

COASTAL AND MARINE ECOSYSTEMS MANAGEMENT STRATEGY IN INDONESIA

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ABSTRACT

It is well known that estuaries, mangrove, seagrasses beds, and coral reefs are productive ecosystems in the coastal marine areas. The production may goes up to 3,000 g C m² year. It is very high compared with the production in open seas that is only 50-100 g C m² year. The coastal water ecosystems are also known as good habitat for spawning, nursering, and feeding several species of fish. Therefore, the secondary productivity is also high in these ecosystems. Anthropogenic activities in order to use the resources in coastal areas, however, are often dangerous to the life of those ecosystems.

Considering to the anthropogenic activities, the Indonesian government have established several law and regulation for marine environmental protection. These included the establishment of 23 marine conserves areas which cover areas of about 2,800,000 Ha. These areas are expected will be expanded to 10,000,000 Ha by the end of 1995, and 30,000,000 Ha by the year of 2000.

Key Word : Coastal Management Staregy

I. INTRODUCTION

The Indonesian archipelago consists of more than 17,000 islands with over 81,290 km of coastline. As an archipelagic nation, Indonesia's marine environment is a dominating physical reality. 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, such as estuaries, mangrove, seagrasses beds, and coral reefs are productive ecosystems. It is reported that, the marine primary production in these systems

reach to 3,000 g C/m²/year (Mann, 1982). This production is very high compared with the production in open seas, which is only about 50-100 g C/m²/year. The high primary productivity of the coastal waters causes gathering of fish and other marine invertebrates, in these areas, either for spawning, nursering, or feeding purposes. Therefore, the secondary productivities, such as fish, shrimp, and other marine invertebrates, are usually also high in these systems. This condition shows that coastal and marine ecosystem are potentially economics for fisheries sectors. However, other than this, there are also several anthropogenic activities, such as agriculture, industries, mining, shipping, tourism, may use resources potential in the coastal areas. Infact that, these activities often resulted negative impacts on fisheries sectors.

Many evidences proved that the percentage of living coverage, e.g. mangrove and coral reef, decreased, both due to directly and indirectly effects of human activities in the coastal areas. Deforestation of mangrove forest or land clearing in many coastal areas, such as in Sumatera, Java, Sulawesi, for fisheries development and charcoal production resulted decreasing number of total fish caught in those areas (Supriharyono et al, 1990). Bad land management in the coastal areas is also reported that resulted a high sedimentation rate in the coastal waters. Supriharyono (1986) reported the high of sedimentation rate to about 135 mg/cm²/month in the north coast of central Java's waters, which received stream and river waters from eroded areas. This resulted decreasing of

several reef coral species. Moreover, high sedimentation together with other human activities, e.g. dead and/or living coral collection reduced living coral coverage in the reefs around 10% per year (Supriharyono, 1989). This condition will be worse with other human activities impacts, e.g. industries, domestic sewage, mining, harbour, tourism, or others.

In order to conserve coastal and marine environments from destruction, such management to both the living resources and the human activities on these environments, is very important to be done.

II. COASTAL RESOURCES POTENTIAL AND PROBLEM ISSUES IN INDONESIA

Coastal and marine ecosystems could provide nationally economics through several activities, such as shipping or sailing, harbour, off shore oil drilling, marine fisheries, tambak (brackish water ponds), marine tourism, etc. These activities provided a total production of 22% from GDP (Gross Domestic Products) in the year 1992 (Sugandhy, 1993). However, the fact these activities sometimes overlapped between one to another. It is often that development of one sector affects to other sectors, and resulted a decreasing of resources potential of others. This chapter describes coastal and marine resources potential and the problem issues in Indonesia, mainly to living resources utilization.

2.1. Living Resources Potential

Fisheries resources, may be the most important living resources in the coastal and marine ecosystems, although this sector contributes only about 4.4% from the total GDP. It is expected that the sustainable yield from the fisheries could reach 6.6 million tons/year, while currently production is only 1.9 million tons/years (around 28.8% of the fisheries potential). Therefore, there is another 71.2% of fisheries potential or about 4.7 tons/year could be exploited from the coastal and marine ecosystems.

