A Hook and Line Assessment and Angler Survey of the Tallapoosa River Fishery (Alabama, USA)

by

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Abstract

Angler satisfaction is one of many fundamental objectives in the adaptive evaluation of flow prescriptions below R. L. Harris Dam on the Tallapoosa River in Alabama. We have collected fishery specific information to inform future management decisions related to flow regimes. Quantification of the fishery resource below R.L. Harris Dam was conducted using hook and line sampling from canoes and kayaks by multiple anglers during several seasons and three years and over a range of flow conditions. This allowed for an assessment of conditions that may have influenced angler catch statistics in the river. Regulated and unregulated reaches of the river were fished by 2-4 anglers during three different seasons: spring, summer and fall (2013 and 2014). Angling was conducted during different water conditions including river hydrology, water temperature, and weather conditions. Small spinner baits were trolled behind the boats in an attempt to present lures to most species of sport fish (i.e., *Micropterus* spp., *Lepomis* spp., *Morone* spp. and *Ictalurus punctatus*). We recorded each capture encounter in the river during each sampling trip; individual fish were weighed and measured and harvest-per-unit-effort (# fish/angler hour) was calculated by species and by angler. Water temperature was recorded at beginning of sampling trips using a thermometer. Hydrologic data were collected from USGS gages and various metrics were summarized for the angling days. Stepwise multiple regression models were constructed to evaluate impacts of environmental and physical variables on angler catch. Results indicated that water temperature was positively correlated with harvest-per-unit-effort at all study sites and discharge was negatively correlated. The unregulated reach

above the dam had the most diverse catch consisting of eight species. Catch rates varied among seasons and river reach; highest catch rates were observed in the spring in the middle reach below Harris Dam (4.21 fish/h); whereas, the lowest catch rates were also observed in the spring at the site most downstream from the dam (0.38 fish/h).

A mail survey was used to quantify Tallapoosa River angler demographics, preferences and desired fishing conditions. The mail survey was sent to 2000 fishing license holders in counties surrounding the Tallapoosa River between the Georgia state line and Lake Martin, Alabama. An online survey was also available for those anglers who did not receive a mail survey. Signs were posted at access points along the river with instructions for anglers to take the online survey.

Surveyed anglers targeted catfishes and black basses; 55% of the survey respondents were satisfied with the catch rates that averaged 2.04 fish per hour. The average angler was an older white male. Anglers would like to have more days where the river was more suitable to boating. Fishing the Tallapoosa River was an important tradition to the participants in the survey; they do it to be outdoors, to enjoy nature, and for relaxation. Time, lack of access, and unknown water flow conditions were top reasons for not fishing on the Tallapoosa River.

The results of both the fishery independent and angler survey for this river will help inform decisions related to management of the fishery and toward maintaining or increasing angler satisfaction. The models constructed can assist anglers to decide the river conditions and

seasons for targeting certain species. Results from this study indicate that temperature and flow from R.L. Harris dam may influence recreation and angler satisfaction on the river.

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INTRODUCTION

Angler satisfaction and maintaining angling culture is fundamental to the mission of the Alabama Department of Conservation and Natural Resources (Stan Cook, Alabama Department of Wildlife and Freshwater Fisheries, Personal Communication) and because Alabama has over 124,000 km of rivers and streams (Crance and Masser 1996); the fishery resources in lotic systems are a priority of the agency. Most of the rivers of the State are impounded and fisheries (and other resources) are managed variably in reservoirs and in rivers downstream of dams.

The Tallapoosa River system is an example of a basin that is managed for multiple uses including, power production (four hydroelectric dams), consumptive and recreational uses of water (e.g., angling and boating), and conservation of natural resources (Irwin and Freeman 2002; Irwin 2014). The river below R.L. Harris Dam is actively managed in an adaptive framework to meet multiple competing stakeholder objectives, including fishery objectives (Irwin and Freeman 2002; Irwin 2014). Dams are known to negatively impact fisheries (Pringle et al. 2000; Olden et al. 2011) and Harris Dam influences both the flow and thermal regime in the river (Irwin and Freeman 2002). In addition, the entire reach of the river lacks access points for anglers and boatable flows are negligible due to the peaking power generation schedule (Irwin and Freeman 2002). One of the objectives of the Tallapoosa River adaptive management program is to maximize angler satisfaction. The current extent of conditions conducive to a quality recreational fishery and angler access is unknown and should be addressed.

Historically the Tallapoosa River above Lake Martin was touted as having productive fisheries for catfishes and black basses (J. Hornsby, Personal Communication). Accounts written in angler diaries prior to Harris Dam construction indicate that anglers would drive over an hour to fish at Horseshoe Bend, one of the areas on the river with an improved boat ramp to allow

fishing from small aluminum motor boats. Anecdotal reports of catch rates included routine catches of up to twelve "catfish" per person. Species encountered by anglers included Flathead Catfish (yellow catfish; (*Pylodictis olivaris*), Black Basses (*Micropterus henshalli*, *M. tallapoosae*), and minnows (E. Patillo, angler diary 1998). After the installation of Harris Dam angler accounts of diminished catch rates (0.9 fish per hour) and sizes of fish (< 1 pound) were reported (E. Pattilo, angler diary 1998). Since the installation of Harris Dam, some local anglers have indicated a decline in the fisheries; however, a recent article on fly fishing touted the fishery a quality fly fishing destination (Elkins 2014). Given the lack of quality information, quantification of the fishery resources including angler use, attitudes and satisfaction should be conducted.

Because fisheries are social-ecological systems, an understanding of how management of lotic fisheries impacts angler actions and how angler actions may influence fish populations is needed (Fisher and Burroughs 2003; Hunt et al. 2013; Johnston et al. 2013). Management of river flows for angling objectives will require knowledge of how biotic and abiotic variables influence angler catch rates and angler behavior (Jackson and Davies 1986, 1988). Assessment of variables that influence anglers catch rates is not very common in the scientific literature despite an abundance of anecdotal information delivered in the form of fishing calendars (Kuparinen et al. 2010). Experimental fishing has been used infrequently to collect fishery independent data for calculation of fishery metrics such as catch rates, size of catch and species composition (Alford and Jackson 2010; Heermann et al. 3013; March et al. 2014). Various types of modeling approaches have been used to relate angler (or experimental fishing) catch rates to biotic and abiotic variables ranging from Generalized Linear Models (Kuparinen et al. 2010) and multiple regression approaches (Alford and Jackson 2010) to regression trees (Heermann et al.

2013) and spatially explicit analyses (March et al 2014). Alford and Jackson (2010) used multiple regression models to relate experimental angler catch data to environmental variables on a watershed scale. Models that predict catch rates dependent on variables that can be managed below dams (e.g., flow rates) as well as other explanatory variables (e.g., temperature) could improve our ability to effectively manage tailwater fisheries (Jackson and Davies 1988).

Environmental factors can also influence angler behavior; angler effort on the nearby Coosa River in Alabama was highly correlated to environmental variables in the early and late summer (Jackson and Davies 1988). Environmental variables such as discharge, barometric pressure, wind velocity, dissolved oxygen, water clarity, air temperature, and water temperature were regressed against angler effort using stepwise multiple regression models downstream of Jordan Dam. Angler effort was negatively related to water temperature and positively related to average 2-d flow conditions (Jackson and Davies 1988). Knowledge regarding how tailwater management impacts angler demographics, preferences, satisfaction, participation and motivation could influence management of both water releases and the fishery itself (Jackson and Davies 1988; Johnston et al. 2010, 2013). Explicit incorporation of human dimensions into fishery management should improve decision making (Gray and Jordan 2010; Heck et al. 2015).

Angler surveys are used frequently to gather information regarding characteristics of fisheries and the angling experience (Murphy and Willis 1996). Most angler surveys are creel surveys, which are usually directed toward anglers being interviewed at an access point; however, mail surveys can also be used when anglers are not readily accessible on-site. Mail surveys can be used to characterize angler attitudes and opinions within a river drainage (Murphy and Willis 1996). Ultimately, quantification of angler attitudes and their satisfaction level could assist managers in defining ways to maximize recreational opportunities (Fedler and Ditton

1994). The integration of social information regarding angler characteristics and ecological data regarding fisheries should improve our ability to manage sustainable and economically viable ecosystems (Arlinghaus et al. 2013; Bruskotter and Fulton 2013). Provision of quality recreational opportunities may ultimately translate into license sales (Dabrowska et al. 2014) and help to ensure the future of angling culture.

The objectives of this research were to: 1) use experimental angling to quantify the Tallapoosa River fishery in terms of catch rates, species and size composition; 2) quantify the impact of various environmental factors on experimental catch rates, and 3) use a mail survey to quantify Tallapoosa River angler demographics, preferences and desired fishing conditions.

METHODS

The Tallapoosa River headwaters in the state of Georgia, and flows through eastern Alabama until it joins the Coosa River. The study area for this research extended from the unregulated Upper Tallapoosa River near Heflin, Alabama, to the southernmost boundary of the unimpounded piedmont section of the Tallapoosa River near Alexander City, Alabama (Figure 1). Three specific river reaches were sampled to quantify fishery catch statistics. They were: an upper reach of river from Cleburne County Road 18 bridge to Evans Bridge on Cleburne County Road 84 near Heflin, Alabama (6.28 km); a middle river reach from Randolph County Road 15 bridge near Malone, Alabama to the Tallapoosa Wilds boat ramp under Alabama State Highway 22 in Wadley, Alabama (10.62 km); and a lower river reach from Germany Ferry Road boat ramp (Chambers County Road 75) to Horseshoe Bend National Military Park boat ramp (Alabama State Highway 49; 15.45 km; Figure 1). The middle and lower reaches were regulated by R. L. Harris Dam; a hydropeaking plant owned and operated by Alabama Power Company a division of Southern Company.

Fishery Independent Survey -Quantification of the fishery resource at the three study sites was conducted using experimental hook and line sampling from canoes and kayaks by multiple anglers during Fall, Spring, and Summer and over a range of flow conditions. Regulated and unregulated reaches of the river were fished by 2-4 anglers during three different seasons and three years: spring, summer and fall [Summer (June 21- September 21), Fall (September 22-Dec.20), and Spring (March 20-June 20)]. Angling was conducted during different water conditions including river flow, water temperature, and weather conditions. Fishing effort was equal at all sites and seasons. During each season, three days of approximately 5 hours of effort per angler per day was devoted to each of the three river reaches. Identical small yellow spinner

baits were trolled behind the boats in an attempt to present lures to most species of sport fish (i.e., *Micropterus* spp., *Lepomis* spp., *Morone* spp. and *Ictalurus punctatus*). We recorded each capture encounter in the river during each sampling trip; individual fish were weighed (total weight in grams) and measured (total length in mm). Using the total estimator based on catch and effort data measures fishing success for individual species (Murphy and Willis 1996). Total ratio harvest-per-unit-effort (HPUE; Murphy and Willis 1996) was calculated by using the following equation:

$$Total - ratio\ HPUE = \hat{R}_2 = \frac{\sum_{i=1}^{n} h_i}{\sum_{e=1}^{n} e_i} = \frac{fish}{hour} \quad (1)$$

Where $\hat{R}_2$ is the Total-ratio HPUE, h_i is the sum of harvest, and e_i is the sum of hours.

