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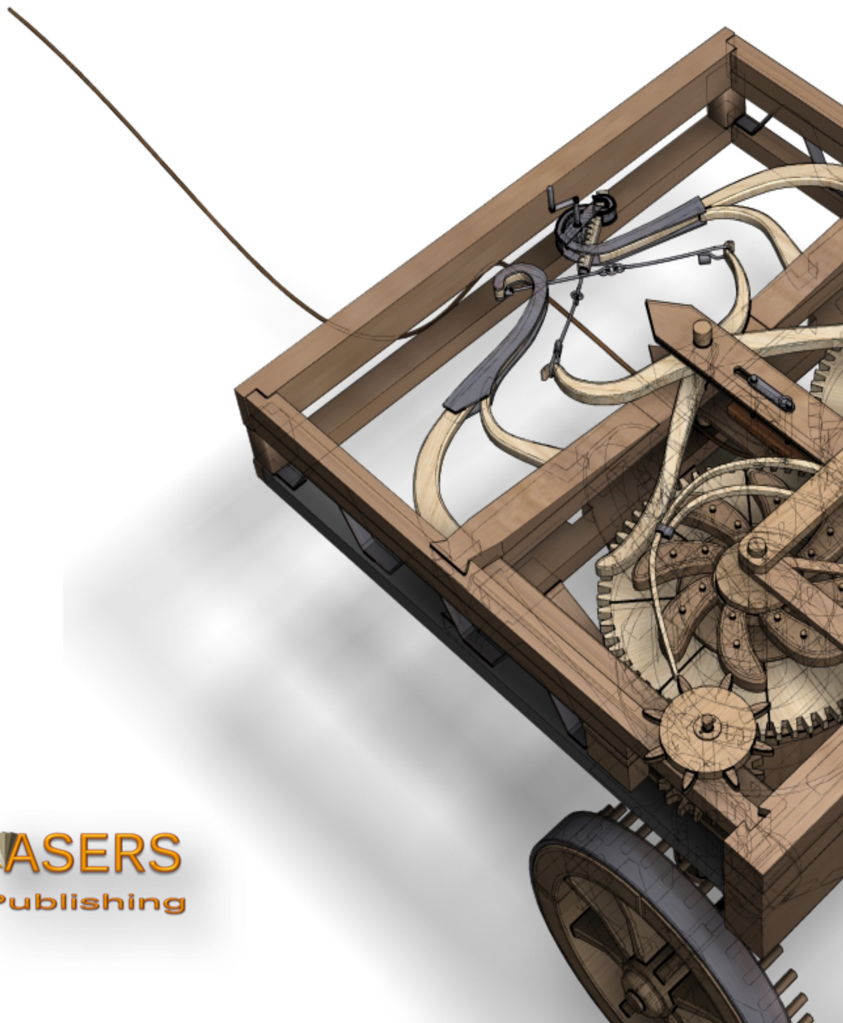

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Table of Contents

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Results of Two Non-Market Valuation Methods Used to Estimate Recreational Fishing in the Lakes Prespa Watershed

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Abstract: Using both the travel cost and contingent valuation methods, a case study of Lakes Prespa was utilized to assess the demand functions for carp and non-carp angling separately. An on-site survey questionnaire was used to collect the data, which was completed in 2019. The results showed that when travel costs and bid amounts are higher or when anglers are traveling in larger groups, they travel less frequently. On the other hand, the number of trips is positively correlated with income, angling experience, the use of a motorized boat, the number of trips taken to other sites, and retirement. The mean daily consumer surplus values for carp and non-carp anglers were calculated to be €7.24 and €4.33, respectively, using the trip cost method, and €7.83 and €4.61 using the contingent valuation method. Regardless of the method of valuation utilized, carp anglers' consumer surplus was more than 1.7 times that of non-carp anglers, demonstrating that ordering in fish species values is robust to valuation methods. Furthermore, the convergent validity of the two techniques was identified. The results will help fisheries managers make more successful and resource-efficient fishing decisions, as well as policymakers justify funding initiatives targeted at managing and protecting this resource.

Keywords: consumer surplus; contingent valuation method; count data models; recreation angling; travel cost model; truncation and endogenous stratification.

JEL Classification: C51; Q57; R11.

Introduction

Natural resources for recreation are non-market products and services, which means that their pricing cannot be determined because they are not directly exchanged in the market. Recreational angling is one of the ecosystem services that nature provides humans at little or no cost. In this study, non-market valuation methods like the contingent valuation method (CVM) and the travel cost method (TCM) are utilized as the main goal of separate analyses to examine the consistency of estimations of angling trip/day consumer surplus (CS) values in Lakes Prespa in 2019.

According to Grantham and Rudd (2015), Lothrop *et al.* (2014), du Preez and Hosking (2011), and Hanley and Barbier (2009), the travel cost method is one of the most well-documented and commonly used approaches for modeling the benefits of angling fisheries. An on-site intercept survey at angling locations was used to collect data, which according to Curtis and Breen (2016), introduces three issues that need to be taken into account during model estimation: over-dispersion (Hilbe 2011), truncation (Shaw 1988; Grogger and Carson 1991; Shrestha *et al.* 2002), and endogenous stratification (Shaw 1988). A careful look at the angling literature shows that in the past few years, new types of count data models have emerged to deal with the problems listed above related to the travel cost method. In this study, a truncated, endogenously stratified negative binomial model was used.

A variety of models based on the CVM method were also used to establish a link between a monetary tradeoff, site characteristics, and the likelihood that an angler will express a preference for a specific fishing site (Haab and McConnell 2002). There are several formats in which the tradeoffs can be presented in CVM, as well as several approaches to performing the statistical analysis (Mitchell and Carson 1989; Haab and McConnell

2002). Keeping this in mind, in this study, a dichotomous choice Logit model with a follow-up approach was developed and employed.

An intriguing question is whether anglers' consumer surplus varies depending on the species of target fish (species-specific effect), *i.e.*, whether anglers should be analyzed as a single group or divided into sub-groups. Another question is whether different CS values are assigned to the same resource using different non-market methods. This study addressed both of these concerns. First, the study's data set was divided into two anglers' sub-groups: carp anglers and non-carp anglers. Second, CS were estimated for two groups of fish species (carp and non-carp) in a single study using two valuation techniques—TCM and CVM models—and then compared. In this study, all estimations were done separately for carp anglers and non-carp anglers.

