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### Assessing public awareness level on the preservation of coral reefs (The case study in Biak Numfor, Papua, Indonesia)

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(Received 5 June, 2018; accepted 20 August, 2018)

#### ABSTRACT

The aim of this study was to assess the level of public awareness on the important of the coral reefs preservation in Biak Numfor, Province Papua, Indonesia. The study employed descriptive qualitative research method. Data collection techniques were using questionnaires and interviews as well as documents. The result of this study showed that the level of public awareness on the coral reefs preservation as follows: (1) in the district of Oridek with a population of 4,665 people, there are 52% aware of the necessity to regulate the management of marine resources corals; (2) in district Aimando (population of 2,209 people) the level of awareness was high with a total 10% concern that the need for regulation management of marine resources and Padoado counties with a population of 1,707 inhabitants that have high levels of awareness about the need to regulate the management of marine resource utilization by 15%, as well as in districts Biak East with a population of 6,098 inhabitants that has a level of consciousness should be setting the management of marine resources especially coral reefs by 15%. In terms of public knowledge about the things that destroy coral reefs for Aimando region has the highest percentage, namely 50% of people already know all that can damage coral reefs. While at the district level Aimando people to things that can damage coral reefs by 21%, then the district Padoado is about 16%, in East Biak district-level people's knowledge to cause damage to coral reefs by 13%. Oridek people in the region have a high level of awareness. With Cernamp program impacts most notably the increased well-being of coastal communities. In order to maintain the balance and preservation of coral reefs need to pass a law governing regulation. Cernamp existence needs to be continued in order to preserve the existence of coral reef ecosystems to sustain life aquatic biota.

**Key words:** Public Awareness, Coral Reefs, Preservation, Papua, Indonesia

#### Introduction

Environmental issues have been the foremost concern today's people have to cope, and it is only growing more complex as they advance. It is believed that human beings are the ones to blame for their slightest footprints causing damages to the environment (Kumar, 2008). However, it is not that the people themselves are unaware of the issues

they generate. The notion is confirmed by individuals, realizing that most of the environmental issues such as coastal ecosystem and forest damage primarily root from their daily activities (Pada, et al., 2011).

The issues also take place in coastal area, in which the area is an essential life-supporting vessel providing resources and commodities for the surrounding people, if utilized properly. In the coastal

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*Key words* : Public Awareness, Coral Reefs, Preservation, Papua, Indonesia

### Introduction

Environmental issues have been the foremost concern today's people have to cope, and it is only growing more complex as they advance. It is believed that human beings are the ones to blame for their slightest footprints causing damages to the environment (Kumurur, 2008). However, it is not that the people themselves are unaware of the issues

they generate. The notion is confirmed by individuals, realizing that most of the environmental issues such as coastal ecosystem and forest damage primarily root from their daily activities (Pada, *et al.*, 2011).

The issues also take place in coastal area, in which the area is an essential life-supporting vessel providing resources and commodities for the surrounding people, if utilized properly. In the coastal

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area, most of the resources are renewable, e.g. fishes, shrimps, mollusks, pearl oysters, crabs, seaweed, mangrove forest, and coral animals, whose existence depends on efforts of preservation by a human. Moreover, the coastal area also possesses potential prospects as a space of environmental services, such as sites and habitats for recreational activities and medium of transportation. This is in line with Haryanto (2008) who argues that the potency of marine and coastal area embodies hidden economic value for everyone, particularly communities in coastal areas.

On the contrary, the promising extent lacks support from efforts of preservation by the surrounding community, shown by their state of ignorance towards the environment, e.g. littering, the preference of burning trash as the most efficient way of cleaning, illegal logging without efforts of reforestation, and construction of housing and offices with no concern of soil infiltration (Dilisti, 2011). This is possibly due to the insufficient information of preserving the environment or lack of motivation from the people of maintaining the existence of the environment.

