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The Bioprospecting of Mangrove Red Snapper Cultivation (*Lutjanus argentimaculatus* Forsskål, 1775) Using Floating Cages

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Abstract

Mangrove red snapper is one of the potential and valuable aquaculture products. The high demand for this fish causes high fishing activities. This condition can threaten their existence in the environment. It is necessary to have aquaculture activities to preserve their existence and meet market demand. Indonesia as a country with wide marine waters should be able to take advantage of the potential of fish farming by using a floating cage system. Thus, this article was written to analyze the bioprospecting of red snapper aquaculture. Based on the literature study, the floating net system has the potential to be developed on a large scale because the system has various advantages over fishing directly from nature. Things that must be considered in the cultivation of mangrove red snapper using floating nets are the area and quality of the floating nets, the composition of the feed, and the chemical components of the feed given to the fish. Based on economic potential, mangrove red snapper cultivation has high prospects which can be used as one of Indonesia's leading export products.

Keywords: Aquaculture; Feed; Floating Net Cages; Snapper.

Abbreviations: AMP (L-Ascorbyl-2-Monoposfate-Mg); FCR (feed conversion ratio), HCG (Human Chorionic Gonadotrophin); Pb (Puberogen)

INTRODUCTION

The high growth of the human population in the world causes the need of increasing food sources, including food sources containing protein. Fish is an important source of animal protein for humans. However, fish consumption in Indonesia is still relatively low when compared to other country such as Japan. It means that fish farming in Indonesia has yet fulfill animal protein needs of the Indonesian people (Langkosono, 2007).

Red snapper (*Lutjanus argentimaculatus*) is a potential source of fishery culture in Indonesia. The high demand for red snapper encourages the cultivation of red snapper which can reduce dependence on wild-caught red snapper supply. Some of the advantages of red snapper cultivation are relatively fast growth rate, high tolerance for water turbidity and salinity, low cannibalism, tolerance for high fish density, and good consumption of artificial feed (Melianawati and Aryati, 2012).

Red snapper (*L. argentimaculatus*) is one of the aquatic commodities with high economic value. The price in the international market in 2003 ranged from USD 5,50 to USD 18,10. In Indonesia, the price is quite varied. In 2011, in West Java Province, the price of the fish was Rp. 35,000/kg (Yasad, 2011; Melianawati and Aryati, 2012). In Lampung, the price of the fish ranged from Rp. 40.000 to Rp. 50.000. Red snapper is a commodity that is in great demand by the public, so the cultivation and production of red snapper is very potential and promising (Melianawati and Aryati, 2012).

Red snapper is one of the most popular fish in Southeast Asia. The high demand for red snapper has not been matched by cultivation at this time, the supply still relies on direct catch from nature which is seasonal, varied, unstable, and less sustainable. In addition, several red snapper cultivation activities are carried out by directly catching the young snapper in the estuary or beach area. This results in a threat to the sustainability and abundance of these fish in nature. Thus, it is necessary for cultivation to be carried out so that the red snapper population in nature is maintained (Chi and True, 2017).

Cultivation of red snapper can be done by using floating cages in the sea. The floating cage is a place made of nets tied to a frame, square in shape, with a size that can reach hundreds of square meters. The size of the cage can be adjusted to the size and number of fish to be cultivated. These cages can be placed in bays, lakes, or reservoirs (Purba, 1994). However, there are several factors that can affect the success of the red snapper (*L. argentimaculatus*) cultivation. Some of these factors are feed, feed composition (Giri et al., 2007), design of floating net cages, as well as various environmental factors such as temperature, salinity, light, and so on (Affan, 2011). Thus, in this paper, the authors discuss several factors that determine the success of red snapper cultivation in more detail.

