An assessment of coastal resources in the northern Sierra Madre Natural Park (Philippines) and an approach for management

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ABSTRACT

The Northern Sierra Madre Natural Park (NSMNP) is located in Luzon, Philippines and is one of the ten priority sites for biodiversity conservation in the Philippines. This paper gives an overview of the outcome of specific studies on the populations of sea turtles, fisheries, coral reefs, seagrass beds and cetaceans, and some constraints to community-based management in this area discussed together with an approach for sustainable management. Management issues in this park include conflicts in resource use between the indigenous people, migrants and non-local fishermen and their socio-cultural attitudes, which influence the acceptability and effectiveness of coastal resource management schemes. Fragmented protection of the coastal zone among various mandated government agencies has led to conflicts and/or overlapping of responsibilities often resulting in inaction. The management approach for the NSMNP is multi-factorial and dynamic and successful involvement of coastal communities in the protection of marine resources has been achieved through their participation in local resource protection groups, a biodiversity monitoring system and other conservation activities.

Keywords Coastal resource management, Conservation, Resource use, Community participation, Philippines

Introduction

The Philippine government has been active in encouraging local level management of coral reefs, recognizing the need to decentralize the management of coastal resources to local governments and resource users and to increase participation of resource users in management. Some successful examples of community-based coastal resource management (CBCRM) in the Philippines have been documented (Rivera and Newkirk 1997). In 1998 a CRM program was started as part of the Northern Sierra Madre Natural Park Conservation Project (NSMNP-CP), initiated by PLAN International Philippines, in response to increasing threats such as degradation of habitats, siltation of reefs from deforested uplands, an increasing number of migrants, destructive fishing techniques and declining catches. The NSMNP, located in north eastern Luzon, is the largest protected area in the Philippines covering 287,861 hectares of forest and 71,629 hectares of marine habitats. The area was selected by the National Integrated Protected Area System (NIPAS) in 1991 and is one of the ten priority sites for biodiversity selected under the NIPAS Act (DENR 1992). The long-term objectives of the project are to: 1) Conserve habitats and associated biodiversity; 2) Restore degraded habitats in both terrestrial and coastal area; 3) Protect the watersheds and 4) Address the socio-economic needs and cultural aspirations of the local inhabitants in the NSMNP and its buffer-zones. This paper gives an overview of the outcome of studies conducted to determine the status and utilization patterns, endangered species and sea grass beds have been conducted (Lavieren 1999, 2000). The results were used to recommend sustainable utilization levels and other conservation measures for the area. The park has a coral reef area of 4,543 ha, a seagrass area of 3,270 ha and 741 ha of mangrove habitat (Fig. 1). During 1999 and 2000 a total of 47 reef transects (50 m) were monitored.

An Overview Of Assessment Studies And Research

Since 1996, several rapid marine resource assessment studies were conducted but it was not until 1999 that more detailed and comprehensive studies were conducted using standardized methods. Specific studies on coral reefs, associated fish communities, fisheries and resource utilization patterns, endangered species and sea grass beds have been conducted (Lavieren 1999, 2000). The results were used to recommend sustainable utilization levels and other conservation measures for the area. The park has a coral reef area of 4,543 ha, a seagrass area of 3,270 ha and 741 ha of mangrove habitat (Fig. 1). During 1999 and 2000 a total of 47 reef transects (50 m) were monitored.

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Economic and Social factors

The NSMNP has four coastal municipalities with a population of about 25,231 (Fig. 1). Two distinct inhabitant groups can be identified in the park, the migrants and the agtas. The migrants have migrated from other areas in the previous few decades and are dominated by Ilocanos but many are also from other Luzon origins and the Visayas. They include full time fishermen, seasonal fishermen/farmers, full time farmers, private sector workers and government workers. The agtas belong to the negrito or aeta ethnic groups of the Philippines and their number in the NSMNP is estimated to be 1,000-1,500 individuals. These nomadic people move their residences mainly due to economic and social necessity. The homeland of the agta’s is predominately the forest but the so-called dumagats or “agta’s of the sea”, live on the beaches. The dumagats frequently trade fish and river shrimp to migrants for rice, coffee, tabacco and sugar. By the National Economic Development Authority (NEDA 1999) standards most of the household populations within the NSMNP are below the poverty threshold.
(23 of which are fixed transects) for fish and coral composition (Fig. 1). Most of the reefs are fringing reefs with a gentle slope, and are not large aggregates but patchily distributed and are directly exposed to the Pacific and to the north eastern monsoon winds, which has lead to impressive dynamic formations. Fig. 2 shows the percentage poor, fair, good and excellent reefs in NSMNP as classified according to the national standard (Gomez et al. 1994). The results show that most reefs are in fair condition (34 Percent (%)), some reefs are still in good (64 %) condition whereas others are severely damaged (2 %). The mortality index (MI= 100*(dead hard coral cover / (live hard coral cover + dead hard coral cover)) found for the reefs ranges between 13 and 49. On average the transects showed 46.6 % (Standard deviation (SD) = 9.5 %) live coral cover and 20.6 % (SD = 8.1 %) dead coral cover.

