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Kenta Tanaka
Faculty of Economics, Musashi University

Keisaku Higashida
School of Economics, Kwansei Gakuin University

Arvin Vista
Department of Agricultural Economics, University of the Philippines Los Baños

Anton Setyo Nugroho
Ministry of Maritime Affairs, Republic of Indonesia

Budi Muhamad Ruslan
Ministry of Marine Affairs and Fisheries, Republic of Indonesia

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SCHOOL OF ECONOMICS

KWANSEI GAKUIN UNIVERSITY

1-155 Uegahara Ichiban-cho
Nishinomiya 662-8501, Japan

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Kenta Tanaka[a], Keisaku Higashida[b†], Arvin Vista[c], Anton Setyo Nugroho[d], Budi Muhamad Ruslan[e]

a) Faculty of Economics, Musashi University
b) Faculty of Economics, Kwansei Gakuin University
c) Department of Agricultural Economics, University of the Philippines Los Baños
d) Ministry of Maritime Affairs, Republic of Indonesia
e) Ministry of Marine Affairs and Fisheries, Republic of Indonesia

Abstract

This paper examines the effect of fishery resource depletion experiences on the social cooperative preferences of fishermen. We adopt (i) the value orientation test to measure cooperativeness and (ii) experiences that are subjectively perceived. Additionally, we focus on the perceived causes of resource depletion experienced by fishermen. Similar to previous studies, we find clear correlations between experiences and preferences. Moreover, we find that the impact of resource depletion experiences depends on whether fishermen perceive artificial factors or changes in the natural environment to be its causes. Particularly, resource depletion experiences caused by artificial factors are likely to make fishermen more cooperative, while those caused by changes in the natural environment are likely to make fishermen less cooperative.

Keywords: Cooperativeness, Experiences, Fishery resource depletion, Value orientation test.
JEL Classificatoin: C93, Q22, Q56.

† Corresponding Author: School of Economics, Kwansei Gakuin University. Address: 1-155, Ichiban-cho, Uegahara, Nishinomiya, Hyogo, 6628501, JAPAN. E-mail: keisaku@kwansei.ac.jp

1. Introduction

It is well known that common pool resources are likely to be overharvested by resource users. Fishery resources are one of the typical common-pool resources that have suffered from overharvesting over the past several decades. According to the Food and Agriculture Organization (FAO) (2014), the ratio of under-fished species is less than 0.2 globally, and not only large scale, but also small scale fishermen have been facing this problem. However, small scale fishermen may suffer from stock depletion more severely than large scale ones. In particular in developing countries, scales are typically too small to be efficient, and the numbers of fishermen on the fishing grounds are too large for a sustainable use of resources.[1]

Consequently, authorities and researchers have been designing resource management measures for avoiding the tragedy of the commons. Although various types of measures, such as output, input, and technology controls, have been implemented globally, this goal has not yet been achieved. Particularly in the case of coastal fisheries, which typically consist of local common pool resources, it is often observed that formal regulations do not work as intended by the authorities, as fishermen sometimes neither know the existence of those regulations nor understand their meaning.

One of the important reasons for top-down management measures not working effectively is that those measures often ignore socio-economic characteristics of local communities and natural conditions of the local common pool resources used by community members. Each community has a history and, accordingly, has unique customs and characteristics. Moreover, the species of fish harvested and climate/water conditions differ across fishing grounds. As such, it is easily predicted that these socio-economic factors and

[1] See also FAO (2014) for the numbers of fishermen and the scales of fishing activities in Asian and African regions.

natural conditions influence the preferences and behavior of fishermen.[2] Subsequently, the implementation of voluntary management measures implemented by local residents/fishermen is important for successful resource management, because local fishermen know their history, customs, and natural conditions. For example, using experiments, Sutter et al. (2010) found that endogenously implemented institutions lead to better cooperation than exogenously implemented ones. Other articles also show that exogenous measures may make local residents less cooperative and/or ruin endogenous cooperative customs (Cardenas et al., 2000; Kits et al., 2014; Velez et al., 2010; Vollan, 2008).[3]

To implement voluntary management schemes smoothly and for them work effectively, cooperation or pro-social behavior of local fishermen plays a key role. Therefore, it is important to clarify the circumstances and conditions under which fishermen's preferences become more cooperative and their behavior more pro-social. For example, although targeted areas are not fishing villages, Handberg and Angelsen (2015) examine pro-social behavior of local forest users in Tanzania using framed field experiments. Moreover, d'Adda (2011) also investigates the effects of social norms and external incentives on pro-social behavior by conducting an artefactual field experiment in Bolivia.

Hence, the purpose of this paper is to clarify the relationship between social cooperative preferences and socio-economic factors of fishermen and fishing villages. In particular, we focus on the effect of experiences on social cooperative behavior.

Recently, the effect of various experiences on preferences and behavior have drawn attention. Previous studies reveal that traumatic events, such as civil wars, can cause changes

[2] Many experimental and empirical articles examined the relationship between socio-economic factors and preferences. For example, see Becker and Mulligan (1997), Bouma et al. (2008), Fehr and Hoff (2011), Gächter et al. (2004), Harbaugh et al. (2002), Henrich (2000), Levin et al (2007), Prediger et al. (2011), Sutter and Kocher (2007), Tanaka and Munro (2013), among others.

[3] On the other hand, government policies that support voluntary management schemes may be able to complement endogenous cooperation (Pongthanapanich and Roth, 2006; Stanley, 2000; Tachibana and Adhikari, 2009).

in preferences. For example, Callen et al. (2014) investigate the relationship between violence and economic risk preferences in Afghanistan. Additionally, Kim and Lee (2014) reveal the relationship between the experience of the Korean War and risk preferences. However, traumatic events may also affect other preferences. Voors et al. (2012) conduct a field experiment in rural Burundi and show that experiencing violence changes risk, time, and social cooperative preferences of people. Moreover, they also verify that severe draughts have the possibility to make people more cooperative.[4]

Preferences of fishermen have also been investigated in relation to fishing activities. Leibbrandt et al. (2013) find that the longer is the experience of fishing activities in a lake, the less cooperative fishermen become. On the other hand, the longer the experience of fishing activities in the sea, the more cooperative fishermen become. That is because fishermen in coastal villages usually cooperate with each other when fishing in the sea, while fishermen in lake villages usually compete with each other for limited fish resources. These experiences influence fishermen's preferences and behavior. As such, Nguyen and Leung (2009) and Nguyen (2011) examine the effect of fishing activities experiences on the risk preference of fishermen, and find that fishermen become less risk averse with a longer fishing experience. Regarding environmental degradation, conflicting results can be observed. For example, according to Karapetyan and d'Adda (2014), local residents who have the experience of environmental degradation tend to donate more and take action for conservation, while Prediger et al. (2014) reveal that environmental scarcity can increase antisocial behavior.

