

Study of Exploitation of Marine Ornamental Fish by Utilizing Artificial Reefs as A Solution for Coral Reef Rehabilitation in Barru Regency

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ABSTRACT

This study aims to determine the diversity of marine ornamental fish species found in natural coral reefs and artificial reefs. This research is descriptive in nature, data collection was carried out by observation or direct observation in the field by catching using nets and sero every 4 days for three months at coral reef and artificial reef locations. The catch is recorded based on the location of the catch. In this study, an artificial reef was created with a concrete construction design in the form of rectangular blocks/boxes. The types of fish caught on natural coral reefs are the parrot fish in the Scaridae family, Trigger fish in the Balistidae family, Titang fish in the Acanthuridae family and Lepu fish in the Scorpaenidae family. Types of fish caught on artificial reefs are; Bracelet giru, Giru striped, waru flower, Sekar spurs, Lencan, Peperek, Tompel, Betok sebra and Trigger

INTRODUCTION

Indonesia is one of the richest countries in ornamental fish species compared to several other ornamental fish producing countries such as Poertorico, Hawaii, the Philippines, Thailand and others (Livengood et al, 1980) and has approximately 253 species. The high diversity of marine ornamental fish species can be a source of foreign exchange in terms of tourism and aesthetics that can be traded. Ornamental fish from Indonesian coral waters have a fairly high selling value such as kepe-kepe from the Chaetodontidae family. This high economic value is the basis for fishermen to utilize ornamental fish in coral waters by using various fishing tools such as bubu, ring nets and even by anesthesia.

The potential of ornamental fish business in Indonesia is supported by the many species of ornamental fish native to this country. For seawater ornamental fish, Indonesia has more than 700 types of species. Indonesia actually has the potential to earn US \$ 60 million-US \$ 65 million per year from ornamental exports, and can become the world's largest exporter of ornamental fish. Data from the Indonesian Ornamental Fish Council (DIHI) states that the value of the global ornamental fish trade reaches US \$ 5 billion with a growth of 8% per year. Of this value, as much as 85% are freshwater ornamental fish and the remaining 15% are marine ornamental fish. The types of marine fish that can be used as marine ornamental fish (household aquarium scale) are crustaceans (example: crabs, hermit crabs and crustaceans); mollusks (e.g. snails, clams and scallops); echinoderms (e.g. starfish, sand-dollars and sea urchins) and other reef fish species (Anon, 2011a).

In general, the supply for local or world marine ornamental fish markets comes from marine ornamental fish fishing in nature (sea), and very rarely comes from captivity or cultivation. To catch this marine ornamental fish, fishermen usually use fishing gear such as beach trawls - small, dipnets, and bubu traps while to collect them, fishermen generally dive using natural divers (masks, snorkels, scuba) equipped with hand nets, fish storage bags and also barrier nets.

Most ornamental fish fishermen are indeed indicated as potassium users, therefore one of the factors for the destruction of coral reef ecosystems due to human pressure is this environmentally unfriendly fishing practice. The poor image of ornamental marine fish fishermen so far is not entirely true, because there are still many marine ornamental fish fishermen who already understand the impact caused by the use of potassium and do not use methods that damage coral reefs in catching marine ornamental fish.

LITERATUR REVIEW

One group of marine life that lives in coral reef areas and has high economic value is reef fish. Reef fish apart from being consumption fish also have value as ornamental fishes. According to Dartnall & Jones (1986), reef fish can be grouped into three groups based on management objectives, namely target fish groups (economic / consumption fish), indicator fish groups and major fish groups (play a role in the food chain).

Reef fish communities have species diversity comparable to the species diversity of stony corals. This high diversity is caused by variations in habitats on coral reefs, where all habitat types are filled by reef fish species (Emor, 1993). About 50-70% of fish on coral reefs are carnivorous fish groups, 15-20% herbivores and the rest are omnivores. Fish from these groups rely heavily on coral health to develop their populations. Most reef fish have high diversity, a large number of species and a wide morphological range (Nybakken, 1988).

