PCBs and Organochlorine Pesticide Residues in Young-of-Year Fish From New and Traditional Near-shore Sampling Areas in the Western Portion of New York State's Great Lakes Basin, 2009

(Includes temporal trends for Aroclor 1254/1260 and p,p'-DDE, 1984 - 2009)

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Division of Fish, Wildlife and Marine Resources
New York State Department of Environmental Conservation
Albany, NY

January 2011

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ABSTRACT

In September 2009, 144 young-of-year (y-o-y) fish composites were collected from near-shore areas within the western portion of New York State's Great Lakes Basin for polychlorinated biphenyl (PCB) and organochlorine (OC) pesticide residue monitoring. Samples were from 14 traditional locations and six new sites that extended from Dunkirk to Olcott, NY. Besides noting changes in contaminant levels since the last (2003) sampling, seven traditional sites with three or more years of Aroclor1254/1260 and p,p'-DDE data were used for trend analysis. Data from new sampling locations were used primarily to isolate contaminant sources or determine the efficacy of past remedial efforts. The trend for Aroclor 1254/1260 and DDE generally showed levels that continue to decline but this is, in some cases, site specific.

The most commonly detected chemical analytes in y-o-y fish were PCB and p,p'-DDE. Other contaminants measured above method detection limits included p,p'-DDD; p,p'-DDT; Mirex; HCB, and alpha and beta HCH. Twelve sites with total PCB concentrations in y-o-y fish that ranged from 110 to 562 ug/Kg wet weight were found to exceed the 1:100 dietary cancer risk standard designed to protect PCB-sensitive mink. The most PCB-contaminated of these sites were: Gill Creek (Buffalo Avenue), Twomile Creek, Gratwick- Riverside Park and upstream Bergholtz Creek. Four other sampling locations [Cayuga Creek (Lindberg Avenue and Porter Road), and the upstream and downstream Little River] exceeded the non-detect Mirex objective designed to protect piscivorus wildlife. Recommendations are presented for sites needing additional remediation.

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INTRODUCTION

The New York State Department of Environmental Conservation (NYSDEC) and its northern counterparts, the Ministry of the Environment (MOE), Ontario, Canada have used young-of-year (y-o-y) fish for monitoring persistent organic contaminants in the Great Lakes Basin dating back into the 1970s (Preddice et al, 2006, 2002, 1998; Skinner et al, 1994, 1989; Suns et al, 1993, 1985, 1983, 1978). NYSDEC has continued this monitoring on an approximate five-year cycle and in this document reports 2009 findings for the western portion of New York State's Great Lakes Basin.

Y-o-y fish are excellent bio-monitors because they are ubiquitous, relatively abundant, are localized near shore in calm waters and have a limited exposure period of only 4 - 6 months when sampled in the fall in New York State. During this short period they can bioaccumulate organic compounds of concern such as polychlorinated biphenyls (PCB) and organochlorine (OC) pesticides. For these reasons y-o-y fish are helpful for finding localized contamination and are helpful for determining the efficacy of cleanup efforts at specific hazardous waste sites. Since there is a fairly extensive (three or more years), historical record of data for seven sampling locations, temporal trends are examined for PCBs (Aroclor 1254/1260) and p,p'-DDE.

METHODS

Sampling

Due to New York State financial constraints only the western portion of the Great Lakes Basin was visited in 2009. The eastern portion will be sampled in the future when resources become available. Y-o-y fish from traditional locations were last sampled in 2003 (Preddice et al, 2006). In 2009, 28 sites were visited from Dunkirk Harbor on Lake Erie, down the Niagara River and across the southern shore of Lake Ontario to Sodus Point (Table 1). The traditional Dunkirk Harbor and Niagara River (Lewiston) sites were again sampled to provide data for contaminants entering and leaving the heavily industrialized Niagara River. Beaver Island State Park and the new Niawanda Park sites, located upstream from the industrialized zone, basically serve as upstream Niagara River control sites. The upstream and downstream Little River sites, as well as sites in Twomile, Cayuga, Bergholtz and Gill Creeks, and two new Niagara River sites were selected to help isolate suspected contaminant sources and, in specific cases, to provide contaminant data that may help determine the efficacy of past remedial activities. The traditional Krull Park site at Olcott was retained primarily to reflect PCB levels to Lake Ontario from nearby Eighteenmile Creek. Sampling in 2009 proved unsuccessful at the Rochester and Sodus Bay sites included in previous monitoring.

Target Species: Because of great abundance, y-o-y spottail shiner, *Notropis hudsonius,* was selected as the primary target species for contaminant monitoring studies through about 1992. In 1996, NYSDEC switched to the nearly ubiquitous bluntnose minnow, *Pimephales notatus,* because the abundance of spottail shiner decreased significantly at most traditional sampling locations. Since then, where spottail shiner and bluntnose minnow were sparse, other fairly common species, e.g. emerald shiner (*Notropis atherinoides*), golden shiner (*Notemigonus crysoleucas*), common shiner (*Luxilus cornutus*), creek chub (*Semotilus atromaculatus),* and river chub (*Nocomis micropogon*) have been saved as needed. [*Note: The river chubs collected at Beaver Island State Park were initially thought to be a localized color variation of the bluntnose minnow and, at Mike Wilkinson's (Fisheries- Region 9) suggestion, their identification was later verified by the Project Leader with the aid of a microscope. A few river chubs were collected at other Niagara River sites but were not included in composites.]*

Collection, Quotas and Handling: Y-o-y fish were collected with a 25-foot-long, 3/16-inch mesh haul seine equipped with center bag. Sampling instructions requested seven composites with 15 y-o-y fish of the same species from each site. During collection, live fish were carefully placed into a food-grade, one-gallon plastic bag with site water until sufficient numbers were obtained. These fish were carried in a small cooler with ice to ensure freshness and to maintain sample integrity. Shortly after collection, individual fish were sorted to species and their total length (TL) was measured to the nearest millimeter. Where fish were abundant, representative individuals of about the same total length were selected for the composites to be analyzed. Each composite was weighed to the nearest 0.1 gram and placed into a hexane-rinsed aluminum foil envelope. Each envelope was folded shut and sealed within a labeled one-quart food-grade freezer bag. Composites from each site were collectively placed in a labeled one-gallon freezer bag and immediately frozen in a larger cooler with dry ice. At the end of each sampling week, frozen samples were transferred by the Project Leader to a secure freezer (~ 20EC) located at the Hale Creek Field Station (HCFS), Gloversville, NY. Here, chemical analyses of the y-o-y fish composites were performed by the Analytical Services Unit (ASU).

