Estimating the Economic Benefits and Costs of Conserving Marine Protected Area in San Jose, Antique, Philippines

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Abstract

The establishment of marine protected areas (MPAs) in the Philippines becomes a priority management strategy to conserve marine biodiversity and address the problem of declining marine resources. Economic studies can be a viable tool to determine MPA as a management option by evaluating their benefits and costs to the community. In order to determine the economic benefits of MPAs in San Jose, Antique, the total economic value of the resource consisting of direct and indirect use and non-use values was determined in 2016. Direct benefits from revenues and tourism amounted to Php 247,739.61 at the time of the study. Concurrently, the indirect functional benefits of MPA amounted to Php 2,162,235 using the benefit-transfer method. In measuring the non-use values of the MPA, the contingent valuation method was used to elicit the people's willingness to pay for the MPA conservation program. The mean willingness to pay (WTP) of 260 participants equals Php 219.00, and the social WTP amounted to Php 5,725,136.89. The total benefits of managing the MPA amounted to Php 8,135,111.50, which exceeded the cost of conserving the MPA, which amounted to only Php 1,235,363.30. The net present values across 25 year period and different interest rates generated positive results.

Keywords:
Total economic value, benefit-cost analysis, direct benefits, indirect benefits, non-use values, willingness to pay, net present value

Introduction

As a part of the Coral Triangle region, the Philippines is prioritized globally for marine conservation (Maypa et al., 2012). It is one of the most diverse countries in the world, endowed with almost all kinds of flora and fauna. It is also abundant in natural resources (Long & Giri, 2011; Cordero & Subade, 2018), especially in marine biodiversity because of its geographic location and tropical climate (Carpenter & Springer, 2005). The annual net economic benefits of shoreline protection from coral reefs were estimated at US$782 million in 2010 (Lauretta et al., 2011). Moreover, in 2015, Brander et al. estimated that the total ecosystem service benefits of achieving 10% coverage of Marine Protected Areas would range from USD 622-923 billion over the period 2015-2050; and for 30% coverage, these would range between USD 719-1,145 billion.

Being an archipelagic country, the Philippines' main source of living is fishing (Philippine Statistics Authority, 2021). However, Philippine marine resources are also experiencing a high level of anthropogenic and climatic impacts and threats (Buncag et al., 2020; Ballad et al., 2018; Brander et al., 2015). It was observed that overexploitation of the fishery sector has resulted in the continuous downward trend of these resources (Pandolfi et al., 2003; Primavera, 2004; Cabral et al., 2014). Though fishes are a renewable resource, they need a certain quantity to reproduce and regenerate again (Hartwick and Olewiler, 1998).

One solution seen to be very effective in addressing the problem of the severe decline of marine resources is establishing marine protected areas (MPAs) (Dudley, 2008). More than 1,900 MPAs covering 200,881 km2 were legally established in the six coral triangle countries, namely, Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Timor-Leste over the last 40 years (White et al., 2014). Its objectives are to establish biodiversity conservation, fisheries sustainability, tourism, and recreation (Lester et al., 2009; Rodwell & Roberts, 2000; Angulo-Valdés & Hatcher, 2010).

In the Philippines, about 1,800 established marine protected areas, primarily small and scattered non-take zones, are

often managed by the community (Cabral et al., 2014; Post, 2015). The Philippine Fisheries Code of 1998 (Republic Act 8550) mandates that every coastal barangay must have 15% of its total area as marine sanctuaries and marine protected areas (Buncag et al., 2020). However, upon implementing MPAs, several problems and issues arise, such that the country would take hundred years to fully protect 10% of its coral reef areas given that the rate of increase in establishing MPAs is too slow (Aliño et al., 2004). Accusations of improper management and insufficient budgeting have bombarded the policy, and only about 16-38% MPAs in the Philippines are efficiently and properly managed (Aliño et al., 2004), and only 0.5% of municipal waters and 2.7- 3.4% of coral reef areas are protected in no-takes MPAs (Weeks et al., 2010).

Across local government units (LGUs) in the country, various MPAs have been set up. In May 1998, Hayuma Foundation Inc. performed a rapid assessment of the reefs in the municipality of San Jose, Antique, and the results paved the way for the protection of the remaining live corals in the barangays of Funda-Dalipe, Madrangca, 3 (Comon) and 4 (Pantalan). In 2001, a total of 67.2 ha of coastal areas was declared MPA through Municipal Ordinance # 2001 - 2. The policy mainly aimed to conserve marine life to sustain people's livelihood (Local Government Unit of Antique, 2007). Moreover, in 2012 another assessment was conducted to produce monitoring data to serve as input for the management of the MPA (Martin & Martin, 2012). A total of 1661 fishes consisting of 28 families was identified, and the presence of endangered species of coral and fishes was seen. However, Azucena and Moreno (2010) found that the establishment of MPA in San Jose had a negative effect on the socioeconomic status of the fishermen living in the barangays, as mentioned above. There was also a significant decline in their income and production.

