ISSN 2250-3153

Monitoring the Biomass Production in Two Venerid Clams

Ampili,M

[*] Department of Zoology,N.S.S.Hindu College, Changanassery,Kottayam,Kerala,India

Abstract- The biometry, biomass production, density and the sex ratio of two edible venerid clams, *Paphia malabarica* and *Meretrix casta* and the hydrologic parameters of the clam beds of Ashtamudi Estuary were monitored for one year. The results of the study indicated that the density and distribution of these clams were influenced by salinity. The largest Paphia clams were obtained in November and the Meretrix clams in April. In *P.malabarica* the tissue mass production increased from July to December and in *M.casta* from April to December. In both species the male and female sex ratio was found to be 1:1. The *P.malabarica* was denser than *M.casta* in the estuary. Increased biomass production, percentage edibility and nutritional values were recorded highest during the monsoon season (June-September) indicating the best time for harvest to keep the fishery sustainable.

Index Terms- Biometry, biomass production, density, *M.casta*, *P.malabarica*, sex-ratio.

I. Introduction

Molluscs are soft bodied, heterogeneous groups of organisms inhabiting a wide variety of environment. Clams are one of the important varieties of molluscs. These are commercially important from the point of view of its nutritional value and as sentinel organism reflecting the environmental pollution. The density and distribution of these organisms are controlled by seasonal changes in environmental factors. The sustainability of the clam fishery depends on the management of wet land and the prudent harvesting practiced there. Despite the fact that advanced researches have been initiated towards problems related to fishery, scant attempts have been made to monitor biomass production in edible venerid clams. Two commercially important venerid clams, *Paphia malabarica* and *Meretrix casta* were selected for the study. These are two important clam species, forming vast beds in the estuaries of Malabar Coast (South-West coast) in India. The clams were exploited from the estuary throughout the year with a ban in fishery from November to February.

The present work was carried out to study the biometry, biomass production and sex ratio in two edible clams, *Paphia malabarica* and *Meretrix casta* in the Ashtamudi Lake and the hydrologic factors affecting their density and distribution.

II. Materials and Methods

1.1. Area studied

Ashtamudi Lake, located in Kollam district, is the second largest estuarine system in Kerala, India. It has a water spread area of about 32 km^2. The lake is located between latitude 8° 53´- 9°2´ N and longitude 76°31´ – 76°41´E. The main basin is about 13 km long and the width varies from a few 100 m to about 3 km. The estuary remains connected to the Arabian Sea throughout the year.

1.2. Clam collection and analytical methods

Random monthly samples were collected from the clam beds of the estuary for a period of one year. The clams collected were transported to the laboratory and kept in aerated habitat water for twenty four hours for defecation. Thirty clams were taken monthly for biometric measurements. Hundred randomly selected clams were sacrificed monthly to observe reproductive state and to determine the sex ratio. Quadrate (0.25m X 0.25m) samples were taken monthly from the estuarine bar mouth to the upper reaches to analyse the density and distribution of the clams.

1.3. Biometric measurements

Length, breadth and depth of individual clams were measured using vernier callipers with 0.01mm accuracy. The distance between the anterior and posterior extremities of the shell in a direction parallel to the ventral margin was recorded as the total length. The distance between the umbo and the ventral margin in a direction perpendicular to the anterior-posterior axis was recorded as breadth. The greatest distance between the outer surfaces of the two valves when they are kept closed together was recorded as depth. The measurements were expressed in centimetres.

The total weight, wet meat weight, dry meat weight, and shell weights were determined to the nearest 0.01mg in an electronic balance. The total weight or the live clam weights were determined after washing off sediment particles adhering to the shell. The clams were cut opened tissue was removed from the shell, washed with distilled water, wiped with tissue paper and weighed. The weights were recorded as the wet weight. The clam meats separated from the shells were kept in hot air oven at 80°C until constant dry weight was obtained. After removing meat the shell weights were recorded. All the weights were expressed in grams. The volume of whole organism and shell were measured to nearest 0.1 ml using displacement method (Quale and Newkirk, 1989). Percentage edibility was estimated by adopting the method of Venkatraman and Chari (1951). Number of individuals per square meter was noted as density.

