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RESEARCH ARTICLE

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## THE SELECTION OF FEATURED REEF FISHING TECHNOLOGY IN PARI ISLAND CLUSTER, SERIBU ISLANDS REGENCY, JAKARTA

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### ABSTRACT

Coral fish have become a common catch target for Pari Island fishermen. The selection of eco-friendly fishing gear is considered important to maintain the stability of coral reef ecosystems and realize sustainable fishing fisheries. The selection of eco-friendly fishing technology is based on the criteria in the Code of Conduct for Responsible Fisheries (CCRF). This research aims to identify coral fish catches and determine superior coral fish and environmentally friendly coral fishing technology. The method of data retrieval is done through observation and interview. Data analysis used is descriptive analysis and CCRF. The results showed that there are 11 species of economically important coral fish, 5 species of dominant coral fish and 3 species of superior coral fish with the length of caught coral fish ranging from 14 cm - 90 cm. The fish is caught using bubu (traps), fishing rods, spearguns, and basic gill nets. Based on CCRF analysis Speargun is the most effective and environmentally friendly fishing gear.

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## INTRODUCTION

Pari Island has a variety of fishery resources, one of which is coral fish. Coral fish are fish that spend their life in coral reef areas. Coral fish are the most numerous organisms and are also strikingly large organisms that can be found on coral reefs (Nybakken, 1992). Some of the fishing activities used by Pari Island fishermen are "bubu" (traps), "sero" (guiding barrier), floating chart, millennium net, muroami net, rampus net, fishing rod, "tonda" (troll line), and fishing rod. This type of fishing gear is relatively few compared to some other fishing areas. In all regions of the Seribu Islands, there are 19 types of fishing gear that actively conduct fishing activities. In addition, the fishing gear used in the Seribu Islands is a speargun. Spearguns are widely used by fishermen to catch coral fish, especially at night. Types of coral fish that are targeted for fishing are yellow-tailed fish, rabbitfish, groupers, and sea cucumbers. Speargun is included in fishing gear that is environmentally friendly, this is in accordance with Zaenalet *al.* (2019), which states that spearfishing is one type of fishing gear that is quite productive in the waters of the Seribu Islands. This fishing activity will certainly affect coral fish stocks in the Seribu Islands, especially Pari Island. Coral fish stocks in the Seribu Islands are decreasing, this is in accordance with Nugraha *et al.* (2020) which states that fishing activities in Jakarta Bay have been going on for a long time and fishing operations are going on quite intensively,

causing high levels of exploitation and already leading to over-exploited. The density of demersal fish and corals in the waters of the Seribu Islands in 2007 ranged from 42-536 tails / 250 m<sup>2</sup>, classified into the criteria of very low density. One of the government programs to maintain fish stocks, especially coral fish, is to keep fish resources there. Government programs, especially for conservation areas, are to use environmentally friendly fishing gear based on CCRF. This is in accordance with Subehiet *al.* (2017) which states that the code of Conduct for Responsible Fisheries is an international principle and standard of behavior patterns for responsible practice. In order to realize sustainable capture fisheries in accordance with the provisions of responsible fisheries implementation (FAO CCRF), the exploitation of marine biological resources must be responsible fisheries, as well as coral fishing. Based on this, the research with the title "Selection of Superior Coral Fishing Technology in the Waters of Pari Island Cluster of Seribu Islands Jakarta Regency" with the aims; (1) identify the catch of coral fish; (2) Know the total length and weight relationship; (3) Make selection of environmentally friendly fish technology.

## METHODOLOGY

The study was conducted for 7 months starting in December 2020 until July 2021. The research was conducted in the waters of the Pari Island cluster (Fig. 1) and the selection of locations was carried out

with the consideration that 1) Pari Island is a conservation area and is an area of fishing activities; 2) many coral fish are found; 3) is a tourist's area.



Figure 1. Research Site

The type of data collected consists of primary data and secondary data. Primary data includes the type and size of reef fish, types of fishing gear, fishing boats, marketing chains, fish prices and the number of fishermen. Primary data is collected through observations and interviews. Secondary data in the form of research supporting data in the form of journals and data from related agencies.

