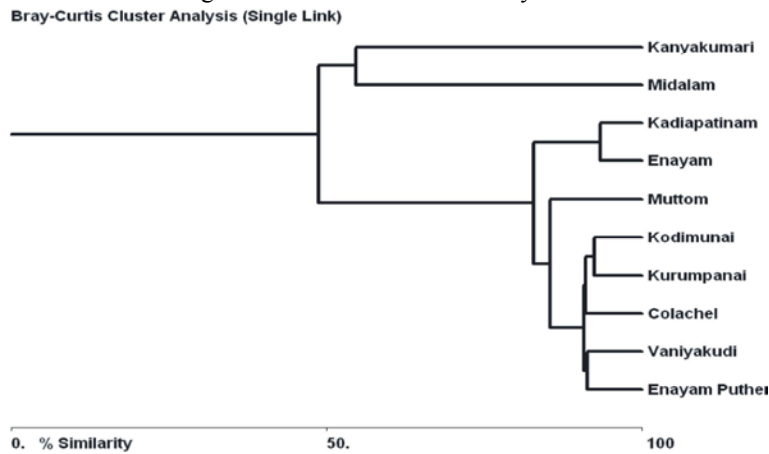


Fig. 4: Cluster analysis based on the variation in the population of brown mussel harvested in the fishing season of 2011 - 2012 at different stations

Table 3: Cost of mussels in coastal areas

Name of the coastal areas	Price details in Rs
Enayamputhenthurai	60 - 100/100 mussels
Enayam	50 - 100/100 mussels
Midalam	80 - 100/100 mussels
Kurumpanai	90-110/100 mussels
Vaniyakudi	80-110/100 mussels
Kodimunai	70-100/100 mussels
Colachel	75 - 105/100 mussels
Kadiapatnam	70 - 100/100 mussels
Muttom	90-110/100 mussels
Kanyakumari	100 - 110/100 mussels

Table 4: Cost of mussel in faraway places from coastal areas

Name of the faraway places	Price details in Rs.
Nagercoil	120 - 200/100 mussels
Marthandam	110- 160/100 mussels
Karungal	110- 150/100 mussels

Table 5: Transport of mussels

Mode of transport	%
Head load	25%
Auto rickshaw	29%
Trucks	46%



Fig. 5: Mussel transportation by head load

Cost of Mussels: The cost of mussel was very low as Rs.3/100 in earlier years but in later years the cost increased. The cost of mussels varied in coastal areas and faraway places. The cost of mussels varied from Rs 50 to Rs 110 for hundred mussels in different stations. The cost of mussel varied from Rs 50 to 100 in Enayam, in Enayamputhenthurai Rs 60 – 100. In some coastal areas



Fig. 6: Mussel transportation by trucks

like Midalam, Colachel and Kanyakumari the cost of mussels varied for hundred mussels and results are presented in Table 3. In places far away from the coast, the cost of mussels was too high compared with coastal areas (Table 4).

Cleaning and Transportation of Mussels: Mussels are cleaned and are transported to various places by head load, trucks and auto rickshaws (Table 5) to nearby areas where as it is transported to far away towns and interior markets by trucks (Fig. 5 and 6).

DISCUSSION

The brown mussel *P. indica* is occurring along the Southwest and Southeast coast of India [1] and it is exploited in many centers for edible purpose. Considerable interest has emerged in developing a range of stabilized mussel product and details of the brown mussel fishery during the earlier years by Joel and Ebenezer [2], Jones [8], Appukuttan and Nair [9] and Appukuttan *et al.* [10]. The rocky coastal areas of Enayam, Enayamputhenthurai and Kadiapatnam coastal areas in Kanyakumari district have abundant mussel beds [3]. Similarly mussel harvest was found to be high in Enayam followed by Kadiapatnam, Enayamputhenthurai and Colachel in the present investigation. The present study revealed that the mussel harvest was high in Enayam, Kadiapatnam and Enayamputhenthurai in both fishing seasons. This may be due to the long fishing season and favorable conditions.

Joel and Ebenezer [2] reported six mussel fishing centers like Colachel, Kodimunai, Vaniyakudi, Kurumpanai, Enayam and Enayamputhenthurai in Kanyakumari district. But the present study indicates that

in ten rocky areas like Enayam, Enayamputhenthurai, Colachel, Midalam, Vaniyakudi, Kodimunai, Kurumpanai, Kadiapatnam, Muttom and Kanyakumari rocky coastal areas, mussel fishing is going on. The harvesting period started in October in some villages such as Kadiapatnam, Enayam and Enayamputhenthurai and carried out till April. The present survey was taken in the brown mussel fishing season of October to April in Kanyakumari district in two fishing seasons of 2010-2012. Jones [8] reported that from September to April regular exploitation of brown mussel is carried out every year from Cape Comorin to Vizhinjam. Appukuttan and Nair [9] reported that the mussel fishery lasted till March with peak landings in October - December period during 1976-1977. But the peak period of harvest of mussels was observed to be during November - January during the study period of 2010 to 2012. The spawning of *P. indica* commences during May and lasts till September and so mussel fishing was banned during this period. Appukuttan and Nair [9] also reported that this season appears to be windy so the sea is rough and mussel fishing is relatively nil during these months as in our present report.

