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Original paper

CORAL REEF MANAGEMENT IN PADAIDO MARINE TOURISM PARK, BIAK NUMFOR
Case Study for The Alternative Solution to Destructive Fishing Practices on Coral Reefs

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ABSTRACT

Coral reef is the most productive marine ecosystem in coastal waters. Unfortunately, this ecosystem has already suffered from non-sustainable human use including destructive fishing practices (bombing and cyanide), coral mining, over fishing, settlement pollution and uncontrolled tourism development. These affected the production of those fisheries resources in coral reefs. In order to manage those resources, such alternative to destructive use need to be studied.

This paper reports alternative solution to destructive fishing practices on coral reefs. The study has been carried out at Padaido Marine Tourism Park, the District of Biak Numfor, West Papua province, for about 2 weeks, 9-18 June 2001. Survey method was used during the study. The data were collected using Participatory Rapid Appraisal (PRA)'s method, with members of fisher group as the participants.

Three kinds of reef fish groups are identified at the Padaido Islands waters, i.e. major group, target group, and indicator group. These include ornamental and consumption fishes. Fish were caught with several fishing gears; while some of them are identified as destructive fishing practices, e.g. bomb, cyanide fishing. However, some of them can be recommended as sustainable fishing technologies, i.e. (1) squid jig, (2) troll line, and (3) hand line.

Key words : Coral reefs management, Destructive Fishing

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INTRODUCTION

Coral reef is the most productive marine ecosystem in coastal waters. The primary productivity may reach up to more than 10 kg C/m^2/year (Gordon and Kelly, 1962). It is higher compared to the primary productivity in the open seas, which is usually only around 50-100 g C/m^2/year (Ryther, 1959). This condition resulted in gathering of varieties species of animals. Therefore the secondary productivity, e.g. fishes, shrimps, lobster, mollusk (shellfish), turtle, and others, is also high in this system. The maximum sustainable yield (MSY) potential of fishes in Indonesian marine waters is estimated about 80,000 tons/year. With the total area of Indonesian coral reefs of about 50,000

km^2, the MSY of reef fishes resources is estimated around 1.6 tons/year. This contributes significantly to the national economy. Salm (1984) reported that the exports of reef–associated fish species from Indonesia, earned more than US$ 97 million, or 16% of the total earnings from fish exports in 1979.

Coral reefs also provide opportunities for tourism development and other economic and financial returns that can be used to improve the welfare of coastal communities. However, the condition of coral reefs in Indonesia has already suffered from non-sustainable human use including destructive fishing practices (bombing and cyanide), coral mining, over fishing, settlement pollution and uncontrolled tourism development. If the destructive uses continue they will result in further deterioration of coral reefs in Indonesia with long-term adverse consequences locally for the welfare of coastal communities and nationally through knock-on effects. Regarding to these problems, in order to protect, rehabilitate and achieve sustainable use of coral reefs and associated ecosystems in Indonesia, in turn, enhance the welfare of coastal communities, it has to be found the sustainable alternative solution for fishing technology and other practices on coral reefs.

The objective of the presents study is to obtain alternative solution to destructive fishing practices on coral reefs at Padaido Marine Tourism Park, the District of Biak Numfor, West Papua province, which used to be one of the COREMAP (Coral Reef Management and Planning Program)'s sites.

MATERIALS AND METHODS

Sampling Technique

The study used survey method. Two kinds of data were collected, i.e. the primary and secondary data. The primary data were collected using Participatory Rapid Appraisal (PRA)'s technique**.** While the participants are members of fishers group, which consist of all of fisher's stratum, i.e. "punggawa" (informal leader/collectors or seller), "juragan" (fishing gears and fishing boat's owner), "pandega" (fishers) and "sawi" (assistant fishers), and they were chosen proportionally according to their number in the fisher population. In addition, these participants are representatives from the three villages in inner and outer of Padaido Marine Tourism Park. While the secondary data were collected from the related departments, e.g. COREMAP office, the Fisheries Services.

