Aquatic Suitability for the Floating Net Cage System in the waters of Jaya Bakti Village, Banggai Regency

[2]Ali S Laadjim, [1.2]Juliana, [2]Mulis

[1]juliana@ung.ac.id
[2]Department of Aquaculture, Faculty of Fishery and Marine Sciences
Universitas Negeri Gorontalo

Abstract

This study aims to analyze the suitability of the floating net cage system for fish farming and determine its feasibility in the marine waters of Jaya Bakti Village, Pagimana District, Banggai Regency. The research method used is surveys; observing the stations while applying the suitability matrix approach by measuring water quality parameters *in situ*. Suitability level obtained at Station I with a score of 71, at Station II obtained a score of 65 and at Station III the score obtained is 96. The waters of Jaya Bakti Village has the aquatic suitability class category of "very suitable" (S1) at all stations. It has the potential as a very suitable locus to develop a floating net cage (KJA) fish farming system.

Keywords: aquatic suitability; aquaculture; net cage.

Introduction

According to Effendi (2003), aquaculture is a business activity and technology for producing aquatic biota. In terms of utilizing natural resources, marine waters are included in areas that are quite widely used for aquaculture activities. The development of marine aquaculture is an effort to increase production and at the same time is a step to preserve the ability of a harmonious and balanced environment in order to balance the utilization by means of fishing. Aquaculture is a form of management and utilization of water resources that are environmentally sound.

The greatest potential to improve the economic welfare of the community through the fisheries sector is to increase fishery production through aquaculture. The potential for aquaculture reaches 57.7 million tons, consisting of 47 million tons of mariculture or marine aquaculture, 5 million tons of aquaculture, and 5.7 million tons of freshwater aquaculture. The largest potential for aquaculture production is mariculture while the utilization rate is still the lowest at 1.5% (Kordi 2011).

The coastal area of Banggai Regency, Central Sulawesi Province has potential resources for the development of the fishing industry, especially marine aquaculture. This is also supported by the Banggai Regency government's policy to start developing the potential of its natural resources to increase the value of regional fishery production. In the context of utilizing the coastal and marine areas of the Banggai Regency through aquaculture activities that are developed, especially ponds, seaweed cultivation and floating net cage fish cultivation, it must be based on supporting elements. Environmental factors are one of the main elements that support the sustainability of cultivation business activities. The other factors that are supporting factors include technology, socio-culture, community economy, infrastructure and human resources. With the interaction between these factors, it is hoped that optimal utilization of coastal areas can be obtained.

Jaya Bakti Village is an area located on the coast of Pagimana District, Banggai Regency, Central Sulawesi Province, the majority of the population of Jaya Bakti Village are Bajo tribes and most of the people are fishermen. In terms of

utilization of marine water resources, the community has carried out fish cultivation activities with a floating net cage system, but the utilization and development of aquaculture potential is not optimal, this is due to the unavailability of data on the suitability of marine aquaculture development. Therefore, it is necessary to conduct research on the analysis of the suitability of land for fish farming with floating net cages to determine whether the marine waters meet the criteria for fish farming activities or not.

Research Methods

This research was conducted for a month during March 2017. The research location is in the sea waters of Jaya Bakti Village, Pagimana District, Banggai Regency, Central Sulawesi Province. The tools used in this research are GPS (Global Positioning System), secchi disk, litmus paper, DO meter, refractometer, thermometer, prediction ball, roll meter, weight, camera, seawater sample, aquades, tissue.

The procedures carried out in this study are as follows: determining the sampling point or observation station by purposive sampling, namely by determining based on certain considerations that refer to the physiography of the location in order to represent or describe the state of the location. The observation station at this location is determined based on the location that is considered to represent the state of the research location. Observation of the coordinates of sampling is done with the help of the Global Positioning System (GPS). Water quality measurements were carried out three times with an interval of once a week at 09.00 or 16.00 Central Indonesian Time with the in situ method and water samples were taken if needed for analysis carried out through the laboratory. Measurements of physical and chemical parameters of water were carried out, among others, temperature, current speed, brightness, depth, water pH, Dissolved Oxygen, salinity and basic substrate.

Data analysis in this study was carried out through the preparation of a aquatic suitability matrix for fish farming activities with the floating net cage system. Determination of the feasibility of waters for the development of aquaculture with floating net cage systems is carried out by the scoring method. Data on the physical and chemical conditions of the waters are used as a reference in determining the criteria for aquatic eligibility. In the scoring method each parameter is valued with different scores. The scores used are very dependent on the experiments or empirical experience.