Sample Processing and Lipid Extraction

The Project Leader partially thawed samples by location, and with a stainless steel scalpel finely diced each composite. Tissue samples were weighed and placed in clean, glass jars and returned to the freezer. Later, frozen tissue samples were freeze dried for approximately 20 – 24 hours and subsequently pulverized with a stainless steel spatula. To obtain the lipid portion of each composite, freeze dried samples were placed on a soxhlet extractor system for about seven hours. Soxhlet extraction was accomplished with 200mL of a 1:1 hexane-acetone solution that was eventually roto-evaporated to dryness which allowed percent lipid and percent moisture to be determined.

Prior to chemical analysis, approximately 0.1 g of sample lipid from each composite was dissolved in hexane and transferred to a glass clean-up column containing 10 g of activated Florisil and 5g of anhydrous sodium sulfate. The sample was eluted with 200 mL of 6% ethyl ether/ petroleum ether and dried with a rotary evaporator. The remaining fraction was diluted with iso-octane containing octachloronaphthalene as an internal standard.

Chemical Analysis

Samples were analyzed for AR1242 and AR1254/1260, and 19 OC pesticides (DDT metabolites; Aldrin; alpha, beta and gamma HCH; Chlordane metabolites; HCB; Heptachlor; Heptachlor epoxide; Mirex and Photomirex) by capillary gas chromatography with an electron capture detector (GC-ECD) following *Standard Operating Procedure OC1.105* adopted by the ASU (USFDA, 1989). In addition, at least ten percent of selected samples with PCB and OC pesticides were qualitatively analyzed by gas chromatography-mass spectrophotometry (GC-MS) to confirm the presence of low level residues. Method Detection Limits (MDLs) and Estimated Quantitation Limits (EQLs) used by the ASU are presented (Table 2).

Quality Control

Calibration of the GC was accomplished with a five-point external standard. For every 20 samples one method blank, one replicate (duplicate), one spiked matrix blank, and one fish tissue reference material *(Coho salmon collected 10/18/2000 from the N. Y. S Salmon River Fish Hatchery)* were analyzed. Criteria for control limits were obtained from *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories* (USEPA, 1994). Control limits for accuracy were based on accepted percent recoveries that ranged from 50 to 150%. Control limits for precision were based on mean relative standard deviations (RSD) of less than or equal to 50% for matrix spikes, reference material and replicate analyses. The MDLs of the various analytes were used to assess potential contamination.

Data Reporting

Analytical data for each composite were reported in micrograms per kilogram (ug/Kg wet weight). Lipid-adjusted values were included primarily for possible future comparisons. *Note: concentrations less than MDLs are "represented" by zeros on data tables.* Site means with composite values less than MDLs were calculated with and without zeros, and are presented as a range. This represents a change from NYSDEC reports prior to 2003 which used one-half the method detection limits for concentrations less than MDLs.

Protective Wildlife Criteria

To determine sites with contaminants that exceed protective piscivorus wildlife criteria, individual composite values and site means for each analyte detected in y-o-y fish were compared to water quality objectives for the Great Lakes (IJC, 1988), and to the NYSDEC 1:100 dietary cancer risk and non-carcinogenic criteria designed to protect sensitive fish-eating wildlife species (Newell et al, 1987). This protective approach assumes that humans living around the Great Lakes Basin do not consume young-of-year fish.

Temporal Trends for PCB and DDE

To determine temporal trends for contaminants in y-o-y fish, seven traditional N.Y. State Great Lakes Basin locations were selected with AR1254/1260 and p,p'-DDE data for three or more years dating back to 1984 (Table 12). To eliminate any effects due to different laboratories and analytical methods only data from samples analyzed by NYSDEC's Analytical Services Unit at the Hale Creek Field Station were selected. AR1016 data were initially included for trend analysis but were eventually dropped since only three locations (Dunkirk Harbor, Gratwick-Riverside Park and Lewiston) had AR1016 data for 3 or 4 years and because most of these values were <MDL. With the aid of SPSS software these analytical data were used to create Box Plots to visually assess temporal trends for AR1254/1260 and DDE at the various sites, by species and year (Figures 10 – 23).

For ten other traditional sampling sites there were only two years (1997 and 2009) with data which is insufficient information to determine long-term trends. However, a comparison of contaminant concentrations in fish from these sites provides some insite to change (Table 8).

These data will likely become more important as the data base for these sites grows.

RESULTS

General

On September 17, 2009 144 y-o-y fish composites collected from August 31 - September 16 from 20 near-shore sites in the western portion of New York State's Great Lakes Basin were delivered to the ASU at the Hale Creek Field Station for chemical analysis. Samples were from 14 traditional sites and six new sites. Also, unsuccessful sampling attempts were made to collect y-o-y fish from Rochester, Sodus Bay, Bergholtz Creek at Williams Road and Cayuga Creek at Lockport Road, and from four new sites which included Niagara River upstream from Twomile Creek, old Black Creek, Lake Ontario at Sodus Point and Gill Creek above Hyde Park Lake. Table 1 presents the number of composites, species and provides a brief location description for each site.

2009 Species Breakdown

- bluntnose minnow (BN) – 86 composites (60%) from 16 sites
- emerald shiner (ES) – 21 composites (14%) from 3 sites
- golden shiner (GS) – 14 composites (10%) from 2 sites
- spottail shiner (ST) – 10 composites (7%) from 2 sites
- common shiner (CS) – 7 composites (5%) from 2 sites
- river chub (RC) – 5 composites (4%) from 1 site
- creek chub (CC) - 1 composite (<1%)

Table 3 presents total lengths (range and mean) and weight for each composite. Table 4 summarizes this field data, by site and species. Mean lengths for all species ranged from 27.1 to 50.8 mm. The larger value is still small enough to assure that most, if not all, fish kept for chemical analysis are young-of-year. In retrospect, a few of the larger fish in the five composites (one creek chub composite and four common shiner composites) from Cayuga Creek at Porter Road should have been aged because some may have been of the 1+ year class instead of y-o-y. Typically, these larger fish would have been discarded but at this site they were saved for chemical analysis because sufficient numbers of smaller fish were unavailable.

Ninety-one of the 144 y-o-y fish composites weighed between 6 and 10 g and 44 composites exceeded 10 g. Only nine composites weighed less than 6 g (Table 3). To provide at least five grams of fish tissue for chemical analyses, 36 composites with several very small fish included 25, 30 or 40 fish per composite instead of the typical 15 (Table 3). Eight composites had less than 15 fish, including the five composites with 5 to 10 larger fish from Cayuga Creek at Porter Rd.