Water temperature (C°) was recorded at the start of each sampling event in each reach using a thermometer. The following data were recorded during each sampling occasion; location, date, start time, stop time, weather, air temperature, wind, water clarity, species, rod, reel, and line type. Hydrologic data (hourly discharge; CMS) were downloaded from the following site specific USGS gages [02412000 Tallapoosa River near Heflin, Alabama; 02414500 Tallapoosa River at Wadley, Alabama; 02414715 Tallapoosa River near New Site, Alabama (Horseshoe Bend)] and the following hydrologic metrics were recorded for each sampling event: discharge in cubic feet per second (CFS) at starting time of sampling, and rising or falling hydrograph at time of sampling.

To determine relations between variation in experimental catch rates and environmental factors, multiple regression models were constructed (Alford and Jackson 2010). Stepwise multiple regression models were constructed to relate individual angler HPUE with

environmental variables (Table 1) during the sampling day (Alford and Jackson 2010). In addition to discharge and water temperature, fishing time, angler, season, rising or falling hydrograph and location were additional variables evaluated in the multiple regression models. Combined species models were constructed for individual sites to relate HPUE to explanatory variables over different years and seasons. Species specific models for the top three occurring species were constructed for each site. A comparison of HPUE between sites was also conducted using a one-way ANOVA test. A Tukey-Kramer test was used to test differences in HPUE between study sites. All analyses were conducted using statistical program R (R Core Team 2013).

Angler Mail Survey- One of the primary objectives of this research was to design and conduct a survey that assessed angler use, attitudes and satisfaction on the Tallapoosa River. A survey was developed (Appendix I) to address these topics and mailed to 2000 anglers selected in a stratified-random sampling design from individuals holding freshwater fishing licenses in the following Alabama counties: Cleburne, Chambers, Tallapoosa, Clay, and Randolph. The survey consisted of questions to determine the angler's level of satisfaction with the river system (Murphy and Willis 1996). The survey also accounted for what species the anglers targeted and asked for their catch data from their last fishing trip. The majority of the questions were answered in a modified Likert response format; values ranged from "1" which was "strongly disagrees" to "7" which was "strongly agreed" (Hudgins 1984). To keep the participants of the survey committed to answering the entire questionnaire the questions consisted of short answer, multiple choice, or checking boxes (Murphy and Willis 1996). There was also an online survey to elicit responses from people who may not have lived within the surrounding counties, or did not hold a fishing license. Signs with related information and links to the survey were posted at

numerous access points within the study area along the river, including Bells Mills Bridge, Evans Bridge, Horseshoe Bend, Wadley, Malone, and local gas stations and bait shops (Figure 1). The online survey was posted and mail surveys were sent out during September 2014. The survey closed March 1 of 2015. Motivations for what brings anglers fishing on the Tallapoosa River will be determined as well as what impedes fishing. The participants were also able to voice their opinions on the regulatory flows and other management of the dam and river. This will be beneficial in providing the Alabama Department of Conservation and Natural Resources information about what was most important to the anglers fishing the Tallapoosa River.

Average daily catch rates from the fishery independent survey was compared to the average daily catch rates reported by anglers to determine if experimental fishing was comparable to what local anglers reported. Histograms were constructed of HPUE over the range of catch rates (0-15 fish/hour) and frequency data for experimental catch and angler reported data were compared the using a Kolmogorov-Smirnov test. A t-test was used to determine if there was a difference in catch rates between anglers who reported they were satisfied and those who were not satisfied.

Principal Component Analysis (PCA) with Varimax Rotation was used to define commonalities between survey questions for motivations and satisfaction (Vaske 2008). Prior to running the PCA, scale questions were assessed using Bartlett's Test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure. Factor analysis was performed if the Bartlett's test was significant and the KMO score was greater than 0.6 (Tabachnick and Fidell, 2001). Factor analysis was then conducted to determine factors within the motivation and satisfaction survey questions.

RESULTS

Fishery Independent Survey: -A total of 442.5 angler hours were expended over the course of this study. In 2013, 18 hook and line sampling trips were made on the Tallapoosa River; six at each site during Summer and Fall. In 2014, 27 hook and line sampling trips to the Tallapoosa River; nine at each site during the Spring, Summer and Fall. In 2015, nine hook and line sampling trips to the Tallapoosa River; three at each site during the Spring. Number of angler hours expended varied by sampling event (Table 2).

A total of ten different species of fish were caught while sampling: Alabama Bass, Redbreast Sunfish (*Lepomis auritus*), Tallapoosa Bass, Bluegill (*Lepomis macrochirus*), White Crappie (*Pomoxis annularis*), Striped Bass (*Morone saxatilis*), Largemouth Bass (*Micropterus salmoides*), Shadow Bass (*Ambloplites ariommus*), White Bass (*Morone chrysops*), and Channel Catfish. The two most common species caught were Redbreast Sunfish and Alabama Bass. More Redbreast Sunfish were caught than Alabama Bass at all sites except for Horseshoe Bend where Alabama Bass had the highest HPUE (Figures 2, 3, 4).

Harvest-per-unit-effort varied among the years and sites (Figure 5). Overall harvest-per-unit-effort was lowest at Horseshoe Bend, averaging 1.16 fish/hour. Harvest-per-unit-effort was greatest at Wadley, averaging 2.08 fish/hour followed by Heflin averaging 1.87 fish/hour (Table 2). The single highest season HPUE occurred at Wadley in the Spring of 2014 at 4.22 fish/hour. The lowest season HPUE was recorded at Horseshoe Bend in the Spring 2015 (0.31 fish/hour; Table 2). Harvest-per-unit-effort was significantly different among the sites based on the results of a one-way ANOVA (p-value=0.0147). The Tukey-Kramer test indicated that there was a significant difference between HPUE at the Wadley and Horseshoe Bend sites (p-value=0.0104).

Environmental and physical variables varied among the river reaches and seasons (Table 3). Discharge (CFS), water temperature (**°C)**, fishing time (h), hydrograph direction (+/-), season, angler, and site were variables related to harvest-per-unit-effort. Ten sampling events were conducted during rising hydrograph conditions; whereas, eight trips were made with a falling hydrograph. At Heflin discharge ranged from 76 to 527 CFS, and water temperature ranged from 8 to 24 °C. Fishing time ranged from 2.0 to3.5 hours. Two sampling events were conducted during rising hydrograph conditions; whereas, sixteen trips were made with a falling hydrograph. During sampling events at Wadley, discharge measurements ranged from 263 to 4000 CFS. Water temperature ranged from 16 to 25 °C. Fishing time ranged from 2.0 to 5.7 hours. Discharge at Horseshoe Bend ranged from 219 to 6170 CFS and water temperature ranged from 13 to 28 °C. Fishing time ranged from 2.5 to3.3 hours. Six sampling events were conducted during rising hydrograph conditions; whereas, twelve trips were made with a falling hydrograph. The number of anglers ranged from 2 to4 for each sampling event at all sites.

Stepwise multiple regression analysis identified specific variables correlated with harvest-per-unit-effort. The combined site model indicated that water temperature accounted for the greatest variation in catch (11.5%). Water temperature had a positive correlation with harvest-per-unit-effort (Table 4). Heflin's model indicated that season (30%) and water temperature (32%) accounted for the greatest variation in catch rates. Discharge accounted for the greatest variability in catch rates at Wadley (50%). Season (5%) and fishing time (9%) accounted for the variability in catch rates at Horseshoe Bend (Table 4).

Stepwise multiple regression analysis identified specific variables correlated with harvest-per-unit-effort for the three most frequently encountered species (Alabama Bass, Tallapoosa Bass, and Redbreast Sunfish) at the different sample sites.

Alabama Bass- The combined model for Alabama Bass indicated water temperature accounted for the highest variation (9%) in HPUE. Water temperature was positively correlated with harvest-per-unit-effort for Alabama Bass in the combined site model. Heflin's model for Alabama Bass indicated discharge (15%), water temperature (26%) and season (18%) explained variation of overall R^2. At Heflin, water temperature was positively correlated with harvest-per-unit-effort and discharge was negatively correlated. Horseshoe Bend's model for Alabama Bass explained the great variation in catch at 58%. Water temperature (5%), Fishing time (5%), and season (6%) contributed most to this estimate. At Horseshoe Bend, water temperature was positively correlated with harvest-per-unit-effort (Table 5).

Tallapoosa Bass-The combined model for Tallapoosa Bass indicated that angler (8%) and a falling hydrograph (6%) contributed most to the variation in harvest-per-unit-effort. This combined site model explained 43% of variation in catch and was the best model for Tallapoosa Bass. In all site specific models where season was significant for Tallapoosa Bass summer had the highest catch rates. Heflin's model for Tallapoosa Bass indicated that discharge (6%) and falling hydrograph (10%) were the most important variables accounting for harvest-per-unit-effort. Discharge had a slight negative correlation with harvest-per-unit-effort. This model explained 16% of variation in harvest-per-unit-effort for Tallapoosa Bass at Heflin. Wadley's model for Tallapoosa Bass indicated discharge (8%), fishing time (5%), falling hydrograph (18%), and season (11%) were the significant variables in explained harvest-per-unit-effort. Discharge was negatively correlated with harvest-per-unit-effort. Horseshoe Bend's model for Tallapoosa Bass indicated discharge (17%), water temperature (7%), and season (13%) explained variation in catch. Both discharge and water temperature was negatively correlated with harvest-per-unit-effort (Table 6).

Redbreast Sunfish- The combined site model for Redbreast Sunfish indicated discharge (2%), water temperature (5%), fishing time (1%) angler (13%), falling hydrograph (2%), Season (1%) and location (11%) were the significant variables in explaining harvest-per-unit-effort (Table 7). The combined site model explained 53% of variability in catch of redbreast sunfish. Discharge had a negative correlation with harvest-per-unit-effort; whereas, water temperature was positively correlated. Heflin's model for Redbreast Sunfish harvest-per-unit-effort indicated discharge (7%), water temperature (28%), angler (33%), and a falling hydrograph (2%) were significant variables. Discharge was negatively correlated with harvest-per-unit-effort; whereas, water temperature was positively correlated. Wadley's model for Redbreast Sunfish indicated that discharge was the variable effecting variability of harvest-per-unit-effort. Discharge explained 29% of the variability in catch of Redbreast Sunfish at Wadley and was negatively correlated with harvest-per-unit-effort. Horseshoe Bend's model for Redbreast Sunfish indicated discharge (27%), season (11%), and a falling hydrograph (25%) were the significant variables explaining variation in harvest-per-unit-effort. This model explained the highest variability (58%; Table 7). Discharge was negatively correlated with harvest-per-unit-effort at Horseshoe Bend.