A total of 30 fish families and >200 species were identified during the visual census surveys which is average compared to some other areas in the Philippines but is expected to increase during ongoing surveys. Small reef associated fish such as Pomacentrids, Labrids, Acanthurids and Chaetodontids make up nearly 80 % of the total fish abundance. The average species richness per transect was 30.3 (SD = 7.7) and this would classify as medium (<30 = low; 30-45 = med; >45 high) according to the national categorization. The average fish density along the transects was 9510.4 fish/ha and if classified according to countrywide method, the fish densities in NSMNP would classify as medium (med = 4000-20,000 fish/ha).

Habitat degradation through sedimentation is apparent in Bicobian bay and Dimasalansan bay where the reefs and seagrass beds are covered by a layer of silt. Uncontrolled upland deforestation since the 1960s has resulted in large amounts of sediment discharge into the sea in many areas.

Five cetacean species were identified in the NSMNP coastal waters: the spinner dolphin (Stenella longirostris), the bottlenose dolphin (Tursiops truncatus), the pilot whale (Globicephala macrorhynchus), the sperm whale (Physseter macrocephalus) and the humpback whale (Megaptera novaeangliae). The cetaceans seem to be widely distributed along the coastline and concentrations of pilot whales and spinner dolphins are present in Palanan bay throughout the year.

The endangered species surveyed include: sea turtles, the dugong (Dugong dugong), the tabon bird (Mega-podius sp.) and the estuarine crocodile (Crocodylus porosus). Three species of marine turtles have been confirmed to occur in NSMNP these are the green turtle (Chelonia mydas), the hawksbill turtle (Eretmochelys imbricata) and the loggerhead turtle (Caretta caretta). Both immature and adult turtles have been sighted either while swimming in the open sea, feeding on seagrass and coral reefs, while mating and while nesting. The green turtle and hawksbill turtle nest in the NSMNP. The estuarine crocodile and dugong have not been seen since 1997, although local fishermen say they sometimes see a large crocodile in Dimasalansan bay (unconfirmed). The estuarine crocodile and dugong are endangered species in the Philippines as the populations have been depleted by hunting and habitat conversion as well as over-fishing (Philippine Red data book 1997). Two dugongs were sighted by a fisherman in 1999 but this remains unconfirmed. The last confirmed sighting of a dugong was in 1997 (Hilterman 1998). The tabon bird nests on Honeymoon island and on Dipudo Island and it is estimated that a population of around 10 tabon birds lives on these two islands which is much less than in the past. Sea turtles have been killed at a large scale since the 1970s and most turtle and tabon bird nests are emptied. Female turtles were slaughtered after laying eggs. The number of turtle and tabon bird nests has strongly decreased since the 1970’s.

**Fig 1.** A map of the Marine area of the Northern Sierra Madre Natural Park and locations of fixed reef monitoring plots.

