Mangrove based aquaculture for vulnerable coastal communities in Sorlagondi village, Andhra Pradesh

Praja Pragathi Seva Sangham (PPSS)

December 2013 – January 2015

Digging of water channels to the IMFSS ponds; a family stocks crabs in their pond © PPSS

Title	Mangrove-based aquaculture for vulnerable communities in Sarlagondi Village, Andhra Pradesh
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Date created	2016-02-01
Main subject	Final Report
Keywords	Andhra Pradesh, Integrated Fisheries Farming System; Aquaculture
Purpose	To convey project interventions, successes, impacts and challenges of the MFF SGF project.
Distribution	MFF Secretariat; NCB India; IUCN India Country Office; IUCN India Member network, IUCN Asia Regional Office
Date distributed	1 March 2016

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Background

Aquaculture around the world has helped to produce more fish, kept the prices of fish relatively stable, and made seafood more accessible to consumers. With over 16% of global animal protein sourced from fish, and rising trends in demand for good quality seafood, aquaculture must step up to meet the need. However, producing more fish sustainably without degrading the environment and depleting natural resources remains a challenge. Irresponsible and destructive aquaculture practices continue to threaten the industry. In India shrimp aquaculture met with devastating consequences in the 1990s as a result of disease outbreaks, leaving hundreds without livelihoods. In 1996 the Supreme Court put a halt to intensive shrimp farming; 60% of landowners were forced to abandon their farms. Investment was needed in India and around Asia, to implement newer, eco-friendly technologies and models, and their adaptation to local conditions.

In Andhra Pradesh fisheries production has increased from 179,130 tonnes in 1995 to 526,282 tonnes in 2014 (Department of Fisheries, Government of Andhra Pradesh). The pressures and threats to wild fish populations have increased over the years with the introduction of newer technologies, and the unsustainable catch of juvenile and breeding individuals. With the degradation of marine habitats and decreasing fish catch, artisanal fisher communities, and other marginalised/vulnerable coastal communities are amongst those worst affected and least benefitted in terms of livelihoods/income security.

Local communities

Sorlagondi village in the Nagayalanka Mandal, Krishna District of Tamil Nadu, has over 498 households, 645 families, with a total adult population of 2733 individuals. 52 of these families are headed by women, largely due to the deaths of the male members at sea. The primary livelihood is fishing, although a few landholding families conduct small-scale aquaculture and agriculture. The village is located approximately 1.5 km from the sea. The success of these is dependent on drought and flooding events, and mismanagement. Several of the aquaculture ponds are degraded, and in a state of disrepair (which the families cannot afford, nor have the technical knowhow to fix). A bund has been created on one side of the village by the State Government in an attempt to prevent the flooding, however salinization continues to be a challenge.

MFF and PPSS are working with the Yenadi tribe, classified as Scheduled Class, and living below the poverty line. 10 families are direct beneficiaries of this project. They live adjacent to a fishermen's community in Sorlagondi, in temporary housing. They depend on the adjacent mangroves. They moved to the region 13 years ago, prior to which they hunted rats for farmers in agricultural fields, earning INR 5 per rat. They are particularly vulnerable to natural disasters, and have no food or income security, often turning to manual or agricultural labour in times of need.

Integrated Mangroves Fishery Farming System

The Integrated Mangrove Fishery Farming System (IMFFS) was first piloted by M. S. Swaminathan Research Foundation (MSSRF) in 2010 through the Mangroves for the Future (MFF) Small Grant Facility (SGF), in Tamil Nadu. The project involved the reclamation of abandoned coastal lands, and the building of local infrastructure including ponds, around and within which bunds and embankments were developed for the plantation of mangroves. The ponds were fed with mangrove-

based fish seeds and organic inputs, like dead fish or organic waste, for their development. Tidal water also provided natural feed and oxygen to the ponds at no cost to the farmer, and proved to be an energy-efficient method for production. As such, the Aquaculture Authority of India is considering this ecosystem-based model to fisheries for eco-labelling.

The system does not compromise on quality and size of produce; both of which are comparable to wild catch. Farmed fish sell at a price market prices, and have the potential to sell for more. Enterprising beneficiaries have started multispecies aquaculture systems within the ponds, including crab culture. Some are sowing and selling ornamental mangrove-associated plants for additional income. IMFSS translates into a sustainable source of revenue for impoverished families and has provided hope to those forced to abandon their previous livelihoods in shrimp farming, without undue damage to the coastal ecosystem. It simultaneously addresses a pressing need: the increasing demand for quality seafood in India, and by the global export market. Farmers, convinced by the merits of implementing the system, have willingly provided their land for free, as demonstration sites. MSSRF is already up-scaling interventions in India through the Climate Adaptation Fund.

