FAMILY FARMING MODEL IN BRACKISHWATER AQUACULTURE FOR LIVELIHOOD SUPPORT OF COMMUNITIES LIVING AROUND ADYAR CREEK AND ESTUARY


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BACKGROUND

Estuarine and coastal areas are complex and dynamic aquatic environment. India has a long coastline of 8,129 km and 6,000 km of this is rich in estuaries, creeks, brackishwater, lagoons and lakes. The southeast coast of India is an important stretch of coastline, where many major rivers drain into the Bay of Bengal and they are rich in marine fauna and flora. Adyar creek is one of the primary and vibrant estuarine ecosystems of Chennai.

<table>
<thead>
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<th>History of Adyar</th>
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<tr>
<td><strong>7th Century</strong></td>
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<tr>
<td>1798</td>
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<tr>
<td>Late 18th &amp; early 19th century</td>
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<tr>
<td>1840</td>
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<tr>
<td>1867</td>
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<tr>
<td>1882</td>
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<tr>
<td>1950</td>
</tr>
<tr>
<td>1993</td>
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<tr>
<td>Late 20th century</td>
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<td>2006</td>
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In 1950s Department of Fisheries, Govt. of Tamil Nadu was involved in the setting up fish and shrimp farms adjacent to the creek under the all India network project on fish farming. It was one among the first brackishwater shrimp farm in south India. But in later years with the urbanisation of Chennai, the Adyar estuary has lost its pristine condition along with the rich fauna, and was under great ecological stress due to progressive encroachment, discharge of untreated sewage, effluents, and solid waste disposal. As a result of degradation, many vital biological attributes of Adyar estuary such as clean brackishwater, faunal and floral diversity and its role as spawning and nursery ground of commercially important finfish and shellfish were lost.

In order to restore the ecology of Adyar estuary, Government of Tamil Nadu has taken up ambitious restoration measures. The eco-restoration activities of Adyar creek undertaken by Chennai Rivers Restoration Trust (CRRT) commenced in January 2008 and launched an ambitious project to clean the estuary (in two phases: 58 acres and 300 acres), with a budget of around Rs. 60 crores. It included excavation of accumulated sludge and debris in the water body which resulted in an increase of the water spread of the creek and has facilitated the ecological function of the creek. Before the implementation of eco-restoration activities, the stormwater drains were misused for sewage discharge.

(Source: Aug 26 2014, The Times of India, Chennai)
During the restoration, the sewage is diverted into the sewer pipeline to prevent the sewage inflow into the creek. Earthen mounds created around the water body, which supports coastal vegetation such as intertidal plants like mangroves, mangrove associates reeds and terrestrial plants. It serves as a niche for birds and other terrestrial animals of creek ecosystem. These mounds also serve as sound barriers against vehicular traffic. The plantation at Adyar creek comprised of six vegetative elements such as trees, shrubs, herbs, grasses, climbers and aquatic plants for planting in aquatic zone, core zone, peripheral zone, inland and littoral zone, along with water margins and hedges, grass cover, specimen tree, rockery etc. During the restoration process, the water bodies have been protected from any external source of pollution. Also, the site was protected from hunting and vandalism of the habitat of birds and reptiles.

At this point, in 2015, ICAR-CIBA, a national research institute, Govt of India has taken up the research cum demonstration work for the development of brackishwater aquaculture in the Adyar creek water bodies with the following objectives: (1) To evaluate and monitor soil and water parameters for the development of brackishwater aquaculture (2) To measure species diversity, density and abundance of available zooplankton and phytoplankton in the creek (3) To demonstrate brackishwater aquaculture technologies among coastal communities for their alternative livelihoods and as income generating activity

SOIL AND WATER QUALITY

To evaluate the potential of aquafarming in Adyar estuary, water and soil characteristics of the creek (from six sampling sites, Fig. 1) were evaluated for two years at monthly intervals. Maximum salinity was recorded in March (33 ppt) and the minimum was recorded in September (7 ppt). The pH of the water was almost stable throughout the year (7.9 to 8.6). Hardness and total alkalinity of the water varied according to the variations in salinity (Fig. 2a & b). Organic carbon and pH of the soil ranged between 0.23 and 2.8% and 7.5 and 8.9 respectively. It is also found that salinity, turbidity (Fig. 3), metabolites and nutrients varied significantly with the tidal pattern of the day (Table. 1). The two years study suggests that the physico-chemical characteristics of the estuary were within the desirable limits for brackishwater farming.
Family farming model in brackishwater aquaculture for livelihood support of communities living around Adyar Creek and Estuary.

