POSSIBILITIES OF MARINE FISH CULTURE IN THE SALT-PAN AREAS AT TUTICORIN

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ABSTRACT

The paper gives an account of the environmental conditions and the aquatic biota in the salt-pan areas at Veppalodai, north of Tuticorin. Cultivable fishes such as *Chanos chanos, Mugil cephalus,* the crab, *Scylla serrata* and the prawn, *Penaeus indicus* have been observed to thrive well. A seasonal fishery for *C. chanos* with an average annual yield of 4,000 kg is existing at present under conditions when no controls are exercised for the normal growth and survival of the naturally recruited stock which is open to the attack of predatory birds, crabs and snakes. It is felt that the possibilities of culturing such species as *C. chanos* are good under controlled conditions and safety from predators.

While culture of fresh water fishes is well established in this country, the progress in the culture of salt-water fishes has been rather slow, inspite of the good scope it offers for increasing the production. When compared with some of the developing countries in Asia, such as Indonesia and Philippines where marine fish culture has made considerable progress in recent years, our country is yet to exploit this potential by utilising the fallow coastal areas for culture practices. Among the coastal saline swamps, back waters, estuarine regions, deltaic marshes and salt-pan areas, the last one has not yet received any attention so far, although James Hornell, as early as 1911 had suggested their development for purposes of cultivating salt-water fish. The Tinnevelly coast of Tamil Nadu, particularly the area around Tuticorin has salt-pans and supports a thriving industry almost throughout the year. Preliminary investigations for assessing the potentialities for culturing marine fishes and prawns in the areas around the salt-pans have been made with reference to the estates belonging to the Veppalodai Salt Corporation, located about 25 km north of Tuticorin (Fig. 1). The present report deals with the possibilities of culturing such of those species which are able to tolerate the high salinity conditions prevailing in the salt-pan areas and thrive well there for culture practices.

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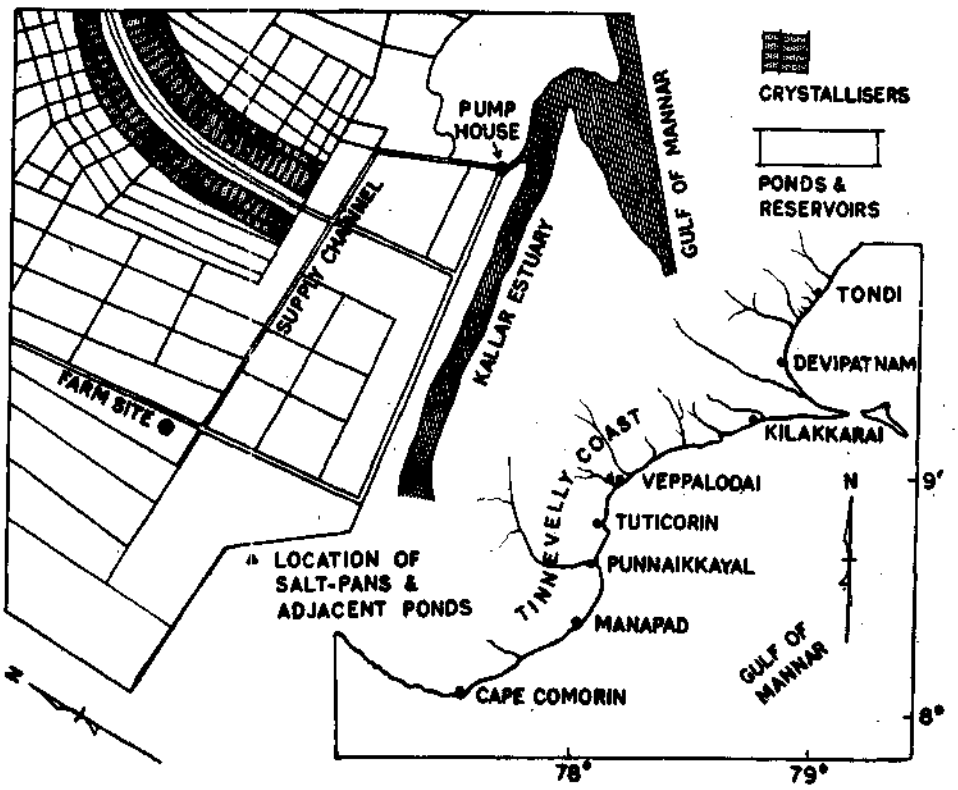

FIG. 1. Map showing the location of Veppalodai, the Kallar Estuary and part of the salt-pan areas.