The first step in the angling demand analysis is to create a trip generation function that links angling trip rates to travel costs for TCM, an increase in trip costs for CVM, and other independent variables. The best demand function form in studies that used both CVM and TCM methods is a double log model, and the only independent variable in the models with any real explanatory power is the travel cost for the TCM method and an increase in trip costs that the angler was asked to pay for the CVM method. As Betz *et al.* (2003) point out, the most arbitrary and debatable aspect of non-market modeling is the selection of independent variables for model estimation. Therefore, another goal of this research was to identify and investigate the variables that affect the demand for recreational angling trips in the Lakes Prespa watershed case study.

In light of the foregoing, the following hypotheses were developed and tested in order to address the issues in this study:

H1: The demand for trips to fish for both carp and non-carp fish species depends on a number of variables.

H2: Regardless of the chosen method of valuation, anglers' CS values for carp and non-carp angling are not equal.

H3: The CS values from the TCM model and the CVM's are comparatively close for the same species of fish.

1. Literature Review

In recreational literature, there is a growing interest in estimating the recreational value of a leisure activity like angling in order to better manage it over other productive uses (Shrestha *et al.* 2002; Hunt *et al.* 2005) and make better decisions about how to manage recreational fisheries (Chizinski *et al.* 2005; Arlinghaus and Mehner 2005; Ferrer *et al.* 2005). In numerous studies (Carson *et al.* 1996; Shrestha and Loomis 2001; Loomis 2006; Rolfe and Dyack 2010; Ng 2011; Loomis and Ng 2012; Khan 2014), variants of the travel cost method, the contingent valuation method, or both methods are the two most commonly used methods for valuing angling. In accordance with this, both CVM and TCM methods were used in separate analyses to evaluate and examine the consistency of estimates of angling values in this study.

In several papers (Garrod and Willis 1999; Ward and Beal 2000; Haab and McConnell 2002; Dorison 2012; Czajkowski *et al.* 2014; He 2014; Khan 2014; Ezebilo 2016; Bertram and Larondelle 2017; Curtis and Breen 2017), based on on-site sampling data, travel cost count-data models were applied in order to estimate the economic values of angling. Because the number of angler trips is recorded as non-negative integers and assumes a semi-log demand functional form, which is very common in the literature, many researchers (Zawacki *et al.* 2000; Curtis 2002; Prado 2006; Bowker *et al.* 2007; Ojumu *et al.* 2009; Loomis and Ng 2012; Lew and Larson 2012; Raguragavan *et al.* 2013; Pascoe *et al.* 2014; Curtis and Stanley 2016; Curtis and Breen 2017; Hynes *et al.* 2017) have used count-data models, such as Poisson and negative binomial models, to evaluate the demand for and value of recreational angling. This is the reason why an on-site intercept survey at angling locations was used to collect data.

The on-site sampling data may show overdispersion in count-data models, which means the variance is higher than the mean because a small number of visitors make many trips while the majority only make a few. Chizinski *et al.* (2005) showed that negative binomial models are often used to deal with overdispersion, which means the variance is higher than the mean, which is not possible with the Poisson model.

During the on-site survey, visitors are contacted on-site, so their number of trips is always at least one and never zero. This is referred to as "truncation." The truncation occurs in count-data models as well because on-site sampling does not target non-visitors; that is, all observed visitors have taken at least the current trip, and non-visitors are not observed. The sample is therefore truncated at zero trips. As a result, Fletcher *et al.* (1990) noted that welfare estimates have an upward bias since individuals who took no trips during the period are not represented. Shrestha *et al.* (2002) highlighted that to address this problem, truncated Poisson or truncated negative binomial regression models can be used. Meanwhile, to address truncation and overdispersion simultaneously, a lot of studies (Kerkvleit *et al.* 2002; Oh *et al.* 2005; Arismendi and Nahuelhual 2007; Prayaga *et al.* 2010; Cameron and Trivedi 2013) have used a truncated negative binomial count-data model.

Shaw (1988) first observed, and this was later confirmed by Parsons (2003) and Hindsley *et al.* (2011), that an on-site survey typically employs a stratified sampling scheme in addition to truncation. Frequent anglers are more likely to be sampled than are anglers who make few visits, thereby biasing the sample in favor of this group. This is known as endogenous stratification. On-site sampling frequently produces endogenously stratified data, implying that frequent visitors are oversampled compared to infrequent visitors. Endogenous stratification is a third problem that happens when on-site sampling makes it more likely to meet people who come back often. Therefore, unmodified Poisson and negative binomial models are no longer suitable for this type of data. As a result, both models were corrected for all the above issues before determining which one performed better in the specific conditions of Lakes Prespa.

Recent recreational angling literature (Curtis 2002; Prado 2006; Martínez-Espiñeira and Amoako-Tuffour, 2008; Ojumu *et al.* 2009; Hynes and Greene 2013; Grilli *et al.* 2017) has recognized and addressed all of the issues raised above by using an endogenously stratified Poisson, or endogenously stratified truncated negative binomial model. Maximum likelihood (Hellerstain 1993) techniques were used in this study to estimate truncated and endogenously stratified Poisson and truncated and endogenously stratified negative binomial count data regressions. The preliminary analysis done in this study revealed that the corrected negative binomial count-data model for truncation and endogenous stratification fits the collected data better than the corrected Poisson model.

A wide range of studies (Mitchell and Carson 1989; Hanemann 1994; Navrud and Mungatana 1994; Alberini and Cooper 2000; Roach *et al.* 2002; Alberini *et al.* 2003; Genius *et al.* 2003; Urama and Hodge 2006) have also used the CVM method as one of the most widely used stated preference methods. It is also widely used as a substitute method for estimating recreational angling demand (Wheeler and Damania 2001; Williams and Bettoli 2003; Whitehead 2006; Prayaga *et al.* 2010).

There is a global discussion about whether the revealed preference (travel cost) method produces more or less accurate estimates than the stated preference (continent valuation) methods, which is problematic. In several studies dealing with angling (Loomis *et al.* 1986; Adamowicz *et al.* 1994; Azevedo *et al.* 2003; Gillig *et al.* 2003; Williams and Bettoli 2003; Brander *et al.* 2006; Loomis 2006; Brander *et al.* 2007; Whitehead *et al.* 2009; Rolfe and Dyack 2010), there was also evidence of some disagreement about whether count-data models based on the travel cost approach give more or less accurate estimates than contingent valuation methods for the same resource. For example, a comparative study conducted by Williams and Bettoli (2003) for trout fishing in eight Tennessee tail-waters concluded that values estimated from CVM exceeded those estimated from TCM. Gillig *et al.* (2003) and Brander *et al.* (2007) also found the same result. The opposite has been discovered by other important papers. Brander *et al.* (2006), Loomis (2006), Whitehead (2006), Whitehead *et al.* (2009), and Rolfe and Dyack (2010) showed that TCM estimates were different and higher than CVM estimates. Loomis and Ng (2012) estimated angling in Colorado State in 2009, and He (2014) estimated it in New York State for 1988 data and found that the values estimated from the CVM and TCM methods were not significantly different. Comparing the consumer surplus values obtained from TCM and CVM for carp and non-carp angling was one of the main goals of this study.

