Routine Monitoring of Toxics in New Jersey Fish

Year 5, The Upper and Lower Delaware River Region and Associated Tributaries, including Delaware Lake, and Delaware River Basin Commission (DRBC) Traditional Sample Sites

Submitted to:

New Jersey Department of Environmental Protection
Office of Science

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ANS: Project # 589

January 8, 2013

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INTRODUCTION

Background

In 1994, research on freshwater fish by the Academy of Natural Sciences (now ANSDU) and the New Jersey Department of Environmental Protection (NJDEP) found mercury concentrations exceeding the risk-based health criteria established by the State of New Jersey. The Department of Health and Senior Services (DHSS) and NJDEP issued statewide, regional, and lake-specific fish consumption advisories for two species, largemouth bass and chain pickerel. Subsequent studies have provided more data on mercury concentrations, as well as data on PCBs, selected organo-chlorine pesticides (OCPs), and other organic contaminants (e.g., PBDEs, dioxins and furans). Additional data were reported in ANSP (1999), Ashley and Horwitz (2000), and Horwitz et al. (2005, 2006, 2008 and 2009). These data have been used to develop water quality assessments for specific waterways (see http://www.state.nj.us/dep/wms/bwqsa/generalinfo.htm for most current list). The State's 303d list of impaired sites (derived from the Clean Water Act) drives the development of Total Maximum Daily Limits (TMDL) and other contaminant control strategies. The results of contaminant monitoring are used to enhance waterbody assessments, to amend existing advisories or, if necessary, develop new advisories, to assist the NJDEP in evaluating trends in contaminant concentrations of these selected species, and to determine necessary, additional research and monitoring studies. The monitoring program described here builds upon NJDEP's Division of Science, Research and Technology (DSRT; now the Office of Science) fish contamination research that identified widespread mercury contamination in the fresh waters of the State, chlordane, polychlorinated biphenyl (PCB) and dioxin contamination in site-specific locations, and PCB contamination predominantly in several estuarine and marine fish species.

In July 2002, the Academy of Natural Sciences of Philadelphia (ANSP) began a Routine Monitoring Program for Toxics in Fish for NJDEP. There has been a clear need for a continuous monitoring program for toxic chemicals in fish to regularly assess the status and trends of fish contamination and related consumption advisories in New Jersey waters, in order to provide current data on a variety of species and sites. Due to the large number of water bodies in the State, the sampling program is based on a rotating assessment of contamination of five regions of the State on a five-year cycle:

1. Passaic River Region;
2. Marine/Estuarine Coastal Region;
3. Raritan River Region;
4. Atlantic Coastal Inland Waterways Region; and
5. Upper and Lower Delaware River Region.

In each period, previously-sampled and new sites have been sampled, so that coverage of water bodies has increased over time and temporal comparisons of trends can be done. Sampling in the Passaic Region was conducted in 2002-2003, the Marine/Estuarine Region in 2004-06, the Raritan River Region in 2006-2007, and the Atlantic Coastal Inland Waterways Region in 2007. These results were reported in Horwitz et al. (2005, 2006, 2008, and 2009). This report presents

findings of the fifth year of the cycle, the Upper and Lower Delaware River Region, which involved freshwater fishes sampled in 2010-11.

The main objective of this program is to provide current and more comprehensive data to the State of New Jersey on concentrations of toxic contaminants in its freshwater fishes. These data are needed to update consumption advisories for targeted species of recreational and commercial importance in areas under current State advisory and/or in selected areas with little or no current information.

Study Design

The 2010-11 study was designed to complete sampling of fishes through four main tasks. Task I consisted of field collection support for the NJDEP and the Delaware Basin River Commission (DRBC) in sampling along the mainstem Delaware River and associated tributaries in the region from Montague to Salem (DRBC traditional sampling sites) at a total of 11 sites (Table 1). The tributaries in which collections were made are mainly downstream of the city of Trenton to the Salem River. Two of the sites sampled are on impoundments along the selected tributaries (Cooper River Lake on the Cooper River and Newton Lake on the Newton Creek). Several sites on tributaries historically sampled were not re-sampled because of difficulty in accessing the sites and, for several sites, low abundance of larger fish at these sites in previous collections. These sites include Assunpink Creek, Evans and Hopkins ponds on the Cooper River, and Newton Creek north. After discussions between NJDEP and DRBC project managers, these sites were replaced with other stations on more accessible tributaries. Species composition and numbers selected for collection at these sites were decided at the time of field sampling and typically included a top predator such as largemouth bass or striped bass, a bottom-feeding catfish species (e.g. channel catfish) and an omnivorous species (e.g. carp). The mainstem river sites sampled are mainly upstream of the city of Trenton, with the Raccoon Creek mouth as the only southern mainstem sampling location. The species collected for this task were species historically analyzed by DRBC that are common in the sampling area, for example a pelagic species (smallmouth bass) and a benthic species (white sucker). Sample sets of fish collected in these areas were transferred to DRBC personnel for subsequent chemical contaminant analysis. The results from the analysis of these samples are not presented in this report. Data on contaminants from DRBC can be found on the DRBC website (http://www.state.nj.us/drbc/quality/datum/fish/).

Task II consisted of the Routine Monitoring component of the study. This task provides fish contamination data through field collection and sample analysis on the status and trends of sites including rivers, creeks and lakes in additional areas within the Delaware drainage. Stations were selected to include previously-sampled sites and to investigate sites with no contaminant data. A total of 26 sites (Table 1) were sampled during this task. With these sites, virtually all lakes that fit the sampling structure criteria in this region have been sampled in one or more of the ANSDU sampling studies. The sampling frame was defined as: 1) lakes and impoundments greater than 15 acres with public access, as listed in the latest version (2003) of NJ Places to Fish; and 2) rivers greater than 12 miles long and without any impoundment. As in recent studies, unique lakes were

selected and specified for sampling, according to either their importance to angling or having been sampled in prior studies. Seven lakes in the region, Assunpink Lake, Cranberry Lake, Lake Hopatcong, Merrill Creek Reservoir, Swartswood Lake, Lake Musconetcong and Mercer Lake, were designated and sampled as unique, with the first five lakes being resampled to compare with the initial study completed in 1992. Because of its size, Lake Hopatcong was sampled at both the south and north ends on separate dates. The data for these two locations showed no clear differences, and are combined in the summary tables.

Species were selected to include predatory species present in a wide number of sites, allowing comparison among sites. These species are either under consumption advisories on a statewide, regional and waterway-specific basis for mercury (Hg) and/or PCB contamination or are regularly consumed by recreational anglers within the State. For this region, largemouth bass, American eel and chain pickerel were the primary species monitored. Additional species were selected at specific sites on the basis of their importance in the fishery at that site. Fourteen species of freshwater fish (see Table 2 for common and scientific names of species) were sampled and analyzed. Some of the originally designated species from a few locations were not able to be collected, and NJDEP and ANSP project managers reapportioned the missing samples and modified the sampling plan. During the course of the study it was decided by NJDEP project managers to replace analyses of dioxin and furans in some samples (as originally proposed) by analysis of several new sites. These sites, Mountain, Little Swartswood and Paulinskill Lakes and a northern site on Lake Hopatcong, were sampled in 2011. In addition, largemouth bass samples from Peddie and Kirkwood lakes (originally examined for mercury only) were analyzed for PCB/OCP's, after finding elevated levels of PCB/OCP's in American eels from Peddie Lake and in carp from Kirkwood Lake. Individual filets from all fish species sampled were analyzed for various analytes (Table 3).

The Task III component included field collection and analysis of fish and red maple leaves from Delaware Lake, Warren County, as a more intensive investigation of potential mercury contamination from a coal-powered energy plant along the Pennsylvania border. Fish samples, including twenty-three two-year old largemouth bass, three adult largemouth bass and bluegill, were collected by NJDEP's Bureau of Freshwater and Biological Monitoring (BFBM) personnel in 2009 for analysis. In addition, composite sets of red maple leaves were collected from trees along the shoreline of Delaware Lake by NJDEP. Delaware Lake was also sampled in 2010 for adult largemouth bass, bluegill and American eel as part of the Routine Monitoring task.

The Task IV component of this study included collection of American eel (N=3) from each of six mainstem (Table 3) Delaware River sites (from Montague at RM 247 to the Raccoon Creek mouth at RM 80). The eel samples were analyzed for polybrominated diphenyl esters (PBDEs), PCB/OCPs and Hg to assess the influence of low to high density industrial regions along the river on a relatively stationary (small home range) species.

In some cases, sites originally selected for sampling could not be sampled, because permission for access could not be obtained (Strawbridge Lake), the site did not fit criteria for inclusion (e.g., Colonial Lake, which was under the size criterion), or the lake was inaccessible (Deer Park Pond).

In these cases, sites were replaced by another site.

Analytes

A total of 330 samples were analyzed. Total mercury was measured on all of the samples while lipid content, PCBs and selected organo-chlorine pesticides (OCPs) were measured on 113 of the samples. The samples were selected to include species most likely to show bioaccumulation of these substances and/or importance to the recreational fisheries. These include predatory fish, benthic fish and fish with high lipid content (e.g. American eels). Polybrominated diphenyl ethers (PBDEs) were measured on 18 American eel samples (American eel). Analytical methods are described in greater detail in the methods section.

SAMPLING PROCEDURES

Field

Specimens were collected by standard fisheries methods and/or by legal angling methods, using an applicable State of New Jersey Freshwater Scientific Collection Permit. Extra specimens, including samples relinquished to the NJ Department of Health for viral hemorrhagic septicemia (VHS) analysis and species of opportunity collected, were retained frozen for possible future analyses.

Fish were collected by a variety of techniques as appropriate to the access of waterbody, location, water levels and species needed. The primary technique used was boat electrofishing. Eel pots, angling, walkalong electrofishing (similar to towbarge electrofishing), and gill netting were also used. Eel pots were used to collect American eels on the Delaware River @ Fort Mifflin and angling was used to collect some specimens from Catfish Pond. Walkalong electrofishing was used to sample wadeable habitat and supplement gill netting at Blue Mountain Lake. Specimens from a few sites were collected by personnel of BFBM (Mountain and Delaware lakes) and by Normandeau Associates (Merrill Creek Reservoir lake trout).

Measurements of pH, conductivity, and water temperature were made at the time of sampling, using a Eutech multi-parameter Testr 35 series.

All information on specimens collected in the field was kept on unique data sheets for each station. Field chain-of-custody forms were completed for each collection trip and were used to track transfers of specimens from other collection groups to ANSP fisheries personnel and within ANSP to track laboratory transfers internally and to outside laboratory facilities.

All specimens were placed on ice as soon after capture as practical. Specimens were held in stainless steel containers (pre-cleaned with Micro cleaning solution and rinsed with ambient water

at each individual station) until processing. Within 24 h of capture (usually less), specimens selected for, PCB and pesticide analysis were wrapped in muffled aluminum foil, sealed with freezer tape, labeled and placed in freezers. The specimens selected for mercury analysis only were frozen in Ziploc-type (plastic) or kitchen bags. Specimens for both PCB and mercury analysis were wrapped in muffled aluminum foil. All specimens were labeled with both internal and external tags and held frozen until thawed for sample preparation. Samples were maintained with complete sample documentation (chain-of-custody forms, etc.).

In order to ensure uncontaminated samples, the sampling gear, coolers, stainless pans and appropriate sample containers (muffled aluminum foil wrap) were cleaned between sampling events. The procedures for cleaning sampling gear and wrapping specimens were consistent with ANSP standard operating procedures (ANSP SOP P-14-12r4, Preparation of fish tissues for contaminant analysis).

Laboratory

All samples were stored frozen until processing in the ANSP laboratory. All transfers of samples were properly documented throughout transport and analysis (internal laboratory chain-of-custody). All laboratory equipment was properly calibrated as per each method completed. Careful cleaning of all laboratory equipment and instruments using the appropriate soaps, solvents, acids, and double deionized water (DDW) was done throughout the program.

Tissue preparation of fish followed common preparation methods for consumption. The selected fish specimens were fileted using clean methods for both trace metals and organic contaminants as outlined in EPA (1995; ANSP SOP P-14-12r4). The samples were filleted with skin off for American eel and catfish species and with skin on and scales removed for all other species. Fileting was done using stainless steel utensils on glass plates. All fish samples were individual filets, typically the left side filet, with the remains (right side, remaining carcass and head) retained for archival material. The archived sample material (including the extra sample homogenate not analyzed) will be retained by ANSP for a period of one year following project final report submission.

CHEMICAL ANALYSES

Each tissue sample was fileted, homogenized and placed into pre-cleaned jars (e.g., ICHEM) for trace metals and organic analyses. Chemical analyses were performed by ANSP using modified U.S. EPA and NOAA Status and Trends approved methods (ANSP SOPs P-16-84r4, P-16-111, P-16-109r1, and P-16-108). Chemical contaminants and ancillary parameters analyzed are listed in Table 3.

As part of quality assurance and quality control (QA/QC), a Standard Reference Material (SRM) was analyzed. The SRM was obtained from the National Institute of Standards and Technology (NIST) or equivalent agency (see Cantillo, 1993; 1995) and consisted of SRM 1946 (Lake Superior Fish Tissue) for both mercury and PCB/OCP analyses. Also, additional duplicate (PCB/OCP and mercury) and triplicate (PCB/OCP) fish tissue samples were analyzed to help assess laboratory variations and provide critical information for the assessment of both geographical and temporal trends.

All glassware and materials coming into contact with the fish were pre-cleaned with the appropriate cleaning agent (e.g., Micro soap, acids, deionized water, solvents, etc.) pertaining to the specific parameter or group of parameters. Cleaning and analytical methods are outlined in the QA/QC documentation for this project (ANSP Ref# 464; January 2007).

Mercury

Extractions and Analyses:
Strong acid digestions were performed using 10 ml nitric acid on approximately 0.5 g homogenized wet fish material in a CEM MARS Xpress microwave digestion system. Mercury quantitation was subsequently accomplished using a Perkin Elmer Fimms 400 Cold Vapor AA. Calibration blanks, intercalibration verification samples, and instrument duplicates were analyzed to ensure instrument performance and accuracy. The QA samples were analyzed at 10% to 15% frequency throughout the study.

Detection Limits and Qualified Data:
The method detection limit (MDL) based on the analysis of 5 replicate samples of a low fish sample. The instrument detection limit (IDL) is based on the repeated analysis of digestion blanks.

PCBs, Organochlorine Pesticides, Polybrominated Diphenyl Ethers,

Extractions and Analyses:
All methods employed were similar to those used in previous monitoring studies for the State of New Jersey and the Delaware River Basin Commission. Homogenized fish samples were stored frozen until extraction. For extraction, samples were thawed and 2 g of the homogenate was sub-sampled using a Teflon-coated spatula. Approximately 30 g of Na_2SO_4 (previously baked at 450°C for 4 h) was added to the sub-sample to eliminate water. The dried sample was then placed in a glass Soxhlet extractor with ca. 200 ml dichloromethane (DCM) for a minimum of 18 h. For PCBs, co-planars and PBDEs the following surrogates were used, respectively: PCB 14, 65 and 166 (35 ng), PCB 77 (21 ng) and PCB 103 (100 ng). The extracts were then sub-sampled for gravimetric lipid determination. For this, a known volume of extract was transferred to a pre-weighed aluminum pan. The solvent was allowed to evaporate under the fume hood for 6-8 h. The residue remaining (lipid) was weighed and percent lipid calculated. Lipids were removed from sample extracts by gel permeation chromatography (GPC) using DCM as the mobile phase. The collected fraction containing analytes was concentrated by roto-evaporation and a N_2 stream. Solid-liquid chromatography using Florisil was performed as an additional clean-up step. Using this technique, PCBs (as well as heptachlor, nonachlors, and DDEs) were eluted from the chromatographic column containing florisil using petroleum ether (F1 fraction). The remaining organochlorine pesticides were eluted using 50:50 petroleum ether and dichloromethane (F2 fraction).

Congener-specific PCBs and organochlorine pesticides were analyzed using an Agilent 6890 gas chromatograph equipped with a ^{63}Ni electron capture detector and a 5% phenylmethyl silicon capillary column. The identification and quantification of PCB congeners follows the '610 Method' (Swackhamer 1987) in which the identities and concentrations of each congener in a mixed Aroclor standard (25:18:18 mixture of Aroclors 1232, 1248 and 1262) were determined by calibration with individual PCB congener standards. Congener identities in the sample extracts were based on their chromatographic retention times relative to the internal standards added (PCBs 30 and 204). In cases where two or more congeners could not be chromatographically resolved, the combined concentrations were reported.

Finally, a subset of extracts from the PCB analyses was used to quantify polybrominated diphenyl ethers (PBDEs), which are components of flame retardants. Twenty-eight singly or coeluting PBDEs (BDE 17, 25, 28+33, 30 47, 49, 66, 71, 75, 85+155, 99, 100, 116, 119, 138, 153, 154, 156, 181, 183, 190, 191, 203, 205, 206, 209; Accustandard, 95–99% purity) were quantified at Duke University, under the supervision of Dr. Heather Stapleton, using a gas chromatography (GC) with a mass spectrometer (MS) operated in negative chemical ionization mode (NCI). GC/MS was equipped with a 0.25mm (i.d.) x 15 m fused silica capillary column coated with 5% phenyl methylpolysiloxane (0.25um film thickness).

Organochlorine pesticides (OCPs) were identified and quantified based on comparisons (retention

times and peak areas) with a known calibration standard prepared from individual compounds.

Quality assurance and control measures were included at a frequency of 10% of the total number of samples. These measures included: evaluation of surrogate recoveries, calculation of blank-based detection limits, use of NIST standard reference materials and involvement in NIST's annual inter-laboratory comparison to assess ANSP's accuracy and precision in quantifying PCBs and OCPs, duplicate analysis, and spike recoveries.

All data and information obtained during the course of this project were kept by the laboratory in either computerized or handwritten form (i.e., notebooks and field sheets) and are available for inspection on request. Field data sheets were used throughout this project. All data were kept on IBM type computers (both hard drives and backed up on fixed media, such as nightly backup from the ANSP server) using Microsoft EXCEL or ACCESS. Reporting of the data was done at specific points during the study.

All data submitted to and generated by ANSP were rigorously documented and underwent external quality assurance by ANSP staff.

Detection Limits and Qualified Data: Organic Contaminants

Detection limits for PCBs and OCPs were defined by the mean plus three times the standard deviation divided by the average extraction mass of measured concentrations in the blanks. Based on these detection limits, measured sample concentrations were qualified as non-detect (ND) or below-detection-limit (BDL), and these qualifiers are contained in the final data package. For data summaries (e.g., mean concentrations among groups of samples) values were uncensored. ND concentrations were treated as zero and the measured concentrations of all other samples were used, even where BDL. While these measured BDL concentrations are not meaningful for interpretation of individual samples, use of the measured concentration reduces potential biases in forming group means. The same approach was used in calculating total concentrations of groups of compounds (e.g, total PCBs, total DDX [DDT, DDE, and DDD], total chlordanes, and total chlorobenzenes). Congeners which are BDL typically contribute relatively little to the sum of compounds within a class, so the difference in treatment of the BDL data has little effect on total concentrations in most cases.

RESULTS

Overview

Data from individual samples are presented in Appendix I (mercury, PCBs, PBDEs, DDXs, chlordanes, and BHCs and lindane) and Appendix II (dieldrin, aldrin, endrin, and endosulfans I and II). Averages and maxima of mercury, total PCBs total DDX, total chlordanes (including heptachlor and heptachlor epoxide), and total BHCs and lindane for each station and species combination are presented in Tables 4 and 5. Tables and the appendices use the sum of uncensored concentrations for constituents of each group. These include some concentrations which are below detection limit (BDL). Non-detect concentrations (ND) are treated as zero. All estimated concentrations of total PCBs, DDXs, total chlordanes, total PBDEs, and dieldrin were above the detection limit. Most concentrations of endrin, aldrin, endosulfan I, and endosulfan II were below the quantitation limit. Where duplicate or triplicate samples were analyzed, the tables only show the original analysis value of toxic contaminants for that sample. The lipid percentage is for the first analysis as well.

Concentrations of several contaminants were correlated among samples (Table 6). PCBs, DDXs, chlordanes, PBDEs, and to a lesser extent BHCs and lindane, were generally highly inter-correlated. Dieldrin,aldrin, endosulfan I and endosulfan II were generally highly inter-correlated. Most other organic contaminants were moderately to weakly correlated. Total mercury was negatively correlated with the organic contaminants, although the correlations are not significant.

The highest average PCB concentrations are seen in American eels from the Delaware River @ Raccoon Creek and @ Fort Mifflin with average concentrations of 2631 and 2156 ng/g wet weight, respectively. High average values of 545 ng/g wet weight are also seen in common carp from Kirkwood Lake. Average PCB concentrations in largemouth bass from Delaware River @ West Deptford are also relatively high compared to other sites.

No detectable mercury was found in the red maple leaves analyzed from trees adjacent to Delaware Lake. The two-year old Largemouth Bass from the lake showed low mercury concentrations (the highest value was 0.07 µg/g wet weight). The adult bass from the lake ranged in concentrations from 0.13-0.32 µg/g wet weight. The concentrations in the adult Bluegill and American Eel were also low (range from 0.021-0.152 µg/g wet weight).

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The American Eels analyzed from the mainstem Delaware River generally showed lower PCB concentrations from Montague downstream to Trenton, then high concentrations from below Trenton downstream to Raccoon Creek (reflecting more industrial influences in the southern portion). This result may also be influenced by the sizes of eels analyzed in the southern portion of the river, which were on the average 25% larger in total length then in the northern portions, representing older specimens. The PBDE concentrations followed a similar trend in showing higher average values in the area downstream of Trenton (average of 102.0 ng/g) than the area upstream of Trenton (average of 43.0 ng/g). The opposite pattern was seen for mercury

concentrations in eels on the river, where the highest average levels were recorded from Montague (0.435 µg/g) and lower values in the downstream areas.

Risk Assessment Based on Exceedances of FDA Action Levels

The United State Food and Drug Administration (USFDA) nationally promulgates guidelines for the consumption of fish and fishery products by issuing action limits. The primary purpose of these limits is to represent the point at or above which the administration will take legal action to remove products from the market. While fish caught by recreational anglers do not fall under FDA purview, the FDA limits are often used as a benchmark for the concentrations above which ingestion is not recommended. The US EPA and individual states, including New Jersey, have promulgated other action limits. These are often based on risk assessments, may vary with target population, and may recommend frequency of consumption rather than setting a single "do not eat" level. These USEPA and State action levels are often lower than those of USFDA. USEPA (2004) defines screening values as "concentrations of target analytes in fish or shellfish tissue that are of potential public health concern and that are used as threshold values against which levels of contamination in similar tissue collected from the ambient environment can be compared." For comparison, screening values (SVs) for recreational fishermen (SVrf) are used below (Table 5-4 in USEPA 2004). SVs for different groups depend on the balance between different consumption rates and lower body weights of children. For noncarcinogens, relationships between SVs for different groups are more complex, since reference doses (e.g., related to developmental or reproductive effects) differ among groups as well.

