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The Effect of Palm Fiber Camouflage on Trap for the Capture of Coral Fishes in Bangka Strait, North Sulawesi Indonesia

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Abstract Bangka Strait, North Sulawesi, Indonesia, has fairly extensive coral reefs. Unfortunately, fishing practice of the traditional traps is usually conducted in destructive way, in which fishermen cover the gear with live corals deliberately broken as a shelter to attract fishing target. This research was aimed to study the effect of palm fiber camouflaged cover on trap to capture coral fishes, and identify the fish caught. This research was done in Bangka Strait, North Minahasa, in November- December 2014, based on experimental method. Six units of traps were operated during seven trips of data callection, where three traps were camouflaged with palm tree fibers, and the other three units without palm fibers. Catches were checked every 4 days, and data were analyzed by t test. The trap catches during the study were 80 fish in total, 53 fish were caught by palm fibers-camouflaged trap, and 27 fish without palm fibers. The t test showed that $t_{0.05} = 4.914 > t_{tab}$ meaning that the trap catch with palm fibers camouflaged is significantly different from that without palm fibers.

Keywords Bangka Strait, Coral reef degradation, Camouflaged trap, Coral fishes

1. Introduction

Marine environments are recently under enormous pressure, arising through anthropogenic causes, such as overfishing and environmental destruction. However, fisheries are able to recover or stabilize their populations when responsible management and regulations are implemented through the use of more sustainable method of fishing in fiheries exploitation [1].

Bangka Strait in North Minahasa Regency of North Sulawesi, Indonesia, has fairly extensive coral reefs with various lifeforms. The strait is also used as a navigation channel by merchant and passenger ships in and out of Bitung Oceanic Port, the location of pearl farming, floating net fish farming, seaweed farming, shrimp pond, fishing areas of halfbeak (*Hemiramphus sp*.), the small pelagic fish used as live bait of pole and line fishing, as well as tourism activities based in Gangga Resort. Mangrove forest in this region is thought to be the largest in the mainland coast of Minahasa. Several locations in the coastal waters have been designated as marine protected areas.

However, the development activities in the coastal areas in recent years have given various significantly negative impacts on the quality of the coral reef resources in Indonesia. Many studies reported that the quality of coral reefs in Indonesia is declining rapidly [2, 3], and only 29 percent of Indonesian coral reefs are in good to excellent conditions [4, 5, 2, 6, 3].

Trap or fish pot is one of the common fishing gears used by fishermen in Bangka Strait to catch reef fish, since it is simple in construction, relatively inexpensive and easy to operate with a small boat. Unfortunately, the fishing practice of the traditional traps is usually conducted in destructive way, where fishermen cover the gear with live coral as a shelter to attract fishing target. When the traps are moved to another fishing location, the fishermen will use new live corals to cover the traps in these locations.

The use of corals to camouflage the gear will damage the corals, while the alternative materials could be used without damaging the corals, such as palm fibers or coconut leaves that are easy to find on land. This research was aimed to study the effect of palm fiber camouflage on trap to catch coral fishes, and identify the type of fish caught.

