

# Willingness to Pay Estimation for the Restoration of Water Quality of a Eutrophic Lake

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## ABSTRACT

Lakes are recognized as highly susceptible to the impacts of various anthropogenic activities, making them one of the most vulnerable aquatic ecosystems. These ecosystems frequently experience degradation due to the lack of policies recognizing the importance of their often overlooked regulating ecosystem services. A contingent valuation approach was employed to assess the stakeholders' willingness to pay (WTP) for the restoration of the water quality of a eutrophic lake using the case of Tadlac Lake, situated within the municipality of Los Baños, Laguna Province, Philippines. The findings of the study revealed that households in the area expressed a WTP of Php 95.88/household/month or Php 1,150.56/household/year (1 USD=55.89 Php), with 72.30% of respondents indicating their readiness to support efforts to improve the water quality of Tadlac Lake. The likelihood of a positive response significantly varied depending on factors such as the offered price, gender, educational attainment, duration of residency, household size, income, and the method of questionnaire administration (cheap talk vs. non-cheap talk). These results underscore the community's favorable disposition towards investing in improving Tadlac Lake's water quality. This valuation study contributes a fresh perspective on lake management strategies. Moreover, it emphasizes the importance of environmental education regarding social-ecological dynamics as a crucial requirement for crafting comprehensive policies that will steer sustainable management of natural lake resources.

## 1. INTRODUCTION

Lake ecosystems are crucial in sustaining and supporting human well-being, serving as sources of potable water, fisheries, recreation, and aesthetic pleasure (Dudgeon et al., 2006; Nakano et al., 2016). However, urbanization and population growth have increased pollution from wastewater discharge, solid waste accumulation, and nutrient runoff into lakes (Bashir et al., 2020). This influx of pollutants has compromised the water quality in many lakes, causing oxygen depletions, algal bloom, and biodiversity loss. Such degradation threatens the ecological balance and jeopardizes the livelihoods of those who rely on the lake for their sustenance and economic activities (Sinclair et al., 2023).

The economic significance of a lake's benefits is contingent upon alterations in its water quality and/or quantity (Jala and Nandagiri, 2015). Quantifying the economic implications of gains or losses from ecosystems can enhance comprehension of the advantages of improving environmental quality and the expenses linked to their decline (Wegner and Pascual, 2011). Nonetheless, the value of ecosystem services for human well-being remains undervalued in decisions about ecosystem utilization, governance, and rehabilitation (Rounsevell et al., 2018). Consequently, the economic appraisal of sustainable lake management has been largely overlooked in scientific inquiry (Gebremedhin et al., 2018).

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The Contingent Valuation Method (CVM) is a commonly used method for assessing the economic value of environmental goods and services that lack market value, such as the conservation of lakes and their ecosystems (Grazhdani, 2015). It entails directly questioning the respondents' willingness to pay for a particular environmental improvement or the compensation they would demand to tolerate a decline (Khong et al., 2019). Willingness to pay (WTP) reveals the perceived value that individuals place on ecosystem services provided by various ecosystems (Clinch, 2004). Ecosystem services comprise a broad spectrum of benefits humans can obtain from ecosystems, such as clean water, recreational opportunities, biodiversity support, and cultural values (Costanza et al., 1997). By understanding people's WTP, policymakers and resource managers can better prioritize conservation efforts, allocate resources effectively, and make informed decisions about land use and development (Dahal et al., 2018). For example, in lake conservation, WTP estimates can provide insight into the economic benefits of maintaining water quality, preserving aquatic habitats, and promoting sustainable recreational activities. This information is crucial for justifying investments in conservation efforts, designing user fees or taxes to fund preservation initiatives, and demonstrating the importance of lakes to local communities and economies (Kumar and Martinez-Alier, 2011).

WTP determination through the CVM approach was also utilized in other studies to evaluate the economic value of ecosystem services provided by lakes. For instance, Janko and Zemedu (2015) assessed the fisherman's willingness to pay for fisheries management. They found that educational attainment, income, and the respondent's perception of lake fishery management significantly influenced their willingness to pay, showing positive correlations. Likewise, Van Oijstaeijen et al. (2020) employed monetary valuation and labor-days payment mechanisms to gauge farmers' preferences for controlling water hyacinth in Lake Tana, Ethiopia. They found that local farmers were willing to contribute over half a million euros annually to eradicate this invasive plant. Šebo et al. (2019) utilized CVM to gauge the value of enhancing lake water quality in Slovakia. In addition, Bueno et al. (2016) similarly employed CVM to assess the worth of urban lake rehabilitation in the Philippines, focusing on water quality improvement. While numerous studies using the CVM to evaluate improvements in lake

water quality have emerged recently, such research remains scarce in the Philippines. Bueno et al. (2016) study is the only available published study in the country where the CVM approach was utilized to investigate stakeholders' WTP in restoring lake water quality. Therefore, addressing the research gap in this area is crucial in establishing a foundational understanding of how stakeholders can contribute to implementing restoration efforts and sustainable water management practices.