Angler Mail Survey.-Responses from the angler survey included 227 from the mailed surveys, three from informational signs, and four referred by others for a total of 234 respondents constituting an 11.4% response rate. Of those, 176 responses were used for analysis, 58 surveys were discarded because the respondents did not fish in the targeted area (i.e., the Tallapoosa River proper). The survey was sent only to five counties surrounding the study site, but a response was received from a total of 12 counties (Figure 8). Anglers moved from the address listed on their fishing license, and their surveys were likely forwarded.

Anglers fished the river 2-10 times per year (51%) and mostly on weekends (57%). April (83%) and May (83%) were the most popular times for fishing. When participants were asked if they fished from Harris Dam to above Lake Martin 78% of the response said yes; while, the other 22% said no. When participants were asked if they fished from Harris Dam to the Georgia State line 61% of the response was yes, while 39% was no. The two most popular fishing spots on the Tallapoosa River were Heflin (19%) and Jaybird Creek (22%). Survey participants (20%) wrote in that they fish in local reservoirs, when asked what area of the river they most often fish (Table 9). These anglers did fish in the Tallapoosa River proper as well as the reservoirs. Over half of the survey participants have been fishing the river for more than 30 years (Table 10) and 53% of participants held state of Alabama resident fishing license (Table 11).

Economics.-The average roundtrip drive for fishing was 40 miles, ranging from 0 to 160 miles. Money spent fishing on the Tallapoosa River each year ranged from $0 to $3000 and averaged $464 per year. Money spent fishing other places in Alabama besides the Tallapoosa River ranged from $0 to $5000 dollars and averaged $480 per year.

Fishing practice and characterization.-Public access points were used by 65% to access the river. When asked about fishing practices, 66% fished from motorboats followed by shore angling (38%), canoe/kayak (24%), and wading (20%) (Table 12). The overall experience of fishing on the Tallapoosa River was rated at 5.23 on a scale from one (very poor) to seven (very good). Not having time to fish, lack of access to the river, and unknown water conditions were reasons that kept people from fishing the river (Table 13). Comparison of survey respondents catch rates and experimental catch rates from this study indicated that anglers averaged 2.04 fish/hour (survey) in comparison to 1.85 fish/hour (experimental) on average for all sites in the

sampling study. The Kolmogorov-Smirnov test indicated that there was no difference between the survey reported catch and the experimental angling catch (p-value=0.8296).

Fishery and River management.-The Alabama Department of Conservation and Natural Resources fishing regulations were familiar to 80% of participants. The regulations were rated a 4.12 on a scale from one to 7; one being too strict 7 being too lenient. Flow conditions for fishing and boating were ranked on a scale from one to seven (from 1 equaled very poor to 7 equaled very good) and scored 4.14 and 4.05 respectively. Anglers who thought river flow conditions were very good for fishing were fishing near Heflin and in reservoirs. Two other activities that were enjoyed on the river were camping and boating (Table 14). Seventy percent of participants wanted more days where flow was more suitable to boating. Over the past several years 48% of anglers did not see any improvement in fishing and 30% had no opinion. Ongoing flow management at R.L. Harris Dam was unheard of by 79% of survey participants. Before going fishing on the river 81% did not check flows provided by USGS water gages, although 58% of these people were familiar with the Alabama Power 1-800-Lakes11 resource for checking the hydroelectric water release schedule.

Angler motivation.-When anglers were asked what they were targeting while fishing on the river they answered Crappie (51%), Black Bass (49%), and Channel Catfish (47%; Figure 9). With a reported catch rate of 2.04 fish per hour, 58% of the participants in the survey were satisfied. When asked what they would like to catch, participants said a stringer of Catfish (42%), large Bass (39%), and Bass and Bluegill (32%); (Figure 10). Seventy-five percent of the "other" response indicated they would like to catch Crappie. When asked to rate their fishing abilities on a scale from one to seven (from 1 being novice to 7 being expert) to the following questions level of fishing, level of fishing knowledge, and level of knowledge of fisheries

management, participants mean response was 4.67, 4.89, and 3.72 respectively. People who fish the Tallapoosa River agree that fishing is an important tradition to them, they have accumulated a lot of fishing equipment, and they enjoy knowing they have a chance to catch a "trophy" (Table 15). To be outdoors, to enjoy nature, and to relax were to three top reasons for participating in fishing the Tallapoosa River (Table 16). Scenic beauty of the fishing areas, the opportunity to see other wildlife, and the health of the fish were most satisfying for anglers (Table 17).

Principle Components Analysis (PCA) was conducted on 18 motivation variables. The Kaiser-Meyer-Olkin was 0.875 and Bartlett's Test was significant (p-value<0.001). The results produced four components, explaining 62.5% of the total variance. The rotated component matrix indicated the first component was "to be outdoors" related variables (explaining 39.7% of total variance), the second component was the activity-specific variables (explaining 10.2% of total variance), the third component was "to catch fish to eat" and "to control the fish population" (explaining 6.6% of total variance) and the fourth component was the social aspects (explaining 6.0% of total variance) (Table 18). These four components explained the most variance in angler motivation on the Tallapoosa River.

Angler specialization.-When anglers were asked what they were targeting on the river, 29% choose a single species the other 71% choose multiple species to target. The single answers were composed of 54% "Anything", 29% "Black Bass", 9% "Striped Bass", and 9% "Crappie". When asked what they would like to see caught and what they were targeting while fishing 74% of these answers matched.

Angler satisfaction.-A t-test was used to determine if there was a difference in the catch rates between anglers who were and were not satisfied. There was a significant difference in the catch rates between those anglers who were satisfied with catch rates and those who were not

satisfied with catch rates (p-value>0.001). The top four answers for reasons that kept anglers from fishing the Tallapoosa River were "other", "did not have time, “unknown water flow conditions”, and "lack of access". Out of 167 responses, 100 anglers responded with a 5,6, or 7 for these answers respectively. Catch rates for these unsatisfied anglers averaged 1.75 fish/hour. Their level of fishing skill compared to other anglers averaged 4.65 on a scale from 1-7. Anglers who were satisfied with catch rate and the overall fishing experience on the Tallapoosa River composed 86% of the respondents. Anglers who reported to have high fishing abilities did not have higher catch rates than those who reported to have lower fishing abilities, fishing knowledge, and knowledge of fisheries management (p-value=2.545).

Principle Components Analysis (PCA) was conducted on 12 satisfaction variables. The Kaiser-Meyer-Olkin was 0.851 and Bartlett’s Test was significant (p-value<0.001). The factor analysis results produced three components, explaining 61.3% of the total variance. The rotated component matrix indicated the first component was site related/management (explaining 41.9% of total variance), the second component was environmental variables (explaining 10.4% of total variance), and the third component was river access (explaining 9.1% of total variance) (Table 19).

Demographics-Males accounted for 86% of participants. Currently employed participants (62% employed) were fishing the river; 64% reported they were not yet retired. Caucasians made up 90% of the study group followed by African Americans (7%) and American Indians (3%) (Table 20). When asked about marital status, 76% responded that they were married. The level of education attained by 32% was a high school diploma or GED (Table 21). Participants reported an average income of $35,000-$49,999 (22%) (Table 22).

DISCUSSSION

Stakeholders involved in ongoing adaptive management of the middle Tallapoosa River identified angler satisfaction as a fundamental objective for measuring consequences of various alternative flow modifications from R.L. Harris Dam (Irwin 2014). The results of both the fishery independent and angler survey for this river will help inform decisions related to management of the fishery and toward maintaining or increasing angler satisfaction (Beardmore et al. 2015). Because fisheries are social-ecological systems, an understanding of how management of stream fisheries impacts angler actions and how angler actions influence fish populations is needed (Fisher and Burroughs 2003; Hunt et al. 2013).

River and stream anglers comprise 44.8% of the angling public and fished 44% of total angling hours in flowing water systems of Alabama in 2011 (268,000 anglers, 4,292 hours; USDOI, USFWS, and USDOC 2011). This level of participation is higher than the reported National average (34%) which is not surprising given the number of kilometers of rivers and streams available for anglers in the State. Furthermore, the level of participation is indicative of the need for information about and for management of fisheries in those systems (Fisher and Burroughs 2003). Angler surveys can be an effective way to collect data regarding angler attitudes, motivations, and fishery use (Murphy and Willis 1996); however, objectives for management must be clear so that these values can be effectively incorporated into management actions (Peterson and Evans 2003).

Quantification of angler preferences and motivations can improve management (Hunt et al. 2013). Survey respondents indicated that their preferred catch would be a stringer of catfish, large bass, and bluegill. Many of the respondents also reported that these were the species that they were targeting indicating that current demand for the Tallapoosa River fishery includes

black basses and catfishes. The current managers of the resource should manage for these species in to maintain or increase angler satisfaction (Harris and Bergersen 1985). Verbal communication with anglers suggest that fishing for catfish is popular at nighttime using poles placed along the bank with baited lines checked throughout the night. Further studies will need to be conducted to research the catfish fishery status in the Tallapoosa River, as they were not targeted in this study. Based on comments received in the survey and other monitoring data (E.R. Irwin, United States Geological Survey, personal communication), the catfish fishery below the dam may be impacted.

Management of flows at the dam may involve a suite of management actions that could either positively or negatively impact fish populations below Harris Dam (Irwin 2014). For example, Martin (2008) determined that nest success of Redbreast Sunfish was negatively impacted by high flows from Harris Dam. Nash and Irwin (1999) indicated slow growing individuals of both Flathead Catfish and Channel Catfish in the regulated portion of the Tallapoosa River. They also believed that growth overfishing may have been occurring and related to fish being harvested at 400mm (about the length that fish were maturing; Nash and Irwin 1999). Sakaris and Irwin (2010) indicated that five years of unfavorable flow conditions could limit population growth of flathead catfish in lotic systems. Unfortunately, the type of experimental fishing that was conducted in this study did not census catfishes very effectively. A creel survey could target catfish anglers on the river or at local boat ramps to receive more information about these anglers. More information on the catfish fisheries may be warranted and consequently the State has started an experimental stocking program to determine if lack of natural recruitment may be contributing to the poor channel catfish fishery.

One-way (direction to manager) means of communication (Gray and Jordan 2010) may not be a desirable or an effective way to include angler information into decision making (Francis et al. 2007). To use the results of my study, anglers will need to be re-engaged to inform them of current and future management options (Peterson and Evans 2003).

Angling catch rates have been reportedly influenced by biotic factors [e.g. population abundance and structure; Crozier and Kennedy 2001; food availability, Lux and Smith 1960], abiotic factors [e.g., water temperature, Kuparinen et al. 2010; Mills et al. 1986], and angler characteristics and preferences [experience, bait/lure type, Heermann et al. 2013]. This study did not measure biotic factors but overall angling catch rates. Species-specific catch rates were explained by multiple environmental variables associated with season, flow metrics and temperature. In addition, for both Tallapoosa Bass and Redbreast Sunfish, angler characters explained variation in catch rate (Heermann et al. 2013). Anglers had a higher influence on catch rates in species-specific models. Fishing experience alone can describe high amounts of variation in catch rates (Heermann et al. 2013).

