

THE APPLICATION OF SEAWATCH INDONESIA MONITORING SYSTEM FOR ENVIRONMENTAL MANAGEMENT OF MARICULTURE

Arif Dwi Santoso* and Bayu Chandra Nursetiarso*

Abstract

Marine culture is the effort section which is relatively new for Indonesian people. In subsequent development, the effort for exploitation of these sources are expanded as equal as decreasing in catching yield and the international trend in fish consumption. In the framework of the marine culture resources rational exploitation, steps of management are needed earlier to prevent decreasing of productivity, ecosystem damaged and in order to save the resources function and also for continuing their effort.

SEAWATCH Indonesia is potential for making a big role to support the utilisation of the resources, it is the near real time data from buoy (physics: current, wave and wind; chemist: oxygen saturation, salinity, temperature, nitrogen and phosphate; biology: attenuation coefficient, for monitoring and forecasting algae bloom). The near real time data resulting from this facilities benefit mariculturist in conducting the marine culture early warning system.

Environmental monitoring and forecasting activities should be done along the marine culture activities (the beginning marine culture, at the marine culture periods and after harvesting time) in order to know the changes of marine environmental condition. SEAWATCH Indonesia monitoring system can be applied more optimally in supporting the marine culture activities, so that can fulfil the need of food and increasing the income and welfare of Indonesia people who are still in monetary crisis until now.

I. INTRODUCTION

Indonesia is an archipelago. Marine aqua culture (*marine culture*) is main potential resources, considered still in preliminary phase, consequently the opportunity to further promote mariculture is still widely open. Indonesia having the longest coastline in the world (about 81,000 km minus East Timor). The physical landscape of Indonesia consist of 6,840,000 km³ of sea areas or in other words 70 % of Indonesia jurisdiction areas is a sea.

* Directorate for Environmental Technology – BPPT

About 89,025 Ha of potential are has been known for cultivation of marine species with the potential production of 46,735,000 ton/Ha/year. The potential of area for marine culture consist of : fin fish culture (3,600 Ha), seaweed culture (25,700 Ha), shell fish culture (57,225), sea cucumber (2,500 Ha). According to the species cultured, potential production of marine is dominated by seaweed (90%), and the rest is fin fish (3%), shell fish (1%), and others (6 %) with the number of the production as follows : shell fish (45,172,000 ton/Ha/year), fin fish (1,080,000 ton/Ha/year), seaweed (483,000 ton/Ha/year). (Gappindo, 1996).

Marine aqua culture, on the other hand, showed good potential for development, particularly in the coastal areas, where there are better conditions in term of nutrients, substratum and sunlight. Several marine species start to be produced in cultivation system with good results : penaeid shrimps, sea weeds, oysters, mussels and others.

Environmental monitoring activities should be done along the marine aqua culture to know the changes of marine environmental condition. SEAWATCH Indonesia is potential for making a big role the monitoring environmental, it is the real time data (physics: current, wave and wind ; chemistry : dissolved oxygen, salinity, temperature, nitrogen and phosphate ; biology : attenuation coefficient for monitoring algae bloom). The real time data resulting from this benefit marine aqua culture in conducting the marine aqua culture early warning system.

Goal

1. Data collection on grouper fish biology that is potential to be developed in the development of marine culture in Indonesia.
2. to supply technology capability in marine culture sector,
3. to increase mariculture product with environmental friendly
4. to monitor parameter physic, chemical, biology and others

II. METHODOLOGY

a. Making Suitable Area Map for Mariculture

1. Collecting of suitable area data for mariculture and for utilization marine area together with other instances.
2. Making the coordination meeting with the others instances for define making map.
3. Resuming the data and conclude of discussion for making map by using G.I.S. technology.

b. Survey for Definite Mariculture Area

After defining region for mariculture has been done by using map, then doing field survey for setup mariculture location accordance by mariculture factors, social, economy and legality.

c. Survey of Seed and Feed

Knowing of sources of seed and feed are needed mainly for recycle activities. Therefor, the kind and composition of fish, getting them easily and environment factors are looked before the mariculture activities.

Seed survey was done in a few places such as in BBL Lampung, market fish Cilincing, market fish Muara Angke, LBAP Jepara and LBAP Situbondo. Whereas feed survey was done in market fish Cilincing, market fish Muara Angke, fish auction place Rawasaban and harbor of fishermen ship in Mauk. Information about feed and seed was got by survey straight in those locations.