Tadlac Lake, situated in Los Baños, Laguna, Philippines, holds significant ecological and socio-economic importance within its local community. Historically, the lake has been a crucial resource for residents, enabling fishing activities primarily through *Oreochromis* (Tilapia) aquaculture. Nevertheless, the unregulated expansion of fishing operations led to eutrophication and deterioration of the lake's water quality. A massive fish kill occurred in December 1999 during the lake's annual turnover, followed by the complete eradication of the remaining fish population in February 2000. The Laguna Lake Development Authority (LLDA), along with the Barangay Council and the Barangay Fisheries and Aquatic Resource Management Council (BFARMC), initiated efforts to rehabilitate the lake by imposing a ban on aquaculture in the area (Santos-Borja, 2008). This ban remains in effect to this day. However, according to the study conducted by Villaruel and Camacho (2022), the lake's eutrophic condition persists despite some improvements in water quality. This could be attributed to the influx of organic matter from residential and commercial establishments along the lake's shoreline. Consequently, this situation underscores the necessity to implement additional or alternative measures to restore the lake's water quality.

Maintaining the good water quality of lakes is essential for their ecological importance and the numerous benefits they provide to society. A healthy lake supports sustainable aquaculture practices and preserves natural biodiversity, making it more attractive for recreational activities and tourism. Assessing residents' WTP in restoring the water quality of a eutrophic lake can offer valuable perspectives on the perceived worth of the lake's ecosystem services and gauge support for conservation and restoration initiatives. Additionally, such exploration could offer insights into the factors influencing willingness to pay, thus aiding policymakers and government officials in refining communication strategies and environmental

protection policies for lake conservation. Hence, this study seeks to determine the economic value of a eutrophic lake's water quality regulation service using the case of Tadalac Lake. This was done by eliciting WTP from its stakeholders. Furthermore, the study also investigates the factors that could influence residents' WTP. Gaining insights into the WTP for water quality restoration in Tadalac Lake can provide valuable understanding regarding the perceived value of lake restoration efforts. A thorough comprehension of the stakeholders' WTP in Tadalac Lake and the factors influencing it can serve as a blueprint for analogous conservation and restoration globally. The findings of this study could provide a comprehensive viewpoint essential for advancing sustainable water management practices on a global scale.

## 2. METHODOLOGY

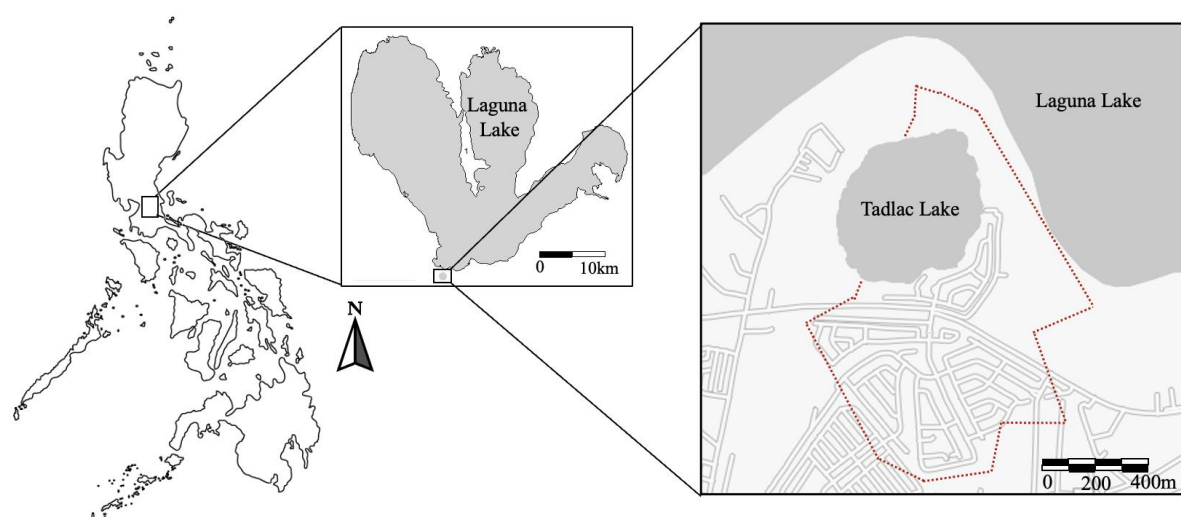
### 2.1 Theoretical framework of contingent valuation method

The CVM was employed to assess the economic worth of an ecological service that lacks a market price. CVM, a technique for estimating values of goods without existing markets, involves structured surveys asking respondents about their willingness to pay for hypothetical changes in environmental goods or services (Mendelsohn and Olmstead, 2009). Widely employed for freshwater ecosystems due to its adaptability and capacity to estimate nonmarket values

(Van Houtven et al., 2007; Zhen et al., 2011), CVM has been shown to estimate values for non-point source pollution such as domestic effluents (Grazhdani, 2015). It entails directly questioning the respondents' willingness to pay for a particular environmental improvement or the compensation they would demand to tolerate a decline (Khong et al., 2019). This study assessed stakeholders' preferences regarding water quality restoration in Tadalac Lake by proposing a theoretical wastewater treatment facility, thereby determining their WTP.

