SOME OBSERVATIONS ON THE INDEX OF CONDITION OF THE CLAM
*MERETRIX CASTA* (CHEMNITZ) IN RELATION TO
MUD AND WATER QUALITIES

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**ABSTRACT**

The physiological condition (Index of condition) of *Meretrix casta* were studied in relation to pH, salinity, dissolved oxygen, total and inorganic phosphates, silicates, nitrates and calcium, and varying coarseness of mud of the experimental ponds and the results were compared with similar observations on natural clam beds in the Athankarai estuary - 15 Km west of Mandapam Camp. The ponds with sandy muddy bottom and rich in nutrients do not seem to be suitable for the culture of this clam.

**INTRODUCTION**

The factors such as salinity, dissolved oxygen, phosphates, organic contents, silt and nature of the bottom are believed to affect the health and condition of shell-fish (Galtsoff et al., 1947; Korringa and Postma, 1957). In view of this, a short study was taken up on the physiological condition (Index of condition) of the clam *Meretrix casta* from ponds 1, 4 and 7 of the Marine fish farm of the Central Marine Fisheries Research Institute, Mandapam Camp. For comparison, the study was extended to the natural clam beds in Athankarai estuary about 15 Km. west of Mandapam Camp.

**MATERIAL AND METHODS**

The clams were handpicked from ponds, 1, 4 and 7 of the Marine Fish farm and Athankarai estuary and kept in the running sea water so as to clean them of their faeces. The Index of condition was determined for each clam by the method of Baird (1958). The number of clams examined from each locality was always more than hundred except for Pond I where only 88 clams were examined.

The study was made in the period July to October when the majority of clams are not in the spawning stage and thus are believed to be in good health.

The water and mud samples were collected along with clams. Water samples refer to the surface samples and the mud samples to the layer of bottom mud of about

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3 inches depth collected by a metal mud sampler. All the collections were made during morning hours. The water samples were analysed for pH, salinity, dissolved oxygen, total and inorganic phosphates, silicates, nitrites and calcium by the standard methods. The mud samples were subjected to grading by the method of Fraser (1932), slightly modified to suit the present investigation and the available test sieves. Sand and mud particles that left on the sieve with the aperture size of 1003 microns (BSS 16), were classified as coarse grade, those left on the sieve with the aperture size of 500 microns (BSS 30) were classified as medium grade while the remaining on the sieve of 62 microns (BSS 250) aperture, were included in the fine grade. All that passed through the sieve of 62 microns was silt.

The total water content of the meat was determined by drying the blended clam meat at 95°C in hot air oven for 36 hours, while the ash was estimated by incinerating the meat at 600°C in a muffle furnace. The entire analytical work was done with triplicate samples and the mean values are reported in this paper.

RESULTS AND DISCUSSION

It will be seen from fig. 1 and Table 2 that, in pond 1 and also in Athankarai estuary, the majority of clams have higher values of index of condition than the clams from other two ponds suggesting thereby that the clams of the former places are of better quality than those inhabiting the ponds 4 and 7. This observation is further supported by the values of total water content (Table 2). Ash content of these clams, however, shows interesting results in that it rises with the water content. It may be mentioned here that the index of condition of clams under investigation appears considerably low than that of mussels of Conway, U.K., reported by Baird (1958).

There is an apparent correlation between the index of condition and the water qualities. It would be seen from the Table 1 that, in pond 1 and Athankarai estuary, the index of condition is high along with the presence of phosphates and nitrites (only in Athankarai) in the waters. This is in contrast to the condition in ponds 4 and 7, where phosphates and nitrites are considerably low along with low index

<table>
<thead>
<tr>
<th>Table 1. Water analysis from different localities</th>
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<tr>
<td><strong>Locality</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Pond 1</td>
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<tr>
<td>Pond 4</td>
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<tr>
<td>Pond 7</td>
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<tr>
<td>Athankarai Estuary</td>
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</table>
Fig. 1. Percentage frequency of the clam *Meretrix casta* belonging to the different groups of index of condition given locality-wise (Figure in the corner of each diagram indicates the number of clams examined from the locality).
values. The 'nil' (?) values of the above nutrients in ponds 4 and 7 (Table 1) may be deceptive as the surface water samples may not contain the nutrients due to non-mixing of water layers or more probably due to their negligible release from the bottom mud. This negligible release could be due to the partial loss of phosphorus as insoluble compounds in the presence of Ferric organic complex, aluminium and calcium (Mortimer, 1941, 1942, 1949; Zicker and Berger, 1956; Banerjee and Ghosh, 1963). The last constituent appears in good quantity in fish ponds (Table 1), and in this context, it is difficult to interpret the release of phosphates in pond 1. Banerjee and Ghosh (1963) observed a rising trend of dissolved phosphates in water along with levels of available phosphorus in the soil.

