Session 73B

Co-management: partnerships for achieving effective resource outcomes on coral reefs – partnerships with and among communities and stakeholders

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Co-management to address livelihood linked threats to coral reefs case study from Gulf of Mannar, southeastern India

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Abstract

The communities living along coast of the Gulf of Mannar depend mainly on the fishery resources for their livelihood. Though reefs in the Gulf of Mannar come under protected area, the coastal communities have easy access to this area. The steady increase of population (34% in 15 years), crafts and competition forced them to diversify into unsustainable methods of fish collection like shore seine fisheries, trap fishing and poaching of ornamental fishes in reef areas. The 2004 Indian Ocean Tsunami made the community significantly aware of the importance of reefs by preventing the devastation in the area. The increase of additional livelihood options through eco development activities under various national and international programs like CORDIO, GCRMN, GEF-UNDP has also helped these fishers reduce their dependence on the sea. However, nowadays the cultivation of exotic seaweed, Kappaphycus alvarezii and seaweed collection in reef areas have inflicted considerable damage to reefs. Due to invasion of exotic seaweed, about 1.2 Km² reef areas have been affected and seaweed collection process creates regular disturbances to reefs. These activities are not permitted as per Wildlife Protection Act of India and respective Government Orders, however the activities are linked to livelihood of over 600 fisher families and there is always conflict of interests between community and reef managers on this issues. The Government through a GEF-UNDP project with 252 grass root level organizations - Village Marine Conservation (VMC) and Eco Development Committees (EDC) has been formed and loans are provided as revolving fund to enhance their livelihood activities and to reduce pressure on reefs.

Keywords: co-management, livelihood, coral reefs, Gulf of Mannar

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Introduction

The Gulf of Mannar in Indian side is situated between 78°08' E to 79°30' E longitudes and 80°35' N to 90°25' N latitudes with a total area of 10,500 sq. km. The Gulf of Mannar is endowed with a rich variety of marine flora and fauna as it includes various coastal habitats mainly coral reefs, seagrass beds, seaweeds and mangroves. These habitats support a wide variety of fauna and flora and a total of 4,223 species are so far identified including 117 species of corals, 13 species of seagrasses, 9 species of mangroves, 641 species of crustaceans, 731 species of mollusks, 441 species of fin fishes and 147 species of seaweeds apart from the seasonally migrating marine mammals like whales, dolphins, porpoises and turtles.

Though Gulf of Mannar is biologically rich area, it has been exploited beyond the limit over the past 4-5 decades because of steady increase of population along the coast and dependence of community on the marine resources for livelihood. Around 29% of the reef area has been degraded due to various anthropogenic and natural factors. Seagrass beds occupy about 101 km² area and over 20% area is already damaged. Almost 2, 00,000 fisher folks of the region are dependent on artisanal fisheries based livelihoods in the region and their well being is closely linked to the ecological security of the coral reef habitats in the Gulf of Mannar region in Tamil Nadu. It is noted that there has been approximately 34% of increase in population along Gulf of Mannar coast in 15 years from 1994 to 2009. As a result of this, there has been an increase in 57% mechanized trawlers, 71% vallam (both motorized sailing) and 68% Catamaran. The basic threats to reefs in Gulf of Mannar are over exploitation of marine resources, habitat destruction, mainly coral mining, pollution (domestic and industrial), destructive fishing practices mainly, inshore trawling, shore seine operation, trap fishing, seaweed and ornamental fish collection in reef area, cultivation of exotic seaweed and coastal development activities.

Materials and methods

Suganthi Devadason Marine Research Institute (SDMRI) has been doing research on coral reefs of Gulf of Mannar since 2001. In this case study, an assessment has been done on the results of various research reports focusing anthropogenic threats witnessed over the years and co-management activities are mainly based on the field tested activities to mitigate the threats.

Results

Livelihood linked anthropogenic threats to reef area

The increase in artisanal fisher population, subsequent rise in fishing boats (Vallam) and limited fishing grounds have forced the fishermen to involve in destructive fishing practices and resource collection. However, these practices are having direct link to their daily livelihood. The following are the major such activities which have greater adverse impact on the reef area of Gulf of Mannar (Fig.1).



