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Willingness to Pay for Mangroves' Coastal Protection: A Case Study in Santo Angel, Calauag, Quezon, Philippines

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ABSTRACT

The mangroves in Santo Angel in the municipality of Calauag, Quezon Province in the Philippines, provide a wide array of ecological services that range from provisioning of resources and habitat to various floral and faunal species to regulating services including coastal protection. Coastal protection from mangroves is needed by the local community as Santo Angel is susceptible to typhoons and storm surges. However, the mangrove's ability to provide coastal defense has considerably declined in the past decades due to overexploitation. Using the double-bounded dichotomous choice contingent valuation method, the willingness to pay (WTP) of the local community for a hypothetical mangrove rehabilitation project aligned towards coastal protection was determined. A total of 210 households were involved in the survey. The results show that 79% of the 210 households expressed WTP for the mangrove rehabilitation project. Furthermore, the mean willingness to pay (MWTP) for the mangrove rehabilitation project was computed at Php 15.44 (USD 0.29) per household per month or equivalent to Php 86, 525.76 (USD 1,659.41) per year for the total number of households in Santo Angel. Findings of the logistic regression analysis revealed that sex, age, membership in environmental organizations, and awareness on both the economic importance and the ecological services provided by mangroves positively affect the WTP of the respondents. In contrast, the bid amount and the respondent's income negatively influence the WTP of the respondents for the mangrove rehabilitation project.

KEYWORDS
Mangroves; Mangrove Rehabilitation; Coastal Protection; Contingent Valuation Method; Willingness to Pay

1. INTRODUCTION

Mangroves are clusters of salt-tolerant trees, shrubs, and ground ferns growing in the seashore areas of tropical and subtropical regions (Clough, 2013). Mangroves are notable for their ability to provide coastal protection against strong wave actions that include tsunamis and storm surges. The role of mangroves as a natural barrier against such processes has been scientifically proven in several parts of the world. For example, during the onslaught of Cyclone Sidr in 2007 in Bangladesh, the Sundarbans Mangrove Forest has been seen to protect coastal communities against strong wind and storm surges (Sarker et al., 2020). In addition, the mangroves in the coastal zones of Florida were able to reduce the height of storm surges during Hurricane Charley in 2004 and Hurricane Wilma in 2005 (Krauss et al., 2009). Further evidence has been seen in the Philippines during the onslaught of Super Typhoon Haiyan in 2013, where coastal villages with intact mangrove forests suffered fewer damages than villages with deteriorating mangrove covers (Seriño et al., 2017).

Despite the importance of mangroves in reducing the impacts of coastal hazards, these coastal forests continue to decline in the planet's tropical and subtropical regions. The study of Bunting et al. (2018) revealed that the global mangrove extent was estimated to be 137,600 km2 in 2010. There was a yearly loss of 0.26% - 0.66% of mangroves globally between 2000 and 2012 (Hamilton & Casey, 2016). The greatest concentration of mangrove loss has been in Southeast Asia where mangrove covers have declined by nearly 50% (Thomas et al., 2017). The reduction of mangrove forests is primarily attributed to human activities such as aquaculture, agricultural expansion, and urban development (Ottinger et al., 2016; Ferreira & Lacerda, 2016; Lai et al., 2015; Jia et al., 2014; Webb et al., 2014; Hamilton, 2013; Martinuzzi et al., 2009; Giri & Muhlhausen, 2008).

Based on the Philippine Forestry Statistics 2020 of the Department of Environment and Natural Resources- Forest Management Bureau (DENR-FMB), the remaining mangrove areas in the country, as of 2015, is around 303,373 ha. Most of these mangrove areas are found in MIMAROPA or Region IV-B (68,416 ha), Bangsamoro Administrative Region of Muslim Mindanao or BARMM (51,742 ha), and in Eastern Visayas or Region VIII (34,052 ha). This estimate is significantly lower than the 500,000 ha mangrove area in the country during the early 1900 (Brown & Fisher, 1920). The reduction of mangroves in the Philippines has been associated with anthropogenic activities such as mangrove land-use conversion (Pacyao & Barail, 2020; Primavera, 1995), exploitation of mangroves for fuelwood and housing materials (Primavera, 2000), and natural hazards such as typhoons and storms surges (Buitre et al., 2019).

