

Youth Empowerment in Mariculture: A Case Study

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Introduction

Sustainable fishing, conservation of fishery resources and preservation of coastal ecosystems form a complex triad of necessary activities that need to be juxtaposed in the best possible way to provide the ideal formula for fisheries management. Today, India faces the threat of increasing fishing pressure, decreasing fish stocks and steady degradation of many coastal ecosystems due to a combination of anthropogenic and natural factors. With the increasing demand for seafood protein and downward slide of catches and low returns in fishing, fishermen are anxious and worried over the future of their profession, livelihoods and more importantly, their next generation. Cage aquaculture presents a solution to these issues as it is a platform widely acceptable to fishing communities and easily adopted by them as an allied or alternate activity.

India has the largest youth population in the world; around 66% of the total population (more than 808 million) is below the age of 35. Nearly 40% of the Indian population is aged 13 to 35 years (defined as youth in the National Youth Policy). The median age in India in 2010 was just 25.2 years, compared to 34.5 years in China. “Youth” is being redefined to cover people in the age group of 15 to 30 years in place of 15 to 35 years (2016). The Indian labour force is set grow very fast and the challenge for the policy makers grows as they become increasingly educated. Globally, youth are three times more likely than adults to be unemployed. Young women typically experience higher rates of unemployment than men. In good or bad times, the Indian youth are more vulnerable to unemployment; it is not just that they would struggle to get a decent job in the formal economy. And therefore, most of them remain underemployed and eke out a living in informal sectors.

The total fishermen families in the Indian marine fisheries are 8,93,258 (CMFRI 2018) living in 3477 fishing villages with landing access in 1363 centres and the total fishermen of 37,74, 577 with 33.2% children. Of these, 34,57,512 (91.6%) are traditional fishers and 6,00,890 families are living Below Poverty Line (67.3).

Tamil Nadu has the highest population of fishermen - 7,95,710; 21.2% of the Indian fishermen population, with 2,01,855 fisher families. The state also has the second highest number of fishing villages (575) and the maximum number of fish landing centres (349) among all maritime states of the country. A total of 1,96,784 fisher families (97.5%) engage in traditional and artisanal fishing along the coast and nearly 1,50,669 fisher families (74.63%) are living Below Poverty line (DADF-CMFRI 2018) which is the highest amongst

all the states. Young boys (17.1%) and girls (15.5%) form nearly 32.6% of the total fisher population, and present good academic records and achievements. In general, the education profiles of fishers from the Tamil Nadu is very good (>70%). The coastal fisher community has more than 5.8% above degree qualification, 6.9% above HS, 24.3% HS and 29.2% primary education status. The recent progressive efforts of governments in educating the children the figures may reflect on the last two decades, then the figures of educated members above degree qualifications would be close to 18% and above higher secondary 21.2% in the younger population of the fishers in the state. The state of Tamil Nadu is to be appreciated for its specific child education programmes which has resulted in this rise. In some districts these figures are very high (Kanyakumari, Thoothukudi, Chennai, Nagapattinam). With the social index of education profiles improving, changes in employment criteria and population shift to urban stations and job-oriented professions, there seems to be a dip in the younger generation taking up the fishing profession; instead, the elderly are either persisting or entering back to the sea front for fishing.

Fishermen and Aquaculture: Only 225 fisher families in the whole of Tamil Nadu are involved in aquaculture, which is just 2.33% of the 9632 fisher families in the country (DADF-CMFRI 2018). A few questions to ponder are -

- Do we still need sea food catered to us by the fishermen?
- Do we make them farmers?
- Do we get our fish from other sources, rather than dependent on fishermen?
- Do we not give them a chance to make us more fish by their own skills and added support?
- Do we have to force them to be labourers when they want to be entrepreneurs?