1.4. Hydrologic parameters

The hydrologic parameters such as salinity, dissolved oxygen, pH and temperature were estimated by standard methods. Salinity was determined by Mohr-Knudsen argentometric titration method (Strickland and Parsons, 1968), Dissolved Oxygen fixed *in situ* was analysed in the lab following modified Winkler's method (Strickland and Parsons, 1968). p^H was measured immediately after collection using a portable p^H meter . Temperature of the water was recorded using a mercury filled Celsius thermometer.

The results were subjected to suitable statistical analysis using statistical package for the Social Sciences (SPSS 20.0 version).The correlation analysis was conducted to determine correlation between the hydrologic parameters and the biological parameters. The Analysis of Variance (ANOVA) was carried out to determine the variance in the mean values of physico-chemical parameters and biological parameters of two clam beds. The sex ratios were tested using chi square test. All statistical procedures were carried out at 5% level of significance.

III. Results

The temporal variations in the hydrologic parameters of the clam-beds during the study period are represented in figures 1 to 4. The average monthly values in salinity (Figure 1) of the *Paphia* bed ranged between 10.515 ppt to 31.195 ppt and in the *Meretrix* bed it was found to vary between 10.793 ppt to 29.295 ppt. The values of dissolved oxygen (DO) (Figure 2) in the Paphia bed showed variation from 2.245 to 7.185 mg/l where as in the Meretrix bed it varied from 3.597 to 10.179 mg/l. The P^H values of water (Figure 3) ranged between 7.8 – 8.36 in the Paphia bed and 7.6 – 8.35 in the Meretrix bed. The temperature ranged between 26° C and 31° C in both the clam beds (Figure 4). Correlation studies revealed that the salinity has highly significant negative correlation with dissolved oxygen (-0.456) and water p^H (-0.216). The density of *Paphia malabarica* exhibited significant positive correlation with salinity (0.218).The dissolved oxygen of the clam beds showed highly significant positive correlation with water p^H (0.518) and negative correlation with temperature (-0.248). The dissolved oxygen showed significant positive correlation with density of *Meretrix casta* (0.228) and significant negative correlation with density of *Paphia malabarica* (-0.227). The temperature of water indicated highly significant negative correlation with p^H (-0.328). The analysis of variance showed no significant variation in the values of salinity, p^H and temperature between sites. ANOVA revealed significant variations in the mean values of dissolved oxygen between sites ($p<0.001$).

The Figure 5 depicts the density (number/m^2) of the two clam species in the estuary. The density of clams exhibited a steady increase from December to May. The clam density decreased from June to October. The maximum density was recorded in May and the minimum in October-November. The clam *Paphia malabarica* was denser than the clam *Meretrix casta* in the estuary.

Results of the biometric measurements of *Paphia malabarica* and *Meretrix casta* are represented in figures 6 to 8. In Paphia the maximum value in total weight (9g) was recorded in July and the minimum value (5.27g) was recorded in March. Where as in *Meretrix casta* the maximum weight recorded was 20.504g in April and the minimum weight of 7.179 g in December. The highest wet tissue weight of 2.412 g was recorded in *Paphia malabarica* in August and for *Meretrix casta* it was 3.765 g in April. The lowest values of wet tissue in Paphia were recorded in February 1.196 g and in Meretrix it was 1.593 in March. The values of dry tissue weight ranged between 0.625 g in March and 1.93g in July in the case of Paphia. In *Meretrix casta* the weight of dry tissue ranged between 0.689 g in February and 1.604g in April (Figure 6). The total volume values ranged between 2.605 ml in March and 5.573 ml in July in Paphia and in Meretrix it varied between 4.383 ml in December and 12.43 ml in April. The shell volume values in *Paphia malabarica* ranged between 1.33 ml in March and 2.97 ml in July .Where as in the case of *Meretrix casta* it varied between 2.04 ml in December and 6.52 ml in April (Figure 6).