Location and Duration of the Study

Survey was carried out at three villages, i.e. Nusi, Wundi and Mbromsi Islands (Map-1). This was conducted for about 2 weeks, 9-18 June 2001.

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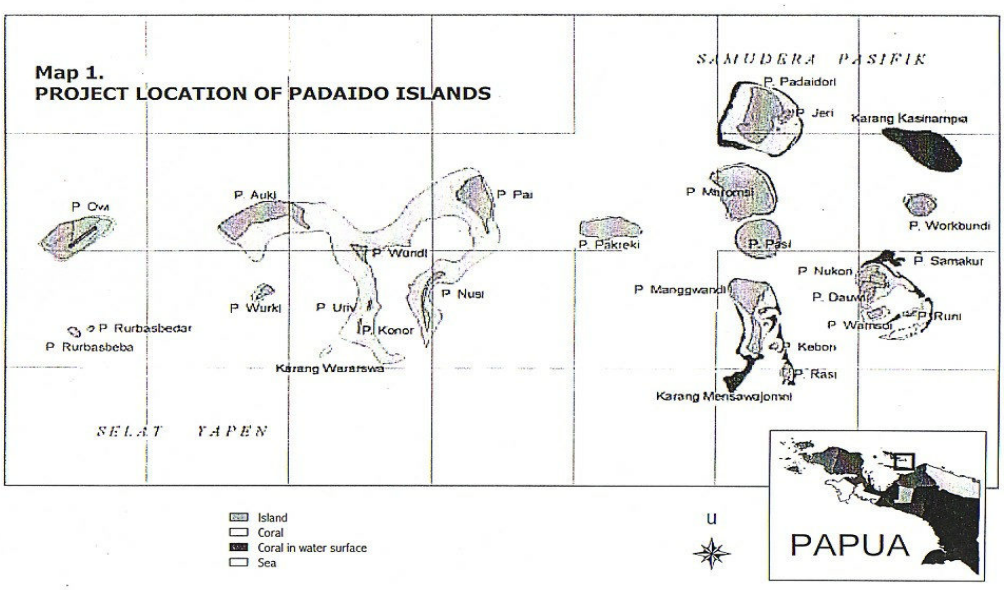

Data Analyses

The data, fishing technologies used by the fishers, were selected by using Analytical Hierarchy. This was used to select the most suitable fishing technology to be further developed, as well as the most destructive fishing practices to be curbed. A selection analysis based on environ-mentally friendly and sustainability princip-les was applied to those mentioned fishing technologies using the following criterions:

(1) High selectivity
(2) Non destructive to habitat
(3) Not harmful to the operator (s)
(4) Good fish quality
(5) The product is harmless for the consumers(s)
(6) Minimum discard
(7) Minimum impact to bio-diversity
(8) Not catching endangered species
(9) Socially accepted
(10) The target species is still under the TAC (Total Allowable Catch)
(11) Profitable
(12) Low investment
(13) Low energy consumption
(14) Legal

Paired comparison matrices and scoring were based on the available data and information, combined with expert judgment which were applied to reveal the best options.

RESULTS AND DISCUSSION

General Description of Padaido Marine Tourism Park

Geographically, Padaido Islands lied between 1°07'-1°22' South Latitude and 136°10'-136°46' East Longitude. The Padaido islands consist of 29 islands, which are divided into two groups of islands, i.e. Upper and Lower Padaido. The Lower Padaido consists of Owi, Auki, Pai, and Nusi Islands. The Upper Padaido consists Padaidori, Mbromsi, Pasi, Miosmanggawandi, Nukori, Dauwi, Wamsoi, Runi, Miosworkbondi, and other small islands. While Pekreki Island is island, located between those two groups islands.

Padaido Islands and surrounding marine areas were stated as the Padaido Marine Tourism Park through the Decree of Minister of Forestry No. 91/Kpts-

VI/1997 dated 13 February 1997, with a total area of around 183,000 hectares. Administratively, this park is located in Sub-District Padaido, District of Biak Numfor, Province of Papua. This area consists of three types of ecosystem, i.e.: mangrove (very small area, particularly in Padaidori Island), sea grass, and coral reefs. There are three types of coral reefs in this area, namely of fringing reef, barrier reef and atoll.

