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Estimating Willingness to Pay for Labeobarbus Fish Species Conservation in Lake Tana, Ethiopia: A Contingent Valuation Study

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Abstract: This study employed Contingent Valuation Method (CVM) to assess the willingness to pay (WTP) by labor of beneficiaries of lake Tana, Ethiopia for the conservation activities of labeobarbus fish species. The WTP was conducted among 357 beneficiaries of the lake in 11 kebeles (districts). The data revealed that 96.9% of the respondents are willing to pay for the conservation activities of labeobarbus fish species by labor work. The mean WTP in working days is estimated at 48.48 labor days per year per household in the four weredas/districts studied, which is equivalent to 4,422,792.4 USD per year. Respondents WTP is significantly influenced by age, sex, economic activity respondents involved in, and the level of understanding of the respondents about future generation without labeobarbus fish species. A full scale campaign on education and environmental conservation activities will help improving the attitudes of the respondents, and if programs can be designed and implemented accordingly, it will help to alleviate the problem of loss (decreasing number) of labeobarbus species flock in lake Tana.

Keywords: Willingness to Pay, Contingent Valuation Methods, Labeobarbus

1. Introduction

Lake Tana is the largest lake in Ethiopia. It contains three commercially important families of fish: Cichlidae, Clariidae and Cyprinidae [11]. According to Nelson [22], family Cyprinidae has the highest diversity among all freshwater fish families in which *Labeobarbus* species of Lake Tana belongs [20]. However, different fishing activities are causing a decline of *Labeobarbus* species in lake Tana, of which fishing at the river mouth during breeding season [11], alteration of breeding and juvenile nursery grounds, poisoning of the spawning stock in rivers using the crushed seeds of *Milletia ferruginea* [1] and silt load [2] are the main to be mentioned. Catch per Unit Effort of the *Labeobarbus* species from the commercial gillnet fishery drastically dropped down from 63 kg per trip in 1991 to 28 kg per trip in 2001 [11]. Economic valuation as a management tool in conservation and management of endangered species has been given emphasis because it establishes what the weight of biodiversity conservation should be when the interest of the whole society is taken into account [26]. Economic value is a measure of what the maximum amount an individual is willing to forego in other goods and services in order to obtain some good, service, or state of the world [17]. A value measured in monetary terms can be seen as the willingness to commit resources to biodiversity conservation [8]. Contingent valuation is a method where by responses are sought from individuals as to their actions contingent on the occurrence of a particular hypothetical situation [9]. This study is therefore proposed to estimate the willingness to pay (WTP) of residents around lake Tana to preserve the continuous presence of Labeobarbus species, and to investigate determinants of willingness to pay.

2. Materials and Methods

2.1. Study Area

Lake Tana is the largest lake in Ethiopia with an area of about 3200 km^2 and is situated in the northwestern part of the country in the highlands at an altitude of about 1800 m and has a catchment area of 16,500 km^2. It is shallow lake with an average depth of 8 m and maximum depth of 14 m and it is turbid, well-mixed [27]. Four districts (Woredas), namely Gonder Zuria, Dembia, Alefa and Bahirdar zuria with eleven kebeles (localities) of the two zones (North Gondar and West Gojam) that are surrounding the lake, have been included in the study. They have a total population of 191,394; 271,053; 170,491 and 182,730, with total households of 37,167; 52,379; 32,521; and 40,834, respectively [10].

