ESTIMATING DEMAND FOR RECREATIONAL FISHING IN ALABAMA USING TRAVEL COST MODEL

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Introduction

Individuals and households pay to enjoy natural resources that the environment can provide. Recreational fishing is provided by water, a natural resource; it is modern and involves fishing for pleasure. It has conventions, rules, licensing restrictions and laws that limit the way in which fish may be caught to ensure sustainable practice amongst anglers. The state of Alabama and the Black-belt has tremendous recreational fishing resources. The public water of the state covers more than one million surface acres with additional 150,000 acres of private bodies of water. The states' Division of Wildlife and Fisheries manages 23 lakes, 77 miles of perennial rivers, streams and delta in Mobile, the Department of Conservation and Natural Resources manages 38 lakes, and the State Park Division has four large reservoirs and 14 lakes (Outdoor Alabama 2007). The quality of the states' water resources could be improved by the government or/and private parties. For this intervention to be considered, an estimation of the current demand for recreational fishing and the possibility of increasing this demand will have to be established.

Whelan and Marsh (1988) used 1987 Irish angling survey and estimated annual domestic angler expenditure of 15.6 million pounds, foreign angler tourist expenditure of 12 million pounds, with both supporting about 1,900 full time jobs with additional 15million pounds in tax revenue to the Irish government.

Justification

Specifically, solutions for economic development of the Alabama Black-Belt counties have been elusive. Natural fisheries and private sport fishing opportunities have the potential to represent a significant natural and economic asset in the Blackbelt region of Alabama. In the existing reservoirs and other public fishing venues, such as county lakes, in the region, current fish populations can be enhanced via aquacultural management practices and infrastructural improvements to the sites in order to attract more recreational fishermen. Also, the plans to improve US Rt. 80 and I-85 through the Western Black-Belt would open the region up. Better access to the area's natural resource base will increase opportunities to develop tourism and recreational outlets in this socially depressed area. As a result, the infrastructure for sport fishing that already exists in the regions' many ponds, lakes, reservoirs and rivers represents prospects for developing the Black-Belt as a recreation destination in the state.

A number of statistics regarding the value of recreational fishing exist at the state and national levels. For example, the US Fish and Wildlife Service conduct the National Survey of Fishing, Hunting, and Wildlife Associated Recreation every five years. The survey obtains data from anglers of all types for every state, on demographics, expenditures, and destinations for outdoor recreators. The data are fairly confounded, as specific destinations are not available to the researcher, and expenditures represent only a fraction of economic value from a societal viewpoint. Thus, this paper covers a full economic analysis based on recreation demand models—a.k.a. Travel Cost models (TCM). This model has long been in use by environmental and resource economists to measure not just the expenditures associated with fishing trips, but to estimate demand curves for fishing. By estimating demand, economists can incorporate opportunity costs as well as estimate consumer surplus associated with fishing activities. Hanson, Wallace, and Hatch (2004) in a study on coastal Alabama recreational live bait reported recreational fishing as a major industry, which as sport complements a wide array of activities associated with the expansion of U.S. tourism. They identified recreational saltwater fishing as an integral part of coastal Alabama economy as evidenced by the increase in the sale of fishing licenses in 1995 and crucial to this was the supply of life baits. Their survey also revealed that businesses involved in lifebaits had annual sales approximated to about $2.3 million between 1997 and 1998. Also, a study by Clont, Hyde and Travnichek (1998) revealed that Alabama's economy gained $1.3 billion from direct spending from fishing activities of resident and nonresident anglers. Overall, recreation fishing activities provide substantial number of jobs to Alabama residents.

Literature Review

Curtis (2002) used count data travel cost model to estimate the demand and economic value of salmon angling in Denegal county, Ireland. Using truncated negative binomial and allowing for endogenous stratification, he found that angling quality, age, and nationality affect recreational fishing demand. The estimated consumer surplus per angler per day was 138 Irish pounds on the average.

Provencher and Bishop (1997) developed a dynamic structural model of the decision to visit a recreation site. The model is applied to the decisions of fishing club members on the Wisconsin shore of Lake Michigan. They concluded that due to the challenges of obtaining appropriate data and some of the limiting assumptions of the model, that this type of model is likely appropriate only in certain circumstances. In many cases the static model will likely yield welfare estimates similar to the dynamic model with much less cost and effort. They concluded that the relative accuracy of and welfare modeling technique requires a carefully conducted empirical investigation.

Tay and McCarthy (1994) investigated fresh water anglers' response to improved water quality. Using a multinomial logit model of destination choice, 1985 data on Indiana anglers, and multiple-sites, the model was used to compute the benefits of alternative water quality improvements. Their results indicate that anglers are sensitive to changes in water quality and anglers' per-trip welfare gains from a 1% reduction in various pollutants range from 4.9 to 25.3 cents and a similar reduction in all-pollutants increases per-trip welfare by 64.5 cents.

