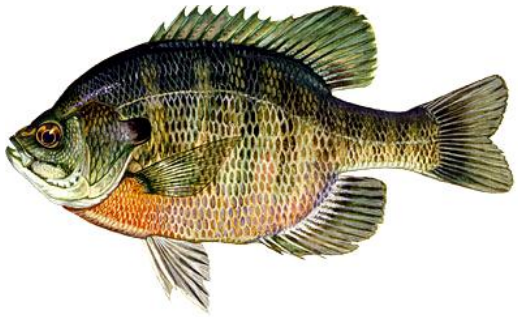
ORNL/TM-2012/161

Fish Bioaccumulation Studies Associated with the Kingston Fly Ash Spill, Spring 2009 – Fall 2010



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FISH BIOACCUMULATION STUDIES ASSOCIATED WITH THE KINGSTON FLY ASH SPILL, SPRING 2009 – FALL 2010

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managed by
UT Battelle, LLC
for the
U.S. Department of Energy
under Contract DE-AC05-00OR22725

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ACKNOWLEDGMENTS

Oak Ridge National Laboratory (ORNL) is appreciative of the Tennessee Valley Authority (TVA) in sponsoring this study and also for providing assistance in the field for collection of fish samples. In particular, we acknowledge Neil Carriker, Tyler Baker, and Dennis Yankee of TVA for their support, encouragement, and interest in this study. Colleagues at ORNL who have contributed to the success of this study are Mark Bevelhimer, Logan Elmore (currently Utah State University), Mark Greeley, Trent Jett, Teresa Mathews, Kitty McCracken, Mark Peterson, Kelly Roy, and Jay Tenney (currently University of Tennessee).

1. INTRODUCTION

In December 2008, an ash dike at the Tennessee Valley Authority (TVA) Kingston Fossil Plant ruptured, releasing over one billion gallons of coal fly ash into the Emory and Clinch Rivers. Coal fly ash may contain several contaminants of concern, but of these selenium (Se) and arsenic (As) have been highlighted because of their toxicity and tendency to bioaccumulate in aquatic food chains. To assess the potential impact of the spilled fly ash on humans and the environment, a comprehensive biological and environmental monitoring program was established, for which resident aquatic organisms (among other sample media) are collected to determine contaminant exposure and evaluate the risk to humans and wildlife.

Studies on bioaccumulation and fish health are major components of the TVA Biological Monitoring Program for the Kingston fly ash project. These studies were initiated in early Spring 2009 for the purposes of: 1) documenting the levels of fly ash-associated metals in various tissues of representative sentinel fish species in the area of the fly ash spill, 2) determining if exposure to fly ash-associated metals causes short, intermediate, or long-term health effects on these sentinel fish species, 3) assessing if there are causal relationships between exposure (to metals) and effects on fish, 4) evaluating, along with information regarding other ecological and physicochemical studies, the nature and route of contaminant transfer though food chains into higher level consumers, 5) providing important information for the Ecological Risk Assessment (ERA) for the Kingston fly ash project, and 6) serving as an important technology transfer or model study focused on how to best evaluate the environmental effects of fly ash, not only at the Kingston site, but also at sites on other aquatic systems where coal-fired generating stations are located.

This report summarizes the bioaccumulation results from the first two years of study after the fly ash spill, including four seasonal collections: Spring 2009, Fall 2009, Spring 2010, and Fall 2010. Both the Spring and Fall studies have focused on 3-4 sentinel fish species that represent different feeding habits, behaviors, and home ranges. In addition to bioaccumulation studies, the Spring investigations also included evaluation of fish health and reproductive integrity on the same fish used for bioaccumulation. Two associated reports present the fish health (Adams et al 2012) and reproductive studies (Greeley et al 2012) conducted in 2009 and 2010. The fish health study conducted in conjunction with the bioaccumulation and reproductive study is critical for assessing and evaluating possible causal relationships between contaminant exposure (bioaccumulation) and the response of fish to exposure as reflected by the various measurements of fish health.

This report emphasizes evaluation of arsenic and selenium bioaccumulation in fish and consists of four related studies (Sections 2 – 5) including, 1) bioaccumulation in liver and ovaries, 2) bioaccumulation in whole body gizzard shad (*Dorosoma cepedianum*), 3) bioaccumulation in muscle tissue or fillets, and 4) a reconstruction analysis which establishes the relationship between selenium in muscle tissue and that of the whole body of bluegill (*Lepomis machrochirus*). Metals other than arsenic and selenium are evaluated separately in Section 6. This report focuses on selenium and arsenic for the following reasons: 1) based on baseline studies conducted in early 2009 in the Emory and Clinch River, only two potentially fly-ash related metals, selenium and arsenic, appeared to be elevated above background or reference levels, 2) selenium and arsenic are two of the metals in coal ash that are known to bioaccumulate and cause toxicity in wildlife, and 3) based on bioaccumulation studies of bluegill and carp (*Cyprinus carpio*) in the Stilling Pond during Spring 2009, which would represent a worst case situation for metal bioaccumulation, selenium and arsenic were the only two metals consistently elevated above background levels in fish.

Each of the four selenium and arsenic evaluations presented in this report include an approach section, a results section which addresses primarily spatial and temporal patterns in bioaccumulation, an interpretation and discussion section, and a synthesis section which provides the main summary points of each study. Other metals in fish from near the spill site are evaluated by comparison with reference sites and evaluation of spatial and temporal trends. Statistical approaches to data analysis will be conducted after the third year of bioaccumulation monitoring when there is a larger n size available for analysis, there has been sufficient time for food-chain driven bioaccumulation (2009 data was likely closer to pre-spill exposures), and data correction factors for selenium and mercury (because of poor analytical recoveries for some samples) have been fully codified by the study team. In this report only regression statistics were used for the reconstruction analysis. This initial report focuses on providing summary statistics for fish metal results and graphical presentations highlighting spatial and temporal bioaccumulation patterns.

2. BIOACCUMULATION - LIVER AND OVARIES

Approach

Studies related to the bioaccumulation of metals in fish liver and ovaries were conducted in Spring 2009 and in Spring 2010. In the Spring of both years field sampling was conducted during April and May when fish were reproductively mature and developing their gonads. In Spring 2009, largemouth bass (*Micropterus salmoides*), bluegill and white crappie (*Pomoxis annularis*) were collected at ERM 8 (upstream reference), ERM 3, ERM 0.9, CRM 1.5, and CRM 8 (where ERM = Emory River mile and CRM = Clinch River mile) (Fig. 1). In Spring 2010 largemouth bass, bluegill, white crappie, and redear sunfish (*Lepomis microlophus*) were collected at ERM 8 (upstream reference), LERM 2 (Little Emory River = upstream reference), ERM 3, ERM 0.9, CRM 1.5, and CRM 8. At each site and for each species and sampling period, the goal was to collect eight mature females, however, in some cases the target goal of eight individuals per site could not be achieved because of unavailability at some sites for some species such as white crappie at ERM 3.

Immediately upon collection by boat electrofishing, a blood sample was taken from each fish and a unique five digit identification number was affixed to each individual fish. They were then placed in a live well onboard the boat. Upon completion of the collection, all fish were transported alive to ORNL's fish processing laboratory for further processing and analysis. At the fish processing lab fish were processed for a suite of individual health indicators, the liver and ovary harvested for metal analysis, and each individual filleted for metal analysis of muscle tissue. In Spring 2009, liver and ovary tissues were sent to ALS Environmental (ALS) for metals analyses by EPA method SW846-6010C and the Spring 2010 liver and ovary samples were sent to Pace Analytical Services (Pace) for analyses by EPA method SW846-6020A.

A suite of 25 metals was analyzed and reported by the ALS lab in the form of a level 4 QA package. Data received from the lab were checked for outliers and qualifers. Based on results from the baseline studies where fish were collected primarily by the Tennessee Wildlife Resources Agency (TWRA) in January and February 2009, only two metals, selenium and arsenic, appeared to be elevated above background or reference levels. In addition, selenium and arsenic are two of the metals in coal ash that are known to bioaccumulate and cause toxicity in wildlife. For example, selenium is known to cause reproductive and developmental problems in fish and birds. Based on the fact that selenium and arsenic were elevated in the baseline samples above background levels, and some of these metals are known to cause toxicity in wildlife, these two metals have been the focus of our fish bioaccumulation and health studies.

Since the Spring 2009 samples were analyzed by the ALS lab using method 6010 which was demonstrated by a Round Robin Study in 2011 to produce higher selenium values than method 6020, a preliminary correction factor was applied to the Spring 2009 data to adjust for this discrepancy. Because liver and ovary samples did not provide sufficient tissue for split samples between labs, a correction factor was calculated based on split lab samples of muscle tissues obtained from the Fall 2009 sampling. In this situation, largemouth bass, bluegill, and channel catfish (*Ictalurus punctatus*) samples from all sites sampled in Fall 2009 were analyzed by both the Pace and ALS labs. For each of the three species, including individual fish collected across all sites, the difference in the Pace and ALS value was determined and a correction factor for each species calculated. An overall correction factor was calculated based on the average difference in the Pace and ALS values for each species and applied to the Spring 2009 liver and ovary data. Further evaluation of the appropriate correction factor for ALS data will likely change the results (draft Mathews et al 2012) and therefore all Spring 2009 selenium concentration data in fish liver and ovaries presented here should be considered approximate.

The liver/ovary data in this report are presented in both a spatial and temporal format. For the spatial presentations, the Spring 2009 and Spring 2010 data are presented in figures that include selenium in liver

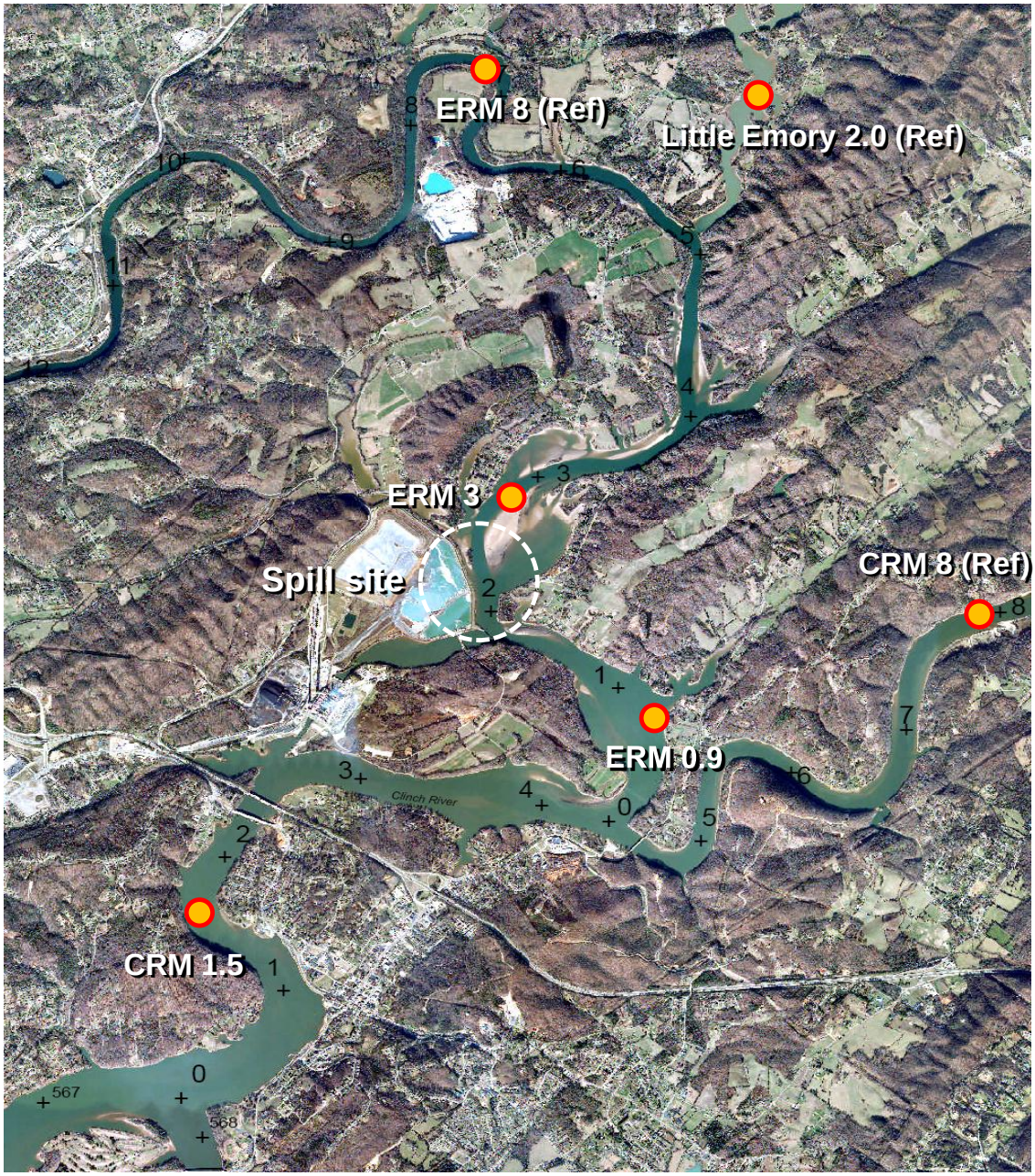

Figure 1. Location of primary sampling sites on the Emory River, Little Emory River, and Clinch River for the fish bioaccumulation study.

and ovary and arsenic in the liver and ovary for each fish species. For the temporal presentation, data in figures compare the 2009 and 2010 results by species, organ (liver and ovary), and metal (selenium and arsenic). Because the livers of bluegill were so small, insufficient tissues were available to analyze metals in this organ.

Results

Spatial Patterns - Spring 2009

In Spring 2009 arsenic in the livers of largemouth bass (LMB) was relatively low with levels being similar among sites (Fig. 2). A similar spatial pattern is also evident for white crappie except fish from CRM 8 were substantially higher than the other sites even though there was relatively high variability among the individual observations. There are no error bars for white crappie at ERM 3 and CRM 1.5 because only one individual could be collected at each of these sites, primarily because of relatively poor habitat. Selenium in the liver of LMB, even though elevated somewhat at ERM 0.9 and at CRM 8, was not substantially different between the reference (ERM 8) and sites downstream of the reference (Fig. 3). Also, levels of selenium in livers of white crappie were similar among sites except for ERM 3.0. Since only one white crappie could be collected at ERM 3.0, the result cannot be considered representative of the species at that location. For arsenic in the ovary of LMB, levels at all sites were similar except for CRM 8 which was slightly elevated. Arsenic levels in the ovaries of white crappie were also similar among sites except that only one individual was captured at ERM 3. Arsenic in bluegill ovaries was highest at ERM 3 and CRM 1.5 and lowest at CRM 8.0 (Fig. 4). Selenium levels in ovaries of LMB were similar at all sites except for a slight elevation at ERM 0.9. Selenium values were also somewhat similar at all sites for white crappie and bluegill except for lower levels at CRM 8 (Fig. 5).

Spatial Patterns - Spring 2010

During Spring 2010, selenium in the livers of bluegill, redear, and white crappie displayed a downstream gradient in bioaccumulation with most levels being lowest at the two upstream reference sites, increasing downstream, and then decreasing at CRM 8.0 (except for white crappie) (Fig. 6). Levels in LMB were similar at all sites except for a slight increase at ERM 0.9. Arsenic in the livers of bluegill, redear, and white crappie displayed a similar downstream pattern to that of selenium with values being generally lowest at the two upstream sites and increasing downstream before declining somewhat at CRM 8 (Fig. 7). The spatial downstream pattern of arsenic in liver of LMB was not as distinct as that of the other 3 species with levels being similar at all sites except for a slight increase at CRM 1.5. Levels of selenium in the ovaries of bluegill and redear (Fig. 8) had a spatial downstream gradient similar to that shown for selenium in the liver (Fig. 6) with lowest values at the reference and increasing downstream. Selenium in the ovaries of white crappie and LMB were similar across sites except there was a slight increase at ERM 0.9 for LMB and CRM 8 for white crappie (Fig. 8). The levels of arsenic in bluegill ovaries were similar at all sites except for a large increase at CRM 1.5, and the pattern of arsenic in the ovary was somewhat similar to that of arsenic in liver (Figs. 7 & 9). Both white crappie and LMB demonstrated a downstream increase in ovarian arsenic levels with values for white crappie at CRM 8.0 being highly elevated (Fig. 9).

Temporal Patterns - White Crappie

Excluding ERM 3 where only one fish was captured, selenium levels in the livers of white crappie were similar among sites in 2009 while in 2010 there were large increases at ERM 3 and CRM 8 and a moderate increase at ERM 0.9 (Fig. 10). Except for CRM 8, levels of selenium in the ovary of white crappie were similar in 2009, increased somewhat at ERM 3 and ERM 0.9 in 2010, and demonstrated a large increase in 2010 at CRM 8 (Fig. 11). Arsenic in the livers and ovarian tissues of white crappie had large increases in 2010 at all sites downstream of the reference site, generally displaying a two- or threefold increase from 2009 to 2010 (Figs. 12 and 13).

Temporal Patterns - Largemouth Bass

Even though selenium levels in the livers of LMB were similar among sites in 2009, large increases were observed at all sites in 2010 (Fig. 14). Selenium levels in ovarian tissues also increased at all sites in 2010 with the reference showing the smallest percentage increase over the year (Fig. 15).

Bioaccumulation of arsenic in livers and ovaries was similar among sites in 2009 except for slightly increased levels at CRM 8 (Figs. 16 and 17). In 2010, however, arsenic values increased by a factor of 2-3 in the ovary and up to a factor of two in the liver over 2009 levels.

Temporal Patterns - Bluegill

Compared to 2009, selenium in bluegill ovaries only showed an increase in 2010 at CRM 1.5 and CRM 8 (Figure 18). Selenium data were not available for bluegill ovaries at ERM 0.9 and arsenic values were not available for bluegill at ERM 8 and ERM 0.9 in 2009 because ovaries were too small to conduct metal analysis. No distinct temporal trends can be observed for arsenic in ovarian tissue because data are unavailable for two sites. One site (ERM 3) had much higher arsenic levels in 2009, and at CRM 1.5 and CRM 8 increases were noted in 2010 even though there were no substantial differences between 2009 and 2010 at these two sites (Fig. 18).

Interpretation and Discussion

Spatial and Temporal Patterns

The most obvious spatial-related observation common to all species in Spring 2009 for both livers and ovaries is the lack of a distinct or clear downstream gradient in bioaccumulation of selenium and arsenic. Occurrence of such a spatial gradient would provide evidence of a possible causal relationship between metal exposure and bioaccumulation of metals in biological tissues. Selenium and arsenic concentrations in ovaries and livers of fish species were generally similar (i.e., within +/- 1 standard error) between reference sites and sites downstream in the Emory and Clinch Rivers in 2009. There were a few exceptions to this finding such as levels of arsenic in liver of white crappie and LMB were slightly elevated at CRM 8 and levels of arsenic were also slightly elevated in LMB ovaries at CRM 8. Lack of a distinct downstream gradient in levels of metals in liver and ovarian tissues is not surprising given that the Spring 2009 sampling was conducted less than 6 months following the ash spill most likely providing insufficient time for any metals released into the environment from the spill to be incorporated into the food chain and transferred into upper trophic level consumers. In addition, for most of the period between the spill and the Spring 2009 collections, the water was relatively cold, biological productivity was at a seasonal low level, and feeding activity by consumers was also at a seasonal low. Therefore, the physicochemical and ecological conditions present during this six month period between the spill and the Spring collections would act in a synergistic fashion, tending to minimize the probability that coal ash-associated contaminants would be incorporated and assimilated into the food chain and transferred to upper levels consumers such as omnivorous and piscivorous fish**.**

The behavior of selenium and arsenic in ovaries and liver during Spring 2010, however, displayed a different spatial pattern compared to Spring 2009. In almost all cases, levels of selenium and arsenic in livers and ovaries of all fish species were higher at all sites in 2010 compared to 2009. Also, in many cases, levels of metals in these two organs were lowest at the reference site and increased to highs downstream in the Emory River or in the Clinch River at CRM 1.5. Except for bluegill, levels of metals in other fish species at CRM 8.0 were higher than in fish at CRM 1.5. Increases in levels of selenium and arsenic in the tissues of these fish in Spring 2010 is not surprising given that sampling was conducted approximately 18 months following the ash spill which should have been sufficient time for fly ash-associated metals to be incorporated into the food chain and transferred into upper trophic level consumers. Since a definitive spatial relationship exists between those areas in the Emory River where exposure to ash-associated metals is highest and where bioaccumulation of metals in livers and ovaries is also the highest, such a relationship provides relatively convincing evidence of a causal connection between metal exposure and bioaccumulation of metals in fish.

Bioaccumulation Patterns Among Fish Species

For this discussion, only the Spring 2010 results are included because levels of metals in tissues during Spring 2009 could be considered "baseline conditions" due to the fact that a sufficient period of time had not elapsed between the time of the spill and collection of fish to allow incorporation of metals into the food chain. In Spring 2010, levels of selenium in the livers of redear sunfish were much higher at all sites

compared to the other three species (Fig. 6). Selenium in ovarian tissue of redear was also much higher than in ovarian tissue of the other three species (Fig. 8). Arsenic was also observed for selenium in liver tissue, levels of selenium in ovary are similar among sites for the other three species except perhaps for bluegill at CRM 1.5 and white crappie at CRM 8 (Fig.8). Liver arsenic levels varied widely among the four fish species including a relatively high variability among individuals within a site (Fig. 7). Redear sunfish and white crappie consistently displayed higher hepatic arsenic levels than largemouth bass and bluegill from the same sites (Fig. 7). The variability in arsenic in ovarian tissues was not as high among sites and species as was observed for arsenic levels in liver tissue (Fig. 8). As was also observed for arsenic in livers, redear and white crappie had the highest ovarian arsenic levels at sites downstream of the spill with bluegill generally having the lowest levels (Fig. 9).

Differences in metal bioaccumulation among fish species can be due to a variety of factors; the most important being diet and food habits, patterns in movement and home range, and physiological differences among species. The most obvious difference in bioaccumulation of selenium and arsenic among species was the extremely high levels of selenium observed in redear liver and ovarian tissue compared to the other three species. Arsenic also generally bioaccumulated to higher levels in liver and ovarian tissue in redear compared to the other three fish species. Studies planned during 2011 are designed to investigate why redear differentially bioaccumulate selenium, and to a lesser degree arsenic, to much higher levels than the other fish species. Two main hypotheses to investigate the differential bioaccumulation of selenium and arsenic in redear are: 1) differences in the diet and food habits of redear that feed primarily on mollusks, and 2) differences in digestive tract physiology with the pH of the stomach and intestine of redear being such that the solubility of selenium is increased, resulting in higher transport and assimilation of certain metals into biological tissues.

The fact that the levels of selenium in livers and ovaries of the other three fish species were somewhat similar among sites indicates that food habits and diet may not be the main influential factors for bioaccumulation. Bluegill and juvenile crappie are generally omnivorous, feeding primarily on macroinvertebrates. Crappie become somewhat predaceous and piscivorous as adults and largemouth bass are primary piscivores, In addition, LMB have somewhat of an intermediate home range, therefore fish captured and analyzed from a certain site may have emigrated from other areas. Conversely, bluegill exhibit high site fidelity, so levels of metals observed in this species would reflect exposure primarily within a limited geographical area. As a testimony to their high site fidelity, selenium levels in bluegill livers and ovaries were higher than white crappie and LMB at 3 of the downstream sites. In summary, feeding habits, the nature of the diet, and site fidelity all play an interacting role in influencing differences in bioaccumulation of arsenic and selenium among fish species and such factors must be taken into account when evaluating and interpreting the dynamics of bioaccumulation in fish.

Differential bioaccumulation in tissues

Over all sites and species, hepatic selenium levels in 2010 ranged from 5-25 mg/kg DW, with most levels (except for redear) in the 6-10 mg/kg DW range (Fig. 6). For selenium in ovarian tissues, concentrations ranged from 4-10 mg/kg DW with most values except for those in redear ranging between 4.5-6.0 mg/kg DW (Fig. 8). It appears, therefore, that selenium is being differentially bioaccumulated in the liver compared to the ovary. Over all sites and species, arsenic levels in the liver ranged from 0.5-7.0 mg/kg DW with most values falling between 1.5-5.0 (Fig. 7). For arsenic in ovarian tissues, the range was between 0.2 and 2.5 with most values falling between 0.5-1.5 mg/kg DW (Fig. 9). Therefore, it appears that arsenic is also differentially bioaccumulated in the liver compared to the ovary. Such a large difference in the bioaccumulation of selenium and arsenic in these two organs has potential implications for fish reproduction. The liver is the primary site where lipo-proteins are synthesized before being transported by the blood to be sequestered in the ovary as the energy-rich yolk of developing eggs. The ecological relevance of this finding is that if selenium and arsenic are being differentially bioaccumulated in the liver, but a large fraction of these metals are not being effectively transferred from the liver to the ovaries, then this inhibited transfer process could minimize metal toxicity during early development.

However, once eggs are spawned, developing eggs and larvae could be exposed to contaminants in the water and sediment which could increase toxicity to these life stages.

Summary and Synthesis

The major summary and synthesis points of the bioaccumulation studies for livers and ovaries are:

1) For the Spring 2009 study, there was no clear or distinct downstream gradient in bioaccumulation of selenium and arsenic in the livers or ovaries of any fish species.
2) In Spring 2009, lack of an obvious downstream gradient in bioaccumulation of metals in fish tissue, which would be evidence of a causal relationship between metal exposure and bioaccumulation, is probably due to a variety of factors. Foremost among these is that there was insufficient time for metals released into the environment to be incorporated into the base of the food chain and transferred through the food chain into upper trophic level consumers.
3) Levels of selenium and arsenic in livers and ovaries of all fish species were higher at most sites in Spring 2010 compared to Spring 2009.
4) In most cases, levels of metals in livers and ovaries during Spring 2010 were lowest at the reference sites and increased downstream. Such a spatial relationship provides evidence of a possible causal connection between exposure to fly ash-associated metals and bioaccumulation of metals in fish.
5) Levels of selenium and arsenic in redear sunfish during Spring 2010 were much higher at all sites compared to levels in the other three species.
6) Levels of selenium in livers and ovarian tissues were similar among sites in Spring 2010 for bluegill, largemouth bass, and white crappie.
7) Feeding habits, nature of the diet, and site fidelity all play an interacting role in influencing differences in bioaccumulation of arsenic and selenium among fish species and such factors must be taken into account when evaluating and interpreting the dynamics of bioaccumulation in fish.
8) Selenium and arsenic concentrations in the same individual fish can be dramatically different in livers and ovaries.
9) Large differences between the liver and ovary in bioaccumulation of selenium and arsenic has potential ecological implications for reproductive competence of fish.
10) If metals are not being effectively transferred from the liver to the ovaries then the implication is that metal toxicity may be minimized during the early life stages. However, once eggs are spawned, developing eggs and larvae could be exposed to contaminants in the water and sediment which could increase toxicity to these life stages.

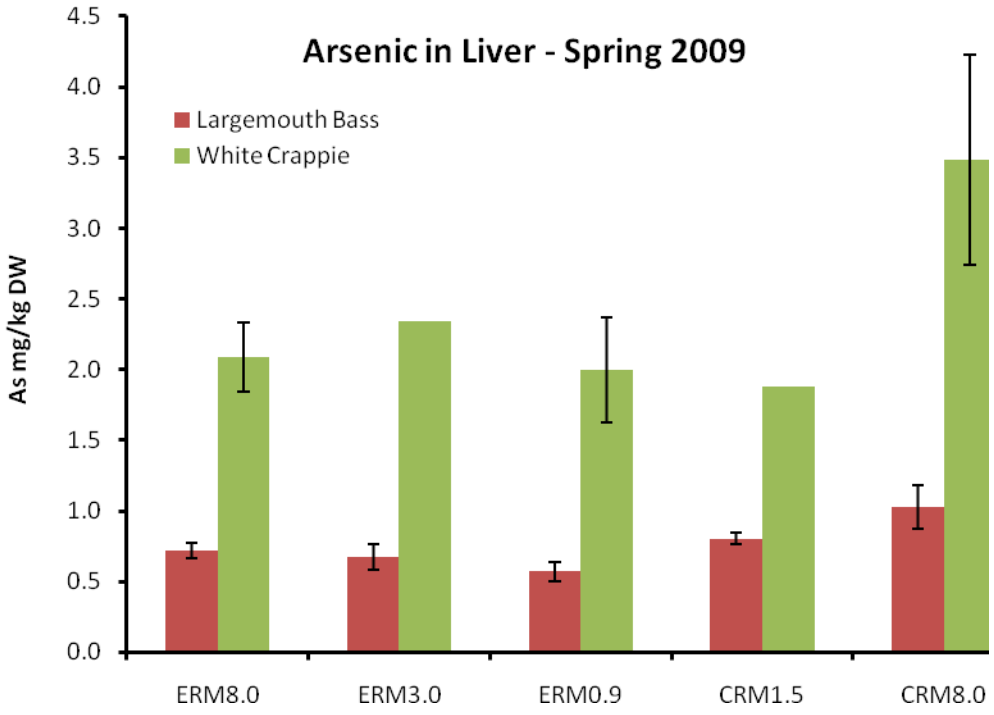

Figure2. Concentration of arsenic in the livers of two fish species at five sample sites during Spring 2009.

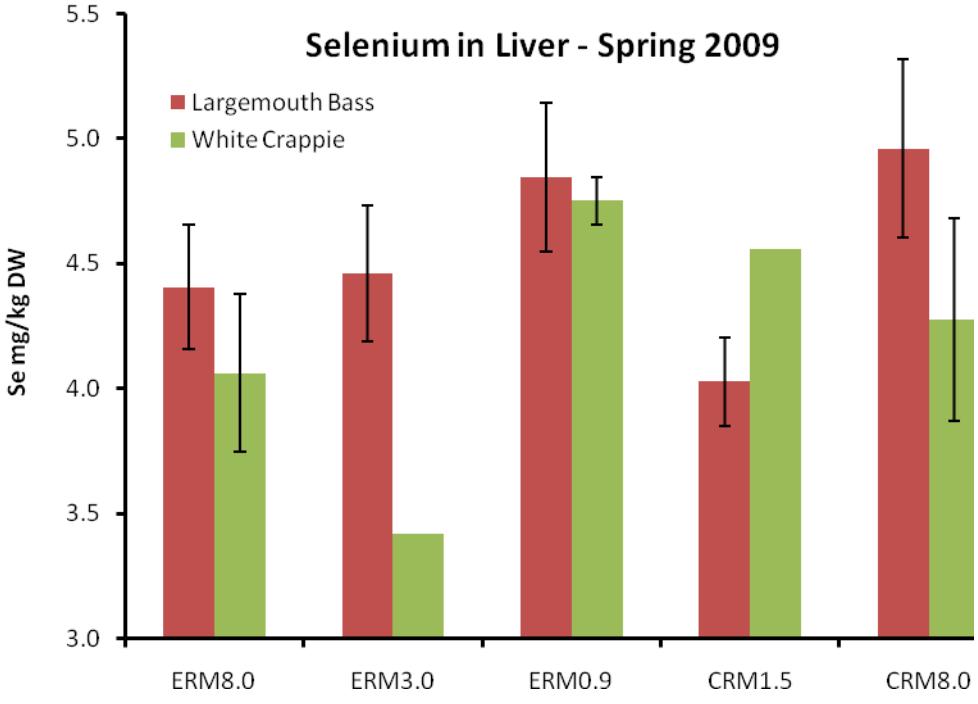

Figure 3. Concentration of selenium in the livers of two fish species at five sample sites during Spring 2009.

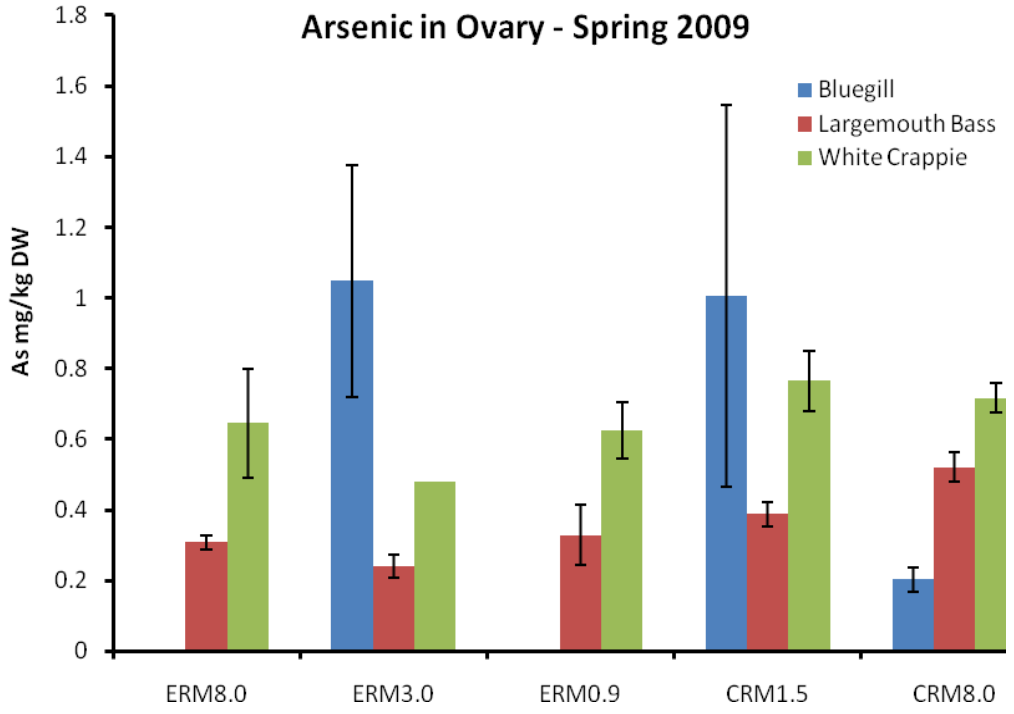

Figure 4. Concentration of arsenic in the ovaries of three fish species at five sample sites during Spring 2009.

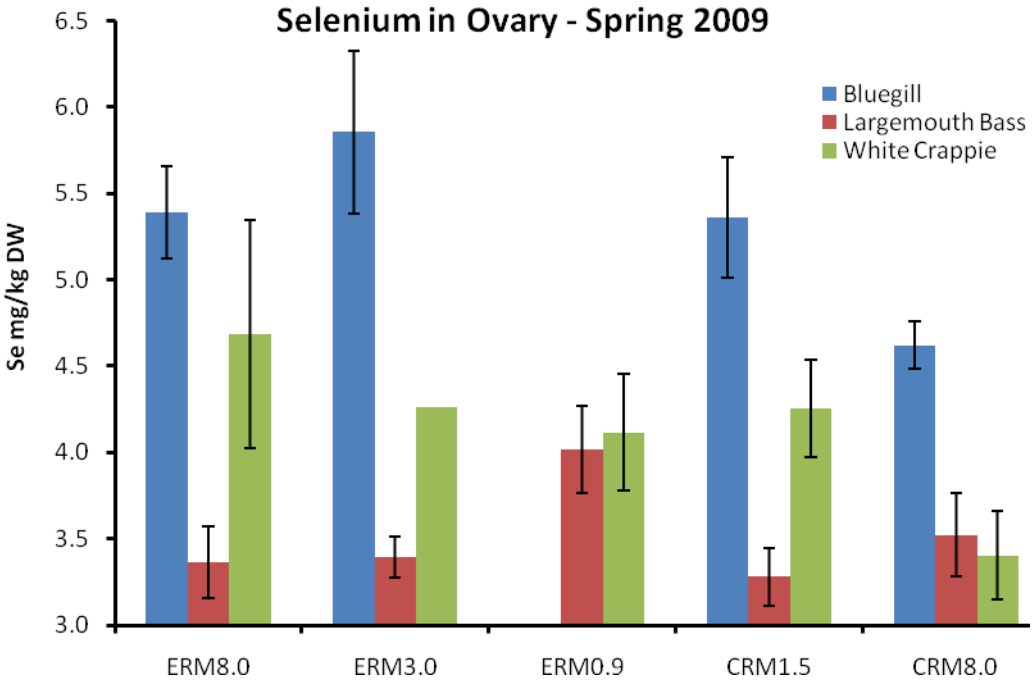

Figure 5. Concentration of selenium in the ovaries of 3 fish species at 5 sample sites during Spring 2009.

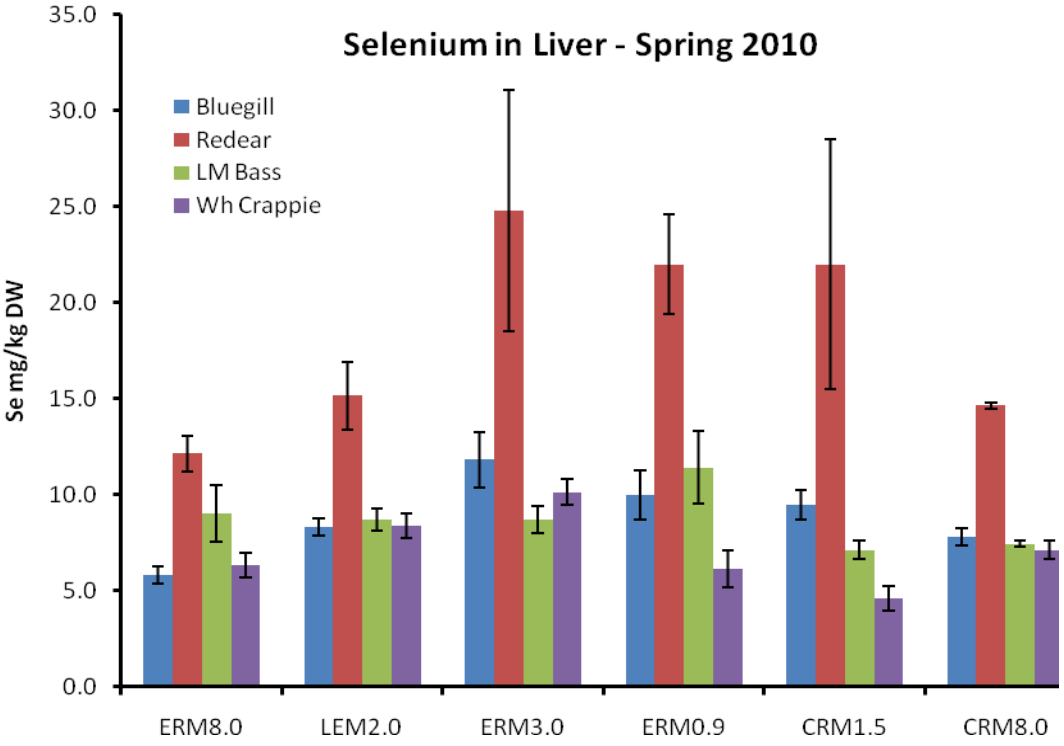

Figure 6. Spatial pattern of selenium levels in livers of 4 fish species at 6 sample sites during Spring 2010.

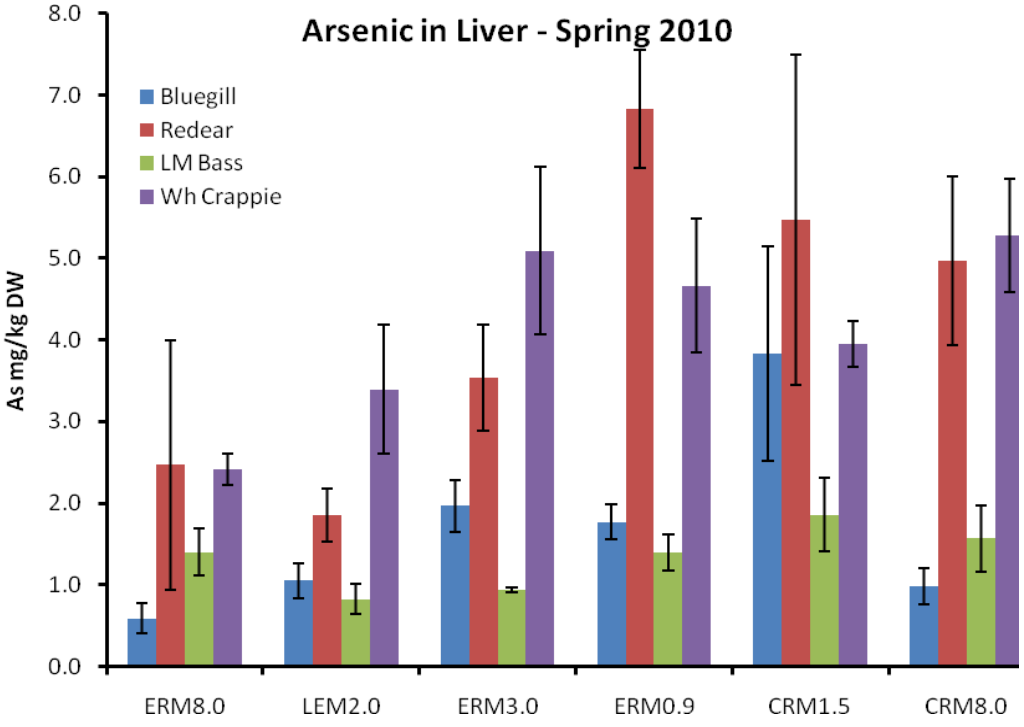

Figure 7. Spatial pattern of arsenic levels in livers of 4 fish species at 6 sample sites during Spring 2010.

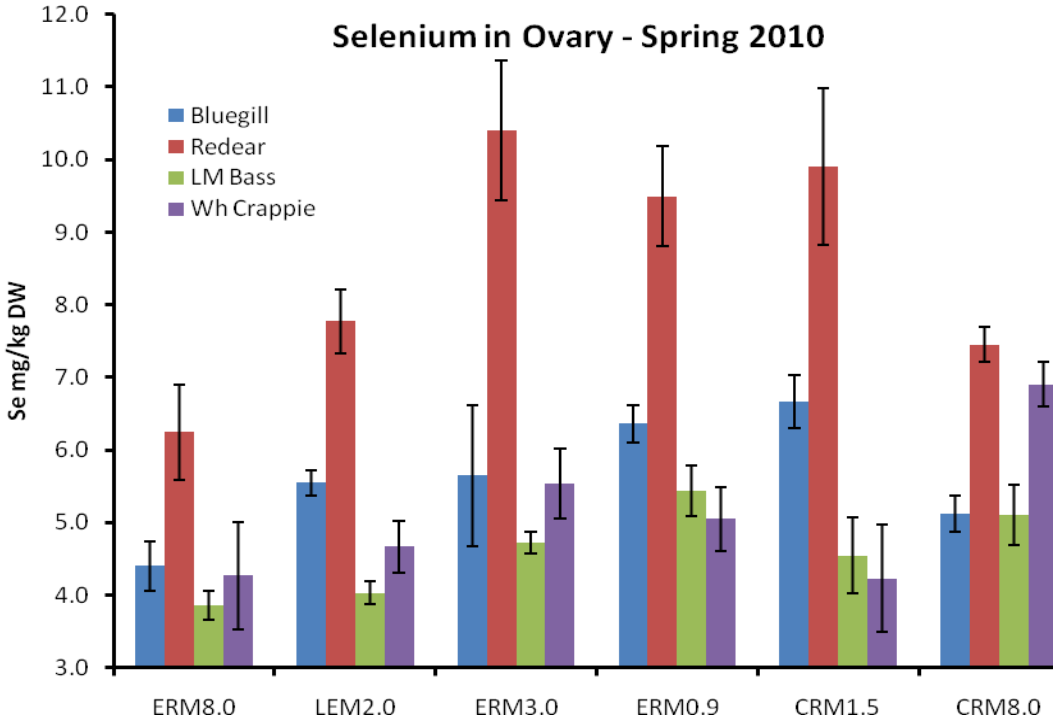

Figure 8. Spatial pattern of selenium in the ovaries of 4 fish species at 6 sample sites during Spring 2010.

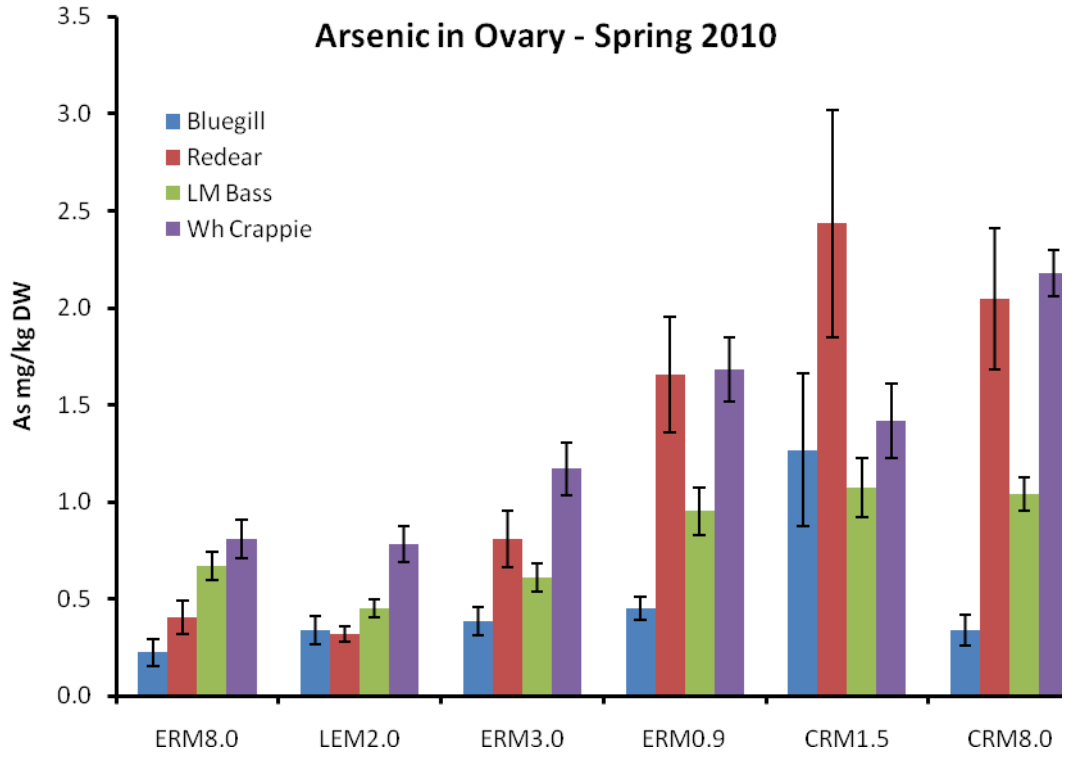

Figure 9. Spatial pattern of arsenic in the ovaries of 4 fish species at 6 sample sites during Spring 2010.

