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Methodology and Results of the Choccolocco Creek Fish Consumption Survey

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1. Methodology of the Choccolocco Creek Fish Consumption Survey

Consumption of fish can be a critical pathway of exposure to polychlorinated biphenyls (PCBs) found in sediments of the waterbodies from which those fish are obtained. The degree of exposure depends upon the amount and type of fish that are consumed, the way they are prepared, and the concentration of the PCBs in those fish. Rates of fish consumption are highly variable and depend upon a number of important factors, including whether consumed fish come from a commercial or a recreational fishery. Commercial fisheries can potentially supply a substantial amount of fish to a large population of consumers. Recreational fisheries, however, supply fish only to sport anglers and the family and friends with whom they share their catch. Fisheries have highly variable consumption patterns that depend upon the sizes, accessibilities, and physical characteristics of the waterbodies, the region of the country and the availability of preferred species. It is important to consider all of these factors in selecting a fish consumption rate for use in a human health risk assessment and, when possible, to collect site-specific information that will provide the most accurate characterization of the potential magnitude of exposures that will be presented by this exposure pathway.

ARCADIS was retained by Pharmacia/Solutia (P/S) to design and conduct a fish consumption study that would provide site-specific information for completing a human health risk assessment of potential exposures to PCBs as a result of consuming fish caught by recreational anglers from Choccolocco Creek in Anniston, Alabama. There are a number of methods available for collecting information about fish consumption habits of angler populations. The United States Environmental Protection Agency (USEPA, 1992) has identified five potential methods for conducting fish consumption surveys. These include telephone, mail, diary, personal interview and creel surveys. Telephone and mail survey methods can be broadly classified as population-based surveys, which involve contacting members of the general population, evaluating whether they are part of the target population, and then recruiting them to participate in the study. In contrast, the personal interview and creel survey approaches can be broadly classified as intercept methods, because anglers are intercepted directly while fishing and asked to participate in the study. The diary method, which involves asking anglers to complete a log of their fishing trips and consumption over time, is usually combined with either the population or intercept method.

Population-based surveys require obtaining contact information for a sample of the local population by randomly contacting households throughout the general population in an attempt to find people who use a particular waterbody for recreational fishing. This method is very effective and efficient when the waterbody is a commercial fishery

or if the waterbody attracts a large percentage of the general population due to its size and location (e.g., the Great Lakes). However, population-based surveys are less effective for small fisheries where only a small segment of the local population is likely to fish. Because population-based surveys ask anglers to report previous fishing activity rather than activity in progress, there is more potential for recall bias to influence the data collected.

There is no commercial fishing in Choccolocco Creek (the Creek), only recreational harvest. The area surrounding the Creek is rural with a low population density, and public access to the Creek itself is very limited. During a four-hour visit to the site on March 29, 2006 only three anglers were observed using the Creek. One was observed fishing at Silver Run Road, and two were observed at the boat ramp adjacent to the Highway 77 overpass. According to anecdotal information obtained during that site visit, the anglers reported that they primarily fished the Creek because it was convenient for them.

Because it was likely that the size of the angler population using the Creek was small and localized, and because public access is limited to a number of well-defined locations, it was determined that the best approach for collecting site-specific fish consumption information would be to conduct an intercept survey at the site (USEPA, 1992). The intercept survey method is beneficial in eliminating recall bias since data are collected at the time of fishing activity. Survey scientists are stationed at identified access points to the Creek in order to interview everyone they observe fishing. However, because only data from a single fishing trip is collected, it is necessary to extrapolate short-term results in order to estimate long-term behavior. It is the long-term behavior patterns that will determine the risk of exposure to PCBs through fish consumption.

A one-year angler intercept survey of Choccolocco Creek began June 28, 2008 and concluded June 27, 2009. The survey was designed and implemented according to the methodology described in the *Sampling and Analysis Plan for the Choccolocco Creek Fish Consumption Study* (SAP) included as Attachment C to the *Phase 1 Field Sampling Plan for Operable Unit 4 of the Anniston PCB Site* (ARCADIS, 2006). The purpose of the survey was to collect site-specific information necessary to characterize the use of the Creek for recreational fishing and the consumption behaviors of the individuals who fish there, in order to inform the human health risk assessment that will be conducted for the Creek. The survey was designed to characterize the Creek by discovering the following:

- the extent of use for fishing, including the number of anglers who fish there, their frequency of fishing during the year, and the number of years they have fished the Creek
- the locations where anglers regularly fished
- the types and sizes of fish caught and harvested for consumption
- the preparation methods used
- the rates of fish consumption
- the demographic characteristics of the angler population

The SAP also proposed the completion of a second survey of residential homeowners who have private access to the Creek. That survey is in its final planning stages and will be implemented in early 2010. The landowners' survey results will be integrated in an updated version of this fish consumption survey report.

1.1 Survey Locations

Potential exposure to PCBs in the fish of Choccolocco Creek is a function of the amount of fish eaten and the concentration of PCBs in the fish. PCB concentrations in Creek sediments and fish demonstrate a spatial component, decreasing with distance downstream from the confluence with Snow Creek (BBL, 2003). Therefore, it is important to understand which species of fish are consumed and where they are harvested in order to provide site-specific estimates of potential exposures and risks.

Investigations of the areas around the Creek and discussions with local anglers led to the conclusion that public access is limited to nine access points, most of which are located on or adjacent to road bridges over the Creek. Therefore, this study was designed to characterize the magnitude of fishing activity and consumption along the length of the Creek between the Snow Creek confluence and its entry into Lake Logan Martin.

A total of nine survey locations were included in the study (Figure 1). These included:

1. Snow Creek
2. Friendship Road Bridge

3. Highway 21
4. Silver Run Road / Flatbridge
5. Priebes Mill Bridge
6. Old Talladega Road
7. Eastaboga Road
8. Jackson Trace Road and
9. Highway 77 Boat Ramp

1.2 Sampling Schedule

The survey was conducted on a total of 101 survey days, representing 27 percent of available days during a one-year period.[1] This sampling intensity was selected to provide sufficient information to reliably characterize fishing and fish consumption behaviors of the angler population (ARCADIS, 2006). The sampling days were divided into two shifts to prevent survey scientist fatigue and to allow for morning, midday and evening sampling.

The study followed a stratified random sample method. Strata were selected to create homogeneous groups of days and to increase precision in the event that mean consumption rates varied by season or day of the week. Stratification also ensured that the sampling days were allocated to higher-use days, and increased the precision of estimates in areas that were of particular interest to the study.

The sampling design accounted for four strata:

- Season (winter, spring, summer and fall)
- Time of the week (weekday or weekend/holiday)
- Location along the Creek (below Jackson Shoals or above it)
- Shift start time (morning or afternoon)

[1] The original survey design included 100 survey days. Due to a scheduling error, an extra survey day was completed, for a total of 101 survey days.

This study also followed an optimal allocation approach method, modified to make use of data available through previous studies (Levy and Lemeshow 1999). Optimal allocation considers angler visitation per season and the seasons with greater consumption variation, which improves the precision of the study results.

The stratification was developed using seasonal data from an Alabama angler freshwater fish consumption study prepared by Fishery Information Management Systems, Inc. for the Alabama Department of Environmental Management (ADEM 1993).[2] This study reported data from August 1992 to July 1993. Consumption calculations were based on two consumption reporting methods (total fish mass harvested and estimated number of four-ounce servings consumed), and differentiated between fish that were consumed from the location at which the anglers were interviewed and fish consumed from other areas in Alabama. Only the data related to fish consumed from the interview site were used in the design of the Choccolocco Creek study.

1.2.1 Seasonal Strata

The simplest form of allocation by season is proportional allocation, where the number of sample days in each season is calculated as the percent of angling activity for the season multiplied by the total number of sample days in the study.

$$n_s = pa_s * N$$

Where:

n_s = number of sampling days in the season

pa_s = percent of angling activity during the survey (based on the ADEM study)

N = number of days in the sampling period (100)

In this case, the seasonal percent (pa_s) of angling activity is the number of interviewed Alabama anglers by season from the ADEM (1993) study.[3]

[2] Although this study does not provide specific information about Choccolocco Creek, it does provide information about seasonal consumption patterns in Alabama, which is sufficient for developing the stratification.

[3] The seasonal percent of angling activity includes all anglers, regardless of consumption reporting method.

To improve the efficiency of the stratification, the seasonal variation in consumption rates demonstrated in the ADEM survey was incorporated into the design for Choccolocco Creek. The above equation was modified to:

$$n_s = \frac{pa_s \text{ x } se_s}{\sum_s pa_s \text{ x } se_s} \text{ x } N$$

Where:

se_s is the standard deviation in the seasonal fish consumption provided in the ADEM (1993) report, based on the harvest method consumption rates

In this framework, the percent of anglers in each proposed stratum was multiplied by the estimated standard deviation in consumption to calculate a seasonal weight. The percent of sampling days allocated to that season was the seasonal weight over the sum of all the seasonal weights. The standard deviation was the mean seasonal consumption multiplied by the relative standard error. The final seasonal sampling distribution was calculated from the new numbers, which accounted for variance.

1.2.2 Time of Week Strata

To further ensure the study focused on high-use days, the stratification also included consideration of weekend and weekday visitation. Other studies have shown (e.g., Kinnell et al. 2007) that total weekend angler visits (Saturday and Sunday) were comparable to total visits throughout the rest of the week (Monday through Friday). To account for this, 50 percent of sampling days (by season and location along the Creek) were allocated to weekends/holidays and 50 percent were allocated to weekdays.

1.2.3 Location Strata

The third level of stratification was the access location along the Creek. It was expected, based on physical characteristics of the access locations, anecdotal information, and observations during a site visit and previous field work, that most anglers fish the Creek below Jackson Shoals (Shoals), where the Creek is larger and there is better access than above the Shoals. In addition, the Highway 77 boat ramp, which was expected to have the highest visitation, is located below Jackson Shoals. However, higher upstream PCB fish tissue concentrations make characterization of potential exposure in the area above Jackson Shoals important. To ensure that usage would also be adequately characterized above the Shoals, the areas above and below

the Shoals were given equal weight (50 percent of the seasonal allocation was assigned to each general area).

1.2.4 Schedule

Table 1 shows the total number of survey days in each stratum. Summer received more sampling days than spring because the ADEM survey indicated that both angler visitation and visitation variance were higher during the summer.

On each sampling day, two survey locations were sampled during a single shift. Shifts were split between morning and afternoon. The Morning Shift interviews began at 7:00 a.m. at the first location and continued until 10:45 a.m. (a total of 3.75 hours), at which time one hour was allotted for lunch and time to move to the second location. Interviews at the second location began at 11:45 a.m. and continued until 3:30 p.m. The Afternoon Shift interviews began at the first location at 11:30 a.m. and continued until 3:15 p.m., at which time one hour was allotted for lunch and time to move to the second location. Interviews at the second location began at 4:15 p.m. and continued until 8:00 p.m.

Table 2 provides the final schedule for sampling.

1.3 Survey Forms

Appendix A provides the interview forms that were used for the study. These forms were developed and then refined based on information obtained from a focus group convened on June 18, 2008, and subsequent pretesting in the field prior to survey initiation. The interview form included questions about the anglers' fishing behavior, demographics, catch and consumption. The missed creel report recorded the angler's observable demographic profile, fishing activity and, when possible, whether the angler caught or kept any fish.

This survey allowed scientists to directly observe where anglers fished the Creek and to record trip-specific information concerning species caught and harvested, frequency of fishing the Creek, and plans for consumption of harvested fish. It also allowed scientists to record additional information about other locations on the Creek where individuals fish in addition to the specific location where they were interviewed. The scientists used maps to determine locations that were reportedly fished by boat (Figure 2).

1.4 Interviews

Survey scientists were stationed at each designated access point on the survey day. Prior to implementation, scientists were equipped with survey forms (Appendix A) and the survey protocol (protocol) (Appendix B), which outlined the appropriate method for conducting an interview and recording responses. The protocol outlined all the pertinent information for the scientist conducting the survey, including the following:

- Detailed instructions for eliciting answers to survey questions
- Approaches for handling contingencies (for example, how to handle inclement weather during a sample day)
- List of frequently asked questions with their associated answers

Additionally, scientists were extensively trained on how to conduct the interview in a manner that would provide accurate data without biasing responses. Scientists were coached on how to ask the questions in the survey, what visual aids to use while conducting the survey and how to handle inquiries from participants.

The scientists attempted to interview all anglers fishing at the site during their shift. If an angler refused to be interviewed, the scientist completed a missed creel report (Appendix A), to record general observations about the angler. The missed creel reports allowed the scientists to record some observable information about anglers even when no interview was conducted, thereby facilitating estimation of total trips and the size of the population using the Creek.

During the interviews, the scientists attempted to recruit anglers for participation in the remainder of the study (e.g., be willing to be interviewed on subsequent survey days). Anglers who agreed to participate were asked to provide information (first name and phone number) that would allow the scientists to identify sets of data from the same individual. Recruiting made the anglers aware that they might be approached in the future, which increased the likelihood that they would agree to talk to scientists on subsequent fishing trips, thereby improving the quality of the data they provided. Recruitment also allowed for identification of repeat anglers in the final dataset and tracking of those repeat anglers over time.

1.5 Sampling Weights and Angler Population Size

The underlying principle of statistical sampling is that the sample represents the population. If the survey is a simple random sample from a population, then the sampled individuals each represent an equal proportion of the population. The number of individuals represented by a sampled individual is expressed as that individual's sampling "weight." For a simple random sample, the ratio between the size of the population and the size of the sample yields the sampling weight, which is the same for each individual. For more complex survey designs, sampling weights are not equivalent for each person included in the sample, but can be determined by considering the sampling design. Sampling weights are an important component of many survey datasets used in risk assessment applications, e.g., the National Health and Nutrition Examination Surveys (NHANES). Taking account of sampling weights in analyzing survey data is required to ensure that the resulting estimates are unbiased (or nearly so) for the parameters of the target population (Vittinghoff et al., 2005).

For an intercept study, where the sample is drawn randomly from a set of *times* rather than *anglers*, calculation of sampling weights is more complex. An intercept survey provides information based on a single "snapshot" of time for a subpopulation of anglers who use the fishery. The size of the angler population is not known prior to the survey. Because the sampling units for the intercept survey are locations visited during a given season on a given day type at a given time of day, the survey represents a stratified random sample of angler *trips*. Extrapolation from sample to population for information that might vary on a trip-by-trip basis (e.g., success rate for catching fish) can be accomplished assuming that each observed trip is a randomly drawn sample from the set of all trips, so unweighted sample statistics provide the "trip population" information desired.