**Data Analysis:** Identification of coral fish species is done based on grouping fish types based on target fish (economically important fish), indicator fish (fish that show the health of coral reefs) and major fish (main fish) namely ornamental fish, analyzed descriptively and presented in the form of tables and graphs. The selection of superior fish commodities in the Pari Island Cluster was carried out in two stages, namely the first to conduct interviews with relevant stakeholders representing fishing communities in the research area and fishing activities and secondly by analyzing the function of value with fish price criteria, marketing, and added value. Production data and production values are not analyzed with value functions because data is not obtained. Selection of environmentally friendly fishing technologies is conducted using multi-criterion analysis, which includes biological, engineering, social, and economic aspects. The criteria used in the study are based on 9 criteria contained in the Code of Conduct for Responsible Fisheries (CCRF). Based on the criteria and weighting, then the analysis is further done using the scoring method with the following formula:

$$X = \frac{\sum X_n}{n}$$

Description:

- X = eco-friendly score
- $\sum X_n$  = Total Score
- n = number of respondents

The score obtained is then made cluster points that can be a reference in determining the ranking / level of environmentally friendly. There are 9 indicators with a score range of each indicator is 1-4, thus the maximum value obtained is 36 points. The category of environmentally friendly fishing gear will be divided into 4 clusters with the following value ranges: 1-9 (highly unfriendly), 1-18 (not friendly), 19-27 (eco-friendly), and 28-36 (highly eco-friendly).

## RESULTS AND DISCUSSION

**Types of Coral Fish:** Based on the results of interviews with fishermen obtained data on the types of reef fish caught are brown-marble grouper, humpback groupers, coral trout, rabbitfish, parrot

fish, and snappers caught with 5 types of fishing gear, namely trap, fishing rod, speargun, guiding barrier, and bottom gillnet (Fig. 2). Based on the results of the study showed that economical coral fish as many as 11 species namely *Caesio cuning*, *Parupeneus barberinus*, *Siganus guttatus*, *Chlorurus sordidus*, *Kyphosus vaigiensis*, *Epinephelus ongus* (Bloch, 1790), *Siganus fuscescens*, *Tylosurus crocodilus*, *Scarus ghobban*, *Scarus tricolor* and *Lutjanus ehrenbergii*. The indicator fish group was not found and the major fish group of 5 species were *Lethrinus lentjan* (Lacepede, 1802), *Siganus guttatus*, *Scarus tricolor*, *Lutjanus ehrenbergii*, and *Scarus ghobban* (Table 1).

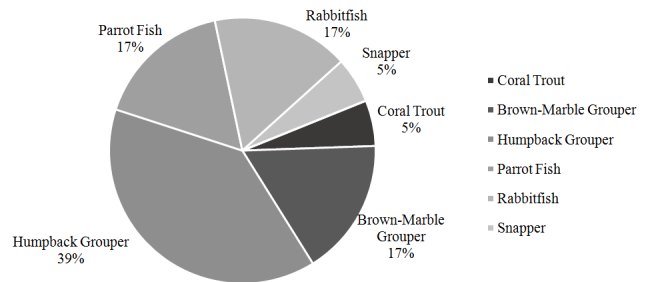


Figure 2. Main Catch

Based on Table 1 it is seen that the caught coral fish is dominated by emperor fish (*Lethrinus lentjan*) as many as 6 fish, followed by rabbitfish (*Siganus guttatus*) as many as 5 fish and tri-colour parrot fish (*Scarus tricolor*) as many as 5 fish (Fig. 3). If associated with the results of the interview there are 4 types of the same fish, namely rabbitfish, parrot fish, grouper, and snapper.



Figure 3. Types of Dominant Coral Fish caught on Pari Island

The dominant length of fish caught in Emperor fish is 18,4–23,5 cm. the size of the fish is included in the category of small/ immature gonads fish, considering based on fishbase Lm value of 27,7 cm. Lm value indicates the value on the length of the first ripe gonad so it can be recommended that the size of a good fish to be caught by fishermen is 27,7 cm. In addition, based on the results of measurements of fish length obtained that Lc (Fig. 4) is 16,5 cm, this shows that generally the size of fish caught by fishermen is 16,5 cm. Based on the data obtained that  $L_c < L_m$  which means that generally fish caught are immature gonads.