Mercury

The USFDA action limit for total mercury in fish tissue is 1 µg/g on a wet weight basis (or 1 ppm) (FDA 2001). Only 3 fish (out of the 330 samples) exceeded this value. The highest concentration for the study was a 44-cm Largemouth Bass from Lake Aeroflex, which had a concentration of 1.17µg/g. Three fish had concentrations between 0.8 and 1.0. Nineteen fish had concentrations between 0.5 and 0.7. Samples exceeding 0.5µg/g consisted mostly of large predatory fish (Largemouth Bass, Walleye and Chain Pickerel) Twenty nine specimens of Largemouth Bass, Chain Pickerel, Walleye and American Eel had concentrations between 0.4-0.5. Higher mercury concentrations were generally seen in lakes in Warren and Sussex counties, most of which are north of Interstate 80.

PCBs

The USFDA "do not eat" limit is 2,000 ng/g for total PCBs. This limit was exceeded by three samples, two eels from the Delaware River @ Raccoon Creek and one eel from the Delaware River @ Fort Mifflin. Many states and organizations recognize that this limit may be too high and use lower limits. One additional American eel sample from the Delaware River @ Fort Mifflin exceeded one-half of the USFDA action limit (1,000ng/g). Four specimens (one eel from Delaware River @ Raccoon Creek and Peddie Lake and two carp from Kirkwood Lake) exceeded 500ng/g.

The NJDEP and NJDHSS have developed a set of risk-based consumption advisories for total PCBs (Post, et al. 2001). Consumption advisories are based on cancer risk levels, non-cancer risks, and distinct advisories are issued for different groups at risk.

Chlordane
The USFDA has set an action limit of 300 ng/g wet weight (or 0.3 ppm) for chlordane (cis and trans forms, equivalent to alpha and gamma forms) in fish. One sample, an American eel from Peddie Lake, exceeded this limit, with a concentration of 642 ng/g wet weight. This Peddie Lake specimen also had high concentrations of DDXs, dieldrin, and aldrin. The SVrf for total chlordanes is 114 ng/g wet weight (based on carcinogenic effects). Four American eels, one from the Delaware River @ Fort Mifflin, two from Delaware River @ Raccoon Creek, and another from Peddie Lake, exceeded this limit.

DDXs
Because of its bioaccumulative nature and toxicity, the USFDA has set an action limit for DDXs (sum of DDTs, DDEs, and DDDs) at 5.0 ppm (5000 ng/g). None of the 2010-11 samples exceeded this limit. The SVrf for total DDXs is 117 ng/g, based on carcinogenic effects. Eighteen samples exceeded this limit.

Dieldrin, Aldrin, Heptachlor and Heptachlor Epoxide
The USFDA's action limit for aldrin and dieldrin in fish is 0.3 ppm (300 ng/g). None of the 2010-11 samples exceeded this limit. The SVrf for dieldrin is (2.5 ng/g) based on carcinogenic effects, which was exceeded by 33 samples.

PBDEs
PBDEs are among a number of flame retardant compounds that have recently been found in aquatic organisms throughout the world. Of the PBDEs that were found in American eels along the mainstem Delaware River, the highest concentration (246.9 ng/g) was observed in a sample from the Delaware River @Fort Mifflin. Two additional eel samples from Delaware River @ Raccoon Creek and Lambertville had levels of 158.3 and 125.7 ng/g, respectively.

Comparison with Data from Previous Studies

A number of sites which had been sampled in 1992 and 1998 were resampled for this study, thereby allowing comparison of temporal trends in concentrations of mercury and PCBs at several locations (Figures 1-19). Since mercury concentrations often increase with size of fish, comparisons are done by comparing mercury concentration-length relationships among years. Only mercury was analyzed in the 1992 study and primarily PCBs (with limited Hg and PBDEs) in the 1998 study, so the data from 2010-11 provide new information on organic contaminants for the sites, but they permit only limited temporal comparisons for organic contaminants.

The most comprehensive comparison is for mercury in largemouth bass and chain pickerel and for PCBs in American eels in the Delaware River region. Overall, concentrations in 2010 were lower than or similar to concentrations in earlier years. The following groups appear to have had lower

mercury concentrations in 2010-11 than in 1992: Assunpink (Largemouth Bass; Figure 2), Lake Hopatcong (Largemouth Bass and Chain Pickerel; Figures 6 and 7), and Merrill Creek Reservoir (Largemouth Bass and Lake Trout; Figures 8 and 9). Mirror Lake (Largemouth Bass; Figure 11), Mountain Lake (Largemouth Bass; Figure 12), Swartswood Lake (Smallmouth Bass and Chain Pickerel; Figures 14 and 15) appear to have had similar concentrations between years. Although Hg concentrations in Chain pickerel at Assunpink Lake in 2010 were lower than those in 1992 (Figure 1), larger fish were caught and analyzed in 1992, so the difference may reflect the Hg-length relationship. Similarly, higher mercury concentrations in Chain Pickerel in Catfish Pond in 2010 likely reflect larger sizes of fish analyzed in 2010 (Figure 3).

There are no clear differences in mercury concentrations among years for two locations in the Delaware River (Figures 4 and 5). The comparison for the Delaware River below Trenton is based on only two individuals from each of the two years, and these don't show a clear concentration-size relationship. Comparisons of mercury concentrations in eels from Raccoon Creek are also unclear. One large eel from 2010 had lower mercury concentrations than other, smaller eels from both 1998 and 2010; otherwise, concentrations in eels from both years appear similar.

There are no clear differences in PCB concentrations between years in American Eel from four locations in the Delaware River (Figures 16-19), although concentrations in the Delaware River below Trenton may have been lower in 2010. Differences in PCB concentrations among years could be obscured by differences in lipid content as well as fish length.

DISCUSSION

A number of specific sites were re-sampled, allowing for comparison of mercury and some PCB concentrations between this study (2010-11) and those from earlier years (1992 and 1998). In general, mercury concentrations in 2010-2011 were similar to or lower than those in earlier collections. Concentrations of mercury in fishes from Merrill Creek Reservoir were lower in 2010-11 than in the earlier study. In the earlier study, high mercury concentrations were attributed to the "new reservoir effect", in which fish from newly-made reservoirs (the Merrill Creek Reservoir was completed in 1988) tend to have high mercury concentrations. The new reservoir effect may be caused by the abundance of detrital material in the first few years after flooding; this detritus forms a substrate for methylating bacteria. Also contributing may be the large number of trees and stumps that are flooded within the reservoir. The recent decrease in mercury concentration may be due to the ageing of the reservoir and loss of this bacterial food source and a reduction of leaching from trees. The reasons for differences in mercury concentrations at other sites (e.g., lower concentrations in 2010-11 at Lake Hopatcong) are as yet unexplained.

Concentrations of mercury (and other contaminants) typically increase with the age of fish. Length provides a surrogate measure of age, particularly within water bodies. In general, within species and sites, larger individuals had higher concentrations of mercury, especially for predatory fish like Largemouth Bass and Chain Pickerel. As a result, relatively high concentrations of mercury were seen in large individuals of Largemouth Bass from a variety sites. However, in comparisons among water bodies, differences in growth rates may weaken overall length-age relationships, and use of fish length as a covariate may be misleading. Heads of many of the specimens analyzed in this study have been archived, allowing for future age/contaminant level analyses.

One of the goals of the study is to locate sites with unusually high concentrations of contaminants. These may indicate historical or current point-source contamination. In this study, high concentrations of PCBs were seen in American eels from Raccoon Creek and the Delaware River at Fort Mifflin and carp from Kirkwood Lake. In addition, American eels from Peddie Lake had high concentrations of DDX's, chlordane and dieldrin. The high concentrations in the lower Delaware River, and probably those in lower Raccoon Creek, reflect historic contamination and ongoing cycling of PCBs from a variety of sources. The source of contaminants at the other sites is not known but could warrant further investigation.

As noted above, high concentrations of mercury were seen in large individuals of predatory fish, such as Largemouth Bass, Chain Pickerel, and Walleye, at a number of sites. Mercury concentrations appeared to be relatively high among all three species sampled at Catfish Pond, which may reflect the moderately acidic conditions in this lake on Kittatinny Ridge. However, other nearby lakes, such as Blue Mountain and Saw Mill Pond, did not show markedly high concentrations.

CONCLUSIONS

This study presents the fifth and final region of the 5-year rotating Routine Monitoring Program initiated in 2002. The study provides relevant data for assessment of potential consumption risks and trends in contaminants. The study included a number of groups of fish that typically bioaccumulate certain organic contaminants. These groups were selected because of high trophic position (e.g., largemouth bass and chain pickerel), lipid content (especially American eel), longevity (e.g., American eel), association with sediment (American eel, yellow and brown bullhead and carp) and/or target species for recreational anglers (e.g., lake trout and walleye). These data are relevant to risk assessment, since they include sizes and species that are targeted by fishermen, and several conclusions can be drawn from the study.

1) Few of the samples exceeded high action levels (e.g., FDA action levels for Hg, PCBs, DDX, and chlordane). However, some samples exceeded various risk-based thresholds, e.g., as used by NJDEP. In some cases, the same specimens exceeded thresholds for multiple contaminants.

2) Mercury concentrations varied among species and usually increased with size within species. Mercury concentrations were higher in larger, predatory fish such as chain pickerel and largemouth bass and lower in the bluegill and bullhead species.

3) Where comparisons were possible, mercury concentrations in this study (2010-2011) were similar to or lower than those of earlier studies (1992 or1998). Concentrations in Merrill Creek Reservoir were lower in 2010-11 than in 1992, which may reflect “ageing” of the reservoir (fish in new reservoirs often have higher mercury concentrations, ultimately due to the amount of decaying organic matter from flooded terrestrial vegetation). Industrial air pollution controls enacted in recent years may also be contributing to the reductions in mercury in some waterbodies.

4) In waterbodies where concentrations of PCBs and OCPs were measured in American eels and other species, concentrations of PCBs, DDXs and chlordanes were typically higher in eels and lowest in the bullhead species. Concentrations of PCBs and OCPs were variable among sites. The highest average concentrations were seen in fish from Delaware River @ Fort Mifflin and Raccoon Creek (PCBs, DDXs and chlordanes), Peddie Lake (DDXs , dieldrin and chlordanes) and Kirkwood Lake (PCBs and DDXs).

5) This fifth year of the Routine Monitoring Program is designed to address these different scales of variation by sampling a range of size of several species, by sampling previously unsampled sites to identify unknown hotspots (Peddie and Kirkwood lakes), by resampling selected sites to analyze temporal trends (Assunpink and Swartswood), and by rotating among regions to investigate broad, regional patterns in fish contamination. The observed patterns of contaminant concentrations in fish reflect individual fish characteristics such as size (typically higher in larger, older fish), trophic level and lipid content (for organic contaminants), site differences indicative of current or past point sources, and regional or local differences which affect contaminant biogeochemistry.

6) The two year old largemouth bass and red maple leaves collected from Delaware Lake showed low concentrations of mercury. The adult bass and bluegill from the lake also had relatively low mercury concentration.

7) The New Jersey Department of Environmental Protection (NJDEP) and the New Jersey Department of Health and Senior Services (DHSS) use risk-based health criteria for establishing consumption advisories for mercury, PCBs, dioxins, and OCPs. These criteria are typically lower than FDA thresholds for advisories for commercial fish. The data from this study and other portions of the routine monitoring program are used by NJDEP and DHSS to develop fish consumption advisories for New Jersey.

8) PBDE concentrations measured in American eels collected along the mainstem Delaware River showed lower concentrations in the northern (upstream) portions and higher concentrations in the southern (downstream) portions of the river. The values in the southern portion are similar to those recorded during previous studies, although only limited numbers of specimens were analyzed.

9) The fifth region in the statewide monitoring of New Jersey fish and shellfish is complete, therefore ending the series of studies spanning from 2002-11. The main objective to provide current and more comprehensive data to the State of New Jersey on concentrations of toxic contaminants in its freshwater fishes and shellfish has been accomplished. The data have been used to update consumption advisories for targeted species of recreational and commercial importance in areas under current State advisory and/or in selected areas with little or no current information. Continued regional monitoring and more comprehensive investigations of specific waterbodies that have shown unusually high levels of contaminates would be prudent.

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TABLES

Table 1. Sites sampled for 2010-11 Routine Monitoring of Toxics in NJ Fish program. Task Selection abbreviations: RM=Routine Monitoring; DRBC=Delaware River Basin Commission Historical Monitoring; MS=Mainstem Special Monitoring (PBDE's); SPM=Special Project Monitoring (Hg).

Station	County	Lat	Long	Task Selection	Previously sampled
Allamuchy Pond	Warren	40.9114	-74.8157	RM	
Assunpink Lake	Monmouth	40.2175	-74.5185	RM	1992
Blue Mountain Lake	Warren	41.1003	-74.9294	RM	
Catfish Pond	Warren	41.0370	-74.9971	RM	1998
Columbia Lake	Warren	40.9259	-75.0845	RM	
Cooper River @ Cooper River Lake	Camden	39.9253	-75.0697	DRBC	
Cranberry Lake	Sussex	40.9543	-74.7466	RM	1992
Delaware Lake	Warren	40.9193	-75.0664	SPM/RM	
Delaware River @ Fort Mifflin	Philadelphia/Gloucester	39.8754	-75.2091	MS	1998
Delaware River @ Lambertville	Hunterdon	40.3604	-74.9470	DRBC/MS	
Delaware River @ Montague	Sussex	41.3068	-74.7990	DRBC/MS	
Delaware River @ Phillipsburg	Hunterdon	40.6903	-75.2038	DRBC/MS	
Delaware River @ Raccoon Creek	Gloucester	39.8091	-75.3817	DRBC/MS	1998
Delaware River @ Trenton	Mercer	40.1688	-73.2755	MS	1998
Delaware River @ West Deptford	Camden	39.8815	-75.1280	RM	
DOD Lake	Salem	39.7497	-75.4569	RM	
Furnace Lake	Warren	40.7962	-75.0129	RM	
Kirkwood Lake	Camden	39.8361	-75.0010	RM	
Lake Aeroflex	Sussex	41.0116	-74.7357	RM	
Lake Hopatcong (south)	Sussex	40.9122	-74.6602	RM	1992
Lake Hopatcong (north)	Morris	40.9764	-74.6155	RM	
Lake Mercer	Mercer	40.2716	-74.6420	RM	
Lake Musconetcong	Sussex	40.9019	-74.7034	RM	
Little Swartswood Lake	Sussex	41.0897	-74.8129	RM	
Mantua Creek @ Paulsboro	Gloucester	39.8307	-75.2355	DRBC	
Merrill Creek Reservoir	Warren	40.7324	-75.0953	RM	1992
Mirror Lake	Burlington	39.9715	-74.5684	RM	1992
Mountain Lake	Warren	40.8608	-74.9825	RM	1992
Newton Creek @ Newton Lake	Camden	39.9078	-75.0755	DRBC	
Oldmans Creek @ Pedricktown	Gloucester/Salem	39.7816	-75.4098	DRBC	
Paulinskill Lake	Sussex	41.0766	-73.2119	RM	
Peddie Lake	Mercer	40.2664	-74.5213	RM	
Rancocas Creek @ Centerton	Burlington	39.9993	74.8800	DRBC	
Rancocas Creek @ Riverside	Burlington	40.0328	74.9372	DRBC	
Salem River @ Carneys Point	Salem	39.6701	-75.4593	DRBC	
Sawmill Pond	Sussex	41.2950	-74.6872	RM	1992*
Steenykill Lake	Sussex	41.3190	-74.6755	RM	1996
Swartswood Lake	Sussex	41.0736	-74.8265	RM	1992
White Lake	Warren	41.0000	-74.9163	RM	

* Different species analyzed

Table 2. Scientific and common names of fishes (and plant leaves) analyzed as part of the 2010-11 Routine Monitoring of Toxics in NJ Fish program

Scientific Name	Common Name
Acer rubrum	Red Maple
Ameiurus natalis	Yellow Bullhead
Ameiurus nebulosus	Brown Bullhead
Anguilla rostrata	American Eel
Cyprinus carpio	Common Carp
Esox niger	Chain Pickerel
Esox masquinongy	Muskellunge
Ictalurus punctatus	Channel Catfish
Lepomis macrochirus	Bluegill (a sunfish)
Micropterus salmoides	Largemouth Bass
Micropterus dolomieu	Smallmouth Bass
Morone saxatilis x chrysops	Striped Bass Hybrid
Perca flavescens	Yellow Perch
Salvelinus namaycush	Lake Trout
Sander vitreus	Walleye

Table 3. List of Analytes for the 2010-11 Routine Monitoring of Toxics in NJ Fish program.			
POLYCHLORINATED BIPHENYLS		**ORGANOCHLORINE PESTICIDES**	**POLYBROMINATED BIPHENYL ETHERS**
1*	136	opDDE	BDE 1 (2-MonoBDE)
3*	77+110	ppDDE	BDE 2 (3-MonoBDE)
4+10	82	op ddt	BDE 3 (4-MonoBDE)
7	151	pp ddt	BDE 7 (2,4-DiBDE)
6	135+144	o,p ddd	BDE 8/11 (2,4'-DiBDE/3,3'-DiBDE)
8+5	107	p,p ddd	BDE 10 (2,6-DiBDE)
19	149		BDE 12 (3,4-DiBDE)
12+13	118	alpha BHC	BDE 13 (3,4'-DiBDE)
18	134	beta BHC	BDE 15 (4,4'-DiBDE)
17	131	delta BHC	BDE 17 (2,2',4-TriBDE)
24+27	146	lindane	BDE 25 (2,3',4-TriBDE)
16+32	153+132+105		BDE 28 (2,4,4'-TriBDE)
29	141	heptachlor	BDE 30 (2,4,6-TriBDE)
26	137+176	heptachlor epoxide	BDE 32 (2,4',6-TriBDE)
25	163+138	oxychlordane	BDE 33 (2',3,4-TriBDE)
31+28	158	gamma chlordane	BDE 35 (3,3',4-TriBDE)
53+33+21	129+178	alpha chlordane	BDE 37 (3,4,4'-TriBDE)
22	187+182	cis nonachlor	BDE 47 (2,2',4,4'-TetraBDE)
45	183	trans nonachlor	BDE 49 (2,2',4,5'-TetraBDE)
46	128		BDE 66 (2,3',4,4'-TetraBDE)
52	185	dieldrin	BDE 71 (2,3',4',6-TetraBDE)
49	174	endrin	BDE 75 (2,4,4',6-TetraBDE)
47	177	aldrin	BDE 77 (3,3',4,4'-TetraBDE)
48	202+171	endosulfan I	BDE 85 (2,2',3,4,4'-PentaBDE)
44	157+200	endosulfan II	BDE 99 (2,2',4,4',5-PentaBDE)
37+42	172+197	**TOTAL MERCURY**	BDE 100 (2,2',4,4',6-PentaBDE)
41+71	180		BDE 116 (2,3,4,5,6-PentaBDE)
64	193		BDE 118 (2,3',4,4',5-PentaBDE)
40	191		BDE 119 (2,3',4,4',6-PentaBDE)
100	199		BDE 126 (3,3',4,4',5-PentaBDE)
63	170+190		BDE 138 (2,2',3,4,4',5'-HexaBDE)
74	198		BDE 153 (2,2',4,4',5,5'-HexaBDE)
70+76	201		BDE 154 (2,2',4,4',5,6'-HexaBDE)
66+95	203+196		BDE 155 (2,2',4,4',6,6'-HexaBDE)
91	189		BDE 166 (2,3,4,4',5,6-HexaBDE)
56+60	208+195		BDE 181 (2,2',3,4,4',5,6-HeptaBDE)
101	207		BDE 183 (2,2',3,4,4',5',6-HeptaBDE)
99	194		BDE 190 (2,3,3',4,4',5,6-HeptaBDE)
83	205		
97	206		
87+81	209		
85			
* = not included in PCB totals, averages, and maxima			

Table 4. Average concentrations of mercury, PCBs, PBDEs, and selected OCPs in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish study.

Station	Common Name	Number of Samples	Ave. Total Length (lab)	Ave. Total Weight (lab)	Ave. Total Lipids	Ave. Total Hg	Ave. Total PCBs	Ave. Total PBDEs	Ave. Total DDXs	Ave. Total BHCs + Lindane	Ave. Total Chlor-danes
			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Allamuchy Pond											
	American eel	3	53.6	309.7	9.96	0.094	30		7	0.126	4.0
	bluegill	3	18.1	113.4		0.171					
	largemouth bass	3	39.7	859.6		0.520					
Assunpink Lake											
	bluegill	3	20.4	159.5		0.075					
	brown bullhead	3	37.5	734.0	0.66	0.069	22		56	0.031	2.2
	chain pickerel	3	41.6	474.7		0.185					
	largemouth bass	3	42.9	1176.7		0.152					
Blue Mountain Lake											
	largemouth bass	3	36.2	827.2		0.262					
	yellow bullhead	3	27.9	287.4	0.50	0.160	7		23	0.036	0.2
	yellow perch	3	20.6	85.7		0.161					
Catfish Pond											
	chain pickerel	3	41.4	360.5		0.687					
	largemouth bass	3	38.2	872.0		0.342					
	yellow perch	3	28.6	266.0		0.483					
Columbia Lake											
	American eel	3	59.4	443.1	15.25	0.181	128		17	0.184	6.9
	chain pickerel	3	57.0	1374.8		0.319					
	largemouth bass	3	45.6	1869.4		0.356					
	striped bass hybrid	2	73.2	5275.0		0.356					
	walleye	2	53.4	1707.8		0.464					
Cranberry Lake											
	brown bullhead	3	31.1	391.7	0.47	0.055	17		4	0.038	1.1
	chain pickerel	3	49.0	609.0		0.579					
	largemouth bass	3	43.0	1237.1		0.388					
	yellow perch	3	26.8	189.6		0.258					
Delaware Lake											
	American eel	3	58.9	420.7	18.54	0.081	108		19	0.053	7.1
	bluegill-adult (2009)	3	18.9	145.3		0.046					
	bluegill-adult (2010)	3	21.3	205.7		0.078					
	largemouth bass-adult (2009)	3	41.8	1121.7		0.230					
	largemouth bass-adult	3	38.6	1005.7		0.147					
	largemouth bass-age2	23	22.9	167.0		0.025					
	red maple leaves	7				0.001					
Delaware River @ Fort Mifflin											
	American eel	3	66.0	562.0	16.03	0.150	2156	114	707	0.737	134.3
Delaware River @ Lambertville											
	American eel	3	59.2	404.05	10.26	0.238	216	58	187	0.124	17.0
Delaware River @ Montague											
	American eel	3	50.6	253.7	14.75	0.435	125	36	53	0.132	9.4
	walleye	3	45.4	951.6		0.350					
Delaware River @ Phillipsburg											
	American eel	3	51.4	295.6	14.36	0.118	228	44	62	0.177	20.2
Delaware River @ Raccoon Creek											
	American eel	3	67.4	717.2	9.69	0.102	2631	90	657	0.772	108.2
Delaware River @ Trenton											
	American eel	3	52.1	282.4	2.35	0.106	158	33	61	0.087	13.6
Delaware River @ West Deptford											
	largemouth bass	3	46.7	1649.2	1.57	0.267	326		69	0.056	15.1

Table 4 (continued). Average concentrations of mercury, PCBs, PBDEs, and selected OCPs in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish study.