Bannear, Stavins, and Wagner (2004) used revealed preferences to infer the environmental benefits evidenced from recreational fishing. The study used panel data on prices of state fishing license in the continental United States over a fifteen year period, combined with substitute prices and demographic variables. A license demand function was estimated with instrumental variable procedure to allow for endogeniety of administered prices. It was revealed that there is variation in the value of recreational fishing across United States and the use of benefits estimates may result in substantial bias in regional analysis.

Hanson, Wallace, and Hatch (2004) in a study on coastal Alabama recreational live bait reported recreational fishing as a major industry, which as sport complements a wide array of activities associated with the expansion of U.S. tourism. They identified recreational saltwater fishing as an integral part of coastal Alabama economy as evidenced by the increase in the sale of fishing licenses in 1995 and crucial to this was the supply of life baits. Their survey also revealed that businesses involved in lifebaits had annual sales approximated to about $2.3 million between 1997 and 1998.

Ditton et al. 2002, writing on recreational fishing as tourism reported that apart from fishing being a recreation activity for residents in each state, it is also a form of tourism that makes anglers cross to other states. Using data from 1996 National Survey of Fishing, Hunting, and Wildlife associated recreation; they reported that the states are pushing to promote tourism, including recreational fishing, in the name of economic development. The study revealed several stakeholders diverse perspectives with respect to fishing as a tourism issue. The study concluded that fishing site managers need to acquire greater awareness of fishing tourism and develop effective partnerships with state and local tourism promotion organizations.

Clont, Hyde and Travnichek (1998) examined recreational fishing in Alabama's public waters. Using 403 surveys, an input-output simulation plan was used to estimate the economic impact of recreational fishing in Alabama. Their study showed that the recreational fishing industry in the state contributed direct spending of $1.3 billion by licensed anglers to the economy and also created jobs in the state. This expenditure sustained about 36,539 workers with annual income of $600 million.

Lupi et al. (1997) estimate the demand for recreational angling in Michigan using the travel-cost model. Using a four level nested logit on one season angler data, they show that travel cost method establishes relationship between the recreational use and the cost and characteristics of the sites and the method is only as good as the statistical link between the between the site quality characteristics and the travel cost method demand for trips to the site.

Feather and Shaw (1999) proposed a method of estimating the cost of leisure time for recreation demand models. They explained that the decision to participate in recreation activity is affected by the constraint on time and money. In their estimation of a shadow wage, the natural log of annual income was regressed on some demographic characteristics of respondents in their survey and the shadow wage equation parameters are used to predict the opportunity cost of time as the shadow wage.

O'Neill and Davis (1991) estimated an angling demand function in Northern Ireland using OLS estimator. The OLS estimator inferred price elasticity of 0.7 and consumer benefits of 9.1 million pounds. The price elasticity of their estimate was positive, which is an indication that the OLS may give a biased estimate when used with count data.

This paper estimates the demand for recreational fishing in Alabama using negative binomial approach. The data for this paper is a count data obtained from the survey of anglers in Alabama State during the fishing year of 2005/2006. Burt and Brewer (1971) reported that direct interview is about the only feasible way to obtain data necessary for the estimation of demand equation. In recent times, demand data such as the one used for this paper are equally obtained from mail and internet surveys and telephone surveys. It is expected that the results of the analysis of this data will be useful to fishery managers in identifying the factors that drive recreational fishing in the state. The welfare estimates obtained from this study could also reveal the value to anglers of the trips to their fishing sites by showing the approximate values of their surplus.

Methodology

Area of Study

The study area will cover the whole state of Alabama. This is because the state has tremendous recreational fishing resources. The public water of the state covers more than one million surface acres with additional 150,000 acres of private bodies of water. The Division of Wildlife and Fisheries manages 23 lakes, 77 miles of perennial rivers, streams and delta in Mobile, the Department of Conservation and Natural Resources manages 38 lakes, and the State Park Division has four large reservoirs and 14 lakes (Outdoor Alabama 2007). However, the bodies of fishing water in the Black-Belt regions of the state are of particular interest as the study wants to capture the revenues to the region as compared to the entire state.

Theoretical Methods and Models of Estimation

Willingness to Pay Method (WTP)

Demand curve reflects marginal willingness to pay (WTP), while the area below the demand curve represents total WTP. This concept is illustrated in the figure I below, which depicts a simple demand curve.

