Economic Impact of Striped Bass Angler Visitation at Lewis Smith Lake, Alabama

by

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Abstract

Recreational fishing for black bass (largemouth bass *Micropterus salmoides* and Alabama bass *M. henshalli*) and stocked striped bass *Morone saxatilis* are popular activities at Lewis Smith Lake, Alabama. The objective of the study was to estimating the value of the striped bass fishery to local cities, counties, and Alabama through expenditures, tax revenue, and consumer surplus. An on-site survey estimated angling effort at 233,756 hours (standard error, 16,968 hours), with 66% of effort targeting black bass and 23% for striped bass. Annual aggregated expenditures were $0.7 million for striped bass anglers. Consumer surplus was estimated at $101 per angler day in 2010. The cost-benefit analysis revealed that for every $1 spent in stocking Lewis Smith Lake with striped bass, between $2 and $3 were generated in tax revenue to local governments and between $8 and $12 in tax revenue for the State of Alabama, including local governments. An independent telephone survey of striped bass anglers appeared to over-estimate the effort and value of the striped bass fishery potentially due to sampling a non-representative sample. Since stocking striped bass at current rates has no significant biological impact to the other sport fishes and costs are more than covered by angler expenditures and tax revenue at Lewis Smith Lake, current stocking rates should be continued to meet the demands of the anglers and support the local economy.

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List of Abbreviations

ADWFF	Alabama Division of Wildlife and Freshwater Fishes
CPE	Catch-per-effort
HPE	Harvest-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 travel cost (price)
Local Angler	angler with residence in Cullman, Walker, or Winston County
Non-local Angler	angler with residency in any other region besides local counties
Opportunity Cost	measure in terms of value of the next best alternative forgone; in this study, a fraction of angler's wage rate applied to the round trip travel time to the recreation site and substitute sites
Substitute Site	similar site that could replace the study site; in this study the opportunity cost of travel to the substitute site was used in the travel cost model
Travel Cost Model	method to estimate travel costs (opportunity cost of travel plus actual expenditures) and visit frequency to establish angler visitation demand for striped bass fishing
Trip	one angler fishing during a one day period
Visit	fishing expedition for one angler and can be multiple days from residency
Willingness-to-pay	maximum an angler is willing to pay to fish

I. INTRODUCTION

Angling is a popular recreational activity across the United States; and many local communities and businesses depend on angling for at least part of their income. In 2006, nearly 806,000 anglers spent $699 million in expenditures related to their angling trips in Alabama (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2007). In many cases, increased access and habitat enhancement of angling sites can result in more revenue generated from anglers' willingness-to-pay (WTP) to go angling (Ojumu 2009); WTP is the maximum one is willing to pay to recreate.

Economic valuation of a natural resource can be derived from any number of methods and have been conducted on a national scale (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2007), statewide (Sorg and Loomis 1986; Ojumu 2009), on individual sites (Schorr et al. 1995; Shrestha et al. 2002), and on multiple sites (Hanson et al. 2002; Williams and Bettoli 2003; Prado 2006; Rolfe and Prayaga 2007). Studies have also been conducted on individual species to understand the economic benefits to a local community (Schorr et al. 1995) or an entire region (Southwick Associates 2005). The travel cost model (TCM) is a methodology used to estimate travel costs (actual expenditures plus an opportunity cost of time to travel roundtrip) to access a site and recreate and explains visitation, which in turn impacts local communities and their economies (Prado 2006). Consumer surplus is the WTP for a recreational trip above and beyond a person's actual trip expenditures and below the recreational trip demand curve (Figure 1). Consumer surplus can be estimated using benefits or costs from the elimination or addition of a site, adjusted entry fees, or changes to the environmental quality of a site, and in the case of this study, consumer surplus represented the

additional costs a recreationist would have been willing to pay to fish for striped bass *Morone saxatilis* on Lewis Smith Lake.

Over the last 20 years, conflicts have arisen on several reservoirs in the southeastern United States between striped bass anglers and anglers targeting other fish species regarding the perceived negative effects resulting from striped bass stocking (Churchill et al. 2002; Waters and McRae 2008). The usual concerns voiced by non-striped bass anglers include predation and competition on their target species by stocked striped bass, along with perceived reductions in catch rate and sizes for their preferred target fish. However, Raborn et al. (2002) found that striped bass consumption of largemouth bass *Micropterus salmoides*, spotted bass *M. punctulatus*, crappie *Pomoxis* spp., and sunfish *Lepomis* spp. in Norris Reservoir, Tennessee, was minimal and thus removal of striped bass would not increase populations of these other sport fish. Similarly, it was found that striped bass diets in Lewis Smith Lake, Alabama consisted of 64% shad (*Dorosoma* spp.) by weight; whereas, largemouth bass and Alabama bass *M. henshalli* diets consisted of 72% and 75% crayfish (*Oronectes* spp.) by weight and shad comprised 6% and 14% by weight, respectively (Shepherd and Maceina 2009). Thus, diet overlap was low among striped bass, largemouth bass, and Alabama bass in Lewis Smith Lake and no decline in relative weights of any species was observed during the study. Typically, little biological data supports angler concerns over the effects of striped bass on other sport fisheries.

Despite the lack of demonstrable biological impacts by striped bass on other species (Shepherd and Maceina 2009), conflicts persist among striped bass anglers and anglers targeting other sport fish species. Another tool for reservoir fishery managers to add another level of understanding to user conflicts is the quantification of economic value of specific fisheries, and in this case, the striped bass fishery. Because striped bass fisheries typically garner widespread

interest from anglers, the value of these fisheries is likely substantial and may help fisheries managers validate and justify their decisions regarding striped bass stocking and management.

Thus, the goals of this study were to estimate the economic value of the striped bass fishery to local and non-local counties surrounding Lewis Smith Lake, Alabama, and secondly, conduct a cost-benefit analysis to compare the annual stocking costs incurred by Alabama Division of Wildlife and Freshwater Fishes (ADWFF) to stock and sustain the striped bass fishery with the economic impact on the local region from striped bass anglers. To accomplish these goals for Lewis Smith Lake, specific objectives of this study were to:

1. Estimate angling effort and expenditures by striped bass anglers and other anglers;
2. estimate the consumer surplus of the striped bass fishery;
3. estimate the distribution of expenditures by striped bass anglers into local cities and counties, as well to the state level;
4. establish the proportion of expenditures by striped bass anglers which go to taxes for use by local counties and cities, and to the State of Alabama; and
5. determine what measures could be taken to increase striped bass angling experiences and expenditures in the local region.

II. LITERATURE REVIEW

II.1. Angler Surveys

Angler surveys allow managers to understand harvest, angling effort, demographics, and the economic impacts of fisheries (Pollock et al. 1994). Anglers can be surveyed either on-site or off-site. Managers use on-site surveys to count and interview the anglers, often in the act of angling or as they leave the body of water. Off-site surveys are conducted away from the angling site and obtain completed trip information, though memory recall may be a factor that reduces the accuracy of the data collected. An on-site survey allows for a better representation of the true population of users including nonresidents, than an off-site survey (Schorr et al. 1995; Hanson et al. 2002; Prado 2006).

A roving creel survey is an on-site survey method designed to interview anglers actively fishing on a body of water with many access points. A roving creel survey on West Point Reservoir, Georgia and Alabama, created a use-prediction model to explain the use among crappie, largemouth bass, bank, and boat anglers and estimated their consumer surplus (Palm and Malvestuto 1983). Schorr et al. (1995) used a roving creel to find the economic impact on the local communities of the striped bass fishery on Lake Texoma, Oklahoma and Texas, using the Impact Analysis for Planning.

Roving-access creel is another on-site survey that is often used when a site has limited entry points and complete trip information is important. An access-roving creel survey was implemented on the Kenai River, Alaska to reduce the potential bias in length of trip data resulting from the angler's harvest of Coho salmon *Oncorhynchus kisutch* (Benard et al. 1998).

Aerial counts can be used to estimate angling effort via instantaneous count and are especially useful in expansive bodies of water which can be counted in a short time span. Volstad

et al. (2006) used aerial counts to estimate effort, catch, and harvest on American shad *Alosa sapidissima* and striped bass in the Delaware River in Delaware, New Jersey, Pennsylvania, and New York. Often, aerial counts need to be adjusted by ground-truthing with creel clerks because of visibility bias as described by Smucker et al. (2010).

A telephone survey is a common off-site method that is moderately priced and often used when results are needed immediately (Dillman 1978). The most well-known use of telephone surveys in natural resource surveys is the one conducted by the U.S. Department of Interior, Fish and Wildlife Service, and U.S. Department of Commerce every five years to estimate travel cost expenditures incurred by anglers and hunters within the entire United States. Additionally, telephone surveys have been commonly used in other surveys targeting natural resource users (Sorg and Loomis 1986; Bernard et al. 1998; Hanson et al 2002; Prado 2006). Bias may result from any number of reasons such as improper sample selection, incomplete frame (demographic differences between sampled and non-sampled populations), recall bias, prestige bias, rounding bias, misinterpretation, deception, and non-responsive error such as refusal to partake in the survey or unable to answer a question (Pollock et al. 1994; Thomson 1991).

Many studies often use multiple survey methods to take into account large complex systems, bias, interview time length, and safety for the creel clerks (Pollock et al. 1994). Moore et al. (1991) used a combination of gill net sampling, roving creel, and aerial counts of anglers to estimate survival rates of stocked striped bass in Smith Mountain Lake, Virginia. A combination of a roving creel and aerial counts of anglers were used to estimate angling effort, catch rate, and attitudes toward aquatic vegetation cover on Lake Seminole, Georgia and Florida (Slipke et al. 1998). Prado (2006) used a bus-route and follow-up telephone survey to determine socioeconomic

characteristics, trip cost, and adjust for recall bias among Oklahoma rainbow trout *Oncorhynchus mykiss* and brown trout *Salmo trutta* anglers on the Lower Illinois River.

Catch-per-effort (CPE) or catch rate of anglers is commonly estimated in creel surveys to measure angling success (Benard et al. 1998). Pollock et al. (1994) explained that estimating trip length for incomplete trips is biased high because successful anglers may tend to fish longer and thus be interviewed at a higher rate than unsuccessful anglers, while Bernard et al. (1998) found bias was not a factor when sampling periods were the same length as the fishing day. Malvestuto et al. (1978) found that incomplete trips' CPE was not significantly different than complete trips' CPE; this means that incomplete trips information can be used as an unbiased estimator for completed trips when using a roving creel survey.

Endogenous stratification is the bias of oversampling anglers who frequent a body of water at a high rate and must be corrected, otherwise known as avidity bias (Parsons 2003). Correcting for endogenous stratification and truncation can be done using the Poisson or negative binomial distribution which allows one to correctly estimate the value and number of trips the average individual takes (Englin and Shonkwiler 1995). Applying a non-uniform probability to intercept anglers can correct this bias (Thomson 1991), as well as by interviewing anglers only once during the study (Ditton and Hunt 2001).

II.2. Economic Valuation

A powerful tool for valuing natural resources used in many recreational activities is the travel cost model (TCM) (Ward and Beal 2000). Consumer surplus can be estimated from the TCM, which is defined as the difference between the price actually paid for a good and the maximum willingness-to-pay (WTP) (Figure 1). A roving creel at West Point Reservoir, Alabama

and Georgia, found that consumer surplus varied by target species and shore versus boat anglers (Palm and Malvestuto 1983). Shrestha et al. (2002) used the TCM in a survey of recreational anglers in the remote region of the Brazilian Panatanal and found that anglers placed a very high value on the fishery due to the shortage of angling sites with biodiversity and non-use values. Prado (2006) found on the lower Illinois River in Oklahoma that stocking of trout was paid for and significantly benefitted the local economy. The value placed by an angler on his/her WTP to fish depends on a multitude of factors including the species targeted, region, response rate, and methodology which can change each year (Johnston et al. 2006).

Rolfe and Prayaga (2007) used two travel cost approaches to estimate the value of angling in three reservoirs in Australia: zonal TCM for frequent visitors and individual TCM for single-use visitors. Zonal TCM is a simpler and less expensive approach that requires a per capita visitation rate to each zone. Individual TCM utilizes more data collected from individuals and generates a regression of the demand. Random utility TCM compares the quality changes of a site when many substitute sites are readily available in addition to the requirements of the individual TCM (King and Mazzotta 2000).

TCM has difficulty in explaining visitation for recreationists who have multi-purposes for their visit (Ward and Beal 2000; Parsons 2003; Prado 2006). Typically, only those with a single-purpose or sole reason for their visit are included in the analysis for the TCM. However, those whose visit length is one day can be assumed that their primary reason for travel was to recreate in the desired activity of interest and can be included in the analysis (Parson 2003). Prado (2006) compared single- and multi-purpose visitors and were treated separately and estimated that there was a significant difference in the consumer surplus.

TCM is used to find the best-fit model in explaining visitation and estimate the consumer surplus based upon many variables including travel cost (actual expenditures plus opportunity cost) or trip cost, the travel or trip cost to a substitute (alternative) site, income, and other demographic and trip characteristic variables (Ward and Beal 2000; Parsons 2003). Omission of the substitute variable can cause bias in the slope coefficient which aids in estimating consumer surplus (Kling 1989).

Opportunity cost is the measure in terms of value of the next best alternative forgone, which also has a definition in the case of TCM as the time spent traveling to and from the site that is incorporated into independent cost variables. Many options to calculate opportunity cost are available for each scenario. Opportunity cost can range from zero to 100% of the wage or even use a flat rate as explained by Feather and Shaw (1998). Both Prado (2006) and Ojumu (2009) used 33% of the wage to reflect the opportunity cost while Williams and Bettoli (2003) used 25%. The proper opportunity cost to use depends upon the study design of the survey.

III. METHODS

The thriving striped bass fishery at Lewis Smith Lake results in angler pleasure, trip expenditures, and income to support businesses located in local and non-local counties and cities. Methods used in this study were chosen, developed, and implemented during 2010/2011 and included:

1. A 12-month on-site roving creel survey (Appendix IX.1);
2. a follow-up telephone survey to the on-site roving creel survey (Appendix IX.2);
3. a roving-access creel survey during summer nights (Appendix IX.1);
4. five aerial counts of angling boats on the reservoir;
5. a telephone survey of striped bass fishing guides (Appendix IX.3); and
6. an independent telephone survey of fishing license holders (ADWFF electronic license database; Appendix IX.4).

These surveys provided detailed data for estimating average and aggregated values for striped bass angler effort, catch-per effort (CPE), harvest-per-effort (HPE), expenditures, tax revenues, and consumer surplus. Surveys were designed to collect expenditure data which could be attributed to specific cities and counties. This allowed for tax revenue calculation for each locale. Consumer surplus was calculated for individuals and aggregated over the population of striped bass anglers. The methods section describes the study site, explains the methodologies used, and how they fit together to achieve the study objectives. Figure 2 provides a schematic of the implemented on-site survey and how data were used to meet project objectives. Note: the independent telephone survey of fishing license holders was excluded from the figure because it was the only source of data, and the roving-access creel was excluded for simplicity.

III.1. Study Site

Lewis Smith Lake is an 8,583-ha, highly dendritic, deep (mean depth of 22 meters) tributary storage impoundment (Floyd et al. 2007). The Alabama Power reservoir is within Cullman, Walker, and Winston counties located in northwest Alabama in the headwaters of the Black Warrior River basin (Figure 3). The reservoir filled in 1961 and is operated by Alabama Power Company for power generation, flood control, and recreation (Bayne et al. 1998). A thermocline typically develops in May with dissolved oxygen becoming stratified by late June (Floyd et al. 2007) and can last until November (Bayne et al. 1998). Lewis Smith Lake is considered an oligotrophic lake, with slightly higher phosphorus concentrations in the Rock and Ryan Creek tributaries that primarily comes from poultry farming (Bayne et al. 1998). Popular sport fish in the reservoir include striped bass, largemouth bass, Alabama bass, crappie, and sunfish. Lewis Smith Lake is managed as a trophy striped bass fishery; however, many anglers also target black bass and crappie (N. Nichols, ADWFF, personal communication).

Striped bass do not naturally reproduce in Lewis Smith Lake and require annual stocking by the ADWFF. Lewis Smith Lake is used as a brood stock source for Gulf Coast strain striped bass for stocking into many regional water bodies (Frugé et al. 2006). Nearly 1.5 million Gulf Coast strain striped bass have been stocked in Lewis Smith Lake since 1983, with an annual average of 60,216 fingerlings stocked from 2005 through 2010. In 2009, a total of 71,850 striped bass were released ranging in weight from 3.9 to 18.3 grams, at a total cost of $3,617, or $0.05 per fingerling (B. K. Rinehard, ADWFF, personal communication). Thus, striped bass stocking at Lewis Smith Lake has an average cost of $0.35 per ha per year from 2005 to 2010.

III.2. On-site Survey – Design and Implementation

Anglers on Lewis Smith Lake were surveyed from February 2010 to January 2011 using a non-uniform probability roving creel survey based upon the methodology by Malvestuto et al. (1978). A random number generator was used to select sampling dates, time blocks, and reservoir sections. There were eight sample days per month, split evenly between weekend and weekdays. Each day was apportioned into three 4-hour time blocks: morning (AM; 06:30 to 10:30), noon (NN; 11:00 to 15:00), and evening (PM; 15:30 to 19:30) of which two randomly selected time blocks were surveyed by boat each day. Time blocks were adjusted for daylight savings time. The number of anglers contacted during each time block ultimately generated the probability striped bass anglers fished within a specific time block *post hoc*.

Due to the dendritic nature of Lewis Smith Lake and the associated logistical constraints, only 3,828 ha (approximately 45% of total surface area) of the reservoir were sampled during the roving creel survey, apportioned into six sections: Upper Ryan, Lower Ryan, Dam Forebay, Rock Creek, Lower Sipsey, and Upper Sipsey (Figure 4). These reservoir sections were selected for the on-site roving creel survey because a large portion of striped bass angler effort was thought to occur in these sections (K. B. Floyd, ADWFF, personal communication) and allowed for a sample in each of the major drainages of the reservoir. To counter selection bias, aerial boat counts (described later in the methods section) were conducted to count anglers in all reservoir sections to obtain probabilities of fishing in each section, and these were used to extrapolate up to the reservoir level *post hoc*. Because public shore access was limited, counts and interviews were conducted with only boat anglers, and shore anglers were not surveyed.

III.2.1. *Instantaneous Counts*

Each on-site creel sample began with an instantaneous count in the designated reservoir section at the beginning of each time block, followed by interviews. Instantaneous counts were conducted by completing a circuit of the reservoir section and counting all boat anglers that were perceived to be fishing within a time block and section, regardless of the perceived fish being targeted. The instantaneous count for the roving-access survey during the night was conducted immediately at 20:00 to ensure enough light was available to finish the count (as mentioned later in the methods section). Binoculars were used to assist in counts for determining numbers of boaters that were angling. Counts were performed to determine the number of anglers fishing a particular section during a particular time block; in addition, probabilities were determined for effort on weekends and weekdays *post hoc*.

II.2.2. *Roving Creel Survey*

The interview portion of the on-site roving creel survey began immediately after the instantaneous count. Clerks intercepted boat anglers during fishing activities and obtained incomplete trip information. There was a base set of questions for all anglers and, if they specified they were striped bass fishing, additional questions were asked of these anglers. GPS coordinates of all completed roving creel surveys were recorded to evaluate areas used by striped bass anglers throughout the year.

Anglers were asked what fish species they pursued during their visit, city and state of residency, quantity of each fish species harvested and released, estimated travel expenditures for the visit, and how much of these expenditures were purchased within the three surrounding local counties, as well as additional socio-demographic questions (Appendix IX.1). Any fish in

possession of the angler was deemed harvested; for example, fish held within a live well were considered harvested, regardless of the angler's intent. The non-striped bass surveys took nearly 3 minutes to complete. Anglers who had been previously interviewed were only asked about the primary fish species they were targeting, effort, catch, and harvest information to reduce avid angler bias in the TCM analysis (Pollock et al. 1994; Ditton and Hunt 2001).

Striped bass anglers were asked several additional questions that included the length of their visit in days, annual striped bass fishing visits, substitute (alternative) sites to fish for striped bass, and demographic questions pertaining to their income, gender, ethnicity, and age (Appendix IX.1). Demographic ranges used in questions for the roving and roving-access survey were the same used by the U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau (2007). Some questions were directed to the party (entire group) that included questions about their expenditures, catch and harvest by species, and party size. In the case of party expenditures, they were later divided by the number in the party to obtain individual expenditures. The remaining questions were posed to the angler being interviewed. In addition, interviewed striped bass anglers were asked if they could be contacted for a follow-up telephone survey (described later in the methods section) to obtain completed visit information. The striped bass angler survey took 7 minutes to complete.

III.2.3. *Roving-Access Creel Survey*

Due to reports of striped bass angling occurring during summer nights (B. Vines, Stripe Fishing Headquarters, personal communication), a night time block (20:00 to 24:00) was added to the survey from June through September. This time block was sampled using a roving-access survey, which was conducted in the Dam Forebay and Upper Ryan sections at well-lit public boat

ramps due to safety concerns for creel clerks. The roving-access creel survey was conducted in addition to the usual roving creel sample. A total of 15 samples were conducted (8 on the weekend), and a minimum of 3 per month, depending upon logistical time constraints. The roving-access creel survey began with an instantaneous count (as mentioned earlier in the methods section) and the interview portion was identical to the roving creel survey.

III.2.4. *Aerial Boat Counts*

Because only 45% of the reservoir water body was sampled during the creel surveys, aerial counts were conducted over the entire reservoir to count boats and compare angler use of surveyed sections to sections not involved in the on-site creel surveys (Figure 4). The random flight schedule included one weekend flight during April, June, and December and one weekday flight during May and October. Angling boats were distinguished from recreational boats from the airplane with relative ease with the exception of pontoon boats, which were counted separately from other angler boats. A random count of pontoon boats during the instantaneous count was conducted because of the difficulty in identifying whether angling or other recreational activities were the primary activity of the users. This ratio was applied to the aerial pontoon counts to help ground-truth the total number of boats angling in each section (Volstad et al. 2006; Smucker et al. 2010). Aerial boat counts for each reservoir section were used to generate the probability of an angler fishing in a particular section of the reservoir *post hoc*.

III.2.5. *Follow-Up Telephone Survey*

A follow-up telephone survey was used to survey striped bass anglers who agreed to be contacted after their on-site creel survey. This was done because the on-site survey represented

incomplete visit information and the follow-up survey information represented completed visit information. The follow-up telephone survey was conducted within two weeks of the on-site survey to avoid issues with memory recall (Prado 2006; U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2007). In the follow-up telephone survey, anglers were asked more detail about their recent visit, including questions pertaining to their perceived quality of the visit, lodging type used, actual travel cost expenditures by expenditure types (fuel, lodging, groceries, restaurant meals, fishing equipment, guide service, boat rentals, tournament fees, boat launch fees, and repair), and the location these purchases occurred (Appendix IX.2). The expenditure types used in the questionnaires were similar to those used by Schorr et al. (1995). The follow-up telephone survey took approximately 7 minutes to complete. Data collected from this survey were assumed to be more accurate than the roving and roving-access creel survey and replaced those expenditures incurred on the visit.

III.2.6. *Fishing Guide Survey*

A 5-minute telephone survey was conducted with the striped bass fishing guides that were encountered on Lewis Smith Lake. Guides were asked how many trips they conducted during 2010, business location, guide experience in years at Lewis Smith Lake, party size, trip length in hours, distance, expenditures by type and location similar to the follow-up telephone survey, number of released and harvested striped bass, bait collection methods, and an open ended question about what could be done to improve the fishery (Appendix IX.3). Where relevant, questions were asked about typical trips.

III.3. On-site Survey – Effort and Catch

Calculations of angler effort, catch, and harvest by species targeted on Lewis Smith Lake were estimated using data gathered from the on-site creel survey and aerial boat counts, using similar procedures as described by Holly et al. (2009). Calculations used to estimate effort, catch-per-effort (CPE), and harvest-per-effort (HPE) were performed by applying non-uniform probabilities as described by Malvestuto et al. (1978). Probabilities were assigned to estimate total angling effort (hours) for all species on the reservoir for a particular day (E) using:

$$E = (I \times t)/p_1 p_2 \quad (1)$$

where I is the instantaneous count of anglers (from on-site creel survey), 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 angling within each section determined from the aerial boat counts. Total effort for the year ($\hat{E}$) was estimated using:

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

where is N the total number of days within the year, $\bar{y}$ is the daily effort for each strata h, either weekend or weekday. Standard error was estimated by using $N \times \sqrt{v}$, where v is variance of daily effort for each strata. Effort for each target species ($\hat{E}_{species}$) was estimated by multiplying $\hat{E}$ by the proportion of anglers targeting each species.

CPE for each species was estimated using $\hat{c}_{species}/\hat{e}_{species}$, where $\hat{c}_{species}$ is the total catch and $\hat{e}_{species}$ is the total effort for anglers targeting each species obtained from the sample in the roving or roving-access creel survey. HPE was estimated by substituting the total harvest for total catch for each species obtained from the sample in the roving or roving-access creel survey. "Catch" was defined as landing a fish being targeted by angling methods and "harvest" was defined as any fish in possession of the angler at the time of the interview, regardless of the

angler's intention to release the fish or not. Total harvest for each species was estimated by $\hat{E}_{species} \times HPE_{species}$.

Trip length was calculated by taking the average of combined completed trip lengths and doubled incomplete trip lengths in hours for each target species (Pollock et al. 1994). The number of trips for each target species ($TRIPS_{species}$), used in the expansion factor later in this section, was determined by dividing $\hat{E}_{species}$ by the mean trip length for that species. 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 residence.

III.4. On-site Survey – Expansion Factor

TCM is described in more detail later, but is defined as a regression analysis of the survey data collected from anglers to define the relationship between the number of fishing visits annually and independent variables. Only anglers whose single-purpose for their visit was to fish were included in the remaining analysis since TCM is not well suited to deal with multi-purpose anglers (Ward and Beal 2000; Prado 2006); also included were anglers who had a visit length of one day even though they had other reasons besides fishing for their visit, since it could be assumed their primary reason of the visit was to fish that day (Parsons 2003). Actual expenditures incurred on the visit for an angler was expanded up to an annual and reservoir expenditure level. An expansion factor for each striped bass angler ($EF_{striped\ bass_a}$) was used to estimate the number of annual visit days represented using:

$$EF_{striped\ bass_a} = (l_a \times TRIPS_{striped\ bass})/m_a \quad (3)$$

where l_a is the proportion of annual trips (days) for angler a represented within the sample multiplied by $TRIPS_{striped\ bass}$, which is the total striped bass angling trips (described in more

detail later in the methods section), and m_a is visit length in days for angler a. Other species angler's expansion factor for black bass, crappie, or sunfish/catfish was estimated according to the methodology used by Williams and Bettoli (2003) that used the proportion an angler represents of the sample size (interviews) for each target species because annual visits or trips per angler was not collected.