Mangrove rehabilitation programs are critical strategies in addressing mangrove degradation in the Philippines. One of these efforts is the National Greening Program (NGP) that was implemented by the DENR through Executive Order No. 26 in 2011 and aimed to plant 1.5 billion trees in 1.5 million hectares of lands of public domain from 2011 to 2016. Based on the NGP commodity road map of the program, mangroves are also one of the major commodities considered, and it is estimated that about 39,726 ha will be planted with mangroves during the 5-year implementation of the program. Apart from NGP, there are also other programs that are locally administered. For example, the mangrove restoration project in Cogtong Bay in Bohol Province was implemented to address the continuous decline of mangroves in the area caused by mangrove land-use conversion and entry of commercial fishers (Maliao and Polohan, 2008). In addition, a multi-partnership mangrove rehabilitation project was carried out in Dasol Bay in Pangasinan Province. The rehabilitation project aims to mitigate the further degradation of mangroves in Dasol Bay due to aquaculture expansions through participatory and community-based approaches (Batay-an and Byers, 2007). Lastly, the Palompon Mangrove Rehabilitation Subproject under the Community-Based Forest Management Program of the DENR was implemented in Palompon, Leyte Province to address mangrove deterioration due to indiscriminate cutting of mangrove trees.

Restoring Philippine mangroves has been recognized to play a crucial role in climate change mitigation and adaptation by enhancing carbon uptake and coastal protection (Camacho et al., 2011). After the passage of Super Typhoon Haiyan in 2013, the Philippine government worked on improving mangroves' condition to serve as a natural barrier against typhoons and storm surges. For example, the Department of Environment and Natural Resources (DENR) has allotted Php 1 billion pesos for a massive rehabilitation project to restore mangrove and beach forests of disaster-affected areas. Aside from government initiatives, non-government organizations (NGOs) have also provided training on proper mangrove conservation, restoration, and management in typhoon-affected regions. Though rehabilitation projects are in place, mangrove restoration efforts in the Philippines have gained minimal success due to the absence of science-based approach guidelines as basis for rehabilitation efforts (López-

Portillo et al., 2017; Primavera & Esteban, 2008). For instance, the One Million Mangrove Planting Program in Cebu Province turned out to be unsuccessful because of the lack of scientific information on the appropriate location and species of mangroves to be planted (Salmo III et al., 2019). In addition, the lack of community participation in the planning, implementation, and monitoring of mangrove restoration projects contributed to the country's low success in mangrove rehabilitation efforts (Camacho et al., 2020).

Studies designed to value the ecosystem services of mangroves as input for conservation, rehabilitation, and management programs have become prevalent in the Philippines since the 1990s. The provisioning and recreational services of mangroves such as timber production, captured fisheries, and tourism have been successfully monetized (Ron & Padilla, 1999; Walton et al., 2006; Samonte-Tan et al., 2007). Furthermore, the protective services of mangroves have also been valued at the national and local levels using both the damage cost approach and the expected damage function approach (Meñendez et al., 2018; Seriño et al., 2017). There are also studies in the Philippines that utilized the contingent valuation method (CVM) in measuring the willingness to pay (WTP) of locals for mangrove conservation and management (Ureta et al., 2014; Carandang et al., 2013; Fernandez et al., 2005). However, no attempt has been done in employing CVM in determining the WTP of coastal communities for mangrove rehabilitation projects aligned towards their coastal defense functions. Such an assessment is perceived to be timely given the increasing rate of mangrove deforestation coupled with the more frequent occurrences of powerful and destructive tropical cyclones in the Philippines.

This research work is the first CVM study that assesses a household's WTP for a mangrove rehabilitation project that is solely aligned with coastal protection in the Philippines. The factors influencing WTP responses, and the perceptions and awareness of the community members toward the protective role of mangroves were also determined.