Regarding overharvesting in fisheries, experiences of depletion may be one of the important factors that influence the cooperativeness and pro-social behavior of fishermen. The reasoning is as follows. Fishermen often face sudden decreases in fish stocks in their

[4] Other types of experiences have been also examined. For example, see Eckel et al. (2009) for experiences of the hurricane Katrina, Eckel et al. (2012) for school environment, and Fisman et al. (2014) for the great recession.

own fishing grounds, and those stocks sometimes recovering over several years. The resource depletion may take place because of artificial factors, such as overharvesting, or because of natural conditions, such as disasters. Irrespective of the reason being artificial or natural, many fishermen perceive that they experience resource depletion. Because fish stocks are what keeps fishermen alive, experiencing resource depletion is likely to change the preferences of fishermen. Because they have to cooperate with each other to operate effective resource management schemes by themselves, these experiences may clearly impact the social cooperative preference.

This paper has three important features. First, we adopt the value orientation test (social value orientation (SVO)), which can be used to measure SVO of subjects and analyze their preference for cooperation. The value orientation test was developed in psychology (e.g., Griesinger and Livingston, 1973; Liebrand, 1984).[5] In this test, a subject answers a series of questions, each of which has two alternatives: each alternative includes the reward to herself/himself and the reward to the partner randomly determined by the experimental organizer. The rewards differ between the two alternatives.[6] The result of the value orientation test represents the weight that an individual attaches both to his or her own welfare and to the welfare of other individuals (Offerman et al., 1996). Considering the condition of experimental sites that include rural areas in developing countries, we believe that this method is the most suitable for our research purpose.[7]

Second, we adopt not only experiences that are objectively verified, but also experiences that are subjectively perceived. It is often difficult to estimate the resource stock precisely: fishery resources being typical examples. Fish moves from region to region, and it is difficult to determine the number of specific species in a certain area, which implies that even

[5] Moreover, Murphy et al. (2011) have introduced a new measure of SVO.
[6] The details of the SVO we adopted will be described in subsection 2.2.
[7] The value orientation tests are used in economics as well (Kanagaretnam et al., 2009; Sharier et al., 2016; Upton, 2009).

scientific stock estimations face uncertainty. Moreover, estimations are conducted in some regions, and not in other regions, even if those regions belong to the same eco-system. Therefore, it is often impossible to know the exact amounts of fish stocks. Consequently, fishermen do not trust scientists. In such cases, subjectively perceived experiences influence the preferences and behavior of fishermen, who make decisions based on their own perception and knowledge of resource depletion.[8,9]

Third, previous studies show that there certainly are correlations between experiences and preferences. On the other hand, those results do not reveal what types of experiences increase or decrease the degree of cooperativeness of resource users. However, the direction of changes in preferences may differ depending on perceived causes of resource depletion. For example, disaster may make people consider that it is meaningless to make efforts for restricting their fishing activities for sustainable use. Therefore, in the questionnaire survey used, we ask fishermen about their perceived causes of resource depletion.

Our results are very interesting. First, in line with previous studies, we find clear correlations between experiences and preferences. Second, the impact of an experience of resource depletion may depend on whether fishermen perceive that the depletion was caused by artificial factors or changes in the natural environment. Particularly, experiences of resource depletion caused by artificial factors are likely to make fishermen more cooperative, while experiences of resource depletion caused by changes in the natural environment are likely to make fishermen less cooperative.

The remainder of this paper is organized as follows: Section 2 provides the details of the

[8] In psychology and economics, the relationship between cognition and behavior has been investigated. For example, see Dickert et al. (2011), Kieslich and Hilbig (2014), Rabin (1994), and Sun and Naveh (2007), among others. Kimball (2015) provides the outline of cognitive economics.

[9] In both theoretical and experimental articles, preferences such as cooperativeness, altruism, and inequality aversion, are often included in utility functions (Aguiar et al., 2010; Brock et al., 2013; Congleton and Fudulu, 1996; Gaspert and Seki, 2003; Hwang and Bowles, 2012; Kamas and Preston, 2012; Korenok et al., 2013; Kotani et al., 2010; Lipford and Yandle, 2009; Nyborg and Rege, 2003; Platteau and Seki, 2007). Therefore, a change in cognition/perception influences parameters and exogenous variables in those utility functions.

experimental survey; Section 3 examines the data and the results of the estimations; and Section 4 provides concluding remarks.

2. Experimental Setting

2.1 Locations

In this study, we carry out experimental sessions in the Philippines and Indonesia. The locations are shown in Figure 1 for the Philippines and Figure 2 for Indonesia. We chose two areas in the Philippines: Puerto Princesa and its suburban area in the Palawan Island and General Santos and its suburban area in the Mindanao Island; and three areas in Indonesia: Kubu Rata District in the Kalimantan Island, Cirebon in the Java Island, and Macassar in the Sulawesi Island. The fishing industry, in particular coastal fishing is one of the important industries for local people in the targeted areas.

The reasons for choosing these areas for the experimental survey are as follows. Natural characteristics, such as fishing species and climate conditions, are different across regions. Moreover, fishery management methods also differ across regions, and some regions have implemented management schemes voluntarily, while central or local governments have enforced measures for controlling fishing activities in other regions. Our purpose is to verify the relationship between experiences and social cooperative preferences of fishermen that universally hold for various fishing communities. For data on one specific country or region, we find that the relationship can be observed only in that specific region, or we may not be able to determine factors that influence preferences. To control such effects, we need to collect data on various types of fishermen, which implies that it is effective to carry out the experimental surveys in more than one country/region.

Details of the venues and the numbers of subjects in each session are shown in Table 1. We conducted 16 experimental sessions in total: eight sessions in the Philippines, and

another eight sessions in Indonesia. We chose three sites in Puerto Princesa and one site in General Santos, considering that the larger the variations in socio-economic and natural backgrounds of fishermen, the more robust the results. Therefore, even when we conducted the experimental sessions more than twice in the same site, the subjects were selected so that the communities represented in one session were different from those in other sessions. In the Philippines, we selected subjects from more than one fishing community in each session, while we selected subjects who are living in the same fishing community for each session in Indonesia.[10] Basically, 16 subjects participated in each session, and we obtained data on 250 subjects in total.

