

## **THE ROLE OF SEAWATCH INDONESIA IN SUPPORTING POLICY FOR THE COASTAL MANAGEMENT IN INDONESIA**

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### ***Abstract***

*In the Indonesian National Guidelines (GBHN) 1998 it is clearly stated that Policy for Marine and Coastal Management in Indonesia is aimed to make efficient use of the marine resources and utilisation in a planned, rational, responsible, appropriate and balanced manner with consideration to the environmental carrying capacity in order to raise the people's prosperity as well as widen the business and job opportunity. Those objectives are expected to be achieved through national land and marine spatial arrangement as a basic for development planning, so that the efforts for making efficient use of the natural resources can be sustainable implemented. The commitment is being stronger as the Indonesian Government include the issue of Integrated Coastal Management on the Indonesian Agenda 21, Part 4 Capture 18 (National Strategy for Sustainable Development).*

*SEAWATCH Indonesia as a multi-institution activity in the Technology Application for Marine Environmental Monitoring, Forecasting, Modelling and Information System is trying to participate in supporting the implementation of the policy either by giving inputs to the policy maker or by executing the policy into the real activity in cooperation with other relevant institution. These efforts are obviously carried out in the SEAWATCH implementation program covering : a) Biodiversity aspect, b) Water quality management aspect, c) Zoning aspect and d) Meteorology and Oceanography aspect*

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## I INTRODUCTION

Since 1970's Indonesia has incorporated environmental concerns into the highest level of state policy. In the Second Longterm Development Plan, the environment has important position and strategic in all aspect of life as stated in the National Guidelines 1998. In respect of the Marine sector, it is emphasized in the Indonesian National Guidelines that marine and coastal areas under Indonesia's sovereignty and jurisdiction are to be exploited and utilized for prosperity and security of the Indonesian people. Furthermore, in the National Guidelines 1998 it is determined that marine and coastal development is directed to diversification, exploitation, and cultivation of marine resources, and maintain the sustainability of ecosystem through application of science and technology.

Indonesia stretches over 5 thousands km from Sumatera in the West to Irian Jaya in the East. It is the largest archipelagic state in the world with land and marine territory of about 7,7 million km<sup>2</sup> consisting of some 17.508 islands, 81.000 km coastline and 70% (5,8 million km<sup>2</sup>) of its territorial area covered by marine waters which are endowed with diverse and rich natural resources.

Approximately 60% of the population live on the coast. Half of this number lives in coastal villages, depend upon local natural resources. If the population currently growing at about 1,8% per year, it is projected that by the end of the century Indonesia will have a total population of about 215 million. The coastal population is growing at more than twice the national average.

Approximately 7,120 of Indonesia's 66.400 villages are classified as coastal villages (Rudiyanto, 1995). Most traditional coastal villages, in comparison with rural villages and urban centres, are characterized as having relatively low averages incomes, traditional cultures, limited supporting institutions, limited elementary school education and weak social, economic, and cultural support infrastructures. Many of coastal villages are isolated from other centres of development. Physical infrastructures and facilities of most such communities (water supply, sewage treatment, solid waste management) are inadequate.

Many villages do not utilize the full potential of marine and coastal resources because the lack of knowledge, skills, technology, equipment and capital necessary to develop appropriate economic activities. Activities outside of fishing are not oriented to the economic activities.

The coastal zone is by far the most economically important part of the marine estate, accounting for over 80% of all marine related activities. Coastal settlements, ranging from major ports to coastal villages, provide employment for about 16 million people or 24 % of the national labour force.

The diverse needs of a large and growing global population, especially in Western Indonesia, are now being limited by the fixed supply of coastal resources (called as : carrying capacity) and the limited ability of coastal ecosystem to assimilate the by-products of human activities (called as assimilative capacity). Ecological and human welfare impacts of coastal degradation may at first be very localized. Eventually, generate wider national and regional effects will be felt.