The range in percent lipid values for individual y-o-y fish composites ranged from 1.51 to 4.92% with river chub having the highest mean of 3.99%. Bluntnose minnow and golden shiner had lower and nearly identical percentages of 2.23% and 2.24%, respectively.

Range and Mean Percent Lipid (and percent standard deviation) by Species

- bluntnose minnow (BN) 1.51 – 4.09, mean = 2.23(0.61%)
- emerald shiner (ES) 1.66 – 4.02, mean = 2.97(0.91%)
- golden shiner (GS) 1.66 – 2.83, mean = 2.24(0.45%)

- river chub (RC) 3.32 – 4.92, mean = 3.99(0.65%)
- common shiner (CS) 2.42 – 4.17, mean = 3.17(0.88%)
- spottail shiner (ST) 2.50 – 3.46, mean = 2.83(0.54%)
- creek chub (CC) 3.27% (1 composite)

Contaminants Detected in 2009 Y-o-y Fish

- AR1242
- AR1254/1260
- p,p'-DDE
- p,p'-DDD
- p,p'-DDT
- HCB
- Mirex
- HCH (alpha and beta isomers)

Total PCB - Table 5 shows that mean total PCB (sum of AR1242 and AR1254/12160) for composites of y-o-y fish ranged from <MDL for Beaver Island State Park composites to greater than 300 ug/Kg wet weight for composites from Twomile Creek (CS – 381, ES – 336 and ST – 432 ug/Kg) and Gill Creek at Buffalo Avenue (ST – 332 and BN – 395 ug/Kg). The greatest total PCB concentration of 562 ug/Kg wet weight was for a bluntnose minnow composite from Gill Creek at Buffalo Avenue. Ten other sites had mean total PCB values between 100 and 201 ug/Kg wet weight (Table 5).

AR1242 – This Aroclor, the lighter of the two PCB Aroclors, was undetected in y-o-y fish composites from Beaver Island State Park and from Dunkirk Harbor. However, with the exception of one upper Gill Creek composite, AR1242 was detected in all other (129) y-o-y fish composites (Table 5). Fifteen of these 129 composites had only the lighter AR1242 while the remainder had both Aroclors. The 15 composites with only AR1242 included four from the Buffalo River, six from the upper Niagara River at Niawanda Park and five from the lower Niagara River at Lewiston. The three sites with the highest mean AR1242 levels (wet weight) in y-o-y fish included Gill Creek at Buffalo Avenue (BN – 230, ST- 197 ug/Kg), Twomile Creek (ST – 216, ES – 182 and CS – 176 ug/Kg) and Gratwick-Riverside Park (BN – 123 ug/Kg).

AR1254/1260 – This PCB Aroclor was detected in 119 of the 144 y-o-y fish composites and similar to AR1242 was not found in any composites from Beaver Island State Park (Table 5). The sites with the three greatest mean concentrations were Twomile Creek (CS – 205, ST – 216 and ES – 154 ug/Kg wet weight), Gill Creek at Buffalo Avenue (ST – 134, BN – 165 ug/Kg wet weight) and upstream Bergholtz Creek (GS – 142 ug/Kg wet weight). Mean AR1254/1260 levels comprised about 50, 40 and 70 percent of the mean total PCB at these three sites, respectively. Fish from the former two sites also have the two most elevated AR1242 levels.

Total DDT – Total DDT in this report represents the sum of three DDT metabolites: p,p'-DDE; p,p'-DDD and p,p'-DDT. Ortho para (2,4') metabolites were unconfirmed via GC-MS analysis. The highest mean total DDT level of 37.3 ug/Kg wet weight was in fish from Cayuga Creek at Porter Road (Table 6). Five other sites had mean total DDT levels of about 10 to 18 ug/Kg wet weight (Table 6). The other 14 sites had mean total DDT levels of <10 ug/Kg wet weight and most of these totals was due to p,p'-DDE.

DDE – Low concentrations of this primary DDT metabolite were detected in 133 of the 144 composites analyzed. The ten composites with levels <MDL of 2 ug/Kg were from the two upstream Niagara River sites at Beaver Island State Park and Niawanda Park, and from the Buffalo River. The greatest mean DDE concentration of 24.3 ug/Kg wet weight was for fish from Cayuga Creek at Porter Road. Here DDE comprised 65% of total DDT. Composites from upstream Bergholtz Creek had a mean DDE level about one-half this amount. The low mean DDE concentration for composites from Twomile Creek, Erie Canal, Cayuga Creek at Lindberg Avenue, Gill Creek at Buffalo Avenue (ST) and from Lake Ontario (Krull Park) ranged from about 7 – 9 ug/Kg wet weight. The remaining composites had even less (Table 6).

DDD – Table 6 shows this DDT metabolite was detected in 47 (33%) y-o-y fish composites from about one-half of the sites. The highest mean DDD level of 13.0 ug/Kg wet weight was measured in common shiner from Cayuga Creek at Porter Road. It was detected at 4 – 7 ug/Kg wet weight in all y-o-y fish composites from Twomile Creek and Cayuga Creek at Lindberg Avenue. Elsewhere it was detected at lower levels or was <MDL.

DDT – The use of this commercial insecticide product was banned in New York State in 1970 yet the metabolite p,p'-DDT was still measured in 61 (42%) of 144 y-o-y fish composites. Low levels of 2 – 7 ug/Kg wet weight were detected in all composites from Twomile Creek, upstream Bergholtz Creek, Cayuga Creek at Lindberg Avenue and Gill Creek at Buffalo Avenue, and in 6 of 7 composites from downstream Bergholtz Creek and downstream Little River (Table 6). The greatest mean p,p'-DDT level of 5.65 ug/Kg wet weight was in young bluntnose minnow from Gill Creek at Buffalo Avenue.

HCB – Residues (2.19 – 3.9 ug/Kg wet weight) of this OC pesticide were detected in only 13 (9%) y-o-y fish composites; three from Pettit Flume and Cayuga Creek at Porter Road, and all seven composites from Gill Creek at Buffalo Avenue (Table 7). The highest mean of 2.3 ug/Kg wet weight from the latter site is only slightly above the MDL.