2.2 A Decomposed Game to Measure Social Value Orientation

Although we conducted six types of games, we explain SVO in detail, which is used in this analysis.[11]

The result of the value orientation test represents the weight that an individual attaches both to his or her own welfare and to the welfare of other individuals (Offerman et al., 1996). From the results of this test, we can classify each subject's characteristics of cooperation into five categories: *altruistic*, *cooperative*, *individualistic*, *competitive*, and *aggressive*. According to the classification established by Offerman et al. (1996) and Park (2000), an individualistic person considers his or her own profit maximization. A cooperative person tends to cooperate with others for mutual benefit, and an altruistic person wants to maximize the benefits of other individuals, regardless of his or her own outcome. Moreover, a competitive person wants to be better off than others, and an aggressive person attempts to create the worst outcome for other individuals, regardless of his or her own outcome.

[10] Particularly, we visited remote areas in Kubu Raya and Macassar. Therefore, the distance between the targeted and neighbor communities is great. Therefore, it was impossible or very costly to collect subjects from more than one community/village for each session.

[11] The other games were a game to extract risk preference, a game to extract time preference, a dictator game, an ultimatum game, and a simple public goods game.

Although there are various types of value orientation tests, we adopted a test based on that of Park (2000).

The game consisted of 24 questions (see Table 2). In each question, subjects chose between two alternatives: Choice A and Choice B. Each option specifies an amount of money to the subject (x) and an amount to another subject with whom the individual is anonymously paired during the game (y). Following Park (2000), we set up the pairs of amounts so that $x^2 + y^2 = 15^2$. Subjects were told that their total points would be the sum of the amount they kept and the amount from their partner. For example, in the case of Question 1, i) if a subject chooses Choice A and his partner Choice A, both he and his partner receive 15 points, ii) if a subject chooses Choice A and his partner Choice B, he receives 14.5 points and his partner 18.9 points, iii) if he chooses Choice B and his partner Choice A, he receives 18.9 points and his partner 14.5 points, and iv) if he chooses Choice B and his partner Choice B, both he and his partner receive 18.4 points. The actual payments to subjects from this game were calculated based on these points.[12]

Social psychologists use the observed motivational vector, which is the ratio of the sum of amounts a subject keeps for himself or herself against the sum of amounts the subject gives to her/his partner, to classify each individual's value orientation. Subjects with an observed motivational vector lying between degree −112.5 and −67.5 are classified as aggressive; subjects with vectors between −67.5 and −22.5 are classified as competitive; subjects with vectors between −22.5 and 22.5 are classified as individualistic; subjects with vectors between 22.5 and 67.5 are classified as cooperative; and subjects with vectors between 67.5 and 112.5 are classified as altruistic.[13] If subjects with vectors greater than 112.5 or smaller than -112.5 cannot be classified. In this study, such subjects are *unidentified*.

[12] It took approximately three hours to complete one session including all games and questionnaire survey. We paid PHP 800 on average per subject in the Philippines and IDR 142,160 on average per subject.

[13] We also follow the classification method of Park (2000).

Generally, observed motivational vector values show the degrees of altruism (or social preference). Therefore, the unidentified type can be divided into two types. In this study, subjects with vectors greater than 112.5 are classified as *upper-unidentified*, while subjects with vectors smaller than -112.5 are classified as *lower-unidentified*. Upper-unidentified subjects may be more altruistic than subjects classified as altruistic, and lower-unidentified subjects may be more aggressive than subjects classified as aggressive. Each subject participated in only one session.

2.3 Questionnaire Survey

After the experimental games, we administered a questionnaire survey, which investigated (i) personal attributes, such as age, occupation, and income; (ii) community attributes, such as customs and biodiversity; (iii) fishing activities, such as species and gears; and (iv) the experience of fish stock depletion.[14]

The most important items are those on fishery resources depletion experiences. We ask the subjects whether they have an experience of serious fishery resource depletion in the past. Additionally, we also ask the subjects who have such experiences about the reason for the resource depletion they experienced. Note again that the experiences and causes are perceived ones. In this questionnaire, the subjects can choose one reason out of four choices (*over fishing*, *storm*, *natural occurrence*, and *other*). When they choose "other," they are requested to write down the specific cause.[15]

According to their choices, we classify their experiences into six types (*Depletion 0*, *Depletion 1*, *Depletion 2*, *Depletion 3*, *Depletion 4*, and *Depletion 5*). *Depletions 1–5* imply

[14] The details of the questionnaire will be distributed upon request.

[15] When we implemented the questionnaire survey in Palawan (sessions 1–4), the question on the reason for resource depletion was not printed on the questionnaire sheet. When we were able to specify the reasons from the answers to other questions, we classified their experiences into one of the five categories (Depletions 1–5). On the other hand, if it was impossible to specify the reasons, we classified their experiences as Depletion 0.

the experience of resource depletion caused by overfishing, typhoons, changes in natural environments, illegal fishing, and clumsy community/people, respectively. Moreover, when a subject has an experience of resource depletion but did not provide any cause, we classify the experience as *Depletion 0*. In the estimations, we use a dummy variable for each classified experience. For example, when a subject has an experience of resource depletion caused by overfishing, the dummy variable, *Depletion 1*, is equal to one, and otherwise it is equal to zero.

The meaning of clumsy community/people should be noted. Subjects whose experiences are classified into *Depletion 5* consider that people tend to act without deliberately considering the consequences, which they may regret later. Or, those subjects consider that people do not care about the result of their fishing activities, which can be exhaustion of fish stocks. Therefore, it is considered that these subjects perceive that resource depletion was caused by fishing activities, but they cannot specify the exact activities or fishermen.

Additionally, we also classify causes into two categories, *artificial* and the *environment*. When the cause is classified as *Depletions 1*, *4*, or *5*, we consider that the cause is artificial, while when the cause is classified as *Depletions 2* or *3*, we consider that the cause is changes in the natural environment. In estimations, we also use one dummy variable for each category. When a subject has an experience of resource depletion caused by overfishing, illegal fishing, or clumsy community/people, the dummy variable *artificial* is equal to one, and otherwise it is equal to zero. On the other hand, when a subject has an experience of resource depletion caused by typhoon or changes in the natural environment, the dummy variable *environment* is equal to one, and otherwise it is equal to zero.

3. Results

3.1 Overview of Value Orientation Results

The results of the value orientation test in all sessions are shown in Table 3. Previous studies show that, on average, seven out of ten persons are classified as individualistic (e.g., Kotani et al. 2014; Park, 2000). Therefore, our results show a different distribution of social cooperative preferences as compared with existing literature. However, samples of previous studies are typically students or people in developed countries. On the other hand, articles that focus on local people in developing countries obtain similar results to ours. For example, Shahrier et al. (2016) conduct a social value orientation test in Bangladesh, and show that individualistic subjects are around 28 percent on average. Additionally, they report that some people are classified as unidentified, which is also in line to our results.