"To identify what the poor have rather than what they do not have" and "strengthen people's own inventive solutions, rather than substitute for, block or undermine them" (Allison and Ellis, 2001)

The introduction of cage farming demonstrations and field trials was one way to open doors to the above situation in our country. The possibility of utilizing the coastal waters of northern Tamil Nadu and the southern coastal areas of Andhra Pradesh for sea cage farming was explored by ICAR-CMFRI during 2008-2010, with funding support from the NFDB. Initially, the sites were chosen based on random criteria for the sake of demonstrations, giving priority to wherever the community was willing and cooperated and the social status of the fishers were weak. The southern districts of Andhra Pradesh (Nellore), northern most part of Tamil Nadu (Thiruvallur) and Kancheepuram districts were chosen for the above reasons, although other facilities like access, infrastructure support and seed and nursery raised stock were handicaps. The demonstration trials were also intended to understand the geographic responses (multilocation testing), social reactions, ocean dynamics and sea cage stability, to provide baseline information for modifications thereof for the furtherance of sea cage farming along the coast.

Although the fishers were made aware of various processes involved such as net maintenance, net exchange and feeding, their initiative on these took a back seat as they wanted hands-on training through practical demonstrations involving them at every step. This was a handicap as some of the sites were quite distant from the CMFRI laboratories and hence, day to day extension was impossible in Isakkapalle in Nellore and Vairavan kuppam in Pulicat.

Fishers were hesitant to enter the waters and skin dive. Besides, their non-fishing time was very precious as they were scouting for their primary needs like fetching firewood, selling fish, and mending nets. The fishers at Nellore were not easily motivated considering the delayed benefits at the end of the crops and did not want to risk their daily ration options. Daily participation was minimal and they adopted a passive “wait and watch” attitude. The regular senior fishers are too stereotyped in fishing and earning on a daily basis and therefore to tune them to be harvester after 5-8 months of farming is too long a wait and too big a task for an immediate adoption. A series of demonstrative and participatory trials on open sea cage farming of different species of fishes and lobsters in coastal villages of Kancheepuram district in Tamil Nadu on the south-east coast of India have clearly indicated that proper integration of scientific approach with the natural know-how of the fisherfolk makes cage aquaculture an efficient tool for sustainable fish production, resource conservation and habitat protection. While the fishing community in Kovalam showed an initial resistance to adopting cage aquaculture, fisherfolk of the other villages were receptive.

Successful sea cage farming of Asian sea bass in Chemmencherry in 2010 paved the way for popularisation of cage aquaculture in adjacent villages and today, Kovalam has developed into a model village for cage aquaculture practices, with as many as 120 active fishermen participants. Our observations show that the fishermen involved in these exercises assimilate information on breeding, growth, feeding, density protocols, compatibility, weather associated behavioural adaptations, handling strategies, nursery rearing of the different species, and they evolve indigenous techniques to carry out the cage farming and get improved yields. They are quick to understand even the minor changes in the surroundings, the benthos, the fouler and other live aggregations in the vicinity of the cages. With fishermen spending more effort and time in rearing different species, there is a visible change in their disposition towards the need to revive falling stocks in the coastal waters. Moving from hunter to farmer, they are quick to appreciate the opportunity cage aquaculture offers towards regulating their dependency on wild stocks and of working together towards replenishing the sea instead of only taking from it.

With more and younger educated fisher youth getting distracted from the marine fishing practices and shift in alternate livelihoods and increasing education levels, a gradual increase in age of actual fishers was observed in many districts. The native traditional fishers have been supplying seafood for centuries to the non-vegetarian population of the country but we see them moving away due to the increasing stress of uncertain and reduced economic returns from their fishing practices. Engaging with fishers hence involved lot of caution and

perseverance and converting them into a new aquaculture allied farming system needed a proper understanding of the social and economic situation.

Catch them young

It is at this juncture that we understood that the orientation must perhaps begin with the educated and active fisher youth and the progressive thinkers within the society, with necessary support and approval from the elderly and the village heads.

Several meetings, discussions and debates with the village heads made this a reality in some villages - Kovalam, Chemmencherry, Elanthoppe, Kasimedu, Ennore. The village heads and the active fisher panchayats decided to permit youth members within the community to enrol as subscribing members of a youth body (Association), participate in farming demonstrations through an MOU with CMFRI and delineate areas in the coast for east coast cage farm operations. Kovalam fishing hamlet in Tamil Nadu is one of the focal points of CMFRI's initiative towards this. As a continuous process of reviving and retaining interest among fisher youth, CMFRI has been conducting awareness and demonstration programmes on seafarming and habitat restoration. A team of fifty young fisher youth (below 30 years of age) were encouraged to form the Association of Kovalam Progressive Fishermen (AKPF) with the approval from the local heads and panchayats. Formation of youth associations at various locations was attempted - AKPF (Association of Kovalam Progressive Fishermen)/ACPF (Association of Kovalam Progressive Fishermen)/APPF (Association of Pudhunemmelikuppam Progressive Fishermen)/ACTPF (Association of Chennai -Thiruvallur Progressive Fishermen)/AKEPF (Association of Kattupalli-Ennore Progressive Fishermen) - in Chennai, Thiruvallur and Kancheepuram districts of north Tamil Nadu and nearly 500 fisher youth enrolled in the programme.