In the multiple-species site-specific models, water temperature, when present, was positively correlated with HPUE. Depressed temperature regimes are known to occur below Harris Dam associated with power generation (Irwin 2014). Discharge was negatively correlated with HPUE for the site specific models when it was included in the models. Low flows may cause fish to be concentrated in deep pools and runs however; fishing these areas may be difficult due to water levels (Tennant 1976). Low flows at Horseshoe Bend made the trips difficult and a lot of boat dragging took time away from angling effort. However; high discharges at the other sites made fishing difficult due to inability to maintain position in the small boats from which we fished.

Alabama Bass, Redbreast Sunfish, and Tallapoosa Bass growth rates were found to be highest in the Wadley section of the Tallapoosa River, during an electrofishing survey (Sammons et. al 2013). It was also found in this study that in Wadley the dominant catch was Redbreast Sunfish followed by Alabama Bass then Tallapoosa Bass, similar to the experimental angling assessment. It was also noted that this section of the river may be more productive because the flows could provide more forage for these species than in areas of lower flow. It is also believed that another possible solution for catch rates being greatest in this section of river may be caused by the lack of public access to this section of river compared to the Heflin and Horseshoe Bend study sites.

Water temperature, discharge, and season had the greatest effect on explaining the variation in catch for Alabama Bass at all study sites. Water temperature was positively correlated with harvest-per-unit-effort in all where it was present and discharge indicated a negative correlation with HPUE. Peak flows cause Alabama Bass to move away from the dam (Earley 2012). Fall was the most successful season for catching Alabama Bass. Alabama Bass move the most during the spring and least in the summer and fall months (Earley 2012).

Tallapoosa Bass models indicated that discharge and water temperature both had a negative correlation with harvest-per-unit-effort. A negative correlation with a falling hydrograph was also indicated by the models. High discharge events cause Tallapoosa Bass to move downstream once discharge is stable they will return to their preferred habitat (Knight 2011, Earley 2012). Spring and summer were the best times to fish for Tallapoosa Bass. It was observed that Tallapoosa Bass were habitat specific to shoal habitat (shallow fast moving water). Adult Tallapoosa Bass are commonly found in shallow river runs with moving current (Knight 2011).

Discharge had the greatest effect on explaining the variation in catch for Redbreast Sunfish at all study sites. All models for Redbreast Sunfish indicated a negative correlation between harvest-per-unit-effort for Redbreast Sunfish and discharge. Redbreast Sunfish nest survival is impacted by peak flows in the Tallapoosa River (Martin 2008). High flow and change in temperature is affecting the survival of Redbreast Sunfish on the Tallapoosa River (Martin 2008). A positive correlation with a falling hydrograph and HPUE was also indicated by all of the models except for Wadley. The higher the discharge the fewer Redbreast Sunfish caught. Water temperature, where present in all models for Redbreast Sunfish indicated a positive correlation with harvest-per-unit-effort. The higher the water temperature the more likely Redbreast Sunfish will be caught at all sites. The cold water released below R.L. Harris Dam may be impacting the fishing success for and survivability of Redbreast Sunfish.

Motivations reported by survey respondents included to be outdoors, to enjoy nature, to relax, enjoy solitude, and viewing wildlife. Many anglers had motivations that were non-catch related which was also reported in a study by Beardmore et al. (2011). Factor analysis was used to determine most important motivations for fishing the Tallapoosa River. To be outdoors and the social aspect of angling accounted for ~45% of the variance in angling motivation for anglers on the Tallapoosa River. Anglers motivated by fishing for food to bring home to eat only explained 6% of this variance. In order to see an increase in the motivation for anglers to use this resource it should be advertised that the Tallapoosa River is a scenic area for users to enjoy nature, wildlife, and simply explore the river.

When asked about what aspects of their fishing experience satisfied them, anglers reported that ensuring that accuracy of the dam release schedule, clarity of fishing regulations, number of boatable days, and local facilities were important. These aspects accounted for ~42% of the

variance associated with satisfaction metrics. In addition the scenic beauty of the fishing areas and opportunity to see other wildlife was also satisfying for anglers and accounted for an additional 10.4% of the variance for this set of attributes. These site attributes are very important to angler's choice of fishing location (Schramm et al. 2003) study and in the results of this study. Finally, the amount of access available for fishing the river was a motivation factor for anglers that explained 9% of the variation in motivation of anglers. To increase the number of anglers who want to fish the Tallapoosa River there may need to be more public access/boat ramps.

In 2002, 2000 surveys were mailed out to random Alabama fishing license holders (Wright and DeVries 2003). The response rate for the survey was 31%, which was higher than the response rate for my survey. However, the typical respondent to this survey was similar to anglers fishing the Tallapoosa River (e.g., male, Caucasian, middle aged, most often with a high school education) yet the average income reported in the 2002 statewide survey was higher ($50,000-$75,000 range). Anglers preferred to catch Largemouth Bass, Crappie, Catfish, Bream, and Striped Bass in that order. Anglers also targeted Crappie, Channel Catfish, and Black Bass in my survey. Fishing from a boat was most popular at 71% followed by pier, dock or bridge (22%) and lastly wading (6%) in 2002 survey. Fishing by boat was also most popular in my survey. It is noted that the survey response was from older anglers in both the 2002 survey and my survey.

The Tallapoosa River fishery has a lot to offer anglers targeting Basses, and Sunfishes; but little is known about fishery-independent catch rates of Catfishes. If the management objective is to promote the fishery, more public access should be offered. The accuracy of the water flow data on both the USGS and Alabama Power resources should be promoted and maintained as accurate as possible. The models constructed can assist anglers to decide in what river

conditions and seasons when to target certain species. Results from this study indicate that temperature and flow from R.L. Harris dam may be influencing recreation and angler satisfaction on the river. The survey can assist to inform managers of what participants expect of the fishery.

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TABLES

Table 1. Summary of variables used in multiple regression analysis, type of measurement, and definition of that measurement collected during sampling.

Variable	Type	Definition and unit
HPUE	Continuous	Harvest-Per-Unit-Effort (Fish/Hour)
CFS	Continuous	Discharge (CFS)
Water Temperature	Continuous	Temperature Water (°C)
Air Temperature	Continuous	Temperature Air (°C)
Fishing Time	Continuous	Time in hours spent fishing
Angler	Categorical	Angler (1-9)
Season	Categorical	3 Seasons (Fall, Spring, Summer)
Rise/Fall	Categorical	Rising or Falling Hydrograph while angling
Location	Categorical	3 locations (Heflin, Wadley, Horseshoe Bend)

Table 2. Summary of sampling seasons average harvest-per-unit-effort (fish/hour) for each of the seasons over a three-year period. Summary of total angling effort in hours also included for seasons over a three-year period.

	2013			2014		2015	
Location	**Summer**	**Fall**	**Spring**	**Summer**	**Fall**	**Spring**	**Mean**
Heflin	0.64	1.82	2.00	3.77	0.58	0.67	1.87
	(27.9)	(16.5)	(17.5)	(30.2)	(15.5)	(6.0)	
Wadley	1.46	1.18	4.22	2.85	2.76	0.83	2.08
	(28.0)	(35.5)	(23.0)	(35.7)	(28.2)	(16.0)	
Horseshoe	2.00	0.61	0.38	1.95	1.53	0.31	1.16
	(20.5)	(37.5)	(21.0)	(37.5)	(28.0)	(18.0)	

Table 3. Site specifics ranges and median of discharge, water temperature, fishing time, number of anglers, and rising or falling hydrograph data. This is represented over the three different sampling seasons Summer, Fall, and Spring at the different study sites: Heflin, Wadley, and Horseshoe Bend.

		Heflin		
		Summer	**Fall**	**Spring**
CFS	Range	122-406	76-420	417-527
	Median	242	99	445
Water	Range	23-24	8-18	18-23
Temp (°C)	Median	23.5	14	20.5
Fishing	Range	3-3.5	2-3.25	2-3
Time (hr)	Median	3.125	2.5	2.375
Anglers	Range	3	2-3	2
	Median	3	2	2
Rise/Fall	# Rise	1	0	1
(# Trips)	# Fall	5	6	5
		Wadley		
		Summer	**Fall**	**Spring**
CFS	Range	276-2390	263-1140	300-4000
	Median	737.5	306	645.5
Water	Range	24-25	17-22	16-22
Temp (°C)	Median	24	21	18.5
Fishing	Range	4-5.25	2.25-5.66	2-4
Time (hr)	Median	4.5	5	3.25
Anglers	Range	2-3	2-3	2
	Median	2	2	2
Rise/Fall	# Rise	2	5	3
(# Trips)	# Fall	4	1	3
		Horseshoe Bend		
		Summer	**Fall**	**Spring**
CFS	Range	219-6060	224-2010	2070-6170
	Median	274	499	4420
Water	Range	24-28	15-21	13-19
Temp (°C)	Median	25	16	17.5
Fishing	Range	3.33-5	3-5	2.5-4
Time (hr)	Median	4.5	4.5	3.25
Anglers	Range	2-3	2-3	2
	Median	2	3	2
Rise/Fall	# Rise	2	3	1
(# Trips)	# Fall	4	3	5

Table 4. Summary of combined and site specific models. Red represents a negative correlation with HPUE. Green represents a positive correlation with HPUE. Gray represents the presence of this variable in the model.

Site	CFS	Water Temp	Fishing Time	Angler	Rise/Fall	Season	R^2
Combined	0.08	0.12				Fall 0.05	0.2955
Heflin	0.20	0.32				Fall 0.29	0.3985
Wadley	0.49				Falling 0.04		0.4942
Horseshoe Bend		0.04	0.09			Fall 0.05	0.5940

Table 5. Summary of Alabama Bass catches combined and site specific models. Red represents a negative correlation with HPUE. Green represents a positive correlation with HPUE. Gray represents the presence of this variable in the model.

Alabama Bass	CFS	Water Temp	Fishing Time	Angler	Rise/Fall	Season	Location	R^2
Combined	0.22	0.09				Fall 0.03	0.03	0.2480
Heflin	0.15	0.26				Fall 0.18		0.3366
Wadley	0.12							0.1190
Horseshoe Bend		0.05	0.06			Fall 0.06		0.5862

Table 6. Summary of Tallapoosa Bass combined and site specific models. Red represents a negative correlation with HPUE. Green represents a positive correlation with HPUE. Gray represents the presence of this variable in the model.

Tallapoosa Bass	CFS	Water Temp	Fishing Time	Angler	Rise/Fall	Season	Location	R^2
Combined	0.01	0.01	0.05	0.08	Falling 0.06	Spring 0.03	0.03	0.4308
Heflin	0.06				Falling 0.10			0.1589
Wadley	0.08		0.05		Falling 0.18	Spring 0.11		0.4025
Horseshoe Bend	0.17	0.07				Summer 0.13		0.3310

Table 7. Summary of Redbreast Sunfish combined and site specific models. Red represents a negative correlation with HPUE. Green represents a positive correlation with HPUE. Gray represents the presence of this variable in the model.