**Fig 2.** Status of the reefs in NSMNP (13 reefs sampled).
Resource use in the NSMNP

Three groups of fishermen can be found in the NSMNP: migrants, dumagats and fishermen from outside the park’s boundaries. These non-local users come from neighboring municipalities, provinces or sometimes countries and are typically more specialized in their resource extraction, employing more efficient and less sustainable methods of extraction. The common traditional fishing methods used in the area are hook and line, gillnets (sigay, lambat), spearguns, long lines (Kitang), fish traps (bintul, bobo; Fig. 3) and fish corrals (baklad; Da Silva 1999). Table 1 shows that there is a difference in the gears used by both local groups in the park. Migrants use gillnets and longlines more often than dumagats, whereas spearguns and hand collecting are used more frequently by dumagats. Dumagats use a speargun (para) that consists of an iron pin, a nylon cord to attach to the arm and a rubber strip to propel the pin and it is used to catch a wide array of fish such as Siganids and Acanthurids on the intertidal reef flats during high tide. A bobo is a tube shaped trap (about 1 m in length) made of plastic or bamboo with an entrance (15 cm diameter) at each side and bait in the middle. Fishing mostly takes place from small, sometimes motorized, bancas (wooden outrigger boats) and Table 1 shows that 43 % of the migrants possess a motorized banca compared to only 13 % of the dumagats. This gives the migrants more opportunities to fish in other areas and further offshore and to use gears such as long lines and gillnets. The dumagats are often restricted to fish near shore. On the fish markets a broad range of species with variable prices have been seen and many target fish are reef or reef-associated fish. Groupers, spiny lobsters, sea cucumbers and shark fins are sold through local middlemen to buyers in Manila. Preliminary data show that the catches in the area have decreased with about 30-40 % in a ten-year period.

The reef flats in NSMNP are heavily exploited and many families depend directly on reef flats for their livelihood. A large number of reef flat animals were identified in NSMNP: 115 species of mollusks (62 gastropods; 48 bivalves; 2 abalones; 2 limpets; 1 chiton sp.), 54 other invertebrate species (33 are exploited) and 94 fish species (55 are exploited). Dumagats and migrants collect or “gather” anything edible they encounter during low tide. They collect shells (Cyprea spp., Trochus spp., Turbo crassus), sea cucumbers (Holothuria spp., Actino-pyga spp.), crabs, octopus and lobsters. The main collecting season is from May-July when low spring tide is during the daytime. Shell collecting is practised by a substantial number of coastal residents for own consumption or for ornamental purposes. The shells are also sold to buyers from Quezon province or Quezon fishermen enter the park themselves to collect shells and molluscs on the reef flats which leads to conflicts with the local fishermen. During high tide different fish species are caught (mainly Siganids, Acanthurids and Lutjanids) using traps, bottom-set gillnets or spearguns. Most dumagats depend directly on their daily catches from the reef flats and an increasing number of migrants come to collect on these flats resulting in high exploitation levels on these flats. The preliminary results of a reef flat survey (Troost and Blok 2000) indicate an over-exploitation of many reef flat invertebrates.

Table 1. Fishing methods and boats in 3 coastal municipalities; % is of the sample.

<table>
<thead>
<tr>
<th>Method</th>
<th>Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hook and line</td>
<td>70</td>
<td>19</td>
</tr>
<tr>
<td>Gillnet</td>
<td>63</td>
<td>7</td>
</tr>
<tr>
<td>Surface pot, traps</td>
<td>39</td>
<td>9</td>
</tr>
<tr>
<td>Long line</td>
<td>35</td>
<td>3</td>
</tr>
<tr>
<td>Speargun</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Fish corral</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hand</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Boats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motorized Banca</td>
<td>43</td>
<td>4</td>
</tr>
<tr>
<td>Non-motorized Banca</td>
<td>44</td>
<td>22</td>
</tr>
</tbody>
</table>

Management Concerns

There are several local issues that influence the management of coastal resources in the NSMNP including: lack of law enforcement, the open access to fishery resources, destructive fishing, resource user conflicts, the size of the park, fragmented protection of the coastal zone and local believes. The general lack of enforcement of laws against illegal fishing practices and the limited access laws of the coastal waters is a mayor problem in the NSMNP. The open access nature of the coastal area allows anyone to enter without the risk of being caught and it creates a lack of ownership among the resource users resulting in competition for the resources. Competition between local and non-local resource users has led to the local use of destructive methods such as dynamite and cyanide. Resource use conflicts are also found between the migrants and the dumagats. One example is that many migrants disregard the traditional fishing grounds (reef flat areas) of dumagats and often collect in large groups near areas where dumagats are residing. Many dumagats are directly dependant on the
Conservation and Restoration