However, as used in risk assessment, exposure factors such as fish consumption rates are not often characterized on a per-trip basis. For these exposure factors, results desired are distributions and statistics representing the *angler population* including individuals who may be fishing from the Creek but were not interviewed during the creel survey, either because they were not encountered during the survey or because they refused to be interviewed. Extrapolating from the sample of angler trips to the angler population is accomplished using sampling weights that are not equal for each interview, but rather represent the likelihood that an individual was included in the survey. Sampling weights correct for avidity bias, i.e., the bias in survey results that occurs because more frequent (i.e., avid) anglers, who may differ from less avid

anglers in fishing success, consumption rate, or related exposure factors, are more likely to be included in the sample.

For an intercept study, this extrapolation from sample to population involves adjusting for the number of times each stratum was sampled throughout the year. Using information from the survey on the number of observed trips in each stratum and estimates of fishing frequency derived from the interviews, sampling weights can be derived for each angler included in the survey. These sampling weights indicate how many anglers in the population are represented by that angler. The sum of the sampling weights provides the estimate of the size of the angler population. The sampling weights can be used in combination with the sample results (i.e., responses and exposure factors calculated from each interview) to correct for avidity bias and thus yield exposure factor value distributions and statistics representative of the angler population rather than just the sample of angler trips.

This study used the weighting approach developed for the Passaic River Creel and Angling Survey (Kinnell et al., 2007; Ray et al. 2007a, 2007b), which has been peer reviewed and accepted as an appropriate technique (Finley et al. 2003). This approach was designed for an infrequently visited system and improves upon earlier attempts to correct for avidity bias, such as that developed by Price et al. (1994).

The sampling weight (w_i) for an angler interview is the inverse of the probability (p) that the respondent is interviewed at least once during the study period. To calculate the probability that an angler is interviewed at least once, it is actually easier to calculate the probability that the angler is *not* interviewed and subtract it from 1. Because the probabilities will vary by stratum, the general formula for deriving the weight for angler i is:

$$w_i = 1/(1 - \prod_j pn_{ij})$$

where pn_{ij} is the probability of angler i not being interviewed in stratum j. Ray et. al. (2007a) show that the probability of not being interviewed within a stratum is represented by the hypergeometric distribution parameterized using the number of interviews for that angler (in this case, 0), the angler's trips within that stratum (t_{ij}), the number of times that stratum was sampled (n_j), and the total number of opportunities to sample within that stratum (N_j):

$$pn_{ij} = H(0, n_j, t_{ij}, N_j).$$

Because there are 32 strata in the survey, there are 32 values of pn_{ij} in the calculation of sampling weights for each completed interview. The number of times that an interview day occurred in a stratum (n_j) and the total number of opportunities to sample within that stratum (N_j) were determined from the sampling plan structure and are presented for each stratum in Table 3. Calculation of an angler's trips within a stratum (t_{ij}) apportions the information derived from an angler regarding trips taken according to the observations of angler trips recorded over the course of the survey for each stratum:

$$t_{ij} = f_{Tj} * t_i$$

where:

f_{Tj} = fraction of all trips observed stratum j = $T_j / \sum_j T_j$

t_i = angler's trips

Table 3 also presents the values of f_{Tj} for each stratum. Because of the seasonal basis for the estimation of the number of an angler's trips from the survey data, the calculations of f_{Tj} and t_i are performed on a season-by-season basis. That is, f_{Tj} is calculated separately for the 8 strata in each of the four seasons, and there are uniquely determined values for t_i for each angler for each of the four seasons.[4]

1.6 Estimation of Consumption Rates

Consumption rates were calculated for each individual who reported harvesting fish for the purpose of consumption. The annualized average daily fish consumption rate was derived for each angler interviewed who held a fish in his or her creel and indicated an intention to eat that fish. This rate was based on the number and weight of each creeled fish and the reported frequency of fishing Choccolocco Creek. Fish consumption rates were estimated using the following equation:

$$CR = M * EP * F * S * 1/D * 1/P$$

[4] This methodology for calculating sampling weights is consistent with that described in Ray et al. (2007a), but different in details than that described in the *Sampling and Analysis* Plan (ARCADIS, 2006) which relied on a pre-publication version of the Ray et al. (2007a) work. Because the intention of the survey was to follow the peer-reviewed methodology used in the Passaic River Survey, the approach that appeared in the published version of the Ray et al. (2007a) article was adopted for analysis of the Choccolocco Creek Survey.

Where:

CR = Annualized average daily consumption rate (g edible fish/day-person)

M = Whole body mass of creeled fish on trip (g whole/ trip)

EP = Edible portion of fish (g edible/g whole)

F = Frequency of fishing trips to Choccolocco Creek (trips/year)

S = Fraction of trips that were successful (unitless)

D = Days per year (365 days/year)

P = Number of individuals who share in consumption of harvest fish (persons)

1.6.1 Whole Body Mass (M)

The whole body mass of each fish observed in the creel was estimated based on length information recorded during the interview, combined with length-weight relationship data, which were obtained from the Alabama Department of Wildlife and Freshwater Fisheries (ADWFF) (unpublished data, Damon Lee Abernethy, Fisheries Development Coordinator, July 28, 2009). To develop whole body mass based on the length of the harvested fish, the species-specific raw data for length and weight of Alabama fish, provided by ADWFF, were both log transformed and a linear regression was fit to the data (Appendix C). Using the regression equation for the trend line, fish weights were calculated based on the lengths of the fish consumed, which were reported on the survey form, using the following equation.

$$W = 10\text{^}Slope * Log(L) - Int$$

Where:

W = Fish mass (grams)

Slope = Slope of the species-specific regression equation (g/mm)

L = Fish length (millimeters)

Int = Intercept

No length / weight data were available from ADWFF for channel catfish. Thus, a species-specific regression equation, published by Brown et al. (1995), was used for this species.

1.6.2 Edible Portion (EP)

An edible portion of 30 percent was used to convert the total fish mass (g) into edible mass (g). This value is recommended by USEPA (1989) guidance and is consistent with the dress-out percentage for fish muscle (without bones) provided in the ADEM (1993) survey data.

1.6.3 Fishing Frequency (F)

The annual number of fishing trips each angler takes is a key element in the consumption analysis and can vary depending upon season and availability of preferred species. Therefore, it was important to collect as much information from the angler as possible, while minimizing recall bias.

During the interview, each angler was asked which seasons and, within a season, which months they typically fish at the Creek. Anglers were also asked the number of trips they had actually taken during the four-week period prior to the interview. As a follow-up question, they were asked to indicate whether that reported four-week frequency was typical of their fishing frequency along the Creek and, if not, to indicate their "usual" frequency. These data were used to estimate the annual fishing frequency through estimating a fishing frequency in trips per week for each season, and then a total number of trips in a season based on the number of weeks in that season.

Trips per week was a convenient unit for expressing fishing frequency because anglers reported frequency in trips per four weeks. The total number of weeks fished in a season ($W_{season\ i}$) was determined based on the number of months reported to be fished (m_{fished}) and the total number of weeks in that season, which was determined from the number of days represented by the three months in that season.

$$W_{season\ i} = (m_{season\ i}) * [(D_{season})/(d_{week} \times M_{season})]]$$

where:

$W_{season\ i}$ = total number of weeks fished during season i (weeks)

$m_{season\ i}$ = number of months fished in a season; reported (1,2, or 3 months)

D_{season} = days in a season (90, 92, 92, and 91 days for winter, spring, summer, and fall, respectively)

d_{week} = days per week (7 days/week)

M_{season} = total number of months in a season (3 months)

For the season when the interview occurred, if the reported fishing frequency for the past four weeks was *not* the angler's usual frequency, then four weeks of that season ($w_{unusual}$ = 4) were assumed to be fished at the reported "unusual" rate ($t_{unusual}$), and the "usual" rate (t_{usual}) was assumed to apply to the remaining weeks fished.[5,6] For other seasons fished by the angler, the usual rate was assumed to apply for all weeks fished (i.e., $w_{unusual}$ = 0 for non-interview seasons).The number of trips taken in a season ($f_{season\ i}$) was calculated for each of the four seasons.

$$f_{season\ i} = t_{unusual} * w_{unusual} + t_{usual} * (W_{season\ i} - w_{unusual})$$

where:

$f_{season\ i}$= seasonal fishing frequency (trips)

$t_{unusual}$ = "unusual" trips frequency (trips/week)

$w_{unusual}$ = number of weeks at which "unusual" fishing rate occurred (0 or 4 weeks)

t_{usual} = "usual" trips frequency (trips/week)

The annual fishing frequency (F_{annual}) was then calculated as the sum of the individual seasonal frequencies.

$$F_{annual} = \sum_i f_{season\ i} = f_{winter} + f_{spring} + f_{summer} + f_{fall}$$

If the angler reported fishing during a season but did not report the specific months fished, it was assumed that angler fished all three months of that season. This ensured that the number of months fished was not underestimated.

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[5] In approximately two-thirds of the cases, the trip frequency an angler indicated for the previous four-week period was also reported as that angler's "usual" frequency.

[6] Weeks were used for convenience as the common unit of time for the fishing frequency in these calculations. Reported frequencies for the past four weeks were divided by four to yield a weekly frequency (either "usual" or "unusual"). If reported, alternate "usual" frequencies were converted to trips per week based on the time unit indicated (i.e., trips per day, per week, per month, or per year).

1.6.4 Fraction of Successful Trips (S)

Fraction of successful trips was intended to use information about repeat interviews to calculate the percent of trips taken that were successful in harvesting fish for consumption. However, only three anglers reported that they had been interviewed previously. In addition, as discussed in more detail in Section 2, these repeat interviews could not be matched with previous interviews. As a result, this information could not be used to estimate a value for S.

Consequently, the total number of trips was instead used to estimate an average success rate for fishing trips. Complete surveys for a total of 52 angler trips were included in the data. During those trips, only eight individuals reported that they had caught any fish, for an overall success rate of 15 percent (8/52 = 15 percent). This success rate was used to estimate fish consumption rates for those individuals who had harvested fish. This assumption is conservative and likely overestimates the amount of fish actually harvested, because only half of the anglers who had caught fish at the time of the interview reported that they retained the fish that they had caught. That is, using the catch rate of 15 percent (rather than the lower “kept” rate) overestimates the fraction of fishing trips that will result in fish consumption.

1.6.5 Days per Year (D)

When conducting a risk assessment of PCB exposures, it is long-term consumption rates (i.e., over a year or an entire multi-year exposure period) that are of most interest. In order to derive an appropriate fish consumption rate to be used in risk assessment, the total amount of fish consumed during the year (*M*EP*F*S*) was divided by 365 days per year to derive an annualized average fish consumption rate to be incorporated into an exposure equation. This is consistent with USEPA guidance (1989, 1997).

1.6.6 Number of Individuals Who Share in Consumption (P)

Anglers who retained fish for consumption were asked to indicate the number and ages of individuals with whom they would share the fish they intended to consume. If all individuals reported were over 12 years of age, P was equal to the number of individuals, including the angler (if appropriate), who were reported to consume fish. If some of the individuals reported were children under the age of 12, it was assumed that they would eat roughly half of the amount of fish that would be consumed by an adult. Thus, if an angler reported that two adults and two children consumed fish, a

value of three was assigned to represent two adult sized portions and two half-sized children's portions. This approach was used to ensure that consumption by adults was not being underestimated by overestimating the size of a child's portion.

1.7 Exposure Duration

Exposure duration in risk assessment refers to the length of time over which a person is exposed to a contaminant via a particular exposure route. In the case of consumption of self-caught fish, exposure duration is the number of years that an angler fishes and eats his or her catch. It can be the same or different as the number of years a person lives in an area. Exposure duration is difficult to measure directly from a survey because surveys record in-progress behavior. This is because the number of years that an angler reports having fished at the time of the survey is less than or equal to the total number of years that an angler will fish a particular waterbody, due to the fact that the angler may continue to fish the waterbody after the survey period. In the Choccolocco Creek survey, the reported duration was determined based on the difference between the year of the interview (i.e., 2008 or 2009) and the birth year reported by the angler.

Studies have established that the longer a person performs a certain behavior (e.g., lives in a residence or fishes at a particular waterbody,) the more likely he or she is to be interviewed in the latter half of his or her total duration (Price et al. 1998; Israeli and Nelson 1992). For this reason, to estimate total fishing duration at Choccolocco Creek, an angler's total exposure duration was estimated to be twice the number of years that the angler reported he or she had fished the Creek at the time of the survey. On average, this provides a conservative representation of the range of total exposure durations in the population of anglers.

Another factor that affects estimation of exposure duration for a population is longevity bias. The creel survey provided a snapshot of the range of durations-to-date, and by estimation, total durations, represented by the anglers who fish in a given year. By the same logic that anglers who fish more times during a year are more likely to be observed and interviewed during the one-year survey, anglers who fish more years than others are more likely to be observed in a one-year survey. That is, the distribution of total duration for a population practicing a behavior during any one year is different from the distribution of durations for all of the individuals who practice a behavior during a multi-year period of time (Price et al. 1998).

The methods of Price et al. (1998) were used to correct for longevity bias. Over a period of years, the total number of individuals N_{Yi} with a particular duration Y_i is given by the size of the group n_{y1} during any given year by an average "turnover rate" ($1/Y_i$) which is the inverse of the average total duration for that group multiplied by the number of years within the time period of interest Y_t (Price et al. 1992).

$$N_{Yi} = n_{yi} * 1/Y_i * Y_t$$

The size of the group n_{yi} is taken from the population size corresponding to a particular duration y_i, which is determined through application of the sampling weights to the sample results for reported duration that are doubled to represent total duration.

The total number of individuals who fish at the site over the time period of interest (N_t) is the sum of the number who fish at each duration within the time period:

$$N_t = \Sigma i\ N_{Yi}$$

While the population size can be determined for any time period, the maximum population will be the number who ever fish within the time period equal to the maximum total duration. For this analysis, the maximum time period is set equal to twice the maximum reported duration.

Exposure duration statistics (e.g., means, percentiles) are then estimated using the total number of individuals with that duration (N_{Yi}) as additional sampling weights. For example, the average total duration for a population over the full time period is computed as the weighted average:

$$Y_t \text{ (average)} = \Sigma i\ [N_{Yi} * Y_i] / \Sigma i\ N_{Yi}$$

1.8 Total Number of Angler Trips to Choccolocco Creek

The stratification structure provides the basis for extrapolating from the observed number of trips to the total number of angler trips that occurred over the course of the year at Choccolocco Creek. This estimate of angler trips relies only on observations of the presence or absence of anglers during a survey period, not the fishing frequencies reported and estimated from the interviews. This estimate can provide a perspective on the degree of under- or over-estimation of fishing frequency and other exposure factors that rely on fishing frequency information, such as fish consumption rates.

The sampling plan includes strata for four seasons (winter, spring, summer, or fall), two day types (weekday and weekend/holiday), two shift beginning times (morning or afternoon), and two locations (above or below Jackson Shoals), resulting in 32 unique strata (4 x 2 x 2 x 2 = 32).