The process involved in the build-up of the Associations were -

1. Primary meetings, with outlay of the objectives
2. Formation of willing, active team leaders and heads
3. Creation of MOU, By-laws, registration and Non-profit Association
4. Election of office bearers, term, logo creation, consent letters
5. Opening of joint bank accounts, record of minutes, stamp and Registered address
6. Creation of subscription fee challans and vouchers of expenditure and receipts of income/revenue.

Hands-on training on cage aquaculture practices (including species selection, seed collection, transportation, nursery rearing, stocking, feeding, cage maintenance, sampling, harvesting and live trade) was imparted to fisherfolk of Kovalam, Chemmencherry, Alambrai, Kadalur chinnakuppam, and other fishing villages of in Chennai and Thiruvallur districts. The small-scale demonstrations began in Kovalam with 3 m, 4 m and later with 6 m GI frame floating cages stocked with seabass, spiny lobster, cobia, pompano, and groupers. The activity was initiated by ICAR-CMFRI, Chennai, following a community participatory approach.

This provided the foundation for the AKPF, which soon became a social movement with the goal to mobilize the fishermen in Kovalam and bring positive social change. They want to do this through community building, schooling about responsible fisheries, activating the distracted youth and by providing an alternative livelihood strategy to the fishermen in the form of open sea cage farming. Open Sea Cage Culture relates to the needs and aspirations of the community by offering a more stable income with less physical risk, build fish stocks again and create positive social change in the community. To be able to affect as much of the people in the community in a positive way the number of people involved in the project exceeds the amount of people that would be necessary to perform Open Sea Cage Culture. This is being done to increase the impact, the activity has on the community. Therefore, the way the activity is being implemented will offer a diversification strategy.

The key concepts that were given the optimal thrust at all meetings and formations were:

1. Learn while you do
2. Do and get experienced
3. Experience gives confidence
4. Make it a profession if it pays
5. Make it a business if it reaps
6. Know your limits
7. That's why you learn and enter into this, for your future
8. If you need it tomorrow, keep it sustained, this is your primary right and domain.
9. Culture teaches to preserve, persevere and sow.
10. Obviously harvest when you can and need.
11. Hunter becomes a farmer if he has a lease

The Association of Kovalam Progressive Fishermen (AKPF) fisher youth of Kovalam, open sea cage operations were carried out successfully for five years and the team reaped income of nearly Rs14,00,000 in various attempts (Sea Bass/Cobia/Spiny lobster). An innovation in marketing was tested for the first time. The cultured fish was sold live to a recreational sport fishing agency in Chennai @ Rs 400/- per kg.

The second innovation tried was the cost reduction by means of using estuarine by-catch of small tilapia as feed. Third innovation was the transfer of marine cage grown fish to terrestrial freshwater ponds in less than a days' time. The total value realized by the AKPF from the sales was Rs 2,40,000/- for the team of 10 members who operated the unit. The Institute is supporting the AKPF members in formulating Open Sea cage farming Project proposals with the support of The State Fisheries Dept, IFAD and NFDB, as a means for promoting fish production, fishery livelihood and attracting youth.