2. MATERIALS AND METHODS

2.1 The Study Area

The geographical location of Santo Angel is presented in Figure 1. Santo Angel is a coastal barangay in the Upper Calauag, Quezon, Philippines. It is bound in the northeastern portion by Lamon Bay, and in the southwestern part by the Calauag Bay. Because of its geographical location and its very low elevation, Santo Angel is susceptible to the destructive impacts of typhoons and storm surges (Lapidez et al., 2015).

Santo Angel is a small but highly populated coastal community. Its total population of 2,153 has a growth rate of 1.34%. This large population size in a small geographic area of the barangay has exerted pressure on the surrounding natural resources, primarily on the mangrove ecosystem. The total mangrove cover in Santo Angel was estimated to be at 351 ha in 2010 but has been significantly reduced by more than 10 ha in just under 5 years (remaining area of 339 ha by 2015). The overexploitation of mangroves for housing materials and charcoal production contributed to the decline of mangroves in the area. The declining condition of mangroves in Santo Angel has raised concerns regarding its potential impacts on the livelihood of the locals who relied on the aquatic resources in the area, and the recent passages of strong typhoons in the region have also brought to the fore the coastal protection that the mangrove stands can provide to the community.

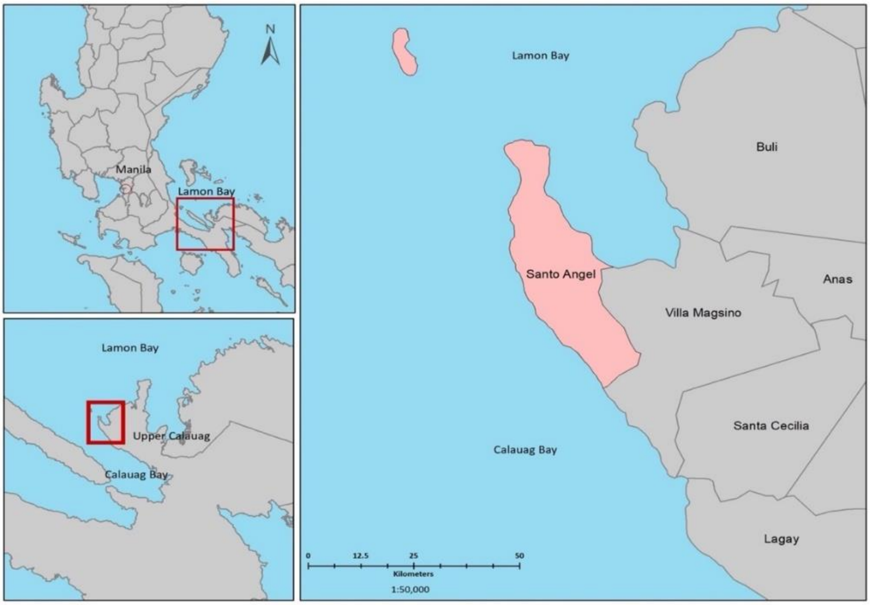

Figure 1. Location of the study area. Santo Angel is a coastal barangay in the municipality of Calauag, Quezon Province.

2.2 Survey Design and Implementation

The contingent valuation method (CVM), originally proposed by Ciriacy-Wantrup (1947), is a valuation technique for measuring the non-use value of environmental resources (Walsh et al., 1984; Brookshire et al., 1983). CVM captures the individual's WTP for ecological goods and services by establishing a hypothetical market (Ekka and Pandit 2012; Kostald, 2000). There are four (4) common types of approaches used in eliciting WTP in CVM. These are the bidding game approach, payment card technique, open-ended (OE) approach, and dichotomous choice (DC) approach. The double-bounded dichotomous choice (DBDC) approach has been applied in estimating the WTP of coastal communities for mangrove conservation (Hasan-Basri et al., 2020) and restoration (Susilo et al., 2017).

