

# Improving Living Conditions for Reef Dependent Fisher Families in Tuticorin, Gulf of Mannar, Southeast coast of India

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## INTRODUCTION

The Tuticorin Coast is the most environmentally stressed coastal area in the Gulf of Mannar (Patterson, 2002). Population increases, lack of other employment opportunities, and low literacy levels force local villagers to depend mainly on the marine resources that can be harvested from around the four coral reef fringed islands off the coast. As most of the fishermen do not have adequate financial support for large vessels, they are restricted to reef areas that are easily accessible with small boats. Strained by decreasing fish catches, they are often compelled to use more effective and also destructive fishing methods, which reduce the productivity of the reefs even further. Overfishing and the use of destructive fishing methods have been prevalent for many years. Coral mining has been practiced for the past several decades, and many poor fishermen are involved in this illegal practice for their daily livelihood (Patterson, 2002). The number of boats involved in mining varies with the fishing season. Although this practice is now considerably less common, it still persists. Cyanide fishing is used to catch reef fishes and the use of various types of destructive fishing nets such as beach seine nets and trawl nets are causing harm to the benthic environment in Tuticorin. Further, a small section of fishermen are also involved in dynamite fishing using gelignite sticks to kill shoaling fishes

which, in turn, destroys the whole reef habitat. Lack of awareness and adequate literacy, limit the villagers understanding of the long-term value of the resources. The development of many industries along the coast, destruction of mangroves for saltpans, and disposal of domestic sewage also pose considerable impact to this ecosystem and the dependent coastal folk (Easterson, 1998; Murugan & Patterson, 2000).

Suganthi Devadason Marine Research Institute (SDMRI) has implemented series of activities to make coastal communities in five selected villages along the Tuticorin coast less dependent on the coral reef resources by providing opportunities for income diversification and alternative livelihoods. Further, efforts have been made to raise the awareness of increasing problems. In order to reduce pressure on the reefs, and make people less vulnerable to changes in the supply of food and income from these ecosystems. This report summarizes the findings and results achieved to date through the following projects:

- Assessment of the socio-economic and fishery status in the villages;
- Creating awareness on the sustainable use of the marine resources;
- Introduction of alternative and supplementary sources of food and income to fisher families.

## SELECTED VILLAGES

The Tuticorin Coast in the Gulf of Mannar is the core region of the southern part of the Marine Biosphere Reserve. Five villages namely Tharuvaikulam, Vellapatti, Thalamuthu nagar/Siluvaipatti complex, Thirespuram and Inico Nagar are dependent on the adjacent reef areas for the fin and shellfishes.

Tharuvaikulam (population: 10 085) is located about 15 km from the main town of Tuticorin.

Vellapatti (population: 2 138) is located about 11 km from Tuticorin. The village is unique as the crab fishery is a major occupation. Recently, a few families have started to operate other gears for trapping of finfishes.

Thalamuthu nagar/Siluvaipatti complex (population: 13 951) includes six fishing villages namely Siluvaipatti, Thalamuthu Nagar, Sameer Vyas Nagar, East Kamaraj Nagar, Anand Nagar and Jesu Nagar. They have a common landing site at Siluvaipatti. The villages are situated close to each other and are located 5 km away from Tuticorin. The chief fishery of these villages is shrimp but it is augmented by small-scale seasonal fishing for cephalopods, emperors and siganids.

Thirespuram (population: 19 368) is located about 1 km north of Tuticorin. It is one of the oldest fishing settlements in this district and the fishermen have migrated to other places.

The total population in Inico Nagar – called Pudukadarkarai (New shore) until 2002 – is 2 189. The major fishery is sardines. On the southern side of this village, there is a small estuarine complex which is lined by stunted *Avicennia marina*. Sometimes the fisher folk also engage in collecting shrimps by hand picking in the mangrove areas.