One cannot simply impose the burden of coral reef management solely to the government. It is expected for the community to integrate with the government in efforts of maintenance to generate an optimal result to preserve coral reef. To maintain it, the slightest contribution from both sides counts. The government is responsible for disseminating to the community of information and knowledge about coral reef – of the kinds and benefits of coral reef, its function, its preservation efforts, and possible impacts if the damage to coral reef gets worse – to be further practiced by the community in actions of utilization and conservation. Given that, the community will develop a sense of belonging of the coral reef, resulting in optimal preservation efforts.

#### Literature Review

Coral reef plays a significant contribution to the surrounding community, either viewed from the social, economic, or cultural aspect. It is the foremost primary underwater ecosystem which supports almost everything to the community: supporting the community's livelihood, as a habitat for commercial commodities, a support of tourism industry, providing sand for the beach, and as a barrier for waves and coastal erosion (Westmacott *et al.*, 2000). Moreover, Dahuri (2003) asserts that coral reef is a productive spot in which it acts as a spawning ground,

nursery ground and feeding ground for the fishes. With that in mind, it is deduced that the breed of fishes surrounding the coral reef is highly productive. Also, Dawes (Supriharyono, 2007) states that coral reef also acts as a medium for other organisms, such as oysters, lobsters, and tortoises. It is mentioned by Dahuri (2003) that a coral reef is possible to provide high organic/primary productivity due to the reef's ability to hold nutrients within the system and to act as a pool, accommodating every input from outside. As a result, the nutrients generated by the coral reef as a metabolic excess are utilized by plants without having to spread them to the water beforehand. There are eight general benefits of coral reef, i.e. (a) a barrier for the beach against the sea breeze, tidal waves, ocean current, and storm; (b) a resource of germplasm and biodiversity essential for food, bio technology, and health industries; (c) a medium for the fishes to breed (decorative fishes and target fishes living within the coral reef); (d) a shelter for underwater organisms; (e) a source of organic materials, enabling the fishes to disguise to hunt for food; (f) as construction material for roads and buildings, raw material for industries and jewelry, such as coral rock; (g) as a potential spot for capture fisheries and coral tourism; and (h) a barrier for beach against wave erosion. Furthermore, loss of food security and values of biodiversity are the possible impacts happening in consequence of damage to the coral reef.

#### Contributing Factors of Damage to Coral Reefs

As an ecosystem, the coral reef is highly susceptible to changes in surrounding environments including human activities, and it requires a long time to recover. Burke *et al.* (2002) mention contributing factors of damage to coral reef, i.e.: (1) poor management of construction within the coastal area; (2) marine activities, such as ship port and direct damage from anchoring; (3) illegal logging and changes in land use, causing an increase of soil sedimentation; (4) over-fishing activities, disturbing the balance within food chain in the coral reef ecosystem; (5) the involvement of bombs and poisons in fishing activities; and (6) global climate change.

Moreover, IUCN (in Supriharyono, 2007) points out five objectives of underwater conservation site, i.e. (1) protecting and maintaining underwater and estuary system, ergo, resulting in long-term sustainable resource of living and preservation of genetic biodiversity; (2) to prevent the decrease and as a

conservation habitat of rare species; (3) to protect the underwater ecosystem from human activities which may damage it; (4) to provide sustainable welfare for the community; (5) as an appropriate management of underwater environment, with broad spectrum for human activities primarily aimed at marine and estuary maintenance. It is essential for the surrounding community to develop mutual understanding, cooperation, and sense of belonging, as a preventive way to minimize the impact of damages to the coral reef.

On top of that, Westmacott *et al.* (2000) asserts that to prevent the widespread damage to coral reef, the government is needed to disseminate to the coastal and fishermen community of these policies, i.e.: (1) setting a no-fishing zone and limitation of allowed fishing tools to use; (2) educating the fishermen to take specific protection for algae-eating and coral-eating fishes into consideration; (3) regulating the fishermen to not perform destructive fishing activities; (4) monitoring the composition and size of catches; (5) developing alternative livelihood sources for the fishermen community (if needed); (6) setting limitation for foreign fishermen by system of granting permissions; and (7) setting regulations limiting coral reef biota harvesting for aquarium and souvenirs.