Station	Common Name	Number of Samples	Ave. Total Length (lab)	Ave. Total Weight (lab)	Ave. Total Lipids	Ave. Total Hg	Ave. Total PCBs	Ave. Total PBDEs	Ave. Total DDXs	Ave. Total BHCs + Lindane	Ave. Total Chlor-danes
			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
DOD Lake											
	bluegill	3	19.1	121.8		0.087					
	common carp	3	55.8	2236.1	3.08	0.163	26		11	0.054	2.8
	largemouth bass	3	37.2	691.5		0.313					
Furnace Lake											
	bluegill	3	17.0	87.6		0.043					
	brown bullhead	3	32.1	467.5	1.01	0.041	7		4	0.038	0.2
	largemouth bass	3	42.7	1351.1		0.444					
Kirkwood Lake											
	bluegill	3	17.0	93.0		0.042					
	common carp	3	51.7	2559.3	11.37	0.084	545		212	0.104	56.1
	largemouth bass	3	40.8	1042.0	0.65	0.255	87		17	0.143	5.4
Lake Aeroflex											
	American eel	3	60.1	418.5	18.14	0.191	34		18	0.057	5.3
	bluegill	3	17.9	107.8		0.108					
	brown bullhead	3	32.1	399.3	1.21	0.048	6		3	0.021	0.6
	chain pickerel	3	46.1	599.0		0.419					
	largemouth bass	3	41.4	1138.8		0.795					
Lake Hopatcong (**two sites combined**)											
	bluegill	3	18.6	121.2		0.044					
	brown bullhead	3	34.6	600.8	2.49	0.036	52		13	0.041	6.2
	chain pickerel	**6**	**51.1**	**742.7**		**0.193**					
	largemouth bass	**6**	**42.0**	**1291.5**		**0.216**					
	walleye	**6**	**53.7**	**1680.0**	**1.24**	**0.341**	**55**		**13**	**0.117**	**9.1**
	yellow perch	3	30.8	336.0		0.204					
Lake Mercer											
	American eel	3	68.9	741.7	12.33	0.169	38		86	0.099	12.3
	bluegill	3	19.1	152.8		0.061					
	channel catfish	3	45.0	903.3	3.99	0.127	96		86	0.062	14.1
	largemouth bass	3	43.9	980.0		0.352					
Lake Musconetcong											
	brown bullhead	3	31.9	448.7	0.79	0.036	19		7	0.039	3.8
	chain pickerel	3	58.0	1316.4		0.263					
	largemouth bass	3	40.4	995.1		0.266					
Little Swartswood Lake											
	brown bullhead	3	30.4	442.9	0.80	0.032	11		9	0.099	0.6
	chain pickerel	3	49.0	824.5		0.278					
	largemouth bass	3	43.3	1504.8		0.512					
Merrill Creek Resevoir											
	bluegill	3	19.9	148.7		0.041					
	brown bullhead	3	37.6	739.7	0.94	0.077	13		6	0.044	1.0
	lake trout	6	60.0	2406.7	9.25	0.184	102		53	0.082	14.5
	largemouth bass	3	47.0	1503.1		0.405					
Mirror Lake											
	American eel	3	62.0	497.3	12.25	0.188	99		199	0.069	41.2
	chain pickerel	3	38.8	231.6		0.324					
	largemouth bass	3	31.0	378.0		0.273					
Mountain Lake											
	bluegill	3	17.7	126.2		0.090					
	common carp	3	65.1	3673.5	5.22	0.094	82		33	0.196	12.5
	largemouth bass	3	36.0	908.3		0.268					
	muskellunge	3	60.3	1447.7		0.137					

Table 4 (continued). Average concentrations of mercury, PCBs, PBDEs, and selected OCPs in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish study.

Station	Common Name	Number of Samples	Ave. Total Length (lab)	Ave. Total Weight (lab)	Ave. Total Lipids	Ave. Total Hg	Ave. Total PCBs	Ave. Total PBDEs	Ave. Total DDXs	Ave. Total BHCs + Lindane	Ave. Total Chlor-danes
			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Paulinskill Lake											
	common carp	3	49.2	1499.3	1.08	0.157	177		15	0.132	2.7
	largemouth bass	3	41.3	1258.8		0.191					
	yellow perch	3	26.7	202.9		0.108					
Peddie Lake											
	American eel	3	59.2	434.7	16.49	0.148	267		602	0.297	288.0
	bluegill	3	18.0	112.0		0.085					
	largemouth bass	3	43.3	1351.6	0.65	0.386	27		36	0.175	4.8
Sawmill Pond											
	American eel	3	58.0	362.2	16.46	0.157	35		41	0.084	9.2
	bluegill	3	17.0	96.4		0.106					
	largemouth bass	3	32.0	383.7		0.342					
Steenykill Lake											
	American eel	3	59.7	416.8	22.57	0.129	47		58	0.122	4.5
	chain pickerel	3	39.5	401.0		0.197					
Swartswood Lake											
	American eel	2	62.7	582.0	14.15	0.159	70		48	0.063	6.7
	bluegill	3	18.9	138.8		0.026					
	chain pickerel	3	43.6	441.5		0.155					
	largemouth bass	3	46.1	1519.4		0.356					
	smallmouth bass	3	44.2	1287.9		0.401					
	walleye	3	49.6	1323.7		0.340					
White Lake											
	American eel	3	56.5	365.6	22.24	0.101	19		10	0.075	2.5
	bluegill	3	19.1	137.8		0.079					
	chain pickerel	3	45.4	631.0		0.315					
	largemouth bass	3	35.0	581.2		0.486					

Table 5. Maximum concentrations of mercury, PCBs, PBDEs, and selected OCPs in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish program.

Station	Common Name	Number of Samples	Ave. Total Length (lab)	Ave. Total Weight (lab)	Ave. Total Lipids	Max. Total Hg	Max. Total PCBs	Max. Total PBDEs	Max. Total DDXs	Max. Total BHCs + Lindane	Max. Total Chlordanes
			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Allamuchy Pond											
	American eel	3	53.6	309.7	9.96	0.13	43		10.3	0.271	5.39
	bluegill	3	18.1	113.4		0.24					
	largemouth bass	3	39.7	859.6		0.69					
Assunpink Lake											
	bluegill	3	20.4	159.5		0.08					
	brown bullhead	3	37.5	734.0	0.66	0.11	44		113.8	0.023	3.73
	chain pickerel	3	41.6	474.7		0.21					
	largemouth bass	3	42.9	1176.7		0.20					
Blue Mountain Lake											
	largemouth bass	3	36.2	827.2		0.49					
	yellow bullhead	3	27.9	287.4	0.50	0.21	9		64.9	0.043	0.26
	yellow perch	3	20.6	85.7		0.17					
Catfish Pond											
	chain pickerel	3	41.4	360.5		1.00					
	largemouth bass	3	38.2	872.0		0.42					
	yellow perch	3	28.6	266.0		0.58					
Columbia Lake											
	American eel	3	59.4	443.1	15.25	0.22	173		22.3	0.445	11.17
	chain pickerel	3	57.0	1374.8		0.36					
	largemouth bass	3	45.6	1869.4		0.37					
	striped bass hybrid	2	73.2	5275.0		0.42					
	walleye	2	53.4	1707.8		0.52					
Cranberry Lake											
	brown bullhead	3	31.1	391.7	0.47	0.07	35		6.1	0.053	1.44
	chain pickerel	3	49.0	609.0		1.14					
	largemouth bass	3	43.0	1237.1		0.57					
	yellow perch	3	26.8	189.6		0.30					
Delaware Lake											
	American eel	3	58.9	420.7	18.54	0.15	237		24.5	0.056	14.93
	bluegill-adult (2009)	3	18.9	145.3		0.08					
	bluegill-adult (2010)	3	21.3	205.7		0.09					
	largemouth bass-adult (2009)	3	41.8	1121.7		0.32					
	largemouth bass-adult (2010)	3	38.6	1005.7		0.20					
	largemouth bass-age2	23	22.9	167.0		0.07					
	red maple leaves (composites)	7				0.00					
Delaware River @ Fort Mifflin											
	American eel	3	66.0	562.0	16.03	0.20	4276	247	1426.4	0.953	270.71
Delaware River @ Lambertville											
	American eel	3	59.17	404.05	10.26	0.43	413	126	261.4	0.151	27.86
Delaware River @ Montague											
	American eel	3	50.6	253.7	14.75	0.51	167	52	76.0	0.161	12.39
	walleye	3	45.4	951.6		0.65					
Delaware River @ Phillipsburg											
	American eel	3	51.4	295.6	14.36	0.14	451	70	138.4	0.222	37.99
Delaware River @ Raccoon Creek											
	American eel	3	67.4	717.2	9.69	0.15	4696	158	1003.4	1.143	172.75
Delaware River @ Trenton											
	American eel	3	52.1	282.4	2.35	0.15	276	53	112.6	0.100	22.67
Delaware River @ West Deptford											
	largemouth bass	3	46.7	1649.2	1.57	0.39	385		93.2	0.102	25.57

Table 5 (continued). Maximum concentrations of mercury, PCBs, PBDEs, and selected OCPs in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish program.

Station	Common Name	Number of Samples	Ave. Total Length (lab)	Ave. Total Weight (lab)	Ave. Total Lipids	Max. Total Hg	Max. Total PCBs	Max. Total PBDEs	Max. Total DDXs	Max. Total BHCs + Lindane	Max. Total Chlordanes
			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
DOD Lake											
	bluegill	3	19.1	121.8		0.13					
	common carp	3	55.8	2236.1	3.08	0.17	34		13.9	0.058	4.23
	largemouth bass	3	37.2	691.5		0.35					
Furnace Lake											
	bluegill	3	17.0	87.6		0.05					
	brown bullhead	3	32.1	467.5	1.01	0.05	10		4.8	0.043	0.32
	largemouth bass	3	42.7	1351.1		0.85					
Kirkwood Lake											
	bluegill	3	17.0	93.0		0.05					
	common carp	3	51.7	2559.3	11.37	0.13	708		255.0	0.135	86.81
	largemouth bass	3	40.8	1042.0	0.65	0.36	177		27.0	0.207	11.14
Lake Aeroflex											
	American eel	3	60.1	418.5	18.14	0.26	59		28.7	0.078	7.25
	bluegill	3	17.9	107.8		0.13					
	brown bullhead	3	32.1	399.3	1.21	0.07	7		4.1	0.023	0.86
	chain pickerel	3	46.1	599.0		0.58					
	largemouth bass	3	41.4	1138.8		1.17					
Lake Hopatcong (two sites)											
	bluegill	3	18.6	121.2		0.06					
	brown bullhead	3	34.6	600.8	2.49	0.05	70		20.5	0.052	11.45
	chain pickerel	6	51.1	742.7		0.37					
	largemouth bass	6	42.0	1291.5		0.26					
	walleye	6	53.7	1680.0	1.24	0.55	83		17.4	0.184	14.92
	yellow perch	3	30.8	336.0		0.28					
Lake Mercer											
	American eel	3	68.9	741.7	12.33	0.24	54		154.0	0.135	21.91
	bluegill	3	19.1	152.8		0.08					
	channel catfish	3	45.0	903.3	3.99	0.14	104		164.8	0.080	20.75
	largemouth bass	3	43.9	980.0		0.66					
Lake Musconetcong											
	brown bullhead	3	31.9	448.7	0.79	0.05	22		9.7	0.047	6.06
	chain pickerel	3	58.0	1316.4		0.31					
	largemouth bass	3	40.4	995.1		0.35					
Little Swartswood Lake											
	brown bullhead	3	30.4	442.9	0.80	0.05	12		9.6	0.106	0.74
	chain pickerel	3	49.0	824.5		0.36					
	largemouth bass	3	43.3	1504.8		0.69					
Merrill Creek Reservoir											
	bluegill	3	19.9	148.7		0.05					
	brown bullhead	3	37.6	739.7	0.94	0.08	23		8.6	0.055	1.45
	lake trout	6	60.0	2406.7	9.25	0.23	136		64.8	0.092	18.28
	largemouth bass	3	47.0	1503.1		0.51					
Mirror Lake											
	American eel	3	62.0	497.3	12.25	0.20	114		248.6	0.087	46.51
	chain pickerel	3	38.8	231.6		0.40					
	largemouth bass	3	31.0	378.0		0.29					
Mountain Lake											
	bluegill	3	17.7	126.2		0.11					
	common carp	3	65.1	3673.5	5.22	0.15	146		58.5	0.260	22.80
	largemouth bass	3	36.0	908.3		0.34					
	muskellunge	3	60.3	1447.7		0.16					

Table 5 (continued). Maximum concentrations of mercury, PCBs, PBDEs, and selected OCPs in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish program.

Station	Common Name	Number of Samples	Ave. Total Length (lab)	Ave. Total Weight (lab)	Ave. Total Lipids	Max. Total Hg	Max. Total PCBs	Max. Total PBDEs	Max. Total DDXs	Max. Total BHCs + Lindane	Max. Total Chlordanes
			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Paulinskill Lake											
	common carp	3	49.2	1499.3	1.08	0.21	246		16.5	0.225	3.26
	largemouth bass	3	41.3	1258.8		0.24					
	yellow perch	3	26.7	202.9		0.14					
Peddie Lake											
	American eel	3	59.2	434.7	16.49	0.21	531		972.2	0.568	642.56
	bluegill	3	18.0	112.0		0.11					
	largemouth bass	3	43.3	1351.6	0.65	0.47	30		43.7	0.247	5.88
Saw Mill Pond											
	American eel	3	58.0	362.2	16.46	0.23	40		48.0	0.093	20.35
	bluegill	3	17.0	96.4		0.17					
	largemouth bass	3	32.0	383.7		0.40					
Steenykill Lake											
	American eel	3	59.7	416.8	22.57	0.14	67		77.8	0.167	5.98
	chain pickerel	3	39.5	401.0		0.26					
Swartswood Lake											
	American eel	2	62.7	582.0	14.15	0.19	120		91.2	0.089	12.74
	bluegill	3	18.9	138.8		0.03					
	chain pickerel	3	43.6	441.5		0.21					
	largemouth bass	3	46.1	1519.4		0.48					
	smallmouth bass	3	44.2	1287.9		0.57					
	walleye	3	49.6	1323.7		0.41					
White Lake											
	American eel	3	56.5	365.6	22.24	0.14	38		21.2	0.084	4.20
	bluegill	3	19.1	137.8		0.15					
	chain pickerel	3	45.4	631.0		0.40					
	largemouth bass	3	35.0	581.2		0.64					

Table 6. Correlation coefficients (r above diagonal and r^2 below diagonal) among concentrations of different organic contaminants among all samples in the 2010 New Jersey Routine Monitoring Program. Boldface shows correlations significant at $p<0.05$ level, with no correction for experiment-wise error.

	Total Lipids	Total Hg	PCBs	PBDEs	DDXs	Total BHC+ lindane	Chlor-danes	Dieldrin	Endrin	Aldrin	Endo-sulfan II	Endo-sulfan I
Total Lipids	1.00	0.38	0.18	0.23	0.19	0.33	0.20	0.34	0.42	0.29	0.34	0.46
Total Hg	0.14	1.00	-0.32	-0.25	-0.25	-0.30	-0.29	-0.29	-0.34	-0.37	-0.10	-0.20
PCBs	0.03	0.10	1.00	**0.84**	**0.96**	**0.87**	**0.96**	**0.55**	0.30	**0.62**	0.40	0.22
PBDEs	0.05	0.06	**0.71**	1.00	**0.89**	**0.60**	**0.89**	0.25	0.20	0.30	0.28	0.05
DDXs	0.04	0.06	**0.93**	**0.79**	1.00	**0.81**	**0.99**	**0.49**	0.27	**0.51**	0.43	0.20
Total BHC+lindane	0.11	0.09	**0.75**	**0.36**	**0.65**	1.00	**0.79**	**0.88**	0.41	**0.85**	**0.70**	**0.56**
Chlordanes	0.04	0.08	**0.92**	**0.80**	**0.98**	**0.63**	1.00	**0.48**	0.30	**0.49**	0.41	0.24
Dieldrin	0.12	0.08	**0.30**	0.06	**0.24**	**0.77**	**0.23**	1.00	**0.52**	**0.87**	**0.84**	**0.81**
Endrin	0.18	0.11	0.09	0.04	0.07	0.16	0.09	**0.27**	1.00	**0.57**	0.27	**0.65**
Aldrin	0.09	0.13	**0.38**	0.09	**0.26**	**0.72**	**0.24**	**0.77**	**0.33**	1.00	**0.49**	**0.72**
Endosulfan II	0.11	0.01	0.16	0.08	0.18	**0.49**	0.16	**0.70**	0.08	**0.24**	1.00	**0.60**
Endosulfan I	0.21	0.04	0.05	0.00	0.04	**0.31**	0.06	**0.65**	**0.42**	**0.52**	**0.36**	1.00

FIGURES

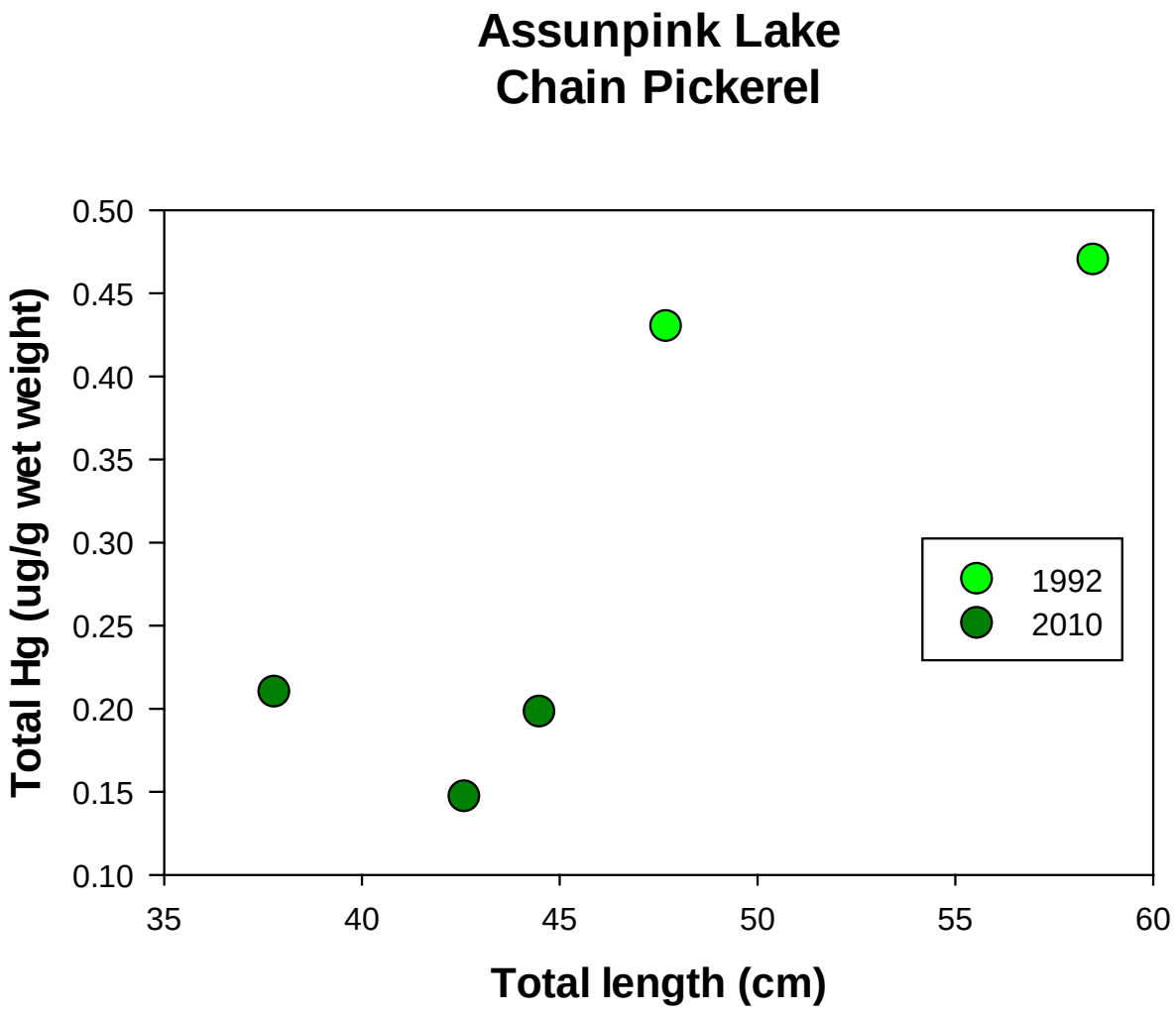

Figure 1. Comparison of concentrations of total mercury in Chain Pickerel from Assunpink Lake between 1992 and 2010 ANSDU routine monitoring studies.

