Economic Impact of Recreational Angler Visitation to Lake Guntersville, Alabama

by

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A thesis submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Fisheries, Master of Science

Auburn, Alabama
December 13, 2013

Keywords: Recreational fishing, Roving creel,
Economic impact, Travel cost model, Aerial boat count survey

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Abstract

Recreational fishing in Alabama is a major revenue source for communities surrounding popular fishing destinations as well as a source of tax revenue for local, regional, and state governments. Statewide economic data on recreational angling allow fishery managers and administrators to recognize the broad impacts recreational fishing has to offer. However, more specific economic data on individual water bodies and targeted fish species are helpful to administrators and managers for proper characterization of the fisheries under their purview. I estimated economic impact of recreational angling expenditures and tax revenues generated by the four major recreational fisheries (black bass, crappie, catfish, and sunfish) at Lake Guntersville, Alabama to the local towns, counties, and state. I also estimated the total recreational angling effort, catch rate, and harvest rate for each of the four major sport fisheries using an on-site survey. Estimated annual effort was 1,287,000 hours (SE, 192,000 hours), with 65% of this directed towards black bass, 25% towards crappie, 5% towards anything, 4% towards sunfish, and 2% towards catfish. Anglers were queried about their expenditures related to their fishing trip, initially during the creel survey and subsequently in the by phone. Total direct expenditures related to recreational angling on Lake Guntersville in 2012 was $13.4 million this generated $425,000 of tax revenue for the local communities and $610,000 for the State. The estimate consumer surplus indicated the average angler was willing to pay $156 more per trip to Lake Guntersville increasing the overall value of the fishery to $45.2 million.

Acknowledgments

I would like to thank Kasie Goodson and our families for their continued support of my endeavors. I would also like to thank the Hodson Family, Natalie McKee, and the Hatcher Family for the assistance they provided during my undergraduate years.

I would like to thank Dr. Steve Sammons for the employment opportunity at Auburn and the confidence he has shown in my ability to succeed as a biologist and graduate student. Dr. Diane Hite was a tremendous help and very gracious with the time she spent to help estimate the value of the fishery. I would like to thank Dr. Terry Hanson for giving me the opportunity to pursue a master's degree and his commitment, support, and guidance throughout the project. Dr. Mike Maceina was an integral part of the sampling design, data analysis, and overall success of the project.

This study was funded by the Alabama Department of Conservation and Natural Resources (ADCNR) in 2012 and 2013. I would like to thank Nick Nichols and Damon Abernathy of ADCNR for providing the creel boats used in the project. I would like to thank Auburn University personnel for their help on many project tasks. Bill Greenhaw was a tremendous pilot; we thank him for all the aerial counts, especially those which were conducted in very difficult flying conditions. Tennessee Valley Authority was generous in storing the boat during the project. Finally, I would like to extend my appreciation to our research assistant Jeff Buckingham. Jeff provided sound advice and knowledge throughout the course of the project and performed all field work professionally, efficiently, and without error.

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List of Abbreviations

ADWFF	Alabama Division of Wildlife and Freshwater Fisheries
CPE	Catch-per-effort
HPE	Harvest-per-effort
LPE	Live-well-per-effort
TCM	Travel cost method
WTP	Willingness-to-pay

Definitions of Note

Consumer Surplus	willingness-to-pay for a recreational visit above and beyond a person's actual expenditures and is the area below the recreational visit demand curve and above the equilibrium visit cost (price)
Local	Marshall, Madison, or Jackson Counties
Nonlocal	All Alabama counties excluding local counties
Border State	Tennessee and Georgia
Non-Border State	Florida, Mississippi and all states that do not border Alabama
Opportunity Cost	measure in terms of value of the next best alternative foregone; in this study, a fraction of angler's wage rate applied to the round trip travel time
Substitute Site	similar site that could replace the study site and in this study was used as part of a substitute site opportunity cost in the travel cost model
Travel Cost Model	method to estimate travel costs (opportunity cost of travel plus actual expenditures) to access a site and fish which estimates angler visitation demand
Trip	one angler fishing during a one day period
Visit	fishing expedition for one angler and can be multiple days from residency origin to site and return to residency
Willingness-to-pay	maximum an angler is willing to pay to fish and includes actual expenditures plus consumer surplus

I. INTRODUCTION

Recreational fishing in Alabama is a major revenue source for the state and communities surrounding popular fishing destinations. In 2011, anglers spent $456 million in expenditures related to their fishing trips in Alabama (U.S Department of the Interior, Fish and Wildlife Service (USDOI, FWS) and U.S. Department of Commerce (USDOC, CB) Census Bureau 2012). Statewide economic data such as these allow fishery managers and administrators to recognize the broad economic impacts of recreational fishing. However, more specific economic data on individual water bodies and targeted fish species are required for administrators and managers to properly characterize the fisheries under their purview. Two types of input that decision makers are often presented with when making environmental management decisions are cost or cost-benefit analysis and stakeholder preferences (Kiker et al. 2009). Therefore, information on the economic impacts of fishing and the values anglers place on fishing can answer specific economic questions and be incorporated into objective, quantitative decision-making analysis (Pollock et al. 1994).

The growing human population is the root of the water supply problem in the Southeast (Seager et al. 2009). Anthropogenic uses of water include hydropower generation, sewage disposal, human consumption, irrigation, navigation, and recreation (Xenpoulos and Lodge 2006). While a direct dollar amount can be placed on many of these uses, the value of recreation is more difficult to estimate and on many water bodies is unknown, especially in terms of recreational angling. Recreational angling expenditures can contribute significantly to the municipalities near popular fishing destinations. Schorr et al. (1995) estimated that striped bass *Morone saxatilis* angling on

Lake Texoma, Texas and Oklahoma had a total economic impact of $57.4 million on the towns and counties that border the lake. Knowledge of the value of these fisheries could provide proper mitigation estimates should these municipalities suffer a loss in revenue due to destruction of the fishery.

I.1. Angler Surveys

Angler surveys are used to collect a wide array of data about anglers and the fisheries they visit. On-site surveys contact anglers during or immediately after a fishing trip, whereas off-site surveys are conducted by telephone, mail, or e-mail. Off-site surveys are able to collect completed trip data; however, the survey can be subject to recall bias (Hiett and Worrall 1977). On-site surveys are beneficial in obtaining information on a particular resource but, due to time constraints, are limited to fewer questions. Also, anglers are less likely to reveal personal demographic information in a face-to-face survey (Ditton and Hunt 2001). Because of these biases, on-site and off-site angler surveys are often used in conjunction. Hunt and Ditton (1996a) used an on-site survey to estimate angling effort and combined it with an off-site mail survey to collect expenditure and demographic data.

Access-point and roving creel are two primary methods used for conducting on-site creel surveys to determine angling effort, catch, and harvest. Access-point surveys are commonly used by state fisheries agencies, typically at sites with limited access points, which allow creel clerks to intercept a large percentage of users at one location and collect completed-trip data (Pollock et al. 1994). A bus-route creel survey is a specialized form of an access point survey in which clerks travel to several access points during a sample day, instead of staying at one access point for the duration of the sample

(Pollock et al. 1994). A bus-route survey is often used to sample large regional fisheries with many access points. Disadvantages include the travel time between sites, lower sample size due to the time spent traveling instead of surveying, and the complexity of scheduling (Pollock et al. 1994). Prado (2006) used a bus-route creel survey on the Lower Illinois River in Oklahoma to determine the socio-economic characteristics of the users, the fishery's consumer surplus, future angler preferences, determine recall bias, estimate angler trips per year, and conduct a cost-benefit analyses.

Roving creel surveys are used to estimate fishing effort, catch rates, and other parameters when access to a fishery occurs at too many points to accommodate a traditional access point design (Pollock et al. 1994). A roving creel survey includes a count of all anglers within a specified section of the water body, followed by surveying anglers within the section. The count provides an instantaneous estimate of effort and the survey provides a sample of the users. Because surveys are conducted while the trip is in progress, complete trip data is not available. Follow-up telephone or mail surveys can be used to acquire complete trip data not available in the on-site interview. Malvestuto et al. (1978) used a roving creel survey with non-uniform probability to estimate catch-per-unit effort (CPUE) and precision associated with monthly estimates of catch and effort on West Point Reservoir, Georgia. Non-uniform probability ensures that the distribution of sampling effort coincides with the distribution of angling effort (Best and Boles 1956). However, this method requires prior knowledge of the fishery in order to match sampling effort with angling effort. A typical modification of this method is to use stratified random sampling in which all shifts and sites are sampled randomly and later assigned probabilities based on data collected during the study. This method is commonly used to

estimate angling effort. For example, it was used by Hanson et al. (2012) to determine the economic impact of the striped bass *Morone saxatilis* sport fishery at Smith Lake, Alabama. Palm and Malvestuto (1983) also used a roving creel survey to estimate recreational angling expenditures at West Point Reservoir, Alabama.

In large systems, conducting creel surveys on the entire water body is not practical. In these cases, aerial boat counts can be used in conjunction with roving creel surveys to extrapolate data collected in the roving creel sample to the entire lake. Volstad et al. (2006) used aerial counts in conjunction with an access creel survey to estimate effort, catch, and harvest of American shad *Alosa sapidissima* and striped bass in the Delaware River and estuary in 2002. Catch, harvest, shore effort, and trip-length data were collected at access points for completed-trip information and boat angler effort was estimated via aerial observations. The aerial survey underestimated shore angling effort, whereas the access-point survey failed to accurately estimate total boat angling effort. However, combining data from both surveys resulted in meeting the target of less than 20% standard error in hours of effort for both species (Volstad et al. 2006). Results indicated that a rigorous probability-based access survey complemented by an aerial survey may be the most cost effective means of obtaining precise unbiased estimates of fishing effort when a combination of boat and shore anglers are spread out over a large geographic region. Soupir (2006) found that effort estimation in aerial flights was consistently lower than effort estimated by the bus-route method. This was possibly due to aerial flights excluding boats that were in transit whereas the bus-route survey assumes all boats are fishing. However, Soupir (2006) concluded that the bus-route method yielded more precise results than did the aerial counts.

I.2. Economic Valuation

Economic valuations of natural resources can be successfully conducted by a variety of methods. The scale on which economic valuations are conducted range from nationwide (USDOI, FWS and USDOC, CB 2012) to specific species on individual water bodies (Hanson et al. 2012), as well as competitive angling (Anderson et al. 2002).

The Travel Cost Model (TCM) is a practical way to estimate the market value of recreational resources, such as estimating the value of recreational fishing at an individual water body (Prado 2006). The TCM is a demand-based model used to value recreational uses of the environment. This model works like a conventional downward sloping demand function in which “quantity demanded” is the number of trips, and “price” is the trip cost of reaching the site (Parsons 2003). Travel cost or "price" is the sum of direct expenditures and opportunity costs of time.

Direct expenditures include fuel for vehicle and boat, lodging, food/drink, fishing equipment, fishing license, tournament fees, and any other purchases made in relation to the fishing trip. Direct expenditures are used to measure economic impacts and tax revenue associated with recreational fishing but they do not convey the total value associated with the resource, but rather reflect the amount of money incurred to reach and use the resource (Palm and Malvestuto 1983). Consumer surplus is the difference between the price actually paid for a good or service and the maximum willingness to pay for it (King and Mazzotta 2000). In fisheries applications, this translates to the maximum an angler would be willing to pay to fish at a particular site. As distance from the site increases, the cost of visiting the site generally increases, thus the number of trips made should decrease, resulting in a downward sloping demand curve (Figure 1.) (King and

Mazzotta 2000). Consumer surplus can be estimated based on the number of visits that are made at different travel costs which is derived from the sample data. After estimation of the demand curve, consumer surplus is estimated based on the parameter estimate of the dependent variable "visits."

Consumer surplus can be estimated using many variables, such as trip cost to the site, travel cost to an alternate site, income, and other demographic and trip characteristic variables (Ward and Beal 2000; Parsons 2003). On-site surveys are subject to endogenous stratification or "avidity bias" which can lead to overestimating consumer surplus. This occurs because avid users of the resource are more likely to be sampled than those who visit less often. In addition, the data is truncated because onsite surveys do not sample nonusers (Englin and Shonkwiler 1995 and Martinez-Espineira 2006). Overdispersion increases error in consumer surplus models, leading to less precise estimates of the value of the resource. Estimation of consumer surplus is prone to overdispersion, which often occurs due to the tendency of a few visitors to a resource making numerous trips, while many visitors make only a few trips.

Opportunity cost is an estimation of the value of a person's time it is calculated by multiplying the time spent traveling to and from the site by a percentage of the angler’s hourly salary derived from their annual salary based on a 40-hour work week. Travel time is generally estimated by dividing the round-trip distance between the origination site and angling site by the average speed limit.

There are three methods of applying the TCM: zonal, individual, and random utility. The zonal TCM is applied by collecting information on the number of visits to the site across various zones of distance from around the resource (King and Mazzotta

2000). The number of trips made and travel costs associated within each zone is then estimated and summed. For this study the individual TCM was used and is similar to the zonal approach, but uses continuous survey data from individual visitors in a statistical analysis, rather than data from zones. This method requires more data but will give more precise results. The random-utility TCM is more complicated and expensive than the other approaches, but is the best approach to estimate benefits of specific characteristics, or quality changes of sites, instead of the entire site. This model focuses on choices among alternative sites, which have different quality characteristics (King and Mazzotta 2000).

Studies have used TCM's to examine variations in consumer surplus across target species and user groups (Palm and Malvestuto 1983), the value of recreational fishing for specific species on individual water bodies (Dorr et al. 2002, Hanson et al. 2012), and to estimate the value of entire recreational fisheries in reservoirs (Hunt and Ditton 1996a). Dorr et al. (2002) determined crappie angling at Sardis Lake, Mississippi generated $2.3 million with an aggregate consumer surplus of $671,000. Hunt and Ditton (1996a) concluded that recreational angling at Lake Fork, Texas generated $27.5 million in direct expenditures with an aggregate consumer surplus of $10.7 million.

Contingent valuation (CV) estimates the values gained or lost by participants who generate consumer surplus, and relies on surveys to estimate consumers' willingness to pay (Hanson et al. 2002; Loomis 2006). For example, Loomis (2006) estimated the change in the number of trips anglers would make to the Snake River and Henry's Fork, Wyoming using CV methods. It was estimated that a 100% increase in catch or a 25% percent increase in the size of fish caught would result in a 64.5% or 66.3% increase in

the number of trips an angler would make, respectively. Hanson et.al (2002) used CV questions to estimate the impacts of water-level changes on lakefront property values and recreational-use expenditures at Lake Martin, Alabama. Results indicated that a permanent one-foot reduction in summer full-pool water levels resulted in a 4 to 15 % decrease in lakefront property values, and recreational expenditures decreased 4 to 30 % for each one-foot reservoir water levels were lowered.

I.3. Site Description

Lake Guntersville is a 27,520-ha mainstream impoundment on the Tennessee River in northeastern Alabama and is the largest reservoir in the state. It was impounded in 1939 for hydroelectric power, flood control, navigation, and water supply; in addition the reservoir provides fishing, water sports, boating, swimming, bird watching, and hunting recreational opportunities (Guntersville Joint Agency Project (GJAP) 1992). The sportfish population in Lake Guntersville is dominated by Largemouth Bass *Micropterus salmoides*, but there are also substantial fisheries for crappie *Pomoxis nigromaculatus* and *P. annularis*, bluegill *Lepomis microchirus*, and redear sunfish *Lepomis microlophus* (Andress et al. 2008). Lake Guntersville is well known for its exceptional Largemouth Bass fishing which attracts numerous tournament trails and out-of-state anglers, thus, it is apparent that the fisheries on Lake Guntersville are important to the economics of the local area (Floyd and Ekema 2011). Lake Guntersville has four major metropolitan areas (Birmingham, Alabama, Atlanta, Georgia, Chattanooga, Tennessee, and Nashville, Tennessee) within 200 miles, three of which are outside the state of Alabama. These metropolitan areas combined have approximately 8.7 million residents (U.S Census Bureau 2010). Out-of-state anglers pay a higher rate for Alabama fishing licenses, and

may spend more money per trip than in-state anglers. Therefore, out-of-state anglers possibly provide greater income per trip to businesses and tax revenues to the State of Alabama than local anglers. According to a travel-cost analysis of the Largemouth Bass fishery at Lake Fork, Texas (Hunt and Ditton 1996) Texas anglers spent an average of $117 per trip, whereas anglers from border-states spent $384 per trip and anglers from non-border states spent an average of $789 per trip. Major national fishing tournament organizations such as the Bass Anglers Sportsman Society (BASS), Forrest L. Wood Tour (FLW), Crappie Masters USA, and King Kat USA regularly hold tournaments on Lake Guntersville. Lake Guntersville also hosts annual corporate and club tournaments from around the country. Tournament angling for Largemouth Bass has grown in popularity, often stimulating local economies, and these anglers can make up the majority of Largemouth Bass anglers on lakes and reservoirs (Schramm et al. 1991).

Impoundments on the Tennessee River such as Lake Guntersville generally have diverse stakeholder groups that have conflicting opinions on many management strategies employed by the Tennessee Valley Authority (TVA) and state fish and wildlife management agencies (Scholten et al. 2008). For example, most Largemouth Bass anglers prefer to fish around vegetation and generally demonstrate the greatest opposition to the control of aquatic macrophytes (Wilde et al. 1992). A study of economic benefits associated with various vegetation control strategies at Lake Guntersville, Alabama, concluded that consumer surplus for anglers was highest under the minimal vegetation control strategy (Henderson 1996). However, the vegetation coverage preferred by anglers decreased the values of lake front properties. The eradication of aquatic vegetation from lakefront home sites at Lake Guntersville was estimated to increase

property values by $122 million (Driscoll et al. 1994, cited by Henderson 1996). The economic value of the recreational fishery was unknown during this study, but property owners were able to quantify the loss in property value due to abundant aquatic vegetation. Because many decisions to allocate funding or labor to a resource are based on the likelihood that the action will result in a positive economic impact, it is imperative that agencies such as ADCNR have economic data to support fisheries management actions and justify spending to support Alabama's recreational fisheries.

The popularity of bass fishing, coupled with the location and overall quality of fishing at Lake Guntersville, creates great potential for the State of Alabama and local communities to acquire income and tax revenues associated with fishing tourism. Angling effort for Largemouth bass ranged from 0.96 million hours in 1990 to 0.41 million hours in 1993 (Wrenn et al. 1996). This project will identify where trips to Lake Guntersville originated, type of lodging used on the trip, trip booking information, and how the anglers became aware of Lake Guntersville. This information will aid the local chambers of commerce and tourism bureaus in realizing markets they are successfully advertising to or are underutilizing to help maximize benefits associated with fishing tourism. Valuation of angler trip expenditures (travel, food, lodging, licenses, tackle, bait, etc.) at Lake Guntersville will allow us to estimate recreational fishing demand for the resource and its contribution to the economy. Estimating expenditures in specific cities and counties will allow us to estimate the resource's impact on local economies and their tax bases as well as the value anglers place on the fishery by species. This economic impact on the cities of Guntersville and Scottsboro, counties of Jackson,

Marshall, and Madison, as well as tax contributions to these locales will be estimated for each of the four major sport fisheries, which are bass, crappie, catfish, and sunfish.

