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Oyster Resources of Ashtamudi Lake, South West Coast of India

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Abstract

Ashtamudi Lake in Kerala has a rich oyster resource dominated by the Indian oyster *Crassostrea madrasensis* and the rock oyster *Saccostrea cucullata*. This resource which is extensively distributed in the estuary sustains a minor fishery. Studies were conducted to understand the seasonal variation in the density and biomass of these two species in the intertidal and subtidal system. The variation in the epifauna associated with the oyster population in different points of the estuary is given. Results of the experiments conducted to study the oyster spatfall season in the estuarine and marine zones is presented and discussed with reference to site selection in oyster farming and periods for setting oyster spat collectors in the estuary.

Introduction

Edible oysters of the genera *Crassostrea* and *Saccostrea* occur in the estuaries, backwaters and coastal areas of India. *Crassostrea madrasensis* is the dominant oyster along Indian coast. In the recent years, extensive surveys were conducted in the estuaries of Tamil Nadu to study the potential oyster resource (Rao *et al.,* 1987; Sarvesan *et al.,* 1988; Thangavelu and Sanjeevaraj, 1988). Along the Kerala coast oyster beds are distributed in the coastal zones and estuaries. Kerala has a rich oyster resource, however hardly any work has been done on the ecology of oyster beds. Purushan *et al.,* (1985) have studied the variation in density and biomass of the oyster beds in Cochin area. Oysters were considered as fouling organisms and their fouling pattern studied (Nair, 1967; Nair and Nair 1985). Ashtamudi Lake in Kerala has extensive oyster beds and oysters are exploited for their meat. Studies by Velayudhan *et al.,* (1995) have suggested the scope for large scale oyster culture in this area. In the present study, the variation in oyster density and biomass, the spatfalll pattern and the organisms related to oyster community is presented.

Materials and Methods

The study was carried out in Ashtamudi Lake lat. 8°45 = 9°28N and long. 76°28 = 77°17'E with a waterspread of 32 km. Four stations were fixed at intervals of 4 kms, with the first station near the Neendakara barmouth. The first three stations were intertidal while the fourth one was a subtidal population located adjacent to the III station. Monthly samples were taken by removing all the oysters and other fauna and flora occurring in 1 sq.m. area. The total number, whole weight and meat weight of oysters were noted. The different faunal groups were identified and their intensity of occurrence was observed.

To study the intensity of spatfall asbestos test panels of 20 x 20cm were exposed at monthly intervals in the estuarine and barmouth region. The experiment was conducted from March 1994 to February 1995. A set of 2 panels each were introduced at each station in the beginning of the month and removed after being exposed for a period of 29 to 30 days. After removal the panels were preserved in formalin for 24 hrs. The number of oyster spat on the panels were counted and the best spat collection period was inferred.

Results and Discussion

Crassostrea madrasensis and *Saccostrea cucullata* occurred in all the stations throughout the period of study. However their dominance in four stations showed variation. The total density of oyster, was highest in Station I situated near the barmouth region and showed a gradual reduction in the subsequent stations reaching a lowest value (av. 82 nos/sq.m) in Station IV in the subtidal zone.

Saccostrea cucullata dominated the population near the barmouth and contributed to nearly 81.7% of the total oysters while in Station II it formed 50.7%. The density of this species was low in the oyster beds in Station III and IV, the minimum density (12 nos/sq.m) being recorded in Station III where it contributed to 14.7% of the total oyster population. Monthly variation in density of *S. cucullata* was noted in all the Stations. In Station I there was wide variation, ranging between a maximum of 258 in February and minimum of 43 nos. in September. In Station III and IV the variation was not as pronounced as in Station I. The densities ranged between 32 to 6 nos/sq.m. and 20 to 11 numbers/sq.m. in Station III and IV respectively (Table I). *C. madrasensis* formed only 18.3% of the population in Station I whereas this was the dominant species in the Station III and IV where it contributed to 85.3 and 81% of the oyster population. In all the stations the densities of *C. madrasensis* fluctuated widely. The densities were high during February - March and low during July - September. The monthly variation was more pronounced in Station I and II where the density ranged between 49 to 14 and 96 to 30 nos./sq.m. In Station III and IV the fluctuation in density was comparatively low ranging between 92 to 50 and 86 to 54 nos/sq.m.