This study had also integrated the DBDC contingent valuation method wherein the respondents were asked to choose "Yes" (if they are willing to pay) or "No" (if they are not willing to pay) for the proposed project. If a respondent stated a "Yes" WTP response for the initial bid (e.g., Php 32 (USD 0.61), the WTP elicitation question will be asked again using a higher bid (e.g., Php 64 (USD 1.22). On the other hand, if a respondent expressed a "No" WTP response for the initial bid (e.g., Php 32), the WTP elicitation question will be asked again using a lower bid (e.g., Php 8). The bid amounts used in the study were Php 8 (USD 0.15), Php 32 (USD 0.61), Php 64 (USD 1.22), and Php 100 (USD 1.91) per month. These values were derived from the results of the focus group discussions (FGDs) attended by the community members of Santo Angel.

A total of 210 household respondents were surveyed. The total number of households was computed using the formula of Cochran (1963) with a 5 % margin of error. The households included in the survey were randomly selected from the barangay's list of households prepared by the Municipal Planning and Development Office of Calauag.

The CV questionnaire was pre-tested on twenty-one (21) households to evaluate the appropriateness and understandability of all the questions included in the questionnaire. The CV questionnaire consists of four sections. The first and second parts of the questionnaire assess the respondents' knowledge, attitude, practices, and awareness on mangroves and storm surges. The third part explains the WTP elicitation question for the proposed mangrove rehabilitation project. This section is further split into two parts. The first part explains the issues and threats faced by the mangroves in Santo Angel. A map showing the extent of mangrove land cover change was presented to the respondents to provide insights on the existing condition of mangroves in the area. It was also explained to the respondents how the deteriorating condition of mangroves might affect the role of mangroves in providing coastal protection for their community. The second section emphasizes the contingent valuation scenario wherein modeled maps, including the storm surge inundation reduction of mangroves and the monetary value of the averted house damages provided by the mangroves, were presented and explained to the respondents. This was done to help the respondents decide whether to pay or not pay for the proposed five-year mangrove rehabilitation project. In addition, several activities as part of the rehabilitation initiative were extensively explained to the respondents to give them an idea on what would happen if the proposed project will be implemented. Payment vehicle mechanisms for the project were also elaborated in this section. Finally, the last part of the questionnaire captured the respondents' socioeconomic characteristics, hypothesizing that these will affect their decision to pay for the proposed project.

2.3 Analytical Techniques

Survey results were analyzed using STATA 11.1 software. Frequency tables were utilized to demonstrate individual results of the survey. Logistic regression analysis was also performed to identify factors that influence a respondent's WTP.

In estimating the mean maximum WTP, the result of logistic regression was used in conformity with the formula proposed by Hanemann (1994). The mean maximum WTP was computed using equation 1:

$$\mathbf{MWTP} = \frac{\mathbf{1}}{|\boldsymbol{\beta}|}\mathbf{ln}\ (\mathbf{1} + \mathbf{e}^{\boldsymbol{\alpha}}) \tag{1}$$

where:

β is the coefficient of the bid amount used in the study

e is a constant with a value of 2.718

α is the constant in the logistic model if there are no additional independent variables, or equal to the sum of the estimated constant plus the sum of the coefficient of all significant variables multiplied by their means (Donovan & Nicholls, 2003).

Mathematically, α is:

$$\propto = \boldsymbol{\alpha_0} + \sum_{\mathbf{j=1}}^{\mathbf{210}} \boldsymbol{\beta}_{\mathbf{j}}\, \bar{\mathbf{x}}_{\mathbf{j}} \tag{2}$$

where:

α_0 is the constant of the logistic model

βj's do not include the bid price coefficient

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics of the Respondents

The socioeconomic profile of the 210 household respondents is given in Table 1. The table showed that with respect to sex, 64.29 % of the respondents are male, while only 35.71 % are female. Regarding age, most of the respondents (49.52 %) belong to the age group of 40 – 59 years old. The majority of the respondents are fishermen (52.86 %) and farmers (8.09 %), which could explain the high number of males as respondents.