The sample is stratified based on the assumption that the stratification variables represent the variables that explain variation in fishing and consumption activity. Accordingly, the number of observed trips for stratum j (t_j) is assumed to be related to the total number of trips for stratum j (T_j) in the same proportion that the number of sampling events within stratum j (n_j) was related to the number of sampling opportunities within stratum j (N_j). That is:

$$T_j/t_j = N_j/n_j$$

and equivalently

$$T_j = (N_j/n_j)*t_j.$$

The total number of trips over all strata is estimated by summing the T_j values for each of the 32 strata.

2. Results

In total, 72 anglers were observed during the survey period. Of these, 52 completed some portion of the creel intercept survey interview while the remaining 20 did not. Of the 20 anglers who were observed but did not complete the interview, four were not interviewed because they were under the age of 16, and the remaining 16 were unwilling to participate. As previously discussed, the survey included nine locations along the Creek. The numbers of individuals observed and interviewed at each location during the course of the survey are provided in Table 4.

Although three anglers indicated they had been interviewed before by survey scientists, their survey results could not be positively matched to their previous responses. An attempt to cross-reference repeat interviews using telephone number, name, county, zip code, age, frequency fished and/or the year they started fishing at the Creek was not successful in allowing conclusive matches to be made. Of the three anglers who indicated they had been interviewed in the past, none had caught any fish on the day they completed the creel survey.

2.1 Locations Fished

The locations where anglers were fishing at the time of the interview were recorded. At Highway 77 (Location 9), the survey scientists asked anglers whether they had fished from shore or from a boat as this location has a boat ramp that allows anglers to launch a boat and move upstream or downstream to fish. Of the 29 anglers interviewed at Highway 77, 28 responded to the question of whether they had fished from shore or a boat that day. Twenty-two of these respondents reported fishing from shore (79 percent) while the remaining six (21 percent) fished from a boat. The anglers who had fished by boat were asked to indicate, on a map provided by the survey scientist, where they had fished. Among those who responded to that question, one angler fished upstream of Highway 77, two anglers fished a half-mile downstream of Highway 77, and two fished Choccolocco Creek near the Route 207 crossing. The sixth respondent declined to report the location fished. None of these anglers had caught fish during his or her trip.

Survey respondents were asked to look at a map provided by the survey scientist and indicate which other locations on the Creek they sometimes fish in addition to the location where they were interviewed. The majority of anglers (31 of 49 respondents or 63 percent) reported that they fish two different locations along the Creek and 11 respondents (22 percent) reported that they only fish a single location on the Creek.

The remaining seven respondents (14 percent) reported that they fish at three, four, or five different locations along the Creek. Table 5 provides a summary of the other locations fished by anglers interviewed at each survey location.

Thirty-six individuals (69 percent) were interviewed below Jackson Shoals and 16 (31 percent) were interviewed above Jackson Shoals. A total of 21 percent of anglers indicated that they fish at locations above Jackson Shoals, 90 percent indicated that they fish below the Shoals; three individuals did not answer the survey question. Of the 36 anglers who were interviewed below the Shoals, 33 reported fishing only below the Shoals, and three indicated that they fish both above and below the Shoals. Of those interviewed above Jackson Shoals, two reported fishing above the Shoals exclusively, 11 indicated that they fished both above and below the Shoals, and the remaining three did not answer the question.

2.2 Sampling Weights and Angler Population Size

Sampling weights were calculated for the 52 anglers who completed interviews according to the methodology described in Section 1.5. For the interviewed anglers, the probability of being intercepted and interviewed over the course of the study ranged from 3 to 99 percent. On average, these anglers had a 51 percent chance of being included in the study. Sampling weights (i.e., the number of individuals in the angler population represented by each angler in the sample) ranged from 1 to 30. The sum of the sampling weights, which yields the angler population size estimate for the survey duration, was 173. That is, the survey results indicate that a total of 173 anglers used the Creek during the one-year survey period.

Sampling weights were used to generate estimates representative of the angler population based on the data collected from angler trips. Both sample and population results are reported in the following sections.

2.3 Fishing Frequency

Anglers were asked how many fishing trips they had made in the previous four weeks (Table 6) and if this was a typical frequency for them or not. As shown in Table 6, anglers reported having taken from one to ten fishing trips during the past four weeks, with the median (i.e., 50th percentile) response being two trips in a four-week period, and the average response being three trips in a four-week period. A number of anglers (N = 16) responded that the reported fishing frequency for the previous four-week period was not their typical fishing frequency. Of these 16 anglers, the majority (eight

anglers or 50 percent) reported usually taking one or less fishing trips in a four-week period. Seven anglers reported that they fished with a higher frequency during the previous four-week period than they usually do, and seven indicated that they typically fish more often in a four-week span. Two individuals did not provide information about their "usual" fishing frequency.[7]

The usual fishing frequency, determined for the anglers as either the frequency reported for the past four weeks or reported as "usual", ranged from 0 to 16 trips in 4 weeks. The median and average frequencies were the same as those reported for the past 4 weeks (Table 6). The median and average usual frequencies representative of the angler population were both two trips in four weeks.

Table 7 presents the annual fishing frequency calculated from the survey data according to the methodology described in Section 1.6.2 for both the sample of angler trips and the angler population. The number of fishing trips an angler takes per year ranged from 1 to 54 trips per year. The median for the sample was ten trips per year. The population median was estimated to 4 trips per year. The average was 13 trips per year for the sample and seven trips per year for the population.

Time of the year was considered in the creel survey, with information recorded regarding both the date of the survey and the months an angler reported fishing during a typical year. The anglers who were interviewed were asked to list all months during which they usually fished. The summer months were most frequently fished with 27, 30, and 37 individuals reporting fishing the Creek in June, July and August, respectively. The next most popular season was spring with 21, 11, and 15 individuals reportedly fishing in March, April and May, respectively. Between eight and ten people reported fishing during at least one of the fall months. Only one person reported fishing in January or February, and three people reported fishing in December.

These results were similar to the observations during the survey. Of the 52 individuals interviewed, 22 were interviewed in the summer months (June, July or August), 16 were interviewed in the spring (March, April, May), eight were interviewed in the fall (September, October, November), and six individuals were interviewed in December. No anglers were observed or interviewed in either January or February. As shown in Table 8, the range of months fished was 1 to 9 months/year. For the sample, the median response was 3 months/year, the average was 4 months/year, and the 95th

[7] For these anglers, the reported frequency was assumed to be the usual frequency in subsequent calculations.

percentile was 6 months/year. No anglers reported fishing the Creek throughout all 12 months of the year. The population median and mean were 3 months/year and the 95th percentile was 6 months/year.

2.4 Hours Fished Per Trip

The creel survey form had a number of questions regarding the duration of an anglers fishing trip on the day of the interview. These questions included the time an angler started fishing, the time of the interview and how long an angler was planning to fish after the interview was concluded. The duration of their current trip could be calculated for 50 anglers, most based on when they started and when they were interviewed at trip end. The majority of anglers reported fishing at the Creek for five hours or less on the day of the interview (Table 9). The range of hours fished for the sample was 1 to 10 hours and both the median and mean trip lengths were 4 hours/trip.

2.5 Exposure Duration

Anglers were asked questions regarding the duration of their personal fishing at Choccolocco Creek, including the number of years they fished both above and below Jackson Shoals, whether they fished in each area yearly, and their current ages. Based on an angler's age and the number of years he or she reported fishing the Creek, it was possible to determine the year each angler first fished at the Creek and his or her age at that time.

The fishing duration was computed for all anglers as the number of years between the first fishing year and the survey year. Because most anglers reported fishing the same number of years above and below the Shoals, results were combined to represent both portions of the site. As shown in Table 10, the reported number of years fishing the Creek ranged from less than one year to 30 years. For both the sample and the population, the mean was 6 years and the 95th percentile fishing duration was 20 years.

The age distributions and years anglers began fishing both above and below the Shoals were very similar, with the majority of anglers calculated to have started fishing in 2005 and having started fishing before the age of 50. Only 1 of the 49 anglers who provided enough information in their survey forms to determine when they began fishing reported starting at or before 16 years old. Additionally, four anglers were estimated to be under the age of 16 years, as reported in the missed creel surveys.

Using the methods described in Section 1.7, the size of the population that ever fishes at the site over a 60-year period (equal to the maximum estimated total duration which was twice the maximum reported duration) and the distribution of years fished (i.e., total exposure durations) within that population were estimated. A total of 1,775 anglers are expected to fish at the site over a period of 60 years, and their average exposure duration is estimated to be 6 years. The 95th percentile for years fished was calculated as 10 years.

2.6 Total Number of Angler Trips

Table 3 shows the number of sampling opportunities, number of sampling events, and observed trips in each of the 32 strata over the course of the survey. The number of sampling opportunities was based on the number of weekdays or weekend days/holidays within each season and the fact that on each day, a sampling shift could begin either in the morning or afternoon and the sampling locations could be either above or below Jackson Shoals, resulting in four sampling opportunities per day of the survey year. From this information, the total number of trips within each stratum was estimated, as was the total number of trips over all strata. Based on the observations in the survey, where the range of observed trips ranged from 0 to 9, the estimated total number of trips within each stratum ranged from 0 to 128. The total number of angler trips for the survey year was estimated at 1,076 trips. Dividing this result by the population size of 173 yields an average of 6 trips per year, which is consistent with the 7 trips per year average rate estimated for the population based on angler-reported fishing frequencies.

2.7 Catch and Harvest Rates

Of the 52 anglers interviewed, eight (15 percent) had caught fish at the time of the interview. Of these, only four had kept any fish they caught and all of those who had kept fish reported that they planned to consume them.

The four remaining anglers who had caught fish at the time of the interview had released them. Of those individuals who reported that they released them, one released them because they were “too small’, one released fish because he did not catch enough fish to keep, and two individuals reported that they only fish for “sport”. Although not specifically asked (to avoid potentially biasing the responses), none of the individuals mentioned the fish advisory that is in place on the Creek or indicated a concern about the quality of the fish in Choccolocco Creek as a reason for not keeping or consuming the catch.

Survey scientists also reported the number of individuals observed, but not interviewed, who appeared to have kept fish. On the completed missed creel reports, scientists reported that six individuals had fish in their possession. However, because these individuals were not interviewed, the sizes and species of fish kept could not be determined and it is not known whether they intended to consume those fish.

Numbers of each species that were caught, kept and retained for consumption are presented in Table 11. No survey respondents had caught crawfish or species of fish other than those listed on the survey form. One individual had caught two turtles that he planned to consume.

2.8 Preparation Methods

The four anglers who indicated that they planned to eat their catch were asked how they planned to prepare the fish. All respondents reported that they would be removing the skin and frying their fish. In additional, all of the consumers indicated that they would only be consuming the muscle/meat of the fish.

2.9 Number of Individuals Sharing in Consumption

Two of the anglers who had harvested fish and intended to consume them indicated that they would be sharing their catch with other people. Both anglers indicated they would be sharing their catch with another adult; therefore P in both cases was two. In both situations a male angler was to share his catch with a female. Two other consumers indicated that they would not be sharing their fish with anyone. Thus, for these individuals, the value of P was one (1).

2.10 Consumption Rates

Table 11 summarizes catch and harvest information from the angler interviews. Consumption rates could only be calculated for three anglers who completed an interview. While one additional angler reported he would be keeping his catch, he did not wish to give any information on the size of the fish he had kept, and thus no consumption rate could be calculated for this angler. As described previously, consumption rates were calculated considering the mass of the fish to be eaten, the edible portion of these fish, the angler's frequency of trips for the year, the fraction of successful trips, the number of days in a year, and the number of people with whom the angler would be sharing his catch.

The first consumer was a 58-year-old male who was interviewed at Highway 77 (Location 9) on March 9, 2009. He reported in his interview that he fishes exclusively at Highway 77, below Jackson Shoals, and his fishing frequency was two trips to the Creek per year. The angler indicated he would be sharing his catch with one other individual, a 49-year-old female. The angler's harvested fish included one 11.75-inch bass, a 4-inch crappie, a 4.5-inch crappie and a 5.25-inch crappie. Using the species-specific length-weight regression equations for each species, the masses of the fish were calculated to be 299 g, 10 g, 15 g and 26 g, respectively, for a total mass of 350 g for the trip.[8] While no information was available for other trips for this individual, he indicated that he fished two times per year. Based on the success rate for the survey overall (15 percent of trips taken were successful in catching fish, as discussed in Section 1.5.3), it is unlikely that the individual would catch fish on the second trip taken. Thus, it was assumed that the total mass of fish harvested by this individual during the year would be 350 g. Using a 30-percent edible portion, it was determined that this individual harvested 105 g of edible fish or 52.5 g of edible mass per consumer. Averaging this over 365 days results in an estimated annualized average consumption rate of 0.14 g/day per person.

The second consumer was a 61-year-old male who was interviewed at Highway 77 (Location 9) on March 22, 2009. He reported that he fishes at both Jackson Trace Road (Location 8) and at Highway 77 and his fishing frequency was 13 trips to the creek per year. The angler indicated that he would be giving his catch to another 64 year old male. The angler's catch included a 4.5-inch brim and a 10-inch crappie. Using length-weight regression equations for each species, the masses of the fish were calculated to be 25 g and 241 g, respectively, for a total mass for the trip of 266 g. If the angler was equally successful on 15 percent of his total fishing trips (two trips), the total fish mass harvested during the year would be 532 g which, after adjusting for edible portion, results in 160 g of edible fish per year. Dividing this mass by the number of consumers (1) and by 365 days results in an estimated annualized average consumption rate of 0.44 g/day per person.

The third angler was a 53-year-old male who was interviewed at Silver Run Road (Location 4) on March 27, 2009. While he reported that he took three trips to the Creek during the previous four-week period, he reported that he usually takes ten trips per

[8] Although the crappie harvested were very small, the data provided by ADWFF included many fish of comparable size. Thus the species-specific regression used to estimate mass was also representative of these smaller sized fish.

month. Based on the months he reported fishing, his total number of trips to the Creek per year was estimated to be 54.

During this trip, this individual harvested one 19.5-inch channel catfish that he intended to consume. Using the length-weight regression for channel catfish, it was estimated that the mass of this fish was 1,194 g. If it is assumed that he is equally successful on 15 percent of his 54 trips (eight trips), it can be estimated that he may harvest a total of 9,552 g/year with an edible portion of 2,866 g. This individual indicated that he did not intend to share his fish with others (P=1). Dividing this edible fish mass by 365 days results in an annualized consumption rate of 7.9 g/day.

This individual also harvested two turtles during this fishing trip, which he intended to consume. While an annualized consumption rate could not be calculated for this individual, this individual indicated that he generally consumes two meals of turtle per year.

Based on the sampling weights for these three anglers, they are estimated to represent 12 individuals (seven percent) of the angler population of 173 individuals. Although only three rates could be calculated, they can reasonably be assumed to represent the range of likely rates because they were derived for anglers who exhibited trip frequencies across the reported range.