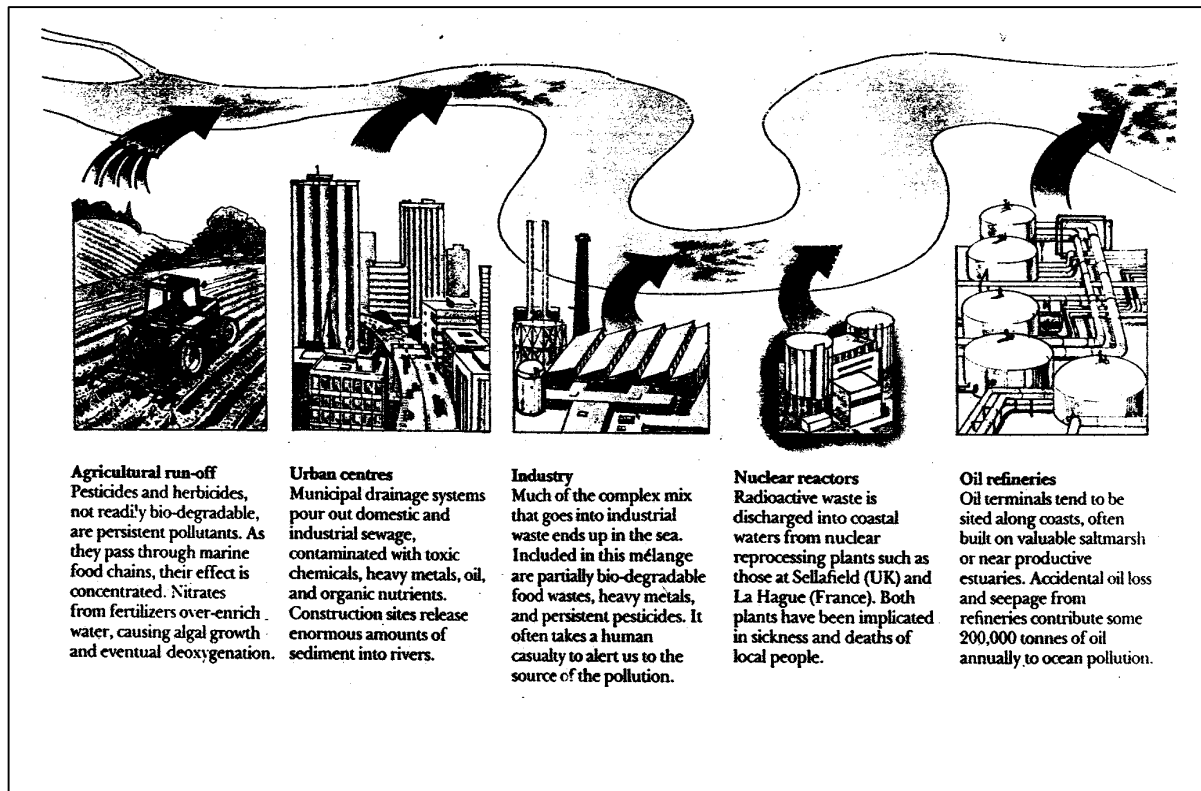


Figure 1. Sources of Pollution, Land-based Pollution

In order to keep the health environment of coastal area, the fundamental challenge is to maintain a level of habitat quality and species diversity that will guarantee the functioning and resilience of ecosystems in the future. The economic and ecological systems are not separate but fundamentally interconnected. There are major reasons why an integrated approach to the management of coastal and ocean areas is needed : a) the many values (economic, ecological, social) present in coastal areas; b) the effects that ocean and coastal uses can have on ocean and coastal environment as well as on one another.

## II NATIONAL COMMITMENT ON COASTAL DEVELOPMENT

Since the Sixth Five Year Development Planning (1993-1998), Indonesia has a special program for coastal development. This commitment is in line with the International effort in trying to have sustainable development as it is stated in the Agenda 21 being declared on the United Conference on Environment and Development (Earth Summit) in June 1992 at Rio de Janeiro, Brazil. The Agenda 21 Global then being adopted to National Agenda 21 by each state including Indonesia as National Strategy for Sustainable Development. Agenda 21 Indonesia, Part 4 Capture 18 consist of issues about Integrated Marine and Coastal Management.

The Indonesian Strategies for Integrated Marine and Coastal Management are planned in order to achieve the succes of an integrated coastal and marine management. It is important to ensure the sustainability of coastal and marine resources, so that those resources can be the strategic products to support the Indonesia's development in the 21<sup>st</sup> century. Regarding to the implementation of the integrated coastal and marine management, several programs are required, including:

1. Integrated coastal resources planning and development.  
To enhance the integrated planning and development, it is required to:
  - a. Improve the planning and development to be more integrated and sustainable, by enhancing public awareness, formulating issues, improving and enforcing the existing laws and regulations.
  - b. Strengthen and enhance the cooperation between institutions in the management of coastal resources both at central and local levels.
  - c. Develop information system to improve the planning and decision making process.
2. Monitoring and protection of coastal and marine environment.  
There are three special approaches needed for monitoring and protection of coastal and marine environment, including:
  - a. The prevention, reduction, and safeguarding of the coastal and marine environmental destructions.
  - b. The protection and the preservation of coastal and marine environment that is ecologically vulnerable, and has critical habitats by involving the related institutions and the communities.
  - c. The enforcement of laws and regulations related to the production and development activities in coastal and marine areas.
3. Sustainable use of marine resources.  
To achieve the sustainable use of marine resources, the following efforts are needed :
  - a. Reassessment of the maximum sustainable yields (MSY) in coastal zone and Exclusive Economic Zone for the fishes that are economically valuable.
  - b. Enhancement of technological and environmental skill in the use of coastal and marine resources, mainly that are related to the catchment and cultivation of fish, the rehabilitation of critical coastal environment, the use of biotechnology, and mineral and hydrocarbon exploration and exploitation in coastal and marine areas.
4. Coastal communities empowerment; in order to empower and to strengthen the coastal communities, the following efforts are required :
  - a. Socialisation of environmentally coastal community development, including the increase of income, the increase of public awareness and the development of local institution, as well as the involvement of local community, non-government institutions, and local government.
  - b. Development of communication and transportation facilities, infrastructure, and public facilities in coastal areas.
  - c. Increase community's income and ensure that the local community can gain the maximum benefit by developing partnership between local government, private sectors and KUD (Village Cooperation Unit).