The aquatic suitability matrix used to determine whether or not the land is suitable for floating net cage cultivation at the research site refers to the Ministry of Fisheries and Marine Affairs (2002) and the Decree of the State Minister of Population and Environment (2004) as shown in Table 1.

Table 1. Aquatic suitability matrix for floating net cage aquaculture system.

Parameters	Factors	Score 5	Score 3	Score 1
		S1	S2	S3
Current (cm/sec)	3	0,2-0,5	0,1-0,2	<0,1;>0,5
Depth (m)	3	10 - 15	5 -10	<5; >15
Substrate	2	sandy	muddy sand	muddy
DO (ppm)	2	>6	4 - 6	<4
Brightness (m)	2	>5	3 - 5	<3
Temp. (^{O}C)	2	28 - 30	25 - 27	<25; >30
Salinity	2	30 - 35	20 - 29	<20; >35
pH	1	6,5 – 8,5	4-6,4; 8,5 – 9,5	<4; >9,5

Source: Radiarta *et al* (2003), DKP (2002), SK Meneg LH (2004), Romimohtarto (2003), Basmi (2000) in Haumau (2005).

The preparation of the suitability matrix begins with the summation of all scores from each suitability parameter to produce the total score (Prahasta, 2002). To determine the suitability class of marine waters for each land use, it is necessary to determine the score range as seen in Table 2.

Table 2. Range score for suitability evaluation

Score Range	Suitability level	Evaluation
63 – 85	S1	Highly appropriate
40 – 62	S2	Appropriate
17 – 39	S3	Not appropriate

Results and Discussion

Physico-chemical parameters of the waters

The environmental conditions of marine waters that are relatively in accordance with the living conditions of the organisms to be cultivated are a success factor in fish farming. The business continuity of developing fish farming using the floating net cage is largely determined by the selection of the right location. The selection of the right aquatic areas will affect the economic value of cultivation because it requires management costs, fish production levels and the mortality rate of cultivated fish.

Selection of the right location will reduce the risk of permanent failure in production activities. Areas selection should also consider boat or ship traffic, so as not to disturb the floating net cages, so cultivated aquatic areas should be selected in bays, straits between adjacent islands or open waters with long barrier coral reefs. The installation of floating net cages also considers the safety from waves and currents. The waters must be protected from storms and waves. It is better if the selected location is close to small islands so that it is protected from the threat of waves and currents. In addition, it must consider the threat of predators. Some marine animals that often disturb cages include puffer fish and large, vicious fish, such as sharks, so that production can be reduced or even completely lost (Directorate General of Fisheries, 1994).

Other considerations in determining areas for marine aquaculture activities according to (Kordi, 2005) are: current velocity between 20-40 cm/second Current is useful in aquaculture activities for replenishing dissolved oxygen in the floating net cages. A good minimum water depth of 5 m or a distance of 2 meter from the bottom to the net lower edge, this will provide an opportunity for changes in the water mass, especially at the bottom of the net used, and avoid friction with the bottom of the water, in addition, the depth of the water is also useful to avoid buildup waste feed, disturbance of basic organisms, and other impurities in the bottom of the net.

Dissolved oxygen content in water is at least 4 ppm. Oxygen is needed by fish for respiration in water and for the growth of marine fish. For fish farming to be successful, the pH of the water should be between 6,5 – 9,0 and optimal growth of fish occurs at pH 7-8. The pH of the water affects the fertility level of the waters because it affects the life of micro-organisms. Acidic waters will be less productive and may kill the cultured fish. While the optimal temperature for growth and survival of fish ranges from 24-32^{o}C. In general, the waters of Jaya Bakti Village based on the results of in situ measurements of physical and chemical parameters show relatively optimal results and can support fish cultivation with floating net cage systems with the exception of the current velocity parameter. The results of measuring water quality parameters in the waters of Jaya Bakti Village can be seen in Table 3.

Table 3. Water quality parameters in the waters of Jaya Bakti Village

Parameters	Measuremets		
	Station 1	Station 2	Station 3
Current (cm/sec)	0,43	0,55	0,57
Depth (m)	6,99	13,36	11,38
Substrate	Muddy sand	Muddy sand	sandy
DO (ppm)	9,37	10,96	11,18
Brightness (m)	6,03	11,54	10,09
Temp. (^{O}C)	26,1	26,2	25,9
Salinity	31,3	31,6	32,3
pH	7	8	8

The difference in current velocity in each station is thought to be caused by the location of the observation location and the tidal conditions at the time of measurement. The results of current velocity measurements in the waters of Jaya Bakti Village are still at the recommended value although not in the ideal range.