METHODOLOGY

Research Material

a. Concrete Blocks

In this study, artificial reef concrete construction design in the form of rectangular blocks / boxes was made as follows:

- Make concrete molds measuring 30 cm long, 15 cm wide and 13 cm high. The mold is made of wooden boards on the inside covered with aluminum plate.
- Prepare a concrete mixture consisting of cement, sand, and gravel in a ratio of 1: 2 : 3.
- The concrete mixture is poured into the mold and to make a hole (hole diameter) about 10 cm, on the concrete block it is temporarily placed glass bottle in the middle of the mold. Holes are made as many as 2 pieces.
- The concrete is opened from the mold after 2-3 days and then placed in the shade for 15 days to dry completely
- The amount of concrete to be molded is 150 pieces

The prepared concrete blocks are transported to the research site with the following steps:

- Concrete blocks are transported using motorboats, the amount of which is adjusted to the carrying capacity of the motorboat
- Beam drop positioning using GPS
- Lowering concrete blocks by hugging to the bottom of the water one by one using a stretched rope.
- After the concrete blocks are lowered (about 50 pieces) then assembled or arranged by tying one to another using plastic ropes so that an artificial reef colony is formed.
- Furthermore, the decline of concrete as an artificial reef is carried out in another location. The number of artificial reef colonies to be lowered is as many as three

b. Fishing Gear

The fishing gear used to exploit reef fish / ornamental fish in this study were barrier nets (gill nets) and scoop nets. The mesh is rectangular, the net

length is 80 m, the width / height is 1.2 m, the mesh size is 1.5 inch made of nylon monofilament (PE). The way to operate fishing gear is by diving using scuba aids around natural coral reefs and artificial coral reefs. Then herd the fish towards the barrier (net), for large fish that are caught in the net collected with fingers, while for small fish in a skirt then put into a container / jerry can containing sea water and aeration.

c. Supporting equipment

Tools used to help smooth the operation of this research include; boat, scuba, snorkel, GPS map Garmin 76 CSX, hand refractometer Atago salinity 0-1000/00, seichi dish, DO meter 12 D 100902 YSI 55044 (oxygen and temperature), underwater camera, plastic bucket size 10 liters, hose 5 meters, aerator and identification book (Marine Fishes of South-East Asia).

Data Retrieval

This research is descriptive, where data collection is carried out by observation or direct observation in the field by catching using nets and seros every 4 days for three months at coral reef and artificial reef locations. The catch is recorded based on the location of the capture. Similarly, environmental parameters in the form of temperature, salinity, oxygen and brightness will be measured at the time of fishing.

RESULTS AND DISCUSSION

Artificial Coral Making

Artificial corals are made with a concrete construction design in the form of rectangular blocks/boxes. Material / material consists of Type II portland cement, sand, krikil with a ratio of 1: 2: 3 as for how to make it as follows: making concrete molds measuring 30 cm long, 15 cm wide and 13 cm high. The mold is made of wooden board on the inside coated with aluminum plate; prepare a concrete mixture consisting of cement, sand and gravel; The concrete mixture is poured into the mold and to make a hole (hole diameter) about 10 cm, on the concrete block it is temporarily placed glass bottle in the middle of the mold. Holes are made as many as 2 pieces; concrete is opened from mold after 2-3 days and then placed in the shade for 15 days so that it dries completely; The amount of concrete to be molded is 150 pieces. According to Anon (2017) in accordance with the aims and objectives of making artificial reefs, objects placed in waters have certain conditions: have durable properties; have many holes or crevices to protect marine life; avoid deposits; does not interfere with the activity of ship traffic; Not polluting to waters.

Artificial reef that has been made is left for several days (± 15 days) so that the material is arranged more densely and massively. Furthermore, concrete blocks are transported using motorboats whose amount is adjusted to the carrying capacity of motorboats, positioning / location of artificial reef using a global positioning system (GPS).



Figure 1. Laying Artificial Reef at Research Site

Concrete blocks are laid by stretching to the bottom of the water one by one using a stretched rope, after the concrete blocks are lowered (about 50 pieces) then assembled or arranged by tying one another using plastic ropes so that an artificial reef colony is formed. The subsequent lowering of concrete blocks was carried out at another location. The number of artificial reef colonies to be lowered is as many as three pieces.

Maintenance and Monitoring

There is nothing special about artificial reef maintenance, but the thing that needs to be considered is checking the condition of the position of the building / reef made whether it is damaged due to natural or human influences.