Dissemination to raise the community's awareness of coral reef conservation is vital, for them to experience sustainable benefits as a result of the preservation efforts. Henceforth, contributions from the community need to be focused on the identification, planning, and implementation of conservation in the coastal area to gain numerous possible benefits (Supriharyono, 2007). Without contributions from the community, it is almost impossible for the government to execute the "Codes of Conduct for Responsible Fisheries" (FAO in Supriharyono, 2007). This is in accordance with the obligation of the government to conduct MCS (Monitoring, Control, and Surveillance) system, aimed to maintain rationality of fish and environment resources management and harmony within utilization and sustainability of fish resources (Supriharyono, 2007). Furthermore, the government has several alternatives of encouraging the community to involve in the management and maintenance of marine resources and environment. By the persuasive way, consultation and intimate approach are available to persuade the community within the area of program implementation to participate. Despite long

duration, it needs in the initial process to work effectively; the persuasion is able to calm down the tension and likelihood of conflicts. Furthermore, Mitchell *et al.* (2007) point out that consultation with the community is preferred to (1) address any upcoming issues more efficiently; (2) obtain information and understanding which is beyond science; (3) formulate socially-accepted alternatives; and (4) develop a sense of belonging to optimize the implementation. The program of raising awareness is mainly aimed to the fishermen community; however, the government needs to consider executing the program to other stakeholders too, since the fishermen only take the role of actors, not policy makers.

The key aspects of sustainable development comprise local empowerment, self-support, and social justice. One effort of implementation are to progress from traditional environmental management of fish resources dominated by professionals from government and private sectors, to the approach which involves different layers of the community (Mitchell *et al.*, 2007). In addition, Westmacott *et al.* (2000) argue that the efforts of developing sustainable fish resources are somehow tricky to execute, considering the numbers of people participating, the local community will have to strive to adapt to the new regulations and to cope with limited sources and options of livelihood. As a consequence, the development of cooperation within the community and availability of alternative sources of income is critical to support the sustainable livelihood. Moreover, the government is urged to conduct an empowerment in economic and social aspects of the local community within the coastal area with the intention to enhance the community's welfare, by utilization of coral reef potencies. If executed properly, the program enables the community to experience sustainable resources of commodities within coral reef ecosystem and to opt for alternative ways of fishing leaving the coral reef undamaged (Heger *et al.*, 1999, 2000, in Westmacott *et al.*, 2000).

### Research Method

The research combined quantitative and qualitative methods, in which the quantitative data were obtained by the survey of 180-240 households in the sample villages in Biak Numfor regency. Of 19 districts in Biak Numfor Regency, this study involved four districts, namely Oridek, Padaido, Biak Timur, and Aimando; all are located in coastal area and is-



land. The districts were preferred due to a higher rate of utilization of the potential natural resources among others. The quantitative data comprised a demographic characteristic of household members and economic standing of the households. Concurrently, the qualitative data were acquired by observation, comprehensive interview, focus group discussions, and forum, aimed to gain better understanding beyond the social and economic condition of the community and its relation to the utilization of marine resources, particularly coral reef.

### Findings and Discussion

Biak Numfor islands regency is located in Papua province, consisting of three main islands: Biak Island (1,833.86 km<sup>2</sup>), Supiori Island (437.11 km<sup>2</sup>), Numfor Island (331.26 km<sup>2</sup>); and 41 smaller islands, e.g. Padaido Island and Mapia Island. The regency has a total area of 4,010 km<sup>2</sup>, with a land area of 2,602.23 km<sup>2</sup>. Biak Numfor is one of the regions with a tropical climate and tropical rain forest, with an average of 2,228 mm yearly. This is due to the regency geographically faces the Pacific Ocean. In addition, it is quite difficult to identify and differentiate between a wet and dry season in Biak Numfor. Based on data of 2004, the maximum temperature recorded is 30.5<sup>o</sup> Celsius on average, while the minimum temperature and average daily temperature have been registered at 23.9<sup>o</sup> Celcius and 27.2<sup>o</sup> Celcius respectively.