The values of height, length, width (Figure 7) revealed that in *Paphia malabarica* the smallest clams were recorded in December and the largest clams in November whereas in *Meretrix casta* the largest clams were obtained in April and the smallest clams in December. The maximum value of percentage edibility in *P.malabarica* was recorded in August (31.5) and for *M.casta* it was (26.01%) in December. The minimum percentage edibility value of 20.67% *(P.malabarica*) and 16.76% *(M.casta*) were obtained in February (Figure 8).

Table Iand Table II represents the sex ratio in *Paphia malabarica* and *Meretrix casta* respectively. In both the species the male and female sex ratio was found to be 1:1.

IV. Discussion

The two venerid clams, *Paphia malabarica* and *Meretrix casta* , forms vast clam beds in Ashtamudi Lake. Both these estuarine clams were found to tolerate a wide range in salinity. *Paphia malabarica* bed is distributed up to the barmouth whereas the *Meretrix casta* occupies the middle region of the estuary. Similar pattern in distribution of two clams in the estuary were reported earlier (Appukuttan *et al*., 2002). During the S-W and N-E monsoon seasons, when salinity was low, more shells were present in the collection of both the species. This showed that lowering of salinity by fresh water intrusion due to heavy rain caused mortality of clams. This indicates that both clam species prefer higher salinity.

The biometric measurements showed that in both the clam species all measurements were found to increase from April to November. Largest specimens were observed during November in the case of Paphia whereas the largest Meretrix species were observed in April. On observing the tissue mass production, it was evident that in *Paphia* the biomass production is increased from July to Decmber. This season correlated with gametogenesis in *Paphia malabarica*. In *Meretrix casta* tissue mass production was found increasing from April to December. The increased wet and dry tissue weight during the reproductive season reflects the accumulation of biochemical nutrients in the body. When population density is considered, the *Paphia malabarica* population is denser than *Meretrix casta*. The best time to harvest *Paphia malabarica* remains during monsoon season (June-September). It coincides with higher caloric value, high condition index and high percentage edibility (Ampili and Shiny,2012). Kumari *et al*. (1977) observed higher values of protein content in *Meretrix casta* from the estuary during monsoon indicating harvest season. In bivalve species, best term for harvesting is just before spawning period when condition index is at peak (Peharda *et al*., 2007). Yildiz *et al*. (2011) observed that the Oyster *Ostrea edulis* showed seasonal variation in the condition index, meat yield and biochemical composition. He also opined that the ideal period for their harvest is from April to August when the condition index was maximum.

Observations on the sex ratio in both the species showed that the male and female sex ratio was found to be 1: 1, that is the males and females are equally represented in the population. This shows that the populations are in equilibrium where in inbreeding and competition for mates does not occur. This also indicates that even if a portion of the potential spawning stock is left in the population, there will still be fertilization. Eventually this recruitment will translate into recovery of stocks provided that sustainable exploitation of the resources is practiced in the area.

ACKNOWLEDGEMENT

The author would like to acknowledge the financial assistance provided by University Grants Commission, India to carry out the project.

REFERENCES

[1] M.Ampili and K.Shiny Sreedhar. Nutritional Conditions: Condition Index, Percentage Edibility and Biochemical Constituents in *Paphia malabarica* (*Chemnitz*).*IJAFST*, 2012,pp.1-19.

[2] APHA. Standard methods for the examination of water and waste water, *American Public Health Association, Inc. Washington D.C.2002.*

[3] K.K.Appukuttan, T.S.Velayudhan, P.Laxmilatha, V.Kripa, P.S.Alloyacious, M.Vinod, G.S.Gayatri,and K.A.Narasimham. Clam resources in the Ashtamudi Lake, a tropical estuary in southern India: management and conservation concern, *Mar.Fish.Infor.Ser.T & E.Ser*. 2002. No.174.