II. Methods

Figure 2 is a schematic of where data was collected and how it was combined to estimate study objectives.

II.1. *Roving Creel Survey*

Roving creel surveys were conducted on Lake Guntersville from January 2012 through December 2012 to estimate angling effort, catch per hour of effort (CPE), harvest per hour of effort (HPE), livewell fish per hour of effort (LPE), and angler expenditures of each sport fishery.

A total of 24,151 ha of Lake Guntersville were surveyed, the study area was divided into three major sections (Figure 3). Section A began at the dam and was 7,336 ha (Figure 4), section B was 8,986 ha (Figure 5), and section C was 7,831ha (Figure 6).

Seven subsections were surveyed within major sections A and B, while section C had 6 subsections. These subsections ranged from 688 to 1,500 ha. Each day of surveying, one of the three major sections was randomly selected to sample; within this major section one of the subsections was also randomly chosen to sample. Areas that could not be navigated at speeds sufficient for an instantaneous count were not included in the roving creel survey, but effort in these areas was documented in the aerial counts.

Data were collected via two, 5-d, on-site survey trips each month over the 12 month period, totaling 120 total survey days. Each of the survey trips consisted of seven roving creel surveys randomly stratified among sections and subsections and three aerial boat counts of the entire reservoir. Roving creel surveys occurred on 3 weekdays and 2

weekend days per 5-d trip. Two roving creel surveys were conducted on the first and last day of each survey trip (i.e.; one weekday and one weekend day). The middle three days consisted of one aerial boat count and one roving creel survey per day. Sampling times for the roving creel surveys were randomly chosen from three possible 4-h time blocks set according to the following guidelines (AM; 07:30 to 11:30), noon (NN; 12:00 to 16:00), and evening (PM; 16:30 to 20:30). During the winter season (December through February) time blocks were 3.5 hours each and occurred one hour earlier without the half-hour spacing so that all three time blocks would occur during daylight hours. Spring was considered to be March through May, summer June through September, and fall was October and November.

Each roving creel survey began with an instantaneous count of anglers within the selected section that lasted no longer than 30 minutes (Appendix IX.3). Time of day and weather conditions such as air and water temperature, wind speed, and presence of precipitation were recorded before the count began. The count began at the most practical point within the section to complete the count and surveys. The instantaneous counts were made by driving the creel boat through the section so that all coves and backwaters could be viewed without obstruction; binoculars were used to view the backs of coves and distant shorelines. The creel boat was driven to the very back of developed coves with numerous docks to ensure boat anglers fishing between the docks would be counted. The count ended as soon as the entire section had been viewed. Counts were apportioned among boat anglers, shore anglers, pontoon boats being used for fishing, and pontoons being used for other purposes (Appendix IX.3). Pontoon boats not being used for fishing were enumerated to increase the accuracy of the aerial boat counts. Angler

counts were immediately followed by angler surveys conducted during the remainder of the 4-h time block, or until all boat and shore anglers in the section were contacted. If more anglers were present than could be surveyed in the allotted time, they were subsampled using a systematic method, such as interviewing every other boat, so that a complete circuit of the section was made. These roving creel survey methods were similar to those used by Malvestuto et al. (1978), Palm and Malvestuto (1983), and Hanson et al. (2012).

Interviews lasted no longer than 5 minutes and questions focused on species specific recreational angling effort and expenditures. All catch and expenditure data were party totals. Questions in the roving creel survey were asked to estimate CPE, HPE, and LPE which was considered to be the number of fish that were placed in the livewell to be released later. Anglers were asked where their trip originated, estimated total trip expenditures, local expenditures within 20 miles of Lake Guntersville, and non-local expenditures. We also asked if the trip was related to a tournament and if so if the angler was pre-fishing or was currently fishing in a tournament, on a guided trip, species of fish being targeted, if we had surveyed them before, starting and expected ending time of their fishing, number of anglers in the party, and how many days they have fished at Lake Guntersville for the target species in the past 12 months. Finally, we asked the distance they traveled to reach the launch site or shoreline access point and concluded with asking for permission to conduct a follow-up telephone survey (Appendix IX.1).

Aerial boat counts (appendix IX.4) were conducted on 24,141ha of Lake Guntersville from the Guntersville Dam to the Highway 117 Bridge near the town of Stevenson, Alabama, from a Cessna 172 at an average altitude of 333 m. Counts took

two hours to complete, and all boats engaged in recreational angling were enumerated per subsection; boats underway and those not fishing were not counted. The counts were conducted by a lead counter with a second counter responsible for recording data and assisting with counting boats that were out of view of the lead counter. Counts were made for each section, and start and end times for each section were recorded. It was difficult to determine from the plane if pontoon boats were being used for angling or other purposes. The percentage of pontoon boats being used for angling versus other uses collected in the roving creel was applied to the number of pontoon boats counted in the aerial counts to prevent overestimating effort.

II.2 ***Follow-Up Telephone Survey***

A follow-up telephone survey was used to collect detailed data for completed trips. The angler interviewed during the roving creel survey was asked to provide their telephone number along with the time of day and day of week they wished to be contacted. These anglers were contacted by phone within two weeks of the interview to avoid issues with recall bias (Prado 2006; USDOI, FWS, and USDOC, CB 2013). If after three attempts they were not contacted they were removed from the list. Questions were focused on the amount of money spent within each expenditure category (Appendix IX.2) and the location that the expenditures occurred. There were eight possible expenditure locations: City of Guntersville , City of Scottsboro, Marshall County, Jackson County, Madison County, State of Alabama, internet, or out-of-state. In addition to expenditure data, questions were asked pertaining to the angler's perceived quality of the fishery, their preferred alternate angling site and distance to this alternate site, demographics and fishing habits, years of angling experience, tournament participation, and the primary

purpose of their trip. Boat anglers were also asked a contingent valuation question to determine if additional trips to fish at Lake Guntersville would be made if parking was guaranteed to be available at the angler's preferred launch site (Appendix IX.2).

II.3 Effort and Catch

Calculations of angler effort, catch, and harvest for each targeted fish category on Lake Guntersville were estimated using data gathered from the on-site creel survey and aerial boat counts, using similar procedures as described by Slipke et al. (1998). Targeted fish categories include bass, crappie, catfish (*Ictalurus furcatus, Ictalurus punctatus,* and *Pylodictis olivaris*), sunfish, and anything or other. Calculations used to estimate effort, CPE, LPE, and HPE were performed by applying non-uniform probabilities (Malvestuto et al. 1978). Probabilities were assigned to estimate total daytime boat angler effort (E) for all target fish categories for the reservoir for a particular day (E) using:

$$E = (I \times A \times t)/p_1 \quad (1)$$

where I is the instantaneous count of boats from aerial boat counts, A is the average number of anglers per boat, t is the length of the time block in hours, and p_1 is the probability of sampling an angler within each time block. Total daytime boat angler effort for each of the four seasons ($\hat{E}$) was estimated using:

$$\hat{E} = \sum_{h=1}^{2} N_h \, \bar{y}_h \quad (2)$$

where N is the total number of days within the season and $\bar{y}$ is the mean daily boat angler effort estimated for each strata *h*, weekend or weekday. The total effort for each season was then summed to estimate annual daytime boat angler effort. Standard error was estimated by $N \times \sqrt{v}$, where v is the variance of daily effort for each strata. Seasonal daytime boat angler effort for each target species ($\hat{E}_{species}$) was estimated by multiplying $\hat{E}$ by the proportion of boat anglers targeting each species during the respective season.

CPE was estimated each day of sampling among boat and shore anglers separately, for each target fish category and was estimated using $\hat{c}_{species}/\hat{e}_{species}$, where $\hat{c}_{species}$ is the total catch observed during the day of sampling and $\hat{e}_{species}$ is the total angler reported hours of effort for each target fish category obtained during the roving creel survey interviews. HPE and LPE were estimated by substituting the total harvest or livewell fish for total catch for each target fish category obtained from the sample in the roving creel survey interview. Total seasonal catch for each target fish category was estimated by $\hat{E}_{species} \times CPE_{species}$, seasonal harvest for each target fish category was estimated by $\hat{E}_{species} \times HPE_{species}$, and livewell fish for each target fish category was estimated by $\hat{E}_{species} \times LPE_{species}$.

Shore effort was calculated based on the instantaneous roving creel angler counts. Counts that did not observe shore anglers were not included in this analysis. Methods used to estimate shore angler effort were similar to those used to estimate boat angler effort (Malvestuto et al. 1978). Probabilities were assigned to estimate total shore angler effort (S) for all target fish categories for the reservoir for a particular day (S) using:

$$S = (C \times t)/p_1 * p_2 \quad (1)$$

where C is the instantaneous count of anglers from the roving creel instantaneous counts, t is the length of the time block in hours, p_1 is the probability of sampling an angler within each time block, and p_2 is the probability of a shore angler fishing within the section. Annual effort was estimated by multiplying mean weekday effort for the year by the total number of weekdays in the year. Weekend effort was estimated using the same methods and the two were summed to produce total annual shore effort.

For this study, trip length was equal to the hours of angling effort the angler put forth on their fishing expedition. Trip length was estimated for each target species by averaging angler-estimated hours of effort for the specific trip of the interview. If an angler was not certain of starting or ending times, the data were omitted from analyses. Mean trip length was estimated seasonally for bass and crappie and annually for sunfish, catfish, and anything due to a smaller sample size. The number of trips per season for each target species ($TRIPS_{species}$), was determined by dividing $\hat{E}_{species}$ by the mean trip length for that species. For the purposes of this study a "trip" was defined as one angler fishing during a one day period, while a "visit" was defined as one fishing expedition for one angler, which could include multiple trip days from his or her place of residence.

Annual night angling trips was estimated through total trip estimates, shore and boat, and data collected in the follow up telephone survey.

$$NT = (T/D) * F * R$$

where *NT* is the total number of night trips made, *T* is estimated annual trips among all anglers, *D* was the mean number of days anglers indicated they had fished at

Lake Guntersville during the previous 12 months regardless of the target species, *F* was the percentage of anglers who indicated they fished at night, *R* was the mean number of night fishing trips the anglers made in the previous 12 months.

II.4 Expenditures and Tax Revenue

Expenditure estimates reported in the follow-up telephone survey were used to estimate average trip cost for each target fish category and the proportion of the total expenditures that occurred in each location. Follow-up telephone survey expenditure data were used due to inaccurate estimates collected in the roving creel. During the roving creel survey, anglers were asked to estimate party expenditures that would be incurred over the duration of the visit. These estimates were inconsistent with the estimates given in the follow-up telephone survey as there was a mean difference of 32% in absolute value between the two estimates. Anglers underestimated visit costs during the roving creel survey by an average of 12.2% compared to estimates collected in the follow-up telephone survey. Follow-up telephone survey data are generally preferred over roving or access creel data due to the surveys ability to collect completed trip information and detailed data which is restricted by time restraints in on-site interviews (Pollock 1994). Interviews that occur before a visit is complete have been known to result in the underestimation of expenditures (Hanson et al. 2012). The appropriate city, county, or Alabama tax rates were applied to their fuel, lodging, and general sales according to tax rates used by the Alabama Department of Revenue (Underwood 2012). Tax revenues were not calculated for out of state expenditures.

To calculate tax revenue generated by fuel sales the tax rate per gallon of gas was divided by the average price of a gallon of regular unleaded gas for Alabama in 2012 of

$3.48 (C. Ingram, AAA Alabama, personal communication). To estimate tax revenue this percentage was then multiplied by total fuel sales in each location. Lodging and general sales tax rates were multiplied by the estimated expenditures in each location. The distribution rates of tax revenue within Alabama, local counties, and cities were obtained from the appropriate revenue official in each local municipality through personal communication (City or County, Clerks) or from Fulford (2012) for Alabama; including Marshall County (Shelley Fisher, County Clerk), City of Guntersville (Betty Jones, City Clerk), Jackson County (Ron Crawford, Jackson County Revenue), City of Scottsboro (Rick Wheeler, City Clerk/Treasurer), Madison County (Revenue Discovery Systems), and Alabama (Fulfurd 2012).

II.5 Angler Socioeconomic Characteristics

Socioeconomic characteristics such as party size, expenditures, distance traveled, annual visits, and income were tested among anglers based on target fish category and angler residence, local, non-local, border-state, and non-border-state. I used the general linear model procedure to run a One Way Analysis of Variance for unbalanced data. I added the appropriate CONTRAST statements to test for significant differences between each individual residence location and target fish category (SAS 2009). Results were considered significant at $P < 0.05$.

II.6 Travel Cost Model

The basis for estimating the TCM for angling on Lake Guntersville was described by Parsons (2003). A regression analysis of the survey data was used to describe the relation between the number of annual angling visits and independent variables, including travel cost, duration of the visit, substitute site opportunity cost of roundtrip travel time,

tournament participation, angling method, target fish category, and socio-demographic characteristics.

An opportunity cost of time spent on the trip is a standard component of travel cost (Parsons, 2003). The wage rate was used to value the angler's time to travel roundtrip from his or her residency to Lake Guntersville. The opportunity cost of time spent fishing (O_a) was estimated using:

$$O_a = ((H_a/2{,}000) * .33) \times (D_a/55\ mph) \quad (6)$$

where H is the annual household income for angler a which was divided by a standard 2,000 hours worked per year (40 hours per week multiplied by 50 weeks per year) to achieve an hourly pay rate. Travel time was valued by using one-third of the hourly wage rate; D_a is the roundtrip distance traveled in miles for the a^{th} angler that is divided by an average speed of 55 miles per hour to obtain hours of travel (Prado 2006; Ojumu 2009).

Travel cost for an individual angler (T_a) was estimated by:

$$T_a = O_a + X_a \quad (5)$$

where X is the summation of an individual's estimated expenditures incurred on the visit, including cost of vehicle operation, lodging, restaurant meals, and groceries, and O is the opportunity cost of travel for each angler a.

The cost of vehicle operation was estimated by multiplying the angler's roundtrip distance in miles to Lake Guntersville by $0.55,which was the Federal mileage

reimbursement rate of vehicle operation per mile for business purposes in 2012 (Internal Revenue Service 2011). This estimate is within the composite average range of $0.52 to $0.78 per mile reported by the American Automotive Association (AAA) in 2013 (AAA 2013).

The demand curve for the quantity of angling visits taken (Q) at varying visitation cost levels was estimated using:

$$Q = \beta_0 \pm \beta_1 T \pm \beta_2 H \pm \beta_3 V \quad (4)$$

where β are the coefficient estimates, T is the accumulated travel costs, H is the angler's household income, and V is a matrix of demographic variables used to explain Q , such as (age, gender, ethnicity, target-fish category, CPE, number of tournaments the angler participated in on Guntersville in the previous 12 months, years of experience, fishing club involvement, and length of visit). It was expected that the demand curve would have an inverse relationship between travel cost and number of visits, i.e., as the visit cost increases (with further distance from the reservoir) the number of visits to the reservoir will decrease.

The survey obtained household income based on an angler's response a series of ranges that matched their household income. The midpoint of each income bracket was used as the value in the TCM. Since the range for the top bracket was infinite (>$300,000), one-half of the preceding income bracket range ($200,000 - $300,000 = $100,000 / 2 = $50,000) was added to the beginning value of the highest income range ($50,000 + $300,000 = $350,000) to become the value for the highest income bracket.

Distance traveled from the origination site to Lake Guntersville and for substitute sites was doubled to determine roundtrip distances in miles.

The TCM is not well suited for multi-purpose visits (Ward and Beal 2000; Parsons 2003; Prado 2006). Therefore, if an angler's sole purpose for visiting the Lake Guntersville area was not to fish (i.e. visiting relatives), they were asked to only report distance traveled and expenditures that were directly related to their fishing trip. If fishing was not the angler's sole purpose for being at Lake Guntersville (i.e. boating or camping was the reason for being at the lake) the data was discarded.

I used a count data model to estimate consumer surplus because the dependent variable, visits, is a nonnegative integer. The negative binomial model was used to correct for endogenous stratification, overdispersion, and truncation. The model corrects for endogenous stratification and truncation by weighting each observation prior to the parameter estimation. The dependent variable visits was weighted by the number of days the angler fished in the previous 12 months. Overdispersion results from neglected or unobserved heterogeneity in the dependent variable, this is corrected for by adding the additional parameter (α) to include the missing heterogeneity. The negative binomial model typically takes the form:

$$\lambda = \exp(\beta_0 + \beta_1 T + \beta_2 H + \beta_3 V + \beta_4 S + a) \quad (7)$$

where λ is the expected number of trips the average person will take "latent demand" and is defined as a function of variables that affect demand, β are coefficients, *T*, *H*, *S*, and *V* are the independent variables where *T* is travel cost, *H* is household

income, and *S* is substitute site opportunity cost and the parameter α determines the degree of dispersion in the predictions (Parsons 2003; Martinez-Espineira et al. 2008). Only statistically significant variables ($P \leq 0.05$) and those that were not collinear with other variables were used in the model (Ward and Beal 2000). The coefficient for travel cost was used to estimate consumer surplus, thus travel cost must be a significant variable in the TCM and must be negatively associated with the dependent variable (Kling 1989; Parsons, 2003). Outliers of variables used in the model were removed using Cook's Distance and Studentized Residuals Versus Leverage Statistic tests (SAS 2009).

II.7 Consumer Surplus

Parsons (2003) methodology was used to estimate consumer surplus on a per angler visit basis, which is the willingness to pay (WTP) to fish above the actual travel costs incurred by the angler. The consumer surplus per angler visit was estimated using:

$$CS = (\hat{\lambda}/-\hat{\beta}_1)/\hat{\lambda} = 1/-\hat{\beta}_1 \qquad (8)$$

where ^ denotes the estimated value using the results from the negative binomial regression in equation (7). To estimate the aggregate consumer surplus for the entire fishery, this value was multiplied by total visits estimated. The standard error of the consumer surplus per angler visit applied the second-order Taylor series approximation (Englin and Shonkwiler 1995) which was estimated using:

$$Var\left(\frac{1}{-\hat{\beta}_1}\right) = (\Upsilon^2/\hat{\beta}_1{}^4) + 2(\Upsilon^4/\hat{\beta}_1{}^6) \qquad (9)$$

where Υ is the standard error of $\hat{\beta}_1$.

Travel cost models were used to calculate consumer surplus for all anglers and the bass and crappie fisheries individually. Consumer surplus was also calculated for local, nonlocal, border state, and non-border-state anglers regardless of their target species. Additionally, consumer surplus was calculated for shore anglers, anglers who made overnight visits, and those who made daytrips.

III. RESULTS

III.1. *Descriptive Survey Statistics*

On-site sampling of Lake Guntersville was composed of 168 roving creel surveys, resulting in 801 interviews during 120 sampling days from January 2012 through December 2012. Each roving creel survey resulted in an average of 4.8 interviews. Only nine on-site interviews were refused by anglers, translating to a response rate of 99%. Of the 801 interviews, 35 (4%) were parties previously sampled in the study. Interviews were conducted with 104 bank angling parties (13%) and 697 boat angling parties (87%).