#### Number of Household Members Involving in Coremap Activities

The survey result elucidates the awareness level of society of Biak Numfor as follows: 47 percents of household members in Oridek district involved in Coremap activities, while in Biak Timur, Aimando, and Padaido, the rate of people involving Coremap activities is 24 percents, 21 percents, and eight percents respectively. The data are presented in following Figure 1.

#### Management of Marine Resources Utilization

As obtained from the survey, the awareness level of Biak Numfor society about the significance of regulations for management and utilization of coral reef is elucidated as follows: 52 percents from 4,665 people in Oridek district are aware that management and use of coral reef need to be regulated. Moreover, in Aimando, 18 percent of 2,209 people have the awareness that the community needs to be

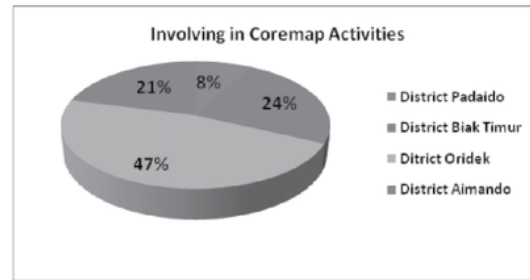


Fig. 1. Percentage of household members' involvement in Core map program

regulated in terms of management and utilization of coral reef. Furthermore, only 15 percent in both Padaido and Biak Timur district (from 1,707 and 6,698 people respectively) whose awareness of the need for rules to regulate the management and utilization of coral reef. To put it simply, the data are shown in Figure 2 as follows:

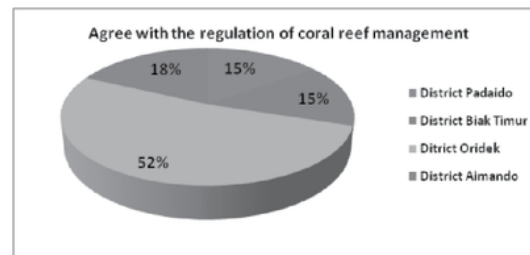


Fig. 2. The awareness of Biak Numfor society towards regulation of coral reef management.

#### Knowledge of Coral Reefs

People in every district in Biak Numfor Regency have different knowledge of coral reefs. Among all society with adequate knowledge within Biak Numfor Regency, 49 percent are from Oridek district, while 21 percents of the group are from Aimando. Moreover, the society in Biak Timur and Padaido needs further dissemination of coral reef information, since only 15 from each district whose sufficient knowledge about the coral reef. The data are illustrated in the following Figure 3.

#### Knowledge of Benefits of Coral Reef

The research discovered that particular group of people in Biak Numfor have already known of the benefits of coral reef prior to the Core map program. The distribution of community members within Biak Numfor whose knowledge of coral reef ben-

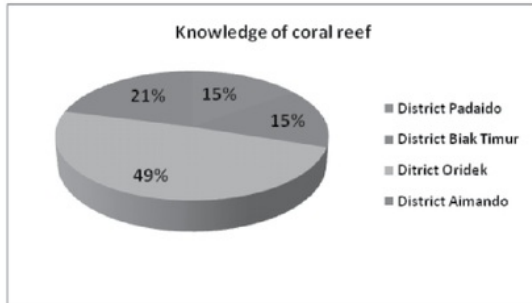


Fig. 3. Percentage of society within Biak Numfor whose knowledge of coral reef

efits is displayed as follows: of all community members within Biak Numfor who understand the coral reef benefits, 49 percents of them are from Oridek district. Moreover, there is 21 percent of the society of Aimando district who understands the benefits of coral reef, while the rest 16 and 14 percents of the group are from Padaido and Biak Timur district respectively.