2.11 Angler Demographics

Limited information about the socioeconomic characteristics of the interviewed anglers was recorded in the survey. The ages of anglers who responded to the survey are presented in Table 10. Age information is not available for the anglers who did not wish to participate in the creel survey (i.e., missed creel reports), although it was estimated that four of those individuals were under the age of 16 years.

Information on the education level of survey respondents was collected from 50 individuals (Table 12). The majority of anglers had completed some high school but had not graduated from high school. Twenty individuals (40 percent) were high school graduates, and four of these (eight percent of the total) had continued their education past high school. One individual reported that he did not attend high school.

Anglers were also asked where they lived. Fifty individuals provided this information. Responses were as follows:

- Talladega 20 anglers (40 percent)
- Eastaboga 7 anglers (14 percent)
- Jenifer 6 anglers (12 percent)
- Munford 6 anglers (12 percent)
- Lincoln 5 anglers (10 percent)
- Sylacauga 4 anglers (8 percent)
- Anniston 1 angler (2 percent)
- Riverside 1 angler (2 percent)

The specific distance each angler drove on the day he or she was interviewed was also calculated. To calculate these values, Google mapping software was used to estimate the driving distance between the location where the angler was interviewed and the center of his or her reported town. A total of 46 anglers provided enough information to estimate this distance. Using this approach, the mean distance travelled to reach their fishing locations was estimated to be 12.6 miles (Table13). The population average distance traveled was estimated to be 8.9 miles. The majority of anglers travelled 10 miles or less to reach the Creek, indicating that Choccolocco Creek does not appear to attract anglers from substantial distances.

The gender of anglers was also recorded: 90 percent of survey respondents were male and the remaining ten percent were females. Of the 20 anglers who were observed but not interviewed, 19 were male and one was female. Overall (survey respondents and missed surveys combined), 91 percent of the anglers observed fishing the Creek were males and nine percent were females.

2.12 Species Preferences for Consumption

Anglers were asked whether they ever eat each particular species of fish, regardless of their angling success for the trip during which they were interviewed. The anglers indicated that bass were the most popular food fish of anglers interviewed at the Creek. Greater than half of anglers who answered the series of questions reported eating all species of fish listed. Anglers were also asked if they ever eat three non-fish species;

turtles, crawfish, and frogs. The majority of anglers reported not eating these species, although seven anglers reported sometimes eating turtles, and one reported sometimes eating crawfish.

Anglers were questioned a second time regarding whether they ever eat turtles, crawfish and frogs from Choccolocco Creek. The six anglers who reported eating non-fish organisms were asked how often they did so.[9] Of the six anglers who indicated that they ate turtles from Choccolocco Creek, one indicated he ate turtles one to two times per year, four people reported that they ate turtles twice per year and one reported eating turtles five times per year. No respondents reported that they consumed frogs from Choccolocco Creek. No anglers reported eating crawfish during this round of questioning.

[9] Survey respondents were asked on two separate occasions during the interview whether they ever ate non-fish species (turtles, crawfish, or frogs) from the Creek. For some survey respondents, the answers are inconsistent. One angler stated that he sometimes eats turtles from the Creek but later responded that he never eats turtles. There were also inconsistencies in reporting the consumption of crawfish. Some individuals reported that they sometimes eat crawfish but when asked specifically about whether they ate crawfish from Choccolocco Creek, they reported that they did not. Since the crawfish that they reported eating may have come from commercial sources or other waterbodies, these answers may not be inconsistent.

3. Uncertainties Analysis

There are a number of uncertainties associated with both the data provided by the respondents and recorded on the creel survey forms and the analyses of those data to derive consumption rates. In general, survey respondents were not always complete and/or consistent in their responses, making it sometimes necessary to make assumptions about their intentions. Critical issues associated with these data are discussed below.

As discussed in Section 1.6.3, it has been assumed that the fraction of successful trips taken by anglers interviewed during the Choccolocco Creek survey is equivalent to the fraction of successful trips measured over the entire population (15 percent). It is likely that anglers will have variable success at catching fish across their fishing trips, depending on the season of the year, the availability of preferred species, and fishing ability. Had data for repeat interviews been available, it could have been used to refine this fraction based on angler-specific data. However, because no information on repeat trips was available, it was necessary to use this more generic approach.

As with the fraction of successful trips, it has been assumed that the mass of fish harvested for consumption by an individual angler is harvested on all successful fishing trips taken by that individual. Individuals will have variable success in catching the same sizes and species of fish that they are likely to consume so that actual harvest may be larger on one day and smaller on another. The impact of this assumption on the estimated consumption rates cannot be determined.

The estimated trips per year for each angler were based on a combination of each angler's reported number of trips during the previous four-week period, the reported "usual" frequency of trips taken, and the number of months the individual reported that he fished the Creek. In some cases, assumptions had to be made about the actual number of trips taken.

For example, one angler reported that she had fished ten times during the previous four-week period, that she fishes the Creek two months of the year, and her usual fishing frequency is six times per year. Thus, to estimate her total trips for the year, her usual frequency of three times per month, was used to represent the number of trips taken during the month she was not interviewed, and was added to the frequency of trips taken during the previous four-week period (ten trips), to derive a total frequency of 13 trips per year.

In addition, a number of anglers reported zero trips during the four-week period. However because they were fishing at the time of the interview, it was assumed that they completed one trip in the previous 4-week period.

Most anglers reported fishing at the Creek every year, but two anglers reported fishing every other year. Applying this information would result in halving the trip frequency for these anglers to represent that the reported number of trips occurs over a two-year rather than a one-year period. Because the adjusted trip frequency for these anglers fell within the range of those for other anglers, a sensitivity analysis indicated that adjusting the trip frequency did not result in a meaningful quantitative effect either on trip frequency statistics or sampling weights.

There were a limited number of individuals (four) who had harvested fish for consumption by the end of their trips. Because one of these individuals did not provide information about the fish that he had harvested, it was only possible to derive annualized consumption rates for three individuals. These ranged from 0.14 to 7.9 g/day.

While two individuals indicated that they only fish for “sport,” and thus they were labeled as non-consumers, the other anglers who had not successfully harvested fish by the end of their trips are not necessarily non-consumers. Most of those individuals reported that they do sometimes eat the types of fish that are present in Choccolocco Creek. It is reasonable to assume that anglers whose consumption rates could not be calculated would have some level of consumption if they successfully harvested fish they like to eat. Thus, the actual consuming angler population may be larger than 12 out of 173, or four percent of anglers, estimated based on the survey data.

The consumption rates derived represent a single year of fishing the Creek but may not be representative of consumption rates during other fishing years. This is because individuals’ fishing activities at a specific waterbody are likely to be variable, depending on their length of residence in the area, weather conditions, changes in interest level, and availability of leisure time. Thus this factor will need to be considered in the risk assessment.

While exposure duration is not included in the calculation of annualized consumption rates, it is an important factor for risk assessment of potential exposure to PCBs, due to the fact that long-term potential cancer risks are based on total exposures that occur over a lifetime. The exposure duration was estimated based on the assumption that an interviewed angler’s total exposure duration was equal to twice the duration up to the

time of the interview. This assumption likely overestimates actual duration given that the average age of interviewed anglers was 49 years.

The population results reported for the survey are based on sampling weights developed following the methodology of Ray et al. (2007a). While this methodology is appropriate for an intercept survey and has been proved applicable to infrequently fished areas, it does depend on angler-reported information on fishing frequency to develop the probability that an angler is (or is not) interviewed. The uncertainties in the fishing frequency estimates are described above. Furthermore, the observations within each stratum are used to apportion trips across strata. Although the stratification of the survey was designed to capture a range of angler behavior, because all areas of the site were not sampled at all possible times, there is some level of uncertainty in the representativeness of the observations within strata with respect to times and locations not actually sampled. However, the fact that trip frequency calculated from observations (average of 6 trips per year) was consistent with frequency calculated from information provided by anglers (average of 7 trips per year) provides an indication that the survey captured enough angler information to yield reliable exposure factor estimates for the population.

4. Comparison to ADEM (1993) Study

The results of the Choccolocco Creek Creel Survey are consistent with the results for similar waterbodies included in the statewide intercept survey conducted for the Alabama Department of Environmental Management by Auburn University Department of Fisheries and Allied Aquacultures (ADEM 1993). That study was an intercept survey conducted in order to estimate daily per capita consumption of freshwater fish by Alabama anglers. The year-long ADEM survey provided estimates of consumption rates based on two different methods: 1) the harvest method, which was based on the mass of fish that had been harvested by the end of the trip (time of the interview), adjusted for edible portion by the information provided on the planned fish cleaning method reported, and adjusted for the number of individuals the angler reported would eat that fish; and 2) the 4-ounce survey method in which the interviewed anglers were asked to report the size (in number of 4-ounce servings, based on a visual aid) of their usual fish meal, regardless of whether they had caught any fish by the end of their trip. In both cases, anglers were asked how many fish meals eaten during the previous month had been obtained from the waterbody they were fishing at the time of the interview. Regardless of the method of estimating the mass of fish consumed by the individual, the rate of consumption was estimated by multiplying the number of reported fish meals by the mass of fish per meal.[10] These anglers were not asked how many months of the year they fished that particular waterbody, so there was no means of calculating sampling weights and adjusting an individual's estimated consumption rate. However, by combining average seasonal estimates of consumption across the entire year over all 29 study sites included in the survey, ADEM reported that the average fish consumption rates were 33 g/day using the harvest method, and 30 g/day using the 4-ounce serving method to estimate mass of fish.

It should be noted, however, that for a number of reasons, these overall estimated rates from the ADEM (1993) survey are not likely to be representative of consumption rates for the angler population using Choccolocco Creek. First, most of the waterbodies selected as survey sites were substantially larger and more accessible than Choccolocco Creek and thus were not representative of fishing activity there. Second, data were extrapolated to derive annualized consumption rates despite the fact that individuals were only interviewed on one occasion, and there was no information collected on the specific months fished by individual anglers. Third, the reported

[10] When an angler had harvested fish for consumption at the time of the interview, that individual's consumption rate was calculated using both methods. For those anglers who had not harvested fish at the time of the interview, only a single consumption rate based on the 4-oz serving method could be calculated.

consumption rates were not adequately corrected for avidity bias. Finally, the consumption rates were based on fish-specific dress out methods reported by the anglers interviewed, rather than the parts of the fish actually consumed. Each of these issues is discussed below.

4.1 Size of Waterbody Surveyed

The ADEM (1993) survey focused on 29 study sites in 11 river drainages in Alabama, including 23 tailwaters and six reservoirs. Most of the survey sites were located on reservoirs and/or tailwaters of major Alabama waterbodies including the Tennessee River, Black Warrior River, Tombigbee River, Tallapoosa River, Alabama River, Coosa River, Mobile River, and Chattahoochee River. All of these are large waterbodies with easy access through fishing piers and/or boat launches. The study was intentionally focused on high use areas in order to intercept as many anglers as possible in the most cost effective manner.

Only three of the rivers included in the ADEM survey were smaller rivers. These were the Pea River, Bear Creek, and Mulberry River. While Bear Creek itself is similar to Choccolocco Creek, the specific survey site was the Bear Creek Impoundment, which is a large, impounded waterbody that is more characteristic of a lake or reservoir. Thus fishing there would not be representative of fishing in a small stream like Choccolocco Creek. Similarly, while parts of the Mulberry River are similar in size to Choccolocco Creek, the area in which the survey was conducted was the tailwater of the Lewis Smith Dam, which is considerably larger and different in nature from Choccolocco Creek. Thus, the only fishery actually surveyed by ADEM that could be considered comparable to Choccolocco Creek was the Pea River.

The size of the fishery affects the angler activity there, as reflected in the number of people fishing in those locations during the survey, the rate of success in harvesting fish, and the consumption estimates developed based on it. The larger waterbodies had higher numbers of individuals fishing at the time of the survey (as many as 129 individuals interviewed in two days at three reservoirs/lakes along the Coosa River) and consumption rates were considerably higher, ranging as high as 44.7g/day for those individuals who fished the Tombigbee during the year and 98.6 g/day for individuals who fished Lake Logan Martin during the summer. In addition, individuals tended to consume higher percentages of their total meals from a single site when fishing the larger rivers. For example, the Tombigbee River was the source of 90 percent of the total meals consumed by the anglers who fished there, based on the harvest method. This phenomenon is similar to that demonstrated for the Great Lakes

fisheries which, due to the availability and accessibility of numerous fishing locations, the diversity of the fish population, and the numbers and sizes of available fish, often make them the sole source of sport-caught fish.

During the ADEM survey, only 18 people were interviewed fishing the Pea River and only five of those individuals had harvested fish at the end of their trip for a 28 percent success rate. Thus, only these people were able to provide the necessary data for estimating consumption using the "harvest method", which was the same method used in evaluating the data from the Choccolocco Creek survey. The average consumption rate for meals obtained from the Pea River, based on the harvest method, was 3.4 g/day (65 percent of all meals consumed during the previous month). This is similar to the average of 2.8 g/day from the Choccolocco Creek survey.[11]

There is often concern that a fish consumption advisory, such as that in place on Choccolocco Creek, may impact consumption rate estimates and thus may not provide information about the level of consumption that would occur if there were no advisory in place. Some of the waterbodies included in the ADEM survey had fish consumption advisories in place at the time of the interview, and these advisories could have affected overall consumption rates. However, while there is currently an advisory of two meals per month for the Pea River, based on the presence of mercury in fish tissue, there is no indication that there was an advisory in place at the time of the ADEM (1993) survey. Thus, it is likely that the consumption rates reported for the Pea River could be considered reasonably representative of the levels of consumption that would occur at Choccolocco Creek if there were no advisory in place.

4.2 Extrapolation of Annualized Consumption Rates Based on Short-term Data

It is likely that reported annualized consumption rates reported in the ADEM survey report overestimate consumption for individual anglers. This is because only short-term (i.e., 1-month) consumption rates could be calculated for each individual angler, and there was no way to determine what consumption rates were for each individual during the months in which angler-specific data were not collected. In order to calculate the long-term rates reported, the rates reported for individual months/seasons of the year were based on those individuals who provided data for each individual month and then

[11] While the average rate of consumption of site meals reported for the same location based on the 4-oz survey method was higher (12 g/day), it is important to note that this rate is based on hypothetical meal sizes rather than the mass of fish actually obtained during fishing. While individuals may report that they like to consume larger fish meals, they may not be able to consume fish meals of those sizes if they cannot catch the necessary fish mass to provide them.

the data for all individuals were combined to derive annualized consumption rates, thereby presuming that the same anglers fish all months of the year.

The data presented in the survey report for the Pea River indicate, however, that there was substantial seasonality in both fishing activity and in success at harvesting fish, as shown in the following table.