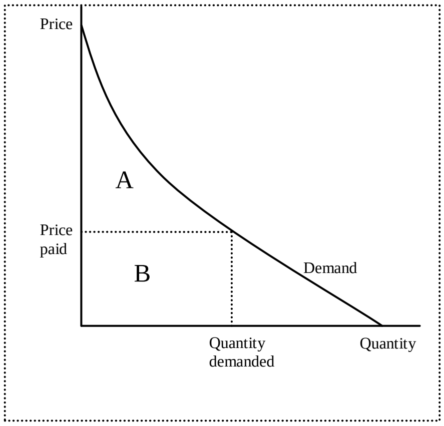

Fig. 1

At the price paid and quantity demanded, total expenditures are represented by area B (i.e. total expenditures = price X quantity). However, analyses that consider only expenditures do not capture the extra value implied by the consumer surplus, area A. Consumer surplus can be thought of as the amount that consumers are WTP over and beyond the amount they actually pay.

For this study, WTP is obtained from the observed total spending by each angler in undertaking a daily fishing trip. Thus, for recreation fishing demand, the price becomes the price of a given fishing trip, while the quantity is the anglers' number of fishing days demanded at each trip price for the 2005/2006 season. The demand curve generated also takes into account opportunity costs of individuals participating in fishing trips. That is, the value of the hours individuals expend on fishing, which could have been used for alternative activities such as working. From an economic standpoint, considering only expenditures would seriously undermine the actual economic cost of fishing.

An ideal fishing site that would enhance fishing experience created in the survey and the anglers were asked under eight different price scenarios how much they would pay to visit such site. The assumption here is that the anglers are equidistance to the hypothetical site. The response to this provides a baseline, or status quo, scenario for comparison with changes in demand to be expected from enhanced fishing experiences.

Travel Cost Method (TCM)

TCM is a used to estimate economic values associated with recreational sites. It is a contingent valuation method that reveals how much an individual is willing to pay for access to an outdoor recreational site. In this study, TCM is used to estimate angler's fishing decisions and their willingness to pay for fishing. It involves detailed analysis of where they fish and the cost of getting to the sites using variables that explain their choice of sites and some demographic characteristics. The steps involved in TCM are, 1) data collection over the observed period, 2) use of statistical methods to estimate a set of equations predicting anglers choices of how they fish based on travel costs, site characteristics, income, and others demographics. 3) The net economic benefits are then estimated.

TCM can also be used to estimate WTP and in the present case, information about willingness to pay to visit hypothetic sport fishing sites that are yet to be in existence. The fishing sites of Alabama are assumed to be the same and as such, a single site model is used in this paper. This because the demand being estimated is the demand for recreational fishing in Alabama as a whole. This is done by observing through survey response the purchases of travel which were made to gain access to the fishing sites. The relationships between the travel costs and access to these sites vary for different individuals because they face different implicit prices. It is expected that the travel and time cost will increase with distance and this information from the survey is used to determine the number of visits to fishing sites at different travel costs "prices". This is then used to construct the demand function for fishing sites as shown in figure I above.

The theoretical TCM model takes the form:

$$Q_d = f(t_c,y,z) \qquad (1)$$

Where Q_d is the number of fishing trips which is also the quantity demanded, t_c is the trip cost which includes all transit expenses (travel cost, access fees, equipment cost and time cost) and is expected to have a negative relationship with the quantity demanded, y is the income of the angler and is expected to have positive relationship with the quantity demanded of recreational fishing. The variable z is a vector of several demographic variables that could affect the demand for recreational fishing, such as age, gender, experience in fishing, activities at the site, education, occupation, fishing boat ownership, distance to fishing sites etc.

Econometric Model

The travel cost model (TCM) is used to estimate the recreation fishing demand in Alabama, where demand is a function of factors like price (travel cost and time cost), angler's characteristics, and site characteristics. The essence of this model stems from the desire to travel to a location to enjoy the services offered by the place and the traveler incurs a cost of overcoming the distance in getting to the desired location. Following from equation 1, Lupi et al. (1997) in estimating demand for recreational fishing showed the relationship between travel cost and the characteristics of fishing sites. Parson (2003) also explains that recreation demand depends on travel cost, demographics, site characteristics and proximities of sites to other substitute sites. Equation 1 is then re-specified to include substitute site. For the purpose of this study, the sites in the state are assumed to have similar characteristics and the distance and travel cost to the sites would be the differentiating factor.

$$Q_d = f\,(t_{c1}, t_{c2,}\, x, y, z, \beta) + \varepsilon_i \tag{2}$$

Where

t_{c2} is the substitute site where it exists and x is a vector of site characteristics, β is the vector of unknown parameters, and ε_i is the random error of the model..

Since the respondents to the survey are anglers that participate in fishing in the state, the models' dependent variable is an integer value making it a count data. Count data travel cost model is widely used in the estimation of recreation demand, Loomis et al. (2000) in estimating the demand for whale watching, Shaw and Jakus (1996) estimated the demand for rock climbing using travel cost model. The dataset for this present study is from anglers that have current fishing license and are assumed to be active. This implies that the trips demand as observed are truncated at positive trips, since license holders will have positive trips. The second problem is is that of endogenous stratification, which may cause a systematic variation in the sampling proportion to be dependent on the characteristics of the anglers in the survey sample, because the sample size of this study is of those with fishing license and is likely include high users of recreation sites or users with positive trips to recreation sites.