## FISHING ACTIVITIES

All these fishing villages depend mainly on fishing on the reef areas around the Tuticorin group of islands; Vaan, Koswari, Vilanguchalli and Kariyachalli. At Tharuvaikulam, boats leave the village by 3 pm and return by 8 am the following day, while at Vallams, boats leave by 4 am if

the target species are finfishes and return by 8 am the same day.

A wide variety of species are landed at Tharuvaikulam, while other villages have more specific target species. In Tharuvaikulam, all 7 gears (table 1) are effective enough to bring in good catches and there are no trawling activities carried out in the village. The whole set up is very healthy and the fishing is sustainable. Good catches of emperors, groupers, jacks, skates and snappers are obtained using maya valai which, along with nets like 5 no valai, 2 no valai, and the irupuri valai, are modified gill nets. Nandu valai is a modified bottom set gill net used to catch crabs. The annual catch of crabs at this village was 104 tons, 90% of which was blue swimming crabs (*Portunus pelagicus*), 7.5% mud crabs (*Scylla serrata* and *S. tranquebarica*), 1.5% crucifix crab (*Charybdis ferriata*) and 1% three spot crab (*Portunus sanguinolentus*).

More than 31 species of gastropods were obtained as by-catch and were usually utilized for shell industries. A variety of fish species were available in the particular fishing village. The landing centers display some reef fishes

**Table 1.** The type of fishing gear used by fisherman in each of the selected villages along the Tuticorin Coast, Gulf of Mannar, India

Village	Gear
<i>Tharuvaikulam</i>	Paru valai, 5 No. valai, 2 No. valai, Maya valai, Crab nets, Hooks and lines, Irupuri valai
<i>Vellapatti</i>	Crab nets
<i>Thalamuthu/Siluvaipatti</i>	Push nets, Shore seines
<i>Thirespuram</i>	Maya valai, Mural valai, Nandu valai, Paru valai, 2 no valai, Disco valai, Irupuri valai, Chala valai, Singhi valai, Kola valai and Trawls like Thallumadi, Ola valai, Kara valai, Hooks
<i>Inico Nagar</i>	Chala valai

that are also landed as by-catch in many of these nets. Some species like butterfly fishes, angelfishes and trigger fishes are consumed locally as well as exported to the neighbouring Kerala state.

At Vellapatti, fishing occurs just once a day. The nets are set around 4 pm and are retrieved at 5 am the next morning. The catch is brought ashore at 9 am and all auctions take place where the catch is landed. Almost 293 tons of crabs have been landed annually, mainly blue swimming crabs, three spot crab, crucifix crab and mud crabs.

At the Thalamuthu nagar/Siluvaipatti complex, fishing is conducted only once per day. The fishermen leave during the night or early in the morning and return around 10 am. In Thalamuthu nagar complex, push nets were used to catch 60 tons of shrimps and associated by-catch of, gastropods, bivalves and crabs. Shore seines targeting emperors, siganids, crabs and cephalopods have produced 11.89 tons annually.

In Thirespuram, fishermen leave by 5 am and return before midnight with catches comprised mostly of both shell and fin fishes. At Inico nagar, the major fishing activity is focused on capturing shoaling sardines. The fishermen leave around 1 am and return by 8 am.

Different types of fishing gears are used in each selected village (table 1). In Tharuvaikulam and Thirespuram, a wide variety of gears are used, whereas in Vellapatti and Inico nagar, fishermen practice only crab and sardine fishing respectively. In the Thalamuthu nagar complex, only push nets and shore seines are used.

Fishermen from these villages also use different types of vessel. The most common vessels used at Tharuvaikulam are both the large boats that operate gill nets and vallams, which are indigenous country crafts. At Vellapatti, on the other hand, only vallams are used for fishing related activities. Fishermen in Thalamuthu nagar and Thirespuram also have vallams but fish for reef fishes like emperors, groupers and snappers. At Inico nagar, the vallams are used only to catch sardines.