Catch Retrieval

The capture is taken after the artificial reef installed / embedded in the sea is left for some time about three months, the length of time depends on the conditions of the waters / oceanographic environment that affect the growth of algae, or a group of coral animals that are symbiotic with a type of algae plant called zooxanthellae.



Figure 2. Several Types of Ornamental Fish Began to Penetrate the Installation Site of Artificial Reef

After being overgrown by these types of algae, usually marine ornamental fish will approach the reef to find food or shelter around the reef for details can be seen in Figure 3. The fishing gear used to exploit reef fish / ornamental fish in this study is a barrier net (gill net) in the shape of a rectangle and scoop net as recommended by Idris in Anon (2011a). Net length 80 meters, width / height 1.2 meters, mesh size 1.5 inch. Gill nets are used to catch large ornamental marine fish, while small fish use scoop nets.



Figure 3. One Type of Ornamental Fish That Is Caught With Nets Installed Around Coral Reefs

The way to operate fishing gear is by diving using scuba aids around natural coral reefs and artificial coral reefs. Fish caught in the net (Figure 4) and entered in the scoop net were taken and put into a 5-liter container (jerry can) containing aerated seawater. At the time of taking the catch, oceanographic parameters (salinity) were also measured with a hand refractometer Atago salinity 0-1000/00, (temperature, dissolved oxygen) with DO meter 12 D 100902 YSI 55044 and (brightness) with a seice dish (Table 1).

Table 1. Results of Measurement of Oceanographic Parameters at the Research Site

Measurement Time	Parameter							
	Station (T.Natural) Water height 1.5 m				Station (T.Artificial) Water height 2 m			
	Temp.	Salinity	Oxygen	Brightness	Temp.	Salinity	Oxygen	Brightness
Pagi	28,5 ⁰ C	33 ⁰ / ₀₀	4,39 mg/l	100%	28,5 ⁰ C	33 ⁰ / ₀₀	4,34mg /l	100%
Siang	28,9 ⁰ C	31 ⁰ / ₀₀	5,95mg /l	100%	28,7 ⁰ C	31 ⁰ / ₀₀	5,03mg /l	100%
Sore	28,7 ⁰ C	31 ⁰ / ₀₀	5,11mg /l	90%	28,4 ⁰ C	31 ⁰ / ₀₀	5,09mg /l	100%

Source: On-Site Measurement Data (2021)

Types of Fish Caught

To find out the types of fish caught on coral reefs and artificial reefs, identification was carried out based on the book Marine Fishes of South-East Asia (A Field Guide for Anglers Divers).

Coral Reef

The types of ornamental fish found in coral reef are types of reef fish that inhabit this area as listed in the following table:

Table 2. Types of Fish Caught With Gill Nets

No	Types of Fish on Natural Coral Reefs	Latin Name	Family
1	Kaka tua	<i>Scarus croicensis</i>	Scaridae
2	Pakol tato	<i>Rhinecanthus verrucosus</i>	Balistidae
3	Lepu	<i>Scorpaenopsis diabolus</i>	Scorpaenidae
3	Titang	<i>Acanthurus spp</i>	Acanturidae
4	Swangi mata besar	<i>Priacantus tayenus</i>	Priacanthidae
5	Lepu	<i>Scorpaenopsis venosa</i>	Scorpaenidae

Source: Data from On-Site Observations (2021)

From the table above, it can be seen that old parrotfish (*Scarus croicensis*) family Scaridae, Triger fish (*Rhinecanthus verrucosus*) family Balistidae, Titang fish (*Acanthurus spp*) family Acanturidae and Lepu fish (*Scorpaenopsis diabolus*) family Scorpaenidae are types of natural coral reef fish (coral reef). This is in accordance with what was stated by Nybakken (1992) that these types of fish eat algae found in natural coral reefs. When viewed from the type of fish caught in the position of 119035'002" BT; 4010'004" LS in areas of natural coral reefs is lacking, it is suspected that in this area the condition of coral reefs has been partially damaged, due to the excesses of the use of materials / tools in exploiting fish resources in this area in the past. According to Burke, at al., 2001 the main threats to coral reefs in Indonesia are overfishing and destructive fishing. The percentage of threats due to overfishing can reach 64% of the total area, and as high as 53% due to fishing by destructive methods.