An important strategy for conserving and restoring coastal habitats and resources in the NSMNP, is the establishment of a marine zonation scheme. The zones and rules are defined by the DENR and include nine categories: Strict Protection Zone (sanctuary), Sustainable Use Zone, Habitat Management Zone, Restoration Zone, Multiple Use Zone, Cultural Zone, Recreational Zone, Special Use Zone, Buffer Zone. Categories of zones have been selected as appropriate to the local situation and in consultation with the different stakeholders (DENR-PASU 2000). A series of small sanctuaries (1-10 ha) has been proposed ranging from sections of reefs to whole reefs. The selection of sites and sizes was based on certain biological data such as the location and status of coral reefs, the associated fish communities, the importance of certain habitats as nursery area, the spawning grounds of commercially important species, the feeding patterns of key species, migration routes and the concentration (or habitats) of endangered species. Furthermore, the traditional fishing habits, social organization, the feasibility to patrol the proposed closed area, how to minimize conflicts between the different resource users, and the willingness of local communities to cooperate were critical in the process of planning and designating marine zones. An important selection criterion was the possibility for organized local (village level) management with clearly defined and uniform fishery ordinances. Much focus was placed on community development and organizing and the forming of village fishermen’s associations. Local management groups were organized and fall under technical and legal assistance and supervision of the Park Superintendent (PASU) and the Protected Area Management Board (PAMAB). The management is a shared responsibility of park wardens, PAMB, Local Government Units (LGUs), Peoples Organizations (POs) and volunteers. Ultimately, the effective optimal scale of the zones and their management will depend on the local communities. The reserves were first legalized with municipal ordinances and a clear system of enforcement was made prior to the establishment. The communities have been involved in the whole planning and implementation process of the zonation scheme including participation in the selection of zones, the delineation of zones and in the installation of sign boards. They were also given the opportunity to come up with their own system of protection for their areas.

Active restoration of reefs in the proposed restoration zones will take place in 2001 through coral transplantation and giant clam restocking. This will be a collaborative effort between PLAN International, DENR, the Marine Science Institute (University of the Philippines), POs and LGUs. Giant clam restocking programs aim at eventually establishing effective breeding populations, which can be left on the reef and have been successful in various sites in the Philippines (Campulong 1993).

**A turtle conservation project**

In collaboration with the Pawican (turtle) Conservation Project (DENR) a turtle conservation project was started in 1999. This project was initiated by several local communities as they recognized the need to protect the remaining turtle populations in the NSMNP. Local community members, park wardens, LGU members and project staff were trained in turtle monitoring and conservation techniques and participated in the establishment of small turtle hatcheries. These hatcheries were
established on or near important nesting beaches and local deputized community members are responsible or patrolling the beaches and maintaining the hatcheries. This successful project was achieved through an intensive information and education campaign and the involvement of local communities in the different project activities.

Environmental education

A village level environmental education program has been implemented to achieve an increase in awareness and change in perceptions among coastal communities. Environmental education aims at creating a positive change in values and behavior of people particularly in their perception and relationship toward the natural environment, moving the communities to actively participate in conservation and resource management. The awareness program is ongoing and in the future, will focus more on the actual established management measures in the park and their effects. Information on marine environment, threats and the proposed management measures in the NSMNP are disseminated to the communities through posters, comics, presentations and meetings. A documentary film on the NSMNP marine environment and threats is shown at schools and community meetings. Frequent visits and meetings with fishing communities are conducted aiming at building up local peoples sense of ownership and participation in the management of NSMNP. Specific activities involving children are conducted such as snorkel excursions for local school children on reefs (Fig. 4). Other field trips for children are sea turtle nesting beach field trips, during which children actively participate in managing activities of established turtle hatcheries. Another activity is the “Dalaw turo” (visit and teach), which is an educational, participatory communication design of teaching specifically made for the Philippines. The objective is to train protected area personnel and other sectors of the society such as teachers and local leaders who have direct influence in the protection of their areas. It involves activities such as guided ecological tours, games and theatre (DENR 1996). Changes in the perceptions among coastal communities have been achieved and many communities are voluntarily involved in the coastal resource management activities. Changes in local beliefs (or myths) are also apparent, as in the case of the crocodile mentioned earlier, the fishermen are now assisting in a detailed monitoring program for the estuarine crocodile and it’s mangrove habitat.