A large number of research studies, on the other hand, have found that anglers' consumer surplus or WTP, as estimated by the same evaluation method, vary depending on the target species of fish. Some studies (Johnston *et al.* 2006) claim that, compared to other fish species, trout has a lower marginal value for anglers. Other researchers (Loomis and Ng 2012) have discovered that trout have a higher marginal value to anglers than other species. In order to determine whether any ordering in species values is robust to the valuation method, the values of carp and non-carp angling were compared in this study using two different valuation methods (travel cost and contingent valuation methods).

According to Rolfe and Dyack (2010), Ng (2011) and Khan (2014), the studies that use both CVM and TCM enable the convergence validity of such non-market valuation techniques to be tested. To accomplish this, it can be assumed that the WTP for access from the CVM and the CS from the TCM will be equal. Calculation in terms of an angler's day of CS and WTP separately was required to test this hypothesis in this study. The WTP was calculated using the dichotomous choice Logit model with a fellow up approach, and the CS was calculated using the truncated and endogenously stratified negative binomial model. These models are more recent when compared to earlier ones.

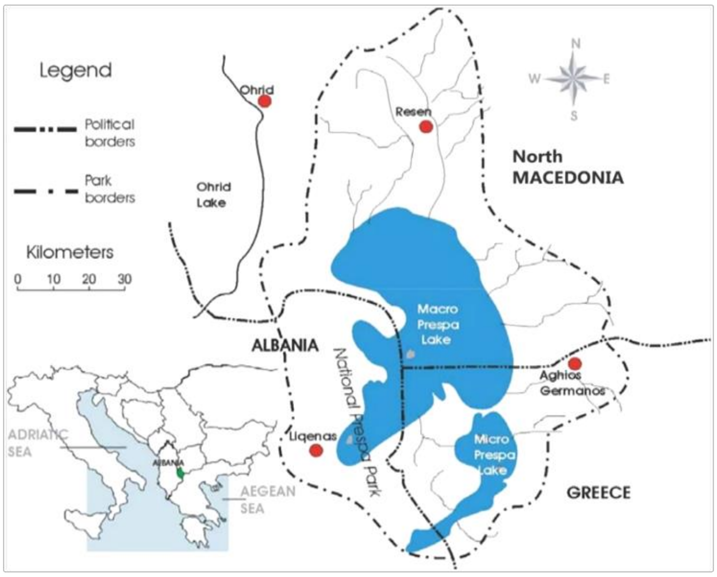
2. Methodology

2.1. An Overview of the Case Study

The Lakes Prespa watershed is located on the border between eastern Albania, Greece, and North Macedonia (Fig. 1). Because it is a wetland area with rich biodiversity and a long human history, the Lakes Prespa watershed is an excellent case study (Grazhdani 2014a). Macro Prespa and Micro Prespa, two interconnected lakes, and mountains surround this high-altitude basin. They are the highest tectonic lakes in the Balkans, standing at an elevation of 853 meters. The three countries share Lake Macro Prespa, which covers 253.6 km^2, while Albania and Greece share Lake Micro Prespa, which covers 47 km^2 (Grazhdani 2021a). On Greek territory, a 4 km long and 500 meter wide isthmus separates the two lakes.

On February 2, 2000, which is World Wetlands Day, the three prime ministers signed the Prespa Park Declaration. This marked the end of years of work to raise awareness about the need to protect the Prespa area, which is the first transboundary protected area in the area. The Ohrid-Prespa Transboundary Reserve, which links Albania and North Macedonia, was added to UNESCO's World Network of Biosphere Reserves in 2014 (Grazhdani 2023).

Figure 1. Lakes Prespa watershed



The Lakes Prespa contain 25 species of fish, 13 of which are native and 8 of which are exotic. Prespa spirlin, Prespa bleak, Prespa barbel, Prespa nase, Prespa minnow, Prespa roach, Prespa trout, and Prespa chub are the eight native species that are peculiar to the area (Spirkovksi *et al.* 2012; Grazhdani 2009). These lakes are unusual in every way because of their high levels of biodiversity and endemism.

Fishing is the most well-liked wildlife-related activity in the Lakes Prespa basin, and both locals and tourists of all ages take pleasure in it. Prespa bleak accounts for approximately 60% of the total fish stock, according to Grazhdani (2009), followed by carp (Cyprinus carpio) (25%), Prespa roach (6%), Prussian carp (Carassius gibelio) (5%), and other species like Prespa barbel and Prespa chub (4%). On the lakes, both recreational and commercial fishing are permitted, but in the rivers, only recreational fishing is permitted.

As a result of its long history in Lakes Prespa, common carp is regarded by locals and anglers as a native species. It is a crucial component of local culture and has significant economic and recreational significance. Currently, recreational fishing is one of the most popular tourism activities in this region. Anglers in the area primarily target carp, bleak, chub, barbell, and other species. Carp are a popular target for anglers in the Lakes Prespa watershed.

The dynamics and growth of recreational fishing in Lakes Prespa, as well as the potential economic benefits, are currently unknown. To our knowledge, no previous research has been done to evaluate the economic value of recreational angling in the Prespa Lakes. Due to these factors, the main objective of this study was to characterize recreational fishing in the Prespa Lakes and calculate its economic benefits. In the case study of the Lakes Prespa watershed, three specific goals were established: 1) to investigate the factors influencing the demand for carp and non-carp recreational angling trips using two non-market valuation methods (travel cost and contingent valuation); 2) to estimate the anglers' consumer surplus for two angler groups: carp and non-carp; and 3) to test the convergent validity of the two methods in the context of recreational angling.

2.2. Data Collection and Analysis

The data was gathered on-site using a self-reported survey questionnaire. The survey was carried out from June to October of 2019 in order to obtain a more accurate picture of angler visitation. To obtain the most representative sample possible, approximately ten days per month and on different days of the week were sampled.

The Dillman *et al.* (2007) mail-back method was used to administer the survey in this study. The questionnaire was created in accordance with the research objectives. Randomly intercepting shoreline and boat anglers at parking lots and boat ramp inspection points yielded the questionnaire respondents. Each angler/group received only one survey packet and was asked to fill it out by one adult angler. The questionnaire, a contact letter, a survey booklet, and a pre-addressed and stamped return envelope were all included in the packet that was distributed to the respondents. The questionnaires were to be returned within 5-7 days. At Lakes Prespa, 485 questionnaires were distributed, and 272 completed and usable surveys were returned, yielding a 56.3% response rate. The respondents were not given any monetary incentives.