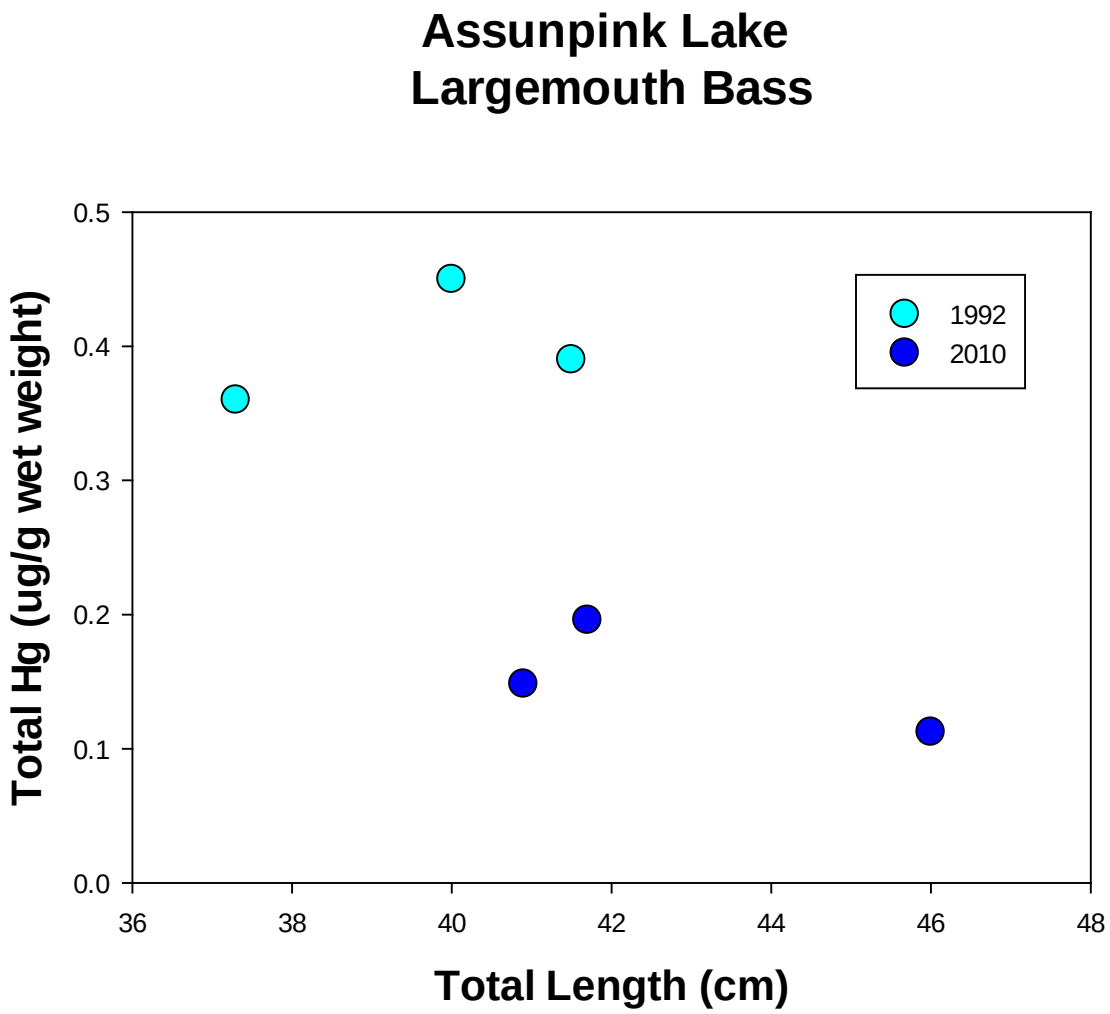

Figure 2. Comparison of concentrations of total mercury in Largemouth Bass from Assunpink Lake between 1992 and 2010 ANSDU routine monitoring studies.

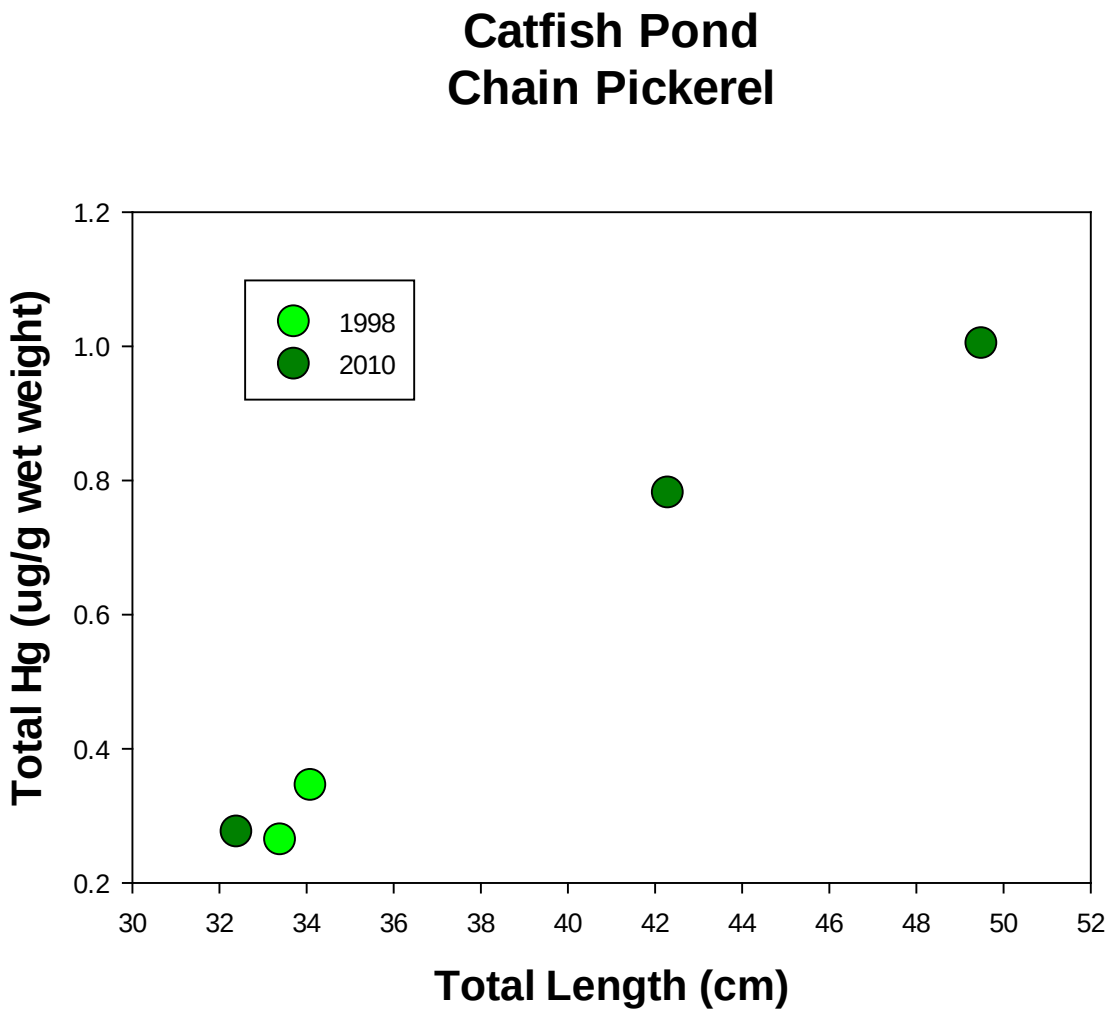

Figure 3. Comparison of concentrations of total mercury in Chain Pickerel from Catfish Pond between 1998 and 2010 ANSDU routine monitoring studies.

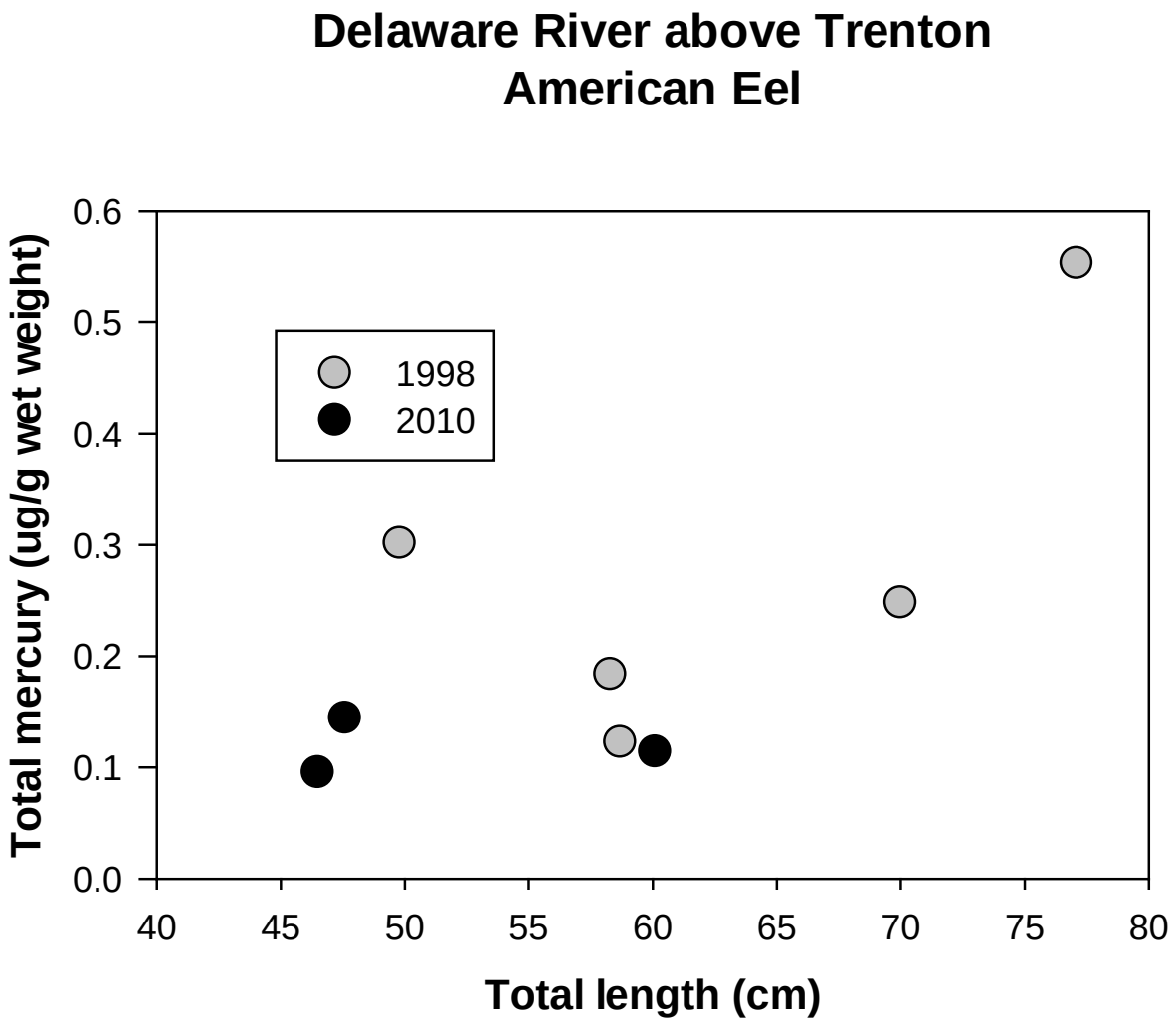

Figure 4. Comparison of concentrations in total mercury in American Eel from Delaware River above Trenton between 1998 and 2010 ANSDU routine monitoring studies.

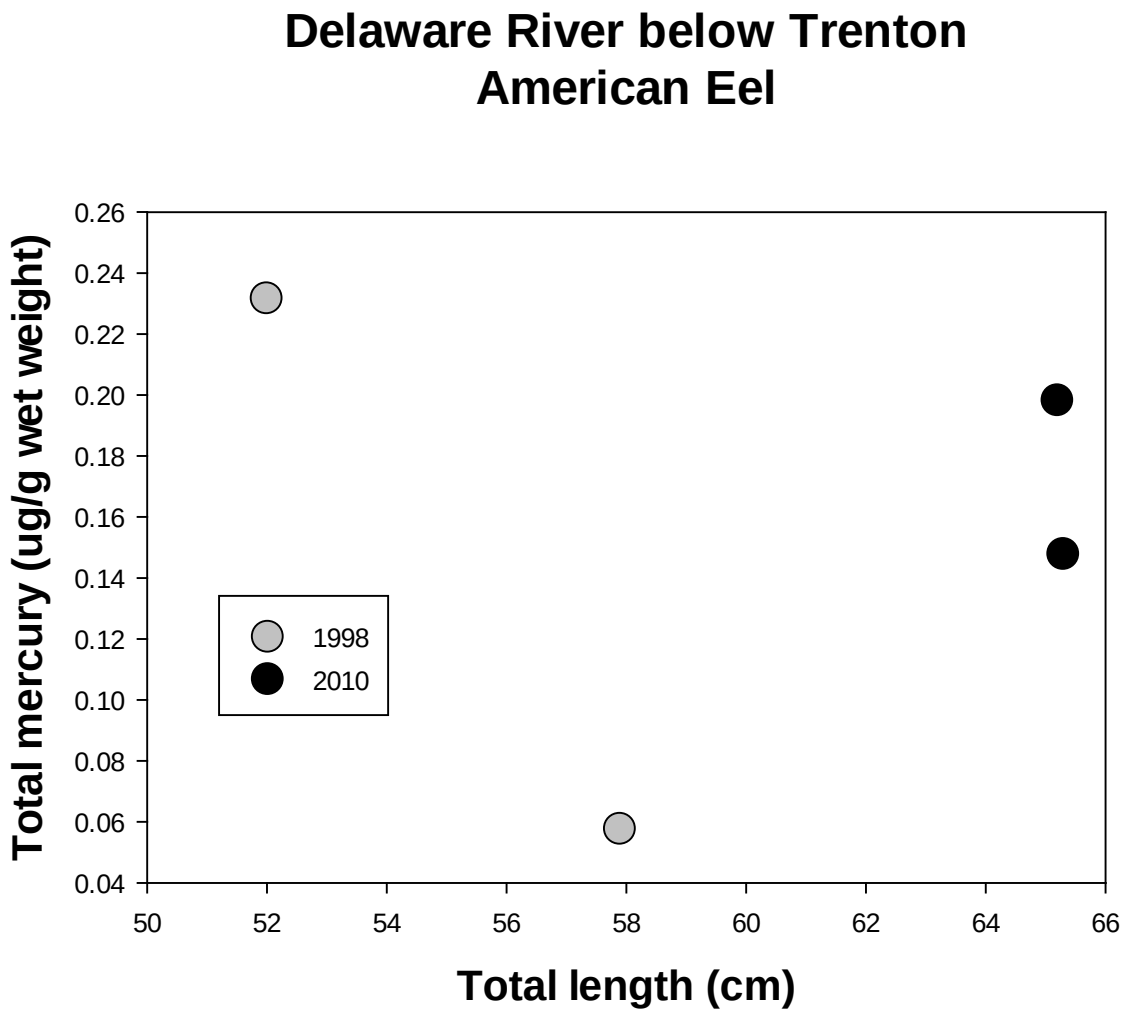

Figure 5. Comparison of concentrations of total mercury in American Eel from Delaware River below Trenton between 1998 and 2010 ANSDU routine monitoring studies.

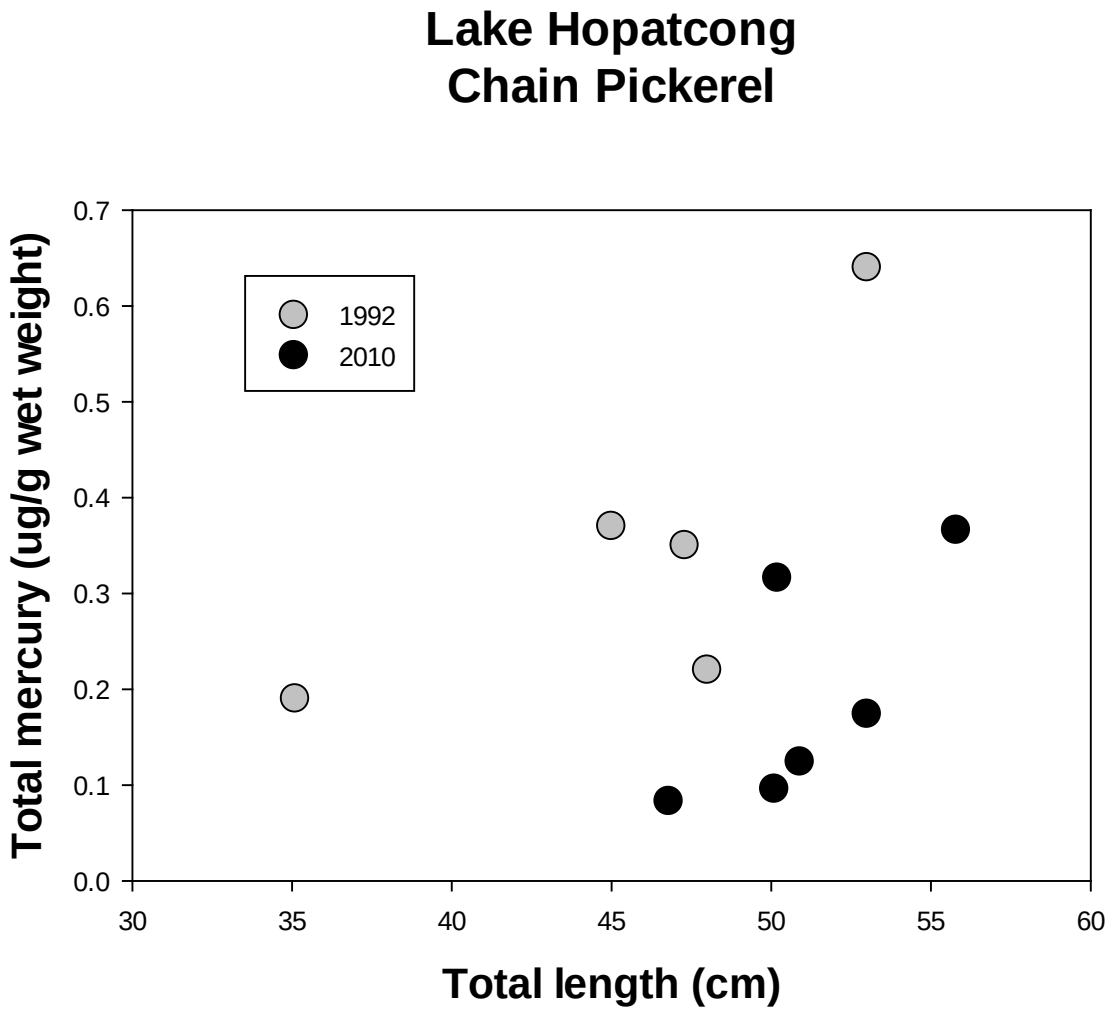

Figure 6. Comparison of concentrations of total mercury in Chain Pickerel from Lake Hopatcong between 1992 and 2010 ANSDU routine monitoring studies.

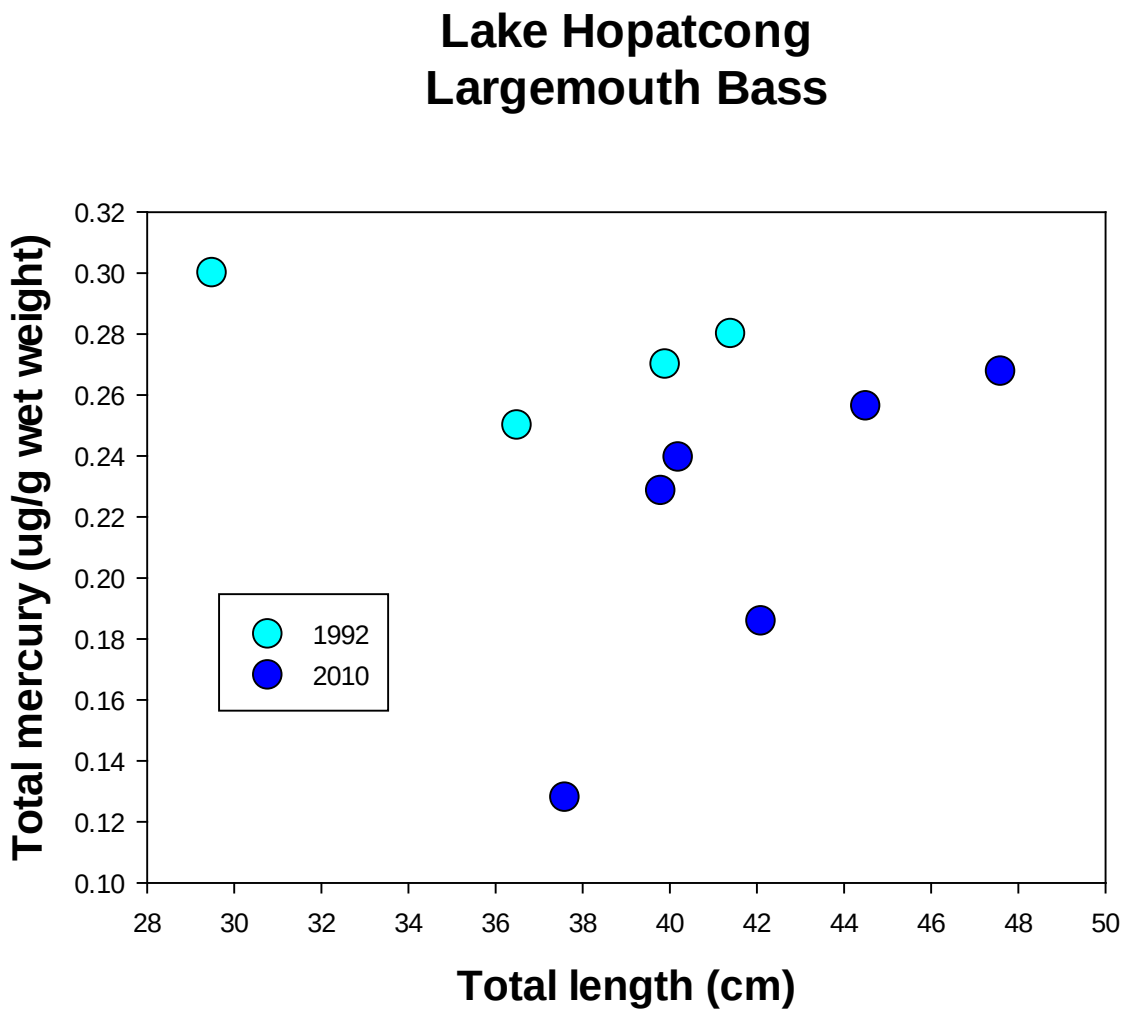

Figure 7. Comparison of concentrations of total mercury in Largemouth Bass from Lake Hopatcong between 1992 and 2010 ANSDU routine monitoring studies.