Fig. 1. Location map of Adyar creek sampling stations

Fig. 2a. Changes in water quality parameters (Mean ±SD) of Adyar creek and estuary
Fig. 2b. Changes in water quality parameters (Mean ±SD) of Adyar creek and estuary.

Fig. 3. Changes in salinity and turbidity level of Adyar creek water under low and high tide.
Table 1. Influence of high and low tide on nutrients and metabolites concentration of Adyar creek water

<table>
<thead>
<tr>
<th>Parameters</th>
<th>High tide</th>
<th>Low tide</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean*±SD</td>
<td>Sea mouth</td>
</tr>
<tr>
<td>pH</td>
<td>8.35±0.079</td>
<td>8.4</td>
</tr>
<tr>
<td>TAN (ppm)</td>
<td>2.036±0.221</td>
<td>0.309</td>
</tr>
<tr>
<td>Nitrite-N (ppm)</td>
<td>0.045±0.033</td>
<td>0.017</td>
</tr>
<tr>
<td>Nitrate-N (ppm)</td>
<td>0.112±0.094</td>
<td>0.0556</td>
</tr>
<tr>
<td>Phosphate (ppm)</td>
<td>0.556±0.041</td>
<td>0.088</td>
</tr>
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(* Mean value of six sampling stations)

**PHYTO AND ZOOPLANKTON**

The spatial and temporal pattern of distribution of phyto and zooplankton in the Adyar estuary were studied monthly from the samples collected in six sites. In phytoplankton, a total of 22 genera from different groups of Bacillariophyceae, Chlorophyceae, Cyanophyceae, Euglenophyceae and Dinophyceae (Fig. 4) were identified, and its abundance and diversity were enumerated. Station 2 and 3 were found to be more diverse than other stations (Fig. 5). Among zooplankton, species of copepod, rotifers and cladocerans dominated (Fig. 6) whereas among phytoplankton Chlorella sp, Chaetoceros sp and Thalassiosira sp dominated in all stations. The abundance of zoo and phytoplankton indicates the potential of this estuary for aquafarming.
Fig. 4. Composition of phytoplankton (%) in each sampling station

Fig. 5. Phytoplankton abundance in each sampling stations
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Fig. 6. Percentage composition of zooplankton in each sampling station