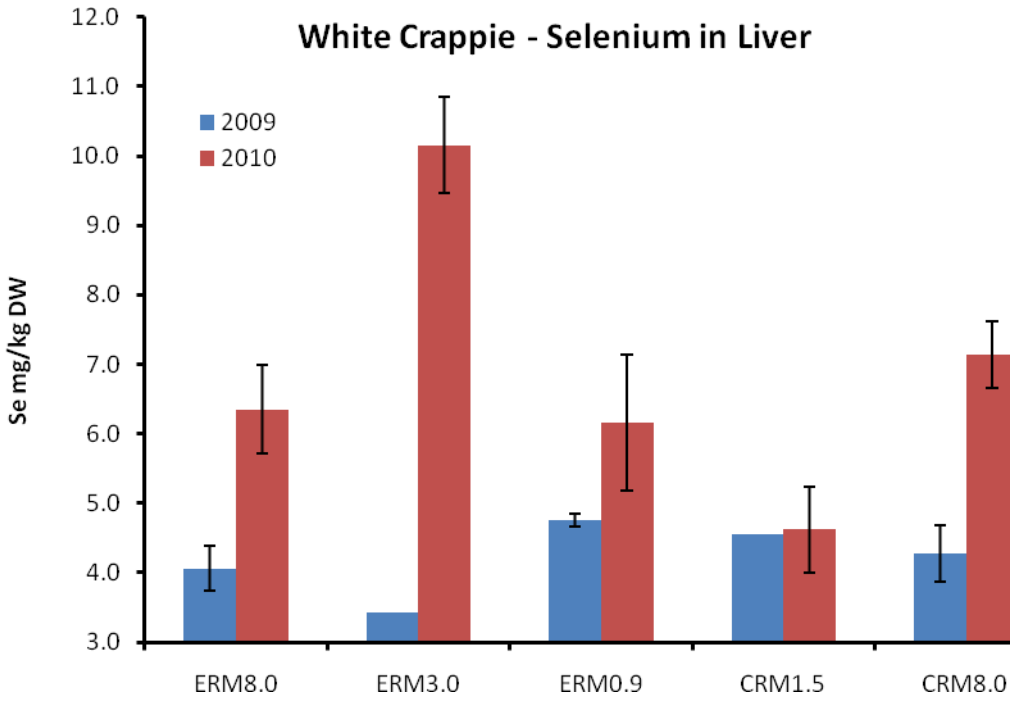

Figure 10. Levels of selenium in the livers of white crappie at 5 sample sites during Spring 2009 and Spring 2010.

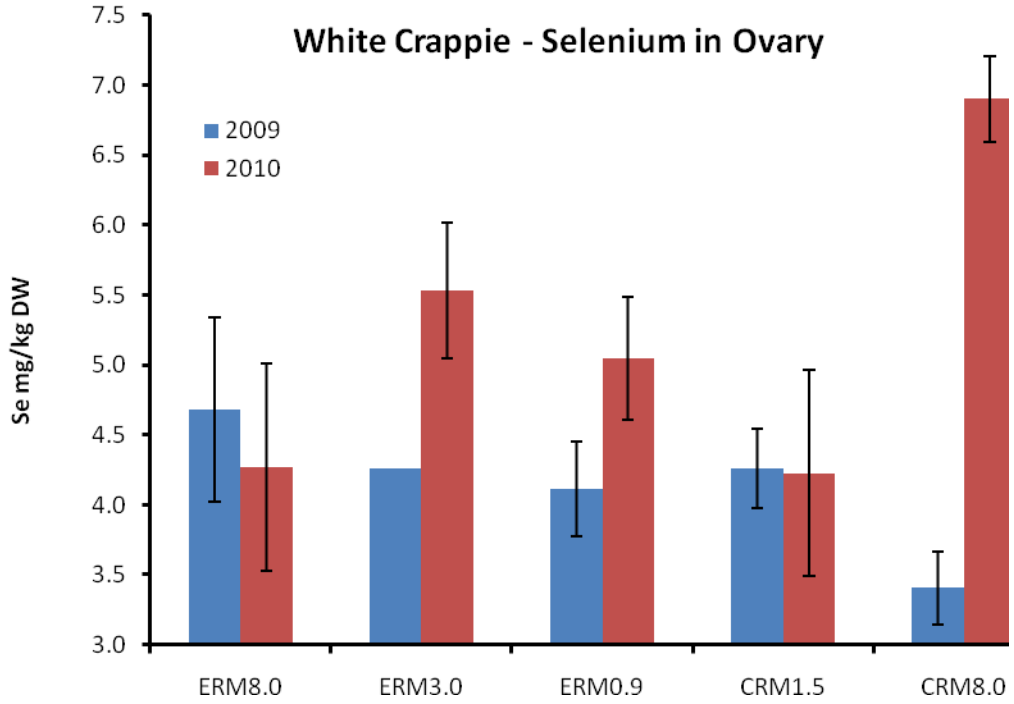

Figure 11. Levels of selenium in the ovaries of white crappie at 5 sample sites during Spring 2009 and Spring 2010.

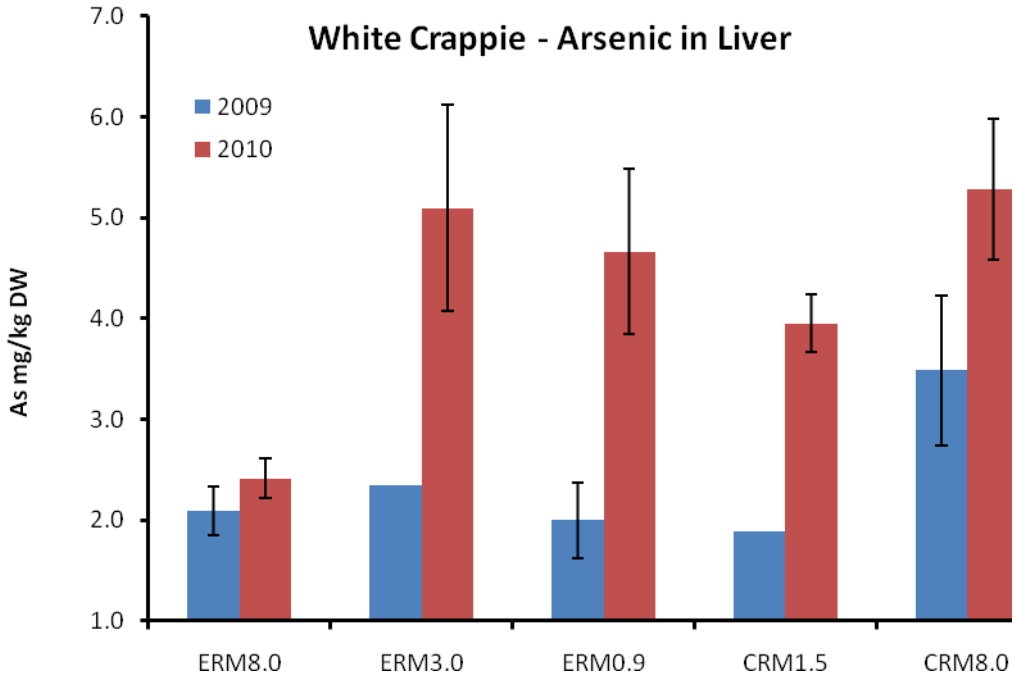

Figure 12. Concentration of arsenic in the livers of white crappie at 5 sample sites during Spring 2009 and Spring 2010.

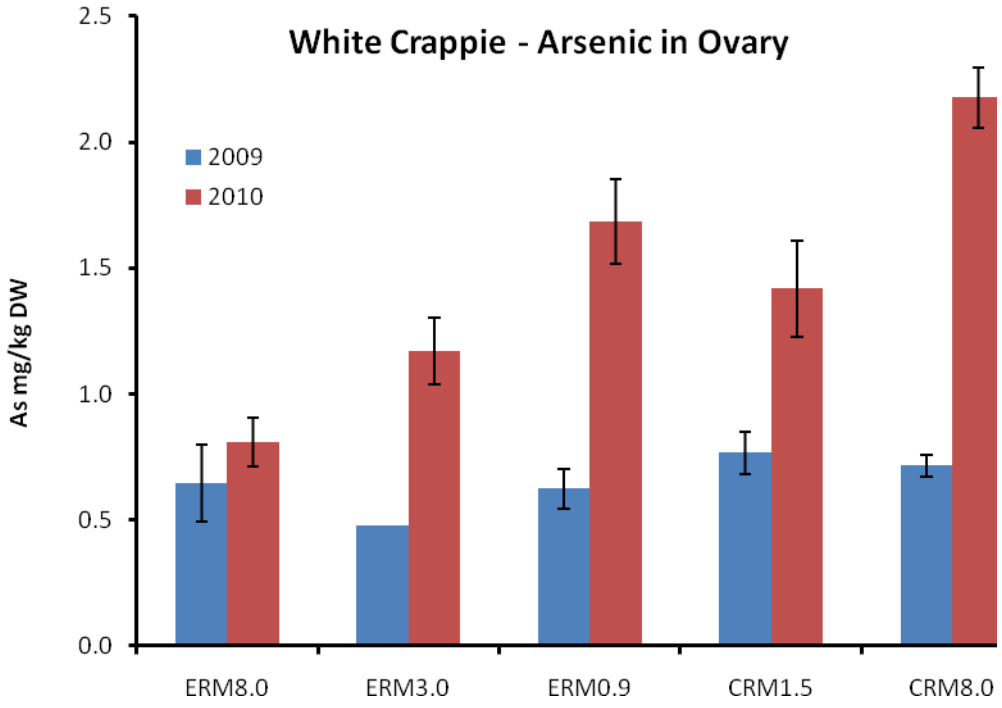

Figure 13. Concentration of arsenic in the ovaries of white crappie at 5 sample sites during Spring 2009 and Spring 2010.

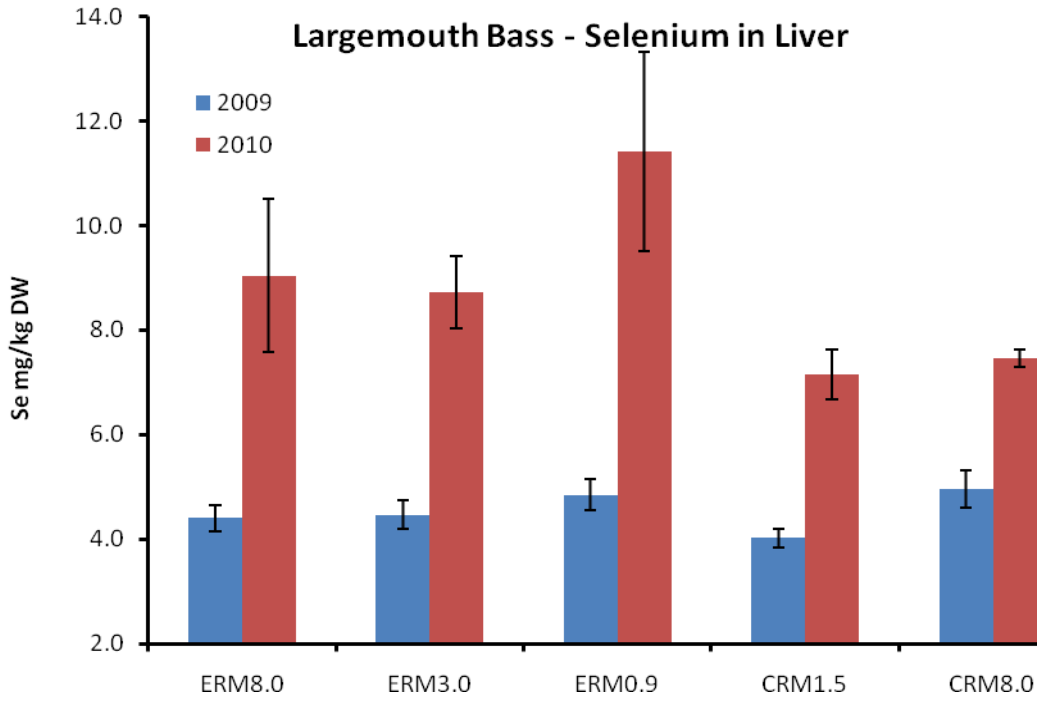

Figure 14. Concentration of selenium in the livers of largemouth bass at 5 sample sites during Spring 2009 and Spring 2010.

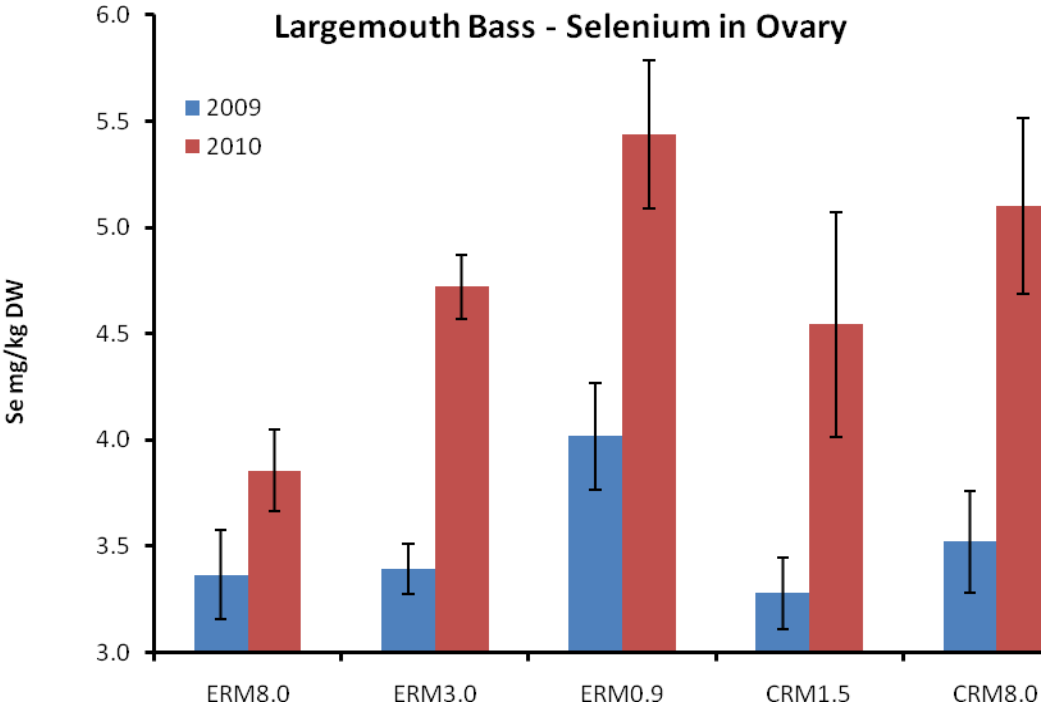

Figure 15. Concentration of selenium in the ovaries of largemouth bass at 5 sample sites during Spring 2009 and Spring 2010.

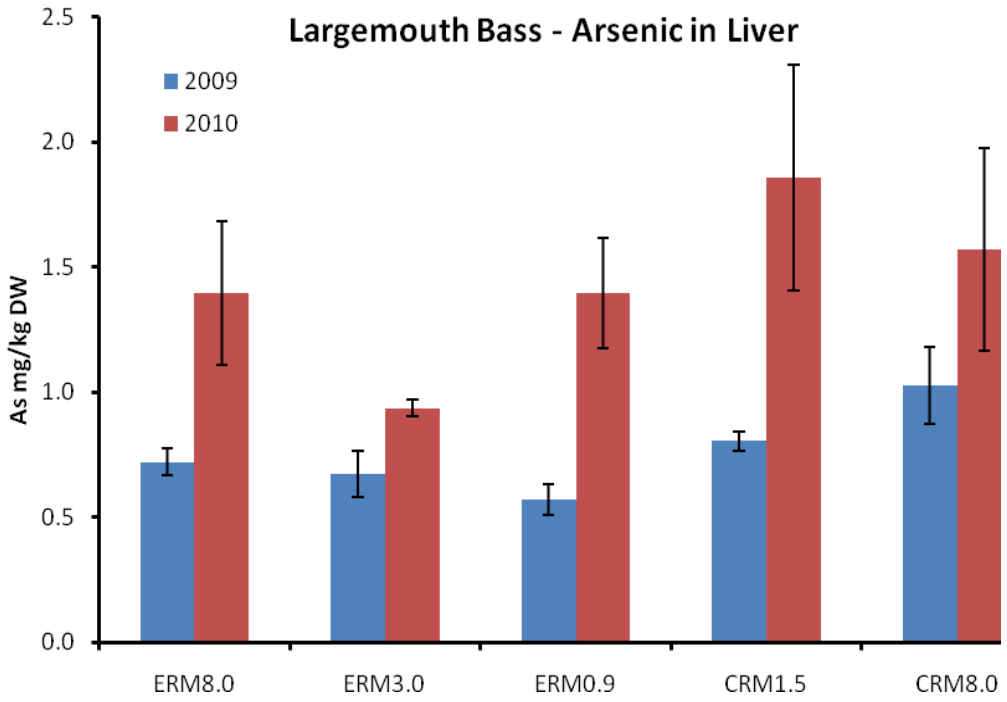

Figure 16. Concentration of arsenic in the livers of largemouth bass at 5 sample sites during Spring 2009 and Spring 2010.

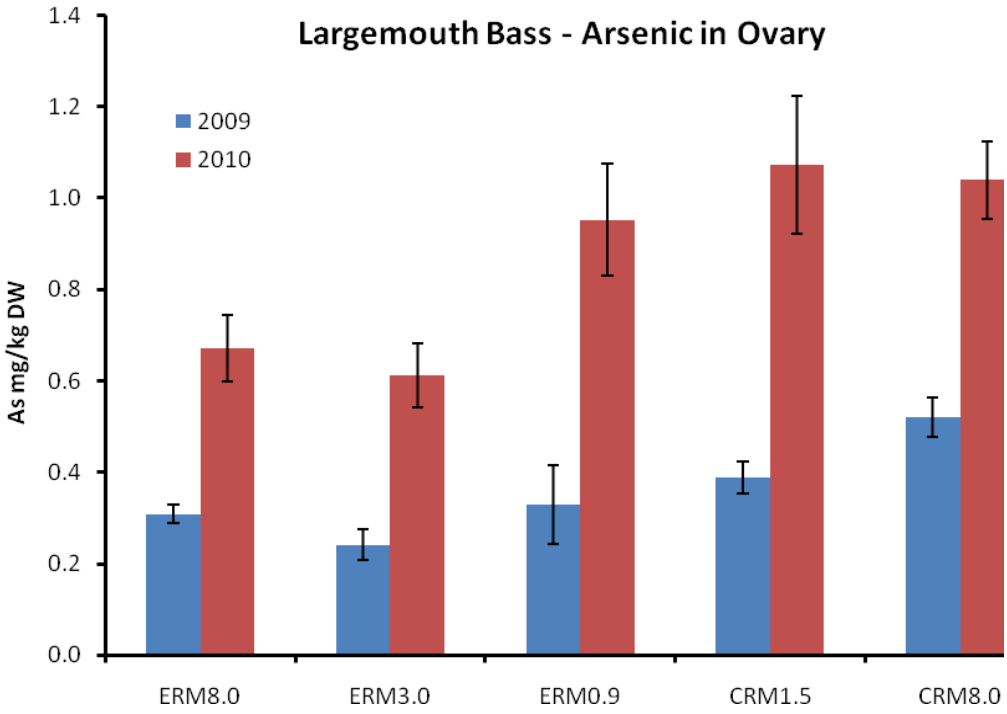

Figure 17. Concentration of arsenic in the ovaries of largemouth bass at 5 sample sites during Spring 2009 and Spring 2010.

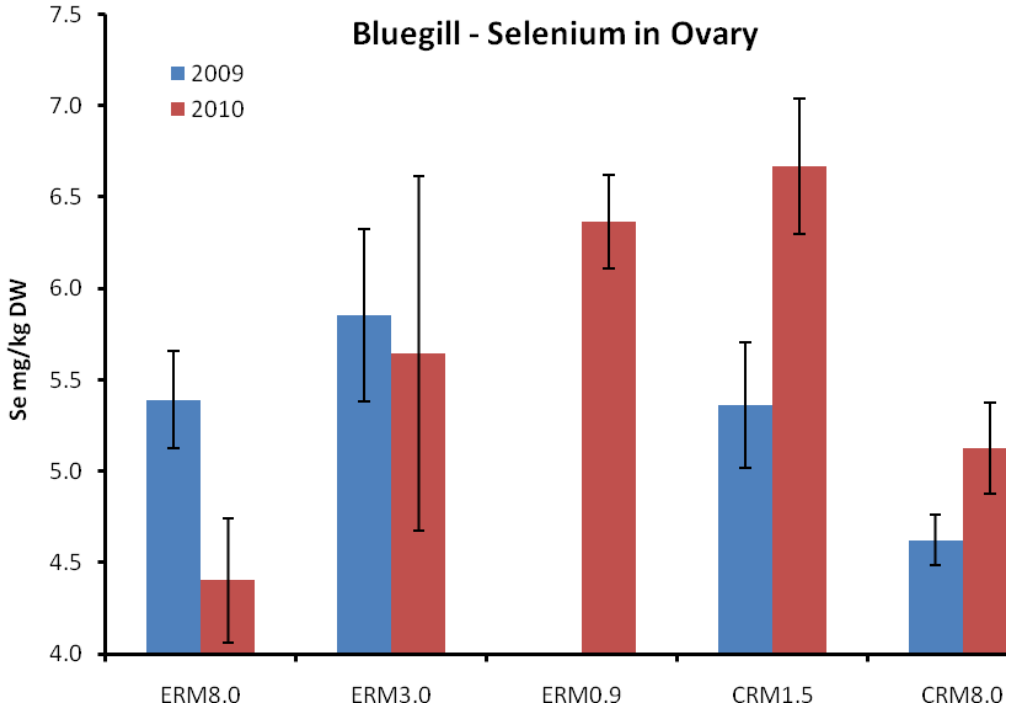

Figure 18. Concentration of selenium in the ovaries of bluegill at 5 sample sites during Spring 2009 and Spring 2010.

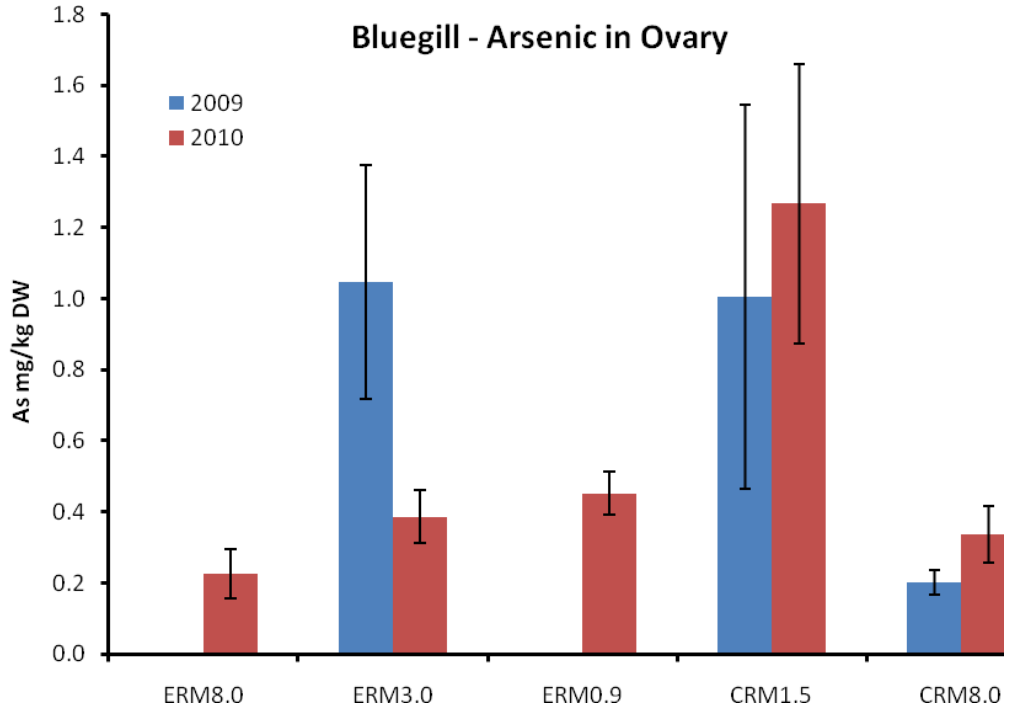

Figure 19. Concentration of arsenic in the ovaries of bluegill at 5 sample sites during Spring 2009 and Spring 2010.

3. BIOACCUMULATION - GIZZARD SHAD STUDIES

Approach

Studies on the bioaccumulation of metals in whole body gizzard shad were conducted in Spring 2009, Fall 2009, and again in Spring 2010. In Spring 2009, gizzard shad were collected at ERM 8, ERM 3, ERM 0.9, CRM 1.5, and CRM 8; in Fall 2009 shad were collected at ERM 3, CRM 1.5, CRM 8, and CRM 25, and in Spring 2010 shad were sampled at ERM 8, LERM2, ERM 3, ERM 0.9, CRM 1.5, CRM 8, and CRM 25. In Spring 2009 and Fall 2009, 24-30 gizzard shad ranging in size from 14-22 cm were collected at each site depending on availability. In Spring 2010, 50-60 shad ranging in size from 14-22 cm were collected at each site, also depending on availability at each site. For sites sampled in Spring 2009 and Fall 2009, three composite samples from each site were prepared with each composite consisting of 8-10 individual shad while in Spring 2010 six composites of 8-10 shad each were prepared for each site. In Spring 2010, three of the six composites were analyzed as whole intact shad and another three composites were analyzed as carcasses where the entire digestive tract including all organs except gonads had been removed. Also, for each site in Spring 2010, three composites were prepared that consisted of the digestive tract and organs removed from those shad in the second set of composites (carcass fish). All shad composites were ground (homogenized) by Pace. The Spring 2009 samples were analyzed for a suite of 25 metals by ALS using EPA method 6010 and the Fall 2009 and Spring 2010 samples were analyzed for 25 metals by Pace using EPA method 6020.

Since the Spring 2009 samples were analyzed by the ALS lab using method 6010, which was demonstrated by the Round Robin Study to result in higher selenium values than method 6020, a correction factor was applied to the Spring 2009 shad data to adjust for this discrepancy. The correction factor was calculated based on split lab samples of muscle tissue from three other fish species collected during the Fall 2009 sampling. The difference in the Pace and ALS values was calculated and a correction factor determined. A final correction factor was calculated based on the average difference in the Pace and ALS values for each species and applied to the Spring 2009 shad data. The shad metal results are presented in this report in both a spatial and temporal format.

Results

Spatial Patterns

Selenium levels in whole shad composites in Spring 2009 were similar among sites ranging from ~2.3 mg/kg DW to 3.4 mg/kg DW with shad from ERM 8 having the highest values (Fig. 20). Arsenic levels were also somewhat similar among sites with levels ranging between 0.6 mg/kg DW at CRM 8 to 1.8 mg/kg DW at ERM 0.9 (Fig. 20). Interestingly, selenium levels in muscle tissue of largemouth bass in Spring 2009 were about the same (ranging between 2.7-3.0 mg/kg DW) as selenium in whole shad which are the primary prey of largemouth bass in most TVA reservoirs (Figs. 20 and 27). In addition, arsenic levels in whole shad were in approximately the same range as arsenic levels in muscle tissue of largemouth bass in Spring 2009 (Fig. 20 and Fig. 28).

Selenium levels in whole shad composites in Fall 2009 displayed much higher variability among sites than they did during Spring 2009, ranging from a low of about 2.2 mg/kg DW at CRM 8 to about 4.5 mg/kg DW at ERM 3 (Fig. 21). A similar spatial pattern is also evident for arsenic with the highest levels at ERM 3 and generally decreasing downstream (Fig. 21). Bioaccumulation of selenium in shad was somewhat higher at ERM 3 in Fall 2009 than in Spring 2009 but levels in shad at the other sites were similar between the two seasons. Arsenic was generally higher at most sites in Fall 2009, particularly at ERM 3 compared to Spring 2009. Except for slightly higher levels in shad at ERM 3.0, levels of selenium in muscle tissues of largemouth bass across sites during Fall 2009 were generally in the same range of selenium in whole shad collected during the same period (Figs. 29 and 21). Levels of arsenic in largemouth bass muscle tissues, however, were generally lower than in whole shad during the same period (Figs. 21 and 30). Levels of selenium in whole shad among sites in Spring 2010 were not much

different from those in Spring 2009 except for a slight elevation at CRM 8 (note: CRM 25 not sampled in Spring 2009) (Figs.20 and 22).

Temporal Patterns

Selenium levels in whole body shad were somewhat similar across the three seasons at most sites (Fig. 23). Excluding CRM 25 which may be influenced by the Bull Run facility upstream, and except for a large elevation in selenium in Fall 2009 at ERM 3.0 and a slight increase during Spring 2010 at CRM 8.0, selenium levels among seasons and sites consistently ranged between 2.0 and 3.0 mg/kg DW (Fig. 23). Even though variability in selenium levels of largemouth bass was greater among sites compared to the variability of selenium among sites for shad, and except for elevated levels of selenium at 3 sites downstream of the spill in Fall 2010, selenium in largemouth bass also generally ranged between 2.0-3.5 mg/kg DW over sites and seasons (Fig. 37). Temporal patterns of arsenic, however, displayed somewhat higher variability among seasons and sites than did selenium (Fig. 24). At ERM 3, CRM 1.5, and CRM 8, levels of arsenic in whole shad increased over the three seasons while at ERM 8 and ERM 0.9 levels remained similar between Spring 2009 and Spring 2010 (Fig. 24). Except for arsenic in shad at ERM 3.0 during Fall 2009 and Spring 2010, arsenic in shad ranged from < 1.0 to ~2.0 mg/kg DW over sites and seasons. However, temporal patterns in levels of arsenic were generally lower in largemouth bass than shad ranging from about 0.5 to 1.4 mg/kg DW over sites and seasons. It appears, therefore, that spatial and temporal patterns in levels of selenium are similar between shad and largemouth bass but somewhat different between these two species for arsenic.

Spring 2010 Special Studies

Adult gizzard shad are considered facultative detritivores primarily because they are benthic feeders consuming detritus, algae (periphyton and associated small macroinvertebrates), and any associated sediment material including deposited coal ash. Since gizzard shad are primarily benthic feeders and therefore have intimate contact with the sediments including coal ash, and they are also the primary prey of many piscivorous fish such as largemouth and striped bass (*Morone saxatilis*), a special bioaccumulation study was conducted on shad in Spring 2010 to determine the relative contribution of shad to metal bioaccumulation in the food chain. As described in the Approach section, at each site composites of whole shad, shad carcasses (whole shad minus digestive tract), and digestive tracts were analyzed for the normal suite of 25 metals. Also for this study, two additional sites including CRM 3.5 and ERM 4.5 were added to the normal suite of sample sites.

Levels of selenium in whole shad (blue line) and carcasses (red line) tracked each other relatively closely across sites varying within +/-0.8 mg/kg DW around a mean of ~2.0mg/kg DW (Fig. 25). Selenium levels in carcasses were slightly lower than those of whole shad due to the absence of the digestive tract and its food contents. Levels of selenium in the digestive tract (green line) varied between 3.0 and about 11.0 mg/kg DW with the highest levels at CRM 8.0. Except for CRM 8, levels of selenium in the digestive tract varied between 3-6 mg/kg DW across sites which represent levels that are 1.5 to 3 times higher than in whole bodies and carcasses (Fig. 25). Levels of arsenic in whole shad and in carcasses also tracked each other relatively closely across sites varying within +/-1.0 mg/kg DW around a mean of about 1.7 mg/kg DW (Fig. 26).

Discussion and Interpretation

Several interesting trends are obvious from the spatial and temporal patterns in selenium and arsenic (Figs. 20-24) and also from the results of the special shad studies conducted during Spring 2010 (Figs. 25 & 26). In all three seasons, levels of selenium and arsenic were somewhat similar among sites except for some slight elevations at ERM 3 during Fall 2009 (Figs. 23 & 24). Selenium levels in whole body shad were remarkably similar across the three seasons at most sites. Relatively consistent levels of selenium and arsenic bioaccumulation in whole body shad over sites and seasons suggests that these metals may be bioaccumulated at consistently the same levels or at stable levels irrespective of the amounts of these metals in the environment. Over the period from Spring 2009 through Fall 2010, there was not a definitive spatial pattern that demonstrated increased selenium bioaccumulation in shad at sites below the

ash spill even though such patterns were observed in the other fish species studied (Figs. 29-42). Arsenic, however, generally increased in the whole body of shad at ERM 3, CRM 1.5 and CRM 8. Another interesting finding is that levels of selenium in the muscle tissues of largemouth bass, which feed primarily on shad, were in the same range of selenium found in shad (Figs. 23 and 37). Since bioaccumulation of selenium is similar in largemouth bass and shad, and levels of selenium did not increase appreciably in shad over the study period, we conclude that (1) selenium may not be differentially or efficiently bioaccumulated in gizzard shad through the food chain, and 2) because this metal is not being bioaccumulated to levels in shad that reflect the apparent bioavailability of metals in the environment (i.e., as shown in the other fish species), levels in largemouth bass do not necessarily reflect bioavailability in the environment because shad are the predominant prey of largemouth bass.

The special shad studies conducted during Spring 2010 also support the results of the spatial and temporal studies conducted with shad from Spring 2009 through Fall 2010. Levels of selenium and arsenic in whole shad and shad carcasses tracked each other fairly consistently over sites, averaging around 2.0 +/- 0.8mg Se/kg DW and 1.7 +/- 1.0mg As/kg DW. However, levels of these two metals in the digestive tract, which includes the food contents, varied between 3-11 mg Se/kg DW and 3-6 mg As/kg DW. Since adult gizzard shad are primarily benthic feeders, relatively high variability of selenium and arsenic in food contents of the digestive tracts among sites suggest that such variability may reflect the spatial heterogeneity of these metals over the aerial extent of the benthic sediments in the Emory and Clinch Rivers. Since the levels of selenium in the gut averaged about 2-3 times higher than in the whole body and carcass, and levels of arsenic averaged about 2-4 times higher than in whole body and carcass, this pattern suggests that the gut contents, which are laden with relatively high levels of Se and As, are not being efficiently incorporated into shad tissue. There are several possible explanations as to why As and Se in the digestive tract may not be incorporated efficiently into the whole body tissues of shad. First, if a high percentage of the metal loading in the digestive tract is associated with the inorganic ash particles themselves, this material would not be processed and assimilated as efficiently as organic material thus bioavailability and incorporation into tissues would be expected to be relatively low. In addition, the solubility of selenium and arsenic compounds depends on a variety of factors such as pH of the digestive tract, therefore, the pH and redox of the gut may not be conducive relative to optimizing the solubility and transport of these metals across biological membranes.

Another possibility that may explain, in part, the inefficient incorporation of As and Se into shad tissue from the digestive tract is related to the unique chemistry of coal ash and the presence of sorption substrates. Coal ash is primarily a silica-based material with substantial amounts of calcium, and such material also contains some iron and aluminum oxides as sorption substrates. The relatively high percentage of various inorganic sorption substrates in the digestive tract of shad would therefore act to retard the maximum solubility of selenium into biological tissues. Large differences in the levels of selenium and arsenic between the digestive tract and the whole body and carcass could be primarily due to a mass balance consideration. For example, even though levels of these two metals are 2-4 times higher in the digestive tract than in body tissues, the excised gut and its contents accounts for approximately 15% of the total body weight of the shad depending on the amount of material in the digestive tract. Assuming, therefore, that the digestive tract is approximately one-sixth of the total weight of a shad, a mass balance calculation reveals that less than half of the difference in the selenium concentration between the digestive tract and the carcass and whole body tissues can be accounted for by the weight of the digestive tract and its contents alone.

Summary and Synthesis

The major summary points for the shad studies are:

1) In all three seasons, levels of selenium and arsenic in whole body shad were somewhat similar among sites except for some slight elevations at ERM 3 and CRM 1.5 during Fall 2009.
2) Selenium levels in whole body shad were remarkably similar across the three seasons at most sites.
3) Relatively consistent levels of selenium and arsenic bioaccumulation in whole body shad over sites and seasons suggests that these metals may be bioaccumulated at consistent or stable rates irrespective of levels of these metals in the environment.
4) It appears that selenium and arsenic are not being differentially or efficiently bioaccumulated in gizzard shad.
5) Levels of selenium in the muscle tissues of largemouth bass, which feed primarily on shad, were generally in the same range as these metals in shad.
6) It also appears that selenium and arsenic are not being highly bioaccumulated in largemouth bass because of the relatively low levels of these metals in shad.
7) Even though levels of Se and As in the digestive tracts of shad were 1.5-3 times higher than in the muscle tissues, these metals appear not to have been efficiently incorporated into body tissues from the gut due to several possible reasons described in the discussion and interpretation section.

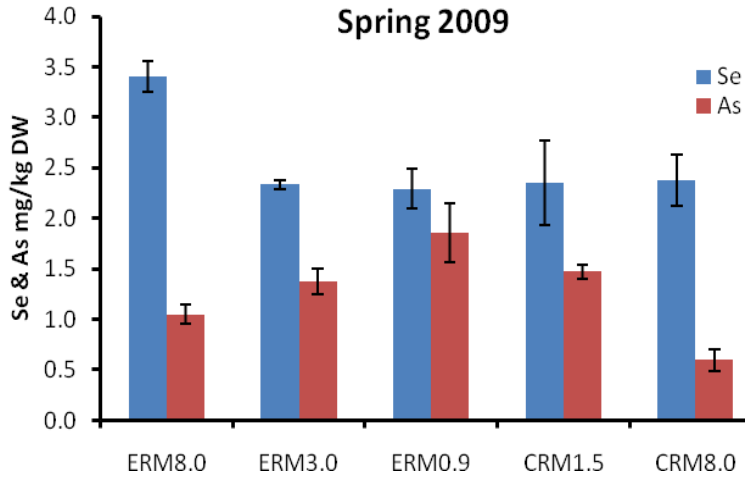

Figure 20. Levels of selenium and arsenic in the whole body of gizzard shad at 5 sample sites during Spring 2009.

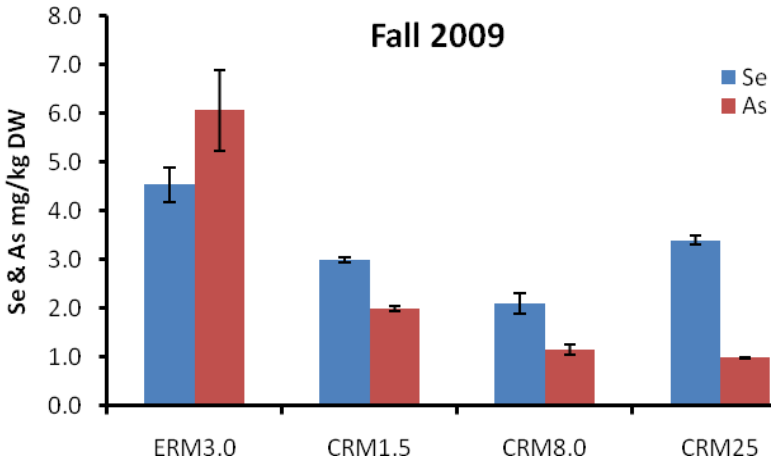

Figure 21. Levels of selenium and arsenic in the whole body of gizzard shad at 4 sample sites during Fall 2009.

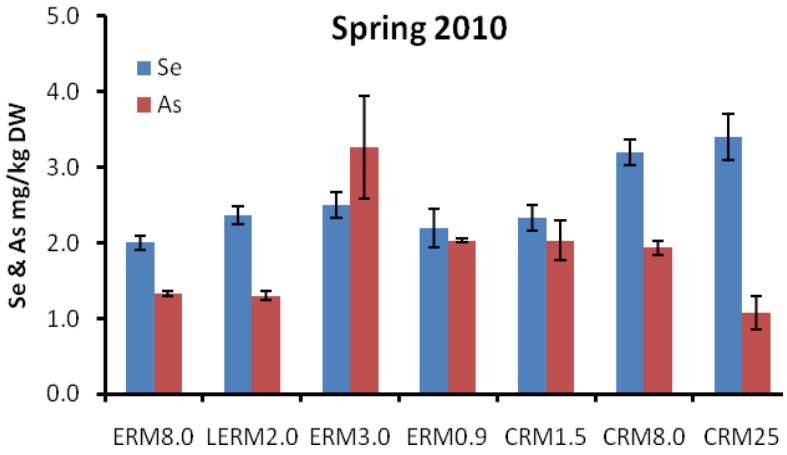

Figure 22. Levels of selenium and arsenic in the whole body of gizzard shad at 7 sample sites during Spring 2010.

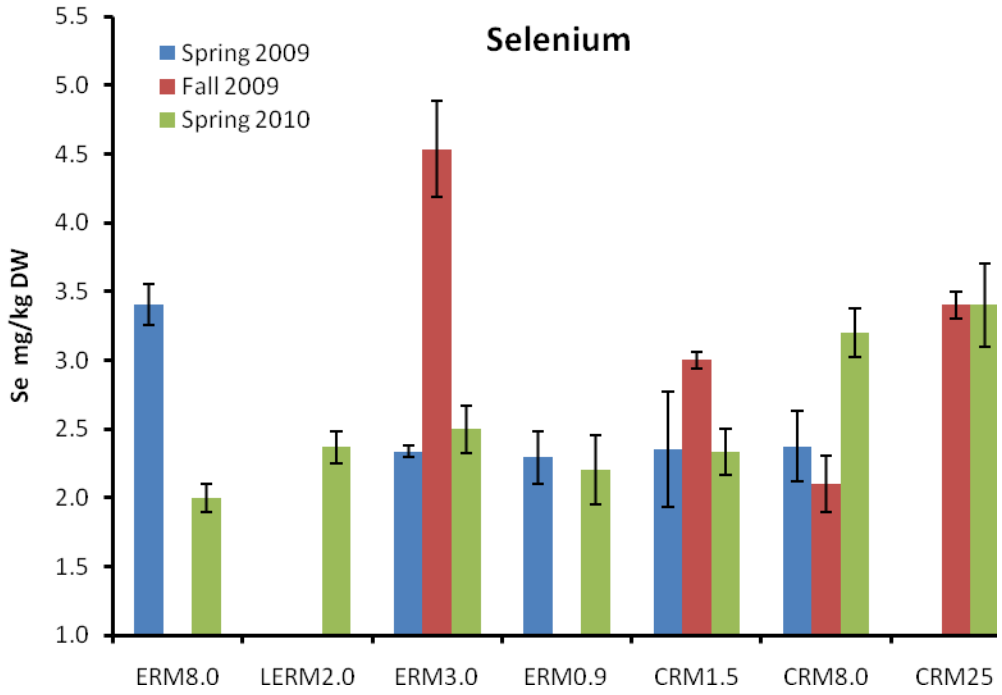

Figure 23. Temporal pattern in the levels of selenium in whole body gizzard shad at 7 sample sites.

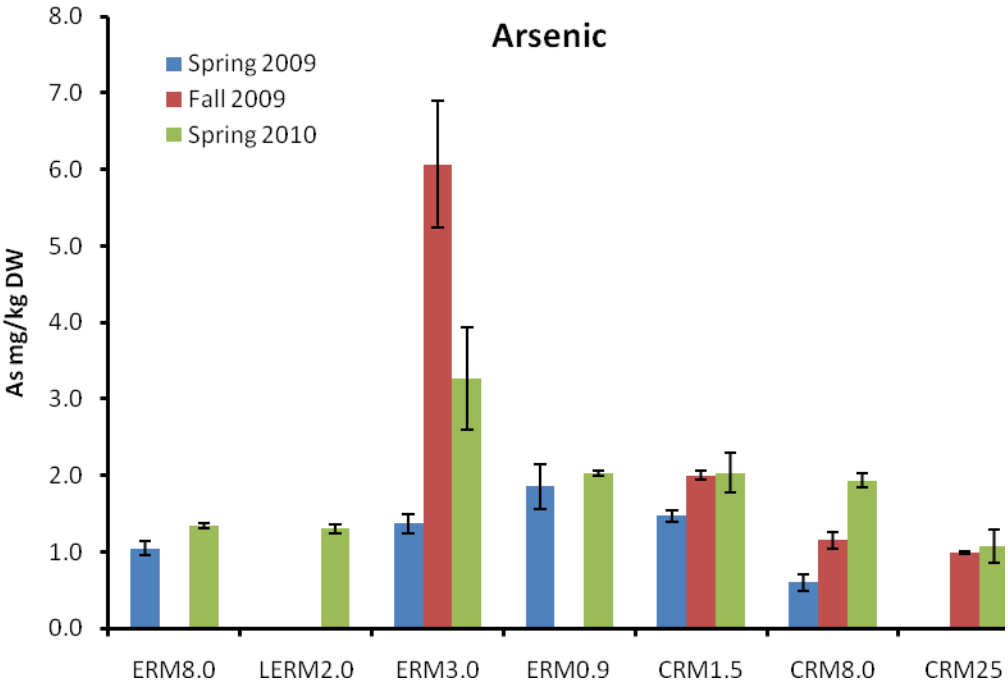

Figure 24. Temporal pattern in the levels of arsenic in whole body gizzard shad at 7 sample sites.

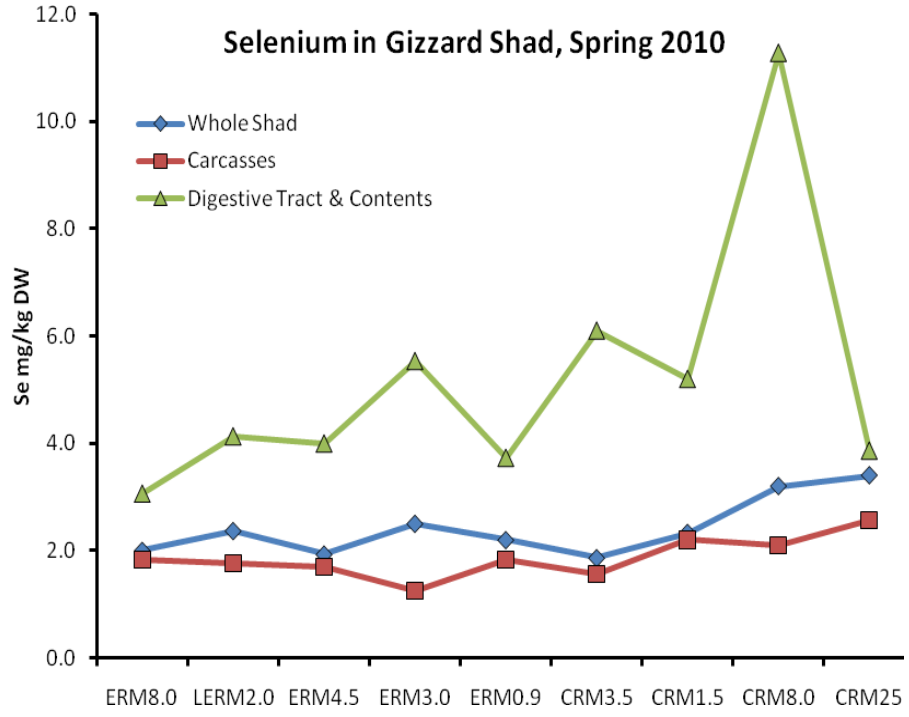

Figure 25. Bioaccumulation of selenium in the whole body, carcass, and digestive tract (gut contents + organs-gonad) of gizzard shad at 9 sites during Spring 2010.

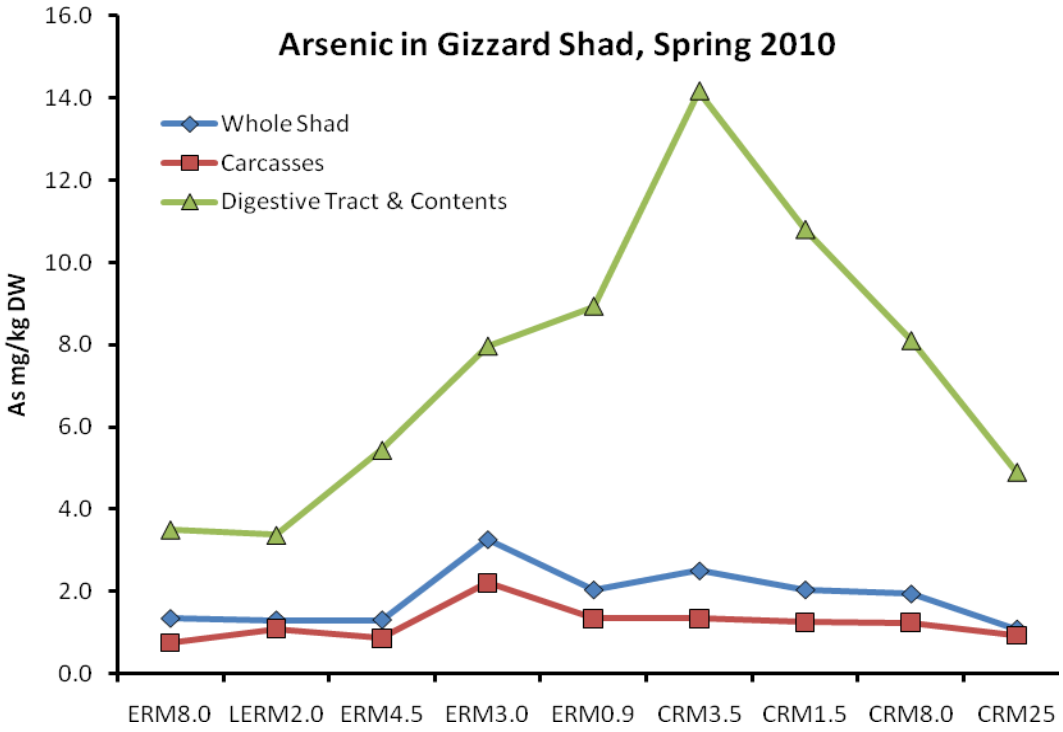

Figure 26. Bioaccumulation of arsenic in the whole body, carcass, and digestive tract (gut contents + organs-gonad) of gizzard shad at 9 sites during Spring 2010.