Objectives

Working in partnership with MSSRF, PPSS has just under 200 ha of mangroves (of the 1700 ha of Government revenue land) using the fishbone canal methodology in the village of Sorlagondi in Krishna District of Andhra Pradesh. A similar model to IMFFS has been integrated on a much smaller-scale to enable some fisher families to culture crabs and small fish. However, there is need for a larger intervention to ensure livelihood and income security for the most impoverished of the coastal community in the village.

This project established the IMFSS system for marginalised fisher families, and the Yenadi tribe, in Sorlagondi village, towards poverty alleviation and food security. The specific objectives of the Small Grant Facility projects were to:

1. Ensure that mangroves around Sorlagondi are conserved and managed effectively
2. Provide equal opportunities for men and women to initiate and implement mangrove associated sustainable aquaculture

Implementation of Activities

Key Activities per Results	**Achievements and Impacts**
Objective 1. Mangroves around Sorlagondi village are conserved and managed effectively	
Activity 1.1. 100 community members or Sorlagondi village are made aware of the importance of mangroves	An orientation meeting was organised in January 2015, to explain the project to the community and gain their trust and commitment. Three awareness workshops were conducted on the importance of mangroves to fisheries production, and various sustainable mangrove-based livelihoods were introduced including IMFSS, fish cage culture and pen culture. Discussions with the community indicated that they were already aware of the importance of mangroves, but what they really took away from the workshop was the means by which they

	could reduce their own dependence on the mangroves without sacrificing any of their needs. Refer to Annex 1 for awareness materials; the poster has been displayed in public places around the village.
Activity 1.2. 100 community members of Sorlagondi village are capacity built in participatory mangrove conservation practices.	Most of the women were already aware of the of mangrove nursery techniques, having done a previous project with PPSS. However the rest of the community was capacity built in rehabilitation and restoration techniques. They value the mangroves as nurseries for crabs and fish which they can catch to supplement their aquaculture pond when required. To this extent they have assumed stewardship of the mangroves
Objective 2. Equal opportunities provided for men and women to initiative mangrove associated sustainable aquaculture	
Activity 2.1. Participatory Rural Assessment conducted to map community profile and resource-use	A Participatory Rural Appraisal (PRA) was carried out in Sorlagondi in February 2015 to collect data on the availability of resources in the village, the common concerns and ways and means to address these issues. The following tools were implemented: history and time line of villages, village transect walk, social mapping exercise, resource mapping exercise, seasonal diagrams, role and significance of institutions, and well-being analyses. Following the 1977 Cyclone Divi, which killed close to 470 people in the village, (225) concrete houses have been constructed, connectivity in terms of telephones and public transport has improved, electricity facilities introduced, and education institutions and sanitation facilities developed. All this however, has not yet been made available to the Yenadi tribe. Inefficient water drainage systems have not been in place, causing stagnant water-pools that propagate mosquito-borne diseases. The village is surrounded by shrimp ponds to the east, paddy fields to the west and north, and the Bay of Bengal to the south (separated by mangrove forest). There is a lack of freshwater in the village. Fishing is banned between April and May, the largest harvests are caught between August and December, however the village is most prone to natural disasters during this time. Most people migrate for agriculture labour in March, June and December (correlating with when their income is highest). Most of the poorest families depend on the local water bodies for fishing to sustain themselves. The timber from *Avicennia marina, A. officinalis*, *Excoecaria agallocha* are used for house construction. *Bruguiera cylindrica* is used for fencing.