Per capita visitation rate for each county or state for striped bass anglers was estimated by summing expanding visits and dividing by the appropriate population level (US Census Bureau 2011). In this case, the visitation rate was divided by 1,000 to estimate striped bass visits per 1,000 people for each county or state.

III.5. On-site Survey – Expenditures and Tax Revenue

In all cases, actual expenditure data from the on-site roving creel survey were used, with the exception of being replaced by follow-up telephone survey data for anglers who completed both surveys. On-site roving creel surveys represented expenditures to date plus an estimation of costs for the rest of the visit, whereas follow-up telephone information represented completed (actual) visit costs. Expanded expenditures by striped bass anglers were sorted by where they occurred such as city within and including the local tri-county area (Cullman, Walker, and Winston counties), outside the local tri-county area, and outside Alabama. The appropriate local city, county, and State of Alabama tax rates were applied to their fuel, lodging, and general sales according to tax rates used by the Alabama Department of Revenue (Underwood 2010). Proportions of expenditures by purchased item (sector) and geographic location from completed follow-up telephone surveys were generated based upon three purchase location strata: 1) local residents living in the tri-county area surrounding Lewis Smith Lake (Cullman, Walker, and

Winston County), 2) non-local Alabama residents (outside the tri-county area), and 3) non-residents of Alabama. On-site interviews without a completed follow-up telephone survey had these proportions applied to their expenditures to estimate total expenditures by the appropriate sector and location.

Fuel expenditures were divided by the average price of regular unleaded gas per gallon for Alabama in 2010 of $2.64 (C. Ingram, AAA Alabama, personal communication) to obtain gallons purchased, then multiplied by the per gallon tax rate to estimate tax revenue for the State of Alabama, local counties, and cities from this expenditure item. Lodging and general sales tax rates were multiplied by the estimated expenditures in those sectors. The distribution of the State of Alabama, local county, and city tax revenue were obtained from the appropriate revenue official in each local county, city, or within the State of Alabama, including Cullman County (C. King, Director Cullman County Sales Tax), Cullman City (W. Moore, Cullman City Accountant), Walker County (J. Farris, Walker County Commission Administrator), Jasper (K. Chambless, Jasper City Clerk), Winston County (S. T. Wright, Winston County Revenue Commissioner), Double Springs (K. Ownby, Double Springs Magistrate), and Alabama (Fulfurd 2010). Only expenditures reported within the county seats of Cullman (Cullman City), Walker (Jasper), and Winston (Double Springs) counties had their corresponding city tax rate applied.

Because anglers targeting other fish species were not asked in detail about where or what was purchased, an average tax rate from the striped bass expenditures was estimated. This was applied to expenditures and expanded for other species anglers to estimate the State of Alabama and local tax revenues by species. Due to the inability to distinguish purchases outside of Alabama for non-striped bass anglers, all purchases were assumed to occur within Alabama. Unless otherwise stated, only striped bass angler data were used in the remaining analyses.

III.6. On-site Survey – Travel Cost Model

A regression analysis of the survey data collected was used to describe the relation between the number of annual striped bass fishing visits and independent variables, including travel cost (opportunity cost of roundtrip travel time for a visit at a specified wage rate plus actual expenditures for food, lodging, bait, etc.) of the visit, distance traveled, duration of the visit, substitute site opportunity cost of roundtrip travel time, and socio-demographic characteristics. "Opportunity costs" were defined as the measure in terms of value of the next best alternative forgone or for the application of this study, a fraction of wage rate for the time required to travel to and from the Lewis Smith Lake angling site. Opportunity cost of a substitute site was included to avoid over estimating consumer surplus (Kling 1989). Substitute site in this study was defined as a similar site for striped bass angling that respondents said would be their next best place to fish for striped bass. Required variables used in other studies' TCM include travel cost, income, and substitute site based upon the premise of individual TCM to estimate an accurate consumer surplus (Kling 1989; Ward and Beal 2000; Parsons 2003).

The TCM is a method to estimate travel costs (opportunity cost plus actual expenditures) to access a site and recreate and explain visitation, which in turn impacts local communities and their economics (Prado 2006). The basis for estimating the TCM for striped bass angling on Lewis Smith Lake was described by Parsons (2003). The individual TCM approach was implemented by using expenditure and socio-demographic data collected from the on-site survey and its companion follow-up telephone survey to estimate the travel cost for individuals and for a "typical" or "average" striped bass angler, similar to Rolfe and Prayaga (2007). Only anglers whose sole purpose (single-purpose) of their visit was to fish for striped bass or were on single day visits to

Lewis Smith Lake to fish were included; TCM is not well suited for multi-purpose visits (Ward and Beal 2000; Parsons 2003; Prado 2006).

The demand curve for striped bass angling at Lewis Smith Lake, or the quantity of striped bass visits taken (*Q*) at varying visitation cost levels, for striped bass anglers at Lewis Smith Lake was estimated using:

$$Q = \beta_0 \pm \beta_1 T \pm \beta_2 H \pm \beta_3 S \pm \beta_4 V \quad (4)$$

where β are the coefficient estimates, T is the accumulated travel costs, H is the angler's household income, S is substitute site opportunity cost and V are possible variables used to explain Q , such as socio-demographic and other variables (age, gender, ethnicity, party size, CPE, guide service use, and length of visit). It was expected that the demand curve will 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.

Travel cost (*T*) and income (H) are required variables used in TCM estimation by other studies (Ward and Beal 2000; Parsons 2003). 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 actual expenditures incurred on the visit to fish for striped bass, including fuel, lodging, restaurant, groceries, angling equipment, guide service, boat launch fees, boat rentals, tournament fees, and repair purchases and O is the opportunity cost of travel for each angler a. An opportunity cost of time spent on the trip is a standard component of the TCM (Parsons, 2003). The wage rate was used to value the angler's time to travel roundtrip from his or her residency to Lewis Smith Lake. The opportunity cost of time spent striped bass fishing (O_a) was estimated using:

$$O_a = ((H_a/2{,}000)/3) \times (D_a/55\ mph) \quad (6)$$

where H is the annual household income for angler a with a standard 2,000 hours worked per year (40 hours per week multiplied by 50 weeks per year) and valuing 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).

The survey obtained income based upon an angler's response to the range he or she falls within. The midpoint of each income bracket was selected as the value to use in the TCM. Since the range for the top bracket was infinite (>$100,000), one-half of the preceding income bracket range ($99,999 - $75,000 = $25,000 / 2 = $12,500) was added to the beginning value of the highest income range ($12,500 + $100,000 = $112,500) to become the value for the highest income bracket. The same procedure was used to estimate the top bracket for age. In cases where demographic information was not obtained from an angler, mean income and age variables of surveyed anglers and the modal response for gender and ethnicity variables were used for each county (or nonresidents). Distance traveled from home to Lewis Smith Lake and for substitute sites was doubled to determine roundtrip distances in miles.

Incorporating a substitute striped bass angling site was necessary in the TCM to reduce potential bias resulting in an overestimated consumer surplus that can occur without incorporating substitute sites with similar characteristics (Kling 1989). The substitute site incorporated into this model (Lake Martin, Alabama) was based upon the majority of responses from substitute site options from angler response and also has similar striped bass fishing site characteristics as Lewis Smith Lake (Sammons 2011).

Angler socioeconomic variables were analyzed through a combination of descriptive statistics that included modal response of gender and ethnicity and the appropriate statistical test

(Tukey's and T-test) by target species and local/non-local striped bass anglers. Significance for all statistical tests was set at $P \leq 0.05$. "Local angler" was defined as an angler with residence from Cullman, Walker, or Winston County while "non-local angler" was defined as an angler with residency from any other region.

Stepwise multiple regressions (F Test) (SAS 2009) were used to help determine the best-fit TCM model, which typically takes the form of natural log of visits explained by the independent variables (Parsons 2003) as seen in:

$$\mathrm{LN}(\lambda) = \beta_0 + \beta_1 T + \beta_2 H + \beta_3 S + \beta_4 V \quad (7)$$

where LN is the natural log and λ is the expected number of visits to ensure nonnegative probabilities. Other model variable selection criteria included statistical significance at $P \leq 0.05$, increased R-squared value for the regression, and multicollinearity between independent variables (Ward and Beal 2000). Another important factor in the TCM model variable selection was the theoretical basis for travel cost's explicative power in explaining the number of striped bass fishing visits an angler would make to Lewis Smith Lake; empirical studies demonstrate the need for the travel cost, income, and substitute site within the regression to accurately estimate consumer surplus (Kling 1989; Parsons, 2003). As mentioned in the following section, the coefficient for travel cost was used to estimate consumer surplus, thus must be significant in explaining visitation (Parsons 2003). Cook's Distance and Studentized Residuals Versus Leverage Statistic tests were used to determine common outliers in the dataset, with these outliers removed before estimating the TCM regression of striped bass angler visits (SAS 2009).

III.7. On-site Surveys – Consumer Surplus

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

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

where ^ denotes the estimated value using the results from the Poisson regression in equation (7). To estimate the aggregate consumer surplus for the entire striped bass 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:

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

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

III.8. Independent Telephone Survey – Design and Implementation

A separate telephone survey (hereafter, "independent telephone survey") was conducted in February, 2011 to survey the general striped bass angler population in the vicinity of Lewis Smith Lake. The goal of this survey was to collect data from infrequent anglers that might have been missed in the on-site survey (Pollock et al. 1994; Hanson et al. 2002) and to estimate travel cost associated with visits by the average striped bass angler. The survey was administered by the Center for Government Services at Auburn University, and contacted anglers who had purchased freshwater angler license in one of the following Alabama counties during 2010: Blount; Cullman; Jefferson; Madison; Montgomery; Morgan; Shelby; St. Clair; Tuscaloosa; Walker; and Winston. These counties were chosen because they represented the counties of residency for striped bass

anglers by the on-site survey. Subjects of this survey were drawn from the electronic fishing license database provided by ADWFF that included electronically purchased licenses and a small percentage of hand-written licenses that were entered into the database. The database provided contact information of these anglers by location the license was purchased, not residency. Assumptions were that the demographics characteristics of anglers contacted through the independent telephone survey were similar to anglers not interviewed.

The independent telephone survey was conducted February 11-20, 2011. Anglers were called between 11 a.m. and 9 p.m. on weekdays, 10 a.m. and 5 p.m. on Saturdays, and 12 p.m. and 6 p.m. on Sundays. A maximum of three attempts were made to reach an angler. Only anglers who were at least 19 years of age were interviewed, which took a maximum of 20 minutes to complete. The independent telephone survey contained many of the same questions used in the on-site roving creel and the follow-up telephone survey (Appendix IX.4). All questions were asked about a "typical" or "average" visit to Lewis Smith Lake during the previous year versus the most recent visit to help avoid anomalies and incorporate data from early season visits for high use anglers (Ojumu 2009).

III.9. Independent Telephone Survey – Effort, Catch, and Expansion Factor

Total annual effort and catch of striped bass was estimated differently than the on-site survey due to a difference in the source of the data. Methodologies in estimating effort and catch followed Pollock et al. (1994). Effort for striped bass anglers ($\widehat{SB}_t$) in trips was calculated using:

$$\widehat{SB}_t = \sum_{c=1}^{l}\left(\frac{t_c}{q_c/Q_c}\right) \quad (10)$$

where q is the number of completed surveys, Q is total number of licenses sold, and t is the number of trips annually taken to fish for striped bass per county c. The expansion factor to

estimate effort and CPE for each county used was $t_c/(\frac{q_c}{Q_c})$. The standard error of trips was estimated by taking the square root of the sum of the following:

$$Var(\widehat{SB}_c) = Q_c^2((\left(\frac{Q_c - q_c}{Q_c}\right)\left(\frac{s_c}{q_c}\right)) \quad (11)$$

where s_c is the standard deviation of effort per c county.

CPE was estimated by first converting catch per party visit to catch per angler trip (C_c) to standardize the response. Estimating CPE (fish/trip) was then performed by substituting C_c for t_c in equation (10), then divided by $\widehat{SB}_t$.

III.10. Independent Telephone Survey – Expenditures, Travel Cost Model, and Consumer Surplus

Only anglers whose single-purpose for the visit was to fish for striped bass and including single day visits were included in the TCM for the independent telephone survey. Expenditures for the striped bass fishery were estimated by applying the expansion factor to expenditures for each angler. To minimize the duration of the interview, all expenditures were assumed to occur within the State of Alabama, of which local purchases were within Cullman, Walker, and Winston counties. Estimation of travel cost and opportunity cost followed equations (5) and (6), respectively. Substitute sites were determined from the on-site survey and included in the regression for the independent telephone survey.

Striped bass anglers that met the TCM requirements for inclusion mentioned above were described and compared by descriptive statistics with the exception of gender and ethnicity where the mode was collected. The appropriate Tukey's and T-tests were conducted by targeted species and local/non-local angler variables. In addition, statistical tests were conducted between on-site

and independent telephone surveyed striped bass anglers. Significance for all statistical tests was set at $P \leq 0.05$.

Determining the best fit model ($P \leq 0.05$) of visits demanded followed the on-site methodology and applied the Poisson regression as was done in equation (7). Estimating the consumer surplus per angler visit and standard error followed the on-site survey in equations (8) and (9) described by Parsons (2003) and Englin and Shonkwiler (1995). Aggregate consumer surplus for the striped bass fishery also followed the on-site survey by multiplying the consumer surplus per angler visit with the estimated visits by the entire fishery.

IV. RESULTS

IV.1. On-site Survey

IV.1.1. *Descriptive Survey Statistics*

On-site sampling of Lewis Smith Lake was composed of 207 creel survey trips resulting in 406 roving creel and roving-access interviews over 96 sampling days during February 2010 through January 2011. Only 12 on-site interviews were refused by anglers that translated into a response rate of 97%. Of the 406 interviews, 48 (12%) were considered repeat anglers who were sampled in a prior creel on this study.

From the on-site roving creel surveys, 32% of pontoon boats counted had people angling and this percentage was applied to aerial boat counts to assist in enumerating total fishing effort on the reservoir. From the five aerial boat counts conducted, Upper Ryan area had the highest proportion of angling boats (24%), followed by Dam Forebay (8%), Lower Sipsey (5%), Upper Sipsey (5%), Lower Ryan (5%), and Rock Creek (5%) (Table 1). The remaining 10 reservoir sections accounted for 48.3% of angling boats (Figure 4). These proportions were used to calculate angling effort for the remainder of the lake. Aerial counts estimated a mean boat density of 2.67 boats per 1,000 acres over the course of the study (Table 1).

During the roving creel survey, a total of 312 anglers were intercepted during the spring (February-May), 181 during the summer (June-September), and 142 during fall and winter (October-January) (Table 2). The majority of anglers (69%) were contacted during weekends and 31% were contacted on weekdays. Of the three seasons sampled by the roving creel, striped bass anglers composed the greatest proportion of boat anglers during summer, while the lowest proportion of crappie anglers were observed in this season (Table 3). In contrast, for the three seasons, black bass anglers composed the lowest proportion of anglers during the summer.

Roving creel surveys intercepted 205 anglers (32%) in Upper Ryan, 78 anglers (12%) in Lower Ryan, 110 anglers (17%) in Dam Forebay, 103 anglers (16%) in Rock Creek, 62 anglers (10%) in Lower Sipsey, and 77 anglers (12%) in Upper Sipsey (Table 4 and Figure 5). The smallest proportion of black bass anglers occurred in Upper Ryan (57%) and the largest was in Upper Sipsey (90%). No striped bass anglers were encountered in the Upper Sipsey, but contributed to 37% of the boat anglers in the Dam Forebay, 24% in both Lower Ryan and Upper Ryan, and 25% in Rock Creek sections (Table 4 and Figure 5). Crappie anglers were not encountered in Lower Ryan and Dam Forebay during the roving creels, but composed 21% of boat anglers in the Upper Ryan area. Sunfish and catfish anglers were rarely encountered and their distribution appeared random throughout the reservoir (Table 4).

Roving creels during the morning shift intercepted 293 anglers (46%), afternoon creels encountered 201 anglers (32%), and evening creels encountered 141 anglers (22%) (Table 5). The majority of striped bass anglers where contacted during the morning creel (71%), whereas the least occurred during the evening shift (8%). Similarly, the majority of black bass anglers were encountered during morning and noon shifts, 40% and 38% respectively, and with the fewest were encountered during the evening shift (22%) (Table 5). In contrast, the greatest number of interviews of crappie, sunfish, and catfish anglers occurred during the evening shift.

IV.1.2. *Effort and Catch*

Total annual fishing effort estimated for all target species during the day (roving creel) was 233,756 hours (standard error, 16,968 hours) with an estimated 44,930 annual trips (Table 6). Most anglers (66%) fished for black bass, followed by striped bass (23%), crappie (10%), and sunfish/catfish (2%). Estimated annual fishing effort during the summer nights (roving-access

creel) was 16,148 hours (standard error, 1,183 hours) with an estimated 4,291 trips (Table 7). Anglers primarily targeted black bass (81%), followed by striped bass (8%), crappie (7%), and sunfish/catfish (4%). Note: roving-access creel data (summer night effort) were not used in any further results because it contributed < 3% of the total striped bass angling effort.

Black bass anglers fished 153,874 hours (standard error, 11,169 hours) over 29,888 trips (Table 6). Mean black bass trip length was estimated at 5.15 hours, average CPE was 0.76 fish/hour, and average HPE was 0.20 fish/hour. The mean harvest and released numbers for Alabama bass was more than five times that for largemouth bass, and released black bass were three times higher than harvested black bass (Table 8).

Striped bass anglers fished 53,009 hours (standard error, 3,848 hours) over 10,206 trips (Table 6). The mean striped bass angling trip length was estimated to be 5.19 hours, average CPE was 0.40 fish/hour, and average HPE was 0.18 fish/hour. Mean striped bass angling party harvest (0.81) and release (0.80) numbers per trip were very similar (Table 8).

Crappie anglers fished 22,455 hours (standard error, 1,630 hours) over 3,196 trips (Table 6). Mean trip length was estimated at 7.03 hours, average CPE was 2.63 fish/hour, and average HPE was 1.71 fish/hour. Angling parties targeting crappie harvested (6.26) more crappie than released (4.82) during their trip (Table 8).

Sunfish and catfish anglers fished 4,417 hours (standard error, 321 hours) over 1,639 trips and had a mean trip length of 2.69 hours (Table 6). Due to minimal effort, CPE and HPE were not calculated for sunfish and catfish anglers. Sunfish mean harvest (4.25) and release (4.00) numbers for the average party were very similar while no catfish were reported caught by anglers targeting them (Table 8).

IV.1.3. *Angler Socioeconomic Characteristics*

Striped bass anglers (single- and multi-purpose visitors) averaged 2.2 anglers per party which were larger than black bass anglers (1.7 anglers per party) (Table 9; $F = 6.8$; $df = 3, 349$; $P = 0.0002$). Single-purpose visitors were only fishing whereas multi-purpose visitors did other activities; only single-purpose visitors that fished for striped bass were used in the TCM regression. Though not significantly different, striped bass anglers had higher mean total expenditures than other angler types (Table 9; $F = 1.91$; $df = 3, 303$; $P = 0.1278$), with the same results for local expenditures ($F = 1.12$; $df = 3, 303$; $P = 0.3394$) (Figure 6).

All anglers (single- and multi-purpose visitors) intercepted in the roving creel, regardless of what they were fishing for, were from 21 counties within Alabama and four states that included California, Indiana, Minnesota, and Kentucky (Table 10). Cullman, Walker, Jefferson, and Winston counties comprised 77% of the interviews. Striped bass anglers intercepted originated from 11 Alabama counties and 3 states that included Indiana, California, and Minnesota (Table 10). Anglers from Cullman, Walker, Jefferson, and Madison counties comprised 74% of the interviews.

A total of 6 of the 10 striped bass guide businesses encountered during the roving creel survey were interviewed during the striped bass guide survey (Table 11). Striped bass guides interviewed had an average of 11 years of experience on Lewis Smith Lake with 120 trips annually. A typical guided striped bass trip had a mean of 2.83 anglers that paid an average of $337.50 for nearly 7 hours of fishing (Table 11). More striped bass were released than harvested. Each trip required the guide to travel an average roundtrip distance of 48 miles. The mean expenses for a trip incurred by the guide were $116.50, with 67% purchased locally within Cullman, Walker, and Winston counties (Table 11). The primary expenditure was fuel (59%),

followed by fishing equipment that included buying bait (30%). Half of the guides typically collected their own bait, while the remaining purchased it.

Single-purpose striped bass visitors had a mean party size of 2.19 anglers, traveled 144 miles roundtrip from their home, and spent 1.63 days (trips) per visit, which included 40 annual visits (Table 12). The typical angler used a guide service 23% of the time and had a mean CPE of 0.36 fish/hour. Lake Martin was found to be the most common substitute site mentioned within Alabama and is a large reservoir with large-sized striped bass similar to Lewis Smith Lake (Sammons 2011). Mean roundtrip distance from their home to the substitute site was 318 miles (Table 12). The typical striped bass angler had a mean age of 47 years, an income of $73,367, and was a male Caucasian. The perceived quality of a trip was 2.4 out of 4.0. The primary attribute to become an excellent trip was catching at least one striped bass (41%) while the secondary reason was to have an increased catch rate (27%) (Figure 7). A poor trip was attributed to not catching striped bass (66%) with the secondary reason being bad weather (20%).

In all cases, actual expenditure data from the on-site roving creel survey were used, with the exception of being replaced by follow-up telephone survey data for anglers who had completed both surveys. On-site roving creel surveys represented expenditures to date plus an estimation of costs for the remainder of the visit, whereas follow-up telephone information represented completed visit costs. Fuel expenditures for a typical striped bass angler comprised 37% of the mean total expenditures, whereas groceries comprised 26%, guide service comprised 25%, and fishing equipment comprised 5% (Table 13). The remaining 7% of expenditures were for repairs, eating at restaurants, lodging, and launch fees. Boat rental and tournament fees were not reported by any striped bass anglers during the on-site survey. Estimated angler expenditure per visit increased by 28% for those who completed the follow-up telephone survey, which implies that

expenditures by anglers intercepted during the visit were underestimated or that unforeseen costs occurred. Anglers purchased the majority of their items (76%) within the local counties (Table 13).

Local striped bass anglers (from Cullman, Walker, or Winston County) traveled shorter distances (28 miles) (Table 14; t = 2.86; df = 24; P = 0.0087) and had shorter lengths for a visit at 1.26 days than non-local anglers (Table 14; t = 2.17; df = 33; P = 0.0375) (269 miles; 2.04 days). Party size, CPE, and guide service use were not statistically different for local and non-local anglers, though guide service use was more likely to occur for non-local anglers. Annual visits by local anglers was significantly higher with 60 visits (Table 14; t = -2.85; df = 42; P = 0.0067) than non-local anglers with 18 visits, while the opportunity cost of travel for non-local anglers at $80.67 (t = 2.66; df = 24; P = 0.0136) and travel cost at $207.27 was greater (t = 3.04; df = 26; P = 0.0053) than local anglers ($6.03; $48.60) (Figure 8). Expenditures were also greater for non-local at $129.60 (Table 14; t = 2.86; df = 30; P = 0.0077) than local anglers at $42.55. Income for local striped bass anglers was significantly lower at $58,654 per year (Table 14; t = 3.53; df = 44; P = 0.001) than non-local anglers with an income at $73,367 (Figure 9). Travel cost ($126.32) which was estimated by expenditures ($84.41) plus opportunity cost ($41.91), substitute site opportunity cost ($78.08), and income ($73,367) were the required independent variables used in the TCM demand estimation.

IV.1.4. *Expenditures and Tax Revenue*

The geographic distribution of striped bass anglers used in the TCM estimation (single-purpose visitors) consisted of 11 Alabama counties and 2 states (Table 15). A total of 7,870 striped bass angler visits occurred based upon the estimate of trips for the striped bass fishery and

each angler's response to annual visits and visit length. The local counties of Walker, Cullman, and Winston had the highest per capita visitation rates, and composed 79% of the estimated annual visits (Table 15 and Figure 10). Jefferson County residents were estimated to have the third-highest number of annual visits, with a visitation rate of 1.87 visits per 1,000 people in the county population. Walker, Cullman, Winston, and Jefferson counties comprised 94% of annual visitation to Lewis Smith Lake to fish for striped bass and generated 76% of the local expenditures made during these activities (Table 15). Only 1% of visits by striped bass anglers originated from outside Alabama but accounted for 17% of the local expenditures. Average visitation rate for all regions were 0.57 visits per 1,000 people in the population.

Annual estimated expenditures generated inside and outside the State of Alabama by the striped bass fishery were $739,140 (Table 15). State of Alabama expenditures were estimated at $733,875, with 84% purchased within the local tri-counties surrounding Lewis Smith Lake ($618,553). Within the State of Alabama, the majority of the expenditures were for fuel ($299,918) and general sales (fishing equipment, groceries, restaurant, launch fees, repair) ($358,516), which together accounted for > 85% of striped bass expenditures (Table 16 and Figure 11). Lodging expenses only accounted for 1%, which was entirely purchased outside the local counties, while expenditures for guide services were 10% of total expenditures.

Estimated tax revenue generated by the striped bass fishery was $44,232 for both local counties (including corresponding county seat) and non-local Alabama counties (Table 16). State of Alabama tax revenue generated from striped bass angling expenditures distributed $342 into local government funds. Local tax revenue generated $11,538 which represented 97% of the total $11,880 that was distributed into the local county and city governments surrounding Lewis Smith Lake (Table 16). The distribution of these funds supported road maintenance (11%), education

(19%), and general funds (70%) (Table 17 and Figure 11). Cullman County received 80%, Walker County received 26%, and Winston County received 4% of the tax revenue distributed to the local county and city government funds.

State of Alabama expenditures of the Lewis Smith Lake fishery for all target species including black bass, striped bass, crappie, sunfish, and catfish was estimated at about $3.0 million, of which $2.7 million was purchased locally (Table 18). The average tax rate applied to striped bass angler expenditures (excluding guide service) was applied to other target species purchases. State of Alabama and local counties estimated tax revenue at $184,592 for the entire fishery at Lewis Smith Lake. Tax revenue generated by striped bass anglers was 24% of the total tax revenue generated by the entire Lewis Smith Lake recreational fishery.

IV.1.5. *Travel Cost Model and Consumer Surplus*

Outlier data were removed, which consisted of < 4% of the dataset. The stepwise multiple regression (P = 0.0004) estimated demand for striped bass fishing visits to Lewis Smith Lake using the TCM approach, and was:

$$LN\ (\lambda) = 5.20012 - 0.00609\,T - 0.00000521\,H + 0.00656\,S\ - 0.96901\,P \qquad (12)$$

where $LN(\lambda)$ was the natural log of expected number of striped bass fishing visits, T was travel cost, H was household income, S was the opportunity cost of travel to the substitute site, and P was party size (Table 19 and Figure 12). An R-square value of 0.36 (df = 4, 45) was estimated by this model. Due to literature requirements for TCM, the travel cost, income, and substitute site opportunity cost of travel independent variables were required to remain in the model (Kling 1989; Parsons 2003). The negative (inverse) signs on the resulting travel cost, income, and party size indicate that an increase in travel cost, income, or party size would cause visitation for striped bass

anglers to decrease. Party size and travel cost were was significant in explaining the demand for striped bass angling, though income and substitute site were not statistically significant at either confidence levels (Table 19). As travel costs increase, the number of visits would decline, but it was not expected that as income increases, a decrease in quantity of striped bass fishing visits would occur. This might be explained by the gap in incomes between local and non-local striped bass angler incomes and that both are included into the dataset used here. Though not significant in the model, it was shown that as the distance to the substitute site increases, visitation increases to Lewis Smith Lake as to be expected.