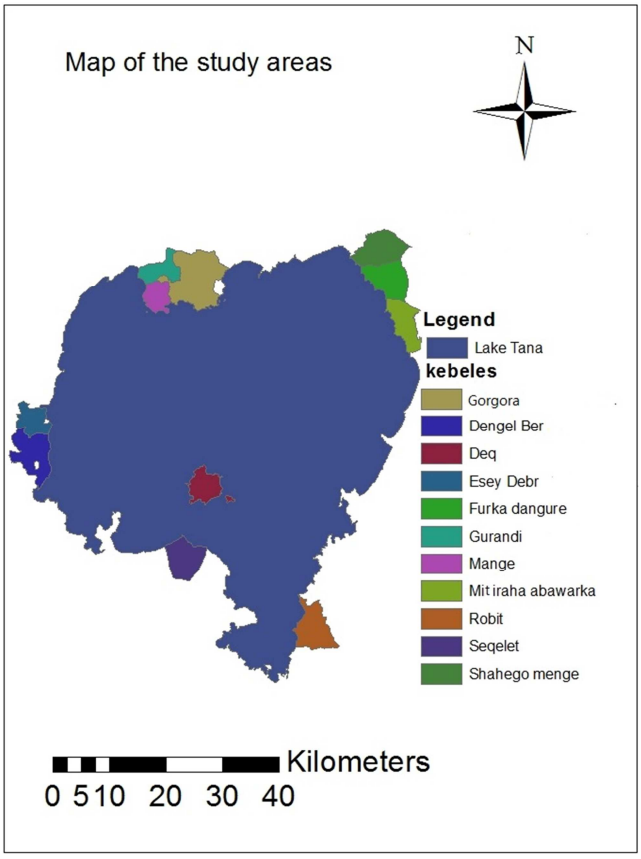

Figure 1. *Map of the study Area.*

2.2. Methodology

2.2.1. Nature of Questionnaire

This study applied the Contingent Valuation Method (CVM) to measure the non-market value of the conservation activities of labeobarbus fish species at Lake Tana. The respondents (N = 357) were presented with a hypothetical conservation and management program for the Labeobarbus fish species in Lake Tana that contained a set of information about Labeobarbus fish species, and the issues that need to be addressed for the conservation of the species in lake Tana including: a) protecting the water shade of the main river channel and the tributaries from deforestation and environmental degradation, b) ensuring environmentally sound dam construction and operation with respect to both upstream and downstream management, c) minimizing water use for irrigation from small tributaries, especially during breeding season, d) rehabilitating the stock using artificial propagation, e) preventing fishing at the river mouth and river during breeding season, f) licensing fishers, g) limiting mesh size (≥10cm) and h) providing effective training and extension work for active participation of the fisher community in management measures. The respondents were also presented with the issue of participation in the planned program which requires the contribution of the residents around the lake to undertake a proposed conservation program, for which they have to pay in labor (participate in the conservation activities by labor). Moreover, the respondents were also informed of possible benefits that they would be getting after the successful implementation of this program vis-à-vis a) ensuring food security b) getting employment opportunities, c) income generation, d) greater possibilities to view more *Labeobarbus* fish spp. in the lake, e) greater opportunities to easy access of Labeobarbus fish *spp*. Then, respondents were presented with the contingent market valuation question: "Are you willing to contribute for Labeobarbus species conservation by labor (days)?" This was presented as a double-bounded dichotomous choice question.

2.2.2. Administration of the Interview

A face-to-face survey was conducted to gather the information through an interview. The interview schedule contained personal profile of the respondent which was designed to gain information about the respondent's social, economic and demographic characteristics. It also contained questions that were designed to assess the attitudes of the respondents on 'development' and 'environment', and the last part contained a question where respondents were presented with dichotomous choice elicitation so as to assess their willingness to pay for the conservation of *Labeobarbus* fish spp. by labor work (number of labor days that respondents could be willing to pay for conservation activities per month). Respondents were provided with offers (1 – 10 days) from which they chose a single choice. Socio-economic data of the respondents are presented in Table 1. A total of 357 respondents were involved in this study. To explore factors that affect respondents' WTP for labeobarbus fish species conservation by labor, binomial logistic regression analysis was carried out. Whether a respondent was willing to pay or not was framed in a binary choice model. Assuming y to represent a dichotomous variable that equals 1, if the respondent is willing to pay and 0 otherwise. The model of the probability of WTP, P (yi = 1), was represented as:

$$\ln [P(yi = 1)/1 - P(yi = 1)]$$

$$= \beta o + \beta 1\ (Age) + \beta 2\ (Sex) + \beta 3\ (Marital) + \beta 4\ (Sizefam) + \beta 5\ (Wealth) + \beta 6\ (Econact) + \beta 7\ (Fugre) + \beta 8\ (Training) + \beta 9\ (Enactive) + \beta 10\ (Distance).$$

2.2.3. Data Analysis

The collected data was analysed (frequency, descriptive statistics and regression analysis) with SPPS [23], and the study area was mapped with ArcGIS [4].

3. Results

3.1. The Study Areas and Frequency of the Respondents

In this study, residents of 11 localities that are found in four districts of two zones have been involved (out of the total of 357 respondents that participated in the study, 277 (77.6%) were residents of North Gondar Zone while 22.4% were that of West Gojam (Appendixes 1).