A total of 12,558 angling boats were observed during 66 aerial boat counts, of which 432 were pontoon boats. Based on counts made during the roving creel surveys, 59% of pontoon boats observed in the aerial flights were used for recreational angling, translating to approximately 254 total angling pontoon boats. Average aerial boat counts were similar across the three major sections, especially when accounting for area (Table 1). Aerial counts estimated a mean boat density of 7.92 boats per 1,000 ha during the 12 month sampling period (Table 1). Maximum boat density observed was 35.49 boats per 1,000 ha on March 17, 2012. More boats (65%) were counted during weekend flights

than weekday flights in all seasons (Table 2). Weekend aerial boat counts observed the majority of angling boats during the AM shift (53%), followed by Noon (32%), and PM (15%). The majority of angler boats on weekday flights were observed during the PM shift (40%), followed by AM (38%), and Noon (23%).

Most interviews during the roving creel survey occurred during the spring (42%) followed by winter (23%), summer (20%), and fall (14%) (Table 3). Overall the majority of parties interviewed were targeting bass (65%) followed by crappie (23%), anything (4.6%), sunfish (4.3%), and catfish (2.2%). These percentages were strongly influenced by season. In all seasons, the majority of parties were targeting bass, but they composed a greater percentage of anglers in the spring (67%) and summer (73%) than they did in the fall (63%) winter (53%) (Table 3). In contrast, crappie angling parties made up the lowest percentage of angling parties in the summer (11%) and the highest (40%) in the winter. Angling parties targeting catfish and sunfish were contacted almost exclusively in the spring and summer (98%), while the majority (76%) of anything anglers were contacted in the spring and winter seasons (Table 3). Thirty-four percent of all bass angling parties said their trip was directly related to a tournament, of these, 46% were currently competing in a tournament and 54% were practicing for an upcoming tournament. The highest percentage of bass angling trips related to tournaments occurred during the fall and winter (45%), followed by summer (40%), and spring (22%).
The majority (41%) of bass angling parties were contacted while fishing in section B, whereas most parties fishing for crappie (40%), sunfish (43%), catfish (67%), and anything (51%) were contacted in section A (Table 4). Most bass (54%), sunfish (54%), and anything (67%) angling parties were contacted during the noon shift, while most

crappie parties (47%) were contacted during the AM shift, and most catfish parties (55%) were contacted during the PM shift (Table 5). The majority of shore effort targeted crappie (61%) and anything (20%), while catfish, sunfish, and bass made up the remaining 19% (Table 7). Most (61%) of the shore angling parties were contacted in section A, followed by section C (23%), and section B (14%).

III.2. ***Effort and Catch***

Total angling effort was estimated at 1.35 million h (SE, 196,000 h) with an estimated 204,000 annual trips (Table 7). Most of this was associated with boat anglers; however, estimated annual shore angling effort was 63,615 h (SE, 11,474 h) resulting in approximately 15,200 trips. In the follow up telephone survey, 35% of anglers indicated that they had fished Lake Guntersville at night in the previous 12 months. These anglers averaged 14 night angling trips per year; which resulted in an estimated 16,400 night angling trips on Lake Guntersville in 2012. Since we did not ask the length of these trips, night effort in hours cannot be calculated (Figure 8).

Excluding shore effort which was minimal at 3,800 h (SE, 680 hours), bass anglers fished 965,000 h (SE, 144,750 h) over 134,000 trips (Table 7). Mean bass trip length was 7.46 h, average CPE was 0.64 bass/h, average HPE was 0.02 bass/h, and average LPUE (livewell fish per h) was 0.05 bass/h (Table 7). Tournament bass anglers had a higher CPE (0.73 bass/h) compared to non-tournament anglers (0.62 bass/h). Tournament anglers who were currently competing when interviewed had an average LPE of 0.19 bass/h.

Boat anglers fishing for crappie fished 214,000 h (SE, 32,100 h) and shore anglers fished 38,800 h (SE, 7,000 h) (Table 7). CPE was similar between boat and shore anglers

at 2.55 and 2.40, respectively. Including shore effort, sunfish anglers fished 62,000 h (SE, 8,850 h) over 13,000 trips. Average CPE was 4.57 sunfish/h, and average HPE was 1.83 sunfish/h (Table 7). Including shore effort, catfish anglers fished 24,000 h (SE, 3,750 h) over 5,500 trips and had a mean trip length of 4.27 hours (Table 7). Catfish anglers caught an average of 0.33 catfish/h and harvested an average of 0.27 catfish/h (Table 7).

Anglers that were not targeting a specific species fished for 29,000 h (SE, 4,350) from a boat and 12,700 h from the shore (SE, 2,300), resulting in an estimated 8,700 trips. These anglers caught an average of 1.57 fish per h and harvested an average of 0.39 fish per h.

III.3. ***Angler Socioeconomic Characteristics***

Party size among target species ranged from a mean of 1.71 for crappie angling parties (N=179) to 1.97 for sunfish angling parties (N=33) (Table 8). Sunfish angler party size was significantly greater than bass parties (P=0.044) and crappie parties (Table 8: P= 0.031. (F=2.18; df=4, 798; P=0.0691).

Average expenditures per angler day collected in the follow-up telephone survey ranged from $81.00 (SE, 5.26) for bass anglers to $28.00 (SE, 11.01) for catfish anglers (Figure 7). Bass anglers spent significantly more than crappie anglers per angler day (P < 0.0001) and anything anglers (P = 0.0137). Estimated total expenditures and local expenditures per angler visit reported in the roving creel survey among all anglers was $150 and $113, respectively (Table 8). There was a significant difference in expenditures reported on-site and expenditures reported in the follow-up telephone survey (Table 9: P< 0.001).

Anglers originated from 29 counties within Alabama and 19 states (Tables 10 and 11). Overall 64% of anglers were from the state of Alabama, 17% were from border states, and 16% were non-border-states. Of the Alabama anglers contacted, 63% were local anglers (Table 10).

Bass anglers traveled the farthest on average to fish at Lake Guntersville (135 miles), followed by sunfish (90 miles), crappie (40 miles), anything (36 miles), and catfish (31 miles) (Table 12). A total of 357 local anglers were interviewed. Of these, 53% were targeting bass, followed by crappie (31%), anything (7%), sunfish (6%), and catfish (4%). Nonlocal anglers participated in 203 interviews. The majority of nonlocal anglers were targeting bass (61%), followed by crappie (28%), anything (5%), sunfish (4%), and catfish (1%). A total of 214 out-of-state anglers were interviewed, of these, 116 were from border-states and 98 were from non-border-states. Bass anglers comprised 90% of out-of-state anglers, followed by crappie (6%), and sunfish (3%). One border-state party was targeting catfish and one was targeting "anything" which combined comprised 1.3% of the out-of-state trips.

Anglers made an average of 47 trips in the 12 months preceding the interview (N=774) and stayed an average of 2.04 days per visit (N=452). Sunfish angler visits were the longest (Mean, 2.69 days, N=13) followed by bass anglers (Mean, 2.35 days, N=303, Table 12). Anything angler visits were shortest on average at 1.10 days (N=20). Bass anglers fished the most days (Mean, 49 days, N=508) in the 12 months preceding their interview, while sunfish anglers fished the least (Mean, 22, N=34, Table 12).

Angler guide use on Lake Guntersville was minimal; two of the 801 parties surveyed were on a guided trip. Both of these parties were targeting bass. Among all

anglers mean roundtrip distance to the preferred substitute site was 120 miles. Wheeler Reservoir was the most common substitute site among all anglers (15%). The average distance to Wheeler reservoir was 46 miles for those who chose it as an alternate site. Preferred substitute sites varied greatly among all anglers with 11% responding that they would not fish a lake other than Guntersville and 5% willing to travel more than 500 miles to an alternate site. Preferred substitute sites varied among angler groups by location of residence, as well based on target fish categories. Wheeler Reservoir was the most common substitute site mentioned among bass anglers. The overall mean distance from a bass angler's residence to their preferred substitute site was 149 miles. Mean one-way distance to Wheeler Reservoir was shorter at 52 miles (Table 12). Weiss Reservoir was the most common substitute site for crappie anglers with a mean distance of 49 miles from the angler's residence (Table 12). Mean substitute site distance among all crappie anglers was 47 miles. The most common response for sunfish, catfish, and anything anglers was "nowhere," indicating that these anglers would not target these species if they could not do so on Lake Guntersville (Table 12).

Among all anglers, average age was 46 years, household income was $90,000, and mode race was Caucasian. Mean angler age varied from 56 years old for catfish anglers (N=7) to 43 years for bass anglers (N=301) (Table 12). The mean trip rating for all anglers was 3.14 out of 5.0. Trip rating ranged from 2.8 among catfish anglers to 3.6 for sunfish anglers. Crappie and bass anglers had an average trip rating of 3.2 followed by anything at 3.1. The most common reasons for an excellent or good trip were catching fish followed by just being on the water. The number one reason anglers didn't enjoy their trip was because of low catch rates.

Party size among non-border-state anglers was significantly greater than local, nonlocal, and border state angling parties (Table 14: F=6.89; df=3, 798; P < 0.0001;). Local anglers (from Marshall, Jackson, or Madison County) traveled an average of 20 miles compared to 57 miles for nonlocal anglers, 140 miles for border state anglers, and 465 miles for non-border-state anglers (Table 14). Local angler's average visit was 1.12 days, which was less than nonlocal anglers (1.62 days), border state anglers (2.73 days), and non-border-state anglers (5.55 days) (Table 22). Party size was greater among non-border-state angling parties (Mean, 2.09) than border state parties, nonlocal parties, and local parties (Table 14; F = 6.89; df = 3, 798; P <0.0001).

Local anglers averaged significantly more trips (Mean, 66) than nonlocal anglers (Mean, 40), border state anglers (Mean, 18), and non-border-state anglers (Mean, 8) (Table 14; F = 23.5; df = 3, 772; P < 0.0001). The average opportunity cost of travel for non-border-state anglers was $386.00, which was greater than border state anglers (Mean, 71.08), nonlocal anglers (Mean, 31.88), and local anglers (Mean, 11.43) (Table 14; F = 37.14; df = 3, 347; P <0.0001). Total visit cost per angler was also greater for non-border-state anglers $591.45, than border state anglers (Mean, 266.52), nonlocal anglers (Mean, 135.82), and local anglers (Mean, 49.52) (Table 14; F = 53.40; df = 3, 451; P < 0.0001).

Income among non-border-state anglers was significantly greater than that of local, non-local, and border state anglers (Table 14; F = 3.24; df = 3, 357; P = 0.022). Income was similar among local, non-local, and border-state anglers. Bass anglers had the highest average income of $99,600, which was significantly greater than crappie,

catfish, and anything anglers. Sunfish anglers average income was $90,700 which was significantly greater than anything anglers (Table 12; $F = 7.48$; $df = 4, 357$; $P < 0.0001$).

Of the anglers who made overnight visits, 34% stayed in a hotel, 30% rented a cabin or house, 7% used a RV park, 6% stayed at a state or county site,10% stayed with friends or family, and 11% used their own private property. Anglers booked their trips an average of 65 days in advance, and 15% of non-border-state anglers heard about Lake Guntersville through television or internet advertising.

III.4. *Expenditures and Tax Revenue*

Among all anglers, fuel expenditures comprised the greatest percentage of expenditures per visit (40%), followed by lodging (23%), groceries (11%), restaurant meals (9%), and equipment expenditures (5%) (Tables 13). The remaining 12% of expenditures were for repairs, guide fees, launch fees, license sales, tournament fees, and miscellaneous items. Anglers reported in the roving creel survey that the majority of their items (75%) were purchased within the local counties (Table 8).

A total of 204,000 angler trips occurred based upon the estimated hours of effort and the average hours per trip for each species. Anglers from the local counties spent a total of $1.40 million (12 %), while nonlocal anglers were responsible for $2.46 million (20%) of all expenditures. Anglers from border and non-border-states were responsible for $2.91 million (24%) and $5.50 million (45%) of total expenditures, respectively.

Daytime boat angling on Lake Guntersville generated $12,300,000 in direct expenditures. An estimated $10.8 million was spent within the State of Alabama, of which 92.5% ($9.9 million) was spent locally (Table 15). Additionally, night angling

generated approximately $1.14 million and shore anglers spent approximately $0.49 million.

Bass anglers made the majority of expenditures ($9.8 million), followed by crappie ($1.4 million), sunfish ($0.7 million), anything ($0.3 million), and catfish ($0.1 million).

Total tax revenue gained by the State of Alabama and local governments through recreational angling on Lake Guntersville was $1.04 million. The state of Alabama received $610,000 of this revenue. General sales generated 46% of this revenue followed by fuel sales (32%), and lodging (22%) (Table 16). The State of Alabama used 28% of these funds to support road maintenance, 46% was used to support state health services, human welfare, and education, 13% was placed in the general fund, 4% was used to promote tourism, and the remaining 10% was returned to the counties for road maintenance, education, and tourism (Table 17).

Tax revenue totaled $425,600 for the local counties of Jackson, Marshall, and Madison and cities of Guntersville and Scottsboro. Jackson County collected $109,000 in tax revenue which was distributed into the community as follows: 9% to roads and bridges, 51% to education, and 40% to tourism (Tables 16 and 17). Recreational angling generated $48,000 of tax revenue for Marshall County (Table 16). These funds were used for tourism (69%), education (25%), and roads and bridges (6%) (Table 26). Madison County received $3,900 of tax revenue which was used for roads and bridges (62%) and education (38%) (Tables 16 and 17).

The city of Scottsboro received $100,200 in tax revenue generated by general sales (59%), lodging (35%), and fuel (6%). The general fund received 79% of this

revenue, 15% was used to support education, and roads and bridges received 6% (Tables 25 and 26). The city of Guntersville received $164,300 in tax revenue generated by general sales (66%), lodging (33%), and fuel (1%). These funds were used to support the general fund (74%), education (16%), and tourism (9%) (Tables 16 and 17). Expenditures, tax revenue, and tax revenue distributions estimates for each fishery is available in tables 18-27.

III.5. *Travel Cost Model and Consumer Surplus*

Binary variables that were significant in explaining angler visitation to Lake Guntersville included, being a nonlocal Alabama angler, out-of-state angler, non-Caucasian angler, and fishing club member. Non-binary variables included travel cost, tournament participation at Lake Guntersville, years of angling experience, and household income (Table 28). An increase in tournament participation, years of angling experience, and being a fishing club member positively influenced visitation, while an increase in the remaining variables were associated with a decrease in visitation. The out-of-state angler variable was most influential in explaining visitation with a parameter estimate of -0.865. Consumer surplus among all anglers was $156 per angler day (SE, $14) and average length of stay was 1.94 days. Total willingness to pay (WTP) was $270 per angler day which was calculated by summing the consumer surplus and travel cost ($114). Thus, consumer surplus represented 70% of the total WTP. Aggregate consumer surplus for the fishery was estimated at $31.8 million. Travel cost per day was derived by dividing the travel cost per visit ($222) by the average length of stay.

Significant variables in explaining bass angler visitation to Lake Guntersville included travel cost, tournament participation at Lake Guntersville, years of angling

experience, nonlocal Alabama angler, out-of-state angler, income, non-Caucasian angler, club membership, and length of visit (Table 29). An increase in tournament participation, years of angling experience, length of visit, and club membership positively influenced visitation while an increase in the remaining variables were associated with a decrease in visitation. The non-Caucasian angler variable was the most influential in explaining visitation with a parameter estimate of -0.876. Consumer surplus among bass anglers was $240 per angler day (SE $39) and average travel cost was $129, resulting in a total WTP of $369 per angler day. Average length of stay among bass anglers was 2.19 days. Consumer surplus represented 65% of the total WTP and aggregate consumer surplus for the bass fishery was estimated at $31.0 million. Travel cost per day was derived by dividing the travel cost per visit ($282) by the average length of stay.

Crappie angler visitation was explained by travel cost, income, and non-Caucasian angler. An increase in income was associated with an increase in visitation while increased travel cost and being a non-Caucasian angler was associated with a decrease in visitation. Non-Caucasian angler was the most influential variable with a parameter estimate of -1.53 (Table 30). Consumer surplus among crappie anglers was $123 per angler day (SE, $32) and average travel cost was $54, therefore total WTP was $177 per angler day. Crappie anglers stayed an average of 1.16 days at Lake Guntersville. Consumer surplus represented 69% of the total WTP and aggregate consumer surplus for the crappie fishery was estimated at $5.78 million. Travel cost per day was derived by dividing the travel cost per visit ($54) by the average length of stay. Sample sizes for sunfish, catfish, and anything anglers were too low for an accurate estimate of consumer surplus.

Visitation to Lake Guntersville by local anglers was positively correlated with years of experience and club membership. Visitation was negatively associated with travel cost, age, and being a non-Caucasian angler, which was the most influential variable (Table 31). Mean consumer surplus for local anglers was $133 per angler day (SE $20) and average travel cost was $35 per angler day which resulted in a total WTP of $168 per angler day. Average length of stay among local anglers was 1.12 days. Consumer surplus accounted for 79% of the total WTP among local anglers and aggregate consumer surplus was estimated at $12.5million. Travel cost per day was derived by dividing the travel cost per visit ($39) by the average length of stay.

Visitation to Lake Guntersville by nonlocal anglers was negatively correlated with travel cost but not significantly correlated with any other variable (Table 32). Nonlocal angler's consumer surplus was $118 per angler day (SE $17) and average travel cost was $102 per angler day which resulted in a total WTP of $220 per angler day. Average length of stay was 1.72 days for nonlocal anglers. Consumer surplus accounted for 54% of the total WTP among nonlocal anglers and aggregate consumer surplus was estimated at $6.31 million. Travel cost per day was derived by dividing the travel cost per visit ($176) by the average length of stay.

Visitation to Lake Guntersville by border-state anglers was negatively correlated with travel cost and positively correlated with tournaments and age, which was the most influential variable (Table 33). Border-state angler's consumer surplus was $107 per angler day (SE $15) and average travel cost was $123 per angler day which results in a total WTP of $230 per angler day. Border-state angler's length of stay averaged of 2.6 days. Consumer surplus accounted for 47% of the total WTP among border state anglers

and aggregate consumer surplus was estimated at $3.30 million. Travel cost per day was derived by dividing the travel cost per visit ($320) by the average length of stay.

Visitation to Lake Guntersville by non-border-state anglers was negatively correlated with travel cost but not significantly correlated with any other variable. Consumer surplus of non-border-state anglers was $296 per angler day (SE $109) and average travel cost was $203 per angler day which resulted in a total WTP of $499 per angler day (Table 34). The average length of stay of these anglers was 5.63 days. Consumer surplus accounted for 59% of the total WTP among non-border-state anglers and aggregate consumer surplus was estimated at $7.98 million. Travel cost per day was derived by dividing the travel cost per visit ($1,145) by the average length of stay.

Visitation to Lake Guntersville by anglers who made overnight visits was negatively correlated with travel cost and positively correlated with tournaments, age, and non-local anglers. Being a non-local angler was the most influential variable with a parameter estimate of 0.52 (Table 35). Consumer surplus for overnight anglers was $110 per angler day (SE, $10) and average travel cost was $150 per angler day which resulted in a total WTP of $260 per angler day. Average length of stay among this group of anglers was 4.13 days and consumer surplus accounted for 42% of the total WTP. Travel cost per day was derived by dividing the travel cost per visit ($619) by the average length of stay.