There are two fisheries activities, which operated in the marine and coastal areas in Indonesia, i.e. capture fishing and fish culture. The labour force for these activities is around 13.6 million people or 16.2% of the entire national labor force. The fisheries activities condition in Indonesia, moreover, are described as follows :

a. Capture Fisheries

The Indonesian marine fisheries are dominated by small scale fisheries, with fishing operation is usually limited in the coastal areas. These contribute to about 90% from the total catch of fisheries production in Indonesia (Martosubroto, 1987). While the remaining fish production (10%) was production from the industrial fisheries (large scale fisheries). These industrial fisheries are fishing fisheries with high valued commodities, namely shrimp and tuna, and mostly operated in the East Indonesian waters, e.g. Arafura Sea, Maluku Sea, Banda Sea, Sulawesi Sea and Seram Sea.

While the small scale fisheries, are more concentrated in the western part of Indonesian waters, e.g. Sumatera, mainly at the Strait of Malacca and in the north coast of Java.

As reported that the fisheries production from Indonesian waters could reach to 6.6 million tons/year. This production includes pelagic fish 2.5 million tons/year, demersal fish 2.5 million tons/year, small pelagic 3.5 million tons/year, large pelagic 441.0 thousand tons/year, skipjack 275.0 thousand tons/year, tuna 166 thousand tons/year, penaid shrimp 69.0 thousand tons/year, other crustaceans 25.0 thousand tons/year, and coral reef fishes 48.0 thousand tons/year. These potential, however, is only about a quarter be harvested in the coastal and marine ecosystems. Therefore, such development of fishing technique and may also fishing equipments are very important.

b. Aquaculture

Aquaculture, both marine and brackish water pond cultures, is another fisheries sector which also important in association with the utilization of living resources in the coastal and marine ecosystems. Although the production of aquaculture may be only about 0.8% from the total economic effort of the production in the coastal and marine resources, but this sector has developed rapidly in Indonesia, with the developing of fisheries technology and increasing demand of fish in markets abroad. Marine organisms are being cultured (marine culture) in Indonesia, include fin fish, e.g. grouper (*Epinephelus spp*), sea

bass or barramundi (*Lates calcarifer*), snappers (*Lutjanus spp*), and other ornamental fish; invertebrates, e.g. shrimp, crabs, pearl oysters, and sea cucumber, and seaweeds.

Other than marine culture, some fish are cultured in the brackish water ponds (*tambak*). Brackish waters fish cultured are developed at the coastal areas in many places of Indonesia. It is recorded that brackish water fish culture has been growing about 15% per year in Indonesia, especially for shrimp culture. In Sumatera, for example, brackish water pond has been a steady increase in several provinces, mainly Aceh and North Sumatera (Burdrige *et al.*, 1988). *Tambak* in Aceh province covered an area of 22,793 ha in 1979, this had increased to 30,248 ha in 1983. While in the North Sumatera, the area of *tambak* was about 839 ha in 1979, and 2,063 in 1983.

2.2. Problem and Issues to Coastal Management

It is well known that the coastal and marine ecosystem are potential productive ecosystems in Indonesia. However, there are associated problems with development of utilization of natural resources in the coastal and marine ecosystems to fisheries production. The problems are listed as follows :

- 1) National development in most developing countries, may increase the numbers of industries. The risk of these are possibly decreasing of water quality in streams, rivers and/or marine waters. It is recorded that industrialism activity grown rapidly in the many parts of Indonesia, particularly in the coastal areas. Unfortunately those industries were not completed with waste water treatment installation. Therefore, their effluents often pollute to the river or stream and finally to the sea. These may cause destruction and degradation to the marine and coastal ecosystems. This condition will be worse with the existing 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 with intensively 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.
- 2) Other anthropogenic activities at the coastal areas are also reported to affect reducing of water quality. Poor land practices and deforestation (both in up-land forest and mangrove forest) lead to erosion, rendering the water in estuaries and bay turbid, especially during the wet season. In north coast of Java (Bandengan Bay, Jepara) for instance, the rate of sedimentation reaches up to 135 mg/cm²/day in the wet season (Supriharyono, 1986). In addition heavy sediment load in that area during the wet season affected the life of reef corals. The growth rate of branching coral *Acropora aspera*, was only 1.6 mm/28 days in the wet season, while in the dry season reached to 11.3 mm/28 days.