### 2.2 Sampling site and sample size

The study covered Tadalac Lake in Los Baños, Laguna (Figure 1). Currently, the lake is not open for aquaculture activity, but fishing and recreational activities are allowed there. The stakeholders of the lake include the residents of the Barangay (village) Tadalac living near the lake. The appropriate sample size was computed from the total population of the stakeholders using Slovin's formula. The interview was conducted exclusively with household heads, such as the wife, husband, or any adult member responsible for income generation and decision-making about the family's finances. The head of the household is described as any adult family member who contributes to the household's earnings and has the authority to make financial decisions on behalf of the household (Indab, 2008).



**Figure 1.** Tadalac Lake map highlighting Brgy. Tadalac (14.1824°N, 121.2061°E). The area within the red dotted line is the jurisdiction of Brgy. Tadalac. Residents residing in this area are the respondents of the study.

### 2.3 Questionnaire structure

The survey was done by face-to-face interview. The questionnaire formulated (See Supplementary data) is divided into three categories: socio-

demographic profile, knowledge, attitude, and perception on the lake, and WTP elicitation questions. The first part of the questionnaire involves the socio-demographic profile of the respondents, including the

name, age, gender, marital status, educational attainment, and number of people in the household. The second part involves questions about the uses of the lake and aims to determine the provisional services that the stakeholders derive from the lake. The last part of the questionnaire involves questions that will elucidate how the stakeholders value the lake in terms of its provisioning services (water, fish, etc).

A focus group discussion was also held with the barangay officials and residents to acquire significant information and stakeholders' perceptions regarding the status of the lake. The information acquired was used in the finalization of the questionnaire. Before conducting the survey, pretesting of the survey questionnaire was carried out to assess the appropriateness and efficiency of the participating institutions, payment scheduling, technical, and political viability of the program, and the clarity of the scenario and questions employed. The pretesting facilitated the identification of any questionnaire sections that were ambiguous or challenging for respondents to comprehend. Accordingly, necessary revisions were implemented before the commencement of the main survey. Furthermore, all questionnaires were translated into Filipino for easier understanding.

After the questionnaires were finalized, they were categorized into two groups: the cheap talk (CT) questionnaire and the non-cheap talk (NCT) questionnaire. For the cheap talk questionnaire, the respondents were informed that other respondents would also pay the same amount of a particular bid. Meanwhile, respondents were not told that other respondents would pay the same bid amount for the non-cheap talk questionnaire. The cheap talk mechanism was used since it can affect the frequency of respondents who will say yes to a specific bid (Aadland and Caplan, 2006).

## 2.4 Payment scheme

The question regarding willingness to pay (WTP) was presented in a format where respondents had to choose between two options: whether they were willing to pay a specific amount. If a respondent is willing to pay, they were asked about their preferred payment scheme: monthly, quarterly, or yearly. Eight (8) bids in Philippine Peso (Php) currency were used to ascertain the stakeholder's WTP. The bids are Php 20, Php 40, Php 60, Php 80, Php 100, Php 120, Php 140, and Php 160. The bid amount was distributed equally to the CT and NCT questionnaires. The same

number of NT and NCT questionnaires were used in the survey to avoid strategic bias.

## 2.5 Determination of mean willingness to pay (MWTP) and factors affecting it

The CVM was adopted in the study to determine the stakeholders' WTP for the water quality restoration of Tadlac Lake. The MWTP was calculated using the formula in the study of Hanemann (1994):

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

Where;  $\beta$  represents the coefficient of the bid price, while  $\alpha$  serves as a constant. This constant is determined either by the absence of additional independent variables or by the combination of the estimated constant and the sum of all other independent variable coefficients multiplied by their means (Donovan and Nicholls, 2003), i.e.

$$\alpha_0 + \sum_{j=1}^k \beta_j \bar{X}_j$$

Where;  $\alpha_0$  represents the constant of the logistic model, while the coefficients  $\beta_j$ 's do not account for the coefficient of the bid price.

Besides the bid price, various other variables may impact respondents' WTP. Thus, the function below incorporates all such factors anticipated to influence WTP among Tadlac residents:

$$WTP_2 = F(X_1, X_2, X_3, X_4, D_1, D_2, D_3, D_4)$$

Factors that could affect the WTP were  $X_1$  (respondent's age),  $X_2$  (educational attainment),  $X_3$  (bid prices), and  $X_4$  (respondent's income). This formula also incorporated dummy variables, with 1 and 0 serving as the respective placeholders for them: D1: gender (0=male; 1=female respondents); D2: respondents' educational level (1=had at least a college degree; 0=secondary school completer or lower educational level)

The respondent's WTP and the factors influencing their WTP were calculated using logistic regression. Logistic regression was also done using SPSS ver. 20.