[4] L.K.Kumari, M.D.Rajagopal, and S.Vijayaraghavan. Some aspects of biology and biochemistry of the backwater clam, *Meretrix casta* (Chemnitz), *Mahasagar Bull.NIO.,* 1977,pp,157-163.

[5] M.Peharda, C.A.Richardson, I.Mladineo, S.Šestanovic, Z.Popovic, J.Bolotin and N.Vrgoc. Age, growth, structure of *Modiolus barbus* from the Adriatic, *Mar.Biol*., 2007,pp,629-638.

[6] D.B.Quale, and G.F.Newkirck, Farming bivalve molluscs methods for study and development. In.P.A.Sandifer (ed.) Advances in World Aquaculture Volume.1.World Aqua.Soc.and IDRC. 1989.

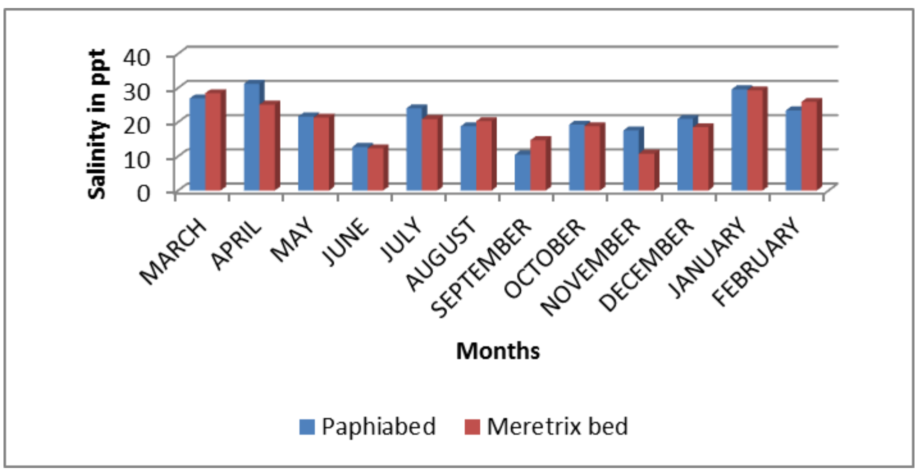
[7] J.D.H. Strickland and T.R. Parsons. A practical hand book of sea water analysis. *Bull. Fisheries Res. Board Can*.,1968,pp,167-311.

[8] R.Venkataraman and S.T. Chari. Studies on oysters and clams: Biochemical variations. *Ind. Jour. Med. Res.,* 1951,pp, 533-541.

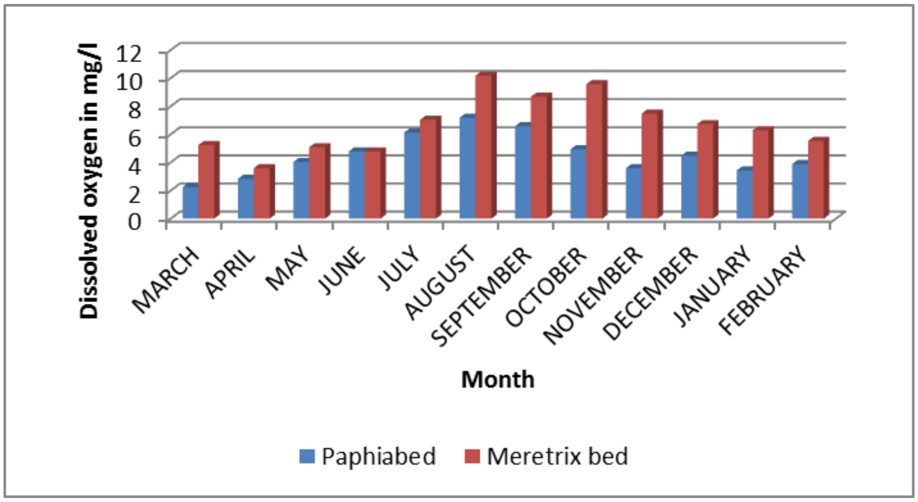
[9] H.Yildiz, S.Berber,S.Acarli and P.Vural. Seasonal variation in the condition index, meat yield and biochemical composition of the flat oyster *Ostrea edulis* (Linnaeus,1758) from the Dardanelles, Turky, *Ital. J. Anim. Sci*.,2011,pp,22-26.