Questions of the initial questionnaire were developed using previous travel cost and contingent valuation model literature (Ahn *et al.* 2000; Zawacki *et al.* 2000; Bowker *et al.* 2007; Ng 2011). The survey's design included questions about the demographics of Lakes Prespa carp anglers, travel and angling costs, their preferences, and a wide range of participation and attitude-related characteristics. After several revisions to check the content and construct validity (including expert judgments and recommendations) and his pre-testing to clarify the questionnaire's comprehensiveness and potential areas of ambiguity (Fink 2013; Nardi 2013), 30 anglers were chosen to provide feedback on the questionnaire's clarity and ease of use. Questions were made to be reliable and valid. Using Cronbach's alpha coefficient, reliability estimates were calculated for each respondent. The closer the correlation is to 1.0, the more reliable the estimate (Nardi 2013). Acceptable Cronbach's alpha coefficients were those greater than 0.7 (Kline 1999). The Cronbach's alpha for this study was 0.81.

Dummy variables were generated as necessary, calculations and formatting improvements were made, and all data was entered into a database file. The database file was then put into STATA version 12.1 (StataCorp 2011) so that descriptive statistics could be calculated and all estimation procedures could be done.

2.3. Variables Description and Multicollinearity Analysis

To investigate the effects of various angler and participation characteristics on angling in Lakes Prespa and to evaluate the economic value of angling, the dependent and independent variables were first chosen. The variables were selected in accordance with economic theory and earlier research on recreation travel that employed comparable modeling methods. The fishing and recreation literature is fairly consistent in how the dependent variable is defined for the TMC method. Du Preez and Hosking (2011) used the individual's number of trips to the Rhodes site in the previous year. The dependent variable in Kerkvliet and Nowell's (2000) and Curtis's (2002) models was defined as the number of days the angler spent fishing in the specified location. The number of trips an individual made to Lakes Prespa in the previous 12 months for the sole purpose of carp angling served as the dependent variable for the TMC model used in this study. Anglers' decision to pay or not to pay a predetermined amount toward the cost of their trip to go angling in the Lakes Prespa served as the dependent variable for the CVM model.

Several independent factors from the following groups were the focus of this study: *sociodemographic*, which is required to account for individual differences in preferences, interests, and opportunities in a demand model, such as an angler's age, gender, retired status, number of people per household, angler per household, number of people sharing trip expenses, angler’s education level, and years of angling experience; *economic*: annual household income, travel cost; *participation characteristics*: number of individuals in an angler's group, use or non-use of a motorized boat for fishing, hourly catch rate, days per trip, number of trips to other fishing sites in the previous year, number of hours spent fishing on trip, travel distance, and other factors: perceived weather and water quality index, as well as membership in a fishing club.

By screening and deleting some of the independent factors based on practical tests, multicollinearity is avoided in this study. This was accomplished using Pearson's product moment correlation coefficient (r) and the variance inflation factor (VIF). VIF was used to find multivariate associations, while r was utilized to find bivariate correlations. In order to ensure independence between the independent factors that would be utilized in regression models, the independent variables in this study were eliminated using a threshold value of 0.60 for r (good correlations between variables when r is over 0.60) (AcaStat 2014; Grazhdani 2016) and a VIF value greater than 4 (Park 2003; Grazhdani 2016). The reader can find more details about the procedure used for analyzing variables' multicollinearity in Grazhdani (2016). The definitions of the final variables chosen are shown in Table 1, along with the corresponding VIF values.

Table 1. Independent variables definitions and VIF values

Variable	Definition	VIF value
Age	Respondent's age in years	2.21
Gender	If respondent is male = 1, otherwise = 0	3.01
Retired status	If respondent is retired = 1, otherwise = 0	2.37
Education	Highest level of formal education obtained (1 = elementary, 6 = graduate school)	2.57
Income	Annual angler's income (€/year)	2.04
TravelCost	Euro amount spent per person to make a trip (€/person)	2.65
MotoboatUse	If angler uses a motorized boat for fishing = 1, and if not = 0	2.62
GroupSize	Number of people in angler's travel party	2.91
YearsExp	Years of carp angling experience of each individual	2.01
ContributePaying	Determine the number of household members who contribute to the angler's household expenses	2.67
ElsewhereTrip	Number of trips to other fishing sites in last 12 months	3.54
ExpenseShare	Number of people sharing trip expenses	2.07
DayPerTrip	Number of days spent on trip	1.83
BidAmount	Angler's willingness to pay a pre-determined increase (in €) in the cost of his trip	2.04
Conditions	Perceived weather and water conditions (1 to 5, excellent = 5, terrible = 1)	3.01
FishClubMemb	If respondent is fishing club member = 1, otherwise = 0	3.21

2.4. Non-Market Valuation Models Used in this Study

In the next two sub-sections, are briefly describe the non-market valuation models that were used in this study.

2.4.1. Model 1: Truncated and Endogenously Stratified Negative Binomial (TES-NB) Model

The Poisson model is the basic count data model that satisfies the discrete probability density function and non-negative integers (Hellerstein 1991; Perman *et al.* 2003). The probability density function for an angler *i* making a given number of trips n_i is given by (Grilli *et al.* 2017; Greene 2007):

$$\text{Prob}\ (y = n_i) = \frac{\exp(-\lambda_i)\,\lambda_i^{n_i}}{n_i!} \qquad (1)$$

where i = 1,..., N denotes the number of observations, and parameter λ is a function of travel, site and respondent characteristics, including travel cost (TC). The trip demand function can then be expressed as follows:

$$\ln(\lambda) = \beta_0 + \beta_{TC} X_{TC} + \ldots + \beta_n X_n \qquad (2)$$

where β_{TC} is the travel cost coefficient.

The traditional Poisson model is recognized for assuming equidispersion, which means that the distribution's mean and variance are equal (Cameron and Trivedi 2013). This assumption isn't true in the real world because, for many data sets from recreational demand models, the variance is higher than the conditional mean, leading to overdispersion. Due to this, the overdispersion problem can be addressed using the negative binomial model (Shrestha *et al.* 2002; Bin *et al.* 2005; Martnez-Espieira and Amoako-Tuffour 2008). The likelihood function for this model is provided by Englin and Shonkwiler (1995). Cameron and Trivedi (2013) suggested the following negative binomial distribution with an additional parameter α to control the level of overdispersion in the population:

$$\text{Prob}\ (y = n_i) = \frac{\Gamma(1/\alpha + n_i)}{\Gamma(1/\alpha)\Gamma(n_i + 1)} \left(\frac{1}{1+\alpha\lambda_i}\right)^{1/\alpha} \left(\frac{\alpha\lambda_i}{1+\alpha\lambda_i}\right)^{n_i} \qquad (3)$$

where Γ is the gamma function.