3.2. Socioeconomic Characteristics of the Respondents

Out of the total of the 357 respondents, 287 (80.4%) were males and the rest (19.6%) were females. The range of age of the respondents was between 18 and 73 years. Among these, 116 respondents (32.5%) were found between 29 and 38 years of ages (the dominant age group). The majority of the respondents (294) were married (82.4%) and with average family size of 5.06 (18.2%). Out of the respondents, 115 have an educational level coded as illiterate (32.2%) dominating the other groups. Their wealth status, which was ranked in reference to the local situations, was dominated by those who are better of (187, 52.4%). Out of the total of 357 respondents, 260 (72.8%) had exposure to environmental conservation activities mainly in eradication of water hyacinth (10.4%), soil and water conservation (48.7%) and both (10.9%). They also had training on fish and environmental issues (140, 39.2%). The distance of the respondents' house from the lake ranged from 1 minute (those who live on the island of the lake) to 2 hours walk, but time required by the majority (67, 18.8%) to reach the lake was about 30 minutes. Their livelihood depends on farming (131, 36.7%), fishing (75, 21%), farming and fishing (135, 37.8%) and others (15, 4.2%). The preferred fish species of respondents were tilapia 29.1% (104), labeobarbus 17.9% (64) and African catfish 10.9% (39). The reasons for their preferences to species to catch are high price (110, 30.8%), for food (39, 10.9%) and high catch per unit effort (14, 3.9%). 32.9% of the respondents said that their average daily fish catch was 10kg. Of the total respondents, 314 (88%) are convinced that lake Tana and its natural resources are not properly managed, but the remaining 43 (12%) believed otherwise. The major problems listed by those who believe that the lake is not properly managed include infestation by water hyacinth (102, 28.6%), illegal fishing (69, 19.3%) and deforestation (67, 18.8%). 259 (72.5%) of the respondents strongly agree that the labeobarbus species flock is under severe pressure and its yield is declining, while 11 (3.1%) of the respondents disagree with the ideas of the former. 285 (79.8%) of the respondents strongly agree on the need to participate in the conservation of labeobarbus fish species and believe that it is everyone's duty to involve in the conservation activities. Almost half of the respondents (177, 49.6%) strongly agreed to the point that households who have more family members should contribute more labor for labeobarbus species conservation. 247 (69.2%) of the respondents did not know that labeobarbus fish species is endemic to Ethiopia, but the remaining 110, (30.8%) knew already that the flock is endemic. 222 (62.2%) of the respondents know the breeding season and site of labeobarbus fish species, but the rest 135 (37.8%) do not know it. According to the respondents, the major threats to Labeobarbus species are destruction of breeding grounds (27.5%), using fish poisoning method through the use of powdered seed of *Milletia ferruginea*, use of small sized nets (96, 26.9%), increasing number of fishers (50, 14.0%) and fishing during breeding season (47, 13.2%) are the other major threats to the labeobarbus flock. Consequently, 289 (81%) of respondents are very concerned about future generation needs.

Table 1. *Socioeconomic characteristics of the respondents.*

Age group	frequency	Percent (%)
18	6	1.7
19-28	94	26.3
29-38	116	32.5
39-48	91	25.5
49-58	35	9.8
59-68	12	3.4
69-73	3	.8
Sex		
Male	287	80.4
Female	70	19.6
Marital status		
Married	294	82.4
Single	34	9.5
Divorced	20	5.6
Widowed	9	2.5
Size of the family		
1	14	3.9
2	41	11.5
3	37	10.4
4	56	15.7
5	65	18.2
6	54	15.1
7	37	10.4
8	24	6.7
9	16	4.5
10	12	3.4
11	1	.3
Educational status		
Illiterate	115	32.2
Informal	99	27.7
Elementary	109	30.5
High school	30	8.4
Vocational	1	.3
College and above	3	.8
The wealth status		
Rich	24	6.7
Better of	187	52.4
Poor	146	40.9
Total	357	100

3.3. Willingness to Pay

The respondents' willingness to pay (WTP) for the conservation of Labeobarbus fish species by labor was very high. Out of the total 357 respondents, 346 (96.9%) were willing to pay. However, 11 respondents (3.1%) were not willing to pay. The mean WTP and median are 4.03 and 4.00 labor days/month/household, respectively. Reasons stated by

the respondents that are not willing to pay ranged from: "I am weak, so I cannot contribute any labor work (9, 2.5%)", "I do not feel the problem (1, 0.3%)" to "it is government's responsibility to take conservation actions (1, 0.3%)". The mean willingness to pay is estimated at 48.48 labor days per year per household with an aggregate benefit of 1931350.4046 labor days per year in the four weredas studied, which is equivalent to 4,422,792.4 USD