Consumer surplus for a typical striped bass angler was estimated at $164 per visit (standard error, $89) (Table 20). Total willingness-to-pay (WTP) to fish for a striped bass angler at Lewis Smith Lake was the consumer surplus plus travel cost for the typical striped bass angler ($126; Table 14) and was $290 per visit (Table 20). Thus, consumer surplus represented 57% of the total WTP for a striped bass angler. Converting angler consumer surplus from per visit to per day resulted in an estimate of $101. Aggregate consumer surplus for the striped bass fishery was estimated at $1.3 million.

IV.2. Independent Telephone Survey

IV.2.1. *Descriptive Survey Statistics*

Telephone numbers were provided by ADWFF, in which the Center for Governmental Studies (Auburn University) conducted the telephone survey that contained 9,769 anglers and completed 1,932 interviews (20%) (Table 21). The list contained licenses that were entered electronically into the ADWFF database at the time of their purchase; many businesses still offer hand-written licenses of which only a small percentage had been entered into the electronic

database. The list provided represented 13% of the licenses sold in the sampled region (Table 21). Using the total number of electronically and handwritten fishing licenses sold in the sampled region, a sample rate of 2.6% was calculated from the total 73,090 freshwater angler license holders for 2010.

An estimated 17% of anglers sampled during the independent telephone survey fished at Lewis Smith Lake. Cullman County had the highest number of license holders who fished at Lewis Smith Lake (54%) while Tuscaloosa County had the lowest (3%) (Table 21). The independent telephone survey determined that the majority of anglers who fished at Lewis Smith Lake primarily targeted black bass (59%), followed by striped bass (25%) (Table 22). Crappie, sunfish, and catfish anglers contributed to the remaining species targeted and each represented less than 10% of the targeted species.

IV.2.2. *Effort and Catch*

Annual effort estimated in trips for striped bass angling was 41,761 (standard error, 1,384 trips) and a CPE of 1.83 fish per trip (Table 23). Anglers who purchased their fishing licenses in Cullman, Walker, Winston, and Jefferson counties accounted for > 75% of annual striped bass angling effort. Montgomery and Morgan County licensed anglers reported the highest CPE (2.95-2.96 fish/trip), while those from Winston County had the lowest (0.01 fish/trip) (Table 23).

IV.2.3. *Angler Socioeconomic Characteristics*

Party size of sunfish/catfish anglers were larger than striped bass (single- and multi-purpose visitors), black bass, and crappie angling parties (Table 24; $F = 5.21$, $df = 3, 329$; $P = 0.0016$). Total striped bass expenditures per angler visit were higher than those for black bass and

crappie anglers (Table 24; F = 4.05; df = 3, 329; P = 0.0076), as well as local expenditures (Table 24; F = 5.59; df = 3, 329; P = 0.0009), while sunfish and catfish anglers did not have any significantly different (Figure 13).

The independent telephone survey contacted anglers who visited Lewis Smith Lake in 2010 from 47 counties within Alabama and 21 states (single- and multi-purpose visitors) (Table 25). The majority of interviewed anglers from Alabama who fished at Lewis Smith Lake were from Jefferson County while Tennessee was the most frequent state of origin for non-residents. Interviewed striped bass anglers were from 14 different counties within Alabama and 6 states; Jefferson and Walker counties contributed half of the interviews (Table 25).

Only striped bass anglers who had a single-purpose for the visit (striped bass fish) were used in the remaining analyses. Mean party size was 2.31 anglers and 11 annual visits with a length of 1.67 days per visit (Table 26). Roundtrip distance was estimated with an average of 110 miles from the angler's residence to Lewis Smith Lake, and substitute site roundtrip distance to Lake Martin, Alabama was 273 miles. Guide services were used by only 9% of the anglers and had an average CPE of 2.04 fish per trip (Table 26). The respondents had a mean age of 46 years, income of $65,000, and were typically male Caucasians. The mean expenditure per angler visit was $138.75 with 87% of all expenditures being purchased locally. Fishing equipment (24%) was the largest expenditure, followed by fuel (23%), grocery (13%), lodging (13%), and repair (12%) (Table 26). Guide service, tournament, restaurant, and launch fee purchases contributed a combined 14% of the total expenditures. All expenditure types available in the survey were used by the sampled anglers.

Local anglers visited Lewis Smith Lake more (16 annual visits) than non-local anglers (6 annual visits) to fish for striped bass (Table 27; t = -2.05; df = 32; P = 0.0492) (Figure 14). Use of

a guide service was not reported by local anglers while non-local anglers used the service 18% of the time (Table 27; t = 2.66; df = 33; P = 0.012) (Figure 15). Though not significantly different, local anglers were found to have a greater mean roundtrip distance (130 miles) than non-local striped bass anglers (91 miles) (Table 27; t = -0.70; df = 31; P = 0.4885) and thus the opportunity cost of travel to Lewis Smith Lake from their home was higher for local ($19.10) than non-local anglers ($18.98) (Table 27; t = 1.25; df = 50; P = 0.2178), potentially due to outliers or misinformation. Local angler expenditures ($101.70) were lower but not significantly different than non-local anglers ($171.50) (Table 27; t = 1.29; df = 48; P = 0.2035). Though not significantly different, opportunity cost was higher for local anglers ($19.10) (Table 27; t = 1.25; df = 50; P = 0.2178) and had lower travel costs ($120.80) (t = 1.67; df = 50; P = 0.1012) than non-local anglers ($18.98; $190.48) (Figure 14). The mean income was lower for local ($57,857) than for non-local anglers ($72,407), but was not significantly different (Table 27; t = 1.65; df = 53; P = 0.1042) (Figure 15).

IV.2.4. *Expenditures and Tax Revenue*

The geographic distribution of striped bass anglers used in the TCM estimation (single-purpose visitors) consisted of 13 Alabama counties and 3 states (Table 28). Striped bass anglers went on an estimated 26,948 annual visits based upon the angler's response to number of annual visits and associated expansion factor. The local counties of Walker, Cullman, and Winston had the highest per capita visitation rates (74-121 visits per 1,000 people), and composed 62% of the estimated annual visits (Table 28 and Figure 16). Jefferson County residents were estimated to have the third-highest number of annual visits at 3,781, with a visitation rate of 5.74 visits per 1,000 people. Morgan and Blount counties contributed 15% of annual visits with 2,644 and 1,318,

respectively. Cullman, Walker, Winston, Jefferson, Morgan, and Blount counties contributed to 91% of visits with 88% of local expenditures for striped bass angling (Table 28). Only 0.01% of visits by striped bass angling originated from outside the State of Alabama which accounted for 0.02% of the local expenditures. The average visitation rate for all counties and states was 1.41 visits per 1,000 people.

Striped bass angler expenditures were assumed to occur within the State of Alabama and were estimated $2.6 million, with 89% purchased in the local tri-county region (Table 28). Estimated striped bass angler local expenditures were at $2.3 million, which included fuel, lodging, general sales, and guide services. Estimation of tax revenue and further analysis expenditures was not included in this report due to potential over-estimation of effort and value of the fishery, as mentioned in the discussion.

IV.2.5. *Travel Cost Model and Consumer Surplus*

Outlier data were removed, which consisted of < 5% of the dataset. The step-wise regression (P=0.0054) estimated demand for striped bass fishing visits to Lewis Smith Lake as:

$$LN(\lambda) = 0.89255 - 0.0009595T + 0.00001219H - 0.00311S + 0.19453C - 1.29803G \quad (13)$$

where $LN\ (\lambda)$ was the natural log of expected number of striped bass fishing visits, T was the travel cost, H was the household income, S was the opportunity cost of travel to the substitute site, C was CPE in trips, and G was the binary response if a guide service was used (Table 29 and Figure 17). Due to TCM requirements found in the literature, travel cost, income, and substitute site opportunity cost independent variables were included in the model (Kling 1989; Parsons 2003). The negative signs on the resulting travel cost, substitute site opportunity cost, and guide service use indicate that any increase in these independent variables would result in a decrease in

visitation for striped bass anglers. Income, CPE, and guide service use were significant in explaining visitation; however, the best-fit model was only able to account for the travel cost variable in being significant at $P < 0.10$ which explains that as travel cost increases, visitation decreases (Table 29). Only 25% of the variability in the demand of visits (df = 5, 55) was explained through travel cost, income, substitute site opportunity cost, CPE, and guide use.

Consumer surplus per angler visit was estimated at $1,042 (standard error, $716) (Table 30). Striped bass angler total WTP per visit at Lewis Smith was estimated at $1,200, which was estimated by consumer surplus plus travel cost ($120; Table 27). Consumer surplus represented 87% of the total WTP for a striped bass angler. Converting angler consumer surplus from per visit to per day resulted in an estimate of $624. Aggregate consumer surplus of the striped bass fishery was estimated at $28 million.

IV.3. Comparison of Survey Methods

The proportion of effort for striped bass was similar for both the on-site (23%) and independent telephone surveys (25%) (Table 30). Independent telephone survey estimates for effort in hours, trips, and visits and expenditures (State of Alabama and local) at the reservoir level were nearly four-fold higher than the on-site survey for striped bass angling. However, the proportion that was purchased within the local tri-county region was very similar for the independent telephone (89%) and on-site survey (84%). Per angler visit expenditures, opportunity cost, and travel cost were similar between the independent telephone ($139; $19; $158) and on-site survey ($84; $42; $126) (Table 30). Per angler visit consumer surplus estimated by the independent telephone survey was nearly six-fold higher ($1,042) than the on-site survey ($164). Based upon the proportion that the consumer represents within an angler's total WTP to striped

bass fish, the on-site survey was much lower (57%) than the independent telephone survey (89%). The combination of higher estimates of effort and angler visit consumer surplus resulted in an aggregate consumer surplus nearly twenty-two times higher for the independent telephone survey.

Comparing the typical striped bass angler between the two methods only found significant difference in the number of visits being higher for the on-site survey (40 annual visits) when compared with the independent telephone survey (11 annual visits) (Table 31; $t = 3.47$; $df = 60$; $P = 0.001$). Travel cost expenditures between the two survey methods was found to not be significantly different (Table 31; $t = -0.83$; $df = 114$; $P = 0.4106$), as was income ($t = 1.26$; $df = 100$; $P = 0.21$).

On-site surveyed non-local anglers traveled further roundtrip (269 miles) than independent telephone surveyed non-local anglers (91 miles) (Table 31; $t = 2.10$; $df = 25$; $P = 0.0459$) which resulted in independent telephone surveyed non-local anglers having lower opportunity costs ($t = 2.20$; $df = 24$; $P = 0.0378$). The number of visits was similar between the two methodologies for non-local anglers (Table 31; $t = 1.54$; $df = 25$; $P = 0.1356$), as was travel cost ($t = 0.24$; $df = 55$; $P = 0.8138$).

Many differences were detected between the two methodologies for local anglers. On-site survey found local anglers traveled shorter roundtrip distances (28 miles) (Table 31; $t = -1.84$; $df = 27$; $P = 0.0754$), had more visits (60 annual visits) ($t = 3.25$; $df = 34$; $P = 0.0026$), and used a guide service more often (15%) ($t = 2.13$; $df = 26$; $P = 0.0431$) than local anglers who participated in the independent telephone survey (130 miles; 16 annual visits; 0%). Local angler expenditures were significantly higher for the independent telephone survey at $101.70 per visit than the on-site survey at $42.55 (Table 31; $t = -2.28$; $df = 38$; $P = 0.0281$). Though not significantly different, local anglers had increased opportunity costs of travel for the independent telephone survey at

$19.10 (Table 31; t = -1.54; df = 31; P = 0.1331) than the on-site survey at $6.03. Local anglers had significantly lower travel costs per visit for the on-site survey ($48.60) than the independent telephone survey ($120.80) (Table 31; t = -2.55; df = 38; P = 0.015).

V. DISCUSSION

V.1. On-site Survey

The on-site roving creel survey and the follow-up telephone surveys took approximately 7 minutes each to complete that were conducted throughout the 12-month study period. Due to striped bass fishing techniques, such as trolling with down-riggers or with free-swimming bait, it would have been difficult to collect angler data without interfering with the angler's fishing activity, so, in addition to the on-site survey, a follow-up telephone survey was conducted. Anglers underestimated expenditures for the roving creel survey when compared to the follow-up telephone survey estimates. This allowed for a more in-depth interview and obtained completed visit information (Ditton and Hunt 2001). Striped bass anglers were very cooperative in completing both surveys.

The majority of Lewis Smith Lake anglers targeted black bass, with striped bass anglers representing the second-largest component of the fishery. Although on-site survey reservoir sections on Lewis Smith Lake were chosen to increase the odds of encountering striped bass anglers, no striped bass anglers were encountered in the Upper Sipsey area during the study and minimal encounters occurred in the Lower Sipsey area (Figure 5). This area of the reservoir was characterized by a low density of shad *Dorosoma* spp., a primary prey source of striped bass (Shepherd and Maceina 2009), limited boating access, and a lower population base in the surrounding area (U.S. Census Bureau 2011), all of which may have combined to reduce striped bass population density and anglers seeking striped bass in these sections of the reservoir. This study found striped bass angling effort was highest in the Upper Ryan area during the spring and fall seasons and in the Dam Forebay area during the summer, which matched *a priori* assumptions of biologists (K. Floyd, ADWFF, personal communication). Also, the morning appeared to be a

popular time for striped bass angling, especially during the summer months. A roving-access creel was attempted to estimate effort during the summer nights, but striped bass fishing during this time period was found to contribute an insignificant portion of the total striped bass effort and was not included in the valuation of the fishery.

The on-site survey had a higher probability of interviewing an angler who frequented the lake multiple times compared to a one-time visitor and is known as endogenous stratification or avidity bias (Englin and Shonkwiler 1995). Endogenous stratification was corrected by applying a non-uniform probability of sampling strategy, interviewing an angler only once for demographic and economic questions during the study, and applying a Poisson distribution to accurately estimate the value and visitation to Lewis Smith Lake (Thomson 1991; Ditton and Hunt 2001; Prado 2006). Because our roving creel survey utilized a non-uniform probability of sampling strategy, which relied heavily on randomization and is believed to be more realistic snapshot of the fishery than the independent telephone survey (more will be said about this later).

Increased expenditures by striped bass anglers were likely due in part to higher incomes and frequent use of a guide service. Alabama anglers in general were estimated to have an income range of $50,000 to $74,999 by the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation Survey (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2007) and was estimated at approximately $58,000 by Ojumu (2009), which were lower than Lewis Smith Lake striped bass angler income ($73,367). Income levels were higher for non-local anglers, which may increase their WTP to fish for striped bass, as well as the use of guide service compared to local striped bass anglers.

Guide services allow some anglers the opportunity to pursue trophy striped bass, which otherwise may not be available to them. Striped bass anglers typically used a center console boat;

however a variety of boat types were found to be used during this study including pontoon, bass, Jon, and ski boats. Other major investments to target striped bass generally include electronics, a multitude of fishing tackle that often involves buying or catching bait for each trip, and local knowledge; a guide service provides a unique opportunity to the general public to target trophy striped bass without having to deal with all of these expenditures (B. Vines, personal communication). Guide services were considered local businesses that supplement the rural community's economy, further adding to the value of the striped bass fishery.

Although the length of the visit in days was longer for non-local anglers, this did not necessarily translate into lodging expenses. This was confirmed through the follow-up telephone survey that found very few anglers reported using a hotel or renting a cabin. Most anglers who spent multiple days at Lewis Smith Lake usually did so at a second home or stayed at a residence owned by friends or family.

Due to Lewis Smith Lake's rural location and a relatively small population, the visitation rate based upon the populations of Cullman, Walker, and Winston counties was much higher than the rate for non-local counties. The short distance and relative ease of travel to Lewis Smith Lake from Alabama's largest populated county, Jefferson (including Birmingham), contributed to the large number of annual visits to the reservoir while having a lower visitation rate. Non-resident anglers contributed very little to the fishery in visits, but their higher expenditures enabled local communities to benefit from this new money.

A majority of striped bass angler expenditures were considered general sales which included fishing equipment, food purchases, launch fees, and repair service purchases. These expenditures contributed to the largest tax revenue generated. However, State of Alabama tax revenue for general sales did not trickle down into the local county and city governments directly.

Instead, a constant dollar amount ($378,000) was passed back to local governments (half based upon population and half on equality with 67 counties in Alabama), which occurred regardless of striped bass angler expenditures occurring or not (Fulford 2010). Because of the indirect effect of the State of Alabama general sales taxes, local taxes applied to expenditures contributed to the majority of local government funds.

Fuel for vehicle and boat travel was the next largest expenditure category. However, because local fuel tax was relatively low, little tax revenue was generated for local communities. By comparison, State of Alabama fuel tax rate was much higher and generated more tax revenue for the state. A portion of the State of Alabama fuel tax revenue was distributed back to the local county and city governments which were based on the population. Due to the low population base (U.S. Census Bureau 2011), local counties received minimal tax revenue derived from striped bass angler's travel (fuel) from the State of Alabama.

Minimal expenditures were reported for lodging and none within the local counties surrounding Lewis Smith Lake. Unlike general sales and fuel taxes, local and State of Alabama lodging taxes contribute directly to local county and city government funds. Considering the infrequent use of lodging by striped bass anglers, lodging tax revenue did not aid in supporting the programs for local tourism or economic development. Whether this was due to a lack of lodging options available to anglers in the area or a product of striped bass angler behavior could not be determined from this study.

Though only $11,880 in tax revenue could be accounted for in the local communities surrounding Lewis Smith Lake from striped bass angler visitation, this revenue is still a direct benefit to the local community that would otherwise not be available; tax revenue collected by the State of Alabama from fuel, lodging, and general sales also benefit many different statewide

programs (Fulford 2010). In contrast, direct striped bass angler expenditures in the local communities were substantial, and demonstrated the inherent value of the fishery to the businesses and their employees in these communities. There were approximately $618,553 in local expenditures and with a multiplier effect of 1.5 to 2.0 there would be between $0.9 million and $1.2 million in monies injected into and used within the local economies from the striped bass fishery.

A cost-benefit analysis of the distributed funds to local county and city governments was conducted. Direct benefits ($44,232 in tax revenues to the State of Alabama and local counties that included $11,880 in local government funds) used in the cost-benefit analysis did not include guide service sales nor indirect benefits, such as option and non-use values. An option value would be the value placed by anglers who do not currently fish at Lewis Smith Lake but value the possibility of a future opportunity while a non-use value would be expressed by the general population that understands a striped bass fishery exists though never will fish at this reservoir. The cost of maintaining the striped bass population in Lewis Smith Lake required annual stocking by ADWFF. In 2009, 71,850 fingerling striped bass with an average weight of 13.6 grams were stocked at a cost of $3,617 (B. K. Rinehard, ADWFF, personal communication). Southwick and Loftus (2003) estimated stocking striped bass to cost $0.08 per one-inch fingerling with a total stocking cost in 2009 estimated at $5,748. The cost-benefit analysis to all tax revenue generated for local communities and Alabama by the striped bass fishery was $1 in stocking cost that generates $8 to $12 in tax benefit. The cost-benefit analysis resulted in $2 to $3 in tax revenue generated to the local counties and cities government funds for every $1 spent to stock the reservoir. Thus, the benefits gained from a striped bass stocking program in a suitable reservoir like Lewis Smith Lake far outweighed the costs.

Many studies that used the TCM found travel cost (actual expenditures plus opportunity cost), income, and substitute site opportunity cost variables to be necessary in explaining visitation to a recreation site and measuring consumer surplus (Kling 1989; Ward and Beal 2000; Parsons 2003). This study examined a combination of potential survey variables to better understand what contributing factors explain angler demand (number of angler visits for striped bass anglers at Lewis Smith Lake). The on-site survey TCM regression found angler visitation was best explained by party size and travel cost. An increase in travel cost or larger party sizes (i.e., non-local anglers) translated into fewer striped bass fishing visits. Based upon various similar TCM studies, an R-squared value of 0.30 or greater is common (Sorg and Loomis 1986; Rolfe and Prayaga 2007; Cullinan 2011) as was found in this study.

Based upon the negative slope and the statistical significance of travel cost, the model was reliable in explaining visitation and estimating consumer surplus of an angler for a visit. Striped bass angler consumer surplus converted from per visit to per day was $101. By comparison, regional studies estimated the consumer surplus to fish in Tennessee for trout to be between $7 and $18 per day (Williams and Bettoli 2003), another trout fishery within Oklahoma had an estimated $112 per day consumer surplus (Prado 2006), and the average Alabama angler had a consumer surplus of $33 per day (Ojumu 2009). The striped bass fishery consumer surplus appeared realistic when one considers the uniqueness of the striped bass fishery at Lewis Smith Lake (managed as a trophy fishery), high angler income level, and that each year, region, or different species targeted which could cause consumer surplus to be lower, or in this case higher than other fisheries (Johnston et al. 2006). The consumer surplus represented 56% of the total WTP (consumer surplus plus travel cost) for a striped bass angler, which implied that there was some room to increase the cost of fishing for striped bass at Lewis Smith Lake for the typical angler (though not all anglers).

A similar study on Atlantic salmon *Salmo salar* fishing in Ireland found the consumer surplus representing a high proportion of the total WTP to fish (67%) (Curtis 2002).

V.2. Independent Telephone Survey

The 2-week independent telephone survey took approximately 15 minutes to complete for each angler. Some results were similar between the on-site and independent telephone survey. These similarities included that striped bass anglers did not represent the majority of the fishery, but was the second most commonly targeted species, local counties (Cullman, Walker, and Winston) had the highest per capita visitation rates, anglers residing further from Lewis Smith Lake had increased expenditures. Detailed discussion about differences and similarities between the two methodologies is in the following section.

Striped bass anglers had significantly higher expenditures per visit than other anglers. This was likely explained by higher income levels, specifically for non-local anglers when compared to the typical Alabama angler (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2007; Ojumu 2009). Another possible factor was the guide service use, which is an added expense for some anglers. During this study, it was not evident if there were guide services targeting other species.

Interestingly, two non-local counties had the highest CPE which could be attributed to either increase CPE with guide service use or recall bias, while one of the local counties reported the lowest CPE. On average, local anglers traveled further than non-local anglers, although the difference was not statistically significant. While unexpected, this could be attributed to the combination of a few local anglers reporting very high driving distances and non-local anglers (resident and non-resident) reporting short driving distances for their visit. This resulted in the

opportunity cost for local anglers to be higher than for non-local anglers. This could be caused by including some anglers reporting incorrect distances and/or locations of their residence. The independent telephone interviewers could also misinterpret an angler's response to living in his/her second home on the reservoir and what constitutes a visit (Parsons 2003). Another possibility was that the interviewers were trained to not influence or bias a response, thus when or if asked to clarify a question, the interviewers could only repeat the question.

Following the same literature requirements used in the on-site survey to estimate the consumer surplus, independent variables included in the model were travel cost, income, substitute site opportunity cost, and other variables significant in explaining visitation (Kling 1989; Ward and Beal 2000; Parsons 2003). Likely due to the inconsistency in the data, it was difficult to find a best-fit model to explain visitation. Even so, the best-fit model was only able to estimate the travel cost coefficient significant at $P < 0.10$, with a low R-squared value (0.25) for the model when compared to other studies (Sorg and Loomis 1986; Ward and Beal 2000; Rolfe and Prayaga 2007; Cullinan 2011). The model predicted that as price (travel cost) increased, the number of visits decreased; the same can be said with the guide service use since it was an added cost for the visit which increases price and that non-local anglers use the service more often. Visitation increased for anglers who have higher income and CPE, as expected.

In part due to the lack of significance in the travel cost coefficient, a very high per visit consumer surplus was estimated; this was converted to a per day estimate ($624). Very little literature supports an estimate above $100, with the exception of a unique study on a fishery in a remote region within Brazil that also included the opportunity of wildlife viewing by Shrestha et al. (2002). The only obvious similarity between these two fisheries was the higher income level for participating anglers which is not enough to justify the independent telephone survey's high

estimate. The consumer surplus represented 87% of the total WTP (consumer surplus plus travel cost) for a striped bass angler, which raises concerns about its validity. By comparison, one of the higher proportions that consumer surplus represented for a fishery was 67% (Curtis 2002).

V.3. Comparison of Survey Methods

Striped bass angling effort estimated by the independent telephone survey was nearly four-fold higher than that of the on-site survey, which seems unrealistic due to high level of sampling effort in the on-site survey and presumably more accurate results. Though summer night effort was not included in the TCM analysis, it was unlikely that a significant night fishery existed for striped bass angling based on the results of the roving-access creel survey which represented < 3% of the annual effort. Aerial counts were not originally budgeted into the project, but deemed necessary to estimate effort in non-sampled reservoir sectors; because they were an *ad hoc* addition to the survey efforts only five flights were conducted. Additional aerial boat counts would have resulted in more precise estimates of striped bass angling effort, which may have increased estimated effort in non-sampled sections. However, it is worth noting that the limitation of creel is that counts inevitably miss a few anglers, thus is typically a minimum estimate of angling effort (Pollock et al. 1994). Despite these caveats, it was unlikely that the on-site creel survey missed enough striped bass anglers to account for a four-fold difference in estimated effort by the on-site and the independent telephone surveys. Contributing to the increased effort in the independent telephone survey, Morgan and Blount counties to name a few, contributed a much higher proportion of effort in annual visits than in the on-site survey. Thus, the difference between these two estimates was likely contributed to over-estimation of effort by the independent telephone survey data analysis.

Recall bias likely occurred at some level due to questions pertaining to visits made during the previous year (Appendix IX.4). The response rate for the on-site survey was much higher than for the independent telephone survey. This difference was likely attributable to participants preferring a personal contact with someone they met versus a random telephone call from an unknown person. The on-site survey gave creel clerks the opportunity to interact and better interpret participant's responses, whereas, the independent telephone survey had a disconnect between the interviewers and the anglers (Dillman 1978; Pollock et al. 1994). It has been found that in some mail surveys, non-response bias or failure to complete the survey can make accurate estimation of effort difficult (Thomson 1991); this bias could also play into the inaccurate estimation of effort in the independent telephone survey.

Assumptions were made that anglers contacted by the independent telephone survey had no difference in behavior and demographic characteristics than those not contacted or not on the list provided by ADWFF. This study did not test for these potential differences and only contacted anglers who purchased fishing licenses in specified counties that were entered into an electronic database which excluded many who hand-written licenses. Conducting this study on a small number of individuals in the angling population may have been led to additional biases that likely affected the results of the independent telephone survey.