Count data models are usually estimated based on the Poisson or negative binomial distributions. The negative binomial model is the most common alternative to Poisson regression because it addresses the issue of over-dispersion by including a dispersion parameter in the model to accommodate the unobserved heterogeneity in the count data. Booth et al. (2003) explain that Poisson model suffers from lack of flexibility in modeling variances. The resulting over dispersion from it can results in biased estimates of the other parameters and lead to difficulty in interpreting the results. The negative binomial on the other hand leads to a meaningful parameter estimates and inferences. Gourieroux et al. (1984) explains that the negative binomial model provides a consistent estimator even when the dependent variable exhibits over dispersion, a form of heteroscedasticity.

Shaw (1988) identified non-negative integers, truncation, and endogenous stratification as problems in on-site samples. He then extended the traditional travel cost model to correct for endogenous stratification to show that if Q_i is the number of trips demanded by person i (i = 1,..N), the negative binomial log-likelihood function for trip demand controlling for endogenous stratification is given by

$$\ln L = \sum_{i=1}^{N} [\ln q_i + \ln(\delta(qi + 1/a)) - \ln(\delta(qi+1)) - \ln(\delta(1/a)) + qi \ln a + (qi-1)\ln \lambda_i - (q_i + 1/a)\ln(1 + a\lambda_i)] \qquad (3)$$

Where α and λi are parameters of the negative binomial distribution. λ_i is the expected latent demand defined as a function of variables that affect demand.

$\lambda_i = \lambda(Xi, \beta)$

δ (.) is the negative binomial density function of the sample size, which is

$$\delta(Qi|\, t_{c1}, t_{c2,} x, y, z) = Q_i \tau\{Q_i + 1/\alpha_i)\ \alpha i^{Qi}\ \lambda_i^{Qi-1}(1+ \alpha i \lambda i)^{-(Qi+1/\alpha i)} \,/\, \tau\{Q_i + 1\}\ \tau\{1/\alpha_i\}$$

The conditional mean and variance are given as

$$E(Qi|\, t_{c1}, t_{c2,} x, y, z) = \lambda i + 1 + \alpha\lambda i \ \text{ and } \ Var(Qi|\, t_{c1}, t_{c2,} x, y, z) = \lambda i\,(1 + \alpha + \alpha\lambda i + \alpha^2\lambda i)$$

Following the conventional approach in applying count data model in recreation demand as applied by Englin and Shonkwiler (1995), Shaw (1988), Curtis (2002), Grogger and Carson (1991), Haab and McConnell (2002), the latent demand of each respondent to the survey, λi, is modeled as a semi logarithm function of all the dependent variables in equation 2.

$$\text{Ln } \lambda_i = f\,(t_{c1}, t_{c2,} x, y, z) \qquad (4)$$

$$\text{Ln } \lambda_i = \beta_0 + \beta_1 tc_{1i} + \beta_2 FEXP_i + \beta_3 AVSD_i + \beta_4 AVCT_i + \beta_5 AGE_i + \beta_6 EDU_i + \beta_7 INC_{ii} \qquad (5)$$

$E(Qi|\, t_{c1}, t_{c2,} x, y, z) = \lambda i$ = exp(b0 + b1*AVTC + b2*FEXP + b3*AVSD +

b4*AVCT + b5*FLIC + b6*AGE + b7*EDUC + b8*INC) (6)

Where

AVTC = travel cost to fishing site in dollars

FEXP = fishing experience in years

AVSD = Average site distance in miles

AVCT = Average catch per trip

FLIC = Current Fishing License

AGE = age of respondent in years

EDU = level of education

INC = income of the respondent

΄E = Error term (unobserved individual differences /heterogeneity)

The marginal effect of each coefficient on the mean or expected fishing days is given by

$$\partial E(Q_i \mid (Tc, x, y, z) \big/ \partial(tc, x, y, z)_j = (1+\alpha)\lambda_i \beta_j \tag{7}$$

Consumer surplus, CS, is obtained by integrating the demand function in equation 5 over the relevant price range from P0 to the choke price, P1. This is done between the mean travel cost, λ, and the choke price. For the negative binomial model, it is estimated as follows

$$CS = \int_{p0}^{p1} \lambda_i dP = \frac{\lambda_i}{\beta_1} \int_{P0}^{P1} \tag{8}$$

The goal of this travel cost model is to estimate consumer surpluses that would stand for welfare measures. In order to be certain about the welfare measures, assumptions about the model are made following Haab and McConnell (2002).

The first assumption is that travel and time costs are proxies for the price of recreational trips and these costs do not provide utility on their own sakes. Second, the travel time in neutral in providing utility or disutility and that this assumption is not violated since the anglers do not provide information on preference of the site visited over other sites. Third is that the trips are single purpose trips taken to the recreation site for the sole purpose of recreation. Finally, the quantity of fishing days consumed relates to Alabama fishing sites for all consumers. This follows from the assumption that all the sites have similar characteristics.