Resource protection and law enforcement

A key component of this strategy is the establishment of community based marine resource protection groups or “Bantay dagat” groups. These patrol groups are organized at the barangay (village) level and include members from the Park Superintendent Unit (PASU), POs, police, LGUs, Fishermen’s associations and volunteers. The members were trained in coastal resource management skills and coastal law enforcement and are deputized as fishwardens. Initially, logistical and operational support is given by the NGOs and eventually will be taken over as joint responsibility by the LGUs, DENR and the Bureau of Fisheries and Aquatic Resources (BFAR). Since the implementation of the Local Government Code (LGC) in 1991, the LGUs play an important role in local coastal resource management (LGC 1991). The LGC stipulates the decentralization of authority and responsibilities of resource management from national to the local government and the municipal government is now responsible for enforcing laws and prosecution within the municipal waters. The LGC also stipulates that the municipality gets exclusive fishing rights and other uses of municipal waters within 15 km from the coastline (Agybayani 1995). The NSMNP coastal municipalities were encouraged to pass their respective basic fishery ordinances, which will provide a legal framework for resource management. Another important program component is capacity building of the LGUs. The management competence of LGUs and their partnership with local communities and other government agencies has been found to be critical for coastal resource management to be effective in the Philippines (McManus et al. 1997). Other ways proposed to reduce the conflicts among coastal resource users, are to further improve the license and permit system for non-local fishermen entering the park and to expedite further processing of the tenured migrant instrument in order to establish tenure by legal migrants and dumagats in the coastal zone. Establishment of tenure security will provide the much-needed basis for custodianship of the area and a less open access situation, which will reduce conflicts between resource users. Currently, many organized protection groups voluntarily assist in fishery law enforcement and are joining patrols and reporting law violations. A marked decrease in the use of illegal activities has been achieved. Social control has become a major factor in stopping the use of illegal fishing methods within many communities.

Sustainable livelihood development

Ways to increase income either from fishing or other alternative livelihoods were discussed with the coastal communities during numerous barangay meetings. The project has assisted fishermen’s associations in identifying and prioritising alternative livelihood projects and has provided technical assistance, trainings and financing arrangements. Some successful livelihood projects have been started such as an oyster culture, milkfish (bangus) pens, shell craft, crab-fattening, fish paste (bagoong) processing, lobster cages and seaweed cultures (Eucheuma spp.). These projects have developed strong incentives among the local communities to maintain a healthy environment and to assist in certain management activities. The success of these projects depends strongly on the provision of an adequate market and product transportation, therefore much of the projects efforts are put into market analysis in Manila and other areas. Controlled community ecotourism is also recommended as alternative income for local residents in the future. This
could include activities as: scuba diving, turtle nesting beach activities and whale watching.

Monitoring and research

A community-based marine biodiversity monitoring system (BMS) is being set up in the park involving project staff, park wardens, members from Pos and LGUs and local fishermen in order to make biodiversity monitoring a sustainable activity. The BMS was developed by DENR and the Nordic Agency for Development and Environmental Conservation (NOR-DECO) during 1998-2000 to strengthen community assisted management of protected areas in the Philippines (DENR 2000). It aims at improving the information available for decision makers in the protected area through the regular collecting of data on natural biological resources and their utilization with participation of protected area (PA) communities. The objectives of the BMS are to:

- Provide a cost effective and standardized method in monitoring trends
- Systematically generate up to date information necessary for effective and efficient management of protected areas
- Involve local communities and other stakeholders in generating information
- Strengthen the capabilities of PA staff, DENR, PAMB and local communities in data collection, analysis and interpretation.

The monitoring system includes simple surveys of: reefs, seagrass beds, fish catch and endangered species. The methods are simple such as the transect swim method which involves snorkeling along 100 m transects during which a predetermined list of target and indicator species are counted, substrate cover is estimated and endangered species are monitored. Community involvement in monitoring activities has increased awareness and strengthened the commitment and participation in the conservation of the marine area. More scientific monitoring and research is being conducted by trained and experienced project staff, consultants, research institutes and scientists to provide more detailed and technical information and both methods serve as inputs for updating the management of the park. Supporting research is management focused, concentrating on tasks such as developing sustainability factors and determining the effect of certain management measures.