Fig. 1 Map showing the islands of Gulf of Mannar and identified livelihood linked threats to coral reefs

Shore seine operation

Shore seine, a traditional fishing method involves bottom trawling and makes huge impact on the coastal ecosystem. It was observed that important habitats such as coral reefs and seagrasses are affected severely by this shore seine operation. Most of the catch was observed to be juvenile in nature or very small in size (67.76%) (Raj et al. 2016). These bottom trawls are designed to tow along the sea floor, on which its operation indiscriminately smashes everything on their way crushing, killing, burying and exposing to predators the benthic fauna. It causes physical and biological damages that are irreversible, extensive and long (Kaiser and de Groot 2000). In Gulf of Mannar, the shore seine operation is conducted on the reef areas in southern group of islands by

group of fishermen involving several poor families. The important concern over the shore seine operation its use in the coral reef areas. The corals in Gulf of Mannar occur mainly around the islands (Edward et al. 2007). Coral mining which was happening until 2005 had already degraded the pristine reefs of Gulf of Mannar (Mahadevan and Nayar 1972). After the complete halt of mining in 2005, coral are recovering. But, shore seine operation in the islands mean there is no possibility of new recruits in the dragging area. Since dead corals which are the base for new coral recruits are dragged ashore, the area becomes incapable for coral recruitment. There is increasing evidence that fishing activities have facilitated shifts in some reef communities from coral to algal dominated phases (Huges 1994) and such phenomenon is currently being experienced in Gulf of Mannar (Raj et al. 2006). The fishermen who are involved in shore seine operation are poor who can't afford to buy big mechanized crafts. The use of destructive gears like shore seines by groups involving several families are regular practice in Gulf of Mannar for their daily livelihood.

Seaweed collection

In Gulf of Mannar Marine National Park, both live and dead corals are found together around the shallow areas of the islands. The seaweeds (Gelidiella acerosa, Gracilaria edulis, Sargassum wightii and *Turbinaria conoides*) grow mainly on the dead corals, which also form suitable substratum for attachment of new coral recruits (coral larvae). The exploitation of seaweeds in the reef areas of marine national park at depth between 0.5m and 1.5m mainly by fisher women caused the following severe impacts to the reef ecosystem. Over 500 fisher women involve in seaweed collection in the reef area in the northern Gulf of Mannar for their daily livelihood. The seaweed collectors mechanically plug or scrap the seaweeds attached to the dead corals, which is affecting the attachment of coral recruits, coral growth and live coral cover. Substrate instability which minimizes the chance of further new coral recruits (coral larvae) attachment in the affected area, leading to reduction of live coral area. The seaweed collectors while collecting seaweeds mechanically damage the nearby large number of live coral colonies especially branching corals, which leads to stress and it affects the growth, survival and reproduction (spawning). The seaweed resources are drastically depleted. For instance, Gelidiella acerosa is almost locally extinct. Seaweeds are integral part of the coral reef ecosystem as it serves as very good feed for various associated herbivorous fishes. When the seaweeds are removed and live corals colonies are damaged, the associated dependent fishery resources vanish from the reef area due to lack of food and habitat. Several people (more than 10 people) involve in seaweed collection in an area at a time and so the live coral damage is very severe along with increase of turbidity and sedimentation in the reef area. Anchoring of boat on the reef area causes very severe mechanical damage to the live coral reefs continuously.

Ornamental fish collection

The practice of ornamental fish collection in the reef areas of 21 islands is happening regularly over a decade. Though this unorganized trade is managed by commercial traders, the collection is done by poor fishermen. The peak season for this activity is during November – April when calm season prevails. The major locations are Mandapam, Ervadi, Keezhakkarai, Vembar and Tuticorin and 40 to 50 fishermen in each location involved in the collection of reef and seagrass associated ornamental fishes. Eight to ten small boats ('Vallams' or 'Vathais') are involved in each location. The collection is made using fish traps, Scoop net operation, and Skin diving. Fishermen earn Rs.6000 to 7000 per month depending upon the fish catch, season and variety of fishes. The artisanal fishermen while going for regular fishing also involved in the collection of ornamental fish in the reef areas to enhance the daily income.

Trap fishing

Trap fishing is a method by which reef fishes are caught by setting a bamboo made trap in the reef area. The traps are set in the reef areas by damaging the corals. The other indirect damage is depletion of herbivore fishes which feed on macro algae. Corals and algae live in a reef area with a competition for the space. The exploitation of herbivore fishes leads to the proliferation of macro algae. Nowadays, there is an increase in the operation of fish traps by the artisanal fishermen in Gulf of Mannar. The traps are basically 90 cm in length, 88 cm in width and 55 cm in height at the entrance point. The trap mouth is oval in shape and measures 55 cm x 35 cm. The lead-way from the mouth region extends to about 85 cm. The overall view of the trap is almost like a wing and the wing-like-extensions on the side measure 25 cm. About 6-10 fishermen carry 20-25 traps in one country boat (Vallam/Vathai) and setting them close to the reef or in between reef covered area. To hide the traps in the reef, the fisher folk break off live corals especially massive corals to cover them. The bait kept inside is basically waste shrimp head collected from processing plants. The entire crew leaves around 5 am in the morning and set the traps in many places. After the traps are set, Styrofoam is used as floats for marking and stones are used as sinkers to send the trap to the bottom.

