THE PROBLEMS OF COASTAL AND MARINE RESOURCES MANAGEMENT IN INDONESIA

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ABSTRACT

It is a well known fact that parts of the coastal marine ecosystem, such as estuaries, mangrove, sea-weed beds, and coral reefs, are very productive . The primary production may go up to 10,000 g C/m2/year in these systems. It is very high compared with the primary production in open seas that is only 50-100 g C/m2/year. As a result the rate of the secondary production, such as fish, and other marine faunas, which live in these system, are also high. Anthropogenic activities carried out in order to use the resources in coastal areas, such as destructive fishing practices, coral mining, mangrove cutting, may affect fish (including other marine faunas) production.

Considering the destructive nature of some human activities in the coastal areas, the Indonesian government has established several laws and regulations for marine environmental protection. These included the establishment of 37 marine conservation areas which cover an area of about 2,800,000 Ha. It is expected that these areas will be expanded to 30,000,000 Ha by the year 2000, but there is no assurance whether this expansion can be reached or not. In the meantime a strategy to find alternatives to destructive practices in coastal and marine ecosystems is being prepared.

Keywords : Coastal and Marine Resources Management

I. INTRODUCTION

The Indonesian archipelago consists of about 17,508 islands with over 81,290 km of coastline. As an archipelagic nation, Indonesia is dominated by marine environment. The sea makes up 81.7 % (5.8 million square kilometers) of the nation's total area. In addition to 0.3 million square kilometers of territorial waters, Indonesia's jurisdiction extends over a further 2.7 million square kilometers of oceans as its Exclusive Economic Zone (EEZ).

Coastal and marine ecosystems, which consist of estuaries, mangrove, seaweed beds, and coral reefs are productive. It has been reported that the primary marine production in these systems may reach an average of 3,000 g C/m^2/year, and even in some systems such as coral reef waters, their primary productivity may go up to 11,680 g C/m^2/year, e.g. as recorded in Hawaii by Gordon and Kelly (Supriharyono, 2000). In contrast, the productivity in surrounding areas is only 21-27 g C/m^2/year. Several researchers suggested that in general, the primary production is very low in open seas, which is only about 50-100 g C/m2/year, compared with that in the reef waters (Supriharyono, 2000),. The high primary productivity of the coastal waters causes the gathering of fish and other marine invertebrates, in these areas, either for spawning, nursing, or feeding purposes. Therefore, the secondary productivity, such as fish, shrimp, and other marine invertebrates, are usually also high in these systems.

The fisheries sector together with other activities in coastal and marine

areas, such as shipping or sailing, harbour activities, off-shore oil drilling, marine fisheries, tambak (brackish water pond) exploitation and marine tourism provide national economic income. These activities produced a total of 22 % of the GDP (Gross Domestic Products) in the year 1992 (Sugandhy, 1993). However, the above activities in order to use the natural resources in the coastal areas often overlapped between one another, and resulted in the decrease of resources potential in those areas.

With regard to the problems above, management of both the living resources and the human activities in the coastal areas may be needed. This paper describes several summaries of studies which had been carried out in many parts of Indonesian coastal areas, such as the Riau Islands (Supriharyono *et al*, 1990), South Sulawesi (Supriharyono *et al*, 1990), North Sulawesi (Supriharyono *et al*, 1993), North Coast of Central Java (Supriharyono *et al*, 1990, 1992). This paper also reports a national strategy for the coastal management in Indonesia.