METHODS

The writing of this paper was carried out by exploring various literature related to red snapper cultivation and other related sources. A literature study is an activity of searching various sources of information or reading thoroughly on a topic to be discussed. Materials or sources of information that can be used in library research include books, journals, magazines, and other sources. The steps in the literature study are choosing topics to be discussed, exploring topics and related information, conducting research focus, collecting information sources, managing and presenting data, and compiling reports (Sari, 2020).

The data used in writing this paper is secondary data. Secondary data is data obtained indirectly. Secondary data is obtained from various data sources, such as the internet, statistical data, books, journals, and so on (Tanujaya, 2017). In writing this paper, secondary data were obtained from journals and theses related to red snapper cultivation.

RESULTS AND DISCUSSION

Mangrove Red Snapper (*Lutjanus argentimaculatus*)

Snapper belongs to the Lutjanidae family, which consists of 103 species. These fish live in shallow to medium sea areas to a depth of 100-500 m. These fish are classified as predatory fish. Snapper is actively looking for prey at night. The natural foods for these fish are crabs, shrimp, small fish, plankton, and squid. In general, snapper reproduces by involving mating between female and male snapper (WWF-Indonesia, 2015). One of the snappers that are known among the public is the red snapper.

Figure 1. The morphology of mangrove red snapper (*Lutjanus argentimaculatus*) (obtained from fishider.org).

This fish has a distribution area that includes the Indo-Pacific waters, the Line Islands in North Africa to the waters of Australia, and the Ryukyu Islands, Japan. These fish can be found in bays and beaches, to estuaries (Purba, 1994). The classification of red snapper is as follows:

Kingdom : Animalia
Phylum : Chordata
Class : Teleostei
Order : Perciformes
Family : Lutjanidae
Genus : Lutjanus
Species : *Lutjanus argentimaculatus* Forsskål, 1775

The red snapper has a slightly flattened body, the back is higher, the head is pointed, the upper jawbone sinks when the fish opens its mouth. The fish has a forked caudal fin, red on top, and silvery-white on the underside. The dorsal fin has 10 spines, 13 to 15 weak rays, the anal fin has 3 spines and 8 to 19 weak rays, the pectoral fin has 14 to 15 rays weak finger. The lateral line consisted of 45 to 48 pieces. The structure of the gill cover in these fish is grooved (Purba, 1994).

The existence of red snappers in nature is also influenced by their habitat. Red snapper spawning occurs in estuaries. The destruction of the estuary area causes red snapper spawning to decrease. This also has an impact on the red snapper population in nature (Chi & True, 2017). Red snapper fry is often found in the river estuaries that are in direct contact with mangroves with a salinity level of 10-25 ppt. The tillers are found on rocks and sandy areas. Saplings aged 3-10 cm are often found on rocks. Tillers measuring less than 3 cm are often found in sandy areas and seaweed. The natural feed for red snapper fry is shrimp, small fish, zoobenthos, and zooplankton (Chi & True, 2017).

Snapper (*Lutjanus* sp.) is one of the demersal fish that has high economic value and is in demand by the public. Snapper is not very active, can form small groups, the migration rate is not too far, and the life cycle is stable. This is because this fish lives on the seabed which is relatively more stable than the surface. Coastal degradation is one of the threats to the existence of this fish. The distribution area of snapper is not too wide so environmental degradation will directly affect the existence of these fish. In addition, the high fishing activity causes the population to become increasingly threatening in nature (Sriati, 2011).

Reef fish such as snappers play an important role in ecological functions. The presence of these fish in their habitat supports the productivity of the habitat. However, fishing for reef fish that is not environmentally friendly has caused damage to these habitats. Until now, about 75% of coral reef habitats in Indonesia have been damaged due to destructive fishing by fishermen. In addition to habitat destruction, another factor is the over-exploitation of these fish. Some fishermen use potassium or a kind of anesthetic poison to catch the fish. This is because the selling price is higher when the fish are still alive (WWF-Indonesia, 2015).