Season	Pea River	
	Number of Anglers Interviewed[1]	Number of Anglers Interviewed Who Had Harvested Fish[2]
Winter	9	0
Spring	10	3
Summer	4	0
Fall	4	2

[1]Source: Table B1, ADEM (1993)
[2]Source: Table B3, ADEM (1993)

As indicated above, four individuals were interviewed at the Pea River during the Fall and during the Summer, with nine individuals interviewed during the winter and ten individuals interviewed during the spring. The number of anglers who had harvested fish at the time of the interview did not follow this same seasonal pattern, however. While 9 of 27 individuals were interviewed at the Pea River during the winter, none of those individuals had harvested fish at the time of the interview. In addition, because of the way the survey was conducted (only one interview per angler), the anglers interviewed in the winter were not the same individuals interviewed in any of the other seasons.

Based on the information collected during the ADEM (1993) survey, the number of months or seasons of the year that individual anglers fished cannot be determined. Thus, while the data across seasons were combined to derive a long-term consumption rate estimate, it is not possible to determine whether the rates derived using this approach actually represented consumption patterns for the individual anglers interviewed. Instead the consumption estimates derived likely overestimated

consumption for those anglers who did not fish throughout the year. Indeed, the angler observation component of the survey supports the notion that most anglers do not generally fish year round.

Fishing effort tends to be seasonal in nature, and that seasonality is clearly demonstrated in the ADEM (1993) survey report and in the data collected for the Choccolocco Creek. In the Choccolocco Creek survey, there were no anglers interviewed who reported fishing from the Creek during every month of the year. In fact, the average number of months fished during the year was three. As reported in Table 8, most anglers fished three months of the year or less, and the maximum number of months reported fishing was nine.

4.3 Avidity Bias

In addition, the ADEM fish consumption rates have not been adjusted to reflect avidity bias that results from a short-term intercept survey. While the ADEM survey report discussed avidity bias and attempted to make some correction for it by combining data from repeat interviews if it was believed an individual was interviewed on more than one occasion, it did not correct for the fact that individuals who fish more frequently are more likely to be interviewed.

As discussed by Price et al. (1994), USEPA (1997), and Ray et al. (2007a), intercept surveys are likely to overestimate the actual consumption rates of the total angler population that uses a specific waterbody. This is because individuals who fish more frequently are more likely to be intercepted than are anglers who fish less frequently, so that any sample based on an intercept survey methodology is likely to oversample the more avid anglers and under-sample those individuals who do not fish as regularly (Price et al. 1994; Puffer et al. 1981; USEPA 1997; Ray et al. 2007a). Many fishing surveys attempt to adjust for this fact in estimating population size, although few fish consumptions surveys have taken this factor into account. It is reasonable to assume, however, that fish consumption rates are a function of fishing frequency, since it is necessary to catch more fish in order to eat more fish. This factor should also be considered when attempting to extrapolate fish consumption rates for an angler population based on an intercept survey sample. The need to use fishing frequency to weight results from an intercept survey to represent the angler population was acknowledged and discussed by USEPA (1997) as was done in adjusting results for the Choccolocco Creek survey.

While the fishing frequency may not exactly predict the rate of consumption, as discussed by USEPA (1997), it is reasonable to conclude that fish consumption rates calculated without any consideration of fishing frequency, as was done in the rates reported by ADEM (1993), are likely to overestimate consumption for the total angler population due to the oversampling of more avid anglers. Unfortunately, it is not possible, based on the information collected and reported by ADEM (1993), to determine what the impact of avidity bias may have been on the reported consumption rates. It is very likely, however, that the site-specific consumption rates reported in that study have been overestimated for the total populations using the individual fisheries.

4.4 Dress-Out Percentages

The ADEM (1993) methodology requested that anglers indicate how they intended to dress-out the fish they were planning to eat based on the following six options:

- Method A – Whole fish with only viscera removed (70 percent of total mass)
- Method B – Whole fish gutted, scaled and head removed (50 percent of total mass)
- Method C – Whole fish skinned with head removed (40 percent of total mass)
- Method D – Fish steaks and/or fillets with bones (50 percent of total mass)
- Method E – Fillets without rib bones (30 percent of total mass)
- Method F – Fillets with rib bones (45 percent of total mass)

It was assumed that the remaining masses based on the reported dress-out methods were representative of the edible portions of the fish that were actually eaten. For example, based on data collected as part of the survey, ADEM reported that Method A, which involved removal of the viscera only, resulted in a dressed out percentage of 70 percent of the total fish mass; this percentage of the total mass for that fish was then assumed to represent the edible portion of the fish.

Dress-out mass, however, is often not synonymous with the mass of the fish that is actually consumed. This is especially true for small panfish which are difficult to handle and thus are often cooked with head and bones intact. While the fish may be cooked in this manner, it does not mean that the individual eats the entire fish. Most likely the

individual does not eat the head, fins, tail and bones of the fish, all of which contribute substantially to the dress-out mass measured. Instead, most anglers eat only the muscle mass of the fish (Method E), as shown in this and other surveys (Ebert et al. 1993). The edible portion based on this method was shown to be 30 percent and is consistent with the edible portion assumption that is recommended by EPA (1989). Assuming that the dress-out percentages are synonymous with the edible portion may have overestimated the mass of fish actually consumed by a factor ranging from 1.3 to 2.3. It is likely that for those fish that were reported consumed in the ADEM survey, and were reportedly dressed-out using Methods A, B, C, D, or F, the mass of the fish actually consumed was substantially less than the amount assumed in developing the consumption rate for that individual. Unfortunately, with the information available in the ADEM (1993) survey report, it is not possible to determine the impact of this assumption on the estimated consumption rates for individual anglers. Table 2 of that report indicates that a substantial portion of the fish harvested were dressed out using a method other than Method E, further indicating that it is likely that actual consumption was overestimated.

5. Summary and Conclusions

The Choccolocco Creek intercept survey was conducted between June 28, 2008 and June 27, 2009 on a total of 101 survey days. During that period, a total of 72 anglers were observed fishing the Creek, and 52 of those anglers were interviewed about their fishing behavior and consumption habits. The vast majority of anglers were observed fishing below Jackson Shoals, particularly in the area of the Highway 77 overpass.

The structure of the sampling plan and the number of anglers observed and interviewed indicated that an angler fishing at the Creek had, on average, a 51 percent chance of being encountered while fishing. Accordingly, each interviewed angler represented between 1 and 30 anglers within the population. Based on these sampling weights, the interviewed anglers were determined to represent a total population of 173 anglers who use the Creek over a year.

The annual fishing frequency was estimated both from the angler observations and from information provided by anglers during interviews. The methods yielded consistent results: an average of 6 trips per year based on observations and 7 trips per year based on interviews

Of the 52 anglers interviewed, eight individuals had caught fish at the time of the interview, and only four of those individuals had retained fish for consumption. Consumption rates were calculated for the three individuals who had harvested fish and who provided adequate additional information to allow consumption rates to be calculated. Based on the sizes of the fish harvested, the frequency of fishing the Creek, the rate of success in catching fish, the months the individuals fished the Creek, and the number of individuals who would share in its consumption, consumption rates ranging from 0.14 to 7.9 g/day were estimated. These rates are consistent with rates reported for the Pea River in Alabama (ADEM 1993), which is the most similar to Choccolocco Creek in size and nature of all waterbodies included in that survey.

Reported information on years fished was used to estimate exposure duration for a fish consumption scenario. The average number of years fished at Choccolocco Creek was estimated to be 6 years, and the 90th percentile exposure duration was estimated to be 8 years. A total of 1,775 anglers are estimated to ever fish at Choccolocco Creek based on a maximum duration of 60 years. This population size represents

approximately two percent of the persons living in towns within 9 miles of the site, the estimated average distance traveled to fish at the Creek.[12]

In conclusion, the Choccolocco Creek Intercept Survey confirms that, while some local anglers enjoy recreational fishing at the Creek, the Creek is not a particularly popular fishing destination, especially above Jackson Shoals. The average and high-end estimates for the number of years fished at the site are on the order of one-third of the default exposure durations typically used in human health risk assessment. Less than 10 percent of anglers consume fish from the Creek, and these anglers do so on an infrequent basis. Even for the small consuming angler population captured in this survey, the average and high-end consumption rates are similar to rates reported for the Pea River (ADEM, 1993) but lower than rates reported for larger waterbodies in Alabama.

[12] The fraction of total population is based on a population size of 76,537 persons, which was estimated using 2008 census data for the towns of Anniston, Oxford, Talladega, Munford, Mount Oliver, Lincoln and Eastaboga.

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Tables

Table 1
Distribution of Sample Days (1)

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Location	Winter		Spring		Summer		Fall		All Seasons
	Weekend Day	Week Day	Weekend Day	Week Day	Weekend Day	Week Day	Weekend Day	Week Day	Total Sample Days by Location
Above Jackson Shoals	4	4	6	6	10	10	5	5	50
Below Jackson Shoals	4	4	6	7	10	10	5	5	51
Total Sample Days	8	8	12	13	20	20	10	10	101

Notes:

(1) The survey was originally designed to have a total of 100 survey days. However, the survey clerks misread the sampling schedule and thus conducted one additional day of sampling on a Spring weekday in 2009, bringing the total number of sampling days to 101.

Table 2
Sampling Schedule for Choccolocco Creek Creel/Angler Survey

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Site	Location Description	
1	Snow Creek (Oxford Lake Park)	Above Jackson Shoals (JS)
2	Friendship Road Access Bridge	Above Jackson Shoals (JS)
3	Highway 21 Access Bridge	Above Jackson Shoals (JS)
4	Silver Run Road / Flatbridge	Above Jackson Shoals (JS)
5	Priebes Mill Bridge	Above Jackson Shoals (JS)
6	Old Talladega Road (Curry Station Road)	Above Jackson Shoals (JS)
7	Eastaboga Road	Above Jackson Shoals (JS)
8	Jackson Trace Road	Below Jackson Shoals (JS)
9	Highway 77	Below Jackson Shoals (JS)

Date	Survey Day	Season	Day Type	Location	Shift	Site 1	Site 2
6/28/2008	1	Summer	WE/H	Above JS	Morning	1	4
6/29/2008	2	Summer	WE/H	Above JS	Morning	4	5
7/1/2008	3	Summer	WD	Above JS	Afternoon	5	6
7/3/2008	4	Summer	WD	Above JS	Morning	7	3
7/4/2008	5	Summer	WE/H	Below JS	Afternoon	9	8
7/6/2008	6	Summer	WE/H	Below JS	Morning	8	9
7/8/2008	7	Summer	WD	Below JS	Afternoon	8	9
7/13/2008	8	Summer	WE/H	Above JS	Afternoon	6	7
7/18/2008	9	Summer	WD	Below JS	Morning	9	8
7/20/2008	10	Summer	WE/H	Above JS	Afternoon	2	5
7/22/2008	11	Summer	WD	Above JS	Morning	4	6
7/25/2008	12	Summer	WD	Below JS	Afternoon	9	8
7/26/2008	13	Summer	WE/H	Above JS	Morning	7	3
7/27/2008	14	Summer	WE/H	Below JS	Morning	9	8
7/30/2008	15	Summer	WD	Above JS	Afternoon	5	4
8/2/2008	16	Summer	WE/H	Below JS	Afternoon	9	8
8/3/2008	17	Summer	WE/H	Above JS	Morning	4	2
8/4/2008	18	Summer	WD	Above JS	Morning	4	2
8/10/2008	19	Summer	WE/H	Above JS	Afternoon	4	3
8/11/2008	20	Summer	WD	Below JS	Morning	9	8
8/16/2008	21	Summer	WE/H	Below JS	Afternoon	8	9
8/17/2008	22	Summer	WE/H	Below JS	Morning	8	9
8/18/2008	23	Summer	WD	Below JS	Morning	9	8
8/19/2008	24	Summer	WD	Below JS	Afternoon	9	8
8/21/2008	25	Summer	WD	Above JS	Afternoon	1	3
8/22/2008	26	Summer	WD	Below JS	Morning	9	8
8/24/2008	27	Summer	WE/H	Above JS	Morning	3	1
8/30/2008	28	Summer	WE/H	Below JS	Afternoon	8	9
8/31/2008	29	Summer	WE/H	Above JS	Afternoon	5	4
9/1/2008	30	Fall	WE/H	Below JS	Afternoon	9	8

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5	Priebes Mill Bridge				Above Jackson Shoals (JS)		
6	Old Talladega Road (Curry Station Road)				Above Jackson Shoals (JS)		
7	Eastaboga Road				Above Jackson Shoals (JS)		
8	Jackson Trace Road				Below Jackson Shoals (JS)		
9	Highway 77				Below Jackson Shoals (JS)		
9/5/2008	31	Fall	WD	Above JS	Afternoon	5	1
9/6/2008	32	Fall	WE/H	Below JS	Morning	8	9
9/15/2008	33	Fall	WD	Below JS	Afternoon	8	9
9/19/2008	34	Fall	WD	Above JS	Morning	2	1
9/21/2008	35	Fall	WE/H	Below JS	Afternoon	9	8
9/23/2008	36	Fall	WD	Below JS	Morning	9	8
9/30/2008	37	Fall	WD	Above JS	Afternoon	7	5
10/5/2008	38	Fall	WE/H	Above JS	Morning	6	1
10/8/2008	39	Fall	WD	Below JS	Afternoon	9	8
10/10/2008	40	Fall	WD	Above JS	Afternoon	1	5
10/13/2008	41	Fall	WE/H	Above JS	Morning	2	3
10/18/2008	42	Fall	WE/H	Below JS	Afternoon	9	8
10/24/2008	43	Fall	WD	Below JS	Morning	9	8
10/25/2008	44	Fall	WE/H	Above JS	Morning	2	6
10/27/2008	45	Fall	WD	Above JS	Morning	2	5
11/1/2008	46	Fall	WE/H	Above JS	Afternoon	5	3
11/2/2008	47	Fall	WE/H	Above JS	Afternoon	1	2
11/8/2008	48	Fall	WE/H	Below JS	Morning	9	8
11/20/2008	49	Fall	WD	Below JS	Morning	9	8
12/1/2008	50	Winter	WD	Above JS	Morning	2	7
12/6/2008	51	Winter	WE/H	Above JS	Morning	5	1
12/7/2008	52	Winter	WE/H	Above JS	Afternoon	1	7
12/9/2008	53	Winter	WD	Above JS	Afternoon	2	4
12/10/2008	54	Winter	WD	Above JS	Afternoon	6	1
12/13/2008	55	Winter	WE/H	Below JS	Afternoon	9	8
12/29/2008	56	Winter	WD	Below JS	Morning	8	9
12/31/2008	57	Winter	WD	Below JS	Morning	8	9
1/4/2009	58	Winter	WE/H	Below JS	Morning	8	9
1/10/2009	59	Winter	WE/H	Below JS	Afternoon	9	8
1/11/2009	60	Winter	WE/H	Below JS	Morning	8	9
1/15/2009	61	Winter	WD	Below JS	Afternoon	8	9