- d. Provision of training to increase skills and the development of fisherybased industries.
5. Safeguarding the Economic Exclusive Zone (EEZ).  
In order to safeguard the EEZ, the following efforts are needed :
- a. Strengthen the skill in monitoring to safeguard coastal zone and marine resources from illegal exploitation, trans-boundary pollution (pollution from the neighbour country) and illegal trading activities.
  - b. Strengthen the coordination and communication among related institutions.
  - c. Development of bilateral as well as regional forum in information transfer related to the safetiness of EEZ.
6. Management of climate change and tsunami impact.  
The management of climate change and tsunami impact needs strategies, including
- a. Undertake a systematic observation and research in relation to the problems of marine environment, atmosphere dynamics, social economic, environmental impacts of climate change, sea level rise and its deviation.
  - b. The development of efforts in anticipating, resolving, and improving the impact of tsunami, climate change, and sea level rise in human and marine resources.
  - c. Enhancement public awareness on the impact of sea level rise and tsunami.

Furthermore, to execute all those strategies, there are several special programs planned and executed the Indonesian Government for coastal development and have the aims at increasing the conservation function and the ecosystem of coastal and sea area, as well as controlling environmental damage to coastal and sea areas and to increase the capability of coastal society in environmental management.

Priority actions that have to be implemented in this program are among others as follows :

1. Development of coastal spatial planning methods and marine and coastal resource exploitation mechanism
2. Institutional development related to the management of marine and coastal areas, especially in areas of high density development activities
3. Rehabilitation of coastal damages
4. Prevention, tackling and guarding of damaged coastal and coral reefs
5. Regional and rural development, particularly of low-income coastal villages, and improving the capabilities of poor societies in coastal areas through education and skill training.
6. Creating business opportunity for coastal societies
7. Improving research in Marine and Coastal Ecosystem

Moreover, for the Protected Coastal Areas, specific actions to be recommended are as follows :

1. Evaluate traditional marine and coastal management system
2. Design projects which benefit the local people and maintain sustainable resources practices.

3. Provide employment/income generating opportunities and/or other benefits to local communities living adjacent to protected areas to relieve pressure on these areas and to preserve their biodiversity
4. Develop pilot project for active community participation in management of protected areas, buffer zone of marine and wetland ecosystem
5. Use rapid appraisal planning methods at village community level in buffer zones bordering conservation areas.

It is obvious that the approach of Indonesia for the policy for marine and coastal management is making the efficient use of the marine resources and utilization in a planned, rational, responsible, appropriate and balanced manner with paying attention to the environmental carrying capacity through national land and marine spatial planning for prosperity and security of the Indonesian people.

### **III. ISSUES IN THE COASTAL MANAGEMENT IN INDONESIA**

The coastal areas contain many of the fastest growing economic activities such as industry, agriculture, trade, tourism, oil and gas, etc. There are currently a number of issues facing coastal management in Indonesia, i.e (Rudyanto, 1995) :

#### **1. Wetland and estuary reclamations**

A vast area of low energy shoreline has been reclaimed in the decades, a process that is continuing. The decline in world oil price as well as the profitability of shrimp culture, have relentlessly converted the use of many coastal land areas in the country, specifically on the North Coast of West Java, which become almost entirely brackish water shrimp ponds. Since then, there are no mangrove forest left on this area. Furthermore, the massive conversion of mangroves becoming shrimp ponds could be a factor that has brought about the decline in catch per unit effort of fishermen in these coastal waters.

#### **2. Waste disposal into coastal environment.**

For years coastal waters have been viewed as a convenient dumping ground for waste material or energy. Many urban, industrial and agricultural developments in coastal areas are sited in highly productive coastal wetlands and estuaries and are often poorly planned or regulated. Engineering and development projects are modifying coastal ecosystem on a very large scale. The wastewater from most urban and industrial areas are discharge directly into the sea, or indirectly via river systems, with little or no treatment. In this way the coastal zone is not only manipulated and disturbed, but its water become polluted with biological and chemical contaminants.

#### **3. Recreational despoliation and destabilization of coast.**

The widespread marketing of coastal recreation in the last decades has led to the ugly disfigurement of many previously scenic coast, and to the destruction of fragile ecosystems. This is ironic, as it was often the attraction of this ecosystems that encourage the initial development.