Cultivation of Mangrove Red Snapper (*Lutjanus argentimaculatus*)

Indonesia is the second-largest producer of cultivated fish in the world after China. In 2012, aquaculture production in Indonesia reached 9.675.553 tons. The production of snapper itself ranks fourth with total production reaching 6.198 tons. From 1999 to 2012, the percentage increase in snapper production in Indonesia increased by 11.43% (Ministry of Marine Affairs and Fisheries, 2013; Giri et al., 2007).

The cultivation of red snapper attracts attention because of its high growth. Red snapper is a euryhaline fish that has good adaptation to salinity concentrations in the waters. This fish is able to live in waters containing high salinity of 35 ppt to freshwater with a salt concentration of 0 ppt. This ability causes the red snapper to have the potential to be cultivated in ponds filled with fresh water. The development of red snapper cultivation in freshwater opens new opportunities for entrepreneurs and the community in providing a supply of red snapper stock in the market (Muyot et al., 2021).

Cultivation of red snapper can be done by giving a stimulant hormone. The hormones used in the spawning induction are HCG (Human Chorionic Gonadotrophin) and Pb (Puberogen) hormone. Induction is done by injecting hormones into the body of the fish through the back of the pectoral fins, in the area between the backs, or on the line of the ribs. The size of the broodstock of red snapper that is ready to spawn is 3 kg to 7 kg. At this weight, the broodstock red snapper is about 4 to 5 years old. In general, red snapper gonad maturation occurs in January and October. The best spawning time for red snapper is 11:00 am to 04:30 pm (Purba, 1994).

In the cultivation of red snapper, it is necessary to pay attention to feeding. The quality and nutritional content of the feed given must be maintained so that the cultivated snapper can grow well. Availability of feed is one of the determining factors for the success of red snapper cultivation. In providing appropriate feed, it is necessary to pay attention to the adequacy of nutrients or macro and micronutrients needed by the fish. However, feeding should be done by having a feed that has economic value so that it can maximize the benefits that will be obtained from the red snapper cultivation process (Giri et al., 2007).

One of the important sources of nutrition in the process of fish growth is the provision of protein-containing feed. Protein is one of the important nutrients for the growth of red snapper. Provision of optimum feed protein levels can stimulate the growth process of fish. However, protein levels in the feed must be considered and adjusted to the needs of the fish. The protein content in the feed must also be adjusted to the content of other nutrients so that the desired growth rate of fish can be achieved so that the yield will be high (Giri et al., 2007).

Cultivation of mangrove red snapper in freshwater is also very potent. The analysis that should be carried out in cultivaing are the growth rate, endurance, feed conversion ratio (FCR), and the profit. Cultivation of red snapper in freshwater ponds can be fed in the form of dry pellets. Acclimatization that can be done on red snapper to the level of salinity is carried out for 1 to 2 weeks. Cultivation of red snapper in freshwater can be done in rivers, ponds, or lakes. The use of cages can maximize the number of fish cultivated, the costs used are also economical, also valuable (Muyot et al., 2021).

Cultivation of Mangrove Red Snapper (*L. argentimaculatus*) using the Floating Net Cage System

Fish cultivation in the open ocean can be carried out using a floating net cage system. A floating net cage is a container that is placed in the water and filled with fish that is used to maintain the cultured fish. The cages must have an effective and strong design so that they are durable (Tatengkorang, 2020).

The success of fish culture in waters is determined by the carrying capacity of the aquatic environment. The carrying capacity of the environment is the ability of an environment to support the life processes of living things in the long term. The carrying capacity of the environment is the ability of the environment to support the welfare of the life of living things that live or exist in the environment. In another sense, the carrying capacity of the environment is closely related to the availability of natural resources and environmental factors in determining the rate of life of living things. The environmental carrying capacity of waters is very important for the success of aquaculture in that environment (Anrosana & Gemaputri, 2018).