The independent telephone survey found that local anglers traveled further which translated into higher opportunity costs than non-local anglers; the opposite was found to occur for the on-site survey. One possible reason for this finding was that anglers misinformed telephone interviewers about their actual residency, by claiming the lake as their home when in actuality it would be considered a vacation home and gave responses based upon their entire visit for the summer (Pollock et al. 1994). Though an attempt was made to clarify this issue, more effort

needed to be made to classify these anglers as either a local angler with individual day trips or non-local angler with one visit that has many individual angling trip days (Parsons 2003). The manner in which these angler visits were treated could greatly influence the results of any TCM. The method of collecting data limited the possibility to verify or further explore any of the participant's answers, whereas the on-site creek clerks had the ability to ask additional questions to better understand and interpret respondent's answers. For example, multiple anglers surveyed by the independent telephone survey stated that they had expenditures on fishing tournaments for striped bass; however, interactions with striped bass anglers and guides during the on-site survey revealed that no striped bass fishing tournaments had been documented on Lewis Smith Lake for many years.

Based upon the small proportion of licenses within the electronic database, the majority of the licenses sold were hand-written. When considering that both methodologies found that striped bass anglers had a higher income than anglers targeting other fish species and that Alabama had a lower mean income for much of its residents (U.S. Census Bureau 2011), it appeared likely that the study over-sampled anglers who were less likely to purchase a license that was hand-written. Though this study did not test for demographic differences between those who purchased their license electronically and hand-written, it could be possible that anglers with higher income have more options when it comes to purchasing a license each year and were targeted in the independent telephones survey. Findings from this study indicated that higher income level anglers target striped bass, specifically when compared to other literature (U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2007; Ojumu 2009).

The four-fold increase in the estimated effort by the independent telephone survey and six-fold increase in the consumer surplus resulted in a twenty-two-fold increase in the aggregate

consumer surplus of the fishery. This was partially a result of the independent telephone survey TCM's low ability to explain the variability and lack of significance for the travel cost coefficient. A lack of support for the independent telephone survey was also evident by other regional studies that estimated angler consumer surplus near or below $100 as was the on-site survey (Sorg and Loomis 1986; Shrestha et al. 2002; Prado 2006; Ojumu 2009) which indicated to a lack of support for the independent telephone survey results. Even though each species, year, region, and methodology used could provide a unique WTP to fish (Johnston et al. 2006), the independent telephone survey consumer surplus estimate appeared to be over-estimated.

Based upon these inconsistencies and differences with the on-site survey results, the independent telephone survey over-estimated the striped bass fishery effort and value. As mentioned earlier, this method could be improved by sampling a better representation of anglers to reduce a potential bias in demographics of the angling community in this study (Pollock et al. 1994). Verification of answers given by the respondent angler could reduce the inconsistencies within the data. Reducing the complexity of the questions asked and limiting the length of the independent telephone survey could have improved the quality of the data collected as well (Dillman 1978). Other issues may be important in explaining the over-estimation of effort and value by the independent telephone survey such as: memory of a typical visit over the prior year (recall bias); knowledge about the questions asked; truthfulness (prestige bias), and; accuracy (rounding bias) of responses (Pollock et al. 1994). Non-response bias with the independent telephone survey also likely contributed to the inaccurate estimate of effort and value of the fishery (Thomson 1991). Subtle differences in methodologies have been noted to cause large differences in the end results for non-market valuation studies (Johnston et al. 2006)

V.4. Conclusion and Management Implications

Striped bass angling at Lewis Smith Lake is of importance and value to the State of Alabama, specifically to the local communities that benefit directly and indirectly from the annual stocking by ADWFF, but also the entire state. As described earlier, the stocking of Lewis Smith Lake with fingerling striped bass was justified through tax revenue generation through angler expenditures within the local community and businesses. Since the current stocking rate of striped bass has been found to cause no significant biological impact to the other sport fisheries in Lewis Smith Lake (Shepherd and Maceina 2009), stocking should be continued to help meet the demands of the anglers and support the local economy.

Both surveys aided in understanding various components of the fishery. Due to issues found with the independent telephone survey, on-site surveys should continue to be the primary source of data to understand a fishery and its non-market value. Without the opportunity to collect completed visit information, the value of the fishery would have been underestimated for the on-site survey, as it was found that completed visit expenditures were larger (28%) than thought by the angler when he/she estimated completed visit expenditures from within the trip. With some adjustments in questions, verification of responses, and a potentially better representative sample (such as the entire licensed angler population or a subsample of an entire regional population), the independent telephone survey would still be an appropriate and inexpensive instrument to collect data to better understand natural resource value by the public.

Discussions with community leaders about these results would allow for a better understanding of how natural resources can directly benefit them and what could be done to increase local tax revenue. The striped bass fishery at Lewis Smith Lake drew anglers from higher income brackets that spent more money per visit than anglers targeting other species. It would be

in the best interest of the local communities, guide services, and ADWFF to promote their resource to markets outside the tri-county geographic region, and to non-residents, as they likely spend more than local anglers. Advertising to non-local anglers could increase demand, especially to those without a striped bass fishery nearby. The demand for striped bass angling and the value far outweigh the cost of stocking the fishery; with proper advertising and promotion to non-local anglers the value of the Lewis Smith Lake fishery could increase. Increased visitation would directly benefit both local and statewide economies. The lack of lodging use may need to be studied more to determine if sufficient lodging is available to meet the needs of non-local striped bass anglers who likely would need a place to spend the night.

However, to retain local and non-local anglers, the trophy component of the fishery should be maintained or improved. Most of the anglers primarily were concerned with catching fish, while some anglers and guides did express their concern of fewer trophy-sized striped bass. This potential could be attributable to increased harvest rates from anglers, in addition to natural mortality (Hanson et al. 2012). Some striped bass fisheries were more geared towards smaller-sized fish and high catch rates, such as Lake Texoma, Texas and Oklahoma (Schorr et al. 1995). However, with many options of other fish species to catch in the region, having a unique characteristic such as a trophy striped bass component to the reservoir is invaluable, particularly the close proximity a high population base, Jefferson County (Johnston et al. 2006). Consumer surplus of the striped bass fishery at Lewis Smith Lake was found to be higher than other fisheries in the region, implying that anglers placed a high value on catching striped bass out of Lewis Smith Lake. Meeting and prioritizing the diverse demands of varied angler desires should play a role in developing fishery management plans for striped bass at Lewis Smith Lake.

One important study question to consider would be whether the cost-benefit analysis was scalable by stocking more or less striped bass in the reservoir, potentially impacting CPE and size of fish caught (Johnston et al. 2006; Loomis 2006). Could ADWFF stock at a lower or higher rate and still see the same stocking cost-tax revenue benefit ratio? Stocking too many striped bass in Lewis Smith Lake may possibly decrease the value of the fishery through increased intra- and inter-specific competition, which would affect growth rates and could possibly negate the study findings of Shepard and Maceina (2009). Of course, every angler wants to catch more trophy fish, however, this is rarely if ever possible in any fishery. The open-access nature of the fishery should be taken into account when trying to increase visitation with the limited recruitment of trophy-sized fish (Hanson et al 2012). Another question to consider was the effect of increased visitation of summer anglers on mortality of larger adult striped bass through catch and release mortality. Many adult striped bass have low survival rates after being pulled up from the deep cool waters to warm/hot water and then being released (Thompson et al. 2007; Sammons 2011). Striped bass should continue to be managed for the long run to ensure future generations can enjoy opportunities that currently exist in Lewis Smith Lake.

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VII. TABLES

Table 1. Aerial boat count (N=5) information for each reservoir section, including boat angling effort (angling boats per 1,000 water surface acres) during the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Section	Mean	Std Dev	Total	%	Acres	Boats Per 1,000 Acres
Upper Ryan	13.6	14.43	68	23.9	3,056	4.45
Lower Ryan	2.8	3.56	14	4.9	961	2.91
Dam Forebay	4.4	4.28	22	7.7	1,795	2.45
Rock Creek	2.6	1.52	13	4.6	1,230	2.11
Lower Sipsey	3.0	5.10	15	5.3	1,545	1.94
Upper Sipsey	3.0	4.06	15	5.3	874	3.43
Simpson	5.4	6.66	27	9.5	1,304	4.14
Mid Ryan	2.4	4.34	12	4.2	1,031	2.33
Lick/Coon	3.2	3.96	16	5.6	340	9.41
Lower Rock/Sipsey	5.4	5.18	27	9.5	3,752	1.44
Crooked/White Oak	2.8	2.95	14	4.9	1,122	2.50
Upper Rock	0.8	1.30	4	1.4	329	2.43
Clear/Coon	2.4	2.51	12	4.2	904	2.66
Brush/Mid Sipsey	3.8	6.38	19	6.7	2,383	1.60
Upper Sipsey/Rock House	1.2	0.45	6	2.1	622	1.93
Total	56.8	-	284	100.0	21,248	-
Average	-	-	-	-	-	2.67

Table 2. Weekend and weekday strata anglers contacted by season during the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

	Spring		Summer		Fall/winter		Total	
Strata	N	%	N	%	N	%	N	%
Weekend	188	60.3	134	74.0	118	83.1	440	69.3
Weekday	124	39.7	47	26.0	24	16.9	195	30.7
Total	312	100.0	181	100.0	142	100.0	635	100.0

Table 3. Anglers targeting specific species by season contacted during the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

	Spring		Summer		Fall/Winter		Total	
Angler Type	N	%	N	%	N	%	N	%
Black bass	221	70.8	105	58.0	92	64.8	418	65.8
Striped bass	46	14.7	68	37.6	30	21.1	144	22.7
Crappie	42	13.5	2	1.1	17	12.0	61	9.6
Sunfish/Catfish	3	1.0	6	3.3	3	2.1	12	1.9
Total	312	100.0	181	100.0	142	100.0	635	100.0

Table 4. Anglers targeting specific species by reservoir section contacted during the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

	Black Bass		Striped Bass		Crappie		Sunfish/Catfish		Total	
Section	N	%	N	%	N	%	N	%	N	%
Upper Ryan	114	56.6	49	23.9	42	20.5	0	0.0	205	32.3
Lower Ryan	53	67.9	19	24.4	0	0.0	6	7.7	78	12.3
Dam Forebay	65	59.1	41	37.3	0	0.0	4	3.6	110	17.3
Rock Creek	70	68.0	26	25.2	7	6.8	0	0.0	103	16.2
Lower Sipsey	47	75.8	9	14.5	4	6.5	2	3.2	62	9.8
Upper Sipsey	69	89.6	0	0.0	8	10.4	0	0.0	77	12.1
Total	418	65.8	144	22.7	61	9.6	12	1.9	635	100.0

Table 5. Anglers targeting specific species by sampling time block (morning [AM], noon [NN], and evening [PM]) contacted by the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

	AM		NN		PM		Total	
Angler Type	N	%	N	%	N	%	N	%
Black Bass	167	40.0	158	37.8	93	22.2	418	65.8
Striped Bass	102	70.8	30	20.8	12	8.3	144	22.7
Crappie	20	32.8	12	19.7	29	47.5	61	9.6
Sunfish/Catfish	4	33.3	1	8.3	7	58.3	12	1.9
Total	293	46.1	201	31.7	141	22.2	635	100.0

Table 6. Angling effort (hours), catch rate (fish per hour), and harvest rate (fish per hour) information during the day by species (hours) obtained by the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Angler Type	Angling Effort	Standard Error	Angling Effort %	Average Trip Length	Trips	CPE	HPE	Harvest
Black Bass	153,874	11,169	65.8	5.15	29,888	0.76	0.20	30,775
Striped Bass	53,009	3,848	22.7	5.19	10,206	0.40	0.18	9,542
Crappie	22,455	1,630	9.6	7.03	3,196	2.63	1.71	38,399
Sunfish/Catfish	4,417	321	1.9	2.69	1,639	-	-	-
Total	233,756	16,968	100.0	-	44,930	-	-	-
Average	-	-	-	5.20	-	-	-	-

Table 7. Angling effort (hours) during summer nights by species obtained by the on-site roving-access creel survey, Lewis Smith Lake, Alabama from June through September 2010.

Angler Type	Angling Effort	Standard Error	Angling Effort %	Average Trip Length	Trips
Black Bass	13,079	958	81.0	3.93	3,331
Striped Bass	1,292	95	8.0	3.19	405
Crappie	1,130	83	7.0	3.99	283
Sunfish/Catfish	646	47	4.0	2.38	272
Total	16,148	1,183	100.0	-	4,291

Table 8. Mean number of fish harvested and released per party trip from the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Angler Type	Variable	N	Mean	Std Dev	Min	Max
Black Bass	Largemouth Bass Harvest	245	0.12	0.54	0	5
Black Bass	Largemouth Bass Release	245	0.38	1.06	0	7
Black Bass	Alabama Bass Harvest	245	0.67	1.54	0	9
Black Bass	Alabama Bass Release	245	1.93	3.25	0	23
Striped Bass	Harvest	64	0.81	1.59	0	6
Striped Bass	Release	64	0.80	1.78	0	10
Crappie	Harvest	38	6.26	11.43	0	60
Crappie	Release	38	4.82	7.42	0	35
Sunfish	Harvest	4	4.25	3.30	0	8
Sunfish	Release	4	4.00	2.83	0	6
Catfish	Harvest	2	0.00	0.00	0	0
Catfish	Release	2	0.00	0.00	0	0

Table 9. Mean unadjusted party size, expenditures, and local expenditures (Cullman, Walker, and Winston Counties) by target species per angler visit from the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Angler Type	N	Party Size	Expenditures ($)	Local Expenditures ($)
Black Bass	208	1.71 [b] (0.80)	45.09 [a] (135.36)	40.38 [a] (134.84)
Striped Bass	59	2.22 [a] (0.90)	83.19 [a] (105.87)	67.64 [a] (84.32)
Crappie	35	1.79 [ab] (0.74)	28.79 [a] (44.50)	25.93 [a] (35.48)
Sunfish/Catfish	5	2.00 [ab] (0.89)	47.23 [a] (68.05)	47.23 [a] (68.05)

[1] Striped bass angler data excluded data from the follow-up telephone survey (completed trip information) and included both single- and multi-purpose visitors.

[2] Means with same superscript were not statistically different (Tukey's Test; $P > 0.05$) and standard deviations are in parenthesis.

Table 10. Striped bass and all anglers contacted by residency from the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

	All		Striped Bass	
County or State	N	%	N	%
Cullman	88	27.8	15	25.4
Walker	61	19.3	9	15.3
Jefferson	59	18.7	14	23.7
Winston	36	11.4	3	5.1
Morgan	22	7.0	2	3.4
Madison	13	4.1	6	10.2
Blount	10	3.2	1	1.7
St. Clair	3	0.9	2	3.4
Limestone	3	0.9	1	1.7
Calhoun	2	0.6	0	0.0
Fayette	2	0.6	0	0.0
Lawrence	2	0.6	0	0.0
Tuscaloosa	1	0.3	1	1.7
Baldwin	1	0.3	0	0.0
Cleburne	1	0.3	0	0.0
Dallas	1	0.3	0	0.0
Etowah	1	0.3	0	0.0
Marion	1	0.3	0	0.0
Montgomery	1	0.3	1	1.7
Colbert	1	0.3	0	0.0
Hale	1	0.3	0	0.0
California	2	0.6	1	1.7
Indiana	2	0.6	2	3.4
Minnesota	1	0.3	1	1.7
Kentucky	1	0.3	0	0.0
Total	316	100.0	59	100.0

[1] Duplicate interviews of the same angler were excluded.

[2] Single- and multi-purpose visitors were included.

Table 11. Summary of striped bass fishing guide survey responses based upon a typical trip during the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Variable	N	Mean	Std Dev	Min	Max
Employees	6	1.83	0.98	1	3
Experience (years)	6	11	7	4	22
Distance (miles)	6	48	40	4	100
Trips (days)	6	120	84	45	275
Trip Price ($)	4	337.50	25.00	300	350
Trip Length (hours)	6	6.83	0.75	6	8
Party Size	6	2.83	0.41	2	3
Striped Bass Harvest	6	3.67	1.63	2	6
Striped Bass Release	6	5.00	2.97	1	9
Catch Bait (1 = Y, 0 = N)	6	0.5	0.55	0	1
Fuel ($)	6	69.17	31.05	40	125
Groceries ($)	6	10.17	6.49	5	20
Restaurant ($)	6	1.33	2.16	0	5
Fishing Equipment ($)	6	34.50	13.23	15	50
Repair ($)	6	1.33	1.03	0	2
Total Expenditures ($)	6	116.50	32.88	78	172
Local Expenditures ($)	6	78.50	37.40	17	115

[1] Trip price was for the average party size and distance was roundtrip.

[2] Local expenditures were within Cullman, Walker, or Winston County.

Table 12. Summary of striped bass angler variables during the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Variable	N	Mean	Std Dev	Min	Max
Distance (miles)	52	144	313	0	2,000
Visits	52	40	58	1	226
Length (days)	52	1.63	1.31	1	7
Party Size	52	2.19	0.82	1	4
Guide (1=Y, 0=N)	52	0.23	0.43	0	1
CPE (fish per hour)	52	0.36	0.70	0	4.13
Substitute Site Distance (miles)	52	318	350	110	2,298
Quality (1=poor, 4=excellent)	34	2.44	1.11	1	4
Gender	51	Male	-	-	-
Ethnicity	51	Caucasian	-	-	-
Age	51	47	14	17	70
Income ($)	49	73,367	34,242	5,000	112,500

[1] Distance was roundtrip, substitute site was Lake Martin, Alabama, and the mode was reported for gender and ethnicity.

[2] Only single-purpose visitors were included.

Table 13. Summary of striped bass angler expenditures (N=52) obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Expenditures Type	Mean	Std Dev	Min	Max
Fuel ($)	30.87	50.55	0	305
Lodging ($)	0.58	3.47	0	25
Groceries ($)	21.91	51.13	0	317
Restaurant ($)	2.23	5.50	0	30
Fishing Equipment ($)	4.53	6.68	0	30
Guide ($)	20.82	37.58	0	138
Tournament Fee ($)	0.00	0.00	0	0
Boat Rental ($)	0.00	0.00	0	0
Launch Fee ($)	0.51	1.67	0	10
Repair ($)	2.96	10.55	0	63
Total Expenditures ($)	84.41	114.16	0	628
Local Expenditures ($)	64.17	83.72	0	495

[1] Local expenditures were within Cullman, Walker, or Winston County.

[2] Anglers who completed the follow-up telephone survey had their expenditures used, while those who did not complete the follow-up telephone survey used their roving creel survey responses.

[3] Only single-purpose visitors were included.

Table 14. Summary of striped bass angler variables, including costs associated with travel by location of residency obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Variable	Local Angler	Non-local Angler	Typical Angler (overall mean)
Distance (miles)	28 [b]	269 [a]	144
Visits	60 [a]	18 [b]	40
Length (days)	1.26 [b]	2.04 [a]	1.63
Party Size	2.07 [a]	2.32 [a]	2.19
Guide (1=Y, 2=N)	0.15 [a]	0.32 [a]	0.23
CPE (fish per hour)	0.40 [a]	0.33 [a]	0.36
Expenditures ($)	42.55 [b]	129.60 [a]	84.41
Opportunity Cost ($)	6.03 [b]	80.67 [a]	41.91
Travel Cost (Expenditures + Opportunity Cost) ($)	48.60 [b]	207.27 [a]	126.32
Substitute Site Distance (miles)	259 [a]	382 [a]	318
Substitute Site Opportunity Cost ($)	46.32 [a]	112.38 [a]	78.08
Ethnicity	Caucasian	Caucasian	Caucasian
Age	49 [a]	44 [a]	47
Income ($)	58,654 [b]	90,000 [a]	73,367

[1] Distance was roundtrip, opportunity cost was one-third of wage rate to for roundtrip travel time, the substitute site was Lake Martin, Alabama, and mode was used for ethnicity.

[2] Local (Cullman, Walker, or Winston County) and non-local angler mean variables with the same superscript were not statistically different (T-test; $P > 0.05$).

[3] Only single-purpose visitors were included.

Table 15. Striped bass angler expenditures and visitation by residency from the on-site survey, Lewis Smith Lake from February 2010 through January 2011.

County or State	Total Expenditures	State of Alabama Expenditures	Local Expenditures	Annual Visits	Population	Visitation Rate (Visits per 1,000 people)
Walker	$ 196,776	$ 196,776	$ 172,307	2,743	67,023	40.92
Cullman	$ 159,622	$ 159,622	$ 137,328	2,674	80,406	33.26
Winston	$ 12,477	$ 12,477	$ 12,362	772	24,484	31.54
Jefferson	$ 158,762	$ 158,762	$ 145,484	1,233	658,466	1.87
Morgan	$ 22,524	$ 22,524	$ 6,859	118	119,490	0.99
Madison	$ 33,514	$ 33,514	$ 24,562	167	334,811	0.50
St. Clair	$ 9,700	$ 9,700	$ 7,872	30	83,593	0.36
Blount	$ 342	$ 342	$ 250	11	57,322	0.20
Limestone	$ 2,450	$ 2,450	$ 2,450	8	82,782	0.09
Montgomery	$ 6,657	$ 6,657	$ 4,857	19	229,363	0.08
Tuscaloosa	$ 1,902	$ 1,902	$ 1,388	4	194,656	0.02
Indiana	$ 123,001	$ 118,816	$ 94,470	80	6,483,802	0.01
Minnesota	$ 11,412	$ 10,331	$ 8,365	11	5,303,925	0.002
Total	$ 739,140	$ 733,875	$ 618,553	7,870	13,720,123	-
Average	-	-	-	-	-	0.57

[1] Total expenditures include purchases outside of Alabama and local expenditures were within Cullman, Walker, or Winston County.

[2] Only single-purpose visitors were included.

[3] County and state population were obtained from the U.S. Census Bureau (2011).

Table 16. Tax revenue generated and distributed from striped bass angler expenditures obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Sector	Local				State of Alabama				Total
	Expenditures	%	Tax Rate	Revenue	Expenditures	%	Tax Rate	Revenue	Revenue
Fuel	$ 262,546	42.4	0.5%	$ 1,228	$ 299,918	40.9	6.1%	$ 18,171	$ 19,399
Lodging	$ 0	0.0	6.1%	$ 0	$ 4,538	0.6	4.0%	$ 182	$ 182
General Sales	$ 285,104	46.1	3.6%	$ 10,311	$ 358,516	48.9	4.0%	$ 14,341	$ 24,651
Guide Service	$ 70,902	11.5	na	na	$ 70,902	9.7	na	na	na
Total	$ 618,553	100.0	-	$ 11,538	$ 733,875	100.0	-	$ 32,693	$ 44,232
Distributed to Local Government Funds	-	100.0	-	$ 11,538	-	1.0	-	$ 342	$ 11,880

[1] Local expenditures are contained within the State of Alabama expenditures and were within Cullman, Walker, or Winston County.

[2] The fuel tax rate in percent was based upon 2010 price for $2.64 per gallon within the State of Alabama (C. Ingram, AAA Alabama, personal communication) because the tax rate was $0.02 and $0.16 per gallon for local and State of Alabama, respectively.

[3] Due to $0.00 expenditures for local lodging, the average local tax rate available was shown for ease of presentation.

Table 17. Distribution of the State of Alabama and local tax revenue generated from striped bass angler expenditures obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Local Government Funds	Cullman	Walker	Winston	Total
Education	$ 163	$ 1,899	$ 211	$ 2,273
Road Maintenance	$ 647	$ 584	$ 71	$ 1,301
Tourism	$ 0	$ 0	$ 0	$ 0
Economic Development	$ 0	$ 0	$ 0	$ 0
General Fund	$ 7,525	$ 629	$ 152	$ 8,306
Total	$ 8,335	$ 3,111	$ 434	$ 11,880

[1] Based upon State of Alabama and local tax rates for fuel, lodging, and general sales.

Table 18. Expenditure and tax revenue generated by species targeted obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

	Local			State of Alabama			Total
Angler Type	Expenditures	Tax Rate	Tax Revenue	Expenditures	Tax Rate	Tax Revenue	Revenue
Black Bass	$ 1,711,575	1.9%	$ 31,928	$ 1,947,187	4.5%	$ 86,745	$ 118,673
Striped Bass	$ 618,553	1.9%	$ 11,538	$ 733,875	4.5%	$ 32,693	$ 44,232
Crappie	$ 143,628	1.9%	$ 2,679	$ 153,616	4.5%	$ 6,843	$ 9,523
Sunfish/Catfish	$ 192,473	1.9%	$ 3,590	$ 192,473	4.5%	$ 8,575	$ 12,165
Total	$ 2,666,228	-	$ 49,736	$ 3,027,150	-	$ 134,856	$ 184,592

[1] Local expenditures were contained within State of Alabama expenditures and were within Cullman, Walker, or Winston County; expenditures by target species other than striped bass were assumed to occur within the State of Alabama.

[2] The average tax rate applied to non-striped bass angler expenditures was generated by expenditures from striped bass anglers that occurred within the State of Alabama from the follow-up telephone survey.

Table 19. Results from the travel cost model regression for striped bass anglers obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

Variable	Parameter Estimate	Standard Error	Pr > |t|
Intercept	5.20012	0.63826	< 0.0001
Travel Cost	- 0.00609	0.00278	0.0338
Income	- 0.00000521	0.00000787	0.5115
Substitute Site Opportunity Cost	0.00656	0.00733	0.3757
Party Size	- 0.96901	0.27268	0.0009
Pr > F	0.0004		
R-Square	0.3599		
Adjusted R-Square	0.303		
Degrees of Freedom (Model)	4		
Degrees of Freedom (Error)	45		

[1] Dependent variable was the natural log of annual visits.

[2] Required independent variables based upon literature were travel cost, income, and substitute site opportunity cost.

[3] Only single-purpose visitors were included.

Table 20. Summary of descriptive statistics of the striped bass fishery at the reservoir and angler level obtained from the on-site survey, Lewis Smith Lake, Alabama, February 2010 through January 2011.

Level	Description	Estimate	Standard Error
Reservoir	% Striped Bass Effort	22.7	-
Reservoir	Effort (hours)	53,009	3,848
Reservoir	Trips (days)	10,206	-
Reservoir	Visits	7,870	-
Reservoir	Total Expenditures	$ 739,140	-
Reservoir	State of Alabama Expenditures	$ 733,875	-
Reservoir	Local Expenditures	$ 618,553	-
Reservoir	Tax Revenue (State of Alabama and local)	$ 44,232	-
Reservoir	Local Government Funds	$ 11,880	-
Reservoir	Consumer Surplus	$ 1,292,381	-
Angler	Expenditures (per visit)	$ 84	-
Angler	Opportunity Cost (per visit)	$ 42	-
Angler	Travel Cost (per visit)	$ 126	-
Angler	Consumer Surplus (per visit)	$ 164	89
Angler	WTP (per visit)	$ 290	-

[1] Local is within Cullman, Walker, or Winston County.