Mirex – This OC product was measured in 26 (18%) of the 144 y-o-y fish samples. It was detected in all composites from both Little River sites and from both Cayuga Creek sites. The greatest mean of 27.5 ug/Kg wet weight was at the Cayuga Creek - Porter Road site where composites had 23.8 – 52.6 ug/Kg wet weight. At the other sites where Mirex was detected, concentrations were less than 10 ug/Kg wet weight (Table 7).

alpha HCH – Residues of this OC pesticide were detected only in the nine y-o-y fish composites from Gill Creek at Buffalo Avenue (Table 7). The two spottail shiner composites collected at this site had a mean of 37.3 ug/Kg wet weight and the seven bluntnose minnow composites had a mean of 25.1 ug/Kg wet weight. The highest concentration of 42.5 ug/Kg wet weight was in one bluntnose minnow composite.

beta HCH – Residues of this HCH isomer were also measured only in Gill Creek fish. Table 7 shows it was detected in the nine composites from the downstream Buffalo Avenue site and at lower levels in 6 of 7 composites from the upstream site at Ferry Street. At Buffalo Avenue the mean for the two spottail shiner composites was 21 ug/Kg wet weight and that for the seven bluntnose minnow composites was 16 ug/Kg wet weight. The bluntnose minnow composites from upstream had a smaller mean of 5 ug/Kg wet weight.

Sample Integrity and Quality Control

The Project Leader transferred excellent quality, frozen y-o-y fish composites to the freezer at HCFS at the end of each September collection week. From late November to mid-December he assisted the ASU by processing and freeze-drying the samples to shorten the time prior to chemical analysis. Shortly thereafter, the ASU began the soxhlet extraction and sample cleanup steps which were followed by the GC chemical analyses in January and February 2010. By mid-March 2010, analytical data were released after GC-MS confirmation and quality control checks were completed. All quality control data (%R and %RSD) were within acceptable limits and demonstrated very good precision and accuracy (Table 10).

Method Blanks – For this project, nine method blanks were processed through the entire extraction, clean-up and analytical process to identify potential laboratory or instrument contamination. Analyte concentrations for each method blank were less than the respective MDLs (Table 10).

Replicate (dupl.) Analyses – Nine replicate analyses (labeled as dupl. on Tables 5 - 7) were performed for this project. Mean percent relative standard deviations (RSD) for both PCB Aroclors; p,p'-DDE; p,p'-DDD; p,p'-DDT and Mirex were low and ranged from 2.78 to 3.78 Table 10). The highest mean RSD of 4.01 was for HCB. Mean percent RSDs for other analytes in replicates were even less.

Reference Material – Nine reference material analyses were performed but only four analytes (AR1242; AR1254/1260; p,p'-DDE and Mirex) had sufficient levels to evaluate accuracy. Mean percent recoveries for these ranged from 98.5 to 116%, and mean RSD ranged from 4.17 to 6.67% (Table 10).

Matrix Spikes – Nine matrix spike analyses were performed; three without a fish oil additive and six subsequent analyses with the oil additive to enhance percent recovery of AR1242. Mean percent recovery of AR1242 with fish oil showed slight improvement for 14 of 21 analytes listed (Table 10). Percent relative deviations for these analytes in the spiking solutions ranged from a low of 2.28% for Aldrin to a high of 15.69% for alpha-HCH (Table 10).

DISCUSSION

Sampling

Budgetary constraints in 2009 caused this Great Lakes Basin y-o-y fish contaminant monitoring project to be divided into two separate projects. Fish for the western project, which this report describes, were sampled in 2009. Sites in the eastern portion are to be visited when resources become available. The 2009 y-o-y fish were collected from 20 locations that extended from Dunkirk on Lake Erie to Krull Park on Lake Ontario. Sampling locations included 14 traditional sites primarily for monitoring purposes, as well as, six new locations selected to help isolate previously suspected sources or to help evaluate the efficacy of remediation.

Analytes Detected in Y-o-y Fish

PCB AR1242 – This Aroclor was detected in 129 (90%) of the 144 fish composites at concentrations that ranged from less than the MDL of 10 ug/Kg) to 349 ug/Kg wet weight in one composite from Gill Creek at Buffalo Avenue (Table 5). AR1242 was not detected in any fish composites from upstream control sites at Dunkirk Harbor or Beaver Island State Park and was the only Aroclor detected in fish from Buffalo River (n=4), Lewiston (n=5) and Niawanda Park (n=6) (Table 5). The sites with the three highest mean AR1242 concentration included Gill Creek at Buffalo Avenue (BN – 230 and ST – 197 ug/Kg wet weight), Twomile Creek (BN – 216, ES – 182 and CS – 176 ug/Kg wet weight), and Gratwick-Riverside Park (BN – 123 ug/Kg wet weight).

At the new Niagara River site located between Pettit Flume and Gratwick-Riverside Park, mean AR1242 level (72.9 ug/Kg wet weight) in y-o-y fish was about five times greater than the mean upriver at Niawanda Park (14.5 ug/Kg wet weight) (Table 5). This increase probably reflects the impact of AR1242 input from Twomile Creek and the Erie Canal and, perhaps from the nearby waste treatment plant or contaminated storm sewers. The reason for the increase is not Pettit Flume which had a low mean AR1242 level that was nearly the same as at Niawanda Park (Table 5).

A short distance downstream at Gratwick-Riverside Park, the mean AR1242 level in y-o-y fish increased to 123 ug/Kg wet weight. This increase indicates another nearby PCB source which is likely the adjacent landfill adjacent to and under part of Gratwick-Riverside Park.

Further downstream at the upstream edge of the 102nd Street Landfill and at the upstream Little River site, the mean AR1242 levels in y-o-y fish were practically the same (66.6 and 60.4 ug/Kg), which is about one-half that at Gratwick-Riverside Park. This demonstrates no additional input of AR1242 at these two locations and shows the effect Niagara River dilution.

The mean AR1242 concentration for y-o-y fish from the downstream Little River decreased further and was about one-half that of fish from the upstream Little River site. Disregarding the dilution effect of the Niagara River, this indicates no significant contribution of AR1242 from Cayuga or Bergholtz Creeks, despite greater mean AR1242 levels in fish from these two tributaries (Table 5).

The traditional upstream Bergholtz Creek site at Williams Road had very low flow in September 2009 and insufficient numbers of fish to make even one composite of y-o-y fish. Therefore, two new Bergholtz Creek stations, both accessible by boat, were established further downstream at sites located upstream and downstream from old Black Creek, which in itself was also devoid of fish. *[As part of the Love Canal remedial package, most of Black Creek was rerouted several miles upstream through culverts where it rejoins Bergholtz Creek.]* Young golden shiner composites from the new upstream and new downstream Bergholtz Creek sites had mean AR1242 levels of 58.4 and 30.8 ug/Kg wet weight, respectively. The greater mean at the upstream site may indicate the presence of an upstream PCB source or may reflect the beneficial effect of Love Canal-related remedial dredging downstream nearer the confluence with Cayuga Creek.