III. RESULTS AND DISCUSSION

1. Grouper Fish Biology

Grouper fish consist of several species such as tiger grouper fish (*Ephinephelus fuscogatus*), mud grouper fish (*Ephinephelus suillus*), sunu grouper (*Plectropoma leopardus*), eye brow grouper (*Cheilinus undulatus*), red grouper (*Ephinephelus akaara*), et cetera. Fish of these types posses a high market value, even though the price level is dependent upon the species. In the international community, the fish is known as the Grouper. The fish, which belongs to the serranidae family, consist of more than 46 species living dispersed with various types of habitation. Several types are already cultured.

2. Taxonomy

Knowledge about taxonomy must be acquired before culturing effort is conducted, in preventing the possibility of choosing wrong species. Taxonomy is required to determine the classification and to discover the types of grouper fish which are economically beneficial to culture. The types of grouper fish which are commonly cultured are tiger grouper (*Ephinephelus fuscogatus*), mud grouper (*Ephinephelus suillus*), sunu grouper (*Plectropoma leopardus*), and eye brow grouper (*Cheilinus undulatus*).

Temminck dan Schlegel, (1842) classify the fish as follows :

Super class	: Pisces
Class	: Osteichthyes
Super order	: Percomorphi
Order	: Percoide
Family	: Serranidae
Sub Family	: Ephinephelinae
Genus	: Ephenephelus

3. Morphology

Morphology is one of biology aspects which must be acquired in detail to recognize the types of fish which can be easily cultured in the field. Mastering the knowledge of morphological characteristics, such as stretched and gilig body shape, skin reflection and mouth shape, ease the identification of desired species directly in the field. Grouper fish posses the following characteristics : operculum is grown with 1-3 thorns, preoperculum VI-XII, anal fin III, 7-12, lateral fin I, 5, caudal fin 17 and back bone consists of 24-35.

4. Life Cycle

Grouper fish is one of the types of fish which live within rocks and corals, in the depth of 15-30 fathoms. Whereas, newly hatched larva is pelagic until the age of roughly 30-40 days. Grouper fish are “ Protogynous hermaphodite “, meaning that their sex changes from female to male if their size reaches more than 50 cm or if the weight has exceeded 4 kg. This sex alteration occurs naturally. Sex determination can only be done by “Striping” when the fish has reached gonad maturation. The father will discharge milky white sperm liquid and the mother will expel some eggs which has undergone ovulation when striping is conducted.

5. Behavior and Eating Habit

Behavior and eating habit must be learnt and understood so that the available technology can be implemented correctly for every cultivated species. Grouper fish can be classified as wild fish, living in solitude and commonly found in coral reef and estuary area. Grouper fish likes shelters as a hiding place and avoid direct sunlight. The fish looks for food by attacking the prey from its hiding place. The types of food it likes are fish, squids and prawns sized 10 - 25 % of its own size. The ratio between its feed and its body weight decreases as its weight increases.

a. Marine culture Activities

1. The Floating Cage Making

The steps of making floating cage are making design, choosing roof, connecting roof, setup drum into a framework of the floating cage and assemble become a floating cage unit. Almost of all raw materials was come from Kelapa Island but a little from out side (Jakarta City). Assemble of floating cage is on Kelapa island beach. Then, it setup on the coordinate by fishermen’s motor helping.

There are 4 units of the floating cage had made. One unit is consists of 4 fishpond. The size net is $(3 \times 3 \times 3) \text{ m}^3$ whereas the size of one unit of the floating cage is $(8 \times 8) \text{ m}^2$. Total using of drum is 74 drum; 9 drum for a bamboo construction and 12 for a roof construction. There are two sizes of the net using on the floating cage unit. Those are $3 \times 3 \times 3 \text{ m}^3$ (a big net) and $3 \times 1,3 \times 1,3 \text{ m}^3$ (a little net). The ballast is also used as an anchor. It is made by combining sand, cement, and reef (2: 1: 1). The size of the ballast is $(50 \times 30 \times 45) \text{ m}^3$. Its shape is like a pyramid, which is be cut on top.

The Watch House (16 m^2) has built inside floating cage. It functions for watching over the fishes and keep fish maintenance items, such as dry net, etc., and also keep in warm and protect from sea wind. The house filled in with little sponge bed, stove, lights, storage box, etc. The house in East side from the cage with three ballast. One as an anchor and another are natural coral. North and South sides tide out with one ballast, and the West side tide out three ballast.