According to Laffoley et al. (2008), the loss of benefits of fisher folks is due to the restriction of fishing in the selected fishing grounds as mandated by the marine protected areas implemented in their area. Since the program started, fishers need to exert more effort to go to the unrestricted areas in order to have a catch. This phenomenon entails greater time and financial costs to the fishers and minimal catches due to the smaller area assigned for fishing. Azucena and Moreno (2010) also stressed that improper management

and inadequate funding were seen as some significant possible reasons for the inefficiency of the policy.

Many researchers, authors, and cases argue about the likely magnitudes of the benefits and costs of MPAs. Some have advocated the need for immediate implementation of these areas to counteract the negative impacts of fishing (Russ & Alcala 2004) and highlighted the numerous benefits that MPAs can provide to society (Ballantine, 2014) and the environment (Barton 1994; Costanza et al. 1997). In the same manner, some studies and sectors also claimed that due to the program, fishers lost opportunities to earn and restricted their livelihoods (Sanchirico et al. 2002), while others have expressed doubts about the ability of MPAs to deliver biological benefits (Smith & Wilen 2003; Fletcher et al. 2015).

This study attempted to analyze the benefits of the establishment of MPA and the costs it entailed to the government and the community affected. Economics can help progress the debate by taking a whole community perspective to assess the benefits and costs of conserving MPA and quantifying gains and losses over time. By expressing both benefits and costs in economic terms, ecological importance can be partially translated into monetary value that facilitates decision-making by enabling comparisons between benefits and costs (Beaumont et al., 2008).

The results of this study would also enable the local government to determine the area of strength and weaknesses of the MPA program and develop a better strategy to improve management. The San Jose, Antique community would also realize whether or not their efforts toward sustainable use of marine resources would provide them potential benefits in the future.

Methodology

The Study Site

San Jose, Antique is considered a first-class municipality located in the southwestern part of Panay Island in the Western Visayas (Figure 1). It is surrounded by three municipalities: Belison on the northern, Sibalom on the eastern, and Hamtic

on the southern side, where the Sulu Sea is on the western side.

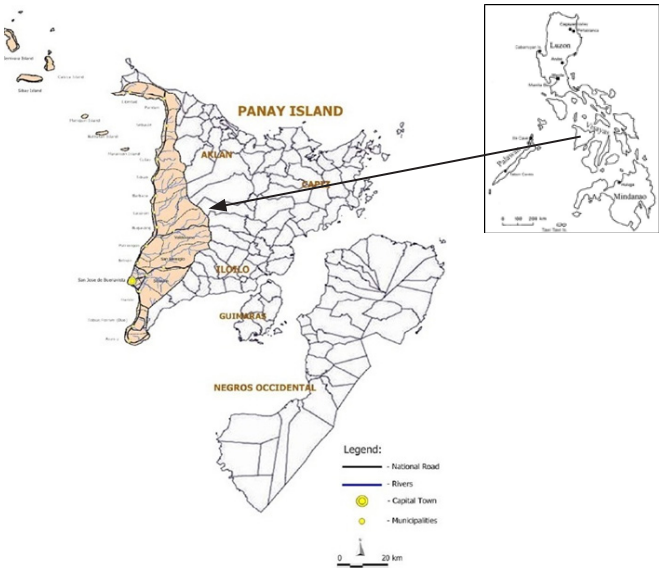
The municipality of San Jose generally, has a flat topography with a land area of 4450 ha and a coastline of 13.65 km (Municipal Profile, 2015).

The municipality of San Jose is composed of 28 barangays. Thirteen of these are coastal barangays, and only four barangays implemented marine protected areas. These barangays are Madrangca, Funda Dalipe, Brgy. 3, and Brgy. 4, which were chosen as study sites.

Data Collection

Primary and secondary sources of data were utilized in this study. Primary data were collected through surveys, key informant interviews, and focus group discussions. Secondary data were obtained from the different offices of the municipal government of San Jose, the Municipal Environment and Natural Resources (MENR), Panay Process Foundation, and relevant information from the respective barangays and published articles on MPA.