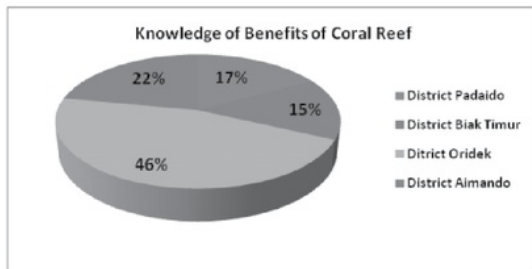


Fig. 4. Percentage of society within Biak Numfor whose knowledge of benefits of coral reef

**Knowledge of Contributing Factors Damaging the Coral Reef**

The observation reveals that the society in Biak Numfor needs more dissemination of coral reef and factors causing damage to it. This is due to the knowledge is not distributed evenly to every district in Biak Numfor regency. Of all community members whose knowledge of the factors damaging coral reef, 50 percent are from Oridek

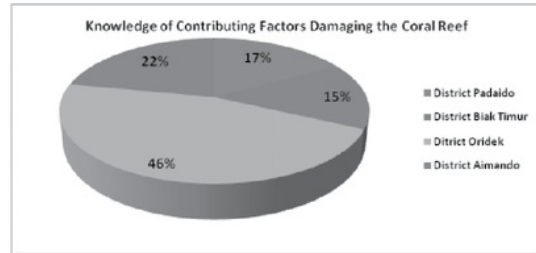
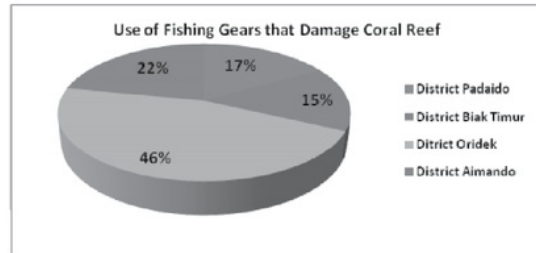


Fig. 5. Percentage of community members in Biak Numfor who understand of factors damaging the coral reef

**Use of Fishing Gears that Damage Coral Reef**

The following Figure 6 illustrates that some community members in Biak Numfor have realized of the impact of damages to coral reef and thus, opposing the use of dangerous fishing gears to the coral reef. 52 percents of the group are from Oridek district, while 16 percent are from Padaido. Additionally, there are 16 percents and 14 percents of the group which belongs to Padaido and Biak Timur district respectively. The data is shown in the following Fig 6.



district, while 21 percents of the group are from Aimando district. Moreover, the rest 16 percents and 13 percents of the group belong to Padaido and Biak Timur district respectively. The data are displayed in Figure 5 as follows.

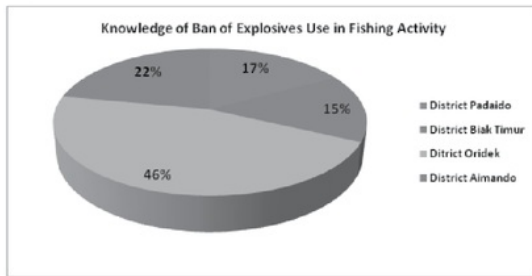
**Fig. 6.** Percentage of community members within Biak Numfor opposing the use of dangerous fishing tools to the coral reef

**Knowledge of Ban of Explosives Use in Fishing Activity**

There are some community members in Biak Numfor who understand of the destructive force of explosives in fishing activity, and the damage to the coral reef. However, the information needs to be disseminated more comprehensively, as it is unevenly distributed to each member within the community. Of all people whose knowledge of damage of explosives to the coral reef, 47 percents, and 21 percent belong to Oridek and Aimando district respectively. Moreover, 17 percents of the group are from Padaido, while 15 percent are from Biak



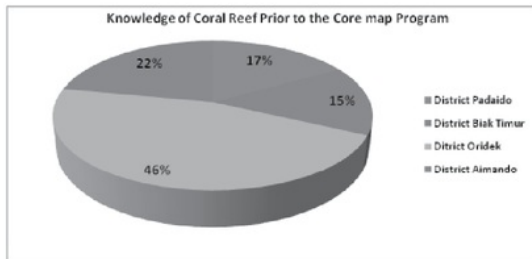
Timur. The percentage is elucidated in following Figure 7.