2. Seed Spreading

After finished Floating net-cage, we set the nets for a week and then readily to spread out the seed. The seeds are panther-fish (*Cromileptes altivelis*), sunu grouper

(*Plectropomus leopardus*), tiger grouper (*Epinephelus fuscogutatus*), and mud grouper (*Epinephelus suillus*).

Panther fish (*Cromileptes altivelis*), also known as Grace Kelly, brought in from LOKA LBAP Situbondo. We have done a acclimatization test for the fishes to find out for suitable seeds in new environment. For a week those fish have given food, and the same time have watch the change include they behavior. Then doing the bigger seeds spread.

3. Preparing Feed

The feed for panther-fish and non-panther-fish is fresh smaller fish. There are much choice as feed for them, such as *Sardinella longiceps*, *Clupea* sp., *Sardinella fimbriata*, *Selaroides* sp., *Rastrellinger kanagurta*, *Stelophorus indicus*, *Loligo* sp., *Carangoides* sp., and *Nemipterus* sp. They are found by bought from fishermen as their catching from the sea.

4. Feed Storage

Fresh feed from fishermen are store in a freezer. Before put in it, its stomach are cleaned. Hygiene of the feed influenced to fin fish and storage quality.

Feeding process still did it until fish satisfied (*adlibitum*). Total feed has did given until 10% of fin fish weight total. Small fish for panther-fish feed has cut about 1 cm². It's suitable for fish length size (2-4 cm). Another fish feed has cut about 2-3 cm. Feeding process continue with thrown the feed slices to slices in to the water.

5. Net Cleaning

The nets has clean with brush once a week for big net and once in three days for little net for the place of Grace Kelly. Before clean out the dirty nets, we transfer the fish in another clean net. The nets pulled out from water and put in inside the cage, then brushed out the dirt such as algae and shell with sea water. The cleaning process will be done in empty cage nets for fish culture safety. The nets dry and saved for used again if it wet.

6. Therapy of fish diseases

In culture maintenance, fin fish in net cage especially Grace Kelly or non panther-fish grouper can be attack fish disease. The different indication can showed on. Grace Kelly indication showing :

1. Anorexia
2. Open wounded in fin tail

Non panther-fish symptom showing :

1. Anorexia
2. Make group of swim
3. Slow activity and response
4. Open wounded in body and fin tail

After the symptom showed, those fin fish start died. The action has done for cure those fin fish, like soaking for 30 minutes in to the box which filled in sea water and methylene blue 200 mg/L. It has to be done together with nets clean once a week.

8. Fish Sorting

A good growth fish, has chosen based on length size, separated in different net. It is avoid cannibalism behavior of big grouper to little grouper mainly the difference until 50 %.

b. Water Quality Treatment

During treatment period, the water quality monitoring is conducted. Monitoring is performed to acquire the water quality changes which can influence the cultivation activity. During the larva cultivation, the water quality monitoring result was as follows :

- Temperature 28 - 31 °C (daily change was not more than 1,5 °C)
- Salinity 29 - 32 ppt
- pH 8
- DO was more than 5 ppm

From the above data, it is shown that the water quality was still within the acceptable range for the fish larva life (Boyd, 1982).

c. Diseases and Their Treatment

During the period of grouper larva cultivation, mouse diseases which appear and are detected, are as follows :

Worm Parasite

This disease attacks larva aged 15 - 25 days. The characteristics of larva being attacked by worms are scars at certain areas of their bodies and when observed under a microscope, worms are detected. The treatment conducted is by rinsing the fish in freshwater for 15-20 minute.

Nerocilla

The parasite is oval in shape, white, has six pair of legs, can reach 3 cm in length, and commonly sticks on the fish mouth and gills. Often, it is also found on the skin. The attacked fish loses its appetite, and often damage occurs on its gill. The attack on the gill can be serious, in which ulcers occur at part of the gill where the parasite attack the meat tissue of the gill. Treatment of the parasite can be done manually, namely by picking it up directly using a pincer, or by soaking the fish in 200 ppm formalin solution.

Argulus sp

The parasite is thin like a nail, its dimension is 2-3 mm, sticks on the surface of the fish body (skin and gill). *Argulus* has a sucking tool in the form of two antennas resembling a hook and a needle equipped with poison. The characteristics of fish attacked by *Argulus* are the fish swims slowly, its appetite decreases, its colour is rather pale, its scales easily rot, and the fish scrubs its body to the basin wall frequently.