Life stages of *Cyclopoid copepod*
Cladocera sp

Chaetoceros sp
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Soil water quality and natural productivity studies of estuary suggest the regaining of the health of the Adyar estuarine ecosystem. Thus, ICAR-CIBA initiated experimental demonstration trials of brackishwater finfish and shellfishes in pens and cages. In the pen and cage farming activities, we have involved families living in the fringes of the estuary, as a livelihood support model. For standardizing the suitable candidate species for farming in this water body, an experiment was initiated during 2016-17 with selected finfishes and shellfishes in cage and pen to understand the relative suitability of different species such as Milkfish, *Mystus gulio*, Seabass, Snapper, Pearlspot, and Mud crab. Based on the soil and water quality, social conditions and feasibility of suitable brackishwater species, two pen (100 sq m) structures 1500 meter away from the Adyar Creek mouth, besides Foreshore Estate signal, were installed and stocked Milkfish and Mud crab in December 2017.
A total of 50 mud crabs (body weight 95 - 250 g; total weight 9.6 kg) were stoked in pen and whereas 20 crabs were stocked individually in 20 floating boxes. Crabs were fed with trash fish (at the rate of 10% total biomass) daily twice and reared for 40 days. After 40 days of rearing the crabs in the boxes grew from an average weight of 109.9 g to 212.8 g and the crabs stocked in the pen reached a final weight of 168 to 627 g. A total of 230 milkfish fry (avg. wt - 4.8 g; avg length 6.7 cm) was stocked in 100 m² pen structure. Fish were allowed to feed naturally available feed and in addition to that, the fishes were fed with the formulated feed prepared by ICAR-CIBA @ 5% body weight daily in two times. After 55 DOC, the average weight and length of milkfish was 52.5 g and 20.2 cm respectively. The adopted 10 nos. of fisher folks (5 families; 2 nos. from each family) who are all living around Adyar creek and estuary are trained with cage and pen installation, maintenance, feeding to animals, handling of crabs, and sampling etc. The feeding schedule with the behavior of fish and crab were monitored by the fisher folks every day.
After stocking of fish and crab, water quality parameters like pH, DO and salinity was monitored once in 15 days. During our regular monitoring, it has been observed that the water flows into the fish and crab culture demonstration areas were minimised due to less incoming water from the sea towards Adyar creek since January 2018, especially during summer and pre-monsoon seasons. It closed the Adyar mouth slowly, followed by formation of sand-bar towards the fish and crab culture demonstration cages. This sand-bar prevents the exchange of water between marine and freshwater ecotone. Ultimately the water quality of fish and crab culture demonstration areas were deteriorated followed by mortality was occurred after attaining an average weight of 52.5 g and 168-627 g of fish and crab respectively. However, the beneficiaries realized Rs, 18785/- worthy of fish and crab through harvest in February 2018.
Mud crab culture at Adyar creek
ECONOMICS OF INTERVENTION

Poverty, disguised unemployment and engagement in unproductive activities due to surplus time at disposal are commonly reported among fishermen communities. At micro level the community has benefitted in terms of additional employment and income to a group of 10 fishermen. More than monetary gains, the community is made aware of productive capacity of the rejuvenated system due to the concerted efforts of Tamil Nadu State Government through CRRT. Fishermen could benefit economically and nutritionally, and the fishing and city community will also benefit by cleaner and better ecosystem.

SUMMARY AND LESSONS LEARNT

Brackishwater aquaculture Initiatives by CIBA in the Adyar estuary with the participation of self-help groups from nearby villages, revealed the potential of the estuary as a food production system, also with scope of generating employment and income generation. This initiative becomes a model for resource use plan for aquaculture development in adyar
creek areas, Tamil Nadu and other states. Therefore, the partnership of strong expert and technological support available with ICAR-CIBA and trained fishermen group at the grass root level will provide synergy and create a platform for the future sustainability of the farming system in adyar creek water bodies.

However, obstruction at the barmouth of the Adyar estuary especially during the summer months due to the sand bar formation is emerged as a constraint, in keeping the aquaculture activity and healthy biotic condition in the waterbody. In order to keep the living environment in the estuary, and promoting aquaculture which has the potential to provide food, employment and income to the nearby village folks, CRRT who has already spent more than 60 crores in cleaning and restoring life to the valuable estuary in the heart of Chennai city. Regular dredging to enhance and ensure the free flow of water to the estuary is a requirement, which could be coordinated by CRRT along with other related Government Department, to upkeep the life of Adyar estuary. The cleaning and restoration of dead Adyar estuary to life by sincere effort by a State Government body, and using the water body for production of food livelihood activities, can be a model, for other such estuarine water bodies in urban conditions.
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SEEDS OF FISH FARMING SOWN IN ADYAR CREEK

Five Families Chosen
By CIBA To Rear Fish In
Restored Water Body

Four decades ago the Adyar Creek teemed with fish, drawing birds from far off shores for feeding. Today, however, efforts are on to grow fish, albeit in cages. In the now restored but ecologically fragile water body, Central Institute of Brackishwater Aquaculture (CIBA) has set up cages to help local fishermen harvest three species of fish. CIBA director K R Vijayan told TOI that after the creek was cleaned by Chemical River Restoration Trust (CRT), it was decided to help local fishermen by setting up cages in a portion of the water body. Initially, the species of sea bass, pearlspot and milkfish were released into the cages. We provided the feed for the fish but only milkfish survived in the cages,” said Vijayan. “For tidal movement could have affected the survival of the other two species we believe,” he said.