Table 2
Sampling Schedule for Choccolocco Creek Creel/Angler Survey

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Site	Location Description						
1	Snow Creek (Oxford Lake Park)				Above Jackson Shoals (JS)		
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4	Silver Run Road / Flatbridge				Above Jackson Shoals (JS)		
5	Priebes Mill Bridge				Above Jackson Shoals (JS)		
6	Old Talladega Road (Curry Station Road)				Above Jackson Shoals (JS)		
7	Eastaboga Road				Above Jackson Shoals (JS)		
8	Jackson Trace Road				Below Jackson Shoals (JS)		
9	Highway 77				Below Jackson Shoals (JS)		
1/31/2009	62	Winter	WE/H	Above JS	Morning	7	4
2/2/2009	63	Winter	WD	Above JS	Morning	1	7
2/22/2009	64	Winter	WE/H	Above JS	Afternoon	6	5
2/23/2009	65	Winter	WD	Below JS	Afternoon	9	8
3/9/2009	66	Spring	WD	Below JS	Morning	9	8
3/15/2009	67	Spring	WE/H	Above JS	Afternoon	3	5
3/22/2009	68	Spring	WE/H	Below JS	Morning	8	9
3/23/2009	69	Spring	WD	Above JS	Morning	6	5
3/26/2009	70	Spring	WD	Below JS	Morning	9	8
3/27/2009	71	Spring	WD	Above JS	Morning	6	4
3/28/2009	72	Spring	WE/H	Below JS	Morning	8	9
4/1/2009	73	Spring	WD	Below JS	Afternoon	9	8
4/4/2009	74	Spring	WE/H	Above JS	Afternoon	7	5
4/5/2009	75	Spring	WE/H	Below JS	Morning	8	9
4/7/2009	76	Spring	WD	Below JS	Afternoon	9	8
4/10/2009	77	Spring	WD	Above JS	Afternoon	6	3
4/11/2009	78	Spring	WE/H	Above JS	Morning	4	6
4/21/2009	79	Spring	WD	Below JS	Afternoon	9	8
4/23/2009	80	Spring	WD	Above JS	Afternoon	1	4
5/2/2009	81	Spring	WE/H	Above JS	Morning	4	1
5/3/2009	82	Spring	WE/H	Below JS	Afternoon	8	9
5/5/2009	83	Spring	WD	Above JS	Morning	4	7
5/9/2009	84	Spring	WE/H	Below JS	Afternoon	9	8
5/15/2009 (1)	85	Spring	WD	Below JS	Afternoon	9	8
5/16/2009	86	Spring	WE/H	Above JS	Afternoon	6	2
5/18/2009	87	Spring	WD	Above JS	Afternoon	4	5
5/20/2009	88	Spring	WD	Below JS	Morning	9	8
5/23/2009	89	Spring	WE/H	Above JS	Morning	2	1
5/25/2009	90	Spring	WE/H	Below JS	Afternoon	9	8
6/2/2009	91	Summer	WD	Above JS	Afternoon	6	2
6/4/2009	92	Summer	WD	Above JS	Afternoon	5	2

Table 2
Sampling Schedule for Choccolocco Creek Creel/Angler Survey

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Site	Location Description						
1	Snow Creek (Oxford Lake Park)				Above Jackson Shoals (JS)		
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5	Priebes Mill Bridge				Above Jackson Shoals (JS)		
6	Old Talladega Road (Curry Station Road)				Above Jackson Shoals (JS)		
7	Eastaboga Road				Above Jackson Shoals (JS)		
8	Jackson Trace Road				Below Jackson Shoals (JS)		
9	Highway 77				Below Jackson Shoals (JS)		
6/5/2009	93	Summer	WD	Below JS	Morning	9	8
6/13/2009	94	Summer	WE/H	Below JS	Afternoon	8	9
6/14/2009	95	Summer	WE/H	Above JS	Afternoon	3	7
6/17/2009	96	Summer	WD	Above JS	Morning	5	7
6/18/2009	97	Summer	WD	Above JS	Morning	3	7
6/21/2009	98	Summer	WE/H	Below JS	Morning	8	9
6/22/2009	99	Summer	WD	Below JS	Afternoon	9	8
6/26/2009	100	Summer	WD	Below JS	Afternoon	8	9
6/27/2009	101	Summer	WE/H	Below JS	Morning	8	9

Notes:

(1) This day was not in the original sampling plan, but was added accidentially by survey clerks.

JS = Jackson Shoals

WD = weekday

WE/H = weekend/holiday

Table 3
Sampling Units, Observed Trips, and Represented Trips by Stratum

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Stratum Descriptors				Number of Possible Sampling Units[2]	Number of Units Sampled	Fraction of Units Sampled	Number of Angler Trips Observed	Number of Angler Trips Represented by Observations	Fraction of Observed Trips in Season[3]
Season	Day Type	Shift Start	Location	(N_j)	(n_j)	(n_j / N_j)	(t_j)	($T_j = [N_j / n_j] * t_j$)	($f_{Tj} = T_j / \Sigma T_{j\ season}$)
Winter	Weekday	Morning	Above JS[1]	61	2	3%	1	31	23%
Winter	Weekday	Morning	Below JS	61	2	3%	0	0	0%
Winter	Weekday	Afternoon	Above JS	61	2	3%	2	61	45%
Winter	Weekday	Afternoon	Below JS	61	2	3%	0	0	0%
Winter	Weekend/Holiday	Morning	Above JS	29	2	7%	1	15	11%
Winter	Weekend/Holiday	Morning	Below JS	29	2	7%	0	0	0%
Winter	Weekend/Holiday	Afternoon	Above JS	29	2	7%	1	15	11%
Winter	Weekend/Holiday	Afternoon	Below JS	29	2	7%	1	15	11%
Spring	Weekday	Morning	Above JS	64	3	5%	1	21	6%
Spring	Weekday	Morning	Below JS	64	3	5%	6	128	38%
Spring	Weekday	Afternoon	Above JS	64	3	5%	0	0	0%
Spring	Weekday	Afternoon	Below JS	64	4	6%	6	96	28%
Spring	Weekend/Holiday	Morning	Above JS	28	3	11%	0	0	0%
Spring	Weekend/Holiday	Morning	Below JS	28	3	11%	6	56	17%
Spring	Weekend/Holiday	Afternoon	Above JS	28	3	11%	0	0	0%
Spring	Weekend/Holiday	Afternoon	Below JS	28	3	11%	4	37	11%
Summer	Weekday	Morning	Above JS	64	5	8%	3	38	12%
Summer	Weekday	Morning	Below JS	64	5	8%	9	115	37%
Summer	Weekday	Afternoon	Above JS	64	5	8%	0	0	0%
Summer	Weekday	Afternoon	Below JS	64	5	8%	9	115	37%
Summer	Weekend/Holiday	Morning	Above JS	28	5	18%	0	0	0%

Table 3
Sampling Units, Observed Trips, and Represented Trips by Stratum

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Stratum Descriptors				Number of Possible Sampling Units[2]	Number of Units Sampled	Fraction of Units Sampled	Number of Angler Trips Observed	Number of Angler Trips Represented by Observations	Fraction of Observed Trips in Season[3]
Season	Day Type	Shift Start	Location	(N_j)	(n_j)	(n_j / N_j)	(t_j)	($T_j = [N_j / n_j] * t_j$)	($f_{Tj} = T_j / \Sigma T_j$ season)
Summer	Weekend/Holiday	Morning	Below JS	28	5	18%	1	6	2%
Summer	Weekend/Holiday	Afternoon	Above JS	28	5	18%	4	22	7%
Summer	Weekend/Holiday	Afternoon	Below JS	28	5	18%	2	11	4%
Fall	Weekday	Morning	Above JS	61	2	3%	3	92	31%
Fall	Weekday	Morning	Below JS	61	3	5%	3	61	21%
Fall	Weekday	Afternoon	Above JS	61	3	5%	0	0	0%
Fall	Weekday	Afternoon	Below JS	61	2	3%	2	61	21%
Fall	Weekend/Holiday	Morning	Above JS	30	3	10%	0	0	0%
Fall	Weekend/Holiday	Morning	Below JS	30	2	7%	0	0	0%
Fall	Weekend/Holiday	Afternoon	Above JS	30	2	7%	2	30	10%
Fall	Weekend/Holiday	Afternoon	Below JS	30	3	10%	5	50	17%
Totals				1460	101	NA	72	1076	NA

Notes:

1. JS = Jackson Shoals

2. Because any of the four combinations of two shift starts and two locations could be selected for sampling on a given day, the total number of sampling units is equal to 4 times the number of days in the sampling period (4 x 365 = 1460).

3. ΣT_j is computed by season as the sum of the 8 T_j values for the 8 strata within each season. The f_{Tj} values for each season sum to 100 percent.

Table 4
Anglers Observed and Interviewed Along Choccolocco Creek

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Location	Anglers Observed	Percentage of Total	Completed Survey	Missed Survey
1. Snow Creek	5	7%	5	0
2. Friendship Road Bridge	3	4%	2	1
3. Highway 21	0	0%	0	0
4. Silver Run Road / Flatbridge	7	10%	7	0
5. Priebes Mill Bridge	1	1%	1	0
6. Old Talladega Road	1	1%	1	0
7. Eastaboga Road	1	1%	0	1
8. Jackson Trace Road	16	22%	7	9
9. Highway 77 Boat Ramp	38	53%	29	9
Totals	72	100%	52	20

Table 5
Distribution of Fishing Locations Along Choccolocco Creek

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

Loc. #	Location of Interview	Number of Anglers Interviewed at Location	Number of Anglers indicating Location as Alternate Fishing Location								
			Above Jackson Shoals							Below Jackson Shoals	
			Snow Creek	Friendship Road	Highway 21	Silver Run Road	Priebes Mill Road	Old Talledega Road	Estaboga Road	Jackson Trace Road	Highway 77
1	Snow Creek	5	--	0	0	1	0	0	0	1	2
2	Friendship Road	2	0	--	0	0	0	0	0	0	1
3	Highway 21	0	NA	NA	--	NA	NA	NA	NA	NA	NA
4	Silver Run Road	7	0	0	0	--	0	1	0	4	6
5	Priebes Mill Road	1	0	0	0	0	--	0	0	0	1
6	Old Talledega Road	1	0	0	0	1	1	--	0	1	1
7	Estaboga Road	0	NA	NA	NA	NA	NA	NA	--	NA	NA
8	Jackson Trace Road	7	0	0	0	0	0	0	0	--	--
9	Highway 77	29	0	0	0	2	0	0	1	13	19
Totals		52	0	0	0	4	1	1	1	19	30

Notes:

NA: Not applicable as no individuals were interviewed at either Highway 21 or Eastoboga Road.

Note: Because respondents could indicate more than one alternate location, the number of anglers indicating alternate locations could exceed the number of anglers interviewed at a particular location.

Table 6
Distribution of Reported and "Usual" Trips in a Four-Week Period

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

	Reported for Past Four Weeks		"Usual" Trips in Four Weeks	
	Sample	Population	Sample	Population
Number Represented	52	173	52	173
Min	1	1	0	0
Max	10	10	16	16
Mean	3	2	3	2
5th Percentile	1	1	1	0
10th Percentile	1	1	1	0
15th Percentile	1	1	1	1
20th Percentile	1	1	1	1
25th Percentile	2	1	2	1
30th Percentile	2	1	2	1
35th Percentile	2	1	2	1
40th Percentile	2	2	2	1
45th Percentile	2	2	2	1
50th Percentile (Median)	2	2	3	2
55th Percentile	3	2	3	2
60th Percentile	3	2	3	2
65th Percentile	3	2	3	2
70th Percentile	3	2	3	2
75th Percentile	3	3	4	3
80th Percentile	4	3	4	3
85th Percentile	4	3	4	4
90th Percentile	4	4	5	4
95th Percentile	6	4	8	5

Note:
Results rounded to integers.

Table 7
Distribution of Trips Per Year Calculated for Survey Respondents

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

	Trips Per Year	
	Sample	**Population**
Number Represented	52	173
Min	1	1
Max	54	54
Mean	13	7
5th Percentile	2	2
10th Percentile	3	2
15th Percentile	4	2
20th Percentile	5	3
25th Percentile	6	3
30th Percentile	7	3
35th Percentile	7	3
40th Percentile	8	3
45th Percentile	10	3
50th Percentile (Median)	10	4
55th Percentile	11	7
60th Percentile	11	7
65th Percentile	13	7
70th Percentile	13	8
75th Percentile	13	10
80th Percentile	16	11
85th Percentile	20	13
90th Percentile	28	13
95th Percentile	38	20

Note:
Results rounded to integers.

Table 8
Distribution of Number of Months Fished Per Year

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

	Number of Months Fished Per Year	
	Sample	**Population**
Number Represented	52	173
Min	1	1
Max	9	9
Mean	4	3
5th Percentile	2	1
10th Percentile	2	2
15th Percentile	2	2
20th Percentile	2	2
25th Percentile	3	2
30th Percentile	3	3
35th Percentile	3	3
40th Percentile	3	3
45th Percentile	3	3
50th Percentile (Median)	3	3
55th Percentile	3	3
60th Percentile	3	3
65th Percentile	4	3
70th Percentile	5	3
75th Percentile	5	3
80th Percentile	6	4
85th Percentile	6	5
90th Percentile	6	6
95th Percentile	6	6

Note:
Results rounded to integers.