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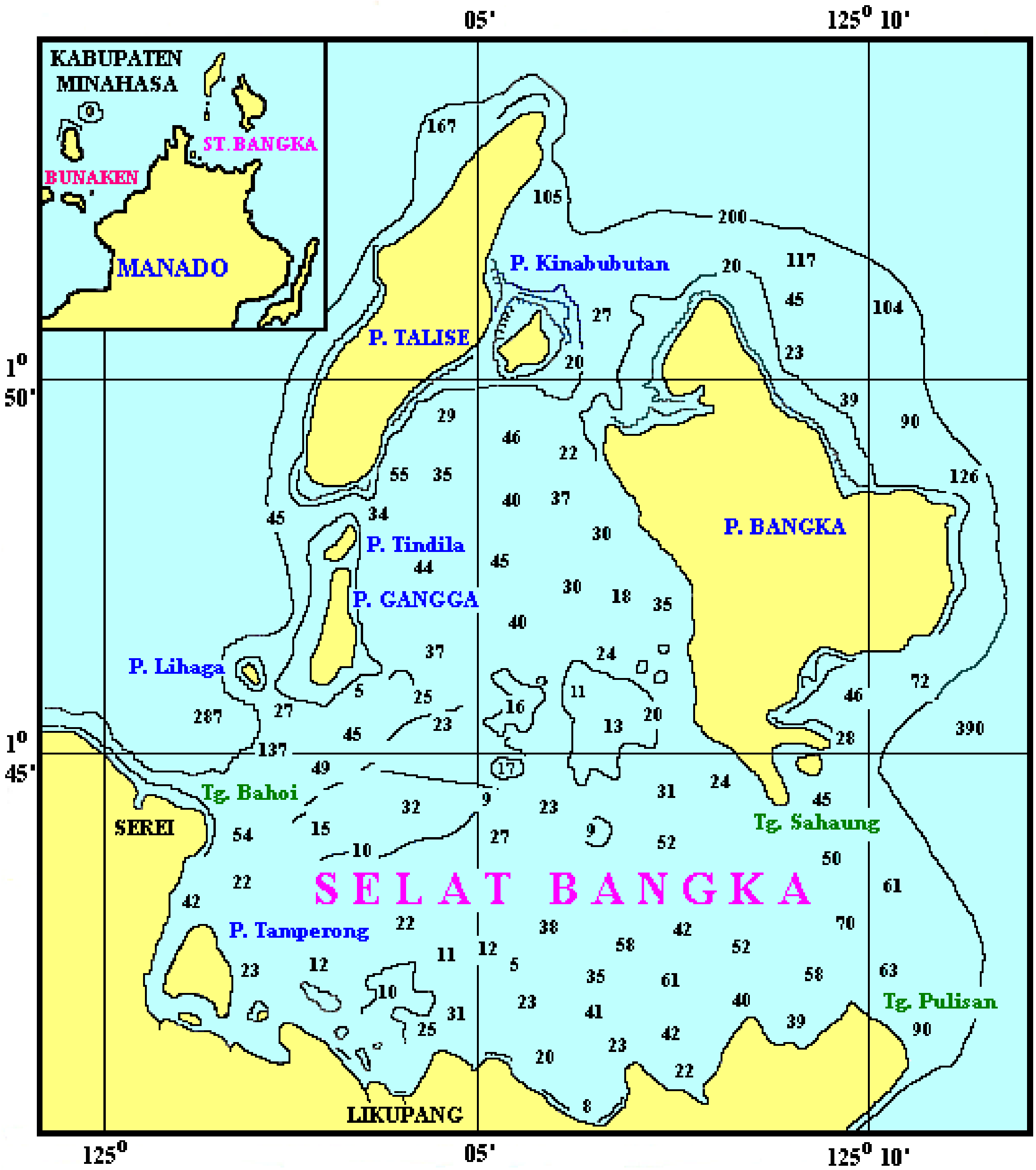