Redbreast	CFS	Water Temp	Fishing Time	Angler	Rise/Fall	Season	Location	R^2
Combined	0.02	0.05	0.01	0.13	Falling 0.02	Fall 0.01	0.11	0.5265
Heflin	0.07	0.28		0.33	Falling 0.02			0.4957
Wadley	0.29							0.2979
Horseshoe Bend	0.27				Falling 0.25	Spring 0.11		0.5790

Table 8. What months did you fish on the Tallapoosa River in Alabama?

Month	Percent
January	27%
February	40%
March	66%
April	83%
May	83%
June	70%
July	59%
August	57%
September	70%
October	59%
November	34%
December	26%

Table 9. What area of the river do you most often fish?

Answer	%
Wadley	12%
Heflin	19%
Directly below Harris Dam	7%
Malone	3%
Horseshoe Bend	17%
Jaybird Creek	22%
Other	20%
Total	100%

Table 10. How many years have you been fishing the Tallapoosa River?

Answer	%
1-3	5%
4-10	10%
11-20	16%
20-30	18%
31-40	21%
50+	31%
Total	100%

Table 11. What type of fishing license did you purchase for the 2014 season?

Answer	%
Resident Fishing	53%
Non-resident Fishing	2%
Resident Hunting and Fishing	40%
Non-resident Hunting and Fishing	1%
No license (exempt)	5%
Total	100%

Table 12. How are you fishing the river?

Answer	%
Motorboat	66%
Canoe/Kayak	24%
Shore angling	38%
Wading	20%
Other	6%

Table 13. Please indicate your level of agreement with each of the following reasons that kept you from fishing the Tallapoosa River (1-7).

Question	Mean
Lack of Access	3.62
Unknown water flow conditions	3.64
I did not have time	3.91
It is too expensive to go fishing	2.72
Inadequate facilities	2.95
Unsure of fishing success	3.05
Fishing regulations	2.43
Cost of fishing license	2.39
Other:	5.00

Table 14. Are there other types of recreation that you enjoy on the river?

Answer	%
Canoeing	34%
Hunting	22%
Camping	57%
Tubing	19%
Boating	51%
Other	20%

Table 15. Indicate your level of agreement with the following statements about fishing the Tallapoosa River (1-7).

Question	Mean
Fishing is an important tradition to me	6.29
I have accumulated a lot of fishing equipment	5.63
I enjoy knowing I have a chance to catch a "trophy"	5.43
I want to introduce fishing activities to other people	5.36
I would rather fish than any other recreation	4.92
The trip is successful even if no fish were caught	4.60
Fishing is a part of my identity	4.45
I find that a lot of my life is organized around fishing	4.33
I want to keep the fish I catch	4.31
I am just as happy if I don't catch fish	4.20
I want to release the fish I catch	3.96
If I stopped fishing, I would probably lose touch with a lot of friends	3.32
I am only satisfied if I catch fish	2.73

Table 16. How important are the reasons why you participate in fishing the Tallapoosa River? (1-7)

Question	Mean
To be outdoors	6.35
For relaxation	6.26
To enjoy nature	6.25
To enjoy solitude while on the river	6.12
To experience the excitement of catching fish	6.08
To get away from regular routine	5.98
Chance of catching fish	5.90
The challenge of fishing	5.86
To do something with my family	5.73
To view other wildlife in their natural setting	5.64
Exploration	5.46
To be with others who enjoy the same things	5.45
The physical exercise provided by fishing	5.29
To develop my fishing skills	5.29
To share my knowledge and skills with others	4.94
To bring home fish to eat	4.93
Size of fish	4.78
To be alone	4.40
To bring home a trophy fish	4.15
To control the fish population	3.58

Table 17. Please indicate how satisfied you are with the following statements about the Tallapoosa River (1-7).

Question	Mean
Scenic beauty of fishing areas	5.76
The opportunity to see other wildlife	5.66
The health of the fish	5.43
The clarity of the fishing regulations	4.85
Number of boatable days	4.84
My ability to find an area to fish	4.79
Number of fish thought to be in the river	4.46
Overall number of fish caught	4.42
Accuracy of the dam release schedule	4.08
Amount of public land available for fishing	4.05
Local facilities	3.88
Amount of private land available for fishing	3.66

Table 18. Motivation Rotated Component Matrix Means. Highs means indicated high motivation low mean indicated not important to motivation.

	Component			
	1	2	3	4
Percent of variance explained by component	39.663%	10.248%	6.628%	5.973%
To enjoy nature	**.814**	.106	.119	.011
To enjoy solitude while on the river	**.756**	.206	.227	-.146
To view other wildlife in their natural setting	**.752**	.208	-.060	.174
For relaxation	**.747**	.101	.208	-.166
Exploration	**.747**	.276	.095	-.009
To be outdoors	**.692**	.303	-.086	.226
The physical exercise provided by fishing	**.566**	.240	.359	.267
To bring home a trophy fish	.041	**.788**	-.052	.043
Size of fish	.124	**.705**	.162	.010
To experience the excitement of catching fish	.318	**.677**	.298	.006
The challenge of fishing	.402	**.621**	.120	-.030
Chance of catching fish	.289	**.610**	.446	-.021
To develop my fishing skills	.279	**.575**	.383	.029
To share my knowledge and skills with others	.280	**.519**	.271	.284
To bring home fish to eat	.093	.173	**.783**	-.033
To control the fish population	.048	.173	**.747**	.087
To do something with my family	.307	.251	.252	**.742**
To be alone	.409	.221	.189	**-.616**

Table 19. Satisfaction Rotated Component Matrix. Highs means indicated high satisfaction low mean indicated not important to satisfaction.

	Component		
	1	2	3
Percent of variance explained by component	41.895%	10.372%	9.075%
Accuracy of the dam release schedule	**.800**	.085	.147
Local facilities	**.696**	.088	.364
Number of boatable days	**.655**	.217	.198
The clarity of the fishing regulations	**.579**	.350	.195
The opportunity to see other wildlife	.196	**.793**	.120
Scenic beauty of fishing areas	-.007	**.777**	.311
The health of the fish	.223	**.690**	.259
Overall number of fish caught	.536	**.627**	-.074
Number of fish thought to be in the river	.513	**.546**	.051
Amount of private land available for fishing	.083	.171	**.836**
Amount of public land available for fishing	.357	.125	**.763**
My ability to find an area to fish	.290	.298	**.444**

Table 20. What is your ethnicity?

Answer	%
American Indian	2%
Black/African American	7%
Latino	0%
Asian	0%
White/Caucasian	89%
Other	1%
Total	100%

Table 21. What is your highest level of education completed?

Answer	%
Did not complete High School	17%
High School Diploma or GED	30%
Associate degree	9%
Graduate or professional degree	6%
Some college, but no degree	22%
Bachelor Degree	13%
Other	4%
Total	100%

Table 22. Annual income in 2014.

Answer	%
Less than $14,999	15%
$15,000 to $19,999	5%
$20,000 to $24,999	11%
$25,000 to $34,999	14%
$35,000 to $49,999	22%
$50,000 to $74,999	20%
$75,000 to $99,999	8%
$100,000 to $149,999	3%
$150,000 or more	1%
Total	100%

FIGURES

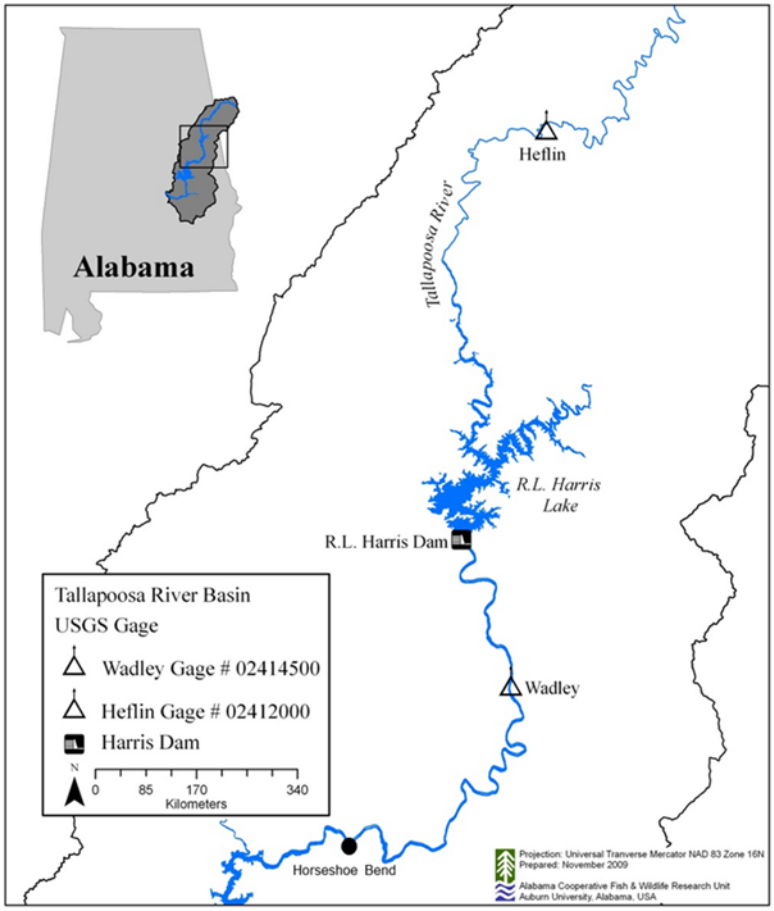


Figure 1. Location of study sites in the Tallapoosa River Basin. The river is regulated below Harris Dam (Wadley site, near gage Δ#02414500), and unregulated above Harris Lake (Heflin site, near gage Δ#02412000). The regulated site at Horseshoe Bend is noted by a closed black circle (●). USGS gages are maintained at Heflin, Wadley and New Site (not on map) Alabama, USA.

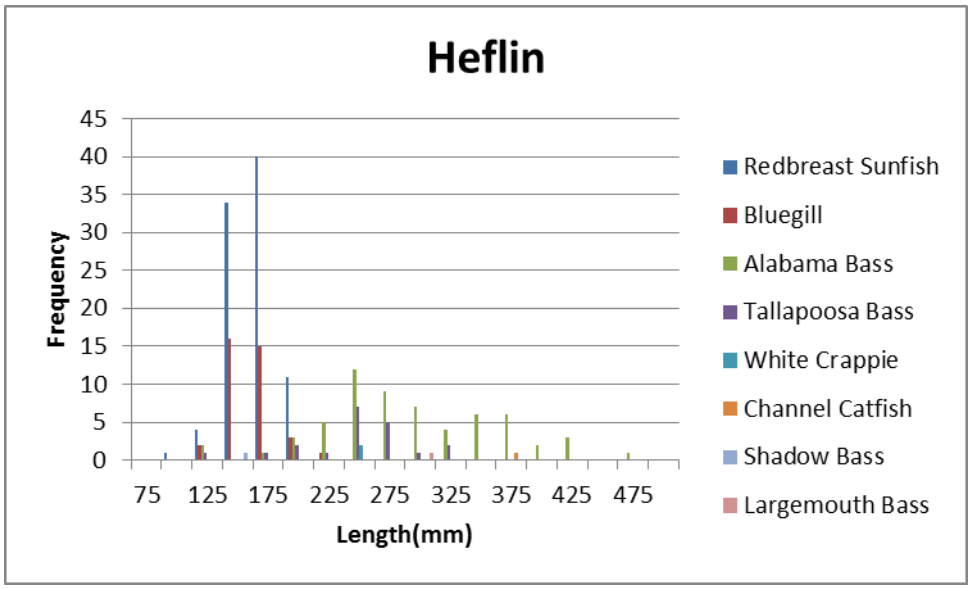


Figure 2. Length-frequency of fish captured by hook and line at the Heflin site.