- The treatment of this disease by soaking :
- NH₄Cl 1 1,5 % for 15 minutes
- 200 ppm formalin solution for 1 hour
- 100% freshwater for 10 - 20 minute

Fin rot disease

Caused by several types of bacteria, namely *Myxobacter sp*, *Vibrio sp*, *Pseudomonas sp* and Cocci positive gram. The symptoms of this attack is gill damage. The fish tail looks scraped.

Treatment can be conducted by soaking in :

- 15 ppm Nitrofurazone for 4 hours
- 50 ppm Chloramphenicol for 2 hours
- 100 % freshwater for 10 - 20 minutes

d. Initial Results Of Research

Briefly, the result of the research can be reported on 2 fish germ spreading.

Germ	Survival rate	Last number of fish	Problems
Mud Grouper	65 %	52 fishes	<ul style="list-style-type: none"> - Unskilled human resources - Trash fish feed supply was not guaranteed - Inevitable pollutant - Bad germ condition - Thieves
Mouse grouper	2 %	45 then disappears	

Table 1. First Spreading, location : P. Kelapa (7 months)

Germ	Survival rate	Last number of fish	Problems
Mud Grouper	95 %	52 fishes	Cannibalism of Sea bass germ was difficult to prevent
Mouse Grouper	92 %	189 fishes	
Tiger Gruoper	99,4 %	505 fishes	
Sea Bass	40 %	410 fishes	

Table 2. Second spreading, location: P. Pemagaran (has only been running for 4 months)

Fish type	FR	FCR	SR	DWI	F
Mouse Grouper	5 – 10%	6,3	92%	0.45	Trash fish
Sea Bass	10%	5,5	40%	-	Pelet & Trash fish

Table 3. In detail, the development of fish in the second spreading was as follows :

Note :

- FR (Feeding rate): Percentage of feed given for the total weight of cultivated fish
- FCR (Feed conversion Ratio): Given feed amount to gain 1000 gr of biota weight

- SR (Survival Rate): Survival rate of cultivated biota
- DWI(Daily Weight Increase)
- F (Feed): Type of feed given

IV. CONCLUSION AND SUGGESTION

1. The government program in improving the income and life standard of fisherman and fish cultivator must be a continuous effort and supported by everyone.
2. The mouse grouper fish cultivation is potential to develop and to become the side business of fisherman and fish farmer.

Suggestion

1. It is necessary to conduct further experiments on every aspects of mouse grouper fish cultivation, for instance the effect of solid spreading on the harvest result. The effect of artificial feed enrichment on the larva life sustainability, etc. Therefore, it is expected that the marine cultivation activity can develop rapidly.

REFERENCE

1. Anonim, 1993, **Petunjuk Pelaksanaan Penanggulangan Penyakit Ikan**, Ditjen Perikanan, Direktorat Bina Sumber Hayati, 41p
2. Anonim, 1995, Budidaya Ikan Grouper dalam Kliping aneka artikel/berita ikan grouper, volume 14 No 14, jakarta p:6 - 13
3. Chong ang Cholo, 1986, Common Diseases of Marine Food Fish in Fisheries Handbook No. 2, Singapura, 34p
4. Murni Sutjiati, **Penyakit Ikan**, Universitas Brawijaya, Malang, 184p
5. Djamali A., dkk., 1996. **Biologi Ikan Grouper di Indonesia**. Pusat Penelitian dan Pengembangan Oseanologi - LIPI.
6. Mubiarto, Prof. Dr., 1984. **Nelayan dan Kemiskinan** . Study Ekonomi Antropologi di dua Pantai. CV. Rajawali. Jakarta.
7. Majalah Aqua, 1992. **Majalah Mahasiswa** Fakultas Perikanan Universitas Brawijaya. Vol. 21.
8. Nurdjana, M.L.1996. Pemanfaatan Sumberdaya Laut dengan Teknologi Tepat Guna: Suatu Inisiatif Masyarakat dan Sektor Swasta. Dalam **Seminar Sehari Teknologi Lingkungan dan Pengembangan Bisnis Masa Depan** diselenggraakan oleh Kantor Menteri Negara Lingkungan Hidup dan Atheus, Jakarta.
9. Sukadi, M.F. et al., 1989. **Petunjuk Teknis Budidaya Ikan dalam Keramba Jaring Apung**. Seri Pengembangan Hasil Penelitian No. PHP/KAN/08/1989. Balai Penelitian dan Pengembangan Pertanian. Jakarta.