of blood lactic acid. Activity decreased during the first 5 and 10 minutes but by 15 minutes the fishes were so exhausted that they reacted very little. The blood pH values dropped significantly by 5, 10, and 15 minutes. The same views were also reported by Gerard C. Le Tendre (1968) and Black (1958).

The blood pH may, therefore, be said to be a more reliable indicator of the condition of the fish, and hyperactivity can be considered as a lethal factor in fresh water teleosts.

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ON THE CULTURE POSSIBILITIES OF *MERETRIX CASTA* IN BHIMUNIPATNAM BACKWATERS

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ABSRACT

It is observed that a rich natural bed of the clam *Meretrix casta* existed in the Bhimunipatnam backwaters, 32 kilometers north of Visakhapatnam. Some interesting points of observation on this bed are presented in this note.

Location of the clam bed:

The river *Gosthani* flowing in a south-easterly direction joins the sea at Bhimunipatnam. The clam bed is situated 3.3 km north of the river mouth (map) in the shallow areas of the estuary. The area of the clam bed is fairly extensive occupying 3.17 hectares, the depth range was from ½ m to 2 m. The tidal influence extends a kilometer further north of this region where the clam bed is situated.

Hydrological conditions:

The salinity, temperature, PH, and dissolved-oxygen values both at the river mouth and in the clam bed area from May-September '76 are shown in

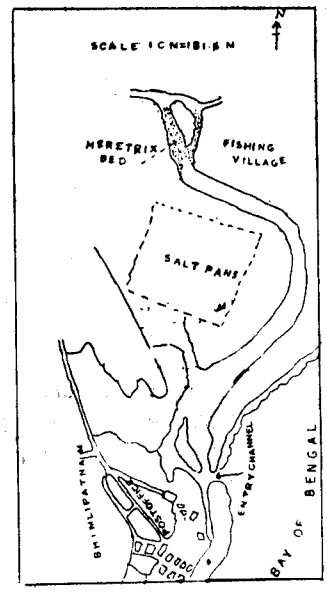

FIG. 1. Map showing Bhimunipatnam back water and the dam bed.

Table 1. In May, the salinity values near the river mouth and in the clam-bed area were nearly equal. In June, when the river-mouth was closed, the salinity over the clam bed increased. During July and August there was a sharp decline in the salinity at the clam bed due to freshwater influx and absence of tidal influence due to closure of the river mouth. In September, the salinity had further gone down to less than 1 ‰. The pH, dissolved-oxygen and temperature values did not show much change.

Planktological condition:

From April 76 to the first week of June Phytoplankton was abundant over the clam bed. *Coscinodiscus* spp; *Rhizosolenia* sp, *Asterionella japonica, Pleurosigma* sp, *Lauderia* sp, *Biddulphia* sp, *Skeletonema* sp, *Fragillaria oceanica, Nitzchia* sp, *Chaetoceros* sp, and the dinoflagellate *Ceratium* spp., were observed in large numbers. This period happens to be the bloom period for phytoplankton in the Bay of Bengal and rich plankton is carried with the tidal water up the river.

Nauplii of cirripedes and copepods, copepodites of *Oithona rigida* and *Euterpina acutifrons* were predominant in the plankton from later half of June till the end of September. Though there were no marine diatoms due to absence of tidal influence, some species of freshwater chain diatoms were noticed in the samples on account of the admixture of river waters.

Table. 1. *Environmental parameters at the river mouth and in the clam bed during May-Sept. 76.*

		Water temp. °C.	Salinity	PH	Dissolved oxygen ppl mille.	Remarks
12-5-76	River mouth	29.5	32.97	8.2	2.23	
	Calm bed	28.0	—	8.2	4.03	
26-5-75	River mouth	27.5	32.83	8.4	2.64	
	Calm bed	32.0	31.56	8.2	1.72	
1-6-76	River mouth	30.5	33.17	8.0	3.70	River mouth
	Calm bed	29.0	34.05	8.0	2.46	closed on 16-6-76.
29-7-76	River mouth	27.0	33.37	8.0	4.09	River mouth
	Calm bed	30.5	22.72	8.0	4.09	opened on 16-7-76
9-8-76	River mouth	31.0	20.55	8.2	6.04	River mouth
	Calm bed	29.5	13.15	8.0	5.9	closed on 9-8-76
30-8-76	River mouth	28.0	30.30	8.2	3.99	
	Calm bed	29.0	1.0	8.0	3.95	
14-9-76	River mouth	31.0	16.22	8.2	4.78	
	Calm bed	30.5	1.0	8.4	4.00	River mouth opened

The substratum:

39 grab samples were collected mostly in the clam bed and some in the adjacent areas. Each collection was separated into four fractions by sieving and sedimentation. The results of the analysis are given in Table 2. Owing to the low topographic gradient and active sedimentation most of the bottom materials in the area are unconsolidated mud and sand in various combinations. As is usually the case with such estuarine areas, mud was found characteristic of the upper regions where there was reduced current action. Sand was found in the channels and near the river mouth. A feature many estuaries where the river water, completely or fully utilised for irrigational purposes, does not cause floods, is the development of extensive tidal flats. These flats are inhabited by communities of burrowing and tube-dwelling organisms, feeding on suspended matter, detritus, and in many cases the organic material in the mud itself. At Bhimunipatnam *M. casta* were invariably found in areas where mud, sand and detritus were observed in combination. They were not present in exclusively muddy or sandy bottoms. One of the ecologically most important characteristic of the muddy bottom of the estuaries is the tendency to certain water of high salinity as the tide recedes. This property enables the organisms to penetrate a greater distance in the estuary and also to tide over periods when the salinity of the overlying water declines due to land drainage.