From the total islands at The Padaido islands (29 islands), only nine islands are inhabited, with the population density ranged from 7-51 people/km^2. The majority of people in Padaido Islands work as fishers. They usually catch tuna and reef-fish using traditional fishing techniques such as hook and line, and nets. The fishing season begins from April to October when the water is relatively calm. Some destructive fishing practices, such as blasting and poisoning, are still employed by people in this area. They consume fish for their family (subsistent product). Other than fishers, some people work on agriculture sector, such as cultivation (cassava, corn, taro, and vegetables), horticulture (coconut plant), and livestock (pig and chicken). Those fisheries and agriculture products are sold around Biak Island, particularly to Bosnik and Biak City. They may earn some Rp 260,000.00/month as a fisher, while for the coconut industry, they are able to earn Rp 18,000.00/month.

Existing Coral Reefs Condition

At least 171 species derived from 56 genera or 16 families of reef corals were observed in Padaido Islands (Wouthuyzen *et al,* 1995). The dominant species of reefs in Padaido Island are *Acropora sp, Sarcophyton sp,* and *Sinularia sp, Montipora sp, Porites sp,* and *Pocillopora sp*. The living coral coverage is reported about 43%, which mainly belong to massive corals (23.5%) and branching corals (19.5%). There are two sources of coral damage in these islands, i.e. fishing with bomb, which cause of coral damage at almost 80% of the reef areas, and effects of coral grassing by *Acanthaster planci*. In general, corals grow luxuriantly in the reef flat, reef edge, and reef slope faced to the open sea. However, in some locations, due to fishing with bomb, reef corals have been damaged. In the depth of 1-2 m, there is a lot of small colony corals, mainly from the genera of *Favia*, *Favites*, *Goniastrea* and *Acropora* (Suharsono and Leatemia, 1995).

Reef Fishes Condition

About 114 species with 37 genera of reef-fish are recorded in the Padaido waters (Suharsono and Leatemia, 1995; and Wouthuyzen *et al*, 1995). These are grouped into three groups according to the target, indicator and majority of the fish, i.e. target or consumption group (Family Caesiodadae), indicator group (Family Chaetodontidae) and major group (Family Pomacentridae). These cover 10 dominant species, i.e. *Apogon, Epinephelus, Gymnothorax, Canthigaster, Rhine-canthus, Melichthys, Balistoides, Pterois, Siganus,* and *Acanthurus*. While Yayasan Terangi *et al* (2000), which observed in several islands in Padaido Bawah (Auki, Pai and Wundi Islands) and Padaido Atas (Miosmangwandi, Dauwi, Padaidori and Mbromsi Islands) showed that damsel fishes tended to dominate those areas (100-1000 fishes/m), followed with butterfly fishes, surgeon fishes, and wrasse (particularly at surrounding Wundi, Auki, Pai and Dauwi Islands), (10-100 fishes/m). Majority the size of these fishes were small (<20 cm), with exception of such wrasse (*Cheilinus, Epibulus, Pteragogus, Pseudo-cheilinus, Pseudocheilinops, Wetmorella, Hemigymnus, Gomphosus, Thalassoma, Pseudodax, Anampses, Pseudojuloides, Stethojulis, Pseudocoris, Hologymnosus, Cheilio*, and *Coris*) which were observed up to 30-50 cm. As well, these fishes tended very abundance, such as at

Padaidori Island, particularly at the north and North East of the island.

Existing Fishing Technology

Fishing technology of the fishers at Padaido Bawah, such as Nusi Island, mostly are carried out traditionally. Their fishing gear includes the hook and line, gillnets, arrow, and spear. Majority the fishers use small traditional fishing boat on canoe. With small canoes, their fishing ground could only reach very limited and close areas. Their fishing duration, usually very short, only about 2-3 hours. They were unable to sell their fishes directly to the market (Bosnik), located about 23 km from the Nusi Island. Therefore, they stored their fishes in cold boxes and sold them to the market at Bosnik during the market day, i.e. Tuesday, Thursday, and Saturday, using a special transport boat equipped with outboard motor. Different with the fishers in "Padaido Atas", such as Mbromsi Island, the majority of them sold their fishes at Biak Kota any day. They have a unique manner for fishing transportation. The motor boat usually carried about 10 canoes to the fishing ground, soon after arrived they spread and start their fishing activities. The owner of the motor boat usually act as collector of fishes captured by the canoe fishers. He usually collects fishes up to about 300-400 Kg, and sells them to Biak Kota.