The level of depth of water used in fish farming determines the success of aquaculture. The depth from the bottom of the cage to the optimum bottom at low tide is about 4-5 m. the depth of the cage and the waters used to determine whether or not a location is suitable for use as a fishery cultivation area. Another factor that also influences is the level of lighting or water brightness. This is related to the level of light penetration into the waters. The level of water clarity is influenced by the presence of suspended particles in the water environment. Light is needed by photosynthetic organisms to carry out the process of photosynthesis. This is very necessary for the phytoplankton contained in the cages to carry out the photosynthesis process. The phytoplankton can also be used as natural food for fish cultured in cages. The optimum brightness value for aquaculture in the sea is 70.35% (Affan, 2011).

Another factor that also affects the success of aquaculture is strong currents. The flow rate of water in an environment will affect the distribution of suspended particles in the water. In addition, currents are also related to the amount of dissolved oxygen in the waters. The design and construction of cages must be adapted to the flow of water. This is because the strength of the current can reduce the risk of fouling in the cages used. If the current is less than 25 cm/sec, the fouling organisms will be more easily attached to the cages used. The attachment of fouling organisms will reduce and disrupt the circulation of dissolved oxygen in the cage. The minimum current velocity that can still be used in cage cultivation is 5-15 cm/sec (Affan, 2011).

Temperature also plays an important role in the success of aquaculture in waters. Temperature affects the metabolic rate of cultured organisms. An increase in temperature can reduce dissolved oxygen levels in the water. Thus, at too high temperatures, the respiratory activity of the cultured fish will be disturbed. The optimum temperature in fish farming is 27-37 ^{o}C (Affan, 2011). Dissolved oxygen is one of the key factors in fish farming. Lack of dissolved oxygen can reduce the consumption of fish feed, this results in the inhibition of the growth of the fish (Riadhi et al., 2017).

Fish farming using cages placed in saltwater or the sea is also affected by salinity. The optimum salinity in the cultivation is 30-35 ppt. However, the optimum salinity must be adjusted to the type of fish to be cultivated. Certain fish have a higher salinity tolerance value than other species. The degree of acidity or pH of the water environment used also affects the success of the cultivation carried out. The pH value of seawater, in general, is in the range of 7.5-8.4. The closer to the river estuary area, the pH will change due to the influence of freshwater flowing into the sea (Affan, 2011).

One of the factors that cause the failure of fish farming is the presence of parasites that attack the cultured fish. Endoparasites are parasites that usually attack the organs and body cavities of cultured fish. Some of the endoparasites that attack fish are nematodes, trematodes, cestodes, and several types of protozoa. The parasitic infection causes the growth of fish to be stunted. Parasitic infection also causes a decrease in the consumption of fish feed. Another thing to worry about is the zoonic nature of the parasite so that it can infect humans who eat the fish (Puspitarini et al., 2018). The endoparasites reported infecting red snapper are *Anisakis physeter* and *Cucullanus heterochorus*. *Anisakis* larvae at stage two can be eaten by small fish which are then eaten by red snapper. Then it will develop into a third-stage larva in red snapper. One of the factors that cause red snapper infection is a dirty water environment (Puspitarini et al., 2018).

In Indonesia, a lot of fish farming is also done openly in nature. The cultivation is carried out using floating cages placed in reservoirs, rivers, ponds, and so on. Aquaculture can be divided into two, namely marine aquaculture and freshwater aquaculture. Both types of cultivation have their own characteristics. In fish farming, there are several subsystems that are interconnected with each other. The system includes the procurement of facilities and infrastructure, production systems, post-production systems, and supporting sub-systems. In the production subsystem, various cultivation activities are involved, starting from the initial maintenance process to harvesting. The system also involves feeding the cultured fish (Deswati & Adrison, 2019).

Some of the advantages of aquaculture using cages are that it can maximize the location of the waters as a location for fish cultivation, the population of cultivated fish is easy to control, avoids predators, is easy to transfer, is more economical, can maximize the water used, maintained water circulation, is easy to harvest, and lower maintenance costs. low (Purba, 1994).