The brown mussel *P. indica* was fished from the rocks at a depth of 5 to 30 feet using skin diving and the catches are kept in bag nets which are locally known as "Katcha net". Bivalve fishing won't be carried out in their spawning and spat settling season between May to September. The fishing grounds of the present study includes rocky coastal areas such as Enayam, Enayamputhenthurai, Midalam, Kodimunai, Kurumpanai, Kadiapatnam, Colachel, Muttom, Vaniyakudi and Kanyakumari of Kanyakumari district. The highest landing was observed in these areas during the period of November to January which was similar to the report of Victor and Lazarus, 2000. Shanthini [11] reported that the sea is relatively calm and the visibility is high in these months. These factors are favorable for skin divers to collect large quantities of brown mussels. The peak fishing season of the bivalve mussel was observed during November to January. Renitta [12] reported that gastropods such as *H. pugilinus* and *C. ramosus* were collected from 10 to 40 ft depth when the water is clear in Tuticorin coast. Nearly 144 catamarans were engaged in mussel fishery during the study period (2010-2012). Jones [8] reported that 270 catamarans were engaged in mussel fishery in Kanyakumari district with the annual catch of 322.4 tons. Mussel fishing operations were intensified since 1986 and 75% of the mussels collected were transported to adjacent Trivandrum district [2]. The estimated landings for the whole district consisting

of 10 mussel fishing centers and was observed to be 1227.93 tons during the fishing season of 2010 – 2011 and 1131.75 tons during 2011 – 2012. Joel and Ebenezer, [2] reported that the estimated mussel landings have ranged from as low as 182 tons on 1982 – 83 to 1534 tons in 1984-1985. Kuriakose *et al.* [13] described the mussel fishery in Kerala state has been estimated 3043, 3074 and 2579 tons during 1981-1982, 1982-1983 and 1983-1984 respectively. The seasonal average quantity of mussel collected per fishing trip varied from 40 kg in 1982-1983 to 93 kg in 1984–1985. The monthly average quantity of mussel collected per fishing trip varied from 12 kg to 83 kg in the coastal areas of Kanyakumari district. The length of the mussel harvested during the season ranged between 1.3 Cm to 11.3 Cm and the weight ranged between 2.4 g to 62.2 g. The consumer preferred the average sized mussels with the length of 7 Cm and above [13].

Jones and Alagarwami [5] and Jones [8], investigated the distribution and fishery of mussels. Kuriakose [14] studied the growth rate, breeding habits and early development of the mussels. The present study indicated that the growth rate and development of brown mussel was higher i.e., 5 to 12 Cm.

Jones [8] had described that the mussel fishing was done as an off time occupation by the fishermen but during peak season most of them are engaged in full time mussel fishing. The fishing was done mainly during 9 AM to 4 PM. But the present study reported that the mussel fishing was done as an off time. The fishing was done mainly during 6.00 AM to 9.30 AM. Jones [8] also reported that cycle loads mussels were taken to interior markets around Trivandrum city during their peak fishing season. It was observed in the present study that the fishermen came back to the shore with their catches and the fisher women cleaned the mussels and took the mussels as head load to sell in the local markets. Buses, auto rickshaws or trucks are used for transport to faraway places. Appukkuttan and Nair [9] reported that, in 1976-1977 the mussel fishery lasted till March with peak landing from October to December and in 1977-1978 fishing started in September and lasted till January. In 1978, fishing commenced in October and lasted till January 1979. Present study indicates that the mussel fishery commenced from October to April. The peak landing period was between November to January and the mussel landings were better than the previous years in Kanyakumari coast. The survey revealed that mussel fishing is done from October to April even though mussels are available on the rocks of the rocky coastal

areas throughout the year. The mussels spawn in the rest of the months and so mussel fishing is banned in these periods for the conservation of resources. Regarding the cost of mussels, in 1980s the cost was very low and it was Rs.3 to 5 for hundred mussels [10]. The retail price in and around the fish landing centers varied from Rs. 2 to 4 for hundred mussels and occasionally it went up to Rs. 7 [2]. But later cost of mussels increased a lot and it varied between coastal areas and faraway places. In the presence study the mussel cost increased to 50 -110 Rs/100 mussels in the coastal areas and exceed up to Rs.200 in faraway places. Further the price of the mussels was based on consumers demand. The price of the mussel was very low as Rs.5/100 mussels in 1987 [15]. People are well educated about the delicacy and nutritive value of mussels and the price ranged from Rs. 50 - 80 /100 mussels during the last decade [16].

During the study period it was observed that nearly 1200 fishermen were involved in mussel fishing in 10 villages of Kanyakumari coastal area and the catch was nearly 1227.93 tons of mussels during the period of 2010 - 2011 and 1131.75 tons during 2011 -2012.