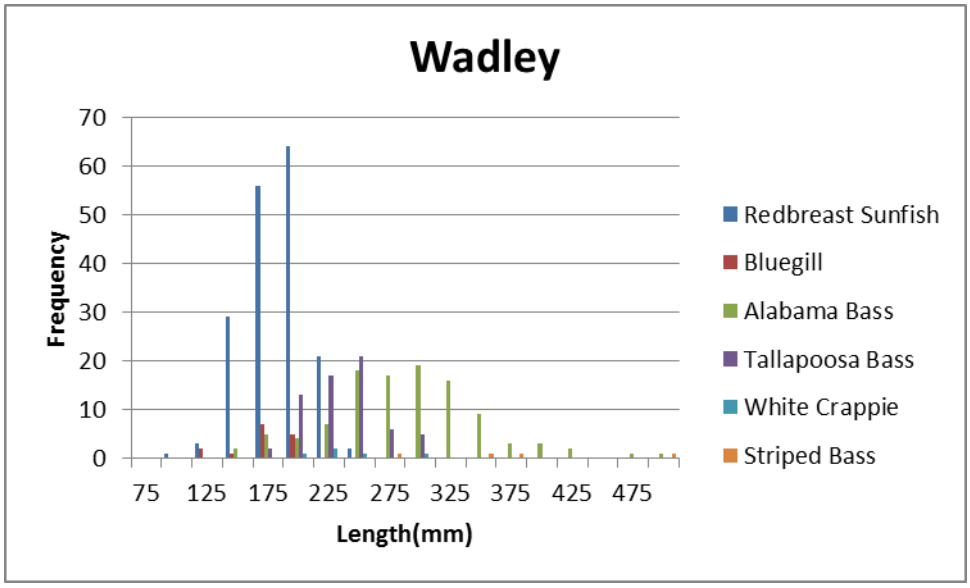


Figure 3. Length-frequency of fish captured by hook and line at the Wadley site.

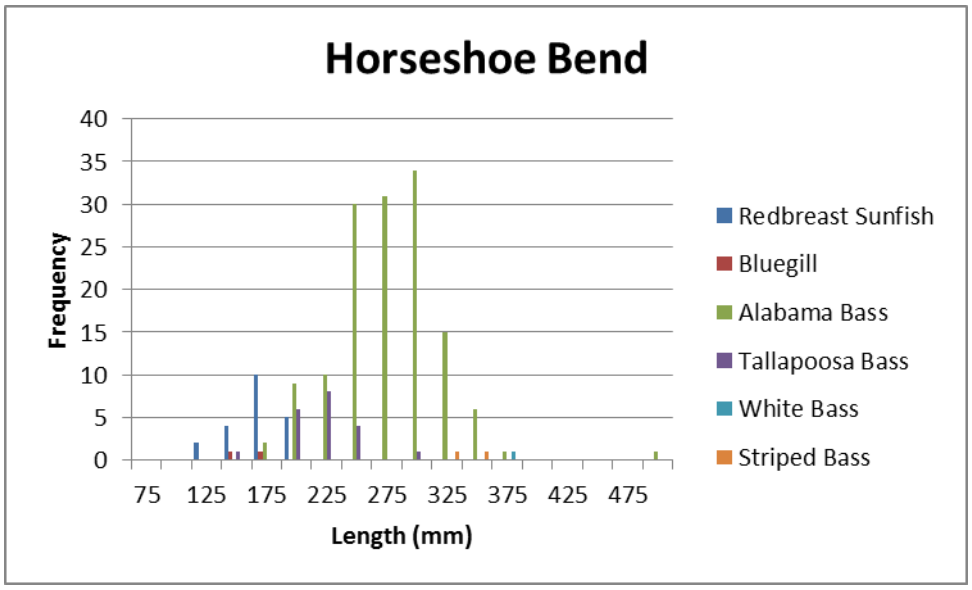


Figure 4. Length-frequency of fish captured by hook and line at the Horseshoe Bend site.

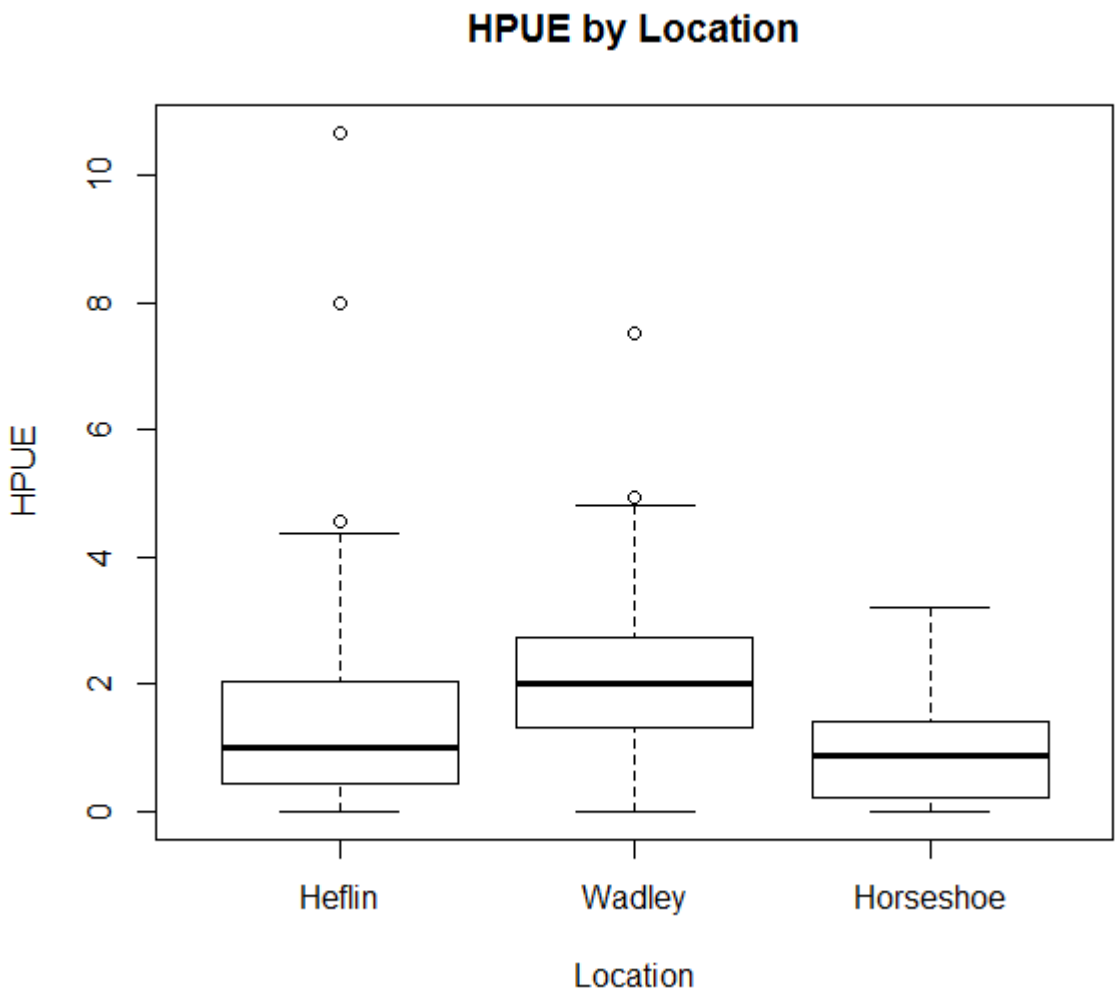


Figure 5. Box plot for HPUE by Location for study reaches on the Tallapoosa River.

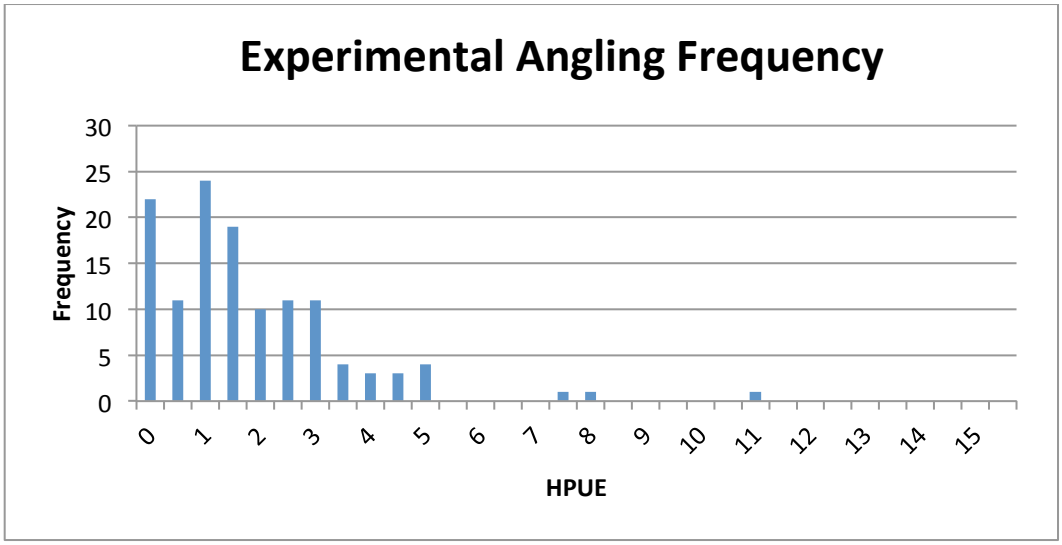


Figure 6. Histogram showing frequency of HPUE values for the experimental angling.