Truncation and endogenous stratification are two additional potentially serious problems with on-site sampled data that need to be corrected (Nakatani and Sato 2010; Shaw 1988). Welfare estimates will be biased if truncation and endogenous stratification are not considered.

Shaw (1988) explained how to correct the Poisson model for truncation and endogenous stratification by adjusting the dependent variable in equation (1) by subtracting 1 from each of its values. By revising equation 3 as shown below, the NB model is adjusted for truncation and endogenous stratification (Grilli *et al.* 2017; Martínez-Espiñeira and Amoako-Tuffour 2008):

$$\text{Prob}\ (y = n_i)\ = \frac{\Gamma(\alpha_i^{-1} + n_i)}{\Gamma(\alpha_i^{-1})\ \Gamma\ (n_i + 1)}\ \alpha_i^{n_i}\ \lambda_i^{n_i}\ (1\ +\ \alpha_i\ \lambda_i)^{n_i} \quad (4)$$

In order to determine which type - Poisson or negative binomial - is a better fit for the data gathered, the performance of both corrected models was estimated in this study. The following goodness-of-fit metrics were used for comparison: log-likelihood value (the larger the value, the better the fit), Akaike Information Criteria (AIC), and Bayesian Schwartz Criteria (BSC) (the smaller the AIC and BIC value, the better the model is). Only a brief summary of the results is given in order to save space. All coefficients in both models were estimated to have the same sign and nearly identical magnitudes. Only the goodness of fit and statistical significance metrics varied slightly. The NB model performs better than the Poisson model, as evidenced by the fact that the NB model's log-likelihood value (-394.839) was greater than the Poisson model's (-409.643). The AIC and BIC statistics for the NB model were lower (514.7 and 555.4, respectively) than for the Poisson model (530.5 and 568.1, respectively), indicating that this model fits the data better. Additionally, the over-dispersion parameter ln (α), which was statistically significant, showed that the data is over-dispersed and should be simulated using an NB distribution. Our results show that the corrected NB model performs better than the corrected Poisson model. The results are in agreement with Curtis and Stanley's (2013) findings. The NB corrected for truncation and endogenous stratification (TES-NB) was hence chosen for further analysis.

The following econometric model function was estimated to perform the individual TES-NB analysis:

$$\text{NumberTrips} = \exp\ (\beta_0 + \beta_{TC}\text{TravelCost} + \beta_2\ \text{Income} + \beta_3\text{Age} + \beta_4\text{MotoboatUse} + \beta_5\ \text{GroupSize} + \beta_6\ \text{YearsExp} + \beta_7\ \text{ElsewhereTrip} + \beta_8\ \text{Education} + \beta_9\ \text{ContributePaying} + \varepsilon_i \quad (5)$$

where *NumberTrips*, the dependent variable, represents the self-reported number of trips the angler took to Lakes Prespa during the previous year (year 2018).

The main independent variable, travel cost (*TravelCost*), was calculated as a continuous variable that represented the sum of the four financial components listed below: the amount of money spent per person on the trip (including lodging), the amount of money spent per person on gas if the angler uses a motorized boat, anglers' opportunity costs of time, and the amount of money spent per person on fishing costs. Additional dependent variables are: *Income*, the annual household income; *Age*, the anglers' ages in years; *MotorboatUse* is a dummy variable that indicates whether or not the anglers used a motorized boat on their fishing trip. The total number of adults and children traveling in the group is referred to as the *GroupSize variable*. *YearsExp*, the number of years spent angling; ElsewhereTrip - the number of trips made to all fishing locations other than the one where the anglers were surveyed during the previous year; *Education*, the angler's level of education*;* The number of household members who contribute to the angler's household expenses is referred to as ContributePaying variable.

After estimating the function's setting parameters and assuming that the coefficient on *TravelCost* represents cost trade-offs (Rolfe and Gregg 2012), the consumer's surplus (CS) can be calculated as follows (Ward and Beal 2000; Haab and McConnell 2002; Gillespie *et al.* 2017):

$$CS = -1/\ \beta_{TC} \quad (6)$$

Using the travel cost coefficient β_{TC} and its standard error (SD β_{TC}), the confidence intervals (CI) for the 95% confidence level were calculated as follows (Lansdell and Gangadharan 2003):

$$CS_L = -1/\ [\beta_{TC} + 1.96\ (SD\ \beta_{TC})];\ CS_U = -1/\ [\beta_{TC} - 1.96\ (SD\ \beta_{TC})] \quad (7)$$

2.4.2. Model 2: Logit Contingent Valuation Model (LM-CVM)

The contingent valuation method comes in a variety of formats, including the linear probability model, the logit model, and the probit model. As for elicitation techniques, there are several options, including the bidding game, the payment card, the discrete choice (take it or leave it) offer, the discrete choice with follow-up approaches, and the modified dichotomous approach. The dichotomous choice Logit model (LM) with a follow-up approach was used in this study.

The dichotomous choice format asked, "Would you be willing to pay or would you not be willing to pay a pre-determined amount toward the cost of your trip for angling in the Lakes Prespa?" The relationship between anglers' willingness to pay and their sociodemographic, economic, and participation characteristics was investigated using a Logit model in this question. If the respondent says yes, another question is asked with a higher bid amount chosen at random from a pre-determined list. If the respondent says no, the follow-up question uses a lower bid amount chosen at random from another pre-specified list.

The statistical Logit regression model used to calculate demand for carp and non-carp fishing in Lakes Prespa looks like this:

$$\ln \{P(BidChoice = 1)/[1 - P(BidChoice = 1]\} = \beta_0 + \beta_1 BidAmount + \beta_2 Conditions + \beta_3 Gender + \beta_4 Retired + \beta_5 FishClubMemb + \varepsilon_i \quad (8)$$

where *BidChoice* is the dependent variable and indicates whether or not an angler was willing to pay the amount requested during the survey. The number 1 represents a yes vote, and the number 0 represents a no vote. The independent variable "*BidAmount*" specifies the increase in trip cost that the angler was asked to pay. *Conditions*, the second independent variable in the model, measures the perceived weather and water quality conditions (1 to 5, excellent = 5, terrible = 1). Additionally, survey questions were made to gather data on the gender of anglers, their status as retirees, and their membership in fishing clubs.