Table 2. *The frequency of the Bids of WTP.*

Bids of WTP (labor days)	Frequency	Percent
1	6	1.7
2	21	5.9
3	104	29.1
4	73	20.4
5	117	32.8
6	22	6.2
7	2	0.6
8	0	0
9	0	0
10	1	0.3
Total	346	96.9
Unwilling to pay	11	3.1

The statistical mean, median, st. deviation, minimum and maximum of willingness to pay in labor days per month (N = 346) were 4.03, 4.00, 1.205, 1 and 10, respectively.

3.4. Factors Influencing Willingness to Pay

Result of the logistic regression model is presented in Table 3. Among the group of respondents who were willing to pay, age, sex, economic activities respondents were involved in (Econact) and whether or not respondents are concerned with the fate of future generation (Fugre) had a positive effect on the respondents' WTP. The other independent variables didn't affect respondents' WTP. The percentage of correct prediction of the logit model was 98%.

Table 3. *The results of logistic regression analysis (N=357), * = significant at 0.05.*

Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp (B)	95% C.I. for EXP (B)	
							Lower	Upper
Age	1.019	0.347	8.610	1	0.003*	2.771	1.403	5.474
Sex	-2.051	0.958	4.584	1	0.032*	0.129	0.020	0.841
Marital	-1.164	0.667	3.050	1	0.081	0.312	0.084	1.153
Sizefam	-.326	0.203	2.574	1	0.109	0.722	0.485	1.075
Wealth	1.683	0.932	3.263	1	0.071	5.380	0.867	33.403
Econact	-1.510	0.639	5.589	1	0.018*	0.221	0.063	0.772
Fugre	2.921	0.892	10.732	1	0.001*	18.554	3.233	106.492
Enactive	0.122	0.942	0.017	1	0.897	1.130	0.178	7.160
Training	0.852	0.907	0.882	1	0.348	2.345	0.396	13.885
Distance	-0.577	0.762	0.573	1	0.449	0.561	0.126	2.502
Constant	-10.818	4.193	6.656	1	0.010	0.000		
- 2 log likelihood	58.457							
Percentage of Correct Prediction	98							

Note; Age, Sex, Marital (marital status), Sizefam (size of the family), Wealth (wealth status), Econact (economic activity respondents involved in), Fugre (the level of understanding for the future generation), Enactive (participation in environmental activities), Training (training in fish and environmental conservation issues), distance (distance from the lake)

Table 4. *Economic value of labeobarbus species conservation.*

Woredas (Districts) (A)	Total households (B)	Percent of protest zero in each weredas (C)	Expected households to have a protest zero (D)	Expected households with valid responses (E)	Mean (WTP) (F)	Aggregate benefit (labour) (G)	Aggregate benefit (in Money) (H)
Gonder Zuria	37,167	0	0	37167	48.24	1,792,936.08	4,105,823.6232
Dembia	52,379	2	1,047.58	51,331.42	49.92	2,562,464.4864	5,868,043.673856
Alefa	32,521	7	2,276.47	30,244.53	47.28	1,429,961.3784	3,274,611.556536
Bahirdar Zuria	40,834	2	816.68	40,017.32	48.48	1,940,039.6736	4,442,690.852544
Mean					48.48	1,931,350.4046	4,422,792.426534

A. The list of weredas (districts) included in the study
B. Total households of the weredas/districts
C. Percent of protest zeros (not willing to pay) in each weredas/districts for the planned labeobarbus fish conservation activities
D. 11 (0 - 7%) of our 357 sampled households were protest zeros (Gonder zuria 0%, Dembia 2%, Alefa 7% and Bahirdar zuria 2%), so they were excluded from further analysis. It is calculated by multiplying the percentage of sampled protest zeros with the total households (C*B)
E. The expected number of households which are expected to protest for the proposed project. It is calculated as (B – D)
F. The mean willingness to pay calculated from the maximum amount of labour days that a respondent could pay for labeobarbus fish conservation activities in a year
G. Mean multiplied by expected households with valid responses to the proposed program measured in labor (F*E)
H. The total aggregate benefit in money equivalent in US dollar, which is calculated by multiplying the total labour days of the respondents with the minimum wage rate per day in the study area (2.29 USD which is equivalent to 50 Ethiopian Birr) [10] at the time of data collection.