Day trip angler visitation was positively correlated with tournaments and negatively correlated with travel cost, and being a non-local, non-Caucasian, or out-of-state angler. Visitation was influenced the most by being an out-of-state angler with a parameter estimate of -0.89 (Table 36). Consumer surplus was $175 per angler day (SE,

$35) and average travel cost was $52 per angler day which resulted in a total WTP of $227 per angler day. Consumer surplus accounted for 77% of the total WTP among daytrip anglers.

Shore angler visitation was negatively associated with travel cost, income, and being a non-Caucasian angler (Table 37). Consumer surplus was $91 per angler day (SE, $50) and average travel cost was $34 per angler day which results in a total WTP of $125 per angler day. There were no observations of shore anglers making multiple day trips. Consumer surplus accounted for 73% of the total WTP among shore anglers.

III.6. Contingent Valuation

Anglers were asked in the follow-up telephone survey if the availability of boat ramps and parking spaces was a limiting factor in the number of trips they made to Lake Guntersville. Of the 452 anglers interviewed, only 25 (5.5%) responded that they would make additional trips if they were guaranteed a parking space at the ramp of their choice. These anglers said they would make an average of 12 additional trips per year and mean expenditures per angler day among these anglers was $58. An outlier response of 150 additional trips was removed from the data. The season anglers indicated that access limited trips the most was spring, and the Mud Creek ramp most often limited visits.

V. DISCUSSION

V.I. *Aerial Boat Counts*

By supplementing the roving creel survey with aerial boat counts and follow-up telephone surveys, I was able to accurately estimate angling effort and expenditures for each of the four major fisheries on Lake Guntersville. Without aerial counts, expanding

effort from the creel section to the reservoir level could have significantly increased error in estimating effort. Aerial boat counts were able to enumerate angling boats in the study area in two hours, which efficiently quantified effort in the headwaters of tributaries and in the backs of large densely vegetated bays. Excluding these areas from the roving creel maximized the number of creels conducted in more heavily fished areas of the lake, thus increasing total interviews. Volstad et al. (2006) used aerial counts to estimate boat angling effort of American shad and striped bass in the Delaware River and Estuary. The target of less than 20% standard error was met for both species when combining aerial and access surveys but was not met with estimates based solely on either type of survey. Similarly, addition of aerial counts in the Lake Guntersville survey resulted in a standard error of total angling effort below 20%. Aerial counts were also used by Malvestuto (1978), Slipke et al. (1998), and Hanson et al. (2012) to aid in estimating angling effort.

V.2. ***On-site Angler surveys***

Each roving creel resulted in an average of 4.8 interviews. Hanson et al. (2012) averaged 1.9 interviews per creel in a similarly designed roving creel survey conducted on Smith Lake, Alabama in 2010. On-site surveys were denied by 2.6% of anglers in the Smith Lake study compared to 1.1% in this study (Hansen et al. 2012). It would have been difficult to approach anglers fishing from private property without interfering with their fishing or intruding on their privacy, therefore these anglers were not included in this study. Anglers were regularly observed fishing from private piers in the spring, but rarely in other seasons.

On-site surveys have a higher probability of interviewing an angler who frequents the lake multiple times compared to a one-time visitor and is known as endogenous

stratification or avidity bias (Englin and Shonkwiler 1995). In addition, to weighting each observation prior to the parameter estimation, endogenous stratification was corrected by applying a non-uniform probability sampling strategy, interviewing an angler only once for demographic and economic questions, and obtaining a large sample size (N=801). Thomson (1991) determined that fishing avidity did not influence an angler's expenditures per trip, applying a non-uniform probability sampling strategy could derive an avidity bias corrected sample, and a relatively precise estimate of mean trips per angler could be reached if the sample size is sufficiently large. Therefore, we do not expect endogenous stratification to influence our results.

Results from the roving-creel survey differed from those of an access-point creel survey conducted by the ADCNR from March 1, to May 13, 2011. A major difference in the two studies was in the distribution of effort among species, in the access-point survey 93% of interviewees targeted bass compared to only 65% in the roving-creel survey. The failure of the access-point survey to contact shore anglers likely contributed to this difference. Shore anglers made up 13% of all interviews in the roving creel and most (61 %) were targeting crappie. Also, sampling at major access points could oversample tournament bass anglers who rely on the large parking areas and well maintained ramps, while under sampling other anglers who may choose to avoid busy access points. The access-point survey reached more anglers (432) in 6 sampling days than the roving creel (304) in 15 sampling days over the same time period. The access point survey lasted 8 hours each day and was only conducted on weekends. Sixty percent of roving creel survey days lasted 4 hours and 50% of sampling occurred on weekdays.

V.3. ***Follow-up Telephone survey***

Follow-up telephone surveys were used to collect completed visit data and to keep the on-site interviews brief. Follow-up telephone survey response rate was 56% which was 43% higher than the response rate seen for mail-in surveys given to crappie anglers at Sardis Lake, Mississippi in 1995 (Dorr et al. 2002). The follow-up telephone survey response rate for crappie anglers at Lake Guntersville was 57%. Non-response in the follow-up telephone survey was due to anglers either denying permission to be contacted by telephone, wrong or disconnected telephone numbers, or I was not able to reach them in three call attempts.

Hanson et al (2012) found that anglers at Lewis Smith Lake, Alabama underestimated total visit costs by 28% in the roving creel as compared to the follow-up telephone survey. Anglers in the Lewis Smith Lake study were asked to estimate trip cost up to the point of the interview, and then to estimate future visit expenditures. In this study, the question was consolidated into one estimate for the entire visit. This may have led to a more accurate estimate as anglers underestimated expenditures by 12% in the on-site survey. Asking the anglers how much they spent on items individually during the follow-up telephone survey seemed to increase their ability to recall purchases and increase the accuracy of their estimate. The follow-up telephone survey allowed the creel clerk to clarify questions and ensure the angler was reporting expenditures correctly. This was especially helpful in aiding anglers that were unfamiliar with the local area to determine which town or county the purchases were made in.

In May through June of 2012, 445 hectares of the 792 hectare Roseberry Creek was treated with the aquatic herbicide fluridone. This project was coordinated by the

Roseberry Rescue Group a non-profit organization, and funded by the City of Scottsboro, Jackson County Legislative Commission, and lakefront property owners. Anglers were asked at the conclusion of the survey to provide any comments they had about the fishery. The most common response was on the issue of aquatic vegetation, 28.5% of all comments were directed at this topic with 23% of anglers wanting limited or no vegetation control and 5.5% wanting increased vegetation control. Of those wanting limited or decreased control, 25% said they were concerned with vegetation control because of herbicide pollution, or that it should be the responsibility of a government agency not lake residents. The remaining 75% were concerned solely due to the perceived effects it would have on their fishing experience. The second most common comment (25%) was that the angler was pleased with the current management practices, quality of fishing, and/or facilities. Improvement of boat ramps and associated amenities such as courtesy docks, ramp lighting, and public restrooms were the topic of 21% of comments, while poor fishing (5%), lack of law enforcement (5%), regulation and management concerns (11%), and limiting tournaments (4.5%) generated the remaining comments.

V.4. *Effort and Catch*

Wrenn et al. (1996) estimated Largemouth bass received 960,417 hours of angling effort in 1990; this estimate declined to 406,484 in 1993 and rose to 516,242 in 1994. Bass angling effort in this study was estimated to be 965,000 hours. The percent of anglers targeting bass, crappie, and anything was very similar to that of Lake Fork (Storey 2012) and Sam Rayburn Reservoir (Driscoll and Ashe 2011) two nationally acclaimed bass fisheries in Texas. The percentage of anglers targeting bass ranged from

73 to 76.4% among the three reservoirs. Crappie effort was equal at 17% at Lake Fork and Lake Guntersville but lower at 11.8% on Sam Rayburn Reservoir. Angling effort for anything was similar among the three reservoirs making up 2.3% to 3.6% of the total effort. Catch rates for crappie were similar among the reservoirs ranging from 2.36 to 2.57 fish/hour. Bass catch rates were similar between Lake Fork and Lake Guntersville at 0.60 and 0.64 bass/hour, respectively. Catch rates at Sam Rayburn Reservoir were almost twice as high at 1.20 bass/hour. The catch rate of bass by anglers is reflective of those observed by state agencies in annual electro-fishing surveys. CPE of electrofishing samples at Fork and Guntersville yielded 66.5 and 68.2 bass/hour respectively, whereas Sam Rayburn yielded 200 bass/hour. (Storey 2012, Floyd and Ekema 2011, and Driscoll and Ashe 2011).

Catfish angling was apparently more popular in the Texas reservoirs than at Lake Guntersville. Catfish anglers made up 5% of angler effort on Lake Fork and 12% of angler effort on Sam Rayburn Reservoir in 2011, but only 1.8% of the effort on Lake Guntersville. Catch rates for catfish were also higher at Lake Fork and Sam Rayburn Reservoir, (1.98 and 2.81 fish/hour, respectively), than at Lake Guntersville (0.33 fish/hour). No anglers reported that they targeted sunfish on Lake Fork and Sam Rayburn Reservoir, and few (5%) reported targeting this group on Lake Guntersville. Anglers on Guntersville targeting bass, crappie, catfish, and anything fished an average of 34 to 49 days per year, while anglers only targeted sunfish 22 days per year supporting the idea that this is a seasonal sunfish fishery. Total annual hours of effort per surface acre were similar at Lakes Fork and Guntersville (approximately 55 hours/ha). Which were much higher than at Sam Rayburn at (7.8/ha) (Driscoll and Ash 2011; Storey 2012).

V. 5. ***Expenditures and Tax Revenue***

The national survey of Fishing, Hunting, and Wildlife Associated Recreation is conducted every five years nationwide. While nationwide expenditures related to fishing increased from $36.0 billion to $41.8 billion between 2001 and 2011, expenditures in Alabama have decreased from $723 million to $456 million during the same time period. Specifically, expenditures decreased by $219 million since 2006 in Alabama (U.S Department of the Interior, Fish and Wildlife Service and U.S Department of Commerce, U.S. Census Bureau 2002, 2007, and 2012).

Anglers that resided in the local tri-county area generated $1.4 million, while non-local Alabama residents spent $2.5 million. Less than 1% of resident anglers indicated that they would travel outside the state to go fishing if they could not fish at Lake Guntersville. Thus, if recreational angling was not available at Lake Guntersville resident angling expenditures would still circulate in the Alabama economy and not provide additional economic impact to the State of Alabama (Crompton et al. 2001; Chen et al. 2003; Stoll and Ditton 2006). However, anglers indicated that there were no other angling options within the local counties around Lake Guntersville that could take its place, and 86% of them indicated that they would go elsewhere to fish while the remaining anglers indicated that they would not fish at all. Similarly out-of-state anglers spent approximately $8.4 million in direct expenditures to fish Lake Guntersville. Most of these anglers would choose to fish outside the state of Alabama if fishing was unavailable at Lake Guntersville; 16% of them said their alternate site was in Alabama; however none of them were in the tri-county area. Thus, loss of fishing opportunity in

Lake Guntersville would result in a severe economic loss within the local communities surrounding the reservoir.

Fuel for vehicle and boat travel was the largest expenditure category. The fuel tax rate was 0.00287% in Marshall County and Guntersville which generated $5,240 in tax revenue on $1.78 million in sales. By comparison, the tax rate in Jackson County and Scottsboro was 0.00862% and generated $16,200 in tax revenue on $1.84 million in sales. State of Alabama fuel tax rate was much higher (4.6%) and generated $197,000 in tax revenue for the state. Approximately 6.6% of fuel tax revenue collected by the State of Alabama is distributed back to local county and city governments. This revenue is distributed partly based on population (55%) and the remaining 45% is distributed equally among the 67 counties. Fuel expenditures related to recreational angling at Lake Guntersville resulted in $1,200 being distributed back to the local county governments by the state. A revision of the Alabama tax code that went into effect on 10/01/2012 increased the percentage of fuel tax revenue distributed back to local governments (Fulford 2012). This revision created most of the revenue distributed back to the tri-county area by the state and will continue to increase funds for local governments in 2013. In addition to returning more funds to local governments, the revision designates $0.0015 per gallon of the $0.16 per gallon fuel tax for the ADCNR. Recreational fishing on Lake Guntersville generated $319 of revenue for the ADCNR through this revision between October 1 and December 31 in 2012.

The second largest expenditure category was general sales which includes fishing equipment, groceries, restaurant meals, launch fees, and repair service purchases. These expenditures created the most tax revenue of any expenditure category. However, State

of Alabama tax revenue for general sales does not trickle down into the local county and city governments directly. Instead, a constant dollar amount ($378,000) was distributed back to local governments (half based upon population and half distributed evenly among the 67 Alabama Counties), which occurs regardless of angler expenditures (Fulford 2012). Because of the indirect effect of the State of Alabama general sales taxes, local taxes applied to expenditures contributed to the vast majority of local government funds.

Lodging was the third largest generator of tax revenue among the expenditure categories. Marshall and Jackson counties are within the Alabama Mountain Lakes Region which imposes an additional 1% lodging tax to promote tourism in Alabama. In addition, Marshall and Jackson counties impose a $1.00 per night tax on all hotel and rental cabins which also goes to promoting tourism in the counties.

This study calculated direct expenditures associated with individual trips, boat repair, maintenance, and equipment expenditures generally occur separate from individual trips. Therefore, it is expected that expenditures for these items total much more than what was documented in this study.

Recreational Fishing on Lake Guntersville generated a significant percentage of the lodging tax revenue collected by Marshall and Jackson Counties, 15 and 20% respectively. However, the percentages of tax revenue for general sales and fuel generated by recreation angling were much lower ranging from 0.02% and 1.82%. These expenditures made up a negligible percentage of revenue in Madison County.

V. 6. *Consumer Surplus*

This study examined 17 survey variables to better understand what factors explain angler demand at Lake Guntersville. The variable distance was collinear with travel cost in all models and was removed from the analysis. The variable alternate site opportunity cost was not significant in any models and was not included in the analysis. We found that an increase in travel cost decreases visitation among all angling groups. Being a non-Caucasian angler was negatively associated with visitation in six out of the ten models, this variable was not significant in the other four models. An increase in years of angling experience was associated with an increase in visitation in three of the ten models. When applicable, being a nonlocal or out of state angler was negatively correlated with visitation. Tournament participation or club membership was positively correlated with visitation in five out of ten models and was not significant in the other five. An increase in income was associated with a decrease in visitation in three models and was positively related to visitation in one model. Income was not a significant variable in the other six models (Tables 37-46).

A negative binomial model was used to estimate a mean consumer surplus per angler day of $156 at Lake Guntersville. These results were similar to several other studies that used a negative binomial model to estimate consumer surplus. Prado (2006) estimated a mean consumer surplus of $112 per angler day for trout anglers on the Lower Illinois River, Oklahoma. Lothrop (in press, 2012) also used a negative binomial model to estimate a mean consumer surplus of $77 per angler visit for striped bass angling at Lewis Smith Lake, Alabama. Shrestha (2001) estimated a mean consumer surplus of $86 per angler day among recreational anglers at the Brazilian Pantanal. A high consumer

surplus was expected at Lake Guntersville due its reputation as a premier fishing destination. Other premier fishing destinations had similar consumer surplus estimates such as the Snake River, Idaho ($159; Kerkvliet et al. 2002) and Yellowstone National Park ($172; Nowell and Kerkvliet 2000).

Lewis Smith Lake and Lake Guntersville are located in North Alabama within 40 miles of each other. However, the fisheries and the anglers that visit them are very different. In 2010, 22% of Lewis Smith Lake angling parties targeted striped bass and 65% targeted Largemouth bass and Alabama bass *Micropterus henshalli* (Hanson et al. 2011). Similarly in this study 65% of angling parties targeted bass, however striped bass angling is not available on Lake Guntersville. Crappie angling parties made up 18% of boat angling parties contacted in this study. The overall out-of-state angler percentage at Lake Guntersville was 28%, while 37% of bass anglers were from out-of-state. There were no observed out-of-state anglers targeting bass at Lewis Smith Lake, however 7% of striped bass anglers were from out-of -state. Lake Guntersville bass fishing is often featured on television shows and magazine articles attracting anglers from across the country. There are few quality bass fishing destinations for anglers that reside in Kentucky, Indiana, and Ohio, which helps to explain the high visitation rate (Table 11). Anglers from these states made up 62% of all non-border-state anglers, in comparison anglers from the states of Florida and Mississippi made up 2% of the non-border-state anglers. However, there are several quality substitute striped bass fisheries in Tennessee and Northern Georgia that anglers would likely visit instead of traveling the extra distance to fish at Smith Lake, thus resulting in a lower consumer surplus among striped bass anglers at Lewis Smith Lake.

Consumer surplus at Lake Fork, Texas, a premier reservoir known for trophy Largemouth bass, was estimated at $32 per angler day by Hunt and Ditton (1996). However, this estimate was reached using the open-ended question or "bid" method. Similarly, the bid method resulted in a relatively low consumer surplus estimate of $9 per angler day for crappie anglers at Sardis Lake, Mississippi (Dorr et al. 2002); while my study estimated a consumer surplus of $123 per angler day for crappie anglers at Lake Guntersville. The Sardis Lake study presented anglers with a dichotomous-choice contingent valuation (CV) question which presented a bid of $3 to $400 that the angler could accept or decline. The model also included trip satisfaction and angler behavior questions which were hypothesized to affect WTP. The bid method can be subject to anchoring bias in which anglers rely too heavily or 'anchor' their decision based on the bid amount that was presented to them. For example, a respondent may regard the proposed amount as conveying an approximate value of the amenity's true value and anchor his WTP amount on the proposed amount (Herriges and Schogren 1994).

Consumer surplus was similar among local, non-local, and border-state anglers ranging from $133 to $107 per angler day. However, consumer surplus was much higher for non-border-state anglers at $296 per angler day.

VI. *Conclusions and Management Implications*

As expected, bass anglers put forth the most angling effort, traveled the farthest, and were responsible for 80% of expenditures. Trips related to tournaments generated approximately $3.2 million of the total expenditures. Amateur big bass tournaments such as the Oakley Big Bass and Sealy Outdoors Big Bass Splash can significantly increase fishing tourism in off seasons. For example, the average aerial boat count for the fall

season was 172 (SD, 173). Aerial boat counts on the days of the Oakley Big Bass Tournament and the Gambler Lures Tournament were 642 and 278, respectively. Average fall boat counts excluding these tournament days was 91 (SD, 38). Details of the economic impacts of such tournaments are currently being evaluated by researchers at Auburn University.