Fisheries management

Although there are indications that many target species in the NSMNP are over-exploited, no sound fishery data is available to use as basis for fishery management in the park. Therefore, a fishery monitoring program was started in June 2000 in collaboration with the BFAR as part of their National Stock Assessment Project (NSAP). The activities include assessing commercial fish stocks and describing the resource utilization patterns in the coastal area. A series of trainings were conducted on species and gear identification and catch and gear assessment techniques. The fisheries monitoring groups include members from the POs, Fishermen’s associations, LGUs and DENR from the 4 coastal municipalities. Analysis and report preparation are the responsibility of the BFAR and sustainable levels of fishing effort, the appropriate (sustainable) gears and maximum sustainable yields in the NSMNP will be proposed. Initial funding is shouldered by PLAN International and will eventually be taken over by the DENR.

Conclusions

The management approach to address the different issues in this park is complex and dynamic and includes: management zoning, education, community participation, partnership of different stakeholders, authority sharing, a clear and uniform law enforcement system and habitat restoration (Table 2).

It aims at transforming coastal communities into resource managers through trainings, information campaigns, organizing and law enforcement efforts in order to achieve sustainable utilization and development in the area and equitable access to the coastal zone. Participatory planning and implementation at the barangay level, supported by appropriate government line agencies and local government units, is part of our effort to achieve an enduring and self-sufficient system. Initial results show that our strategies have proven to be successful. Community involvement in monitoring activities has increased awareness and strengthened the commitment and participation in the conservation of the marine area. Environmental education has led to local initiatives to conserve marine resources and a decrease in illegal fishing. A strong citizens participation in our activities has led to effective enforcement and adoption of environmental laws and the protection of the marine environment. It is important to realize however, that many of our efforts will depend primarily on sustained support and participation of the different stakeholders.
Table 2. Summary of the coastal resource management issues and strategies for NSMNP.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Strategies</th>
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<tbody>
<tr>
<td><strong>A. Resource Degradation</strong></td>
<td><strong>A. Resource conservation and restoration</strong></td>
</tr>
<tr>
<td>1. Fishery resources over-exploited</td>
<td>1. Fisheries management</td>
</tr>
<tr>
<td></td>
<td>Stock assessment project, gear and boat inventory, sustainable gears, no-fishing zones, uniform fisheries ordinances, information campaigns, law enforcement teams, regulated licensing and granting permits, ban illegal fishing, provide alternative livelihood, monitoring</td>
</tr>
<tr>
<td>2. Degraded habitats</td>
<td>2. Habitat conservation and rehabilitation:</td>
</tr>
<tr>
<td></td>
<td>Establish a zonation scheme (sanctuaries, restoration zones), local management groups, active restoration through giant clam restocking and coral transplantation, biodiversity monitoring and research, ban upland deforestation, integrate with shore line-terrestrial management plan</td>
</tr>
<tr>
<td><strong>B. Threat to endangered species</strong></td>
<td><strong>B. Conservation, monitoring and research</strong></td>
</tr>
<tr>
<td></td>
<td>Habitat management zones, information campaign, community based turtle conservation project, monitoring and research, local patrol groups, promote eco-tourism</td>
</tr>
<tr>
<td><strong>C. Lack of enforcement</strong></td>
<td><strong>C. Resource protection and law enforcement</strong></td>
</tr>
<tr>
<td></td>
<td>Local (village) “Bantay dagat” groups, community organizing, uniform and clear municipal ordinances, regulated licensing and granting permits</td>
</tr>
<tr>
<td><strong>D. Low environmental awareness</strong></td>
<td><strong>D. Environmental education</strong></td>
</tr>
<tr>
<td></td>
<td>Village level environmental education, field trips for children, community involved in biodiversity monitoring system, “dalaw turo”, educational materials, media</td>
</tr>
<tr>
<td><strong>E. Conflicts resource users</strong></td>
<td><strong>E. Clear access laws-law enforcement</strong></td>
</tr>
<tr>
<td></td>
<td>Community organizing, tenure security uniform fisheries ordinances, information campaigns, regulated licensing and granting permits, alternative livelihood</td>
</tr>
<tr>
<td><strong>F. Lack of alternative income</strong></td>
<td><strong>F. Sustainable livelihood development</strong></td>
</tr>
<tr>
<td></td>
<td>Livelihood projects, evaluate existing livelihood projects, market analysis, financing arrangements, skills training</td>
</tr>
</tbody>
</table>

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