4. Discussion

The result indicated that there is a very high willingness to pay (96.9% of the respondents) for the conservation activities of labeobarbus fish species by labor work. Only 3.1% of the respondents did not agree to contribute labor to the proposed program of conservation. The high positive response might be related to the sharp decrease in the number of labeobarbus species in Lake Tana with implications on income from the fish sale and home consumption of the respondents. The respondents agreed to contribute an average of 48.48 labor days/year/household for the planned conservation activities that has an aggregate benefit of 1,931,350.4046 labor days per year which is equivalent to 4,422,792.4 USD.

In this study, age significantly affected the WTP. Holding other things constant, as the age of a respondent increases by one unit, the amount of labor days that he/she could pay for the labeobarbus fish conservation activities increases by 2.771 among the total population. As indicated in the results section, the older the respondents, the more was the "yes" response to the contingent valuation question, as was reported by [5] and [29]. This might suggest that the older people have the chance to compare the current fish production with the previous, hence considering the urgent need for conservation. The same positive contribution of age to the WTP for conservation was reported by other authors [6, 7, 16, 25].

Results indicated also that the more the level of understanding of respondents for the future generation (Fugre), the more they were (94.2% of 357) willing to pay.

Sex also had a significant effect on WTP. In this study, it was found that the WTP decreased as the number of female respondents increased. Out of the total of 70 female respondents 7.1% of them were not willing to pay compared to 2.1% of males out of the total 287 male respondents. This might, among others, indicate the existence of conservation knowledge gap between the two sexes. It might also be possible that females are less concerned with the conservation activities since they have other priority household related activities such as fetching water and firewood, preparation of food for the family which is not, often, conducted by males. In the study area, fishing is mainly carried out by males, and this might have affected the level of understanding of females on what is happening on the fishing grounds and consequently their low responses for envisaged conservation programs. This study is in line with the result of [3] who did report a higher probability of willingness of male visitors to pay for conservation of game reserve than their female counterparts. The same result indicating positive relationship between male gender and WTP was also reported by Wang and Jia [28], and Hejazi, Shamsudin and Rahim [13].

In the study, marital status of the respondents did not appear as a significant predictor of WTP, but the negative sign of the status indicated that as people got married, their WTP decreased (3.4% of married respondents said "no" to the conservation plan but all single respondents accepted it). The married respondents preferred to use their time and energy for the immediate well-being of their family compared to the singles. The family size had insignificant contribution to the WTP. Its negative sign indicated that bigger families are less interested in the conservation plan, hence showed low WTP. This may be because of the high likelihood of getting other economic activities (e.g. farming) for bigger families than smaller ones. This result is in line with what Tiwari [24] and Neda [19] reported where by family size had a negative influence on WTP for conservation activities. The other factors, namely: participation in environmental activities (enactive), training, and wealth status were insignificant predictors for willingness to pay, but the positive sign of these factors indicated that participation in environmental activities, training in fish and environmental conservation issues, and wealth status of the respondents were positively related to the probability of paying. In the same manner, in valuing the benefits of improved lake quality, Girma [12] concluded that fishermen with higher income/wealth are willing to pay higher. According to Kotchen and Reiling, [15]; and López-mosquera and Sánchez, [18], attitude towards the environment has been found to be a significant determinant of WTP.

In the present study, the economic activities of the respondents (econact) had a significant (0.018) contribution to their WTP. An increase in the economic activity by one unit results in a decrease of the willingness to pay of the respondents by 0.221. The negative sign of Econact (economic activities the respondents were involved) suggested that it will reduce the respondents' willingness to pay as people will have other options of economic activities to be involved in (i.e., farming; 36.7%, fishing; 21%, both farming and fishing; 37.8% and other activities; 4%). This is in line with what has been reported by Nega [21], who reported that alternative income negatively affects WTP in a study conducted to value the economic benefit of irrigation water. In this study, distance from the lake had not had a significant effect on the WTP of the respondents but as it increased, the WTP of the respondents decreased. The same trend was reported by Jennifer and John, [14] where distance negatively affected WTP for wetlands habitat and wildlife contamination control programs.