In addition to the bass fishery, the crappie fishery also made significant contributions to the local economies. Shore based angling generated $480,000 in expenditures, the majority of which was spent by anglers targeting crappie. Although there are public piers and parks available to shore anglers, these facilities are not located in prime fishing areas and anglers reported that catch rates at these locations were relatively low. The vast majority of shore angling occurred at bridges where anglers reported high catch rates of crappie. Shore access to these bridges is difficult due to steep slippery rip-rap banks and lack of facilities such as walkways, lighting, restrooms, trashcans, or piers. Also, use of this fishery may be limited by the lack of parking areas or signage that informs the public of these fishing opportunities. At Lake Havasu, Arizona six public fishing sites were constructed with amenities such as parking lots, walking trails, fishing piers, restrooms, and picnic areas (Jacobsen and Koch 2008). These sites were constructed in areas known to be productive fishing locations and artificial fish attractors were placed close by to provide a quality fishing experience to visitors. These shoreline facilities received more than 80,000 angler use days per year which was a 200% increase in fishing activity (Jacobsen and Koch 2008). Shore-angler effort could potentially be increased at Lake Guntersville by constructing proper facilities for these anglers, which would translate into increased economic value and tax revenue

for the state of Alabama and local communities. In addition to increased revenue, such public fishing areas would help to provide quality fishing experiences to children, beginning anglers, and physically challenged anglers.

Sunfish anglers put forth 62,000 hours of effort constituting 4% of total effort. While this was a small percentage of the total effort, 17% of anglers targeting sunfish were out-of-state anglers and spent $700,000. Bluegill L. *microchirus* are a popular species for anglers in many parts of the country. A creel survey on Two Sisters Lake, Wisconsin documented 14% of effort was for sunfish (Tobias and Blonski 2012), Potoka Lake, Indiana sunfish effort was 57% (Carnahan 2000), and Lake Seminole, Georgia sunfish effort was 29% (Slipke et. al 1998). Sunfish are normally a small component of fisheries in Southeastern U.S reservoirs (Lovell and Greene 2009, Driscoll and Ash 2011, and Storey 2012); however, sunfish anglers showed a willingness to travel to Lake Guntersville in 2012, and promotion of sunfish angling opportunities at Lake Guntersville to the appropriate markets would help maximize fishing tourism.

Boat ramps and parking areas appear to be sufficient for the majority (94%) of anglers. However, 21% of comments in the follow-up telephone survey were based on the improvement of boat ramps and associated facilities while only 1% commented positively about ramps and facilities.

With demand for water resources increasing, conflicts among user groups over the use of water are expected to increase. Resource management decisions are often made based largely on economic benefits, so knowledge of the economic value of recreational fisheries is needed to allow a more balanced decision approach. When water use

decisions impact fisheries, these economic estimates of recreational angling expenditures and state/local tax revenue are important.

A goal of this study was to aid local Chambers of Commerce and tourism bureaus in realizing markets and recognizing successful advertising campaigns. Fifteen percent of non-border-state anglers said they heard about Lake Guntersville through a media source or by a tournament being held there. Non-border-state anglers were responsible for 45% of all expenditures observed in this study. Consumer surplus per angler day for these anglers was $296 which multiplied by the average length of visit (5.63 days) results in a consumer surplus of $1,666 per angler visit. Anglers from Indiana, Kentucky, West Virginia, and Ohio made up 70% of all non-border-state anglers. It is recommended that the chambers of commerce and tourism bureaus direct advertising resources to these markets.

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VIII. Tables

Table 1. Boat counts during 66 aerial surveys for each major reservoir section, including boat angling effort (angling boats per 1,000 water surface acres), Lake Guntersville, Alabama from January 2012 through December 2012.

Section	Mean	Std Dev	Total	%	Hectares	Boats per 1,000 Hectares
A	55.6	52.1	3,666	29	7,336	7.57
B	72.2	67.3	4,767	38	8,986	8.03
C	62.5	63.9	4,125	33	7,831	8.00
Total	190.3	-	12,558	100.0	24,153	-
Average	-	-	-	-	-	7.92

Table 2. Weekend and weekday strata aerial angler boat counts by season, an equal number of flights occurred on weekends and weekdays, Lake Guntersville, Alabama from January 2012 through December 2012.

	Spring (N=17)	Summer (N=21)	Fall (N=11)	Winter (N=17)	Total (N=66)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Weekend	449.5 (287.1)	159.5 (75.7)	247.5 (25.1)	166.5 (130.1)	244.9 (209.5)
Weekday	277.9 (120.8)	79.9 (25.1)	82.2 (44.1)	66.8 (54.0)	132.3 (116.3)

Table 3. Anglers targeting specific species by season contacted during the on-site roving creel survey, Lake Guntersville, Alabama from January 2012 through December 2012.

	Spring	Summer	Fall	Winter	Total
Angler Type	N	N	N	N	N
Bass	235	118	72	98	523
Crappie	57	18	39	74	188
Sunfish	25	9	1	0	35
Catfish	7	11	0	0	18
Anything	16	6	3	12	37
Total	340	162	115	184	801

Table 4. Anglers targeting specific species by reservoir section contacted during the on-site roving creel survey, Lake Guntersville, Alabama from January 2012 through December 2012.

	Bass	Crappie	Sunfish	Catfish	Anything	Total
Section	N	N	N	N	N	N
A	149	76	15	12	19	271
B	216	69	12	1	6	304
C	158	43	8	5	12	226
Total	523	188	35	18	37	801

Table 5. Angling parties targeting specific species by sampling time block (morning [AM], noon [NN], and evening [PM]) contacted by the on-site roving creel survey, Lake Guntersville, Alabama from January 2012 through December 2012.

	AM (N=45)	NN (N=70)	PM (N=52)	Total (N=167)
Angler Type	N	N	N	N
Bass	101	284	138	523
Crappie	56	88	44	188
Sunfish	4	19	12	35
Catfish	2	6	10	18
Anything	6	23	8	37
Total	169	420	212	801

Table 6. Comparison of ADCNR access point creel survey data collected between March 1st and May 13th 2011 and data collected during the roving creel survey, Lake Guntersville,

	Auburn Data 01/01/2012 - 12/31/12	Auburn Data 03/01/2012 - 05/13/2012	ADCNR Data 03/01/2012 - 05/13/2012
Parties Interviewed	801	304	432
Mean Trip Length (Hours)	6.75	7.22	7.25
Parties Fishing for Bass	523 (65%)	209 (69%)	405 (93%)
Mean Trip Length for Bass Anglers (Hours)	7.83	7.46	7.10
Parties Fishing for Crappie	187 (23%)	55 (18%)	14 (3%)
Mean Trip Length for Crappie (Hours)	5.63	6.22	4.84
Parties Fishing for Anything	37 (4.6%)	13 (4.3%)	3 (0.7%)
Parties Fishing for Other Species	53 (7%)	24 (8%)	14 (3%)
Bass harvest rate (bass/hr.)	0.02	0.03	0.02
Bass catch rate (bass/hr.)	0.64	0.60	0.75
Crappie harvest rate (crappie/hour)	1.38	1.18	0.19
Crappie catch rate (crappie/hour)	2.54	3.10	0.53

Table 7. Angling effort (hours), catch rate (CPE), harvest rate (HPE), and percent total effort (%) by target species and method obtained by the on-site roving creel survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Method	Target Species	Effort	%	Trip Length	Trips	CPE	HPE	Harvest
Boat	Bass	965,000 (144,750)	75	7.46	129,332	0.64	0.02	19,300
	Crappie	214,000 (32,100)	17	5.60	38,200	2.55	1.33	284,620
	Sunfish	58,200 (8,730)	5	4.98	11,700	4.8	2.03	118,146
	Catfish	19,000 (2,850)	1	4.54	4,200	0.33	0.27	5,130
	Anything	29,000 (4,350)	3	5.26	5,500	1.57	0.39	11,310
	Boat Total	1,285,000	101	-	189,000	-	-	-
Shore	Bass	3,800 (680)	6	6.33	600	-	-	-
	Crappie	38,800 (7,000)	61	4.43	8,758	2.40	1.21	47,000
	Sunfish	3,800 (680)	6	2.95	1,288	-	-	-
	Catfish	5,000 (900)	8	3.86	1,295	-	-	-
	Anything	12,700 (2,300)	20	3.95	3,215	0.56	0.31	3,900
	Shore Total	63,615	100	4.30	15,157	-	-	-

Table 7. Continued.

Method	Target Species	Effort	%	Trip Length	Trips	CPE	HPE	Harvest
All data	Bass	968,800 (145,400)	72	7.47	129,932	0.64	0.02	19,300
	Crappie	252,800 (39,100)	19	5.63	46,958	2.47	1.33	284,620
	Sunfish	62,000 (9,400)	5	4.65	12,988	4.57	1.83	113,500
	Catfish	24,000 (3,750)	2	4.27	5,495	0.33	0.27	5,130
	Anything	41,700 (6,650)	3	5.15	8,715	1.57	0.39	11,310
	Total	1,349,000	101	-	204,000	-	-	-

Table 8. Mean party size, expenditures, and local expenditures (Marshall, Madison, and Jackson Counties) by target species per angler visit from the on-site roving creel survey, means with same superscript were not statistically different (One Way ANOVA; $P > 0.05$) and standard deviations are in parenthesis
, Lake Guntersville, Alabama from January 2012 through December 2012.

Angler Type	N	Party Size	Expenditures ($)	Local Expenditures ($)
Bass	509	1.74 [a] (0.58)	198.38 [a] (307.17)	147.33 [a] (255.28)
Crappie	179	1.71 [a] (0.80)	51.86 [b] (114.62)	44.41 [b] (108.27)
Sunfish	33	1.97 [b] (0.66)	135.20 [a] (275.58)	116.95 [a] (246.12)
Catfish	17	1.94 [b] (1.00)	16.99 [b] (11.59)	14.37 [b] (11.71)
Anything	34	1.91 [b] (0.64)	31.72 [b] (62.44)	27.99 [b] (54.73)
All Anglers	772	1.84 (0.76)	150.37 (270.78)	113.86 (225.01)

Table 9. Mean total expenditures by target species per party visit reported in the on-site roving creel survey, compared to mean total expenditures reported in the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Angler Type	N	On-Site Expenditures ($)	Follow-up Expenditures ($)	Difference in Means ($)	Degrees of Freedom	t-Value	P-Value
Bass	303	337	381	-44	299	-3.47	0.006
Crappie	108	95	95	0	107	0.01	0.995
Sunfish	13	320	346	-26	12	-0.57	0.581
Catfish	7	26	108	-82	6	-1.18	0.282
Anything	19	57	90	-33	18	-2.06	0.054
All Anglers	450	262	294	-32	446	-3.63	<0.001

[1]A paired t test was used to test for differences in means

Table 10. Alabama anglers contacted by county and target species from the on-site roving creel survey, Lake Guntersville, Alabama from January 2012 through December 2012.

County	Total	Bass	Crappie	Sunfish	Catfish	Anything
Marshall	253	116	80	15	13	16
Jackson	144	70	33	10	3	14
Madison	233	113	75	12	11	15
DeKalb	74	23	35	3	2	10
Jefferson	71	43	17	1	0	4
Blount	42	23	7	1	1	6
Etowah	34	16	9	5	2	0
Cullman	40	24	9	0	0	2
Tuscaloosa	7	2	5	0	0	0
Lauderdale	7	5	2	0	0	0
St. Clair	6	6	0	0	0	0
Limestone	4	2	2	0	0	0
Morgan	31	16	9	5	0	0
Franklin	4	4	0	0	0	0
Winston	2	2	0	0	0	0
Shelby	2	2	0	0	0	0
Calhoun	11	9	2	0	0	0
Walker	12	10	2	0	0	0
Clay	1	1	0	0	0	0
Colbert	2	2	0	0	0	0
Cherokee	5	4	1	0	0	0
Talladega	3	3	0	0	0	0
Mobile	2	0	0	2	0	0
Hale	4	4	0	0	0	0
Chilton	3	3	0	0	0	0
Chambers	4	2	0	0	0	0
Marengo	2	2	0	0	0	0
Dallas	4	4	0	0	0	0
Total	1,007	511	288	54	32	67

Table 11. All anglers contacted by state and target species from the on-site roving creel survey, Lake Guntersville, Alabama from January 2012 through December 2012.

State	Total	Bass	Crappie	Sunfish	Catfish	Anything
Alabama	993	539	296	56	33	69
Georgia	46	44	0	2	0	0
Tennessee	162	144	14	2	2	0
Kentucky	70	61	5	4	0	0
Ohio	22	22	0	0	0	0
Illinois	10	10	0	0	0	0
West Virginia	15	15	0	0	0	0
Indiana	34	24	5	3	0	2
Virginia	9	9	0	0	0	0
Michigan	6	6	0	0	0	0
Arkansas	9	9	0	0	0	0
North Carolina	6	6	0	0	0	0
Florida	5	3	0	2	0	0
Washington	3	3	0	0	0	0
Maryland	2	2	0	0	0	0
Missouri	7	7	0	0	0	0
Mississippi	2	2	0	0	0	0
Louisiana	1	1	0	0	0	0
California	2	2	0	0	0	0
Total	1,404	909	320	69	35	71

Table 12. Summary of angler variable means, SD in parenthesis, collected at, Lake Guntersville, Alabama from January 2012 through December 2012. Including distance- one way distance from the trip origination site to the reservoir access point, Visits- number of total days the angler fished Lake Guntersville divided by the length of stay, Length- number of days the angler was at Lake Guntersville, Access- did access to Lake Guntersville limit trips taken 1= yes, 0=no, Club Member- was the angler a member of a fishing club or organization 1= yes, 0=no, Age- anglers age, Household income- annual household income, Tournaments- number of tournaments the angler participated in on Lake Guntersville in the previous 12 months.

Variable	Bass	Crappie	Sunfish	Catfish	Anything
Distance (km)	217 (349)	64 (102)	144 (247)	50 (53)	58 (106)
Visits	49 (63)	41 (55)	22 (49)	35 (43)	39 (60)
Length (days)	2.3 (2.2)	1.3 (1.0)	2.7 (3.61)	1.3 (0.8)	1.1 (.45)
Access	0.08 (0.27)	0.12 (0.32)	0.0 (0.0)	0.0 (0.0)	0.06 (0.24)
Club Member	0.52 (0.50)	0.15 (0.36)	0.00 (0.00)	0.00 (0.00)	0.06 (0.24)
Substitute Site Dist (km)	241 (461)	77 (61)	95 (127)	50 (7)	80 (61)
Quality	3.2 (1.4)	3.2 (1.2)	3.9 (1.1)	2.9 (1.2)	3 (1.3)
Age	50 (14)	54 (14)	59 (11)	61 (12)	56 (11)
Household Income	99,800 (60,139)	71,343 (53,788)	90,750 (43,647)	33,333 (15,877)	42,656 (20,985)
Tournaments	6.1 (12.8)	2.0 (6.0)	0.2 (0.6)	0.0 (0.0)	1.0 (3.1)

Table 13. Summary of angler expenditures per party visit, SD in parenthesis, collected at, Lake Guntersville, Alabama from January 2012 through December 2012.

Variable	Bass	Crappie	Sunfish	Catfish	Anything
Fuel ($)	156 (182)	43 (57)	98 (168)	34 (35)	26 (23)
Lodging ($)	93 (195)	12 (55)	105 (203)	25 (67)	18 (54)
Groceries ($)	39 (69)	16 (32)	53 (112)	21 (46)	10 (10)
Restaurant ($)	38 (85)	6 (17)	23 (35)	9 (17)	12 (23)
Fishing Equipment ($)	28 (62)	10 (24)	40 (59)	4 (6)	0.06 (0.24)
Guide ($)	1 (22)	0 (0)	0 (0)	0 (0)	0 (0)
Tournament Fee ($)	12 (45)	0 (0)	0 (0)	0 (0)	0 (0)
Rental ($)	0 (2)	0 (0)	0 (0)	0 (0)	10 (46)
Launch Fee ($)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Repair ($)	6 (70)	5 (49)	13 (49)	14 (38)	10 (45)

Table 14. Summary of angler variables, including costs associated with travel by location of residency, Lake Guntersville, Alabama from January 2012 through December 2012. Distance was one way, opportunity cost was one-third of hourly wage rate multiplied by roundtrip travel time, and the mode ethnicity was Caucasian for each location. Local (Marshall, Madison, or Jackson County) non-local, border state, and non-border state angler mean variables with the same superscript were not statistically different (One Way ANOVA; $P > 0.05$).

Variable	Local	Non-local	Border-State	Non-Border State	Overall mean
N	357	203	117	97	-
Distance (miles)	20 [a]	57 [b]	140[c]	465[d]	105
Trips	66[a]	40 [b]	18[c]	8[d]	47
Length (days)	1.12 [a]	1.62 [b]	2.73[c]	5.55[d]	2.04
Party Size	1.67[a]	1.74 [a]	1.77[a]	2.09 [b]	1.78
Expenditures per angler visit($)	49.52[a]	135.82[b]	266.52[c]	591.45 [d]	171.00
Opportunity Cost ($)	11.43 [a]	31.88 [b]	71.08[c]	386.00[d]	74.99
Travel Cost ($)	49.52[a]	135.82[b]	266.52[c]	591.45 [d]	253.84
Substitute Site Distance (miles)	62.96[a]	51.32[a]	123.33[b]	464.75[c]	120.81
Substitute Site Opportunity Cost ($)	28.42 [a]	33.32 [a]	75.72[b]	339.03 [c]	77.47
Age	53 [a]	52 [a]	49[a]	51[a]	52
Income ($)	83,306[b]	86,122 [a]	98,008[a]	111,413[b]	90,111

Table 15. Angler expenditures and visitation by state residency, Lake Guntersville, Alabama from January 2012 through December 2012.

State	Total Expenditures ($)	State of Alabama Expenditures	Local Expenditures	Annual Visits	Population	Visitation Rate (Visits per 1,000 people)
Alabama	3,884,382	3,884,382	3,165,021	136,782	4,800,000	28.65
Georgia	623,237	483,287	437,067	6,806	9,900,000	0.67
Tennessee	2,287,628	1,876,249	1,861,701	23,967	6,500,000	3.58
Kentucky	1,395,540	1,172,310	1,130,694	10,356	4,400,000	2.28
Ohio	513,763	410,642	403,277	3,255	11,500,000	0.27
Illinois	170,057	133,229	133,229	1,479	12,900,000	0.11
West Virginia	531,257	460,546	460,546	2,219	1,900,000	1.13
Indiana	822,205	688,332	674,982	5,030	6,500,000	0.75
Virginia	364,146	294,631	286,345	1,332	8,200,000	0.16
Michigan	307,706	257,600	257,600	888	9,900,000	0.09
Arkansas	116,011	93,361	93,361	1,332	2,950,000	0.44
North Carolina	115,274	110,671	110,671	888	9,750,000	0.09
Florida	85,443	73,934	49,075	740	19,300,000	0.04
Washington	227,971	142,712	122,456	444	6,900,000	0.06
Maryland	148,789	114,170	114,170	296	5,900,000	0.05
Missouri	216,738	179,909	179,909	1,036	6,000,000	0.17
Mississippi	96,768	78,354	78,354	296	2,980,000	0.10
Louisiana	261,485	233,864	233,864	148	4,600,000	0.03
California	122,456	85,627	85,62	296	38,040,000	0.01
Total	12,300,000	10,773,000	9,877,000	197,600	-	-

Table 16. Tax revenue generated by angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012. The fuel tax rate was based on the average price per gallon for regular unleaded ($3.48) in the State of Alabama in 2012. Alabama fuel tax rate increased from $0.16 to $0.19 on 10/01/2012. (C. Ingram, AAA Alabama, personal communication). General sales tax in Marshall County does not apply to purchases made within the cities of Guntersville, Arab, Boaz, and Albertville.