The progressive fishermen youth boys of Kadalur Chinnakuppam, Kancheepuram district, TN guided by the mariculture team from CMFRI Kovalam, Chennai, carried out culture of nursery raised Asian sea bass fingerlings and other marine wild caught juveniles of species, like *Parastromateus niger*, *Lutjanus argentimaculatus* and *Etroplus suratensis*, in the

backwaters and creeks near the village in small indigenous fixed cage nets of 3m x 4m x 2m. A low scale cage culture cycle was attempted by fishermen youth Cuddalore Chinnakuppam by stocking 114 numbers of Asian sea bass in community rearing with limited numbers of black pomfrets, Indian halibut, lutjanids and therapons (wild caught seeds) in an indigenous cage suspended in the estuarine-barmouth zone. After 125 days of culture, 45 kg of sea bass was harvested and sold as live game fish. The value realized was Rs 18,750/-. The operations suggested that the Indian Salmon, Indian halibut, Black pomfrets, Lutjanids and Cobia grow well –compatible and tolerated upto 5ppt salinity levels. The black pomfrets grew well on jelly fishes which are abundant in the saline creeks. The low cost model cages made of casuarina poles and stocked with sea bass and cobia fingerlings is promoted at Cuddalore Chinnakuppam by a Fisher youth team. The seed (300 nos Asian sea Bass in 2015) was nursery reared and shifted to their units from our facility. The sea bass and the mangrove jacks were transported live to the shore and sold live to a gaming resort and realised rates of Rs. 500/- per kg, and they were shifted to fresh water conditions in less than two hours with no mortality.

Enterprising fishermen of Kovalam village (Kancheepuram district, Tamil Nadu), with the able support of youth from the Association of Kovalam Progressive Fishermen (AKPF) trained under the mariculture team from CMFRI Kovalam Field Laboratory, demonstrated their interest and skills by taking up farming of the Asian sea bass along with tilapia and *Megalops cyprinoides*. The attempt was carried out by the fishermen in a small pond of 125 sq.m area of less than a metre depth in almost fresh water conditions. A total of 450 pre-conditioned sea bass seeds of 10cm size were transported from the RGCA hatchery at Sirkazhi in Feb 2015 and grown in the pond till August 2015 (200 DOC). The harvest obtained was 142 kg of seabass (89% survival rate), 120 kg of tilapia and 10 kg of *M. cyprinoides*. A value of Rs 25,000/- (Rupees twenty-five thousand) was realised from the harvest; as the water levels were too low at harvest time the animals could not be collected in a stress-free status. Live transport was thus not possible.

Subsequently due to the integral performance of the fisher youth the TN State Department of Fisheries invited the team to take up scaled up cage farming programme under the FIMSUL II. As a result of the participatory cage culture works carried out under this project, the trained fishermen youth of Kovalam (members of the Association of Kovalam Progressive Fishers) was identified by the TN state Fisheries Department to carry out pilot scale demonstration of open sea cage culture under FIMSUL II project by operating 4 units of 6 m dia GI cages in 2016 under the supervision of the experts from CMFRI Chennai.

Under FIMSUL II project, four GI cages were installed in the sea off Kovalam in April 2016 and stocked with varying densities of cobia as a livelihood initiative by the disengaged fisher youth of Kovalam fishing community with funding support by the TN State Fisheries Department under FIMSUL II. The cages stocked with 725(8.5/m³), 650(7.6/m³), 650(7.6/m³) and 240(2.8/m³) cobia fingerlings were stocked during 30.09.2016 and harvested on 01.10.2016, after completing 173, 156, 150 and 150 DOC respectively. Four teams of 10 AKPF youth members each were identified to carry out the cage operations with

technical guidance from the CMFRI mariculture team at Kovalam Field Laboratory of RC of CMFRI, Chennai. The initial stocking sizes were 14-17 mm TL and 18-23 g weight. The fishes were fed with low-value fishes like tilapia, sardines, milkfish, small mullets, lesser sardines, *Thryssa*, and trawl discards (small sized goat fishes, croakers, threadfin breams, silverbellies, ribbonfish, crabs, puffer fishes, carangids, rabbit fishes etc.). The net survival realized was 76%, 70%, 68% and 88% respectively, with more than 75% of the fishes attaining 2 kg weight. Some loss (200nos) was also incurred due to net damage caused in the first cage immediately after stocking (balance 525,6.2/m³) due to rough weather. The best results were obtained for the cage with lowest stocking density (2-3nos/m³). In spite that the days of culture was only 150 the last cage with lowest density gave highest survival and average weight (2.2kg) The trials also showed that the advisable sizes for cage site stocking is 20-30 gm sized individuals and the culture duration should be 180-190 days to improve the growth, to yield fishes of more than 3 kg weight. The harvested stock was purchased by a seafood exporter, Jude Foods India Ltd., based at Kanyakumari, and the prices of Rs 300/- per kg for fish weighing & >2 kg and Rs 180/- per kg for fish weighing 1-2 kg were realized. A total of eight lakhs was realized from the sales of the harvests and assets were transferred to the beneficiary teams for the next operations.