5. Conclusion

This study provides strong evidence that almost all of the respondents (96.9%) are willing to pay for the labeobarbus conservation activities by labor. The mean WTP was estimated to be 48.48 labor days per year per households with an aggregate benefit of 1,931,350.4046 labor days per year in the four weredas studied which is equivalent to 4,422,792.4 USD. Age, sex, economic activities of the respondents, and the levels of understanding of the respondents about future generation without labeobarbus fish

species affected the WTP of the respondents significantly. Married respondents were less interested in participating in the conservation activities than singles. The family size affected the respondents WTP negatively. The wealth status of respondents, participation on training in fish and environmental conservation issues, and on environmental activities had a positive contribution to the WTP of respondents, but distance from the lake affected the WTP negatively.

Recommendation

Labeobarbus fish species of Lake Tana is threatened by combinations of factors. The findings of this study indicated that majority of the respondents were willing to pay for the conservation of the species. Therefore, a well-coordinated program focusing on education and environmental conservation awareness creation programs should be designed and implemented to harness such positive response to save the Labeobarbus fish species of lake Tana for the present and future generations.

Appendixes

Table A1. *The study Area and frequency of respondents.*

Zone	*Frequency*	*Gender*		*Percent*
		Male	*Female*	
West Gojam	*80*	*65*	*15*	*22.4*
North Gonder	*277*	*222*	*55*	*77.6*
Wereda				
Bahir Dar Zuria	80	65	15	22.4
Gonder Zuria	98	76	22	27.5
Alefa	116	90	26	32.5
Dembia	63	56	7	17.6
Kebele				
Shahego Menge	19	14	5	5.3
Furka Dangure	27	22	5	7.6
Mitiraha Abawarka	52	40	12	14.6
Deq	61	46	15	17.1
Robbit	8	8	0	2.2
Seqelet	11	11	0	3.1
Gorgora	32	25	7	9.0
Gurandi	34	31	3	9.5
Mange	31	31	0	8.7
Esey Deber	34	24	10	9.5
Dengel Ber	48	35	13	13.4
Total	*357*			*100*

References

[1] Abebe Ameha (2004). The effect of birbira, *Milletia ferruginea* (Hochst.) Baker on some *Barbus* spp. (Cyprinidae, Teleostei) in Gumara River (Lake Tana), Ethiopia. MSc Thesis, Addis Ababa University.

[2] Abebe Getahun, Eshete Dejen and Wassie Anteneh (2008). Fishery studies of Ribb River, Lake Tana Basin, Ethiopia. Ethiopian Nile Irrigation and Drainage Project Coordination Office, Ministry of Water Resources, Final report E1573, Vol. 2, Addis Ababa, Ethiopia.

[3] Abdullahi Adamu, Mohd Rusli Yacob, Alias Radam and Rohasliney Hashim (2015) Factors Determining Visitors' Willingness to Pay for Conservation in Yankari Game Reserve, Bauchi, Nigeria Int. Journal of Economics and Management 9 (S): 95–114.

[4] ArcGIS 10.3.1. Copy Right 1995-2015 Ersi, USA.

[5] Asikini Yoeu and Isabelita Pabuayon, (2011). Willingness to Pay for the Conservation of Flooded Forest in the Tonle Sap Biosphere Reserve, Cambodia. IJERD – International Journal of Environmental and Rural Development (2011) 2-2. pp. 1-5.

[6] Baral, N., Stern, M. J., and Bhattarai, R. (2008). Contingent valuation of ecotourism in Annapurna conservation area, Nepal: Implications for sustainable park maintenance and local development. Ecological Economics, 66 (2-3), 218–227. doi: 10.1016/j.ecolecon.2008.02.004.

[7] Bhandari, A. K., and Heshmati, A. (2010). Willingness to Pay for Biodiversity Conservation. Journal of Travel and Tourism Marketing, 27 (6), 612–623. doi: 10.1080/10548408.2010.507156.

[8] Bra¨uer, I., (2003). Money as an indicator: to make use of economic evaluation for biodiversity conservation. Agriculture, Ecosystems & Environment 98, 483-491.

[9] Cho, W., Bae, D. and Kim, H. S. (2008). Economic valuation methods of biodiversity. Environ. Eng. Res. 13 (1): 41-48,

[10] CSA, 2007. Central Statistical Agency, Addis Ababa, Ethiopia.