AUTHORS

First Author – Ampili,M. Department of Zoology, N.S.S.Hindu College, Changanassery, Kottayam, Kerala, India., Email: ampilirajeev@gmail.com

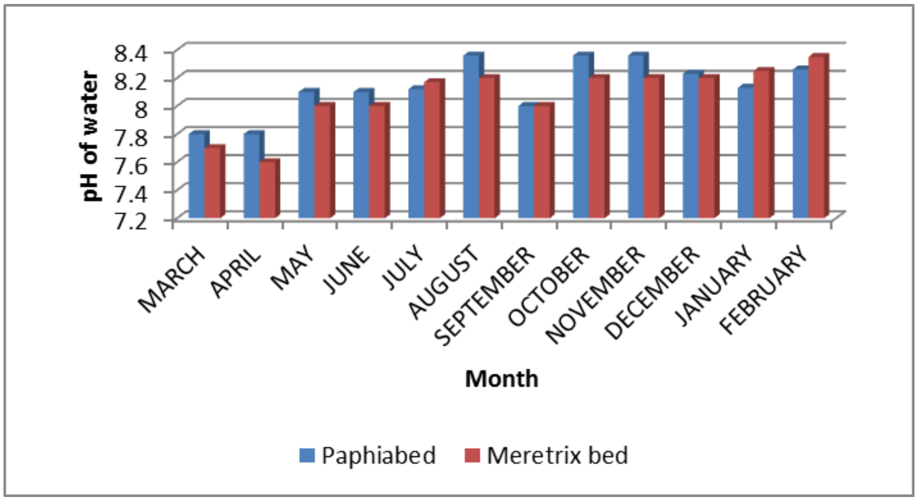


P<0.01
Figure 1: Salinity variations in the clam beds



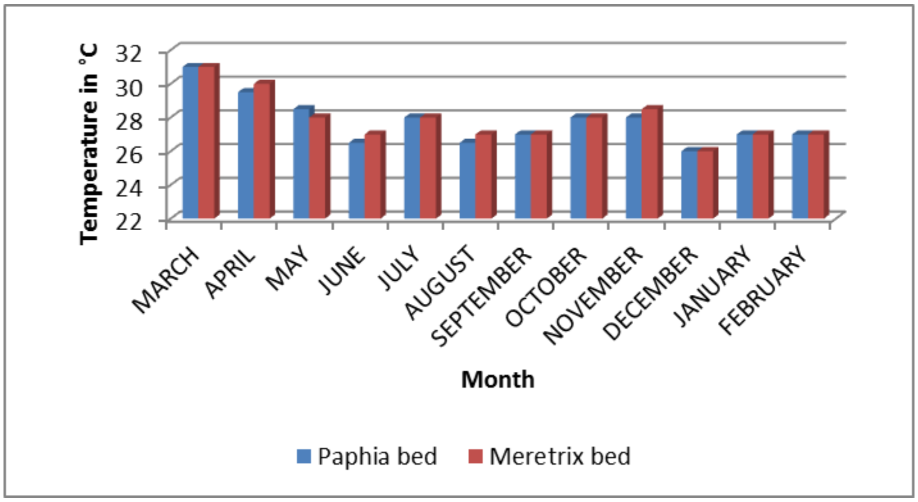
P< 0.01

Figure 2: Dissolved oxygen variations in the clam beds



P<0.01

Figure 3: Variations in the water p^H of clam beds



P<0.01

Figure 4:Variations in the water temperature of clam beds