II. PROBLEM AND ISSUES OF COASTAL DEVELOPMENT

It is well known that the coastal and marine ecosystems are potential productive ecosystems for Indonesia. However, there are problems associated with the develop-ment of the use of natural resources in the coastal and marine ecosystems to fisheries production. The problems and issues are listed as follows:

2.1. Impact of Industrial Development

National development in most developing countries, including Indonesia is characterized by increasing numbers of industries. The number of industries increased about 256% from 1978 to 1995 in Indonesia, with an average of about 15%/year (BPS, 1995). The majority of these industries grow rapidly in the big cities, particularly in the coastal areas. Unfortunately, not all those industries were provided with waste water treatment installations. Therefore, their effluent often polluted the river or stream and thus they finally polluted the sea. This resulted in the possible decrease of water quality in streams, rivers and/or marine waters, at the risk of the destruction and degradation of the marine and coastal ecosystems. This condition will be worse with the existence of other activities such as mangrove clearing. Fish production in the coastal waters in the North Sulawesi, for example, decreased about 1,53 % in 1991 because of intensive mangrove clearing (Supriharyono *et al*, 1993). Besides this, the increasing rate of shipping, some carrying toxic and hazardous materials could possibly endanger marine organisms by marine pollution as well.

2.2. Impact of Deforestation

It is a fact that many forests in the upper regions have been changed, either for agricultural or settlement purposeqs. Such deforestation resulted in a high sedimentation rate in the coastal waters.

Supriharyono (1986) reported that deforestation and bad land management in upper region areas have resulted in a high sedimentation rate in the north coast of the waters of Central Java, which accepted stream and river waters from eroded areas. The sedimentation reached about 135 mg/cm^2/month. Moreover, this resulted in the decrease of living coral reef coverage in some areas, from around 40% to below 30% (Supriharyono, 1990). The rest of living corals showed a stress condition with slow growth (Supriharyono, 1986, 1988, 1990). In a recent study in Karimunjawa National Park, Supriharyono

et al (1999) reported that mangrove clearing in Karimunjawa and Kamojan Islands have affected reef growth in the islands closed to cutting activities, e.g. Cemara Kecil Island..

2.3. Destructive Practices on Coastal Ecosystem

Since most industries are located in the coastal areas, fishing operation areas of the small-scale fishermen become narrower and narrower. Meanwhile, in coastal communities, the social condition of the majority of their members, particularly the fishermen, are appalling. Most have a background of low education and skill, the majority only finished Elementary School (Preliminary School), and some of them did not even pass it.. In this condition, therefore, it is very difficult for them to compete with fishermen with modern fishing technology. As a result of their low education and skill, many of them are only employed in the coastal areas. Some of them even use destructive fishing techniques, such as the use ofexplosives and toxic materials (KCN). These practices are found in many places in the coastal and marine ecosystem in Indonesia, e.g. Strait of Mallaca, Riau Islands (East Sumatera), Jakarta Bay (West Java), Karimunjawa Islands (Central Java), Bunaken (North Sulawesi), Taka Bonerate Islands (South Sulawesi), Padaido Islands (Biak Numfor-Papua), and others (Supriharyono *et al* in progress). These fishing practices resulted in the destruction of the marine and coastal system, mainly the coral reefs (Supriharyono *et al*, 1990; 1992; 1993).

2.4. Mangrove Forest Clearing

Many researchers, e.g. Soegiarto and Polunin, 1982; KLH, 1993, have reported that mangrove, as part of an ecosystem, provides valuable economic potential in the coastal areas, since this system contains high marine productivity, such as fish, shrimp, lobster, mollusk, and turtle. Unfortunately, the mangrove stands were often cut due to several reasons. Much evidence proved that the percentage of living mangrove çoverage decreased, both due to direct and indirect effects of human activities in the coastal areas. Deforestation of mangrove forest or land clearing in many coastal areas, such s in Sumatra, Java, Kalimantan, Sulawesi, for fisheries development and charcoal production resulted in the decrease of the number of total fish caught in those areas (Supriharyono *et al*, 1990;). It is recorded that about 11,012 Ha of mangrove areas were lost in Asahan, Deli Serdang, and Langkat Districts, North Sumatra Province due to charcoal production (Kurniawan, 1998). Mangrove clearing for charcoal industries is also reported in the provinces of of Riau, South Sulawesi, East Kalimantan (Kasim Moosa *et al*, 1996). In addition, the annual production of charcoal is reported to be about 7.000 - 15.000 m^3 in Riau, and 70.000 m^3 in East Kalimantan. These figures, however, is still under the government quota for charcoal export, i.e. 500.000 m3 per year. The loss of mangrove trees affected not only the charcoal industry, but also fishery development.