Figure 1
The Map of the Province of Antique Showing the Encircled Study Site



In order to collect the primary data, letters were sent to the municipal government of San Jose asking for approval and recommendation to conduct the study in the municipality. Focus group discussions were conducted with immediate stakeholders of the MPAs, such as fisher folk, bantay-dagat crews monitoring team, and selected local officials to gather relevant information that was incorporated and served as a guide to frame essential questions included in the interview schedule of the study. The gathering of primary data was conducted from December 2015 to May 2016.

Key informant interview using a prepared, structured questionnaire was conducted among local officials, barangay councils of each barangay, representative of the local government of San Jose, and experts in the field of MPA and non-government organization. This was done to assess and determine the range of costs and benefits related to MPA's establishment, management, operation, and maintenance.

An interview schedule was designed to gather information on the survey respondents' knowledge, perception, and problems in the MPA. On a scale of 1 to 5, participants were asked to rate MPAs importance to the environment. The respondents were also asked about their willingness to pay for the conservation of MPA in the municipality.

To compute the sample size, the researcher used the following equation:

$$n1 = \frac{N1}{N} * n \quad \textit{(Proportional Formula)}$$

where N symbolizes the total household of the four barangays

$$N = N1 + N2 + N3 + N4$$

and n is derived by using the formula for a large population

$$n_0 = \frac{(1.96)^2\left(\frac{1}{4}\right)}{(0.05)^2}$$

then n is adjusted for the small population using the formula below

$$n = \frac{n_0}{1 + \frac{n_0}{N}}$$

Brgy 4=157; 3) Brgy. Madrangca=33; and 4) Brgy. Funda Dalipe =57. A total of 260 respondents were across the four barangays.

Estimating the Costs and Benefits of Conserving MPA

Total costs

The concept of total economic cost is applied to fully account for all of the expenditures and losses associated with establishing and maintaining MPAs. Emerton (1999) defined total economic costs as the sum of management costs and opportunity costs. Management costs are direct physical expenditures on the equipment, infrastructure, and human resources required to manage MPAs. This is of two kinds, fixed costs, and variable costs. Fixed costs include the cost of established infrastructure, specifically the watchtowers, semi-concrete structures, furniture inside the built structures, gears used by the monitoring team, patrol boats, and others. Variable costs include maintenance and operation costs and labor costs. Maintenance and operation costs include the expenditure on new equipment that lasts only a year. Labor costs are allotted to pay individuals monitoring, enforcing regulations, and maintaining the MPAs.

On the other hand, opportunity costs are land and resources used foregone or precluded due to MPAs establishment and restriction of economic activities in the area. These are foregone alternative income and profits provided by investments in human, physical, and financial resources because of the establishment of MPAs.

In this study, the total cost is a function of total fixed cost, variable cost, and opportunity cost, as shown by the formula.

TC=TFC+TVC+TOC

Where TC=Total cost

TFC=Total Fixed Cost

TVC=Total Variable Cost

TOC=Total Opportunity Cost

The total cost can be derived by solving for the summation of all costs discounted over a period of time. This is shown in the formula below:

$$TC = \sum_{t=1}^{n} \frac{Cj}{(1+r)t}$$

Where Ci represents the different costs, r is the discount rate, t is the project's time or year, and n is the total number of years.

Total Benefits

To identify the benefits of implementing a marine protected area in San Jose, Antique. This is possible by attaching a monetary value to the benefits through market prices, contingent valuation, and benefits transfer methods. The market price technique is used to put a monetary value on the benefits from the direct usage of the project. Direct use includes the revenue obtained from fish harvest, permits, licenses, and fines. On the other hand, indirect use values could be estimated using the benefits transfer method from related studies since there is a constraint of time, resources, and information to derive this kind of value from the marine protected area in San Jose, Antique. The indirect benefits of coral reefs in MPAs were adopted based on the study of Costanza et al. (1997). These benefits are 1) coastal protection, 2) waste treatment and 3) food and biological control.

Finally, the contingent valuation method was used to measure the non-use benefits or the conservation value of the marine reserve as perceived by the participants. This method is an appropriate economic tool for this study which is not based on the observed market behavior or prices but rather on how people value the marine goods accessed after the conservation. This can be done by asking the participants how they are willing to pay to conserve the marine protected area in the four coastal barangay. Willingness to pay is a dependent variable, and for this study, it was estimated using the independent variables: bid price, monthly household income, age, sex, civil status, educational attainment, and knowledge index (Subade & Francisco, 2014)

The willingness to pay (WTP) is dependent on other variables, assuming a formula of:

WTP = f(X1, X2, X3,..,Xn)

Where:

WTP = willingness to pay for the conservation of MPAs given the bid price

X1 = Age
X2 = Sex
X3= Civil Status
X4=Educational Attainment
X5=Size of Household
X6=Income ofHousehold
X7=Knowledge index rating
X8=Bid Price

WTP is used to measure the non-use benefit of the MPAs using the parametric estimates method. The formula below was utilized in this study.