Sushma [17] reported a total of 4862 tons of inland fish catch, 33925 tones of marine fish catch and total number of fishermen engaged were approximately 36198 numbers in Cuddalore, Nagapattinam and Kanyakumari district in 2005. Present investigation reveals that over 2000 fisher folk exclusively depend on mussel fishery for their livelihood during the six month period. The mussel, *P. indica* is locally known as ‘thodu’, ‘chippi’ and ‘kallikka’. Mussels are steamed and their meat is shucked and eaten with or without condiments. Though it is a much relished item of sea food in some quarters, the mussel is in a high demand in this district. Most of the catch is also transported to markets in Trivandrum district as there is a great demand for it Mussels were earlier considered as poor man’s food but nowadays the demand is more among all type of people. So during fishing season, fishermen do intense fishing of mussels and due to the demand price also increases and this economically empower the fishermen economically.

ACKNOWLEDGEMENT

The authors are thankful to Dr. J.K. Patterson Edward, Director of Suganthi Devadason Marine Research Institute for his permission and the fisher folks of Kanyakumari district for providing us all information’s about mussel fishing.

REFERENCES

1. Kuriakose, P.S. and N.B. Nair, 1976. The genus *Perna* along the coasts of India with the description of a new species *Perna indica*. Aqua. Biol., 1: 25-36.
2. Joel, J.J. and I.P. Ebenezer, 1989. The current trend of the mussel fishery in the Kanyakumari district of Tamil Nadu. Mar. Fish. Infer. Seru, T and E Ser., 100: 9-13.
3. Ramachandran, N., K. Ramakrishnan Nair and K.T. Thomas, 1998. Stock assessment of the brown mussel, *Perna indica* (Kuriakose and Nair) from the southwest coast of India. Indian J. Fish., 45: 437-439.
4. Wood, A.R., S. Apte, E.S. Mac Avoy and J.P.A. Gardner, 2007. A molecular phylogeny of the marine mussel genus *Perna* (Bivalvia: Mytilidae) based on nuclear (ITS1and2) and mitochondrial (COI) DNA sequences. Molecular Phylogenetics and Evolution, 44: 685-698
5. Jones, S. and K. Alagarswami, 1973. Mussel fishery resources of India. Proc. Symp. Living Resources of the Seas around India, Central Marine Fisheries Research Institute, Cochin, pp: 641-647.
6. Srinath, M., S. Kuriakose and K.G. Mini, 2005. Methodology for estimation of marine fish landings in India. CMFRI Spl. Publ., pp: 86: 57.
7. Neil Mc Aleece, P.J.D., 1997. Lambs head and Paterson, G.I.J., Originators, Biodiversity Pro. The Natural History Museum, London.
8. Jones, S., 1950. Observations on the bionomics and fishery of the brown mussel (*Mytilus* sp.) of the Cape Comorin region of peninsular India. J. Bombay Nat. Hist. Sac., 49: 519-528.
9. Appukuttan, K.K. and T.P. Nair, 1980. Fishery and biology of the brown mussel, *Perna indica* Kuriakose and Nair. CMFRI Bulletin, 29: 5-9.
10. Appukuttan, K.K., T.P. Nair, Mathew Joseph and K.T. Thomas, 1988. Brown mussel (*Perna indica*) resources of the southwest coast of India and the results of farming experiments at Vizhinjam. CMFRI Bulletin, 42: 257-263.
11. Shanthini, F.C., 2003. Value added products from underutilized marine Gastropod, *Pleuroploca trapezium* (Mollusca: Gastropoda: Fasciolaridae), PhD thesis, Manonmanium Sundaranar Univercity, India, pp: 187.
12. Renitta, R., 2005. Development of value added products from marine molluscs, *Chicoreus ramosus* (Gastropoda: Muricidae) and *Hemifusus pugilinus* (Gastropoda: melongenidae) and popularization. PhD thesis, Manonmanium Sundaranar Univercity, India.
13. Kuriakose, P.S., M.P. Sivaosan and V.G. Sunrendranathan, 1987. Fishery resource of the green mussel *Perna viridis* along the west coast of India. National seminar on shellfish resources and farming held at Tuticorin, India, CMFRI, Cochin, 4: 19- 21.
14. Kuriakose, P.S., 1973. Studies on the Mytilidae of the Indian Coast. Ph.D. Thesis, University of Kerala, pp: 347.
15. Appukuttan, K.K., T. Prabhakaran Nair, Mathew Joseph and K.T. Thomas, 1987. Brown mussel (*Perna indica*) resources on the south west coast of India and the results of farming experiments at Vizhinjam. National seminar of Shellfish resources and farming, Tuticorin 19 - 21 January, 1987, session II - VI). CMFRI Bulletin, 42(Part two): pp: 257-263.
16. Patterson, J., 2001. Canning of smoked brown mussel *Perna indica*. Phuket Mar. Biol. Cent. Spec. Publ., 25: 219-220.
17. Sushma, G., 2009. Integrated coastal zone management plan for tsunami affected coastal areas in cuddalore, Nagapattinam and Kanyakumari district, Tamil Nadu, Southern India. PhD thesis, Manonmanium Sundaranar University, India.