4. BIOACCUMULATION - MUSCLE TISSUE (FILLETS)

Approach

Bioaccumulation studies of metals in fillets or muscle tissue were conducted in Spring 2009, Fall 2009, Spring 2010, and Fall 2010. Spring sampling was conducted in April and May of both years in conjunction with the fish health and reproductive studies. The Fall studies were conducted from late September through early November of both years. In Spring 2009, largemouth bass, bluegill and white crappie were collected at ERM 8 (upstream reference), ERM 3, ERM 0.9, CRM 1.5, and CRM 8. In Spring 2010 largemouth bass, bluegill, white crappie, and redear sunfish were collected at ERM 8 (upstream reference), LERM2 (upstream reference), ERM 3, ERM 0.9, CRM 1.5, and CRM 8. In Fall 2009 and 2010 bluegill, largemouth bass, and channel catfish were collected at the same sample sites as in Spring 2009. At each site and for each species and sampling period, the goal was to collect eight individuals of each species, however, in a few cases the target goal of eight individuals per site could not be achieved because of unavailability at a site of some species such as white crappie. Immediately upon collection by boat electrofishing, a blood sample was taken from each fish and a tag with a unique five digit identification number was affixed to each individual fish. They were then placed in a live well onboard the boat, and subsequently transported, alive in aerated coolers, to ORNL for bioaccumulation and fish health processing. The fish were processed for a variety of individual health indicators, the livers and ovaries harvested for metals analyses, and six individuals of each species filleted for metals analyses of muscle tissues. Fillets from all species during all four seasons were analyzed by Pace for a suite of 25 metals using EPA method 6020.

Based on preliminary results from the baseline studies which included fish collected primarily by TWRA in January and February 2009, only two metals, selenium and arsenic, appeared to be elevated above background or reference levels. In addition, bioaccumulation studies of bluegill and carp collected from the Stilling Pond (which would represent a worst case situation for bioaccumulation) in April 2009 revealed that selenium and arsenic were the only two metals elevated above background levels in muscle tissue. Also, selenium and arsenic are two of the metals in coal ash that are known to bioaccumulate and cause toxicity in various wildlife species including fish and birds. For example, selenium at high concentrations is known to cause reproductive and developmental anomalies in fish and birds. Based on the fact that selenium and arsenic were elevated in the baseline samples and in fish from the Stilling Pond and also known to cause toxicity in wildlife, these two metals have been the focus of our fish bioaccumulation and health studies. In addition, we also conducted an analysis of the other metals and these results are presented in Section 6.

The muscle (fillet) data in this report are presented in both spatial and temporal formats. For the spatial presentations, levels of selenium and arsenic in four species are presented separately for each of the four seasons. For the temporal presentation, data are presented by species for both selenium and arsenic over the four seasons (Spring 2009, Fall 2009, Spring 2010, Fall 2010).

Results

Spatial Patterns - Spring 2009

Levels of selenium in muscle tissue during Spring 2009 for bluegill and largemouth bass were lowest at the upstream Emory River reference site (ERM 8), increased to a high at ERM 3, and then gradually decreased downstream (Fig. 27). Selenium in white crappie fillets also increased at the two ash spill sites (ERM 3 and 0.9) and decreased downstream (Fig. 27). Bioaccumulation of arsenic in bluegill during Spring 2009 basically followed a similar spatial pattern to that of selenium with the lowest values at the upstream reference site and then increased downstream at the ash spill sites. Levels of arsenic in largemouth bass and white crappie, however, also increased somewhat downstream of the reference site but did not decrease at the two Clinch River sites (Fig. 28).

Spatial Patterns - Fall 2009

For all three species (bluegill, largemouth bass, channel catfish) selenium levels were generally lower at the two upstream reference sites and highest immediately downstream of the spill. For bluegill, selenium at CRM 1.5 remained at about the same levels as at the two Emory sites below the spill, but in catfish and bass, selenium decreased somewhat at this site compared to the two lower Emory River sites (Fig. 29). Across sites, selenium was highest in bluegill, followed by intermediate levels in bass, and the lowest levels were observed in catfish (Fig. 29). Bioaccumulation of arsenic in muscle tissue displayed somewhat of the same spatial pattern in bluegill and bass as did selenium with the lowest levels at the upstream reference, increasing downstream in the Emory River below the spill, and then maintaining relatively high levels at the two Clinch River sites without an obvious downstream decrease (Fig. 30). Levels of arsenic for catfish at sites upstream of the spill were too low for analytical detection.

Spatial Patterns - Spring 2010

Selenium levels in muscle tissue displayed similar spatial trends among the four fish species during Spring 2010. Basically, levels were generally lower at the upstream reference sites, highest at the two sites in the Emory downstream from the spill, and decreased at CRM 1.5 for white crappie and LMB even though values remained high at CRM 1.5 for bluegill and redear at this site (Fig. 31). Across all sites, selenium levels were highest in redear, followed by bluegill, largemouth bass, and then white crappie. Even though the spatial pattern in arsenic was somewhat similar to selenium across sites, there were some slight differences demonstrated among species. Redear, white crappie, and bass displayed the lowest levels at the two upstream reference sites with the highest levels downstream at ERM 0.9 and CRM 1.5 (Fig. 32). Levels of arsenic in bluegill, however, were similar among sites except for a relatively large increase at CRM 1.5 (Fig. 32).

Spatial Patterns - Fall 2010

As was also observed for the Spring 2010 spatial patterns, selenium levels in muscle tissue displayed similar spatial trends among the three species even though absolute levels were different (Fig. 33). Bioaccumulation of selenium was generally lowest in all three species at the two reference sites, increased downstream of the spill peaking at CRM 1.5 for bluegill and bass, and remained at a constant level below the spill for catfish. Bioaccumulation across sites was highest in bluegill and lowest in channel catfish. The spatial pattern of arsenic in the three species was somewhat similar to that observed for selenium with values lowest at the two reference sites, increasing below the spill, and then decreasing somewhat at CRM 1.5 for bluegill and bass (Fig. 34). One major difference in the spatial patterns of selenium and arsenic for the three species is that selenium generally remained high at CRM 1.5 while arsenic decreased somewhat for bluegill and bass at CRM 1.5. Another major difference between the spatial patterns of selenium and arsenic for the three species is that selenium was higher in bluegill than in bass while arsenic was lower in bluegill than in bass. Levels of arsenic in catfish at the two reference sites were below detection limits and thus could not be plotted in Fig. 34.

Temporal Pattern - Bluegill

The temporal pattern of selenium in bluegill within sites was relatively consistent over the four seasons from Spring 2009 through Fall 2010 (Fig. 35). Levels at the two reference sites (ERM 8 and LERM 2) were the lowest and also similar over time except for a spike in Spring 2010 at ERM 8. Selenium levels at ERM 3, ERM 0.9, and CRM 8 were very similar over time while there was a relatively large increase at CRM 1.5 during Fall 2010. Temporal trends of arsenic in bluegill across each site were not as consistent among seasons as was observed for selenium and the variability around the mean was also greater than that observed for selenium (Fig. 36). Arsenic levels increased at three sites (ERM 3, ERM 0.9, CRM 1.5) during 2010 (Spring and Fall together) compared to 2009. The missing histograms in Fig. 35 indicate that arsenic was below the analytical detection limits in those particular samples especially at the two reference sites.

Temporal Pattern - Largemouth Bass

As was also observed for selenium in bluegill, selenium in largemouth bass demonstrated a relative consistent pattern over the four seasons at most sites (Fig. 37). Except for Spring 2009 at ERM 8 and CRM 8, the temporal patterns in the levels of selenium were fairly similar at all sites except CRM 1.5. Selenium in Fall 2010 had the largest increase at CRM 1.5 compared with levels in previous seasons at this site. Surprisingly, bioaccumulation of arsenic in largemouth bass demonstrated a more consistent temporal pattern than that observed for bluegill (Figs. 36 & 38). Levels of arsenic were the lowest at the two reference sites and increased downstream, even maintaining relatively high and consistent levels at the positive control site, CRM 8. Arsenic did have a relatively large increase at ERM 0.9 in Spring and Fall 2010 but was relatively consistent among seasons at the other sites.

Temporal Pattern - Channel Catfish

Channel catfish are only sampled in the Fall, therefore only two seasons, Fall 2009 and Fall 2010, are available for temporal comparison. During both seasons, levels of selenium in catfish were lowest at ERM 8 and highest at the three sites downstream of the spill (Fig. 39). Even though there were slight increases in selenium at three sites in Fall 2010, these increases were not substantially higher than levels in Fall 2009. Because levels of arsenic were so low in catfish and many samples were below the analytical detection limits, several missing data points (histograms) are evident in Fig. 40. However, arsenic levels in catfish were higher at three sites in Fall 2010 compared to Fall 2009.

Temporal Pattern - White Crappie

White crappie were sampled in the Spring of 2009 at five sites and in the Spring of 2010 at six sites. In Spring 2009 selenium was higher at four sites than during 2010 with levels at ERM 4.5 being similar both years (Fig. 41). Also during both years, levels of selenium at the reference site (ERM 8) were lower than at ERM 3, but not lower than at ERM 0.9. Arsenic displayed more of a distinct downstream gradient in muscle tissue of white crappie than did selenium with levels being lowest at the two reference sites, and increasing downstream (Fig. 42). It appears, therefore, that white crappie may be better indicators of arsenic levels of in the environment than they would be of selenium levels. Such differences in spatial gradients in selenium and arsenic in white crappie could be due to variations in food habits and also to the fact that few white crappie could be collected from the lower Emory River sites due to the poor habitat for crappie in this reach of the river.

Interpretation and Discussion

Spatial and Temporal Patterns

Because the three main study species demonstrated distinct spatial gradients in bioaccumulation of selenium and arsenic over all four seasons, such patterns provide reasonable evidence that a causal relationship may exist between presence of fly ash-associated metals and bioaccumulation of metals in fish along the downstream gradient of the Emory and Clinch Rivers. Establishment of possible causal relationships among environmental factors in ecological systems is based on the principles of epidemiology in human health, and when extended to ecological systems, is generally referred to as ecoepidemiology. Ecoepidemiology is the evaluation of ecological disturbances and damages in relation

to their specific causes and involves assessing the relatively probability that factors in the environment cause changes, effects, or damage, to various components of ecological systems. A causal relationship may exist between exposure and effects when evidence indicates environmental factors increase the probability of an observed effect or change in the target biological system and, conversely, a reduction in such factors decrease the occurrence of that effect or a change in the target system. Two of the main criteria for providing evidence of causal relationships in field situations are 1) biological response gradients, and 2) time order or temporality. The biological response gradient criterion involves demonstrating that there is a dose-response relationship either spatially and/or temporally within the system and the time order criterion includes evidence that the cause preceded the effect in time. Both of these criteria, and especially the biological response gradient criteria, provide evidence, based on this study, that there appears to be a causal association between the presence of fly ash-associated metals and bioaccumulation of these metals in fish tissue. Such relationships are demonstrated by the relatively strong associations between the spatial distribution of ash deposits in Emory and Clinch Rivers and levels of selenium and arsenic bioaccumulation in these fish species over the period of this study. Also, the Spring 2010 liver and organ results provide further evidence of such a possible causal relationship (Figs. 8 & 9). However, the time order or temporality criterion does not provide as strong a causal association as does the biological gradient criterion. Circumstantial evidence for this criterion is based on two levels of observations, 1) selenium and arsenic in fish livers and ovaries during the Spring 2009 did not show a definitive spatial gradient in bioaccumulation probably because such levels represented "baseline" conditions because sufficient time had not elapsed for metals to be bioaccumulated in these organs, and 2) results of the bioaccumulation studies during the baseline period (Jan-March 2009) showed little evidence of a spatial gradient in bioaccumulation. Therefore, the primary evidence for the time order criterion for causality is the relatively strong spatial patterns observed in bioaccumulation a year after the ash spill (assuming that there were a few weeks lag between the spill, exposure to fish, and bioaccumulation in the food chain).

Analysis of temporal patterns in bioaccumulation shows that levels of selenium and arsenic were relatively consistent over the four seasons at the two reference sites for the three main study species - bluegill, largemouth bass, and channel catfish. Levels of selenium in these three species at the two Emory River sites downstream of the spill were also relatively consistent over the four seasons with little indication that levels were increasing or decreasing over this period. However, relatively large increases of selenium in bass and bluegill occurred during Fall 2010 at CRM 1.5 with catfish showing a slight increase over this period. Increased levels of selenium at CRM 1.5 during the latter half of this study suggest that the major area of selenium bioaccumulation may have shifted over time downstream from the lower Emory River sites into the Clinch River below the confluence of the Emory River. We can only speculate why this may have occurred but perhaps some of the finer ash particles could have been transported downstream and settled out in the lower Clinch immediately upstream of the confluence with the Tennessee River. Past studies involving the Watts Bar/Clinch River Superfund study in the early and mid-1990s showed that fine particles and their associated contaminants tended to settle out in the area just upstream of the Tennessee River confluence with the Clinch due to a mixing zone in this area which reduced currents and thus favored deposition of finer suspended particles.

Arsenic in bass and bluegill showed similar temporal patterns to that of selenium in bluegill and bass with no apparent indication of major increases or decreases in bioaccumulation over time at any of the sites. As was also observed for selenium, arsenic levels at CRM 8 in all species remained relatively constant over time with levels of these metals being intermediate between the reference sites and those sites downstream of the spill. Thus, CRM 8 appears to function as a "positive control" site because it cannot be considered a true reference due to its proximity to legacy contamination sources which originate upstream from the DOE facilities. The observation that there have not been any major increases or decreases in bioaccumulation of selenium and arsenic in these fish species during the latter part of this study (except for perhaps Se in bass at ERM 3 and As in bass at ERM 0.9), suggest that these metals were still available in the environment and being transported through the food chain. However, since the time of the last sampling (Fall 2010) most of the ash has been removed from the Emory River and the 2011

results may show some declines in bioaccumulation in these metals particularly at the lower Emory River sites.

Bioaccumulation Patterns Among Fish Species

There are distinct differences among fish species in the amounts of selenium and arsenic that are bioaccumulated in muscle tissue. For selenium, levels are higher in bluegill, intermediate in bass, and lowest in catfish. Arsenic levels are highest in bass, intermediate in bluegill, and again, lowest in catfish. Such trends and differences among fish species were similar over seasons. Differences between these species in metal bioaccumulation is probably due to a combination of factors including feeding habits, quality and quantity of dietary items, site fidelity, and perhaps also digestive tract physiology. Bluegills sampled from the ash exposed sites were not only feeding on benthic organisms that probably had direct contact with the sediment and ash material, but the small home range of this species would also dictate that they would be more or less continually exposed to the ash within a restricted area. Largemouth bass have wider home ranges than bluegill but smaller home ranges than channel catfish and would, therefore, not necessarily be exposed to ash as consistently as bluegill. In addition, bass are piscivores, feeding almost exclusively on shad. The section on gizzard shad bioaccumulation in this report showed that whole body levels of selenium are relatively low in shad therefore bass are not ingesting food items with high levels of selenium. Differences between species in bioaccumulation of arsenic are more difficult to explain than differences in selenium but could be partially related to physiology of the digestive tract. The solubility of arsenic and therefore its bioavailability and transport through biological membranes in the digestive tract could be a function of gut pH. Bass being carnivorous, would tend have a lower pH in the gut than in less piscivorous species such as bluegill. Arsenic is known to be more soluble at circumneutral pHs compared to higher pHs which probably occur in the digestive tract of omnivorous sunfish species. Therefore, the large differences in arsenic bioaccumulation between bluegill and largemouth bass could possibly be explained, in part, by differences in the pH of the digestive track of these two fish species.

Summary and Synthesis

The major summary and synthesis points of the bioaccumulation studies for muscle tissue are:

1) All four fish species, and especially bluegill and largemouth bass, demonstrate a distinct spatial gradient in bioaccumulation of selenium and arsenic in the Emory and Clinch Rivers over all four study seasons from 2009-2010.
2) Such spatial patterns provide rather convincing evidence (based on two ecoepidemiological criteria) that there is a causal relationship between presence of fly ash-associated metals and metal bioaccumulation in fish along the downstream gradient of the Emory and Clinch Rivers.
3) Temporal patterns in bioaccumulation show that levels of selenium and arsenic were relatively consistent over the four seasons at the reference sites for the three main study species - bluegill, largemouth bass, and catfish.
4) Relatively consistent levels of metals in fish at most sites over the time period of this study (except for perhaps Se in bass at ERM 3 and As in bass at ERM 0.9), suggests that these metals were still available in the environment and being transported through the food chain. However, since the time of the last sampling (Fall 2010) most of the ash had been removed from the Emory River and the 2011 results may show some declines in bioaccumulation of these metal particularly at the lower Emory River sites.
5) Increased levels of selenium at CRM 1.5 during the latter half of this study suggest that the major area of selenium bioaccumulation may have shifted over time from the lower Emory River further downstream into the Clinch River.
6) Bioaccumulation levels of selenium and arsenic in fish at CRM 8 are intermediate between those at the reference sites and those in the Emory River downstream of the spill.
7) CRM 8 appears to serve as a “positive control” site because it cannot be considered a true reference due to its proximity to legacy contamination sources upstream of this site.

8) There are distinct differences among species in the amounts of selenium and arsenic that are bioaccumulated in muscle tissue. For selenium, levels are higher in bluegill, intermediate in bass, and lowest in catfish and, for arsenic, levels are highest in bass, intermediate in bluegill , and lowest in catfish.
9) Differences in levels of metal bioaccumulation in the species of fish studied are due to a combination of factors such as feeding habits, quality and quantity of dietary items, site fidelity, and also perhaps digestive tract physiology.

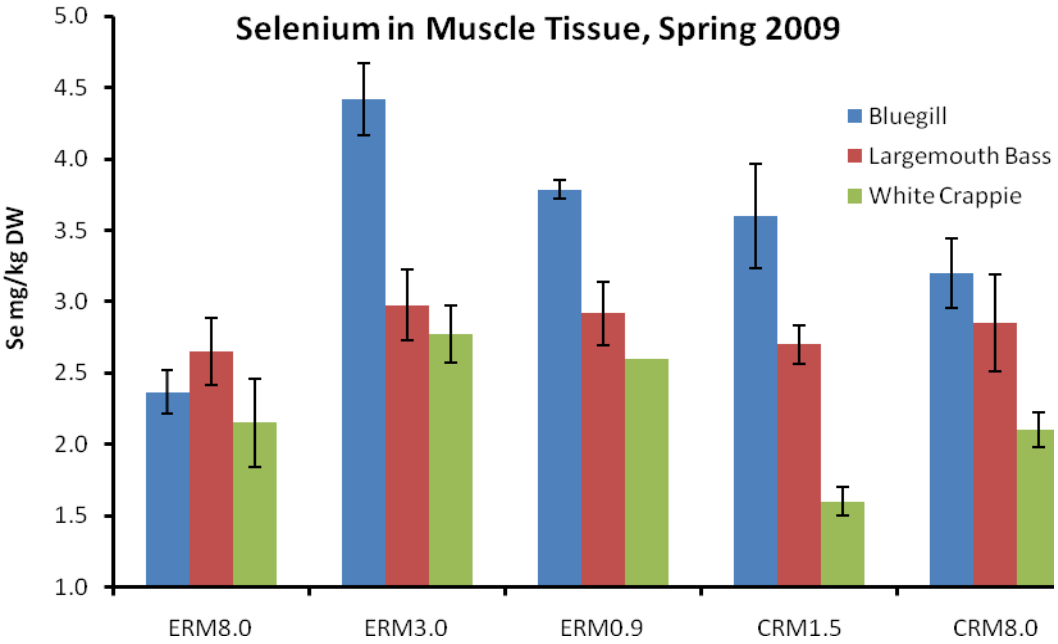

Figure 27. Spatial pattern in bioaccumulation of selenium in muscle tissues of 3 fish species during Spring 2009.

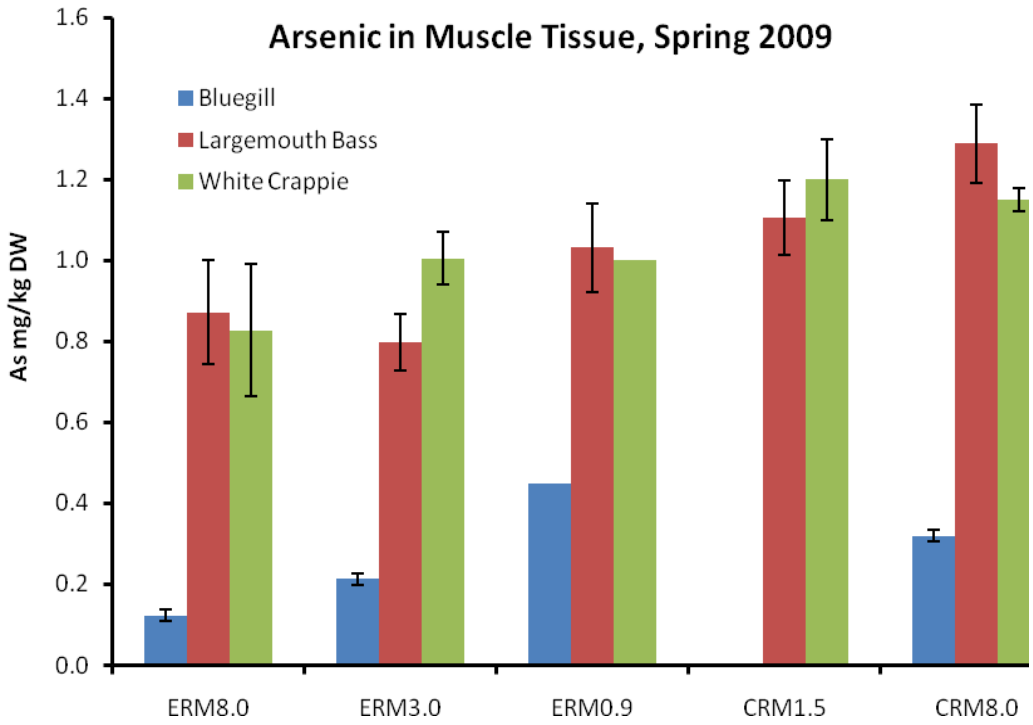

Figure 28. Spatial pattern in bioaccumulation of arsenic in muscle tissues of 3 fish species during Spring 2009.

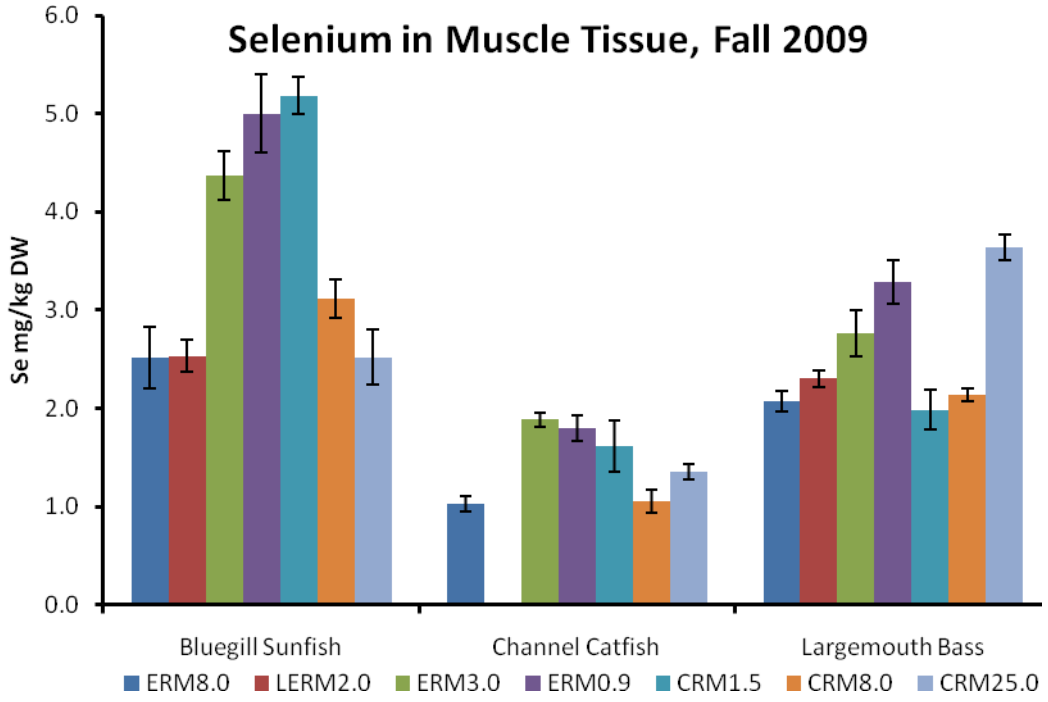

Figure 29. Spatial pattern in bioaccumulation of selenium in muscle tissues of 3 fish species during Fall 2009.

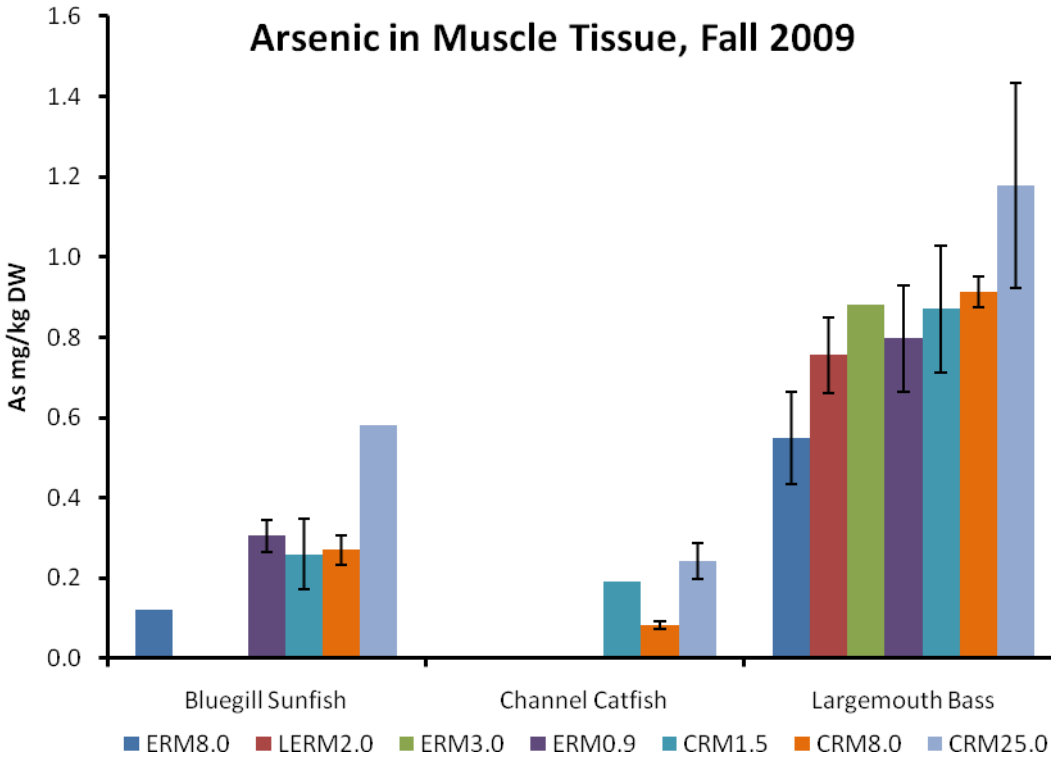

Figure 30. Spatial pattern in bioaccumulation of arsenic in muscle tissues of 3 fish species during Fall 2009.

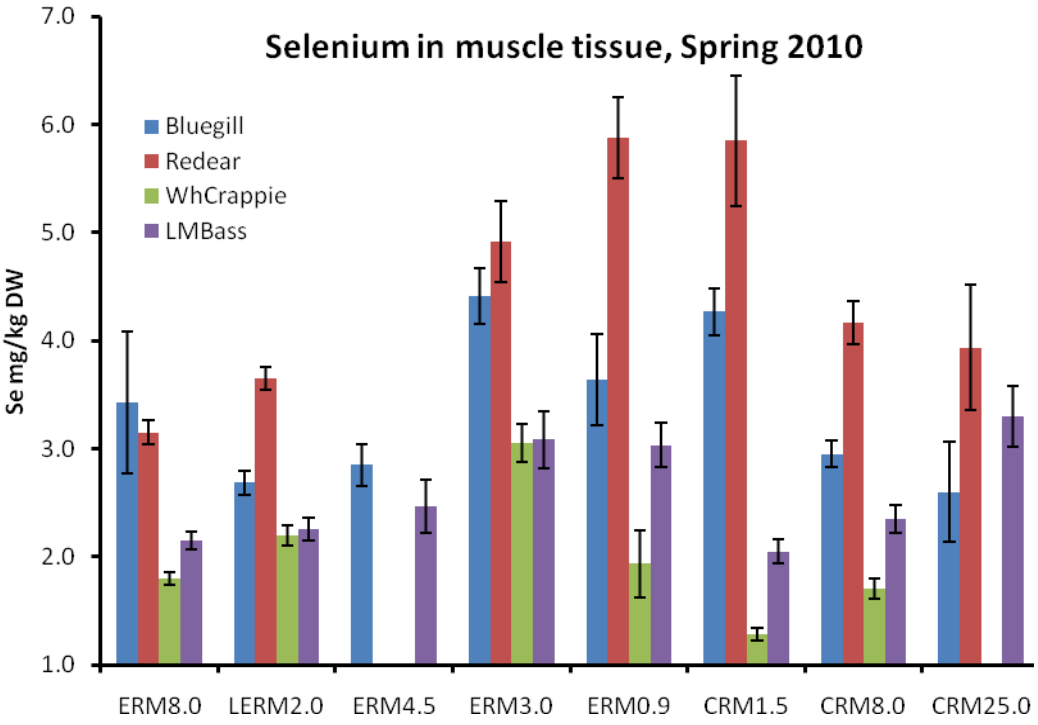

Figure 31. Spatial pattern in bioaccumulation of selenium in muscle tissues of 4 fish species during Spring 2010.

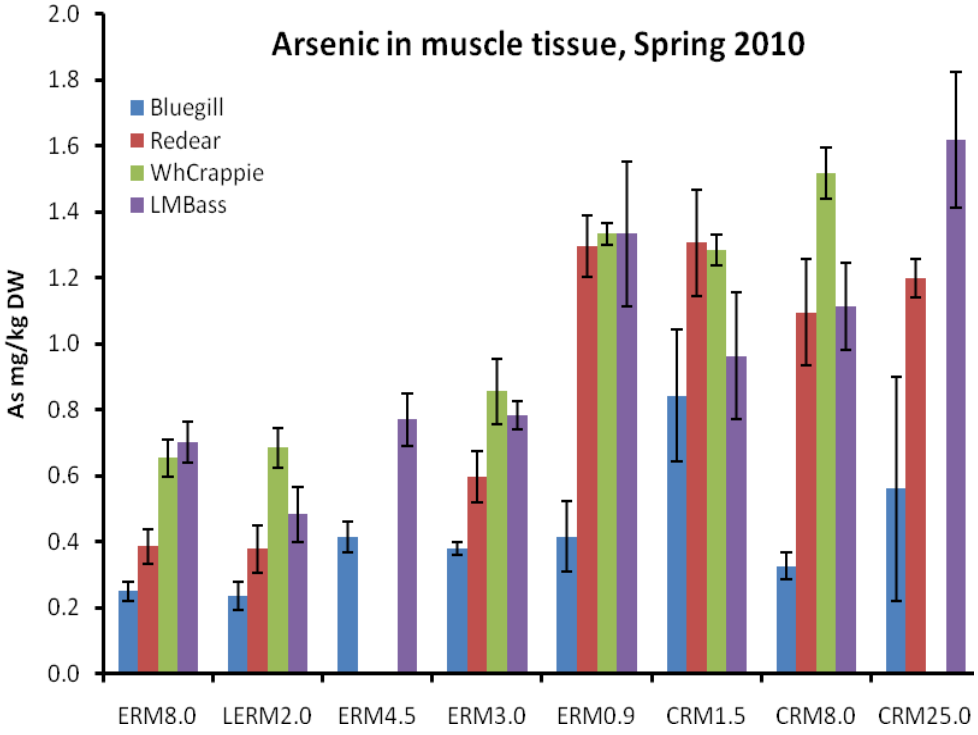

Figure 32. Spatial pattern in bioaccumulation of arsenic in muscle tissues of 4 fish species during Spring 2010.

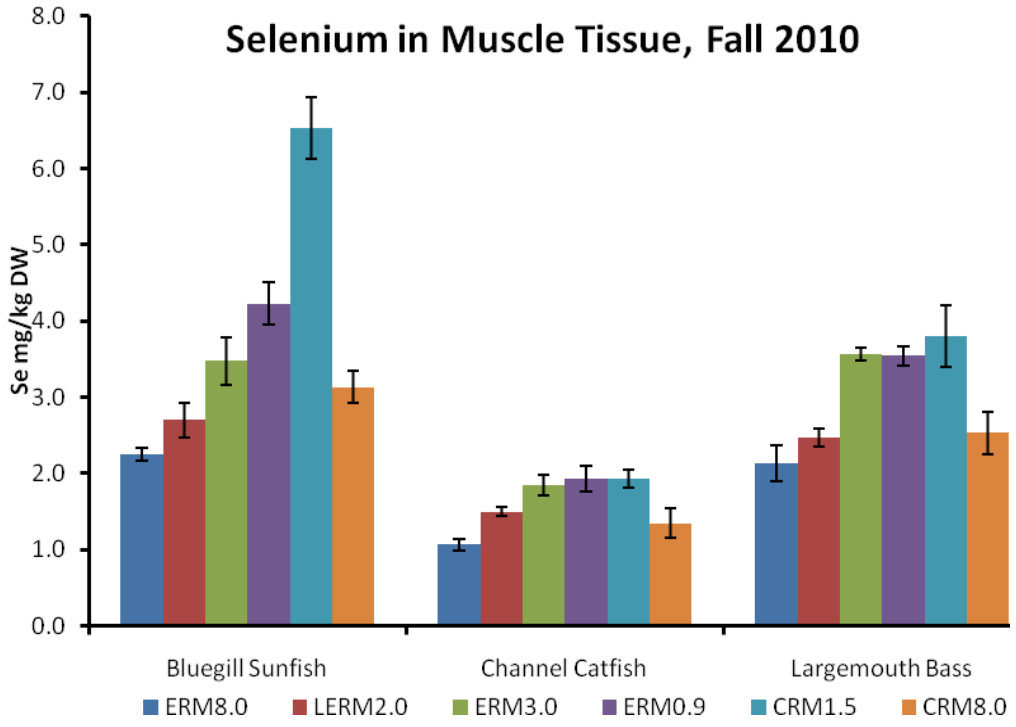

Figure 33. Spatial pattern in bioaccumulation of selenium in muscle tissues of 3 fish species during Fall 2010.

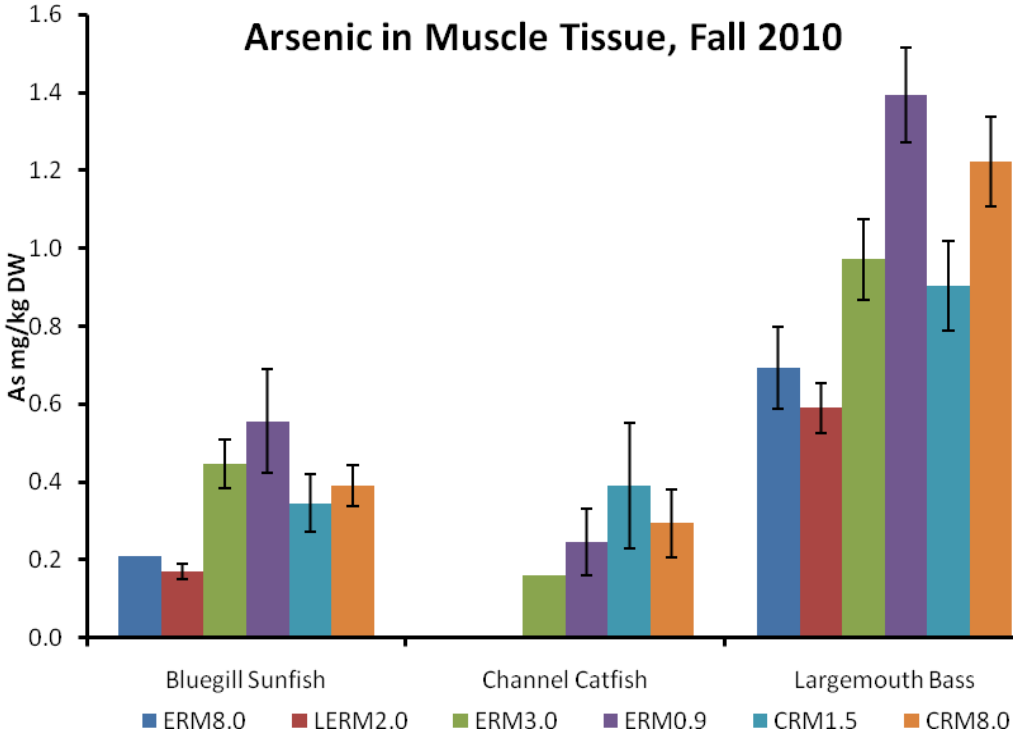

Figure 34. Spatial pattern in bioaccumulation of arsenic in muscle tissues of 3 fish species during Fall 2010.

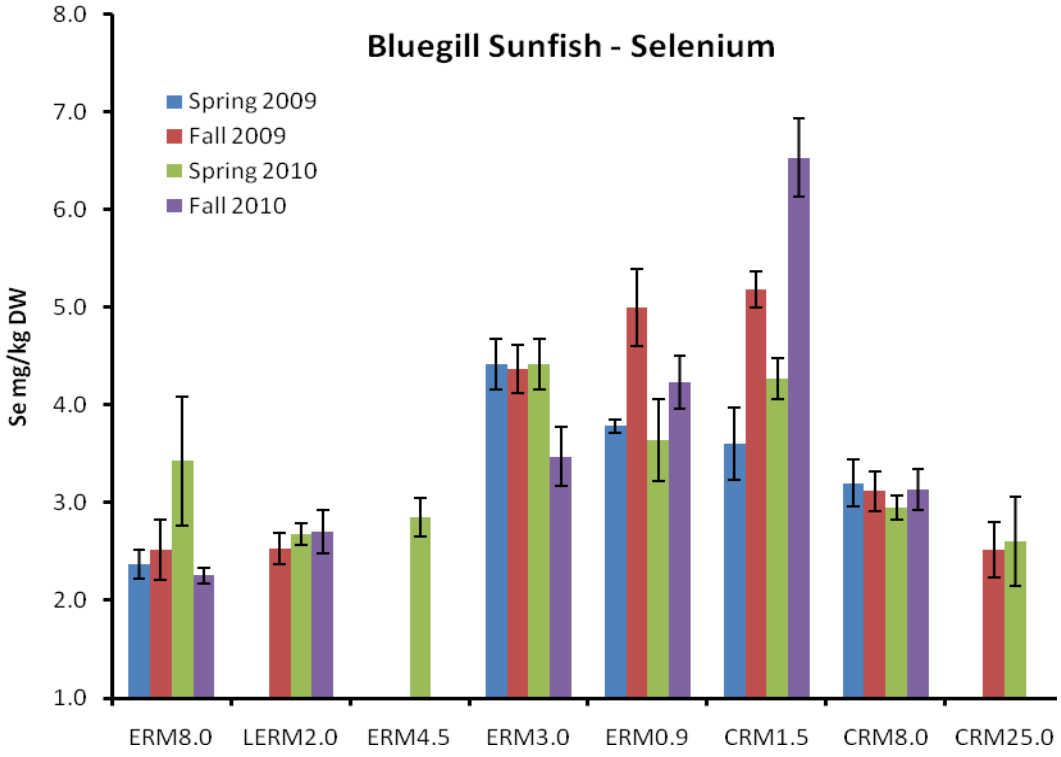

Figure 35. Temporal pattern of selenium in muscle tissues of bluegill over 4 seasons and 8 sample sites.

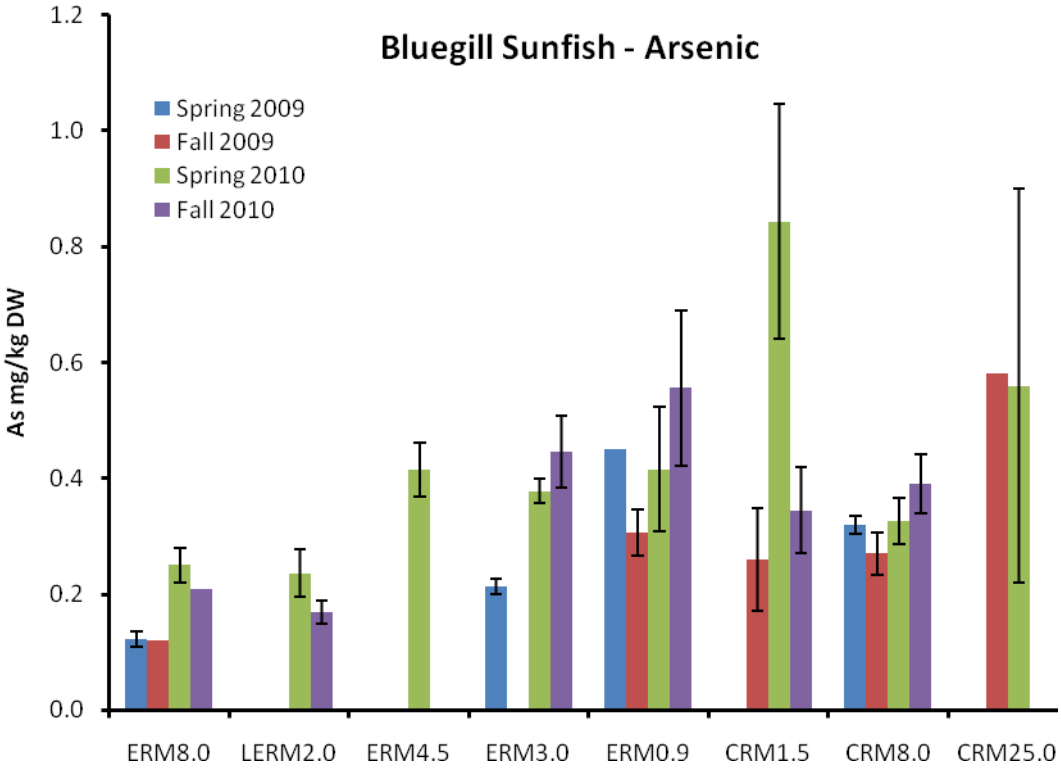

Figure 36. Temporal pattern of arsenic in muscle tissues of bluegill over 4 seasons and 8 sample sites.

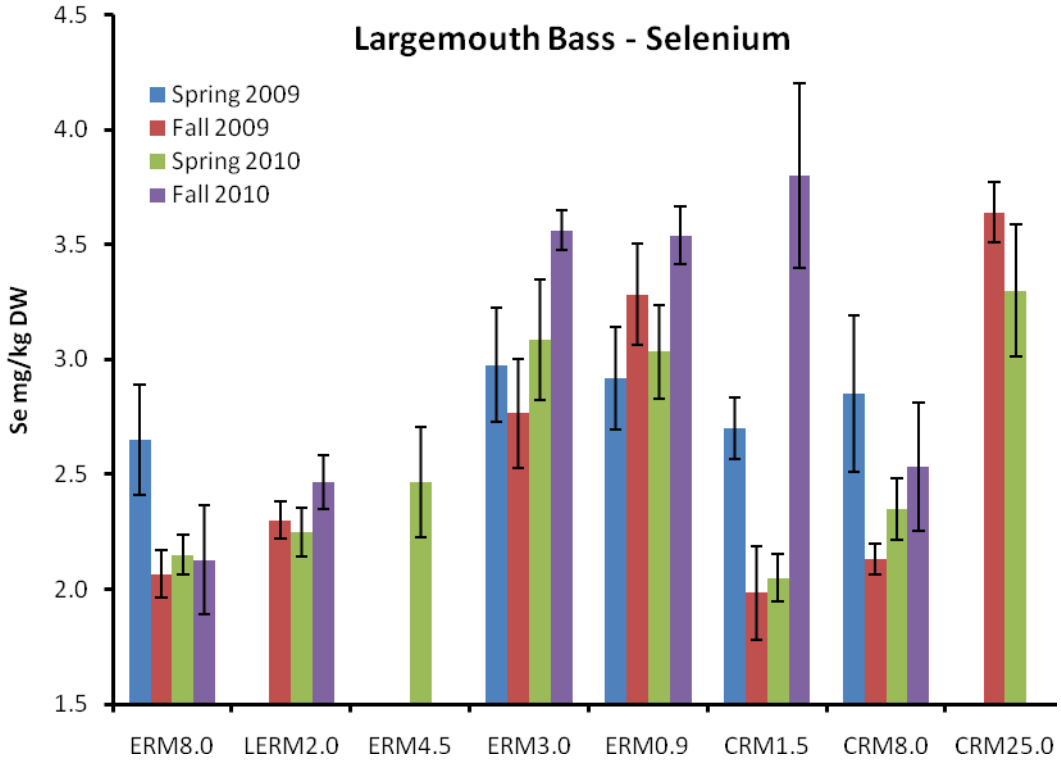

Figure 37. Temporal pattern of selenium in muscle tissues of largemouth bass over 4 seasons and 8 sample sites.

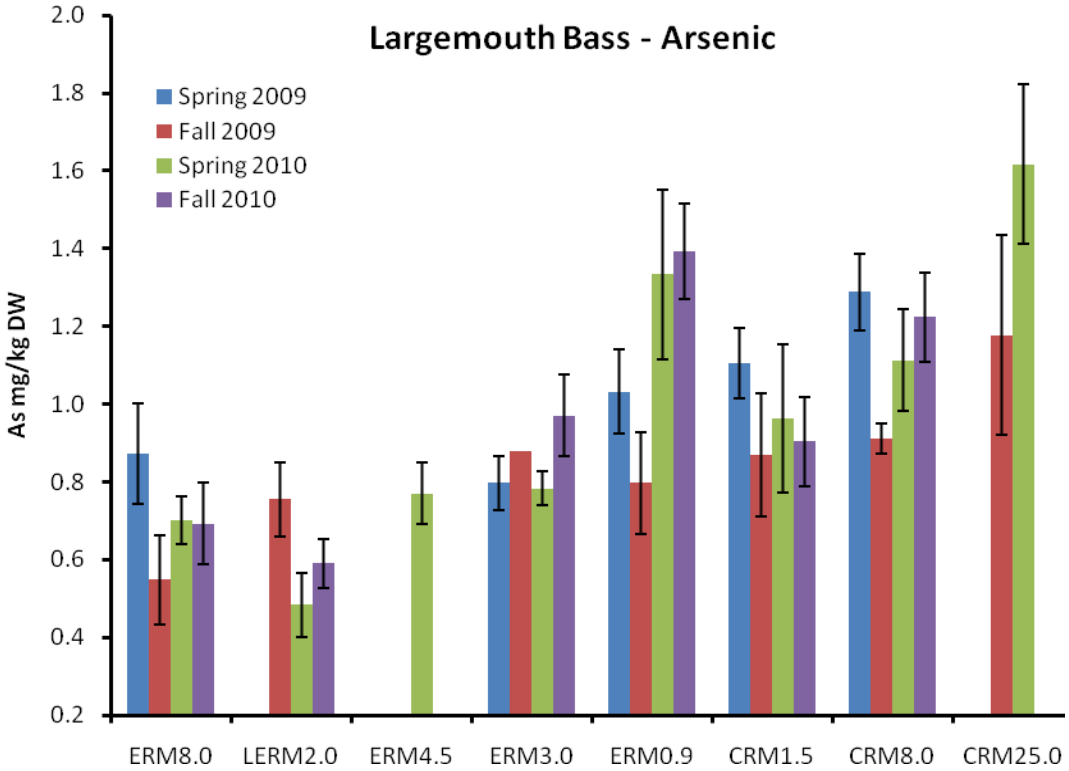

Figure 38. Temporal pattern of arsenic in muscle tissues of largemouth bass over 4 seasons and 8 sample sites.