The dependent variable is the number of fishing days during the 2005/2006 fishing season. The average travel cost to fishing sites is the sum of travel costs, which includes gasoline, fishing equipments, food, lodging, site access fees etc. The average site distance is the mean of the distance travelled by each respondent to their two most visited sites. Average catch per trip refers to the number of fish the angler catches per trip. The level of education as a rank variable from one to seven, less than 9th grade is the least, ranked 1, and graduate or professional degree as the highest with a rank of 7. The income variable for each respondent was taken as the median of the income group reported by each respondent.

Table 1: Descriptive Statistics of Variables

Variable	Label	Mean	Std Dev	Min	Max
Number of Fishing Trips	**FTRP**	33.086	40.474	1	250
Fishing Experience in Years	**FEXP**	33.036	14.285	1	70
Average Catch Per Trip	**AVCT**	11.751	17.991	0	250
Amount willing to Pay for Site Improvement	**AMT**	14.608	9.527	0	30
Average Site Distance	**AVSD**	81.259	99.508	0	1300
Average Trip Cost	**AVTC**	216.347	477.496	2	9604.5
Age	**AGE1**	45.436	13.868	22	70
AGE (18-35)	**AGE_D1**	0.267	0.443	0	1
AGE (36-50)	**AGE_D2**	0.332	0.471	0	1
AGE (over 50)	**AGE_D3**	0.401	0.490	0	1
Education	**EDUC**	4.254	1.529	1	7
EDU (No Diploma -0-12th grade)	**EDU_D1**	0.414	0.493	0	1
EDU (High School - Some College)	**EDU_D2**	0.369	0.483	0	1
EDU (BSc. And Above)	**EDU_D3**	0.218	0.413	0	1
Household Income	**P_INC**	57806.500	13809.270	18180	87251.96
Site Characteristics					
Nat1 (Natural Fish Features)	**Nat1_D**	0.583	0.493	0	1
Nat2 (Natural Site Features)	**Nat2_D**	0.510	0.500	0	1
Close to home, shopping, Restaurant	**Con1_D**	0.723	0.448	0	1
Restroom, vending, and Parking Facilities	**Con2_D**	0.429	0.495	0	1
Picnic, lodging, and Camping Facilities	**Phy1_D**	0.836	0.370	0	1

Boating, and Marinas	**Phy2_D**	0.246	0.431	0	1
Swimming, and Antiquing	**Rec1_D**	0.489	0.500	0	1
Relaxing and Wildlife watching	**Rec2_D**	0.672	0.470	0	1

For recreational trip data, the variance is always greater than the mean and this shows the over dispersion of the count data (Haab and McConnell, 2002). The distribution of the count data for this paper shows that as well and justifies the use of negative binomial that does not assume that the conditional mean and variance are equal. It is expected that the demand for recreation will decrease with increasing travel cost. The relationship of fishing experience with demand for recreational fishing cannot be predicted since experience may be related to fishing as a profession and not as recreation. Average site distance is expected to have a negative relationship with demand for recreation, because distance could result in higher fishing cost or just discourage the angler from going to fishing sites. It is expected that those willing to pay for site improvements are not satisfied with the conditions of the sites which they have visited, thus, this variable is expected to have a negative relationship with the number of fishing trips. The demand relationship with age and level of education cannot be predicted. Higher income is expected to have a negative relationship with recreation demand. This is because higher income earner may lose more income by taking time out for recreation activity like sport fishing. The site characteristics are all assumed to be desirable and are all expected to have positive relationship with the demand for recreation trips.

Results

Four different model specifications are estimated using a negative binomial model that controls for endogenous stratification and truncation using likelihood ratio test. The specifications are as follows

1. Ln λ_i = $\beta_0 + \beta_1 AVTC_{1i} + \beta_2 FEXP_i + \beta_3 AVSD_i + \beta_4 AVCT_i + \beta_5 AGE1_i + \beta_6 EDUC_i + \beta_7 P\_INC_{ii} + \beta_{8i} AMT$

2. Ln $\lambda_i = \beta_0 + \beta_1 AVTC_{1i} + \beta_2 FEXP_i + \beta_3 AVSD_i + \beta_4 AVCT_i + \beta_5 AGE\_D1_i + \beta_6 AGE\_D2 + \beta_7 EDUC_i + \beta_8 P\_INC_{ii} + \beta_9 AMT$

3. Ln $\lambda_i = \beta_0 + \beta_1 AVTC_{1i} + \beta_2 FEXP_i + \beta_3 AVSD_i + \beta_4 AVCT_i + \beta_5 EDU\_D1_i + \beta_6 EDU\_D2 + \beta_7 EDU\_D3_i + \beta_8 P\_INC_{ii} + \beta_9 AMT$

Model 2 shows the effects of different age groups while model 3 shows the different effects of the education levels. The fourth kind of specifications shows the effects of the site characteristics on fishing trips and completely leaves out all the demographic variables. The four models in this group are specified to include natural characteristics, convenient characteristics, physical characteristics, and recreation characteristics respectively. The aim is to observe the marginal effects of these site characteristics on the number of recreation trips.