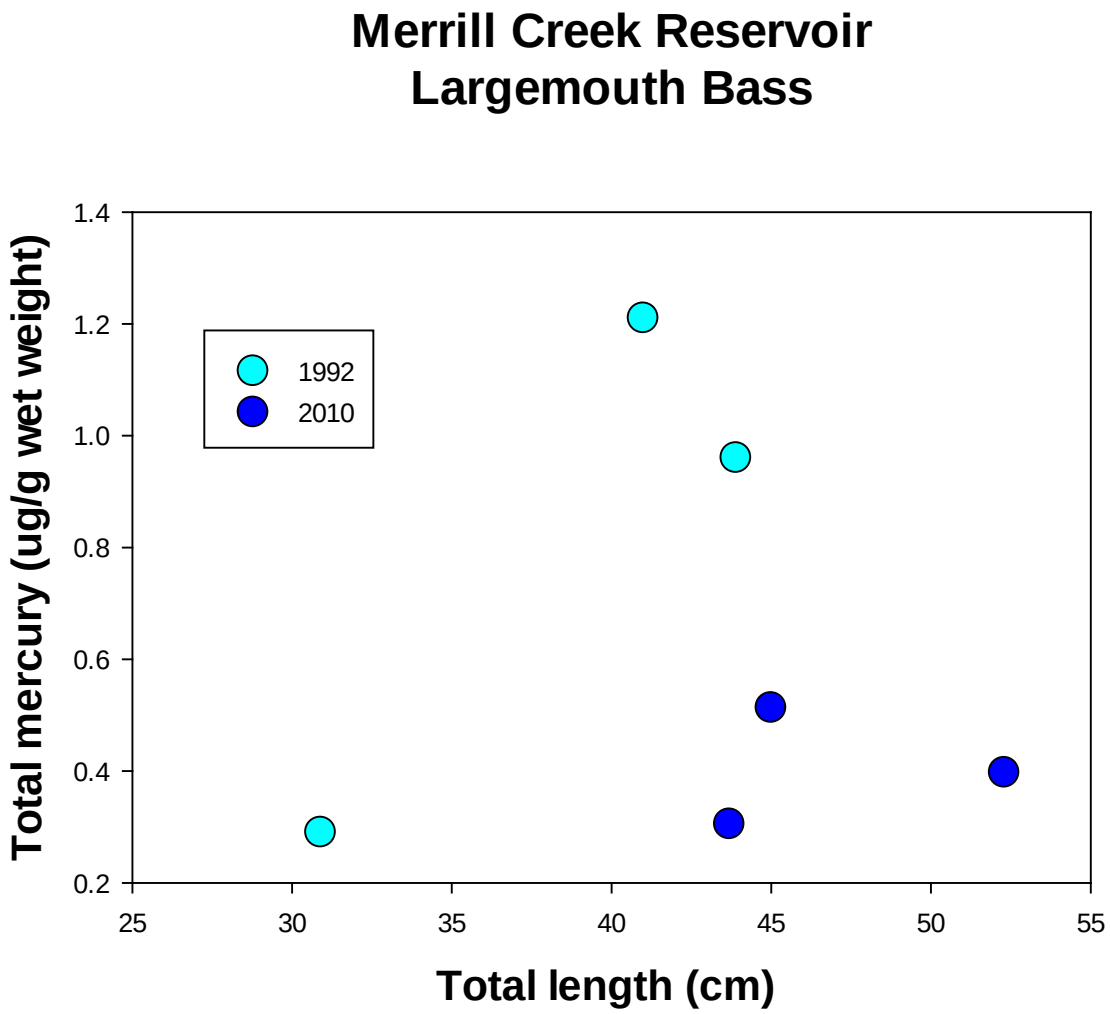

Figure 8. Comparison of concentrations of total mercury in Largemouth Bass from Merrill Creek Reservoir between 1992 and 2010 ANSDU routine monitoring studies.

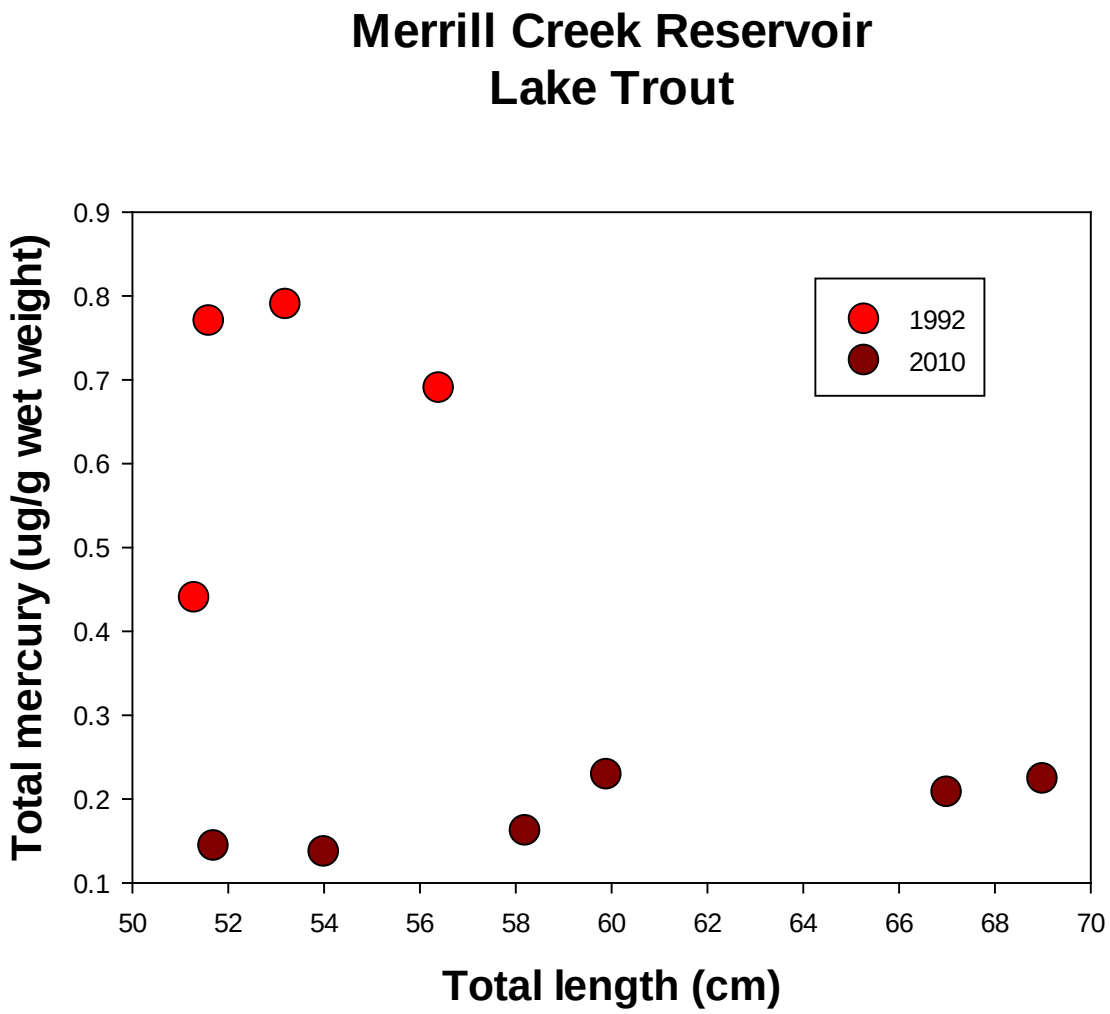

Figure 9. Comparison of concentrations of total mercury in Lake Trout from Merrill Creek Reservoir between 1992 and 2010 ANSDU routine monitoring studies.

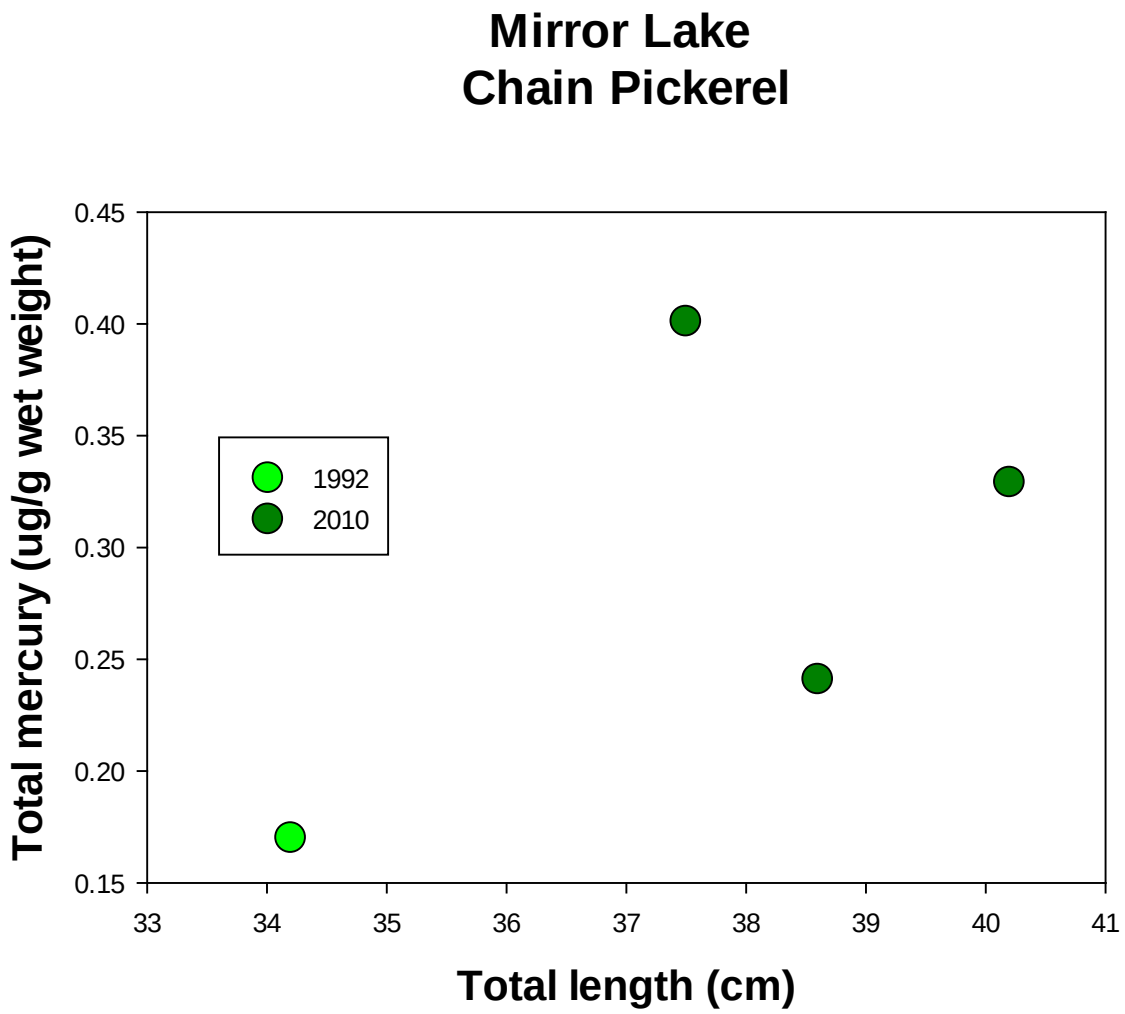

Figure 10. Comparison of concentrations of total mercury in Chain Pickerel from Mirror Lake between 1992 and 2010 ANSDU routine monitoring studies.

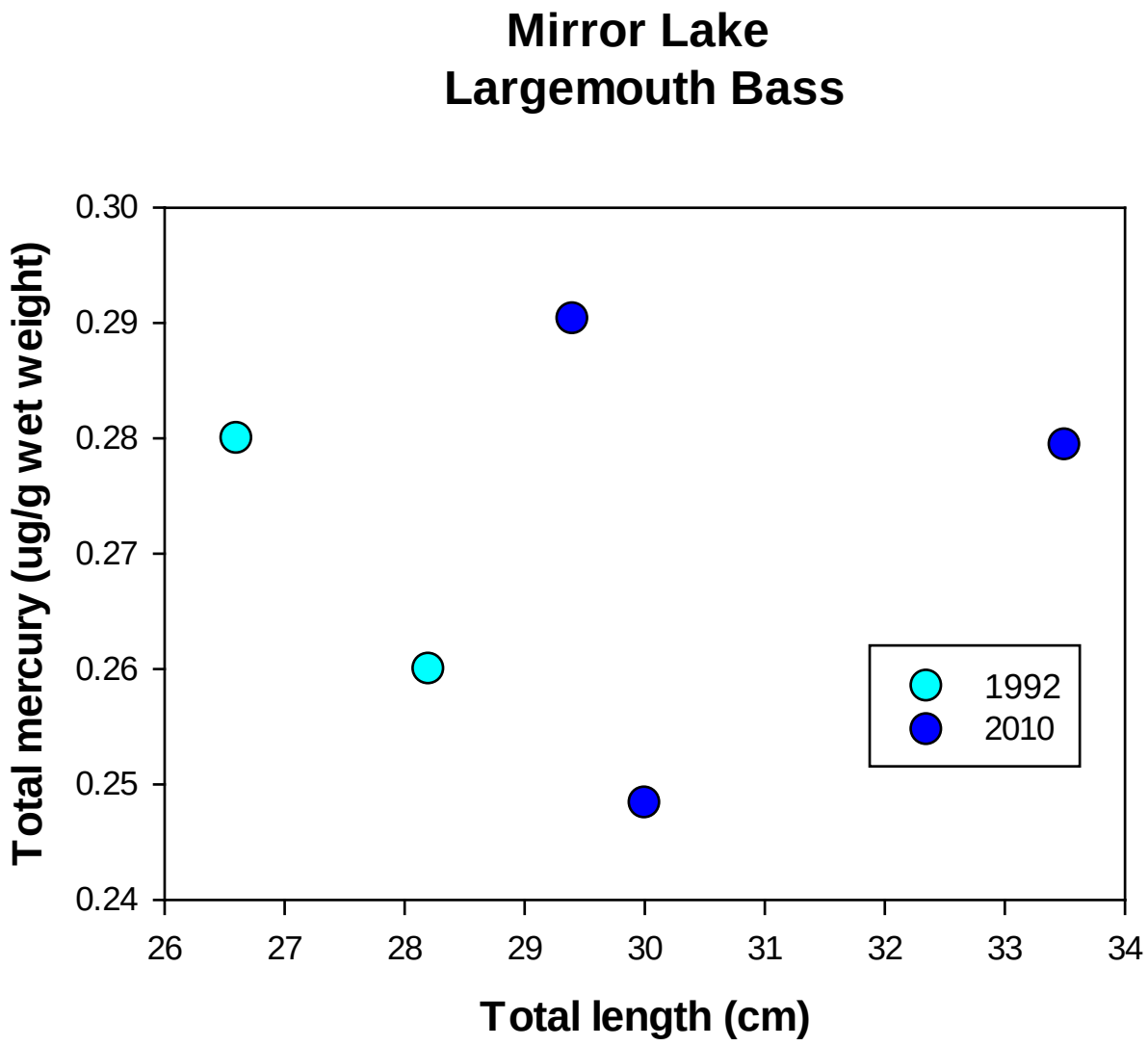

Figure 11. Comparison of concentrations of total mercury in Largemouth Bass from Mirror Lake between 1992 and 2010 ANSDU routine monitoring studies.

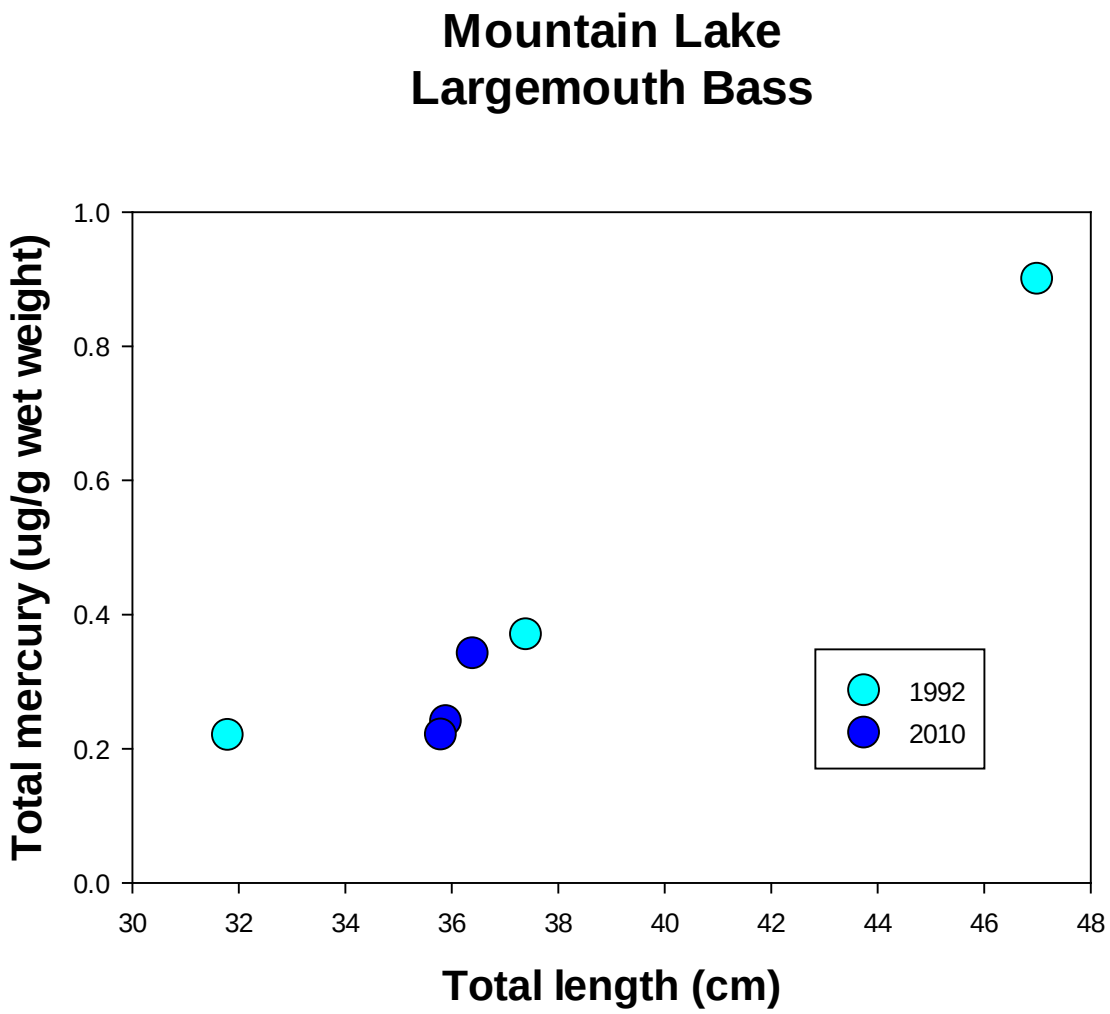

Figure 12. Comparison of concentrations of total mercury in Largemouth Bass from Mountain Lake between 1992 and 2010 ANSDU routine monitoring studies.

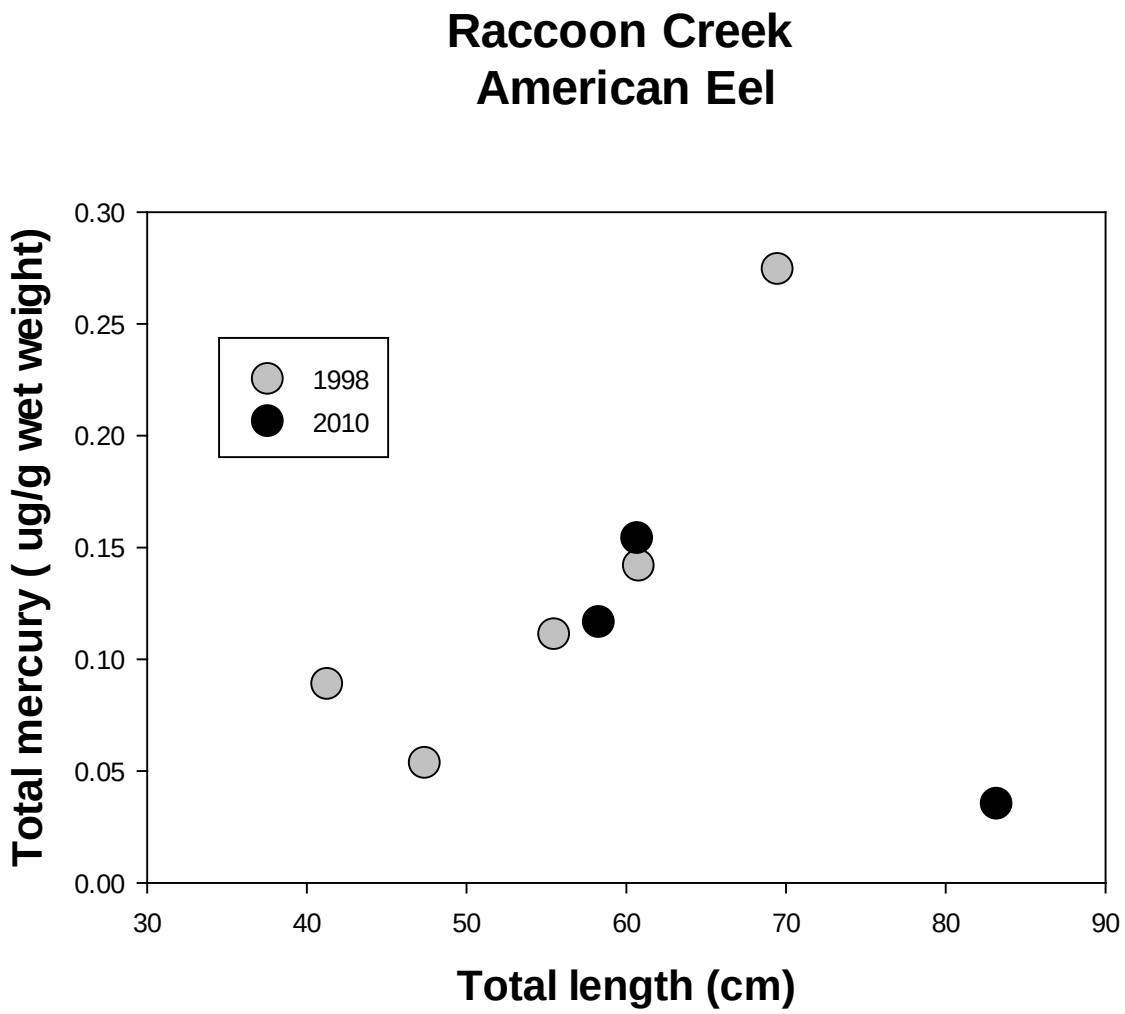

Figure 13. Comparison of concentrations of total mercury in American Eel from Raccoon Creek between 1998 and 2010 ANSDU routine monitoring studies.