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HYDROLOGICAL AND SOIL CONDITIONS

For purposes of the salt industry of the Corporation sea water is pumped from the mouth of the Kallar Estuary (Fig. 1) into channels and is stored in large reservoirs and ponds (Fig. 2A), from where the water is diverted by means of sluices into secondary reservoirs, ponds and|or salt-pans for evaporation and crystallization of salt. Apart from the salt-pans where the salinity values reach more than 200‰ and the substratum is one of encrustations of the common salt, the reservoirs and ponds which have salinity less than 100‰ may be broadly classified under two categories. In the first type of reservoirs or ponds sea water is pumped from the estuary directly and from there the water almost continuously flows into other ponds. In this type the salinity range is not much different from the range found in the adjacent inshore waters of the sea, namely 35‰ to 40‰. Surface water temperature in these ponds usually varies between 27° and 32°C and the bottom is made up of thick

FIG. 2. A. A view of the salt-water ponds in Veppalodai.
B. Fishing operations in the ponds and reservoirs.

greyish clay with an admixture of sand grains and shell fragments. Below a depth of about 1 cm the porosity is poor and the colour of the thick clay changes to black in deeper layers.

In the second category of ponds and reservoirs, the water is stored for quite some time and the salinity increases considerably reaching upto 80‰ in some cases. Surface water temperature varies between 24° and 30°C and

the bottom is made up of loose greyish mud and sand with good porosity upto about 1·5 to 3 cm depth. Below this, porosity decreases gradually and the clay becomes thicker and blacker as the depth increases; beyond a depth of about 20 to 25 cm the clay is quite hard.

Aquatic Biota

The biota of the salt-pan areas of Veppalodai, excluding fishes, prawns and crabs which are treated separately, shows certain differences in their quantity depending upon the characteristics of the environment. The following five types of environment and their biota have been recognised in the course of the present investigations:— (1) The salt-pans proper and the water masses in which the salinity is considerably high and never below 100‰, (2) The reservoirs and ponds in which the salinity ranges between 80‰ and 100‰, (3) The areas where the salinity range is between 40‰ and 60‰ and (5) The areas where the salinity shows a range of 35‰ to 40‰.

(1) In some of the salt-pans where evaporation is high and there is complete encrustation of salt crystals at the bottom a few individuals of *Artemia* sp. have been collected. *Artemia* sp. have been found to be tolerant to high values of salinity as they have been observed in ponds having a salinity of 240‰.

(2) In the second category of ponds, small amounts of biota may be present in the form of a few planktonic organisms like copepods and green algal filaments. In a few cases green algae have been recorded from the substratum also.

(3) The biota in ponds where the water is stagnant for some time and has salinity between 60‰ and 80‰ is observed to be made up mainly of brown and green algae (*Chaetomorpha brachygonia* Harvey) in the substratum and small quantities of surface plankton composed of copepods, green algae and sea grass (*Halodule* sp.).

(4) In ponds having salinity between 40‰ and 60‰ algae have been observed on the substratum, but in addition to them vast numbers of amphipods have been observed below the algae as well as in the surface mud of these ponds. Plankton in the ponds of this category is made up of copepods, mysids and amphipods.

(5) In the fifth category of ponds and reservoirs, where the sea water is pumped from the estuary directly and in which the flow of water is continuous, the plankton is considerably more in quantity than in the previous categories. It is composed of copepods (Calanoids, *Microsetella, Euterpina* etc.), zoea and magalopa larvae, *Sagitta,* ctenophores, fish larvae and diatoms (such as *Nitzschia, Coscinodiscus, Thalassiothrix, Asterionella* and *Thalassiosira*). The bottom fauna in these ponds is made up of Gastropods, burrowing crabs

and juvenile gobioid fishes. In localities where the substratum is hard enough, barnacles, the bivalve *Musculista arcuatula* Hanley and edible oysters (*Crassostrea* sp.) have colonised.

Fishes, Prawns and Crabs

The fishes found in the salt-pan areas include *Chanos chanos* (Forskal), *Nematalosa nasus* (Bloch), *Elops saurus* Linnaeus, *Mugil cephalus* Linnaeus, *Lates calcarifer* (Bloch), *Tilapia mossambica* (Peters), *Tylosurus crocodilus* (Le Sueur), *Sillago sihama* (Forskal), *Eleutheronema tetradacylum* (Shaw), *Carangoides praeustus* Bennett, *Epinephelus tauvina* (Forskal) and *Therapon* spp. Fishes are totally absent in ponds having salinity above 100‰. A few *C. chanos, N. nasus* and *E. saurus* have been recorded in ponds with salinity upto 87.25‰. Though these three species have been recorded in ponds having salinities from 35‰ to 87.25‰, the vast majority of these fishes have been caught from ponds having salinities of 40‰ to 60‰. *M. cephalus, S. sihama, E. tetradactylum* and *T. crocodilus,* all much relished table fishes, are found occasionally in ponds having 35‰ to 45‰ salinity only.