This was the first instance of a large-scale cage operation carried out exclusively by fisher youth on this coast. Major progressive outcomes of this initiative include, diverting the attention of about 80 fisher youth who are distracted/disengaged from active fishing towards a sustainable livelihood option. □ Promoting the use of estuarine and coastal low-value catches (like Tilapia, lesser sardines, therapons, trevallies, silverbellies etc.), which are otherwise wasted, and engaging non-capital intensive fishing activities. Utilization of “would be” trawl discards freshly collected from trawl boats off the village, directly at sea. Using opportunity costs and labour investment in feed sourcing, net mending, diving, fish seed supply, nursery rearing, marketing of fish and fish cage fabrication. □ Improving coastal livelihood of small-scale artisanal fishers who can exploit the fish aggregations in the vicinity of the sea cages. Developing organizing skills, leadership and fishery management aptitudes in the fisher youth. Total cooperation among the fisher youth in carrying out all the activities including seed transportation, nursery rearing, cage and net fabrication, mooring, stocking, feeding, net exchange, harvesting and marketing. Involvement of the fisher youth in identifying market avenues and strategies. Community participation towards coastal livelihood promotion and active participation of younger generation towards increased productivity. □ Mobilising youth towards integrated conservation and management of resources and sustainable fishing practices, proper utilisation of wasted resources and integrating all sectors of a coastal community towards farming the sea. 10 more units were subsequently sanctioned by the TNFD (2017) to be operated by youth of three fishing villages viz. Kovalam, Chemmencherry and Pudunemmel Kuppam in Chingleput district by the addition of two new Associations (ACPF and APPF) along the lines of AKPF. The MoU was prepared for the works along with the 4 units which were operated previous year. A total of 300 beneficiaries underwent these trials and developed the skill towards this activity.

A small survey-based exercise done at Kovalam, Chingleput District in Tamil Nadu gave us some insights on the youth and their attitude. After nearly 3 years of successful run of cage farms at Kovalam this study was undertaken. An enquiry format with data on their inputs on their biological knowledge, qualifications, choice of professions, reasons of withdrawing from fishing, reasons for falling fish catch and options for coastal livelihoods was collected.

Criteria for assessing biological knowledge:

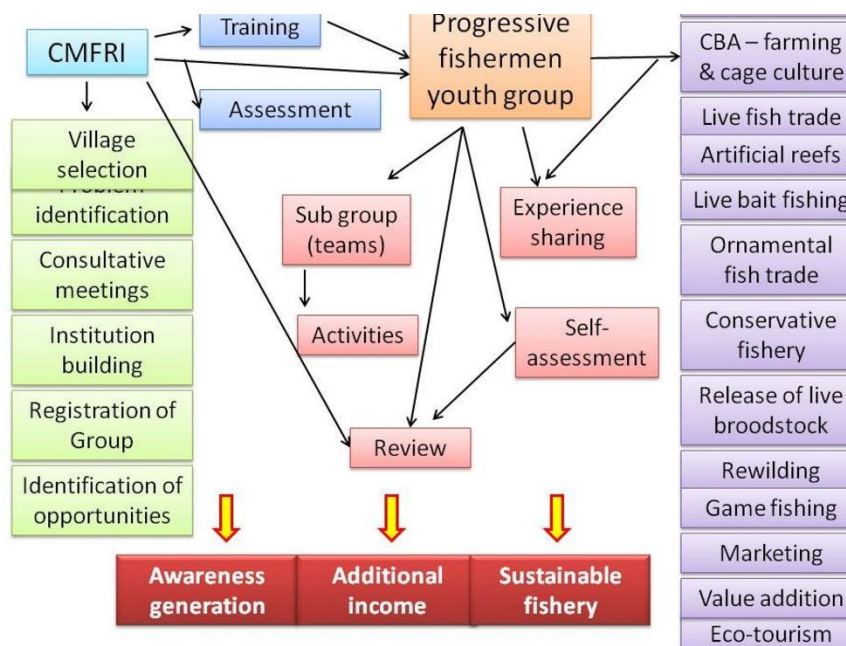
Local availability of fish & shellfish; Migration in fishes; Spawning seasons of different fishes