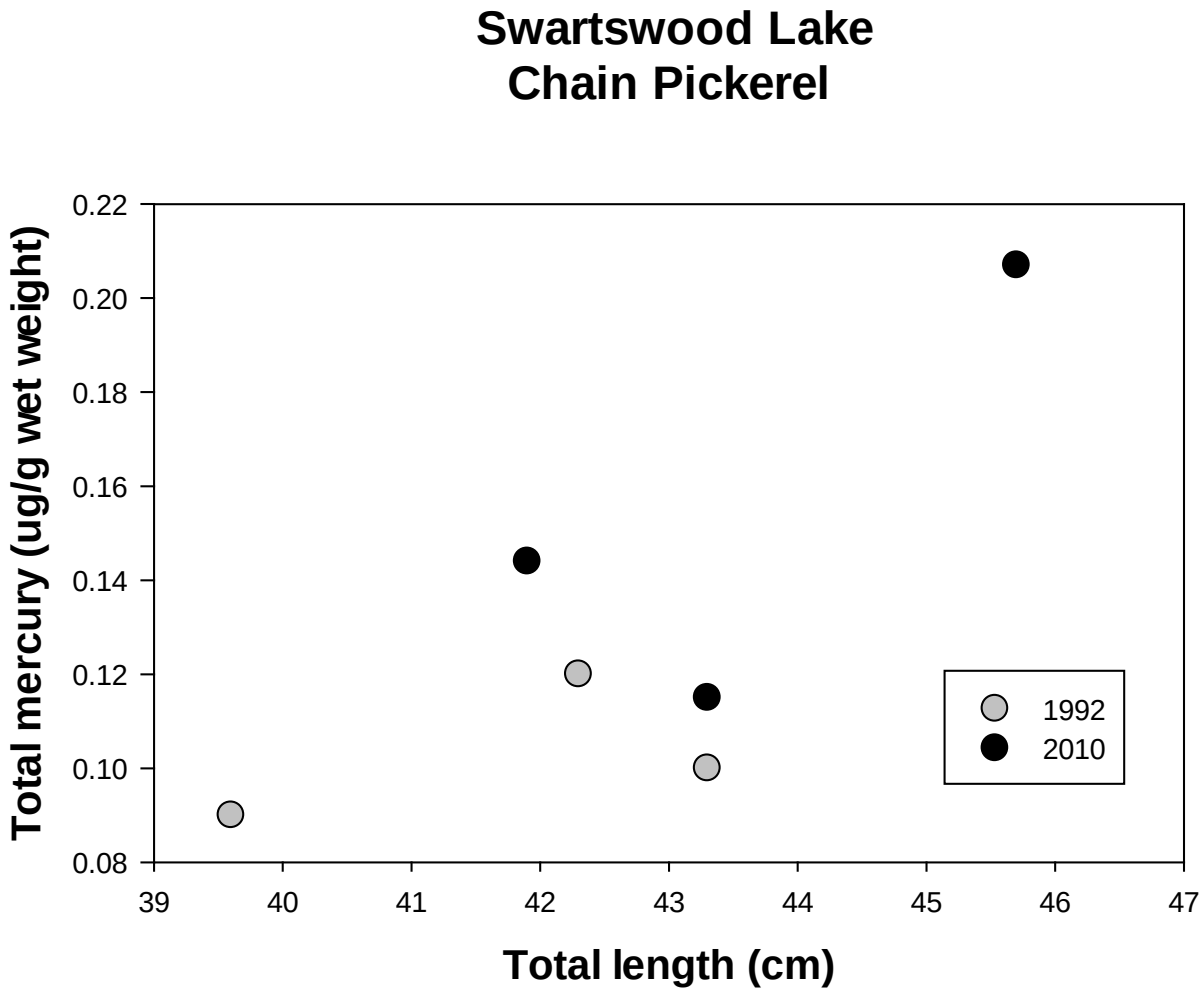

Figure 14. Comparison of concentrations of total mercury in Chain Pickerel from Swartswood Lake between 1992 and 2010 ANSDU routine monitoring studies.

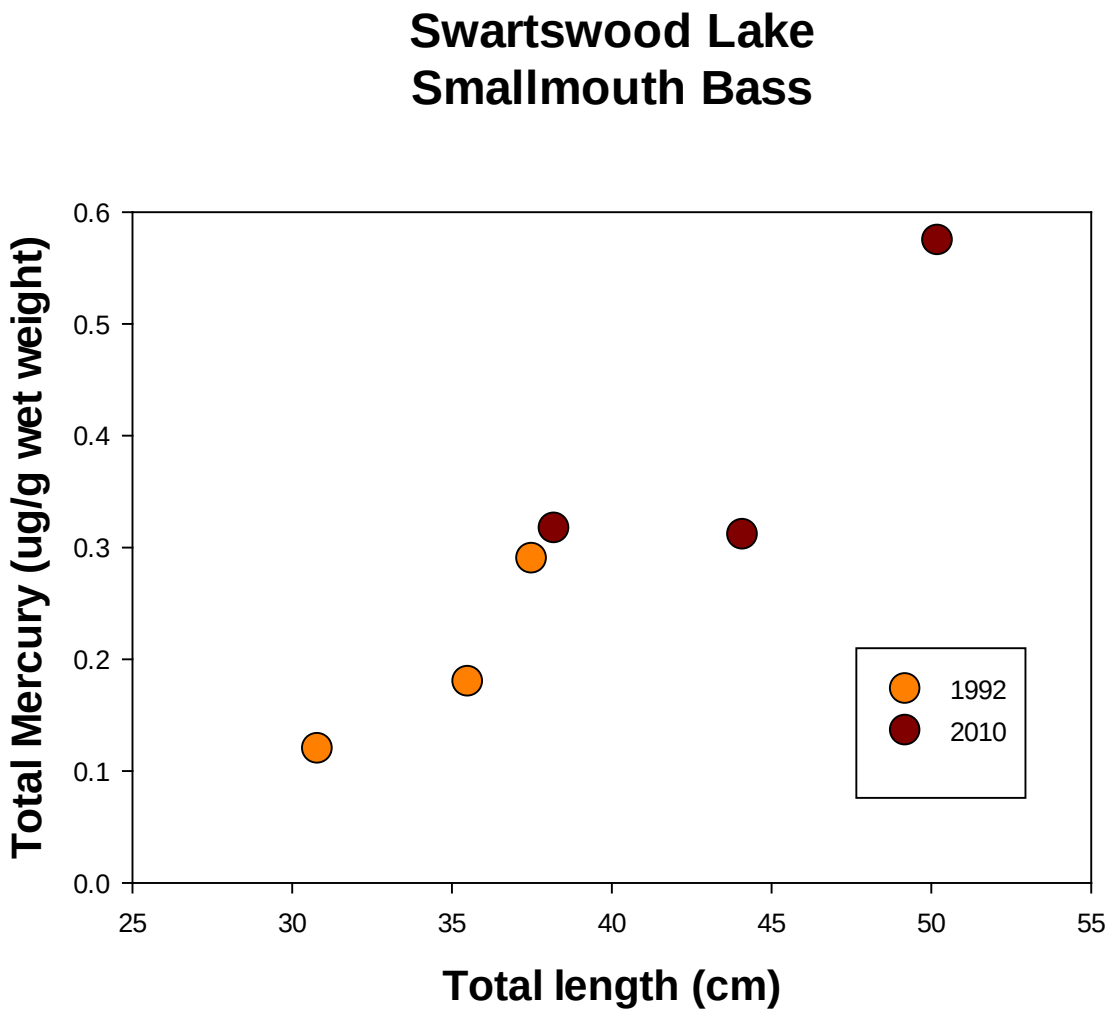

Figure 15. Comparison of concentrations of total mercury in Smallmouth Bass from Swartswood Lake between 1992 and 2010 ANSDU routine monitoring studies.

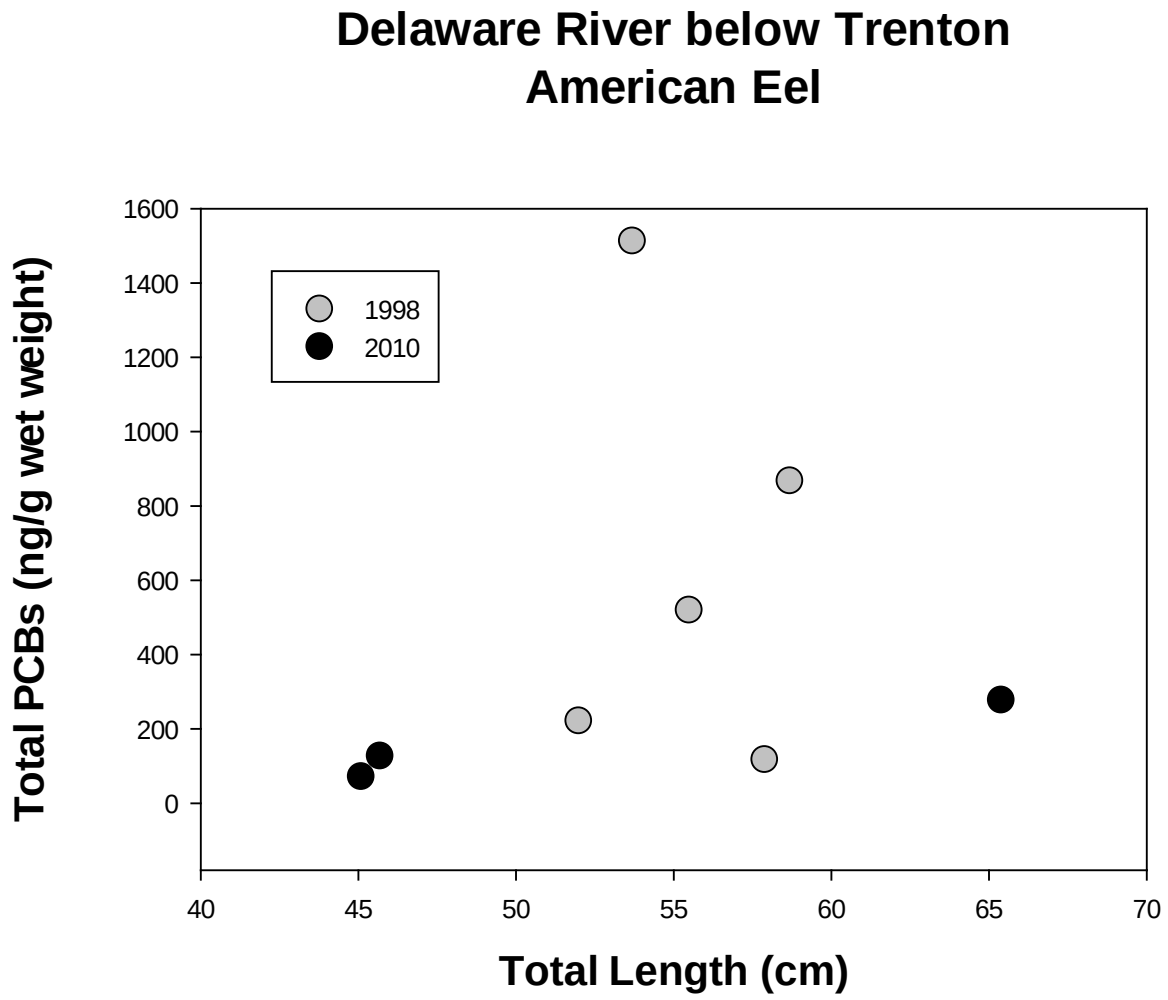

Figure 16. Comparison of concentrations of total PCBs in American Eel from Delaware River below Trenton between 1998 and 2010 ANSDU routine monitoring studies.

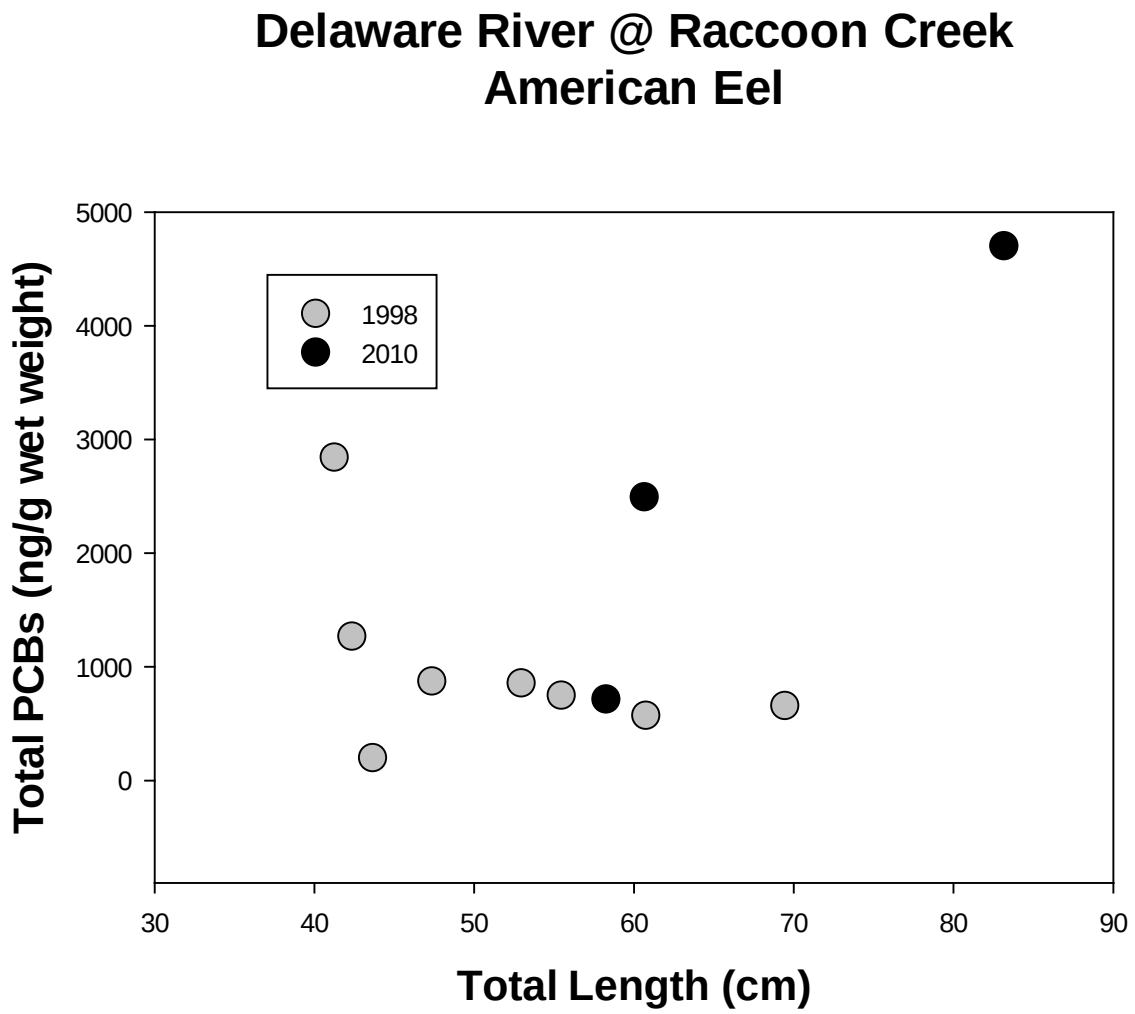

Figure 17. Comparison of concentrations of total PCBs in American Eel from Delaware River @ Raccoon Creek between 1998 and 2010 ANSDU routine monitoring studies.

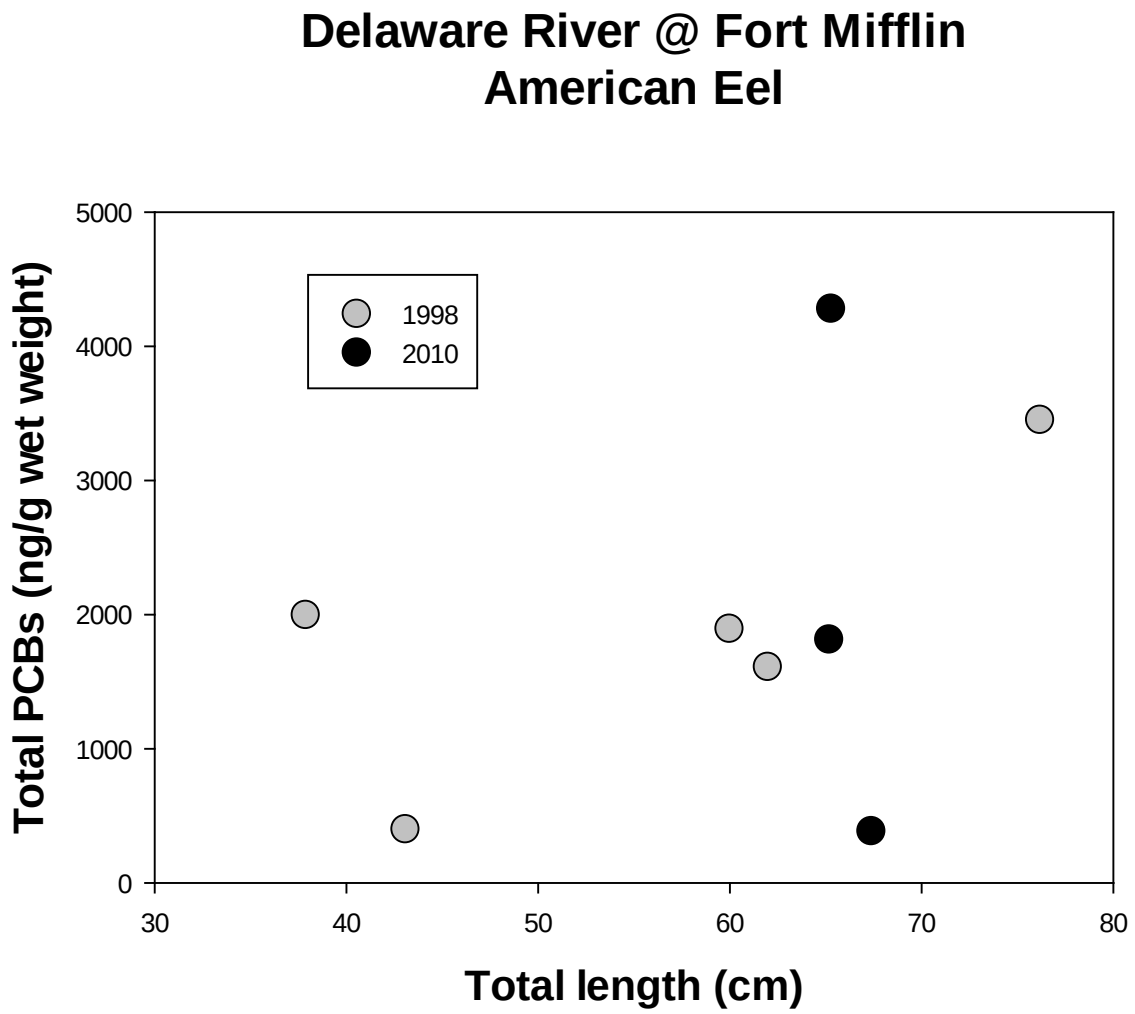

Figure 18. Comparison of concentrations of total PCBs in American Eel from Delaware River @ Fort Mifflin between 1998 and 2010 ANSDU routine monitoring studies.

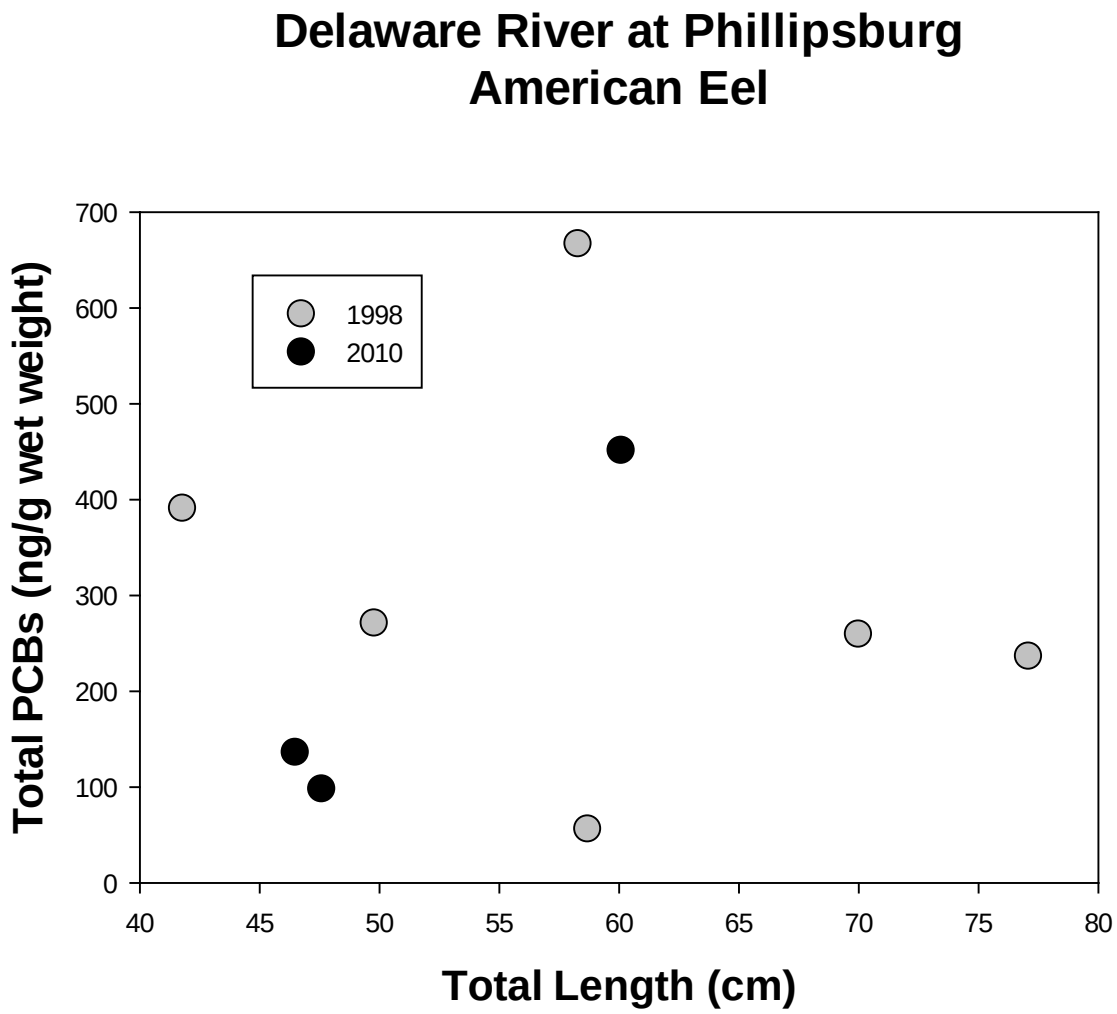

Figure 19. Comparison of concentrations of total PCBs in American Eel from Delaware River at Phillipsburg between 1998 and 2010 ANSDU routine monitoring studies.