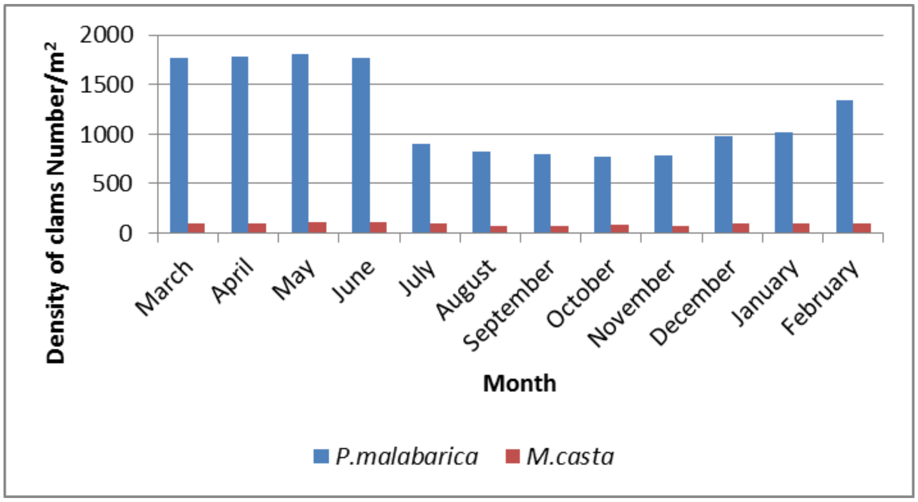


Figure 5: Density of clams in the estuary

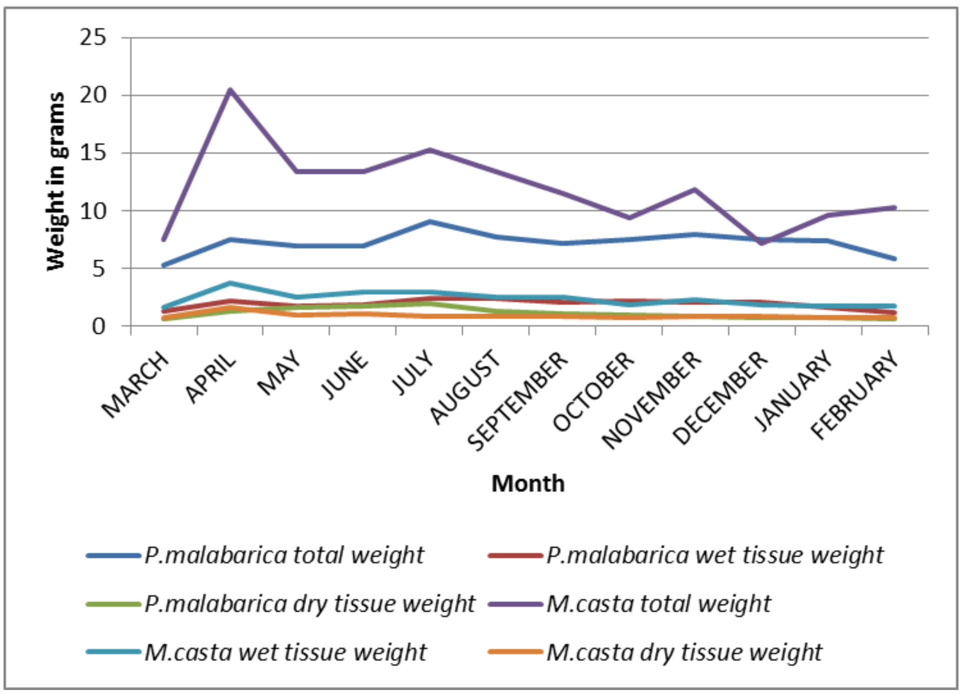


Figure 6: Weights of clams collected

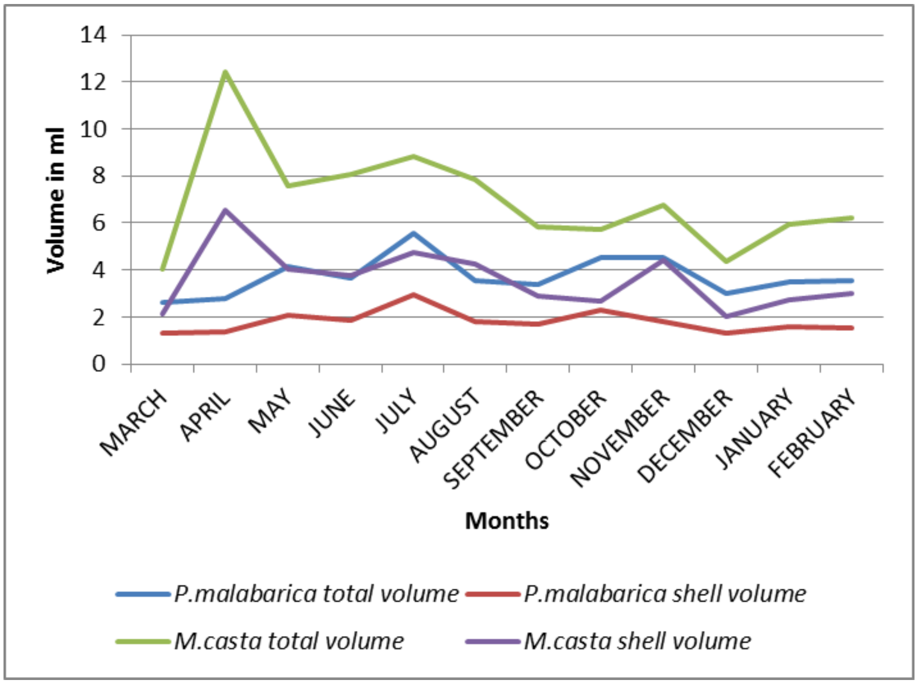


Figure 7: Volumes of clams collected

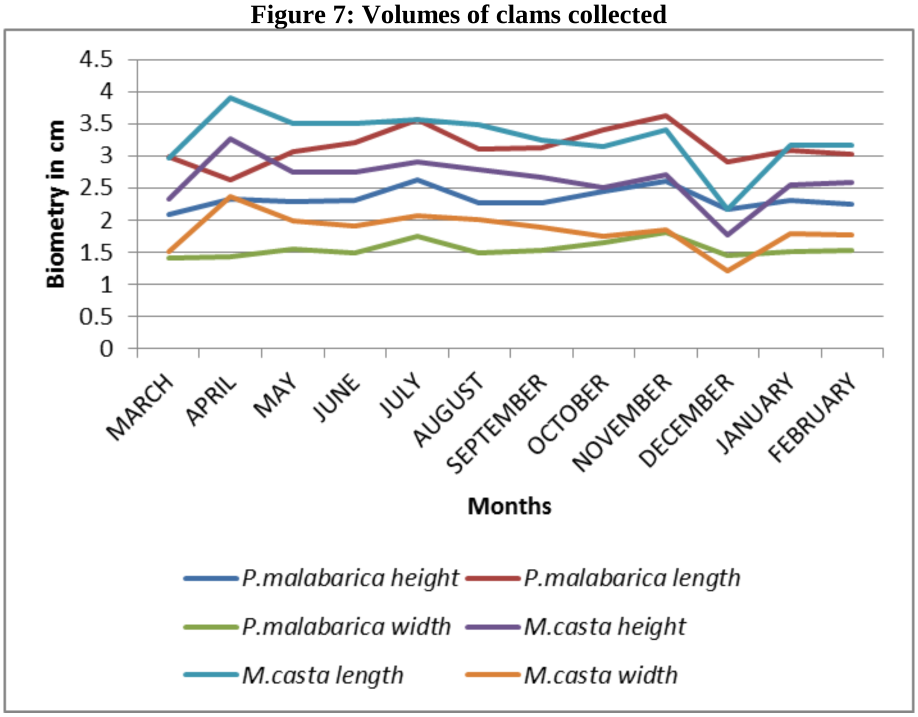


Figure 8: Shell morphometry of the clams collected

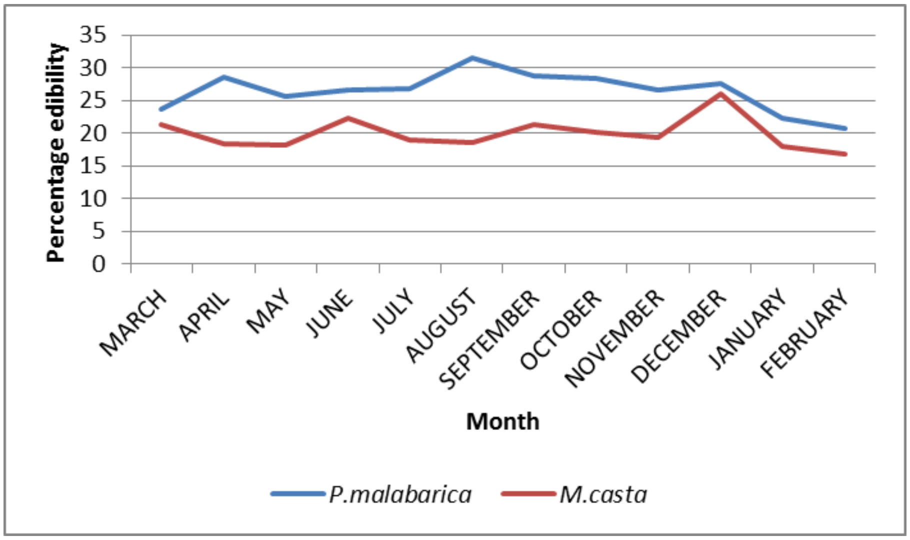


Figure 9 :Temporal variations in percentage edibility