Table 2: Model Parameter Estimates

Parameter		**Estimate**	**Standard Error**	**Marginal Effects**	**Chi-Square**	**Pr > ChiSq**
Intercept	**b0**	4.1617***	0.2172	0.9039	367.2	<.0001
AVTC	**b1**	-0.0016**	0.0001	-0.1347	4.75	0.0293
FEXP	**b2**	0.0148***	0.0038	0.9968	15.08	0.0001
AVSD	**b3**	-0.0017***	0.0004	-0.1145	17.11	<.0001
AVCT	**b4**	0.0041*	0.0024	0.2761	2.79	0.0948
AGE1	**b5**	-0.0173***	0.0043	-1.1652	16.25	<.0001
EDUC	**b6**	-0.1711**	0.0716	-11.5241	5.72	0.0168
P_INC	**b7**	5.59E-06***	8.15E-06	0.0004	11.16	0.0044
AMT	**b8**	0.0074*	0.0043	0.4984	3.04	0.081
Dispersion	**α**	1.0431***	0.0522			

***Significance at 1%, * Significance at 10%   Mean fishing day demanded = 33.14days

Criterion	**DF**	**Value**	**Value/DF**
Deviance	699	803.7458	1.1499
Scaled Deviance	699	803.7458	1.1499
Pearson Chi-Square	699	978.7714	1.4002
Scaled Pearson X2	699	978.7714	1.4002
Log Likelihood		69881.8823	

The result of the parameter estimates in the first specification is presented in table 2 while the others are presented in the appendix. The dispersion parameter, α, is positive and statistically significant in all the specifications. The deviance and the Pearson Chi-Square values for all models when divided by the degree of freedom are all greater than one. These indicate that the data is over dispersed and a regular poison estimation will give wrong estimates, thus confirming that the chosen models are adequate.

For all the specifications, the models' predicted mean fishing days demanded by the anglers is 33.14days, which is approximately the same as the actual mean fishing days of 33.09 in table 1. This satisfies the property of the negative binomial that the sample mean of the predicted number of trips demanded equals the sample mean of the observed value of trips demanded (Haab and McConnell, 2002). The log likelihood value of the model is 69881.88 exceeds the tabulated chi square and indicates that the parameter and the dispersion parameter are not zero. This rejects the null hypothesis of $ß_0 = ß_1 = ß_2 = ß_3 = ß_4 = ß_5 = ß_6 = ß_7 = ß_8 = \alpha = 0$.

The estimates in the model are negative binomial regression estimates for a unit increase in the explanatory variables. The own price effect, $ß_{1,}$ is -0.002, it is the negative binomial regression estimate for a unit increase in price of recreation. It is negative and small and it is statistically significant at 1 percent. This means that if the other variables in the model are held constant, a dollar increase in price will cause the expected demand to decrease by 0.13 unit as indicated by the marginal effect in table 2. This is an intuitive elasticity value. Fishing experience has a positive relationship with the demand and is statistically significant at 1 percent with a marginal increase of 0.99 extra day demand for recreational fishing days. Age, education, and income all have negative marginal effects on demand for fishing days.

For these models, the mean willingness to pay for access to fishing sites changes to the extent that the coefficient of the average travel cost (own-travel cost) changes. The welfare is calculated from the mean trips and the estimate of the travel cost following from equation 8, $(33.14/1+ ß_1)$ = \$33.17 per trip on the average for all the model specifications. The mean willingness to pay (WTP) for recreational fishing in Alabama is the consumer surplus plus the mean travel cost (33.17 + 216.35) is $249.52 for the 2005/2006 fishing season. The CS estimated in this study is not too different from the consumer surplus estimate of Layman et al. (1996) who estimated a CS of $51 per day for Alaskan Pacific salmon recreational fisheries.

The education variable in table 3 shows that those that belong to the highest education class are less likely to fish in Alabama waters compared to those in the lower education groups. The marginal effects show 44.43, 41.89, and -212.53 going from the low to high education levels. The age variable in table 4 shows that beyond the age of 50 years old, the number recreation fish trips will be reducing.

Table 5 shows that the by improving natural characteristics of the fishing sites like fish size, number, and varieties; shades at the fishing sites, peace and scenery, the number of fishing trips would increase. Site convenience characteristics like proximity to homes, shopping places, and restaurants will increase trips to fishing sites, with marginal effect of 2.14 as shown in table 6. Table 7 shows that physical characteristics like camping places, picnicking places and lodging have positive marginal effect of 5.26 while relaxation, wildlife watching, and meditating places at fishing sites can create marginal effect of 22.09 as shown in table 8.