Appendix I.

Data for Individual Samples for Mercury, PCBs, DDX, BHCs and Lindane, PBDEs and Chlordanes

Appendix I. Specimen characteristics and contaminant concentrations for the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Leaf samples analyzed as composites.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	Total Hg	Total PCBs	Total PBDEs	Total DDXs	Total BHCs + Lindane	Total Chlor-danes
	Common Name			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Allamuchy Pond												
	American eel	F-4651	4796	52.9	347.0	11.13	0.086	43		10	0.271	5.39
	American eel	F-4652	4797	51.9	258.0	9.55	0.067	30		7	0.036	2.96
	American eel	F-4653	4798	55.9	324.0	9.21	0.127	18		5	0.069	3.65
	bluegill	F-4735	5019	19	120.3		0.211					
	bluegill	F-4737	5017	17.2	88.8		0.236					
	bluegill	F-4738	5016	18	131.0		0.068					
	largemouth bass	F-4740	5005	39.5	672.8		0.685					
	largemouth bass	F-4739	5015	33.4	486.0		0.349					
	largemouth bass	F-4741	5004	46.2	1420.0		0.526					
Assunpink Lake												
	brown bullhead	F-4655	4800	34.9	562.0	0.44	0.054	9		21	0.031	1.37
	brown bullhead	F-4660	4805	38.1	778.0	0.00	0.042	13		32	0.034	1.42
	brown bullhead	F-4659	4804	39.5	862.0	1.54	0.110	44		114	0.029	3.73
	chain pickerel	F-4765	5177	37.8	332.0		0.210					
	chain pickerel	F-4766	5178	44.5	595.7		0.198					
	chain pickerel	F-4764	5176	42.6	496.6		0.147					
	bluegill	F-4762	5174	19	145.7		0.061					
	bluegill	F-4761	5173	21.2	149.8		0.083					
	bluegill	F-4763	5175	20.9	183.1		0.083					
	largemouth bass	F-4776	5198	41.7	1017.9		0.196					
	largemouth bass	F-4777	5199	46	1422.3		0.112					
	largemouth bass	F-4775	5197	40.9	1089.9		0.148					
Blue Mountain Lake												
	yellow bullhead	F-4902	5508	29.2	319.0	0.57	0.208	9		3	0.027	0.26
	yellow bullhead	F-4904	5510	27.5	280.4	0.39	0.127	7		65	0.039	0.18
	yellow bullhead	F-4903	5509	27	263.0	0.54	0.145	5		2	0.043	0.10
	largemouth bass	F-4860	5377	44.2	1489.6		0.487					
	largemouth bass	F-4858	5375	29.2	350.9		0.086					
	largemouth bass	F-4859	5376	35.1	641.0		0.212					
	yellow perch	F-4906	5512	20.6	90.5		0.150					
	yellow perch	F-4905	5511	20.2	76.7		0.162					
	yellow perch	F-4907	5513	20.9	89.8		0.171					
Catfish Pond												
	chain pickerel	F-4911	5517	32.4	205.9		0.276					
	chain pickerel	F-4913	5519	49.5	583.5		1.004					
	chain pickerel	F-4912	5518	42.3	292.1		0.781					
	largemouth bass	F-4916	5522	40.8	1060.1		0.417					
	largemouth bass	F-4915	5521	41.7	1040.3		0.410					
	largemouth bass	F-4914	5520	32.1	515.7		0.200					
	yellow perch	F-4910	5516	30	332.6		0.437					
	yellow perch	F-4909	5515	28.6	233.4		0.577					
	yellow perch	F-4908	5514	27.2	231.9		0.436					
Columbia Lake												
	American eel	F-4789	5297	58	436.9	17.37	0.159	143		22	0.076	7.18
	American eel	F-4788	5296	57.2	327.9	5.01	0.223	69		8	0.032	2.26
	American eel	F-4790	5298	63	564.6	23.35	0.162	173		21	0.445	11.17
	chain pickerel	F-4837	5354	56.8	1506.4		0.304					
	chain pickerel	F-4838	5355	56.1	1274.7		0.289					
	chain pickerel	F-4836	5353	58	1343.5		0.364					
	largemouth bass	F-4792	5300	47.5	2058.3		0.373					
	largemouth bass	F-4791	5299	39.8	1014.4		0.361					
	largemouth bass	F-4793	5301	49.5	2535.5		0.333					
	striped bass	F-4931	5537	69.9	4200.0		0.424					
	striped bass	F-4930	5536	76.5	6350.0		0.288					
	walleye	F-4929	5535	50.6	1381.1		0.408					
	walleye	F-4928	5534	56.1	2034.4		0.520					

Appendix I (continued). Specimen characteristics and contaminant concentrations for the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Leaf samples analyzed as composites.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	Total Hg	Total PCBs	Total PBDEs	Total DDXs	Total BHCs + Lindane	Total Chlor-danes
	Common Name			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Cranberry Lake												
	brown bullhead	F-4658	4803	32.1	480.0	0.69	0.058	9		2	0.025	0.90
	brown bullhead	F-4657	4802	31.5	396.0	0.48	0.037	8		3	0.036	0.91
	brown bullhead	F-4656	4801	29.8	299.0	0.25	0.071	35		6	0.053	1.44
	chain pickerel	F-4749	5073	46	505.0		0.343					
	chain pickerel	F-4748	5072	42.6	442.0		0.255					
	chain pickerel	F-4750	5074	58.5	880.0		1.140					
	largemouth bass	F-4784	5292	49.9	1769.1		0.573					
	largemouth bass	F-4780	5288	42.8	1246.1		0.342					
	largemouth bass	F-4779	5287	36.2	696.0		0.248					
	yellow perch	F-4770	5192	26.4	187.2		0.302					
	yellow perch	F-4772	5194	29.5	238.6		0.276					
	yellow perch	F-4771	5193	24.5	143.0		0.197					
Delaware Lake												
	American eel	F-4901	5507	57.6	402.6	17.92	0.034	54		19	0.049	3.37
	American eel	F-4900	5506	57.5	405.8	17.13	0.058	35		15	0.056	3.02
	American eel	F-4899	5505	61.5	453.7	20.56	0.152	237		24	0.054	14.93
	Red Maple	F-4755	5079				0.000					
	Red Maple	F-4754	5078				0.000					
	Red Maple	F-4756	5080				0.000					
	Red Maple	F-4760	5084				0.000					
	Red Maple	F-4757	5081				0.000					
	Red Maple	F-4758	5082				0.000					
	bluegill	F-4713	4915	22.7	235.0		0.086					
	bluegill	F-4712	4914	21	209.0		0.085					
	bluegill	F-4711	4913	20.1	173.0		0.062					
	bluegill	F-4710	4912	19.5	166.0		0.077					
	bluegill	F-4709	4911	19.3	142.0		0.041					
	bluegill	F-4708	4910	17.9	128.0		0.021					
	largemouth bass	F-4694	4885	24.3	213.0		0.024					
	largemouth bass	F-4692	4883	23.9	213.0		0.049					
	largemouth bass	F-4686	4866	22.2	153.0		0.026					
	largemouth bass	F-4705	4896	23.2	175.0		0.005					
	largemouth bass	F-4699	4890	26.2	234.0		0.025					
	largemouth bass	F-4685	4865	22.2	146.0		0.004					
	largemouth bass	F-4703	4894	25.7	251.0		0.031					
	largemouth bass	F-4700	4891	25.2	204.0		0.066					
	largemouth bass	F-4684	4864	22	142.0		0.031					
	largemouth bass	F-4695	4886	20.2	109.0		0.011					
	largemouth bass	F-4702	4893	22.4	154.0		0.024					
	largemouth bass	F-4691	4882	20.6	108.0		0.024					
	largemouth bass	F-4698	4889	26.5	244.0		0.049					
	largemouth bass	F-4687	4867	21.4	140.0		0.005					
	largemouth bass	F-4689	4880	20.9	120.0		-0.004					
	largemouth bass	F-4696	4887	21	123.0		0.005					
	largemouth bass	F-4693	4884	22.5	149.0		0.018					
	largemouth bass	F-4688	4879	21.5	142.0		0.031					
	largemouth bass	F-4690	4881	24	196.0		0.013					
	largemouth bass	F-4701	4892	23.9	183.0		0.045					
	largemouth bass	F-4704	4895	21.4	136.0		0.041					
	largemouth bass	F-4697	4888	22.4	153.0		0.027					
	largemouth bass	F-4683	4863	22.1	152.0		0.018					
	largemouth bass	F-4714	4916	32.5	509.0		0.070					
	largemouth bass	F-4715	4917	37	777.0		0.170					
	largemouth bass	F-4706	4897	39.2	909.0		0.126					
	largemouth bass	F-4707	4898	41.7	1115.0		0.243					
	largemouth bass	F-4717	4919	44.5	1341.0		0.322					
	largemouth bass	F-4716	4918	46.2	1731.0		0.201					

Appendix I (continued). Specimen characteristics and contaminant concentrations for the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Leaf samples analyzed as composites.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	Total Hg	Total PCBs	Total PBDEs	Total DDXs	Total BHCs + Lindane	Total Chlor-danes
	Common Name			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Delaware River @ Fort Mifflin												
	American eel	F-7097	7952	67.4	578.1	18.34	0.107	382	19.49	79	0.543	27.23
	American eel	F-7098	7953	65.2	554.8	15.97	0.198	1811	74.47	614	0.953	105.03
	American eel	F-7099	7954	65.3	552.9	13.79	0.146	4276	246.93	1426	0.716	270.71
Delaware River @ Lambertville												
	American eel	F-7085	7940	53.4	275.1	4.51	0.117	144	37.66	111	0.101	14.53
	American eel	F-7089	7944	61.4	423.9	15.77	0.432	90	11.09	189	0.120	8.49
	American eel	F-7090	7945	62.7	513.2	10.49	0.164	413	125.75	261	0.151	27.86
Delaware River @ Montague												
	American eel	F-4884	5490	49.7	250.2	20.96	0.396	167	52.18	76	0.161	12.39
	American eel	F-4885	5491	45.2	183.2	19.10	0.514	129	35.64	56	0.147	11.52
	American eel	F-4886	5492	57	327.7	4.19	0.396	78	20.53	28	0.089	4.16
	walleye	F-4861	5378	39.3	590.4		0.179					
	walleye	F-4862	5379	45.9	1027.5		0.219					
	walleye	F-4863	5380	51	1237.0		0.653					
Delaware River @ Phillipsburg												
	American eel	F-7094	7949	47.6	224.0	16.61	0.144	98	69.71	24	0.110	8.26
	American eel	F-7095	7950	46.5	217.8	9.43	0.095	136	10.48	24	0.200	14.34
	American eel	F-7096	7951	60.1	445.2	17.05	0.114	451	51.31	138	0.222	37.99
Delaware River @ Raccoon Creek												
	American eel	F-7086	7941	58.3	355.4	3.25	0.116	709	18.68	248	0.224	35.27
	American eel	F-7087	7942	60.7	478.9	12.76	0.154	2488	93.91	720	0.950	116.66
	American eel	F-7088	7943	83.2	1317.2	13.07	0.035	4696	158.32	1003	1.143	172.75
Delaware River @ Trenton												
	American eel	F-7091	7946	45.1	191.4	0.59	0.149	71	13.28	17	0.065	5.87
	American eel	F-7092	7947	45.7	173.2	3.88	0.071	126	32.15	53	0.096	12.24
	American eel	F-7093	7948	65.4	482.7	2.57	0.098	276	53.06	113	0.100	22.67
Delaware River @ West Deptford												
	largemouth bass	F-4922	5528	44.5	1662.7	2.75	0.129	385		83	0.102	25.57
	largemouth bass	F-4923	5529	49.5	1597.4	0.98	0.392	362		93	0.030	13.54
	largemouth bass	F-4924	5530	46	1687.4	0.98	0.280	231		30	0.036	6.22
DOD Lake												
	common carp	F-4925	5531	57.6	2474.5	3.22	0.168	34		14	0.058	4.23
	common carp	F-4926	5532	53	1836.1	1.23	0.162	9		4	0.047	0.66
	common carp	F-4927	5533	56.7	2397.7	4.79	0.159	34		14	0.056	3.48
	bluegill	F-4839	5356	19.2	112.5		0.132					
	bluegill	F-4840	5357	19.5	125.0		0.071					
	bluegill	F-4841	5358	18.7	127.8		0.058					
	largemouth bass	F-4842	5359	37.4	653.0		0.338					
	largemouth bass	F-4843	5360	36.2	701.7		0.353					
	largemouth bass	F-4844	5361	38	719.8		0.248					
Furnace Lake												
	brown bullhead	F-4794	5302	35.9	616.5	1.13	0.040	10		3	0.034	0.32
	brown bullhead	F-4795	5303	33.3	524.7	1.32	0.045	6		3	0.038	0.20
	brown bullhead	F-4796	5304	27	261.4	0.57	0.037	6		5	0.043	0.19
	bluegill	F-4855	5372	17.8	103.2		0.028					
	bluegill	F-4856	5373	16.6	85.8		0.053					
	bluegill	F-4857	5374	16.5	73.8		0.049					
	largemouth bass	F-4803	5311	38.2	972.3		0.148					
	largemouth bass	F-4804	5312	44.7	1530.9		0.331					
	largemouth bass	F-4805	5313	45.1	1550.0		0.853					

Appendix I (continued). Specimen characteristics and contaminant concentrations for the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Leaf samples analyzed as composites.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	Total Hg	Total PCBs	Total PBDEs	Total DDXs	Total BHCs + Lindane	Total Chlor-danes
	Common Name			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Kirkwood Lake												
	common carp	F-4724	4961	50	3503.0	4.06	0.083	346		140	0.066	25.93
	common carp	F-4725	4962	52	2005.0	20.75	0.128	708		255	0.110	86.81
	common carp	F-4726	4963	53.1	2170.0	9.30	0.042	581		243	0.135	55.60
	bluegill	F-4718	4955	16	82.0		0.041					
	bluegill	F-4719	4956	17.4	98.0		0.051					
	bluegill	F-4720	4957	17.6	99.0		0.034					
	largemouth bass	F-4721	4958	32.5	518.0	0.84	0.167	177		27	0.210	11.14
	largemouth bass	F-4722	4959	45.3	1405.0	0.42	0.364	41		13	0.130	1.68
	largemouth bass	F-4723	4960	44.5	1203.0	0.68	0.235	42		11	0.090	3.27
Lake Aeroflex												
	brown bullhead	F-4881	5487	32.4	376.0	0.83	0.067	7		4	0.023	0.64
	brown bullhead	F-4882	5488	31.5	383.7	0.82	0.033	3		2	0.019	0.27
	brown bullhead	F-4883	5489	32.4	438.2	1.98	0.045	6		4	0.021	0.86
	American eel	F-4878	5484	59.5	390.2	15.22	0.158	59		29	0.060	7.25
	American eel	F-4879	5485	55.4	327.4	16.26	0.260	21		12	0.034	4.23
	American eel	F-4880	5486	65.5	537.8	22.93	0.155	21		15	0.078	4.50
	chain pickerel	F-4851	5368	38.4	327.1		0.279					
	chain pickerel	F-4852	5369	45.8	604.1		0.394					
	chain pickerel	F-4853	5370	54.2	865.8		0.584					
	bluegill	F-4848	5365	18.3	115.2		0.093					
	bluegill	F-4849	5366	17.4	95.3		0.101					
	bluegill	F-4850	5367	18	112.7		0.129					
	largemouth bass	F-4854	5371	35.4	645.2		0.302					
	largemouth bass	F-4864	5381	44.1	1241.5		0.908					
	largemouth bass	F-4865	5382	44.6	1529.7		1.173					
Lake Hopatcong (south)												
	brown bullhead	F-4797	5305	32.1	475.3	1.95	0.048	31		7	0.022	3.01
	brown bullhead	F-4798	5306	34.5	573.5	1.88	0.021	54		11	0.052	4.07
	brown bullhead	F-4800	5308	37.2	753.7	3.65	0.039	70		20	0.048	11.45
	chain pickerel	F-4833	5350	53	917.8		0.174					
	chain pickerel	F-4834	5351	55.8	724.6		0.366					
	chain pickerel	F-4835	5352	50.2	826.1		0.316					
	bluegill	F-4818	5330	18.4	118.3		0.033					
	bluegill	F-4819	5331	18.5	110.5		0.056					
	bluegill	F-4820	5332	18.9	134.7		0.042					
	largemouth bass	F-4824	5336	39.8	983.5		0.229					
	largemouth bass	F-4825	5337	37.6	743.1		0.128					
	largemouth bass	F-4826	5338	40.2	1260.0		0.240					
	yellow perch	F-4821	5333	29.8	316.2		0.159					
	yellow perch	F-4822	5334	31.3	331.4		0.172					
	yellow perch	F-4823	5335	31.4	360.4		0.281					
	walleye	F-4799	5307	42.5	730.8	0.50	0.178	26		4	0.100	2.93
	walleye	F-4801	5309	44.2	827.4	1.09	0.502	46		15	0.039	7.83
	walleye	F-4802	5310	49.1	1141.9	1.19	0.123	35		10	0.038	4.43
Lake Hopatcong (north)												
	chain pickerel	F-7073	7928	50.1	728.4		0.096					
	chain pickerel	F-7074	7929	50.9	706.9		0.124					
	chain pickerel	F-7075	7930	46.8	552.6		0.083					
	largemouth bass	F-7076	7931	44.5	1470.0		0.256					
	largemouth bass	F-7077	7932	42.1	1308.0		0.186					
	largemouth bass	F-7078	7933	47.6	1984.1		0.257					
	walleye	F-7079	7934	56.7	1814.4	1.74	0.408	63		16	0.181	10.80
	walleye	F-7080	7935	58.3	2202.4	1.77	0.284	76		17	0.184	14.92
	walleye	F-7081	7936	71.1	3363.2	1.13	0.548	83		14	0.159	13.64

Appendix I (continued). Specimen characteristics and contaminant concentrations for the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Leaf samples analyzed as composites.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	Total Hg	Total PCBs	Total PBDEs	Total DDXs	Total BHCs + Lindane	Total Chlor-danes
	Common Name			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Lake Mercer												
	American eel	F-4654	4799	59.8	442.0	7.79	0.131	29		93	0.063	5.59
	American eel	F-4661	4809	75.2	871.0	14.13	0.138	33		10	0.100	9.51
	American eel	F-4662	4810	71.8	912.0	15.07	0.239	54		154	0.135	21.91
	channel catfish	F-4667	4815	40.9	588.0	4.27	0.143	94		59	0.080	20.75
	channel catfish	F-4669	4828	44.2	849.0	3.90	0.106	91		34	0.035	14.11
	channel catfish	F-4671	4830	50	1273.0	3.81	0.133	104		165	0.070	7.59
	bluegill	F-4733	5021	19.9	168.9		0.043					
	bluegill	F-4734	5020	18.9	162.5		0.066					
	bluegill	F-4736	5018	18.4	127.0		0.075					
	largemouth bass	F-4751	5075	42.1	1280.0		0.217					
	largemouth bass	F-4752	5076	40.1	420.0		0.176					
	largemouth bass	F-4753	5077	49.5	1240.0		0.662					
Lake Musconetcong												
	brown bullhead	F-4663	4811	32.2	482.0	1.50	0.019	22		10	0.047	6.06
	brown bullhead	F-4664	4812	30.8	432.0	0.45	0.051	18		6	0.034	4.48
	brown bullhead	F-4665	4813	32.6	432.0	0.44	0.037	16		5	0.037	0.75
	chain pickerel	F-4785	5293	57.1	1278.8		0.235					
	chain pickerel	F-4786	5294	57.5	1315.1		0.250					
	chain pickerel	F-4787	5295	59.5	1355.2		0.305					
	largemouth bass	F-4781	5289	42.3	1143.0		0.198					
	largemouth bass	F-4782	5290	39	949.2		0.354					
	largemouth bass	F-4783	5291	39.8	893.0		0.247					
Little Swartswood Lake												
	brown bullhead	F-7048	7903	30.4	446.3	0.67	0.050	9		10	0.101	0.45
	brown bullhead	F-7049	7904	29.5	354.5	1.14	0.027	12		9	0.089	0.74
	brown bullhead	F-7050	7905	31.4	527.7	0.59	0.019	12		9	0.106	0.60
	chain pickerel	F-7046	7901	36.7	335.4		0.216					
	chain pickerel	F-7047	7902	52	821.1		0.364					
	chain pickerel	F-7051	7906	58.4	1316.9		0.255					
	largemouth bass	F-7052	7907	41.1	1267.1		0.402					
	largemouth bass	F-7053	7908	43.4	1479.4		0.448					
	largemouth bass	F-7054	7909	45.4	1767.7		0.687					
Merrill Creek Reservoir												
	brown bullhead	F-4666	4814	36.9	640.0	0.75	0.074	9		5	0.042	0.70
	brown bullhead	F-4668	4827	37.1	741.0	1.02	0.072	23		9	0.055	1.45
	brown bullhead	F-4670	4829	38.7	838.0	1.04	0.084	7		4	0.035	0.91
	bluegill	F-4767	5189	19	134.8		0.034					
	bluegill	F-4768	5190	20.9	167.0		0.046					
	bluegill	F-4769	5191	19.7	144.4		0.043					
	largemouth bass	F-4773	5195	43.7	1019.0		0.305					
	largemouth bass	F-4774	5196	45	1143.5		0.513					
	largemouth bass	F-4778	5200	52.3	2346.7		0.397					
	lake trout	F-4872	5389	58.2	1834.1	10.08	0.162	102		51	0.081	13.53
	lake trout	F-4873	5390	51.7	1463.0	9.21	0.144	75		42	0.082	11.73
	lake trout	F-4874	5391	54	1392.9	8.71	0.137	64		37	0.081	9.09
	lake trout	F-4875	5392	59.9	1884.3	8.80	0.229	108		63	0.080	16.40
	lake trout	F-4876	5393	67	3971.9	9.45	0.208	125		65	0.074	18.28
	lake trout	F-4877	5394	69	3894.0	9.28	0.224	136		62	0.092	18.12