- 3) Since most industries are located in the coastal areas, fishing operation areas of the small scale fishermen become narrow and narrow. While the social condition of the coastal communities, particularly fishermen, majority are poor and have low education and skill backgrounds. As the social status condition, therefore, it is very difficult for them to compensate the modern fishing technology. In order to utilize the living resources in the coastal ecosystem, it is often over-exploited. Results of the study on the coastal management at several places in Indonesia (Supriharyono et al, 1990; 1992; 1993) showed an evidence of over-exploitation of the natural resources in the marine and coastal zone. This resulted destruction of coastal ecosystems, such as coral reefs, mangrove, sea grass, and ornamental fish. Such social problems may have to be taken into account for the coastal management planning.
- 4) There is also another problem in association with the natural disaster in the coastal and marine ecosystems, that is the practice of fishing by using explosive and toxic/hazardous materials. These practices are found in many places of coastal and marine ecosystem in Indonesia, e.g. Strait of Malacca, Riau Islands (East Sumatera), Jakarta Bay (West Java), Karimunjawa Islands (Central Java), Bunaken (North Sulawesi), Ujung Pandang (South Sulawesi), and others in the Eastern parts of Indonesia. These fishing activities use dynamites and toxic material (mostly KCN), and resulted destruction of the marine and coastal zone, mainly coral reef ecosystems.
- 5) The developing of fish culture, mainly brackish water ponds (*tambaks*), resulted a bad impact to environment. There are many evidences extension of *tambaks* areas at the mangrove ecosystems. 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 Sumatera have been cleared for *tambak* development (Burdridge et al, 1988). Moreover, based on ecological balance and sustainable management principle, Sugandhy (1993), assistant to the minister of state for environment of Indonesia, considers that about 10-20% of mangrove forests (4.3 million ha) are still possible to be cleared for *tambaks* development in Indonesia. This would result in a production estimated at around 1,495,000 ton/year of diversified of products, e.g. shrimps, fish, crabs, shell fish, etc. While it is still about 238,000 ha from these areas have being exploited. In addition, these mangrove forests, majority are concentrated in the coasts of North Java, South Sulawesi, South Kalimantan, Eastern parts of Sumatera, and West Nusa Tenggara.
- 6) Land mangrove clearing may affect of fish habitat in the coastal areas. Together with industrial sewage and possibly of oil spill may damage on marine productivity. It was reported in the North Sulawesi province, that marine fish production decreased

from about 69,452.7 ton in 1990 to 68,388.7 ton in 1991 (or about 1.53 %). Although it was not known the reason of that decreasing, this was due to mangrove clearing or others. The fact that the local government still allow cutting of mangrove up to 61%, with exception that in the *tambak's* area should be planted by mangroves plants as a green belt. These "remaining" mangrove in the *tambaks* are expected will be functioned as a buffer zone.

- 7) There are also evidences that mangrove forests are cut not only for *tambak's* development, but for other purposes, e.g. fire wood, charcoal. In Riau province, for example, mangrove forests were cut intensively. The wood production increased about 14.5%, from 16,288.920 m³ in 1984/85 to 18,649.178 m³ in 1985/86. While total charcoal production increased about 17.5%, that was 10,901.062 m² in 1984/85 and increased to 12,808.41 m² in 1985/86. As well as, the clearing of mangrove forests may be used as tidal rice fields, housing, etc. This condition, if not be controlled will lead to serious degradation.

III. COASTAL AND MARINE ECOSYSTEMS MANAGEMENT STRATEGY

As has been reported in the previous chapter that the living resources in the marine and coastal environment, e.g. coral reefs, mangroves, seagrass

beds, and estuaries, are potentially important on supporting economical asset for Indonesian GDP from the fisheries and other sectors. Therefore, it is considered that management of coastal and marine environments may be important, since the fact that anthropogenic activities in order to use those resources often affect to the living resources potential. According to Sugandhy (1993) management of such environment should not be separated from on-land environment management strategies. It is necessarily to integrate the existing activities on-land and those in the coastal areas. This 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. As well as the marine sustainable development has to be implemented in an optimal way taking into consideration the carrying capacity of nature together with the enhancement of the People's Welfare.