## 3. RESULTS AND DISCUSSION

### 3.1 Socio-economic profile of the respondents

Table 1 shows the respondents' socio-economic profile. Most respondents are female, with 69.79% (n=268), while male respondents account only for



30.21% (n=116). The respondent gender demographic contrasts the general population census, indicating that the Philippine population comprises 50.14% males and 49.86% females. The ages of the respondents were presented into age classes. Majority of the respondents belong to the age class 30-39 with 37.50% (n=144), followed by age class 50-59 with 18.75% (n=72), then 40-49 (14.58%), followed by age class 20-29 and 60-69 both having a 12.50% (n=48). The age class with the lowest number of respondents are the brackets of 70-79 and 80-89, with 3.13% and 1.04%, respectively. For educational attainment, it follows the result of the study conducted by [Weinstein in 2010](#) that most of the graduates in the rural areas in the Philippines are at secondary level and do not pursue tertiary education. Most of the respondents are graduates of high school (44.79%; n=171), followed by college and vocational degree holders with 37.50% (n=68), and last are elementary graduates with 17.70% (n=36). Most respondents have lived in the barangay Tadalac for 31-40 years (23.96%), followed by respondents living in the area for 0-10 years (20.83%). The respondents living for 21-30 years in Tadalac are the 3<sup>rd</sup> highest with 15.63%. This is followed by 13.54% of respondents living in the barangay for 41-50 years and 12.50% living for 51-60 years. Respondents living for 11-20

years come next (8.33%) and last live for 61-70 years in the area (5.21%). Regarding household size, 53.13% of the participants were from small households (1-4 members per household), whereas 46.88% resided in larger families (5-8 members per household). A large proportion stated that their dependents were 2-3 individuals (58.33%), while 23.96% of the respondents indicated that their dependents were only 0-1 persons. Among the respondents, a cumulative 272 (70.83%) reported average monthly income of Php 10,000 or less. This income falls significantly below the income benchmark of Php 13,797 established by the Philippine Statistics Office in 2023 to cover the essential monthly needs, both food and non-food, of a family consisting of five members ([Mapa, 2023](#)). Merely 3.12% of the respondents declared an income exceeding Php 30,001. With Laguna Lake and Tadalac Lake within proximity, the majority of the respondents earned through fishing and farming (27.08%; n=104), followed by non-farm businesses such as sari-sari (small) store, tricycle operators, and others (20.83%; n=80). In terms of house ownership, the majority of the respondents own their house (65.63%; n=252), with the bungalow type being the most common among the respondents (67.71%; n=260).

**Table 1.** Socio-economic profile of the respondents inhabiting Tadalac Lake (n=384)

| Variable                | Response                              | Frequency | Percentage (%) |
|-------------------------|---------------------------------------|-----------|----------------|
| Gender                  | Female                                | 268       | 69.79          |
|                         | Male                                  | 116       | 30.21          |
| Age                     | 20-29                                 | 48        | 12.50          |
|                         | 30-39                                 | 144       | 37.50          |
|                         | 40-49                                 | 56        | 14.58          |
|                         | 50-59                                 | 72        | 18.75          |
|                         | 60-69                                 | 48        | 12.50          |
|                         | 70-79                                 | 12        | 3.13           |
|                         | 80-89                                 | 4         | 1.04           |
| Educational attainment  | Elementary                            | 36        | 17.70          |
|                         | High School                           | 172       | 44.79          |
|                         | College, vocational school, and above | 68        | 37.50          |
| Years living in Tadalac | 0-10                                  | 80        | 20.83          |
|                         | 11-20                                 | 32        | 8.33           |
|                         | 21-30                                 | 60        | 15.63          |
|                         | 31-40                                 | 92        | 23.96          |
|                         | 41-50                                 | 52        | 13.54          |
|                         | 51-60                                 | 48        | 12.50          |
|                         | 61-70                                 | 20        | 5.21           |
| Household size          | 1-4                                   | 204       | 53.13          |
|                         | 5-8                                   | 180       | 46.88          |

**Table 1.** Socio-economic profile of the respondents inhabiting Tadalac Lake (n=384) (cont.)

| Variable               | Response            | Frequency | Percentage (%) |
|------------------------|---------------------|-----------|----------------|
| Number of dependents   | 0-1                 | 92        | 23.96          |
|                        | 2-3                 | 224       | 58.33          |
|                        | 4-5                 | 64        | 16.67          |
|                        | 6 above             | 4         | 1.04           |
| Household income (Php) | 0-10,000            | 272       | 70.83          |
|                        | 10,001-20,000       | 80        | 20.83          |
|                        | 20,001-30,000       | 20        | 5.21           |
|                        | 30,001-40,000       | 4         | 1.04           |
|                        | 40,001-50,000       | 4         | 1.04           |
|                        | 50,001-60,000       | 4         | 1.04           |
| Source of income       | Farming/Fishing     | 104       | 27.08          |
|                        | Hired labor         | 48        | 12.50          |
|                        | Private employee    | 60        | 15.63          |
|                        | Government employee | 48        | 12.50          |
|                        | Resort employee     | 8         | 2.08           |
|                        | Non-farm business   | 80        | 20.83          |
|                        | Other               | 36        | 9.38           |
| Ownership of the house | Own                 | 252       | 65.63          |
|                        | Rent                | 56        | 14.58          |
|                        | Share               | 20        | 5.21           |
|                        | Caretaker           | 12        | 3.13           |
|                        | Squat               | 20        | 5.21           |
|                        | Others              | 24        | 6.25           |
| Kind of the house      | Bungalow            | 260       | 67.71          |
|                        | Nipa Hut            | 44        | 11.46          |
|                        | Apartment           | 52        | 13.54          |
|                        | Others              | 28        | 7.29           |