The mean AR1242 level in fish from Cayuga Creek at Lindberg Avenue, located in an un-remediated section of creek, was 35.2 ug/Kg wet weight, a level between that of fish from the downstream Bergholtz Creek and downstream Little River sites. Fish from the upstream Cayuga Creek site at Porter Road site had a mean AR1242 level (40.9 ug/Kg wet weight) that was a little higher than the mean at Lindberg Avenue or at the downstream Bergholtz Creek site which suggested the presence of a PCB source to Cayuga Creek upstream from Porter Road. A 2005 contaminant track-down study, which utilized Passive In-Situ Chemical Extraction

Samplers (PISCES) as well as y-o-y fish, focused on Cayuga Creek upstream from Porter Road. This study isolated a PCB source leading to a large hanger building at the Niagara Falls Air Reserve Station (Preddice and Trometer, 2007). *[In 2009 an attempt was made to collect y-o-y fish at the semi-traditional Lockport Road site located upstream from the air base but insufficient numbers were collected.]*

Much further downriver in another Niagara River tributary known as Gill Creek (Buffalo Avenue site), y-o-y fish had the highest mean AR1242 level of 230 ug/Kg wet weight detected in this study. This mean is about 20 times greater than the mean for fish from Ferry Street located less than one mile upstream (Table 5). Another difference between the two Gill Creek locations is that AR1242 comprised only 17% of the mean total PCB in upstream fish but nearly 60% of the mean total PCB at the downstream site. The lower section of Gill Creek, which is adjacent to the DuPont Chemical includes the Buffalo Avenue y-o-y fish site, has previously undergone two remedial cleanup projects. The 2009 y-o-y fish contaminant data indicate this location is still very contaminated and in need of more remedial investigation. Much of Gill Creek between Buffalo Avenue and Ferry Street is relatively flat, 2 – 4 feet deep and has sluggish laminar flow which allows fine sediment to accumulate in this section during frequent changes in Niagara River levels. Although not analyzed for this project, this sediment is very likely quite contaminated and should be dredged in any future remedial projects.

At the most downstream Niagara River site at Lewiston, the mean AR1242 level in y-o-y fish decreased to 19.7 ug/Kg wet weight which is a level similar to that for fish from the upstream Niagara River reference site at Niawanda Park (Table 5).

At the only 2009 Lake Ontario site (Krull Park at Olcott, NY), the mean AR1242 level in y-o-y fish was moderate (82.5 ug/Kg wet weight) (Table 5). This mean was expected to be similar to the mean (19.7 ug/Kg wet weight) for fish from Lewiston. However, the nearly 60 ug/Kg increase likely reflects the effect of PCB contamination from nearby Eighteenmile Creek).

PCB AR1254/1260 - The heavier PCB Aroclor 1254/1260, which has a greater tendency to bioaccumulate in fish, was detected in 119 (83%) of the 144 y-o-y fish composites at concentrations that ranged from just above the MDL of 30 ug/Kg to a high of 216 ug/Kg wet weight at Twomile Creek (Table 5). Similar to AR1242, AR1254/1260 was not detected in fish collected at Beaver Island State Park, and was detected in only 1 of 7 composites from Niawanda Park and 2 of 7 composites from Lewiston. With the exception of these three sites and four composites from the Buffalo River, AR1254/1260 was detected in all other y-o-y composites. Table 5 shows the three highest mean AR1254/1260 levels were for fish from Twomile Creek (ST – 216, CS – 205 and ES – 154 ug/Kg wet weight); Gill Creek at Buffalo Avenue (BN – 165 and ST – 134 ug/Kg wet weight) and from the upstream Bergholtz Creek site (GS – 142 ug/Kg wet weight). The former two sites had the highest mean AR1242 levels as well. Fish from Gill Creek at Buffalo Avenue had a mean level 2-3 times greater than that at Ferry Street located a short distance upstream. This demonstrated that this twice remediated downstream Gill Creek site adjacent to DuPont Chemical is still seriously contaminated and worthy of further investigation.

Compared with the upstream Niagara River site at Niawanda Park, mean AR1254/1260 levels in y-o-y fish more than doubled (64.7 ug/Kg wet weight) that downstream at the new Niagara River site between Pettit Flume and Gratwick-Riverside Park. This increase is likely due to input from Twomile Creek, the Erie Canal or perhaps from the nearby waste treatment plant or contaminated storm sewers rather than from nearby Pettit Flume where the AR1254/1260 mean was less (48.1ug/Kg wet weight). Further downstream in the Niagara

River at Gratwick-Riverside Park the mean AR1254/1260 level in fish increased slightly. This increase, similar to that for AR1242 was likely due to input from the adjacent landfill. A short distance downriver at the upstream edge of the 102nd Street Landfill the mean AR1254/1260 level was virtually the same as at Gratwick-Riverside Park (Table 5). This demonstrated no additional AR1254/1260 input. Further downriver at the upstream Little River site, Niagara River dilution reduced the mean AR1254/1260 for y-o-y fish to 56.6 ug/Kg wet weight. At the downstream Little River site the mean increased slightly to 68.9 ug/Kg wet weight which likely reflects the influence of three un-remediated areas: upper Bergholtz Creek, Little River near the102nd Street Landfill and lower Cayuga Creek (Lindberg Avenue).

The AR1254/1260 means for y-o-y fish from upper Bergholtz Creek (142 ug/Kg wet weight) and from Cayuga Creek at Lindberg Avenue (83.2 ug/Kg wet weight) were greater than the mean (51.6 ug/Kg wet weight) for upstream fish from Porter Road (Table 5). The PCB source that affects fish at Porter Road appears to be a separate source because the two PCB Aroclors comprise 40 and 60% of the mean PCB total at Porter Road whereas they comprise 30 and 70% of the mean PCB total for the two Bergholtz Creek sites and the Lindberg Avenue site. This is also supported by the 2005 PISCES contaminant track-down study that located a separate PCB source in drainage leading to a large hanger building at the Niagara Falls Air Reserve Station (Preddice and Trometer, 2007). The greater mean total PCB in upstream Bergholtz Creek fish may also indicate an upstream source. The lower mean at the downstream site may reflect the beneficial effect of remedial dredging performed nearer the mouth of this creek.

The mean AR1254/1260 concentration for y-o-y fish collected from Lake Ontario at Krull Park was anticipated to be similar to that for fish from the Niagara River at Lewiston but instead was four times higher (36.9 versus 9.10 ug/Kg wet weight) which is likely due to AR1254/1260 from Eighteenmile Creek.