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 law and regulation for environmental management. These, among other, are:

- Act No. 5/1967 on the Basic Provinces 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. 4/1982 on the Basic Provisions on the Management of Living Environment;
- 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. 24/1992 on the Spatial Planning.

3.2. Marine Sustainable Development

Considering the marine sustainable resources, the Indonesian Marine Conservation Programme has proposed the establishment of 10 million hectares of marine conservation areas, distributed over 85 reserves in Indonesian marine waters country by the end of the on going Five Year Development Plan (1995). On the long term, this will be established for 30 million hectares in the year 2,000. 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 proposal of coastal zone conservation strategies is based on National Conservation Strategies which consists of three aspects, namely:

- a) To maintain essential ecological processes and life support systems;
- b) To preserve coastal and marine biodiversities;
- c) To ensure the sustainable utilization of species and ecosystems.

According to Directorate General of Forest Protection and Nature Conservation (PHPA), it is currently still about 28% from the marine proposed area (2,800,000 hectares) has been conserved, which involve about 23 marine areas. These marine conservations include 14 marine areas for Strict Marine Nature Reserve, two areas for Wildlife Marine Nature Reserve and seven areas for Marine Nature Recreation Parks and Marine National Park (Appendix 1).

- Strict Marine Nature Reserve (*Cagar Alam Laut*) is a small or large marine area, which strictly protected, no interference and use limited to non-manipulate research and monitoring;
- Wildlife Marine Nature Reserve (*Suaka Marga Satwa Laut*) is a small or large marine area, which strictly protected, may require some manipulation of species or habitat as a part of management; use limited to research, monitoring and education;
- Marine Nature Recreation Parks (*Taman Wisata Laut*) is marine area, principally for natural beauty and

recreation, may have low value for conservation;

- Marine National Park (*Taman Nasional Laut*) is large marine area; outstanding natural value; of national, regional and global significance; large enough for recreational and educational use without decreasing conservation value;

In order to conserve coastal and marine bio-diversity, Salm (1984) introduced another type of marine reserve, i.e. Multiple-Use Marine Reserve. It is extremely large areas to allow traditional use resources, controlled commercial harvest, tourism development and strict protection of critical areas. To anticipate these, PHPA established a zonation system. The zonation system includes, i.e. sanctuary zone, wilderness zone, intensive use zone (recreation zone) and buffer zone.

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

It is expected with this zonation, marine nature resources utilization are concentrated at certain areas. In the fact, however, there are still major constraints to affective coastal habitat management (Djohani, 1989; Supriharyono et al, 1992 and 1993). These are mainly :

- lack of clear delineation of the responsibilities of individual ministries regarding cross-sectorial impacts;
- the fact that coastal habitats are not subjects to local government management, since provincial authority extends only to the water line.
- lack of raw building materials, resulted that many of local people (coastal community) substitute those materials with stony corals;
- lack of law enforcement, many fishermen still use dangerous fishing equipment, e.g. explosive, toxic materials (KCN);
- lack of infrastructure;
- lack of community participation on environmental conservation;
- lack of control, monitoring and evaluation on conserved areas.

Other than those constraints, in several conserved areas, e.g. Karimunjawa's Strict Marine Nature Reserve and Bunaken's Marine National park, it is found that the border between zones is not clear. It is sometimes that sanctuary or protected zone is located closely to the intensive use zone or sharing with the human settlements. Even, it happens that the protected zone (island) is belong to the private. Therefore these will affect on the action of management. As well as, many evidences proved that the sanctuary or protected zones are becoming objects for sport diving by some divers, since these are usually the best zones in coral reef ecosystems (Supriharyono *et al*, 1992; 1993).

According to these constraints, 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 as cross-sectorally approach. Sugandhy (1993) considers 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;
- the management team should have a pyramid structure 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. 5/1974 on the Government Devolution of Authority to Regional Governments or Provinces, with that management model, it is expected that local governments will have own authority to conserve their areas.

IV. CONCLUSION

Anthropogenic activities in the coastal and marine environments affected a decreasing of their living resources potential in Indonesia. Together with establishment of environmental law and regulation, in order to tackle the pro-

blems here, the government also established a number of marine conserves in 23 regions of Indonesia.