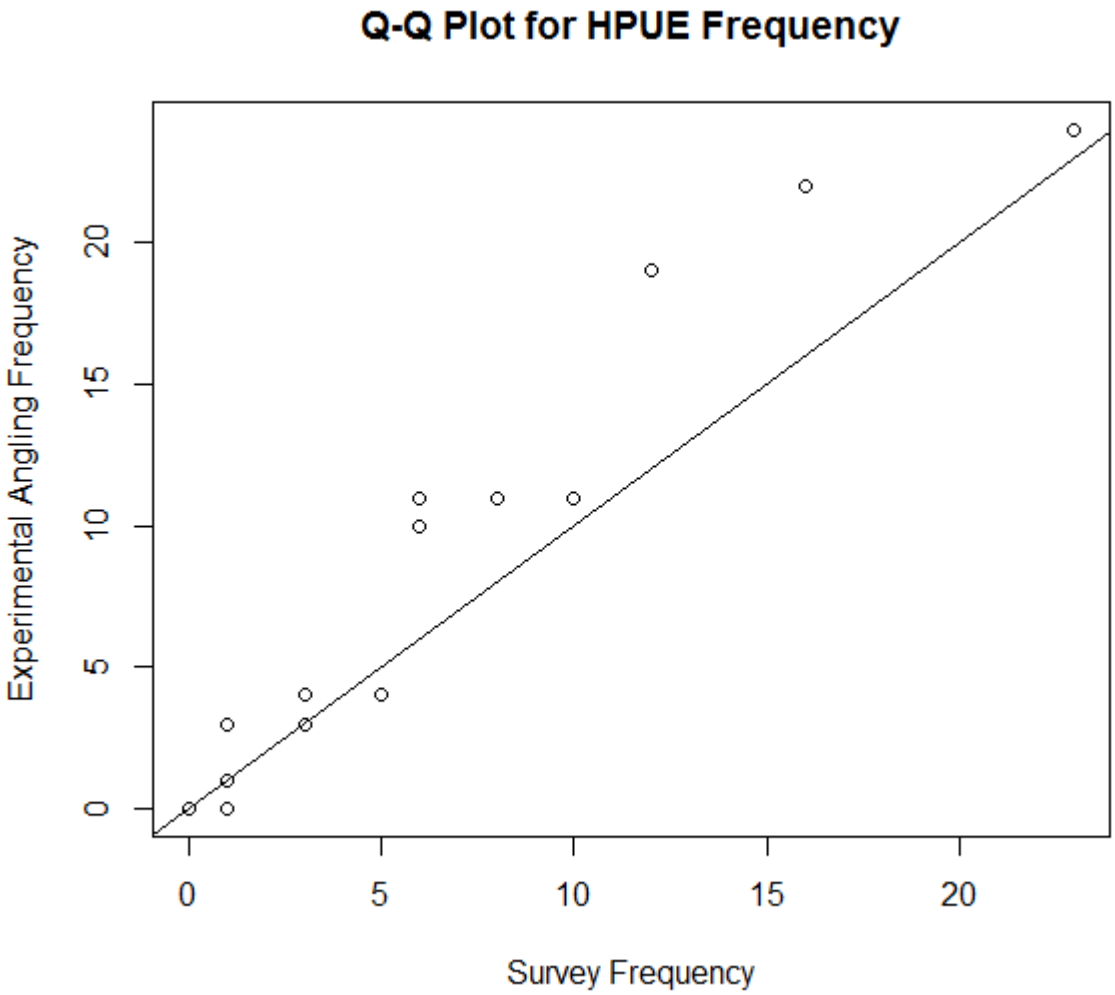


Figure 7. Q-Q Plot for Kolmogorov-Smirnov Test showing normal distribution for Survey HPUE and Experimental Angling HPUE.

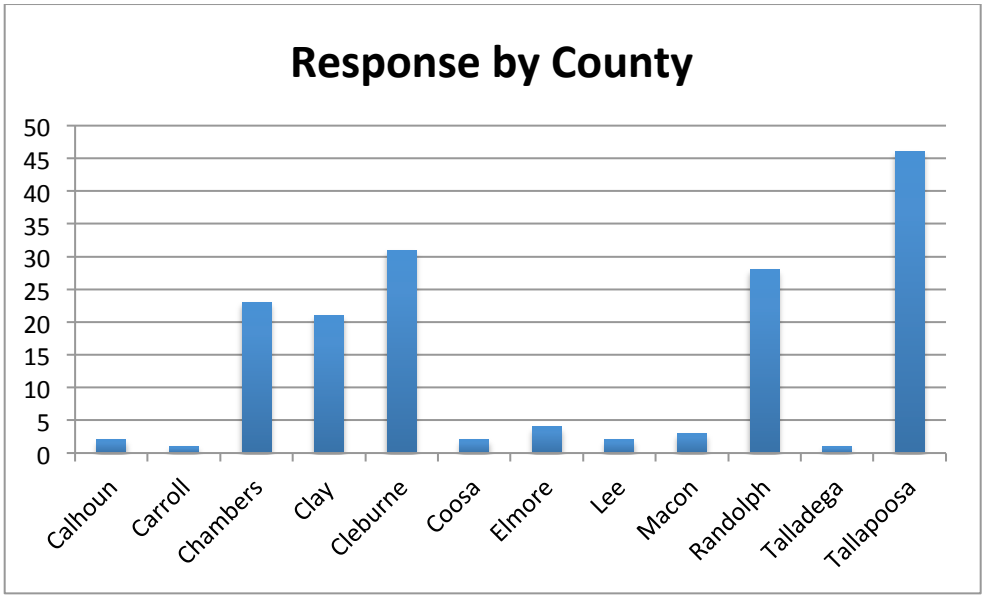


Figure 8. Survey response by county.

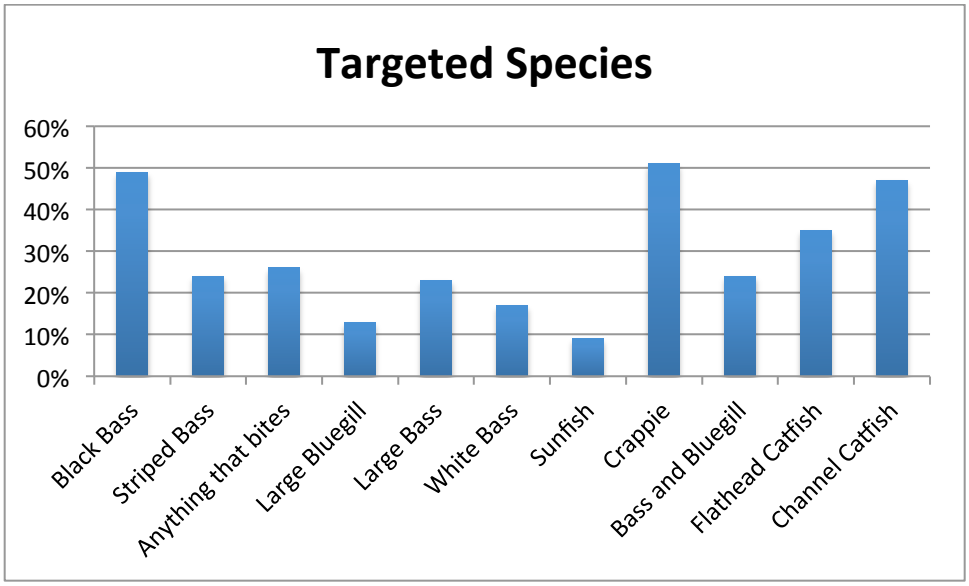


Figure 9. Species targeted by anglers.

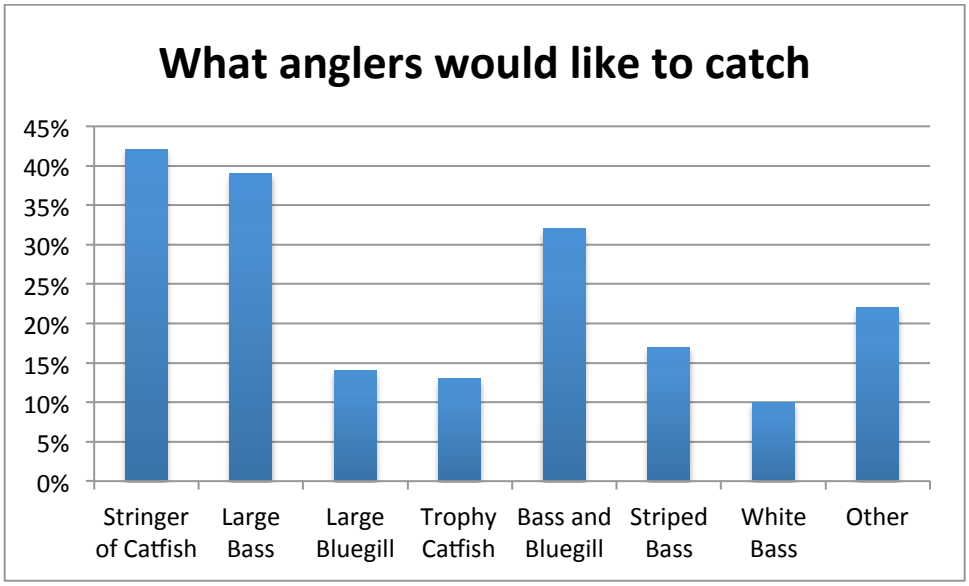


Figure 10. What would you like to see caught in an average trip?

Appendix I

2014 Tallapoosa River Angler Survey

Understanding your angling and management preferences

A Study By:
Alabama Division of Wildlife and Freshwater Fisheries
and
School of Fisheries, Aquaculture, and Aquatic Sciences
Auburn University

Greetings from Auburn University and the

Alabama Division of Wildlife and Freshwater Fisheries

The Alabama Division of Wildlife and Freshwater Fisheries (WFF) believe angler attitudes and satisfaction are important. For this reason, WFF has contracted with Auburn University (AU) to gather information related to angler satisfaction and other issues related to the Tallapoosa River. WFF appreciates your support of our fishing heritage through your purchase of a fishing license. The preferred method of managing Alabama's fisheries resources is through regulated fishing. WFF strives to keep a balance that is beneficial to Alabama's fisheries populations and its anglers. Proper management requires input from those who fish in Alabama.

The best way we have of learning about angling related issues is by asking a diversity of anglers to share their thoughts and opinions. You are one of a number of randomly selected fishing license buyers who we are asking to complete this survey. This questionnaire is only available to participants age 19 and over that purchased a fishing license for the 2014-2015 seasons. The questions should take about 10-20 minutes to complete. Your responses are voluntary and will be kept confidential. Your answers will never be associated with your mailing address or your name. We appreciate and value your input and look forward to receiving the completed survey.

Your decision about whether or not to participate will not jeopardize your future relations with AU, the School of Fisheries, Aquaculture, and Aquatic Science, or WFF. If you have any questions about the survey, please call Clark Gerken by telephone at (334)-844-9318 or by email at cng0004@tigermail.auburn.edu. If you have any questions about your rights as a research participant, you may contact the Auburn University office of Human Subjects Research or Institutional Review Board by telephone at (334) 844-5966 or by email hsubjec@auburn.edu

By taking a few minutes to share your experiences, you will be helping WFF have a better understanding of Alabama Anglers. The information you share with us will be used to enhance angling and management decisions in Alabama. We look forward to receiving your responses.

Sincerely,

Russell Wright, Associate Professor
School of Fisheries, Aquaculture, Aquatic Sciences
Auburn University

Chuck Sykes
Director
Division of WFF

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO.