[2] Only single-purpose visitors were included.

Table 21. Summary of Alabama fishing license holders and sample rate by county of purchase obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

County	Total Licenses	Electronic List	Response Rate (%)	N	Sample Rate (%)	Expansion Factor	Lewis Smith Lake		
							N	%	Anglers
Blount	1,437	122	15.6	19	1.3	75.6	3	15.8	227
Cullman	4,687	359	22.3	80	1.7	58.6	43	53.8	2,519
Jefferson	16,576	2,334	18.8	439	2.6	37.8	70	15.9	2,643
Madison	11,630	1,380	20.6	284	2.4	41.0	14	4.9	573
Montgomery	4,274	1,004	19.1	192	4.5	22.3	10	5.2	223
Morgan	6,170	672	20.8	140	2.3	44.1	27	19.3	1,190
Shelby	8,071	837	19.5	163	2.0	49.5	12	7.4	594
St. Clair	6,698	647	18.4	119	1.8	56.3	9	7.6	507
Tuscaloosa	6,880	803	20.3	163	2.4	42.2	5	3.1	211
Walker	5,150	1,275	20.9	266	5.2	19.4	119	44.7	2,304
Winston	1,517	336	19.9	67	4.4	22.6	21	31.3	475
Total	73,090	9,769	-	1,932	-	-	333	-	11,466
Average	-	-	19.8	-	2.6	37.8	-	17.2	-

[1] Freshwater angler license information was provided by N. Nichols (ADWFF, 2011).

Table 22. Summary of anglers by target species and purchase location for license obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

	Striped Bass			Black Bass			Crappie			Sunfish/Catfish			Total	
County	N	Anglers	%	N	Anglers	%	N	Anglers	%	N	Anglers	%	N	Anglers
Blount	0	0	0.0	3	227	100.0	0	0	0.0	0	0	0.0	3	227
Cullman	9	527	20.9	25	1,465	58.1	6	352	14.0	3	176	7.0	43	2,519
Jefferson	23	868	32.9	39	1,473	55.7	1	38	1.4	7	264	10.0	70	2,643
Madison	2	82	14.3	11	450	78.6	1	41	7.1	0	0	0.0	14	573
Montgomery	3	67	30.0	5	111	50.0	0	0	0.0	2	45	20.0	10	223
Morgan	5	220	18.5	18	793	66.7	2	88	7.4	2	88	7.4	27	1,190
Shelby	3	149	25.0	8	396	66.7	1	50	8.3	0	0	0.0	12	594
St. Clair	5	281	55.6	4	225	44.4	0	0	0.0	0	0	0.0	9	507
Tuscaloosa	2	84	40.0	2	84	40.0	1	42	20.0	0	0	0.0	5	211
Walker	26	503	21.8	66	1,278	55.5	21	407	17.6	6	116	5.0	119	2,304
Winston	4	91	19.0	13	294	61.9	4	91	19.0	0	0	0.0	21	475
Total	82	2,873	25.1	194	6,797	59.3	37	1,107	9.7	20	689	6.0	333	11,466

Table 23. Striped bass angling effort (trips) and catch rate (fish per trip) obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

County	Effort	Standard Error	%	CPE
Blount	0	-	0.0	-
Cullman	9,550	746	22.9	2.15
Jefferson	10,270	753	24.6	0.87
Madison	655	96	1.6	1.77
Montgomery	1,581	163	3.8	2.96
Morgan	3,394	314	8.1	2.95
Shelby	594	138	1.4	0.90
St. Clair	3,096	467	7.4	2.01
Tuscaloosa	464	111	1.1	1.59
Walker	8,422	511	20.2	2.81
Winston	3,736	384	8.9	0.01
Total	41,761	1,384	100.0	-
Average	-	-	-	1.83

Table 24. Mean unadjusted angler party size, expenditures, and local expenditures (Cullman, Walker, and Winston Counties) by target species per angler visit obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

Angler Type	N	Party Size	Expenditures ($)	Local Expenditures ($)
Black Bass	194	2.25 [b] (0.92)	60.90 [b] (142.06)	42.08 [b] (82.58)
Striped Bass	82	2.24 [b] (0.79)	131.75 [a] (215.00)	116.22 [a] (203.13)
Crappie	37	2.03 [b] (0.64)	34.93 [b] (32.06)	28.58 [b] (21.78)
Sunfish/Catfish	20	3.00 [a] (1.49)	132.23 [ab] (441.77)	121.07 [ab] (442.60)

[1] Angler data included both single- and multi-purpose visitors.

[2] Means with same superscript were not statistically different (Tukey's Test; $P > 0.05$) and standard deviations are in parenthesis.

Table 25. Striped bass and all anglers interviewed by residency obtained from the independent telephone survey in 2010.

	All		Striped Bass	
County or State	N	%	N	%
Jefferson	462	23.91	21	25.61
Madison	228	11.80	2	2.39
Walker	220	11.39	20	24.39
Montgomery	167	8.64	2	2.39
Morgan	134	6.94	3	3.70
Tuscaloosa	114	5.90	3	3.70
Shelby	104	5.38	3	3.70
Cullman	77	3.99	9	10.98
St. Clair	74	3.83	3	3.70
Winston	74	3.83	6	7.32
Blount	23	1.19	1	1.22
Bibb	16	0.83	0	0.00
Limestone	16	0.83	0	0.00
Marion	13	0.67	1	1.22
Hale	12	0.62	0	0.00
Talladega	11	0.57	0	0.00
Chilton	10	0.52	0	0.00
Elmore	10	0.52	0	0.00
Fayette	9	0.47	0	0.00
Pickens	9	0.47	0	0.00
Marshall	8	0.41	0	0.00
Etowah	6	0.31	0	0.00
Macon	6	0.31	0	0.00
Jackson	4	0.21	0	0.00
Lamar	4	0.21	0	0.00
Lauderdale	4	0.21	0	0.00
Lawrence	4	0.21	0	0.00
Mobile	4	0.21	0	0.00
Autauga	3	0.16	0	0.00
Calhoun	3	0.16	1	1.22
Choctaw	3	0.16	0	0.00
Baldwin	2	0.10	0	0.00
Clarke	2	0.10	0	0.00
Colbert	2	0.10	0	0.00
Escambia	2	0.10	1	1.22

Table 25. Continued

County or State	All		Striped Bass	
	N	%	N	%
Franklin	2	0.10	0	0.00
Houston	2	0.10	0	0.00
Wilcox	2	0.10	0	0.00
Chamber	1	0.05	0	0.00
Clay	1	0.05	0	0.00
Dale	1	0.05	0	0.00
Greene	1	0.05	0	0.00
Marengo	1	0.05	0	0.00
Pike	1	0.05	0	0.00
Russell	1	0.05	0	0.00
Sumter	1	0.05	0	0.00
Tallapoosa	1	0.05	0	0.00
Tennessee	16	0.83	0	0.00
Florida	10	0.52	0	0.00
Georgia	9	0.47	0	0.00
Kentucky	6	0.31	1	1.22
Indiana	5	0.26	0	0.00
Arkansas	4	0.21	0	0.00
Texas	4	0.21	0	0.00
Mississippi	3	0.16	1	1.22
Ohio	3	0.16	0	0.00
Illinois	2	0.10	0	0.00
Missouri	2	0.10	1	1.22
North Carolina	2	0.10	1	1.22
Pennsylvania	2	0.10	0	0.00
Virginia	2	0.10	1	1.22
Colorado	1	0.05	0	0.00
Louisiana	1	0.05	0	0.00
Maryland	1	0.05	1	1.22
New York	1	0.05	0	0.00
South Carolina	1	0.05	0	0.00
Utah	1	0.05	0	0.00
Wisconsin	1	0.05	0	0.00
Total	1,932	100.00	82	100.00

[1] Single- and multi-purpose visitors were included.

Table 26. Summary of striped bass angler variables, including expenditures obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

Variable	N	Mean	Std Dev	Min	Max
Distance (miles)	64	110	209	0	1,200
Visits	64	11	19	1	150
Length (days)	64	1.67	1.94	1	14
Party Size	64	2.31	0.83	1	5
Guide (1=Y, 0=N)	64	0.09	0.29	0	1
CPE (fish per trip)	64	2.04	1.88	0	8.75
Substitute Site Distance (miles)	64	273	221	90	1,490
Fuel ($)	64	32.21	59.94	0	425
Lodging ($)	64	18.35	113.95	0	900
Groceries ($)	64	18.45	31.79	0	225
Restaurant ($)	64	4.73	10.76	0	60
Fishing Equipment ($)	64	33.38	79.47	0	500
Guide ($)	64	6.08	23.54	0	133.33
Tournament ($)	64	5.39	17.05	0	100
Launch Fee ($)	64	3.36	16.04	0	125
Repair ($)	64	16.82	60.65	0	400
Expenditures ($)	64	138.75	226.23	1.25	1,675
Local Expenditures ($)	64	120.38	212.30	0	1,550
Gender	64	Male	-	-	-
Ethnicity	63	Caucasian	-	-	-
Age	62	46	14	22	70
Income ($)	55	65,000	33,208	5,000	112,500

[1] Local expenditures were within Cullman, Walker, or Winston County.

[2] Distance was roundtrip, substitute site was Lake Martin, Alabama, and the mode was reported for gender and ethnicity.

[3] Only single-purpose visitors were included.

Table 27. Summary of striped bass angler variables, including costs associated with travel by location of residency obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

Variable	Local Angler	Non-local Angler	Typical Angler (overall mean)
Distance (miles)	130 [a]	91 [a]	110
Visits	16 [a]	6 [b]	11
Length (days)	1.63 [a]	1.71 [a]	1.67
Party Size	2.37 [a]	2.27 [a]	2.31
Guide (1=Y, 0=N)	0.00 [b]	0.18 [a]	0.09
CPE (fish per trip)	2.08 [a]	2.01 [a]	2.04
Expenditures ($)	101.70 [a]	171.50 [a]	138.75
Opportunity Cost ($)	19.10 [a]	18.98 [a]	19.04
Travel Cost (Expenditures + Opportunity Cost) ($)	120.80 [a]	190.48 [a]	157.79
Substitute Site Distance (miles)	253 [a]	291 [a]	273
Substitute Site Opportunity Cost ($)	43.57 [a]	61.12 [a]	52.89
Ethnicity	Caucasian	Caucasian	Caucasian
Age	43 [a]	48 [a]	46
Income ($)	57,857 [a]	72,407 [a]	65,000

[1] Distance was roundtrip, opportunity cost was one-third of wage rate to for roundtrip travel time, substitute site was Lake Martin, Alabama, and the mode was reported for ethnicity.

[2] Local (Cullman, Walker, or Winston County) and non-local angler mean variables with the same superscript were not statistically different (T-test; $P > 0.05$).

[3] Only single-purpose visitors were included.

Table 28. Striped bass angler expenditures and visitation obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

County or State	State of Alabama Expenditures	Local Expenditures	Annual Visits	Population	Visitation Rate (Visits per 1,000 people)
Walker	$ 879,758	$ 807,007	8,096	67,023	120.80
Winston	$ 73,950	$ 73,950	2,761	24,484	112.76
Cullman	$ 490,551	$ 464,186	5,954	80,406	74.05
Blount	$ 65,911	$ 65,911	1,318	57,322	23.00
Morgan	$ 249,004	$ 249,004	2,644	119,490	22.13
St. Clair	$ 48,019	$ 35,727	774	83,593	9.26
Jefferson	$ 517,841	$ 381,872	3,781	658,466	5.74
Montgomery	$ 126,328	$ 126,328	557	229,363	2.43
Escambia	$ 9,061	$ 6,796	76	38,319	1.97
Tuscaloosa	$ 16,503	$ 7,322	178	194,656	0.91
Shelby	$ 57,484	$ 46,675	178	195,085	0.91
Madison	$ 18,018	$ 14,729	287	334,811	0.86
Calhoun	$ 4,327	$ 352	70	118,572	0.59
Mississippi	$ 28,177	$ 28,177	121	2,967,297	0.04
Virginia	$ 6,641	$ 6,641	102	8,001,024	0.01
Missouri	$ 7,918	$ 7,918	51	5,988,927	0.01
Total	$ 2,599,489	$ 2,322,594	26,948	19,158,838	-
Average	-	-	-	-	1.41

[1] Local expenditures were within Cullman, Walker, or Winston County.

[2] Only single-purpose visitors were included.

[3] County and state population were obtained from the U.S. Census Bureau (2011).

Table 29. Results from the travel cost model regression for striped bass anglers obtained from the independent telephone survey for Lewis Smith Lake, Alabama during 2010.

Variable	Parameter Estimate	Standard Error	Pr > |t|
Intercept	0.89255	0.37174	0.0198
Travel Cost	- 0.0009595	0.00052	0.0715
Income	0.00001219	$4.7x10^{-6}$	0.012
Substitute Site Opportunity Cost	- 0.00311	0.00323	0.3398
CPE	0.19453	0.07573	0.013
Guide	- 0.29803	0.48208	0.0094
Pr > F	0.0054		
R-Square	0.2541		
Adjusted R-Square	0.1863		
Degrees of Freedom (Model)	4		
Degrees of Freedom (Error)	55		

[1] Dependent variable was the natural log of annual visits.

[2] Required independent variables based upon literature were travel cost, income, and substitute site opportunity cost of travel.

[3] Only single-purpose visitors were included.

Table 30. Comparison of descriptive statistics of the striped bass fishery at the reservoir and angler level obtained from the on-site (February 2010 through January 2011) and independent telephone survey (2010), Lewis Smith Lake, Alabama.

		On-site			Independent Telephone		
Level	Description	N	Estimate	SE	N	Estimate	SE
Reservoir	% Striped Bass Anglers	635	22.7	-	1,932	25.1	-
Reservoir	Effort (hours)	144	53,009	3,848	82	216,906	-
Reservoir	Trips	144	10,206	-	82	41,761	1,384
Reservoir	Visits	52	7,870	-	64	26,948	-
Reservoir	State of Alabama Expenditures	52	$ 733,875	-	64	$ 2,599,489	-
Reservoir	Local Expenditures	52	$ 618,533	-	64	$ 2,322,594	-
Reservoir	Consumer Surplus	50	$ 1,292,381	-	61	$28,084,925	-
Angler	Expenditures (per visit)	52	$ 84	-	64	$ 139	-
Angler	Opportunity Cost (per visit)	52	$ 42	-	64	$ 19	-
Angler	Travel Cost (per visit)	52	$ 126	-	64	$ 158	-
Angler	Consumer Surplus (per visit)	50	$ 164	89	61	$ 1,042	716
Angler	WTP (per visit)	50	$ 290	-	61	$ 1,200	-

[1] Local expenditures were within Cullman, Walker, or Winston County.

[2] Only single-purpose visitors were included.

[3] Effort in trips from independent telephone survey was divided by 5.19 hours per trip estimated from on-site survey.

Table 31. Comparison of striped bass angler variables, including costs associated with travel by location of residency between the on-site (February 2010 through January 2011) and independent telephone survey (2010), Lewis Smith Lake, Alabama.

Variable	Local		Non-local		Typical	
	On-site	Independent Telephone	On-site	Independent Telephone	On-site	Independent Telephone
Distance (miles)	28 [a]	130 [a]	269 [a]	91 [b]	144 [a]	110 [a]
Visits	60 [a]	16 [b]	18 [a]	6 [a]	40 [a]	11 [b]
Length (days)	1.26 [a]	1.63 [a]	2.04 [a]	1.71 [a]	1.63 [a]	1.67 [a]
Party Size	2.07 [a]	2.37 [a]	2.32 [a]	2.27 [a]	2.19 [a]	2.31 [a]
Guide (1=Y, 0=N)	0.15 [a]	0.00 [b]	0.32 [a]	0.18 [a]	0.23 [a]	0.09 [a]
Expenditures ($)	42.55 [b]	101.70 [a]	129.60 [a]	171.50 [a]	84.41 [a]	138.75 [a]
Opportunity Cost ($)	6.03 [a]	19.10 [a]	80.67 [a]	18.98 [b]	41.91 [a]	19.04 [a]
Travel Cost ($)	48.60 [b]	120.80 [a]	207.27 [a]	190.48 [a]	126.32 [a]	157.79 [a]
Substitute Site Distance (miles)	259 [a]	253 [a]	382 [a]	291 [a]	318 [a]	273 [a]
Substitute Site Opportunity Cost ($)	46.32 [a]	43.57 [a]	112.32 [a]	61.12 [a]	78.08 [a]	52.89 [a]
Age	49 [a]	43 [a]	44 [a]	48 [a]	47 [a]	46 [a]
Income ($)	58,654 [a]	57,857 [a]	90,000 [a]	72,407 [a]	73,367 [a]	65,000 [a]

[1] Distance was roundtrip, opportunity cost was one-third of wage rate to for roundtrip travel time, and the substitute site was Lake Martin, Alabama, and the mode was used for ethnicity.

[2] Local (Cullman, Walker, or Winston County) and non-local angler mean variables with the same superscript were not statistically different (T-test; $P > 0.05$).

[3] Only single-purpose visitors were included.

VIII. FIGURES

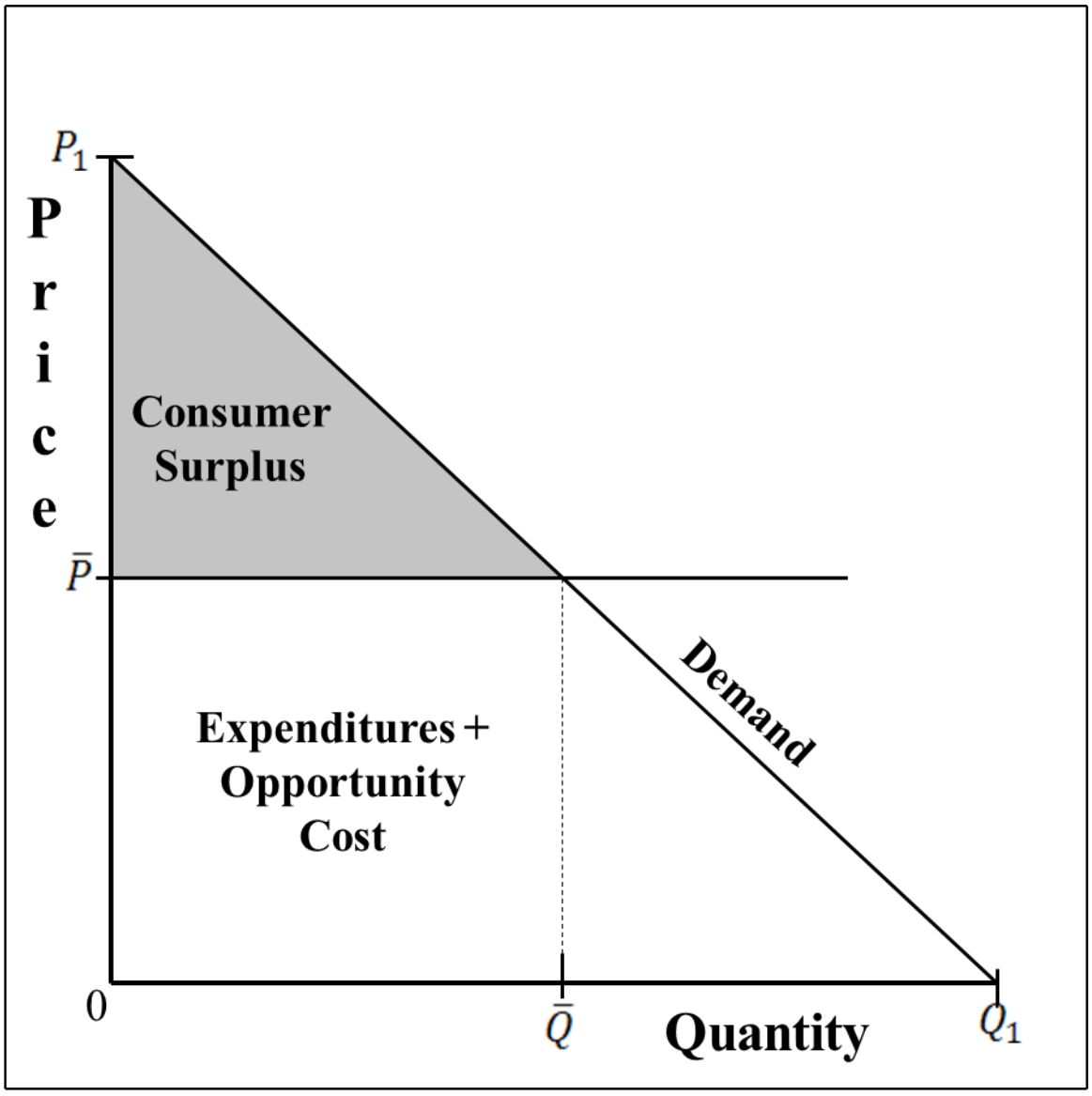

Figure 1. Graphical representation of a demand curve (quantity demanded) and consumer surplus. P_1 is the maximum visit price that one is willing to pay and Q_1 is the maximum number of visits a consumer will demand at a price of \$0. $\bar{P}$ is the equilibrium (mean) price paid and $\bar{Q}$ is the 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.

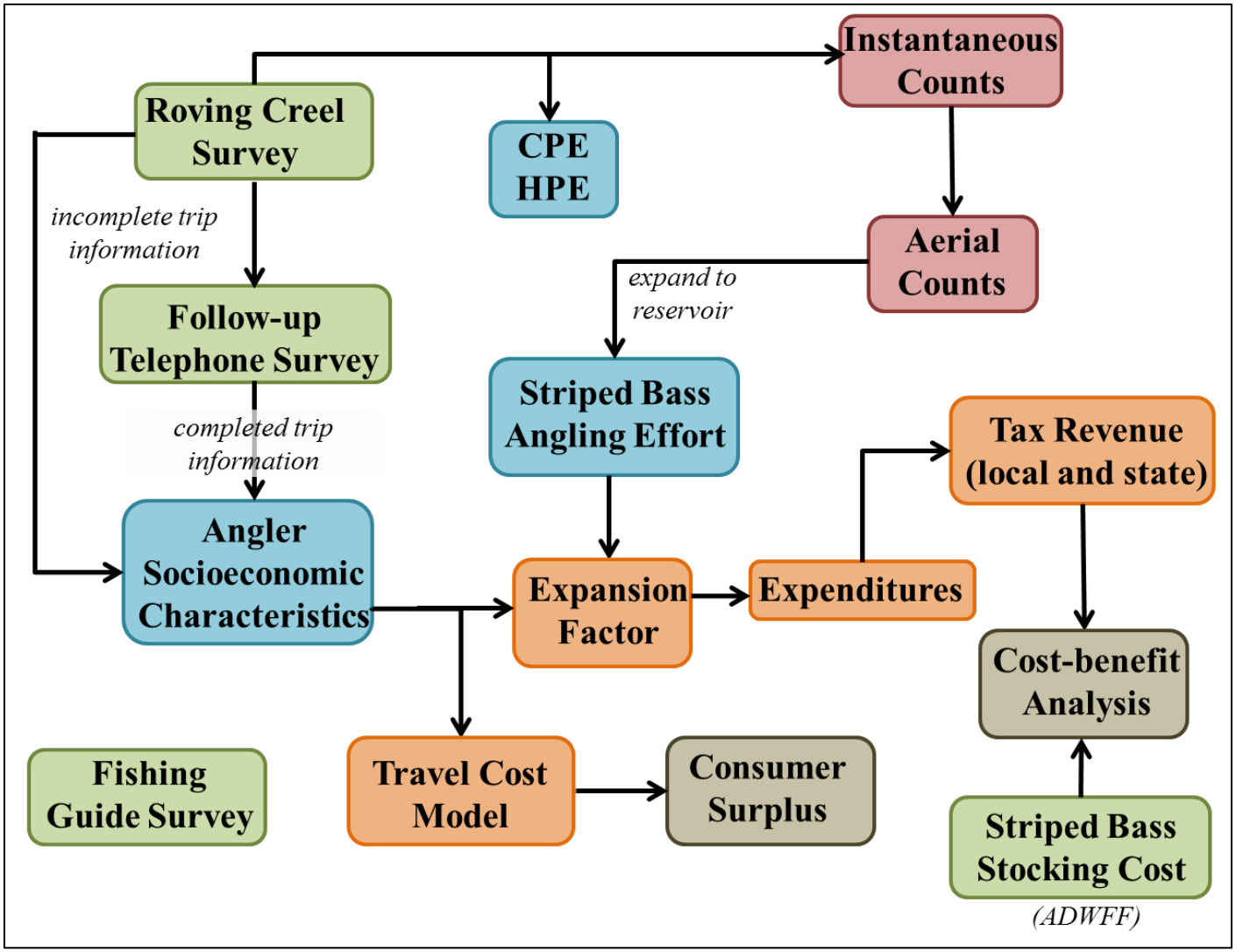

Figure 2. Flow chart of the on-site survey: data collection methodology and use of data to estimate study objectives. The independent telephone survey of license holders was excluded because it was the only source of data used in the analysis.