Mean WTP=(-α)/β =(-(constant+(coefficient of variables*mean of variables)))/(coefficient of bid_price)
Social Mean WTP = (percentage of respondents who are willing to pay) x (total households of the barangay) x (mean WTP)

Table 1 shows the total economic benefits of conserving the MPA with its measurement techniques.

Table 1
Total Economic Benefits from the MPAs in San Jose, Antique and its Measurement Techniques (2016)

Type of Usage	Variable	Measurement Technique
Direct Use	Fish Catch Permits and Licenses Fines	Market Price Market Price Market Price
Indirect Use	Coral Reefs: -coastal protection -waste treatment -food production and biological control -fish habitat	 Benefit Transfer Method Benefit Transfer Method Benefit Transfer Method Benefit Transfer Method
Non-Use Value	Conservation Value	Contingent Valuation Method

Total benefits are the total economic value of the marine reserve and are a function of use and non-use benefits or value as stated:

$$TB = \sum_{t=1}^{n} 1 \frac{Bj}{(1+r)t}$$

Where Bj represents the different benefits, r is the discount rate, t is the project's time or year, and n is the project's total number of years.

Net present value (NPV) will determine the project's viability. The general formula for NPV is:

$$NPV = \sum_{t=1}^{n} \frac{(Bt - Ct)}{(1+r)t}$$

Where:
B = Benefits of MPAs at time (t)
C = Costs of MPAs at time (t)
t = number of years
r = interest rate
n = duration of the project

To determine how much the society earns and returns for what it invests, the researcher computed the benefit-cost ratio using the formula:

$$BCR = \frac{\sum_{t=1}^{n} \frac{Bi}{(1+r)t}}{\sum_{t=1}^{n} \frac{Ci}{(1+r)t}}$$

Where:
B = benefits of MPA conservation
C= costs of MPA conservation
t = number of years
r = interest rate
n = duration of the project

Results and Discussion

MPAs provide a range of benefits for fisheries, local economies, and the marine environment (Angulo-Valdés & Hatcher, 2010; Davis et al., 2019; Sala et al., 2013). In order to formulate

well-organized social and economic policies and institutional frameworks for MPAs, it is essential to estimate their value (Birol et al., 2006, Buncag et al., 2020). Many valuation techniques and studies of environmental goods and services have been developed to quantify their economic values. Marine protected areas have also gained the attention of numerous valuation studies to elicit the monetary values of these types of ecosystems (Akhter & Yew, 2013).

1. Economic and Biological Importance of Marine Protected Areas

More than 60% of the participants agreed that MPAs are essential in the environment. The majority of the participants (64.6%) rated 5. MPAs have been established to protect critical habitats of marine life and other marine resources by restoring their productiveness and preventing degradation amidst exposure to different stressors (Mora et al., 2011; Bates et al., 2014). MPAs with no-take zones are critical in arresting and possibly reversing the global and local decline in fish population and productivity (Angulo-Valdés & Hatcher, 2010; Birol et al., 2006). In an MPA, the consumers directly benefit from the reserve. The coastal community, fisherfolks, gleaners, and tourists, among others, will receive ecosystem services.

Costs and Benefits of Conservation of San Jose de Buenavista Marine Protected Area

Costs

The cost of conserving San Jose de Buenavista MPA is divided into two parts: management and opportunity costs. Management costs can be dissected into fixed and variable costs. Fixed costs include furniture and equipment expenses, law enforcement expenses, resource assessment expenses, permits and licensing fees, telephone, and power expenses (Table 2). Furniture and equipment expenses include the equipment and materials purchased for managing MPA, which amounted to about Php 411,431.00. This investment was already considered a sunk cost, a cost that has already been incurred, and its recovery is difficult. Next is the law enforcement expenses, with an annual cost of Php 25,000.00. The MENR officer stated that the cost includes procuring and replacing buoys, floaters, and suspension markers for the

sanctuary. This is needed to demarcate the sanctuary as the no-take zone from the buffer zone. The MENR officer is also given a monthly cellular load allowance amounting to Php 2,000 for telephone and communication expenses. This is necessary whenever there are urgent matters that need to be addressed and discussed right away concerning the management of the sanctuary. Power expenses include the monthly cost of electricity and water used in the MPA gallery near the MPA area.