As judged from the quantity of the commercially important milk-fish, *Chanos chanos,* caught from the different localities having different salinities, this appears to thrive well in ponds having salinity of 40‰ to 60‰ and attain large sizes of upto 525 mm total length. In ponds having salinity of more than 60‰ this does not appear to thrive well, although caught occasionally. Usually smaller fish (120-250 mm) are found in waters of lower salinity (35-50 ‰) and larger specimens (200-525 mm) in waters of both low and high salinity (35-87.25 ‰), thus indicating that with progressive growth the fish becomes more adaptable to varying ranges of salinity. Schuster (1952) has recorded 46‰ as the highest salinity in the tambak ponds of Java, where *Chanos* culture is practised. But, in the course of the present investigations large number of *C. chanos* have been caught from waters having salinity as high as 60‰, not to mention of the occasional catches from ponds having salinity upto 87.25‰. Water temperature in the various *Chanos* ponds of Veppalodai usually vary between 24° and 32°C in the morning hours; and no correlation has been found to exist between the temperature of the water and abundance of the fish in the pan areas. This is in agreement with the view of Schuster (1952) that for the culture of *Chanos* the temperature of the water is only indirectly important.

The stomach contents of *Chanos* of size range of 200-350 mm total length collected from the ponds having 40‰ to 60‰ salinity, in which the water is not stagnant for a long time and inhabited by amphipods, have revealed the presence of the remains predominantly of amphipods, along with copepods, detritus and mud. *Chanos* of similar size range collected from ponds of similar salinity ranges, but in which the water has been stagnant for a long time with good growth of brown and green algae in the substratum have shown algal filaments, detritus and mud in their stomach inclusions. Tampi (1958)

in the course of his investigations on the food of this fish has stated that *Chanos* in their later stages of growth appear to be capable of consuming and digesting a variety of animal matter along with plant material that are available in the surroundings. The present studies also show a similar pattern in the feeding habits of this fish.

Prawns are found in fairly good numbers in ponds having a salinity range of 40 to 60 ‰. Two species, viz., *Penaeus indicus* H. Milne Edwards and *Penaeus monodon* Fabricius both commercially important, have been recorded. The size range of the former is between 80 and 120 mm, while that of the latter is between 100 and 150 mm. Juvenile prawns, measuring 10-20 mm have also been recorded from such ponds; they have been observed to graze upon the detritus and algal growth found on the substratum. Gopalakrishnan (1952) has stated that *P. indicus* feeds on whatever material it comes across and that it is partly predatory in habit chasing smaller crustaceans. Culture practices for this species do not appear to be prevalent, although juveniles are trapped in paddy fields adjoining backwaters of Kerala. Extensive culture of *P. monodon* is practised in Philippines and Formosa (Borja and Rasalan, 1968) because of its capability of withstanding a wide range of salinity.

The crab, *Scylla serrata* (Forskal), which is also economically important has been recorded in small numbers in ponds having salinity between 35‰ and 45‰. The carapace width of the crabs ranged from 100 to 150 mm.

Possibilities of Culture

As may be seen from the foregoing account, the areas in and around the salt-pans afford suitable environment for the survival and growth of some of the commercially important marine fishes and prawns. The facts that *C. chanos* are able to tolerate a wide range of salinity and thrive well in waters having even high values upto 60 ‰, subsisting on whatever food elements available and reaching more than 50 cm in length and that the prawns *P. indicus* and *P. monodon* thrive equally well in similarly high salinity waters, open up possibilities for culturing them in an organised and systematic way in the salt-pan areas. This is all the more important because *C. chanos* and *P. monodon* have proved to be valuable for cultivation in some of the south-east Asian countries. Also the other important species such as *M. cephalus, E. tetradactylum* and *S. sihama* whose salinity tolerance is not so wide, but which appear to thrive well in low salinity waters, deserve to be given fair trial in order to assess their farming potentialities.

At present an unorganised and seasonal fishery is existing in the salt-pan areas of Veppalodai (Fig. 2B) especially for *Chanos chanos*. It is reported that *C. chanos* thriving in high saline waters are more delicious than the ones caught from the sea and that they have greater demand. An average annual income of Rs. 5,000 is reported to be obtained from sale of fish caught in the salt-pans in recent years; the weight of the catches from the ponds and reservoirs during the three months of active fishing, July, August and September