Table 9 shows that mean total PCB for y-o-y fish composites from 13 of the 20 locations sampled exceed the 110 ug/Kg total PCB criterion designed as the 1:100 dietary cancer risk concentration for PCB-sensitive mink (Newell et al, 1987). The downstream Bergholtz Creek site was included at the bottom of Table 9 because at least two composites from that location had PCB totals only slightly less than the protective criterion.

p,p'-DDE - This primary metabolite of the banned, commercial insecticide product DDT, was detected in 133 (92%) of the 144 y-o-y fish composites which just barely made it the most common contaminant in 2009 y-o-y fish. DDE was <MDL in a few composites from the upper Niagara River (Beaver Island State Park and Niawanda Park), and from the Buffalo River (Table 6). The relatively low levels in composites ranged from just above the MDL of 2 ug/Kg wet weight to 30 ug/Kg wet weight in Cayuga Creek fish from Porter Road where the highest mean DDE of 24.3 ug/Kg wet weight occurred. This relatively low but more elevated level for this study suggests an upstream source such as a landfill or an area with contaminated fill. The next two highest mean levels of 10.04 and 9.24 ug/Kg wet weight were measured in fish from upstream Bergholtz Creek and from Krull Park (Lake Ontario, Olcott), respectively. The level at Krull Park was expected because this site lies in the "Fruit Belt" along the southern shore of Lake Ontario where DDT was applied in orchards for many years prior to 1970. The upstream Bergholtz Creek number supports the PCB data which may indicate an upstream source.

p,p'-DDD –This DDT metabolite was detected in only 22 (15%) y-o-y fish composites at low levels that ranged from just above the MDL of 2 ug/Kg wet weight to 14.4 ug/Kg wet weight at Cayuga Creek (Porter Road) (Table 6). DDD was detected in all y-o-y fish composites from

Cayuga and Twomile Creeks. Data indicate an upstream source to both creeks, particularly for Cayuga Creek because the mean level at the upstream Porter Road was greatest, 13.0 versus 3.84 ug/Kg wet weight. A few composites from both Gill Creek sites also demonstrated residues of DDD contamination from somewhere upstream in this Niagara River tributary.

p,p'-DDT - Residue of the this commercial insecticide was detected in 62 (43%) of the 144 y-o-y fish composites. The very low levels ranged from just above the MDL (2 ug/Kg) to 7.28 ug/Kg wet weight at the Buffalo Avenue site on Gill Creek (Table 6). It was detected in all composites from Twomile Creek, Cayuga Creek at Lindberg Avenue, Gill Creek at Buffalo Avenue, upstream Bergholtz Creek, and in 6 of 7 composites from the downstream Bergholtz Creek and downstream Little River sites. The presence of p,p'-DDT in fish from Twomile Creek and lower Gill Creek are suggestive of localized upstream sources. The p,p'-DDT in fish from the downstream Little River site probably reflects material washed downstream mostly from Cayuga Creek and Bergholtz Creek. The concentrations from lower Cayuga Creek (Lindberg Avenue) and from the two Bergholtz Creek sites are similar and may be due to an upstream source to Bergholtz Creek. This is supported by 2005 PISCES data that shows p,p'-DDT in y-o-y fish from upper Bergholtz Creek (Walmore Road) but not in fish from Cayuga Creek at Porter or Lockport Roads (Preddice and Trometer, 2007). Mean total DDT was greatest (37.3 ug/Kg wet weight) in y-o-y fish from Cayuga Creek at Porter Road followed by the mean total DDT in fish from Twomile Creek (22.7 ug/Kg wet weight) and from upstream Bergholtz Creek (14.3 ug/Kg wet weight) (Table 6). Mean total DDT (DDD +DDE+DDT) levels in y-o-y fish from all 20 y-o-y fish sites sampled in 2009 were far below the 200 ug/Kg criterion designed to protect sensitive wildlife (Newell et al, 1987).

HCB – Hexachlorobenezene is an industrial chemical often associated with wastes from the production of insecticides. Very low levels (2.21 – 3.90 ug/Kg wet weight) were detected in y-o-y fish from Pettit Flume, Cayuga Creek at Porter Road and from Gill Creek at Buffalo Avenue (Table 7). HCB levels in Pettit Flume and Gill Creek have been addressed through past remediation. However, the presence of HCB in fish from Cayuga Creek at Porter Road, similar to elevated PCB and DDT at this location, indicates the presence of an upstream source. HCB levels detected in y-o-y fish in this study were far below the 200 ug/Kg criterion designed to protect sensitive wildlife (Newell et al, 1987).

Mirex – This EPA commercial insecticide, which the U.S. banned in 1978, was used extensively to control fire ants particularly in the southern part of the United States, and as a flame retardant in electronics, plastics and fabrics (Eisler, 1985). In New York State, Mirex was produced in the Niagara Frontier and still exists in some industrial landfills. It was also used in the Oswego River drainage where remedial efforts have since controlled contamination at the former Armstrong Cork Company.

Despite being banned in N.Y. S for over 30 years, Mirex was still detected in 2009 y-o-y fish at levels ranging from a low 2.03 ug/Kg to a high of 52.6 ug/Kg wet weight at the Cayuga Creek site at Porter Road (Table 7). Low levels were detected in composites from the upstream and downstream Little River sites, and from Cayuga Creek at Lindberg Avenue. Similarly low Mirex levels in fish from the latter two sites are likely due to the same source. However, the higher levels in fish from the Porter Road site, similar to PCB, DDT and HCB data from this site, suggest a source located upstream from Porter Road. All 2005 fish composites collected from the Porter Road site had Mirex levels (37.9 – 58.4 ug/Kg wet weight) similar to those measured in 2009 (Preddice and Trometer, 2007). Fish from both Little River sites and from both Cayuga Creek sites exceed the objective of less than the 2 ug/Kg MDL designed to protect sensitive fish-eating wildlife (IJC, 1987).

HCH – Hexachlorocyclohexane more commonly known as the insecticide Lindane [also known as Benzenehexachloride (BHC)] was detected in 2009 y-o-y fish but only as the alpha and beta isomers. These two isomers plus the gamma and delta isomers, predominate in the technical grade of Lindane but only the gamma isomer is reported to be toxic to insects (Deo et al, 1982). Relatively low levels of alpha and beta HCH were detected in all fish from Gill Creek at Buffalo Avenue whereas lower levels of only the beta isomer were detected upstream at Ferry Street. The higher levels of both isomers in fish from Buffalo Avenue, which is adjacent to the twice remediated DuPont Chemical site, indicates the creek is still affected by contamination from this site. The detection of HCH upstream at Ferry Street indicates another low level HCH source further upstream. HCH levels in y-o-y fish collected in this study were well below the 510 ug/Kg level designed to protect sensitive fish-eating wildlife (Newell et al, 1987).