Table 1. Socioeconomic profile of the respondents (n=210)

Variable	Response	Frequency	%
Sex	Male	135	64.29
	Female	75	35.71
Age	20 – 39 years old	83	39.53
	40 – 59 years old	104	49.52
	60 – 79 years old	23	10.95
Occupation	Fishermen	111	52.86
	Farmers	17	8.09
	Animal Raisers	9	4.29
	Others*	73	34.76
Years of residency	1 – 19 years	50	23.81
	20 – 39 years	99	47.14
	40 – 59 years	52	24.76
	> 60 years	9	4.29
Membership in environmental organization	Member	37	17.62
	Not Member	173	82.38
Cumulative monthly household income	Php 1 – 10, 000	145	69.04
	Php 10, 001 – 20, 000	50	23.8
	Php 20,001 – 30, 000	10	4.78
	Php 30, 001 – 40, 000	5	2.38

* Includes store owners, barangay workers, boatmen, teachers, utility workers, and carpenters

Most of the respondents (47.14 %) live in the area for 20 – 39 years, while only 9 % live for more than 60 years in Santo Angel. Only 17.62 % of the respondents claimed membership in an environmental organization in the community. A total of 145 respondents have a cumulative monthly household income ranging from Php 1 – 10,000 (0.01 – 191 USD). Only 5 of the respondents have a monthly income ranging from Php 30,000 – 40,000 (575 – 767 USD). The average income of the respondents was computed at Php 9,819.39 (USD 188.31) which is lower than the Php 20, 515.00 (USD 393.44) annual poverty threshold of the Quezon province in 2015 (Philippine Statistics Authority, 2016).

3.2 Knowledge, Attitude, Practices, and Awareness on Mangroves and Storm Surges

Primary data collection in terms of the respondent's knowledge, attitude, practices, and awareness on mangroves and storm surges were elicited in the survey questionnaire.

As presented in Table 2, most of the respondents (98.10 %) showed high awareness on the importance of mangroves in the community. It was supported by the findings that 95. 24 % are also aware of the ecological services of mangroves. The present results are complimentary to Gomez & Badalgo's (2016) findings stating that most of the coastal communities in Bacolod and Kauswagan in Lanao Del Norte, Philippines have high awareness on the importance as well as the ecological services provided by mangroves.

Table 2. Knowledge, attitude, practices, and awareness of the respondents on mangroves and storm surges

Variable	Response	Frequency	%
Awareness on the importance of mangroves	Aware	206	98.1
	Not Aware	4	1.9
Awareness on the ecosystem services of mangroves	Aware	200	95.24
	Not Aware	10	4.76
Perceived Ecosystem Services Provided by Mangroves	Regulating Services	142	71
	Supporting Services	41	21
	Provisioning Services	14	7
	Cultural Services	3	1
Awareness on the storm surge protective function of mangroves	Aware	95	64.62
	Not Aware	52	35.37
Condition of mangroves	Decreasing	116	55.77
	Increasing	66	31.73
	Just the same	19	9.13
	No observation	7	3.37
Awareness on storm surges	Aware	155	73.81
	Not Aware	55	26.19
Awareness on the susceptibility of the area to storm surges	Aware	138	65.71
	Not Aware	72	34.29
Preparedness for storm surges	Prepared	121	57.62
	Unprepared	89	42.38

Among the ecological services provided by mangroves, regulatory services are the most acknowledged, as perceived by 71% of the respondents. In addition, 64.62 % of the respondents claimed awareness on the ability of mangroves to protect their community from storm surges. Given the high awareness on the ecological importance of mangroves, 55.77 % of the respondents stated that the mangroves in Santo Angel are decreasing. During the interview, respondents enumerated that mangrove harvesting for charcoal production is the main cause of the decline of mangroves in Santo Angel. This particular result supports the findings of Garcia et al. (2014) that cutting mangroves for fuel and charcoal is one of the main activities contributing to the decrease of mangroves in the Philippines.

In terms of the awareness of storm surges, 73.81 % of the respondents were aware of the phenomenon in which 65.71 % perceived that Santo Angel is susceptible to this coastal hazard. Despite the high awareness, only 57.62 % of the respondents asserted preparedness for storm surges.