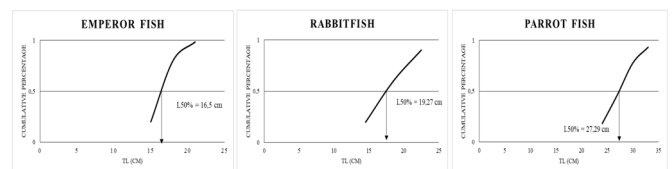


Figure 4. Lc Value

Rabbitfish caught have a length of 13–21,5 cm, Lm value based on fishbase is 18,1 cm. Thus the fish that was caught has experienced the first ripe gonad. In addition, based on data on the length of rabbitfish, the size of the fish that was first caught was 19,27 cm. This shows that  $L_c > L_m$  which means that the fish caught is generally mature gonad so that the resource status of rabbitfish is still good. This is in accordance with Sparre & Venema (1992) which states that if the fish has a size of  $L_c > L_m$ , then the situation does not harm the fish population but if fishery management is not sustainable then the stock of rabbitfish can be depleted.

**Table 1. Coral Fish Catch with Speargun Fishing Gear and Nets**

No.	Species	Local Name	TL (cm)	W (gr)	Lm (cm)	Ref.	Ref.	FG
1	<i>Lethrinuslentjan</i> (Lacepede, 1802)	Lencam/ Tamba	18,5	103	27,1		1	Bg
2	<i>Parupeneusbarberinus</i>	Janggung	23	153	12 (F)		2	Bg
3	<i>Lutjanus synagris</i>	Tanda-tanda	23	188	23,8		1	Sg
4	<i>Siganusguttatus</i>	Baronang	21,5	57	18,1		1	Sg
5	<i>Scarustricolor</i>	Kakatua/ Mogong	29,5	113	-			Sg
6	<i>Caesiocuning</i>	EkorKuning	24,3	43	22,92		3	Sg
7	<i>Lethrinuslentjan</i> (Lacepede, 1802)	Lencam/ Tamba	19	85	27,7		1	Sg
8	<i>Lethrinuslentjan</i> (Lacepede, 1802)	Lencam/ Tamba	18,4	71	27,7		1	Sg
9	<i>Siganusguttatus</i>	Baronang	21,5	85	18,1		1	Sg
10	<i>Siganusguttatus</i>	Baronang	20	71	18,1		1	Sg
11	<i>Scarustricolor</i>	Kakatua/ Mogong	32,5	170	-			Sg
12	<i>Chlorurus sordidus</i>	Kakatua/ Mogong	24	99	15		1	Sg
13	<i>Scarustricolor</i>	Kakatua/ Mogong	23,5	85	-			Sg
14	<i>Siganusguttatus</i>	Baronang	18	57	18,1		1	Sg
15	<i>Kyphosusvaigiensis</i>	Ela	18,4	65	28,4 (M), 36 (F)		4	Sg
16	<i>Epinephelusongus</i> (Bloch, 1790)	KerapuHitam	31	148	24		5	Sg
17	<i>Scarustricolor</i>	Kakatua/ Mogong	29	142	-			Sg
18	<i>Lethrinuslentjan</i> (Lacepede, 1802)	Lencam/ Tamba	21	71	27,7		1	Sg
19	<i>Siganusfuscescens</i>	Baronang Susu	21,5	57	5,6		1	Sg
20	<i>Tylosuruscrocodilus</i>	Cendro	64	198	51,7		1	Sg
21	<i>Tylosuruscrocodilus</i>	Cendro	90	150	51,7		1	Sg
22	<i>Siganusfuscescens</i>	Baronang Susu	24	188	5,6		1	Bg
23	<i>Scarushobban</i>	KakakTuaBiru	27	329	24,3 (M), 31,6 (F)		6	Bg
24	<i>Lethrinuslentjan</i> (Lacepede, 1802)	Lencam/ Tamba	23,5	209	27,7		1	Bg
25	<i>Lutjanus carponotatus</i>	Penggaru	19,5	116	18,6		1	Bg
26	<i>Siganusguttatus</i>	Baronang	13	54	18,1		1	Bg
27	<i>Scarusrivulatus</i> (Valenciennes, 1840)	Kakatua/ Mogongljo	22	216	24,3 (M), 16,9 (F)		6	Bg
28	<i>Scolopsistaeniopierus</i>	Pasir-pasir	19	96	15		7	Bg
29	<i>Lutjanus ehrenbergii</i>	Tanda-tanda	17	91	23,8		1	Bg
30	<i>Lethrinuslentjan</i> (Lacepede, 1802)	Lencam/ Tamba	14	47	27,7		1	Bg
31	<i>Scarustricolor</i>	Kakatua/ Mogong	27,6	132	-			Bg