Currents greatly affect water exchange in cages and can also function in cleaning fish metabolic waste, but currents that are too large can damage the infrastructure of floating net cages. In addition, it can also stress the fish because the fish will spend a lot of energy to stay in the cage and being doubted can make the fish's appetite decrease.

The depth at each station varied from 6 to 13 m. This is categorized as very suitable for fish cultivation with floating net cage systems.

The bottom waters of Jaya Bakti Village at are muddy sand and sandy. This can be said to be suitable and very optimal in the development of aquaculture business with floating net cage systems.

According to Mayunar et al.(1995) in Sudradjat et al.,(1995) the design and construction of cages in fish farming with a floating net cage system must be adjusted to the current speed and the conditions of the bottom waters (mud, sand and coral). The bottom condition of the waters is important in determining the type and size of the anchor as well as the distance from the cage to the bottom of the water to avoid turbidity due to undercurrents.

The results of the measurement of dissolved oxygen in the waters of Jaya Bakti village ranged from 9 ppm to 11 ppm. These water conditions are included in the very appropriate class category in assessing the level of aquatic area suitability.

The brightness of the waters of Jaya Bakti Village for the development of floating net cage fish cultivation ranges from 6 m to 11 m. Waters that have a good level of brightness cause sunlight to penetrate deep into the waters. This means that the brightness value is an indicator of the clarity of a waters and is very good for use as a fish farming location.

The water temperature in Jaya Bakti village ranges from 25^{O}C to 27^{O}C. According to Senoaji (2009), although the temperature is not lethal, it can inhibit the cultivation process, because if the temperature rises, the oxygen content decreases so that the photosynthesis process becomes hampered.

From the results of in situ measurements at the research location, it can be seen that the temperature conditions are less than optimal in fish farming with floating net cage systems. This is thought to be caused by changes in the weather at the time of taking measurements at the research location.

The average salinity value obtained during in situ measurements at the research site from the three stations was 31-32 ppt. This value is considered optimal for floating net cages. According to Radiarta et al (2003) a good value for fish culture in floating net cages ranges from 30-35 ppt.

Appropriate salinity will result in the production level of aquaculture activities not being optimal, this is because fish growth will be disrupted. (Hartoko da Alexander, 2009) said that large fluctuations in salinity caused the kidneys and gills to be unable to regulate osmosis of body fluids. Determination of the area for marine cultivation is not recommended in areas that are too close to the mainland because in that area there is a lot of fresh water input which can cause the salinity of the area to be inappropriate.

The degree of acidity (pH) that is good for fish farming activities in the sea is between 6 - 8.5. The standard pH value of the quality of water bodies for aquatic biota life ranges from 6.0 - 9.0. If the waters contain free carbon dioxide and carbonate ions then pH tends to be acidic and the pH will increase again if CO2 and HCO3 begin to decrease. The results showed that there were differences at each sampling station. The marine waters of Jaya Bakti Village have a pH value of 7-8, so based on the pH value these waters are very suitable for fish farming.

Aquatic suitability analysis

Determination of aquatic area suitability for fish farming with floating net cages refers to a suitability matrix scoring method based on measurements of various water physical and chemical parameters.

Analysis of the aquatic area suitability for fish cultivation with floating net cages is divided into 3 suitability classes, namely: very suitable (S1), meaning that this land has the potential to be developed for fish cultivation with floating net cages and does not have limiting factors on the utilization to be applied; appropriate (S2) means that this land is still possible to be used even though it has some limitations but is not permanent; unsuitable (N) means that this land has a permanent barrier so that it cannot be utilized and is more suitable to be used as a conservation area. The results of the evaluation of suitability classes for floating net cages are presented in Tabel 4.

Table 4. Evaluation of aquatic area suitability matrix for floating net cage system.

Stations	Score	Suitability	Evaluation
1	71	S1	Highly appropriate
2	65	S1	Highly appropriate
3	69	S1	Highly appropriate

All of the observed station points had a suitability level of S1 (Highly approppriate), meaning that the marine waters in Jaya bakti village are very suitable for fish cultivation development land.

Conclusion

All observation stations showed an appropriate range for fish cultivation and safe for fish farming activities with a floating net cage system.

The aquatic area suitability matrix analysis shows that the waters, in general, are in class S1 (Highly Approppriate) for floating net cage system. This means that the sea waters of Jaya Bakti Village, can be categorized as a suitable location for the development of fish cultivation.

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