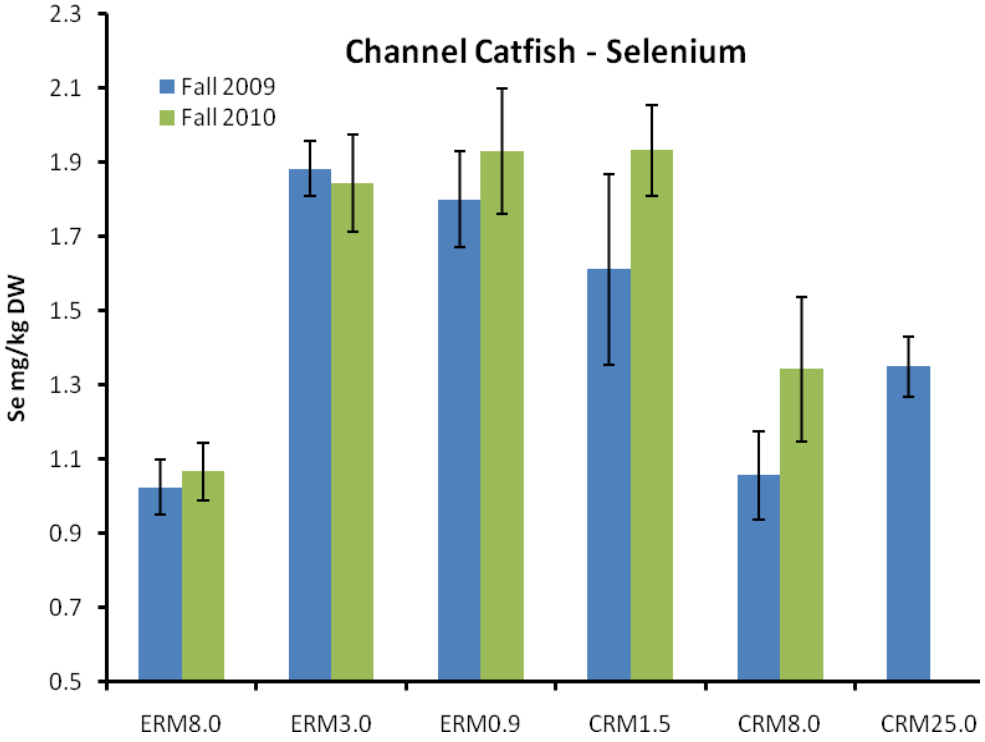

Figure 39. Temporal pattern of selenium in muscle tissues of channel catfish over 2 seasons and 6 sample sites.

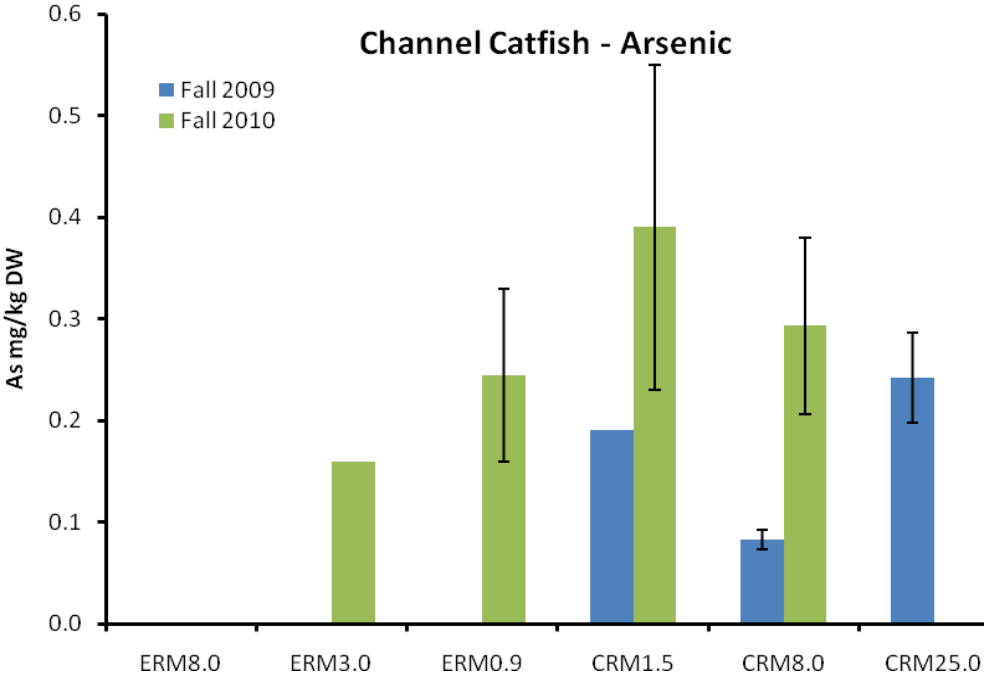

Figure 40. Temporal pattern of arsenic in muscle tissues of channel catfish over 2 seasons and 6 sample sites.

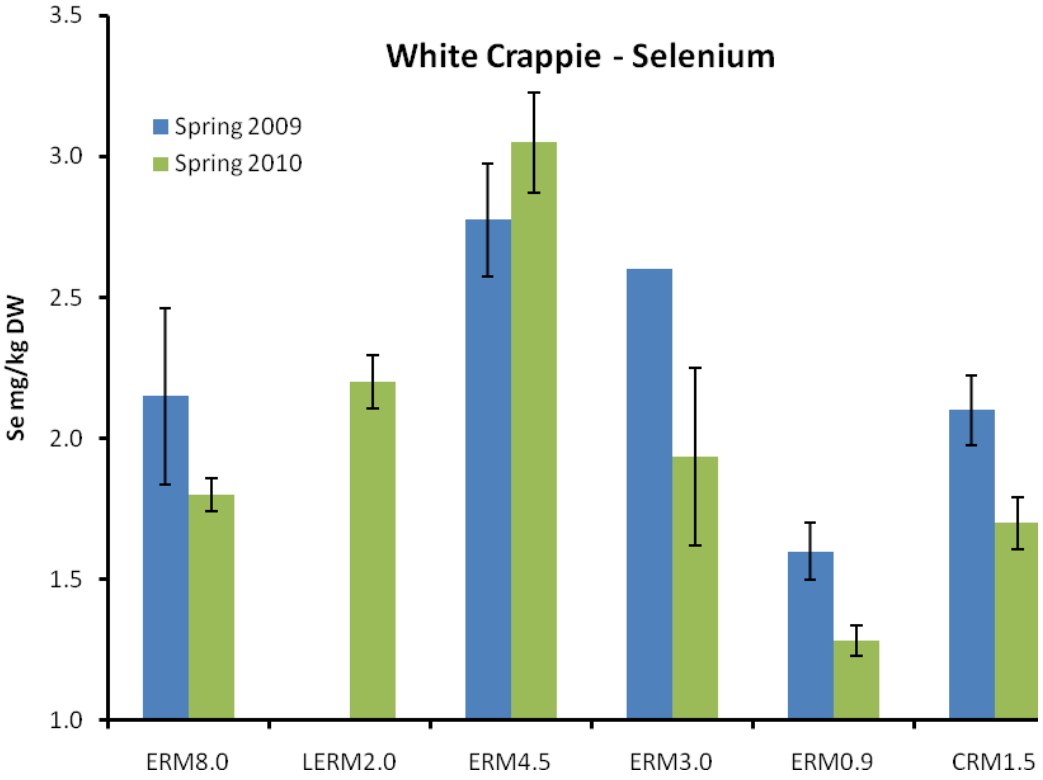

Figure 41. Temporal pattern of selenium in muscle tissues of while crappie over 2 seasons and 6 sample sites.

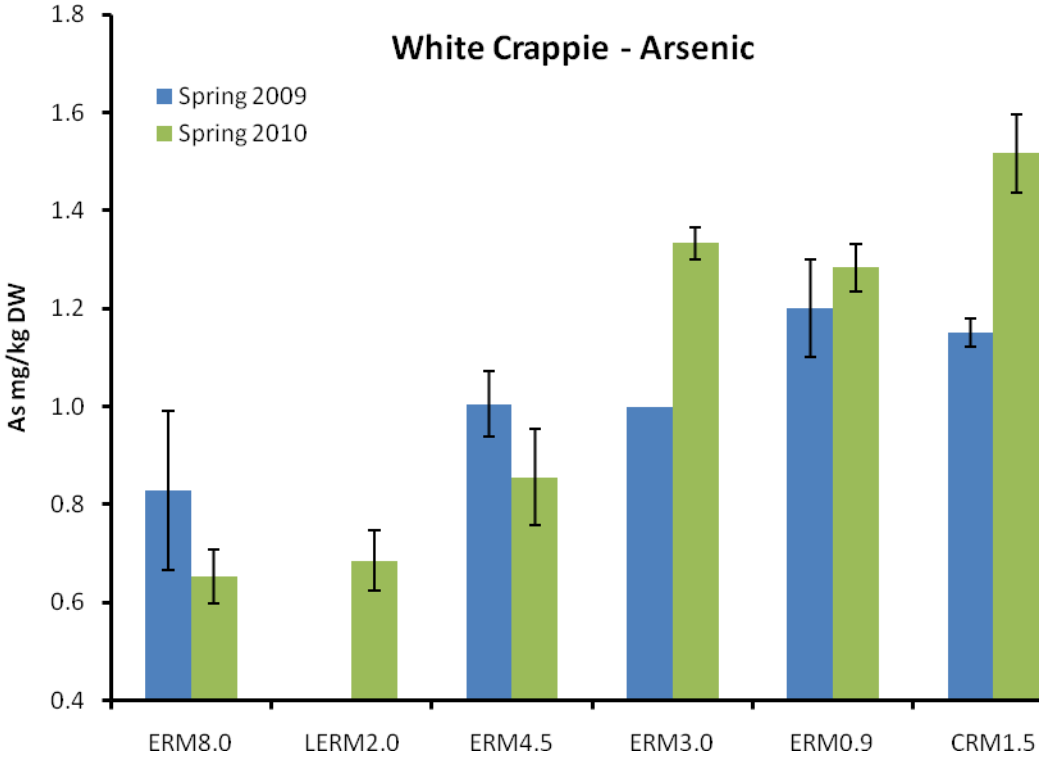

Figure 42. Temporal pattern of arsenic in muscle tissues of while crappie over 2 seasons and 6 sample sites.

5. RECONSTRUCTION ANALYSIS

Approach

To determine the quantitative relationship between bioaccumulation of metals in fillets (muscle tissue) and whole body of fish, a reconstruction analysis study was conducted on bluegill and largemouth bass in Fall 2009 and Spring 2010. Estimation of metal levels in the whole bodies of fish using bioaccumulation data from fillet samples would provide several advantages to environmental monitoring and assessment programs including 1) reduce the cost and labor involved in processing whole fish for analytical analysis, 2) serve as a standard for EPA and other agencies whose regulatory criteria are based on whole body levels of contaminants in fish, and 3) provide a baseline of fillet/whole body relationships which could be used in future and long-term biomonitoring programs.

Fish used in the reconstruction analysis to establish quantitative relationships between metal levels in fillets and whole bodies consisted of a subset of those fish processed for our normal bioaccumulation and fish health studies. For both seasons, eight individuals each of bluegill and largemouth bass were collected at each site of which all eight individuals were processed for fish health analysis and six of the eight fish were processed for bioaccumulation. For each site, species, and season, three fish were selected randomly for the reconstruction analysis. In processing fish for reconstruction analysis, individuals were filleted and the remaining carcass with internal organs were kept separate (packaged and labeled separately) from the fillets for bioaccumulation analysis. In Fall 2009 and Spring 2010, three bluegill and three largemouth bass from each of seven sites (ERM 8, LERM 2, ERM 3, ERM 0.9, CRM 1.5, CRM 8, CRM 25) were processed for reconstruction analysis. In addition, in Spring 2010, six bluegill and six largemouth bass were processed from two additional sites (ERM 4.5 and CRM 3.5). Fillet and carcass samples were sent to Pace via TVA for metal analysis according to EPA method 6020. For this report a reconstruction analysis to establish the quantitative relationship of selenium in fillets and whole body of bluegill is presented. From the data provided by the analytical lab, selenium levels in whole body (expressed as mg/kg DW) of each fish were determined by the following calculations:

(1) (fillet total weight *x* Se level in fillet) + (carcass total weight *x* Se in carcass) = total selenium in whole body,
(2) total Se in whole body / total fillet and carcass wt = selenium as mg/kgDW of whole body

Following calculation of the selenium in whole body of each fish (expressed as mg/kg DW), regression statistics were performed to determine the quantitative relationship between fillet and whole body selenium (both expressed as mg/kg DW). Regression statistics were first run separately on the bluegill from the two seasons to determine if there was a seasonal effect of this relationship. A total of 27 individual data points (measured values on both fillets and whole body) were available for the Spring 2010 regression analysis and a total of 26 individual values for the Fall 2009 regression analysis. If regression lines for the two seasons were statistically similar (slope of regression lines similar) then data from both seasons were combined into one regression. In this case a total of 53 data points were used in the combined regression because there were no seasonal differences in the relationship between fillet and whole body. Regressions were run using linear, logarithmic, exponential, and power curve models to determine the best fit of the data to the models based on the calculated R^2 value of the associations.

Results and Discussion

For the Spring 2010 bluegill data, regression statistics using both a linear and logarithmic fit to the data points provided similar R^2 values (0.73 and 0.75, respectively) indicating that both regression models were similar in their ability to predict the whole body levels of selenium based on fillet selenium levels (Fig. 43). Similarly, for the Fall 2009 bluegill data, both regression models yielded comparable R^2 values (0.90 and 0.92 for the linear and log models, respectively) (Fig. 44). Even though both models for both seasons provided very good fits to the data, both models for the Fall data provided a better fit to the data

than they did for the Spring. When the log models for Spring and Fall are plotted together on the same figure (Fig. 45) slight differences between the two seasons can be seen in the ability of the models to fit the data. The log model for the Fall provides an R^2 of 0.92 and the log model for the Spring a R^2 of 0.75. However, when the linear models for Spring and Fall are plotted together on the same figure (Fig. 46) the regression for the Fall data provides a better fit of the data than does the linear regression for the Spring. When data for both Fall 2009 and Spring 2010 are combined and plotted on one figure, the linear and log regression provide almost exact fits to the data with the R^2 for the linear being 0.81 and the R^2 for the log model being 0.83 (Fig. 47).

To illustrate how well the models fit the data and predict whole body selenium levels based on fillet values of selenium, the linear and log regressions in figures 43 and 44 are used to predict the whole body selenium levels for the Fall 2009 and Spring 2010 data from a fillet level of 5.0 mg/kg DW. Also the linear and log models based on the combined Fall and Spring data are used to predict whole body selenium from a fillet value of 5.0 mg/kg DW. For the Spring 2010 data the log and linear models predicted whole body selenium levels of 3.58 and 3.65 mg/kg DW, respectively. For the Fall 2010 data, the log and linear regressions predicted whole body selenium levels of 3.36 and 3.37 mg/kg DW, respectively. For the combined model (Fig. 47), the log and linear models predicted whole body selenium levels of 3.67 and 3.49 mg/kg DW, respectively. Thus both regression models during both seasons did a good job in predicting whole body selenium levels from fillet values.

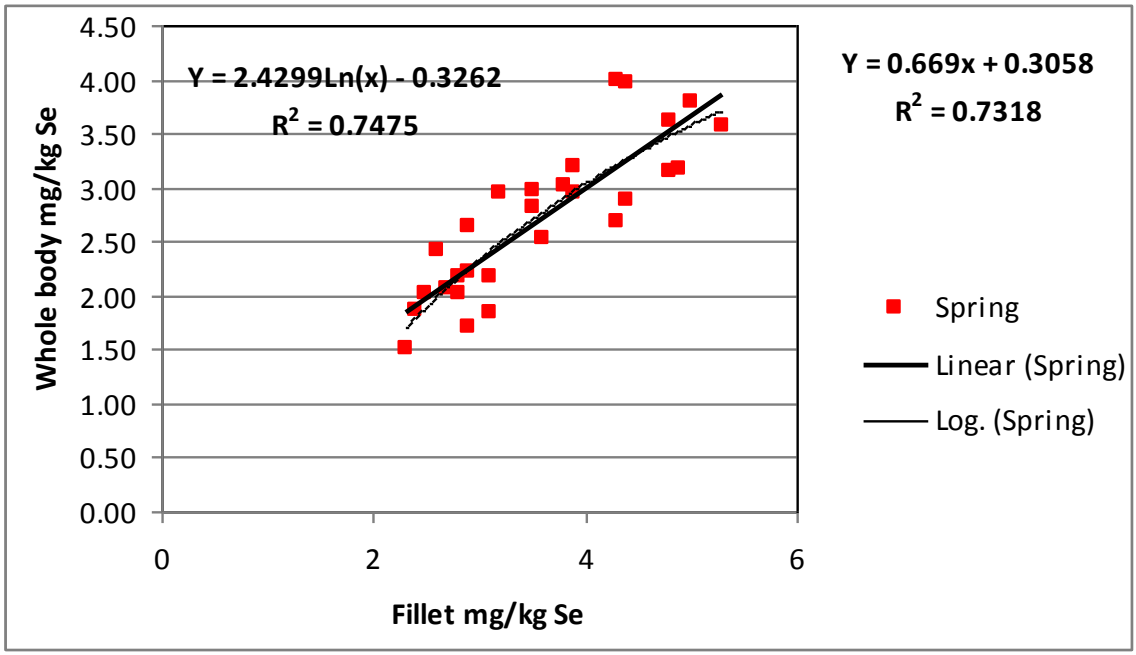

Figure 43. Statistical relationship between selenium levels in fillet and whole body of bluegill in Spring 2010 based on linear and logarithmic regression models.

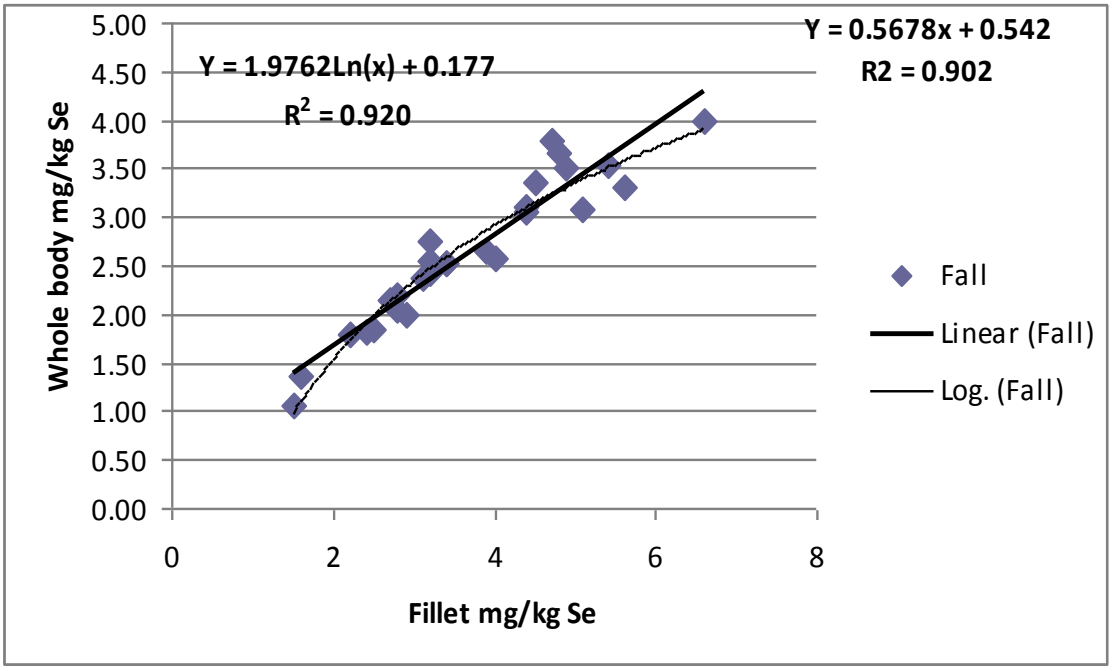

Figure 44. Statistical relationship between selenium levels in fillet and whole body of bluegill in Fall 2009 based on linear and logarithmic regression models.

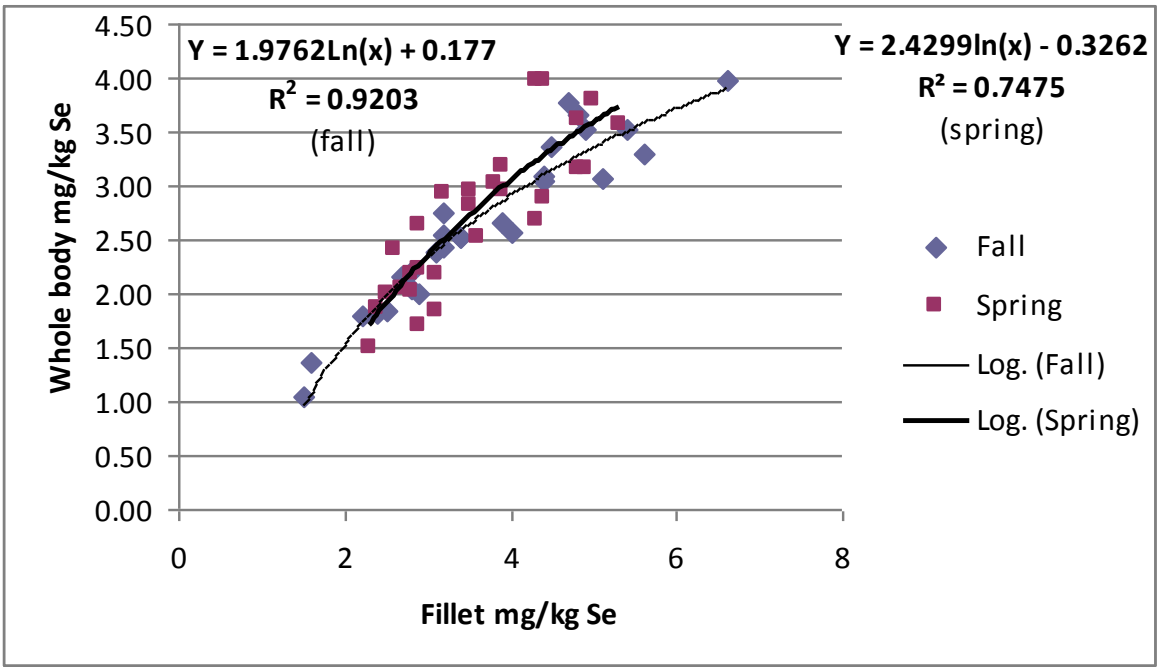

Figure 45. Comparison of the statistical relationship between selenium levels in fillet and whole body of bluegill in Fall 2009 and Spring 2010 based on logarithmic regression models.

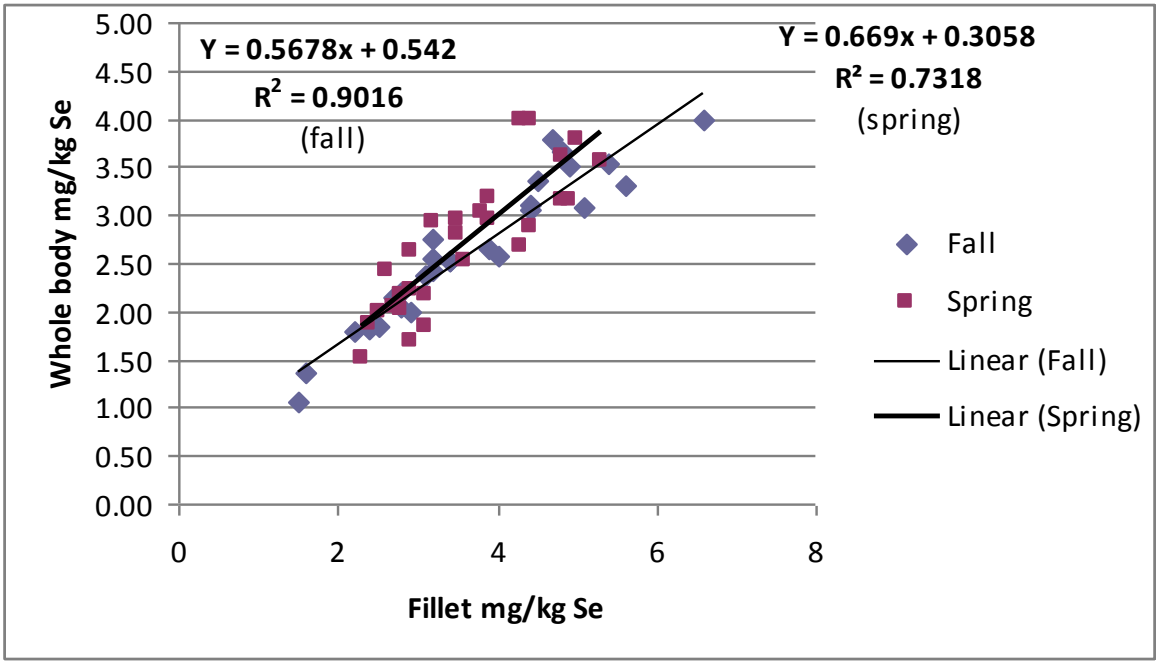

Figure 46. Comparison of the statistical relationship between selenium levels in fillet and whole body of bluegill in Fall 2009 and Spring 2010 based on linear regression models.

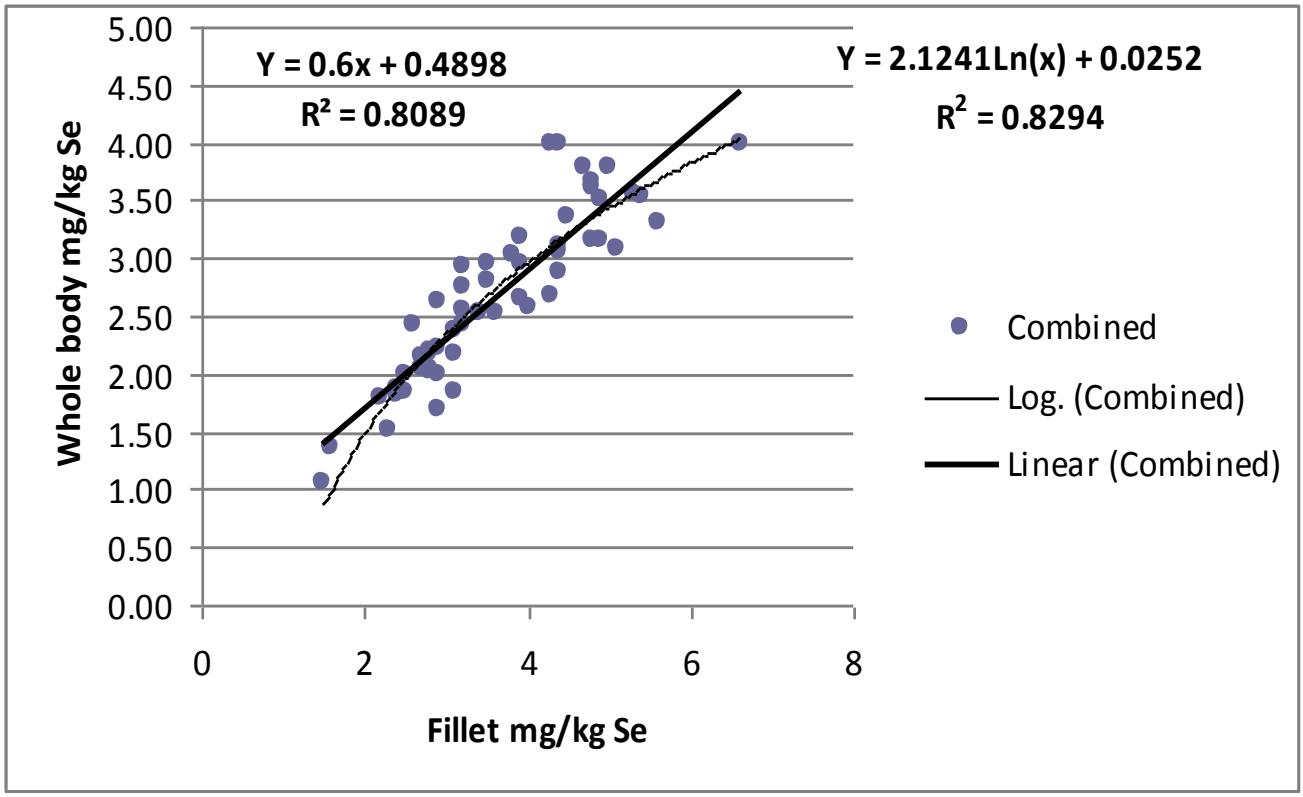

Figure 47. Statistical relationship between selenium levels in fillet and whole body of bluegill based on the combined Spring 2010 and Fall 2009 data using linear and logarithmic regression models.

6. EVALUATION OF OTHER METALS IN FISH

This evaluation addresses the general spatial and temporal patterns in other ICP metals analyzed in fish tissue at these same sample sites across the four study seasons. Only those metals that were detected (i.e., greater than instrument detection limit) in at least 10% of the samples are included in this evaluation. In addition, according to EPA, essential nutrients such as calcium, iron, magnesium, sodium, and potassium should be excluded from such an analysis. The following metals were detected in less than 10% of the samples over all species, sites, and seasons and are thus are excluded from this evaluation including silver, aluminum, barium, beryllium cadmium, cobalt, molybdenum, antimony, thallium, and vanadium. Also, the five essential nutrients listed above are excluded, leaving the following metals to be evaluated on a spatial and temporal basis including, chromium (Cr), copper (Cu), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), selenium (Se), arsenic (As), strontium (Sr), and zinc (Zn). Summary statistics including the mean, minimum and maximum values, and number of non-detects for each of the 25 ICP metals analyzed in each fish species from each site for each of the four sample seasons are presented in Appendix A.

Note that at the time of publication of this report, results for mercury have not been validated due to low recoveries during analysis (*draft* Mathews et al 2012). Samples are currently being re-analyzed for mercury, and these results will be presented in a future report. While the absolute Hg concentrations may change in re-analysis, we do not expect the overall spatial and temporal trends to be affected, as the low recovery bias appears to be systematic across a given sample type.

6.1 SPATIAL EVALUATION

Approach and Justification

Spatial patterns in these ten metals are evaluated on a seasonal basis for each fish species. For Spring 2009 and Spring 2010, spatial trends in metals are evaluated for bluegill, largemouth bass, and white crappie and for Fall 2009 and Fall 2010 spatial patterns in bluegill, largemouth bass, and channel catfish are assessed.

A semi-quantitative evaluation of spatial gradients for each of the ten metals for each fish species was based on a weight-of-evidence approach using three main assessment criteria. These criteria are: (1) concentrations of metals at one or both reference sites (e.g., ERM 8 or LERM 2) were lower than levels at the other sample sites, (2) concentrations of a metal at sites in the Emory River downstream of the spill including ERM 3 and ERM 0.9 were both greater that the reference site(s), and (3) concentrations of a metal at the positive control site (CRM 8 and or CRM 25) were less than the two Emory sites below the spill (ERM 3 and ERM 0.9). Also, for these last criteria to be valid, the concentration of a particular metal at CRM 8.0 generally had to be less than the two lower Emory River sites but greater than the reference site(s). For each fish species and metal combination at each season, existence of a spatial gradient was evaluated based on these three assessment criteria. If a particular species-metal combination resulted in all three criteria being satisfied, then that particular combination was classified as a relatively strong gradient. If, however, a particular species-metal combination resulted in two of the three criteria being satisfied, then that gradient was considered to be a relatively moderate or weak gradient. If only one or no criteria resulted from a particular species-metal combination then there was no definitive evidence to claim that a spatial gradient existed. The major assumption underlying the basis for detecting a spatial gradient using these three assessment criteria is that if a spatial gradient is observed then such a gradient is most likely due to metals associated with the fly ash

spill. Justification for using this weight-of-evidence approach for assessing spatial gradients in metals is that (1) the ecological risk assessment approach itself is based on a weight-of-evidence approach and this assessment of spatial gradients is consistent with such an approach, (2) use of conventional statistics to assess such gradients has its limitations such as the extremely large number of possible species, metal, season, and site combinations or comparisons which would make it difficult to evaluate any true patterns or trends in the data, and (3) if based on traditional statistical approaches, a high variance or standard deviation in any species-metal comparison could be caused by just one outlier (out of six fish per site) therefore masking any real true difference in spatial patterns that may exist. In fact, the weight-of evidence approach itself minimizes the probability of making Type I and Type II errors (Adams and Ham 2011; Beliaeff and Burgeot 2002; Hall and Giddings 2000). A Type I error claims, for example, that there exists a downstream spatial gradient when in fact it does not, and in the second case (Type II) a claim is made that there is not a spatial gradient when, in fact, such a gradient does exists.

Results

An evaluation of the spatial gradients for each fish species-metal combination is presented by season in Table 1. For each species-metal combination, a 0, 1, 2, and/or 3 was assigned following the criteria described in the Approach section above. It is evident from this summary table that selenium demonstrates the strongest downstream gradient for every species-season combination except for perhaps largemouth bass in Spring 2009. For almost all species-season combinations, all three assessment criteria were satisfied for selenium in the detection of spatial gradients. Such definitive evidence for a downstream spatial gradient in selenium was also presented and discussed in the Fish Bioaccumulation Report submitted to TVA in June 2011. Even though arsenic did not display the strong spatial gradients shown by selenium, in almost every species-seasonal combination involving arsenic, two of the three assessment criteria were satisfied resulting in the conclusion that arsenic demonstrated a moderate spatial gradient which most likely can be attributed to fly-ash associated metals. This again is the same conclusion reached in the Fish Bioaccumulation Report. Five metals, (Hg, Ni, Cu, Mn and Sr) showed some very slight or weak indications of a downstream gradient for a few species-seasonal comparisons but there is not enough evidence to conclude that there is any degree of spatial gradient that can be attributed to the ash spill. Lastly, three metals, lead, zinc, and chromium showed no evidence of a downstream gradient therefore levels of these metals in fish collected from the Emory and Clinch Rivers cannot be remotely attributed to the ash spill.

In summary, this weight-of-evidence approach for evaluating downstream spatial gradients in metals demonstrates that levels of selenium and possibly arsenic in fish are most likely due to fly ash-associated metals. However, five other metals which showed a slight or weak spatial gradient may have also been caused by fly ash-associated metals but the evidence presented in Table 1 is not conclusive enough to make such a definitive claim. The remaining metals, including Pb, Zn, Cr and the ten other metals that were mostly below detection limits (see first paragraph) obviously do not demonstrate any semblance of a spatial downstream gradient therefore the levels of these 13 metals observed in fish cannot be attributed to the fly ash spill.

6.2 TEMPORAL EVALUATION

For the temporal pattern evaluation the following criteria were used (1) only those metals which demonstrated a strong spatial gradient (selenium), a moderate spatial gradient (arsenic), and a weak or slight gradient (Hg, Sr, Cu, Mn, Ni) were evaluated on a temporal basis, (2) only those fish species where bioaccumulated metals were measured for four seasons (largemouth bass and bluegill) were included, (3) only those sites where metals were measured for at least three seasons were included, and (4) to qualify for a temporal change (i.e., increase or decrease) at least

two observations (two seasonal values) had to be higher or lower, respectively, than the Spring 2009 values.

Table 2 summarized the results of the temporal pattern evaluation. For selenium in bluegill, one site had an increase over time, another a decrease, and the remaining four sites demonstrated no temporal pattern. For selenium in bass, five of the six sites demonstrated no temporal change while levels at ERM 3 increased over time. Arsenic in bluegill had no temporal change at four sites while ERM 3 and ERM 0.9 demonstrated some level of increase. Arsenic in bass, however had no temporal change at three sites, some level of increase at two sites and a decrease at one site. For the other five metals in Table 2 that demonstrated slight or weak spatial gradients, among sites there was a mixture of no temporal changes and with several observed increases, primarily for nickel over time.

Even though some temporal trends are indicated in Table 2 for both bluegill and bass across sites for all metals, little confidence or credence can be put in these results (or patterns) because (1) for ten of the 28 metal-reference site combinations either a temporal increase or decrease is indicated which is counterintuitive of what would be expected of a true reference site (a true reference site would not be expected to demonstrate a consistent pattern of change over time unless all the other sites in the same aquatic system also demonstrated the same pattern of change), (2) including only four seasons in a temporal evaluation of this nature may not be sufficient time to adequately evaluate temporal trends because of the long lag time typically required for environmental contaminants to enter and be transferred through the food chain, and (3) since a large proportion of the temporal changes seen in the various site-metal combination for both species demonstrate increases over time, particular for Cu and Ni, such changes may indicate that some variations or modifications in analytical analysis for some metals may have occurred over the period of this study and therefore such temporal changes do not necessarily reflect the true behavior of these metals in the environment.

In summary, even though some temporal patterns for various site-metal combinations are indicated for both fish species in Table 2, little confidence or credence should be placed on these results because of the three reasons discussed above. To adequately evaluate temporal trends of metals bioaccumulated in fish, a much longer time period than the 18 months represented by this study is necessary because of the relatively long lag times between availability of contaminants in the environment and the incorporation and transfer of these contaminants into fish tissue particularly for higher trophic-level species.

Table 1. Evaluation of spatial gradients for 10 fish species-metal combinations over 4 sample seasons. Numbers 1 – 3 represent 3 criteria for assessing spatial gradients where 1 = a metal value for 1 or both reference sites is less than values at other sites for a particular species – metal combination; 2 = metal values at both ERM 3 and 0.9 greater than reference levels; 3 = the positive control site (CRM 8.0) is generally less than both ERM 3 and 0.9 but higher than reference; 0 = none of the 3 assessment criteria apply for a particular species – metal combination. *Note that at the time of publication of this report, results for mercury have not been validated due to low recoveries during analysis. Samples are currently being re-analyzed for mercury, and these results will be presented in a future report. While the absolute Hg concentrations may change in re-analysis, we do not expect the overall spatial trends to be affected, as the low recovery bias appears to be systematic across a given sample type.*

Season/Species	As	Se	Hg	Ni	Cu	Mn	Pb	Sr	Zn	Cr
Spring 2009										
Bluegill	1,2	1,2,3	0	0	1,2,3	0	0	1,2	1,2	0
LM Bass	1	1,2	0	0	0	1,2,3	0	1,2,3	1,2	0
Wh Crappie	1,2	1,2,3	0	0	1,2	0	0	0	0	0
Fall 2009										
Bluegill	1,2	1,2,3	0	0	0	0	0	0	0	0
Ch Catfish	1	1,2,3	0	1,2,3	1,2,3	1,2,3	0	0	0	0
LM Bass	1,2	1,2,3	0	1,2,3	0	1,2,3	0	1,2	0	0
Spring 2010										
Bluegill	3	1,2	0	0	0	0	0	0	0	0
LM Bass	1,2	1,2,3	0	0	0	0	0	0	0	0
Redear	1,2	1,2,3	1,2,3	0	0	0	0	0	0	0
Wh Crappie	1,2	1,3	1,2	0	1,2,3	0	0	0	3	0
Fall 2010										
Bluegill	1,2,3	1,2,3	3	0	1,2	0	0	3	0	0
Ch Catfish	1,2	1,2,3	0	0	0	0	0	0	0	0
LM Bass	1,2	1,2,3	0	0	1,2,3	1,2	0	1,2	0	0

Table 2. Evaluation of temporal patterns for various site–metal combinations for bluegill and largemouth bass. NP = no temporal pattern observed for a particular site–metal combination; I and SI = temporal increase and slight temporal increase, respectively, for a particular site-metal combination; D and SD = temporal decrease and slight temporal decrease, respectively, for a particular site–metal combination. *Note that at the time of publication of this report, results for mercury have not been validated due to low recoveries during analysis. Samples are currently being re-analyzed for mercury, and these results will be presented in a future report. While the absolute Hg concentrations may change in re-analysis, we do not expect the overall temporal trends to be affected, as the low recovery bias appears to be systematic across a given sample type.*

Species/Site	As	Se	Hg	Sr	Cu	Mn	Ni
Bluegill							
ERM 8	NP	NP	NP	I	NP	I	NP
LERM 2	NP	NP	NP	NP	D	NP	NP
ERM 3	I	D	I	I	SD	I	NP
ERM 0.9	SI	NP	NP	SD	NP	NP	I
CRM 1.5	NP	I	NP	NP	NP	NP	I
CRM 8.0	NP	NP	NP	NP	NP	NP	I
LM Bass							
ERM 8	NP	NP	NP	I	SI	I	I
LERM 2	D	NP	NP	NP	NP	NP	I
ERM 3	SI	I	NP	NP	I	I	I
ERM 0.9	SI	NP	NP	I	I	I	I
CRM 1.5	NP	NP	SI	NP	I	NP	I
CRM 8	NP	NP	SI	NP	NP	I	I

7. REFERENCES

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APPENDIX A:

SUMMARY STATISTICS

Note that at the time of publication of this report, results for mercury have not been validated due to low recoveries during analysis and potential correction factors are being considered. To the degree possible samples are being re-analyzed for mercury, and these results will be presented in a future report.