1997 and 2009 Comparison of PCB, DDE and Mirex Levels at Specific Sites

Temporal trends in contaminant levels were not assessed for several y-o-y fish sites because only limited NYSDEC data were available. Ten of these sites have 1997 and 2009 data for Aroclors, DDE and Mirex which leads to limited but useful comparisons (Table 8). The ten sites include Pettit Flume, upstream Little River, Twomile Creek, and sites in Cayuga, Gill and Bergholtz Creeks. *Note: the lighter Aroclor was measured as AR1016/1248 in 1997 whereas in 2009 the lighter Aroclor was measured as AR1242.*

Pettit Flume – Despite differences in species collected in 1997 and 2009, changes in PCB Aroclors and DDE levels in young fish composites were minimal. Remedial activities accomplished during this period, which included sediment removal and replacement of wetland plants, did not affect already low DDE levels in y-o-y fish. The greater Aroclor levels in 2009 do not reflect the benefit of cleanup activity. Mirex was never detected in y-o-y fish from 1997 or 2009.

Niagara River/upstream Little River – Six composites of bluntnose minnow (BN) were collected at this site in 1997 and seven in 2009. Since 1997, the mean lighter Aroclor level in y-o-y fish increased from 26 to 60.4 ug/Kg wet weight as the mean level of the heavier AR1254/1260 decreased from about 80 to 57ug/Kg wet weight. There were no appreciable changes in mean DDE or mean Mirex levels in young fish composites from this site. In 1997 and 2009, mean total PCB levels in y-o-y fish barely exceed the criterion designed to protect PCB-sensitive mink.

Twomile Creek – Emerald shiner data for 1996 (not sampled in 1997) and 2009 show similar (329 versus 336 ug/Kg wet weight) concentrations. DDE levels were relatively low during both years and decreased even further (13 to 6.43 ug/Kg wet weight) by 2009. Mirex continued to be undetected in fish from this Niagara River tributary. Total PCB levels at this site in 2009 still exceed the criterion designed to protect PCB-sensitive mink by a factor of about three.

Cayuga Creek – At the Porter Road site, four composites of y-o-y fish from 1997, three composites from 2005 and four composites from 2009 indicate that by 2009 mean total PCB decreased considerably (~40%) but still remained just above the protective criterion to protect fish eating wildlife. The decrease since 2005 was due to lesser amounts of both Aroclors and a nearly doubling of the percent lipid. Mirex levels in young fish, which were higher than at any other y-o-y sampling location, also decreased considerably (~36%) but continued to exceed the non-detect criterion designed to protect sensitive wildlife. The decrease was primarily due to less AR1254/1260. During this period, DDE levels basically remain unchanged at levels far below the protective total DDT criterion. Downstream at Lindberg Avenue in 2009, bluntnose minnow data show a decrease in mean total PCB which is similar to that upstream (Table 8).This decrease is due mostly to a decrease in AR1254/1260 and not a change in percent lipid. Similar to the upstream site, mean total PCB and mean Mirex levels in y-o-y fish continue to exceed the criteria designed to protect sensitive piscivorus wildlife.

Bergholtz Creek – In 2009 it was necessary to delete the traditional upstream location at Williams Road and select new downstream sites where there was sufficient flow and fish. As a result, two new sites were established, one above and one below the remaining portion of Black Creek. Black Creek was chosen as the divide because it was an important pathway for much contamination from Love Canal. During the Love Canal remedial process, most of lower Black Creek and its combined storm drainage were re-routed further upstream in Bergholtz Creek. The most obvious contaminant difference in fish from 1997 at Williams Road versus fish from the new upstream location above Black Creek was the nearly 3.5 fold decrease in the mean AR1254/1260 level (Table 8). There was also a significant decrease in the lipid adjusted mean total PCB due primarily to less AR1254/1260 and a more than doubling of the percent lipid. In 2009, mean total PCB in Bergholtz Creek fish still remained above the criterion designed to protect sensitive piscivorus wildlife. The 2009 mean total PCB at the new downstream site was less than upstream and slightly less than the PCB criterion designed to protect sensitive fish-eating wildlife. Mean low levels of DDE in y-o-y fish have showed no change since 1997. Mirex has never been detected in Bergholtz Creek fish.

Gill Creek – In 1997 and 2009 y-o-y fish from this Niagara River tributary were collected upstream at Ferry Street (Station 15 A) and downstream at Buffalo Avenue (Station 15 B) near the DuPont Chemical site. Sampling during these two years resulted in a small amount of data which is unfortunate because composites from the downstream site are among the most PCB-contaminated fish encountered. At the upstream Ferry Street site the mean level of the lighter PCB Aroclor and low mean level of DDE showed little change but the mean level of the heavier Aroclor 1254/1260 level decreased from 216 to 55 ug/Kg wet weight (Table 8). The mean lipid adjusted total PCB level decreased significantly primarily due to less AR1254/1260 and was not related to a change in percent lipid. By 2009, the mean total PCB became less than the criterion designed to protect piscivorus wildlife. Mirex in y-o-y fish continued to be undetected. Downstream at Buffalo Avenue, close to the DuPont Chemical site, changes in contaminant levels in young fish were more pronounced. The most obvious difference in contaminant levels from 1997 to 2009 was the 82- 86% decrease in mean total PCB which dropped from 2,187 to 332(ST) and 395(BN) ug/Kg wet weight. Similar to upstream, the change in mean lipid adjusted total PCB was due primarily to less AR1254/1260 and not related to differences in percent lipid. No doubt this decrease was due to remedial efforts yet mean total PCB in 2009 still exceed the criterion designed to protect sensitive fish-eating wildlife. Low Mirex levels were detected in 1997 fish but were <MDL of 2 ug/Kg wet

weight in 2009.

Temporal Trends in AR1254/1260 and DDE at Seven Traditional Sites, 1984 - 2009

Table 12 lists seven traditional y-o-y fish sampling locations (Dunkirk Harbor, Niagara River at Beaver Island State Park, Buffalo River, Niagara River at Gratwick-Riverside Park, downstream Little River, Niagara River at Lewiston and Lake Ontario at Krull Park). Each of these sampling locations have three or more years of AR1254/1260 and p,p'-DDE wet weight data that were used to create box plots to help visualize temporal trends for these contaminants. Figures 10 – 28 show the box plots with associated statistical data below. Percent lipid was examined to determine how it might affect differences in AR1254/1260 and DDE means over time and there was no correlation found.