Figure 1. Study site

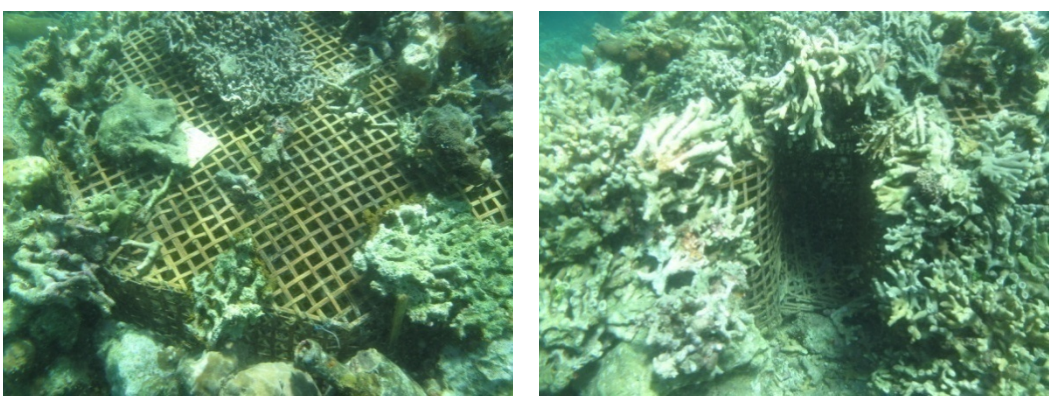

Figure 2. An example of trap settings that damages the environment

2. Method

This study was done in Bangka Strait North Minahasa in November- December 2014, based on experimental method. Traps used in this study were made of iron frame of 10 mm, with 120 cm long, 60 cm wide, and 50 cm high. The trap walls and entrances were made of PE net 380 D/12, two inches in mesh size. Six units of traps were operated during seven trips for data collection, in which three units were camouflaged with palm tree fibers and the other three units without palm fibers. All traps were operated without bait at the depth of about 7-10 m. Catches were checked every 4 days. Catch data were analyzed using t test [7], as follows:

$$t = \frac{\overline{X} - \overline{Y}}{S_{\overline{D}}}; \; S_{\overline{D}} = \frac{\sum D^2 - (\sum D)^2 / n}{n-1};$$

or

$$t = \frac{\overline{X} - \overline{Y}}{\sqrt{\frac{\sum D^2 - (\sum D)^2 / n}{n-1}}}$$

3. Results and Discussion

Catch and Analysis

The catch of trap during the study was 80 fish in total consist of 2 genera; 53 fish was caught by palm fibers camouflaged trap, and 27 fish was caught by trap without camouflaged (Table 1). The types of fish are caught.

The trap catch during the study consisted of 80 fish in total, belonging to 16 genera and 27 species, in which 53 fish were caught in palm fibers-camouflaged traps, and 27 fish in traps without palm fibers. Fish species caught are presented in Table 1.

Table 1. Fish species caught in both trap treatments

No	Genus name and Species	Common name	Traps		Total
			Cam[1]	Uncam[2]	
1	*Cephalopholis sonnerati*	Tomato rockcod	3	0	3
2	*Cephalopholis miniata*	Coral cod	2	1	3
3	*Cehphalopholis microprion*	Dothead rockcod	1	1	2
4	*Cephalopholis urodeta*	Flag-tailed Rockcod	2	0	2
5	*Cehphalopholis boenak*	Brown-banded rockcod	2	1	3
6	*Epinephelus faciatus*	Black-tipped cod	3	0	3
7	*Epinephelus quoyanus*	Long-finned rockcod	2	1	3
8	*Epinephelus merra*	Honeycomb cod	2	1	3
9	*Plectropomus leopardus*	Coral trout	3	0	3
10	*Plectropomus aerolatus*	Polkadot cod	2	1	3
11	*Siganus vulpinus*	Foxface	3	1	4
12	*Siganus puellus*	Blue-lined spinefoot	2	0	2
12	*Siganus canaliculatus*	Smudgespot spinefoot	3	1	4
14	*Stenochaetus striatus*	Line bristletooth	2	0	2
15	*Zebrasoma scopas*	Blue-line tang	2	1	3
16	*Naso fageni*	Blunt unicornfish	1	0	1
17	*Plectorhinchus lessoni*	Triped sweetlips	3	1	4
18	*Scolopsis bilineatus*	Bridled monocle bream	2	1	3
19	*Thalassoma lunare*	Moon wrasse	3	2	5
20	*Chaetodon oxycephalus*	Spotnape butterflyfish	0	2	2
21	*Chaetodon melannotus*	Blackback butterflyfish	2	1	3
22	*Chaetodon klleinii*	Klein's butterflyfish	2	3	5
23	*Zanclus cornutus*	Moorish idol	1	3	4
24	*Abudefduf vaigiensis*	Sergeant major	0	2	2
25	*Pomacentrus brachialis*	Charcoal damsel	0	3	3
26	*Scarus ghobban*	Blue-barred parrotfish	2	0	2
27	*Parupeneus multifasciatus*	Banded goatfish	3	0	3
Total			**53**	**27**	**80**

Note: 1) Camouflaged traps;
2) Uncamouflaged traps.