#### 4. Sustaining productivity and diversity in coastal ecosystem.

Uncontrolled exploitation and enrichment of many coastal ecosystems has forced changes in ecological structures, productivity and diversity. Many natural coastal systems are finely balanced, perhaps recycling only a small quantity of nutrients to sustain production. Uncontrolled nutrient gains or losses can alter an ecosystem significantly. Moreover, unsympathetic management may in itself lead to deterioration, especially in geomorphological and ecological diversity.

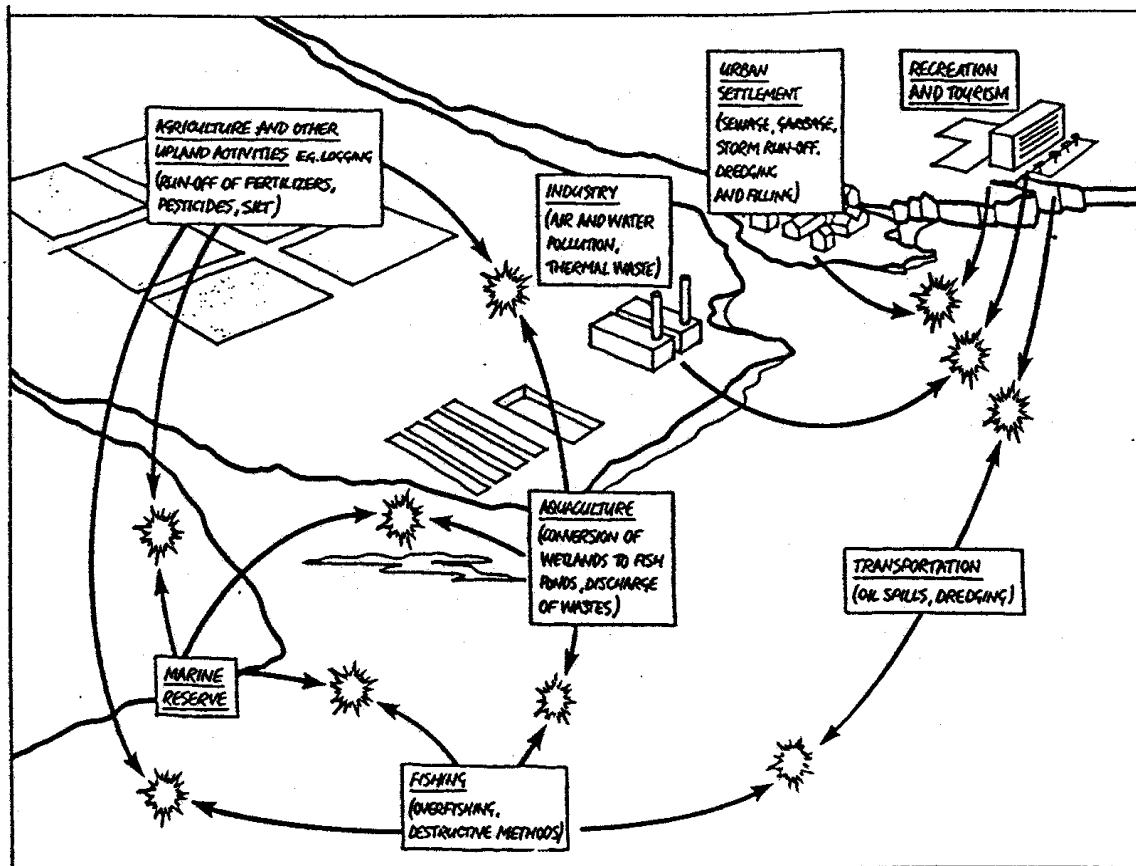


Figure 2. Some Potentially Conflicting Uses of Coastal Resources

In many cases, coastal management is a complex affair involving political, economic and environmental arguments. In some cases, e.g. coast erosion or extraction of beach places, the activities and therefore the problems, are site specific, while in others, notably recreation and waste disposal, there is more scope for adjustment. Many issues have a clear spatial dimension, allowing rational decision on siting, zoning, timing to facilitate management. Coastal hazards (tsunamis, floods, etc) present special difficulties. Most are a periodic phenomena of uncontrollable magnitude. In this connection, there is no unified international approach to coastal zone management.

The complex nature of both the natural and the social systems of the coastal zone requires its planning and management to be based on an integrated and holistic approach, on multi-disciplinary integration, and on the integration of the information-producing sectoral agencies, through the networking of data bases, data centres, GIS,

and other information systems. In addition, management strategy for coastal and marine environments should not be separate from on-land environmental management strategies. It is necessary to integrate the existing activities on land and those in coastal areas to minimize conflicts of interest in utilizing natural resources, and controlling sea pollution originating from land. This will ultimately result in an integration of central government's top-down and the district / provincial government's bottom-up planning approach.