3.3 Factors Influencing the WTP of the Respondents for Mangrove Rehabilitation Project

Logistic regression analysis was applied in the study to determine the factors that influence the respondent's WTP. The results of the analysis are shown in Table 3. Complimentary with the results of previous contingent valuation studies on mangrove rehabilitation (Susilo et al., 2017; Ekka & Pandit, 2012; Stone et al., 2008), bid amounts negatively affect the WTP of the respondents. In the present study, as the bid amount increases, the probability of the respondents to willingly pay for the rehabilitation project decreases by 0.20 %. This particular finding follows the law of supply and demand wherein the quantity demanded for goods and services decreases as the price increases.

Income negatively affects the WTP of the respondents. As the respondent's income increases, the probability of willingness to pay for the rehabilitation project decreases by 0.006 %. As stated above, most of the respondents were poor, which affects their ability to pay for the proposed mangrove rehabilitation project even if there will be a slight increase in their income. The negative relationship of income with the respondents' WTP was also seen in the CVM studies of Musa et al. (2020) and Ekka & Pandit (2012) on mangrove restoration and conservation.

The sex of the respondents displays a positive relationship with the respondents' WTP. If the respondent is female, the probability of willingness to pay would be higher by 9.30 %. This result is consistent with the findings of Pham et al. (2018), that men were likely to pay less for mangrove rehabilitation programs than women. Similarly, the age of the respondent positively affects the respondent's WTP. Older respondents are more willing to pay than younger respondents. Older respondents are more aware of the degradation of mangroves in the community, which can translate into a positive WTP for a mangrove rehabilitation project. The regression results also revealed that membership in an environmental organization had a positive influence in elucidating WTP. Respondents who are members of an environmental organization will be likely to pay for the mangrove rehabilitation project. Lastly, the awareness of the respondents on the importance and on the ecosystem services of mangroves positively affects WTP responses for the mangrove rehabilitation project. If the respondent is aware of the importance of mangroves and their ecosystem services, the probability of agreeing to pay would be higher. Locals are willing to pay more for mangrove rehabilitation projects when they acknowledge the benefits of mangroves, including their ecological services (Susilo et al., 2017).

3.4 Computation of Mean Willingness to Pay

The study used parametric estimation to compute the mean willingness to pay (MWTP) of the household respondents for the proposed mangrove rehabilitation project aligned for coastal protection in Santo Angel. Using Equation (1) by Hanemann (1994), the MWTP of the households was calculated at Php 15.44 (USD 0.29) per household per month or equivalent to Php 86, 525.76 (USD 1,659.41) yearly considering all the households in Santo Angel. The five-year contribution of the community for the mangrove rehabilitation project was computed at Php 432,628.80 (USD 8,297.06).

Table 3. Summary of the results of the logistic regression testing the significance of the different variables influencing the respondent's WTP

Variable	Coefficient	P-Value (Significance Of Coefficient)	Marginal Effects	P-Value (Significance Of Marginal Effects)
Sex	1.438	0.006*	0.093	0.039**
Income	- 0.001	0.000*	- 0.00006	0.000*
Age	0.043	0.036**	0. 002	0.071***
Years of residency	- 0. 015	0.310^{ns}	- 0.000	0.330^{ns}
Membership to an environmental organization	1.153	0.086***	0.059	0.114^{ns}

Variable	Coefficient	P-Value (Significance Of Coefficient)	Marginal Effects	P-Value (Significance Of Marginal Effects)
Bid amounts	- 0.049	0.000*	- 0.002	0.001*
Awareness on the importance of mangroves	2.511	0.098***	0.357	0.318^{ns}
Awareness on the ecosystem services of mangroves	3.082	0.007*	0.483	0.070**
Awareness on the susceptibility of the area to storm surges	- 0.002	0.983^{ns}	- 0.000	0.983^{ns}
Preparedness for storm surges	- 0.051	0.928^{ns}	- 0.0002	0.928^{ns}

Prob>chi2 = 0.000, Psuedo R2 = 0.4011: *1% Confidence Level, **5% Confidence Level, ***10% Confidence Level, ns (not significant)