Table 1: Monthly variation in Oyster Density (Nos. per sq.m.) in Ashtamudi Lake

Month	Station I		Station II		Station III		Station IV	
	S	C	S	C	S	C	S	C
March 1994	180	38	88	68	19	92	14	86
April	145	27	76	53	8	87	13	75
May	148	28	68	55	16	64	18	54
June	147	29	47	34	15	68	20	58
July	98	16	52	38	6	53	20	57
August	78	14	30	28	9	50	19	56
September	43	19	28	30	6	55	16	53
October	48	18	29	28	8	52	11	58
November	47	21	31	38	8	83	16	63
December	98	28	47	96	13	89	13	79
January 1995	208	48	58	78	12	93	12	78
February	258	49	72	62	32	104	18	84

S: *Saccostrea cucullata*
C: *Crassostrea madrasenisis*

The distribution oysters in Ashtamudi lake showed zonation. *S. cucullata* dominated in the barmouth region and *C. madrasensis* in the estuarine region. Such zonation has been observed in mangrove oysters. *C. rhizophorae* is the common species in the Caribbean, but under more marine conditions *C. rhizophorae* is replaced by other oysters like *Isognamon bicolor* or I. alatus. (Bacon *et al.,* 1990). Such variation in density and zonation has been attributed to variation in salinity tolerance levels. The high densities during February - March can be attributed to the spat settled after the peak spawning in November - December and the low density during June to September to the mortality caused due to monsoon. Similar density variation has been observed in the oyster bed in Cochin area (Purushan *et al.,* 1985). Mortality due to low saline conditions created by the south west monsoon is the main cause for low density. High density is related to spatfall.

Oyster biomass was highest, average 256 g/sq.m in Station II and lowest, 177g/sq.m. in Station III. *Saccostrea cucullata* with an average biomass of 165 g/sq.m. contributed to 76.2% of total oyster biomass in Station I. Towards the estuarine region, the biomass contributed by this to the total oyster biomass showed a decreasing trend reaching a minimum of 10.7% in Station IV. In Station I, the variation in biomass ranged between a maximum of 250.9 g/sq.m. in May and a minimum of 102.2 g/sq.m. in January. The biomass of *Saccostrea cucullata* ranged between a minimum of 46.8 and a maximum of 131.4 g/sq.m. in July and May respectively in Station II. In the estuarine region, the fluctuation in biomass was not as pronounced as that in the first two stations, since the biomass values ranged from 29 to 12 g/sq.m. and 28 to 11.8 g/sq.m in Station III and IV respectively. Variations in biomass of *S. cucullata* is given in Table 2.

C. madrasensis contributed to 88 to 89% of the total oyster biomass in Station III and IV. Towards the barmouth region the biomass contribution by this species showed a decreasing trend, reaching a minimum, 51.4 g/sq.m. in Station I contributing only 23.8% of the oyster population. The biomass of *C. madrasensis* did not show much variation, in Station I while in Station II, the biomass fluctuated widely ranging between a minimum of 73.2 g/sq.m. in August and maximum of 256.6 g/sq.m. in May. In Station III and IV the higher values, 189, and 228 g/sq.m. were noted in October. The biomass was low, 123 g/per sq.m (May) and 132 g/sq.m (Feb) in Station III and IV respectively. The biomass variation of *C. madrasensis* is given in Table 2.

Table 2: Variation in Oyster biomass (g. per sq.m.) in Ashtamudi Lake

Month	Station I		Station II		Station III		Station IV	
	S	C	S	C	S	C	S	C
March 1994	162.3	32.0	63.9	198.0	12.3	152.0	11.8	138.0
April	180.4	36.0	108.3	225.0	24.0	182.0	22.1	153.0
May	250.9	45.0	131.4	256.6	29.0	123.0	23.5	159.0
June	247.6	48.0	56.9	164.0	28.0	148.0	15.6	169.0
July	223.3	52.0	46.8	135.0	16.0	137.0	17.2	162.0
August	102.2	58.0	24.9	73.2	12.0	146.0	18.2	172.0
September	116.9	56.0	23.2	96.0	17.0	138.0	17.8	205.0
October	147.7	59.0	68.1	108.0	24.0	189.0	20.2	228.0
November	153.8	62.1	99.3	223.0	27.0	203.0	28.1	213.0
December	168.3	64.0	128.1	215.0	25.8	163.0	27.1	173.0
January 1995	102.2	53.0	119.7	198.0	16.2	152.0	23.2	148.0
February	131.1	52.0	108.6	213.0	18.0	143.0	28.2	132.0