Table A-1: Spring 2009 - Bluegill Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.47	0.47	1.60	6 / 6	0.85
Moisture	%		79.7	79.7	81.9	6 / 6	80.5
Aluminum	mg/kg	0.8932 / 0.8932	0.9774	0.9774	3.2680	5 / 6	1.9708
Antimony	mg/kg	0.0190 / 0.0199	ND			0 / 6	
Arsenic	mg/kg	0.0380 / 0.0780	ND			0 / 6	
Barium	mg/kg		0.0297	0.0297	0.0508	6 / 6	0.0410
Beryllium	mg/kg	0.0032 / 0.0034	ND			0 / 6	
Boron	mg/kg	0.0634 / 0.0653	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0138	ND			0 / 6	
Calcium	mg/kg		153.8460	153.8460	876.9600	6 / 6	384.6327
Chromium	mg/kg	0.1231 / 0.1254	ND			0 / 6	
Cobalt	mg/kg	0.0052 / 0.0146	ND			0 / 6	
Copper	mg/kg		0.1900	0.1900	0.3400	6 / 6	0.2528
Iron	mg/kg	12.4528 / 12.5600	ND			0 / 6	
Lead	mg/kg	0.0106 / 0.0106	0.0199	0.0199	0.0322	4 / 6	0.0282
Magnesium	mg/kg		242.5400	242.5400	294.0000	6 / 6	272.8700
Manganese	mg/kg		0.1525	0.1525	0.7000	6 / 6	0.3671
Mercury	mg/kg		0.0300	0.0300	0.0760	6 / 6	0.0467
Molybdenum	mg/kg	0.0117 / 0.0167	ND			0 / 6	
Nickel	mg/kg		0.0376	0.0376	0.0418	6 / 6	0.0393
Potassium	mg/kg		2968.4000	2968.4000	3306.6000	6 / 6	3165.7167
Selenium	mg/kg		0.4422	0.4422	0.8550	6 / 6	0.7000
Silver	mg/kg	0.0030 / 0.0031	ND			0 / 6	
Sodium	mg/kg		300.0000	300.0000	389.7600	6 / 6	335.2433
Strontium	mg/kg		0.0620	0.0620	0.7308	6 / 6	0.2713
Thallium	mg/kg	0.0147 / 0.0285	ND			0 / 6	
Vanadium	mg/kg	0.0543 / 0.0560	ND			0 / 6	
Zinc	mg/kg		8.6600	8.6600	18.0061	6 / 6	12.8668

Table A-2: Spring 2009 - Largemouth Bass Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.57	0.57	2.50	6 / 6	1.31
Moisture	%		78.2	78.2	80.1	6 / 6	79.3
Aluminum	mg/kg	0.8320 / 0.8976	ND			0 / 6	
Antimony	mg/kg	0.0274 / 0.0364	ND			0 / 6	
Arsenic	mg/kg		0.1731	0.1731	0.3165	6 / 6	0.2295
Barium	mg/kg	0.0191 / 0.0204	0.0283	0.0283	0.0788	2 / 6	0.0536
Beryllium	mg/kg	0.0031 / 0.0033	0.0057	0.0057	0.0057	1 / 6	0.0057
Boron	mg/kg	0.0597 / 0.0653	ND			0 / 6	
Cadium	mg/kg	0.0056 / 0.0059	0.0083	0.0083	0.0083	1 / 6	0.0083
Calcium	mg/kg		165.9840	165.9840	2080.6000	6 / 6	652.8073
Chromium	mg/kg	0.1144 / 0.1244	ND			0 / 6	
Cobalt	mg/kg	0.0051 / 0.0096	ND			0 / 6	
Copper	mg/kg		0.1751	0.1751	0.3165	6 / 6	0.2454
Iron	mg/kg	11.6064 / 12.5256	ND			0 / 6	
Lead	mg/kg	0.0098 / 0.0106	ND			0 / 6	
Magnesium	mg/kg		267.9700	267.9700	305.0200	6 / 6	279.5000
Manganese	mg/kg		0.1174	0.1174	0.3434	6 / 6	0.1946
Mercury	mg/kg		0.0528	0.0528	0.1353	6 / 6	0.0763
Molybdenum	mg/kg	0.0100 / 0.0116	ND			0 / 6	
Nickel	mg/kg	0.0312 / 0.0525	ND			0 / 6	
Potassium	mg/kg		3737.0000	3737.0000	4018.8000	6 / 6	3829.1667
Selenium	mg/kg		0.4578	0.4578	0.6330	6 / 6	0.5577
Silver	mg/kg	0.0027 / 0.0031	ND			0 / 6	
Sodium	mg/kg		382.0800	382.0800	508.5100	6 / 6	446.7517
Strontium	mg/kg		0.0770	0.0770	1.7170	6 / 6	0.4710
Thallium	mg/kg	0.0137 / 0.0147	ND			0 / 6	
Vanadium	mg/kg	0.0517 / 0.0551	ND			0 / 6	
Zinc	mg/kg		5.1143	5.1143	12.4490	6 / 6	7.5030

Table A-3: Spring 2009 - White Crappie Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.50	1.50	2.60	2 / 2	2.05
Moisture	%		77.6	77.6	78.6	2 / 2	78.1
Aluminum	mg/kg	0.8064 / 0.8346	ND			0 / 2	
Antimony	mg/kg	0.0314 / 0.0364	ND			0 / 2	
Arsenic	mg/kg		0.2354	0.2354	0.2912	2 / 2	0.2633
Barium	mg/kg	0.0188 / 0.0193	ND			0 / 2	
Beryllium	mg/kg	0.0029 / 0.0030	ND			0 / 2	
Boron	mg/kg	0.0582 / 0.0599	ND			0 / 2	
Cadium	mg/kg	0.0054 / 0.0056	ND			0 / 2	
Calcium	mg/kg		202.8720	202.8720	360.6400	2 / 2	281.7560
Chromium	mg/kg	0.1142 / 0.1156	ND			0 / 2	
Cobalt	mg/kg	0.0045 / 0.0045	ND			0 / 2	
Copper	mg/kg	0.1691 / 0.1691	0.1904	0.1904	0.1904	1 / 2	0.1904
Iron	mg/kg	11.4240 / 11.7058	ND			0 / 2	
Lead	mg/kg	0.0096 / 0.0098	ND			0 / 2	
Magnesium	mg/kg		293.4400	293.4400	299.6000	2 / 2	296.5200
Manganese	mg/kg		0.0942	0.0942	0.1635	2 / 2	0.1288
Mercury	mg/kg		0.0098	0.0098	0.0112	2 / 2	0.0105
Molybdenum	mg/kg	0.0099 / 0.0101	ND			0 / 2	
Nickel	mg/kg	0.0314 / 0.0321	ND			0 / 2	
Potassium	mg/kg		3673.6000	3673.6000	3809.2000	2 / 2	3741.4000
Selenium	mg/kg		0.3360	0.3360	0.3638	2 / 2	0.3499
Silver	mg/kg	0.0027 / 0.0028	ND			0 / 2	
Sodium	mg/kg		273.2800	273.2800	312.4400	2 / 2	292.8600
Strontium	mg/kg		0.0685	0.0685	0.1770	2 / 2	0.1227
Thallium	mg/kg	0.0134 / 0.0137	ND			0 / 2	
Vanadium	mg/kg	0.0493 / 0.0514	ND			0 / 2	
Zinc	mg/kg		4.5368	4.5368	5.0848	2 / 2	4.8108

Table A-4: Fall 2009 - Bluegill Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.30	0.30	0.71	6 / 6	0.51
Moisture	%		78.5	78.5	84.7	6 / 6	80.9
Aluminum	mg/kg	0.8471 / 2.8800	ND			0 / 6	
Antimony	mg/kg	0.0180 / 0.0193	ND			0 / 6	
Arsenic	mg/kg	0.0493 / 0.0506	0.0230	0.0230	0.0918	4 / 6	0.0479
Barium	mg/kg		0.0276	0.0276	0.1980	6 / 6	0.0975
Beryllium	mg/kg	0.0031 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0612 / 0.0738	ND			0 / 6	
Cadium	mg/kg	0.0057 / 0.0216	ND			0 / 6	
Calcium	mg/kg		139.6730	139.6730	1980.0000	6 / 6	721.9588
Chromium	mg/kg	0.1163 / 0.1230	0.2561	0.2561	0.2561	1 / 6	0.2561
Cobalt	mg/kg	0.0046 / 0.0103	ND			0 / 6	
Copper	mg/kg		0.2665	0.2665	0.5220	6 / 6	0.3301
Iron	mg/kg	11.0123 / 12.2706	ND			0 / 6	
Lead	mg/kg	0.0099 / 0.0105	ND			0 / 6	
Magnesium	mg/kg		250.9200	250.9200	338.4000	6 / 6	277.9400
Manganese	mg/kg		0.1230	0.1230	0.8280	6 / 6	0.4253
Mercury	mg/kg	0.0237 / 0.0237	0.0270	0.0270	0.0595	5 / 6	0.0389
Molybdenum	mg/kg	0.0103 / 0.0109	ND			0 / 6	
Nickel	mg/kg	0.0317 / 0.0344	0.0468	0.0468	0.1123	3 / 6	0.0852
Potassium	mg/kg		3009.6000	3009.6000	3618.0000	6 / 6	3205.6667
Selenium	mg/kg		0.8568	0.8568	1.1395	6 / 6	0.9901
Silver	mg/kg	0.0029 / 0.0031	ND			0 / 6	
Sodium	mg/kg		262.3000	262.3000	375.1500	6 / 6	316.5433
Strontium	mg/kg		0.0926	0.0926	2.1240	6 / 6	0.7262
Thallium	mg/kg	0.0138 / 0.0146	ND			0 / 6	
Vanadium	mg/kg	0.0520 / 0.0554	ND			0 / 6	
Zinc	mg/kg		9.8400	9.8400	20.5970	6 / 6	14.0553

Table A-5: Fall 2009 - Channel Catfish Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.80	1.80	8.50	5 / 5	5.10
Moisture	%		75.9	75.9	83.3	5 / 5	78.4
Aluminum	mg/kg		3.0820	3.0820	6.1217	5 / 5	4.6400
Antimony	mg/kg	0.0175 / 0.0188	0.2338	0.2338	0.4440	3 / 5	0.3384
Arsenic	mg/kg	0.0302 / 0.0333	0.0317	0.0317	0.0317	1 / 5	0.0317
Barium	mg/kg	0.0186 / 0.0186	0.0289	0.0289	0.0601	4 / 5	0.0406
Beryllium	mg/kg	0.0029 / 0.0033	ND			0 / 5	
Boron	mg/kg	0.0575 / 0.0641	ND			0 / 5	
Cadium	mg/kg		0.0081	0.0081	0.1398	5 / 5	0.0594
Calcium	mg/kg		67.4880	67.4880	766.5300	5 / 5	271.2114
Chromium	mg/kg		0.1332	0.1332	0.2505	5 / 5	0.1804
Cobalt	mg/kg		0.0044	0.0044	0.0075	5 / 5	0.0063
Copper	mg/kg		0.2277	0.2277	0.4820	5 / 5	0.3272
Iron	mg/kg	11.1444 / 12.2213	ND			0 / 5	
Lead	mg/kg		0.0200	0.0200	3.4945	5 / 5	1.9691
Magnesium	mg/kg		203.7960	203.7960	236.4700	5 / 5	220.7026
Manganese	mg/kg		0.1199	0.1199	0.2338	5 / 5	0.1547
Mercury	mg/kg		0.0398	0.0398	0.2169	5 / 5	0.1176
Molybdenum	mg/kg	0.0098 / 0.0106	ND			0 / 5	
Nickel	mg/kg		0.0483	0.0483	0.0771	5 / 5	0.0679
Potassium	mg/kg		3552.0000	3552.0000	3904.2000	5 / 5	3703.7800
Selenium	mg/kg		0.2314	0.2314	0.5083	5 / 5	0.3418
Silver	mg/kg	0.0027 / 0.0029	ND			0 / 5	
Sodium	mg/kg		307.1900	307.1900	468.4200	5 / 5	371.7080
Strontium	mg/kg		0.0644	0.0644	0.6680	5 / 5	0.2386
Thallium	mg/kg	0.0266 / 0.0294	ND			0 / 5	
Vanadium	mg/kg	0.0981 / 0.1077	ND			0 / 5	
Zinc	mg/kg		5.5200	5.5200	13.3934	5 / 5	8.9640

Table A-6: Fall 2009 - Largemouth Bass Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.23	0.23	4.90	6 / 6	2.40
Moisture	%		75.9	75.9	80.4	6 / 6	78.7
Aluminum	mg/kg	1.5111 / 2.9402	ND			0 / 6	
Antimony	mg/kg	0.0180 / 0.0193	0.0487	0.0487	0.2070	3 / 6	0.1225
Arsenic	mg/kg		0.0586	0.0586	0.2892	6 / 6	0.1892
Barium	mg/kg		0.0186	0.0186	0.0426	6 / 6	0.0304
Beryllium	mg/kg	0.0029 / 0.0032	ND			0 / 6	
Boron	mg/kg	0.0580 / 0.0650	ND			0 / 6	
Cadium	mg/kg	0.0116 / 0.0161	0.1212	0.1212	0.1212	1 / 6	0.1212
Calcium	mg/kg		264.9600	264.9600	1192.4800	6 / 6	617.6683
Chromium	mg/kg		0.1350	0.1350	0.4646	6 / 6	0.2380
Cobalt	mg/kg	0.0047 / 0.0128	ND			0 / 6	
Copper	mg/kg		0.1827	0.1827	0.2892	6 / 6	0.2415
Iron	mg/kg	11.0152 / 11.9712	13.9725	13.9725	13.9725	1 / 6	13.9725
Lead	mg/kg	0.0147 / 0.0147	0.1567	0.1567	2.2977	5 / 6	0.8816
Magnesium	mg/kg		279.5600	279.5600	298.4100	6 / 6	289.7583
Manganese	mg/kg		0.1201	0.1201	0.2436	6 / 6	0.1789
Mercury	mg/kg		0.0337	0.0337	0.0687	6 / 6	0.0522
Molybdenum	mg/kg	0.0097 / 0.0108	ND			0 / 6	
Nickel	mg/kg		0.0311	0.0311	0.2222	6 / 6	0.0699
Potassium	mg/kg		3308.9000	3308.9000	3575.4000	6 / 6	3449.5333
Selenium	mg/kg		0.3519	0.3519	0.5858	6 / 6	0.4191
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		333.2000	333.2000	403.6800	6 / 6	375.7817
Strontium	mg/kg		0.1739	0.1739	0.9048	6 / 6	0.5083
Thallium	mg/kg	0.0132 / 0.0146	ND			0 / 6	
Vanadium	mg/kg	0.0497 / 0.0548	ND			0 / 6	
Zinc	mg/kg		7.9808	7.9808	10.8192	6 / 6	9.1629

Table A-7: Spring 2010 - Bluegill Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.55	0.55	2.70	6 / 6	1.64
Moisture	%		78.3	78.3	83.8	6 / 6	81.1
Aluminum	mg/kg	3.9928 / 4.1148	ND			0 / 6	
Antimony	mg/kg	0.0144 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.0543	0.0543	0.3216	6 / 6	0.1606
Barium	mg/kg	0.0460 / 0.0463	0.0503	0.0503	0.0586	4 / 6	0.0541
Beryllium	mg/kg	0.0288 / 0.0308	ND			0 / 6	
Boron	mg/kg	0.4048 / 0.4246	ND			0 / 6	
Cadium	mg/kg	0.0075 / 0.0156	ND			0 / 6	
Calcium	mg/kg		190.6840	190.6840	487.8000	6 / 6	306.6173
Chromium	mg/kg	0.1266 / 0.1312	ND			0 / 6	
Cobalt	mg/kg	0.0140 / 0.0144	0.0154	0.0154	0.0154	1 / 6	0.0154
Copper	mg/kg		0.2160	0.2160	0.4221	6 / 6	0.2851
Iron	mg/kg	12.0152 / 12.4092	ND			0 / 6	
Lead	mg/kg	0.0276 / 0.0292	0.0651	0.0651	0.0651	1 / 6	0.0651
Magnesium	mg/kg		243.0000	243.0000	340.6900	6 / 6	290.1200
Manganese	mg/kg		0.1840	0.1840	0.3906	6 / 6	0.2926
Mercury	mg/kg		0.0369	0.0369	0.0773	6 / 6	0.0550
Molybdenum	mg/kg	0.0347 / 0.0362	ND			0 / 6	
Nickel	mg/kg	0.0972 / 0.1004	ND			0 / 6	
Potassium	mg/kg		3159.0000	3159.0000	3906.0000	6 / 6	3682.9833
Selenium	mg/kg		0.6440	0.6440	1.0633	6 / 6	0.8096
Silver	mg/kg	0.0028 / 0.0029	ND			0 / 6	
Sodium	mg/kg		299.9200	299.9200	501.2700	6 / 6	365.7517
Strontium	mg/kg		0.1776	0.1776	0.4140	6 / 6	0.2795
Thallium	mg/kg	0.0178 / 0.0302	ND			0 / 6	
Vanadium	mg/kg	0.0091 / 0.0911	ND			0 / 6	
Zinc	mg/kg		12.7144	12.7144	16.2408	6 / 6	14.6036

Table A-8: Spring 2010 - Largemouth Bass Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.42	0.42	2.20	6 / 6	1.16
Moisture	%		76.6	76.6	80.4	6 / 6	78.7
Aluminum	mg/kg	3.7018 / 4.1418	ND			0 / 6	
Antimony	mg/kg	0.0134 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.0588	0.0588	0.3345	6 / 6	0.2089
Barium	mg/kg	0.0424 / 0.0474	ND			0 / 6	
Beryllium	mg/kg	0.0268 / 0.0309	ND			0 / 6	
Boron	mg/kg	0.3791 / 0.4326	ND			0 / 6	
Cadium	mg/kg	0.0071 / 0.0080	ND			0 / 6	
Calcium	mg/kg		157.5840	157.5840	451.1400	6 / 6	291.4877
Chromium	mg/kg	0.1182 / 0.1318	ND			0 / 6	
Cobalt	mg/kg	0.0129 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.1940	0.1940	0.5352	6 / 6	0.3674
Iron	mg/kg	11.1277 / 12.4722	ND			0 / 6	
Lead	mg/kg	0.0268 / 0.0288	ND			0 / 6	
Magnesium	mg/kg		258.7200	258.7200	327.5400	6 / 6	297.5300
Manganese	mg/kg	0.1643 / 0.1705	0.1695	0.1695	0.2884	4 / 6	0.2058
Mercury	mg/kg		0.0421	0.0421	0.3952	6 / 6	0.1443
Molybdenum	mg/kg	0.0333 / 0.0374	ND			0 / 6	
Nickel	mg/kg	0.0892 / 0.0980	0.1030	0.1030	0.1339	2 / 6	0.1184
Potassium	mg/kg		3679.5000	3679.5000	4181.8000	6 / 6	3955.4833
Selenium	mg/kg		0.3914	0.3914	0.5325	6 / 6	0.4363
Silver	mg/kg	0.0027 / 0.0096	ND			0 / 6	
Sodium	mg/kg		339.3000	339.3000	554.6800	6 / 6	448.0917
Strontium	mg/kg		0.0862	0.0862	0.3345	6 / 6	0.1910
Thallium	mg/kg	0.0127 / 0.0147	ND			0 / 6	
Vanadium	mg/kg	0.0424 / 0.0474	ND			0 / 6	
Zinc	mg/kg		5.6056	5.6056	17.5100	6 / 6	10.3333

Table A-9: Spring 2010 - Red Ear Sunfish Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.19	0.19	0.61	6 / 6	0.29
Moisture	%		80.8	80.8	83.4	6 / 6	82.5
Aluminum	mg/kg	3.6354 / 4.1520	ND			0 / 6	
Antimony	mg/kg	0.0131 / 0.0151	ND			0 / 6	
Arsenic	mg/kg		0.1520	0.1520	0.3154	6 / 6	0.2264
Barium	mg/kg	0.0415 / 0.0473	0.0518	0.0518	0.0923	2 / 6	0.0721
Beryllium	mg/kg	0.0266 / 0.0311	ND			0 / 6	
Boron	mg/kg	0.3818 / 0.4325	ND			0 / 6	
Cadium	mg/kg	0.0070 / 0.0080	ND			0 / 6	
Calcium	mg/kg		110.3740	110.3740	805.4500	6 / 6	309.0578
Chromium	mg/kg	0.1145 / 0.1315	ND			0 / 6	
Cobalt	mg/kg	0.0128 / 0.0145	ND			0 / 6	
Copper	mg/kg	0.1488 / 0.1488	0.1606	0.1606	0.2688	5 / 6	0.2002
Iron	mg/kg	10.9394 / 12.4906	ND			0 / 6	
Lead	mg/kg	0.0249 / 0.0294	ND			0 / 6	
Magnesium	mg/kg		217.4600	217.4600	278.8500	6 / 6	250.6217
Manganese	mg/kg	0.1544 / 0.1730	0.4344	0.4344	0.4344	1 / 6	0.4344
Mercury	mg/kg		0.0381	0.0381	0.1031	6 / 6	0.0611
Molybdenum	mg/kg	0.0315 / 0.0363	ND			0 / 6	
Nickel	mg/kg	0.0880 / 0.1003	ND			0 / 6	
Potassium	mg/kg		3386.4000	3386.4000	3763.2000	6 / 6	3591.8167
Selenium	mg/kg		0.4901	0.4901	1.2864	6 / 6	1.0294
Silver	mg/kg	0.0027 / 0.0029	ND			0 / 6	
Sodium	mg/kg		282.2400	282.2400	621.9200	6 / 6	412.3167
Strontium	mg/kg		0.0709	0.0709	0.6516	6 / 6	0.2061
Thallium	mg/kg	0.0125 / 0.0152	ND			0 / 6	
Vanadium	mg/kg	0.0415 / 0.0473	ND			0 / 6	
Zinc	mg/kg		8.6866	8.6866	18.5280	6 / 6	12.6668

Table A-10: Spring 2010 - White Crappie Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.20	1.20	2.40	6 / 6	1.93
Moisture	%		77.5	77.5	79.0	6 / 6	78.4
Aluminum	mg/kg	3.5070 / 4.1140	ND			0 / 6	
Antimony	mg/kg	0.0126 / 0.0147	ND			0 / 6	
Arsenic	mg/kg		0.2354	0.2354	0.3052	6 / 6	0.2774
Barium	mg/kg	0.0399 / 0.0462	ND			0 / 6	
Beryllium	mg/kg	0.0252 / 0.0308	ND			0 / 6	
Boron	mg/kg	0.3570 / 0.4180	ND			0 / 6	
Cadium	mg/kg	0.0066 / 0.0079	ND			0 / 6	
Calcium	mg/kg		126.0000	126.0000	286.0000	6 / 6	176.3117
Chromium	mg/kg	0.1113 / 0.1298	0.1198	0.1198	0.1198	1 / 6	0.1198
Cobalt	mg/kg	0.0124 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.2100	0.2100	0.4410	6 / 6	0.2869
Iron	mg/kg	10.5420 / 12.3640	ND			0 / 6	
Lead	mg/kg	0.0252 / 0.0286	ND			0 / 6	
Magnesium	mg/kg		258.9400	258.9400	313.9200	6 / 6	283.2350
Manganese	mg/kg	0.1491 / 0.1659	0.2068	0.2068	0.2068	1 / 6	0.2068
Mercury	mg/kg		0.0144	0.0144	0.0546	6 / 6	0.0348
Molybdenum	mg/kg	0.0315 / 0.0352	ND			0 / 6	
Nickel	mg/kg	0.0861 / 0.1012	0.1134	0.1134	0.1134	1 / 6	0.1134
Potassium	mg/kg		3723.6000	3723.6000	4338.2000	6 / 6	4055.8000
Selenium	mg/kg		0.2354	0.2354	0.3150	6 / 6	0.2771
Silver	mg/kg	0.0025 / 0.0029	ND			0 / 6	
Sodium	mg/kg		298.2000	298.2000	401.1000	6 / 6	338.2400
Strontium	mg/kg		0.0495	0.0495	0.1716	6 / 6	0.0903
Thallium	mg/kg	0.0120 / 0.0141	ND			0 / 6	
Vanadium	mg/kg	0.0399 / 0.0462	ND			0 / 6	
Zinc	mg/kg		5.6496	5.6496	8.8830	6 / 6	7.0270

Table A-11: Fall 2010 - Bluegill Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.69	0.69	1.50	6 / 6	1.05
Moisture	%		79.0	79.0	80.4	6 / 6	79.9
Aluminum	mg/kg	3.7824 / 4.1209	ND			0 / 6	
Antimony	mg/kg	0.0137 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.0333	0.0333	0.1128	6 / 6	0.0695
Barium	mg/kg	0.0433 / 0.0467	0.0504	0.0504	0.2460	3 / 6	0.1160
Beryllium	mg/kg	0.0571 / 0.0614	ND			0 / 6	
Boron	mg/kg	0.3895 / 0.4263	ND			0 / 6	
Cadium	mg/kg	0.0073 / 0.0079	ND			0 / 6	
Calcium	mg/kg		165.8510	165.8510	2747.0000	6 / 6	663.9502
Chromium	mg/kg	0.1202 / 0.1302	ND			0 / 6	
Cobalt	mg/kg	0.0134 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.2030	0.2030	0.3485	6 / 6	0.2686
Iron	mg/kg	11.4063 / 12.4033	ND			0 / 6	
Lead	mg/kg	0.0256 / 0.0294	ND			0 / 6	
Magnesium	mg/kg		263.9800	263.9800	325.5000	6 / 6	292.7317
Manganese	mg/kg	0.1686 / 0.1686	0.1980	0.1980	1.5785	5 / 6	0.5314
Mercury	mg/kg		0.0410	0.0410	0.0804	6 / 6	0.0583
Molybdenum	mg/kg	0.0328 / 0.0365	ND			0 / 6	
Nickel	mg/kg	0.0926 / 0.1015	ND			0 / 6	
Potassium	mg/kg		3214.4000	3214.4000	3927.0000	6 / 6	3426.8333
Selenium	mg/kg		1.0865	1.0865	1.5246	6 / 6	1.3131
Silver	mg/kg	0.0027 / 0.0030	0.0046	0.0046	0.0046	1 / 6	0.0046
Sodium	mg/kg		356.7000	356.7000	437.3400	6 / 6	399.0500
Strontium	mg/kg		0.1543	0.1543	2.7265	6 / 6	0.6416
Thallium	mg/kg	0.0130 / 0.0142	ND			0 / 6	
Vanadium	mg/kg	0.0431 / 0.0467	ND			0 / 6	
Zinc	mg/kg		16.1308	16.1308	23.9850	6 / 6	18.7740

Table A-12: Fall 2010 - Channel Catfish Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.57	0.57	1.80	6 / 6	0.94
Moisture	%		78.9	78.9	81.4	6 / 6	80.2
Aluminum	mg/kg	3.6270 / 4.1382	ND			0 / 6	
Antimony	mg/kg	0.0131 / 0.0150	ND			0 / 6	
Arsenic	mg/kg	0.0284 / 0.0560	0.0251	0.0251	0.0465	2 / 6	0.0358
Barium	mg/kg	0.0409 / 0.0481	0.0085	0.0085	0.0085	1 / 6	0.0085
Beryllium	mg/kg	0.0263 / 0.0598	ND			0 / 6	
Boron	mg/kg	0.3720 / 0.4389	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0079	ND			0 / 6	
Calcium	mg/kg		66.8620	66.8620	86.4640	6 / 6	76.1868
Chromium	mg/kg	0.1151 / 0.1317	ND			0 / 6	
Cobalt	mg/kg	0.0128 / 0.0146	ND			0 / 6	
Copper	mg/kg		0.0473	0.0473	0.5597	6 / 6	0.2210
Iron	mg/kg	10.9368 / 12.4982	ND			0 / 6	
Lead	mg/kg	0.0253 / 0.0293	ND			0 / 6	
Magnesium	mg/kg		236.3400	236.3400	259.5300	6 / 6	251.0733
Manganese	mg/kg	0.1544 / 0.1756	0.0323	0.0323	0.2321	2 / 6	0.1322
Mercury	mg/kg		0.0088	0.0088	0.1372	6 / 6	0.0700
Molybdenum	mg/kg	0.0316 / 0.0359	ND			0 / 6	
Nickel	mg/kg	0.0886 / 0.1003	0.0283	0.0283	0.0283	1 / 6	0.0283
Potassium	mg/kg		3840.2000	3840.2000	4516.2000	6 / 6	4119.2167
Selenium	mg/kg		0.0567	0.0567	0.4278	6 / 6	0.2305
Silver	mg/kg	0.0025 / 0.0029	ND			0 / 6	
Sodium	mg/kg		338.5200	338.5200	463.2000	6 / 6	381.9033
Strontium	mg/kg		0.0129	0.0129	0.0768	6 / 6	0.0459
Thallium	mg/kg	0.0125 / 0.0142	ND			0 / 6	
Vanadium	mg/kg	0.0409 / 0.0481	ND			0 / 6	
Zinc	mg/kg		1.1913	1.1913	8.3376	6 / 6	3.9226

Table A-13: Fall 2010 - Largemouth Bass Fillet at Clinch River Mile 1.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.49	0.49	1.20	6 / 6	0.76
Moisture	%		78.6	78.6	80.8	6 / 6	79.6
Aluminum	mg/kg	3.5319 / 4.0660	ND			0 / 6	
Antimony	mg/kg	0.0127 / 0.0148	ND			0 / 6	
Arsenic	mg/kg		0.1023	0.1023	0.2782	6 / 6	0.1861
Barium	mg/kg	0.0405 / 0.0471	ND			0 / 6	
Beryllium	mg/kg	0.0521 / 0.0621	ND			0 / 6	
Boron	mg/kg	0.3667 / 0.4280	ND			0 / 6	
Cadium	mg/kg	0.0068 / 0.0077	ND			0 / 6	
Calcium	mg/kg		203.7280	203.7280	754.6300	6 / 6	442.3597
Chromium	mg/kg	0.1119 / 0.1284	ND			0 / 6	
Cobalt	mg/kg	0.0124 / 0.0143	ND			0 / 6	
Copper	mg/kg		0.2496	0.2496	0.5778	6 / 6	0.3785
Iron	mg/kg	10.6536 / 12.2836	ND			0 / 6	
Lead	mg/kg	0.0247 / 0.0278	ND			0 / 6	
Magnesium	mg/kg		261.1200	261.1200	324.2400	6 / 6	299.2067
Manganese	mg/kg	0.1733 / 0.1733	0.1751	0.1751	0.2702	5 / 6	0.2037
Mercury	mg/kg		0.0618	0.0618	0.1776	6 / 6	0.0940
Molybdenum	mg/kg	0.0309 / 0.0364	ND			0 / 6	
Nickel	mg/kg	0.0865 / 0.0984	0.1094	0.1094	0.1094	1 / 6	0.1094
Potassium	mg/kg		3493.3000	3493.3000	3959.0000	6 / 6	3787.6667
Selenium	mg/kg		0.5184	0.5184	1.0036	6 / 6	0.7730
Silver	mg/kg	0.0025 / 0.0030	ND			0 / 6	
Sodium	mg/kg		360.5000	360.5000	484.4300	6 / 6	420.3167
Strontium	mg/kg		0.1391	0.1391	0.5983	6 / 6	0.3214
Thallium	mg/kg	0.0122 / 0.0141	ND			0 / 6	
Vanadium	mg/kg	0.0405 / 0.0471	ND			0 / 6	
Zinc	mg/kg		9.5808	9.5808	16.1667	6 / 6	12.3035

Table A-14: Fall 2009 - Bluegill Fillet at Clinch River Mile 25.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.28	0.28	0.88	6 / 6	0.53
Moisture	%		79.4	79.4	81.4	6 / 6	80.7
Aluminum	mg/kg	0.8460 / 1.7711	ND			0 / 6	
Antimony	mg/kg	0.0169 / 0.0192	ND			0 / 6	
Arsenic	mg/kg	0.0314 / 0.0856	0.1154	0.1154	0.1154	1 / 6	0.1154
Barium	mg/kg		0.0409	0.0409	0.4512	6 / 6	0.1789
Beryllium	mg/kg	0.0030 / 0.0034	ND			0 / 6	
Boron	mg/kg	0.0639 / 0.1617	ND			0 / 6	
Cadium	mg/kg	0.0052 / 0.0226	ND			0 / 6	
Calcium	mg/kg		204.6000	204.6000	3252.4000	6 / 6	1598.1667
Chromium	mg/kg	0.1095 / 0.1241	ND			0 / 6	
Cobalt	mg/kg	0.0044 / 0.0065	ND			0 / 6	
Copper	mg/kg		0.2256	0.2256	0.5076	6 / 6	0.3123
Iron	mg/kg	10.9450 / 12.4644	ND			0 / 6	
Lead	mg/kg	0.0102 / 0.0105	0.0121	0.0121	0.0226	2 / 6	0.0173
Magnesium	mg/kg		273.4200	273.4200	348.1400	6 / 6	311.2367
Manganese	mg/kg		0.0940	0.0940	1.5471	6 / 6	0.7744
Mercury	mg/kg		0.0147	0.0147	0.0226	6 / 6	0.0179
Molybdenum	mg/kg	0.0096 / 0.0147	ND			0 / 6	
Nickel	mg/kg	0.0316 / 0.0414	ND			0 / 6	
Potassium	mg/kg		3087.6000	3087.6000	3800.9000	6 / 6	3468.5667
Selenium	mg/kg		0.3296	0.3296	0.6324	6 / 6	0.4825
Silver	mg/kg	0.0026 / 0.0031	ND			0 / 6	
Sodium	mg/kg		290.5400	290.5400	423.0000	6 / 6	364.0883
Strontium	mg/kg		0.1469	0.1469	2.7448	6 / 6	1.1884
Thallium	mg/kg	0.0129 / 0.0147	ND			0 / 6	
Vanadium	mg/kg	0.0961 / 0.1096	ND			0 / 6	
Zinc	mg/kg		12.1644	12.1644	19.3640	6 / 6	15.5984

Table A-15: Fall 2009 - Channel Catfish Fillet at Clinch River Mile 25.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		3.90	3.90	9.90	6 / 6	6.00
Moisture	%		77.2	77.2	82.2	6 / 6	79.7
Aluminum	mg/kg		1.2064	1.2064	3.6490	6 / 6	2.7168
Antimony	mg/kg	0.0171 / 0.0196	0.1596	0.1596	0.5016	2 / 6	0.3306
Arsenic	mg/kg	0.0329 / 0.0329	0.0270	0.0270	0.0798	5 / 6	0.0508
Barium	mg/kg	0.0181 / 0.0400	ND			0 / 6	
Beryllium	mg/kg	0.0029 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0562 / 0.1520	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0365	ND			0 / 6	
Calcium	mg/kg		51.8320	51.8320	91.4000	6 / 6	65.3350
Chromium	mg/kg	0.1094 / 0.1210	0.1144	0.1144	0.2000	3 / 6	0.1515
Cobalt	mg/kg	0.0066 / 0.0148	ND			0 / 6	
Copper	mg/kg		0.2080	0.2080	0.4800	6 / 6	0.3014
Iron	mg/kg	10.9824 / 12.2683	ND			0 / 6	
Lead	mg/kg		0.0257	0.0257	5.4131	6 / 6	1.1784
Magnesium	mg/kg		188.2980	188.2980	218.0000	6 / 6	206.3172
Manganese	mg/kg		0.1144	0.1144	0.2200	6 / 6	0.1463
Mercury	mg/kg		0.0200	0.0200	0.1109	6 / 6	0.0537
Molybdenum	mg/kg	0.0096 / 0.0128	ND			0 / 6	
Nickel	mg/kg		0.0356	0.0356	0.0840	6 / 6	0.0532
Potassium	mg/kg		3128.4000	3128.4000	3595.6000	6 / 6	3378.1000
Selenium	mg/kg		0.0338	0.0338	0.3328	6 / 6	0.2526
Silver	mg/kg	0.0027 / 0.0030	0.0028	0.0028	0.0028	1 / 6	0.0028
Sodium	mg/kg		259.8800	259.8800	429.6600	6 / 6	342.0717
Strontium	mg/kg		0.0376	0.0376	0.0931	6 / 6	0.0613
Thallium	mg/kg	0.0395 / 0.0443	ND			0 / 6	
Vanadium	mg/kg	0.0478 / 0.0543	ND			0 / 6	
Zinc	mg/kg		5.2208	5.2208	7.1200	6 / 6	6.2479

Table A-16: Fall 2009 - Largemouth Bass Fillet at Clinch River Mile 25.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.98	0.98	2.30	5 / 5	1.74
Moisture	%		76.4	76.4	81.2	5 / 5	78.1
Aluminum	mg/kg	0.7668 / 1.9824	ND			0 / 5	
Antimony	mg/kg	0.0178 / 0.0178	0.0277	0.0277	0.2053	4 / 5	0.1157
Arsenic	mg/kg		0.1410	0.1410	0.4047	5 / 5	0.2602
Barium	mg/kg	0.0188 / 0.0188	0.0248	0.0248	0.0614	4 / 5	0.0409
Beryllium	mg/kg	0.0028 / 0.0033	ND			0 / 5	
Boron	mg/kg	0.0554 / 0.0635	ND			0 / 5	
Cadium	mg/kg	0.0056 / 0.0376	ND			0 / 5	
Calcium	mg/kg		93.4360	93.4360	549.5400	5 / 5	294.4852
Chromium	mg/kg		0.1274	0.1274	0.2700	5 / 5	0.1835
Cobalt	mg/kg	0.0043 / 0.0068	ND			0 / 5	
Copper	mg/kg		0.3195	0.3195	1.0620	5 / 5	0.4931
Iron	mg/kg	10.7991 / 12.2435	ND			0 / 5	
Lead	mg/kg		0.0198	0.0198	1.8172	5 / 5	0.8495
Magnesium	mg/kg		183.1360	183.1360	305.5000	5 / 5	256.8592
Manganese	mg/kg		0.0833	0.0833	0.1770	5 / 5	0.1188
Mercury	mg/kg		0.0158	0.0158	0.0733	5 / 5	0.0485
Molybdenum	mg/kg	0.0094 / 0.0106	ND			0 / 5	
Nickel	mg/kg	0.0360 / 0.0752	ND			0 / 5	
Potassium	mg/kg		2619.6000	2619.6000	4159.5000	5 / 5	3466.2400
Selenium	mg/kg		0.7332	0.7332	0.9165	5 / 5	0.7961
Silver	mg/kg	0.0026 / 0.0031	ND			0 / 5	
Sodium	mg/kg		328.0200	328.0200	446.0400	5 / 5	386.5480
Strontium	mg/kg		0.0395	0.0395	0.4686	5 / 5	0.2264
Thallium	mg/kg	0.0128 / 0.0143	ND			0 / 5	
Vanadium	mg/kg	0.0952 / 0.1074	ND			0 / 5	
Zinc	mg/kg		9.3436	9.3436	35.8720	5 / 5	15.9975

Table A-17: Spring 2010 - Bluegill Fillet at Clinch River Mile 25.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.64	0.64	0.88	3 / 3	0.78
Moisture	%		77.8	77.8	79.2	3 / 3	78.5
Aluminum	mg/kg	3.8064 / 3.9775	ND			0 / 3	
Antimony	mg/kg	0.0137 / 0.0144	ND			0 / 3	
Arsenic	mg/kg	0.0289 / 0.0289	0.0458	0.0458	0.1935	2 / 3	0.1196
Barium	mg/kg	0.0466 / 0.0466	0.1419	0.1419	0.1435	2 / 3	0.1427
Beryllium	mg/kg	0.0289 / 0.0301	ND			0 / 3	
Boron	mg/kg	0.3952 / 0.4218	ND			0 / 3	
Cadium	mg/kg	0.0153 / 0.0153	0.0144	0.0144	0.0144	1 / 3	0.0144
Calcium	mg/kg		196.0260	196.0260	2042.5600	3 / 3	1379.0120
Chromium	mg/kg	0.1206 / 0.1269	ND			0 / 3	
Cobalt	mg/kg	0.0133 / 0.0140	0.0170	0.0170	0.0170	1 / 3	0.0170
Copper	mg/kg		0.2220	0.2220	0.4576	3 / 3	0.3197
Iron	mg/kg	11.4816 / 11.9970	ND			0 / 3	
Lead	mg/kg	0.0266 / 0.0280	ND			0 / 3	
Magnesium	mg/kg		297.4400	297.4400	328.9500	3 / 3	313.1367
Manganese	mg/kg		0.2664	0.2664	1.7888	3 / 3	0.9001
Mercury	mg/kg		0.0115	0.0115	0.0237	3 / 3	0.0187
Molybdenum	mg/kg	0.0333 / 0.0355	ND			0 / 3	
Nickel	mg/kg	0.0968 / 0.0977	0.1082	0.1082	0.1082	1 / 3	0.1082
Potassium	mg/kg		3556.8000	3556.8000	4240.2000	3 / 3	3917.6667
Selenium	mg/kg		0.3774	0.3774	0.6656	3 / 3	0.5555
Silver	mg/kg	0.0027 / 0.0029	ND			0 / 3	
Sodium	mg/kg		415.1400	415.1400	472.1600	3 / 3	436.2333
Strontium	mg/kg		0.1177	0.1177	1.4620	3 / 3	1.0119
Thallium	mg/kg	0.0131 / 0.0138	ND			0 / 3	
Vanadium	mg/kg	0.0874 / 0.0910	ND			0 / 3	
Zinc	mg/kg		9.7680	9.7680	20.8000	3 / 3	15.4998

Table A-18: Spring 2010 - Largemouth Bass Fillet at Clinch River Mile 25.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.42	0.42	2.20	6 / 6	1.25
Moisture	%		77.8	77.8	80.3	6 / 6	79.0
Aluminum	mg/kg	3.5854 / 4.0803	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0148	ND			0 / 6	
Arsenic	mg/kg		0.1970	0.1970	0.4944	6 / 6	0.3417
Barium	mg/kg	0.0414 / 0.0469	ND			0 / 6	
Beryllium	mg/kg	0.0256 / 0.0305	ND			0 / 6	
Boron	mg/kg	0.3740 / 0.4263	ND			0 / 6	
Cadium	mg/kg	0.0068 / 0.0077	ND			0 / 6	
Calcium	mg/kg		89.0440	89.0440	874.9300	6 / 6	297.0957
Chromium	mg/kg	0.1144 / 0.1278	0.1624	0.1624	0.4334	2 / 6	0.2979
Cobalt	mg/kg	0.0125 / 0.0144	ND			0 / 6	
Copper	mg/kg		0.1848	0.1848	0.3152	6 / 6	0.2174
Iron	mg/kg	10.8020 / 12.2815	ND			0 / 6	
Lead	mg/kg	0.0242 / 0.0284	0.0433	0.0433	0.0433	1 / 6	0.0433
Magnesium	mg/kg		244.2800	244.2800	306.3600	6 / 6	283.2450
Manganese	mg/kg	0.1518 / 0.1725	0.1827	0.1827	0.1827	1 / 6	0.1827
Mercury	mg/kg		0.0296	0.0296	0.0853	6 / 6	0.0548
Molybdenum	mg/kg	0.0308 / 0.0365	ND			0 / 6	
Nickel	mg/kg	0.0880 / 0.2343	0.1056	0.1056	0.2758	2 / 6	0.1907
Potassium	mg/kg		3506.6000	3506.6000	4151.4000	6 / 6	3946.0500
Selenium	mg/kg		0.5720	0.5720	1.0212	6 / 6	0.6953
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		336.8700	336.8700	417.3600	6 / 6	384.2067
Strontium	mg/kg		0.0433	0.0433	0.7917	6 / 6	0.2117
Thallium	mg/kg	0.0123 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0414 / 0.0469	ND			0 / 6	
Zinc	mg/kg		7.3698	7.3698	20.2910	6 / 6	11.0503

Table A-19: Spring 2010 - Red Ear Sunfish Fillet at Clinch River Mile 25.0

Lipids	%		0.36	0.36	0.37	3 / 3	0.36
Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Moisture	%		78.1	78.1	80.8	3 / 3	79.2
Aluminum	mg/kg	3.6594 / 4.0896	ND			0 / 3	
Antimony	mg/kg	0.0133 / 0.0148	ND			0 / 3	
Arsenic	mg/kg		0.2304	0.2304	0.2847	3 / 3	0.2502
Barium	mg/kg	0.0428 / 0.0461	0.0767	0.0767	0.0767	1 / 3	0.0767
Beryllium	mg/kg	0.0278 / 0.0307	ND			0 / 3	
Boron	mg/kg	0.3852 / 0.4224	ND			0 / 3	
Cadium	mg/kg	0.0071 / 0.0077	ND			0 / 3	
Calcium	mg/kg		113.2060	113.2060	481.8000	3 / 3	257.9833
Chromium	mg/kg	0.1156 / 0.1286	ND			0 / 3	
Cobalt	mg/kg	0.0128 / 0.0144	ND			0 / 3	
Copper	mg/kg		0.2354	0.2354	0.2688	3 / 3	0.2484
Iron	mg/kg	11.0210 / 12.3072	ND			0 / 3	
Lead	mg/kg	0.0257 / 0.0288	ND			0 / 3	
Magnesium	mg/kg		270.7200	270.7200	293.4600	3 / 3	284.3600
Manganese	mg/kg	0.1562 / 0.1747	0.2847	0.2847	0.2847	1 / 3	0.2847
Mercury	mg/kg		0.0300	0.0300	0.0941	3 / 3	0.0552
Molybdenum	mg/kg	0.0321 / 0.0365	ND			0 / 3	
Nickel	mg/kg	0.0899 / 0.0942	0.1670	0.1670	0.1670	1 / 3	0.1670
Potassium	mg/kg		3372.6000	3372.6000	3916.8000	3 / 3	3671.0000
Selenium	mg/kg		0.5760	0.5760	1.0950	3 / 3	0.8281
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 3	
Sodium	mg/kg		350.9600	350.9600	435.8100	3 / 3	397.2967
Strontium	mg/kg		0.0492	0.0492	0.3285	3 / 3	0.1656
Thallium	mg/kg	0.0134 / 0.0161	ND			0 / 3	
Vanadium	mg/kg	0.0428 / 0.0461	ND			0 / 3	
Zinc	mg/kg		7.9872	7.9872	17.2698	3 / 3	13.0180

Table A-20: Spring 2009 - Bluegill Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.56	0.56	1.10	6 / 6	0.74
Moisture	%		78.7	78.7	83.6	6 / 6	81.4
Aluminum	mg/kg	0.7920 / 0.8528	ND			0 / 6	
Antimony	mg/kg	0.0234 / 0.0283	ND			0 / 6	
Arsenic	mg/kg		0.0478	0.0478	0.0684	6 / 6	0.0597
Barium	mg/kg		0.0270	0.0270	0.1274	6 / 6	0.0668
Beryllium	mg/kg	0.0029 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0576 / 0.0623	ND			0 / 6	
Cadium	mg/kg	0.0054 / 0.0058	ND			0 / 6	
Calcium	mg/kg		203.4000	203.4000	2653.2000	6 / 6	1049.5450
Chromium	mg/kg	0.1116 / 0.1197	ND			0 / 6	
Cobalt	mg/kg	0.0048 / 0.0133	ND			0 / 6	
Copper	mg/kg		0.1725	0.1725	0.2700	6 / 6	0.2286
Iron	mg/kg	11.2140 / 12.1196	ND			0 / 6	
Lead	mg/kg	0.0095 / 0.0103	ND			0 / 6	
Magnesium	mg/kg		269.2800	269.2800	299.1300	6 / 6	283.3183
Manganese	mg/kg		0.1728	0.1728	1.2672	6 / 6	0.5203
Mercury	mg/kg		0.0344	0.0344	0.0873	6 / 6	0.0536
Molybdenum	mg/kg	0.0097 / 0.0125	ND			0 / 6	
Nickel	mg/kg	0.0317 / 0.0576	ND			0 / 6	
Potassium	mg/kg		3152.4000	3152.4000	3627.8000	6 / 6	3371.3500
Selenium	mg/kg		0.4950	0.4950	0.6888	6 / 6	0.5910
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		260.1900	260.1900	381.2700	6 / 6	317.9917
Strontium	mg/kg		0.1242	0.1242	2.2968	6 / 6	0.8364
Thallium	mg/kg	0.0131 / 0.0143	ND			0 / 6	
Vanadium	mg/kg	0.0486 / 0.0541	ND			0 / 6	
Zinc	mg/kg		8.2644	8.2644	20.1960	6 / 6	13.3347

Table A-21: Spring 2009 - Largemouth Bass Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.10	1.10	3.00	6 / 6	2.00
Moisture	%		78.3	78.3	79.7	6 / 6	78.9
Aluminum	mg/kg	0.8772 / 0.8944	ND			0 / 6	
Antimony	mg/kg	0.0191 / 0.0193	ND			0 / 6	
Arsenic	mg/kg		0.1897	0.1897	0.3472	6 / 6	0.2718
Barium	mg/kg	0.0203 / 0.0206	ND			0 / 6	
Beryllium	mg/kg	0.0032 / 0.0063	ND			0 / 6	
Boron	mg/kg	0.0632 / 0.0651	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0061	ND			0 / 6	
Calcium	mg/kg		119.5670	119.5670	365.5000	6 / 6	227.1493
Chromium	mg/kg	0.1226 / 0.1244	0.2233	0.2233	0.2233	1 / 6	0.2233
Cobalt	mg/kg	0.0048 / 0.0085	ND			0 / 6	
Copper	mg/kg	0.1795 / 0.1795	0.2387	0.2387	0.3952	5 / 6	0.2916
Iron	mg/kg	12.4270 / 12.5048	ND			0 / 6	
Lead	mg/kg	0.0105 / 0.0106	ND			0 / 6	
Magnesium	mg/kg		206.8010	206.8010	268.7500	6 / 6	246.5185
Manganese	mg/kg		0.1040	0.1040	0.1806	6 / 6	0.1359
Mercury	mg/kg		0.0387	0.0387	0.1000	6 / 6	0.0596
Molybdenum	mg/kg	0.0108 / 0.0109	0.0158	0.0158	0.0158	1 / 6	0.0158
Nickel	mg/kg	0.0326 / 0.0345	0.0458	0.0458	0.0458	1 / 6	0.0458
Potassium	mg/kg		2821.0000	2821.0000	3676.5000	6 / 6	3445.9667
Selenium	mg/kg		0.3468	0.3468	0.7696	6 / 6	0.6002
Silver	mg/kg	0.0029 / 0.0031	ND			0 / 6	
Sodium	mg/kg		334.1800	334.1800	440.9600	6 / 6	391.8533
Strontium	mg/kg	0.0206 / 0.0326	0.0816	0.0816	0.2107	4 / 6	0.1393
Thallium	mg/kg	0.0146 / 0.0180	ND			0 / 6	
Vanadium	mg/kg	0.0538 / 0.0551	ND			0 / 6	
Zinc	mg/kg		6.5076	6.5076	10.8790	6 / 6	9.1630

Table A-22: Spring 2009 - White Crappie Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.87	0.87	1.60	4 / 4	1.32
Moisture	%		79.5	79.5	80.2	4 / 4	79.8
Aluminum	mg/kg	0.8815 / 0.8976	ND			0 / 4	
Antimony	mg/kg	0.0192 / 0.0406	0.0224	0.0224	0.0224	1 / 4	0.0224
Arsenic	mg/kg		0.2178	0.2178	0.2460	4 / 4	0.2330
Barium	mg/kg	0.0609 / 0.0609	0.0308	0.0308	0.1802	3 / 4	0.0860
Beryllium	mg/kg	0.0033 / 0.0150	ND			0 / 4	
Boron	mg/kg	0.0636 / 0.0653	ND			0 / 4	
Cadium	mg/kg	0.0059 / 0.0140	ND			0 / 4	
Calcium	mg/kg		94.2480	94.2480	671.9300	4 / 4	434.2345
Chromium	mg/kg	0.1230 / 0.1247	ND			0 / 4	
Cobalt	mg/kg	0.0049 / 0.0099	ND			0 / 4	
Copper	mg/kg	0.1802 / 0.1816	0.1929	0.1929	0.5125	2 / 4	0.3527
Iron	mg/kg	12.4230 / 12.5256	ND			0 / 4	
Lead	mg/kg	0.0105 / 0.0106	ND			0 / 4	
Magnesium	mg/kg		271.3200	271.3200	289.0500	4 / 4	279.8975
Manganese	mg/kg		0.1285	0.1285	0.3654	4 / 4	0.2446
Mercury	mg/kg	0.0195 / 0.0195	0.0286	0.0286	0.0893	3 / 4	0.0617
Molybdenum	mg/kg	0.0108 / 0.0109	ND			0 / 4	
Nickel	mg/kg	0.0328 / 0.1117	ND			0 / 4	
Potassium	mg/kg		3623.4000	3623.4000	3854.0000	4 / 4	3736.3250
Selenium	mg/kg		0.3762	0.3762	0.4920	4 / 4	0.4257
Silver	mg/kg	0.0030 / 0.0031	ND			0 / 4	
Sodium	mg/kg		235.6200	235.6200	265.9300	4 / 4	249.1225
Strontium	mg/kg	0.0347 / 0.0347	0.2460	0.2460	0.4466	3 / 4	0.3629
Thallium	mg/kg	0.0146 / 0.0177	ND			0 / 4	
Vanadium	mg/kg	0.0551 / 0.1096	ND			0 / 4	
Zinc	mg/kg		6.5142	6.5142	9.5880	4 / 4	7.8939