Variable costs include local traveling, training, and seminar and labor expenses (Table 2). Local traveling expenses amounted to Php 30,000.00. This amount was spent for fuel during the conduct of the Students Environmental Awareness Day (S.E.A. Day) at school and sea as part of the LGU San Jose de Buenavista environmental educational program. On the other hand, training and seminar expenses amounted to Php 187,818.00. For the labor cost, Php 459, 384.00 is the estimated annual salary of the designated officer for MENR and three technical staff. There is one volunteer educator among the staff.

The opportunity cost was considered in the computation of the conservation of MPA, which amounted to Php 110,730.30 (Table 2). This amount is supposedly the benefit that LGU San Jose can acquire if the amount (marked with an asterisk) were invested in the bank with 15% as the interest rate. This is considered a foregone benefit. Table 2 shows the variable costs and some of the fixed costs summed up to arrive at such an amount as the opportunity cost. The costs marked with an asterisk are considered the recurring cost and yearly investment for managing the MPA. If the money spent in the conservation of MPA will be invested in the bank, the interest incurred from this amount is the opportunity cost which is Php 110,730.30.

Table 2
List of Costs of San Jose dB MPA (2016)

Costs	Estimated Amount
Fixed Costs	
1. Furniture and Equipment	Php 411,431.00
2. Law Enforcement Section	Php 25,000*
3. Resource Assessment Section	No assessment
4. Permits and Licensing Section	No data
5. Telephone Expenses	Php 24,000*
6. Power Expenses	Php 12,000*
Variable Costs	
1. Local Travelling Expenses	Php 30,000*
2. Training and Seminar Expenses	Php 187,818.00 *
3. Labor Cost	Php 459,384.00*
Opportunity Cost (i=15%)	
1. Interest Rate for the Government Investments	
Total Cost	Php 1,235,363.30

Note: *added to compute for the Opportunity cost

The total cost of San Jose de Buenavista MPA amounted to Php 1,235,363.30. This is the cost incurred by the LGU San Jose de Buenavista in managing the MPA. Sanchirico et al. (2002) asserted that there had been less emphasis and attention on the potential costs of MPAs. Costs associated with managing MPAs will tend to increase due to the need for monitoring and enforcement because expected benefits will not be realized if there is little or no monitoring and enforcement of the protected areas. These costs depend on several factors, such as the size, location, and use of restrictions, fishery management regulations,

According to Azucena and Moreno (2010), study participants in San Jose de Buenavista MPA perceived that their income was declining and there was a lack of sustainable programs to help them earn. The establishment of MPA in their area delimited their fishing capacity and increased transportation costs.

Benefits

Direct use values or benefits include fish catch and tourism revenue. The study participants provided the data for the computation of the total revenue from the fish catch. During the face-to-face interview, participants were asked about the kinds of fish, and the quantity per fish caught for the past three months. Peak season usually starts from December to May, and lean season for the remaining months. Data gathering was conducted during March. Thus, it falls into peak season. The six-month peak season's revenue amounted to Php 117, 159.74. While for the six months of the lean season, according to the participants, the catch is only about half of the peak's catch, so the estimated revenue during the lean season amounted to Php 58,579.872. Thus, the total estimated revenue derived from fish catch has amounted to Php 175,739.61.

In Sumilon Island, fishing, particularly destructive fishing, was halted for ten years after establishing a marine sanctuary in the area (White et al. 2006). These have resulted in the improved condition of coral reef substrate, increased fish abundance, and increased fish catch (but not in the sanctuary) on the Sumilon Island reef. White et al. (2006) expressed that the benefits of MPAs in the Philippines are heavy and significant. Proper formation and considerable management of MPAs can also propel marine and coastal conservation needs by preserving essential habitats and significant species and protecting particular areas.

Income derived from tourism during the S.E.A. Day environmental campaign entrance fee generated an amount of Php 12,000. This is considered the non-consumptive use value of the MPA, specifically for educational purposes. The Great Barrier Reef in Australia draws in about 1.92 million visitors per day spent, valued at more than $ 6.4 billion in 2012 relative to $A192.5 million of Great Barrier Reef commercial fisheries (Deloitte Access Economics, 2013).

local fishing practices and customs, and existing technology.

Indirect benefits, on the other hand, are considered functional benefits that MPA can provide (Barton, 1994). As can be seen in the table, the indirect benefits that the San Jose de Buenavista MPA can provide include coastal protection, waste treatment, and biological and food production. Due to time and logistics constraints, the researchers used an important economic tool for valuating resources' value: the Benefit Transfer Method. This method utilized the values generated by the study site (the original study) and can be transferred to the policy site (this study). Costanza et al. (1997) provided a global economic value of the coral reefs, and this study adopted such values. Costanza et al. (1997) provided the value of each indirect benefit in the table per hectare per year. Coastal protection is valued at $2750, multiplied by Php 47, the current peso-dollar rate after which, multiplied to 15 hectares of coral reefs in San Jose de Buenavista MPA, thus amounting to Php 1,938,750.00, while waste treatment computed with the same process amounted to Php 40,890.00. The biological and food production is valued at $259 and amounts to Php 182,595.00.