The development of brackish water fish culture, mainly when the demand for banana prawns (*Penaeus monodon*) increased in the export markets, rsulted in the clearing of several areas of mangrove. The mangrove forests were cut and turned intor brackish water ponds (tambaks). For example, about 5,000 ha mangrove forests in North Sumatera, 20,000 ha in Riau, 75,000 ha in Aceh, and 1,750 ha in South Sumatra have been cleared for tambak development (Burdridge *et al*, 1988). In Karimunjawa and Kamojan Islands (parts of Karimunjawa Islands, Jepara), some of 51,9 Ha of mangrove have been cut for the

tambaks in 1999. This mangrove clearing increased in these areas year to year (Balai Taman Nasional Kepulauan Karimunjawa, 1999).

There are also evidences that mangrove forests are cut not only for the development of tambaks , but also for other purposes, e.g. the production of fire wood and charcoal. In Riau province, for example, mangrove forests were cut intensively. The wood production increased about 14.5 %, from 16,288.920 m^3 in 1984/85 to 18,649.178 m^3 in 1985/86. The total production of charcoal increased about 17.5 %, namely from 10,901.062 m^2 in 1984/85 and increased to 12,808.41 m^2 in 1985/86. In addition, the clearing of mangrove forests was also carried out in order to construct tidal rice fields, housing, etc. This condition, if not supervised, will lead to serious degradation.

III. COASTAL AND MARINE ECOSYSTEM MANAGEMENT STRATEGY

In managing the coastal and marine environment, Sugandhy (1993) suggests that management of these environment should not be separated from on-land environment. It is necessary to integrate the existing activities on-land and those in the coastal areas. It is expected that it will minimize conflicts of interest in utilizing natural resources and overcoming pollution on the seas originating from land.

The management should cover efforts in planning, utilization efforts, maintenance, control, evaluation and restoration, rehabilitation, development and conservation of the marine and coastal environments. The marine and coastal management have to develop the optimum (sustainable) utilization of the resources in those areas in an effective

and efficient way. At the same time, sustainable marine development has to be implemented optimally, taking into consideration the carrying capacity of nature together with the enhancement of the People's Welfare. In many cases, fishermen may not know whether their activities are endangering the marine environment or not. For example, many fishing practices, such as muro-ami, bomb-fishing, and the use of potassium cyanide endanger coral reefs. Therefore, the government through COREMAP, is currently developing a project seeking alternative practices to reduce and finally stop destructive fishing techniques on coral reefs (Supriharyono et al., in progress). The project takes places in Taka Bonerate and Padaido Islands (parts of COREMAP projects). This project plans to seek sustainable fishing techniques, marine culture and alternative livelihood for the coastal community, mainly at those sites.

3.1. Basic Rules and Regulations in the Coastal Zone Management

Considering the problems in the coastal and marine environments, the Indonesian government has established several laws and regulations for environmental management. These, among others, are:
- Act No. 5/1967 on the Basic Provisions of Forestry;
- Act No. 1/1973 on the Continental Shelf of Indonesia;
- Act No. 5/1974 on the Government Devolution of Authority to Regional Governments or Provinces;
- Act No. 5/1983 on EEZ of Indonesia;
- Act No. 5/1985 on Fisheries;
- Act No. 9/1990 on Tourism;
- Act No. 5/1990 on the Conservation of Natural Living Resources and their ecosystems;
- Act No. 23/1992 on the Basic Provisions on the Management of Living Environment;

- Act No. 24/1992 on the Spatial Planning;
- Act No. 5/1994 on the Ratification of the United Nations Convention on Biological Diversity.