The sample means of the independent variables are used to calculate the mean WTP values (Loomis and Ng 2012):

$$WTP = \ln\{1 + \exp[\beta_0 + \sum(\beta_n Z_n)]\}/\beta_1 \quad (9)$$

where β_n denotes the vector of coefficients, and Z_n denotes the sample means of the independent variables.

3. Results and Discussion

3.1. Sampling Results

The sample size for the TES-NB and LM-CVM analyses was 272, with 141 anglers targeting carp and 131 targeting non-carp fish on their angling trip. In Table 2, a summary of the descriptive statistics for the variables used in the regression models is shown.

Table 2. Mean and standard errors (in parentheses) of variables

Variable	Carp angler	Non-carp angler
Income (in €/year)	6542 (45.8)	6478 (76.4)
Age	56.6 (4.2)	59.7 (6.4)
Gender	0.71 (0.38)	0.78 (0.32)
Retied status	0.24 (0.16)	0.19 (0.11)
Education	4.76 (0.28)	4.43 (0.36)
TravelCost	€15.39 (1.43)	€10.28 (1.38)
MotoboatUse	0.48 (0.18)	0.64 (0.12)
GroupSize	3.26 (0.28)	3.02 (0.31)
YearsExp	17.4 (4.32)	16.6 (5.31)
ElsewhereTrip	6.05 (0.29)	11.66 (0.38)
ContributePaying	1.54 (0.12)	1.44 (0.22)
Conditions	3.59 (0.31)	3.27 (0.46)
FishClubMemb	0.78 (0.32)	0.68 (0.31)
AnnualTrip	4.16 (0.34)	5.93 (0.44)
DayPerTrip	1.74 (0.32)	2.01 (0.34)
ExpenseShare	2.04 (0.42)	1.81 (0.37)
CatchPerHour	0.78 (0.12)	0.73 (0.21)
FishHourTrip	8.97 (0.42)	9.55 (0.49)

The following conclusion may be drawn from Table 2's results: compared to non-carp anglers, carp anglers made fewer annual travel trips, fished for fewer days and hours per trip, visited fewer other sites, and caught fewer fish per trip. Additionally, they were less willing to go boat fishing. Carp anglers, on the other hand, arrived in a larger group with more people sharing trip costs.

Figure 2 depicts more details on the differences between the two angler groups. A 5-point Likert scale (from 1 = not important to 5 = extremely important) was used in the survey to ask respondents to rank the importance of several trip-related characteristics.

Figure 2. Ten most important characteristicts of angler trip

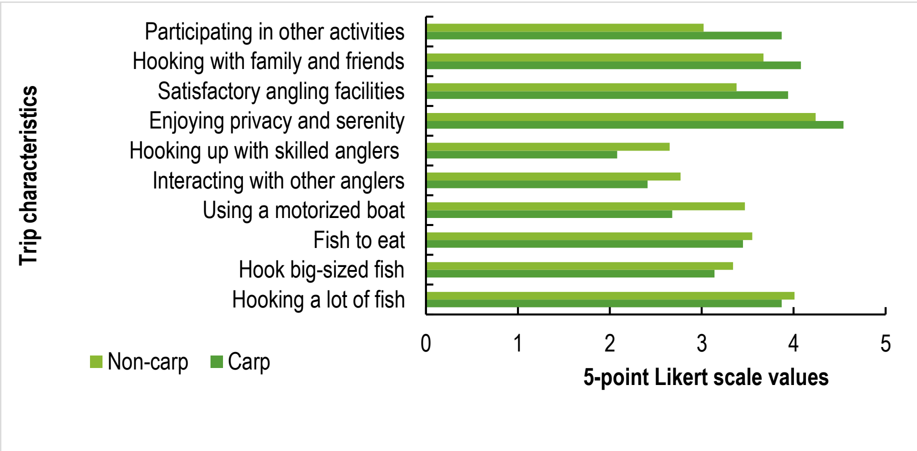


Figure 2 shows that hooking a lot of fish, hooking big-sized fish, and having fish to eat are trip characteristics that carp anglers place a lower value on. Furthermore, carp anglers thought that using a motorized boat, interacting with other anglers, and hooking up with skilled anglers were less important. Carp anglers, on the other hand, stated that enjoying privacy and serenity, having satisfactory angling facilities (clean and adequate angling sites, restrooms, and parking, etc.), hooking up with family and friends, as well as the ability to participate in other activities like wildlife viewing, camping, horseback riding, hiking, backpacking, photography were more important while on their trips. In other words, those who fish for carp can be described as "generalists," who include angling in their overall recreational activities, whereas those who fish for other species are "specialists," who go on angling trips more frequently each year (and stay on them for longer periods of time) and who place a higher value on the act of catching fish.

3.2. Analysis of the Factors Affecting the Demand for Recreational Angling Trips for Carp and Non-Carp Fish in Lakes Prespa

3.2.1. Results of TES-NB Models Estimation

The number of angling trips taken by the angler to Lakes Prespa in the previous year was the dependent variable in this study. It was hypothesized to be explained by travel cost, income, sociodemographic characteristics, participation characteristics, and other independent variables. Table 3 summarizes the estimation results for the TES-NB models for carp and non-carp, separately. Every variable in the TES-NB models was 10% or more significant.

At the 0.01 level, the coefficient of the independent variable travel cost was negative and highly significant. This was expected and consistent with TCM theory, as an increase in travel costs to the fishing site reduces the number of trips an angler would make to fish at Lakes Prespa.

The household income coefficient was significant and positive, which is consistent with our expectations that anglers with higher household incomes have more financial freedom to travel. This result is consistent with findings by Bin *et al.* (2005) and Martínez-Espiñeira and Amoako-Tuffour (2008). Other studies on the cost of travel have discovered that income has a negative or insignificant coefficient (Sohngen *et al.* 2000; Zawacki *et al.* 2000; Loomis 2003; du Preez *et al.* 2011; Hynes *et al.* 2015; 2017).

As expected, the coefficient for the variable labeled age was significant at the 0.05 level and had a negative sign, indicating that as the angler gets older, the number of trips to lakes decreases. This result indicates that as anglers get older, they may become less energetic and thus demand fewer trips. The findings agree with those of Ojumu *et al.* (2009) and Ng (2011) but not with those of Prayaga *et al.* (2010) and Ready *et al.* (2012).

The motorboat usage variable's coefficient was positive and statistically significant at the 0.05 level. This finding suggests that, when other factors are held constant, anglers who use motorboats tend to go angling more frequently than those who do not. The latter study's finding concurs with that made by Loomis and Ng (2012).