Although coastal management has been programmed, included a zoning system for maintaining the human activities in marine conserved areas, but the fact that there are still major constraints to affect of this programme. The coastal and marine management need to be integrated cross-sectorial.

REFERENCES

- Burbridge, P.R., Koesoebiono, and R. Dahuri. 1988. Problems and Issues in Coastal Resources Management and Planning in Eastern Sumatera and the Strait of Malacca, pp 8-117. Burbridge, P.R., Koesoebiono, H. Dirschl and B. Patton (Eds) Coastal Zone Management in the Strait of Malacca. DESC/EMDI.
- Djohani, R. 1989. Marine Conservation Development of Indonesia (Coral Reef Policy). A World Wildlife Fund Report for the WWF Indonesia Programme, Jakarta.
- Mann, K.H. 1982. Ecology of coastal waters: A systems Approach. Blackwell Scientific Publications, Oxford.
- Martosubroto, P. 1987. Development and management of Indonesian marine fishery resources. National Workshop on Development, Management and the Use of Indo-

- nesian Marine Resources, Jakarta 23-26 June, 1987.
- Ministerial Office of Population and Environment. 1992a. National Strategy and action plan on conservation and coral reef ecosystem management. Seminar on Strategy of Conservation and Coral Reef Ecosystem Management, Jakarta, 28-29 Juli 1992.
- Salm, R.V. 1984. Man's use of coral reefs., pp 15-22. In Kenchington, R.A. and B.E.T. Hudson (eds.) Coral Reef Management Handbook. UNESCO - ROSTSEA, Jakarta.
- Sugandhy, A. 1993. Integrated Marine and Coastal Resources Management. The World Coast Conference, 1-5 November 1993, Noordwijk, The Hague, Netherland.
- Supriharyono. 1986. The effects of sedimentation on a fringing reef in north central Java, Indonesia. PhD Thesis. Depart. Zoology, The University of Newcastle upon Tyne, UK.
- Supriharyono. 1988. Man-made induced damage on reef corals at Bandengan Bay, Jepara, Central Java, Indonesia. Research Institute, Diponegoro University, Semarang.
- Supriharyono. 1990. Comparison study of the usage of line and quadrat transect technique for measurement of coral community at Bandengan Bay, Jepara. Research Institute, Diponegoro University, Semarang.
- Supriharyono, Handoyo, Azis Nur Bambang, and Sudharto. 1990. Study on Coastal Management in Riau Islands, Strait of Makasar, and North Coast of Central Java. Research Institute, Diponegoro University, Semarang.
- Supriharyono, Ruswahyuni, Herri Busono, Titik Ekowati, Sunarsih, and Septrianto. 1992. National Strategy on Coral Reef Management in Karimunjawa Islands, Central Java. Research Institute, Diponegoro University, Semarang.
- Supriharyono, Titik Ekowati, Sunarsih and Ria Djuwita. 1993. National Strategy on Coral Reef Management in Bunaken's National Marine Park, North Sulawesi. Research Institute, Diponegoro University, Semarang.
- Sya'rani, L. and N.G. Willoughby. 1985. The traditional management of marine resources in Indonesia, with particular reference to Central Java. In Ruddle, K. and R.E. Johannes (Eds.) The traditional Knowledge and Management of Coastal Systems in Asia and the Pacific. UNESCO - ROSTSEA, Jakarta, Indonesia, pp 255-264.
- USAID. 1992. Coral Reef and Mangroves in Bunaken's National Marine Park. Seminar on Strategy of Conservation and Coral Reef Ecosystem Management, Jakarta, 28-29 July 1992.

Appendix I. Marine reserves in Indonesia.