Description: Lm: length maturity; Ref: reference

FG: Fishing Gear; Sg : Speargun; Nt : bottom gillnet; M: male; F: female; 1: (fishbase.se); 2 : Longenecker et al. (2013); 3 : Indarsyah et al. (2008) 4: Yamaguchi et al.(2011); 5: Ulya et al.(2020); 6 : Tuwo et al. (2021); 7: Ernawati and Badrudin (2007)

**Table 2. Function Value Analysis Matrix in Selecting Superior Commodities**

Fish Types	Price (Rp/kg)	Function value	Marketing	Additional value	Combined value	Rank
<i>Caesiocuning</i>	25.000	0,25	1	1	2,25	3
<i>Parupeneusbarberinus</i>	25.000	0,25	1	1	2,25	3
<i>Siganusguttatus</i>	40.000	0,625	1	1	2,63	2
<i>Chlorurus sordidus</i>	15.000	0	1	1	2	5
<i>Kyphosusvaigiensis</i>	25.000	0,25	1	1	2,25	3
<i>Epinephelusongus</i>	25.000	0,25	1	1	2,25	3
<i>Siganusfuscescens</i>	55.000	1	1	1	3	1
<i>Tylosuruscrocodilus</i>	15.000	0	1	1	2	5
<i>Scarushobban</i>	15.000	0	1	1	2	5
<i>Lutjanus ehrenbergii</i>	23.000	0,2	1	1	2,2	4
<i>Scarustricolor</i>	15.000	0	1	1	2	5

Parrot fish have a length between 23,4–32,5 cm with unknown Lm data, while for blue-parrot fish (*Scarushobban*) caught at a length of 27 cm. Based on Tuwoet al.(2021a) stated that the Lm value of female blue-parrot fish is 24,3 cm, and the length of male fish is 31,6 cm. green-parrot fish (*Scarusrivulatus*) caught has a length of 22 cm, while according to Tuwoet al. (2021b), *Scarusrivulatus* fish with Lm value of 24,3 cm, and in male fish found at a length of 16,9 cm. Caught also blackgrouper (*Epinephelusongus*) with a length of 31 cm, this size is thought to have matured the first gonad, this refers to Ulyayet al. (2020), Lm value found at a length of 24 cm.

**Superior Coral Fish:** Based on the results of the analysis of the value function obtained that the black-rabbitfish (*Siganus fuscescens*) is the superior fish followed by the rabbitfish (*Siganus guttatus*) as presented in Table 2. Based on Table 2, the third seeded fish obtained several types of fish considering the same price factor, namely yellowtail fusilier(*Caesio cuning*), dash-and-dot goatfish (*Parupeneus barberinus*), brassy chub (*Kyphosus vaigiensis*), and black grouper (*Epinephelus ongus*). The same marketing value is due to fishermen only selling fish to the domestic market even the catch is usually to meet household needs or sold in food stalls. If the harvest is large, then the catch they collect to middlemen, the rest is sold to Muara

Angke Fishing port or to Tangerang City. The fish was sold in fresh form and there is no other added value is in processed form so that on the assessment of "additional value" is given a score of one (Table 2). Rabbitfish is a coral fish that is in demand by the community not only on Pari Island but in Jakarta. This coral fish is in demand by the public because of the good quality of meat, this is in accordance with Wahyuningtyas et al. (2015) stated that the body parts of rabbitfish caught in the Seribu Islands show that the proportion of meat is the largest composition (45,67%) on the body of rabbitfish. In addition, fish has the highest essential amino acids (lysine which is 1,30%) and the highest non-essential amino acids (glutamate which is 1,98%), total fatty acids identified as many as 27 types namely 11 types of saturated fatty acid (SFA), 7 types of monounsaturated fatty acid (MUFA), and 9 types of polyunsaturated fatty acid (PUFA), vitamin B12 of 1,40 µg / 100g, potassium of 1.050,95 mg / 100g and the presence of collagen in the skin of rabbitfish. Based on the results of the interview, various types of coral fish were found caught at several locations, namely Lagoon, Pari Island in the West, East, and North stated in Figure 5 which is dominated in the West of Pari Island.