Conclusion and Policy Implications

This study has found that the angler mean willingness to pay for recreational fishing in Alabama is $249.52 and the consumer surplus is about 13% of this amount. The implication for fishery managers and private fishing site owners is that there is a scope for them to increase their revenues.

To capture this surplus, the owners and managers of recreation fishing sites need to target their marketing to the respondents that are less sensitive to price changes. Table 2 of this paper shows that age and education variables are negatively related to trip demand. Both have the large marginal effects and will respond price changes. For both variables, the site managers need to target the age groups and education levels that have high marginal effects. The managers could target younger anglers in order to increase revenues. Site distance is negatively related to recreation demand and this implies that those that manage such sites should make sure that those who live within their neighborhood are aware of their existence while they keep advertising to the distance visitors. This follows from the fact that fishing experience is positively related to the demand for fishing days. If younger anglers are targeted, they would have had longer years of experience by the time they get older and would have positive impact on the demand for fishing days in the state.

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APPENDIX

Table3: (MODEL 2) Examines the Effects of Education Level

Parameter	DF	Estimate	Standard Error	Marginal Effect	Chi-Square	Pr > ChiSq
Intercept	**b0**	2.9017***	0.4845	195.4390	35.86	<.0001
AVTC	**b1**	-0.0002**	0.0001	-0.0135	4.72	0.0298
FEXP	**b2**	0.0045*	0.0029	0.3031	2.36	0.1248
AVSD	**b3**	-0.0021***	0.0004	-0.1414	26.72	<.0001
AVCT	**b4**	0.0036*	0.0025	0.2425	2.04	0.1536
P_INC	**b5**	-0.00001***	2.86E-06	-0.0007	0.02	0.8754
AMT	**b6**	0.007	0.0042	0.4715	2.76	0.0969
EDU_D1	**b7**	0.6597***	0.2285	44.4330	8.33	0.0039
EDU_D2	**b8**	0.622***	0.1392	41.8937	19.95	<.0001
EDU_D3	**b9**	-3.1555***	1.0035	-212.5333		
Dispersion	**ALPHA**	1.0397***	0.0521	70.0272		

***Significance at 1%, * Significance at 10%   Mean fishing day demanded = 33.14days

Criterion	DF	Value	Value/DF
Deviance	700	803.48	1.1478
Scaled Deviance	700	803.48	1.1478
Pearson Chi-Square	700	1021.8	1.4597
Scaled Pearson X2	700	1021.8	1.4597
Log Likelihood		69882	

Table 4: (MODEL 3) Examines the Effects of Age Groups

Parameter		Estimate	Standard Error	Marginal Effect	Chi-Square	Pr > ChiSq
Intercept	**b0**	4.105***	0.2078	276.4853	229.57	<.0001
AVTC	**b1**	-0.00018**	0.000081	-0.01212	2.43	0.1194
FEXP	**b2**	0.0069**	0.002925	0.464738	21.33	<.0001
AVSD	**b3**	-0.00214***	0.000442	-0.14414	26.98	<.0001
AVCT	**b4**	0.004397*	0.00258	0.296152	2.91	0.088
INC	**b5**	-0.00001***	3.21E-06	-0.00067	20.27	<.0001
AMT	**b6**	0.006643	0.004427	0.447428	2.79	0.095
AGE_D1	**b7**	1.5264***	0.009187	102.8081	23.17	<.0001
AGE_D2	**b8**	1.1432***	0.001184	76.99828	8.96	0.0028
AGE_D3	**b9**	0.9871***	0.006497	66.48443	3.56	0.0025
Dispersion	**α**	1.0646***	0.05313			

***Significance at 1%, * Significance at 10%   Mean fishing day demanded = 33.14days

Criterion	DF	Value	Value/DF
Deviance	700	803.06	1.1472
Scaled Deviance	700	803.06	1.1472

Pearson Chi-Square	700	949.82	1.3569
Scaled Pearson X2	700	949.82	1.3569
Log Likelihood		69885	

MODEL 4: Site Characteristic Models

Table5: Natural Characteristics

Parameter	Estimate	Standard Error	Marginal Effect	Chi-Square	Pr > ChiSq
Intercept	3.8668	0.2419	260.442	255.52	<.0001
AVTC	-0.0002**	0.0001	-0.01347	5.13	0.0236
FEXP	0.0063**	0.0028	0.42433	5.09	0.0241
AVSD	-0.002***	0.0004	-0.13471	26.07	<.0001
AVCT	0.0044**	0.0026	0.29635	2.91	0.0883
P_INC	-0.00016***	0.0001	-0.01078	23.27	<.0001
AMT	0.0063*	0.0043	0.42433	2.21	0.1367
Nat1_D	0.2235***	0.1437	15.0535	2.42	0.1199
Nat2_D	0.2999***	0.1405	20.1993	4.56	0.0328
Dispersion	1.0593***	0.0529	71.3473		