Table A-23: Fall 2009 - Bluegill Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.22	0.22	0.41	6 / 6	0.33
Moisture	%		78.8	78.8	81.6	6 / 6	80.7
Aluminum	mg/kg	0.8692 / 1.8333	ND			0 / 6	
Antimony	mg/kg	0.0184 / 0.0189	ND			0 / 6	
Arsenic	mg/kg		0.0333	0.0333	0.0718	6 / 6	0.0517
Barium	mg/kg		0.0360	0.0360	0.1803	6 / 6	0.0855
Beryllium	mg/kg	0.0031 / 0.0061	ND			0 / 6	
Boron	mg/kg	0.0636 / 0.2208	ND			0 / 6	
Cadium	mg/kg	0.0058 / 0.0221	ND			0 / 6	
Calcium	mg/kg		263.2000	263.2000	2548.0000	6 / 6	1054.6217
Chromium	mg/kg	0.1203 / 0.1233	ND			0 / 6	
Cobalt	mg/kg	0.0049 / 0.0140	ND			0 / 6	
Copper	mg/kg		0.2120	0.2120	0.6016	6 / 6	0.4278
Iron	mg/kg	12.1260 / 12.3795	ND			0 / 6	
Lead	mg/kg	0.0104 / 0.0106	0.0175	0.0175	0.0489	2 / 6	0.0332
Magnesium	mg/kg		250.0400	250.0400	288.1200	6 / 6	264.5383
Manganese	mg/kg	0.2068 / 0.9828	ND			0 / 6	
Mercury	mg/kg		0.0397	0.0397	0.0902	6 / 6	0.0529
Molybdenum	mg/kg	0.0105 / 0.0221	ND			0 / 6	
Nickel	mg/kg	0.0339 / 0.0339	0.0359	0.0359	0.0564	5 / 6	0.0450
Potassium	mg/kg		3061.8000	3061.8000	3328.4000	6 / 6	3160.7667
Selenium	mg/kg		0.5076	0.5076	0.7360	6 / 6	0.6007
Silver	mg/kg	0.0028 / 0.0048	ND			0 / 6	
Sodium	mg/kg		330.7500	330.7500	402.9600	6 / 6	352.9383
Strontium	mg/kg		0.2256	0.2256	2.0384	6 / 6	0.8417
Thallium	mg/kg	0.0143 / 0.0146	ND			0 / 6	
Vanadium	mg/kg	0.0526 / 0.0552	ND			0 / 6	
Zinc	mg/kg		8.5050	8.5050	22.4480	6 / 6	14.8926

Table A-24: Fall 2009 - Channel Catfish Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		3.20	3.20	7.90	6 / 6	4.92
Moisture	%		71.2	71.2	82.3	6 / 6	78.3
Aluminum	mg/kg	2.8072 / 2.8072	2.4289	2.4289	5.2128	5 / 6	3.7951
Antimony	mg/kg	0.0177 / 0.0490	ND			0 / 6	
Arsenic	mg/kg	0.0309 / 0.0337	0.0169	0.0169	0.0220	4 / 6	0.0187
Barium	mg/kg	0.0201 / 0.0201	0.0299	0.0299	0.0423	5 / 6	0.0341
Beryllium	mg/kg	0.0029 / 0.0032	ND			0 / 6	
Boron	mg/kg	0.0568 / 0.0636	ND			0 / 6	
Cadium	mg/kg	0.0206 / 0.0206	0.0072	0.0072	0.0250	5 / 6	0.0183
Calcium	mg/kg		68.2640	68.2640	96.1180	6 / 6	80.5550
Chromium	mg/kg		0.2760	0.2760	0.9307	6 / 6	0.4978
Cobalt	mg/kg	0.0184 / 0.0184	0.0062	0.0062	0.0102	5 / 6	0.0083
Copper	mg/kg		0.2904	0.2904	0.3540	6 / 6	0.3214
Iron	mg/kg	10.8733 / 12.3794	ND			0 / 6	
Lead	mg/kg		0.0449	0.0449	0.5184	6 / 6	0.2548
Magnesium	mg/kg		187.6800	187.6800	229.9000	6 / 6	210.5633
Manganese	mg/kg	0.1646 / 0.1646	0.1566	0.1566	0.1958	5 / 6	0.1705
Mercury	mg/kg		0.0387	0.0387	0.1027	6 / 6	0.0729
Molybdenum	mg/kg	0.0095 / 0.0107	ND			0 / 6	
Nickel	mg/kg		0.0423	0.0423	0.0655	6 / 6	0.0575
Potassium	mg/kg		3540.0000	3540.0000	3790.4000	6 / 6	3671.4000
Selenium	mg/kg		0.1717	0.1717	0.2951	6 / 6	0.2224
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		275.3280	275.3280	404.1400	6 / 6	319.5380
Strontium	mg/kg		0.0626	0.0626	0.1010	6 / 6	0.0819
Thallium	mg/kg	0.0143 / 0.0297	ND			0 / 6	
Vanadium	mg/kg	0.0532 / 0.1086	ND			0 / 6	
Zinc	mg/kg		5.7431	5.7431	7.7472	6 / 6	6.8007

Table A-25: Fall 2009 - Largemouth Bass Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.49	0.49	2.70	6 / 6	1.65
Moisture	%		76.3	76.3	79.3	6 / 6	78.1
Aluminum	mg/kg	1.6200 / 4.5582	ND			0 / 6	
Antimony	mg/kg	0.0178 / 0.0341	ND			0 / 6	
Arsenic	mg/kg		0.1598	0.1598	0.2297	6 / 6	0.2003
Barium	mg/kg	0.0183 / 0.0201	0.0232	0.0232	0.0360	2 / 6	0.0296
Beryllium	mg/kg	0.0030 / 0.0032	ND			0 / 6	
Boron	mg/kg	0.0575 / 0.0648	ND			0 / 6	
Cadium	mg/kg	0.0058 / 0.0403	0.0441	0.0441	0.0498	2 / 6	0.0469
Calcium	mg/kg		130.3560	130.3560	1208.4000	6 / 6	370.7167
Chromium	mg/kg	0.1108 / 0.1208	0.1296	0.1296	0.4266	4 / 6	0.2189
Cobalt	mg/kg	0.0046 / 0.0095	ND			0 / 6	
Copper	mg/kg		0.1683	0.1683	0.2607	6 / 6	0.2226
Iron	mg/kg	11.1612 / 12.1900	ND			0 / 6	
Lead	mg/kg		0.0156	0.0156	0.3621	6 / 6	0.1508
Magnesium	mg/kg		266.8000	266.8000	318.0000	6 / 6	284.1517
Manganese	mg/kg	0.1235 / 0.2056	ND			0 / 6	
Mercury	mg/kg		0.0469	0.0469	0.1160	6 / 6	0.0858
Molybdenum	mg/kg	0.0098 / 0.0128	ND			0 / 6	
Nickel	mg/kg		0.0298	0.0298	0.1398	6 / 6	0.0731
Potassium	mg/kg		3389.1000	3389.1000	3773.6000	6 / 6	3642.4833
Selenium	mg/kg		0.4104	0.4104	0.5214	6 / 6	0.4681
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		330.1500	330.1500	488.2200	6 / 6	407.0567
Strontium	mg/kg		0.0575	0.0575	0.8268	6 / 6	0.2339
Thallium	mg/kg	0.0132 / 0.0144	ND			0 / 6	
Vanadium	mg/kg	0.0490 / 0.0540	ND			0 / 6	
Zinc	mg/kg		7.3080	7.3080	12.6558	6 / 6	9.1485

Table A-26: Spring 2010 - Bluegill Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.55	0.55	1.30	6 / 6	0.88
Moisture	%		79.6	79.6	82.8	6 / 6	81.5
Aluminum	mg/kg	3.7496 / 4.1208	ND			0 / 6	
Antimony	mg/kg	0.0136 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.0338	0.0338	0.0774	6 / 6	0.0598
Barium	mg/kg	0.0430 / 0.0478	ND			0 / 6	
Beryllium	mg/kg	0.0275 / 0.0308	ND			0 / 6	
Boron	mg/kg	0.3956 / 0.4284	ND			0 / 6	
Cadium	mg/kg	0.0071 / 0.0159	ND			0 / 6	
Calcium	mg/kg		132.0420	132.0420	584.0100	6 / 6	360.4740
Chromium	mg/kg	0.1187 / 0.1306	ND			0 / 6	
Cobalt	mg/kg	0.0132 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.2457	0.2457	0.4136	6 / 6	0.3221
Iron	mg/kg	11.2832 / 12.4032	ND			0 / 6	
Lead	mg/kg	0.0258 / 0.0290	ND			0 / 6	
Magnesium	mg/kg		249.4000	249.4000	318.2400	6 / 6	276.8083
Manganese	mg/kg		0.1892	0.1892	0.7749	6 / 6	0.3743
Mercury	mg/kg		0.0567	0.0567	0.1053	6 / 6	0.0794
Molybdenum	mg/kg	0.0321 / 0.0367	ND			0 / 6	
Nickel	mg/kg	0.0907 / 0.3760	ND			0 / 6	
Potassium	mg/kg		3451.5000	3451.5000	3937.2000	6 / 6	3644.8833
Selenium	mg/kg		0.4956	0.4956	0.6335	6 / 6	0.5458
Silver	mg/kg	0.0026 / 0.0031	ND			0 / 6	
Sodium	mg/kg		233.6400	233.6400	351.5600	6 / 6	291.6833
Strontium	mg/kg		0.0796	0.0796	0.4347	6 / 6	0.2563
Thallium	mg/kg	0.0129 / 0.0143	ND			0 / 6	
Vanadium	mg/kg	0.0430 / 0.0471	ND			0 / 6	
Zinc	mg/kg		12.6252	12.6252	20.6400	6 / 6	16.9448

Table A-27: Spring 2010 - Largemouth Bass Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.00	1.00	1.60	6 / 6	1.28
Moisture	%		78.4	78.4	79.1	6 / 6	78.8
Aluminum	mg/kg	3.8127 / 4.1173	ND			0 / 6	
Antimony	mg/kg	0.0138 / 0.0148	ND			0 / 6	
Arsenic	mg/kg		0.1308	0.1308	0.3135	6 / 6	0.2357
Barium	mg/kg	0.0447 / 0.0481	ND			0 / 6	
Beryllium	mg/kg	0.0277 / 0.0314	ND			0 / 6	
Boron	mg/kg	0.4047 / 0.4220	ND			0 / 6	
Cadium	mg/kg	0.0072 / 0.0079	ND			0 / 6	
Calcium	mg/kg		144.5350	144.5350	342.7600	6 / 6	250.4203
Chromium	mg/kg	0.1214 / 0.1317	0.2508	0.2508	0.2508	1 / 6	0.2508
Cobalt	mg/kg	0.0134 / 0.0144	ND			0 / 6	
Copper	mg/kg		0.1498	0.1498	0.3344	6 / 6	0.2539
Iron	mg/kg	11.4807 / 12.4355	ND			0 / 6	
Lead	mg/kg	0.0256 / 0.0293	ND			0 / 6	
Magnesium	mg/kg		269.6400	269.6400	311.0400	6 / 6	288.9967
Manganese	mg/kg	0.1712 / 0.1756	0.1896	0.1896	0.2376	3 / 6	0.2190
Mercury	mg/kg		0.0857	0.0857	0.1685	6 / 6	0.1338
Molybdenum	mg/kg	0.0341 / 0.0359	ND			0 / 6	
Nickel	mg/kg	0.0937 / 0.1003	0.1233	0.1233	0.1233	1 / 6	0.1233
Potassium	mg/kg		3723.6000	3723.6000	4493.5000	6 / 6	4089.6667
Selenium	mg/kg		0.4220	0.4220	0.5852	6 / 6	0.4977
Silver	mg/kg	0.0028 / 0.0030	ND			0 / 6	
Sodium	mg/kg		384.5600	384.5600	483.8400	6 / 6	440.1883
Strontium	mg/kg		0.0654	0.0654	0.2299	6 / 6	0.1413
Thallium	mg/kg	0.0132 / 0.0180	ND			0 / 6	
Vanadium	mg/kg	0.0426 / 0.0481	0.0815	0.0815	0.0815	1 / 6	0.0815
Zinc	mg/kg		4.1356	4.1356	8.6944	6 / 6	7.4224

Table A-28: Spring 2010 - Red Ear Sunfish Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.17	0.17	0.60	6 / 6	0.35
Moisture	%		79.0	79.0	82.5	6 / 6	81.0
Aluminum	mg/kg	3.5400 / 4.1580	ND			0 / 6	
Antimony	mg/kg	0.0128 / 0.0151	ND			0 / 6	
Arsenic	mg/kg		0.1260	0.1260	0.3056	6 / 6	0.2063
Barium	mg/kg	0.0438 / 0.0483	0.0516	0.0516	0.2960	4 / 6	0.1265
Beryllium	mg/kg	0.0260 / 0.0315	ND			0 / 6	
Boron	mg/kg	0.3600 / 0.4255	ND			0 / 6	
Cadium	mg/kg	0.0068 / 0.0080	ND			0 / 6	
Calcium	mg/kg		95.1300	95.1300	3071.0000	6 / 6	804.6950
Chromium	mg/kg	0.1120 / 0.1323	ND			0 / 6	
Cobalt	mg/kg	0.0124 / 0.0147	ND			0 / 6	
Copper	mg/kg		0.1698	0.1698	0.2520	6 / 6	0.2063
Iron	mg/kg	10.6600 / 12.5160	ND			0 / 6	
Lead	mg/kg	0.0240 / 0.0294	ND			0 / 6	
Magnesium	mg/kg		248.3000	248.3000	281.2000	6 / 6	264.8033
Manganese	mg/kg	0.1628 / 0.1764	0.1660	0.1660	0.7770	3 / 6	0.4456
Mercury	mg/kg		0.0336	0.0336	0.1146	6 / 6	0.0604
Molybdenum	mg/kg	0.0320 / 0.0358	ND			0 / 6	
Nickel	mg/kg	0.0860 / 0.1008	ND			0 / 6	
Potassium	mg/kg		3459.5000	3459.5000	3840.0000	6 / 6	3612.2333
Selenium	mg/kg		0.7030	0.7030	0.9550	6 / 6	0.7894
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		275.6600	275.6600	479.1500	6 / 6	350.8950
Strontium	mg/kg	0.0462 / 0.0462	0.0963	0.0963	1.9425	5 / 6	0.5822
Thallium	mg/kg	0.0122 / 0.0143	ND			0 / 6	
Vanadium	mg/kg	0.0400 / 0.0483	ND			0 / 6	
Zinc	mg/kg		11.3050	11.3050	18.0495	6 / 6	13.6649

Table A-29: Spring 2010 - White Crappie Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.60	0.60	3.20	6 / 6	1.62
Moisture	%		77.9	77.9	80.1	6 / 6	79.1
Aluminum	mg/kg	3.6330 / 4.1370	ND			0 / 6	
Antimony	mg/kg	0.0132 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.2388	0.2388	0.3570	6 / 6	0.3179
Barium	mg/kg	0.0420 / 0.0483	0.0540	0.0540	0.0540	1 / 6	0.0540
Beryllium	mg/kg	0.0273 / 0.0315	ND			0 / 6	
Boron	mg/kg	0.3780 / 0.4200	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0080	ND			0 / 6	
Calcium	mg/kg		117.1830	117.1830	1337.0400	6 / 6	396.6915
Chromium	mg/kg	0.1155 / 0.1323	ND			0 / 6	
Cobalt	mg/kg	0.0128 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.1706	0.1706	0.2144	6 / 6	0.1929
Iron	mg/kg	10.9620 / 12.4740	ND			0 / 6	
Lead	mg/kg	0.0252 / 0.0294	ND			0 / 6	
Magnesium	mg/kg		252.0000	252.0000	313.2000	6 / 6	279.5400
Manganese	mg/kg	0.1554 / 0.1764	0.4320	0.4320	0.4320	1 / 6	0.4320
Mercury	mg/kg		0.0336	0.0336	0.1771	6 / 6	0.1057
Molybdenum	mg/kg	0.0315 / 0.0358	ND			0 / 6	
Nickel	mg/kg	0.0882 / 0.1008	ND			0 / 6	
Potassium	mg/kg		3696.0000	3696.0000	4212.0000	6 / 6	3964.3167
Selenium	mg/kg		0.2985	0.2985	0.4410	6 / 6	0.3564
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		265.2000	265.2000	325.6200	6 / 6	303.9317
Strontium	mg/kg		0.0643	0.0643	0.9072	6 / 6	0.2493
Thallium	mg/kg	0.0137 / 0.0294	ND			0 / 6	
Vanadium	mg/kg	0.0420 / 0.0483	ND			0 / 6	
Zinc	mg/kg		5.2337	5.2337	6.8250	6 / 6	6.2811

Table A-30: Fall 2010 - Bluegill Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.40	1.40	3.20	6 / 6	2.32
Moisture	%		79.2	79.2	81.2	6 / 6	79.9
Aluminum	mg/kg	3.7224 / 4.0397	ND			0 / 6	
Antimony	mg/kg	0.0135 / 0.0145	ND			0 / 6	
Arsenic	mg/kg		0.0395	0.0395	0.1066	6 / 6	0.0788
Barium	mg/kg		0.0505	0.0505	0.1353	6 / 6	0.0832
Beryllium	mg/kg	0.0282 / 0.0303	ND			0 / 6	
Boron	mg/kg	0.3895 / 0.4242	ND			0 / 6	
Cadium	mg/kg	0.0071 / 0.0078	ND			0 / 6	
Calcium	mg/kg		260.5800	260.5800	1059.8500	6 / 6	647.2250
Chromium	mg/kg	0.1184 / 0.1274	0.2424	0.2424	0.2424	1 / 6	0.2424
Cobalt	mg/kg	0.0132 / 0.0143	ND			0 / 6	
Copper	mg/kg		0.0846	0.0846	0.2626	6 / 6	0.2043
Iron	mg/kg	11.2236 / 12.1788	ND			0 / 6	
Lead	mg/kg	0.0263 / 0.0283	0.0438	0.0438	0.0438	1 / 6	0.0438
Magnesium	mg/kg		280.5900	280.5900	303.6800	6 / 6	288.1083
Manganese	mg/kg		0.3030	0.3030	0.9568	6 / 6	0.5550
Mercury	mg/kg		0.0431	0.0431	0.0603	6 / 6	0.0503
Molybdenum	mg/kg	0.0320 / 0.0364	ND			0 / 6	
Nickel	mg/kg	0.0902 / 0.0995	ND			0 / 6	
Potassium	mg/kg		3259.5000	3259.5000	3710.5000	6 / 6	3480.1500
Selenium	mg/kg		0.4920	0.4920	0.7585	6 / 6	0.6291
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		299.5200	299.5200	426.7600	6 / 6	378.7483
Strontium	mg/kg		0.2222	0.2222	0.9635	6 / 6	0.5824
Thallium	mg/kg	0.0128 / 0.0139	ND			0 / 6	
Vanadium	mg/kg	0.0431 / 0.0465	ND			0 / 6	
Zinc	mg/kg		11.0656	11.0656	18.6140	6 / 6	14.1772

Table A-31: Fall 2010 - Channel Catfish Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.00	1.00	4.80	6 / 6	2.38
Moisture	%		77.4	77.4	82.6	6 / 6	80.3
Aluminum	mg/kg	3.6400 / 4.1200	ND			0 / 6	
Antimony	mg/kg	0.0131 / 0.0148	ND			0 / 6	
Arsenic	mg/kg	0.0261 / 0.0289	0.0339	0.0339	0.0819	3 / 6	0.0554
Barium	mg/kg	0.0418 / 0.0480	ND			0 / 6	
Beryllium	mg/kg	0.0273 / 0.0300	ND			0 / 6	
Boron	mg/kg	0.3822 / 0.4200	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0076	0.0196	0.0196	0.0196	1 / 6	0.0196
Calcium	mg/kg		56.3400	56.3400	72.5940	6 / 6	65.4090
Chromium	mg/kg	0.1165 / 0.1300	ND			0 / 6	
Cobalt	mg/kg	0.0127 / 0.0144	0.0140	0.0140	0.0183	2 / 6	0.0161
Copper	mg/kg		0.2610	0.2610	0.4746	6 / 6	0.3561
Iron	mg/kg	10.9746 / 12.3800	ND			0 / 6	
Lead	mg/kg	0.0255 / 0.0280	0.0271	0.0271	0.0271	1 / 6	0.0271
Magnesium	mg/kg		194.8800	194.8800	257.5200	6 / 6	229.6400
Manganese	mg/kg	0.1566 / 0.1760	0.2730	0.2730	0.2730	1 / 6	0.2730
Mercury	mg/kg		0.0455	0.0455	0.1740	6 / 6	0.0859
Molybdenum	mg/kg	0.0328 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0892 / 0.1000	0.2131	0.2131	0.2131	1 / 6	0.2131
Potassium	mg/kg		3636.6000	3636.6000	3909.8000	6 / 6	3828.1667
Selenium	mg/kg		0.1494	0.1494	0.3774	6 / 6	0.2648
Silver	mg/kg	0.0025 / 0.0030	ND			0 / 6	
Sodium	mg/kg		296.6600	296.6600	448.0000	6 / 6	380.7300
Strontium	mg/kg		0.0612	0.0612	0.0768	6 / 6	0.0709
Thallium	mg/kg	0.0126 / 0.0142	ND			0 / 6	
Vanadium	mg/kg	0.0418 / 0.0460	ND			0 / 6	
Zinc	mg/kg		4.3326	4.3326	6.0162	6 / 6	5.3064

Table A-32: Fall 2010 - Largemouth Bass Fillet at Clinch River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.40	0.40	1.70	6 / 6	1.10
Moisture	%		77.5	77.5	79.4	6 / 6	78.4
Aluminum	mg/kg	3.6594 / 3.9240	ND			0 / 6	
Antimony	mg/kg	0.0133 / 0.0142	ND			0 / 6	
Arsenic	mg/kg		0.1742	0.1742	0.3375	6 / 6	0.2650
Barium	mg/kg	0.0428 / 0.0458	ND			0 / 6	
Beryllium	mg/kg	0.0278 / 0.0293	ND			0 / 6	
Boron	mg/kg	0.3852 / 0.4142	ND			0 / 6	
Cadium	mg/kg	0.0071 / 0.0074	ND			0 / 6	
Calcium	mg/kg		167.0900	167.0900	841.0200	6 / 6	465.9760
Chromium	mg/kg	0.1156 / 0.1243	ND			0 / 6	
Cobalt	mg/kg	0.0128 / 0.0137	0.0135	0.0135	0.0135	1 / 6	0.0135
Copper	mg/kg		0.2365	0.2365	0.6104	6 / 6	0.3639
Iron	mg/kg	11.0424 / 11.8156	ND			0 / 6	
Lead	mg/kg	0.0257 / 0.0283	ND			0 / 6	
Magnesium	mg/kg		275.2000	275.2000	330.7500	6 / 6	301.7950
Manganese	mg/kg	0.1591 / 0.1679	0.1710	0.1710	0.2354	3 / 6	0.1962
Mercury	mg/kg		0.0589	0.0589	0.1462	6 / 6	0.1001
Molybdenum	mg/kg	0.0321 / 0.0349	ND			0 / 6	
Nickel	mg/kg	0.0899 / 0.0968	ND			0 / 6	
Potassium	mg/kg		3547.5000	3547.5000	4140.0000	6 / 6	3904.6167
Selenium	mg/kg		0.4120	0.4120	0.7704	6 / 6	0.5474
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 6	
Sodium	mg/kg		398.9400	398.9400	500.7600	6 / 6	455.9683
Strontium	mg/kg		0.0760	0.0760	0.5992	6 / 6	0.3160
Thallium	mg/kg	0.0126 / 0.0135	ND			0 / 6	
Vanadium	mg/kg	0.0428 / 0.0458	ND			0 / 6	
Zinc	mg/kg		8.6860	8.6860	19.1316	6 / 6	12.3866

Table A-33: Spring 2009 - Bluegill Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.47	0.47	0.99	6 / 6	0.65
Moisture	%		77.9	77.9	81.5	6 / 6	79.5
Aluminum	mg/kg		1.2998	1.2998	4.6640	6 / 6	2.4023
Antimony	mg/kg	0.0185 / 0.0194	ND			0 / 6	
Arsenic	mg/kg	0.0389 / 0.0796	0.0995	0.0995	0.0995	1 / 6	0.0995
Barium	mg/kg		0.0408	0.0408	0.4074	6 / 6	0.1112
Beryllium	mg/kg	0.0033 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0638 / 0.0653	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0060	ND			0 / 6	
Calcium	mg/kg		134.4360	134.4360	5606.6000	6 / 6	1267.1360
Chromium	mg/kg	0.1232 / 0.1244	ND			0 / 6	
Cobalt	mg/kg	0.0072 / 0.0137	ND			0 / 6	
Copper	mg/kg		0.1897	0.1897	1.8564	6 / 6	0.5234
Iron	mg/kg	12.4320 / 12.5324	ND			0 / 6	
Lead	mg/kg	0.0105 / 0.0106	0.0151	0.0151	0.0619	2 / 6	0.0385
Magnesium	mg/kg		267.2400	267.2400	343.3800	6 / 6	291.5267
Manganese	mg/kg		0.1489	0.1489	5.4126	6 / 6	1.2701
Mercury	mg/kg	0.0243 / 0.0243	0.0306	0.0306	0.0592	5 / 6	0.0475
Molybdenum	mg/kg	0.0128 / 0.0330	ND			0 / 6	
Nickel	mg/kg		0.0194	0.0194	0.0530	6 / 6	0.0456
Potassium	mg/kg		3330.0000	3330.0000	3580.2000	6 / 6	3458.6000
Selenium	mg/kg		0.6984	0.6984	0.8580	6 / 6	0.7749
Silver	mg/kg	0.0030 / 0.0031	ND			0 / 6	
Sodium	mg/kg		257.4000	257.4000	330.4800	6 / 6	300.7617
Strontium	mg/kg		0.0694	0.0694	4.6172	6 / 6	1.0193
Thallium	mg/kg	0.0146 / 0.0147	ND			0 / 6	
Vanadium	mg/kg	0.0543 / 0.0555	ND			0 / 6	
Zinc	mg/kg		12.4875	12.4875	16.7810	6 / 6	14.1231

Table A-34: Spring 2009 - Largemouth Bass Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.79	0.79	4.10	6 / 6	2.12
Moisture	%		76.7	76.7	80.6	6 / 6	78.9
Aluminum	mg/kg	0.8730 / 0.8865	ND			0 / 6	
Antimony	mg/kg	0.0192 / 0.0194	ND			0 / 6	
Arsenic	mg/kg		0.1399	0.1399	0.3029	6 / 6	0.2202
Barium	mg/kg	0.0197 / 0.0302	ND			0 / 6	
Beryllium	mg/kg	0.0032 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0640 / 0.0652	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0061	ND			0 / 6	
Calcium	mg/kg		149.3530	149.3530	436.4500	6 / 6	244.6027
Chromium	mg/kg	0.1222 / 0.1247	ND			0 / 6	
Cobalt	mg/kg	0.0049 / 0.0111	ND			0 / 6	
Copper	mg/kg	0.1812 / 0.1812	0.2086	0.2086	0.2376	5 / 6	0.2190
Iron	mg/kg	12.3966 / 12.5354	ND			0 / 6	
Lead	mg/kg	0.0105 / 0.0107	ND			0 / 6	
Magnesium	mg/kg		252.5200	252.5200	285.1800	6 / 6	271.5600
Manganese	mg/kg		0.1084	0.1084	0.2365	6 / 6	0.1518
Mercury	mg/kg		0.0489	0.0489	0.1084	6 / 6	0.0762
Molybdenum	mg/kg	0.0107 / 0.0110	ND			0 / 6	
Nickel	mg/kg	0.0330 / 0.0344	0.0342	0.0342	0.0769	4 / 6	0.0490
Potassium	mg/kg		3448.4000	3448.4000	3585.4000	6 / 6	3519.8000
Selenium	mg/kg		0.4708	0.4708	0.7289	6 / 6	0.6121
Silver	mg/kg	0.0029 / 0.0030	ND			0 / 6	
Sodium	mg/kg		336.9600	336.9600	468.7000	6 / 6	401.7233
Strontium	mg/kg		0.0466	0.0466	0.2580	6 / 6	0.1230
Thallium	mg/kg	0.0146 / 0.0148	ND			0 / 6	
Vanadium	mg/kg	0.0540 / 0.0559	ND			0 / 6	
Zinc	mg/kg		6.1204	6.1204	10.5924	6 / 6	8.0484

Table A-35: Spring 2009 - White Crappie Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.20	1.20	1.20	1 / 1	1.20
Moisture	%		80.4	80.4	80.4	1 / 1	80.4
Aluminum	mg/kg	0.8820 / 0.8820	ND			0 / 1	
Antimony	mg/kg	0.0192 / 0.0192	ND			0 / 1	
Arsenic	mg/kg		0.1960	0.1960	0.1960	1 / 1	0.1960
Barium	mg/kg	0.0196 / 0.0196	ND			0 / 1	
Beryllium	mg/kg	0.0033 / 0.0033	ND			0 / 1	
Boron	mg/kg	0.0647 / 0.0647	ND			0 / 1	
Cadium	mg/kg	0.0061 / 0.0061	ND			0 / 1	
Calcium	mg/kg		258.7200	258.7200	258.7200	1 / 1	258.7200
Chromium	mg/kg	0.1235 / 0.1235	ND			0 / 1	
Cobalt	mg/kg	0.0049 / 0.0049	ND			0 / 1	
Copper	mg/kg		0.3136	0.3136	0.3136	1 / 1	0.3136
Iron	mg/kg	12.4656 / 12.4656	ND			0 / 1	
Lead	mg/kg	0.0106 / 0.0106	ND			0 / 1	
Magnesium	mg/kg		268.5200	268.5200	268.5200	1 / 1	268.5200
Manganese	mg/kg		0.1156	0.1156	0.1156	1 / 1	0.1156
Mercury	mg/kg	0.0216 / 0.0216	ND			0 / 1	
Molybdenum	mg/kg	0.0108 / 0.0108	ND			0 / 1	
Nickel	mg/kg		0.0706	0.0706	0.0706	1 / 1	0.0706
Potassium	mg/kg		3547.6000	3547.6000	3547.6000	1 / 1	3547.6000
Selenium	mg/kg		0.5096	0.5096	0.5096	1 / 1	0.5096
Silver	mg/kg	0.0029 / 0.0029	ND			0 / 1	
Sodium	mg/kg		284.2000	284.2000	284.2000	1 / 1	284.2000
Strontium	mg/kg		0.1215	0.1215	0.1215	1 / 1	0.1215
Thallium	mg/kg	0.0216 / 0.0216	ND			0 / 1	
Vanadium	mg/kg	0.0549 / 0.0549	ND			0 / 1	
Zinc	mg/kg		4.9980	4.9980	4.9980	1 / 1	4.9980

Table A-36: Fall 2009 - Bluegill Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.33	0.33	0.94	6 / 6	0.66
Moisture	%		79.8	79.8	82.3	6 / 6	80.8
Aluminum	mg/kg	0.8358 / 1.7860	ND			0 / 6	
Antimony	mg/kg	0.0179 / 0.0195	ND			0 / 6	
Arsenic	mg/kg	0.0338 / 0.0338	0.0389	0.0389	0.0828	5 / 6	0.0596
Barium	mg/kg		0.0282	0.0282	0.0996	6 / 6	0.0622
Beryllium	mg/kg	0.0030 / 0.0032	ND			0 / 6	
Boron	mg/kg	0.0602 / 0.1818	ND			0 / 6	
Cadium	mg/kg	0.0056 / 0.0109	0.0543	0.0543	0.0543	1 / 6	0.0543
Calcium	mg/kg		91.7440	91.7440	797.9700	6 / 6	463.3840
Chromium	mg/kg	0.1147 / 0.1221	ND			0 / 6	
Cobalt	mg/kg	0.0045 / 0.0106	ND			0 / 6	
Copper	mg/kg	0.1770 / 0.1770	0.1880	0.1880	0.3008	5 / 6	0.2502
Iron	mg/kg	11.5996 / 12.3192	ND			0 / 6	
Lead	mg/kg	0.0098 / 0.0104	ND			0 / 6	
Magnesium	mg/kg		240.7900	240.7900	299.4900	6 / 6	268.5533
Manganese	mg/kg		0.1147	0.1147	0.3618	6 / 6	0.2674
Mercury	mg/kg		0.0299	0.0299	0.0482	6 / 6	0.0378
Molybdenum	mg/kg	0.0102 / 0.0141	ND			0 / 6	
Nickel	mg/kg	0.0318 / 0.0336	0.0195	0.0195	0.0343	3 / 6	0.0286
Potassium	mg/kg		2965.1000	2965.1000	3271.2000	6 / 6	3125.9000
Selenium	mg/kg		0.7562	0.7562	1.1682	6 / 6	0.9563
Silver	mg/kg	0.0028 / 0.0030	ND			0 / 6	
Sodium	mg/kg		246.2800	246.2800	413.9200	6 / 6	313.0300
Strontium	mg/kg	0.0620 / 0.5841	0.7708	0.7708	0.7839	2 / 6	0.7774
Thallium	mg/kg	0.0137 / 0.0145	ND			0 / 6	
Vanadium	mg/kg	0.0508 / 0.0549	ND			0 / 6	
Zinc	mg/kg		9.7485	9.7485	18.6648	6 / 6	13.0500

Table A-37: Fall 2009 - Channel Catfish Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.60	1.60	4.80	6 / 6	2.75
Moisture	%		79.5	79.5	82.5	6 / 6	80.7
Aluminum	mg/kg		2.9930	2.9930	5.1800	6 / 6	4.0852
Antimony	mg/kg	0.0175 / 0.1480	ND			0 / 6	
Arsenic	mg/kg	0.0308 / 0.0336	ND			0 / 6	
Barium	mg/kg		0.0260	0.0260	0.0963	6 / 6	0.0436
Beryllium	mg/kg	0.0030 / 0.0086	ND			0 / 6	
Boron	mg/kg	0.0574 / 0.1186	ND			0 / 6	
Cadium	mg/kg		0.0157	0.0157	0.0560	6 / 6	0.0323
Calcium	mg/kg		64.2600	64.2600	135.3300	6 / 6	80.7800
Chromium	mg/kg		0.1251	0.1251	0.5775	6 / 6	0.2623
Cobalt	mg/kg		0.0062	0.0062	0.0135	6 / 6	0.0100
Copper	mg/kg		0.2400	0.2400	0.7800	6 / 6	0.3915
Iron	mg/kg	11.2955 / 12.3816	ND			0 / 6	
Lead	mg/kg	0.0098 / 0.0098	0.0543	0.0543	1.2800	5 / 6	0.4633
Magnesium	mg/kg		187.2000	187.2000	234.0000	6 / 6	209.9367
Manganese	mg/kg		0.1420	0.1420	0.2255	6 / 6	0.1823
Mercury	mg/kg		0.0254	0.0254	0.2211	6 / 6	0.0801
Molybdenum	mg/kg	0.0098 / 0.0107	ND			0 / 6	
Nickel	mg/kg		0.0480	0.0480	0.1663	6 / 6	0.0819
Potassium	mg/kg		3204.0000	3204.0000	3900.0000	6 / 6	3518.6667
Selenium	mg/kg		0.2520	0.2520	0.4400	6 / 6	0.3494
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		250.2000	250.2000	456.2700	6 / 6	324.6783
Strontium	mg/kg		0.0580	0.0580	0.1151	6 / 6	0.0791
Thallium	mg/kg	0.0271 / 0.0297	ND			0 / 6	
Vanadium	mg/kg	0.0992 / 0.1089	ND			0 / 6	
Zinc	mg/kg		4.0775	4.0775	6.3315	6 / 6	5.4328

Table A-38: Fall 2009 - Largemouth Bass Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.64	0.64	4.50	6 / 6	2.11
Moisture	%		77.8	77.8	81.0	6 / 6	79.6
Aluminum	mg/kg	1.3870 / 3.7200	ND			0 / 6	
Antimony	mg/kg	0.0169 / 0.1088	ND			0 / 6	
Arsenic	mg/kg		0.0595	0.0595	0.2354	6 / 6	0.1630
Barium	mg/kg	0.0189 / 0.0190	0.0266	0.0266	0.1027	4 / 6	0.0543
Beryllium	mg/kg	0.0029 / 0.0032	ND			0 / 6	
Boron	mg/kg	0.0570 / 0.0686	ND			0 / 6	
Cadium	mg/kg	0.0053 / 0.0218	ND			0 / 6	
Calcium	mg/kg		137.0880	137.0880	346.0000	6 / 6	209.7407
Chromium	mg/kg		0.2568	0.2568	0.5600	6 / 6	0.3530
Cobalt	mg/kg	0.0048 / 0.0220	ND			0 / 6	
Copper	mg/kg		0.1862	0.1862	0.4440	6 / 6	0.2976
Iron	mg/kg	10.9630 / 12.3400	19.4916	19.4916	19.4916	1 / 6	19.4916
Lead	mg/kg	0.0093 / 0.0104	0.0645	0.0645	1.1766	2 / 6	0.6205
Magnesium	mg/kg		255.3600	255.3600	276.0000	6 / 6	268.4300
Manganese	mg/kg		0.1310	0.1310	0.2600	6 / 6	0.1774
Mercury	mg/kg		0.0666	0.0666	0.3072	6 / 6	0.1104
Molybdenum	mg/kg	0.0095 / 0.0144	ND			0 / 6	
Nickel	mg/kg		0.0428	0.0428	0.1020	6 / 6	0.0705
Potassium	mg/kg		3473.6000	3473.6000	3894.8000	6 / 6	3635.5333
Selenium	mg/kg		0.5400	0.5400	0.7872	6 / 6	0.6705
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		335.9800	335.9800	433.9200	6 / 6	372.5833
Strontium	mg/kg	0.0749 / 0.2600	ND			0 / 6	
Thallium	mg/kg	0.0129 / 0.0146	ND			0 / 6	
Vanadium	mg/kg	0.0475 / 0.0540	ND			0 / 6	
Zinc	mg/kg		4.6848	4.6848	12.8060	6 / 6	9.8943

Table A-39: Spring 2010 - Bluegill Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.78	0.78	1.30	5 / 5	1.04
Moisture	%		76.3	76.3	81.1	5 / 5	79.5
Aluminum	mg/kg	3.8664 / 4.1475	ND			0 / 5	
Antimony	mg/kg	0.0140 / 0.0149	ND			0 / 5	
Arsenic	mg/kg		0.0379	0.0379	0.1501	5 / 5	0.0822
Barium	mg/kg	0.0454 / 0.0478	0.0569	0.0569	0.1064	2 / 5	0.0816
Beryllium	mg/kg	0.0302 / 0.0616	ND			0 / 5	
Boron	mg/kg	0.4104 / 0.4266	ND			0 / 5	
Cadium	mg/kg	0.0073 / 0.0159	ND			0 / 5	
Calcium	mg/kg		153.3600	153.3600	769.5000	5 / 5	420.9296
Chromium	mg/kg	0.1231 / 0.1304	0.2470	0.2470	0.2470	1 / 5	0.2470
Cobalt	mg/kg	0.0136 / 0.0145	ND			0 / 5	
Copper	mg/kg		0.2376	0.2376	0.3990	5 / 5	0.3030
Iron	mg/kg	11.6424 / 12.4662	13.9270	13.9270	13.9270	1 / 5	13.9270
Lead	mg/kg	0.0259 / 0.0287	ND			0 / 5	
Magnesium	mg/kg		268.3800	268.3800	292.2300	5 / 5	281.8540
Manganese	mg/kg		0.2376	0.2376	1.1020	5 / 5	0.4531
Mercury	mg/kg		0.0454	0.0454	0.1375	5 / 5	0.0670
Molybdenum	mg/kg	0.0342 / 0.0363	ND			0 / 5	
Nickel	mg/kg	0.0950 / 0.1019	0.1140	0.1140	0.1140	1 / 5	0.1140
Potassium	mg/kg		3246.9000	3246.9000	3724.5000	5 / 5	3522.7600
Selenium	mg/kg		0.5510	0.5510	0.8883	5 / 5	0.7342
Silver	mg/kg	0.0028 / 0.0099	ND			0 / 5	
Sodium	mg/kg		274.0500	274.0500	369.7200	5 / 5	312.0520
Strontium	mg/kg		0.0821	0.0821	0.7220	5 / 5	0.3487
Thallium	mg/kg	0.0134 / 0.0427	ND			0 / 5	
Vanadium	mg/kg	0.0432 / 0.0948	ND			0 / 5	
Zinc	mg/kg		11.2752	11.2752	21.6618	5 / 5	15.9531

Table A-40: Spring 2010 - Largemouth Bass Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.36	0.36	1.90	6 / 6	1.08
Moisture	%		78.7	78.7	81.4	6 / 6	79.5
Aluminum	mg/kg	3.7014 / 8.2800	ND			0 / 6	
Antimony	mg/kg	0.0134 / 0.0290	ND			0 / 6	
Arsenic	mg/kg		0.0744	0.0744	0.3654	6 / 6	0.2763
Barium	mg/kg	0.0428 / 0.0952	ND			0 / 6	
Beryllium	mg/kg	0.0279 / 0.0600	ND			0 / 6	
Boron	mg/kg	0.3906 / 0.8487	ND			0 / 6	
Cadium	mg/kg	0.0071 / 0.0157	ND			0 / 6	
Calcium	mg/kg		144.2010	144.2010	468.6000	6 / 6	285.4785
Chromium	mg/kg	0.1172 / 0.2691	ND			0 / 6	
Cobalt	mg/kg	0.0130 / 0.0290	ND			0 / 6	
Copper	mg/kg	0.2898 / 0.2898	0.1841	0.1841	0.2678	5 / 6	0.2245
Iron	mg/kg	11.1414 / 24.8400	ND			0 / 6	
Lead	mg/kg	0.0260 / 0.0290	ND			0 / 6	
Magnesium	mg/kg		247.3800	247.3800	332.2800	6 / 6	294.1633
Manganese	mg/kg	0.1581 / 0.3519	0.1726	0.1726	0.1811	2 / 6	0.1768
Mercury	mg/kg		0.0639	0.0639	0.2976	6 / 6	0.1169
Molybdenum	mg/kg	0.0316 / 0.0725	ND			0 / 6	
Nickel	mg/kg	0.0911 / 0.2029	ND			0 / 6	
Potassium	mg/kg	3557.1000 / 3726.0000	3608.4000	3608.4000	4161.5000	3 / 6	3860.3000
Selenium	mg/kg		0.4968	0.4968	0.7254	6 / 6	0.6174
Silver	mg/kg	0.0026 / 0.0060	ND			0 / 6	
Sodium	mg/kg		367.4300	367.4300	507.7800	6 / 6	423.3667
Strontium	mg/kg		0.0746	0.0746	0.3621	6 / 6	0.1926
Thallium	mg/kg	0.0128 / 0.0352	ND			0 / 6	
Vanadium	mg/kg	0.0428 / 0.0952	ND			0 / 6	
Zinc	mg/kg		5.6730	5.6730	13.9518	6 / 6	8.4267

Table A-41: Spring 2010 - Red Ear Sunfish Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.16	0.16	0.41	5 / 5	0.26
Moisture	%		81.1	81.1	83.5	5 / 5	82.2
Aluminum	mg/kg	3.9501 / 4.0832	ND			0 / 5	
Antimony	mg/kg	0.0144 / 0.0148	ND			0 / 5	
Arsenic	mg/kg		0.1725	0.1725	0.2646	5 / 5	0.2306
Barium	mg/kg	0.0454 / 0.0475	0.1320	0.1320	0.1320	1 / 5	0.1320
Beryllium	mg/kg	0.0284 / 0.0299	ND			0 / 5	
Boron	mg/kg	0.4158 / 0.4290	ND			0 / 5	
Cadium	mg/kg	0.0076 / 0.0078	ND			0 / 5	
Calcium	mg/kg		110.0000	110.0000	861.3000	5 / 5	307.3828
Chromium	mg/kg	0.1247 / 0.1302	ND			0 / 5	
Cobalt	mg/kg	0.0140 / 0.0144	ND			0 / 5	
Copper	mg/kg		0.2464	0.2464	0.3680	5 / 5	0.3103
Iron	mg/kg	11.9070 / 12.3024	ND			0 / 5	
Lead	mg/kg	0.0276 / 0.0284	ND			0 / 5	
Magnesium	mg/kg		245.8500	245.8500	267.5200	5 / 5	260.9760
Manganese	mg/kg	0.1682 / 0.1742	0.2475	0.2475	0.2475	1 / 5	0.2475
Mercury	mg/kg		0.0475	0.0475	0.0875	5 / 5	0.0694
Molybdenum	mg/kg	0.0340 / 0.0363	ND			0 / 5	
Nickel	mg/kg	0.0964 / 0.1003	ND			0 / 5	
Potassium	mg/kg		3382.5000	3382.5000	3661.6000	5 / 5	3476.8800
Selenium	mg/kg		0.8745	0.8745	1.2848	5 / 5	1.0466
Silver	mg/kg	0.0095 / 0.0099	ND			0 / 5	
Sodium	mg/kg		309.7600	309.7600	461.1600	5 / 5	367.8020
Strontium	mg/kg		0.0686	0.0686	0.6765	5 / 5	0.2273
Thallium	mg/kg	0.0136 / 0.0141	ND			0 / 5	
Vanadium	mg/kg	0.0454 / 0.0462	ND			0 / 5	
Zinc	mg/kg		10.9472	10.9472	18.9520	5 / 5	14.8128

Table A-42: Spring 2010 - White Crappie Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.86	0.86	3.80	6 / 6	1.68
Moisture	%		77.5	77.5	82.5	6 / 6	79.4
Aluminum	mg/kg	3.6450 / 4.1209	ND			0 / 6	
Antimony	mg/kg	0.0133 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.2275	0.2275	0.3052	6 / 6	0.2747
Barium	mg/kg	0.0414 / 0.0473	ND			0 / 6	
Beryllium	mg/kg	0.0262 / 0.0305	ND			0 / 6	
Boron	mg/kg	0.3706 / 0.4263	ND			0 / 6	
Cadium	mg/kg	0.0070 / 0.0079	ND			0 / 6	
Calcium	mg/kg		123.2000	123.2000	579.8800	6 / 6	276.2483
Chromium	mg/kg	0.1148 / 0.1313	ND			0 / 6	
Cobalt	mg/kg	0.0128 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.1645	0.1645	0.2244	6 / 6	0.1944
Iron	mg/kg	10.9800 / 12.3830	17.4650	17.4650	17.4650	1 / 6	17.4650
Lead	mg/kg	0.0248 / 0.0284	ND			0 / 6	
Magnesium	mg/kg		246.7500	246.7500	336.9800	6 / 6	288.9317
Manganese	mg/kg	0.1553 / 0.1750	0.1675	0.1675	0.2180	2 / 6	0.1927
Mercury	mg/kg		0.0280	0.0280	0.1320	6 / 6	0.0635
Molybdenum	mg/kg	0.0315 / 0.0368	ND			0 / 6	
Nickel	mg/kg	0.0894 / 0.0998	ND			0 / 6	
Potassium	mg/kg		3535.0000	3535.0000	4466.0000	6 / 6	4009.1500
Selenium	mg/kg		0.1750	0.1750	0.6293	6 / 6	0.4017
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		261.1200	261.1200	427.5000	6 / 6	320.1817
Strontium	mg/kg		0.0578	0.0578	0.4796	6 / 6	0.1965
Thallium	mg/kg	0.0126 / 0.0382	ND			0 / 6	
Vanadium	mg/kg	0.0414 / 0.0473	ND			0 / 6	
Zinc	mg/kg		5.7116	5.7116	12.1176	6 / 6	7.1642