S: *Saccostrea cucullata*
C: *Crassostrea madrasenisis*

The oysters were attached to the embankments in the intertidal zone near barmouth and estuarine regions of the estuary. Near the barmouth oysters were not found in the subtidal region whereas in the subtidal region, adjacent to Station III there was an oyster bed which was patchy in nature. In this subtidal population oysters were attached mainly to dead shells of clams and gastropods.

The macrofauna associated with oysters were categorised into foulers, borers and interstitial fauna. Barnacles and calcareous polychaete worms formed the major foulers occurring throughout the year in Station I and II while in Station III and IV there were found only in low intensity and were completely absent during July and August. *Modiolus* and seaweeds were the major foulers in Station III. Heavy fouling by seaweeds was a peculiarity noticed in Station III. Green algae, like *Ulva, Chaetomorpha* and *Enteromorpha* brown algae *Ectocarpus* and red algae *Amphirova* were noticed on the oysters from July to February. Fouling in general was low in the subtidal populations (Station IV). Boring by the sponge *Cliona* was noticed in Station I, however the intensity of boring was low since only less than 25% of the oysters examined were infected. Intense boring by the mudworm *Polydora* sp. was the prominent feature in the oyster population in Station III and IV, where boring was noticed in 80 to 85% of the *Saccostrea cucullata* examined. Only 5 to 10% of the population were infected in Station II.

The oyster beds in the barmouth area had intense fouling by barnacles and polychaetes when compared with the estuarine stations. Similar dominance of these two foulers in the marine area when compared to the estuarine zone of Mangalore has been attributed to their preference for high saline environment (Menon *et al.,* 1975). Seaweeds have formed a part of oyster beds in many parts of the world, (Littlewood, 1991). Rao and Sundaram (1972) have reported on the occurrence of *Enteromorpha* and *Caulerpa* in the oyster beds in Palk Bay. However in the present study it was observed there is lustrous growth of seaweeds in the Ashtamudi Lake in the estuarine area during the monsoon and postmonsoon period only.

Infestation by *Polydora* has been observed in *S. cucullata.* In French Polynesia the entire culture operation of *S. cucullata* had to be abandoned due to parasitation by *Polydora* on cultured organisms (Coeroli *et al.,* 1984). In the present study also *S. cucullata* was noted to be heavily infected by the mudworm in the estuarine region while in the barmouth region it was comparatively low.

Other fauna which were closely associated with the oyster beds and forming an important part of the oyster community were *Nereis,* isopods, adult crabs, prawn and fish larvae, Crustacean larvae and gastropods. In Station IV other mollusc like *Paphia malabarica, Meretrix casta* and *Perna virides* were noted. Post larvae of commercially important penaeid and nonpenaeid prawns and larvae of *Macrobracium* were seen to occupy the sheltered area created by dead oyster shells in the oyster beds. Fishes were important grazers visiting the oyster beds frequently.

Settlement of spat of *C. madrasensis* was seen on the panels kept in the barmouth and estuarine region throughout the year. Spatfall was intense during November to January in both the sites, the maximum being 35 nos/panel kept near in the barmouth region and 24 numbers/panel in December in the estuarine region(From June to August the settlement was negligible. Another minor peak with an intensity of 11 and 9 numbers/panel was seen in the barmouth and estuary in May respectively. Saccostrea cucullata spat were more in the barmouth region, ranging between 13 to 1 numbers/panel while in the estuarine region the maximum numbers of spat noticed was 4 number per panel.

The studies on spatfall indicate that the spat can be collected from the estuary during November to January period and also during May. However the spat settled during May are prone to mortality caused by monsoon in the succeeding months. Menon *et al.,* (1977) have suggested that though the larvae of oysters are present in the plankton of Mangalore waters throughout the year, their peak settlement after the settlement of barnacle may be due to competition for sapce which plays a decisive role in the settlement of foulers.

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