Moreover, our results show that the numbers of subjects classified into a certain type are different across sessions, which indicate that social preferences may depend on regional socio-economic and natural characteristics. Additionally, trends clearly differ between the two countries. For example, the ratio of cooperative subjects in Indonesia is greater than that in the Philippines, while the ratio of individualistic subjects in Indonesia is smaller than that in the Philippines. However, the ratios of competitive and aggressive subjects in Indonesia are greater than in the Philippines.

In both countries, the ratio of cooperative subjects in our experimental survey is relatively high. Generally, fishermen who fish in the sea tend to be cooperative, because they often have to cooperate with each other to catch fish and avoid accidents caused by storms. Because all of our subjects are harvesting fish in the sea. Thus, our results are consistent with the results of Leibbrandt (2013).

3.2 Factor Analysis of Social Value Orientation by Ordinary Least Squares Estimation

To show the robust relationship between social cooperative preferences and experience of fishery resource depletion, we estimate the following equation by ordinary least squares with

robust standard errors:

$$SVO_i = \sum_{k=1}^{6} Depletion_{i,k} + age_i + edu_i + punishment_i + fishers_i + program_i + trouble_i + D_s + c + \varepsilon \,, \quad (1)$$

where *i* denote the index for each subject. *SVO* is the social value orientation index based on the value orientation test. We use the observed motivational vector (the ratio of the sum of amounts a subject keeps for himself or herself against the sum of amounts the subject gives to her/his partner) as the SVO value. In this estimation, the observed motivational vector is used as *SVO*. *Depletions* are key variables that represent fishery resource depletion experiences. As discussed in the previous section, we classify the experiences of resource depletion into six types. In model 1, we use dummy variables of all six types as independent variables. In model 2, we adopt the second classification method described in the previous section: we classify *Depletions 1*, *4*, and *5* as resource depletions caused by artificial factors, and *Depletions 2* and *3* as resource depletions caused by environmental factors. Moreover, in model 3, we also include *Depletion 0* into the artificial factors.

Age represents the age of each subject. Previous studies show that the degree of altruism is correlated with age. To control the subject's age effect on *SVO*, we add *Age* as one of the independent variables. *Edu* represents the educational record of each subject, ranging from 0 to 3: the subjects who do not have the any educational record are classified as 0; the subjects who graduated from an elementary school are classified as 1; the subjects who graduated from a junior high school or high school are classified as 2; and the subjects who graduated from a university or college are classified as 3. Previous studies also show that the social value orientation index is correlated with education (Shahrier et al., 2016). Therefore, we also add the academic record as an independent variable. *Punishment* is a dummy variable to

represent whether each subject's community has a punishment rule for violators of fishing rules enforced in this community. *Fishers* shows the number of fishermen in each subject's community. *Program* is also a dummy variable showing whether each subject has an experience of joining an official program for resource conservation, fisheries management, or better fishing technique. Because such programs may change the behavior of fishermen towards being environmentally friendly, we adopt this dummy variable as an independent variable. *Trouble* is a dummy variable that shows whether each subject has experience of conflict with other fishermen. D_s is the experimental session dummy, which captures the regional effect of each experimental site. As previously discussed, we cannot omit the session bias in each experiment. Therefore, D_s contributes to controlling the sample location bias. Table 4 shows the data description of each independent variable.

Table 5 shows the estimation results based on equation (1). First, we focus on the estimation result of the variables related to resource depletion experiences. Some of the dummy variables related to resource depletion experiences show significant correlation with *SVO*. In model 1, the coefficients of *Depletion 0* and *Depletion 5* are significantly positive, while the coefficient of *Depletion 3* is significantly negative. These results imply that different types of experiences have different impacts on social cooperative preferences.

In fact, the results of models 2 and 3 show the same trend. According to the estimation results of model 2, the coefficient of *artificial* (*Depletions 1*, *4*, and *5*) is significantly positive, while the coefficient of *environment* (*Depletions 2* and *3*) is significantly negative. Even if *Depletion 0* is classified as a resource depletion caused by artificial factors, the same results are obtained (model 3). These results reveal that the impact of a resource depletion experience depends on whether fishermen perceive that the depletion was caused by artificial factors or changes in the natural environment. Particularly, experiences of resource depletion caused by artificial factors are likely to make fishermen more cooperative. On the other hand,

experiences of resource depletion caused by changes in natural environments are likely to make fishermen less cooperative.

The possible reasons for these changes in social cooperative preferences are as follows. Assume that a fisherman considers that he experienced resource depletion due to artificial factors, such as overfishing or illegal fishing. As such, he learned the importance of cooperation among fishermen to decrease fishing efforts and avoid resource exhaustion. Therefore, not only his behavior changes towards being more cooperative, but also his preferences become more cooperative. On the other hand, assume that a fisherman considers that a natural disaster took fishery resources away from him and his colleagues. In this case, he may consider that it is meaningless for fishermen to cooperate with each other and pay costs to avoid resource exhaustion. Therefore, he may become less effective after experiencing the disaster and the ensuing resource depletion than before.

Estimation results of other independent variables are similar in all estimation models. The coefficients of *Edu* and *Fishers* are significantly positive in all three models. However, Shahrier et al. (2016) obtain opposite results on education: the persons who have a high educational background tend to be less cooperative. One possible reason for obtaining the opposite sign for the coefficient of education is that our subjects are fishermen. A person with advanced education understands that fishermen have to cooperate with each other to operate better resource management systems. Therefore, the more highly a subject is educated, the more cooperative he becomes. If a large number of fishermen live in the same community, social pressure may be high, while, in small communities, residence and fishing locations may be distant from other fishermen. Therefore, fishermen living in such small communities do not feel strong social pressure for cooperation.

Punishment shows the negative correlation with the social cooperative preference, which implies that subjects who live in communities with punishment mechanisms are less

cooperative than subjects who live in communities that do not have such mechanisms. Generally, it is considered that exogenous implementation of a resource management scheme makes local resource users more selfish, while voluntary implementation makes them less selfish. When governments implement punishment mechanisms in the villages we visited, this result is in line with the results in existing literature (e.g., Ostrom, 2000). However, when punishment mechanisms are voluntary, this result is inconsistent with the logic of the relationship between enforcement of management schemes and cooperativeness of local residents. Moreover, this result may show the reverse causal relationship with dependent variable: communities need to introduce strict rules if community members have low social cooperative preferences.

Finally, *Program* shows the positive correlation with the dependent variable in models 2 and 3. Government programs encourage the importance of managing fishery resources. Therefore, the programs that have educational effects may increase the cooperativeness of fishermen.

3.3 Factor Analysis of Social Value Orientation by Multinomial Logit Estimation

As mentioned in the previous section, some subjects are classified as upper-unidentified or lower-unidentified. However, some of the subjects who are classified as upper-unidentified have similar motivational vectors as those who are lower-unidentified.[16] Although our previous estimations clarify the strength of social cooperative preferences, we cannot omit the bias caused by unidentified subjects. To confirm the robustness of our results, we also estimate the degree of social cooperative preferences using a multinomial logit model.