Types of reef fishes, Minimum and maximum sizes in fishery; Fecundity in fishes; Behavioural adaptations of fish to weather & currents; Prey-predator relationships; Spatio-temporal availability of lobsters; Spiny lobster seed collection techniques; Handling of live lobsters; Breeding & mating in lobsters; Molting & stunting in lobsters; Larval fragility; Sea bass brooder availability, size & growth rate, grading & cannibalism, Nursery rearing, Feed for grow out *etc.*

Between the two groups, maximum number of respondents among the non-AKPF ranked income-oriented factors as the main reason for diverting from fishing activities while among the AKPF members, fish availability and income-oriented factors were viewed almost equally. This difference in perception is possibly due to the involvement of the AKPF in habitat enhancement programs, fish farming, lobster fattening, fish nursery rearing, cage farming and rewilding.

The proportion of members with higher qualification is almost evenly spread between both the groups. However, the higher proportion of diploma and ITI degree holders among the non AKPF members explains the tendency of this group to move away from fishing activities. Members with a low level of education (VII-IX) are more in the AKPF group and they have to bank on their ancestral profession. Naturally, their concern for the resources will be more.

The increasing involvement of fisher youth in the mariculture activities has seen a tremendous change in their perceptions and option choices for their future ventures. The biological intricacies and the sensitivity factors of marine organisms to physico-chemical factors and stress to fish populations are better understood by the progressive members of the farming team. Their willingness to reduce fishing intensity, ban damaging methods and gears, rotate fishing grounds and share the resource by turn and limit the captures by sizes and return of undersized ones and breeders were the positive signs from these members.



Initiation, formation of teams and progressive development of cage farming and the livelihood options emerging.

The following management decisions were derived from and by the farming groups -

1. Reduce intensity of fishing and capital investments.
2. Improve reef fishery areas by adding benthic reef modules.
3. Ban on shallow gillnets for rays and skates and no more nets for sea bass and Ghol brooders.
4. Develop source banks for seed, feed, brooders, and work towards sustaining them.
5. No capture of turtles and dolphins; engage in their rescues.
6. No use of umbrella nets for gastropods and thus preserve the benthos.
7. shallow purse seines not to be allowed to reduce juvenile depletion of fish stocks.
8. No bottom set gill nets on reef areas to avoid biodiversity losses.
9. Release of juveniles of perches, catfishes, groupers, lobsters from their nets—capture only commercial sizes.
10. Rewild one percent of cage grown local varieties back -revival of stocks to waters and involve younger fishers. Invite CSR funding behind this event
11. Encourage beach cleanliness and cleanup discards of plastics as the sea bottoms are very important for the habitats and the life in the sea.
12. Develop skills in scuba diving, surfing, swimming, tourist guides, photography, developing marine aquaria, live fish trade, gaming in surf zone train more fisher youth from adjoining villages into positive participation –learning first, owning later and then manage engage in sports and remain fit.
13. Utilizing resources like captured fishes of low value for feeding farmed fishes.

14. Transporting cage grown fishes to gaming and live fish markets for higher premium and quality sea food restaurants.

Let us allow the fisher society to own a resource and then see the transformation. Cage farming is definitely a tool towards that direction. An integration of aquaculture and fisherman is essential in making the sea farming policy in this country. The enrollment of more educated fisher youth into furtherance of mariculture in the country would also ensure that the management of the coastal productivity and carrying capacity and intensity of operations would remain self-regulated as they are the primary stakeholders and responsible citizens. The enormous number of fisher youth turning out into the programmes and their willingness to adopt new skills is a positive sign. But the financial inputs and spatial limitations were inhibitions. A positive approach with Insurance and banking support and more infrastructure and consistent seed and feed supply could see the diversification take off very soon.

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CMFRI-FSI-DOF (2020). Marine Fisheries Census -2016 India, CMFRI -ICAR, Ministry of Agriculture and Farmers Welfare, Fishery Survey of India, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, 116p.Cage farmed Fish harvest by fisher youth of Chemmencherry