For its pilot project, near Srinivaspuram, after the creek was restored, CIBA has adopted the family farming mode. Since its launch in February, CIBA has trained 15 farmers from five families to feed the fish and monitor their growth.

Srinivasapura resident TSP Ravindranath, one of the beneficiaries of the project, said sand from the river bed had to be cleared regularly for the tidal movement to be favourable for fish culture. “A good tidal movement will help the fish grow,” he said.

Since February, once a month, fish samples from the cages are collected and sent to Central Institute of Fisheries Technology for quality checks. This was necessary because the eastern side of the creek, a dumping ground for those living in the adjoining houses, is highly polluted. The laboratory results have been positive so far.

Ravindranath said milkfish could be harvested six months after fish weighing. It would fetch $10, which the families can share among them. “CIBA has given us a good livelihood option which will provide an additional income in the future,” Ravindra said.

Vijayan said fishermen involved in the project need not work full time. “This is an auxiliary activity. They have to visit the cages twice a day, for feeding. They can attend to their daily businesses as well,” he said.

By August end, CIBA is hoping for a rich harvest and the fishermen good earnings. Vijayan said if the harvesting of milkfish in the creek is successful and sustainable, more such cage culturing can be taken up.

NEW LEASE OF LIFE

THE BLUEPRINT

➢ Three species of brackishwater fish—sea bass, milkfish and pearl spot—will be reared in cages
➢ Five cages have been sunk in the creek in a 1000sq.m area
➢ First ever caged fish culture in the Adyar creek and estuary

THE TEAM

➢ A total of 10 families from five families selected by Central Institute of Brackishwater Aquaculture (CIBA) involved in project
➢ They have been trained with cage installation, cage maintenance, feeding and periodic sampling

THEIR CHANCES

➢ Water samples from six locations of the creek have been collected by CIBA
➢ Collected water has been tested before trials were released in cages
➢ Key soil and water parameters studied over a period of time showed the site was suitable for rearing specific varieties of fish

MARKET RATES (per kg)

Sea Bass $250
Pearl Spot $150
Milkfish $150

Where old threats loom large

Close to 56 crore may have been spent to restore the Adyar creek and estuaries in phases by the Chemical River Restoration Trust (CRT). But mouthfuls of plastic and garbage are threatening the ecology again.

A state government official said the Tamil Nadu Shun Committee Board had built structures to house those living in the slums. More than 200 houses were built but around these new low-income housing structures have cropped up.

A Srinivaspuram resident said more than 3,000 unauthorised houses had come up in and around the slums. "The illegal structures had resulted in the creek polluting it," he said.

Ravindranath, another resident, said sewage from the illegal settlements must be treated in the pumping station near Pereshow Estate by bacteria. "If this sewage pollution levels in the creek will come down and enhance its recreation," he said.

A senior official from the Shun Committee said the government was planning to demolish the unauthorised buildings along the Adyar creek. When contacted, a CRT source said the Shun Committee Board was organising awareness programmes in the absence of their role "after people who were against dumping waste in the creek. "But with regard to the encroachments near the slum settlements, the government has to take a decision. It is not out mandate," the source said.
Bringing the Adyar Creek back to life can also mean restoring livelihoods of the local population

by Expert Contributors | Jul 16, 2018 | Environment | 0 comments

By Magnetic Manifestations (Wikimedia Commons)

Adyar creek is one of the primary and vibrant estuarine ecosystems of Chennai. In the 1950s, the department of fisheries, government of Tamil Nadu, was involved in the setting up of fish and shrimp farms adjacent to the creek under the all-India network project on fish farming. It was one among the first brackishwater shrimp farms in south India. But in later years, with the urbanisation of Chennai, the Adyar estuary lost its pristine condition along with the rich fauna, and was under great ecological stress due to progressive encroachment, discharge of untreated sewage, effluents, and solid waste disposal.

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by Expert Contributors | July 17, 2018 | கருவக்குறிகள் | 0 comments

English, தமிழ்

Dharmasabai Thangam, Author, has contributed to the article. The original article is in Tamil, and it is translated into English below.

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