Dependent variables are the dummy variables based on each type (*upper-unidentified*, *altruistic*, *cooperative*, *individualistic*, *competitive*, *aggressive*, and *lower-unidentified*). The

[16] For example, a subject whose vector value is 179 is classified as upper-unidentified, while a subject whose value of vector is -179 is classified as lower-unidentified.

estimation results are shown in Table 6.

The results show that the subject's type based on the SVO test is affected by resource depletion experiences. In particular, *altruistic* and *cooperative* types show significant correlation with such experiences. For example, *Depletion 2* decreases the choice probability of *altruistic* and *cooperative*. Additionally, *Depletion 3* decreases the choice probability of altruistic. On the other hand, *Depletion 5* increases the choice probability of *altruistic* and *cooperative*. These results imply that resource depletion experiences particularly affect social cooperative preferences of subjects whose social cooperativeness indices are relatively high. The result of the multinomial logit estimation also supports the results obtained by the ordinary least squares estimation: Correlations between perceived fishery resource depletion experiences and cooperativeness exists and the direction of the effect of experiences on cooperativeness depends on perceived causes of experiences.

4. Conclusion

We have examined the effect of fishery resource depletion experiences on the social cooperative preferences of fishermen. We adopted (i) the value orientation test to measure cooperativeness and (ii) experiences that are subjectively perceived. Additionally, we focus on the perceived causes of resource depletion experienced by fishermen.

Our results support the results obtained in the previous studies in the sense that there are clear correlations between perceived experiences and social cooperative preferences. Moreover, we found that the impact of resource depletion experiences depends on whether fishermen perceive artificial factors or changes in the natural environment to be its causes. Particularly, resource depletion experiences caused by artificial factors are likely to make fishermen more cooperative, while those caused by changes in the natural environment are likely to make fishermen less cooperative.

Although our results are clear, it would be interesting and important to survey more regions for obtaining more robust results. It would be also interesting to investigate correlations between experiences and other types of preferences.

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References

Aguiar, F., P. Braňas-Garza, M. P. Espinoza, L. M. Miller (2010). Personal identity: A theoretical and experimental analysis. *Journal of Economic Methodology* 17, 261-275.

Becker, G. S., C. B. Mulligan (1997). The endogenous determination of time preference. *Quarterly Journal of Economics* 112, 729-758.

Bouma, J., E. Bulte, D. van Soest (2008). Trust and cooperation: Social capital and community resource management. Journal of Environmental Economics and Management 56, 155-166.

Brock, M., A. Lange, E. Y. Ozbay (2013). Dictating the risk: Experimental evidence on giving in risky environments. *American Economic Review* 103, 415-437.

Callen, M., M. Isaqzadeh, J. D. Long, C. Sprenger (2014). Violence and risk preference: experimental evidence from Afghanistan. *American Economic Review* 104, 123-148.

Cardenas, J. C., J. Stranlund, C. Willis (2000). Local environmental control and institutional crowding-out. *World Development* 28, 1719-1733.

Congleton, R. D., P. Fudulu (1996). On the rationality of mutually immiserating coercion. Journal of Economic Behavior and Organization 30, 133-136.

d'Adda, G. (2011). Motivation crowding in environmental protection: Evidence from an artefactual field experiment. Ecological Economics 70, 2083-2097.

Dickert, S., J. Kleber, E. Peters, P. Slovic (2011). Numeracy as a precursor to pro-social behavior: The impact of numeracy and presentation format on the cognitive mechanisms underlying donation decisions. *Judgement and Decision Making* 6, 638-650.

Eckel, C. C., M. A. El-Gamal, R. K. Wilson (2009). Risk loving after the storm: A Bayesian-network study of hurricane Katrina evacuees. *Journal of Economic Behavior and Organization* 69, 110-124.

Eckel, C. C., P. J. Grossman, C. A. Johnson, A. C. M. de Oliveira, C. Rojas, R. K. Wilson (2012). School environment and risk preferences: Experimental evidence. *Journal of Risk and Uncertainty* 45, 265-292.

FAO (2014). The state of world fisheries and aquaculture. Food and Agriculture Organization of the United Nations.

Fehr, E., K. Hoff (2011). Introduction: Tastes, castes and culture: The influence of society on preferences. *Economic Journal* 121, F396-F412.

Fisman, R., P. Jakiela, S. Kariv (2014). How did distributional preferences change during the great recession? *NBER Working Paper Series* 20146.

Gächter, S., B. Herrmann, C. Thöni (2004). Trust, voluntary cooperation, and socio-economic background: survey and experimental evidence. Journal of Economic

Behavior and Organiztion 55, 505-531.

Gaspart, F., Seki, E., 2003. Cooperation, status seeking and competitive behavior: theory and evidence. Journal of Economic Behavior and Organization 51, 51-77.

Geng, S., Y. Peng, J. Shachat, H. Zhong (2015). Adolescents, cognitive ability, and minimax play. *Economics Letters* 128, 54-58.

Griesinger, D. W., J. W. Livingston Jr. (1973). Toward a model of interpersonal motivation in experimental games. *Behavioral Science* 18, 173-188.

Handberg, Ø, N., A. Angelsen (2015). Experimental tests of tropical forest conservation measures. *Journal of Economic Behavior and Organization* 118, 346-359.

Harbaugh, W. T., K. Krause, L. Vesterlund (2002). Risk attitudes of adults and children: Choices over small and large probability gains and losses. *Experimental Economics* 5, 53-84.

Henrich, J. (2000). Does culture matter in economic behavior? Ultimatum game bargaining among the Machiguenga of the Peruvian Amazon. *American Economic Review* 90, 973-979.

Hwang, S., S. Bowles (2012). Is altruism bad for cooperation? *Journal of Economic Behavior and Organization* 83, 330-341.

Kamas, L., A. Preston (2012). Distributive and reciprocal fairness: What can we learn from the heterogeneity of social preferences? *Journal of Economic Psychology* 33, 538-553.

Kanagaretnam, K., S. Mestelman, K. Nainar, M. Shehata (2009). The impact of social value orientation and risk attitudes on trust and reciprocity. Journal of Economic Psychology 30, 368-380.

Karapetyan, D., G. d'Adda (2014). Determinants of conservation among the rural poor: A charitable contribution experiment. *Ecological Economics* 99, 74-87.

Kieslich, P. J., B. E. Hilbig (2014). Cognitive conflict in social dilemmas: An analysis of

response dynamics. *Judgement and Decision Making* 9, 510-522.