Every day the fishermen visit the site to collect the fishes trapped inside and leave the trap in the same place or change the place according to the abundance of fish population. The peak season for the trap fishing in Gulf of Mannar is between October to January followed by February to May and June to September is the off-season. The targeted fish are Parrot fish, grouper, snapper, rabbit fish, sweet lips, wrasse, goat fish, and honeycomb eel and non-targeted fish species are coral cat fish, squirrel fish, butterfly fish, razor fish, trigger fish, goby, puffer, surgeon fish, angel, banner fish. Uprooting of coral colonies and coral recruits, breaking of coral branches, bleaching through shadowing, dislodgement of dead corals and other benthic organisms were the common damages in Gulf of Mannar.

Cultivation of exotic seaweed Kappaphycus alvarezii

The Kappaphycus alvarezii is red seaweed native to Philippines and is an invasive species in the non-native environs of Gulf of Mannar. This exotic seaweed was introduced in Gulf of Mannar in 2005 for mariculture for enhancing livelihood among coastal people without conducting proper Environmental Impact Assessment. This alga is the source of sulphated polysaccharides commonly called "carrageenan" which is used in food and pharmaceutical. The alga is able to coalesce into the tissue of the coral, providing a strong means for attachment, and thus allowing the alga to persist in high wave energy environments. It spreads mainly by fragmentation (pieces of seaweed float to new locations) and can overgrow and kill coral by smothering, shading it from sunlight and abrasion. It causes shifts from diverse coral reef to a seaweed-dominated, low-diversity reef and changes the bottom structure of the reef, reduces access to crevices and holes. Thus the habitat loss may impact the commercial and recreational fisheries. The cultivation of this alga started close to reef areas in 2005 and in 2007, bioinvasion was first observed on branching corals of Acropora sp. in Krusadai island of Gulf of Mannar. Within 24 months, reef areas of over 1.2 km², destroying over 500 branching and massive coral colonies of Acropora cytherea, A. formosa, A. nobilis, Montipora digitata and Porites solida, size ranging from small (< 20 cm) to larger (> 80 cm) colonies happened in Krusadai Island. This alga is being cultivated by fisher folk (few belong to Self Help Groups). The harvest period is about 45-60 days. The buying rate for the fresh product is Rs. 2/kg and for the dried product Rs.20/kg. Buyers prefer dried products and approximately 500 kg of wet algae give 50 kg of dried material (10:1) (Edward and Bhatt, 2012).

Discussion

Co-management to address the issues

The major reef areas in Gulf of Mannar is distributed around the 21 islands between Rameswaram and Tuticorin covering a coastal length of about 160 Km with a total area cover of 560 Km². These islands and the surrounding shallow coastal areas are declared as Gulf of Mannar Marine National Park by the Government of Tamil Nadu. The reef areas are close to the coasts to about 8 Km and hence, illegal entry of fishermen into the Marine National Park area is common, though protection and enforcement is in force. The Government of India is funding the Marine National Park through various schemes to protect and conserve corals. The funds are available for awareness creation, capacity building, alternate livelihood, research, protection and enforcement since the declaration of Marine National Park.

Considering the importance of this coastal area, biodiversity conservation and sustainable utilization by the dependent coastal community, the GEF-UNDP in collaboration with Government of Tamil Nadu (GOTN), and Government of India (GOI) implemented the seven year program titled "Conservation and sustainable use of Gulf of Mannar Biosphere Reserve's coastal bio-diversity" in 2002, and extended it till 2012. The project is a pioneering initiative with people's participation in marine biodiversity conservation and sustainable marine resource management. The project was implemented through a special agency, The Gulf of Mannar Biosphere Reserve Trust (GOMBRT), a registered Trust of the Government of Tamilnadu to ensure effective inter-sectoral co-ordination and facilitating main streaming of bio-diversity conservation issues into the productive sector and policy development. The important areas concentrated are awareness creation, capacity building, research, eco development & alternative livelihood and Strengthening the capacity and infrastructure of the Gulf of Mannar Marine National Park. The key component of eco-development is to minimize the dependence of the people on the resources through development of alternate income generation and livelihood security programs. To implement the eco development activities, Grass root level community organization - Village Marine Conservation and Eco-development Committees (VMC&EDCs) with a mandate for linking conservation and livelihood improvements have been established in 252 villages/hamlets (Melkani 2012). Community based awareness building and alternative livelihood programs, adult and environmental education, empowering fisher women

through ICT in reef conservation and management are few programs which made considerable impact among fisher community (Patterson et al. 2008a, 2008b, 2008c, 2009).

Livelihood issues are always on the rise along the coastal areas mainly due to population growth and subsequent indiscriminate resource exploitation. Though the key habitats like coral reef are well protected through laws, there is little success because of the failure to provide alternative sources of income to the fisher folk. In several cases, the artisanal fisher folk are exploited by commercial traders and this is also linked to non-availability of viable technologies. Though Forest Department, who are the custodian of the coastal areas are thriving hard to protect corals and associated biodiversity and considerable awareness has also been created, the success of conservation initiatives depend on the active participation of local community in conservation which is linked to their daily livelihood.

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