The classification of the total benefit covers the conservation value or the non-use value of marine protected areas in San Jose de Buenavista, Antique. The contingent valuation method was used to measure the non-use value. In addition, the parametric estimates method was used to measure the mean willingness to pay. Table 3 shows the coefficient and mean of the variables that were used to compute the mean WTP.

Table 3

Mean WTP Using Parametric Estimates. San Jose de Buenavista, Antique (2016)

	APHA		BETA	
Parameters	Coefficient	Mean	Parameter	Coefficient
Constant	3.05541		bid_price	−0.00990883
Knowledge score	−0.090793	5.12		
Sex	0.164997	0.59		
Age	−0.018613	47.02		
Educational attainment	0.0501706	10.24		
civil status	−0.2023	2.37		
Household size	−0.170499	4.68		
total_family income	4.57539e-06	172885.32		

Mean WTP = (-(3.05541+(-0.090793*5.12)+(0.164997*0.59)+(-0.018613*47.02)+(0.0501706*10.24)+(-0.2023*4.68)+(4.57539e-06*172885.32)))/(-0.00990883) = Php 219.17

The derived value of mean WTP was rounded off to Php 219.00. The mean WTP of Php 219.00 is much higher compared with other studies, such as the mean WTP for the Sagay Marine Reserve, which is only Php 90.00 (Guanzon and Lagera, 2006) and the mean WTP of Php 187.50 to support the patrolling and monitoring of community-based MPAs in Cagayan Province (Ballad et al. 2018). The mean WTP was then multiplied by 59.62% of the total number of households in the four barangays, which is 3,654, since 59.52% was the percentage of participants willing to pay for the conservation program out of 260. This will represent the value that the people of San Jose de Buenavista, Antique, will be willing to pay for the conservation of marine protected areas in their municipality monthly. In order to come up with the annual conservation value, it will be multiplied by 12 as shown in the equation below. This value is the Social WTP amounting to Php. 5,725,136.89. Social WTP =12*[219*(3654*0.5962)] =Php 5,725,136.89

The total annual non-use benefits of the marine protected areas in San Jose de Buenavista, Antique, is Php. 5,725,136.89. This is also the conservation value of the MPA.

The summary of the various benefits calculated is shown in

Table 4 . The total benefits of San Jose de Buenavista MPA amounted to Php 8,075,111.50

Table 4

List of Benefits of San Jose de Buenavista Marine Protected Area (2016)

	Quantity	Price Per Unit	Inclusive Period	Amount (Php)
		Use Values		
Direct Benefits				
1. Revenue From Fish Catch			2015-2016	175,739.61**
2. Tourism	2000 students	Php 6.00	2014-2015	12,000**
Indirect Benefits				
1. Coastal Protection	15 hectares	$2750***	One year	1,938,750.00
2. Waste Treatment	15 hectares	$58***	One year	40,890.00
3. Biological and Food Production	15 hectares	$259***	One year	182,595.00
		Non-use Values		
Conservation Value		Php 219	One year	5,725,136.89
Total Benefits				Php 8,075,111.50

* See discussion ** Estimated *** Benefit Transfer Method, Costanza et al., (1997)
$1= Php 47.00

Net Present Values

In order to determine the economic viability of the conservation efforts for the MPA, accounting for the present values of the future costs and benefits is a must. Before proceeding to the computation of NPV, the future costs and benefits must be discounted first to determine their present values. Discounting is necessary as it accounts for the time value of money, an idea that the money received today is worth more than the money to be received later or in the future. It is also because of the social rate of time preference that people prefer to have present consumption over future consumption. Furthermore, discounting must be taken first to know the present values of such future costs and benefits.

The table below shows the net present value at different discount rates/ interest rates. This study used five different discount

rates, and these (i)s were utilized to aid the comparison of NPV across time and possible interest rates. In a 50-year period and at 5%, 10%, 12%, 15%, and 20%, the NPV range from Php 124,865,933.31 to Php 34,194,983.08. It can also be observed that as the discount rate increases, NPV decreases. A high discount rate can reduce sizable future benefits and costs to minimal present values (Henrichson and Rinaldi, 2014).