Kim, Y. J. Lee (2014). The long-run impact of a traumatic experience on risk aversion. *Journal of Economic Behavior and Organization* 108, 174-186.

Kimball, M. (2015). Cognitive economics. Japanese Economic Review 66, 167-181.

Kits, G., W. L. Adamowicz, P. C. Boxall (2014). Do conservation auctions crowd out voluntary environmentally friendly activities? *Ecological Economics* 105, 118-123.

Korenok, O., E. L. Millner, L. Razzolini (2013). Impure altruism in dictators' giving. *Journal of Public Economics* 97, 1-8.

Kotani, K., K. D. Messer, W. D. Schulze (2010). Matching grants and charitable giving: Why people sometimes provide a helping hand to fund environmental goods. *Agricultural and Resource Economics Review* 39, 324-343.

Kotani, K., K. Tanaka, S. Managi (2010). Cooperative choice and its framing effect under threshold uncertainty in a provision point mechanism. *Economic Governance* 15, 329-353.

Leibbrandt, A., U. Greezy, J. A. List (2013). Rise and fall of competitiveness in individualistic and collectivistic societies. *PNAS* 110, 9305-9308.

Levin, I. P., S. S. Hart, J. A. Weller, L. A. Harshman (2007). Stability of choices in risky decision-making task: A 3-year longitudinal study with children and adults. *Journal of Behavioral Decision Making* 20, 241-252.

Liebrand, W. B. G. (1984). The effect of social motives, communication and group size on behavior in an N-person multi-stage mixed-motive game. *European Journal of Social Psychology* 14, 239-264.

Lipford, J. W., B. Yandle (2009). The determinants of purposeful voluntarism. *Journal of Socio-Economics* 38, 72-79.

Murphy, R. O., K. A. Ackerman, M. J. J. Handgraaf (2011). Measuring social value orientation. *Judgement and Decision Making* 6, 771-781.

Nguyen, Q. (2011). Does nurture matter: Theory and experimental investigation on the effect of working environment on risk and time preferences. *Journal of Risk and Uncertainty* 43, 245-270.

Nguyen, Q., P. Leung (2009). Do fishermen have different attitudes toward risk? An application of prospect theory to the study of Vietnamese fishermen. *Journal of Agricultural and Resource Economics* 34, 518-538.

Nyborg, K., M. Rege (2003). Does public policy crowd out private contributions to public goods? *Public Choice* 115, 397-418.

Offermen, T., J. Sonnemans, A. Schram (1996). Value orientations, expectations and voluntary contributions in public goods. *Economic Journal* 106, 817-845.

Ostrom, E. (2000). Collective action and the evolution of social norms. *Journal of Economic Perspectives* 14, 137-158.

Platteau, J., E. Seki (2007). Heterogeneity, social esteem and feasibility of collective action. *Journal of Development Economics* 83, 302-325.

Pongthanapanich,T., E. Roth, 2006. Voluntary management in Thai shrimp farming. Aquaculture Economics and Management 10, 265-287.

Prediger, S., B. Vollan, M. Frölich (2011). The impact of culture and ecology on cooperation in a common-pool resource experiment. *Ecological Economics* 70, 1599-1608.

Prediger, S., B. Vollan, B. Herrmann (2014). Resource scarcity and antisocial behavior. *Journal of Public Economics* 119, 1-9.

Rabin, M. (1994). Cognitive dissonance and social change. *Journal of Economic Behavior and Organization* 23, 177-194.

Shahrier, S., K. Kotani, K. Kakinaka (2016). Social value orientation and capitalism in societies. Working Paper Series SDES 2016-1, Research Center for Social Design Engineering, Kochi University of Technology.

Stanley, D. L., 2000. The economics of the adoption of BMPs: The case of mariculture water management. Ecological Economics 35, 145-155.

Sun, R., I. Naveh (2007). Social institution, cognition, and survival: A cognitive-social simulation. *Mind and Society* 6, 115-142.

Sutter, M., S. Haigner, M. G. Kocher, 2010. Choosing the carrot or the stick? Endogenous institutional choice in social dilemma situations. Review of Economic Studies 77, 1540-1566.

Sutter, M., M. G. Kocher (2007). Trust and trustworthiness across different age groups. *Games and Economic Behavior* 59, 364-382.

Tachibana, T., S. Adhikari, 2009. Does community-based management improve natural resource condition? Evidence from the forests in Nepal. Land Economics 85, 107-131.

Tanaka, Y., A. Munro (2013). Regional variation in risk and time preferences: Evidince from a large-scale field experiment in Rural Uganda. *Journal of African Economies* 23, 151-187.

Upton, D. R. (2009). Implications of social value orientation and budget levels on group performance and performance variance. *Journal of Management Accounting Research* 21, 293-316.

Velez, M. A., J. J. Murphy, J. K. Stranlund (2010). Centralized and decentralized management of local common pool resourcecs in the developing world: Experimental evidence from fishing communities in Columbia. *Economic Inquiry* 48, 254-265.

Vollan, B. (2008). Socio-economic explanations for crowding-out effects from economic field experiments in southern Africa. *Ecological Economics* 67, 560-573.

Voors, M. J., E. E. M. Nillesen, P. Verwimp, E. H. Bulte, R. Lensink, D. P. Van Soest (2012). Violent conflict and behavior: A field experiment in Burundi. *American Economic Review* 102, 941-964.

Table 1. Location of Experimental Sessions

Session No	Country	City	The number of subjects
1	The Philippines	Puerto Princesa (Palawan)	14
2	The Philippines	Puerto Princesa (Palawan)	16
3	The Philippines	Puerto Princesa (Palawan)	16
4	The Philippines	Puerto Princesa (Palawan)	16
5	The Philippines	General Santos (Mindanao)	16
6	The Philippines	General Santos (Mindanao)	16
7	The Philippines	General Santos (Mindanao)	16
8	The Philippines	General Santos (Mindanao)	16
9	Indonesia	Sungai Nibung, Kubu Raya District (Kalimantan)	16
10	Indonesia	Dabong, Kubu Raya District (Kalimantan)	16
11	Indonesia	Mertasinga, Gunung Jati Sub District, Cirebon (Java)	16
12	Indonesia	Karangreja, Suranengala Sub District, Cirebon (Java)	16
13	Indonesia	Grogol, Gunung Jati Sub District Cirebon (Java)	12
14	Indonesia	Barrang Cadi, Makassar (Sulawesi)	16
15	Indonesia	Untia, Makassar (Sulawesi)	16
16	Indonesia	Baronbong, Makassar (Sulawesi)	16