Table. 2. *Analysis of the grab samples.*

	No. of grab samples Calm bed	Outside clam bed	Total	% of sand	% of fine sediment	Organisms observed in 3 factions.
April 76	1	—	6	95%	5%	Fine sediment
		5		98%	2%	*Pleurosigma*
May 76	6	—		90%	10%	*Coscinodiscus*
		1	7	98%	2%	Other diatom
June 76	2	—	2	95%	5%	fragmets & fine organic ooze.
July 76	4	—	4			
August 76	20	—	20	90%	10%	
				90%	10%	*Meretrix* other bivalves Gastro-
Sept. 76	24	—	24	—	—	pods Polychaetes; Amphipods

Density distribution of the clam:

In addition to these, 13 more grab samples were collected in September and analysed to estimate the population density of the clam. The grab scooped an area of 330 sq. cm. and density |M^2 was calculated on that basis. The date wise distribution of this density is given in Table 3. It was observed that density of the clam was maximum in areas where the volume of organc detritus was comparatively more. The harvesting was done by the local fishermen in July and August. Therefore, the data had been presented separately for the pre harvest and post harvest period. In the pre harvest period the maximum density observed was 11,999 shells|metre^2 and the average was 4181 shells|metre^2. Even the highest density observed in the post-harvest season was less than the average for pre-harvest period. The difference between the average densities worked out to 2790 shells which probably indicates, harvest|metre2. The weight of 2790 shells (with flesh) was estimated by weighing a random sample from the harvest which weighed 2.1 kg. From these figures it would work out that about 21 tons of clams were removed from a hectare and a total of over 66 tons of clams from the entire area. Thus the standing crop before harvest worked out to 33 tons|hectare.

Harvesting operations:

The bulk of the clams harvested during the season (July-August) was used for lime industry besides little quantities used for domestic consumption. An average number of 12 to 15 boats per day was found fishing during the peak season. Shells for domestic consumption were collected sporadically, involving 20-30 persons (including children) on an average, every day. A close-meshed nylon bag with a rectangular G.I. sheet mouth frame (40 x 20 cm) was em-

Table. 3. *Date-wise distribution of density of clam.*

	Number in grab sample	Number/m2	Date	Number in grab sample	Number /m2
26-4-76	243	7362.8	29-7-76	10	303.0
12-5-76	24	727.2	"	37	1121.1
"	396	11998.8	"	59	1787.7
"	121	3666.3	9-8-76	20	606.0
26-5-76	170	5151.0	"	25	757.5
"	28	848.4	"	78	2363.4
21-6-76	59	1787.7	"	40	1212.0
"	63	1908.9	"	36	1090.8
			"	37	1121.1
			30-8-76	114	2454.2
			"	24	727.2
			"	75	2272.5
			"	71	2151.3
			"	50	1515.0
			"	10	303.0
	AVERAGE	4181.4		AVERAGE	1385.7

ployed to scoop out the shells. The bag with its contents was vigorously shaken in the water till all the mud washed off leaving only clams inside the bag. The clams thus collected were loaded in boats and taken to Bhimunipatnam for marketing. A boat load of clams fetches about Rs. 20/- to Rs. 30/- depending on the demand, and each boat with a crew of two fishermen harvest a boat load in a day. Ten lorry loads of clam were harvested in July and August 1976.

Size groups in the harvest:

Random samples were taken from the heaps of harvested clams and were measured. Clams measuring more than 20 mm (largest diameter) formed only 5% of the harvest. The clams in the grab samples measured earlier also showed that only 5% of the clams were larger than 20 mm size. However, a few clams collected from the bed measured more than 40 mm. The maximum size recorded was 55 mm maximum weight 74 g.

Influence of lowering salinity:

The closure of the river mouth, preventing tidal water entering the backwaters, and the freshwater inundation during the mouth of August ,resulted in a drastic change in the salinity. The harvesting was done at this period and at least two-third of the standing crop was removed. Grab collections were made in the second week of September to find the density of the clam and the relevant data are given in Table 4. The density was drastically reduced and more

dead shells were observed than live ones. As the grab scrapes only the surface up to 5-10cm depth, the bottom was dug with hands and live clams were found burried in the sand. The size of these clams ranged from 13mm to 55mm with a modal size of 20-24mm. Thus the clam appears to tide over the adverse environmental conditions by burrowing into the substratum.

Table. 4. *Density distribution of clam on* 14-9-76.

Sl. No.	No. in grab sample	Number per|m2	Volume of dead shell per|m2 in c.c.
1	10	303	455
2	4	121	303
3	41	1242	606
4	8	242	152
5	1	30	152
6	6	182	455
7	23	697	606
8	2	61	606
9	—	—	121
10	14	424	1515
11	1	30	61
12	—	—	152
13	7	212	606

Bardach *et al* (1972) described clam-culture practices in Japan and South East Asia. *Meretrix casta* is an edible clam and can grow up to 55 mm in the locality. But at present clams measuring less than 20 mm are being harvested, primarily for the lime industry. There are areas adjacent to this clam bed which are suitable, for all practical purposes, to grow the clam. The size of the clam in the present bed remains small probably due to very high density. A good number of these clams can be removed from the present bed and transplanted in adjacent areas. By this removal, the remaining clam in the bed may grow to a better szie. The transplanted clam help in a lateral extension of the present bed. It is possible to bring at least 3 hectares of the adjacent area under clam cultivation by this process. The labour involved is minimal.

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