As seen in Table 5, the conservation of the San Jose de Buenavista MPA generated a positive NPV across time and different discount rates. The conservation effort produced a greater economic benefit compared to the costs it incurred. The project's benefits outweigh its costs.

Table 5
Net Present Values of San Jose dB MPA (2016)

Year	Discount rate				
	0.05	0.10	0.12	0.15	0.20
1	6,514,045.90	6,217,952.91	6,106,918.04	5,947,607.13	5,699,790.17
2	6,203,853.24	5,652,684.46	5,452,605.39	5,171,832.29	4,749,825.14
3	5,908,431.66	5,138,804.06	4,868,397.67	4,497,245.47	3,958,187.62
4	5,627,077.77	4,671,640.05	4,346,783.63	3,910,648.23	3,298,489.68
5	5,359,121.69	4,246,945.50	3,881,056.82	3,400,563.68	2,748,741.40
6	5,103,925.42	3,860,859.55	3,465,229.30	2,957,011.90	2,290,617.83
7	4,860,881.35	3,509,872.32	3,093,954.73	2,571,314.69	1,908,848.19
8	4,629,410.81	3,190,793.01	2,762,459.58	2,235,925.82	1,590,706.83
9	4,408,962.67	2,900,720.92	2,466,481.77	1,944,283.32	1,325,589.02
10	4,199,012.07	2,637,019.02	2,202,215.87	1,690,681.15	1,104,657.52
11	3,999,059.12	2,397,290.02	1,966,264.17	1,470,157.52	920,547.93
12	3,808,627.73	2,179,354.56	1,755,593.00	1,278,397.84	767,123.28
13	3,627,264.50	1,981,231.42	1,567,493.75	1,111,650.30	639,269.40
14	3,454,537.62	1,801,119.47	1,399,548.00	966,652.43	532,724.50
15	3,290,035.83	1,637,381.34	1,249,596.42	840,567.33	443,937.08
16	3,133,367.46	1,488,528.49	1,115,711.09	730,928.12	369,947.57
17	2,984,159.48	1,353,207.72	996,170.62	635,589.67	308,289.64
18	2,842,056.65	1,230,188.83	889,438.05	552,686.67	552,686.67
19	2,706,720.62	1,118,353.49	794,141.12	480,597.10	214,090.03
20	2,577,829.16	1,016,684.99	709,054.57	417,910.52	178,408.36
21	2,455,075.39	924,259.08	633,084.44	363,400.45	148,673.63

22	2,338,167.04	840,235.53	565,253.96	316,000.40	123,894.69
23	2,226,825.75	763,850.48	504,691.04	274,782.95	103,245.58
24	2,120,786.43	694,409.53	450,617.00	238,941.70	86,037.98
25	2,019,796.60	631,281.39	402,336.61	207,775.39	71,698.32
26	1,923,615.81	573,892.17	359,229.11	180,674.25	59,748.60
27	1,832,015.06	521,720.15	320,740.28	157,108.04	49,790.50
28	1,744,776.25	474,291.05	286,375.25	136,615.69	41,492.08
29	1,661,691.66	431,173.68	255,692.19	118,796.25	34,576.73
30	1,582,563.49	391,976.07	228,296.59	103,301.09	28,813.95
31	1,507,203.32	356,341.89	203,836.25	89,827.03	24,011.62
32	1,435,431.74	323,947.17	181,996.65	78,110.46	20,009.68
33	1,367,077.84	294,497.43	162,497.01	67,922.14	16,674.74
34	1,301,978.90	267,724.93	145,086.61	59,062.73	13,895.61
35	1,239,979.90	243,386.30	129,541.62	51,358.90	11,579.68
36	1,180,933.24	221,260.28	115,662.16	44,659.91	9,649.73
37	1,124,698.32	201,145.70	103,269.79	38,834.71	8,041.44
38	1,071,141.26	182,859.73	92,205.17	33,769.31	6,701.20
3.9	1,020,134.53	166,236.12	82,326.04	29,364.62	5,584.34
40	971,556.70	151,123.75	73,505.39	25,534.45	4,653.61
41	925,292.10	137,385.22	65,629.82	22,203.87	3,878.01
42	881,230.57	124,895.66	58,598.05	19,307.71	3,231.68
43.	839,267.21	113,541.51	52,319.69	16,789.32	2,693.06
44	799,302.10	103,219.55	46,714.01	14,599.40	2,244.22
45	761,240.10	93,835.96	41,708.93	12,695.13	1,870.18
46	724,990.57	85,305.41	37,240.12	11,039.25	1,558.49
47	690,467.21	77,550.38	33,250.11	9,599.35	1,298.74
48	657,587.82	70,500.34	29,687.60	8,347.26	1,082.28
49	626,274.11	64,091.22	26,506.78	7,258.48	901.90
50	596,451.53	58,264.75	23,666.77	6,311.73	751.58
Total	124,865,933.31	67,814,834.54	56,800,678.59	45,556,243.16	34,194,983.08