Table 9
Distribution of Hours Fished Per Trip

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

	Hours Fished per Trip	
	Sample	**Population**
Number Represented	50	170
Min	0.75	0.75
Max	10.2	10.2
Mean	4.5	4.1
5th Percentile	1.4	1.7
10th Percentile	2.1	2.2
15th Percentile	2.2	2.7
20th Percentile	2.6	3.2
25th Percentile	3.0	3.3
30th Percentile	3.2	3.5
35th Percentile	3.5	3.5
40th Percentile	3.8	3.5
45th Percentile	3.8	3.7
50th Percentile (Median)	4.2	3.8
55th Percentile	4.3	4.2
60th Percentile	4.3	4.3
65th Percentile	4.6	4.3
70th Percentile	5.2	4.3
75th Percentile	5.3	5.2
80th Percentile	5.8	5.3
85th Percentile	7.2	7.3
90th Percentile	8.0	8
95th Percentile	8.8	8.5

Table 10
Distributions of Angler Age, Years Fished at Site, and Starting Age

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

	Age of Angler[1]		Reported Years Fished at Site[2]		Starting Age for Fishing[3]		Total Fishing Duration at Site[4]	
	Sample	Population	Sample	Population	Sample	Population	Sample	Population
Number Represented	49	168	51	171	48	166	51	1775
Min	21	21	1	1	16	16	2	2
Max	67	67	30	30	64	64	60	60
Mean	49	50	6	6	42	45	12	6
5th Percentile	31	29	1	1	25	28	2	2
10th Percentile	36	36	1	2	29	33	2	2
15th Percentile	36	37	2	2	33	34	4	2
20th Percentile	38	42	2	2	34	36	4	2
25th Percentile	41	43	2	3	34	38	4	2
30th Percentile	43	46	2	3	36	38	4	2
35th Percentile	44	48	3	3	37	40	6	3
40th Percentile	46	51	3	3	38	43	6	3
45th Percentile	46	54	3	3	40	44	6	3
50th Percentile (Median)	48	56	4	3	43	47	8	4
55th Percentile	48	58	4	3	43	52	8	4
60th Percentile	53	61	5	4	44	55	10	4
65th Percentile	54	61	5	5	47	57	10	4
70th Percentile	56	61	5	5	49	58	10	4
75th Percentile	58	61	6	5	51	58	12	4
80th Percentile	61	61	10	6	53	58	20	4
85th Percentile	62	63	10	10	56	59	20	6
90th Percentile	63	63	12	12	58	59	24	8
95th Percentile	64	65	20	20	59	60	40	10

Notes:
1. Age of Angler = Year of Interview - Reported Birth Year. Three anglers who completed an interview did not provide birth years.
2. Represents number of years fished at site above and/or below Jackson Shoals at time of interview. One angler did not indicate fishing duration for either portion of the site. For the two anglers who reported different years fished above and below Jackson Shoals, value is average of years fished.
3. Starting Age for Fishing at Site = Age of Angler - Years fished at Site. Two anglers who provided duration information did not provide birth year.
4. Total duration estimated as twice reported duration (years fished at site) for individual anglers in sample, then adjusted using sampling weights and for longevity bias using the methods of Price et al. (1998) to represent the population of anglers that ever fishes at the Site.

Table 11
Angler Catch and Harvest

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

	Bass	Striped Bass	Brim	Crappie	Channel Catfish	Blue Catfish	Sunfish	Turtles	Crawfish	Other Fish Species
Number Caught	1	12	7	8	3	0	0	2	0	0
Number Kept	1	0	1	8	1	0	0	2	0	0
To Be Consumed	1	0	1	8	1	0	0	2	0	0
Size Harvested (1)	11.75"	NA	4.5"	4", 4.5", 5.25", 10"	19.5"	NA	NA	10", 11" (wide)	NA	NA

Notes:
NA: Not applicable
(1) Although anglers reported keeping eight crappie, length information is only available for four of these fish as one angler would not allow the survey clerk to measure his catch.

Table 12
Angler Education Level

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

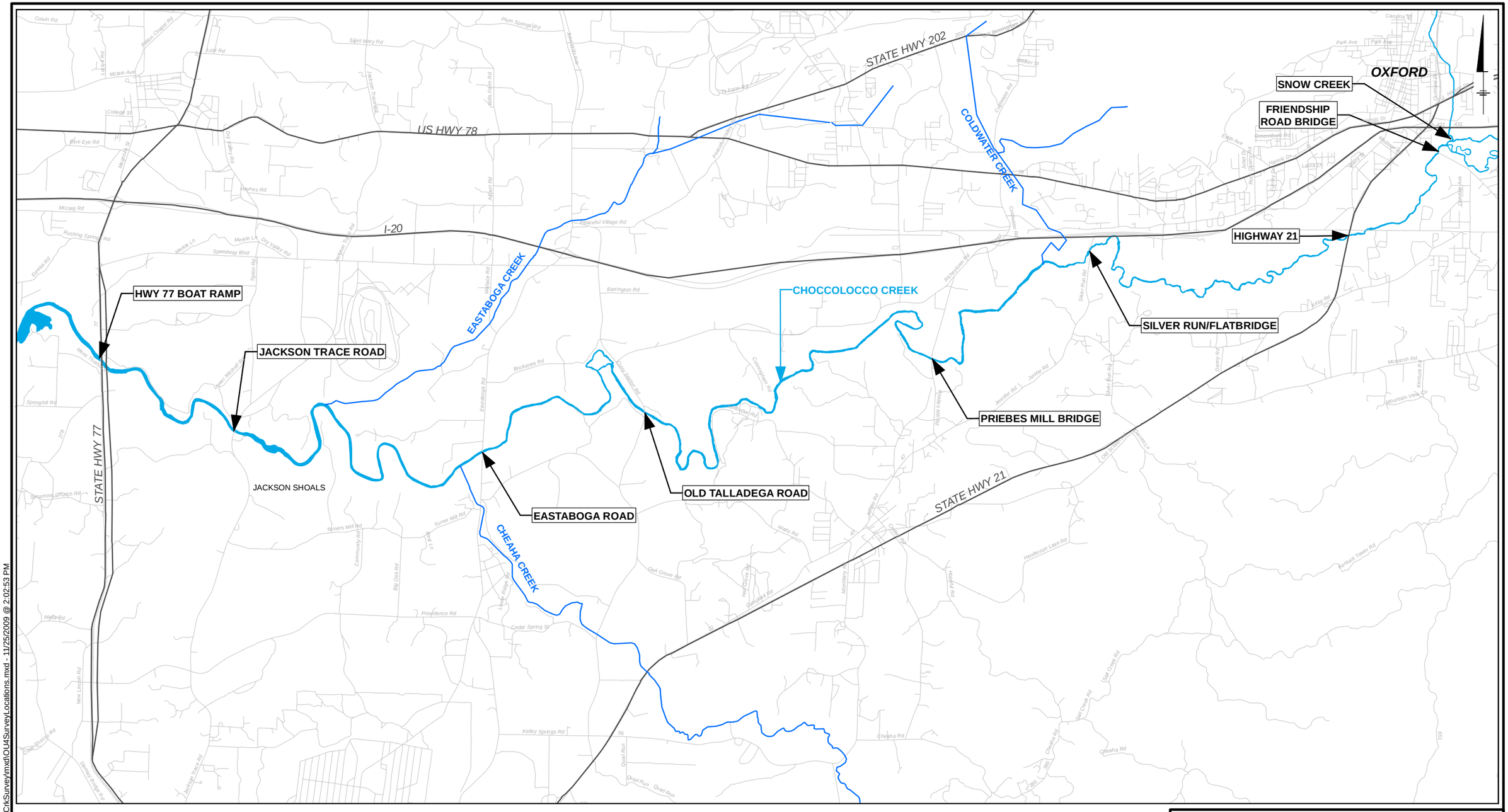
Education Level	Number of Respondents	Percentage of Respondents
No High School	1	2%
Some High School	29	58%
High School Graduate	16	32%
Some College	3	6%
College Graduate	1	2%
Some Graduate School	0	0%

Table 13
Distribution of Driving Distance to Fishing Location

Methodology and Results of the Choccolocco Creek Fish Consumption Survey
Anniston PCB Site, Anniston AL

	Driving Distance	
	Sample	**Population**
Number of Respondents	46	110
Min	2.9	2.9
Max	43.4	43.4
Mean	12.6	8.9
5th Percentile	3.0	4.9
10th Percentile	3.1	8.6
15th Percentile	6.0	8.6
20th Percentile	7.2	8.6
25th Percentile	8.6	8.6
30th Percentile	8.6	8.6
35th Percentile	9.7	10.0
40th Percentile	10.1	10.0
45th Percentile	10.1	10.1
50th Percentile (Median)	10.1	10.1
55th Percentile	10.1	10.1
60th Percentile	10.3	11.2
65th Percentile	10.5	11.2
70th Percentile	15.3	11.2
75th Percentile	17.3	17.5
80th Percentile	17.4	17.5
85th Percentile	17.5	21.1
90th Percentile	21.5	30.9
95th Percentile	31.0	31.0

Figures



0 6,500 13,000 Feet

GRAPHIC SCALE

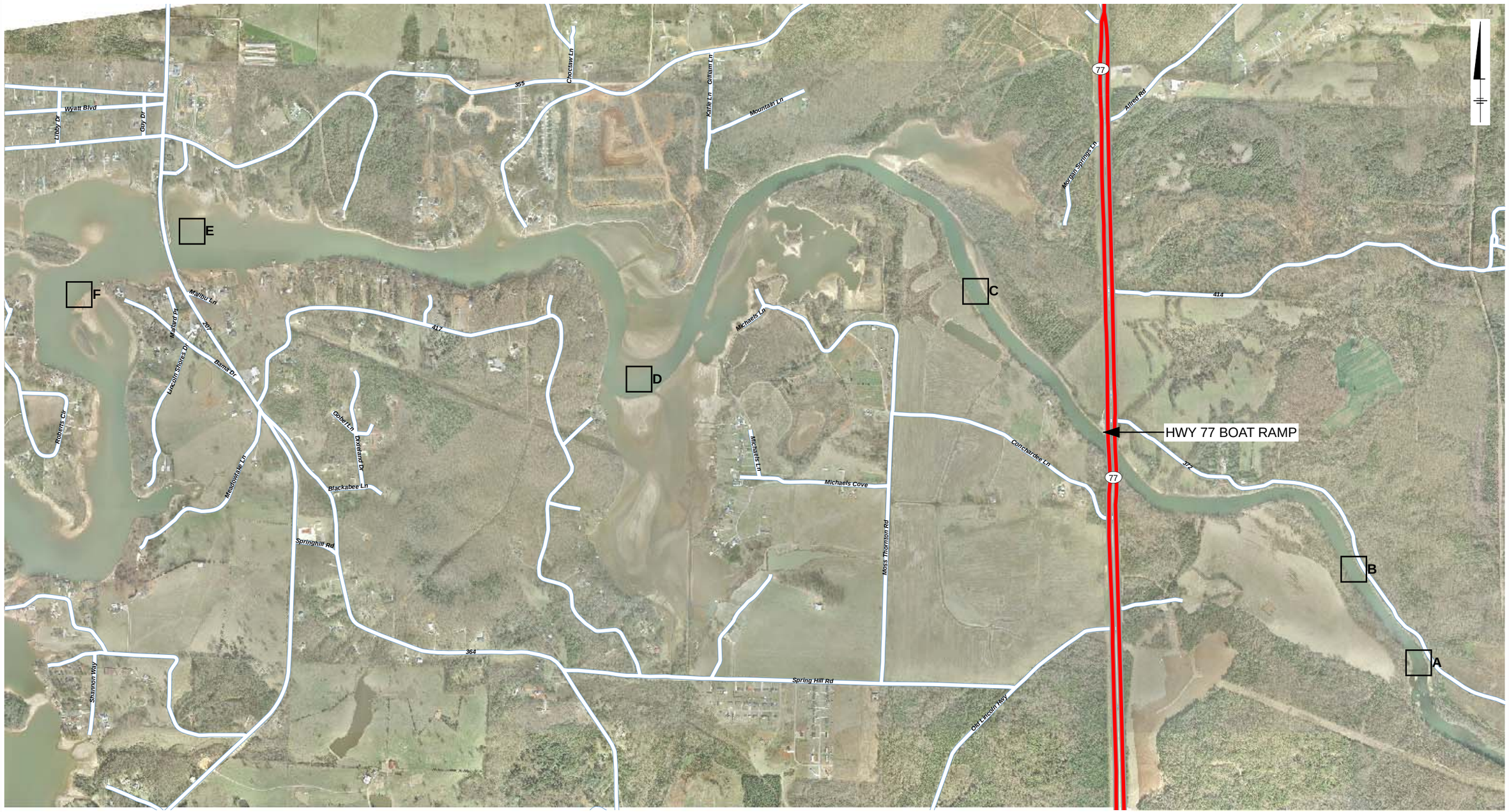
ANNISTON PCB SITE
ANNISTON, ALABAMA
METHODOLOGY AND RESULTS OF THE CHOCCOLOCCO CREEK FISH CONSUMPTION SURVEY

SURVEY LOCATIONS

ARCADIS

FIGURE 1

CITY: ROCH DIV/GROUP: 40 DB: EAL LD: PIC: PM: TM: TR:
Project (Project #)
Q:\Anniston_PCB_site\Method_Results_ChocCrkSurvey\mxd\OU4SurveyLocations.mxd - 11/25/2009 @ 2:02:53 PM



LEGEND:

FISHING AREAS

0 1,300 2,600 Feet

GRAPHIC SCALE

ANNISTON PCB SITE
ANNISTON, ALABAMA
METHODOLOGY AND RESULTS OF THE CHOCCOLOCCO CREEK FISH CONSUMPTION SURVEY

FISHING AREAS

ARCADIS

FIGURE 2

CITY: ROCH DIV/GROUP: 40 DB: LD: EAL PIC: AF PM: TM: MS TR:
Anniston
Q:\Anniston_PCB_site\Method_Results_ChocCrkSurvey\mxd\CreelSurvey_fishingLocs.mxd - 11/25/2009 @ 2:03:26 PM

ARCADIS

Appendix A

Creel Survey Forms

Choccolocco Creek Creel/Angler Survey

Interviewer: _____

Location*: 1 2 3 4 5 6 7 8 9

Date: _____ Shift: AM PM

Interview Start Time: _____

Introduction

Good morning (afternoon). We're doing a fishing study of Choccolocco Creek. Can I ask you a few, quick questions? Yes No → Try to Convert Converted? → Yes No → Missed Creel Report

1a) Have we interviewed you before? No ➔ **(Continue)** Yes ➔ **(Complete 1b and 1c, then skip to Q9a)**

So that we can match up our records,
1b) What are the last 4 digits of your phone number?_____
1c) What is your first name?_____

2) In a typical year, what months or seasons do you fish Choccolocco Creek? *(Ask for the specific season fished. If fished in a season ask which months fished)*
Winter (Dec, Jan, Feb) Spring (Mar, Apr, May) Summer (Jun, Jul, Aug) Fall (Sep, Oct, Nov)

3) Do you ever fish at *(circle all that apply)*: Snow Creek in Oxford Lake Park | Friendship Road (behind Comfort Inn) | Highway 21 | Silver Run Road/Flatbridge | Priebes Mill Road | Old Talledega Road (Curry Station Road) | Estaboga Road | Jackson Trace Road | Highway 77

4a) How many years have you fished Choccolocco Creek above or upstream of Jackson Shoals? _____ years

4b) Frequency fished? *(If they stated more than one year in previous question)*
Every year__ Every other year__ Every 5 years__ Other*(specify how often)*_____

5a) How many years have you fished Choccolocco Creek below or downstream of Jackson Shoals? _____ years

5b) Frequency fished? *(If they stated more than one year in previous question)*
Every year__ Every other year__ Every 5 years__ Other*(specify how often)*_____

6a) Do you ever eat turtles caught from Choccolocco Creek? No **(Skip to Q.7a)** Yes **(Go to Q.6b)** **6b)** How often? Meals per year _____