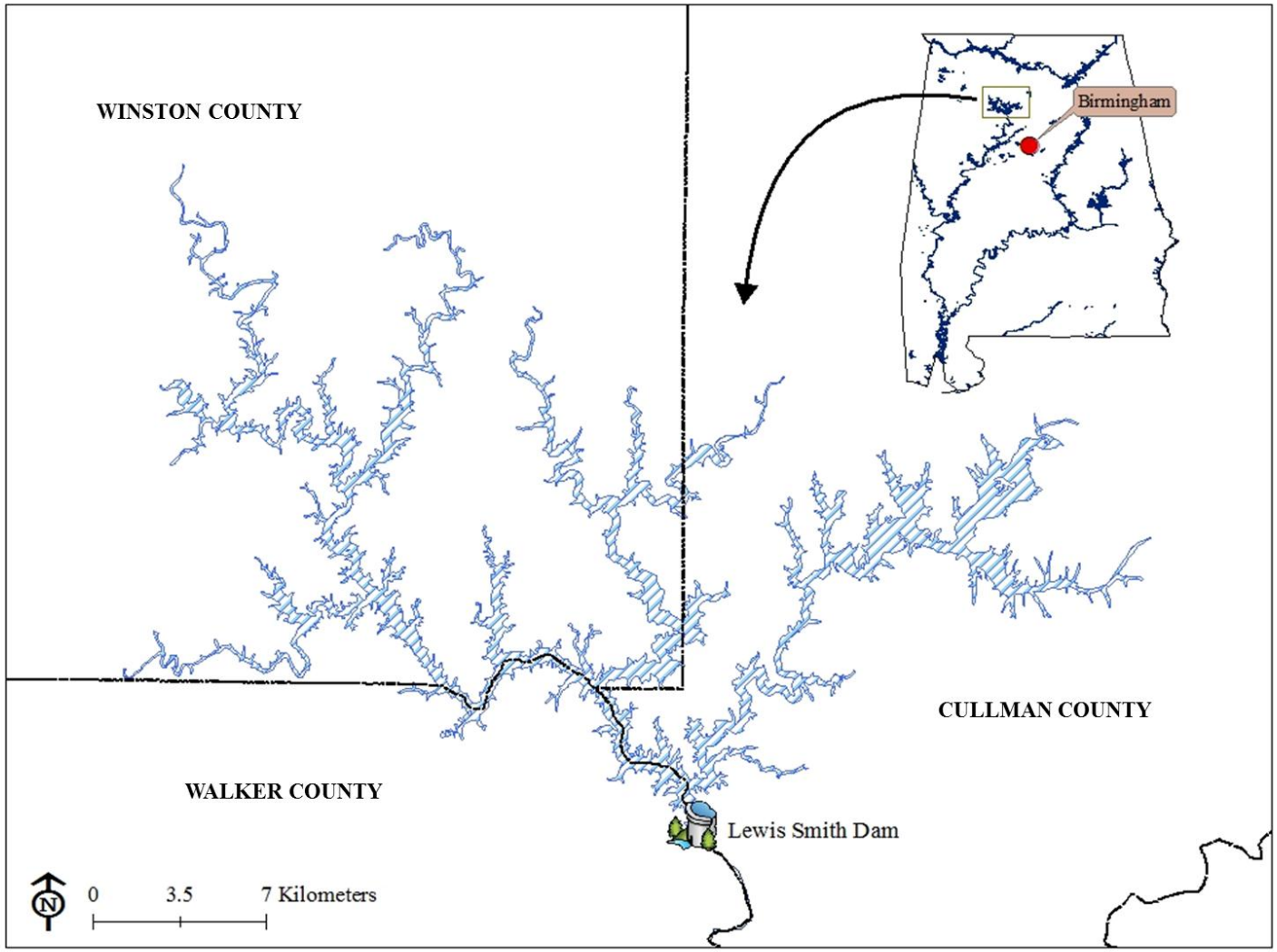

Figure 3. Location of Lewis Smith Lake, Alabama and local counties (Cullman, Walker, and Winston) with county boundaries shown by dashed lines.

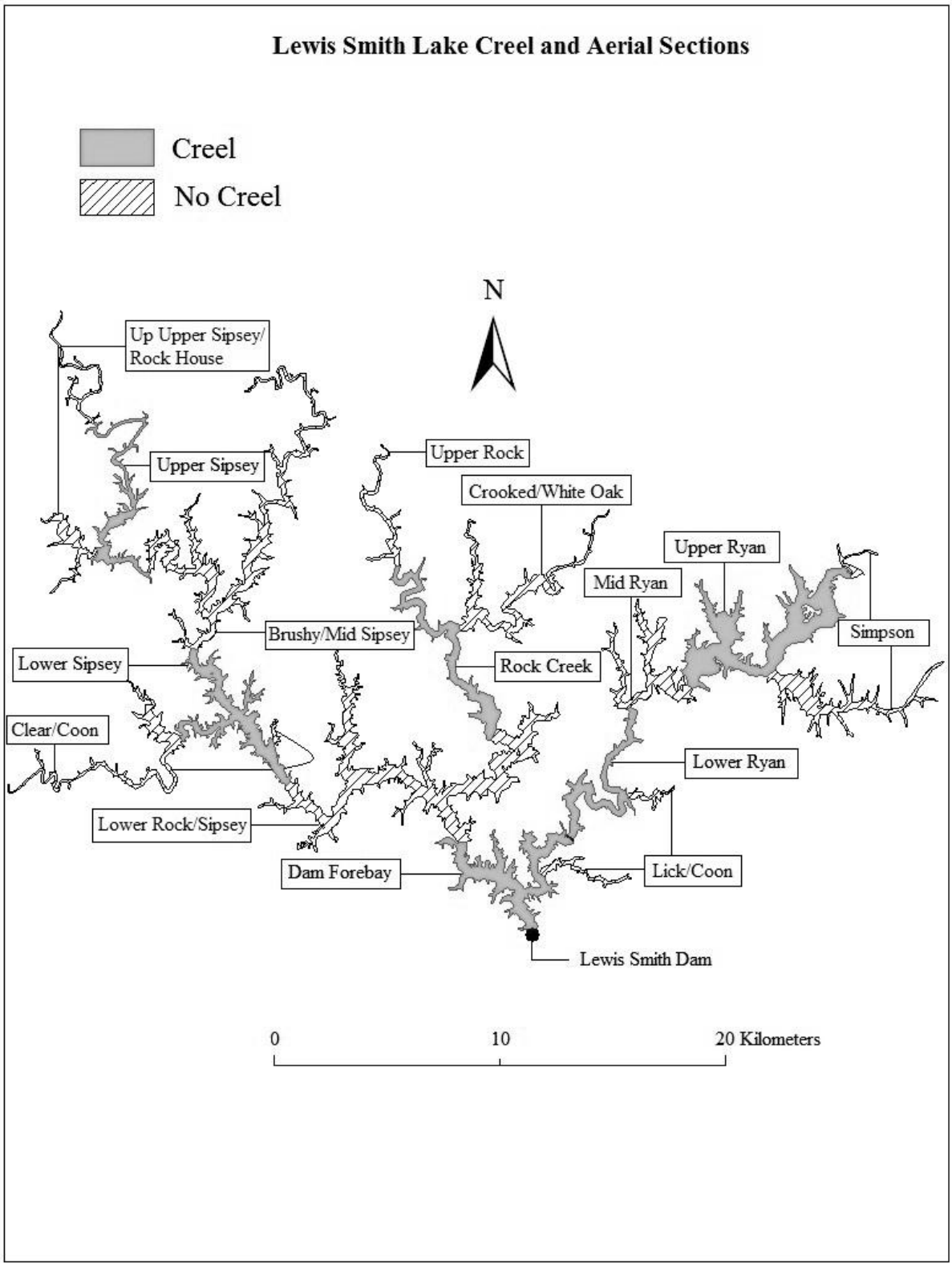

Figure 4. Reservoir sections at Lewis Smith Lake, Alabama sampled during on-site survey.

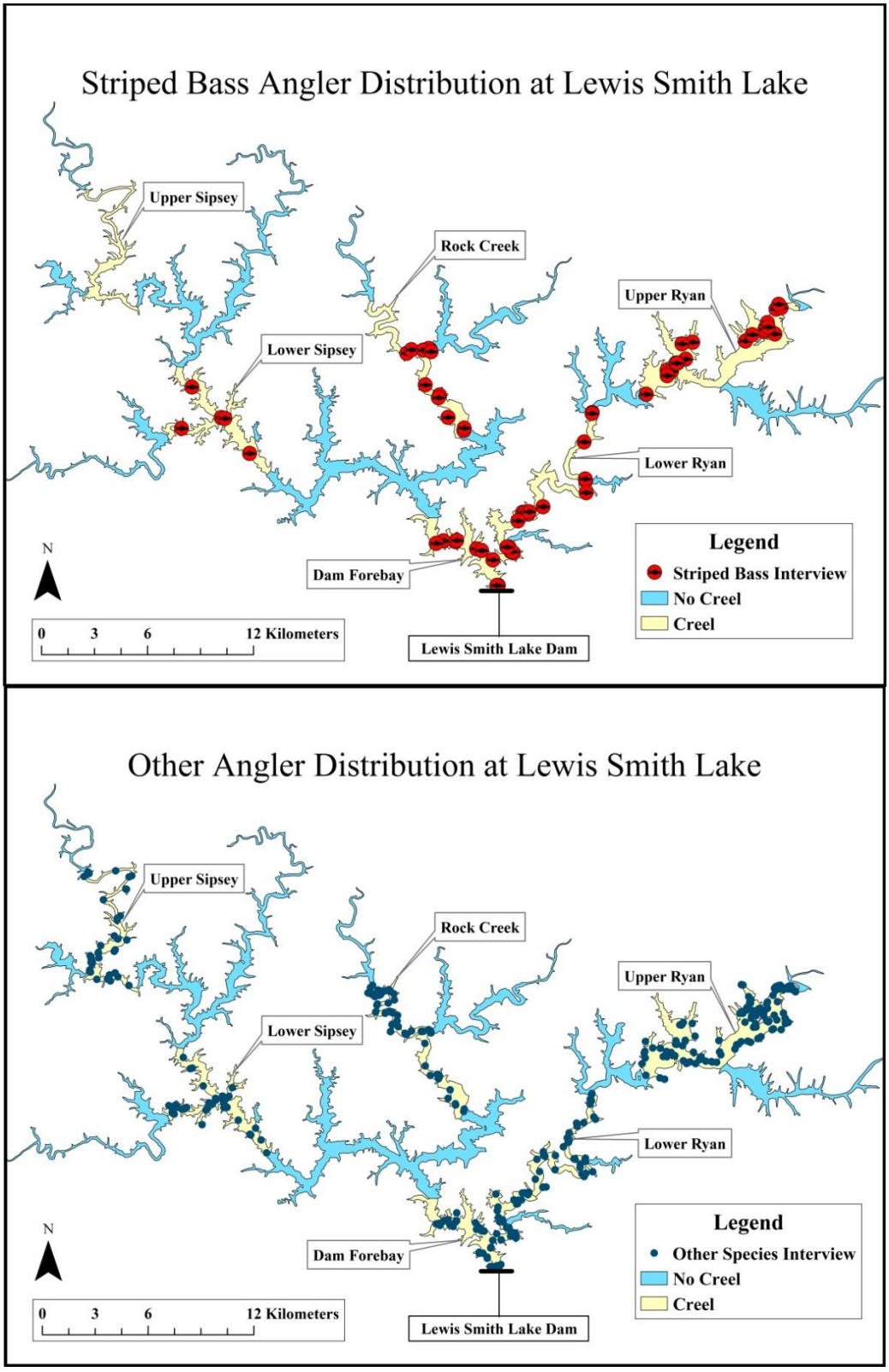

Figure 5. Location of anglers contacted during the on-site roving creel at Lewis Smith Lake, February 2010 through January 2011.

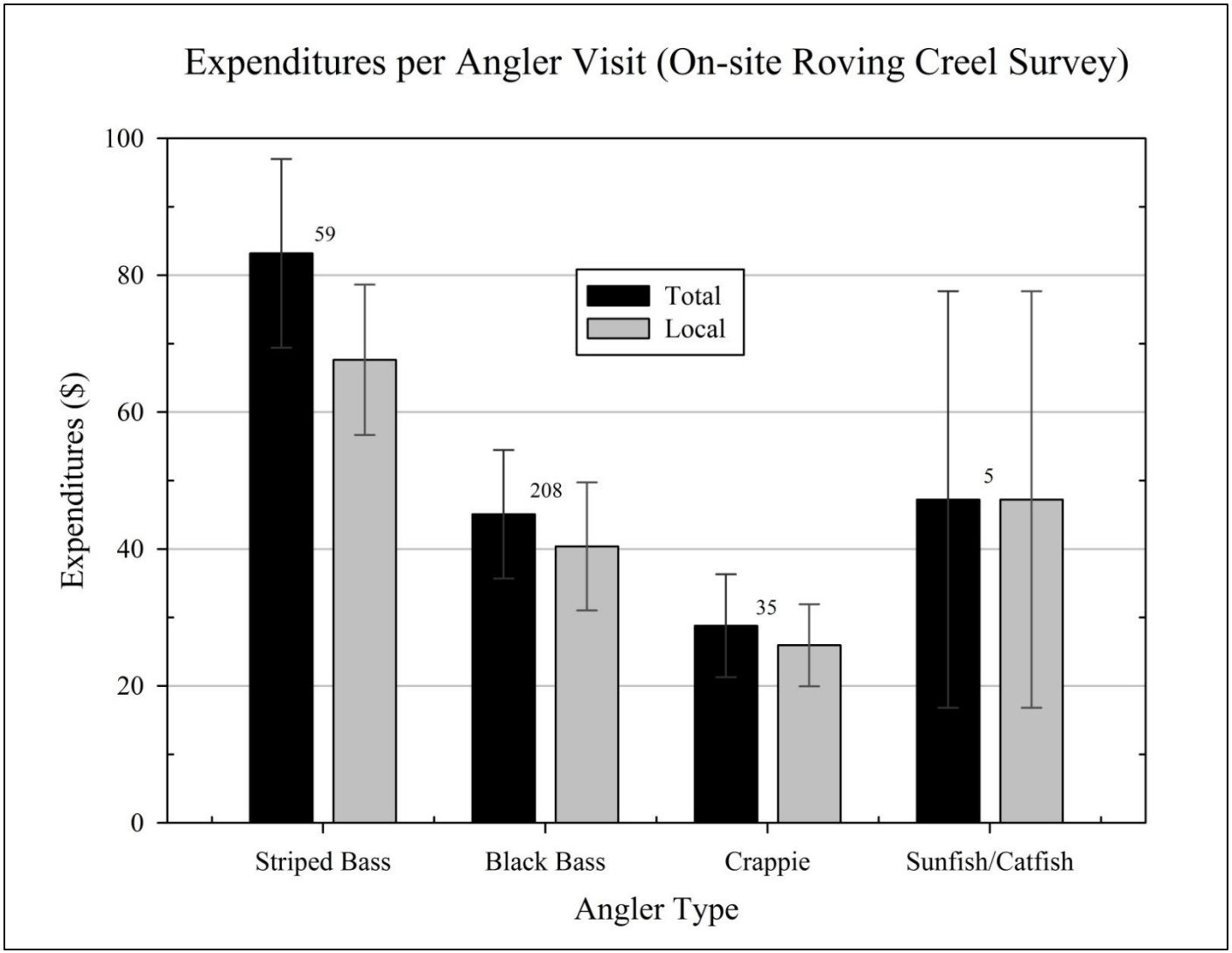

Figure 6. Mean total and local (Cullman, Winston, and Walker counties) expenditures per angler visit by target species obtained from the on-site roving creel survey, Lewis Smith Lake, Alabama from February 2010 through January 2011. Striped bass angler data excluded the follow-up telephone survey data and included both single- and multi-purpose visitors.

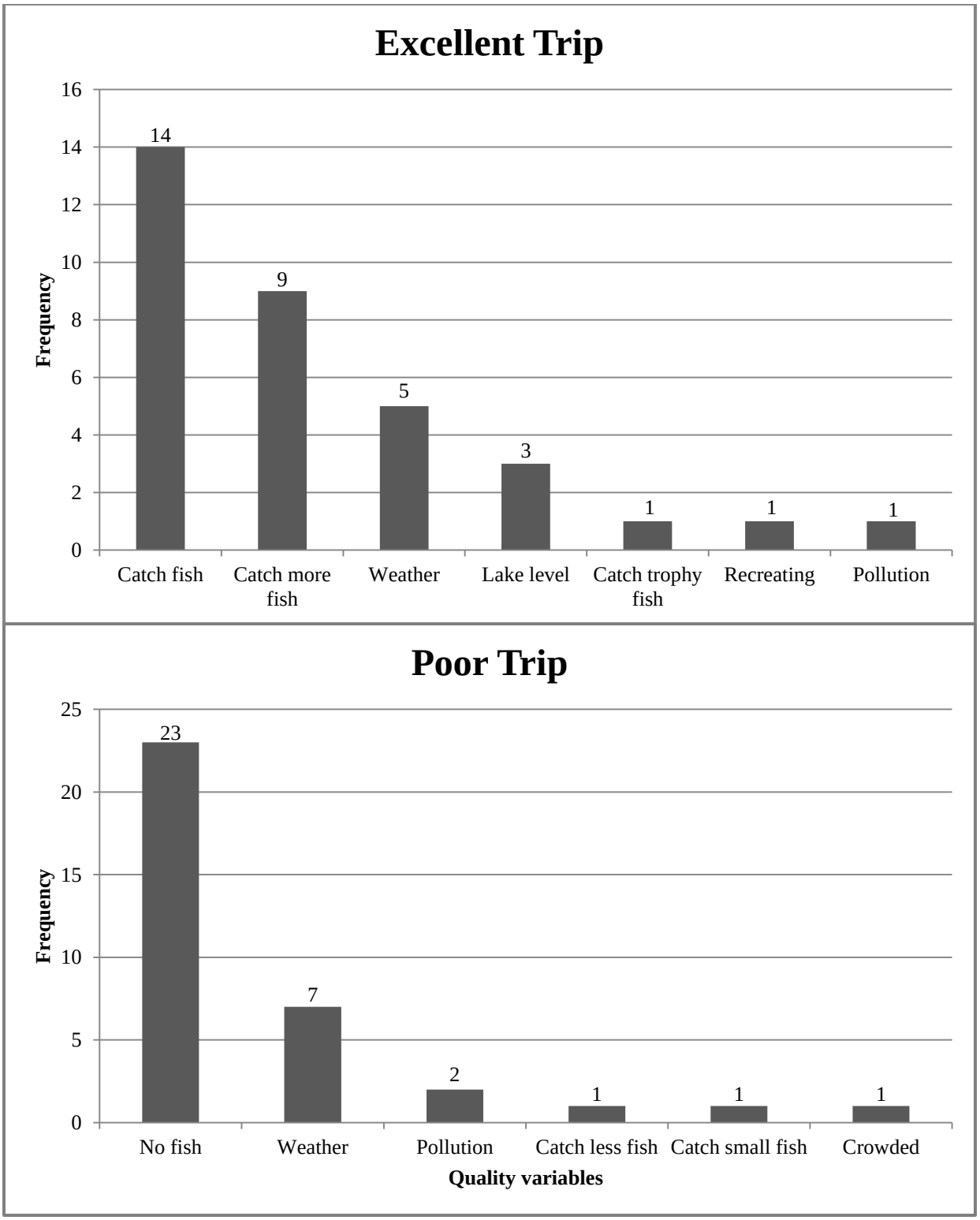

Figure 7. Frequency of quality response for an excellent or poor visit by striped bass anglers obtained from the on-site follow-up telephone survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

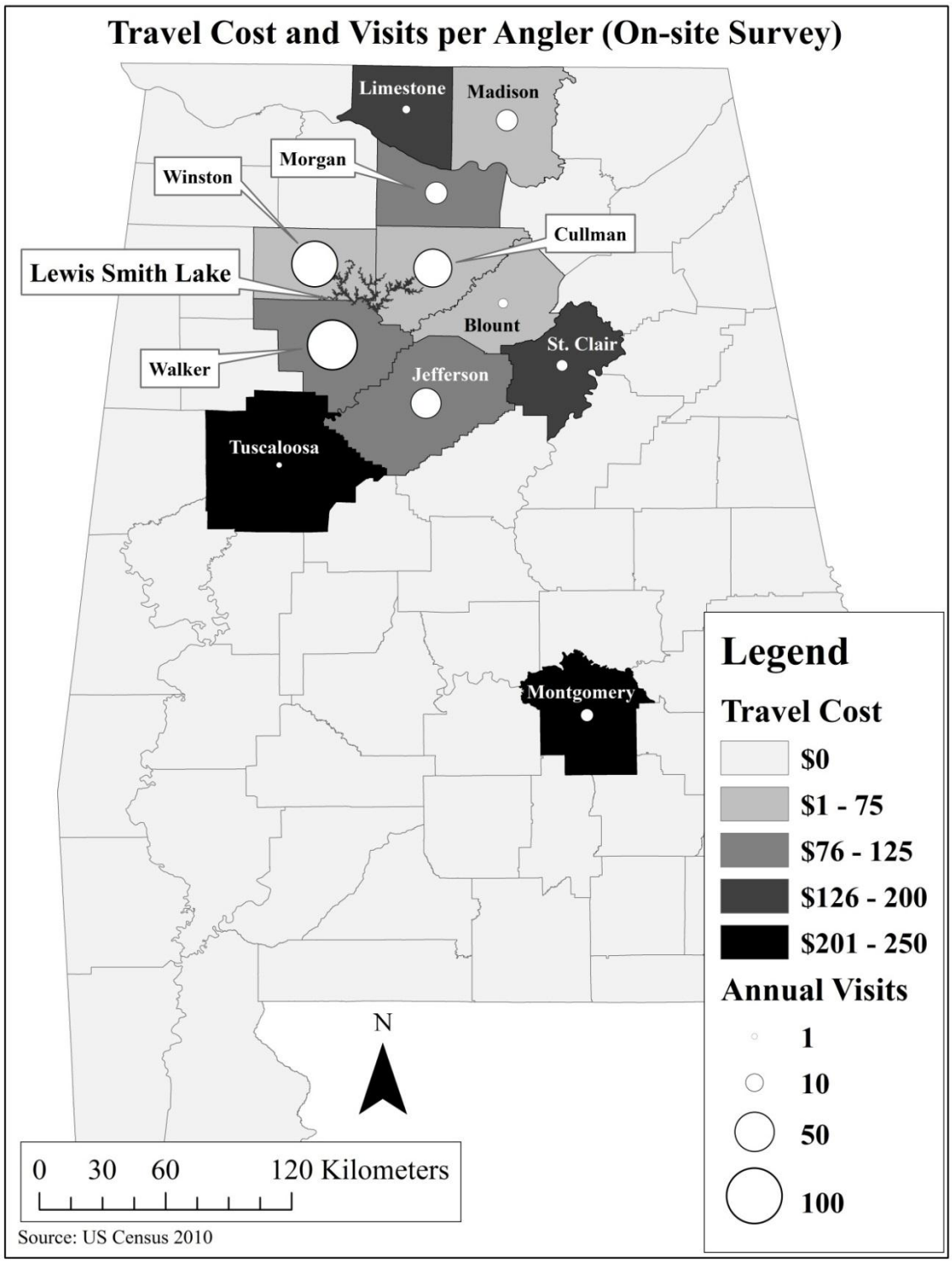

Figure 8. Mean striped bass angler travel cost (expenditures plus opportunity cost) and annual visits by Alabama county of residency obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011. Only single-purpose visitors were included.

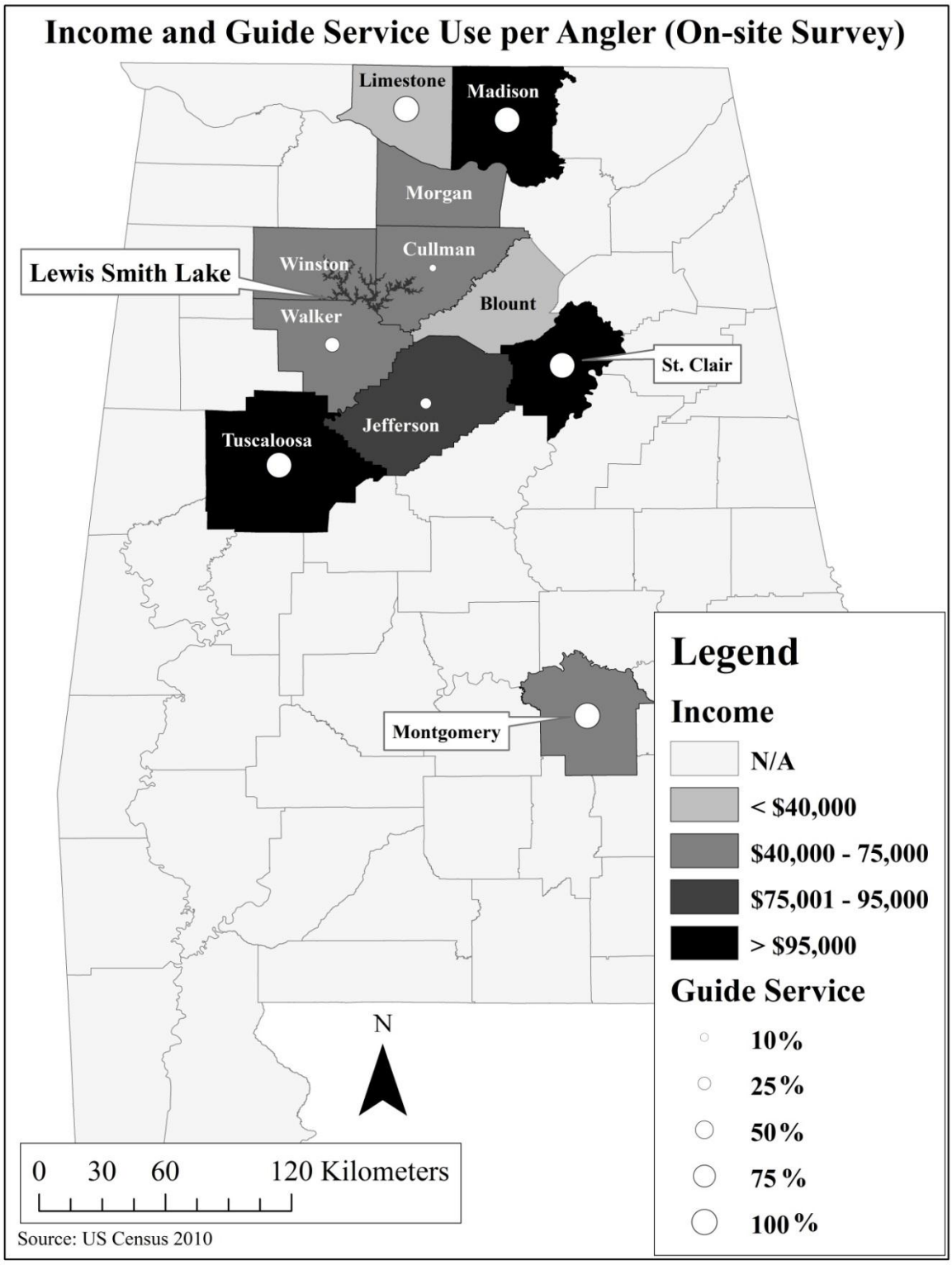

Figure 9. Mean striped bass angler income and guide service use by Alabama county of residency obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011. Only single-purpose visitors were included.