Artificial Reef

Types of ornamental fish found in artificial reef areas caught / collected with a skirt can be seen in Table 2. The existence of these fish around artificial reefs is thought to be because artificial reefs that have been installed in the waters already resemble real coral reefs, already overgrown with algae called zooxanhellae. In addition, the depth of the water of about 1.2 meters allows the intensity of sunlight to directly hit artificial reefs so that photosynthesis in zooxanhellae grows fast and develops. Artificial reef that has been overgrown with algae and plankton in the end fish gather and find food around the artificial reef.

Table 3. Types of Ornamental Fish Caught With a Skirt

No	Types of Fish on Artificial Reefs	Latin Name	Family
1	Giru gelang	<i>Amphiprion percula</i>	<i>Pomacentridae</i>
2	Giru balong strip	<i>Premnas biaculeatus</i>	<i>Pomacentridae</i>
3	Bunga waru	<i>Monodactylus argenteus</i>	<i>Monodactylidae</i>
4	Sekar taji	<i>Acanthurus lineatus</i>	<i>Acanthuridae</i>
5	Lencan	<i>Lethrinus sp</i>	<i>Lethrinidae</i>
6	Peperek	<i>Leoignathus sp</i>	<i>Leoignathidae</i>
8	Tompel	<i>Amphiprion ephippium</i>	<i>Pomacentridae</i>
9	Betok sebra	<i>Dascylus melanurus</i>	<i>Pomacentridae</i>
10	Triger	<i>Balistoides spp</i>	<i>Balistoidae</i>

Source: Data From On-Site Observations (2021)

Based on the table above, this type of fish is a fish caught in the position 119035'001"BT;4010'003" during the day, or diurnal fish that are active during the day and are the largest group in coral reef ecosystems. This is according to what Nybakken (1988) stated the types are the families Pomacentridae, Labridae, Acanthuridae, Chaetodontidae, Serranidae, Pomacanthidae, Lutjanidae, Balistidae, Cirrhitidae, Tetraodontidae, Blenniidae and Gobiidae further stated that diurnal fishes feed and live on the surface of corals and feed on plankton passing over them. Giru gelang fish and betok sebra fish from the Pomacentridae family are types of ornamental fish that are also called nemons/clown fish because of their brilliant color predominantly caught with skirts around the artificial reef area, this artificial reef is installed near the coral reef. Fish are the largest number of organism and are also large, striking organisms that can be found on coral reefs (Nybakken, 1992).

If connected with oceanographic parameters in the morning and afternoon temperatures 28.50-28.90C, salinity 31-330/00 with dissolved oxygen levels 4.39-5.95 mg / l, brightness levels of 100% where the water conditions in this location are in accordance with the life of reef fish species, This is reinforced by the results of Alldredge and King's research (1977) that fish species of chaetodontidae family, scaridae family, Haemullidae obtained at a cross of 29.8 ‰ - 33 ‰, temperature 29° -30°C, dissolved oxygen 5.16 -13.3 mg/l, and brightness level 3.775 - 4.6 meters.

CONCLUSION

Types of fish caught on natural coral reefs (coral reef) are old parrot fish (*Scarus croicensis*) family Scaridae, Trigger fish (*Rhinecanthus verrucosus*) family Balistidae, Titang fish (*Acanthurus* spp) family Acanthuridae and Lepu fish (*Scorpaenopsis diabolus*) family Scorpaenidae

The types of fish caught on artificial reef are; Giru bracelet (*Amphiprion percula*) family Pomacentridae, Giru balong strip (*Premnas biaculeatus*) family Pomacentridae, Waru flower (*Monadactylus argenteus*) family Monadactylidae, Sekar spur (*Acanthurus lineatus*) family Acanthuridae, Lencan (*Lethrinus* sp) family Lethrinidae, Peperek (*Leoignathus* sp) family Leoignathidae, Tompel (*Amphiprion ephippium*) family Pomacentridae, Betok sebra (*Dascylus melanurus*) family Pomacentridae and Trigger (*Balistoides* spp) family Balistidae.

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