With these rules and regulations, it is hoped that the marine environmental damage due to human activities will decrease. In many places where these rules and regulations are not taking effect, the cause might be lack of socializing.

3.2. Sustainable Marine Development

In reference to marine sustainable resources, the Indonesian Marine Conservation Programme has established 10 million hectares of marine conservation areas, distributed over 85 reserves in Indonesian marine waters. The selection of the marine conservation areas is mainly based on the Marine Atlas, and information from several agencies which are involved in marine activities, e.g. fisheries, tourism, and marine research institutions. The objective of marine conservation is based on National Conservation Strategies, which were adopted from the IUCN (1994) for MPA (Marine Protected Areas). The objective of Indonesian marine conservation covers three aspects, namely:
a) To maintain essential ecological processes and life support systems;
b) To preserve coastal and marine bio-diversities;
c) To ensure the sustainable utilization of species and ecosystems.

These areas of marine reserves will be expanded up to 30 million hectares by the end of year 2000. But, so far this programme has not been evaluated yet,and there is no assurance whether it has been realized or not. According to the Directorate General of Forest Protection and Nature Conservation (PHPA), in 1994 only 28% of the planned expansion has

been realized, from the total marine proposed area (2,800,000 hectares), which involved about 37 marine areas (Anonymous, 1994). These marine conservation include 14 marine areas for Strict Marine Nature Reserve, six areas for Wildlife Marine Nature Reserve and seven areas for Marine Nature Recreation Parks and 10 Marine National Park. These marine reserves are distinguished from one to another by the intensity of interference of human activities in these areas. These characteristics are as follows:

Strict Marine Nature Reserve, (Cagar Alam Laut) is a small or large marine area, which is strictly protected, with no interference and its use is limited to non-manipulative research and monitoring;
- Wildlife Marine Nature Reserve (Suaka Marga Satwa Laut) is a small or large marine area, which is strictly protected, where some manipulation of species or habitat as a part of management are permitted; its use is limited to research, monitoring and education;
- Marine Nature Recreation Parks (Taman Wisata Laut) is a marine area, principally for natural beauty and recreation, which may have low value for conservation; and
- Marine National Park (Taman Nasional Laut) is a large marine area which has an outstanding natural value; of national, regional and global significance and vast enough for recreational and educational use without decreasing conservation value;

Since these conservation areas are located close to human activities, which would likely use marine resource potentials in surrounding areas, it is sometimes very difficult to manage those activities without disturbing the coastal and marine bio-diversity. Considering this fact, another type of marine reserve, i.e. Multiple-Use Marine Reserve , should be

proposed (Salm, 1984). This marine reserve is an extremely large marine area to allow additional use of the resources, in which commercial harvest is controlled, allowing tourism development buit with strict protection of critical areas. To anticipate these marine reserves, the PHPA established a zoning system. The zoning system includes, among others, sanctuary zones, wilderness zones, intensive use zones (recreation zone) and buffer zones. These zones are characterized by the following usages: '

- **Sanctuary zone**, is a strictly protected zone, either as habitats or for the protection of its species;
- **Wilderness zone** is a protected zone with limited visitor use;
- **Intensive use zone**, is a zone with a broad range of recreational activities (development controlled by specific guidelines);
- **Buffer zone**, for the continuation of all sustainable and existing uses and activities.