Table 2. Alternatives in the Value Orientation Test

No	Option A	Option B
1	(0, 15)	(3.9, 14.5)
2	(3.9, 14.5)	(7.5, 13)
3	(7.5, 13)	(10.6, 10.6)
4	(10.6, 10.6)	(13, 7.5)
5	(13, 7.5)	(14.5, 3.9)
6	(14.5, 3.9)	(15, 0)
7	(15, 0)	(14.5, -3.9)
8	(14.5, -3.9)	(13, -7.5)
9	(13, -7.5)	(10.6, -10.6)
10	(10.6, -10.6)	(7.5, -13)
11	(7.5, -13)	(3.9, -14.5)
12	(3.9, -14.5)	(0, -15)
13	(0, -15)	(-3.9, -14.5)
14	(-3.9, -14.5)	(-7.5, -13)
15	(-7.5, -13)	(-10.6, -10.6)
16	(-10.6, -10.6)	(-13, -7.5)
17	(-13, -7.5)	(-14.5, -3.9)
18	(-14.5, -3.9)	(-15, 0)
19	(-15, 0)	(-14.5, 3.9)
20	(-14.5, 3.9)	(-13, 7.5)
21	(-13, 7.5)	(-10.6, -10.6)
22	(-10.6, 10.6)	(-7.5, 13)
23	(-7.5, 13)	(-3.9, 14.5)
24	(-3.9, 14.5)	(0, 15)

Table 3. Summary of the Result of the Value Orientation Test

Session No	Unidentified: Upper	Altruistic	Cooperative	Individualistic
	> 112.5	112.5 to 67.5	67.5 to 22.5	22.5 to -22.5
1	50.00%	7.14%	21.43%	7.14%
2	25.00%	18.75%	12.50%	12.50%
3	0.00%	0.00%	0.00%	100.00%
4	43.75%	6.25%	6.25%	18.75%
5	18.75%	12.50%	18.75%	25.00%
6	18.75%	6.25%	18.75%	25.00%
7	12.50%	12.50%	0.00%	43.75%
8	6.25%	18.75%	31.25%	6.25%
9	6.25%	18.75%	43.75%	25.00%
10	18.75%	0.00%	12.50%	43.75%
11	25.00%	6.25%	37.50%	12.50%
12	6.25%	18.75%	25.00%	12.50%
13	0.00%	8.33%	33.33%	16.67%
14	12.50%	12.50%	25.00%	18.75%
15	25.00%	6.25%	6.25%	31.25%
16	31.25%	6.25%	6.25%	31.25%
The Philippines (Average)	21.43%	10.32%	13.49%	30.16%
Indonesia (Average)	16.13%	9.68%	23.39%	24.19%
Total	18.80%	10.00%	18.40%	27.20%

Table 3. Continued.

Session No	Competitive	Aggressive	Unidentified: Lower
	−22.5 to −67.5	−67.5 to −112.5	-112.5<
1	0.00%	0.00%	14.29%
2	18.75%	0.00%	12.50%
3	0.00%	0.00%	0.00%
4	6.25%	0.00%	18.75%
5	6.25%	12.50%	6.25%
6	18.75%	6.25%	6.25%
7	6.25%	6.25%	18.75%
8	18.75%	6.25%	12.50%
9	0.00%	6.25%	0.00%
10	0.00%	12.50%	12.50%
11	6.25%	12.50%	0.00%
12	18.75%	18.75%	0.00%
13	25.00%	8.33%	8.33%
14	18.75%	6.25%	6.25%
15	25.00%	6.25%	0.00%
16	18.75%	6.25%	0.00%
The Philippines (Average)	9.52%	3.97%	11.11%
Indonesia (Average)	13.71%	9.68%	3.23%
Total	11.60%	6.80%	7.20%

Table 4. Summary Statistics of Independent Variables

Session No	The number of subjects	Average					
		Age	Fishers	edu	Gender	trouble	programs
1	14	50.071	847.692	1.857	1.000	0.786	0.769
2	16	32.938	167.083	2.000	1.000	0.750	0.688
3	16	42.250	77.375	1.938	1.000	0.938	0.563
4	16	38.125	146.786	2.125	1.000	0.938	0.875
5	16	43.188	286.313	2.125	0.750	0.875	1.000
6	16	46.438	124.357	1.750	1.000	0.688	0.563
7	16	39.063	142.769	1.875	1.000	0.563	0.750
8	16	34.733	256.400	2.000	0.867	0.438	0.313
9	16	39.400	88.267	1.867	0.938	0.750	0.438
10	16	49.375	15.188	1.400	1.000	0.438	0.438
11	16	40.125	25103.250	1.692	1.000	0.125	0.438
12	16	35.813	72.938	1.625	0.938	0.500	0.188
13	12	37.500	58.833	1.500	1.000	0.417	0.250
14	16	37.500	595.077	1.250	0.938	0.938	0.750
15	16	45.333	17.214	1.333	1.000	0.813	0.938
16	16	36.875	76.154	1.250	0.938	0.750	0.750
Total	Average	40.526	1909.782	1.730	0.960	0.672	0.610
	Median	40.000	60.000	2.000	-	-	-
	SD	12.436	20725.156	0.726	-	-	-
	Max	84.000	300000.000	3.000	-	-	-
	Min	13.000	2.000	0.000	-	-	-

Table 5. Factor Analysis of Social Value Orientation by Ordinary Least Squares

Independent variable	Model 1	Independent variable	Model 2	Independent variable	Model 3
Depletion0	35.642*	*Depletion0*	31.966*	*Depletion*	29.555**
(No answer)	(1.83)		(1.66)	*0, 1, 4 and 5*	(2.08)
Depletion1	25.896	*Depletion*	27.865*	*Depletion*	-33.802*
(Over fishing)	(1.32)	*1, 4 and 5*	(1.69)	*2,3*	(-1.69)
Depletion2	-16.297	*Depletion*	-33.856*		
(Typhoon)	(-0.34)	*2 and 3*	(-1.69)		
Depletion3	-37.215*				
(Natural)	(-1.90)				
Depletion4	20.208				
(Illegal fishing)	(0.82)				
Depletion5	133.108***				
(Clumsy)	(3.94)				
Age	-0.097		0.018		0.022
	(-0.18)		(0.03)		(0.04)
Edu	21.109**		22.259**		22.338**
	(2.31)		(2.40)		(2.42)
Punishment	-36.609***		-34.355**		-34.483**
	(-2.62)		(-2.50)		(-2.53)
Fishers	0.000**		0.000*		0.000*
	(1.64)		(1.72)		(1.74)
Programs	21.095		22.835*		22.793*
	(1.61)		(1.75)		(1.75)
Trouble	-12.858		-12.789		-12.848
	(-1.04)		(-1.03)		(-1.03)
c	-33.359		-37.517		-37.522
	(-0.76)		(-0.84)		(-0.84)
R2	0.220		0.201		0.200
Observations	218		218		218

Note) Values in parentheses are t-values. *Significant at the 10% level, **significant at the 5% level, ***significant at the 1% level.