Despite showing and explaining to the respondents the land cover maps, the status quo of mangroves, and the potential benefits of the rehabilitation project in Santo Angel, the locals generally have a low mean WTP for the proposed mangrove rehabilitation project. The MWTP calculated in the present study is comparably lower than other contingent valuation studies on mangrove rehabilitation, conservation, and management in the Philippines. For instance, Fernandez et al., (2005) recorded a Php 142.75 per month MWTP for mangrove restoration in Sibuyan, Guimaras, while Carandang et al. (2013) reported a Php 50.30 per month and Php 44.00 per month MWTP for sustainable mangrove management in Palawan and Bohol. Furthermore, Ureta et al. (2014) calculated a Php 30.39 per month MWTP for coastal biodiversity conservation in Oroquieta City in Misamis Occidental. The respondents' low computed mean willingness to pay for the mangrove rehabilitation project could be a manifestation of their low income despite showing high awareness on the regulating and protective functions of mangroves in the area.

3.5 Reason for “Yes” and “No” WTP Responses

Without any restriction on the amount as a contribution, 79% of the household respondents were willing to pay for the rehabilitation project, while only 21 % were unwilling to pay for the rehabilitation initiative. This finding highlighted that majority of the locals in Santo Angel are willing to offer payments for the restoration of mangroves in their community. In addition, the locals' "YES" WTP responses signify their participation in mangrove rehabilitation efforts. Hence, any effort towards mangrove rehabilitation should capitalize on these members of the population, and that they should be part of future mangrove rehabilitation projects in the area.

Among the 79% of household respondents who agreed to pay for the rehabilitation project, 80.12% believed that rehabilitating their mangroves would soon protect them against calamities such as typhoons and storm surges. This high attribution to coastal defense is probably due to the high awareness of the locals on the susceptibility of Santo Angel to typhoons and storm surges. Furthermore, 25.30% of the respondents are willing to pay for the rehabilitation project to enhance the mangroves' ecosystem services. These results suggest that the locals in Santo Angel will support mangrove rehabilitation projects, especially the ones designed to improve the coastal defense function and other ecological services of mangroves. On the other hand, out of the 21% of household respondents who disagreed to pay for the mangrove rehabilitation project, 90.90% reasoned out that they are financially incapable of paying even if the rehabilitation project would benefit them and their community. Policymakers and governmental agencies should recognize these limitations and consider alternatives in crafting mangrove rehabilitation projects in Santo Angel. Non-monetary contributions, such as growing of mangrove propagules and voluntary labor can be considered potential contributions from this sector of the society. However, 6.81% of the respondents who disagreed with paying believe that the local government should fund this kind of initiative. Improving information dissemination campaigns, especially on the cumulative impacts of mangrove protection and the overall common good that it can bring to everyone in the community may likely persuade this sector to look at how they can help themselves without relying on the national government alone.

4. CONCLUSION

Using the Contingent Valuation Method, the willingness to pay of the locals of Santo Angel for a mangrove rehabilitation project that is aligned with coastal protection was assessed. The mean willingness to pay of the households for the proposed project was calculated at Php 15.44 (USD 0.29) per household per month or equivalent to Php 432,628.80 (USD 8,297.06) for the five-year duration of the proposed project. The majority of the respondents were willing to pay for the mangrove rehabilitation project. Locals believed that restoring their mangroves would protect them from typhoons and storm surges. Findings also showed that bid amounts, income, sex, age, membership in environmental organizations, and awareness on mangroves' importance and ecological services significantly influence a respondent’s willingness to pay for the mangrove rehabilitation project.

The recent valuation study successfully estimated the non-use value of mangroves for coastal protection. The calculated MWTP value and the identified factors affecting WTP can be utilized to design and implement community-based mangrove rehabilitation projects directed towards the protection of Santo Angel and other coastal areas in the Quezon province against impacts from extreme weather events, tsunamis, and even sea level rise. Further valuation of other ecological services of mangroves should be explored as input for the holistic rehabilitation and conservation of mangroves in Santo Angel.

Author Contributions: W. Gagarin performed the actual conduct of the study, analyzed and interpreted the collected data, and prepared the journal manuscript. D. Eslava supervised the entire process of the research. R. Ancog, C. Tiburan, and N. Ramos provided valuable inputs for the formulation of research design, survey questionnaire, including the analysis and interpretation of data and geospatial mapping of the study area.

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