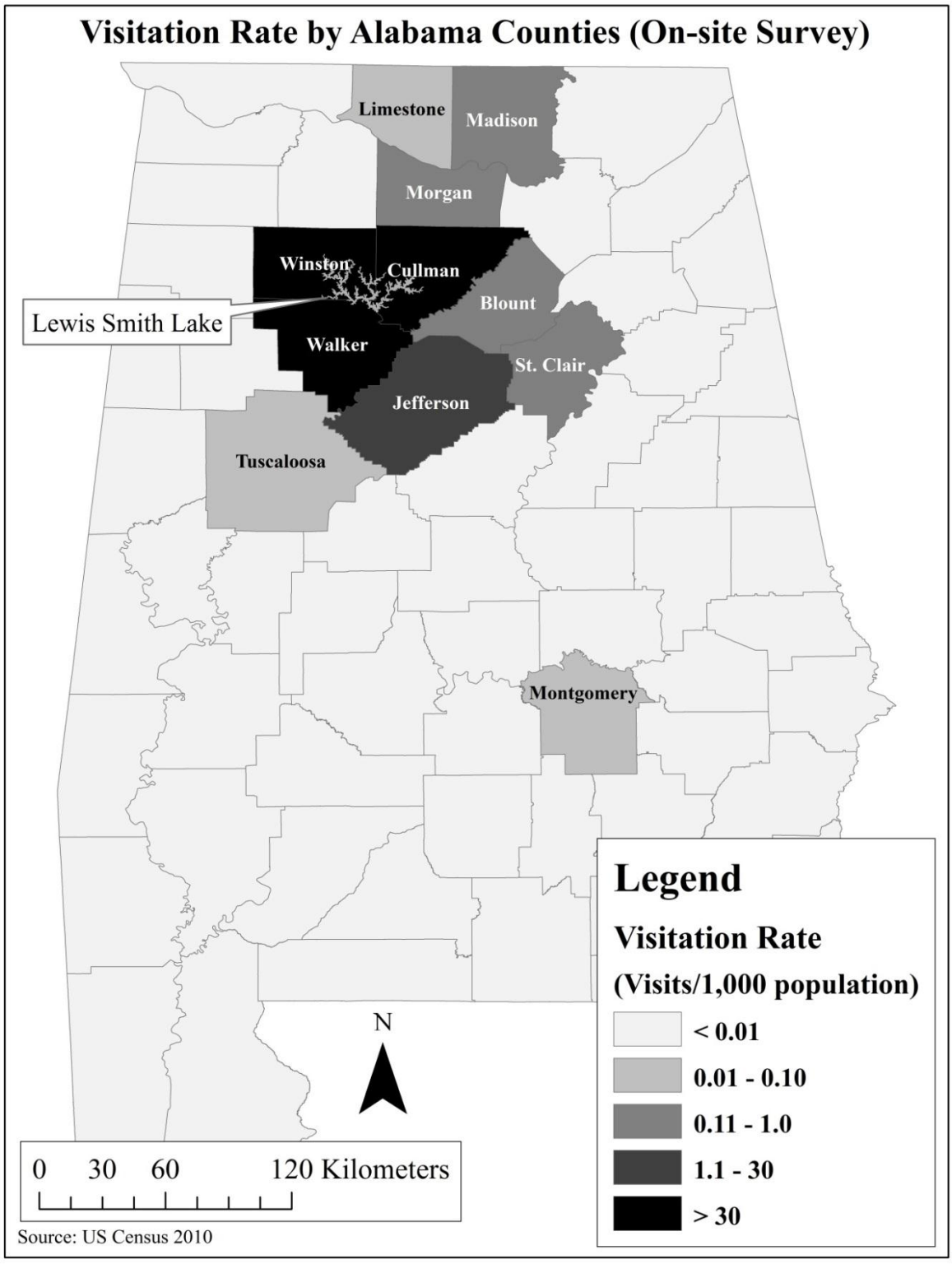

Figure 10. Striped bass angler visitation rate (visits per 1,000 people) by Alabama county obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011. Only single-purpose visitors were included.

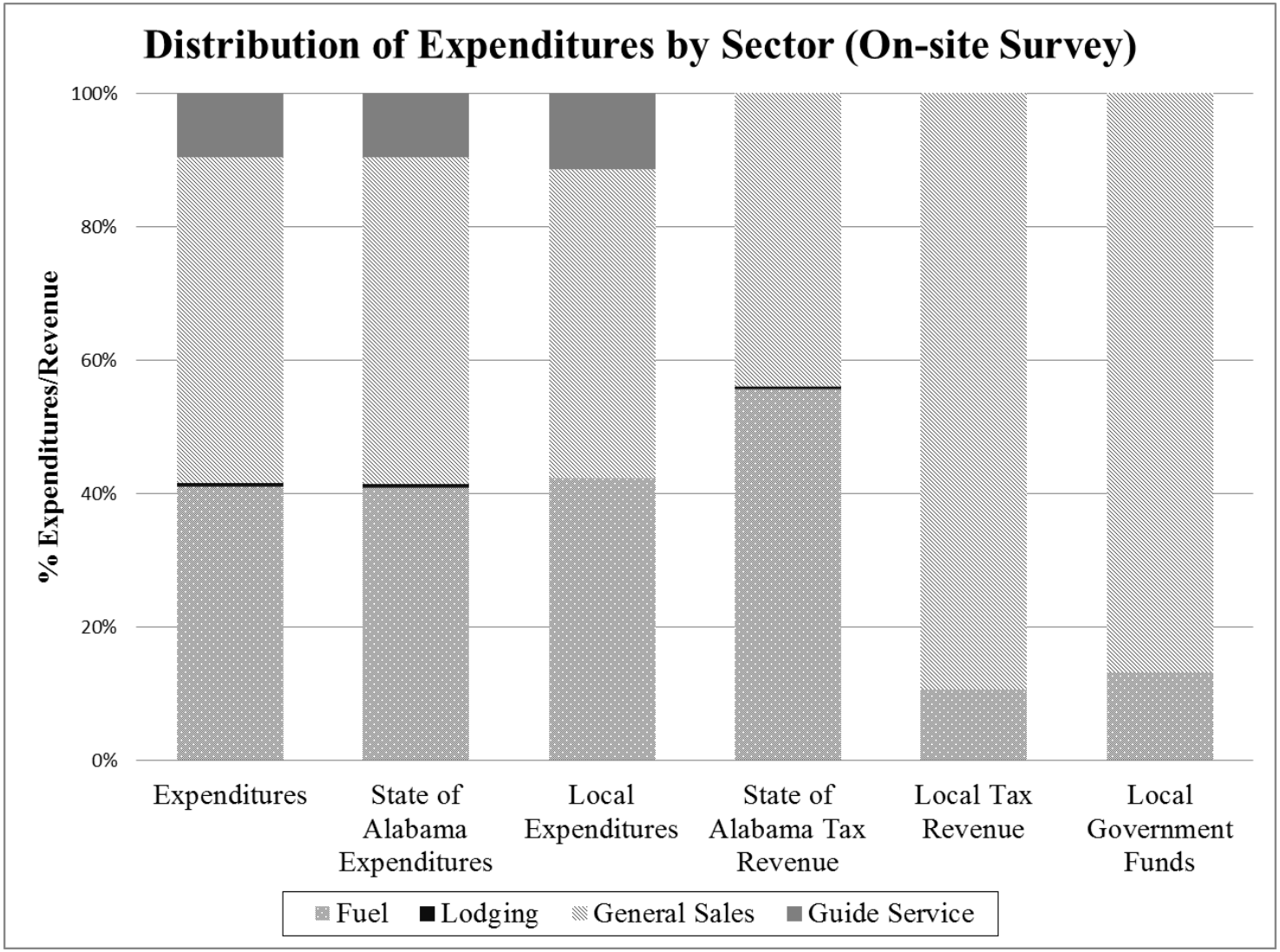

Figure 11. Proportion of striped bass angler expenditures and tax revenue by sector (types of items purchased) obtained from the on-site survey, Lewis Smith Lake, February 2010 through January 2011. Local refers to within Cullman, Walker, or Winston counties.

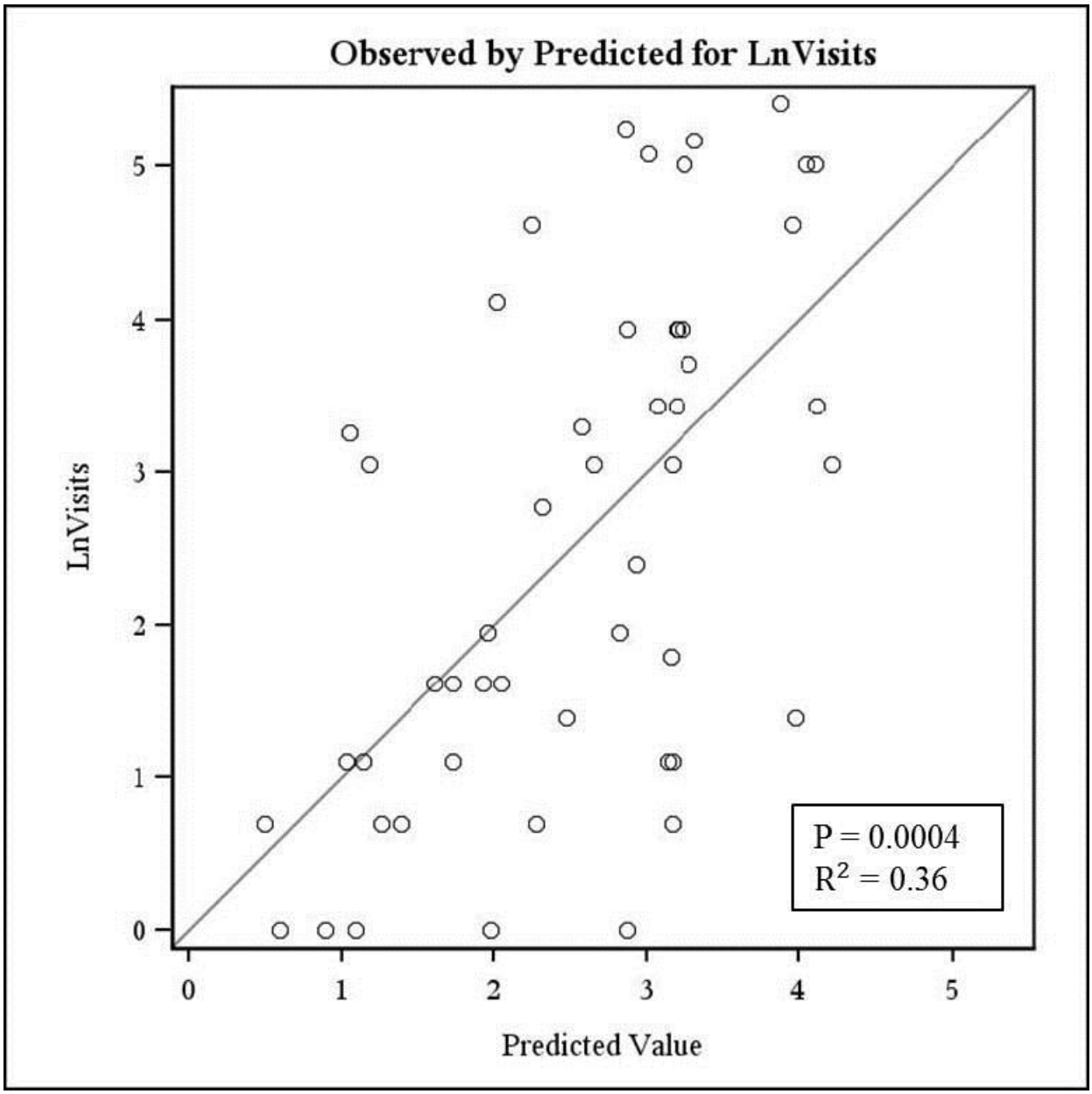

Figure 12. Travel cost model regression for observed versus predicted of the natural log of striped bass angler visits, with the independent variables that include travel cost, income, substitute site opportunity cost, and party size obtained from the on-site survey, Lewis Smith Lake, Alabama from February 2010 through January 2011.

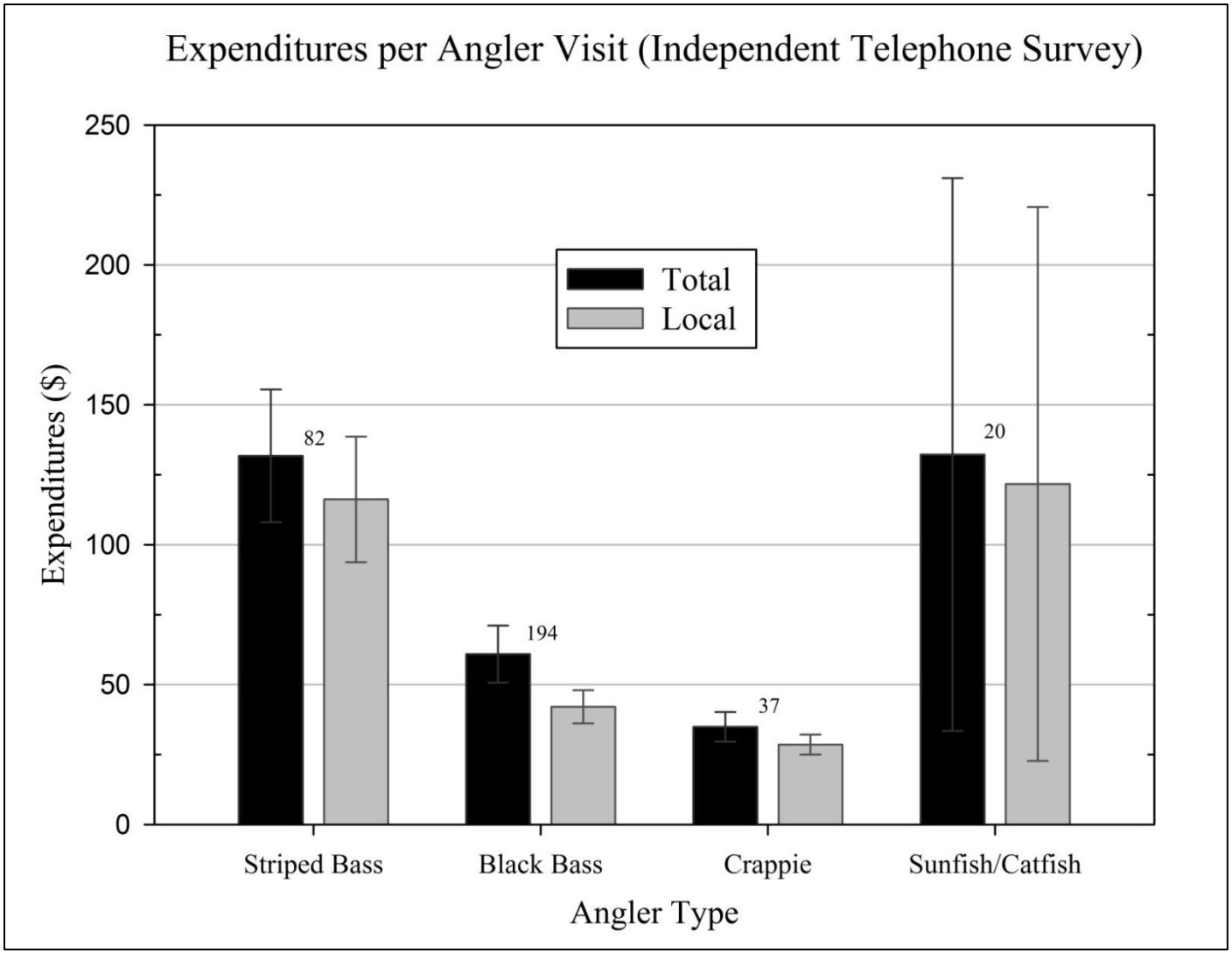

Figure 13. Mean total and local (Cullman, Winston, and Walker counties) expenditures per angler visit by target species obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010. Both single- and multi-purpose visitors were included.

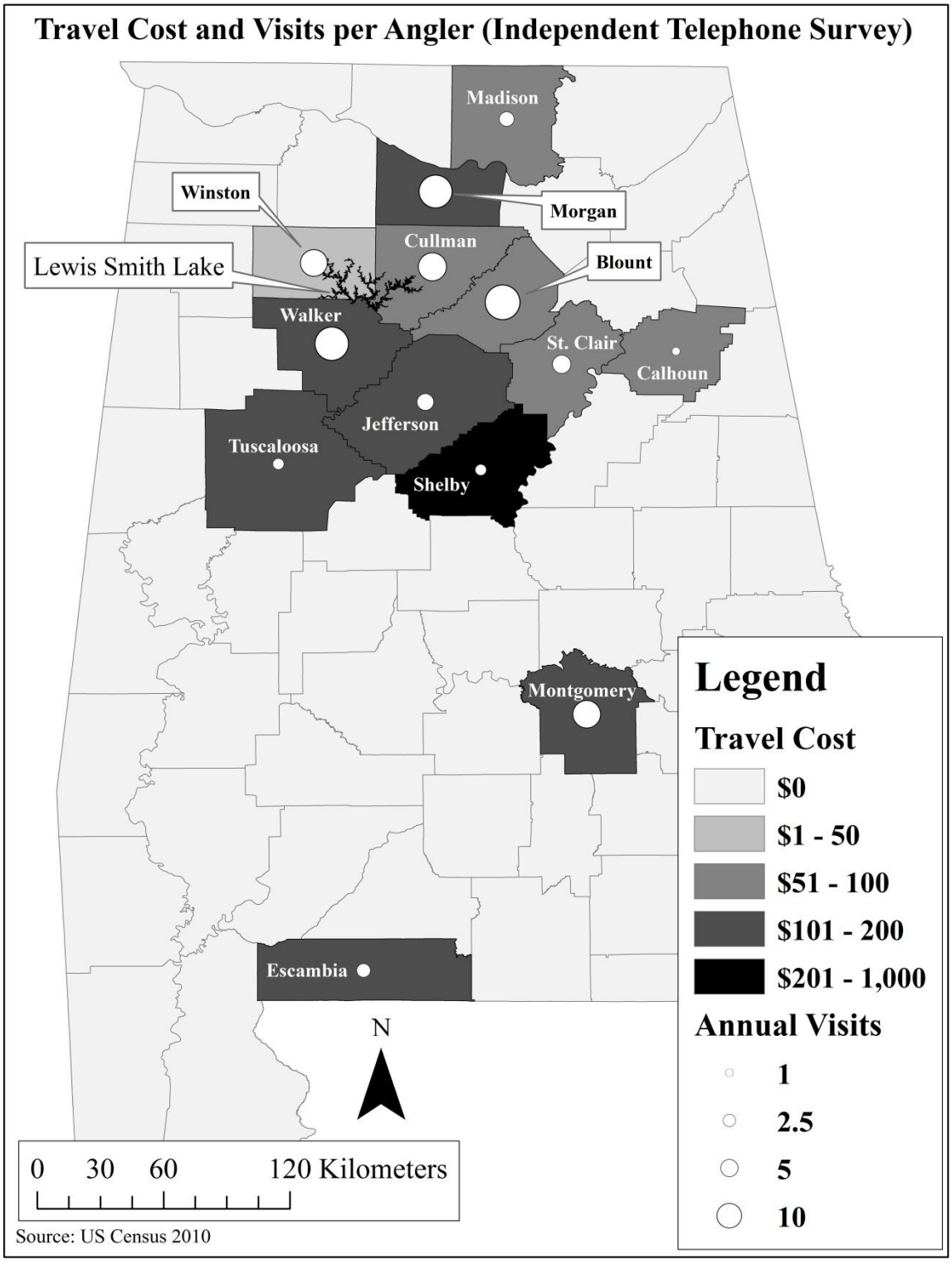

Figure 14. Mean striped bass angler travel cost (expenditures plus opportunity cost) and annual visits by Alabama county of residency obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010. Only single-purpose visitors were included.

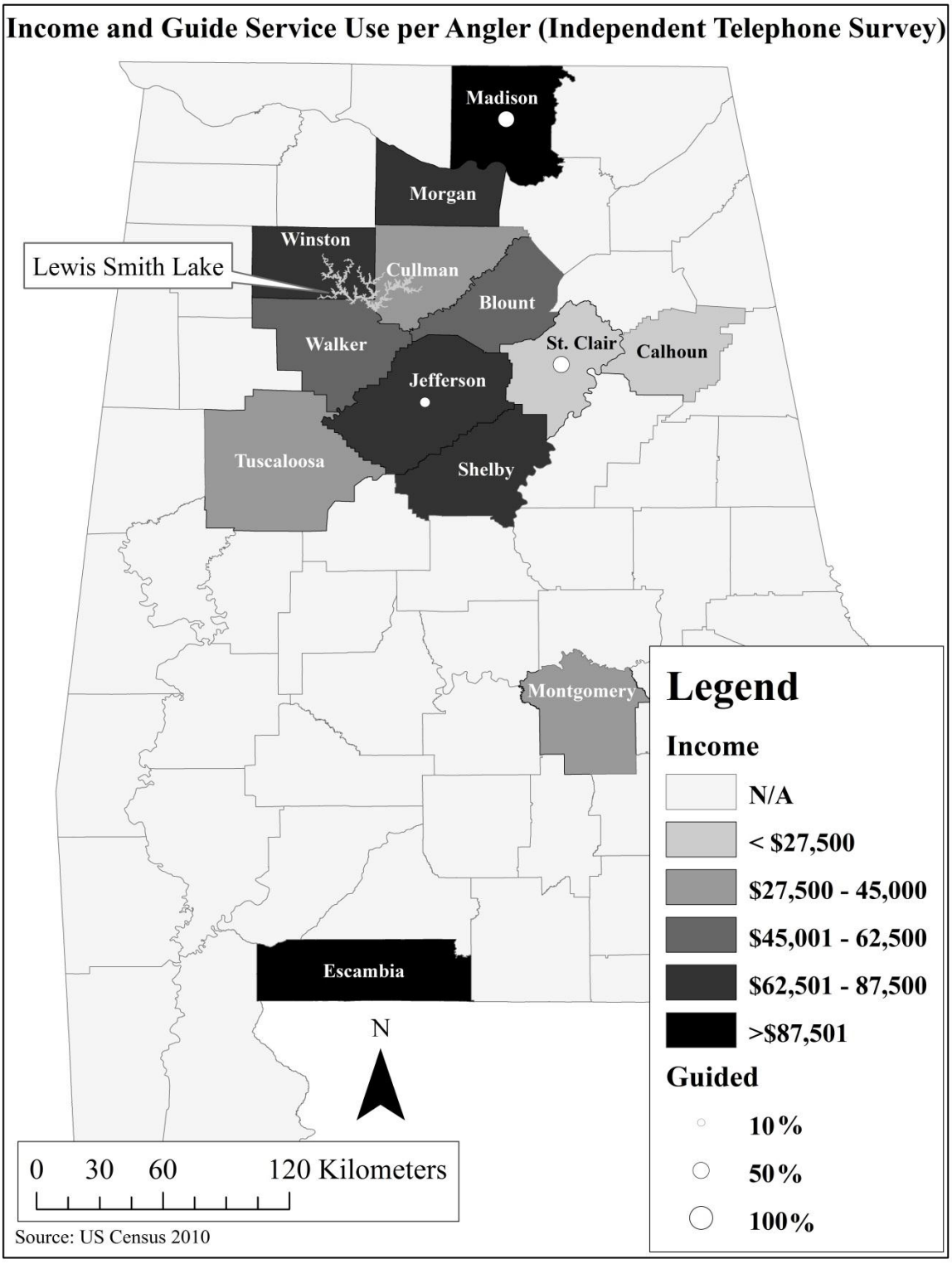

Figure 15. Mean striped bass angler income and guide service use by Alabama county of residency obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010. Only single-purpose visitors were included.

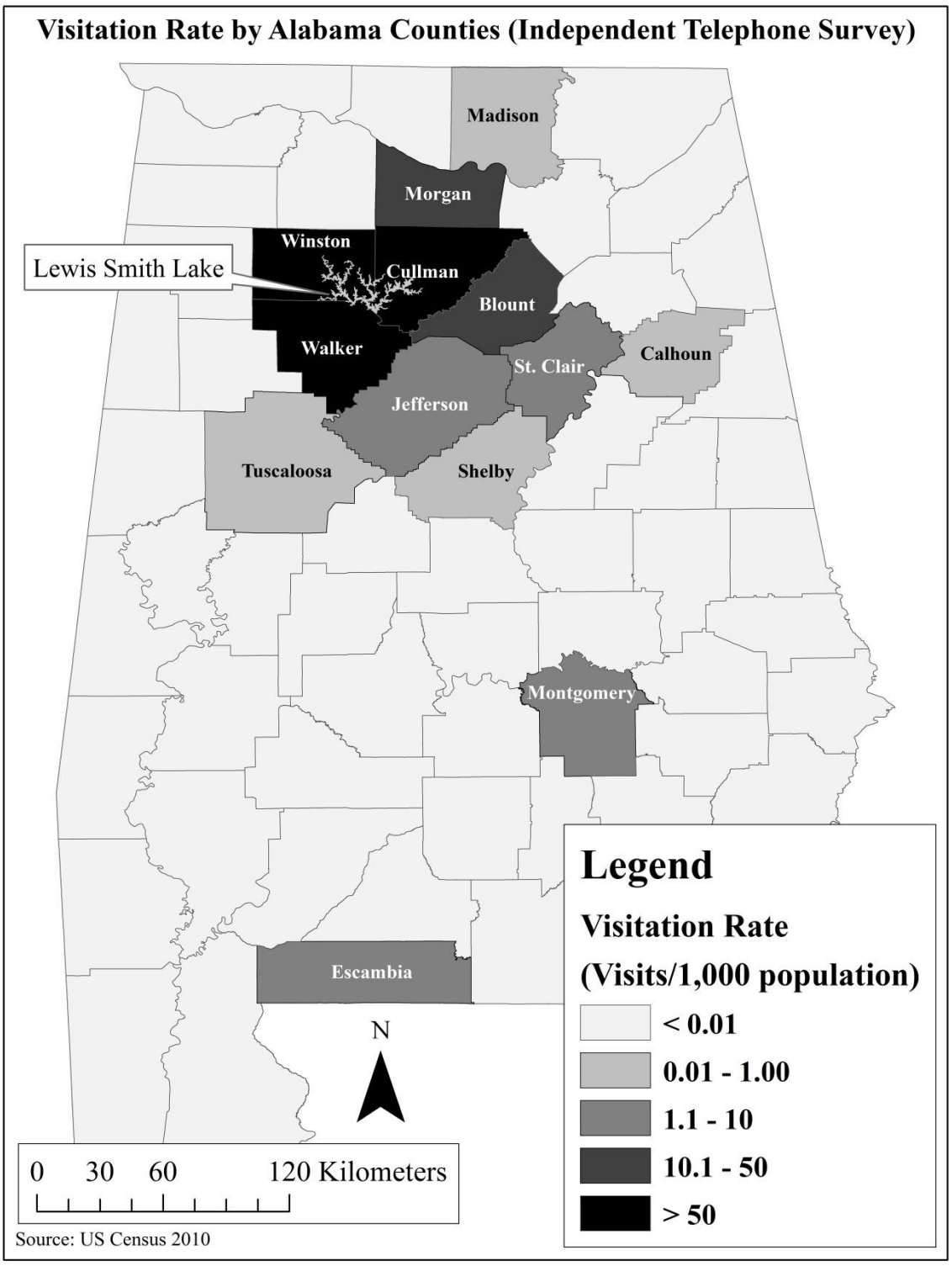

Figure 16. Striped bass angler visitation rate (visits per 1,000 people) by Alabama county obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010. Only single-purpose visitors were included.