Table 3. Results of TES-NB models estimation

Variable	Carp anglers	Non-carp anglers
Constant	1.1542 (0.3057)**	1.3541 (0.4321)**
TravelCost	-0.0772 (0.008)***	-0.1120 (0.015)***
Income	0.0345 (0.002)*	0.0268 (0.003)*
Age	-0.0007 (0.00004)**	-0.0009 (0.00005)**
MotoboatUse	0.4091 (0.1025)**	0.5762 (0.1481)**
GroupSize	-0.0892 (0.0039)**	-0.0625 (0.0107)**
YearsExp	0.0246 (0.005) ***	0.0319 (0.006)***
ElsewhereTrip	0.3621 (0.098)***	0.0587 (0.007)***
Education	-0.2356 (0.0678)***	0.1159 (0.0521)***
ContributePaying	0.3874 (0.0762)*	-0.2053 (0.0672)*
N	141	131
McFadden's R^2:	0.1954	0.1637

*** = 1% level of significance, ** = 5 % level of significance, * = 10 % level of significance. Numbers in parentheses are standard errors.

The group size variable coefficient was negative and significant at the 0.05 level, indicating that as the number of participants in the group increased, the demand for trips decreased, all else being equal. Because fishing is typically a lone sport, and even though some degree of companionship may be desired, many anglers are assumed to seek solitude, away from crowds, when going on an angling trip, which may be one explanation for this result. The group size coefficient was also reported to be negative and significant by Taylor and Gratton (2000) and Loomis and Ng (2012). However, according to Hynes *et al.* (2015), the number of angling trips does not seem to be impacted by group size.

The coefficient for the years of experience variable was positive and statistically significant at the 0.01 level, demonstrating that the years of experience in fishing is a predictor of interest in or preference for fishing: the longer an angler has been involved in angling, the more fishing trips the angler would take, holding other variables constant. Ojumu *et al.* (2009) also found the same outcome.

If all other variables remained constant, it would appear that anglers made more trips to other fishing sites in the past 12 months based on the estimated coefficient, which was positive and statistically significant at the 0.01 level. This is consistent with Ng's (2011) outcome.

At the 0.01 level, the coefficient of the education variable was found to be negative and significant for carp. This finding implies that anglers with a higher level of education are more likely to take fewer trips. The effect of education was expected to be negative because many studies in the literature found that anglers with higher education levels were less likely to go angling than those with lower education levels (Lupi *et al.* 1998; Ojumu *et al.* 2009). In this study, however, the sign for education was positive for non-crap.

The number of household members contributing to the angler's household expenses was another important factor influencing the number of trips in Prespa Park. The sign for the number of people paying household expenses varied across both types of anglers.

3.2.2. Results of LM-CVM Regressions' Estimation

Table 4 provides a summary of the estimation results from LM-CVM regressions, where the estimated coefficient values and standard errors (in parentheses) are given.

Table 4 shows that the variable "*BidAmount*" was statistically significant at the 0.01 level, while the rest of the variables were significant at the 0.05 or 0.10 level. According to the Logit model results, an increase in trip costs (*BidAmount*) was highly significant and negatively correlated with anglers' decisions. The fact that this variable has a negative sign is in line with economic theory, which says that as the bid goes up, the probability of a yes answer goes down.

Table 4. Results of LM-CVM models estimation

Variable	Carp anglers	Non-carp anglers
Constant	2.145 (0.5497)**	1.098 (0.3781)*
BidAmount	-0.2524 (0.018)***	-0.2329 (0.013)***
Conditions	0.209 (0.0952)*	0.131 (0.0098)
Retired	0.406 (0.123)**	0.425 (079)**
Gender	0.528 (0.138)*	0.398 (0.092)
FishClubMemb	0.032 (0.087)*	0.028 (0.065)
N	141	131
Pseudo R-squared	0.2743	0.2988

*** = 1% level of significance, ** = 5 % level of significance, and * = 10 % level of significance. Numbers in parentheses are standard errors.

The effects of "perceived weather and water conditions" on trip frequency are less pronounced. For carp anglers, it was discovered to be significant, but not for non-carp anglers.

All else being equal, retired status may be regarded as an indicator of time availability; thus, retired anglers tend to take more fishing trips. It was positive and statistically significant at the 0.05 level in this study.

Gender was also included in this model to see if there was a link between demand for carp and non-carp angling trips. Gender was only positive and significant for carp anglers, implying that men spent more time angling than women did. In other studies (Prado 2006; du Preez and Hosking 2011) on how much it costs to travel for fishing, gender was not found to make a difference.

The coefficient for the variable "fishing club membership" was also positive and significant only for carp anglers. This means that an angler who purchase a membership is more likely to fish often.

3.3. Analyzing Estimates of Consumer Surpluses

The results of the consumer surplus analysis are presented in this section of the paper. The estimated coefficients of the travel cost variable for each group of anglers were used to calculate the average consumer surplus using the regression results from the TES-NB model. Using equation (6), the average consumer surplus value for carp and non-carp anglers per trip was €12.95 and €8.93, respectively (Table 5). Equation (9) and the regression results from the LM-CVM model showed that the average consumer surplus value per angler per trip for carp and non-carp anglers was €14.01 and €9.14, respectively (Table 5).

Because the TES-NB model's travel costs and the LM-CVM regression's increase in expenses were per angler trip, the angler per day consumer surplus was calculated by dividing the mean CS/trip values by the average number of days per trip values (from Table 2). Table 5 displays the CSs per angler day for both carp and non-carp anglers using the TES-NB and LM-CVM models. The mean consumer surplus value per day estimated from the TES-NB model was €7.24, with a 95% confidence interval of €5.75 to €8.71 for carp anglers, and €4.33, with a 95% confidence interval of €3.06 to €4.81 for non-carp anglers. For carp and non-carp anglers, the mean CS/day estimated from the LM-CVM model was, respectively, €7.83 and €4.61.

Table 5. Angler consumer surpluses estimates for both carp and non-carp anglers

Variable	TES-NB		LM-CVM	
	Carp	Non-carp	Carp	Non-carp
Mean CS/trip	€12.95	€8.93	€14.01	€9.14
Mean CS/day 95% CI	€7.24 (€5.75 - €8.71)	€4.33 (€3.06 - €4.81)	€7.83	€4.61

First, Table 5's findings demonstrate that both non-market valuation methods consistently showed that angler-day consumer surplus for carp angling was at the same ratio (about 1.7 times) higher than non-carp's for the TES-NB and LM-CVM models, respectively. This finding suggests that the relative values of angling for carp versus other species are robust to non-market valuation methods.

Second, the TES-NB models' 95% CI for the angler-day value estimates for both carp and non-carp species did not overlap. So, the hypothesis that the consumer surplus values of two different fish species are not the same, no matter what method of valuation is used, was proven to be true.