For the purpose of catch comparison between trap treatments, data in Table 2 were simplified and further processed into as Table 3. The t test analysis showed that $t_{0.01} = 4.914 > t_{tab}$, meaning that the fish catch of the trap with palm fibers is significantly different from that without palm fibers.

Table 2. Total catch of traps with treatment (individual)

Trips	Camouflaged traps				Uncamouflaged trap			
	1	*2*	*3*	Total	*1*	*2*	*3*	Total
1	3	2	2	7	1	2	0	3
2	2	3	3	8	1	2	1	4
3	2	2	3	7	1	1	2	4
4	3	2	4	9	1	1	3	5
5	4	3	2	9	1	2	1	4
6	2	3	2	7	1	2	1	4
7	3	1	2	6	1	1	1	3
Total	**19**	**16**	**18**	**53**	**7**	**11**	**9**	**27**

Table 3. Comparative analysis of median sample observation of the trap catch

Trip	Camouflaged traps (X)	Uncamouflaged trap (Y)	D (X –Y)	D^2
1	7	3	4	16
2	8	4	4	16
3	7	4	3	9
4	9	5	4	16
5	9	4	5	25
6	7	4	3	9
7	6	3	3	9
Total	**53**	**27**	**26**	**100**
Mean	**7.57**	**3.86**		

$\boldsymbol{X} = 7{,}57$; $\boldsymbol{Y} = 3{,}86$; $(\Sigma D)^2 = 26^2 = 676$; $\Sigma D^2 = 100$; $\boldsymbol{X} - \boldsymbol{Y} = 3{,}71$

Significance level (α) = 1% (0.01); t table with degrees of freedom (db) = n - 1 = 6.

$t_{0{,}01;\,6} = 3.707$ (the value in the table t).

4. Discussion

Trap fishing gear has been very extensively used in the world, but the basic concept is the same in all cases, in which fish or other marine animals will enter into traps through one or more conical entrance [8]. The success of trap fishing gear is dependent on the behavior of marine animals as target of fishing. The gear size acts as a fishing function, where the marine animals can enter and escape [9].

The fish response to the trap and its surrounding is done through smell and sight or eagerness to take refuge from predators. The use of the sense of smell in fish occurs in traps baited, while the sense of sight or sheltered occur in unbaited trap. Most traditional traps operated in Bangka Strait is without bait, and thus it needs to be camouflaged with coral to attract fish sheltering.

The results provide information that camouflaged traps with other materials, such as palm fibers other than live corals, could also increase the catch. The amount of traps operated in Bangka Strait until 2014 was 65 units. Fishing locations of the traps were usually moved after 7 trips or about a month. The amount of coral cover needed to disguise traps per unit is about 1 sq.m. If it is assumed that 40 units of the traps can operate throughout the year (10 months), so the amount of coral damages in Bangka Strait could reach 400 sq m per year.

The total average economic value of coral reefs in Indonesia represented by West Lombok is > US $ 1.0 / m^2 (4). Thus, the value of damaged coral reefs in the Bangka Strait is far greater than US $ 400/m^2/year. In some countries, the value of compensation for damaging coral reefs from the ship accident or pollution is between $ 10-1000 / m^2, such as Mexico, United States, Pacific and Egypt have established the average fine coral reef damage of US $ 1,000/m^2 based on the restoration cost.

Realizing this condition, efforts of all stakeholders are needed to minimize environmental damages from fishing operations of traditional traps and to ensure the sustainability of coastal community source of Bangka Strait.

5. Conclusions

Trap fishing gear using palm fiber camouflage can obtain higher catches (66.25%) than that without palm fibers (33.75%). The types of fish caught consisted of 16 genera and 27 species and 76.25% dominated by the target species. Materials palm fibers can be used as an impostor pot to replace the habit of damaging corals in Bangka Strait.

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