#### **IV SEAWATCH INDONESIA ; A TECHNOLOGY APPLICATION FOR MONITORING, FORECASTING, MODELLING AND INFORMATION SYSTEM FOR MARINE ENVIRONMENT**

To cope with all the problems occur on the Indonesian coastal and ocean areas as well as to carry out the policy on the Marine and Coastal Management, one of the activities has been done as a multi-institution activity called as Seawatch Indonesia. Seawatch Indonesia is a cooperation in Science and Technology between Indonesia and Norway in the area of Technology Application for Monitoring, Forecasting, Modelling and Information System for Marine Environment. Seawatch Indonesia has the objectives as follows :

1. Construction and Mooring of observatory buoys (12 buoys) in the locations of Northern Coast of Java Islands and Mallaca Strait.
2. Acquisition, transmission, processing, distribution and utilization of collected data.
3. To provide data that contribute to the national and international programs for preserving and restoring the marine environment and the marine living resources, supporting a continued sustainable development, increasing productivity, enhancing social welfare and provide employment i.e :
  - for early warning system of natural phenomenon including possible marine hazards of disaster (tsunami, harmful algae blooms, etc)
  - for marine meteorological data for safety of life and navigation at sea
  - for analysis of upwelling monsoonal currents and Indonesia throughflow
  - for the study of global climate changes caused by the El-Nino / ENSO
  - for the study of Sea level Rise
4. To conduct study on the possibility of developing marine sensors for tropical condition as well as the transmitting system.
5. To increase technological capability in marine production sector.

In the execution of the cooperation, the project divide the activities into 3 (three) aspects :

1. Project management, consist of several activities as follows:
  - Buoy Operation and Maintenance
  - Data Management
  - Monitoring, Forecasting and Modelling
  - Human Resources Development ; through the activities of Joint Research, Trainings and courses, Post Graduate Studies, Workshop and Seminar



– Quality Assurance

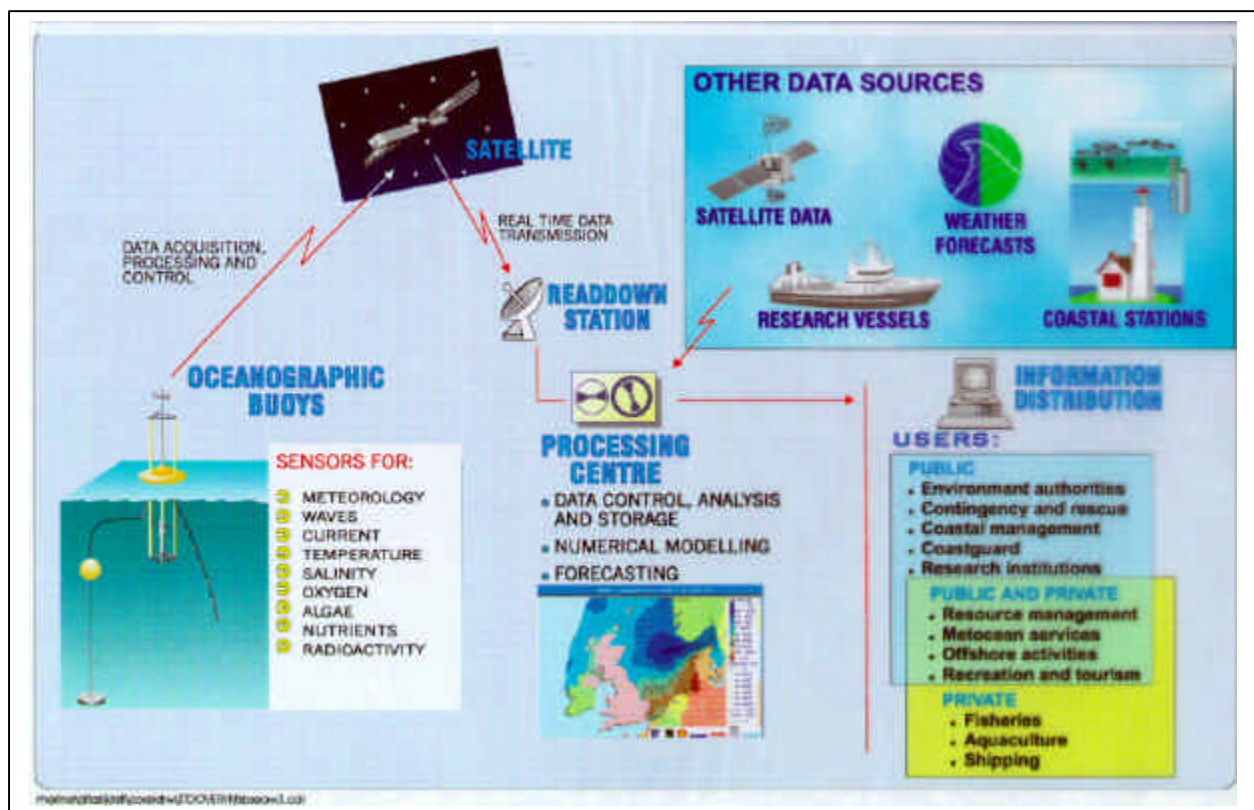


Figure 3. Seawatch Information System

Data Implementation Program, consist of :