Location	Lodging Tax	Lodging Expenditures (millions)	Lodging Tax Revenue	General Sales Tax	General Sales Expenditures	General Sales Tax Revenue	Fuel Tax	Fuel Expenditures	Fuel Tax Revenue
Guntersville	6.00%	$907,000	$54,400	4.00%	2,699,000	$108,000	0.00287%	$851,000	$ 2,240
Scottsboro	5.00%	$690,000	35,000	3.00%	$1,974,000	$59,000	0.00862%	$715,000	$ 6,200
Marshall County	1.00% + 1.00 per night	$1,476,000	$33,200	1.00%	$1,198,006	$12,000	0.00287%	$925,000	$2,700
Jackson County	2.00% + 1.00 per night	$1,177,000	$43,300	2.00%	$2,777,000	$56,000	0.00862%	$1,131,000	$9,700
Madison County	1.00%	$0.00	$0.00	1.50%	$101,000	$1,500	0.00862%	$213,000	$2,400
State of Alabama	5.00%	$2,653,000	$133,000	4.00%	$7,006,000	$280,000	4.60%	$3,728,000	$197,000
Total	-	$298,900	-	-	-	$516,500	-	-	$220,200

Table 17. Distribution of tax revenue generated by angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama during the 2012 calendar year roads and bridges in the city of Guntersville were funded through the general fund.

Location	Roads and Bridges	Education	Tourism	General Fund	Health Services / Human Resources/ Education/ State Parks
Guntersville	-	$27,000	$15,200	$122,100	N/A
Scottsboro	$6,200	$14,800	$0.00	$79,400	N/A
Marshall County	$2,700	$12,000	$34,000	$0.00	N/A
Jackson County	$9,700	$ 56,000	$44,100	$0.00	N/A
Madison County	$2,400	$1,500	$0.00	$0.00	N/A
State of Alabama	$172,000	N/A	$27,000	$80,000	$280,000
ADCNR	$0.00	$0.00	$0.00	$319	N/A

Table 18. Tax revenue generated by bass angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Lodging Tax	Lodging Expenditures	Lodging Tax Revenue	General Sales Tax	General Sales Expenditures	General Sales Tax Revenue	Fuel Tax	Fuel Expenditures	Fuel Tax Revenue
Guntersville	6.00%	$888,000	$53,300	4.00%	2,456,000	$98,000	0.00287%	$754,000	$2,000
Scottsboro	5.00%	$618,000	30,100	3.00%	$1,718,000	$51,500	0.00862%	$666,000	$5,800
Marshall County	1.00% + 1.00 per night	$1,456,000	$32,800	1.00%	$1,124,00	$10,200	0.00287%	$807,000	$2,600
Jackson County	2.00% + 1.00 per night	$1,001,000	$41,000	2.00%	$2,270,000	$45,400	0.00862%	$996,000	$8,800
Madison County	1.00%	$0.00	$0.00	1.50%	$43,000	$645	0.00862%	$155,000	$1,700
State of Alabama	5.00%	$2,458,000	$122,900	4.00%	$5,975,000	$239,000	4.60%	$3,183,000	$168,100

[1] The fuel tax rate was based on the average price per gallon for regular unleaded ($3.48) in the State of Alabama in 2012 (C. Ingram, AAA Alabama, personal communication).

[2] General sales tax in Marshall County does not apply to purchases made within the cities of Guntersville, Arab, Boaz, and Albertville.

Table 19. Distribution of tax revenue generated by bass angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Roads and Bridges	Education	Tourism	General Fund	Health Services / Human Resources/ Education/ State Parks
Guntersville	Funded by GF	$24,500	$13,325	$115,500	N/A
Scottsboro	$5,800	$12,885	$0.00	$68,800	N/A
Marshall County	$2,600	$10,200	$32,800	$0.00	N/A
Jackson County	$8,800	$45,400	$41,000	$0.00	N/A
Madison County	$1,700	$645	$0.00	$0.00	N/A
State of Alabama	$107,000	N/A	$24,500	$74,000	$239,000
ADCNR	$0.00	$0.00	$0.00	$269	N/A

Table 20. Tax revenue generated by crappie angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Lodging Tax	Lodging Expenditures	Lodging Tax Revenue	General Sales Tax	General Sales Expenditures	General Sales Tax Revenue	Fuel Tax	Fuel Expenditures	Fuel Tax Revenue
Guntersville	6.00%	$0.00	$0.00	4.00%	$74,000	$3,000	0.00287%	$88,000	$230
Scottsboro	5.00%	$42,500	$2,100	3.00%	$124,300	$3,700	0.00862%	$42,400	$370
Marshall County	1.00% + 1.00 per night	$0.00	$0.00	1.00%	$113,800	$1,100	0.00287%	$103,000	$330
Jackson County	2.00% + 1.00 per night	$74,300	$2,400	2.00%	$252,000	$5,000	0.00862%	$158,600	$700
Madison County	1.00%	$0.00	$0.00	1.50%	$24,300	$360	0.00862%	$29,900	$340
State of Alabama	5.00%	$74,300	$3,700	4.00%	$495,000	$19,800	4.60%	$391,800	$20,700

[1] The fuel tax rate was based on the average price per gallon for regular unleaded ($3.48) in the State of Alabama in 2012. Alabama fuel tax rate increased from $0.16 to $0.19 on 10/01/2012. (C. Ingram, AAA Alabama, personal communication).

[2] General sales tax in Marshall County does not apply to purchases made within the cities of Guntersville, Arab, Boaz, and Albertville.

Table 21. Distribution of tax revenue generated by crappie angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Roads and Bridges	Education	Tourism	General Fund	Health Services / Human Resources/ Education/ State Parks
Guntersville	Funded by GF	$750	$0.00	$2,500	N/A
Scottsboro	$370	$930.00	$0.00	$2,800	N/A
Marshall County	$330	$1,100	$0.00	$0.00	N/A
Jackson County	$700	$5,000	$2,400	$0.00	N/A
Madison County	$340	$360	$0.00	$0.00	N/A
State of Alabama	$18,000	N/A	$740	$2,200	$19,800
ADCNR	$0.00	$0.00	$0.00	$30	N/A

Table 22. Tax revenue generated by sunfish angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Lodging Tax	Lodging Expenditures	Lodging Tax Revenue	General Sales Tax	General Sales Expenditures	General Sales Tax Revenue	Fuel Tax	Fuel Expenditures	Fuel Tax Revenue
Guntersville	6.00%	$5,700	$340	4.00%	$54,000	$2,200	0.00287%	$4,700	$10
Scottsboro	5.00%	$29,000	$1,500	3.00%	$97,700	$3,000	0.00862%	$6,300	$60
Marshall County	1.00% + 1.00 per night	$5,700	$130	1.00%	$23,900	$240	0.00287%	$5,800	$20
Jackson County	2.00% + 1.00 per night	$101,300	$3,300	2.00%	$194,700	$3,900	0.00862%	$5,100	$50
Madison County	1.00%	$0.00	$0.00	1.50%	$900	$15	0.00862%	$3,400	$40
State of Alabama	5.00%	$107,000	$5,400	4.00%	$275,700	$11,000	4.60%	$83,600	$4,400

[1] The fuel tax rate was based on the average price per gallon for regular unleaded ($3.48) in the State of Alabama in 2012. Alabama fuel tax rate increased from $0.16 to $0.19 on 10/01/2012. (C. Ingram, AAA Alabama, personal communication).

[2] General sales tax in Marshall County does not apply to purchases made within the cities of Guntersville, Arab, Boaz, and Albertville.

Table 23. Distribution of tax revenue generated by sunfish angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Roads and Bridges	Education	Tourism	General Fund	Health Services / Human Resources/ Education/ State Parks
Guntersville	Funded by GF	$550	$85	$1,900	N/A
Scottsboro	$60	$730.00	$0.00	$3,700	N/A
Marshall County	$20	$240	$130	$0.00	N/A
Jackson County	$50	$3,900	$3,300	$0.00	N/A
Madison County	$40	$15	$0.00	$0.00	N/A
State of Alabama	$3,800	N/A	$1,100	$3,200	$11,000
ADCNR	$0.00	$0.00	$0.00	$7	N/A

Table 24. Tax revenue generated by catfish angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Lodging Tax	Lodging Expenditures	Lodging Tax Revenue	General Sales Tax	General Sales Expenditures	General Sales Tax Revenue	Fuel Tax	Fuel Expenditures	Fuel Tax Revenue
Guntersville	6.00%	$0.00	$0.00	4.00%	$2,100	$80	0.00287%	$2,300	$5
Scottsboro	5.00%	$0.00	$0.00	3.00%	$30,200	$600	0.00862%	$0.00	$0.00
Marshall County	1.00% + 1.00 per night	$0.00	$0.00	1.00%	$0.00	$0.00	0.00287%	$480	$2
Jackson County	2.00% + 1.00 per night	$0.00	$0.00	2.00%	$30,200	$600	0.00862%	$0.00	$0.00
Madison County	1.00%	$0.00	$0.00	1.50%	$12,200	$180	0.00862%	$14,000	$157
State of Alabama	5.00%	$0.00	$0.00	4.00%	$46,800	$1,900	4.60%	$22,200	$1,171

[1] The fuel tax rate was based on the average price per gallon for regular unleaded ($3.48) in the State of Alabama in 2012. Alabama fuel tax rate increased from $0.16 to $0.19 per gallon on 10/01/2012. (C. Ingram, AAA Alabama, personal communication).

[2] General sales tax in Marshall County does not apply to purchases made within the cities of Guntersville, Arab, Boaz, and Albertville.

Table 25. Distribution of tax revenue generated by catfish angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Roads and Bridges	Education	Tourism	General Fund	Health Services / Human Resources/ Education/ State Parks
Guntersville	Funded by GF	$20	$0.00	$65	N/A
Scottsboro	$0.00	$230.00	$0.00	$690	N/A
Marshall County	$2	$0.00	$0.00	$0.00	N/A
Jackson County	$0.00	$600	$0.00	$0.00	N/A
Madison County	$157	$180	$0.00	$0.00	N/A
State of Alabama	$1,000	N/A	$0.00	$0.00	$1,900
ADCNR	$0.00	$0.00	$0.00	$2	N/A

Table 26. Tax revenue generated by anything angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Lodging Tax	Lodging Expenditures	Lodging Tax Revenue	General Sales Tax	General Sales Expenditures	General Sales Tax Revenue	Fuel Tax	Fuel Expenditures	Fuel Tax Revenue
Guntersville	6.00%	$13,600	$800	4.00%	$36,800	$1,500	0.00287%	$1,800	$5
Scottsboro	5.00%	$29,000	$1,500	3.00%	$4,200	$130	0.00862%	$0.00	$0.00
Marshall County	1.00% + 1.00 per night	$13,600	$300	1.00%	$21,600	$210	0.00287%	$9,000	$30
Jackson County	2.00% + 1.00 per night	$29,000	$940	2.00%	$29,000	$590	0.00862%	$6,100	$50
Madison County	1.00%	$0.00	$0.00	1.50%	$19,000	$290	0.00862%	$10,600	$120
State of Alabama	5.00%	$13,600	$680	4.00%	$110,800	$4,400	4.60%	$47,800	$2,500

[1] The fuel tax rate was based on the average price per gallon for regular unleaded ($3.48) in the State of Alabama in 2012. Alabama fuel tax rate increased from $0.16 to $0.19 per gallon on 10/01/2012. (C. Ingram, AAA Alabama, personal communication).

[2] General sales tax in Marshall County does not apply to purchases made within the cities of Guntersville, Arab, Boaz, and Albertville.

Table 27. Distribution of tax revenue generated by anything angler expenditures obtained from the follow-up telephone survey, Lake Guntersville, Alabama from January 2012 through December 2012.

Location	Roads and Bridges	Education	Tourism	General Fund	Health Services / Human Resources/ Education/ State Parks
Guntersville	Funded by GF	$375	$200	$1,500	N/A
Scottsboro	$0.00	$30.00	$0.00	$1,600	N/A
Marshall County	$30	$210	$300	$0.00	N/A
Jackson County	$50	$590	$940	$0.00	N/A
Madison County	$120	$290	$0.00	$0.00	N/A
State of Alabama	$2,175	N/A	$140	$400	$4,400
ADCNR	$0.00	$0.00	$0.00	$4	N/A

Table 28. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by all anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	6.2440	0.5462	<0.0001	N/A	N/A
Travel cost	-0.0033	0.0003	<0.0001	$222	$368
Tournaments	0.0055	0.0024	0.0195	4.55	10.55
Years of experience	0.0062	0.0021	0.0035	37.0	14.7
Nonlocal Alabama angler	-0.6040	0.0876	<0.0001	0.22	0.41
Out of state angler	-0.8648	0.1365	<0.0001	0.27	0.44
Log of actual Income/1,000	-0.1305	0.0485	0.0072	11.2	0.66
Non Caucasian angler	-0.5658	0.1936	0.0035	0.04	0.19
Club	0.2054	0.0657	0.0018	0.39	0.49
Dispersion	18.2879	1.2292			
Model Information					
DF (Error)	392				
Consumer Surplus per angler day	$156	$14			
Log-likelihood					
χ^2	425				
AIC	3,687				

Table 29. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by bass anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	6.5153	0.7339	<0.0001	N/A	N/A
Travel cost	-0.0019	0.0003	<0.0001	$282	$416
Tournaments	0.0056	0.0025	0.0247	5.99	12.08
Years of experience	0.0069	0.0027	0.0109	34.0	13.6
Nonlocal Alabama angler	-0.4662	0.0999	<0.0001	0.24	0.43
Out of state angler	-0.7616	0.1357	<0.0001	0.35	0.48
Log of actual Income/1,000	-0.1897	0.0631	0.0026	11.33	0.65
Non Caucasian angler	-0.8758	0.3829	0.0222	0.02	0.13
Club	0.2442	0.0765	0.0014	0.53	0.50
Length of Visit	0.1587	0.0362	<0.0001	2.20	1.94
Dispersion	14.5273	1.1514			
Model Information					
DF (Error)	262				
Consumer Surplus per angler day	$240	$39			
Log-likelihood					
χ^2	242				
AIC	2,531				

Table 30. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by crappie anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	1.8523	1.3702	0.1764	N/A	N/A
Travel cost	-0.0070	0.0017	<0.0001	$54	$58
Log of actual Income/1,000	0.2996	0.1268	0.0181	10.95	0.67
Non Caucasian angler	-1.5282	0.4270	0.0003	0.07	0.26
Dispersion	21.8635	2.7565			
Model Information					
DF (Error)	93				
Consumer Surplus per angler day	$123	$32			
Log-likelihood					
χ^2	90				
AIC	953				

Table 31. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by local anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	5.0852	0.1633	<0.0001	N/A	N/A
Travel cost	-0.0067	0.0010	<0.0001	$39	$49
Age	-0.0876	0.0427	0.0403	5.27	1.42
Non Caucasian angler	-0.6550	0.4270	0.0003	0.04	0.19
Years of experience	0.0113	0.0044	0.0110	37.4	14.8
Club	0.3149	0.0831	0.0002	0.34	0.48
Dispersion	27.0351	2.7108			
Model Information					
DF (Error)	173				
Consumer Surplus per angler day	$133	$20			
Log-likelihood					
χ^2	159				
AIC	1,916				

Table 32. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by nonlocal anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	4.5875	0.1000	<0.0001	N/A	N/A
Travel cost	-0.0049	0.0007	<0.0001	$176	$217
Dispersion	12.6629	1.8727			
Model Information					
DF (Error)	84				
Consumer Surplus per angler day	$118	$17			
Log-likelihood					
χ^2	78				
AIC	726				

Table 33. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by border state anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	1.6701	0.3155	<0.0001	N/A	N/A
Travel cost	-0.0036	0.0005	<0.0001	$320	$274
Tournaments	0.0330	0.0060	<0.0001	3.191	7.40
Age	0.3929	0.0516	<0.0001	4.85	1.55
Dispersion	5.1543	1.1427			
Model Information					
DF (Error)	57				
Consumer Surplus per angler day	$107	$15			
Log-likelihood					
χ^2	57				
AIC	399				

Table 34. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by non-border-state anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	1.3640	0.2647	<0.0001	N/A	N/A
Travel cost	-0.0006	0.0002	0.0244	$1,145	$696
Dispersion	2.7482	0.7966			
Model Information					
DF (Error)	46				
Consumer Surplus per angler day	$296	$109			
Log-likelihood					
χ^2	231				
AIC	184				

Table 35. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by anglers whose visits were longer than one day at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	1.460	0.3882	0.0032	N/A	N/A
Travel cost	-0.0022	0.0002	<0.0001	$1,145	$696
Tournaments	0.0550	0.0101	<0.0001		
Age	0.3696	0.0593	<0.0001		
nonlocal	0.5216	0.1357	0.0001		
Dispersion	7.6557	1.1891			
Model Information					
DF (Error)	105				
Consumer Surplus per angler day	$110	$10			
Log-likelihood					
χ^2	110				
AIC	610				

Table 36. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by daytrip anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	5.1011	0.0499	<0.0001	N/A	N/A
Travel cost	-0.0057	0.0011	<0.0001	$52	$45
Tournaments	0.0082	0.0022	0.0003	5.50	10.82
Non Caucasian angler	-0.7359	0.2009	0.0002	0.05	0.22
Nonlocal	-0.4201	0.1130	0.0002	0.21	0.41
Out of State	-0.8865	0.1930	<0.0001	0.09	0.29
Dispersion	20.0721	1.5686			
Model Information					
DF (Error)	285				
Consumer Surplus per angler day	$175	$35			
Log-likelihood					
χ^2	271				
AIC	1,426				

Table 37. Results from the TCM regression (negative binomial distribution) to explain the demand for visitation by shore anglers at Lake Guntersville, 2012. Dependent variable is *visits*.