### 3.2 Knowledge, attitudes, and practices in Tadalac Lake

Knowledge, attitudes, and perceptions of the respondents about the lake were summarized and presented in [Table 2](#). The majority of the respondents believed that they obtained benefits from the lake (78.13%). Sightseeing, recreation, washing clothes, and fishing were identified as the primary benefits they derive from the lake. Less than 50% of the respondents agreed that the lake was cleaned after the massive fish occurred in 1999 (about 42.17%; n=164). Moreover, they believed that the protection of the lake was necessary and that it was the responsibility of the residents to take care of it.

An overwhelming favorable rating (yes=96.88%) was achieved when the respondents were asked if it was good that the lake would be maintained clean. Furthermore, the majority of the respondents also agreed to the removal of the fish cages in the lake (63.54%). Fish cages were removed

from the lake after the massive fish kill in 1999 as part of the rehabilitation of the lake. The lake is still closed for aquaculture, although there are few fish cages. Also, respondents (57%) agreed that the lake's periphery should be free from any establishments like resorts and houses to improve its water quality.

### 3.3 Determination of willingness to pay and factors influencing it

Of the 384 respondents surveyed, 361 were deemed valid, with 23 protest bidders excluded ([Table 3](#)). Protest bids are frequently submitted by respondents who may hold a value for the commodity that is either higher or lower than the average but decline to pay due to ethical or other considerations ([Halstead et al., 1992](#)). Most respondents (72.30%; n=252) agreed to pay the bid price they were randomly assigned. On the other hand, 100 respondents were unwilling to pay the bid price they were asked (27.70%) for the water quality improvement

intervention (Table 3). This finding clearly shows the overwhelming interest among residents of Brgy. Tadalac to support the improvements of the water quality of Tadalac Lake. The WTP of the respondents

reflects the value they place on the water regulation service provided by Tadalac Lake. The bid price signifies the sum they will pay for the suggested intervention (Reis et al., 2022).

**Table 2.** The respondents' knowledge, attitude, and perception on Tadalac Lake

| Variables (Questions)   | Response        | Frequency | Percentage |
|---|-----------------|-----------|------------|
| Recipient of the lake's services<br>(Do you benefit from the lake?)                                 | Yes             | 300       | 78.13      |
|   | No              | 60        | 15.63      |
|   | Undecided       | 24        | 6.25       |
| Benefits from the lake<br>(In what ways do you benefit from the lake?)                              | Recreation      | 60        | 15.63      |
|   | Sightseeing     | 160       | 41.67      |
|   | Drinking        | 16        | 4.17       |
|   | Washing clothes | 60        | 15.63      |
|   | Fishing         | 40        | 10.42      |
|   | Watering plants | 32        | 8.33       |
|   | Others          | 16        | 4.17       |
| Is the protection of the lake necessary?  | Yes             | 380       | 98.96      |
|   | No              | 4         | 1.04       |
|   | Undecided       | 0         | 0.00       |
| Is it the responsibility of residents to take care of the lake?                                     | Yes             | 376       | 97.92      |
|   | No              | 8         | 2.08       |
|   | Undecided       | 0         | 0.00       |
| Do you think the lake was cleaned after the massive fish kill?                                      | Yes             | 164       | 42.71      |
|   | No              | 140       | 36.46      |
|   | Undecided       | 80        | 20.83      |
| Is it good to maintain the lake clean?  | Yes             | 372       | 96.88      |
|   | No              | 4         | 1.04       |
|   | Undecided       | 8         | 2.08       |
| Are you in favor of the removal of the fish cages in the lake?                                      | Yes             | 244       | 63.54      |
|   | No              | 96        | 25.00      |
|   | Undecided       | 44        | 11.46      |
| Is it good that there are no establishments along the bank of the lake, such as resorts and houses? | Yes             | 220       | 57.29      |
|   | No              | 112       | 29.17      |
|   | Undecided       | 52        | 13.54      |
| If you compare the lake's condition during the 1990s, can you say that the lake was cleaner before? | Yes             | 120       | 31.25      |
|   | No              | 196       | 51.04      |
|   | Undecided       | 68        | 17.71      |
| Are you in favor of opening the lake for aquaculture again?   | Yes             | 124       | 32.29      |
|   | No              | 220       | 57.29      |
|   | Undecided       | 40        | 10.42      |

**Table 3.** Distribution of respondents who gave positive and negative WTP\*

| Willingness to pay         | Frequency | Percentage |
|----------------------------|-----------|------------|
| Positive (Yes to the Bids) | 261       | 72.30      |
| Negative (No to the Bids)  | 100       | 27.70      |
| Total                      | 361       | 100.00     |

\*protest bidders – 23

Logistic regression was utilized to assess the MWTP. In the regression model (Table 4), the likelihood of voting “yes” (coded as 1) or “no” (coded as 2) was analyzed in relation to bid prices exclusively. The bid price variable demonstrated statistical significance at a 95% confidence level, with a negative coefficient consistent with economic expectations. This suggests that as bid prices increase, the likelihood

of the respondents' WTP diminishes (Luangmany et al., 2009).