Table I: Sex ratio in *Paphia malabarica*

MONTH	MALE	FEMALE	INDETERMINATE	TOTAL	SEX RATIO M:F
MARCH	30	40	30	100	01:01.3
APRIL	48	45	7	100	01:00.9
MAY	47	50	3	100	01:01.1
JUNE	46	50	4	100	01:01.1
JULY	45	49	6	100	01:01.1
AUGUST	47	51	2	100	01:01.1
SEPTEMBER	48	52	-	100	01:01.1
OCTOBER	46	54	-	100	01:01.2
NOVEMBER	49	51	-	100	01:01.0
DECEMBER	46	54	-	100	01:01.2
JANUARY	48	50	2	100	01:01.0
FEBRUARY	25	27	48	100	01:01.1
TOTAL (N)	525	573	102	1200	
%	43.75	47.75	8.5	100	

Table II: Sex ratio in *Meretrix casta*

MONTH	MALE	FEMALE	INDETERMINATE	TOTAL	SEX RATIO M:F
MARCH	42	58	-	100	01:01.4
APRIL	48	52	-	100	01:01.1
MAY	45	55	-	100	01:01.2
JUNE	40	42	18	100	01:01.0

JULY	45	53	2	100	01:01.2
AUGUST	56	40	4	100	01:00.7
SEPTEMBER	56	44	-	100	01:00.8
OCTOBER	47	53	-	100	01:01.1
NOVEMBER	49	51	-	100	01:01.0
DECEMBER	44	51	5	100	01:01.2
JANUARY	45	49	6	100	01:01.1
FEBRUARY	26	25	49	100	01:01.0
TOTAL (N)	543	573	84	1200	
%	45.25	47.75	7	100	