The Auburn University Review board has approved this document for use from June 2014 to

Protocol #

Angling on the Tallapoosa River

1. Have you fished on the Tallapoosa River from below Harris Dam (Lake Wedowee) to Jaybird Creek (above Lake Martin)?

   ○ Yes ○ No

2. Have you fished on the Tallapoosa River from above Harris Dam (Lake Wedowee) to the Georgia State line?

   ○ Yes ○ No

3. How often have you fished the river in the last twelve months?

   ○ once ○ 10-20
   ○ 2-5 ○ 21-50
   ○ 6-10 ○ more than 50

4. What months do you plan on fishing (check all that apply)

   ○ January ○ July
   ○ February ○ August
   ○ March ○ September
   ○ April ○ October
   ○ May ○ November
   ○ June ○ December

5. Are your fishing trips mostly on weekends or weekdays?

   ○ Weekday ○ Weekend

6. What area of the river do you ***most often*** fish?

   ○ Wadley
   ○ Heflin
   ○ Directly below Harris Dam
   ○ Malone
   ○ Horseshoe Bend
   ○ Jaybird Creek
   ○ Other (please specify) _____

7. How many fishing trips are you planning to make to the Tallapoosa River this year?

   ○ once ○ 10-20
   ○ 2-5 ○ 21-50
   ○ 6-10 ○ more than 50

8. How many years have you been fishing the Tallapoosa River?

   ○ 1-3 ○ 20-30
   ○ 4-10 ○ 31-40
   ○ 11-20 ○ more than 40

9. How old were you when you first went fishing on the Tallapoosa River?

   _____ Years

10. Which type of fishing license did you purchase for the 2014 season

    ○ Resident Fishing ○ Resident Hunting and Fishing
    ○ Non-resident Fishing ○ Non-resident Hunting and Fishing

11. Which of the Following species do you target when fishing the river?

- ○ Black Bass (largemouth, redeye, "spotted")
- ○ Striped Bass
- ○ Anything that bites
- ○ Large Bluegill
- ○ Large Bass
- ○ White Bass
- ○ Sunfish
- ○ Crappie
- ○ Bass and Bluegill
- ○ Flathead Catfish
- ○ Channel Catfish

12. How are you accessing the river?

- ○ Public Access
- ○ Private land access

13. How are you fishing the river?

- ○ Motorboat
- ○ Canoe/Kayak
- ○ Shore angling
- ○ Wading
- ○ Other (please specify) _____

14. On a scale of 1-7 (7 being best) how would you rate the overall experience of fishing on the Tallapoosa River?

1	2	3	4	5	6	7
Very Poor			Neither Poor nor good			Very Good
○	○	○	○	○	○	○

15. On your most recent trip to the Tallapoosa River how many fish did you catch and how many hours did you fish?

#fish _____ #hours _____

16. Were you satisfied with this catch rate? ○ Yes ○ No

17. Indicate your level of agreement with the following statements about Please indicate your level of agreement with each of the following reasons that kept you from fishing the Tallapoosa River?

	1 Strongly disagree	2	3	4	5	6	7 Strongly agree
Lack of Access	○	○	○	○	○	○	○
Unknown water flow conditions	○	○	○	○	○	○	○
I did not have time	○	○	○	○	○	○	○
It is too expensive to go fishing	○	○	○	○	○	○	○
Inadequate facilities	○	○	○	○	○	○	○
Unsure of fishing success	○	○	○	○	○	○	○
Fishing regulations	○	○	○	○	○	○	○
Cost of fishing license	○	○	○	○	○	○	○
Other : _____	○	○	○	○	○	○	○

18. Are you familiar with the Department of Conservation's regulations about fishing in the Tallapoosa River? ○Yes ○No

19. On a scale of 1-7 (7 being best) how would you rate fishing regulations on the Tallapoosa River?

1	2	3	4	5	6	7
Too Strict			Neither Strict nor Lenient			Too Lenient
○	○	○	○	○	○	○

20. On a scale of 1-7 (7 being best) how would you rate the river flow conditions for fishing on the Tallapoosa River?

1	2	3	4	5	6	7
Very Poor			Neither Poor nor good			Very Good
○	○	○	○	○	○	○

21. Are there other types of recreation that you enjoy on the river?

- ○ Canoeing
- ○ Tubing
- ○ Hunting
- ○ Boating
- ○ Camping
- ○ Other (please specify) _____

22. What would you like to see caught in an average trip?

- ○ Stringer of Catfish
- ○ Bass and Bluegill
- ○ Large Bass
- ○ Striped Bass
- ○ Large Bluegill
- ○ White Bass
- ○ Trophy Catfish
- ○ Other (please specify) _____

23. Please rate your fishing abilities in comparison to other anglers.

	1	2	3	4	5	6	7
	Novice						Expert
Level of fishing skill	○	○	○	○	○	○	○
Level of fishing knowledge	○	○	○	○	○	○	○
Level of knowledge of fisheries management	○	○	○	○	○	○	○

24. Indicate your level of agreement with the following statements about fishing in the Tallapoosa River.

	1	2	3	4	5	6	7
	Strongly disagree						Strongly agree
Fishing is an important tradition to me	○	○	○	○	○	○	○
I have accumulated a lot of fishing equipment	○	○	○	○	○	○	○
I find that a lot of my life is organized around fishing	○	○	○	○	○	○	○
If I stopped fishing, I would probably lose touch with a lot of friends	○	○	○	○	○	○	○
I would rather fish than any other recreation	○	○	○	○	○	○	○
Fishing is a part of my identity	○	○	○	○	○	○	○
I am just as happy if I don't catch fish	○	○	○	○	○	○	○
The trip is successful even if no fish were caught	○	○	○	○	○	○	○
I am only satisfied if I catch fish	○	○	○	○	○	○	○
I want to keep the fish I catch	○	○	○	○	○	○	○
I want to release the fish I catch	○	○	○	○	○	○	○
I want to introduce fishing activities to other people.	○	○	○	○	○	○	○
I enjoy knowing I have a chance to catch a "trophy"	○	○	○	○	○	○	○

25. How important are the reasons why you participate in fishing the Tallapoosa River?

	1	2	3	4	5	6	7
	Strongly disagree						Strongly agree
To be outdoors	○	○	○	○	○	○	○
To do something with my family	○	○	○	○	○	○	○
Chance of catching fish	○	○	○	○	○	○	○
To experience the excitement of catching fish	○	○	○	○	○	○	○
To bring home fish to eat	○	○	○	○	○	○	○
To bring home a trophy fish	○	○	○	○	○	○	○
Size of fish	○	○	○	○	○	○	○
To view other wildlife in their natural setting	○	○	○	○	○	○	○
The physical exercise provided by fishing	○	○	○	○	○	○	○
To enjoy solitude while on the river	○	○	○	○	○	○	○
To develop my fishing skills	○	○	○	○	○	○	○
To control the fish population	○	○	○	○	○	○	○
To be with others who enjoy the same things	○	○	○	○	○	○	○
To get away from regular routine	○	○	○	○	○	○	○
The challenge of fishing	○	○	○	○	○	○	○
To enjoy nature	○	○	○	○	○	○	○
Exploration	○	○	○	○	○	○	○
For relaxation	○	○	○	○	○	○	○
To be alone	○	○	○	○	○	○	○
To share my skills and knowledge with others	○	○	○	○	○	○	○

26. Please indicate how satisfied you are with the following statements about your experience while fishing the Tallapoosa River.

	1	2	3	4	5	6	7
	Strongly disagree						Strongly agree
My ability to find an area to fish	○	○	○	○	○	○	○
Amount of public land available for fishing	○	○	○	○	○	○	○
Amount of private land available for fishing	○	○	○	○	○	○	○
Scenic beauty of fishing areas	○	○	○	○	○	○	○
Number of fish thought to be in the river	○	○	○	○	○	○	○
Overall number of fish caught	○	○	○	○	○	○	○
The health of the fish	○	○	○	○	○	○	○
The opportunity to see other wildlife	○	○	○	○	○	○	○
The clarity of the fishing regulations	○	○	○	○	○	○	○
Number of boatable days	○	○	○	○	○	○	○
Accuracy of the dam release schedule	○	○	○	○	○	○	○
Local facilities	○	○	○	○	○	○	○

27. Approximately how much do you spend each year :

Fishing on the Tallapoosa River?

$

Fishing in other places in Alabama besides theTallapoosa River?

$

28. How far do you travel per trip to fish the river? Miles round trip

29. Are you familiar with the Alabama Power 1-800-Lakes11 resource for checking the hydroelectric water release schedule on the river?

○ Yes ○ No

30. If so, do you call before going out on the river or fishing?

○ Yes ○ No

31. Are you aware of the US Geological Survey water gage data located online (http://waterwatch.usgs.gov/)?

○ Yes ○ No

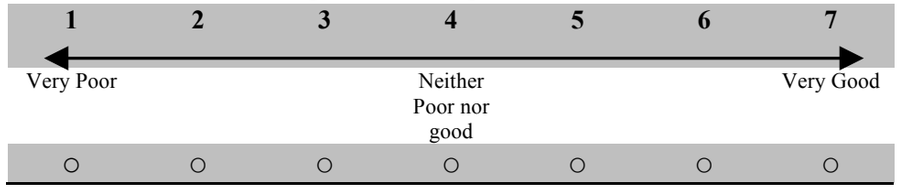
32. If so, do you use this resource to check water levels before going out on the river or fishing?

○ Yes ○ No

33. What flows would you consider ideal for fishing? Specific location? Day and time of week?

34. Would you like to have more days where flows on the river were more suitable to boating? ○ Yes ○ No

35. On a scale of 1-7 (7 being best) how would you rate the river flow conditions for boating on the Tallapoosa River?



36. In your opinion, has the fishing improved in the last several years?

○ Yes ○ No

37. Are you aware of the flow management that is ongoing at Harris Dam?

○ Yes ○ No

38. What management changes would you like to see in the river below Harris Dam?

Demographic Information

For statistical purposes, we need to ask you a few demographic questions. Please remember that your information is confidential!

39. What year were you born? ____

40. County of Residence? ____

41. What is your gender?

○Male ○Female

42. Including yourself how many people live in your household? ____ people

43. Are you retired?

○Yes ○No

44. What is your ethnicity

○American Indian ○Asian

○Black/African American ○White/Caucasian

○Latino ○Other

45. What is your marital status?

○ Single

○ Married

46. Are you currently employed?

○Yes ○No

47. What is your highest level of education completed?

○ Did not complete High School ○ Graduate or professional degree

○ High School Diploma or GED ○ Some college, but no degree

○ Associate degree ○ Bachelor Degree

○ Other ____

48. Please check the box that corresponds to your annual income in 2014. This information is only used to understand angler satisfaction and management preference across income groups.

○ Less than $14,999

○ $15,000 to $19,999

○ $20,000 to $24,999

○ $25,000 to $34,999

○ $35,000 to $49,999

○ $50,000 to $74,999

○ $75,000 to $99,999

○ $100,000 to $149,999

○ $150,000 or more

Thank you for participating in this study!!

Your answers to this survey will provide our agency with useful information regarding the management and conservation of our natural resources. We appreciate your participation in the survey and value your continued support and purchase of Alabama fishing licenses.

Please provide any additional comments here.