Red snapper cultivation includes several activities. These cultivation activities include parental rearing, larval rearing, and seed maintenance. One of the determining factors for the success of red snapper cultivation is the eggs to be developed. When the eggs have hatched and developed into larvae, the feeding and the amount of feed given should be appropriate. In the larval phase, the food for the red snapper chicks can be in the form of small rotifers that match the larval mouth opening (Melianawati & Aryati, 2012).

Marine fish cultivation using floating cages has several impacts on fishermen. In fish farming using floating cages, feed is given to support the growth process of the fish. Not all of the feed given will be eaten by the fish in the cage, some of the feed will be released into the environment outside the cage. The positive side of this is the approach of the fish in the cages to the cage area so that it can help fishermen in harvesting fish in the area (Deswati & Adrison, 2019).

Meanwhile, incentive feeding can also be misused as a “feed pump”. The feed pump is an excessive feeding of fish that is carried out continuously until the fish that are cultivated are completely full. This practice leads to overfeeding. Overfeeding is a bad practice for feeding fish. This excessive feed reduces feed efficiency and increases the amount of feed that is wasted in the environment (Deswati & Adrison, 2019). Excessive feeding in fish farming activities using cages in the ocean is the potential for upwelling. The upwelling that occurs is caused by the buildup or deposition of excessive feed and accumulates below sea level. This triggers a backflow due to changes in water temperature. This backflow will bring the leftover feedback to the surface which can eventually poison the fish in the cage (Deswati & Adrison, 2019).

A study on the cultivation of *Lutjanus* species using floating net cages had been carried out by Castillo-Vargasmachuca et al. (2012). It was conducted to observe the growth of pacific red snapper (*L. peru*). The results of their study stated that the fish had a potential growth rate and biomass. The cultivation process using floating net cages also is prosperous to be developed on a commercial scale to meet market demand. Another study was conducted by Castillo-Vargasmachuca et al. (2007) who analyzed the growth of rose snapper (*L. guttatus*) cultivated in floating cages. They found that the cultivated fish had a high survival rate. Subadults have a survival rate of up to 74.7%. However, some aspects need to be considered in cultivating this fish in floating net cages, such as the availability of natural feed.

Marine cultivation or sea farming in Indonesia is highly prosperous as a maritime country with most of its territory consisting of sea water. If this potential can be optimized, the community's economy will also be higher. Still, the cultivation process requires strong management effectiveness (Sunardi et al. 2020). Therefore, in this paper, the authors discussed the bioprospecting of mangrove red snapper cultivation using floating net cages, as well as feed needs and the economic bioprospects.

Mangrove Red Snapper (*L. argentimaculatus*) Feed Needs

The concentration of certain proteins in the feed can affect the rate of feed consumption by farmed fish. Improper protein levels will reduce the rate of feed consumption by the fish. a feed with protein concentrations of 32% to 40% did not reduce the rate of fish feed consumption. However, increasing the protein content to 52% reduced the consumption of red snapper feed. As a result, the higher the protein content in the feed, the faster the protein needs to be needed by the fish will be fulfilled so that the consumption of fish feed will decrease. As a result, the rate of feed consumption by sea bass is low when the protein content is too high in the feed (Giri et al., 2007).

Feed efficiency is influenced by the protein content in the feed. Feed efficiency is the proportion of the addition of fish biomass to the amount of feed given and consumed by the fish. The higher the feed efficiency value, the better the quality of the fish feed. In red snapper, the highest feed efficiency is in feed containing protein with a concentration of 40% or more than 40%. Thus, at this concentration, red snapper were able to utilize their feed efficiently for increasing their biomass (Giri et al., 2007).