## ASSESSMENT OF SOCIO-ECONOMIC STATUS

Questionnaires were used to acquire pertinent household, socio-economic and fishing related information. Interviews were then conducted with focus groups such as the village administration and fisher folk of either sex.

The majority of the coastal families in the five villages depend solely on the income generated through fishing activities for their livelihood. Many fishing families are poor and lack the basic facilities such as clean drinking water, sanitation and electricity. Health and education seem to be the immediate issue in parallel with poor sanitary conditions. The five villages have different modes of fishing with a variety of gears. Illegal coral mining is considerably less common and more efforts to raise awareness of the damage this activity causes in the area can eradicate this occupation.

### Annual Income of Fishermen

*Tharuvaikulam:* The average annual income depends on the type of vessel used by the fisherman. Fishermen who are involved in fishing with small boats earn about Rs. 30 000–45 000 annually, while those involved in fishing with traditional vallam earn between Rs. 25 000–30 000 annually. The poorest fishermen are those that operate small 'vathai', which are generally used to transport goods and fishermen from the small boats to the shore.

*Vellapatti:* Fisher folk earn average annual income of between Rs. 30 000 and 45 000, although there are seasonal differences throughout the year. During peak seasons, they are able to earn Rs. 1 000 per day while during the lean season only Rs. 50–100 per day is earned.

*Thalamuthu nagar:* The fishermen are able to earn about Rs. 35 000 to 45 000 annually. During peak seasons, they earn around Rs. 1 000 per day while during the lean seasons they are satisfied with a meagre Rs. 75 per day.

*Thirespuram:* The average annual income of fishermen in Thirespuram varies according to the species targeted or the type of fishing they are engaged in. Chank divers earn up to Rs. 500 per day during the peak seasons while sometimes, they do not even earn a single rupees. Gill net operators, earn around Rs. 600–800 per day during

the peak season and only Rs. 50–100 during the lean season. Fishermen who are employed as deck hands on trawlers, work in shifts with one day on and one day off and earn around Rs. 150 per working day.

*Inico nagar*: The average annual income of fishermen in the sardine fishery is estimated to be around Rs. 15 000–21 000, with monthly incomes fluctuating, between Rs. 750–2 000 depending upon the season.

### **The Role of Self Help Groups**

The Self Help Groups (SHGs) in all villages play a major role in the generation, saving and wise use of financial resources. The Government is encouraging SHGs in order create confidence among the women. In Indian culture, the women at home play an important role in maintaining the family and also it is believed that the women would be more reliable in repayment of borrowed funds and so it would be easy to sustain any programmes with their involvement. The majority of the women SHG's are under the control of the Tuticorin Multipurpose Social Service Society (TMSSS) run by the Roman Catholic Diocese. The Bishop of Tuticorn District is the president and is assisted by several members. There are 98 SHG's under the administration of the TMSSS in all the coastal villages of Tuticorin with a total of 2 019 members. The main objectives of the TMSSS are to:

- bring socio-economic changes by organizing technical programmes;
- develop skills for income generating programmes;
- improve the sense of saving;
- remove illiteracy among children below 14 years of age.

The number of SHG's in each village varies with the population of the respective village. Each SHG consists of a president, secretary, treasurer and 17 members. In each village, all the SHGs are managed by a single coordinator who meets with the groups once a month to assess and co-ordinate their activities. The SHG's play a leading role in the generation and administration of

saved funds. The amount saved by each varies but ranges between Rs. 50 000 and Rs. 100 000 (US\$ 1 064 and 2 128). The total savings of all 98 SHGs of Tuticorin up to March 2002 was Rs. 5 030 843 (US\$ 107 039) (TMSSS Annual Report 2001–2002). Each group deposits their savings in a bank and the related original papers are lodged at the TMSSS office. Each SHG meets once in a week in order to discuss the wise use of funds, repayment of loans and the plan for the coming week.