	Avicennia is the major wood used for fuel. Villagers depend on mangroves for fodder. Cattle both buffaloes and cows are grazing inside the mangroves.
Activity 2.2. Formation of a village level institution through democratic processes, for management of natural resources	Community stewardship of the mangroves has been established through the development of the Sorlagondi Village Development and Management Committee. This village-level institution of the 11 executive body members (from the fishermen and Yendai tribe) has 6 women (including the Secretary and Treasurer), and has the responsibility of managing the natural resources. It also handles domestic conflicts as and when required.
Activity 2.3 100 community members of Sarlagondi village are capacity built in mangrove-associated, eco-friendly and sustainable aquaculture practices	50 women and 50 men were trained in participatory mangrove conservation and aquaculture practices. 18 Yenadi community members were trained in IMFFS. Mr. P. Venkateswara Rao (PPSS) explained the project objectives and the methods. Dr. R. Ramasubramanian (MSSRF, Kakinada) explained and demonstrated mangrove nursery techniques, mangrove restoration techniques, and aquaculture practices through IMFFS.
Activity 2.4. Development of 8 ponds in Sarlagondi village on revenue land	10 ponds have been developed on Government revenue land (permissions were obtained prior to project initiation) and are functional, for 10 families of the Yenadi tribe. The ponds themselves have been developed along canals between 2 previously constructed and unused ponds within the mangrove plantations (planted by the Andhra Pradesh Forest Department and MSSRF) – a freshwater feeder canal has also been constructed to ensure efficient freshwater input. The women did mention that instead of processing and marketing fish for the predominant part of the day (in addition to their daily household work) they now spend time tending to their aquaculture ponds and ensuring that nearby villagers, birds and jackals don't disturb the ponds. Men and women, particularly amongst the fishermen community, and not so much with the Yenadi tribe, seem to share responsibilities equally.
Activity 2.5. Strengthening bunds and pipes for tidal flow into IMFFS ponds	10 families were provided ponds under a previous project implemented by PPSS and MSSRF, funded by SRDC, in 2008. Most of the ponds were facing issues related to changes in freshwater inflows, and erosion due to climate. Through the MFF project bamboo sticks and nylon mesh was introduced to prevent escape of crabs and fish from the ponds, as well to prevent cattle from getting near the pond. Eight cement canals were depended and inlets constructed for the transfer of

	water from the main canals into the ponds. The canals were dug up to 1 meter to hold up to 3 feet of water during low tides. The fishermen were grateful to MFF for providing funds to the repair the bunds, and place new pipes, the degradation of which they lost income over. During discussions with the village fishermen's association and representative from the Panchayat, they reinforced their commitment to help the Yendai tribesmen in ensuring livelihood security, and to ensure that they were included in the Population Census in future, specifically so that they could avail of existing Government schemes.

Outcomes and Impacts

The 8 ponds were stocked with approximately 500 crabs, and 120 juvenile fish sourced from the wild and from the Central Institute for Brackish Water (CIBA), in total in September 2015. These were collectively worth INR 11,000. On average the cost of organic feed per pond is INR 4,320; it is suspected that over time this cost will vary depending on the tides and in periods of drought and flooding. Some funds for the feed came from the project; trash fish feed was also provided by CIBA.

Within the first three months, during which the crabs developed within the IMFFS ponds, the community made several intermediate harvests (as and when they required funds), and a final harvest 3 months later in early January (when the fish and crabs had reached optimum size). The harvest was sold in the local markets, and to intermediaries for export. During the mid-term harvests, 106 crabs were sold in total, fetching an average collective price of INR 112,400 in profit for the families. The final harvest (which was an integrated fisheries harvest) yielded a significant profit for the families of INR 295,925. The harvest sold included approximately 270 kg of crabs, and 61 kg of fish. This was despite survival rates of up to 60% as some families exceeded the carrying capacity of the ponds by stocking them with too many individuals.

On average a single Yenadi tribal family earned between INR 15,000 to 30,000 from their IMFSS pond within the first 4 months of construction. The fishermen families earned between INR 24,850 and 45, 280 from their established rehabilitated ponds.

Recommendations and Lessons Learned

The Integrated Mangroves Fisheries Farming requires relatively low cost seed investment, is sustainable and environmentally friendly. The families can farm food in the relative safety of a closed system, with little or no effluent, mimicking nature (through the integration of mangrove plantations, and use of tidal influx), through no use of equipment, thus making the system energy efficient, and with sustainable and healthy feed ingredients (e.g. trash fish, and supplements brought in by the tides).

One of the biggest advantages for the communities is the fact that they can now sell crabs or fish whenever they need the money, instead of borrowing from money lenders and building up debt. There is a sense of financial security and empowerment growing amongst the families.

The project is a good example of how State Governments, IGOs (IUCN), and NGO's with close community associations (PPSS) and technical knowledge (MSSRF) can partner to provide sustainable coastal livelihoods to marginalised communities in need.

Sustainability

It has been established that the IMFFS works but the system now needs scale, which requires associations with entrepreneurs and existing business to ensure that the products are well marketed and the communities continue to benefit. The system further requires policy support (particularly since most existing mangrove areas are under the Forest Department), and the aid of Government schemes for better replication potential.

The interventions now need to be up-scaled to address the needs of all the families of the Yenadi tribe. There is potential to strengthen and value-add for existing families implementing the IMFSS, such as fish pickle-making.

Annex 1. Awareness materials generated for distribution to communities