The MWTP was calculated using the formula  $\text{Mean}_{(\text{bids})} = \alpha/\beta$ . Employing the parametric method, the MWTP was determined to be -0.767/-0.008, resulting in Php 95.88. This signifies that the average maximum WTP for the water quality restoration of Tadlac Lake stands at Php 95.88 per household per month. For a year, this totals to Php 1,150.56 per household. This trend is mostly likely affected by the respondents' income, which is one of the major significant determinants of WTP. As shown in Table 5, the frequency of individuals who voted yes at lower bid prices (Php 20-100) was higher than those who voted yes at higher bid price levels (Php 120-160). Moreover, respondents whose monthly household income was Php 10,000 or less voted for a lower bid

price. As the bid price increases, families from lower monthly income brackets tend to vote less in favor of the higher bid price. Conversely, respondents earning Php 10,001 and above monthly are more inclined to vote for a higher bid price. This is very prominent at Php 120, Php 140, and Php 160 bid prices. Furthermore, this finding is supported by the logistic regression model (Table 6) in which household income is one of the significant variables that determined the probability of the respondents' WTP (correlation coefficient 0.281;  $p < 0.001$ ). This outcome aligns with the previous findings of Xiong et al. (2018), Mumbi and Watanabe (2020), and Hao et al. (2023), who similarly identified income and bid price as notable determinants impacting WTP, wherein respondents with a higher income were more willing to pay than their counterparts.

**Table 4.** Results of the regression analysis using only bids as a factor

| Model 1 (Bids only) |             |         |         |
|---------------------|-------------|---------|---------|
| Variable            | Coefficient | T-ratio | P-value |
| Constant            | -0.767      | 2.383   | 0.0001  |
| Bid                 | -0.008      | 0.251   | 0.0001  |

**Table 5.** The frequency of respondents who voted yes grouped according to their monthly income per price bid (n=384)

| Monthly income per household | Bid price (Php) |    |    |    |     |     |     |     |
|------------------------------|-----------------|----|----|----|-----|-----|-----|-----|
|                              | 20              | 40 | 60 | 80 | 100 | 120 | 140 | 160 |
| 0-10,000                     | 36              | 32 | 12 | 32 | 24  | 4   | -   | -   |
| 10,001-20,000                | -               | -  | 11 | 4  | 12  | 20  | 21  | 16  |
| 20,001-30,000                | 4               | -  | 16 | -  | -   | -   | -   | -   |
| 30,001-40,000                | -               | -  | -  | 4  | 4   | -   | -   | -   |
| 40,001-50,000                | -               | 4  | -  | -  | -   | -   | 1   | 4   |
| Total                        | 40              | 36 | 39 | 40 | 40  | 24  | 22  | 20  |

Aside from the bid price and monthly household income, other variables that affect the respondents' willingness to vote in favor of a particular bid were also presented in Table 6. Gender, educational attainment, years of stay in Tadlac, household size, and cheap talk or non-cheap talk questionnaire were the significant variables that influenced the WTP of the respondents.

It was observed that female respondents account for 64.78% (n=184) of individuals who voted yes for the bids asked, while males account for 35.21% (n=100) only (Table 7). Gender difference affects decision-making attitudes (Villanueva-Moya and

Exposito, 2020). Minasyan and Tovmasyan (2020) argued that women were participating in many of the decision-making activities on par with men. Women have an influence on monetary decision-making. Klesment and Bavel (2022) stated that women are predominantly involved in financial decision-making within marital contexts. In the Philippines, the monetary expenses are often decided by women in the household as they are the ones who handle and keep the money on behalf of the family. Therefore, it is highly probable that women would respond positively to WTP requests, given their role in managing household finances.