**Selection of Eco-Friendly Fishing Technology:** Based on the results of an analysis of 9 CCRF criteria against 4 types of fishing gear, namely speargun, basic gill net, fishing rod and bubu obtained the

result that speargun is the most effective and very environmentally friendly fishing gear, as seen in Figure 6. Fishing gear used to catch coral fish on Pari Island is a speargun and a basic gillnet (bottom gillnet). Based on interviews with fishermen on Pari Island that spearguns are more catches than bottom gillnet, this is due to the way of fishing with spearguns that fishermen dive and see fish directly. At night, coral fish movement is slow making it easier for fishermen to catch fish rather than with other fishing gear such as having to wait for fish trapped or entangled.

of <1 mile. The number of crew is more than 3 people. The most catches are groupers, snappers, rabbitfish and parrot fish. Based on interviews with fishermen stated that spearguns are eco-friendly fishing gear because based on CCRF criteria: catches do not harm consumers, fish caught are generally large fish (not small fish), no by-catch, do not catch protected species, provide minimum impact to habitat and do not harm fishermen. This is in accordance with Zaenal et al. (2019) stated that spearfishing on Tidung Island is a fishing gear grouped as fishing gear is very eco-friendly because fishing with

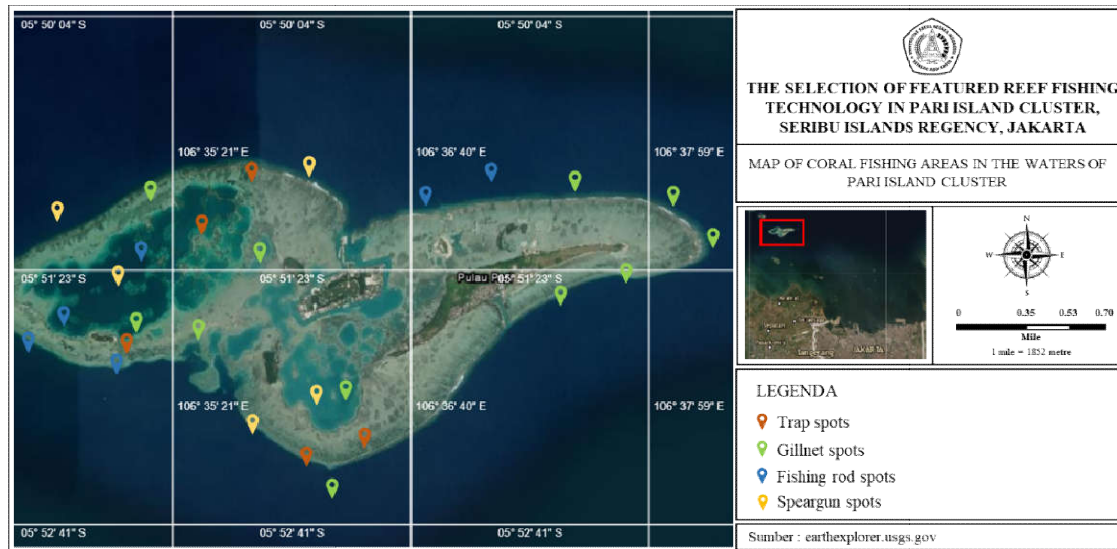


Figure 5. Map of Coral Fishing Areas in Pari Island Cluster

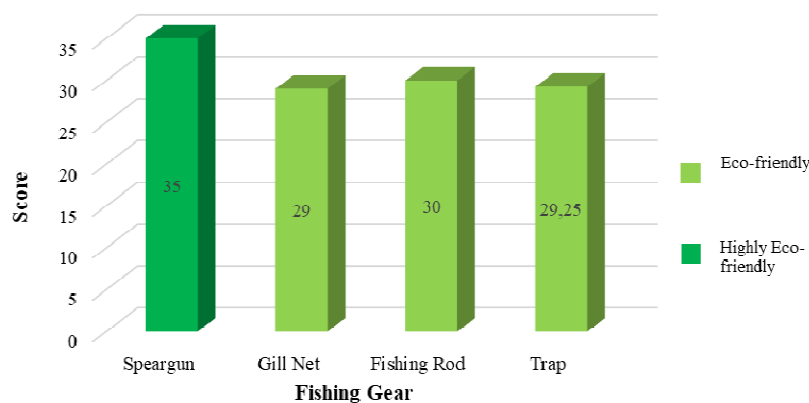


Figure 6. Eco-friendly Fishing Gear Score

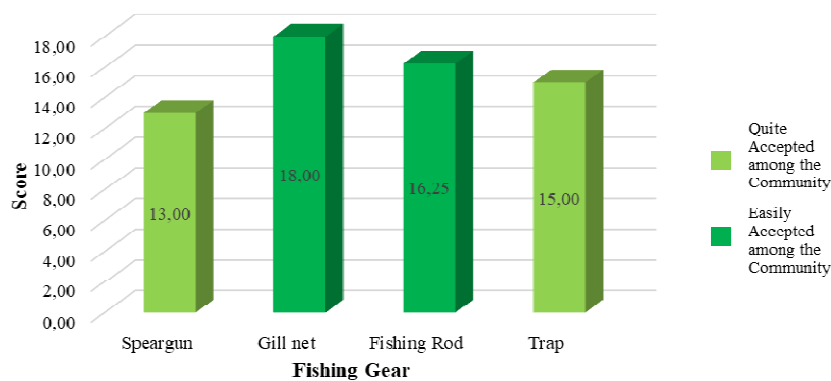


Figure 7. Fishing Gear Score Based on Socioeconomic Aspects

The boat used by speargun fishermen is made of belian wood with a length of 3-6 m, a width of 1,25 m and a height of 1,5 m. Equipped with a 7.5 PK Dongfeng brand outboard engine operated at a distance

fishing equipment whose operation is actively chasing fish that are allowed to be caught with a decent size to catch, it is impossible for fishermen to shoot juvenile fish or small fish because it will be