**Fig. 7.** Percentage of the community members who understand of the damage of explosives in fishing activity

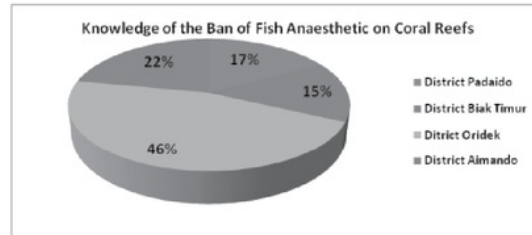
**Knowledge of Coral Reef Prior to the Core map Program**

Previous to the core map program, there are some community members in Biak Numfor whose basic understanding of coral reef. Aimando is the district with most members whose basic knowledge of coral reef before the implementation of core map program, with 70 percents, while in Oriodek, there are 30 percents of community members whose basic understanding of coral reef. On the contrary, community members in Padaido and Biak Timur have no initial knowledge of the coral reef before the core map program. The data is displayed as follows.



**Fig. 8.** Percentage of community members within Biak Numfor whose basic knowledge of the coral reef prior to core map program

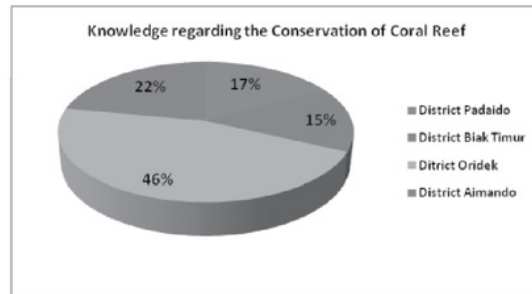
Aimando district is at 21 percent and the Padaido district has the lowest percentage among all with 15 percent. The following Figure 9 illustrates the explanation of people’s understanding regarding such an issue:



**Fig. 9.** Understand the Ban of Fish Anesthetic on Coral Reefs

**Knowledge regarding the Conservation of Coral Reef**

The percentage of the understanding of people of Biak Numfor Regency on the conservation of coral reef is varied. The percentage of the Oridek district is at 48 percent, Aimando with 21 percent, and the lowest districts are Padaido and Biak Timur with the percentage at 16 % and 15 % respectively. This is described in the following Figure 10:



**Knowledge of the Ban of Fish Anaesthetic on Coral Reefs**

People’s knowledge regarding the ban of anesthetic

on coral reefs in each district is different; in Oridek district, the percentage of people's understanding is at 41 percent preceded by Biak Timur district with 23 percent. Furthermore, the percentage of

**Fig. 10.** Understand the Ban of Fish Anaesthetic on Coral Reefs

**Knowledge of Core map Program**

People's knowledge of core map program in each district is different; in Oridek district, the percentage of people's knowledge is at 48 percent, followed by Aimando district with 21 percent and Padaido district with 16 percent. Further, the lowest percentage among all is Biak Timur district with 15 percent. The following Figure 11 explains people's knowledge regarding such an issue:

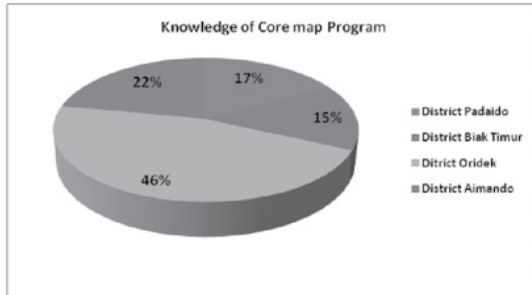


Fig. 11. Knowledge of Core map Program

**Eagerness to Involve in Core map Activity**

People’s eagerness to involve in core map activities in Biak Numfor Regency is at a different level. Each district has its own percentage, in which Padaido district gets 17 percent of its total population who wants to involve in core map activities, and then it is followed by Biak Timur district with 15 percent and Oridek district with 46 percent. Aimando district, however, arrives at 22 percent of its total population. Figure 14 illustrates people’s eagerness to involve in core map activities.