The savings were loaned to SHGs for various purposes, so that they could avoid borrowing from money-lenders at high interest rates, which was found to be one of the reasons for the continued poor economic status of the households. In order to rectify this situation, women within the villages were encouraged to increase their savings to enable them to use the available funds for income generating activities. On behalf of each SHG, TMSSS takes a loan that is three times the amount of the total saved by each group and distributes the money to the members of respective groups based on their contribution. Each member is required to pay back the amount loaned in monthly instalments within 21 months at 9% interest. The women use these loans mainly to help their family members (husband/sons) to buy fishing materials or for family functions. In addition, women belonging to SHGs are empowered in social and economical domains and actively participate in decision making and planning processes, linking them with micro-enterprises and banking institutions (Patterson, 2003).

The livelihood of fishermen is jeopardized by declining reef resources resulting from overexploitation by growing populations and an ever-increasing number of fishing boats, which are employing increasingly destructive methods to catch fish. In addition, all fishing activities within these villages tend to be controlled by middlemen who offer loans to fishermen for boats and nets in return for a certain portion of their catch to be sold to them at a low fixed price. The inability of fishermen to sell their entire catches at fair market prices has hindered the economic development and financial security of many coastal fisher folk. For example, at Inico Nagar, all

the auctions are carried out through middlemen who get a commission of 6–7%. As a result, the fishermen are forever indebted to these middlemen who grow wealthier while the fisher folk who carry out all hard work obtain only meager prices for their catches. The basic reasons behind the problems are lack of awareness and alternative livelihoods.

### CREATION OF AWARENESS

In 2001, a survey to assess the awareness of fisher folk about corals determined that only 29% of men and 3.1% of women were aware of the ecological significance of corals (Patterson *et al.*, 2002). Thus, SDMRI has conducted series of awareness programmes in these villages, to promote the importance of corals, healthy fishing practices and the need to curb illegal coral quarrying and destructive fishing practices (figure 1). Mainly fisher women were targeted as they play a very important role



**Figure 1.** Coral reefs awareness programme in Tharuvaikulam village in Tuticorin coast.

within the family and social set up. By explaining to the women the ill effects of coral quarrying, the loss of habitat for many fin and shellfishes and loss of potential fishery zones in the near future, the message subsequently reached the ears of active male fishing representatives in their family. The awareness programmes also focused on families actively involved in removing live and dead corals from the offshore islands and, as a result they have now started to argue against destructive activities in all villages. In Vellapatti, coral quarrying has stopped totally, and the fishermen have also adopted less destructive fishing methods. The fisher women in Tharuvaikulam are strongly opposing coral mining and destructive fishing which has curbed these activities considerably. The practice of dynamite fishing using gelignite and amatol sticks has ceased completely in Thirespuram village, once famous for this type of illegal fishing. The women fisher folk have turned out to be the most effective educators of the male working members of their families. They have also informed their Self Help Groups (SHGs) that conservation should be practiced by them in order to maintain the resources for future generations. Following the completion of this series of awareness programmes, another survey of the knowledge about ecological significance of corals among male and female fisher folk determined that awareness levels had increased beyond 80% and 20% in males and females respectively. Through our awareness programmes, the basic knowledge about the need of conservation of the coral reef ecosystem was increased substantially.

### ALTERNATIVE LIVELIHOOD SCHEMES

In order to improve the living conditions of fisher folk and to reduce the pressure in the marine ecosystem, alternative livelihood schemes were introduced to empower the women under Self Help Group (SHG) to earn extra income on their own, to help their family to enhance their socio-economic status.

Apart from short-term training programmes on pickle preparation from marine fishes and shrimps, no viable

alternative livelihood programmes have been implemented in the past. SDMRI has involved in the capacity building especially on vermi-composting, crab fattening and development of value added products from under-utilized resources such as gastropod meat with support from CORDIO and other agencies.