- Biodiversity Assessment (type and quantity of organism; environmental quality monitoring in the terms of physics and biochemistry conditions as well as human activities impact; productivity; and conservation of biodiversity).
- Water quality Assessment (for the heavy metal and hydrocarbon)
- Zonation Assessment to have input for Marine and Coastal Zone Development and Management
- Meteorology and Oceanography Assessment for the purpose of the study of El-Nino, Sea level Rise, Global Climate Change etc.

2. Transfer of Technology and Development Program, consist of :

- Study for Technology Development of The Bouy and Marine Information System
- Study for Sensor Technology
- Study for Fouling Protection
- Study for Developing Calibration Laboratory.

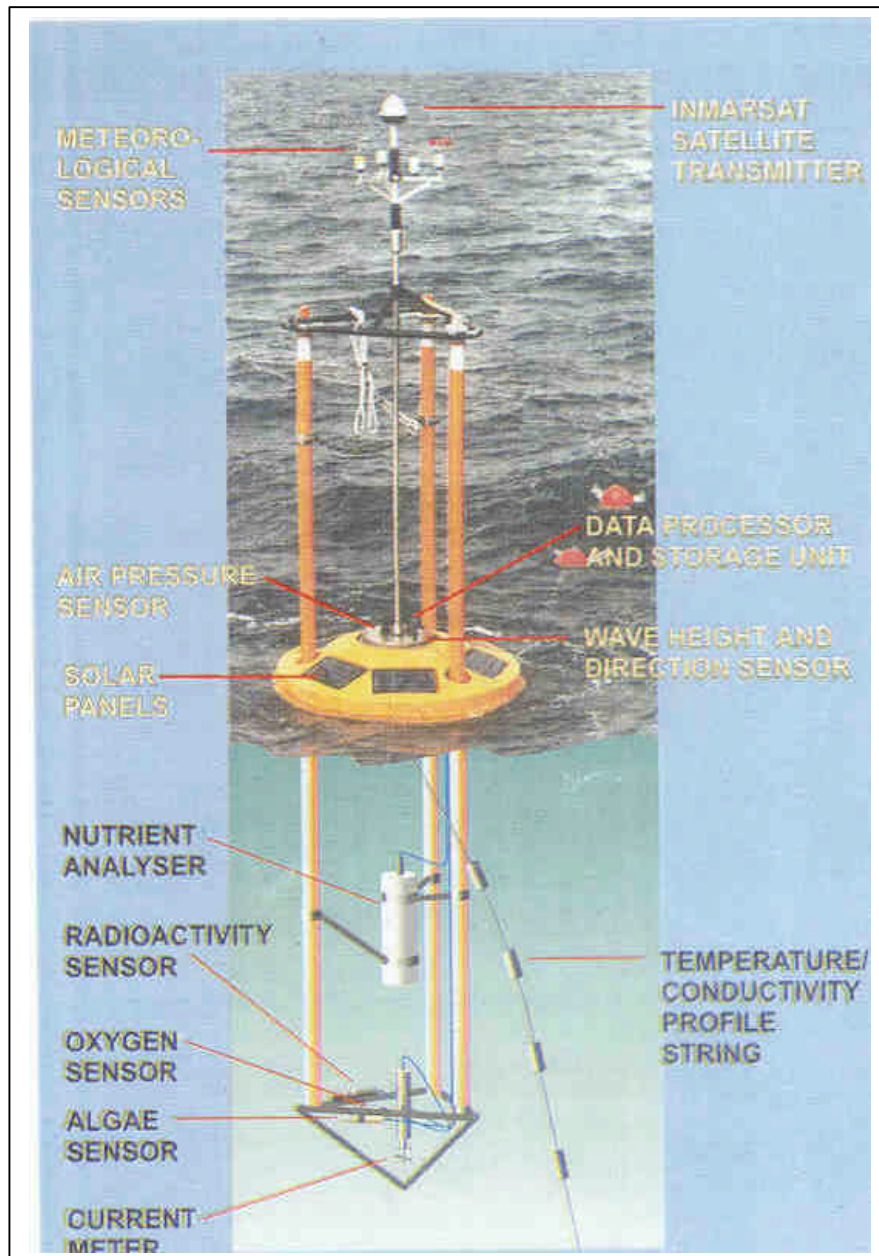


Figure 4. Buoy Seawatch Indonesia

Furthermore, it can be considered that the advantages coming from implementing the Seawatch Indonesia system compared to other system normally use in could be listed as follows:

- Can provide data in a continuous and regular manner with a very short time delay (a real time system).
- Could cover large or significant areas simultaneously, giving the opportunity of describing a synoptic situation.
- Can provide a large number of related parameters supporting each other when trying to describe the situation. Among the parameters are also biological and chemical related parameters.