***Significance at 1%, * Significance at 10%   Mean fishing day demanded = 33.14days

Criterion	DF	Value	Value/DF
Deviance	699	804.9077	1.1515
Scaled Deviance	699	804.9077	1.1515
Pearson Chi-Square	699	1014.4186	1.4512
Scaled Pearson X2	699	1014.4186	1.4512
Log Likelihood		69875.5326	

Table 6: Convenient Characteristics

Parameter		Estimate	Standard Error	Marginal Effect	Chi-Square	Pr > ChiSq
Intercept	**b0**	4.1269***	0.2445	277.9603	284.97	<.0001
AVTC	**b1**	-0.0002**	0.0001	-0.0135	5.6	0.018
FEXP	**b2**	0.0061**	0.0028	0.4109	4.68	0.0305
AVSD	**b3**	-0.002***	0.0004	-0.1347	26.01	<.0001
AVCT	**b4**	0.0044*	0.0025	0.2964	2.98	0.0842
P_INC	**b5**	-0.00001***	3.14E-06	-0.0007	21.46	<.0001
AMT	**b6**	0.0063	0.0043	0.4243	2.2	0.138
Con1_D	**b8**	0.0319***	0.1273	2.1486	0.06	0.8023
Con2_D	**b9**	-0.0467***	0.1156	-3.1454	0.16	0.686
Dispersion	**α**	1.0647***	0.0531	71.7110		

***Significance at 1%, * Significance at 10%   Mean fishing day demanded = 33.14days

Criterion	DF	Value	Value/DF
Deviance	699	805.26	1.152
Scaled Deviance	699	805.26	1.152
Pearson Chi-Square	699	1006.4	1.4397

Scaled Pearson X2	699	1006.4	1.4397
Log Likelihood		69873	

Table 7:Physical Characteristics

Parameter		**Estimate**	**Standard Error**	**Marginal Effect**	**Chi-Square**	**Pr > ChiSq**
Intercept	**b0**	4.2648***	0.2694	287.2483	250.64	<.0001
AVTC	**b1**	-0.0002***	0.0001	-0.0135	5.24	0.0221
FEXP	**b2**	0.0064**	0.0028	0.4311	5.18	0.0228
AVSD	**b3**	-0.002***	0.0004	-0.1347	26.21	<.0001
AVCT	**b4**	0.0041*	0.0025	0.2761	2.61	0.1059
P_INC	**b5**	-0.0001***	2.68E-06	-0.0007	23.29	<.0001
AMT	**b6**	0.0067*	0.0043	0.4513	2.48	0.1153
Phy1_D	**b8**	0.0781***	0.17	5.2603	0.21	0.6458
Phy2_D	**b9**	-0.1867***	0.1463	-1.5749	1.63	0.2018
Dispersion	**α**	1.0628***	0.053	71.5831		

***Significance at 1%, * Significance at 10%   Mean fishing day demanded = 33.14days

Criterion	**DF**	**Value**	**Value/DF**
Deviance	699	805.09	1.1518
Scaled Deviance	699	805.09	1.1518
Pearson Chi-Square	699	1011	1.4463
Scaled Pearson X2	699	1011	1.4463
Log Likelihood		69874	

Table 8: Recreation Characteristics

Parameter	**DF**	**Estimate**	**Standard Error**	**Marginal Effect**	**Chi-Square**	**Pr > ChiSq**
Intercept	**b0**	4.5367***	0.2484	305.5617	333.62	<.0001
AVTC	**b1**	-0.0002***	0.0001	-0.0135	5.46	0.0195
FEXP	**b2**	0.006*	0.0028	0.4041	4.56	0.0328
AVSD	**b3**	-0.002***	0.0004	-0.1347	25.39	<.0001
AVCT	**b4**	0.005**	0.0025	0.3368	3.84	0.0502
P_INC	**b5**	0.00001***	2.93E-06	0.0007	25.36	<.0001
AMT	**b6**	0.0071*	0.0042	0.4782	2.78	0.0957
Rec1_D	**b8**	-0.281***	0.1139	-18.9263	6.08	0.0136
Rec2_D	**b9**	0.328***	0.122	22.0919	7.23	0.0072
Dispersion	**ALPHA**	1.0565***	0.0528	71.1588		

***Significance at 1%, * Significance at 10%   Mean fishing day demanded = 33.14days

Criterion	**DF**	**Value**	**Value/DF**
Deviance	699	804.46	1.1509
Scaled Deviance	699	804.46	1.1509

Pearson Chi-Square	699	973.24	1.3923
Scaled Pearson X2	699	973.24	1.3923
Log Likelihood		69877	