Table A-43: Fall 2010 - Bluegill Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.72	0.72	1.70	5 / 5	1.14
Moisture	%		76.6	76.6	80.8	6 / 6	79.1
Aluminum	mg/kg	3.6000 / 4.1000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.0520	0.0520	0.2400	6 / 6	0.1180
Barium	mg/kg		0.0510	0.0510	0.2400	6 / 6	0.1310
Beryllium	mg/kg	0.0270 / 0.0300	ND			0 / 6	
Boron	mg/kg	0.3800 / 0.4300	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0078	ND			0 / 6	
Calcium	mg/kg		276.0000	276.0000	1750.0000	6 / 6	1008.5000
Chromium	mg/kg	0.1200 / 0.1300	0.1800	0.1800	0.2700	2 / 6	0.2250
Cobalt	mg/kg	0.0130 / 0.0140	ND			0 / 6	
Copper	mg/kg		0.3100	0.3100	0.9400	6 / 6	0.5050
Iron	mg/kg	11.0000 / 12.4000	ND			0 / 6	
Lead	mg/kg	0.0250 / 0.0290	0.0840	0.0840	0.0840	1 / 6	0.0840
Magnesium	mg/kg		324.0000	324.0000	382.0000	6 / 6	350.0000
Manganese	mg/kg		0.2400	0.2400	1.1000	6 / 6	0.5450
Mercury	mg/kg		0.0310	0.0310	0.0720	6 / 6	0.0508
Molybdenum	mg/kg	0.0320 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0890 / 0.1000	0.1600	0.1600	0.1600	1 / 6	0.1600
Potassium	mg/kg		3360.0000	3360.0000	4000.0000	6 / 6	3758.3333
Selenium	mg/kg		0.7200	0.7200	1.1000	6 / 6	0.8800
Silver	mg/kg	0.0030 / 0.0030	0.0110	0.0110	0.0250	5 / 6	0.0170
Sodium	mg/kg		328.0000	328.0000	451.0000	6 / 6	366.8333
Strontium	mg/kg		0.2400	0.2400	2.0000	6 / 6	0.9883
Thallium	mg/kg	0.0130 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0420 / 0.0470	0.0590	0.0590	0.0590	1 / 6	0.0590
Zinc	mg/kg		12.7000	12.7000	15.3000	6 / 6	14.1500

Table A-44: Fall 2010 - Channel Catfish Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.10	1.10	5.50	6 / 6	2.07
Moisture	%		77.9	77.9	81.8	6 / 6	80.3
Aluminum	mg/kg	3.6000 / 4.2000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Arsenic	mg/kg	0.0250 / 0.0290	0.0729	0.0729	0.0729	1 / 6	0.0729
Barium	mg/kg	0.0410 / 0.0480	ND			0 / 6	
Beryllium	mg/kg	0.0260 / 0.0310	ND			0 / 6	
Boron	mg/kg	0.3700 / 0.4300	ND			0 / 6	
Cadium	mg/kg	0.0068 / 0.0075	0.0180	0.0180	0.0180	1 / 6	0.0180
Calcium	mg/kg		57.2390	57.2390	113.0000	6 / 6	78.1465
Chromium	mg/kg	0.1100 / 0.1300	ND			0 / 6	
Cobalt	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Copper	mg/kg		0.2800	0.2800	0.6460	6 / 6	0.4236
Iron	mg/kg	10.8000 / 12.5000	ND			0 / 6	
Lead	mg/kg	0.0250 / 0.0290	ND			0 / 6	
Magnesium	mg/kg		227.6300	227.6300	272.0000	6 / 6	256.1717
Manganese	mg/kg	0.1500 / 0.1800	0.2000	0.2000	0.2000	1 / 6	0.2000
Mercury	mg/kg		0.0440	0.0440	0.1100	6 / 6	0.0742
Molybdenum	mg/kg	0.0320 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0880 / 0.1000	0.1102	0.1102	0.1102	1 / 6	0.1102
Potassium	mg/kg		3889.6000	3889.6000	4320.0000	6 / 6	4076.6000
Selenium	mg/kg		0.2900	0.2900	0.5300	6 / 6	0.3796
Silver	mg/kg	0.0026 / 0.0041	ND			0 / 6	
Sodium	mg/kg		338.2000	338.2000	441.0000	6 / 6	396.8617
Strontium	mg/kg		0.0540	0.0540	0.1100	6 / 6	0.0738
Thallium	mg/kg	0.0120 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0410 / 0.0470	ND			0 / 6	
Zinc	mg/kg		4.8000	4.8000	8.3000	6 / 6	6.4679

Table A-45: Fall 2010 - Largemouth Bass Fillet at Emory River Mile 0.9

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.20	0.20	2.50	6 / 6	1.40
Moisture	%		76.3	76.3	83.1	6 / 6	78.7
Aluminum	mg/kg	3.5000 / 4.1000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.1400	0.1400	0.3800	6 / 6	0.3017
Barium	mg/kg	0.0400 / 0.0470	0.0560	0.0560	0.0560	1 / 6	0.0560
Beryllium	mg/kg	0.0260 / 0.0300	ND			0 / 6	
Boron	mg/kg	0.3600 / 0.4300	ND			0 / 6	
Cadium	mg/kg	0.0067 / 0.0078	ND			0 / 6	
Calcium	mg/kg		193.0000	193.0000	941.0000	6 / 6	416.8333
Chromium	mg/kg	0.1100 / 0.1300	ND			0 / 6	
Cobalt	mg/kg	0.0120 / 0.0140	ND			0 / 6	
Copper	mg/kg		0.3000	0.3000	0.4400	6 / 6	0.3633
Iron	mg/kg	10.6000 / 12.4000	ND			0 / 6	
Lead	mg/kg	0.0240 / 0.0290	ND			0 / 6	
Magnesium	mg/kg		256.0000	256.0000	353.0000	6 / 6	322.0000
Manganese	mg/kg	0.1500 / 0.1700	0.1800	0.1800	0.2900	4 / 6	0.2125
Mercury	mg/kg		0.0690	0.0690	0.2800	6 / 6	0.1092
Molybdenum	mg/kg	0.0310 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0860 / 0.1000	ND			0 / 6	
Potassium	mg/kg		3120.0000	3120.0000	4290.0000	6 / 6	3886.6667
Selenium	mg/kg		0.6600	0.6600	0.8100	6 / 6	0.7483
Silver	mg/kg	0.0025 / 0.0030	ND			0 / 6	
Sodium	mg/kg		385.0000	385.0000	628.0000	6 / 6	451.6667
Strontium	mg/kg		0.1200	0.1200	0.7500	6 / 6	0.3000
Thallium	mg/kg	0.0130 / 0.0160	ND			0 / 6	
Vanadium	mg/kg	0.0400 / 0.0470	ND			0 / 6	
Zinc	mg/kg		9.1000	9.1000	20.3000	6 / 6	12.7500

Table A-46: Spring 2009 - Bluegill Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.42	0.42	1.40	5 / 5	0.79
Moisture	%		80.3	80.3	83.8	6 / 6	81.6
Aluminum	mg/kg	0.8748 / 3.3855	ND			0 / 6	
Antimony	mg/kg	0.0183 / 0.0194	ND			0 / 6	
Arsenic	mg/kg		0.0309	0.0309	0.0481	6 / 6	0.0394
Barium	mg/kg	0.0421 / 0.0426	0.0405	0.0405	0.0823	4 / 6	0.0574
Beryllium	mg/kg	0.0099 / 0.0100	ND			0 / 6	
Boron	mg/kg	0.0637 / 0.1627	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0060	ND			0 / 6	
Calcium	mg/kg		108.3360	108.3360	1004.7000	6 / 6	500.1867
Chromium	mg/kg	0.1226 / 0.1241	ND			0 / 6	
Cobalt	mg/kg		0.0080	0.0080	0.0135	6 / 6	0.0106
Copper	mg/kg	0.1782 / 0.1782	0.1830	0.1830	0.3281	5 / 6	0.2465
Iron	mg/kg	12.3708 / 12.5060	ND			0 / 6	
Lead	mg/kg	0.0104 / 0.0106	ND			0 / 6	
Magnesium	mg/kg		243.3900	243.3900	284.9000	6 / 6	264.4433
Manganese	mg/kg		0.1574	0.1574	0.7293	6 / 6	0.3783
Mercury	mg/kg		0.0224	0.0224	0.0502	6 / 6	0.0370
Molybdenum	mg/kg	0.0109 / 0.0146	ND			0 / 6	
Nickel	mg/kg	0.0340 / 0.1135	0.2316	0.2316	0.2316	1 / 6	0.2316
Potassium	mg/kg		3179.0000	3179.0000	3885.0000	6 / 6	3470.5000
Selenium	mg/kg		0.7106	0.7106	1.0422	6 / 6	0.8132
Silver	mg/kg	0.0029 / 0.0031	ND			0 / 6	
Sodium	mg/kg		267.1800	267.1800	353.1900	6 / 6	308.2550
Strontium	mg/kg		0.0366	0.0366	0.8865	6 / 6	0.4263
Thallium	mg/kg	0.0146 / 0.0161	ND			0 / 6	
Vanadium	mg/kg	0.0540 / 0.0555	ND			0 / 6	
Zinc	mg/kg		7.4987	7.4987	10.9350	6 / 6	9.7727

Table A-47: Spring 2009 - Largemouth Bass Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.40	0.40	1.30	5 / 5	0.85
Moisture	%		77.8	77.8	81.5	5 / 5	79.9
Aluminum	mg/kg	0.8820 / 0.8880	1.5662	1.5662	1.5662	1 / 5	1.5662
Antimony	mg/kg	0.0185 / 0.0192	0.0204	0.0204	0.0204	1 / 5	0.0204
Arsenic	mg/kg		0.0882	0.0882	0.2220	5 / 5	0.1478
Barium	mg/kg	0.0206 / 0.0420	0.0255	0.0255	0.0315	2 / 5	0.0285
Beryllium	mg/kg	0.0033 / 0.0149	ND			0 / 5	
Boron	mg/kg	0.0630 / 0.0649	ND			0 / 5	
Cadium	mg/kg	0.0059 / 0.0139	ND			0 / 5	
Calcium	mg/kg		140.7480	140.7480	501.3500	5 / 5	299.9676
Chromium	mg/kg	0.1235 / 0.1243	ND			0 / 5	
Cobalt	mg/kg	0.0048 / 0.0080	ND			0 / 5	
Copper	mg/kg	0.1795 / 0.1803	0.2101	0.2101	0.2730	3 / 5	0.2424
Iron	mg/kg	12.4110 / 12.5208	ND			0 / 5	
Lead	mg/kg	0.0105 / 0.0107	ND			0 / 5	
Magnesium	mg/kg		250.8800	250.8800	279.7200	5 / 5	261.6820
Manganese	mg/kg		0.1155	0.1155	0.1610	5 / 5	0.1369
Mercury	mg/kg		0.0488	0.0488	0.1910	5 / 5	0.1030
Molybdenum	mg/kg	0.0107 / 0.0109	ND			0 / 5	
Nickel	mg/kg	0.0333 / 0.0378	ND			0 / 5	
Potassium	mg/kg		3478.0000	3478.0000	4263.0000	5 / 5	3800.9800
Selenium	mg/kg		0.4810	0.4810	0.7326	5 / 5	0.5912
Silver	mg/kg	0.0029 / 0.0031	ND			0 / 5	
Sodium	mg/kg		397.3800	397.3800	453.2500	5 / 5	415.5420
Strontium	mg/kg	0.0311 / 0.0311	0.1512	0.1512	0.3885	4 / 5	0.2248
Thallium	mg/kg	0.0145 / 0.0147	ND			0 / 5	
Vanadium	mg/kg	0.0549 / 0.1092	ND			0 / 5	
Zinc	mg/kg		5.5272	5.5272	11.4552	5 / 5	7.9913

Table A-48: Spring 2009 - White Crappie Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.40	1.40	2.10	4 / 4	1.85
Moisture	%		78.6	78.6	80.0	4 / 4	79.2
Aluminum	mg/kg	0.8774 / 0.8904	ND			0 / 4	
Antimony	mg/kg	0.0192 / 0.0193	0.0196	0.0196	0.0196	1 / 4	0.0196
Arsenic	mg/kg		0.1875	0.1875	0.2544	4 / 4	0.2093
Barium	mg/kg	0.0206 / 0.0206	0.0240	0.0240	0.0257	2 / 4	0.0248
Beryllium	mg/kg	0.0032 / 0.0033	ND			0 / 4	
Boron	mg/kg	0.0636 / 0.0642	ND			0 / 4	
Cadium	mg/kg	0.0059 / 0.0060	ND			0 / 4	
Calcium	mg/kg		135.8920	135.8920	455.2600	4 / 4	297.0425
Chromium	mg/kg	0.1230 / 0.1241	ND			0 / 4	
Cobalt	mg/kg	0.0048 / 0.0049	ND			0 / 4	
Copper	mg/kg	0.1802 / 0.1819	0.3600	0.3600	0.3600	1 / 4	0.3600
Iron	mg/kg	12.4000 / 12.5042	ND			0 / 4	
Lead	mg/kg	0.0105 / 0.0106	ND			0 / 4	
Magnesium	mg/kg		262.0000	262.0000	295.3200	4 / 4	274.6650
Manganese	mg/kg		0.0933	0.0933	0.1627	4 / 4	0.1262
Mercury	mg/kg	0.0182 / 0.0195	0.0309	0.0309	0.0760	2 / 4	0.0535
Molybdenum	mg/kg	0.0108 / 0.0109	ND			0 / 4	
Nickel	mg/kg	0.0330 / 0.0342	ND			0 / 4	
Potassium	mg/kg		3540.0000	3540.0000	3702.2000	4 / 4	3612.8000
Selenium	mg/kg		0.4876	0.4876	0.6420	4 / 4	0.5763
Silver	mg/kg	0.0030 / 0.0031	ND			0 / 4	
Sodium	mg/kg		276.0000	276.0000	313.7600	4 / 4	295.4700
Strontium	mg/kg	0.0278 / 0.0339	0.2472	0.2472	0.3600	2 / 4	0.3036
Thallium	mg/kg	0.0146 / 0.0220	ND			0 / 4	
Vanadium	mg/kg	0.0540 / 0.0556	ND			0 / 4	
Zinc	mg/kg		4.6652	4.6652	6.7980	4 / 4	5.6315

Table A-49: Fall 2009 - Bluegill Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.18	0.18	0.49	6 / 6	0.33
Moisture	%		78.3	78.3	82.9	6 / 6	81.1
Aluminum	mg/kg	0.8256 / 1.3032	ND			0 / 6	
Antimony	mg/kg	0.0171 / 0.0199	ND			0 / 6	
Arsenic	mg/kg	0.0316 / 0.0679	ND			0 / 6	
Barium	mg/kg	0.0407 / 0.1071	0.1991	0.1991	0.1991	1 / 6	0.1991
Beryllium	mg/kg	0.0029 / 0.0062	ND			0 / 6	
Boron	mg/kg	0.0582 / 0.1358	ND			0 / 6	
Cadium	mg/kg	0.0055 / 0.0263	ND			0 / 6	
Calcium	mg/kg		155.5880	155.5880	2081.5000	6 / 6	929.2413
Chromium	mg/kg	0.1125 / 0.1231	ND			0 / 6	
Cobalt	mg/kg	0.0048 / 0.0139	ND			0 / 6	
Copper	mg/kg		0.3096	0.3096	0.6076	6 / 6	0.4221
Iron	mg/kg	11.3490 / 12.4166	ND			0 / 6	
Lead	mg/kg	0.0097 / 0.0174	ND			0 / 6	
Magnesium	mg/kg		247.6800	247.6800	340.6900	6 / 6	282.5383
Manganese	mg/kg		0.1940	0.1940	1.4118	6 / 6	0.5553
Mercury	mg/kg		0.0272	0.0272	0.0545	6 / 6	0.0395
Molybdenum	mg/kg	0.0099 / 0.0109	ND			0 / 6	
Nickel	mg/kg		0.0325	0.0325	0.0489	6 / 6	0.0383
Potassium	mg/kg		3250.8000	3250.8000	4383.4000	6 / 6	3540.6667
Selenium	mg/kg		0.6840	0.6840	0.9548	6 / 6	0.8241
Silver	mg/kg	0.0027 / 0.0031	ND			0 / 6	
Sodium	mg/kg		225.0400	225.0400	439.8300	6 / 6	342.9050
Strontium	mg/kg		0.1145	0.1145	2.2987	6 / 6	0.9511
Thallium	mg/kg	0.0135 / 0.0272	ND			0 / 6	
Vanadium	mg/kg	0.0504 / 0.0543	ND			0 / 6	
Zinc	mg/kg		10.5436	10.5436	15.6203	6 / 6	13.1080

Table A-50: Fall 2009 - Channel Catfish Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.20	1.20	5.10	6 / 6	3.25
Moisture	%		79.6	79.6	84.2	6 / 6	81.6
Aluminum	mg/kg	1.6999 / 5.5401	7.0686	7.0686	7.0686	1 / 6	7.0686
Antimony	mg/kg	0.0176 / 0.1044	0.7752	0.7752	0.7752	1 / 6	0.7752
Arsenic	mg/kg	0.0338 / 0.0814	ND			0 / 6	
Barium	mg/kg	0.0229 / 0.0761	ND			0 / 6	
Beryllium	mg/kg	0.0029 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0551 / 0.0758	ND			0 / 6	
Cadium	mg/kg	0.0067 / 0.1221	ND			0 / 6	
Calcium	mg/kg		57.9860	57.9860	100.1820	6 / 6	70.9107
Chromium	mg/kg		0.1242	0.1242	0.6320	6 / 6	0.2284
Cobalt	mg/kg	0.0043 / 0.0195	ND			0 / 6	
Copper	mg/kg		0.2292	0.2292	0.7965	6 / 6	0.3629
Iron	mg/kg	10.8732 / 12.4992	ND			0 / 6	
Lead	mg/kg	0.0104 / 0.0130	0.1304	0.1304	7.6704	4 / 6	2.4823
Magnesium	mg/kg		212.0100	212.0100	230.5200	6 / 6	221.7617
Manganese	mg/kg		0.1266	0.1266	0.2655	6 / 6	0.1782
Mercury	mg/kg		0.0301	0.0301	0.1890	6 / 6	0.0740
Molybdenum	mg/kg	0.0094 / 0.0108	ND			0 / 6	
Nickel	mg/kg		0.0420	0.0420	0.3024	6 / 6	0.1084
Potassium	mg/kg		3458.7000	3458.7000	3813.0000	6 / 6	3668.5833
Selenium	mg/kg		0.3213	0.3213	0.3672	6 / 6	0.3448
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		231.1100	231.1100	373.4700	6 / 6	282.5833
Strontium	mg/kg	0.0567 / 0.1151	ND			0 / 6	
Thallium	mg/kg	0.0129 / 0.0147	ND			0 / 6	
Vanadium	mg/kg	0.0469 / 0.0558	ND			0 / 6	
Zinc	mg/kg		4.9296	4.9296	6.6906	6 / 6	5.8383

Table A-51: Fall 2009 - Largemouth Bass Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.58	0.58	7.30	6 / 6	3.05
Moisture	%		76.3	76.3	80.9	6 / 6	78.3
Aluminum	mg/kg	2.6910 / 4.6989	6.4940	6.4940	109.7310	3 / 6	43.3407
Antimony	mg/kg	0.0180 / 0.0849	0.2784	0.2784	2.2470	2 / 6	1.2627
Arsenic	mg/kg	0.1433 / 0.1801	0.2042	0.2042	0.2042	1 / 6	0.2042
Barium	mg/kg	0.0176 / 0.0401	ND			0 / 6	
Beryllium	mg/kg	0.0028 / 0.0032	ND			0 / 6	
Boron	mg/kg	0.0557 / 0.0613	ND			0 / 6	
Cadium	mg/kg	0.0073 / 0.0812	0.3438	0.3438	1.3248	2 / 6	0.8343
Calcium	mg/kg		115.4190	115.4190	409.5000	6 / 6	195.2862
Chromium	mg/kg		0.1260	0.1260	0.4761	6 / 6	0.2201
Cobalt	mg/kg	0.0044 / 0.0140	ND			0 / 6	
Copper	mg/kg		0.2323	0.2323	0.4872	6 / 6	0.3438
Iron	mg/kg	10.6720 / 11.8040	ND			0 / 6	
Lead	mg/kg	0.0261 / 0.0535	0.7245	0.7245	25.4100	4 / 6	7.4502
Magnesium	mg/kg		267.4000	267.4000	294.6400	6 / 6	286.1267
Manganese	mg/kg		0.1114	0.1114	0.1760	6 / 6	0.1474
Mercury	mg/kg		0.0510	0.0510	0.1218	6 / 6	0.0769
Molybdenum	mg/kg	0.0093 / 0.0102	ND			0 / 6	
Nickel	mg/kg		0.0420	0.0420	0.1509	6 / 6	0.0822
Potassium	mg/kg		3648.1000	3648.1000	4171.2000	6 / 6	3880.4500
Selenium	mg/kg		0.4540	0.4540	0.7140	6 / 6	0.5947
Silver	mg/kg	0.0026 / 0.0058	ND			0 / 6	
Sodium	mg/kg		347.3100	347.3100	419.4900	6 / 6	388.2983
Strontium	mg/kg	0.0568 / 0.1108	0.1677	0.1677	0.2940	2 / 6	0.2308
Thallium	mg/kg	0.0125 / 0.0178	ND			0 / 6	
Vanadium	mg/kg	0.0464 / 0.0522	ND			0 / 6	
Zinc	mg/kg		5.5161	5.5161	9.3208	6 / 6	8.0783

Table A-52: Spring 2010 - Bluegill Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.33	0.33	1.50	6 / 6	0.86
Moisture	%		78.7	78.7	82.3	6 / 6	80.9
Aluminum	mg/kg	3.7053 / 4.1478	ND			0 / 6	
Antimony	mg/kg	0.0134 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.0555	0.0555	0.0896	6 / 6	0.0725
Barium	mg/kg		0.0521	0.0521	0.3621	6 / 6	0.1266
Beryllium	mg/kg	0.0269 / 0.0299	ND			0 / 6	
Boron	mg/kg	0.3759 / 0.4278	ND			0 / 6	
Cadium	mg/kg	0.0070 / 0.0078	ND			0 / 6	
Calcium	mg/kg		386.8800	386.8800	5431.5000	6 / 6	1688.4300
Chromium	mg/kg	0.1171 / 0.1321	ND			0 / 6	
Cobalt	mg/kg	0.0143 / 0.0145	0.0136	0.0136	0.0211	4 / 6	0.0160
Copper	mg/kg		0.1786	0.1786	0.5310	6 / 6	0.3322
Iron	mg/kg	11.1517 / 12.4806	ND			0 / 6	
Lead	mg/kg	0.0250 / 0.0298	0.0298	0.0298	0.0867	2 / 6	0.0583
Magnesium	mg/kg		238.0700	238.0700	394.0500	6 / 6	294.3667
Manganese	mg/kg		0.2604	0.2604	2.1726	6 / 6	0.7312
Mercury	mg/kg		0.0478	0.0478	0.0770	6 / 6	0.0578
Molybdenum	mg/kg	0.0322 / 0.0372	ND			0 / 6	
Nickel	mg/kg	0.0902 / 0.1004	0.2189	0.2189	0.2189	1 / 6	0.2189
Potassium	mg/kg		3129.6000	3129.6000	3876.6000	6 / 6	3414.6833
Selenium	mg/kg		0.6265	0.6265	1.1289	6 / 6	0.8481
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		303.1800	303.1800	380.5500	6 / 6	343.0467
Strontium	mg/kg		0.3906	0.3906	5.6019	6 / 6	1.7118
Thallium	mg/kg	0.0127 / 0.0242	ND			0 / 6	
Vanadium	mg/kg	0.0422 / 0.0478	ND			0 / 6	
Zinc	mg/kg		9.3259	9.3259	14.9739	6 / 6	11.6039

Table A-53: Spring 2010 - Largemouth Bass Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.56	0.56	2.00	6 / 6	1.20
Moisture	%		78.1	78.1	79.3	6 / 6	78.7
Aluminum	mg/kg	3.6504 / 4.1580	ND			0 / 6	
Antimony	mg/kg	0.0132 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.1283	0.1283	0.1965	6 / 6	0.1671
Barium	mg/kg	0.0410 / 0.0483	ND			0 / 6	
Beryllium	mg/kg	0.0259 / 0.0596	ND			0 / 6	
Boron	mg/kg	0.3672 / 0.4200	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0080	ND			0 / 6	
Calcium	mg/kg		145.1970	145.1970	493.2400	6 / 6	289.7577
Chromium	mg/kg	0.1166 / 0.1323	ND			0 / 6	
Cobalt	mg/kg	0.0127 / 0.0143	0.0162	0.0162	0.0162	1 / 6	0.0162
Copper	mg/kg		0.1925	0.1925	7.2792	6 / 6	1.4022
Iron	mg/kg	10.9728 / 12.4950	ND			0 / 6	
Lead	mg/kg	0.0263 / 0.0294	0.2376	0.2376	0.2376	1 / 6	0.2376
Magnesium	mg/kg		267.1800	267.1800	308.7900	6 / 6	286.8017
Manganese	mg/kg	0.1599 / 0.1764	0.1685	0.1685	0.2299	2 / 6	0.1992
Mercury	mg/kg		0.0591	0.0591	0.1862	6 / 6	0.1123
Molybdenum	mg/kg	0.0324 / 0.0357	ND			0 / 6	
Nickel	mg/kg	0.0920 / 0.1008	0.7560	0.7560	0.7560	1 / 6	0.7560
Potassium	mg/kg		3996.0000	3996.0000	4161.0000	6 / 6	4082.7167
Selenium	mg/kg		0.4536	0.4536	0.8760	6 / 6	0.6575
Silver	mg/kg	0.0026 / 0.0096	ND			0 / 6	
Sodium	mg/kg		394.8000	394.8000	466.4700	6 / 6	431.2517
Strontium	mg/kg		0.0810	0.0810	0.3762	6 / 6	0.1954
Thallium	mg/kg	0.0125 / 0.0397	ND			0 / 6	
Vanadium	mg/kg	0.0410 / 0.0483	ND			0 / 6	
Zinc	mg/kg		4.9680	4.9680	10.5840	6 / 6	7.3241

Table A-54: Spring 2010 - Red Ear Sunfish Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.12	0.12	0.97	6 / 6	0.41
Moisture	%		79.7	79.7	82.6	6 / 6	81.8
Aluminum	mg/kg	3.5931 / 3.9960	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0144	ND			0 / 6	
Arsenic	mg/kg		0.0806	0.0806	0.1530	6 / 6	0.1082
Barium	mg/kg	0.0418 / 0.0455	0.0483	0.0483	0.1624	3 / 6	0.0948
Beryllium	mg/kg	0.0261 / 0.0298	ND			0 / 6	
Boron	mg/kg	0.3654 / 0.4140	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0076	ND			0 / 6	
Calcium	mg/kg		88.0440	88.0440	799.8200	6 / 6	274.1185
Chromium	mg/kg	0.1137 / 0.1260	0.1365	0.1365	0.1365	1 / 6	0.1365
Cobalt	mg/kg	0.0126 / 0.0140	ND			0 / 6	
Copper	mg/kg	0.1420 / 0.1420	0.1453	0.1453	0.3960	5 / 6	0.2653
Iron	mg/kg	10.8402 / 12.0420	ND			0 / 6	
Lead	mg/kg	0.0244 / 0.0280	ND			0 / 6	
Magnesium	mg/kg		225.7500	225.7500	282.1700	6 / 6	243.1667
Manganese	mg/kg	0.1549 / 0.1701	0.2160	0.2160	0.4872	2 / 6	0.3516
Mercury	mg/kg		0.0365	0.0365	0.0992	6 / 6	0.0669
Molybdenum	mg/kg	0.0313 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0873 / 0.0972	0.1019	0.1019	0.1019	1 / 6	0.1019
Potassium	mg/kg		3530.8000	3530.8000	3877.3000	6 / 6	3671.0833
Selenium	mg/kg		0.6981	0.6981	1.1700	6 / 6	0.8941
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 6	
Sodium	mg/kg		286.2300	286.2300	401.9400	6 / 6	327.1383
Strontium	mg/kg		0.0473	0.0473	0.6902	6 / 6	0.2220
Thallium	mg/kg	0.0125 / 0.0175	ND			0 / 6	
Vanadium	mg/kg	0.0406 / 0.0455	ND			0 / 6	
Zinc	mg/kg		8.6826	8.6826	17.2144	6 / 6	11.1757

Table A-55: Spring 2010 - White Crappie Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.22	0.22	0.68	6 / 6	0.44
Moisture	%		78.0	78.0	81.9	6 / 6	80.7
Aluminum	mg/kg	3.8915 / 4.1548	ND			0 / 6	
Antimony	mg/kg	0.0141 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.1195	0.1195	0.2256	6 / 6	0.1642
Barium	mg/kg	0.0453 / 0.0470	ND			0 / 6	
Beryllium	mg/kg	0.0288 / 0.0308	ND			0 / 6	
Boron	mg/kg	0.3982 / 0.4324	ND			0 / 6	
Cadium	mg/kg	0.0074 / 0.0079	ND			0 / 6	
Calcium	mg/kg		98.2830	98.2830	400.9000	6 / 6	196.0612
Chromium	mg/kg	0.1231 / 0.1316	ND			0 / 6	
Cobalt	mg/kg	0.0138 / 0.0147	ND			0 / 6	
Copper	mg/kg	0.1504 / 0.1504	0.1558	0.1558	2.7448	5 / 6	0.8642
Iron	mg/kg	11.7107 / 12.4832	ND			0 / 6	
Lead	mg/kg	0.0272 / 0.0286	0.0442	0.0442	0.0978	2 / 6	0.0710
Magnesium	mg/kg		264.9600	264.9600	278.2400	6 / 6	270.0750
Manganese	mg/kg	0.1647 / 0.1767	ND			0 / 6	
Mercury	mg/kg		0.0627	0.0627	0.1584	6 / 6	0.1074
Molybdenum	mg/kg	0.0344 / 0.0361	ND			0 / 6	
Nickel	mg/kg	0.0941 / 0.1015	0.1920	0.1920	0.5076	2 / 6	0.3498
Potassium	mg/kg		3628.8000	3628.8000	4004.4000	6 / 6	3820.3833
Selenium	mg/kg		0.5280	0.5280	0.6912	6 / 6	0.5856
Silver	mg/kg	0.0029 / 0.0100	ND			0 / 6	
Sodium	mg/kg		264.2600	264.2600	389.7600	6 / 6	316.5300
Strontium	mg/kg		0.0489	0.0489	0.3420	6 / 6	0.1441
Thallium	mg/kg	0.0134 / 0.0250	ND			0 / 6	
Vanadium	mg/kg	0.0451 / 0.0470	ND			0 / 6	
Zinc	mg/kg		6.1560	6.1560	9.5040	6 / 6	8.1750

Table A-56: Fall 2010 - Bluegill Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.49	0.49	1.50	6 / 6	0.87
Moisture	%		74.5	74.5	81.3	6 / 6	79.9
Aluminum	mg/kg	3.6000 / 4.1000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.0500	0.0500	0.1400	6 / 6	0.0910
Barium	mg/kg		0.0430	0.0430	0.1000	6 / 6	0.0720
Beryllium	mg/kg	0.0270 / 0.0300	ND			0 / 6	
Boron	mg/kg	0.3800 / 0.4300	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0079	ND			0 / 6	
Calcium	mg/kg		201.0000	201.0000	894.0000	6 / 6	559.8333
Chromium	mg/kg	0.1200 / 0.1300	0.1600	0.1600	0.1600	1 / 6	0.1600
Cobalt	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Copper	mg/kg		0.2200	0.2200	0.4100	6 / 6	0.2750
Iron	mg/kg	11.0000 / 12.5000	ND			0 / 6	
Lead	mg/kg	0.0250 / 0.0290	ND			0 / 6	
Magnesium	mg/kg		289.0000	289.0000	362.0000	6 / 6	333.3333
Manganese	mg/kg		0.3000	0.3000	0.8500	6 / 6	0.5883
Mercury	mg/kg		0.0300	0.0300	0.0660	6 / 6	0.0517
Molybdenum	mg/kg	0.0320 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0890 / 0.1000	ND			0 / 6	
Potassium	mg/kg		3370.0000	3370.0000	4120.0000	6 / 6	3713.3333
Selenium	mg/kg		0.5600	0.5600	0.8200	6 / 6	0.6883
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		359.0000	359.0000	455.0000	6 / 6	407.1667
Strontium	mg/kg		0.1500	0.1500	0.8800	6 / 6	0.5500
Thallium	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Vanadium	mg/kg	0.0420 / 0.0470	ND			0 / 6	
Zinc	mg/kg		11.4000	11.4000	15.8000	6 / 6	13.5500

Table A-57: Fall 2010 - Channel Catfish Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.10	1.10	2.60	6 / 6	1.52
Moisture	%		77.8	77.8	81.3	6 / 6	79.9
Aluminum	mg/kg	3.6000 / 4.0000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Arsenic	mg/kg	0.0260 / 0.0280	0.0320	0.0320	0.0320	1 / 6	0.0320
Barium	mg/kg	0.0420 / 0.0460	ND			0 / 6	
Beryllium	mg/kg	0.0270 / 0.0300	ND			0 / 6	
Boron	mg/kg	0.3800 / 0.4200	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0076	ND			0 / 6	
Calcium	mg/kg		64.5000	64.5000	80.3000	6 / 6	73.3333
Chromium	mg/kg	0.1200 / 0.1300	ND			0 / 6	
Cobalt	mg/kg	0.0130 / 0.0140	ND			0 / 6	
Copper	mg/kg		0.2500	0.2500	1.1000	6 / 6	0.4317
Iron	mg/kg	11.0000 / 12.1000	ND			0 / 6	
Lead	mg/kg	0.0250 / 0.0280	0.0310	0.0310	0.0310	1 / 6	0.0310
Magnesium	mg/kg		240.0000	240.0000	288.0000	6 / 6	259.5000
Manganese	mg/kg	0.1600 / 0.1700	0.2000	0.2000	0.2200	2 / 6	0.2100
Mercury	mg/kg		0.0500	0.0500	0.0980	6 / 6	0.0740
Molybdenum	mg/kg	0.0320 / 0.0350	ND			0 / 6	
Nickel	mg/kg	0.0890 / 0.0980	0.1000	0.1000	0.1000	1 / 6	0.1000
Potassium	mg/kg		3570.0000	3570.0000	4580.0000	6 / 6	4170.0000
Selenium	mg/kg		0.2500	0.2500	0.4400	6 / 6	0.3717
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 6	
Sodium	mg/kg		292.0000	292.0000	396.0000	6 / 6	355.8333
Strontium	mg/kg		0.0500	0.0500	0.1100	6 / 6	0.0685
Thallium	mg/kg	0.0130 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0420 / 0.0460	ND			0 / 6	
Zinc	mg/kg		5.4000	5.4000	7.9000	6 / 6	6.6167

Table A-58: Fall 2010 - Largemouth Bass Fillet at Emory River Mile 3.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.42	0.42	1.60	7 / 7	0.94
Moisture	%		77.9	77.9	79.8	7 / 7	78.6
Aluminum	mg/kg	3.6000 / 4.0000	ND			0 / 7	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 7	
Arsenic	mg/kg		0.1600	0.1600	0.3000	7 / 7	0.2086
Barium	mg/kg	0.0420 / 0.0460	ND			0 / 7	
Beryllium	mg/kg	0.0270 / 0.0300	ND			0 / 7	
Boron	mg/kg	0.3800 / 0.4200	ND			0 / 7	
Cadium	mg/kg	0.0069 / 0.0077	ND			0 / 7	
Calcium	mg/kg		149.0000	149.0000	396.0000	7 / 7	242.0000
Chromium	mg/kg	0.1100 / 0.1300	ND			0 / 7	
Cobalt	mg/kg	0.0130 / 0.0140	0.0160	0.0160	0.0160	1 / 7	0.0160
Copper	mg/kg		0.2700	0.2700	0.7100	7 / 7	0.4143
Iron	mg/kg	10.9000 / 12.2000	ND			0 / 7	
Lead	mg/kg	0.0260 / 0.0280	0.0300	0.0300	0.0300	1 / 7	0.0300
Magnesium	mg/kg		291.0000	291.0000	322.0000	7 / 7	310.4286
Manganese	mg/kg	0.1600 / 0.1700	0.1600	0.1600	0.2100	4 / 7	0.1825
Mercury	mg/kg		0.0470	0.0470	0.1400	7 / 7	0.0984
Molybdenum	mg/kg	0.0320 / 0.0360	ND			0 / 7	
Nickel	mg/kg	0.0920 / 0.0990	0.1300	0.1300	0.1300	1 / 7	0.1300
Potassium	mg/kg		3730.0000	3730.0000	4420.0000	7 / 7	4178.5714
Selenium	mg/kg		0.7000	0.7000	0.8500	7 / 7	0.7614
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 7	
Sodium	mg/kg		378.0000	378.0000	458.0000	7 / 7	403.8571
Strontium	mg/kg		0.0660	0.0660	0.3000	7 / 7	0.1523
Thallium	mg/kg	0.0120 / 0.0190	ND			0 / 7	
Vanadium	mg/kg	0.0410 / 0.0460	ND			0 / 7	
Zinc	mg/kg		7.7000	7.7000	15.6000	7 / 7	11.3857

Table A-59: Spring 2010 - Bluegill Fillet at Emory River Mile 4.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.69	0.69	1.60	6 / 6	1.07
Moisture	%		77.5	77.5	81.2	6 / 6	79.7
Aluminum	mg/kg	3.9346 / 4.0803	4.5030	4.5030	7.2675	4 / 6	6.2109
Antimony	mg/kg	0.0137 / 0.0148	ND			0 / 6	
Arsenic	mg/kg		0.0589	0.0589	0.1109	6 / 6	0.0840
Barium	mg/kg		0.0515	0.0515	0.2704	6 / 6	0.1606
Beryllium	mg/kg	0.0270 / 0.0305	ND			0 / 6	
Boron	mg/kg	0.3952 / 0.4263	ND			0 / 6	
Cadium	mg/kg	0.0073 / 0.0077	ND			0 / 6	
Calcium	mg/kg		139.2560	139.2560	1004.6400	6 / 6	605.1177
Chromium	mg/kg	0.1206 / 0.1299	ND			0 / 6	
Cobalt	mg/kg	0.0138 / 0.0138	0.0154	0.0154	0.0270	5 / 6	0.0201
Copper	mg/kg		0.2470	0.2470	0.3825	6 / 6	0.3195
Iron	mg/kg	11.3984 / 12.2815	12.5584	12.5584	12.5584	1 / 6	12.5584
Lead	mg/kg	0.0731 / 0.3536	ND			0 / 6	
Magnesium	mg/kg		251.3200	251.3200	301.5000	6 / 6	271.1067
Manganese	mg/kg		0.5768	0.5768	2.2330	6 / 6	1.8044
Mercury	mg/kg		0.0263	0.0263	0.0513	6 / 6	0.0346
Molybdenum	mg/kg	0.0333 / 0.0365	ND			0 / 6	
Nickel	mg/kg	0.0915 / 0.0995	ND			0 / 6	
Potassium	mg/kg		2557.8000	2557.8000	3369.6000	6 / 6	2827.7667
Selenium	mg/kg		0.4512	0.4512	0.6840	6 / 6	0.5791
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		379.7600	379.7600	521.1800	6 / 6	447.1600
Strontium	mg/kg		0.1401	0.1401	1.3104	6 / 6	0.6960
Thallium	mg/kg	0.0131 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0437 / 0.0467	ND			0 / 6	
Zinc	mg/kg		10.0891	10.0891	18.3600	6 / 6	14.0081

Table A-60: Spring 2010 - Largemouth Bass Fillet at Emory River Mile 4.5

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.44	0.44	3.60	6 / 6	1.16
Moisture	%		76.8	76.8	79.5	6 / 6	78.5
Aluminum	mg/kg	3.7541 / 4.1535	ND			0 / 6	
Antimony	mg/kg	0.0137 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.1066	0.1066	0.2376	6 / 6	0.1658
Barium	mg/kg	0.0432 / 0.0469	0.0492	0.0492	0.0656	2 / 6	0.0574
Beryllium	mg/kg	0.0278 / 0.0308	ND			0 / 6	
Boron	mg/kg	0.3888 / 0.4305	ND			0 / 6	
Cadium	mg/kg	0.0072 / 0.0079	ND			0 / 6	
Calcium	mg/kg		151.4660	151.4660	1316.1000	6 / 6	640.4690
Chromium	mg/kg	0.1230 / 0.1321	0.1432	0.1432	0.1432	1 / 6	0.1432
Cobalt	mg/kg	0.0132 / 0.0147	ND			0 / 6	
Copper	mg/kg		0.2018	0.2018	0.6177	6 / 6	0.3735
Iron	mg/kg	11.3274 / 12.5031	ND			0 / 6	
Lead	mg/kg	0.0259 / 0.0298	ND			0 / 6	
Magnesium	mg/kg		264.4800	264.4800	319.8000	6 / 6	298.9550
Manganese	mg/kg	0.1606 / 0.1768	0.1750	0.1750	0.2460	3 / 6	0.2005
Mercury	mg/kg		0.0605	0.0605	0.1276	6 / 6	0.1011
Molybdenum	mg/kg	0.0326 / 0.0369	ND			0 / 6	
Nickel	mg/kg	0.0950 / 0.1022	0.1085	0.1085	0.1085	1 / 6	0.1085
Potassium	mg/kg		3480.0000	3480.0000	3772.0000	6 / 6	3621.4833
Selenium	mg/kg		0.3712	0.3712	0.6944	6 / 6	0.5265
Silver	mg/kg	0.0028 / 0.0030	ND			0 / 6	
Sodium	mg/kg		319.8000	319.8000	449.1900	6 / 6	402.0017
Strontium	mg/kg		0.0760	0.0760	0.9840	6 / 6	0.4297
Thallium	mg/kg	0.0132 / 0.0160	ND			0 / 6	
Vanadium	mg/kg	0.0472 / 0.1606	ND			0 / 6	
Zinc	mg/kg		5.7768	5.7768	12.9078	6 / 6	9.5623

Table A-61: Spring 2009 - Bluegill Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.43	0.43	0.82	6 / 6	0.60
Moisture	%		80.9	80.9	83.2	6 / 6	81.8
Aluminum	mg/kg	0.8786 / 2.1504	ND			0 / 6	
Antimony	mg/kg	0.0185 / 0.0199	ND			0 / 6	
Arsenic	mg/kg		0.0181	0.0181	0.0319	6 / 6	0.0221
Barium	mg/kg	0.0416 / 0.0416	0.0267	0.0267	0.1848	5 / 6	0.0716
Beryllium	mg/kg	0.0099 / 0.0100	ND			0 / 6	
Boron	mg/kg	0.0634 / 0.0652	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0060	ND			0 / 6	
Calcium	mg/kg		97.3780	97.3780	778.3000	6 / 6	421.4163
Chromium	mg/kg	0.1228 / 0.1249	ND			0 / 6	
Cobalt	mg/kg	0.0099 / 0.0100	0.0057	0.0057	0.0107	4 / 6	0.0075
Copper	mg/kg	0.1792 / 0.1810	0.2101	0.2101	0.2184	3 / 6	0.2140
Iron	mg/kg	12.3710 / 12.5071	ND			0 / 6	
Lead	mg/kg	0.0105 / 0.0107	ND			0 / 6	
Magnesium	mg/kg		252.0000	252.0000	296.0500	6 / 6	277.0283
Manganese	mg/kg		0.1412	0.1412	0.6048	6 / 6	0.4002
Mercury	mg/kg		0.0543	0.0543	0.1810	6 / 6	0.0867
Molybdenum	mg/kg	0.0107 / 0.0109	ND			0 / 6	
Nickel	mg/kg	0.0326 / 0.0936	ND			0 / 6	
Potassium	mg/kg		3158.4000	3158.4000	3705.4000	6 / 6	3485.1333
Selenium	mg/kg		0.3192	0.3192	0.5162	6 / 6	0.4300
Silver	mg/kg	0.0029 / 0.0031	ND			0 / 6	
Sodium	mg/kg		233.4900	233.4900	355.2600	6 / 6	297.4467
Strontium	mg/kg	0.0152 / 0.0152	0.1958	0.1958	0.5792	5 / 6	0.3357
Thallium	mg/kg	0.0146 / 0.0147	ND			0 / 6	
Vanadium	mg/kg	0.0543 / 0.0554	ND			0 / 6	
Zinc	mg/kg		7.0844	7.0844	12.7015	6 / 6	8.6716

Table A-62: Spring 2009 - Largemouth Bass Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.24	0.24	2.50	6 / 6	1.40
Moisture	%		78.7	78.7	81.5	6 / 6	80.1
Aluminum	mg/kg	0.8756 / 2.1300	ND			0 / 6	
Antimony	mg/kg	0.0185 / 0.0194	ND			0 / 6	
Arsenic	mg/kg		0.1117	0.1117	0.2786	6 / 6	0.1744
Barium	mg/kg	0.0418 / 0.0426	0.0843	0.0843	0.0843	1 / 6	0.0843
Beryllium	mg/kg	0.0032 / 0.0034	ND			0 / 6	
Boron	mg/kg	0.0637 / 0.0648	ND			0 / 6	
Cadium	mg/kg	0.0059 / 0.0060	ND			0 / 6	
Calcium	mg/kg		100.2000	100.2000	338.3000	6 / 6	200.8697
Chromium	mg/kg	0.1234 / 0.1240	ND			0 / 6	
Cobalt	mg/kg	0.0050 / 0.0050	0.0050	0.0050	0.0130	5 / 6	0.0076
Copper	mg/kg	0.1803 / 0.1813	0.2600	0.2600	0.3195	3 / 6	0.2927
Iron	mg/kg	12.3872 / 12.5244	ND			0 / 6	
Lead	mg/kg	0.0105 / 0.0107	ND			0 / 6	
Magnesium	mg/kg		240.7900	240.7900	276.6100	6 / 6	256.1133
Manganese	mg/kg		0.0962	0.0962	0.1333	6 / 6	0.1112
Mercury	mg/kg		0.0498	0.0498	0.1776	6 / 6	0.1121
Molybdenum	mg/kg	0.0107 / 0.0109	ND			0 / 6	
Nickel	mg/kg	0.0333 / 0.0490	ND			0 / 6	
Potassium	mg/kg		3422.5000	3422.5000	3860.6000	6 / 6	3593.5333
Selenium	mg/kg		0.3980	0.3980	0.7455	6 / 6	0.5282
Silver	mg/kg	0.0029 / 0.0030	ND			0 / 6	
Sodium	mg/kg		316.0000	316.0000	492.1000	6 / 6	402.7317
Strontium	mg/kg	0.0152 / 0.0152	0.0194	0.0194	0.1990	5 / 6	0.0949
Thallium	mg/kg	0.0145 / 0.0147	ND			0 / 6	
Vanadium	mg/kg	0.0540 / 0.0557	ND			0 / 6	
Zinc	mg/kg		5.0347	5.0347	8.3580	6 / 6	6.6150