Note: Figures above were computed in Philippine peso (Php)

Benefit-Cost Ratio (BCR)

BCR is the ratio of the discounted benefits relative to the discounted costs. A simple computation to solve for the BCR is

that the total benefit is divided by the total cost. Such computation was used since cost and benefit are assumed to be constant across 50 years. The total benefit equals Php 8,075,111.50 divided by the total cost equals Php 1,235,363.3, and the BCR amounts to Php 6.54. This means that for every peso incurred for the conservation of MPA, the society can benefit an amount of Php 6.54 or approxi mately Php 7.00. According to James and Predo (2015), if the BCR of the conservation effort exceeds 1, the present value of benefits isgreater than the present value of costs, then the effort is economically efficient. If computed across time and interest rates, the BCR is still the same. Society can benefit by 7.00 even if the interest rate increases from 5% to 20%.

In order to obtain the economic value of the MPA, total benefits should be divided by the total area of the MPA in hectares. The total benefits generated by the MPA are equal to Php 8,075,111.50, and the San Jose de Buenavista MPA has an area of 67.2 ha.

$$\frac{Php 8,075,111.50}{67.2 hectares} = Php 120,165.3/ha/yr$$

The computation below shows the cost per hectare of conserving MPA. On the other hand, the total cost amounted to about Php 1,235,363.30, which constitutes 15% of the benefits the MPA can generate for society.

$$\frac{Php\ 1,235,363.30}{67.2 hectares} = Php\ 18,383.38/ha/yr$$

The economic value per hectare of San Jose de Buenavista MPA is huge and greater than the cost per hectare, even though some indirect benefits are not accounted for in the study. Hence, although the data was gathered in 2016, the BCA remains applicable since the 50-year period extends through the current year.

Conclusions and Recommendations

The study showed that the economic value of San Jose de Buenavista MPA is worth conserving because the benefit exceeded its cost. The benefit-cost ratio also tells that in every peso investment of the society for the MPA, the society can reap and get Php 7.00 as its benefits. Even if only 25% of the indirect benefits are accounted for, society can still benefit by Php 5.27.

However, the benefits and the costs might be underestimated due to a lack of available data and time and logistics constraints. A more thorough study could capture other benefits that the MPA can provide. The results could have higher economic value and benefits, resulting in positive NPV across time at different interest rates. Nevertheless, the cost-benefit analysis proved that San Jose de Buenavista's conservation program is economically desirable and viable.

The results of this study could supply the LGU with the information needed to develop effective resource-use policies. Given that almost 60% of the study participants were willing to pay for the conservation of the MPA, the LGU of San Jose should implement the conservation program. With such, the respective barangays where the MPA is established can employ a mechanism to capture the WTP of its constituents. Based on the personal interviews conducted in their respective barangays, the respondents suggested that a monthly contribution through barangay collection would immensely helped the conservation program.

The San Jose LGU can also re-establish an MPA management board that would help facilitate coordination and cooperation in managing the MPA across barangays. It is crucial that the LGU San Jose should be freed from any attempt of corruption and irregularities in their conservation efforts toward MPA in order to gain the trust of the community and to implement the conservation program effectively. Community participation is recommended to empower the community and to conduct information and education drives to inform the people about the MPA and its benefits.

It is recommended for each barangay have a standardized record-keeping and data-collection technique to monitor fish catch. Regular monitoring of fish catch is necessary for determining the effectiveness of the management of MPA. Monitoring of fish landing areas in the community may also be included in data collection to be more indicative of the direct benefits of thesee MPAs. Enforcement of fisheries laws and MPA-specific ordinances need to be undertaken, too, considering that huge benefits would be huge compared to costs

Future studies on resource assessment may be done to determine the biological conditions of MPA. Resource assessment was not included in the computation of total costs of managing San

Jose MPA due to lack of assessment during the period of study and unavailability of skilled individuals to conduct the assessment. Perhaps collaboration with other government agencies or educational insti tutions may be established to conduct assessment on the MPA.

Finally, a follow-up study on benefit-cost analysis of San Jose, MPA may be done to include other costs and benefits notcovered by this study. Specifically, enforcement costs as well as opportunity costs of no take zone MPA can be pursued to provide additional inputs to BCA studies

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