Appendix I (continued). Specimen characteristics and contaminant concentrations for the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Leaf samples analyzed as composites.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	Total Hg	Total PCBs	Total PBDEs	Total DDXs	Total BHCs + Lindane	Total Chlor-danes
	Common Name			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Mirror Lake												
	American eel	F-4680	4860	59	381.0	16.21	0.185	114		236	0.087	46.51
	American eel	F-4681	4861	62	556.0	16.32	0.204	75		112	0.050	36.66
	American eel	F-4682	4862	65	555.0	4.23	0.174	108		249	0.070	40.52
	chain pickerel	F-4742	5022	40.2	198.0		0.329					
	chain pickerel	F-4743	5023	38.6	256.1		0.241					
	chain pickerel	F-4744	5024	37.5	240.7		0.401					
	largemouth bass	F-4745	5025	29.4	323.6		0.290					
	largemouth bass	F-4746	5026	30	339.5		0.248					
	largemouth bass	F-4747	5027	33.5	470.9		0.279					
Mountain Lake												
	common carp	F-7070	7925	66.2	3635.3	1.21	0.150	51		18	0.091	5.61
	common carp	F-7071	7926	61.8	3316.2	6.44	0.044	49		23	0.260	9.00
	common carp	F-7072	7927	67.2	4068.9	8.02	0.087	146		59	0.236	22.80
	muskellunge	F-7067	7922	57.6	1148.6		0.131					
	muskellunge	F-7068	7923	58.1	1243.5		0.117					
	muskellunge	F-7069	7924	65.3	1951.0		0.164					
	bluegill	F-7082	7937	18.9	152.1		0.077					
	bluegill	F-7083	7938	18.7	149.2		0.106					
	bluegill	F-7084	7939	15.6	77.5		0.087					
	largemouth bass	F-7064	7919	36.4	860.5		0.342					
	largemouth bass	F-7065	7920	35.9	867.6		0.241					
	largemouth bass	F-7066	7921	35.8	997.0		0.221					
Paulinskill Lake												
	common carp	F-7061	7916	48.6	1405.1	1.31	0.118	246		16	0.075	3.26
	common carp	F-7062	7917	47.9	1409.4	0.89	0.213	120		16	0.225	2.17
	common carp	F-7063	7918	51.2	1683.4	1.04	0.142	165		12	0.097	2.73
	largemouth bass	F-7058	7913	38.1	944.3		0.140					
	largemouth bass	F-7059	7914	38.5	928.6		0.189					
	largemouth bass	F-7060	7915	47.2	1903.6		0.243					
	yellow perch	F-7055	7910	24	153.4		0.085					
	yellow perch	F-7056	7911	27.9	216.9		0.096					
	yellow perch	F-7057	7912	28.1	238.3		0.141					
Peddie Lake												
	American eel	F-4677	4833	60.7	452.0	13.32	0.112	145		461	0.140	161.63
	American eel	F-4678	4834	54.6	331.0	15.79	0.119	125		373	0.183	59.83
	American eel	F-4679	4835	62.4	521.0	20.36	0.213	531		972	0.568	642.56
	bluegill	F-4727	4996	17.8	108.4		0.069					
	bluegill	F-4728	4997	18.1	111.5		0.081					
	bluegill	F-4729	4998	18	116.0		0.105					
	largemouth bass	F-4730	4999	39.4	904.9	0.50	0.271	21		44	0.247	3.73
	largemouth bass	F-4731	5000	44.5	1400.0	0.65	0.414	30		29	0.157	4.80
	largemouth bass	F-4732	5001	46	1750.0	0.79	0.474	30		35	0.120	5.88
Saw Mill Pond												
	American eel	F-4867	5384	60.4	348.9	17.51	0.232	40		48	0.093	20.35
	American eel	F-4868	5385	57	368.0	18.04	0.112	28		41	0.091	3.59
	American eel	F-4870	5387	56.7	369.7	13.82	0.126	37		33	0.067	3.81
	bluegill	F-4827	5344	17.2	100.7		0.129					
	bluegill	F-4828	5345	16.5	83.9		0.165					
	bluegill	F-4829	5346	17.4	104.7		0.025					
	largemouth bass	F-4830	5347	31.6	380.0		0.357					
	largemouth bass	F-4831	5348	30.4	338.1		0.274					
	largemouth bass	F-4832	5349	33.9	432.9		0.396					

Appendix I (continued). Specimen characteristics and contaminant concentrations for the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Leaf samples analyzed as composites.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	Total Hg	Total PCBs	Total PBDEs	Total DDXs	Total BHCs + Lindane	Total Chlor-danes
	Common Name			cm	g	%	ug/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Steenykill Lake												
	American eel	F-4866	5383	55.9	312.5	29.06	0.131	67		78	0.150	5.98
	American eel	F-4869	5386	51.7	245.9	26.65	0.115	32		43	0.167	3.56
	American eel	F-4871	5388	71.5	692.0	11.99	0.140	41		52	0.050	4.00
	chain pickerel	F-4845	5362	39.2	346.4		0.263					
	chain pickerel	F-4846	5363	39.9	472.5		0.186					
	chain pickerel	F-4847	5364	39.5	384.0		0.143					
Swartswood Lake												
	American eel	F-4917	5523	51.5	232.1	0.80	0.124	19		4	0.037	0.68
	American eel	F-4918	5524	73.8	932.0	27.50	0.193	120		91	0.089	12.74
	chain pickerel	F-4809	5321	41.9	419.4		0.144					
	chain pickerel	F-4810	5322	43.3	409.3		0.115					
	chain pickerel	F-4811	5323	45.7	495.8		0.207					
	bluegill	F-4806	5318	19	146.5		0.029					
	bluegill	F-4807	5319	19.4	152.3		0.032					
	bluegill	F-4808	5320	18.2	117.7		0.016					
	smallmouth bass	F-4812	5324	50.2	1772.0		0.575					
	smallmouth bass	F-4813	5325	44.1	1228.2		0.311					
	smallmouth bass	F-4814	5326	38.2	863.4		0.317					
	largemouth bass	F-4815	5327	44.8	1446.1		0.329					
	largemouth bass	F-4816	5328	46.4	1740.6		0.264					
	largemouth bass	F-4817	5329	47.1	1371.5		0.475					
	walleye	F-4919	5525	49.5	1409.0		0.289					
	walleye	F-4920	5526	51.2	1349.5		0.325					
	walleye	F-4921	5527	48.2	1212.8		0.405					
White Lake												
	American eel	F-4887	5493	61	466.6	15.72	0.104	8		3	0.058	1.13
	American eel	F-4888	5494	54.7	322.6	27.34	0.060	38		21	0.084	4.20
	American eel	F-4889	5497	53.8	307.7	23.66	0.139	12		7	0.083	2.25
	chain pickerel	F-4896	5502	43.6	396.3		0.395					
	chain pickerel	F-4897	5503	40.1	376.6		0.278					
	chain pickerel	F-4898	5504	52.5	1120.2		0.273					
	bluegill	F-4890	5495	19.4	150.9		0.049					
	bluegill	F-4891	5496	18.8	125.9		0.153					
	bluegill	F-4892	5498	19.2	136.6		0.036					
	largemouth bass	F-4893	5499	32.4	448.4		0.192					
	largemouth bass	F-4894	5500	34.5	571.1		0.623					
	largemouth bass	F-4895	5501	38	724.0		0.642					

Appendix II.

Data for Individual Samples for Dieldrin, Endrin, Aldrin, and Endosulfans

Appendix II. Concentrations of dieldrin, endrin, aldrin, and endosulfans in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Concentrations below detection limit (BDL) are in italics. ND=non-detect.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	aldrin	dieldrin	endosulfan I	endosulfan II	endrin
	Common Name			cm	g	%	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Allamuchy Pond											
	American eel	F-4651	4796	52.9	347.0	11.13	*0.10*	1.08	ND	0.05	*0.03*
	American eel	F-4652	4797	51.9	258.0	9.55	*0.08*	0.55	*0.01*	0.04	*0.02*
	American eel	F-4653	4798	55.9	324.0	9.21	*0.09*	0.94	*0.01*	*0.02*	*0.02*
Assunpink Lake											
	brown bullhead	F-4655	4800	34.9	562.0	0.44	0.15	1.56	*0.01*	*0.01*	*0.03*
	brown bullhead	F-4660	4805	38.1	778.0	0.00	0.16	1.74	*0.01*	0.05	*0.03*
	brown bullhead	F-4659	4804	39.5	862.0	1.54	0.14	1.40	*0.01*	0.00	*0.02*
Blue Mountain Lake											
	yellow bullhead	F-4902	5508	29.2	319.0	0.57	*0.09*	0.02	0.02	*0.01*	*0.03*
	yellow bullhead	F-4904	5510	27.5	280.4	0.39	*0.11*	0.01	0.01	*0.01*	*0.12*
	yellow bullhead	F-4903	5509	27	263.0	0.54	*0.11*	*0.02*	*0.01*	*0.02*	0.08
Columbia Lake											
	American eel	F-4789	5297	58	436.9	17.37	*0.07*	0.18	0.01	0.01	*0.03*
	American eel	F-4788	5296	57.2	327.9	5.01	*0.10*	0.84	*0.01*	*0.03*	*0.08*
	American eel	F-4790	5298	63	564.6	23.35	0.12	1.61	0.01	0.04	*0.09*
Cranberry Lake											
	brown bullhead	F-4658	4803	32.1	480.0	0.69	*0.09*	0.01	0.01	*0.01*	*0.03*
	brown bullhead	F-4657	4802	31.5	396.0	0.48	*0.09*	0.03	0.01	*0.01*	*0.03*
	brown bullhead	F-4656	4801	29.8	299.0	0.25	*0.08*	*0.03*	*0.02*	*0.01*	*0.01*
Delaware Lake											
	American eel	F-4901	5507	57.6	402.6	17.92	*0.18*	2.73	*0.01*	*0.03*	*0.04*
	American eel	F-4900	5506	57.5	405.8	17.13	*0.11*	0.53	*0.01*	*0.02*	*0.05*
	American eel	F-4899	5505	61.5	453.7	20.56	0.10	0.51	*0.01*	0.02	*0.03*
Delaware River @ Fort Mifflin											
	American eel	F-7098	7953	67.4	578.1	18.34	2.22	84.97	*0.09*	0.74	0.56
	American eel	F-7099	7954	65.2	554.8	15.97	1.12	111.60	0.28	0.40	0.22
	American eel	F-7097	7952	65.3	552.9	13.79	0.51	19.21	*0.06*	0.16	0.25
Delaware River @ Lambertville											
	American eel	F-7085	7940	53.4	275.1	4.51	0.16	3.59	*0.02*	*0.02*	0.15
	American eel	F-7089	7944	61.4	423.9	15.77	0.12	3.12	*0.01*	*0.03*	0.21
	American eel	F-7090	7945	62.7	513.2	10.49	0.23	6.54	*0.07*	*0.04*	0.18
Delaware River @ Montague											
	American eel	F-4884	5490	49.7	250.2	20.96	*0.11*	2.18	0.05	0.12	*0.04*
	American eel	F-4885	5491	45.2	183.2	19.10	0.10	1.87	*0.03*	*0.06*	*0.04*
	American eel	F-4886	5492	57	327.7	4.19	*0.03*	0.47	*0.01*	*0.03*	*0.03*
Delaware River @ Phillipsburg											
	American eel	F-7094	7949	47.6	224.0	16.61	0.08	2.80	*0.02*	*0.05*	*0.09*
	American eel	F-7095	7950	46.5	217.8	9.43	0.13	4.23	*0.01*	0.09	*0.06*
	American eel	F-7096	7951	60.1	445.2	17.05	0.65	22.52	*0.04*	0.17	0.53
Delaware River @ Raccoon Creek											
	American eel	F-7086	7941	58.3	355.4	3.25	0.72	18.05	*0.02*	0.06	0.18
	American eel	F-7087	7942	60.7	478.9	12.76	2.44	81.59	0.10	0.28	*0.10*
	American eel	F-7088	7943	83.2	1317.2	13.07	2.33	74.01	*0.08*	0.14	0.34
Delaware River @ Trenton											
	American eel	F-7091	7946	45.1	191.4	0.59	*0.02*	0.56	*0.02*	*0.02*	*0.03*
	American eel	F-7092	7947	45.7	173.2	3.88	0.11	3.63	*0.02*	*0.06*	*0.05*
	American eel	F-7093	7948	65.4	482.7	2.57	0.11	3.57	*0.03*	*0.03*	*0.06*
Delaware River @ West Deptford											
	largemouth bass	F-4922	5528	44.5	1662.7	2.75	0.37	12.30	0.14	0.12	4.04
	largemouth bass	F-4923	5529	49.5	1597.4	0.98	0.18	3.28	*0.01*	0.05	0.12
	largemouth bass	F-4924	5530	46	1687.4	0.98	0.12	0.43	0.02	*0.01*	0.10

Appendix II (continued). Concentrations of dieldrin, endrin, aldrin, and endosulfans in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Concentrations below detection limit (BDL) are in italics. ND=non-detect.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	aldrin	dieldrin	endosulfan I	endosulfan II	endrin
	Common Name			cm	g	%	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
DOD Lake											
	common carp	F-4925	5531	57.6	2474.5	3.22	0.14	1.19	0.04	*0.02*	0.15
	common carp	F-4926	5532	53	1836.1	1.23	*0.10*	0.31	*0.02*	0.02	0.11
	common carp	F-4927	5533	56.7	2397.7	4.79	0.13	1.80	0.09	0.07	0.18
Furnace Lake											
	brown bullhead	F-4794	5302	35.9	616.5	1.13	*0.05*	0.02	*0.01*	*0.01*	*0.05*
	brown bullhead	F-4795	5303	33.3	524.7	1.32	*0.07*	0.02	*0.01*	*0.01*	*0.05*
	brown bullhead	F-4796	5304	27	261.4	0.57	*0.05*	0.02	*0.01*	*0.01*	*0.04*
Kirkwood Lake											
	common carp	F-4724	4961	50	3503.0	4.06	0.21	1.16	0.10	0.30	0.10
	common carp	F-4725	4962	52	2005.0	20.75	0.45	4.14	0.21	0.57	*0.06*
	common carp	F-4726	4963	53.1	2170.0	9.30	0.44	3.49	0.20	0.51	*0.05*
	largemouth bass	F-4721	4958	32.5	518.0	0.84	*0.01*	0.33	*0.02*	0.11	0.17
	largemouth bass	F-4722	4959	45.3	1405.0	0.42	*0.01*	*0.04*	*0.02*	*0.02*	*0.04*
	largemouth bass	F-4723	4960	44.5	1203.0	0.68	*0.01*	0.18	*0.01*	*0.03*	*0.03*
Lake Aeroflex											
	brown bullhead	F-4881	5487	32.4	376.0	0.83	*0.09*	0.05	*0.00*	*0.00*	*0.02*
	brown bullhead	F-4882	5488	31.5	383.7	0.82	*0.08*	0.04	*0.01*	*0.01*	*0.02*
	brown bullhead	F-4883	5489	32.4	438.2	1.98	*0.07*	0.12	0.02	*0.01*	*0.03*
	American eel	F-4878	5484	59.5	390.2	15.22	0.15	1.37	0.02	0.04	*0.07*
	American eel	F-4879	5485	55.4	327.4	16.26	*0.10*	0.95	*0.01*	*0.01*	*0.03*
	American eel	F-4880	5486	65.5	537.8	22.93	*0.10*	1.25	0.01	*0.02*	*0.06*
Lake Hopatcong (south)											
	brown bullhead	F-4797	5305	32.1	475.3	1.95	*0.08*	0.13	*0.01*	0.04	*0.03*
	brown bullhead	F-4798	5306	34.5	573.5	1.88	*0.07*	0.12	0.01	0.04	*0.05*
	brown bullhead	F-4800	5308	37.2	753.7	3.65	*0.10*	0.41	0.03	0.08	*0.04*
	walleye	F-4799	5307	42.5	730.8	0.50	*0.06*	*0.15*	*0.01*	0.08	*0.03*
	walleye	F-4801	5309	44.2	827.4	1.09	*0.07*	0.39	*0.01*	0.04	*0.05*
	walleye	F-4802	5310	49.1	1141.9	1.19	*0.09*	0.21	*0.01*	0.05	*0.06*
Lake Hopatcong (north)											
	walleye	F-7079	7934	56.7	1814.4	1.74	*0.05*	1.53	*0.02*	*0.05*	*0.10*
	walleye	F-7080	7935	58.3	2202.4	1.77	0.06	2.61	*0.01*	0.07	*0.03*
	walleye	F-7081	7936	71.1	3363.2	1.13	0.05	1.95	*0.06*	0.09	*0.14*
Lake Mercer											
	American eel	F-4654	4799	59.8	442.0	7.79	0.23	4.29	0.02	*0.02*	*0.03*
	American eel	F-4661	4809	75.2	871.0	14.13	0.35	6.60	0.01	*0.03*	*0.06*
	American eel	F-4662	4810	71.8	912.0	15.07	0.55	14.36	0.04	0.06	0.10
	channel catfish	F-4667	4815	40.9	588.0	4.27	0.38	5.24	0.10	0.09	0.11
	channel catfish	F-4669	4828	44.2	849.0	3.90	0.18	2.92	0.08	0.09	*0.06*
	channel catfish	F-4671	4830	50	1273.0	3.81	0.17	0.67	*0.01*	0.04	*0.03*

Appendix II (continued). Concentrations of dieldrin, endrin, aldrin, and endosulfans in samples from the 2010-11 Routine Monitoring of Toxics in NJ Fish program. Concentrations were determined using individual filets taken from whole fish. Concentrations below detection limit (BDL) are in italics. ND=non-detect.

Station		Analytical Number	Chem ID	Total Length (lab)	Total Weight (lab)	Total Lipids	aldrin	dieldrin	endosulfan I	endosulfan II	endrin
	Common Name			cm	g	%	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight	ng/g wet weight
Lake Musconetcong											
	brown bullhead	F-4663	4811	32.2	482.0	1.50	*0.11*	0.36	0.03	0.03	*0.05*
	brown bullhead	F-4664	4812	30.8	432.0	0.45	*0.10*	0.05	0.01	*0.01*	*0.06*
	brown bullhead	F-4665	4813	32.6	432.0	0.44	*0.10*	0.05	0.02	*0.02*	*0.02*
Little Swartswood Lake											
	brown bullhead	F-7048	7903	30.4	446.3	0.67	*0.02*	0.08	*0.02*	*0.03*	*0.05*
	brown bullhead	F-7049	7904	29.5	354.5	1.14	*0.05*	0.12	*0.02*	*0.05*	*0.05*
	brown bullhead	F-7050	7905	31.4	527.7	0.59	*0.03*	0.08	*0.02*	*0.02*	*0.06*
Merrill Creek Reservoir											
	brown bullhead	F-4666	4814	36.9	640.0	0.75	*0.10*	0.07	0.01	*0.01*	*0.02*
	brown bullhead	F-4668	4827	37.1	741.0	1.02	*0.11*	0.16	0.03	*0.01*	*0.02*
	brown bullhead	F-4670	4829	38.7	838.0	1.04	0.12	0.19	ND	*0.01*	*0.02*
	lake trout	F-4872	5389	58.2	1834.1	10.08	0.14	1.46	0.05	0.04	*0.04*
	lake trout	F-4873	5390	51.7	1463.0	9.21	0.13	1.46	0.04	0.04	0.11
	lake trout	F-4874	5391	54	1392.9	8.71	0.12	1.14	0.04	0.03	*0.05*
	lake trout	F-4875	5392	59.9	1884.3	8.80	0.12	1.43	0.04	0.05	*0.04*
	lake trout	F-4876	5393	67	3971.9	9.45	*0.11*	1.35	0.03	0.07	*0.04*
	lake trout	F-4877	5394	69	3894.0	9.28	0.12	1.63	0.05	0.05	0.10
Mirror Lake											
	American eel	F-4680	4860	59	381.0	16.21	1.51	28.77	0.07	0.13	*0.08*
	American eel	F-4681	4861	62	556.0	16.32	1.27	19.13	0.06	0.04	*0.06*
	American eel	F-4682	4862	65	555.0	4.23	1.21	18.32	0.11	ND	*0.06*
Mountain Lake											
	common carp	F-7070	7925	66.2	3635.3	1.21	*0.02*	0.22	ND	*0.03*	*0.07*
	common carp	F-7071	7926	61.8	3316.2	6.44	*0.03*	0.57	*0.07*	0.06	*0.09*
	common carp	F-7072	7927	67.2	4068.9	8.02	0.08	0.84	*0.05*	0.07	*0.03*
Paulinskill Lake											
	common carp	F-7061	7916	48.6	1405.1	1.31	*0.03*	0.18	*0.02*	*0.01*	*0.04*
	common carp	F-7062	7917	47.9	1409.4	0.89	*0.05*	0.20	*0.07*	0.21	*0.08*
	common carp	F-7063	7918	51.2	1683.4	1.04	*0.03*	0.18	*0.01*	*0.02*	*0.03*
Peddie Lake											
	American eel	F-4677	4833	60.7	452.0	13.32	4.80	98.78	0.21	0.26	0.74
	American eel	F-4678	4834	54.6	331.0	15.79	5.22	96.19	0.04	0.08	0.35
	American eel	F-4679	4835	62.4	521.0	20.36	5.37	115.25	0.31	0.57	1.65
	largemouth bass	F-4730	4999	39.4	904.9	0.50	0.05	4.19	ND	0.28	*0.10*
	largemouth bass	F-4731	5000	44.5	1400.0	0.65	*0.04*	2.45	ND	0.07	*0.08*
	largemouth bass	F-4732	5001	46	1750.0	0.79	0.07	4.46	*0.02*	*0.04*	*0.05*
Saw Mill Pond											
	American eel	F-4867	5384	60.4	348.9	17.51	*0.08*	0.70	0.02	0.07	*0.08*
	American eel	F-4868	5385	57	368.0	18.04	*0.11*	0.60	0.01	0.05	*0.02*
	American eel	F-4870	5387	56.7	369.7	13.82	0.11	0.98	0.02	0.04	*0.05*
Steenykill Lake											
	American eel	F-4866	5383	55.9	312.5	29.06	*0.08*	1.02	0.08	0.12	*0.06*
	American eel	F-4869	5386	51.7	245.9	26.65	*0.08*	0.83	0.08	0.09	*0.05*
	American eel	F-4871	5388	71.5	692.0	11.99	*0.10*	0.54	ND	0.05	ND
Swartswood Lake											
	American eel	F-4917	5523	51.5	232.1	0.80	*0.11*	0.04	0.01	*0.01*	*0.08*
	American eel	F-4918	5524	73.8	932.0	27.50	0.14	2.18	0.01	*0.03*	0.34
White Lake											
	American eel	F-4887	5493	61	466.6	15.72	*0.11*	0.55	*0.01*	*0.01*	*0.04*
	American eel	F-4888	5494	54.7	322.6	27.34	*0.11*	1.10	*0.01*	*0.01*	*0.07*
	American eel	F-4889	5497	53.8	307.7	23.66	*0.10*	0.84	*0.01*	*0.01*	*0.03*