### **Vermi-Composting**

Vermi-composting is a simple technique of converting biodegradable wastes into value added biofertilizer using earthworms. Earthworms breakdown degradable waste and consume it along with the soil. Further, the breakdown is taking place in the intestine of the earthworms by the microorganisms and digestive enzymes present in the intestine. The digested materials are expelled in the form of granules called *worm casts*, which are seen in the top layer of soil. The worm casts along with the urine and other secretions of the earthworms, dead adult worms and enormous quantities of beneficial microorganisms are collectively called *Vermi-compost*. The vermi-compost contains all the micronutrients, humus and organic matter, essential for soil health and plant growth.

#### *Vermi-Compost Preparation*

A pit of 2 m x 0.5 m and 1 m deep is dug in the soil and a 5 cm layer of broken bricks or pebbles is spread at the bottom. Thereafter, a thick layer of sand is spread over the pebbles to drain excess water. A layer of soil is spread on top of this, and, after being moisturized, the soil is inoculated with locally collected earthworms. Small lumps of cow dung are placed over the soil and covered with bio wastes like for example dry leaves. This process of spreading alternate layers of cow dung and bio waste is repeated until the pit is filled. Water is sprayed liberally until the entire contents of the pit are moist but not wet. The pit is then watered and monitored regularly for about 25 days, and kept covered with coconut or palmyrah leaves to prevent disturbance of the vermi-bed by birds. After 25 days, the appearance of juvenile earthworms is a healthy sign. Water management is the most important criteria in vermi-culture, as worms require

moisture for their survival. Once a week the contents of the pit should be turned upside down for uniform conversion.

As the compost is getting ready and the change of refuse into a soft, spongy, sweet smelling, dark brown compost is noticeable, no additional water is added which compels the worms to move into the vermi-bed. This will facilitate the harvesting of the compost without much damage to the worms. The harvested compost is placed in the form of a cone on a solid ground in bright sunlight. This will facilitate whatever worms still present in the compost to move to the lower layer. We can recover the worms from the lower layers of the compost and transfer them in a new composting unit.

#### *Benefits*

The organic wastes generated every day, which otherwise can cause environment and health problems can be recycled. The use of vermi-compost will reduce the quantity of the chemical fertilizers. This reduces the input costs for cultivation. And there are no ill effects when using vermi-compost excessively unlike with chemical fertilizers.

The wastelands will be improved when the application of vermi-compost and the introduction of earthworms improve the soil properties. Vermi-compost will change the structure of the soil and provide oxygen to the roots of the plants. Further, an enhanced disease resistance will be developed in the soil.

Vermi-compost increases the quantity and quality of the products. It provides plant growth promoting substances and other essential nutrients to the plants. The taste and quality of the products will be improved and the keeping quality and shelf life period will be enhanced.

It prevents the soil erosion and water evaporation. It improves the soil pH. It enhances the growth of beneficial microorganisms.

Vermi-composting does not require sophisticated instruments that need to be maintained.

It creates job opportunities to rural, coastal and urban populations. The sale of vermi-compost and earthworms



**Figure 2.** Training programme for coastal fisher women in the preparation of vermi-composts.

provides additional or alternate sources of income to women and unemployed youths thereby improving their livelihoods.

#### *Training of Fisher Women*

SDMRI has initiated training programmes on vermi-composting through CORDIO, particularly to coastal fisherwomen belonging to the SHGs of Thirespuram, Punnakayal, Vellapatti and Tharuvaikulam (figure 2). The training programmes were organized as an awareness raising activity because the sources of organic waste available are comparatively large in these areas (seaweeds, sea grasses etc in the shores and dry leaves of shady trees). The women who attend to household work can take care of the vermi-compost pits in their leisure time.