It is quite likely that the water layer immediately overlying the mud rich in nutrients, may be somewhat richer in these constituents. This small layer of water immediately overlying the bottom is more important for the sustenance of filter feeding clams which lie buried in the surface layer of the bottom. The mud analysis (Table 2) indicates that the bottom soil of all ponds contains more organic matter than that of Athankarai estuary. This organic matter, no doubt, is due to the occasional manuring of ponds by cow-dung compost and may also be due to the faecal pellets of the shell-fish themselves (Verwey, 1952). The mud in the ponds selected for study also showed a layer of greenish scum of blue-green algae, diatoms and also the rich bacterial flora. The bottom deposits in the ponds are also rich in phosphates and nitrites but the negligible quantity, especially of phosphates, appears to be released to the overlying waters as discussed earlier. It is felt that at least a part of the soil nitrogen is fixed as bacterial protein which is then easily available to clams.

The mud grading from ponds as well as Athankarai, shows that the percentage of fine grade is fairly high in ponds than in Athankarai estuary. The percentage of silt is more or less the same in all localities except in pond 1 where it is fairly high, being 45.72%. This value, however, appears doubtful as it is possible that a higher density of clams here might have increased the silt content of the bottom (Verwey, 1952). The soils of all these localities are black possibly due to the high content of ferrous sulphide. These conditions are known to be more congenial for the clam _M. casta_. The silt content of the fish ponds though in high percentage, does not appear to harm the clams. It may be mentioned here that the silt content of the above localities is much higher than the localities of thick mud (1.32 - 13.77%) and stony area (11.48%) inhabited by _Mya arenaria_ and _Macoma balthica_, studied by Fraser (1932).

The water content of the mud from ponds and Athankarai (Table 2) is not high and these muds may be comparable to the 'thick' mud (water content 26.64-34.68%) favoured by _Macoma, Mya_ and to some extent _Cardium_ (Fraser, 1932). Walton (1920) and Pirrie et al. (1933) observed that _Cardium edule_ and _Paphia pulastra_ invariably inhabit more sheltered areas and the substratum of fine grade,
<table>
<thead>
<tr>
<th>Locality</th>
<th>No. of clams examined</th>
<th>Average value of the index of condition</th>
<th>Total water content of meat</th>
<th>Total ash content of meat</th>
<th>Organic content %</th>
<th>Water content %</th>
<th>Phosphates Adsorbed P. (μg/g. silt mud)</th>
<th>Total P. (μg/g. mud)</th>
<th>Coarse %</th>
<th>Medium %</th>
<th>Fine %</th>
<th>Silt %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pond 1</td>
<td>88</td>
<td>31.78</td>
<td>72.97</td>
<td>1.47</td>
<td>13.97</td>
<td>40.43</td>
<td>2.38</td>
<td>5.95</td>
<td>66.15</td>
<td>2.48</td>
<td>11.39</td>
<td>40.41</td>
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<tr>
<td>Pond 4</td>
<td>118</td>
<td>22.95</td>
<td>81.29</td>
<td>2.39</td>
<td>17.14</td>
<td>32.93</td>
<td>2.03</td>
<td>5.12</td>
<td>232.22</td>
<td>3.99</td>
<td>5.95</td>
<td>67.98</td>
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<tr>
<td>Pond 7</td>
<td>120</td>
<td>26.16</td>
<td>76.56</td>
<td>1.52</td>
<td>16.02</td>
<td>42.03</td>
<td>2.23</td>
<td>7.55</td>
<td>285.49</td>
<td>3.44</td>
<td>10.34</td>
<td>57.76</td>
</tr>
<tr>
<td>Anthankarai Estuary</td>
<td>120</td>
<td>33.04</td>
<td>71.38</td>
<td>1.04</td>
<td>5.98</td>
<td>35.32</td>
<td>3.28</td>
<td>60.72</td>
<td>586.74</td>
<td>8.19</td>
<td>39.98</td>
<td>27.38</td>
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</table>
high detritus content and blackness of sand due to ferrous sulphide. The clam *M. casta* of the present investigation appears to select more or less a similar habitat. The fish ponds are perhaps more favourable so far as the shelter and fineness of grade are concerned. This also is evident from the fact that shell surfaces of clams from Athankarai estuary were eroded while clams from fish ponds had smooth glossy shell surfaces. It is interesting to note here that *M. meretrix lusoria* from Japan inhabits bays and creeks with freshwater influence and sandy-muddy bottoms composed of 60 to 80 per cent sand, while *M. lamarckii* prefers open ocean coast of Japan (Icho and Oshima, 1938 and Cahn, 1951).

It may thus appear that the sheltered nature, thick sandy-muddy bottom and nutrient conditions of the marine fish ponds at Mandapam are suitable for clam culture. However, closer study of the quality of the clam *M. casta* as indicated by the index of condition which was found to be low, more or less rules out the suitability of fish ponds for clam culture. This however, needs further investigation. The low index value in the clams of fish ponds may probably be due to the constant high salinity, lack of the influence of freshwater and more or less stagnant conditions of the ponds. It is observed that the rate of growth of this clam is also not appreciable in the fish ponds (Durve, 1970).

REFERENCES


* Not referred in original.