Table A-63: Spring 2009 - White Crappie Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.38	0.38	4.30	4 / 4	1.68
Moisture	%		79.1	79.1	81.4	4 / 4	80.2
Aluminum	mg/kg	0.8190 / 0.8556	ND			0 / 4	
Antimony	mg/kg	0.0279 / 0.0351	ND			0 / 4	
Arsenic	mg/kg		0.1108	0.1108	0.2232	4 / 4	0.1620
Barium	mg/kg	0.0191 / 0.0197	0.0209	0.0209	0.0316	2 / 4	0.0263
Beryllium	mg/kg	0.0031 / 0.0032	ND			0 / 4	
Boron	mg/kg	0.0605 / 0.0623	ND			0 / 4	
Cadium	mg/kg	0.0056 / 0.0058	ND			0 / 4	
Calcium	mg/kg		99.2550	99.2550	390.8300	4 / 4	220.4353
Chromium	mg/kg	0.1151 / 0.1190	ND			0 / 4	
Cobalt	mg/kg	0.0045 / 0.0048	ND			0 / 4	
Copper	mg/kg	0.1677 / 0.1693	0.1767	0.1767	0.2412	2 / 4	0.2090
Iron	mg/kg	11.5830 / 11.9970	ND			0 / 4	
Lead	mg/kg	0.0098 / 0.0102	ND			0 / 4	
Magnesium	mg/kg		245.5200	245.5200	282.1500	4 / 4	263.1000
Manganese	mg/kg		0.0858	0.0858	0.1376	4 / 4	0.1103
Mercury	mg/kg		0.0261	0.0261	0.0663	4 / 4	0.0523
Molybdenum	mg/kg	0.0101 / 0.0105	ND			0 / 4	
Nickel	mg/kg	0.0312 / 0.0442	0.2232	0.2232	0.2232	1 / 4	0.2232
Potassium	mg/kg		3568.5000	3568.5000	3782.9000	4 / 4	3657.6500
Selenium	mg/kg		0.2613	0.2613	0.5208	4 / 4	0.4230
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 4	
Sodium	mg/kg		210.6000	210.6000	364.5600	4 / 4	268.6175
Strontium	mg/kg	0.0312 / 0.0312	0.0195	0.0195	0.2604	3 / 4	0.1699
Thallium	mg/kg	0.0137 / 0.0141	ND			0 / 4	
Vanadium	mg/kg	0.0507 / 0.0523	ND			0 / 4	
Zinc	mg/kg		6.1620	6.1620	6.8970	4 / 4	6.5900

Table A-64: Fall 2009 - Bluegill Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.38	0.38	1.00	6 / 6	0.54
Moisture	%		72.2	72.2	81.4	6 / 6	78.3
Aluminum	mg/kg	0.7560 / 2.1473	ND			0 / 6	
Antimony	mg/kg	0.0164 / 0.0192	ND			0 / 6	
Arsenic	mg/kg	0.0134 / 0.0334	ND			0 / 6	
Barium	mg/kg	0.0273 / 0.1872	ND			0 / 6	
Beryllium	mg/kg	0.0027 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0546 / 0.1001	ND			0 / 6	
Cadium	mg/kg	0.0120 / 0.0140	ND			0 / 6	
Calcium	mg/kg		127.0460	127.0460	1404.6100	6 / 6	753.4393
Chromium	mg/kg	0.1050 / 0.1237	ND			0 / 6	
Cobalt	mg/kg	0.0046 / 0.0100	ND			0 / 6	
Copper	mg/kg		0.2141	0.2141	0.3468	6 / 6	0.2667
Iron	mg/kg	10.6680 / 12.4118	ND			0 / 6	
Lead	mg/kg	0.0090 / 0.0106	ND			0 / 6	
Magnesium	mg/kg		212.0400	212.0400	321.1100	6 / 6	276.9900
Manganese	mg/kg		0.1449	0.1449	1.5343	6 / 6	0.7955
Mercury	mg/kg	0.0334 / 0.0366	0.0428	0.0428	0.1209	4 / 6	0.0664
Molybdenum	mg/kg	0.0092 / 0.0108	ND			0 / 6	
Nickel	mg/kg	0.0294 / 0.0539	ND			0 / 6	
Potassium	mg/kg		2678.4000	2678.4000	3900.6000	6 / 6	3430.4667
Selenium	mg/kg		0.2790	0.2790	0.8896	6 / 6	0.5560
Silver	mg/kg	0.0025 / 0.0031	ND			0 / 6	
Sodium	mg/kg		232.5600	232.5600	293.8800	6 / 6	272.8800
Strontium	mg/kg	0.1029 / 0.1029	0.1680	0.1680	1.5366	5 / 6	0.8348
Thallium	mg/kg	0.0126 / 0.0361	ND			0 / 6	
Vanadium	mg/kg	0.0945 / 0.1099	ND			0 / 6	
Zinc	mg/kg		7.5894	7.5894	19.3440	6 / 6	14.6162

Table A-65: Fall 2009 - Channel Catfish Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		1.70	1.70	4.80	6 / 6	2.77
Moisture	%		76.9	76.9	82.8	6 / 6	80.0
Aluminum	mg/kg	1.1890 / 3.6267	ND			0 / 6	
Antimony	mg/kg	0.0173 / 0.1273	0.2145	0.2145	0.4300	2 / 6	0.3223
Arsenic	mg/kg	0.0303 / 0.0334	ND			0 / 6	
Barium	mg/kg	0.0201 / 0.0203	0.0258	0.0258	0.0439	4 / 6	0.0325
Beryllium	mg/kg	0.0134 / 0.0148	ND			0 / 6	
Boron	mg/kg	0.0568 / 0.0636	ND			0 / 6	
Cadium	mg/kg	0.0129 / 0.0312	ND			0 / 6	
Calcium	mg/kg		59.8600	59.8600	75.5080	6 / 6	70.9862
Chromium	mg/kg	0.1230 / 0.1230	0.1720	0.1720	0.2752	5 / 6	0.2138
Cobalt	mg/kg	0.0089 / 0.0098	ND			0 / 6	
Copper	mg/kg		0.2408	0.2408	0.3440	6 / 6	0.2920
Iron	mg/kg	11.1112 / 12.3000	ND			0 / 6	
Lead	mg/kg		0.0122	0.0122	4.1925	6 / 6	1.6841
Magnesium	mg/kg		185.7600	185.7600	228.2600	6 / 6	205.7867
Manganese	mg/kg		0.1187	0.1187	0.2050	6 / 6	0.1574
Mercury	mg/kg	0.0697 / 0.0697	0.0447	0.0447	0.1871	5 / 6	0.0987
Molybdenum	mg/kg	0.0096 / 0.0107	ND			0 / 6	
Nickel	mg/kg		0.0344	0.0344	0.0578	6 / 6	0.0422
Potassium	mg/kg		2975.6000	2975.6000	3638.6000	6 / 6	3363.2000
Selenium	mg/kg		0.1462	0.1462	0.2938	6 / 6	0.2057
Silver	mg/kg	0.0027 / 0.0029	ND			0 / 6	
Sodium	mg/kg		254.1000	254.1000	379.2500	6 / 6	323.8150
Strontium	mg/kg	0.0636 / 0.0780	0.0904	0.0904	0.0924	2 / 6	0.0914
Thallium	mg/kg	0.0131 / 0.0146	ND			0 / 6	
Vanadium	mg/kg	0.0482 / 0.0542	ND			0 / 6	
Zinc	mg/kg		5.7448	5.7448	8.3160	6 / 6	6.6397

Table A-66: Fall 2009 - Largemouth Bass Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.17	0.17	1.80	6 / 6	1.01
Moisture	%		77.7	77.7	80.3	6 / 6	78.9
Aluminum	mg/kg	1.3940 / 11.0112	80.5070	80.5070	80.5070	1 / 6	80.5070
Antimony	mg/kg	0.0170 / 0.1154	0.9812	0.9812	1.1623	2 / 6	1.0718
Arsenic	mg/kg	0.0164 / 0.0841	0.1204	0.1204	0.1773	4 / 6	0.1491
Barium	mg/kg	0.0197 / 0.0434	ND			0 / 6	
Beryllium	mg/kg	0.0028 / 0.0033	ND			0 / 6	
Boron	mg/kg	0.0566 / 0.0651	ND			0 / 6	
Cadium	mg/kg	0.0123 / 0.0473	ND			0 / 6	
Calcium	mg/kg		103.9350	103.9350	292.9500	6 / 6	178.8690
Chromium	mg/kg	0.1091 / 0.1091	0.1620	0.1620	0.3152	5 / 6	0.2228
Cobalt	mg/kg	0.0051 / 0.0100	ND			0 / 6	
Copper	mg/kg	0.1596 / 0.1596	0.1886	0.1886	0.4662	5 / 6	0.3169
Iron	mg/kg	10.9888 / 12.4992	11.6183	11.6183	14.5977	2 / 6	13.1080
Lead	mg/kg	0.0326 / 0.1312	1.1544	1.1544	14.3219	3 / 6	8.9572
Magnesium	mg/kg		262.5700	262.5700	290.8200	6 / 6	273.9333
Manganese	mg/kg		0.0861	0.0861	0.1675	6 / 6	0.1270
Mercury	mg/kg		0.0946	0.0946	0.1989	6 / 6	0.1365
Molybdenum	mg/kg	0.0095 / 0.0165	ND			0 / 6	
Nickel	mg/kg	0.0303 / 0.0694	ND			0 / 6	
Potassium	mg/kg		3636.0000	3636.0000	3915.5000	6 / 6	3799.3000
Selenium	mg/kg		0.3838	0.3838	0.5550	6 / 6	0.4361
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		280.7800	280.7800	336.7300	6 / 6	317.0983
Strontium	mg/kg	0.0369 / 0.1064	0.1778	0.1778	0.1996	2 / 6	0.1887
Thallium	mg/kg	0.0129 / 0.0148	ND			0 / 6	
Vanadium	mg/kg	0.0970 / 0.1107	ND			0 / 6	
Zinc	mg/kg		4.5305	4.5305	16.9911	6 / 6	10.1805

Table A-67: Spring 2010 - Bluegill Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.50	0.50	1.40	6 / 6	0.79
Moisture	%		79.1	79.1	83.5	6 / 6	81.0
Aluminum	mg/kg	3.6300 / 57.6000	ND			0 / 6	
Antimony	mg/kg	0.0132 / 0.2000	ND			0 / 6	
Arsenic	mg/kg	0.0248 / 0.4000	0.0400	0.0400	0.0524	2 / 6	0.0462
Barium	mg/kg	0.0528 / 0.6600	ND			0 / 6	
Beryllium	mg/kg	0.0264 / 0.4200	ND			0 / 6	
Boron	mg/kg	0.3795 / 5.9600	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.1100	ND			0 / 6	
Calcium	mg/kg	200.0130 / 694.0000	445.5000	445.5000	783.5300	3 / 6	635.3567
Chromium	mg/kg	0.1155 / 1.8200	ND			0 / 6	
Cobalt	mg/kg	0.0127 / 0.2000	ND			0 / 6	
Copper	mg/kg	0.6061 / 2.0800	0.2805	0.2805	0.4675	3 / 6	0.3889
Iron	mg/kg	10.9395 / 173.6000	ND			0 / 6	
Lead	mg/kg	0.0248 / 0.2388	0.5200	0.5200	0.5200	1 / 6	0.5200
Magnesium	mg/kg	415.9100 / 694.0000	260.7000	260.7000	321.8600	4 / 6	280.3000
Manganese	mg/kg	0.7106 / 2.4600	0.3630	0.3630	0.9911	3 / 6	0.6819
Mercury	mg/kg	0.0995 / 0.1660	0.0419	0.0419	0.0899	4 / 6	0.0670
Molybdenum	mg/kg	0.0314 / 0.5000	ND			0 / 6	
Nickel	mg/kg	0.0891 / 1.4000	ND			0 / 6	
Potassium	mg/kg	5248.6000 / 10420.0000	3547.5000	3547.5000	3678.4000	4 / 6	3600.6750
Selenium	mg/kg	0.5771 / 0.9800	0.3960	0.3960	1.0032	4 / 6	0.6509
Silver	mg/kg	0.0026 / 0.0420	ND			0 / 6	
Sodium	mg/kg	415.9100 / 694.0000	269.2800	269.2800	376.7400	4 / 6	298.1250
Strontium	mg/kg	0.1818 / 0.6400	0.3300	0.3300	0.7106	3 / 6	0.5046
Thallium	mg/kg	0.0125 / 0.1980	ND			0 / 6	
Vanadium	mg/kg	0.0413 / 0.6600	ND			0 / 6	
Zinc	mg/kg	18.8055 / 31.4000	10.3037	10.3037	13.8930	4 / 6	11.7516

Table A-68: Spring 2010 - Largemouth Bass Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.45	0.45	1.70	6 / 6	0.86
Moisture	%		78.0	78.0	80.7	6 / 6	79.0
Aluminum	mg/kg	3.6135 / 4.1607	ND			0 / 6	
Antimony	mg/kg	0.0131 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.0942	0.0942	0.1848	6 / 6	0.1467
Barium	mg/kg	0.0416 / 0.0484	ND			0 / 6	
Beryllium	mg/kg	0.0263 / 0.0621	ND			0 / 6	
Boron	mg/kg	0.3723 / 0.4400	ND			0 / 6	
Cadium	mg/kg	0.0068 / 0.0079	ND			0 / 6	
Calcium	mg/kg		121.9750	121.9750	542.3300	6 / 6	244.1008
Chromium	mg/kg	0.1139 / 0.1325	ND			0 / 6	
Cobalt	mg/kg	0.0127 / 0.0147	ND			0 / 6	
Copper	mg/kg		0.2460	0.2460	0.5790	6 / 6	0.3242
Iron	mg/kg	10.8624 / 12.5028	ND			0 / 6	
Lead	mg/kg	0.0241 / 0.0290	ND			0 / 6	
Magnesium	mg/kg		254.7600	254.7600	292.6000	6 / 6	275.9183
Manganese	mg/kg	0.1533 / 0.1760	0.2050	0.2050	0.2050	1 / 6	0.2050
Mercury	mg/kg		0.1107	0.1107	0.2123	6 / 6	0.1436
Molybdenum	mg/kg	0.0307 / 0.0374	ND			0 / 6	
Nickel	mg/kg	0.0876 / 0.1014	ND			0 / 6	
Potassium	mg/kg		3920.1000	3920.1000	4334.0000	6 / 6	4110.6333
Selenium	mg/kg		0.3667	0.3667	0.4968	6 / 6	0.4508
Silver	mg/kg	0.0027 / 0.0098	ND			0 / 6	
Sodium	mg/kg		356.9700	356.9700	445.1200	6 / 6	398.7250
Strontium	mg/kg		0.0600	0.0600	0.4053	6 / 6	0.1532
Thallium	mg/kg	0.0125 / 0.0161	ND			0 / 6	
Vanadium	mg/kg	0.0416 / 0.0484	ND			0 / 6	
Zinc	mg/kg		6.2532	6.2532	10.1016	6 / 6	8.7027

Table A-69: Spring 2010 - Red Ear Sunfish Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.39	0.39	0.65	6 / 6	0.53
Moisture	%		81.0	81.0	84.4	6 / 6	82.0
Aluminum	mg/kg	3.7515 / 4.1528	5.8188	5.8188	5.8188	1 / 6	5.8188
Antimony	mg/kg	0.0135 / 0.0150	ND			0 / 6	
Arsenic	mg/kg	0.0285 / 0.0285	0.0458	0.0458	0.0930	5 / 6	0.0682
Barium	mg/kg	0.0428 / 0.1098	ND			0 / 6	
Beryllium	mg/kg	0.0275 / 0.0312	ND			0 / 6	
Boron	mg/kg	0.3843 / 0.4368	ND			0 / 6	
Cadium	mg/kg	0.0071 / 0.0080	ND			0 / 6	
Calcium	mg/kg		85.3740	85.3740	723.1600	6 / 6	496.9807
Chromium	mg/kg	0.1190 / 0.1325	ND			0 / 6	
Cobalt	mg/kg	0.0132 / 0.0147	ND			0 / 6	
Copper	mg/kg		0.1702	0.1702	0.3043	6 / 6	0.2400
Iron	mg/kg	11.3094 / 12.5121	ND			0 / 6	
Lead	mg/kg	0.0256 / 0.0286	ND			0 / 6	
Magnesium	mg/kg		252.7200	252.7200	277.4500	6 / 6	265.0567
Manganese	mg/kg	0.1618 / 0.1716	0.2148	0.2148	0.7030	4 / 6	0.3922
Mercury	mg/kg		0.0323	0.0323	0.0949	6 / 6	0.0551
Molybdenum	mg/kg	0.0329 / 0.0361	ND			0 / 6	
Nickel	mg/kg	0.0915 / 0.1020	0.0981	0.0981	0.0981	1 / 6	0.0981
Potassium	mg/kg		3644.5000	3644.5000	3980.4000	6 / 6	3798.8333
Selenium	mg/kg		0.4992	0.4992	0.6444	6 / 6	0.5656
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		288.8000	288.8000	325.6000	6 / 6	303.7233
Strontium	mg/kg	0.0409 / 0.0409	0.2028	0.2028	0.4940	5 / 6	0.3873
Thallium	mg/kg	0.0130 / 0.0144	ND			0 / 6	
Vanadium	mg/kg	0.0421 / 0.0483	ND			0 / 6	
Zinc	mg/kg		8.1982	8.1982	15.4269	6 / 6	11.8239

Table A-70: Spring 2010 - White Crappie Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.43	0.43	1.20	3 / 3	0.91
Moisture	%		80.2	80.2	80.9	3 / 3	80.5
Aluminum	mg/kg	3.9919 / 4.1370	ND			0 / 3	
Antimony	mg/kg	0.0145 / 0.0150	ND			0 / 3	
Arsenic	mg/kg		0.1089	0.1089	0.1458	3 / 3	0.1276
Barium	mg/kg	0.0455 / 0.0458	0.1182	0.1182	0.1182	1 / 3	0.1182
Beryllium	mg/kg	0.0287 / 0.0315	ND			0 / 3	
Boron	mg/kg	0.4158 / 0.4334	ND			0 / 3	
Cadium	mg/kg	0.0076 / 0.0079	ND			0 / 3	
Calcium	mg/kg		160.5780	160.5780	2836.8000	3 / 3	1078.7093
Chromium	mg/kg	0.1287 / 0.1320	0.1452	0.1452	0.1452	1 / 3	0.1452
Cobalt	mg/kg	0.0141 / 0.0146	ND			0 / 3	
Copper	mg/kg		0.1547	0.1547	0.2376	3 / 3	0.1879
Iron	mg/kg	12.0330 / 12.4898	ND			0 / 3	
Lead	mg/kg	0.0277 / 0.0296	ND			0 / 3	
Magnesium	mg/kg		259.3800	259.3800	319.1400	3 / 3	282.6100
Manganese	mg/kg	0.1700 / 0.1723	0.4728	0.4728	0.4728	1 / 3	0.4728
Mercury	mg/kg		0.0512	0.0512	0.0614	3 / 3	0.0579
Molybdenum	mg/kg	0.0344 / 0.0356	ND			0 / 3	
Nickel	mg/kg	0.0974 / 0.1005	ND			0 / 3	
Potassium	mg/kg		3762.0000	3762.0000	4030.1000	3 / 3	3884.4333
Selenium	mg/kg		0.3366	0.3366	0.3743	3 / 3	0.3516
Silver	mg/kg	0.0029 / 0.0030	ND			0 / 3	
Sodium	mg/kg		199.9800	199.9800	295.5000	3 / 3	250.4733
Strontium	mg/kg		0.0990	0.0990	1.6942	3 / 3	0.6398
Thallium	mg/kg	0.0139 / 0.0187	ND			0 / 3	
Vanadium	mg/kg	0.0455 / 0.0473	ND			0 / 3	
Zinc	mg/kg		6.3221	6.3221	19.9980	3 / 3	11.1111

Table A-71: Fall 2010 - Bluegill Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.43	0.43	2.40	6 / 6	1.44
Moisture	%		80.7	80.7	81.5	6 / 6	80.9
Aluminum	mg/kg	3.6000 / 4.2000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Arsenic	mg/kg	0.0250 / 0.0290	0.0400	0.0400	0.0400	1 / 6	0.0400
Barium	mg/kg	0.0470 / 0.0480	0.0650	0.0650	0.4800	4 / 6	0.2438
Beryllium	mg/kg	0.0270 / 0.0310	ND			0 / 6	
Boron	mg/kg	0.3800 / 0.4300	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0079	ND			0 / 6	
Calcium	mg/kg		156.0000	156.0000	3400.0000	6 / 6	1458.3333
Chromium	mg/kg	0.1100 / 0.1300	0.1300	0.1300	0.6700	2 / 6	0.4000
Cobalt	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Copper	mg/kg		0.2000	0.2000	0.3500	6 / 6	0.2633
Iron	mg/kg	10.9000 / 12.5000	ND			0 / 6	
Lead	mg/kg	0.0250 / 0.0290	ND			0 / 6	
Magnesium	mg/kg		285.0000	285.0000	349.0000	6 / 6	313.5000
Manganese	mg/kg		0.2100	0.2100	7.1000	6 / 6	2.1050
Mercury	mg/kg		0.0480	0.0480	0.1200	6 / 6	0.0813
Molybdenum	mg/kg	0.0320 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0880 / 0.1000	0.3500	0.3500	0.3500	1 / 6	0.3500
Potassium	mg/kg		2610.0000	2610.0000	3460.0000	6 / 6	3125.0000
Selenium	mg/kg		0.3800	0.3800	0.4900	6 / 6	0.4317
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		335.0000	335.0000	823.0000	6 / 6	531.8333
Strontium	mg/kg		0.0970	0.0970	2.8000	6 / 6	1.1862
Thallium	mg/kg	0.0120 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0410 / 0.0470	ND			0 / 6	
Zinc	mg/kg		11.9000	11.9000	19.2000	6 / 6	15.3333

Table A-72: Fall 2010 - Channel Catfish Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.24	0.24	2.80	6 / 6	1.56
Moisture	%		77.7	77.7	84.5	6 / 6	80.3
Aluminum	mg/kg	3.6000 / 4.0000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0140	ND			0 / 6	
Arsenic	mg/kg	0.0250 / 0.0280	ND			0 / 6	
Barium	mg/kg	0.0420 / 0.0460	ND			0 / 6	
Beryllium	mg/kg	0.0270 / 0.0290	ND			0 / 6	
Boron	mg/kg	0.3800 / 0.4100	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0076	ND			0 / 6	
Calcium	mg/kg		65.6000	65.6000	93.7000	6 / 6	84.6833
Chromium	mg/kg	0.1200 / 0.1300	ND			0 / 6	
Cobalt	mg/kg	0.0130 / 0.0140	ND			0 / 6	
Copper	mg/kg		0.2100	0.2100	0.4900	6 / 6	0.3467
Iron	mg/kg	10.9000 / 12.0000	ND			0 / 6	
Lead	mg/kg	0.0250 / 0.0280	ND			0 / 6	
Magnesium	mg/kg		200.0000	200.0000	269.0000	6 / 6	248.3333
Manganese	mg/kg	0.1500 / 0.1700	ND			0 / 6	
Mercury	mg/kg		0.0420	0.0420	0.2400	6 / 6	0.1078
Molybdenum	mg/kg	0.0320 / 0.0350	ND			0 / 6	
Nickel	mg/kg	0.0890 / 0.0970	0.1100	0.1100	0.1300	2 / 6	0.1200
Potassium	mg/kg		3450.0000	3450.0000	4040.0000	6 / 6	3810.0000
Selenium	mg/kg		0.1900	0.1900	0.2300	6 / 6	0.2067
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 6	
Sodium	mg/kg		359.0000	359.0000	591.0000	6 / 6	443.8333
Strontium	mg/kg		0.0540	0.0540	0.0940	6 / 6	0.0715
Thallium	mg/kg	0.0130 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0420 / 0.0460	ND			0 / 6	
Zinc	mg/kg		5.0000	5.0000	10.0000	6 / 6	7.3667

Table A-73: Fall 2010 - Largemouth Bass Fillet at Emory River Mile 8.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.35	0.35	0.72	6 / 6	0.51
Moisture	%		78.1	78.1	80.3	6 / 6	78.9
Aluminum	mg/kg	3.5000 / 4.1000	ND			0 / 6	
Antimony	mg/kg	0.0130 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.0720	0.0720	0.2100	6 / 6	0.1473
Barium	mg/kg	0.0400 / 0.0470	ND			0 / 6	
Beryllium	mg/kg	0.0260 / 0.0300	ND			0 / 6	
Boron	mg/kg	0.3600 / 0.4200	ND			0 / 6	
Cadium	mg/kg	0.0066 / 0.0078	ND			0 / 6	
Calcium	mg/kg		110.0000	110.0000	665.0000	6 / 6	267.3333
Chromium	mg/kg	0.1100 / 0.1300	ND			0 / 6	
Cobalt	mg/kg	0.0120 / 0.0140	ND			0 / 6	
Copper	mg/kg		0.1800	0.1800	0.3600	6 / 6	0.2717
Iron	mg/kg	10.5000 / 12.3000	ND			0 / 6	
Lead	mg/kg	0.0240 / 0.0280	ND			0 / 6	
Magnesium	mg/kg		302.0000	302.0000	322.0000	6 / 6	311.1667
Manganese	mg/kg	0.1500 / 0.1700	ND			0 / 6	
Mercury	mg/kg		0.1200	0.1200	0.1900	6 / 6	0.1467
Molybdenum	mg/kg	0.0310 / 0.0360	ND			0 / 6	
Nickel	mg/kg	0.0850 / 0.1000	ND			0 / 6	
Potassium	mg/kg		3590.0000	3590.0000	3980.0000	6 / 6	3776.6667
Selenium	mg/kg		0.3500	0.3500	0.6600	6 / 6	0.4500
Silver	mg/kg	0.0025 / 0.0029	ND			0 / 6	
Sodium	mg/kg		306.0000	306.0000	365.0000	6 / 6	338.8333
Strontium	mg/kg		0.0420	0.0420	0.4600	6 / 6	0.1630
Thallium	mg/kg	0.0120 / 0.0140	ND			0 / 6	
Vanadium	mg/kg	0.0400 / 0.0470	ND			0 / 6	
Zinc	mg/kg		7.3000	7.3000	14.9000	6 / 6	11.0333

Table A-74: Fall 2009 - Bluegill Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.18	0.18	0.61	6 / 6	0.35
Moisture	%		74.5	74.5	83.4	6 / 6	80.3
Aluminum	mg/kg	0.8740 / 2.3074	ND			0 / 6	
Antimony	mg/kg	0.0163 / 0.0190	ND			0 / 6	
Arsenic	mg/kg	0.0303 / 0.0681	ND			0 / 6	
Barium	mg/kg		0.0313	0.0313	0.1643	6 / 6	0.1012
Beryllium	mg/kg	0.0126 / 0.0150	ND			0 / 6	
Boron	mg/kg	0.1693 / 0.1995	ND			0 / 6	
Cadium	mg/kg	0.0051 / 0.0059	ND			0 / 6	
Calcium	mg/kg		133.3800	133.3800	1284.3900	6 / 6	720.0783
Chromium	mg/kg	0.1046 / 0.1240	ND			0 / 6	
Cobalt	mg/kg	0.0042 / 0.0070	ND			0 / 6	
Copper	mg/kg		0.2015	0.2015	0.3700	6 / 6	0.2738
Iron	mg/kg	10.5576 / 12.4260	ND			0 / 6	
Lead	mg/kg	0.0090 / 0.0523	ND			0 / 6	
Magnesium	mg/kg		223.1100	223.1100	340.4000	6 / 6	282.6600
Manganese	mg/kg		0.1634	0.1634	1.4280	6 / 6	0.7741
Mercury	mg/kg	0.0266 / 0.0370	ND			0 / 6	
Molybdenum	mg/kg	0.0091 / 0.0108	ND			0 / 6	
Nickel	mg/kg	0.0306 / 0.0306	0.0350	0.0350	0.0543	5 / 6	0.0423
Potassium	mg/kg		2814.0000	2814.0000	4397.6000	6 / 6	3531.7667
Selenium	mg/kg		0.4422	0.4422	0.5365	6 / 6	0.4902
Silver	mg/kg	0.0025 / 0.0030	ND			0 / 6	
Sodium	mg/kg		255.0000	255.0000	323.8400	6 / 6	283.5700
Strontium	mg/kg		0.1083	0.1083	1.3944	6 / 6	0.6915
Thallium	mg/kg	0.0125 / 0.0146	ND			0 / 6	
Vanadium	mg/kg	0.0465 / 0.0555	ND			0 / 6	
Zinc	mg/kg		8.4360	8.4360	21.5070	6 / 6	15.8476

Table A-75: Fall 2009 - Largemouth Bass Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.31	0.31	6.20	6 / 6	1.48
Moisture	%		77.6	77.6	79.9	6 / 6	78.4
Aluminum	mg/kg	1.8920 / 11.8479	78.7920	78.7920	78.7920	1 / 6	78.7920
Antimony	mg/kg	0.0180 / 0.0187	0.1183	0.1183	1.0900	3 / 6	0.7537
Arsenic	mg/kg	0.0523 / 0.1266	0.1452	0.1452	0.1862	2 / 6	0.1657
Barium	mg/kg	0.0196 / 0.0196	0.0260	0.0260	0.0402	5 / 6	0.0353
Beryllium	mg/kg	0.0131 / 0.0149	ND			0 / 6	
Boron	mg/kg	0.1748 / 0.1973	ND			0 / 6	
Cadium	mg/kg	0.0056 / 0.0414	ND			0 / 6	
Calcium	mg/kg		108.2400	108.2400	283.4100	6 / 6	186.0343
Chromium	mg/kg	0.1172 / 0.1172	0.1518	0.1518	0.3136	5 / 6	0.2254
Cobalt	mg/kg	0.0044 / 0.0078	ND			0 / 6	
Copper	mg/kg	0.1693 / 0.1693	0.1870	0.1870	0.5037	5 / 6	0.3232
Iron	mg/kg	11.7180 / 12.3078	12.4544	12.4544	13.7994	2 / 6	13.1269
Lead	mg/kg	0.0098 / 0.0220	0.2613	0.2613	0.4599	3 / 6	0.3449
Magnesium	mg/kg		261.3000	261.3000	310.3100	6 / 6	281.7350
Manganese	mg/kg		0.0902	0.0902	0.1658	6 / 6	0.1360
Mercury	mg/kg		0.0605	0.0605	0.0977	6 / 6	0.0842
Molybdenum	mg/kg	0.0094 / 0.0181	ND			0 / 6	
Nickel	mg/kg	0.0326 / 0.0326	0.0396	0.0396	0.0627	5 / 6	0.0526
Potassium	mg/kg		3678.3000	3678.3000	4211.2000	6 / 6	3955.1000
Selenium	mg/kg		0.4221	0.4221	0.5694	6 / 6	0.4983
Silver	mg/kg	0.0026 / 0.0031	ND			0 / 6	
Sodium	mg/kg		311.7400	311.7400	369.6000	6 / 6	332.8533
Strontium	mg/kg	0.0396 / 0.0986	0.1003	0.1003	0.2018	3 / 6	0.1664
Thallium	mg/kg	0.0129 / 0.0146	ND			0 / 6	
Vanadium	mg/kg	0.0521 / 0.0521	0.0632	0.0632	0.4480	5 / 6	0.1814
Zinc	mg/kg		5.3460	5.3460	17.7081	6 / 6	11.1052

Table A-76: Spring 2010 - Bluegill Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.26	0.26	2.40	6 / 6	1.06
Moisture	%		80.5	80.5	82.7	6 / 6	81.5
Aluminum	mg/kg	3.7440 / 4.1520	4.1360	4.1360	4.1360	1 / 6	4.1360
Antimony	mg/kg	0.0130 / 0.0151	ND			0 / 6	
Arsenic	mg/kg	0.0272 / 0.0272	0.0288	0.0288	0.0675	5 / 6	0.0433
Barium	mg/kg	0.0422 / 0.2172	0.0663	0.0663	0.1203	2 / 6	0.0933
Beryllium	mg/kg	0.0290 / 0.0566	ND			0 / 6	
Boron	mg/kg	0.3760 / 0.4325	ND			0 / 6	
Cadium	mg/kg	0.0074 / 0.0148	ND			0 / 6	
Calcium	mg/kg		243.8400	243.8400	1507.7300	6 / 6	833.4733
Chromium	mg/kg	0.1147 / 0.1315	0.1539	0.1539	0.1539	1 / 6	0.1539
Cobalt	mg/kg	0.0128 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.1767	0.1767	0.3077	6 / 6	0.2310
Iron	mg/kg	10.8852 / 12.4906	ND			0 / 6	
Lead	mg/kg	0.0244 / 0.0294	ND			0 / 6	
Magnesium	mg/kg		266.4200	266.4200	302.6800	6 / 6	282.2067
Manganese	mg/kg		0.2880	0.2880	2.6123	6 / 6	1.2247
Mercury	mg/kg		0.0346	0.0346	0.0652	6 / 6	0.0487
Molybdenum	mg/kg	0.0320 / 0.0363	ND			0 / 6	
Nickel	mg/kg	0.0884 / 0.1003	ND			0 / 6	
Potassium	mg/kg		3168.0000	3168.0000	3909.6000	6 / 6	3398.8667
Selenium	mg/kg		0.4344	0.4344	0.5952	6 / 6	0.4975
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 6	
Sodium	mg/kg		262.4500	262.4500	360.9600	6 / 6	301.8950
Strontium	mg/kg		0.1738	0.1738	1.2408	6 / 6	0.6491
Thallium	mg/kg	0.0124 / 0.0144	ND			0 / 6	
Vanadium	mg/kg	0.0453 / 0.0878	ND			0 / 6	
Zinc	mg/kg		10.3296	10.3296	18.4275	6 / 6	13.1224

Table A-77: Spring 2010 - Largemouth Bass Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.29	0.29	1.00	6 / 6	0.56
Moisture	%		78.6	78.6	80.5	6 / 6	79.6
Aluminum	mg/kg	3.5979 / 7.9180	ND			0 / 6	
Antimony	mg/kg	0.0131 / 0.0150	ND			0 / 6	
Arsenic	mg/kg		0.0203	0.0203	0.1438	6 / 6	0.0855
Barium	mg/kg	0.0449 / 0.0468	0.0462	0.0462	0.0462	1 / 6	0.0462
Beryllium	mg/kg	0.0261 / 0.1177	ND			0 / 6	
Boron	mg/kg	0.3819 / 0.8132	ND			0 / 6	
Cadium	mg/kg	0.0068 / 0.0079	ND			0 / 6	
Calcium	mg/kg		107.8350	107.8350	830.1300	6 / 6	371.7375
Chromium	mg/kg	0.1146 / 0.2568	ND			0 / 6	
Cobalt	mg/kg	0.0127 / 0.0278	ND			0 / 6	
Copper	mg/kg		0.1930	0.1930	0.5319	6 / 6	0.3179
Iron	mg/kg	10.8540 / 23.7540	ND			0 / 6	
Lead	mg/kg	0.0241 / 0.0293	0.0296	0.0296	0.0296	1 / 6	0.0296
Magnesium	mg/kg		254.1300	254.1300	312.4400	6 / 6	283.7317
Manganese	mg/kg	0.1675 / 0.3424	0.1709	0.1709	0.1827	2 / 6	0.1768
Mercury	mg/kg		0.0804	0.0804	0.2354	6 / 6	0.1192
Molybdenum	mg/kg	0.0322 / 0.0371	ND			0 / 6	
Nickel	mg/kg	0.0884 / 0.1926	ND			0 / 6	
Potassium	mg/kg		3714.9000	3714.9000	4066.0000	6 / 6	3884.1000
Selenium	mg/kg		0.3940	0.3940	0.5481	6 / 6	0.4597
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		333.4500	333.4500	455.8200	6 / 6	397.7717
Strontium	mg/kg		0.0488	0.0488	0.5427	6 / 6	0.2220
Thallium	mg/kg	0.0125 / 0.0142	ND			0 / 6	
Vanadium	mg/kg	0.0402 / 0.1776	ND			0 / 6	
Zinc	mg/kg		4.1006	4.1006	8.1705	6 / 6	6.1519

Table A-78: Spring 2010 - Red Ear Sunfish Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.14	0.14	1.10	6 / 6	0.36
Moisture	%		81.3	81.3	83.9	6 / 6	82.9
Aluminum	mg/kg	3.7800 / 4.1236	ND			0 / 6	
Antimony	mg/kg	0.0137 / 0.0149	ND			0 / 6	
Arsenic	mg/kg	0.0275 / 0.0275	0.0473	0.0473	0.1152	5 / 6	0.0727
Barium	mg/kg	0.0438 / 0.3268	ND			0 / 6	
Beryllium	mg/kg	0.0280 / 0.0304	ND			0 / 6	
Boron	mg/kg	0.3850 / 0.4225	ND			0 / 6	
Cadium	mg/kg	0.0072 / 0.0078	ND			0 / 6	
Calcium	mg/kg		110.4250	110.4250	1960.8000	6 / 6	786.9558
Chromium	mg/kg	0.1208 / 0.1301	ND			0 / 6	
Cobalt	mg/kg	0.0133 / 0.0145	ND			0 / 6	
Copper	mg/kg		0.2415	0.2415	0.3549	6 / 6	0.2785
Iron	mg/kg	11.4100 / 12.4046	ND			0 / 6	
Lead	mg/kg	0.0263 / 0.0287	ND			0 / 6	
Magnesium	mg/kg		229.2500	229.2500	304.8100	6 / 6	256.3450
Manganese	mg/kg		0.1680	0.1680	1.2155	6 / 6	0.5906
Mercury	mg/kg		0.0430	0.0430	0.0676	6 / 6	0.0507
Molybdenum	mg/kg	0.0333 / 0.0361	ND			0 / 6	
Nickel	mg/kg	0.0928 / 0.1014	ND			0 / 6	
Potassium	mg/kg		3395.0000	3395.0000	3927.0000	6 / 6	3687.5000
Selenium	mg/kg		0.5848	0.5848	0.6732	6 / 6	0.6229
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		278.5300	278.5300	395.5000	6 / 6	332.7967
Strontium	mg/kg		0.1442	0.1442	1.9952	6 / 6	0.6765
Thallium	mg/kg	0.0131 / 0.0142	ND			0 / 6	
Vanadium	mg/kg	0.0435 / 0.0473	ND			0 / 6	
Zinc	mg/kg		9.9932	9.9932	21.0000	6 / 6	13.1037

Table A-79: Spring 2010 - White Crappie Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.48	0.48	2.50	6 / 6	0.90
Moisture	%		77.7	77.7	80.9	6 / 6	79.8
Aluminum	mg/kg	3.5680 / 4.1184	ND			0 / 6	
Antimony	mg/kg	0.0129 / 0.0149	ND			0 / 6	
Arsenic	mg/kg		0.0970	0.0970	0.1762	6 / 6	0.1385
Barium	mg/kg	0.0401 / 0.0458	0.0535	0.0535	0.1168	2 / 6	0.0851
Beryllium	mg/kg	0.0268 / 0.0306	ND			0 / 6	
Boron	mg/kg	0.3791 / 0.4356	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0079	ND			0 / 6	
Calcium	mg/kg		140.6930	140.6930	645.4800	6 / 6	305.5643
Chromium	mg/kg	0.1137 / 0.1280	0.1731	0.1731	0.2376	2 / 6	0.2054
Cobalt	mg/kg	0.0125 / 0.0145	ND			0 / 6	
Copper	mg/kg	0.1413 / 0.1452	0.1604	0.1604	0.1841	4 / 6	0.1732
Iron	mg/kg	10.7709 / 12.4146	ND			0 / 6	
Lead	mg/kg	0.0245 / 0.0287	ND			0 / 6	
Magnesium	mg/kg		259.7600	259.7600	301.0500	6 / 6	277.3283
Manganese	mg/kg	0.1516 / 0.1762	0.2101	0.2101	0.2376	2 / 6	0.2239
Mercury	mg/kg		0.0396	0.0396	0.1089	6 / 6	0.0587
Molybdenum	mg/kg	0.0312 / 0.0363	ND			0 / 6	
Nickel	mg/kg	0.0931 / 0.0974	0.1294	0.1294	0.1583	3 / 6	0.1454
Potassium	mg/kg		3590.8000	3590.8000	4103.2000	6 / 6	3909.2500
Selenium	mg/kg		0.4158	0.4158	0.4966	6 / 6	0.4427
Silver	mg/kg	0.0027 / 0.0030	ND			0 / 6	
Sodium	mg/kg		250.7400	250.7400	294.1400	6 / 6	270.2467
Strontium	mg/kg		0.0657	0.0657	0.4356	6 / 6	0.2061
Thallium	mg/kg	0.0123 / 0.0183	ND			0 / 6	
Vanadium	mg/kg	0.0401 / 0.0475	ND			0 / 6	
Zinc	mg/kg		4.2630	4.2630	7.6615	6 / 6	6.3850

Table A-80: Fall 2010 - Bluegill Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.38	0.38	1.60	6 / 6	0.78
Moisture	%		76.4	76.4	81.8	6 / 6	80.4
Aluminum	mg/kg	3.7052 / 4.0809	ND			0 / 6	
Antimony	mg/kg	0.0135 / 0.0146	ND			0 / 6	
Arsenic	mg/kg	0.0265 / 0.0286	0.0070	0.0070	0.0276	3 / 6	0.0142
Barium	mg/kg	0.0435 / 0.0476	0.0167	0.0167	0.0239	3 / 6	0.0214
Beryllium	mg/kg	0.0283 / 0.0294	ND			0 / 6	
Boron	mg/kg	0.3776 / 0.4232	ND			0 / 6	
Cadium	mg/kg	0.0071 / 0.0077	ND			0 / 6	
Calcium	mg/kg		100.3590	100.3590	1039.2200	6 / 6	463.2812
Chromium	mg/kg	0.1180 / 0.1299	ND			0 / 6	
Cobalt	mg/kg	0.0130 / 0.0143	ND			0 / 6	
Copper	mg/kg	0.1464 / 0.1464	0.0382	0.0382	0.0590	5 / 6	0.0494
Iron	mg/kg	11.1628 / 12.2610	ND			0 / 6	
Lead	mg/kg	0.0260 / 0.0286	ND			0 / 6	
Magnesium	mg/kg		264.6000	264.6000	306.0000	6 / 6	288.5550
Manganese	mg/kg		0.0454	0.0454	0.7316	6 / 6	0.2352
Mercury	mg/kg		0.0040	0.0040	0.0093	6 / 6	0.0069
Molybdenum	mg/kg	0.0330 / 0.0366	ND			0 / 6	
Nickel	mg/kg	0.0897 / 0.0988	ND			0 / 6	
Potassium	mg/kg		3146.4000	3146.4000	4135.8000	6 / 6	3727.4000
Selenium	mg/kg		0.0695	0.0695	0.1322	6 / 6	0.1036
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 6	
Sodium	mg/kg		351.2600	351.2600	524.4000	6 / 6	414.4400
Strontium	mg/kg		0.0138	0.0138	0.1674	6 / 6	0.0959
Thallium	mg/kg	0.0127 / 0.0141	ND			0 / 6	
Vanadium	mg/kg	0.0425 / 0.0460	ND			0 / 6	
Zinc	mg/kg		1.4364	1.4364	12.1540	6 / 6	6.2998

Table A-81: Fall 2010 - Channel Catfish Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.50	0.50	1.40	6 / 6	1.08
Moisture	%		78.7	78.7	82.4	6 / 6	81.0
Aluminum	mg/kg	3.6600 / 4.1536	ND			0 / 6	
Antimony	mg/kg	0.0132 / 0.0150	ND			0 / 6	
Arsenic	mg/kg	0.0256 / 0.0299	ND			0 / 6	
Barium	mg/kg	0.0420 / 0.0475	ND			0 / 6	
Beryllium	mg/kg	0.0260 / 0.0299	ND			0 / 6	
Boron	mg/kg	0.3800 / 0.4224	ND			0 / 6	
Cadium	mg/kg	0.0070 / 0.0079	ND			0 / 6	
Calcium	mg/kg		77.9580	77.9580	103.5180	6 / 6	87.2518
Chromium	mg/kg	0.1160 / 0.1320	ND			0 / 6	
Cobalt	mg/kg	0.0128 / 0.0146	ND			0 / 6	
Copper	mg/kg		0.0256	0.0256	1.0368	6 / 6	0.3959
Iron	mg/kg	11.0000 / 12.4960	ND			0 / 6	
Lead	mg/kg	0.0256 / 0.0282	0.0422	0.0422	0.0422	1 / 6	0.0422
Magnesium	mg/kg		247.0500	247.0500	306.7200	6 / 6	270.2567
Manganese	mg/kg	0.1592 / 0.1665	0.1728	0.1728	0.2288	3 / 6	0.1932
Mercury	mg/kg		0.0088	0.0088	0.1549	6 / 6	0.0565
Molybdenum	mg/kg	0.0320 / 0.0370	ND			0 / 6	
Nickel	mg/kg	0.0900 / 0.1021	ND			0 / 6	
Potassium	mg/kg		4012.8000	4012.8000	4707.7000	6 / 6	4418.6333
Selenium	mg/kg		0.0465	0.0465	0.3264	6 / 6	0.2107
Silver	mg/kg	0.0026 / 0.0030	ND			0 / 6	
Sodium	mg/kg		341.8900	341.8900	428.0000	6 / 6	379.2567
Strontium	mg/kg		0.0127	0.0127	0.0634	6 / 6	0.0427
Thallium	mg/kg	0.0126 / 0.0143	ND			0 / 6	
Vanadium	mg/kg	0.0420 / 0.0475	ND			0 / 6	
Zinc	mg/kg		0.8235	0.8235	7.9800	6 / 6	4.5348

Table A-82: Fall 2010 - Largemouth Bass Fillet at Little Emory River Mile 2.0

Analyte	Units	Detection Limit Range	Minimum	Minimum Detected Result	Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Lipids	%		0.29	0.29	2.10	6 / 6	0.75
Moisture	%		77.9	77.9	80.6	6 / 6	79.1
Aluminum	mg/kg	3.6890 / 4.0365	ND			0 / 6	
Antimony	mg/kg	0.0132 / 0.0147	ND			0 / 6	
Arsenic	mg/kg		0.0150	0.0150	0.0354	6 / 6	0.0259
Barium	mg/kg	0.0412 / 0.0449	0.0118	0.0118	0.0460	2 / 6	0.0289
Beryllium	mg/kg	0.0282 / 0.0293	ND			0 / 6	
Boron	mg/kg	0.3880 / 0.4180	ND			0 / 6	
Cadium	mg/kg	0.0069 / 0.0077	ND			0 / 6	
Calcium	mg/kg		93.7040	93.7040	879.7500	6 / 6	329.8777
Chromium	mg/kg	0.1172 / 0.1283	ND			0 / 6	
Cobalt	mg/kg	0.0130 / 0.0143	ND			0 / 6	
Copper	mg/kg		0.0388	0.0388	0.3762	6 / 6	0.1880
Iron	mg/kg	11.1104 / 12.1923	ND			0 / 6	
Lead	mg/kg	0.0260 / 0.0290	0.0194	0.0194	0.0194	1 / 6	0.0194
Magnesium	mg/kg		263.8400	263.8400	305.9700	6 / 6	284.9883
Manganese	mg/kg	0.1562 / 0.1630	0.0388	0.0388	0.0899	3 / 6	0.0594
Mercury	mg/kg		0.0184	0.0184	0.0716	6 / 6	0.0368
Molybdenum	mg/kg	0.0326 / 0.0355	ND			0 / 6	
Nickel	mg/kg	0.0890 / 0.0938	0.0455	0.0455	0.5852	2 / 6	0.3154
Potassium	mg/kg		4112.8000	4112.8000	4409.9000	6 / 6	4219.3167
Selenium	mg/kg		0.0995	0.0995	0.4462	6 / 6	0.1676
Silver	mg/kg	0.0026 / 0.0029	ND			0 / 6	
Sodium	mg/kg		345.0300	345.0300	362.4400	6 / 6	350.6933
Strontium	mg/kg	0.0420 / 0.0420	0.0095	0.0095	0.1387	5 / 6	0.0529
Thallium	mg/kg	0.0128 / 0.0139	ND			0 / 6	
Vanadium	mg/kg	0.0412 / 0.0460	ND			0 / 6	
Zinc	mg/kg		1.6796	1.6796	11.1397	6 / 6	4.4314