Twenty women from Vellapatti village were trained at a commercial vermi-composting farm at Puliuthu where they obtained practical experience in large-scale vermi-composting methods (figure 3). At Vellapatti, the soil is

sandy in nature and unfit for the preparation of the pits. Therefore, through CORDIO programme, 13 vermi-composting pits were constructed for trained families with brick walls to avoid sinking of the pits and SDMRI



**Figure 3.** Local fisher women gaining practical experience in large-scale vermi-composting methods.



**Figure 4.** Harvested vermi-compost ready for sale.

provided technical back up. Regular monitoring of the pits and technical advice is provided freely to the villagers. Effective composting has continued since the initiation of this vermi-composting programme. SDMRI has arranged buyers for their bio-fertilizer and every pit owner is earning about Rs. 1 500 to 2 000 per crop. The women of Thirespuram have started to prepare vermi-composts in their own in their backyards, and are now able to harvest rich yields of both compost as well as worms that can be utilized for the next filling. Once the bio-fertilizer is ready to be harvested, SDMRI arranges buyers on behalf of the women (figure 4). After the second training programme in Tharuvaikulam in 2004, women started to venture into vermi-composting in their own village. This is an economical improvement for the coastal people and also a viable alternative/additional livelihood option especially to the fisher women.

Vermi-composting has become very popular income generative activity because of its low investment, less time consuming and promising market value. This activity is fast spreading among other villages and SDMRI is keen to provide training to other villages.

## Crab Fattening

All crustaceans undergo 'moulting', a process by which their exoskeleton is shed in order to grow. In recently moulted crabs, the carapace is very soft and are locally known as 'water crabs' and do not fetch attractive prices at the market. Usually, they are discarded. Culturing these crabs until the carapace hardens is called crab fattening. The mud crab (*Scylla serrata*) takes 21 to 24 days for fattening but the swimming crabs *Portunus pelagicus* and *P.sangunolentus* fatten within 7 to 9 days. The fattened crabs generate a normal market price just like other crabs.

### Benefits

Crab fattening is simple process and it can be used as one of the viable alternate livelihood programmes for earning additional income by the fisherwomen. The crab fattening saves the resource and gives an additional income a SHG of between Rs. 1 000 to 1 500 per month.

### Training to Fisherwomen

The daily economic loss for fishermen due to 'moulted crabs' was unavoidable until recently when the crab-fattening process was initiated. Groups of fisherwomen representing the coastal villages were trained in the process of crab fattening by SDMRI during 2002. Responding to the interest put forth by the fisher women of the crab-fishing village Vellapatti, a one-week training programme was organized by SDMRI under the CORDIO programme. The training covered all aspects of fattening from choosing the moulted crabs, fattening, feeding the molted crabs with inexpensive baby clams, *Donax faba* and the harvest of fattened crabs (figure 5). They were trained to fatten the mud crabs and blue swimming crabs.

After the training programme, a proposal was prepared for the construction of a fattening unit exclusively for the SHG women of Vellapatti fishing village. Five SHGs volunteered to take up the responsibility of the entire operation from stocking to harvesting and selling. The district administration sanctioned a grant for the



**Figure 5.** Fisher women feeding crabs held in cement holding tanks with baby clams.

construction of the crab-fattening shed. After the construction of the fattening shed, all the five SHGs, involving around 60 women, were successfully carrying out the fattening programme. Regular monitoring and technical back up was provided by SDMRI as a part of CORDIO programme.

The local women fisher folk of Vellapatti fishing village have taken up crab fattening process to generate income as an alternate livelihood scheme. Initially, the costly and export oriented mud crabs were preferred for fattening, as they are exported in live condition and there is a demand for them throughout the year, and crab stocking was carried out in all tanks. However, the fattening period for mud crabs was found to be as long as 3–4 weeks. Thus, instead of mud crabs, the blue swimming crabs are being fattened for a period of 7 to 9 days with higher stocking density. The moulted blue swimming crabs are purchased for 1 rupee per crab and sold for an attractive price approximately Rs 7–9 per crab. The crab fattening is a viable alternative/additional livelihood programme and could effectively be practiced in Tuticorin coast by SHG fisherwomen in the other villages.