difficult to fish so as not to result in the death of all living things. in the waters and does not damage the habitat. Spearfishing fishing gear is safe for biodiversity. Speargun itself is a tool that is quite accepted among the community because spare parts are easy to find, easy-maintenance, requires special skills, operated for adult fishermen, affordable tool prices, occasional conflicts over fishing areas and theft of fishing equipment. Unlike the case with basic gill net that is easily accepted among the public because of easy use, anyone anywhere can be operated, affordable price, does not require special skills, spare parts are easy to find, easy maintenance, and rarely social conflicts. A complete picture based on the social aspects of the economy of the fishing gear can be seen in Figure 7. The bottom gill net used by Pari Island fishermen has a mesh size of 2 inches with a boat made of meranti wood measuring 3-6 m long, 1,25 m wide and 1,5 m high. Propulsion in the form of a 5 PK outboard engine. Fishing gear is operated at a depth of 1 – 1,5 m with a 1 person ABK. Targets of fishing groupers, parrot fish, emperor fish and rabbitfish, with the most catches are rabbitfish. Based on the interviews with fishermen that the bottom gill net is still environmentally friendly fishing gear because the fishing gear is not dangerous for fishermen, so far fish caught are not protected fish, fish products caught are not harmful to the community. In addition, bottom gill net is socially accepted by the community because of the cheap price of fishing gear and net materials that do not damage the environment. Other fishing gear is not effective because the stock of coral fish in the Seribu Islands is decreasing, this is in accordance with interviews with fishermen on Pari Island that coral fish are not caught on trap fishing gear. This coral fish stock is decreasing can be caused by the increasing in the number of fishermen on Pari Island. The increase in Pari island fishermen was seen in 2017 which amounted to 637 while in 2016 it amounted to 298.

## CONCLUSION

Coral fish caught by Pari island fishermen are economically important coral fish as many as 11 species and a group of major fish 5 species namely *Lethrinus lentjan* (Emperor fish), *Siganus guttatus* (Rabbitfish), *Scarus tricolor* (Tri-colour Parrot fish), *Lutjanus ehrenbergii* (Black-spot Snapper), and *Scarus ghobban* (Blue-parrot fish).

The main coral fish is the Black Rabbitfish (*Siganus fuscescens*). Speargun is an effective and environmentally friendly fishing gear for catching coral fish on Pari Island.

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