7a) Do you ever eat crawfish caught from Choccolocco Creek? No **(Skip to Q.8a)** Yes **(Go to Q.7b)** **7b)** How often? Meals per year _____

8a) Do you ever eat frogs caught from Choccolocco Creek? No **(Skip to Q.9a)** Yes **(Go to Q.8b)** **8b)** How often? Meals per year _____

Fishing Questions

9a) Time started fishing today? _____ am pm **9b)** Are you done fishing here for today? Yes **(Skip to Q.10a)** No **(Go to Q.9c)** **9c)** How much longer are you planning to fish today? _____ hours

10a) **ASK ONLY AT HIGHWAY 77 BOAT RAMP** Did you fish from the shore or from a boat today? Shore **(Skip to Q.11a)** Boat **(Go to Q.10b)** **10b) (Show map)** Where on this map did you fish today? A B C D E F

11a) How many times have you fished here (or at Location from Q.10b) in the last 4 weeks? _____ Times

11b) Is this your usual rate during this season? Yes **(Skip to Q.12)** No **(Go to Q.11c)**
11c) What is your usual rate during this season? _____ times per _____

12) Did you catch anything today? Yes No **(Skip to Q.14f then to Q.17)**

13) May we ask you a few questions about the fish you have caught today? Yes No **(Skip to Q.17)**

***Site Numbering System**

1 Snow Creek (Oxford Lake Park)
2 Friendship Road Access Bridge
3 Highway 21 Access Bridge
4 Silver Run Road\Flatbridge
5 Priebes Mill Bridge
6 Old Talladega Road (Curry Station Road)
7 Eastaboga Road
8 Jackson Trace Road
9 Highway 77

Creeled Catch									
(14a) Have you caught any of the following species of fish today?	**(14b)** Number Caught Today	**(14c)** Number Kept Today	**(14d)** Reason Released Today	**(14e)** Number to be Eaten?	**(14f)** Ever Eat *(Always ask for each species)*	**(14g)** Length of Fish to be Eaten (record length of each fish)	**(14h)** How will these fish be prepared? (if more than 1 fish will be eaten write all that apply)		**(14i)** Parts Consumed (all that apply)	**(14j)** Camera/ Picture #s **(Complete last*)**
							Skin On	Skin Off		
Bass (except Striped bass)					**Y N**					
Striped bass					**Y N**					
Brim					**Y N**					
Crappie					**Y N**					
Channel Catfish					**Y N**					
Blue Catfish					**Y N**					
Sunfish					**Y N**					
Turtle					**Y N**					
Crawfish					**Y N**					
Other_____					**Y N**					

Preparation Methods: 1) Baked 2) Broiled/Grilled 3) Fried 4) Boiled/Poached/Stewed 5) Smoked 6) Raw
Parts Consumed: 1) Muscle/meat 2) Skin 3) Bones 4) Guts/Viscera 5) Head

15) Can we take a quick picture of your catch?	No **(Go to Q.16a)** Yes (If yes) →	**Camera #**_____ **Picture#**_____ **(Go to Q.16a)**

Make sure to take pictures of the fish last. The first picture should be of the entire catch with the ruler in the shot for scale. Next, take pictures of each individual fish with the ruler in the shot. Make sure you record a picture number for each picture taken.

Consumption									
16a)	Number of people that will consume the fish including yourself? _____								
16b)	Description of consumers?	Individual 1	Male	Female	Age _____	Individual 4	Male	Female	Age _____
		Individual 2	Male	Female	Age _____	Individual 5	Male	Female	Age _____
		Individual 3	Male	Female	Age _____	Individual 6	Male	Female	Age _____

Demographic Questions *(Always collect this information)*						
17)	What year were you born? 19 _____		**18)**	Gender *(Record through visual identification only)* :	Male	Female
19)	What's your level of education?	Some High School	High School Graduate	Some College	College Graduate	Some Graduate School
20)	What town do you live in? _____		**21)**	What's your zip code there? _____		
22a)	Would it be okay if we followed up with you over the phone? Yes **(Go to Q.22b)** No		**22b)**	**(If yes)** What is your full phone _____		

Choccolocco Creek Creel/Angler Survey
(Missed Creel Report – 1 Angler* per Form)

Interviewer _____

Location 1 2 3 4 5 6 7 8 9

Date _____ Shift: AM PM

1)	Have you interviewed this angler previously? Yes No Unsure	**2)**	Is the angler under 16? Yes No Unsure
3)	If you've interviewed this person before, what was the angler's name or ID number? *(if you don't remember, leave blank)* _____	**4)**	What time did the angler complete their fishing trip today? ☐☐:☐☐ a.m. p.m.

Fishing Questions

5)	Did the angler catch any fish today?	Yes	No (**Go to Q.9)**	Unsure
6)	Did the angler keep any fish?	Yes	No	Unsure
7)	Did the angler give any fish away?	Yes	No	Unsure

Demographic Questions

9) Gender: Male Female

10) Race: White Black Hispanic Asian/Pacific Islander Native American Other _____ Don't know

11) Reason for completing Missed Creel Report:

1) Angler unwilling to be interviewed
2) Angler unwilling to be re-interviewed
3) Angler is under 16
4) Angler left while other interviews were being conducted
5) Angler avoided interviewer
6) Language failure

*An angler is defined as an individual that is carrying fishing gear. To determine if a boater is also an angler you may need to ask them if they were fishing.

Weather Log Morning Shift

Weather Report

Interviewer _____

Location 1 2 3 4 5 6 7 8 9

Date _____

Shift 7am –3:30 pm

Hour	Anglers Present	Weather Condition*	Temperature
7:00 am			
8:00 am			
9:00 am			
10:00 am			
11:00 am			
12:00 pm			
1:00 pm			
2:00 pm			
3:00 pm			
3:30 pm			

Notes _____

_____

_____

*Weather Condition Codes:

1 – Ice
2 – Snow
3 – Clear
4 – Partly Cloudy
5 - Overcast
6 – Light Rain
7 – Moderate Rain
8 – Heavy Rain

Weather Log Afternoon Shift

Weather Report

Interviewer _____

Location 1 2 3 4 5 6 7 8 9

Date _____

Shift 11:30 am – 8pm

Hour	Anglers Present	Weather Condition*	Temperature
11:30 am			
12:00 pm			
1:00 pm			
2:00 pm			
3:00 pm			
4:00 pm			
5:00 pm			
6:00 pm			
7:00 pm			
8:00 pm			

Notes _____

_____

_____

*Weather Condition Codes:

1 – Ice	5 - Overcast
2 – Snow	6 – Light Rain
3 – Clear	7 – Moderate Rain
4 – Partly Cloudy	8 – Heavy Rain

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Appendix B

Survey Protocol

SURVEY PROTOCOL: FISH CONSUMPTION STUDY

Data Collection Procedures

Beginning of Day Procedures

The survey team will meet at the first assigned interview site and will conduct a brief safety meeting prior to the start of the shift. The safety meeting is designed to identify potential safety hazards that a survey scientist may encounter and establish ways to mitigate the danger. This meeting will be held at 7:00 a.m. for the morning shift and at 11:30 a.m. for the afternoon shift. Each survey day two locations will be covered for a period of 3.75 hours each. The shifts will consist of the following:

- Morning Shift
    - 7:00 a.m. - Safety briefing and start of daily interviewing at first location
    - 10:45 a.m. – Lunch break (30 minutes) and move to day's second location (30 minute allocation)
    - 11:45 a.m. – Start interviewing at second location
    - 3:30 p.m. – Finish interviewing for day
- Afternoon Shift
    - 11:30 a.m. – Safety briefing and start of daily interviewing at first location
    - 3:15 p.m. - Lunch break (30 minutes) and move to day's second location (30 minute allocation)
    - 4:15 p.m. – Start interviewing at second location
    - 8:00 p.m. – Finish interviewing for day

Daily location assignments will be provided prior to each shift. <u>It is extremely important that survey scientists be at their assigned survey locations by 7:00 a.m. for the morning shift and 11:30 a.m. for the afternoon shift.</u>

Site Numbering System

Survey scientists will rove between nine access points along the creek, two per interview day. The nine access points are as follows (this numbering system will correspond to the numbering on the survey forms):

Site Numbering System	
1	Snow Creek (Oxford Lake Park)
2	Friendship Road Access Bridge
3	Highway 21 Access Bridge
4	Silver Run Road\Flatbridge
5	Priebe's Mill Road
6	Old Talladega Road (Curry Station Road)
7	Eastaboga Road
8	Jackson Trace Road
9	Highway 77 Bridge

Sites 1 through 7 are considered to be sites above Jackson Shoals while sites 8 and 9 are below Jackson Shoals. Given the nature of the creek and limited access to the sites above the shoals, sites 8 and 9 will be interviewed more often in total than the other seven sites. Each interview day, survey scientists will either be assigned to rove between two of the seven sites above the shoals or between sites 8 and 9. The selection of sites will occur prior to the beginning of the shift and will be made available in advance.

Supplies

Survey scientists will rove between nine access points along the creek. The scientists will be provided the following:

- First aid kit
- Insect repellant
- Sun screen
- Fish ruler
- Fish guide
- Walkie Talkie
- Safety glasses
- Ankle stabilizing work shoes
- Gloves – to handle fish
- Hand sanitizer
- Emergency contact numbers
- Safety handbook
- Bottled water
- Survey forms

- Maps of the six access points
- A manual of survey protocol
- Temporary rain coats
- A backpack to carry materials
- Miscellaneous supplies (waterproof pens, clipboards, etc.).

Each survey scientist must bring his or her own watch and cell phone to work.

Surveying

The purpose of the survey is to determine the frequency of fishing the creek, the type of species being consumed and how much the angler is consuming. In order to obtain this information, survey scientists will approach every individual or group as they finish their fishing trip. If a group of individuals are fishing together, then the scientist should conduct a separate interview and record a separate interview form for each angler. If an individual or group refuses to be interviewed, then the scientist should record time, date, scientist information, location, and group size on the interview form. In addition, if too many people leave the fishing area at the same time and the scientist cannot stop each group or individual or the angler is under 16, then the scientist should record the same information on a Missed Creel Report for each missed individual or group.

In the event that the survey scientists are moving locations or their shift is over and the anglers are still in the middle of their fishing trip, it will be the scientist's responsibility to try to collect the information from the angler mid-trip. The difference with the information collected mid-trip will be that the scientist will also need to be sure to collect information on how long the angler has already been fishing and the expected length of time they still plan to fish.

Interview Form

When the survey scientist approaches an angler at the end of their fishing trip, they should first ask the respondent if they would be willing to answer a few quick questions. If the respondent declines, try to pursued the respondent to complete the survey. If the respondent continues to decline, the scientist should fill out a missed angler form which will help us to determine how many anglers are fishing the creek in total.

The survey scientist will want to establish what time the angler started fishing in that location for the day; whether they are finished fishing for the day; and if not, how much longer they plan on

fishing. The purpose of these questions is to provide us with information on how long angler's fish during a trip and the typical number of fish caught and consumed for a trip of that length. In addition, if the angler has not finished fishing for the day, determining what time they plan on finishing their trip will allow us to estimate how many fish would have been caught if we had interviewed them at the end of their trip.

If the angler is encountered at the Highway 77 Boat Ramp, the survey scientist should ask the angler whether they fished from a boat or the shore during that trip. If they did fish from a boat it is important that we determine where in the creek they fished or if they fished in the lake. This spot is often used for an access spot to Lake Logan Martin and we need to be able to distinguish between fishing that occurred in the creek versus the lake.

The next set of questions will attempt to determine how many times the angler had fished in the past month and whether or not this is representative of the other two months in the season. The results from this question will be used to estimate how much an angler is catching and consuming if we do not intercept them for the remainder of the season.

The catch questions will be used to obtain specific information on the type of fish caught and the total number and size of the fish that will actually be consumed. We are interested in knowing not only about the fish that they have kept but also their success at catching other fish during this trip. Thus, it will be important to ask them if they have caught any of the listed species during this trip, how many they caught, and how many they released. If they released fish, then it is important to understand why they released them.

Once information about the creeled fish has been collected, the survey scientist should record information on each fish that will be consumed. The most common targeted species are listed on the interview form, as well as a location to record other species. If the species kept is not in the list, please make sure to record the type of fish species which can be identified though use of the fish guide. If the species is not in the fish guide, you may ask the angler to help you identify the fish. For each species of fish that will be consumed, the angler should be asked how many of those fish they plan to eat, the total number of people that will eat the fish, how many of those people are children and how many are adults. Then the fish will need to be measured from tip of snout to tip of one fork of the tail.

After collecting information about the catch and its consumption, ask the demographic questions. Once the interview has been completed, thank the angler for their time and provide the angler with the incentive that is currently being offered (for example, water bottle, drink cooler, etc.).

For specific instructions concerning how to ask each question and record responses, refer to the "Instruction Sheet."

Missed

When the survey scientist misses anglers or when the anglers are below 16 years of age, he or she will fill out the missed creel report. The scientist will use individual discretion to decide if individuals or group members are 16 or older. The scientist should use their own judgment when filling out the missed creel report.

End of Day Procedures

Survey scientists will finish at 3:30 p.m. for morning shifts and 8:00 p.m. for evening shifts. Please do not leave any equipment or refuse at the interview site. The on-site manager will be responsible for reviewing all of the interview forms for completeness at the end of each shift.

Breaks

Each survey scientist will get one 30 minute lunch break per shift. Gas station facilities will be used for restrooms as the access points do not have them.

Weather

Weather conditions such as continuous heavy rain or ice in the winter may end a shift. Conditions such as light rain or cold temperatures will not. Please dress appropriately for the weather conditions during your shift. If the weather is questionable prior to the start of a shift, contact the site supervisor to check on the status of the shift. Only the manager has the authority to end a shift due to weather. For start-and-stop rain or thunder/lightning the survey scientist can use their own discretion on when to enter and leave their vehicle for shelter. If there is thunder/lightning or extremely heavy rain survey scientists should return to their vehicle for shelter and wait to see if the weather clears. If after 30 minutes of continuous heavy rain or thunder/lightning, the manager may decide whether or not to end the shift for the day.

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Appendix C

Weight-Length Regression Equations

Appendix C. Species Specific Length / Weight Regression Equations

Species	Equation
Black Crappie (1)	y = 3.4451x - 5.9028
Brim (1)	y = 3.1973x - 5.1772
Spotted Bass (1)	y = 3.1018x - 5.2004
Channel Catfish (2)	y = 3.294x - 5.8

Notes:
Equations are in the form y = mx -b
y = Fish mass (grams)
m = Slope of the species-specific regression equation (grams/millimeter)
x = Fish length (millimeters)
b = Intercept (unitless)

(1) Regression equations calculated from Alabama Department of Wildlife and Freshwater Fisheries (ADWFF) Data Set.

(2) Regression equation from Brown et al. 1995.