- Supports a wide area of interests or applications, namely: monitoring, forecasting, crisis management and R&D.

Generally we could now say that there is now an increasing acceptance saying that better environmental data will improve the management and give better utilisation of the sea for different commercial purposes. Management decisions, for example, can be related to discharges of industrial and municipal wastes, in order to establish rules and regulations for wastewater treatment plants etc. Industrial utilisation may include areas such as ship traffic, tourism, cooling water, process water, fish farming and fishing. Seawatch Indonesia will hopefully increase the efficiency in managing the marine resources, the system will further produce data, design criteria and forecasts which can be used by marine industries, science and the authorities to improve performance, reduce costs and handle undesirable events.

## **V THE IMPLEMENTATION PROGRAM OF SEAWATCH INDONESIA**

Based on the condition of Indonesia nature as an archipelago, the marine management is automatically related to the coastal management. Therefore marine and coastal will need the integral management. To set the optimal result of Seawatch Indonesia program in supporting the integral management of marine and coastal, the activities of the Implementation Program are divided into :

- a. Biodiversity aspect
- b. Water Quality Management aspect
- c. Zoning aspect
- d. Meteorology and Oceanography aspect

All the activities are executed and focussed to the inter - institutions cooperation in order to cope with related problems and will be connected to the utilisation of marine data and information in monitoring, forecasting and modelling available in the Seawatch Indonesia system that are complementary supported by secondary data from various sources.

### **a. Biodiversity Aspect**

In order to participate actively in protecting, maintaining and utilising the integrated marine and coastal resources in the integrative approach, Seawatch Indonesia is doing some



Figure 5. Mariculture in Seribu Island, Jakarta Bay as one of the Seawatch Indonesia Data Application Activity

Data collected from the buoy are being used for monitoring the water quality surroundings the netcage. activities with the objectives among others : a) assessing the interaction between marine bio-resources and physical, chemical, and oceanographic condition by using the Seawatch technology; b) providing the information as well as developing technology for the marine bio-resources; and c) in order to protect and maintain the marine nature resources Seawatch Indonesia has the activity of building the cooperation with related institutions such as P3O- LIPI, Directorate General of Fishies, Universities, etc.

In the first 3 year period of Seawatch Indonesia project there are several activities executed in relation with biodiversity aspect i.e : Monitoring and Forecasting the phenomenon of algae bloom in the locations where the buoys deployed Indonesia waters; and Pilot Project of the mariculture management in the Indonesia waters.

#### **b. Water Quality Management aspect**

Generally, pollutant source in marine and coastal environment can be divided into several groups, such as; industries, sewage, agriculture, fish culture, mining, shipping and wastewater from cities. The main pollutant substances from that sources are: sediment, nutrient, heavy metal, pesticide, exotic organism, pathogen, litter, oxygen depleting substances, etc. The focus of the assessment of Seawatch Indonesia program are monitoring, forecasting, modelling which has relation with the quality of those parameters, such as heavy metal, sedimentation, sea water temperature, salinity, pH which is related to the activities such as fisheries, medicine and food control, tourism, offshore and onshore mining, sea communication, etc. It is also can be related to the activities of Environmental Impact Assessment.

### c. Zoning Aspect

By implementing the technologies of Seawatch Indonesia, there some activities in zoning aspect can be performed, such as :

- a. Gathering data, analysis, planning and development of coastal area based on its Suitability
- b. Mapping the potential areas for developing the marine and coastal area based on its suitability

The activities can be done by making the suitability map with GIS that include in the Seawatch System for the purpose fish, shrimp, seaweed culture; tourism; management of mangrove, coral reef, etc.