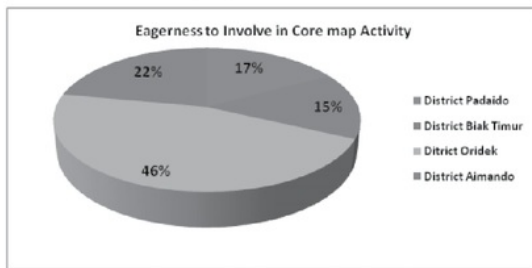


Fig. 14. People’s eagerness to involve in core map activity

**Knowledge of Coral Reef Supervision**

Coral reef supervision should be importantly conducted to avoid its damage that caused by people’s negligence in managing marine resources. Most people in Biak Numfor have understood the marine resources supervision with different levels of knowledge in each district, which Oridek district reaches 41 percent of its total population, followed by Aimando district with 33 percent and Biak Timur district with 22 percent. The lowest percentage of 4 percent, on the other hand, is from Padaido district of its total population. Figure 15 illustrates the explanation.

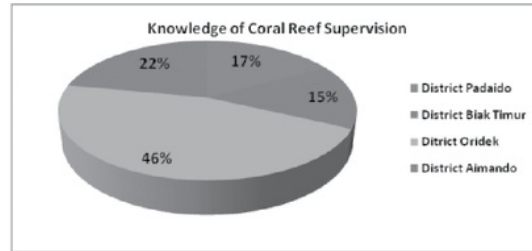


Fig. 15. Knowledge of Supervision

**Sustainability of core map Program**

Core map program gives a positive impact on people’s life improvement in Biak Numfor Regency that they can live independently and preserve the natural resources. On top of it, people are eager to sustain this core map program to maintain its good impact (Naning Romdiati, 2008).

From Figure 16, it illustrates that people in Oridek district want to sustain the program with 50 percent, followed by Aimando district with 20 percent, Padaido and Biak Timur district with 15 percent.

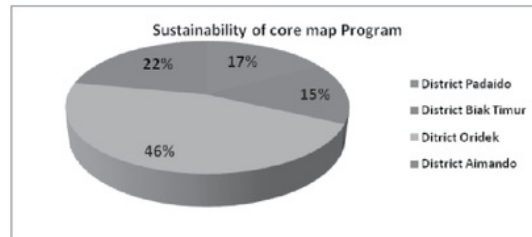


Fig. 16. People’s Eagerness to sustain the core map Program

**Supervision Activities in Each District**

Developing core map program requires community’s involvement in which people in Oridek district have involved at 64 percent, Padaido

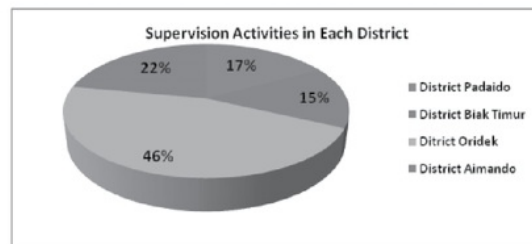


Fig. 17. Supervision Involvement

district at 20 percent and Aimando district at 15 percent. Unfortunately, there is no program involvement from people in Biak Timur district. The following Figure 17 explains this issue.

**Punishment Approval for Violation**

It is necessary to punish people who break the rule for its enforcement around core map location in which community obedience can support the program development.