Destructive Fishing Practices

The result of the study showed that destructive fishing practices occurred in Padaido, particularly at Padaido Bawah, but there is a trend for decreasing of this activity. According to Ditjen Bangda (1998) these practices were not conducted by the Padaido's fishers, but by the fishers from the main land of Biak, such as Mokmer, Biak Timur, Biak Selatan (COREMAP Facilitator, Mr. Herman Warwer pers. com.). However, the result of the survey suggested that some fishers at Padaido, such as Nusi Island, might also used the bomb for fishing. According to the informal leader, this evident may due to the easy access to get the explosive materials. There are many remaining explosives from the Second World War still active to explode.

Fishing with poison, such as Derris (tuba), another destructive fishing method is very common to be used by the local fishers at Padaido Islands. So far, they did not know that this fishing technique endangers the marine environment, including coral reef, since this practice has been used from generation to generation. Another poison, such as cyanide, was identified in Biak, but it was not very common in Padaido.

Selected Fishing Technology

During the field survey in Padaido Islands, seven fishing gear and methods were identified commonly used by the local fishers, as follows:

(1) *Pancing tonda* or troll line: to catch skipjack, eastern little tuna, king mackerel and sometimes yellowfin tuna.
(2) *Pancing dasar* or handline: to catch demersal fishes, such as the red snapper, barramundi, and groupers.
(3) *Pancing dopa* or vertical line: to catch the sead, indian mackerel, and trevallies.
(4) *Pancing cumi-cumi* or squid jig: to squid
(5) *Jaring insang dasar* or bottom gillnet : to catch the red snappers, groupers etc.
(6) *Panah* or arrow: to catch groupers, lobster, octopus, and other coral fishes.
(7) *Bahan peledak* or explosives: for coral reef fishing.

The Analytical Hierarchy Process introduced by Saaty (1986), resulted selected sustainable fishing technologies (**Table 1).** This table shows *pancing tonda* (troll line), and *pancing cumi-cumi* (squid jig) are the most fishing practices which

are sustainable and not destructive for the coral reefs. The hand line, vertical line and bottom gillnet could still be used, as there is not any indication yet of over fishing stage in this fishing area. The arrow fishing has to be limited since there are reports mentioning the coral reefs destruction by the operators. The explosives fishing should be curbed by all means. Through those mentioned considerations the selected fishing technologies to be developed, are: (1) *pancing tonda* (troll line), (2) *pancing cumi-cumi* (squid jig), and (3) *pancing dasar* (hand line). Those three fishing techniques were recommended to be socialized to the fishers at Padaido Islands.

CONCLUSION

Considering the result of the study, it can be concluded as follows:

1. The reef corals coverage at Padaido Islands are under pressure of destructive fishing practices, mainly bomb. This affected about 80% of reef damage in the areas
2. There are three groups of reef fishes, i.e. major, target, and indicator groups, recorded at the study site. These fishes are ornamental fishes and fishes as food, particularly the target group of fishes used to be fishes as food, which used to be consumed as live, fresh and dry fishes. The target or consumption group mainly belongs to Family Caesiodadae, indicator group is Family Chaetodontidae, and major group is Family Pomacentridae.
3. Fishing gears used by the fishers at Padaido Islands include hook and line, gillnets, arrow, and spear.
4. Three sustainable fishing technologies are identified at Padaido, i.e. (1) *pancing cumi-cumi* (squid jig, for squid fishing), (2) *pancing tonda* (troll line, for skipjack fishing), (3) *pancing dasar* (hand line) for demersal fishes.

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