**Table 6.** Correlation analyses between respondents' WTP and their socio-economic profile, method of interview (with or without cheap talk), price of the bid, knowledge, attitude, and perception (excluding protest bidders)

| Variables   | Correlation coefficient | Significance level | Remarks         |
|---|-------------------------|--------------------|-----------------|
| <b>Socio-economic Profiles</b>  |                         |                    |                 |
| a) Bids   | -0.008                  | 0.0001             | Significant     |
| b) Gender   | -8.144                  | 0.0100             | Significant     |
| c) Age  | 0.103                   | 0.0520             | Not significant |
| d) Educational attainment   | -6.652                  | 0.0060             | Significant     |
| e) Years stay in Tadalac  | -0.169                  | 0.0110             | Significant     |
| f) Household size   | 1.276                   | 0.0190             | Significant     |
| g) Number of dependents   | -0.268                  | 0.3420             | Not significant |
| h) Household income (Php)   | 0.281                   | 0.0001             | Significant     |
| i) Source of income   | 2.609                   | 0.1010             | Not significant |
| j) Ownership of the house   | 15.546                  | 1.0000             | Not significant |
| k) Kind of the house  | 3.010                   | 0.3200             | Not significant |
| l) Cheap or non-cheap talk  | 5.195                   | 0.0130             | Significant     |
| <b>Attitude</b>   |                         |                    |                 |
| a) Recipient of the lake's services<br>(Do you benefit from the lake?)  | 19.942                  | 0.9990             | Not significant |
| <b>Knowledge</b>  |                         |                    |                 |
| a) Is the protection of the lake necessary?   | 0.453                   | 0.8130             | Not significant |
| b) Is it the responsibility of residents to take care of the lake?  | 19.59                   | 1.0000             | Not significant |
| c) Do you think the lake was cleaned after the massive fish kill?   | 0.766                   | 0.4150             | Not significant |
| <b>Perception</b>   |                         |                    |                 |
| a) Is it good to maintain the lake clean?   | -1.248                  | 0.4580             | Not significant |
| b) Are you in favor of the removal of the fish cages in the lake?   | -3.056                  | 0.0260             | Not significant |
| c) Is it good that there are no establishments along the bank of the lake, such as resorts and houses?        | 3.410                   | 0.0640             | Not significant |
| d) If you will compare the condition of the lake during the 1990's, can you say that the lake is still clean? | 1.137                   | 0.3650             | Not significant |
| e) Are you in favor of opening the lake for aquaculture again?  | 0.765                   | 0.5180             | Not significant |

The level of education influences decision-making, and the higher an individual's educational attainment, the more concern they have about the events in their environment (Klein, 1999; Kanyoka et al., 2008; Xiong et al., 2018). Educational attainment is a significant variable that affects the WTP of the respondents. Respondents who finished secondary education, tertiary, vocational, or postgraduate degrees responded positively to the bid they were asked. Similar findings were observed by Tziakis et al. (2009) in Northwest Crete, Lamsal et al. (2015) in Nepal, and Makwinja et al. (2019) in Malawi. They found that respondents with higher educational attainment were most likely willing to pay for conservation programs.

Most respondents living in Brgy Tadalac for 31

to 40 years exhibited the highest number of individuals who agreed to pay for the bid prices they were asked for. The number of years the respondents lived in an area significantly affects their knowledge and awareness of the area (Xiong et al., 2018). They are more concerned about the status and improvement of their environment. Citizens who have resided in the area longer can give more concrete answers about the area's status before and after. For example, those respondents who lived in the area longer can determine if the condition of the lake at present is better than before. Meanwhile, respondents who are new to the area might give a vague and unrelated answer about the topic. Hence, the knowledge, attitude, and perception about the lake might vary depending on the years the respondent is present.

**Table 7.** Frequency of individuals who voted yes for every significant variable

| Significant variable                    | Percentage and frequency   |
|---|--|
| Gender                                  | Female=64.78% (n=184)<br>Male=35.21% (n=100)   |
| Educational attainment                  | Elementary=19.72% (n=56)<br>High school=56.34% (n=160)<br>College, Vocational and Postgraduate=23.94% (n=68)   |
| Years of stay in Brgy. Tadlac           | 0-10=19.72% (n=56)<br>11-20=11.17% (n=32)<br>21-30=12.68% (n=36)<br>31-40=23.94% (n=68)<br>41 - 50 = 9.86% (n=28)<br>51-60=12.68% (n=36)<br>61-70=9.86% (n=28) |
| Household size                          | 1-4=59.15% (n=168)<br>5-8=40.85% (n=116)   |
| Cheap talk (CT) or non-cheap talk (NCT) | CT=52.11% (n=148)<br>NCT=47.89% (n=136)  |
| Removal of fish cages in the lake       | Yes=69.01% (n=196)<br>No=23.94% (n=68)<br>Undecided=7.04% (n=20)   |

Household size also influences a household's response to a specific bid price. The household size determines the adequacy or sufficiency of the family's income source (Kolstoe et al., 2022). Families with numerous dependents often face inadequate income sources, leading them to prioritize fulfilling basic needs, as indicated by Attree (2005) and Hosany and Hamilton (2023). Hence, the larger families size, the lower the probability of WTP. This condition was also perceived in the study's findings wherein more respondents from small household sizes tend to be more willing to pay for the bid prices (Table 7). This trend is also evident in the studies of Moffat et al. (2011), Zelalem and Beyene (2012), and Yifei et al. (2018), wherein they observed that as family size increases, the household tends to have a negative attitude toward willingness to pay.