Variable	Parameter Estimate	Standard Error	*Pr > ChiSq*	Mean	SD (Mean)
Intercept	10.2406	1.3869	<0.0001	N/A	N/A
Travel cost	-0.0110	0.0051	<0.0317	$34	$21
Log of actual Income/1,000	-0.4734	0.1356	0.0005	10.65	0.64
Non Caucasian angler	-0.7991	0.2621	0.0023	0.21	0.41
Dispersion	15.6210	3.2353			
Model Information					
DF (Error)	39				
Consumer Surplus per angler day	$91				
Log-likelihood					
χ^2	37				
AIC	445				

IX. FIGURES

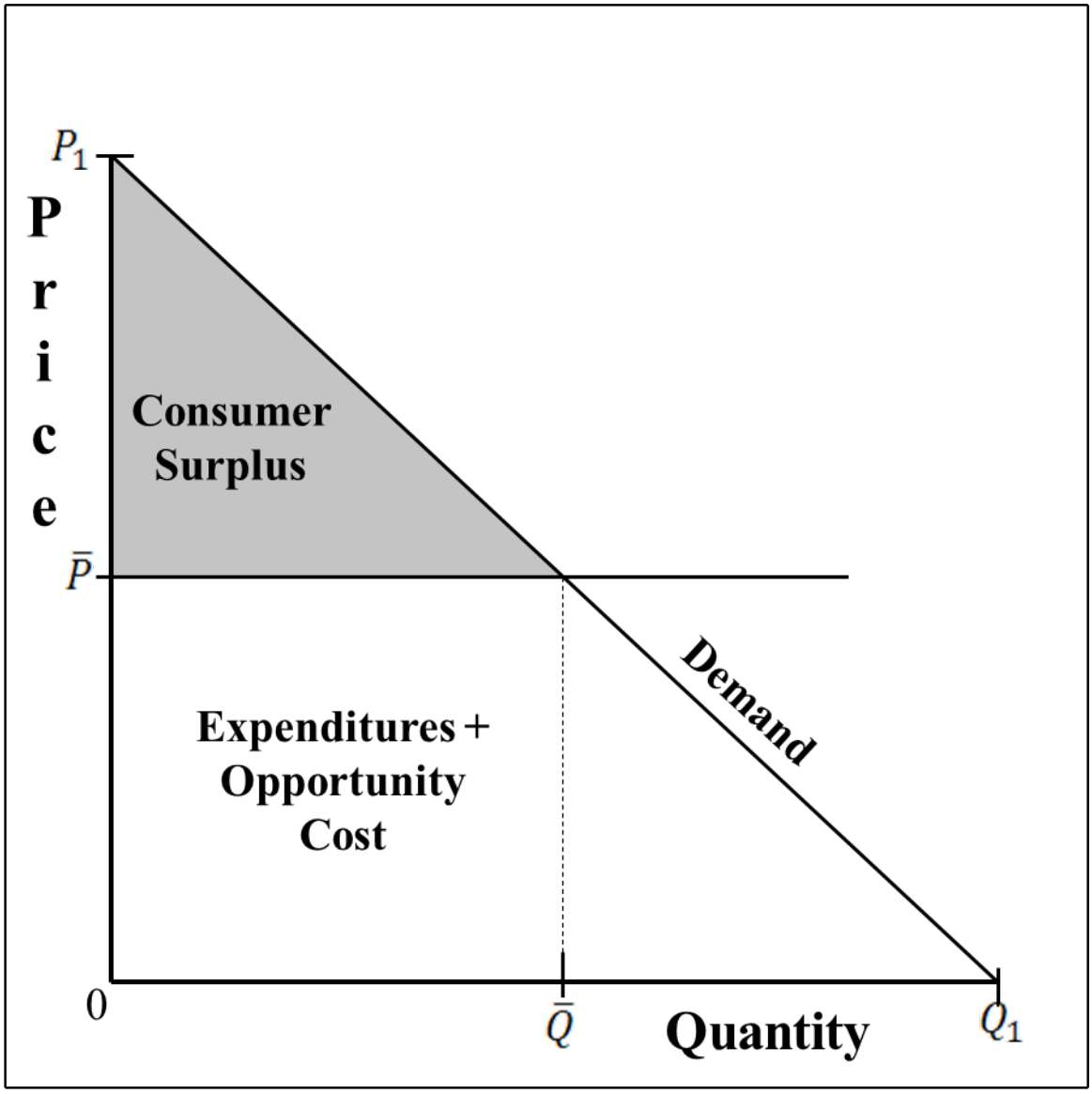

Figure 1. Graphical representation of a demand curve (quantity demanded) and consumer surplus. P_1 is the maximum visit price that one is willing to pay and Q_1 is the maximum number of visits a consumer will demand at a price of \$0. $\bar{P}$ is the equilibrium (mean) price paid and $\bar{Q}$ is the equilibrium (mean) number of visits demanded by a typical (average) consumer. Consumer surplus is the willingness-to-pay for a recreational visit above and beyond a person's actual visit expenditures and is the area below the recreational visit demand curve and above the equilibrium visit cost ($\bar{P}$). Expenditures are actual purchases incurred by the person on the visit plus the opportunity cost of time based on the respondent's wage rate and the calculated roundtrip travel time to the site.

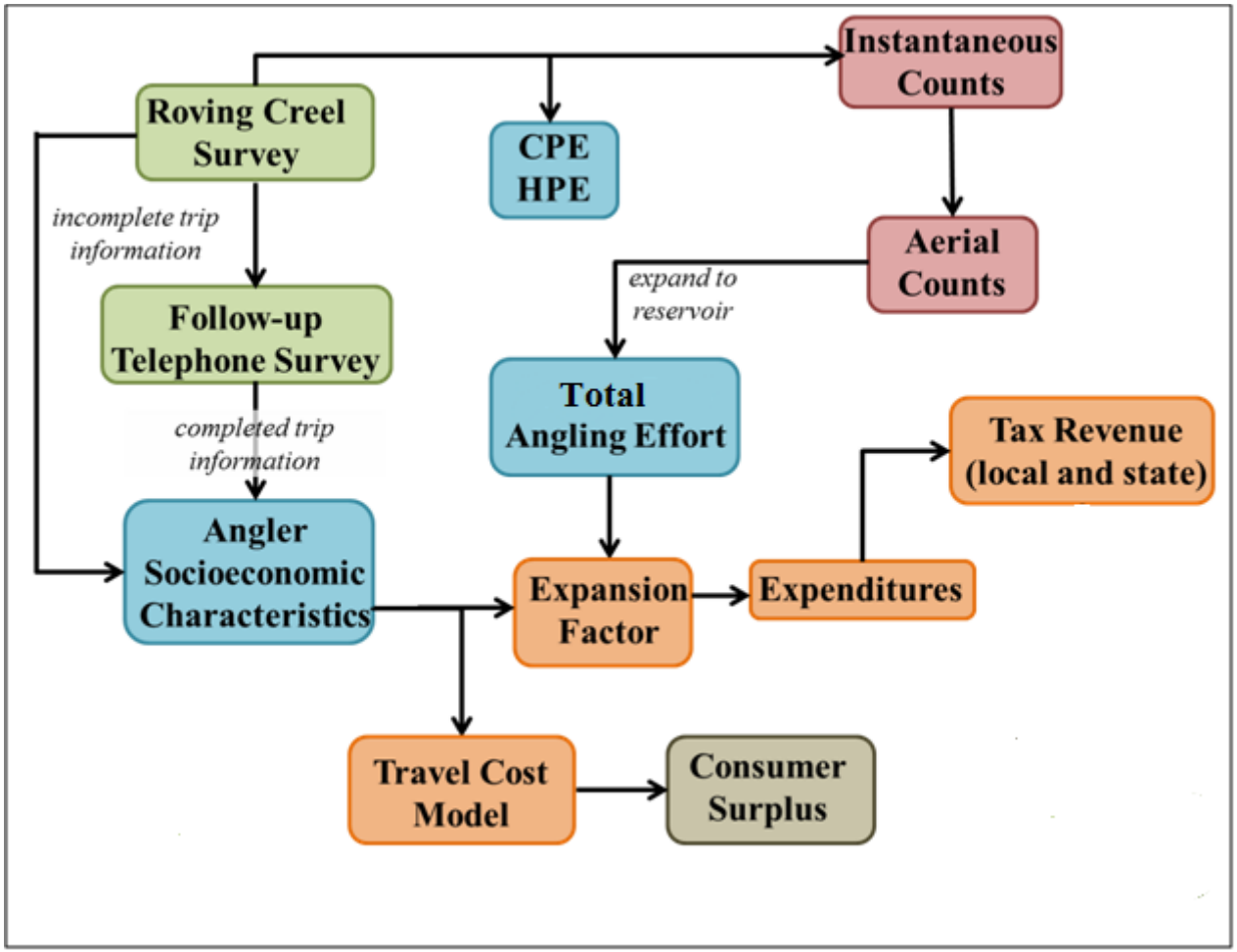

Figure 2. Flow chart of the on-site survey: where data was collected and how it was combined to estimate the study objectives.

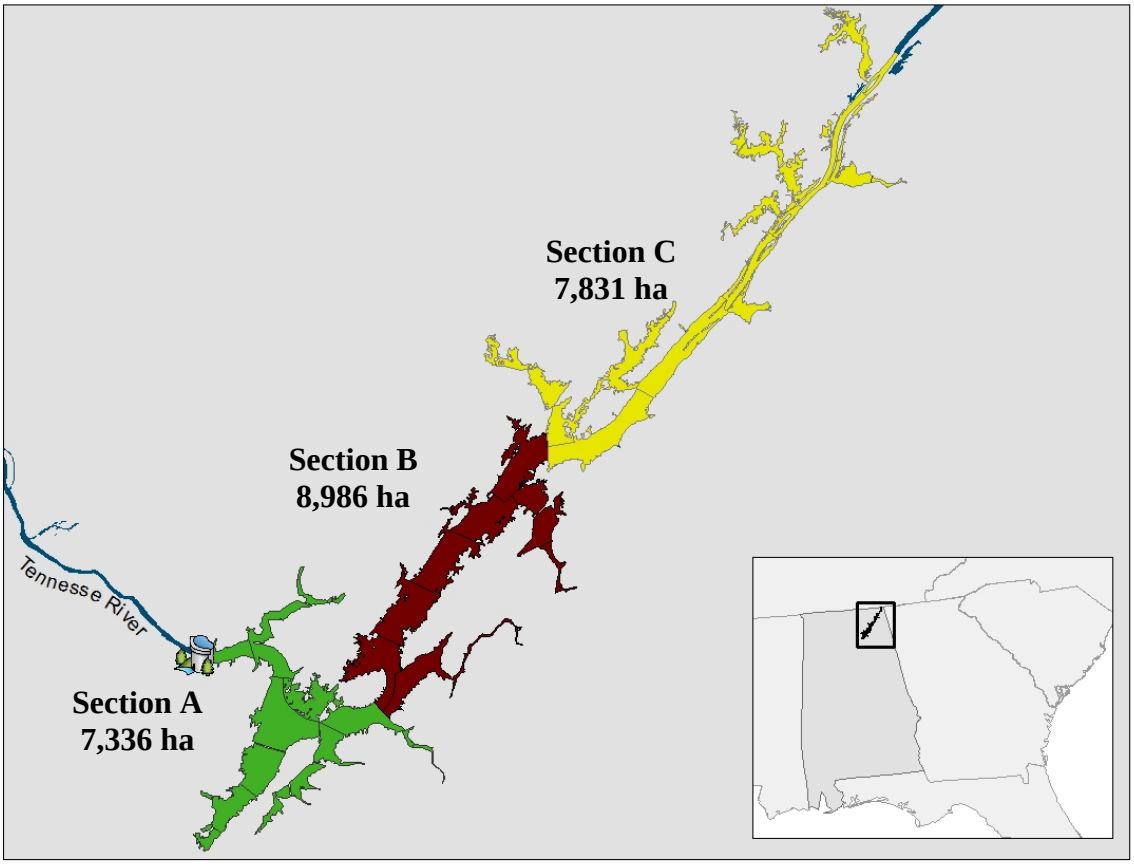

Figure 3. Major reservoir sections A, B, and C at Lake Guntersville, Alabama.

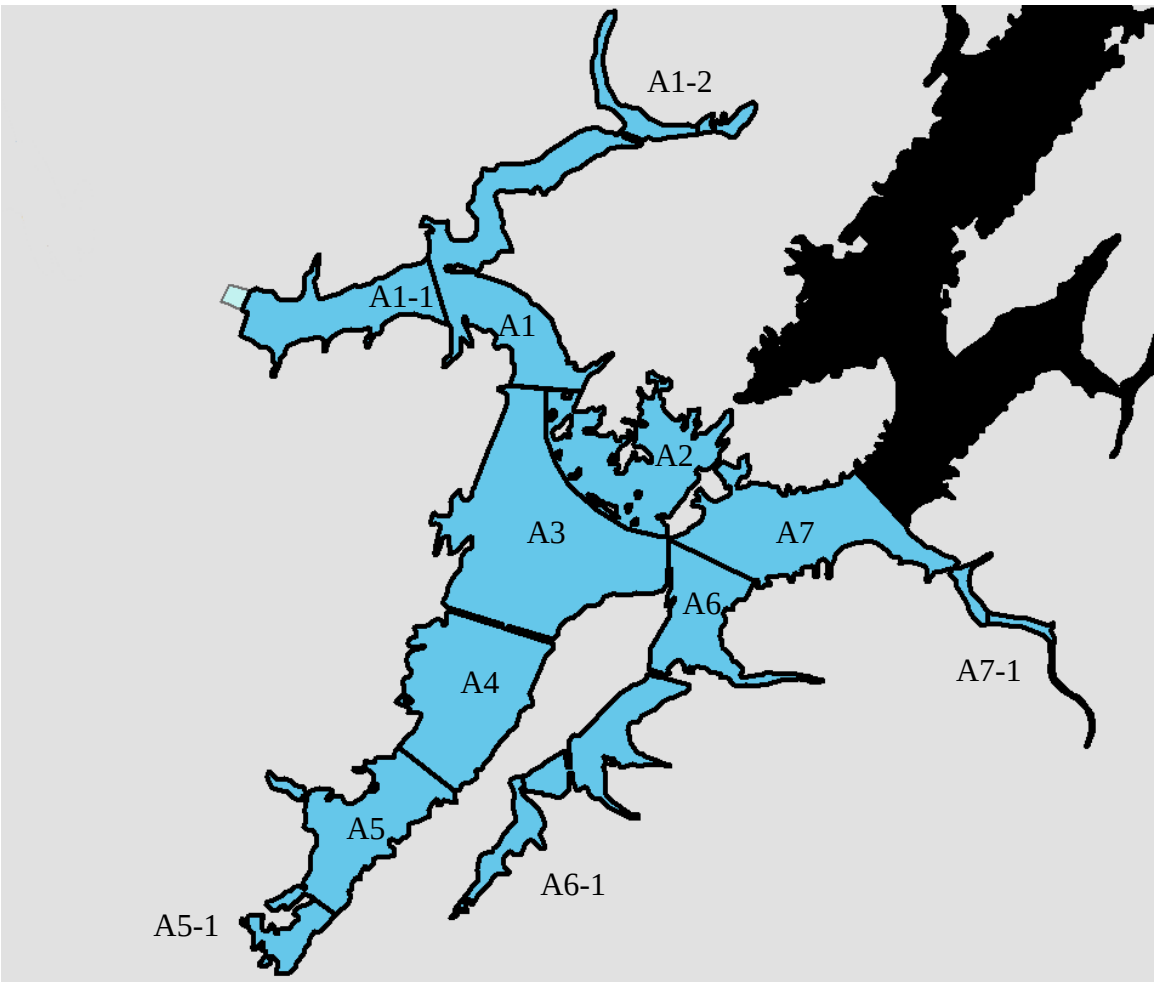

Figure 4. Major reservoir section A at Lake Guntersville, Alabama.

[1] Section numbers that include dashes were not included in the roving creel survey. Effort that occurred in these sections was estimated by aerial boat counts.

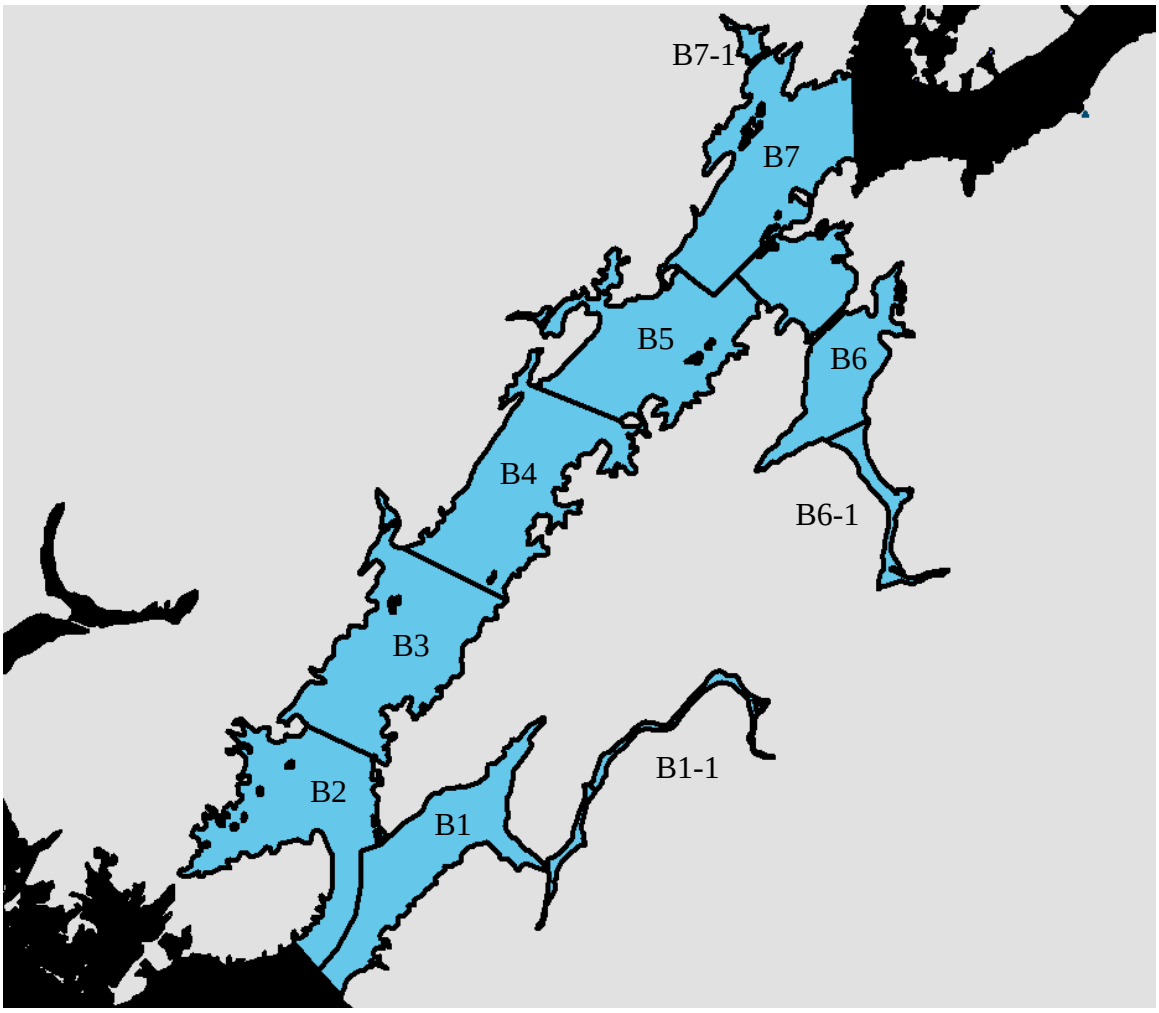

Figure 5. Major reservoir section B at Lake Guntersville, Alabama.

[1] Section numbers that include dashes were not included in the roving creel survey. Effort that occurred in these sections was estimated by aerial boat counts.