The awareness level of individuals towards the rule in Biak Numfor Regency is different; 15 percent of people in Padaido district are aware of the rule, while in Biak Timur, Oridek and Aimando district, the rate of individuals who are aware of the rule is 14 percent, 51 percents, and 20 percent respectively. The data are presented in Figure 18, as follows:

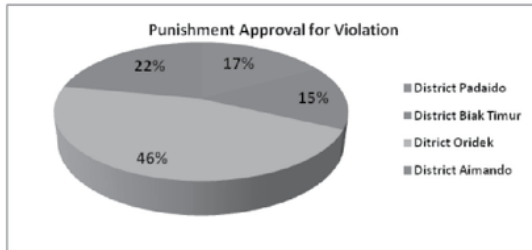


Fig. 18. Punishment Approval for Violation

**Knowledge of Coral Reef Harvesting Ban**

Coral reef as a marine resource should be preserved due to the ecosystem balance in its marine. If there is damage to the coral reef, the other habitats will be affected by its damage as well (Novaczek, 1997). Several coral reefs have been damaged in these days era, and it caused by surrounding people’s daily activity that they have continually harvested coral reef as a building material. For that reason, there should be a regulation regarding the ban of coral reef harvesting in any ways (Asep Sukmara, 2001).

Based on survey results, some respondents from Biak Numfor Regency agree with the rule application on the ban of coral reef harvesting. It is expected that it can help preserving coral reef ecosystem in the region. The data from the survey reveal that people in Oridek district agree with the regulation, and it gets the highest percentage of 53 percent, followed by Biak Timur district and Aimando district that rate of people who approve the ban of coral reef

secutively. The data are presented in Figure 19.

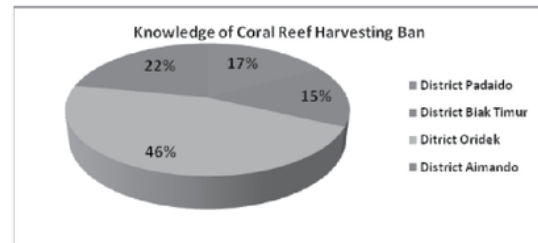
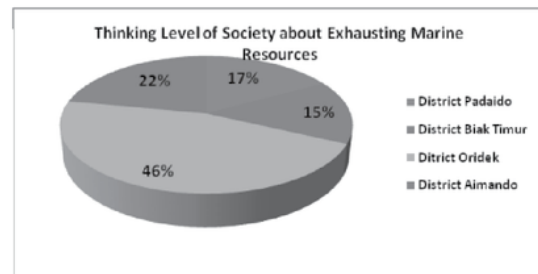


Fig. 19. Knowledge of Coral Reef Harvesting Ban

**Thinking Level of Society about Exhausting Marine Resources**

As obtained from the survey, most people argue that marine resources will be slowly exhausted. A survey in each district acquires various results; 59 percent of people in Oridek district claim that marine resources will be run out, and then the percentage in Biak Timur district is 27 percent. Furthermore, the rate of people in Aimando and Padaido district who believe in exhausting marine resources is only 11 % and 3 % respectively. Figure 20 explains in detail:



harvesting is 30 percent and 12 percent con-

**Fig. 20.** Thinking Level of Society about Exhausting Marine Resources

### **Conclusion**

The purpose of this study is to understand people's role in preserving coral reef through core map program and to discuss the impact of the program on community's welfare improvement around East Region in Indonesia. Environmental preservation is crucial for people to care about; therefore, actual action and broad knowledge are required to conserve coastal area. The results show that (1) people in Oridek district have bigger awareness and thinking level than the other areas, (2) better coral reef is



successfully achieved by implementing core map program, (3) the most dominant impact of core map program is on coastal community's welfare in Biak Numfor Regency, (4) there should be a coral reef balance and preservation after core map program implementation by setting law regulation, (5) core map program sustainability is required to preserve coral reef ecosystem and its marine biota.

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