The type of questionnaire used had a significant influence on the respondents' WTP as more respondents voted 'yes' using the cheap talk questionnaire (52.11%) than the non-cheap talk questionnaire (47.89%) (Table 7). With the cheap talk questionnaire, participants were informed that others would also be paying the same specified bid. This approach was utilized because it could influence other participants' WTP, as they might opt to match the bid they are presented with, knowing that others will do the same. Cummings and Taylor (1999) initially

explored the cheap talk about stated preferences. They incorporated lines within the survey questionnaire to address the issue of hypothetical bias, urging participants to consider the real opportunity costs associated with hypothetical alternatives carefully. Cheap talk breaks the typical anonymity between the survey researchers and the respondents. Employing cheap talk would also mitigate the demand effects during the survey. Demand effects could be anything that may influence the respondents' behavior in the survey (Carlsson et al., 2018). Research on WTP by Lusk (2003), Carlsson et al. (2005), Pontoni et al. (2018), and Lopez-Becerra and Alcon (2021) similarly indicated that employing a cheap talk questionnaire could positively influence attitudes toward willingness to pay.

### 3.4 Reasons for willingness and unwillingness to pay

Respondents who accepted the proposed bid were asked about their rationale for accepting a randomly asked bid (Table 8). Among them, 60.92% (n=173) expressed willingness to pay due to their belief in the project's capacity to "restore the clean water of the lake." It was followed by "conserving the lake will benefit the future generation" (22.18%). The aesthetic value of the lake was also a factor in why respondents were positive for WTP (9.15%). High

attribution to the aesthetic and restoration of the water quality is probably due to ecotourism. Tadlac Lake is currently being used as a recreational and swimming site of Laresio Resort. Maintaining the lake's aesthetic value and good water condition will help the residents, especially those working in the resort, generate income for their families. Notably, according to the barangay officials, most of the resort employees are residents of Brgy. Tadlac.

Conversely, 61% of the respondents who said 'no' to the bid price stated that the government should fund the water quality restoration program for the lake. According to some respondents, the previous lake rehabilitation was carried out by the local government

unit (LGU) and Laguna Lake Development Authority (LLDA); therefore, the government should again take responsibility for further restoring the lake's water quality. In addition, 21% of the respondents who said no pointed out that they don't have the capacity and the money to pay. Another factor that limits the respondents to say 'yes' to a given bid is the bid price. Eighteen percent (18%) indicated that they found the offered bid price too high, leading them to decline. Among those who refused, a majority (68%) reported a monthly income of  $\leq$  Php 10,000. These results align with [Carter and Barrett \(2006\)](#) assertion that poverty diminishes willingness to pay for conservation investments.

**Table 8.** Frequency of individuals who voted yes for every significant variable

| Reasons for 'Yes'                                   | Frequency | Percentage |
|---|-----------|------------|
| Restore the clean water of the lake                 | 173       | 60.92      |
| Conserving the lake will benefit future generations | 63        | 22.18      |
| Aesthetic value                                     | 26        | 9.15       |
| Others  | 14        | 4.93       |
| No answer   | 8         | 2.82       |
| Reasons for 'No'                                    | Frequency | Percentage |
| The government should fund the restoration          | 61        | 61.00      |
| The bid price is too high                           | 18        | 18.00      |
| I don't have the capacity and the money to pay      | 21        | 21.00      |

### 3.5 Policy implications

The study's findings affirm the positive willingness of respondents to pay for water quality restoration of Tadlac Lake. Should government agencies and policymakers consider formalizing a payment scheme, the study's WTP results could provide a foundation. However, it's crucial to consider factors influencing the stakeholders' WTP, such as poverty, as it may impede households' WTP and their readiness to engage in environmental conservation efforts. [Gibson et al. \(2016\)](#) suggested that assessing public preferences through WTP can be challenging when dealing with populations facing severe financial constraints. Thus, exploring alternative payment methods, such as installment payment options or labor contributions, might be more viable. Although this study focused on a specific locality (Tadlac Lake), its findings could serve as a model or basis for implementing institutionalized environmental user fees in other lake restoration initiatives by considering all the factors that could influence the WTP identified in this study.

### 4. CONCLUSION

This study assessed the economic value of Tadlac Lake's water quality regulating ecosystem service by determining the stakeholders' WTP to enhance the lake's water quality. Considering various pertinent variables and factors, the calculated WTP stood at Php 95.88 per household per month or a sum of Php 1,150.56 per household annually. Primary motivations for this willingness to pay included the desire for the lake's water to be restored to cleanliness and a sense of responsibility towards conserving it for future generations. Financial inability and the expectation of government funding for restoration were critical reasons for unwillingness to pay. Factors affecting households' WTP included the offered price, gender, level of education, duration of residence, household size, income, and the method of questionnaire administration.

The elicited WTP for Tadlac Lake's regulatory service prompts a fresh angle in the ongoing discourse surrounding the lake's utilization, with the overarching objective being an all-encompassing

estimate of its total economic value (TEV). Assessing the TEV of Tadlac Lake is crucial for devising and executing appropriate policies for sustainable management that reconcile ecological preservation with the utilization of aquatic resources.

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