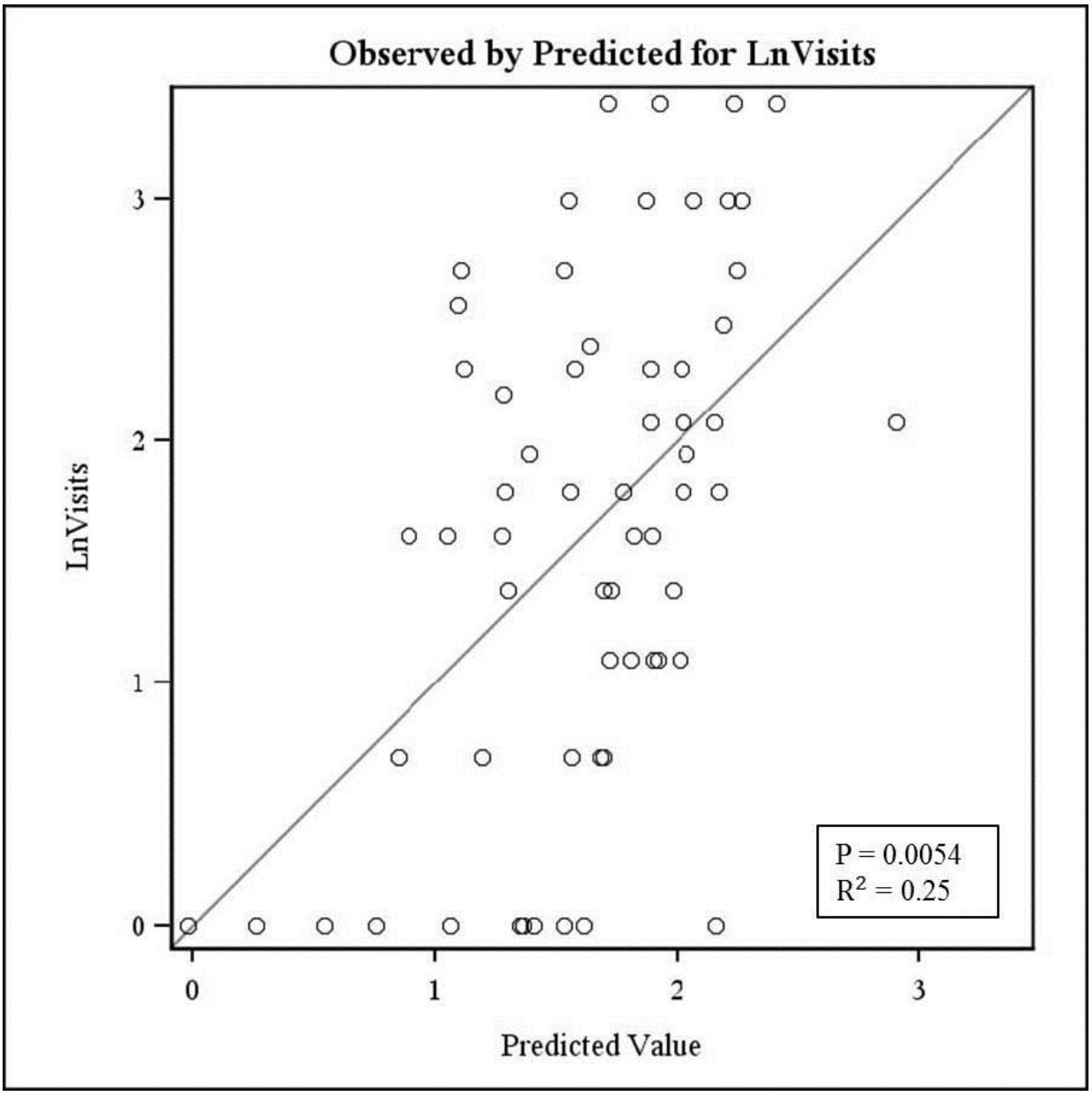

Figure 17. Travel cost model regression for observed versus predicted of the natural log of striped bass angler visits, with the independent variables that include travel cost, income, substitute site opportunity cost, catch rate, and guide service use obtained from the independent telephone survey, Lewis Smith Lake, Alabama during 2010.

IX. APPENDICES

IX.1. On-site Roving Creel Survey Form

On-site Creel Survey

Date: _____ **Section:** *UR LR DF RC LS US* **Shift:** *AM NN PM MN* **Interview:** _____
Creel Clerks *(initials)*: _____ **Interview Time** *(military)*: _____ **GPS** *(if interviewed)*: _____

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. Have we contacted you before about this survey? *Y N*
   a. *(Yes)* Have we contacted you on this particular fishing trip? *Y N*

2. What fish are you primarily fishing for? *Striped bass* *Bass (Alabama/Largemouth)*
   Crappie *Sunfish (Bream)* *Catfish* *Other*_____

3. Number of anglers in your party? _____

4. What time did you start fishing today? _____
   a. Are you finished fishing for the day? *Y N*

5. What city do you live in?
   a. City: _____
   b. State: _____

6. Today, how many fish did you:

Striped Bass	Largemouth Bass	Alabama Bass	Crappie	Other_____
a. Keep: _____	c. Keep: _____	e. Keep: _____	g. Keep: _____	i. Keep: _____
b. Release: _____	d. Release: _____	f. Release: _____	h. Release: _____	j. Release: _____

- - - - - - - - - - *(stop survey if contacted on this fishing trip (yes to 1a))* - - - - - - - - - -

7. *(Non-striped bass anglers only)* How much have you spent so far on this fishing trip, including gas, lodging, food, drinks, ice, fishing equipment, tournament and boat launch fees, and any other items? _____
   a. How much more do you think you will spend on this trip? _____
   b. Of the *$xxx* you will spend on this trip, how much will be spent within 40 miles of Lewis Smith Lake? _____

(Non-striped bass anglers only) That is all we have for this survey. Thank you for your time and have a good day. (end)

- *(if fishing for striped bass, continue)* -

8. How many miles did you travel one way from your home to fish, including driving to the ramp to launch your boat? _____

9. How many days is the length of your trip? _____
   a. How many days will be spent within the Lewis Smith Lake region?_____

10. Is the sole purpose of your trip to fish for striped bass at Lewis Smith Lake? *Y N*
    a. *(No)* What else do you plan on doing while on this trip? _____
    b. Do you target any other fish besides striped bass when fishing at Lewis Smith Lake? *Y N*

11. How much have you spent so far for entire trip, including gas, lodging, food, drinks, ice, fishing equipment, tournament and boat launch fees, and any other items? _____

    a. How much more do you think you will spend on this trip? _____
    b. Of the *$xxx* total you will spend on this trip, how much will be spent to go fishing for striped bass, including gas, lodging, food, drinks, ice, and fishing equipment? _____
    c. Of the *$xxx* total you will spend on this fishing trip, how much will be spent within 40 miles of Lewis Smith Lake? _____

1

12. How many times have you fished for striped bass at Lewis Smith Lake in the past 12 months? _____

13. How did you hear about striped bass fishing in Lewis Smith Lake? *Fishing* *Word of mouth* *Internet* *Local knowledge* *Friends/Family* *Guide Service* *Other*_____

14. If striped bass fishing was not available here, would you travel to another place to fish for them? *Y* *N*
    a. *(Yes)* Where would you go? *Unsure* _____
    b. *(Yes and Location given)* How many miles is this place from your home? _____
    c. *(Yes and Location given)* How many days would the average trip be? _____
    d. *(Yes and Location given)* How many times per year would you travel to this place? _____

15. Is this a guided fishing trip? *Y* *N*
    a. *(Yes)* What guide service are you using? _____
    b. *(No)* Have you ever used a guide to fish for striped bass at Lewis Smith? *Y* *N*

16. Demographic:

    Age: a. *16-17* *b. 18-24* *c. 25-34* *d. 35-44* *e. 45-54* *f. 55-64* *g. >65* *h. No Response*

    Sex: *Male* *Female*

    Ethnicity: a. *White* *b. Hispanic* *c. Black* *d. Asian* *e. Other*_____ *f. No Response*

17. What income bracket would your household fall in?

    a. <$10,000 *b. $10,000-$19,999* *c. $20,000-$24,999* *d. $25,000-$29,999*

    e. $30,000-$34,999 *f. $35,000-$39,999* *g. $40,000-$49,999* *h. $50,000-$74,999*

    i. $75,000-$99,999 *j. >$100,000* *k. No Response*

May we call you in the near future to do a more in-depth survey about your fishing experience and costs for striped bass fishing in Lewis Smith Lake? *Y* *N*

Name: _____
Phone: _____
Is there a time or day of the week that works best for you to be contacted? _____

That is all we need at this time. Thank you very much for your time and have a good day. (end)

NOTES/COMMENTS:

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

Off-site Follow-up Telephone Survey

Date: _____ *Creel Interview:* _____ *Creel Name:* _____ *Creel Date (date):* _____
Clerk: ____ *Creel Telephone:* _____ *Creel Fishing Trip Total Cost (yyy):* _____ *Creel Days:* _____
(Fill out the italicized headings before conducting the interview)

Hello, I am with Auburn University Fisheries Department. I contacted you at Lewis Smith Lake 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 the survey completed?* *Y* *N*

2. How many days is your average trip to Lewis Smith Lake when you fish for striped bass? _____

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

   a. What is the main factor that would make this an excellent fishing trip to fish for striped bass? *Catch fish* *More fish* *Larger fish* *Catch limit* *Weather* *Water temp* *Lake level* *No pollution/trash* *Being on the lake* *Other*_____
   b. What is the main factor that would make this a poor fishing trip to fish for striped bass? *No fish* *Fewer fish* *Smaller fish* *Boat troubles* *Weather* *Water temp* *Lake level* *Pollution/trash* *Other* _____

4. Do you plan on returning to Lewis Smith Lake to fish for striped bass in the future? *Y* *N*

   a. *(Yes)* How many trips do you expect you will go on within the 12 months? _____
   b. *(No)* Why not? _____

5. The next question refers to what kind of boat ramp you most commonly use to access Lewis Smith Lake to fish for striped bass. A private boat ramp is where you obtain permission to access on private property and is otherwise closed to public access. A marina is a privately owned boat ramp that requires a fee to launch a boat. A public boat ramp is one that is open to public use, including USFS, state, county, city or Alabama Power. Do typically use a private, marina, or public boat ramp when fishing for striped bass on Lewis Smith Lake? *Private* *Marina* *Public*

   a. *(Private)* What part of the lake is it located in? *Upper Ryan* *Lower Ryan* *Dam Forebay* *Rock Creek* *Lower Sipsey* *Upper Sipsey* *Other* _____

   b. *(Marina)* Which marina do you use?
   Smith Lake Marina *Speegle's Marina* *Hame's Marina* *Misty Harbor Marina* *Mallard Point Marina* *Ryan Cr. Boating Center* *Grand's Clearwater Marina* *Duskin Point Marina* *Rock Cr. Marina* *Hidden Cove Arrowhead* *Duncan Bridge Marina* *Duncan Bridge Resort* *Lake Shore Inn Marina* *Looney's R. Boat Tours* *Other*_____

   c. *(Public)* Which public ramp do you use? *Smith Lake Park* *Dam Forebay ramp* *Clear Cr. Rec. Area* *Houston Rec. Area* *Corinth Rec. Area* *Swayback Bridge* *Brushy Creek Landing* *Other*_____

6. What kind of lodging did you use on the fishing trip? *Hotel/Motel* *Bed and Breakfast* *RV park (private)* *USFS site* *State site* *County site* *City site* *Friends/Families* *Private property (pp)* *Other* _____ *None*

   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 Lewis Smith Lake? *Y* *N*
      i. If yes, what is the primary fish species you are targeting when fishing?
      Striped bass *Largemouth bass* *Alabama bass* *Crappie* *Bream* *Other*_____
   3. *(PP)* What is the address's zip code? *35503* *35504* *35033* *35053* *35057* *35098* *35540* *35541* *35553* *35572* *Other*_____

7. Do you ever fish from shore or a dock when fishing for striped bass at Lewis Smith Lake? *Y* *N*

   a. *(Yes)* What % of your fishing from shore/dock for striped bass occurs during the night, including dusk? _____
      1. *(Day)* How many days per year do you fish for striped bass during the daytime? ____
      2. *(Day)* What months of the year do you fish for striped bass during the day?
      Jan *Feb* *Mar* *Apr* *May* *Jun* *Jul* *Aug* *Sep* *Oct* *Nov* *Dec*
      3. *(Night)* How many nights per year do you fish for striped bass during the night? _____
      4. *(Night)* What months of the year do you fish for striped bass during the night?
      Jan *Feb* *Mar* *Apr* *May* *Jun* *Jul* *Aug* *Sep* *Oct* *Nov* *Dec*

1

8. When I last interviewed you, you mentioned that you thought that you would spend *$yyy* on gas, lodging, food, ice, fishing equipment, tournament, launch and guide fees on your entire trip to fish for striped bass. Is this figure correct? *Y N*

   a. *(No) H*ow much did you actually spend to fish for striped bass on this trip? _____

9. Next, we are hoping to break down your *$yyy* that you spent to fish for striped bass 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:

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									

That is all we need from you at this time. Thank you very much for your time. (end)

COMMENTS: _____

_____

IX.3. On-site Fishing Guide Survey Form

Guide Survey: _____ *Date:* _____

1. Years experience:_____
2. City of business address:_____
3. Other employees:_____
    a. Years experience:_____
4. Number guided trips in past year:_____
5. Number of anglers taken out on guided trip in past year:_____
6. How many anglers are on a typical guided trip:_____
7. Average cost per trip or angler:_____
8. What type of trips do you offer?

9. Number of scouting trips in past year:_____
10. For a typical guided trip, how much expenses go towards: (scouting trip):
    a. Fuel _____(_____) *Local* _____(_____)
    b. Lodging _____(_____) *Local* _____(_____)
    c. Groceries/drinks/ice_____(_____) *Local* _____(_____)
    d. Restaurant meals _____(_____) *Local* _____(_____)
    e. Fishing equip./bait_____(_____) *Local* _____(_____)
    f. Boat launch/storage fees _____(_____) *Local* _____(_____)
    g. Repair/Maintenance_____(_____) *Local* _____(_____)
    h. Other _____ -_____(_____) *Local* _____(_____)
    i. Other _____ -_____(_____) *Local* _____(_____)
    j. TOTAL _____(_____) *Local* _____(_____)

11. Number of striped bass kept on a typical guided (scouting) trip:_____(_____)
12. Number of striped bass released on a typical guided trip: _____(_____)
13. Number of hours fished on a typical guided trip:_____(_____)
14. Percentage change for this years' versus prior 5 years of business:_____
15. What needs to be done to increase the angling experience and visitation to Lewis Smith Lake to fish for striped bass?_____

_____

_____

16. Comments:_____

_____

_____

IX.4. Independent Telephone Survey Form

Telephone Survey

(INTRODUCTION) Hello, could I speak to __*participant*__?

Hello my name is __*interviewer*__, I am calling from Auburn University Fisheries Department. We are conducting a survey on important issues about fishing in Alabama and you were randomly selected for this study. If you choose to participate, your responses will be confidential. We anticipate that summaries of the study findings will be publicized and your opinions are very important to us. The survey should take no longer than 20 minutes to complete. Before we can begin, I need to confirm that you are 19 years or older. Can we ask you our questions?

1. Did you fish at Lewis Smith Lake within the past 12 months?
   Y N (skip to Question 29) NR (Q29)
2. What species do you primarily target when fishing at Lewis Smith Lake?
   a. *Striped bass (Q7)*
   b. *Bass (spotted and largemouth bass)*
   c. *Crappie*
   d. *Sunfish (bream, bluegill, etc.)*
   e. *Catfish*
   f. *Other*_____
   g. *NR (Q29)*
3. When fishing at Lewis Smith Lake, how many people typically fish in your party, excluding the guide if one was used? _____ *NR*
4. How much did your party spend to go fishing at Lewis Smith Lake on a typical fishing trip, including fuel, lodging, food, ice, bait, repair costs, and guide, tournament, launch and storage fees?
   _____ *NR (Q29)*
5. How much of that was spent within 40 miles of Lewis Smith Lake?[1]
   _____ *(Q28) NR (Q29)*
6. Did you fish for striped bass at Lewis Smith Lake within the past 12 months?
   Y N (Q29) NR (Q29)
7. For the remaining questions, consider your <u>typical</u> trip to Lewis Smith Lake when fishing for <u>striped bass</u>:
   a. When fishing for striped bass at Lewis Smith Lake, how many people typically fish in your party, excluding the guide if one was used? _____ NR
   b. Is the sole purpose of your typical trip to fish for striped bass?
      Y (Q7c) N NR
      i. What other activities do you participate in?
         a. *Fish for other species*
         b. *Boating*
         c. *Wildlife watching*
         d. *Shopping*
         e. *Relaxing*
         f. *Swimming*
         g. *Business*
         h. *Visiting friends/family*
         i. *Other*_____
         j. *NR*

1

ii. What percentage of your expenditures, including fuel, lodging, food, ice, bait, repair costs, and guide, tournament, launch and storage fees, was purchased to fish for striped bass on your typical fishing trip? _____ *NR*

c. How many days is your typical striped bass fishing trip? _____ *NR*

d. How many miles do you travel one way from your residence to Lewis Smith Lake to fish for striped bass on your typical trip? _____ *NR*

e. How much did your party spend on fuel for your boat and vehicle? _____ *NR*
   i. Of that, how much was spent within 40 miles of the lake?[1] _____ *NR*

f. What did your party spend on lodging? _____ *NR*
   i. How much was spent within 40 miles of the lake?[1] _____ *NR*

g. What was the cost for your party on groceries, drinks, and ice? _____ *NR*
   i. What was spent within 40 miles of the lake?[1] _____ *NR*

h. How much did your party spend on restaurant purchases? _____ *NR*
   i. How much was spent within 40 miles of the lake?[1] _____ *NR*

i. What was the cost for your party for bait and fishing equipment? _____ *NR*
   i. What was spent within 40 miles of the lake?[1] _____ *NR*

j. How much did your party spend on guide fees, including tips? _____ *NR*

k. How much did your party spend on tournament fees? _____ *NR*

l. For your party, how much was spent on boat launch and storage fees? _____ *NR*

m. What did your party spend on repair and maintenance? _____ *NR*
   i. How much of that was spent within 40 miles of the lake?[1] _____ *NR*

n. According to what you answered earlier, is VV[2] an accurate estimate of what your party spent to go fishing for striped bass on a typical trip?
   Y (Q8) *N* *NR*
   i. What would be an accurate estimate of what your party spent to go fishing for striped bass? _____ *NR*

8. Which of these arms or areas on the lake do you typically spend the majority of your time fishing for striped bass? To help you, the location of these sections will generally be listed starting at the dam and moving upstream. (A) Dam Forebay, located within 4 miles of the dam in both the Sipsey Fork at Duskin Point and Ryan Creek, or (B) Ryan Creek, starting 4 miles upstream from the dam to the headwaters, or (C) Sipsey Fork, starting 4 miles upstream from the dam at Duskin Point to the headwaters, or (D) Rock Creek from the mouth to the headwaters
   a. *Dam Forebay, located within 4 miles of the dam in both the Sipsey Fork at Duskin Point and Ryan Creek (Q9)*
   b. *Ryan Creek, starting 4 miles upstream from the dam to the headwaters (Q10)*
   c. *Sipsey Fork, starting 4 miles upstream from the dam at Duskin Point to the headwaters (Q13)*
   d. *Rock Creek from the mouth to the headwaters (Q17)*
   e. *NR (Q18)*
9. Which of these two sections do you fish in: (A) Sipsey Fork and Ryan Creek, or (B) Long Branch and Lick Creek?
   a. *Sipsey Fork and Ryan Creek (Q18)*
   b. *Long Branch and Lick Creek (Q18)*
   c. *NR (Q18)*
10. Do you fish downstream or upstream of Big Bridge and Ryan Creek Marina?
   a. *Downstream (Q11)*

b. *Upstream (Q12)*
c. *NR (Q18)*

11. Which of these two sections do you fish: (A) 4 miles upstream of the dam to Big Bridge and Ryan Creek Marina or (B) Coon Creek?
    a. *4 miles of the dam to Big Bridge and Ryan Creek Marina(Q18)*
    b. *Coon Creek (Q18)*
    c. *NR (Q18)*
12. Which of these four sections do you fish in: (A) From Big Bridge and Ryan Creek Marina upstream 3 miles at "the Castle," including Pigeon Roost Creek and Lick Branch, or (B) "the Castle" upstream to Smith Lake Park Boat ramp, including Brogen and Bates Branch, or (C) Simpson Creek, or (D) upstream of Smith Lake Park boat ramp?
    a. *From Big Bridge and Ryan Creek Marina traveling upstream 3 miles at "the Castle," including Pigeon Roost Creek and Lick Branch (Q18)*
    b. *"The Castle" upstream to Smith Lake Park boat ramp, including Brogen and Bates Branch (Q18)*
    c. *Simpson Creek (Q18)*
    d. *Upstream of Smith Lake Park boat ramp (Q18)*
    e. *NR (Q18)*
13. Do you fish downstream or upstream of Duncan Bridge and Marina?
    a. *Downstream (Q18)*
    b. *Upstream (Q14)*
    c. *NR (Q18)*
14. Do you fish downstream, upstream, or in Brushy Creek?
    a. *Downstream (Q15)*
    b. *Upstream (Q16)*
    c. *Brushy Creek (Q18)*
    d. *NR (Q18)*
15. Which of these two sections do you fish: (A) Duncan Bridge and Marina traveling upstream 5 miles to Brushy Creek, including Clear Creek to the US Forest Service boat ramp, or (B) within Clear Creek upstream of the US Forest Service boat ramp, including Coon Creek and Devils Branch?
    a. *Duncan Bridge and Marina traveling upstream 5 miles to Brushy Creek, including Clear Creek to the US Forest Service boat ramp (Q18)*
    b. *Within Clear Creek upstream of the US Forest Service boat ramp, including Coon Creek and Devils Branch (Q18)*
    c. *NR (Q18)*
16. Which of these four sections do you fish: (A) from Brushy Creek to 5 miles upstream, or (B) 5 miles upstream of Brushy Creek to Lakeshore Inn and Hwy 278 Bridge, excluding Hoghouse and Rockhouse Creeks, or (C) Hoghouse and Rockhouse Creeks, or (D) upstream of Lakeshore Inn and Hwy 278 Bridge?
    a. *From Brushy Creek to 5 miles upstream (Q18)*
    b. *5 miles upstream of Brushy Creek to Lakeshore Inn and Hwy 278 Bridge, excluding Hoghouse and Rockhouse Creeks (Q18)*
    c. *Hoghouse and Rockhouse Creeks (Q18)*
    d. *Upstream of Lakeshore Inn and Hwy 278 Bridge (Q18)*
    e. *NR (Q18)*

17. Which of these four sections do you fish: (A) mouth to 5 miles upstream at Rock Creek Marina, or (B) 5 miles upstream from the mouth of Rock Creek at Rock Creek Marina upstream to Swayback Bridge on County Road 77, excluding White Oak and Crooked Creeks, or (C) White Oak and Crooked Creeks, or (D) upstream of Swayback Bridge on County Road 77?
    a. *Mouth to 5 miles upstream at Rock Creek Marina*
    b. *5 miles upstream from the mouth of Rock Creek at Rock Creek Marina upstream to Swayback Bridge on County Road 77, excluding White Oak and Crooked Creeks*
    c. *White Oak and Crooked Creeks*
    d. *Upstream of Swayback Bridge on County Road 77*
    e. *NR*
18. How many striped bass do you catch on a typical trip? _____ *NR*
19. How many trips did you fish for striped bass at Lewis Smith Lake in the past 12 months? _____ *NR*
20. If you were to catch WW[4] striped bass on your typical trip, would you be willing to pay $XX[5] per year in a fee included in your fishing license for stocking striped bass?[3]
    Y N NR
21. Average striped bass in Lewis Smith Lake are 10 lb, would you be willing to pay $XX[5] per year in a fee included in your fishing license for stocking striped bass if you were to catch striped bass averaging YY[6] lbs. on your typical trip?[3]
    Y N NR
22. If on your typical trip you were to catch WW[4] striped bass, would you be willing to go on ZZ[7] trips in a year?[3]
    Y N NR
23. Average striped bass in Lewis Smith Lake are 10 lb, would you be willing to go on ZZ[7] trips in a year if you were to catch striped bass averaging YY[6] lbs. on your typical trip?[3]
    Y N NR
24. What is your age?
    a. *19-24*
    b. *25-34*
    c. *35-44*
    d. *45-54*
    e. *55-64*
    f. *> 65*
    g. *NR*
25. What is your gender?
    a. *Male*
    b. *Female*
    c. *NR*
26. What is your ethnicity?
    a. *White*
    b. *Hispanic*
    c. *Black*
    d. *Asian*
    e. *Other*_____
    f. *NR*

27. Let me know when I mention one of these household income categories that you fall within? (A) less than $10,000, or (B) $10,000-19000, or (C) $20,000-24,999, or (D) $25,000-29,999, or (E) $30,000-34,999, or (F) $35,000-39,999, or (G) $40,000-49,999, or (H) $50,000-74,999, or (I) $75,000-100,000, or (J) greater than $100,0000?
    a. *<$10,000*
    b. *$10,000-19,000*
    c. *$20,000-24,999*
    d. *$25,000-25,999*
    e. *$30,000-34,999*
    f. *$35,000-39,999*
    g. *$40,000-49,999*
    h. *$50,000-74,999*
    i. *$75,000-100,000*
    j. *>$100,000*
    k. *NR*
28. What city and state do you live in? _____ *NR*

Thank you for participating in this survey.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Human Subjects research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.eduor IRBChair@auburn.edu.

If you have any questions or need to contact us, you can call Ryan Lothrop at 334-844-4058 or e-mail at rll0005@tigermail.auburn.edu. (end)

[1]Participants living within Cullman, Winston and Walker counties are assumed typical expenditures occur within 40 miles

[2]Sum of Q7e-Q7m (excluding costs within 40 miles questions) in dollars

[3]Randomly asked only 2 questions: *Q20 & Q21* or *Q22 & Q23*

[4]Randomly assigned catch based upon *Q18* (if catch is 0, then bid offer for catch is 1): 125%, 150%, 175% or 200%.

[5]Randomly assigned price: $1-5, $15, $25 or $50

[6]Randomly assigned weight by lbs.: 12.5, 15, 17.5 or 20

[7]Randomly assigned number of trips added to *Q19* by: 1-5, 15, 25 or 50

IX.5. On-site Fishing Guide Survey Comments

1. Bait is hard to get due to a loss of places, especially in the summer months. Though it may be cost ineffective, could the ADWFF stock bait for anglers to catch and use for fishing. Maybe the state could stock larger sized striped bass to help them reach a larger size, increasing survival.

2. Stock more striped bass; seem to be missing an age group during the past few years. We have an international fishery; I had clients from Sweden and Brazil.

3. Most of my clients want to catch more fish, but a few only want trophy fish. We need to educate the bass anglers on the striped bass versus bass issue. The state needs to patrol more; there are some local and non-local anglers who are definitely keeping more than their limit on a regular basis.

4. We need to have more advertising through magazines and newspaper articles. I have noticed that the striped bass fishing pressure has definitely increased, which at the same time fishing has become tougher with fewer larger fish.

5. We need to advertise to outside the region (and offer guide services available).

6. The economy needs to improve and or make it cheaper for anglers to improve angling numbers. However the fishery is good overall.