In the red snapper feed, the protein content in the feed was 45.4%, the fat content was 9.3%, the fiber content was 1.7%, the ash content was 13.8%, and the nitrogen-free extract was 29. 8%. In the feed also added other substances such as beta-carotene which will stimulate redfish meat. In addition, some vitamins are added to support the growth process of the snapper (Catacutan et al., 2011).

Vitamin C is very important for the growth of red snapper. The addition of L-Ascorbyl-2-Monoposfate-Mg (AMP) affected the growth of the red snapper. The increase in the bodyweight of the fish increased 6 times for 17 weeks. The weight growth decreased on day 60 on media that did not contain AMP. Fish that were not given AMP experienced several abnormalities, such as swelling of the eyes, soft bodies, and abnormalities in the fins. This abnormality is caused by an abnormality in the synthesis of collagen. AMP deficiency causes collagen synthesis to be strained so that the process of forming connective tissue in these fish is abnormal (Catacutan et al., 2011). Protein requirements in the feed are adjusted to the type of fish being farmed. Each species of fish requires varying levels of protein. In addition, the protein content of the feed must also be adjusted to the size of the fish, the quality of the protein, the energy content of the feed, the nutritional balance of the feed, and the level of feeding (Furnichi, 1988; Giri et al., 2007). Protein quality is determined by the profile of amino acid content of the protein. The amino acid content in feed determines the adequacy of protein needed by fish (Giri et al., 2007).

One source of protein feed is fish meal. As for other protein sources, namely vegetable protein derived from nuts, seeds, such as soybeans. However, not all types of fish can utilize these vegetable protein sources properly. The provision of protein in the diet of fish also determines and affects the protein levels of the fish's body. The higher the protein content fed, the higher the protein concentration in the fish's body. In the feed containing 32% protein, the total protein of red snapper was 54.7%. Meanwhile, feeding containing 40% protein produced red snapper with 58.7% body protein. Meanwhile, feed containing protein with a concentration of 52% resulted in red snapper containing 61.9% protein (Giri et al., 2007).

Feeding done three times a day (morning, afternoon, evening) can increase the amount of feed that is wasted in the environment. In this feeding, as much as 25-30% of the feed given is wasted in the environment. In cultivation with a fast and flowing water environment, an excess feed can be channeled to other areas so that it does not accumulate in that area. However, if cultivation is carried out in a calm aquatic environment, there will be a buildup of feed at the bottom which causes an accumulation of phosphate and nitrate. This will reduce water quality and interfere with the health of the fish (Deswati & Adrison, 2019).

Natural feeed found in red snapper (*L. argentimaculatus*) especially in the juvenile phase is *Acetes indicus*, *Acetes* sp., some members of Mysidae, and some zooplankton such as *Clanoida* and *Melita longidactyla*. In addition, they also found feed in the form of members of the Luciferidae, Alpheidae, and so on (Chi & True, 2017).

In general, the sufficient protein content in feed ranges from 30% to 55% (NRC, 1993; Giri et al., 2007). In carnivorous fish, such as grouper, the protein requirement given in the feed reaches 47% to 60%. Red snapper is also a carnivorous fish. Thus, the protein requirement in a red snapper is also relatively high (Giri et al., 2007).

Research by Giri et al., (2007) showed that the protein content in the feed affected the rate of fish weight gain, feed consumption, feed efficiency, and growth of red snapper fry. Provision of red snapper feed containing protein with a content of 32% resulted in a low growth rate and mass weight gain of snapper. Feeding with a protein content of up to 40% resulted in the maximum growth rate and weight gain of snapper. However, feeding with protein content exceeding 40% did not significantly affect the weight gain and growth of red snapper. Thus, in this study, the optimum protein concentration in the feed was 40%.

Giving excessive levels of protein in the fish feed will cause a negative effect. The negative effect that arises is in the form of slowing the growth rate of fish. Excessive feeding results in not having enough energy for fish cells to manage these proteins. This causes an increase in the rate of deamination and excretion of excess amino acids due to the high protein in the feed consumed by fish. In addition, the negative impact of adding feed with too high a protein content is that it can reduce the growth rate of fish (Giri et al., 2007).