Third, the mean angler day values from TES-NB were only marginally lower than those from LM-CVM for both carp and non-carp anglers (by €0.59 and €0.28, respectively) (Table 5). As a result, the estimates from CVM and TCM are fairly close. These estimation results allow for the conclusion that the two valuation techniques show convergent validity. Therefore, the hypothesis that consumer surplus values from TES-NB are reasonably similar to LM-CVM's was also accepted. Because the same anglers were asked to provide data for both methods in the same survey, it's possible that this is one reason why the study found such close agreement between TCM and CVM consumer surplus values. Future research could assist clarify the findings of this study.

Conclusion

In this study, the values of carp versus non-carp anglers were estimated using both travel cost (truncated, endogenously stratified negative binomial, TES-NB) and contingent valuation (dichotomous-choice with follow-up approach, LM-CVM) methods using data from a 2019 angler survey sampled at Lakes Prespa. The findings enabled three major conclusions to be drawn.

The first is that the demand for carp and non-carp angling trips is influenced by various household, angler, and participation characteristics. Travel cost, angler group size, and age were found to be statistically significant variables that have a negative impact on the annual number of trips, while income, use of a motorized boat for fishing, years of experience, retired status, and number of trips to other fishing sites have a positive impact. Both types of anglers saw different signs about education, the number of people contributing to household expenses, and perceived weather and water conditions.

Second, the findings offered convincing proof that the daily mean of angler consumer surpluses differs between two different groups of anglers (carp and non-carp). The TES-NB model estimated anglers' daily consumer surpluses at €7.24 (carp) and €4.33 (non-carp). The LM-CVM model's mean values were €7.83 (carp) and €4.61 (non-carp). As a result, for two different fish species (carp and non-carp), the consumer surplus values calculated by both models are different. Regardless of the method of valuation used, carp anglers have a consumer surplus that is about 1.7 times greater than non-carp anglers. This might be made clearer by examining in the future some of the differences between the two types of anglers.

The third conclusion is that the TES-NB consumer surplus values are reasonably similar to those of the LM-CVM. The values calculated using the stated preference technique are largely comparable to the values calculated using revealed preference techniques. Both models gave equivalent sets of CS for two groups of species, demonstrating the convergent validity of the two valuation methods.

This study is an initial pertinent attempt to calculate the economic value of recreational angling in the case of Lakes Prespa. The gathered data will be helpful in developing carp stocking programs, encouraging the expansion of angling activity in the region while maintaining sustainability as a goal, and may also be helpful in the decision-making process for managing resources sustainably in Lakes Prespa and other similar areas.

It is important to emphasize the need to avoid oversimplifying the management decision-making process by relying solely on economic values. Economic values are an important source of information, but they are only one component of sustainable fishery management. In particular, the benefits to anglers are just one of the factors considered when formulating a sustainable resource management strategy. Along with economic objectives, a balance should be struck between social and ecological goals.

Declaration of Competing Interest

The author declares that she has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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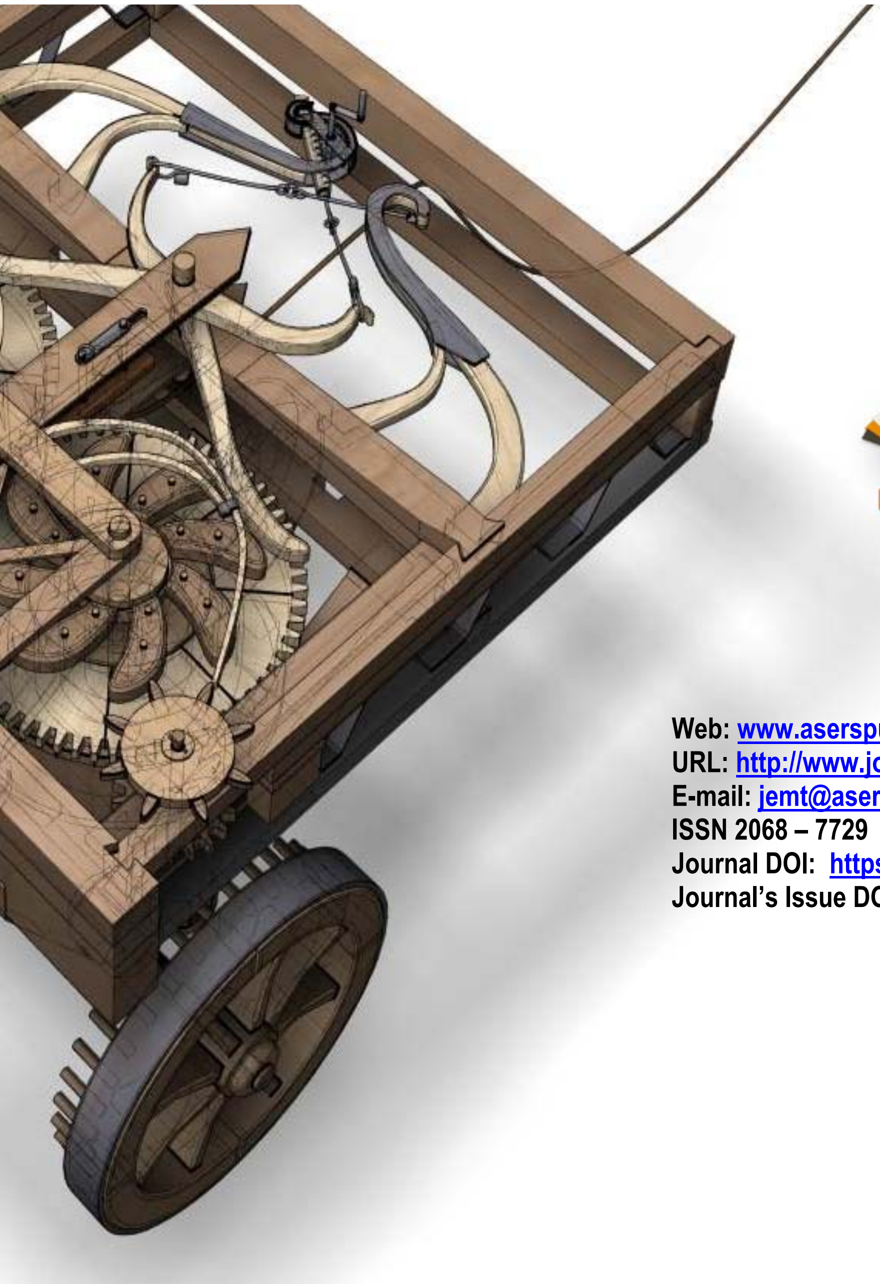

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