Crab fattening has become very popular, as it is highly

viable with good market value. Other funding agencies have also come forward to provide training to coastal folk in crab fattening. However, in order to provide more hands on trainings to fisher folk, a training unit in one of the coastal villages in Gulf of Mannar is essential. This training unit could also help to give proper guidance and monitoring of the fattening activity by the villagers.

### **Development of Value Added Products from Under Utilized Marine Resources (Gastropod Meat)**

#### *Background*

Seafood, primarily in the form of fin fishes, crustaceans and molluscs, has been source of protein since time immemorial. In India, the cost of the seafood (fin fishes and crustaceans) is increasing rapidly due to the high demand in local and export markets making it unaffordable to people in poorer sectors of society. Hence, there is a need to promote an alternative and cheaper source of nutritious food to meet the needs of poor people. In the molluscan group, the cephalopods, bivalves and gastropods form important fishery resources next to crustaceans. Meat from molluscs is rich in protein and they can be an inexpensive source of nutrition. In India, gastropod meat is not popular like other seafood due to lack of awareness combined with the conventional food habit of the people. As direct consumption of gastropod meat may not be appeal to the public, the incorporation of dried meat into some value added products was thought to be more acceptable.

#### *Benefit*

The available gastropod resources can be utilized wisely without any waste. The development of value added products from the under utilized gastropod resources with low technology would help the fisher women to earn extra income during their free hours. The women can also start their own small-scale cottage unit for the preparation of value added products. It would also help to promote an alternative and cheaper source of nutritious food to meet the needs of poor people

### *Training to Fisherwomen*

A total of 25 fisherwomen from Vellapatti village participated in the training programme. Crab fishing is the main fishing activity in Vellapatti village, however huge quantities of gastropods are also landed as by-catch. The gastropods were used only for their beautiful shells and operculum, but the meat was wasted without knowing its nutritional value. During the training, the fisherwomen were made aware of the value of the resources and were taught to prepare value added products such as pickles, soup powder, chutney powder and other common local products using gastropod meat. They were also taught how to hygienically handle the meat to enhance the quality. The follow-up survey conducted after the training programme showed that the villagers started consuming the gastropod meat. Development of value added products from these under utilized gastropods is the first of its kind and will serve as better alternative protein source in the near future. Now the nearby villagers (Tharuvaikulam) are also asking to conduct such kind of programmes. The villagers are also willing to take up small-scale cottage industry to prepare the products from gastropod meat to earn additional income.

The training on the development of value added products using under utilized gastropod meat has created awareness among the fisher folk of Vellapatti village to utilize the meat and also the neighbouring villagers to ask for such training. However, in order to market the developed products locally, the villagers need to set up small-scale unit, which they cannot afford. It would be worth providing such small units in 2 or 3 villages in Gulf of Mannar, so that additional income could be generated by the fisher women through the wise utilization of gastropod meat, which has, by enlarge, been neglected.

### **CONCLUSION**

The people living along the Tuticorin Coast of the Gulf of Mannar mainly depend on the reef resources for their livelihoods. The lack of awareness and viable alternative

livelihood programmes are major hindrances to improving their socio-economic status and also threatens the sustainable use of the reef ecosystem. This 'demonstration project' focusing on awareness and alternative livelihood programmes showed good results among the fisher folk and is now a role model to other coastal villages of the maritime states.

The creation of awareness coupled with alternative livelihood programmes in these villages has created considerable interest among the people to protect, conserve and manage the reef resources for the coming generations. Such a level of awareness and viable options for income and food generating activities should be replicated at a larger geographic scale in order to sustainably use reef resources. SDMRI already plans to initiate similar efforts in other villages in Tuticorin in the near future and throughout Gulf of Mannar in the longer term, and additional donors have showed their interest.

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