No.	Locations	Status	Area (Ha)	Minister Decree	Province
1.	Pulau Pombo	Cagar Alam/ Taman Wisata	1.000	SK. MENTAN No. 327/Kpts-Um/7/73 Tanggal 14-07-1973	Central Maluku
2.	Pulau Banda	Cagar Alam/ Taman Wisata	2.500	SK. MENTAN No. 221/Kpts-Um/4/77 Tanggal 25-04-1977	Central Maluku
3.	Pulau Kasa	Suaka Margasatwa/ Taman Laut	1.100 TL 900 SM	SK. MENTAN No. 653/Kpts- Um/10/78 Tanggal 25- 10-1978	Central Maluku
4.	Kepulauan Seribu	Cagar Alam Laut	108.000	SK. MENTAN No. 527/Kpts-Um/7/82 Tanggal 21-07-1982	DKI Jakarta
5.	Pulau Semama	Suaka Margasatwa	220	SK. MENTAN No. 604/Kpts-Um/8/82 Tanggal 19-08-1982	Berau East Kalimantan
6.	Pulau Sangkalaki	Taman Laut	280	SK. MENTAN No. 604/Kpts-Um/8/82 Tanggal 19-08-1982	Berau East Kalimantan
7.	Pulau Weh	Taman laut	2.600	SK. MENTAN No. 923/Kpts-Um/12/82 Tanggal 24-12-1982	Sabang D.I. Aceh
8.	Tanjung Keluang	Taman Wisata/ Hutan Wisata	2.000	SK. MENHUT No. 046/Kpts-II/84 Tanggal 12-03-1984	Kumai Central Kalimantan
9.	Pulau Dua	Cagar Alam	30	SK. MENHUT No. 253/Kpts-II/84 Tanggal 26-12-1984	Serang West Java
10.	Pulau Sangiang	Suaka Alam	700.35	SK. MENHUT No. 122/Kpts-II/85 Tanggal 26-05-1985	Serang, West Java
11.	Kepulauan Karimata	Cagar Alam Laut	77.000	SK. MENHUT No. 381/Kpts-II/85 Tanggal 27-12-1985	Ketapang West Kalimantan
12.	Kepulauan Karimunjawa	Cagar Alam Laut	111.625	SK. MENHUT No. 123/Kpts-II/86 Tanggal 09-01-1986	Jejara Central Java

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No.	Locations	Status	Area (Ha)	Minister Decree	Province
13.	Pulau Moyo	Hutan Wisata/ Taman Buru/ Taman Laut	22.250 HW 6.000 TL	SK. MENHUT No. 308/Kpts-II/86 Tanggal 29-09-1986	Sumbawa, West Nusa Tenggara
14.	Pulau Bunaken	Cagar Alam Laut/ Hutan Wisata	75.265	SK. MENHUT No. 328/Kpts-II/86 Tanggal 20-10-1986	Minahasa North Sulawesi
15.	Arakan Wawontulap	Cagar Alam laut	13.800	SK. MENHUT No. 328/Kpts-II/86 Tanggal 20-10-1986	Minahasa North Sulawesi
16.	Pulau Teluk Maumere	Taman Wisata Laut	59.450	SK. MENHUT No. 126/Kpts-II/97 Tanggal 21-04-1987	Sikka East Nusa Tenggara
17.	Tujuh Belas Pulau	Taman Wisata Laut	11.900	SK. MENHUT No. 92/Kpts-II/91 Tanggal 04-02-1991	South-East Maluku
18.	Kepulauan Taka Bone Rate	Cagar Alam Laut	530.765	SK. MENHUT No. 100/Kpts-II/89 Tanggal 20-02-1989	Selayar South Sulawesi
19.	Teluk Cendrawasih	Cagar Alam Laut	1.453.500	SK. MENHUT No.058/Kpts-II/90 Tanggal 03-02-1990	Manokwari Irian Jaya
20.	Bukit Barisan Selatan	Cagar Alam Laut	201.600	SK. MENHUT No 058/Kpts-II/90 Tanggal 15-02-1990	South Lampung
21.	Pulau Krakatau dan Perairan	Cagar Alam Laut	11.350	SK. MENHUT No.085/Kpts-II/90 Tanggal 28-02-1990	South Lampung
22.	Leuweung Sancang	Cagar Alam	1.150 683	SK. MENHUT No.92/Kpts-II/90 Tanggal 06-03-1990	Garut West Java
23.	Kepulauan Aru Bagian Tenggara	Cagar Alam Laut	114.000	SK. MENHUT No.72/Kpts-II/91 Tanggal 04-02-1991	South-East Maluku
		Total	2.809.668,35		

Source : PHPA/Subdir Marine Conservation (1991)