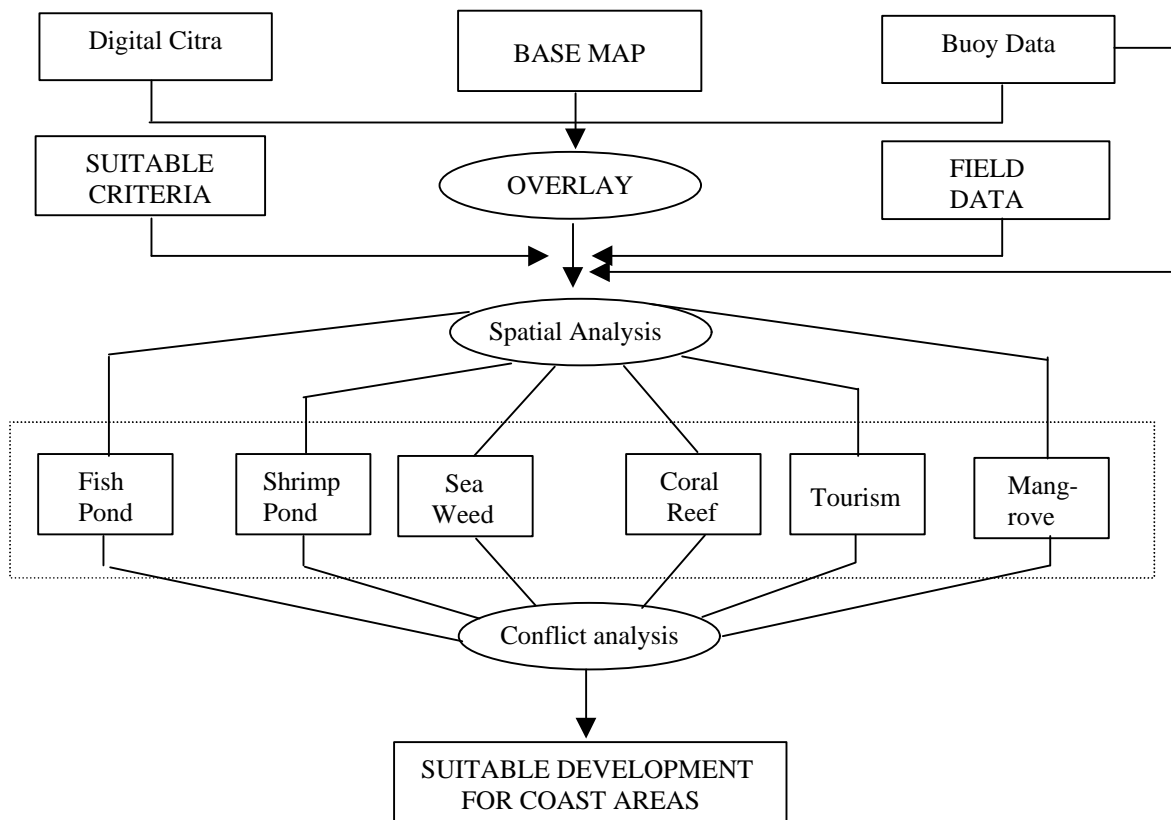


Figure 6. GIS Application for the Seawatch Indonesia Data Application in Supporting Spatial Planning for Coastal Area

### d. Meteorology and Oceanography Aspect

The phenomenon of meteorology and oceanography become the inter-nation assessment, since the effect of the things happen in one part of earth will automatically be affected to the other side of the earth. In order to establish the implementation of

marine information for local, regional or even global level, there are some tasks to be developed in the Seawatch Indonesia System such as:

- a. Complete data base for meteorology and oceanography
- b. Networking in the national, regional and global scale
- c. Hardware and software development
- d. Assessment on meteorology and oceanography used for science and technology application.

Some programs have been arranged to implement the task are among others :

a) making standard procedures for activities of the implementation or the services in meteorology and oceanography issues; b) executing studies that related to the global change and early warning system; c) developing of the existing system for the purpose of operational and commercial aspect as d) well as giving services for consultation and training for the data user.

## **VI CONCLUSION**

1. Government of Indonesia has a strong commitment to carryout the sustainable development in the Marine and Coastal areas as it is clearly stated in the Sixth National Guidelines (1993-1998) that one of the new development sector is Marine Sector. It become stronger that in the Indonesia Agenda 21 Part 4 Capture 18, Integrated Coastal Management is one the important issue.
2. Seawatch Indonesia, the science and technology cooperation between Indonesia and Norway in the field of Technology Application for Monitoring, Forecasting, Modelling dan Information System for Marine Environment will be one of the tools in the implementation of the Indonesia policy for supporting Marine Sector Development.
3. As the cooperation has already been carried out for about 3 years, there are many marine data has collected. To make the data useful either for the input for the decision make or for the user, Seawatch Indonesia has 4 (four) data implementation activities that have a very close relationship to the policy for the marine and coastal zone managemant.
4. Marine Environmental data that has been collected can be used for improving the marine and coastal management, better utilisation of the sea for different commercial purposes, establish rules and regulations, industrial utilization such as ship traffic, tourism, cooling water, fish farming, etc. as well as for the scientific purposes or marine research.
5. Besides using all the marine system information equipment received from Norway, the Indonesia researchers have the intention to develop the system suitable to the tropical condition since Indonesia as a maritime continent indeed has a very strong need to manage the marine and coastal resources for the sake of sustainable development. It can be seen in the Project of Seawatch Indonesia especially for the development of the Seawatch Indonesia Marine Information

System covering the aspects of Buoy Technology, Sensor Technology, Marine Information System, Fouling Protection as well as Calibration Laboratory.

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