It is expected that with this zoning, marine nature resources utilization are concentrated in certain permitted areas. In fact, however, there are still many conflicting conditions. Much evidence proved that there are human activities in the protected zone (Supriharyono *et al*, 1992; 1993; 1999). There are many constraints to achieve ideal marine and coastal management in Indonesia (Djohani, 1989; Ministry of State for Environment, 1996; Supriharyono *et al*, 1992; 1993; 1999; and Supriharyono, 2000). These constraints are mainly:

- lack of clear delineation of the responsibilities of individual ministries regarding cross-sector impacts;
- the fact that coastal habitats are not subjects to local government management, since provincial authority extends only to the water line;
- lack of building materials, with the result that many local people (coastal community) substitute stony corals for

those manufactured materials (bricks and concrete blocks)
- lack of community awareness;
- lack of or a minimum of familiarization of rules and regulations;
- lack of law enforcement: many fishermen still use dangerous fishing equipment, e.g. explosives, toxic materials (KCN);
- lack of infrastructure;
- lack of community participation in environmental conservation; and
- lack of control, monitoring and evaluation on conserved areas.

In addition to the above constraints, in several conserved areas, e.g. Karimunjawa's Strict Marine Nature Reserve and Bunaken's Marine National park, it has been found that the border between zones is not clear. Sometimes a sanctuary or a protected zone is located closely to the intensive use zone or sharing it with human settlements. There are even instances where the protected zone (island) is privately owned, and therefore will affect management actions. In addition, much evidence proved that the sanctuary or protected zones are becoming objects for sport diving by tourists, since these are usually the best zones in the coral reef ecosystems (Supriharyono *et al*, 1992; 1993). This has resulted in the decrease of living coral coverage (Supriharyono *et al*, 1999). Such problem, is also being debated for the Zoning for the Taka Bonerate Marine National Park, in Selayar, South Sulawesi (Mochtar, 2000). In relation to the tourism activities in Karimunjawa National Park, Supriharyono *et al.* (1999) proved that the manager of KNP or the local government faced clean fresh water problems for the tourists, mainly during the dry season. Therefore, for tourist management it may be better to introduce eco-tourism rather than mass tourism.

In the light of these constrains, in order to manage the coastal and marine

environments, therefore, these should be taken into consideration. The management of coastal and marine environments should be integrated in a cross-sector approach. Sugandhy (1993) suggested that the approach or model of management coastal and marine environments may include:

- a hierarchical structure utilizing principles of decentralization within the decision making and planning process;
- the development of administrative and functional procedures, both vertically and horizontally, to enhance the regional development process;
- a pyramidal structure for the management team with participation at different levels, including central and local government, private sector, and the public in general;

As has been stated in the Act No. 22/1999 on Regional Autonomy, which Regional Governments or Provinces have authority to manage their own resources. Hence, it is expected that local governments will be able to conserve their areas.

3.3. Alternatives to Destructive Practices

What is now happening is that members of the coastal community, mainly fishermen, has over-exploited the coastal resources with destructive practices, such as destructive fishing, and coral mining. This may be due the absence of other alternative activities, which might be able to produce subsistence, e.g. food, for their family. Considering this, the Indonesian government through COREMAP's projects, is currently studying alternatives technology replace destructive activities such as destructive fishing and coral mining, for the coastal community. Two sites have been chosen for field pilot, i.e. Taka Bonerate Islands in Selayar, South Sulawesi and Padaido Islands in Biak Numfor, Papua (Supriharyono *et al*, in progress). These alternatives to destructive

fishing practices on coral reefs will consist of three activities, i.e. sustainable fishing technology, sustainable marine culture technology and alternative livelihood for the local community, mainly fishermen in those areas.

IV. CONCLUSION

Anthropogenic activities in the coastal and marine environments caused a decrease in the fishermen's resources potential in Indonesia. To reduce or stop this, the establishment of environmental laws and regulations is inevitable. In addition, in order to tackle the problems, the government has also established a number of marine conserves in 37 regions of Indonesia.

Although coastal management has been programmed, included a zoning system for maintaining human activities in marine conserved areas, the fact is that there are still major constrains affecting this programme, e.g. lack of clear delineation of the responsibilities of individual ministries, lack of community awareness and participation; lack of socialization of rule and regulation, lack of law enforcement, lack of control, monitoring and evaluation on conserved areas. The coastal and marine management, therefore, need to be integrated into cross-sector efforts and activities.

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