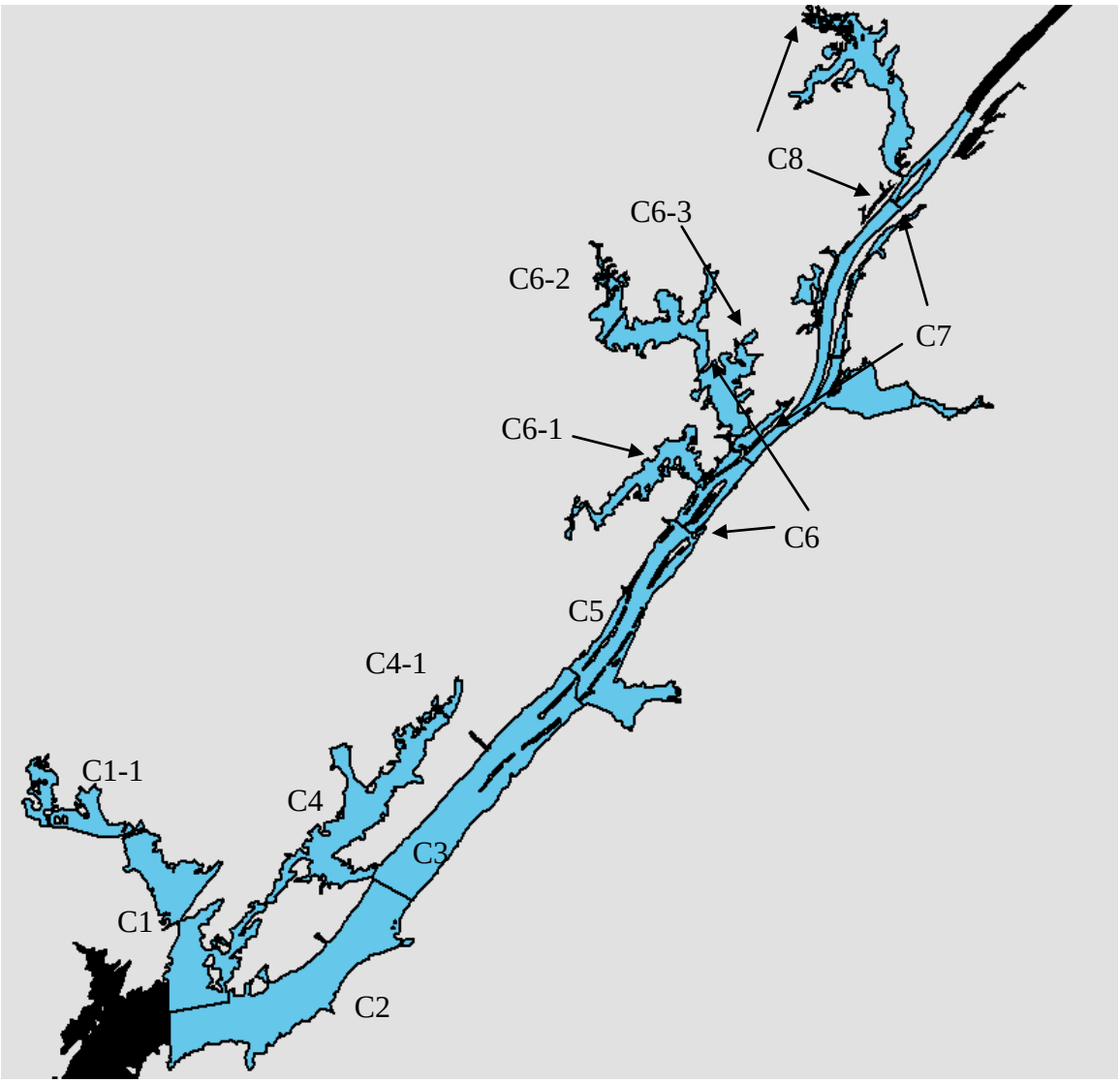

Figure 6. Major reservoir section C at Lake Guntersville, Alabama.

[1] Section numbers that include dashes were not included in the roving creel survey. Effort that occurred in these sections was estimated by aerial boat counts.

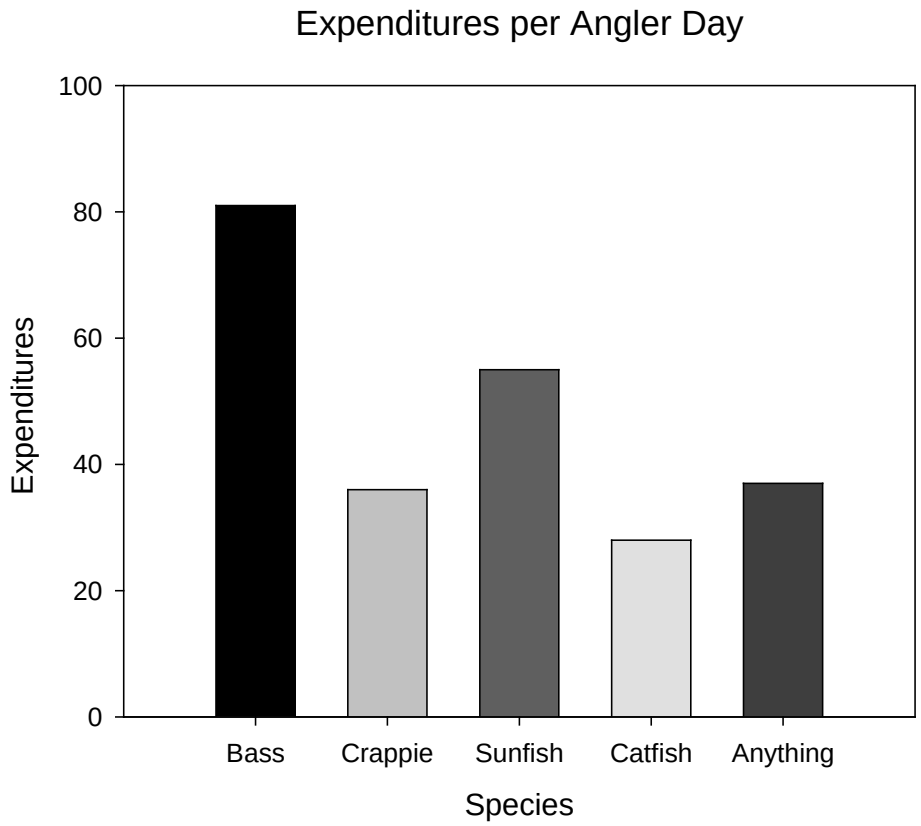

Figure 7. Mean expenditures per angler day for each targeted fish category. Lake Guntersville, 2012.

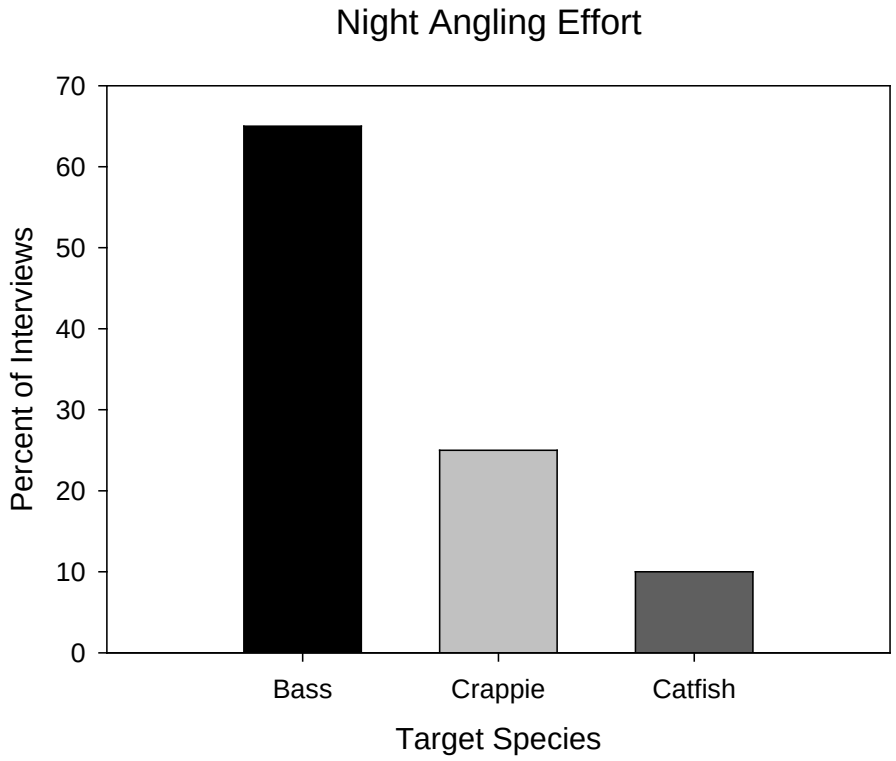

Figure 8. A subsample of anglers that indicated they fished at night on Lake Guntersville in the 12 months preceding their follow-up telephone survey, and their target fish category.

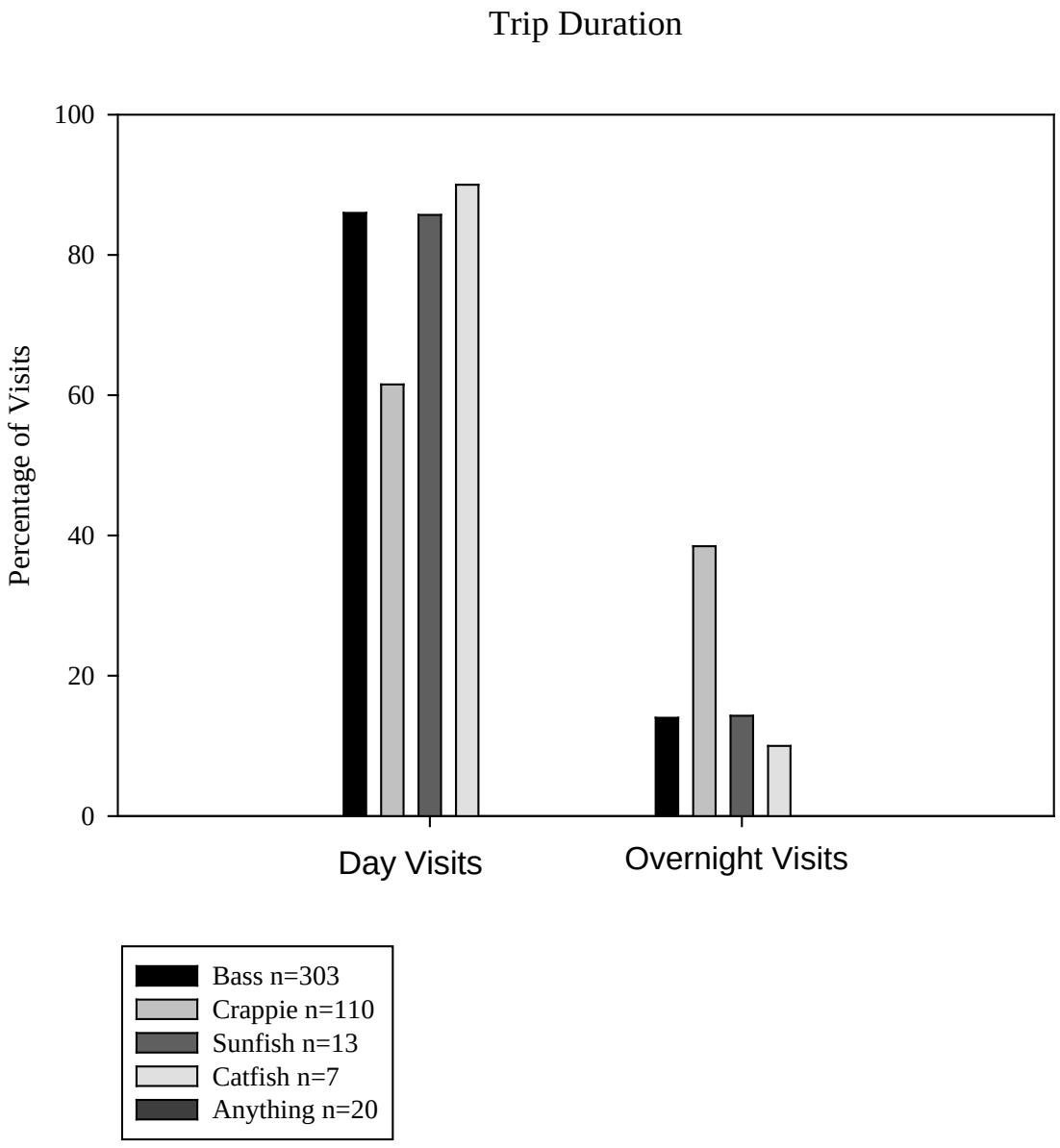

Figure 9. Percentage of one day and overnight angler visits by target species, Lake Guntersville, 2012.

X. APPENDICES

IX.1. On-site Roving Creel Survey Form

Date: _______ **Major River section:** *A B C* **Subsection:** *1 2 3 4 5 6 7* **Shore**: *Y N* **Interview:** _______
Creel Clerks: __________ **Interview Time** *(military)*: ___________ **GPS:** ___________

Hello, we are working with Auburn University Fisheries Department to conduct a fishing survey on this lake. This interview should only take 5 minutes. All of the information you give me today will remain confidential, anonymous and no one will try to sell you anything. May we interview you? *Y N*

- -*(if yes, continue)* -

1. Is this fishing trip in any way related to a tournament? *Y N*

   If yes, A. Currently in a tournament B. Pre-fishing C. Tournament name ____________________
2. Is this a guided fishing trip? *Y N*

3. What fish are you primarily fishing for? *Bass/ Crappie /Sunfish/ Catfish/ anything/ Other*_________
4. Have we contacted you before about this survey? *Y N*
   a. *(Yes)* Have we contacted you on this particular visit? *Y N*

5. Number of adult anglers in your party __________ number of children < 16 _________

6. What time did you start fishing today? __________
   a. Are you finished fishing for the day? *Y N*
   b. What time do expect to quit fishing today? ________________

7. How many of each species have you caught today?

Catfish	Sunfish	Bass	Crappie	Other:__________
Keep: _______	Keep: _______	Keep: _______	Keep: _________	Keep:_________
Release: _______	Release: _______	Release: _______	Release: _________	Release:_________
Livewell: _______	Livewell:_______	Livewell: _______	Livewell:_________	Livewell:________

8. What city do you live in?
   a. City: __________________ b. State __________ c. Lake Resident *Y N*
9. How much will your completed trip cost , including gas, lodging, food, drinks, ice, fishing equipment, tournament and license fees, and any other items?____________
   a. Of the <u>*$xxx*</u> you will spend on this trip, how much will be spent within "20" miles of Lake Guntersville? ___________

10. How many miles did you travel from your home to fish? ________

11. How many days have you fished for _________________ at Lake Guntersville in the past 12 months? ___________

12. Would you allow us to contact you by phone for a more detailed survey in the next two weeks? Y N

13. Contact information: Name:____________________ Phone number: ________________

14. Preferred time of contact Day______________ Time___________

15. M/F Age _______ Ethnicity __________ Income __________ Occupation _____________________

IX.2. Off-site Follow-up Telephone Survey Form

Date: _____ **Clerk:** _____ ***Interview:*** _____ ***Age:*** _____ ***Ethnicity:*** _____

Sex: _____ **Occupation:** _____ ***Income :*** _____ ***Shore:*** *Y N*

(Fill out the italicized headings before conducting the interview)

Hello, I am with Auburn University Fisheries Department. I contacted you at Lake Guntersville on *date*. You gave me permission to conduct a follow up survey about your fishing trip that day. The interview should take only 10 minutes of your time. All the information you give me today will remain confidential, anonymous, and no one will try to sell you anything. May I interview you?

1 Was fishing for *target species* your sole purpose for visiting Lake Guntersville? Y N
   A. If no what was the primary purpose of the trip?_____

2. How many hours did you fish the day I interviewed you on Lake Guntersville? _____

3. For your fishing trip on *date*, the same trip I interviewed you when you were fishing for *target species*, would you rate the quality of that trip as poor, fair, average, good, or excellent? *Poor Fair Average Good Excellent*

4. Do you plan on returning to Lake Guntersville to fish for *target species* in the future? *Y N*
   a. *(Yes)* How many trips do you expect you will go on within the next 12 months? _____
   b. *(No)* Why not? _____

5. If fishing for *target species* was not available at Lake Guntersville where would you go instead? _____

   A. How many miles is this site from your home? _____

6. Does access to Lake Guntersville, as far as launching your boat, ever keep you from fishing there? Y N
   A. What season(s) does limited access effect your fishing *winter/spring/summer/fall*
   B. What ramp do you use the most? _____
   C. How many more days per year would you fish Lake Guntersville if you were guaranteed a parking space? _____

7. Was this an overnight trip? *Y N*

8. How many days did you spend at Lake Guntersville on this visit?_____ How many of these days were spent fishing? _____

9. What type of lodging did you use on the fishing trip? *Hotel/Motel Cabin/house Bed and Breakfast RV park (private) State site County site City site Friends/Families Private property (pp) Other _____ None*
   A. How many days in advance did you book this trip? _____
   B. How did you hear about lake Guntersville? _____
   1. *(PP)* Do you own, rent, or lease this property? *Own Rent Lease*
   2. *(PP)* Is the primary reason you use this property to fish at Lake Guntersville? *Y N*
   3. *(PP)* What city/county is this in?

10. Do you ever fish Lake Guntersville at night? *Y N* How many days per year? _____
    If Yes what species do you fish for? _____

IX.2. Off-site Follow-up Telephone Survey Form

12. How many tournaments have you fished on Lake Guntersville in the past 12 months? _____

13. Are you a member of bass fishing club? Y N Name of Club _____

14. How many years of fishing experience do you have? _____

15. Next, we would like to break down your combined *$yyy* that you spent to fish for *target species* on the trip by what items and by what city you bought it in. If you weren't in a city when you purchased an item, the county will work. How much was spent and where was it bought for:

TOTAL 50% Other _____

Item	TOTAL Cost	Town/County	Cost	Town/County	Cost	Town/County	Cost	Town/County	Cost
Travel/Gas (car/boat/airline)									
Lodging									
Groceries/drinks/ice									
Restaurant meals									
Fishing equipment/bait									
Guide fees/tips									
Boat/fishing rentals									
Tournament fees									
Boat launch/Storage fees									
Repair/Maintenance									
License									
Type of License Purchased									

That is all we need from you at this time. Thank you very much for your time. Do you have any comments about the lake you would like to share?

COMMENTS: _____

IX.3. Roving Creel Instantaneous Count Form

Date	Section	Shift	Start Time	End Time	Wind Speed	Ambient Temp	Water Temp	Precipitation	Boat Anglers	Shore Anglers	Pontoons Fishing	Pontoons Not Fishing

IX.4. Aerial Boat Count Form

Clerk:			**Aerial Boat Count**		Date:		
Major Section	**Subsection**	**Start Time**	**End Time**	**Angler Boats**	**Pontoon Boats**	**Acreage**	**Notes**
A	1					2480	
	1A					1190	
	1B					76	
	2					1800	
	3					3700	
	4					1900	
	5					1725	
	5A					207	
	6					2050	
	6A					300	
	7					2570	
	7A					123	
B	1					2700	
	1A					204	
	2					2600	
	3					3013	
	4					2940	
	5					2717	
	6					2638	
	6A					222	
	7					2995	
	7A					122	
C	1					2055	
	1A					690	
	2					2780	
	3					2998	
	4					1957	
	5					1856	
	6					1334	
	6A					750	
	6B					44	
	6C					1039	
	7					2120	
	8					1730	