[11] de Graaf, M., Machiels, M. A. M., TesfayeWudneh and Sibbing, F. A. (2004). Declining stocks of Lake Tana's endemic Barbus species flock (Pisces; Cyprinidae): natural variation or human impact? Biological Conservation 116: 277–287.

[12] Girma 2006. Valuing the benefits of improved lake quality: an application of choice experiment to the case of Lake Awassa (Thesis). Addis Ababa University, School of Graduate Studies.

[13] Hejazi, R., Shamsudin, M. N., and Rahim, K. A. (2014). Journal of Environmental Planning and Measuring the economic values of natural resources along a freeway: a contingent valuation method. Journal of Environmental Planning and Management, 57 (4), 629–641. doi: 10.1080/09640568.2012.758628.

[14] Jennifer Pate, John Loomis. The effects of distance on willingness to pay values: a case study of wetlands and salmon in California, Ecological Economics, Volume 20, Issue 3, March 1997, Pages 199-207.

[15] Kotchen, M. J., and Reiling, S. D. (2000). Environmental attitudes, motivations, and contingent valuation of nonuse values: a case study involving endangered species. Ecological Economics, 32 (1), 93– 107. doi: 10.1016/S0921-8009(99)00069-5.

[16] Lee, C., and Mjelde, J. W. (2007). Valuation of ecotourism resources using a contingent valuation method: The case of the Korean DMZ. Ecological Economics, 63 (2-3), 511–520.

[17] Lipton, Douglas W., Katherine Wellman, Isobel C. Sheifer and Rodney F. Weiher. 1995. Economic Valuation of Natural Resources. A handbook for Coastal Resource Policymakers. NOAA Coastal Ocean Program Decision Analysis Series No. 5. NOAA Coastal Ocean Office, Silver Spring, MD. Pp. 131.

[18] López-mosquera, N., and Sánchez, M. (2012). Theory of Planned Behavior and the Value-Belief-Norm Theory explaining willingness to pay for a suburban park. Journal of Environmental Management, 113, 251–262. doi: 10.1016/j.jenvman.2012.08.029.

[19] Neda Amiri, Seyed F. Emadian, Asghar Fallah, Kamran Adeli and Hamid Amirnejad. Estimation of conservation value of myrtle (*Myrtuscommunis*) using a contingent valuation method: a case study in a Dooreh forest area, Lorestan Province, Iran. Forest Ecosystems 2015 2: 30 DOI: 10.1186/s40663-015-0051-6.

[20] Nagelkerke, L. A. J. and Sibbing, F. A. (2000). The large barbs (Barbus spp., CyprinidaeTeleostei) of LakeTana (Ethiopia), with a description of a new species, Barbusossensis. Neth J. Zool. 2: 179–214.

[21] Nega Assefa, 2012. Valuing the Economic Benefit of Irrigation Water: Application of Choice Experiment and Contingent Valuation Methods to Ribb Irrigation and Drainage Project in South Gonder, Ethiopia. Addis Ababa University Master's Thesis.

[22] Nelson, J. S. (1994). Fishes of the World. Wiley: New York, 234 pp.

[23] SPSS for Windows, Statistical Packages for Social Sciences, Version 16.0. Chicago, SPSS Inc.

[24] Tiwari D. N. (1998) Determining Economic Value of Irrigation Water, CSERGE Working Paper GEC98-05.

[25] Togridou, A., Hovardas, T., and Pantis, J. D. (2006). Determinants of visitors' willingness to pay for the National Marine Park of Zakynthos, Greece. Ecological Economics, 60, 308–319. DOI: 10.1016/j.ecolecon.2005.12.006.

[26] UNEP, (1995). Global Biodiversity Assessment. Cambridge University Press, Cambridge.

[27] Vijverberg J., Sibbing, F. A. and Dejen, E. 2009. Lake Tana: Source of the Blue Nile. Chapter in: Dumont HJ (ed.), The Nile, Origin, Environments, Limnology and Human Use, Springer, pp. 163-191.

[28] Wang, P.-W., and Jia, J.-B. (2012). Tourists' willingness to pay for biodiversity conservation and environment protection, Dalai Lake protected area: Implications for entrance fee and sustainable management. Ocean and Coastal Management, 62, 24–33. doi: 10.1016/j.ocecoaman.2012.03.001.

[29] Xin Liu, 2009. Willingness to pay among households to prevent coastal resources from polluting by oil spills: A pilot survey, *Marine Pollution Bulletin 58, 1514–1521.*