Table 6. Factor Analysis of Social Value Orientation by Multinomial Logit Model

Variables	Upper Unidentified	Altruistic	Cooperative	Competitive	Aggressive	Lower Unidentified
Depletion0	-0.035	0.047	-1.583*	-1.552	-1.987	-1.256
	(-0.04)	(0.05)	(-1.66)	(-1.44)	(-1.50)	(-1.42)
Depletion1	0.644	0.548	0.254	-0.826	-0.584	0.525
	(0.68)	(0.51)	(0.29)	(-0.83)	(-0.60)	(0.43)
Depletion2	0.264	-7.046***	-17.324***	0.338	-8.096***	1.400
	(0.20)	(-10.09)	(-14.13)	(0.23)	(-12.13)	(0.89)
Depletion3	-17.774***	-18.663***	-1.281	-0.683	0.085	-16.973***
	(-21.64)	(-19.62)	(-1.31)	(-0.78)	(0.07)	(-12.92)
Depletion4	-0.704	-0.575	-0.820	-1.381	-0.999	-16.542***
	(-0.65)	(-0.50)	(-0.92)	(-1.42)	(-0.87)	(-14.51)
Depletion5	18.659***	19.278***	16.994***	-1.479	-1.505	-0.039
	(14.48)	(14.33)	(13.83)	(-1.29)	(-1.44)	(-0.02)
Age	0.015	-0.034	-0.010	0.025	0.052	-0.066**
	(0.57)	(-0.96)	(-0.38)	(1.00)	(1.48)	(-2.22)
Edu	0.453	0.599	0.917**	-0.028	0.166	-0.774
	(1.02)	(1.35)	(2.30)	(-0.05)	(0.28)	(-1.63)
Punishment	-1.537**	-1.759**	-0.108	-0.139	-0.185	0.818
	(-2.33)	(-2.12)	(-0.16)	(-0.22)	(-0.24)	(0.79)
Fishers	0.000	-0.000	0.000	-0.002	0.000	-0.001
	(0.91)	(-0.24)	(0.78)	(-1.34)	(0.88)	(-0.88)
Programs	1.494*	0.262	-0.232	0.190	-0.434	-0.503
	(1.87)	(0.35)	(-0.39)	(0.25)	(-0.54)	(-0.55)
Trouble	-0.715	-1.883**	-0.232	0.123	-0.268	0.220
	(-1.19)	(-2.53)	(-0.40)	(0.18)	(-0.40)	(0.25)
c	-2.076	1.252	-1.563	-1.138	-1.864	2.895
	(-0.92)	(0.59)	(-0.79)	(-0.55)	(-0.78)	(1.11)

Note) Base class is “Individualistic”.

Figure 1. Experiment Locations in the Philippines

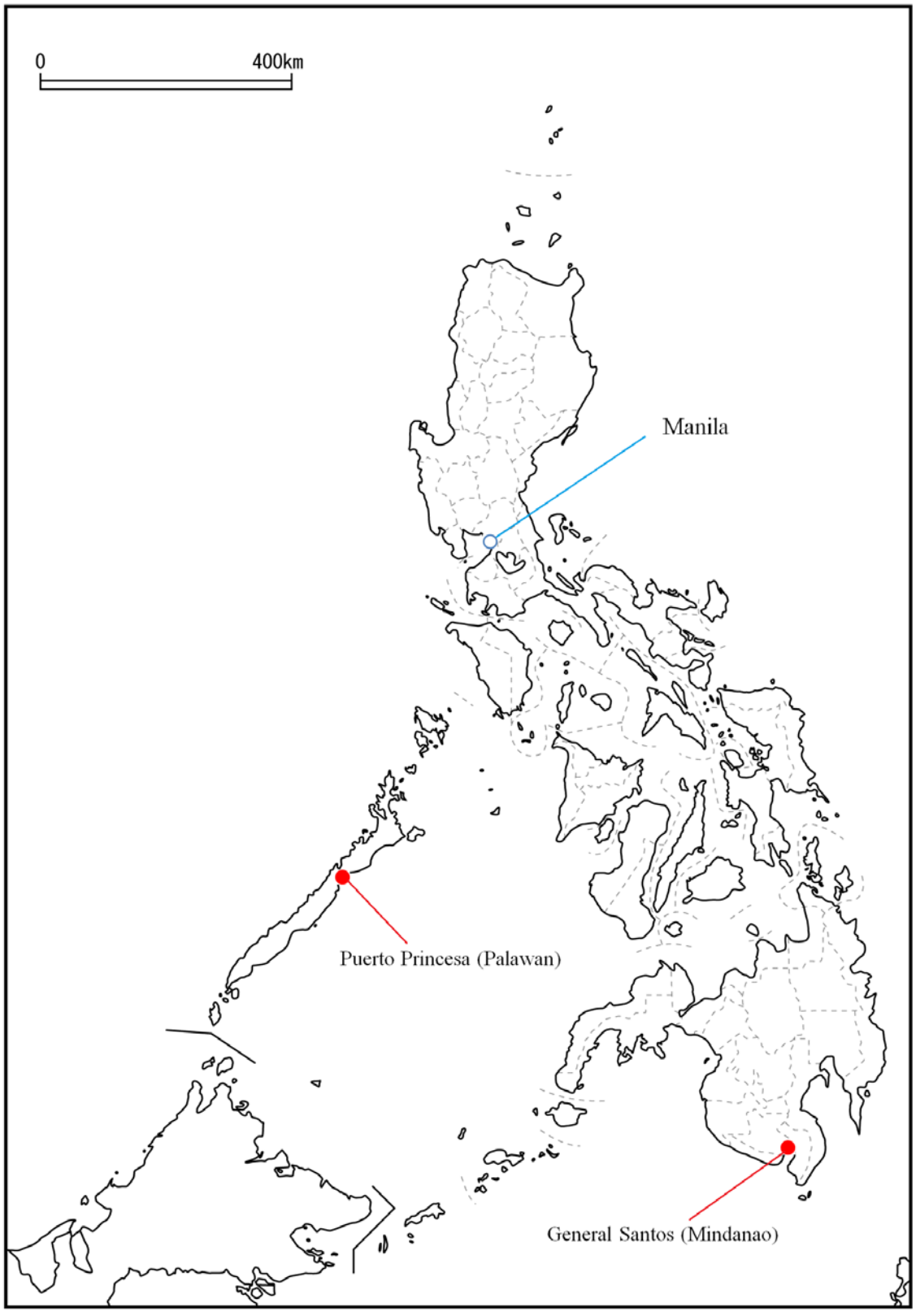

Figure 2. Experiment Locations in Indonesia