In addition, other nutrient compositions such as vitamin C are also needed. The addition of L-Ascorbyl-2-Monoposfate-Mg (AMP) affects the growth of red snapper. The increase in the bodyweight of the fish increased 6 times for 17 weeks. The weight growth decreased on day 60 on media that did not contain AMP. Fish that were not given AMP experienced several abnormalities, such as swelling of the eyes, soft bodies, and abnormalities in the fins. This abnormality is caused by an abnormality in the synthesis of collagen. AMP deficiency causes collagen synthesis to be tense so the process of forming connective tissue in these fish is abnormal (Catacutan et al., 2011).

Giving AMP as much as 60 mg/kg of feed weight is equivalent to giving ascorbic acid as much as 20 mg/kg of feed. This composition is a good composition in overcoming Vitamin C deficiency in red snapper. Administration of AMP in this concentration was effective in supporting the weight growth of red snapper. However, the addition of AMP in higher doses had no effect on fish weight gain. Addition in too high a dose can be toxic to red snapper cells (Catacutan et al., 2011).

Economic Aspects of Mangrove Red Snapper (*L. argentimaculatus*) Cultivation

Fish is one of the foodstuffs that contain high protein needed by body cells. Fish, in general, contain 18-20% protein which is good for the body. Thus, fish has become an important commodity in the economy. One of the fish with high economic value is the red snapper (Reo, 2013).

Based on FAO, from 2010 to 2013, the average catch of red snapper in Indonesia is the highest in the world. The supply of snappers from Indonesia reaches 48.3% of the total supply of snappers in the world. This amount is equivalent to more than 120,000 tons. Next, followed by the Philippines with a total percentage of 8.1%, Brazil 7.7%, Malaysia 7.3%, Mexico 4.9%, Nigeria 3.1%, Thailand 2.0%, Venezuela 1.8%, US 1.8%, and Australia 1.6%. Meanwhile, according to FAO in 2014, the number of import and export markets for snappers has increased significantly. Global snapper export activities in 1990 were around 5.000 tons and increased to more than 10.000 tons. Meanwhile, global snapper import activity in 1990 amounted to 5.000 tons until in 2010 it has increased to 25.000 tons. Meanwhile, the United States is the highest importing country of snapper in the world. The imports come from Mexico, Brazil, Nicaragua, Panama, and Suriname (Amorim & Westmeyer, 2016).

Mangrove red snapper is a high-value aquatic product. Market demand for these fishes is also relatively high with relatively high prices. Red snapper is the most popular snapper in various restaurants in Singapore and Hong Kong (Muyot et al., 2021). Based on FAO (2018), global red snapper production in 2016 reached 9,815 tonnes, which came directly from fishermen's catch, and 10,240 tonnes came from aquaculture. The highest fish farming comes from Southeast Asia. Many of these fish are cultivated using floating cages placed directly in the ocean and using brackish water ponds (Muyot et al., 2021).

Fish that live in reef areas such as snapper and grouper are a very important resource. From an economic point of view, this fish is one of the leading commodities and is the livelihood of fishermen in Indonesia. Indonesia's reef fish production reaches 7% of the world's total reef fish production. This amount is one source of foreign exchange for the country (WWF-Indonesia, 2015).

CONCLUSIONS

The factors that influence the success of red snapper (*L. argentimaculatus*) cultivation using a floating net cage system are the size of the cage, the density of fish in the cage, feeding, and other environmental factors such as temperature, pH, dissolved oxygen, and salinity. Analysis of the growth of red snapper (*L. argentimaculatus*) cultivated using a floating net cage system which includes fish weight gain, absolute growth, specific growth rate, FCR, and Survival Rate. Red snapper is classified as a carnivorous fish so it requires feed with a protein content of 40%.

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