Lake Erie, Dunkirk Harbor - From 1992 to 1997 the median AR1254/1260 levels in y-o-y emerald shiner decreased slightly from 22 to <20 ug/Kg wet weight. The 2009 median AR1254/1260 level in spottail shiner was 31.0 ug/Kg wet weight (Figure 10). For y-o-y spottail shiner from 1984 to 2009 the median values were variable and ranged from 23 to 93.5 ug/Kg wet weight. A trend for AR1254/1260 was unclear. Emerald shiner showed little change in the median DDE values from 1997 and 2009. For spottail shiner the median DDE values for 1984 - 2009 were also variable but ranged only from 4.0 - 18.5 ug/Kg wet weight. The 2009 median DDE level (4.3 ug/Kg wet weight) in spottail shiner was nearly the same in 1997 which was the lowest value for this 25-year period (Figure 17).

Niagara River, Beaver Island State Park – For the period 1987- 1997, the median levels for AR1254/1260 were <MDL of 20 ug/Kg or were only slightly above (21 ug/Kg) for emerald shiner and spottail shiner. The 2009 median AR12544/1260 level for y-o-y river chub was <MDL of 30 ug/Kg, which probably reflects no change (Figure 11). Figure 18 box plots for DDE data show median values that ranged from <MDL to 5.0 ug/Kg wet weight during the period 1987 to 2009. The latest composite values between 2.5 and 3.3 ug/Kg wet weight represent no change.

Buffalo River – The median AR1254/1260 level for spottail shiner was over 400 ug/Kg wet weight in 1985. In subsequent years (1997, 2003 and 2009) median values for bluntnose minnow were consistently less than 100 ug/Kg wet weight which represents a substantial decrease from 1985 (Figure 12). DDE box plots show a decrease from 41ug/Kg wet weight in 1985 to median values of <4.0 ug/Kg in 1997, 2003 and 2009 (Figure 19).

Niagara River, Gratwick-Riverside Park – Figure 13 shows the median AR124/1260 value in 1984 to be <MDL. However, by 1986 there was a statistically significant ($p = 0.05$) increase to 219 ug/Kg wet weight which was unrelated to changes in percent lipid. This rise was unique to this site. Was it related to wastes deposited about this time at the adjacent landfill? The median AR1254/1260 level remained quite high (190 and 174 ug/Kg wet weight) for 1992 and 1997, respectively, but by 2009 once again decreased (73 ug/Kg) (Figure 13). Median DDE values at this site were low (8 – 12 ug/Kg wet weight) from 1984 – 1992 and by 1997 decreased further to less than or equal 6.0 ug/Kg wet weight (Figure 20).

Niagara River/downstream Little River – Median AR1254/1260 concentrations in y-o-y fish from this site in 1997, 2003 and 2009 demonstrate a declining trend which in 2009 was one-half the 1997 level (Figure 14). The low median DDE levels for this same period varied from about 5 – 10 ug/Kg wet weight with a slight spike in 2003. The lowest median concentration of 5.3 ug/Kg, was in 2009 (Figure 21).

Niagara River, Lewiston – Figure 15 shows the median AR1254/1260 levels in young fish from this site ranged from about 40 to 100 ug/Kg wet weight during 1984 – 1987. In subsequent years (1997, 2003 and 2009), the median levels decreased to 24 – 38 ug/Kg wet weight. Figure 22 clearly shows a steady decline in low DDE levels in young fish from this site which began at about 20 ug/Kg wet weight in 1984 and ended at 3.3 ug/Kg wet weight in 2009.

Lake Ontario, Krull Park at Olcott, NY – Box plots of 1992, 1997 and 2009 median AR1254/1260 values show a declining trend from 136 ug/Kg wet weight in 1992, to 47 – 57 ug/Kg by 1997 and 36 ug/Kg wet weight in 2009 (Figure 16). Figure 23 shows a continuous decrease in median DDE levels from 62 ug/Kg in 1992 to 11 – 29 ug/Kg wet weight in 1997 and 8.8 ug/Kg wet weight by 2009.

Summary of Temporal Changes, 1984- 2009

AR1254/1260 – At Dunkirk Harbor, median AR11254/1260 levels were too variable to demonstrate a trend. At Beaver Island State Park AR1254/1260 levels remained low or <MDL, and by 2009 showed no detectable change. Buffalo River y-o-y fish data indicate a large decline from a median of 432 ug/Kg in 1985 to median values that ranged from 30 to 56 ug/Kg wet weight during the period 1997 - 2009. In 1986, the AR1254/1260 level in y-o-y fish from Gratwick-Riverside Park doubled (median = 219 ug/Kg) which represented a unique and significant increase from 1984. By 1992 and 1997 the median values at this site decreased to 185 and 172 ug/Kg, and in 2009 declined further to 76 ug/Kg wet weight. At the downstream Little River site the median AR1254/1260 level in young fish exhibited a clear and continuous decline from 131 and 109 ug/Kg wet weight in 1997 and 2003, respectively, to 68 ug/Kg wet weight in 2009. At Lewiston the median AR1254/1260 levels ranged from about 42 to 109 ug/Kg wet weight from 1984 to 1987 but decreased to 24 – 38 ug/Kg wet weight during subsequent years. A similar pattern occurred in fish from Lake Ontario at Krull Park (Olcott, NY).

DDE - Except for y-o-y fish from the Buffalo River and Krull Park, the median levels of this primary metabolite of the banned (1970) insecticide DDT have been low (<MDL – 18.5 ug/Kg) since the early 1980s. The median concentration for Buffalo River fish in the mid-1980s was about 40 ug/Kg wet weight and this decreased to <4 ug/Kg wet weight during the period 1997 to 2009. At Krull Park in Olcott, NY, which is located within the Fruit Belt along the southern shore of Lake Ontario, the median DDE level was 62 ug/Kg in 1992. This level decreased one-half by 1997 and dropped further to 8.8 ug/Kg wet weight in 2009.

Observation - Since the mid-1990s, it has progressively grown more difficult to collect sufficient numbers of the same y-o-y target fishes, e.g. spottail shiner and bluntnose minnow, at several traditional contaminant monitoring locations in NYS's Great Lakes Basin. Over this period noticeable changes in food web interactions, fish communities and water clarity have been primarily linked to invasive filter-feeding zebra and quagga mussels. The greatly increased water clarity coupled with increased nutrients from the massive mussel beds have enhanced conditions that now support dense growths of the green algae *Cladophora sp*.

Currently rotting and foul-smelling filamentous mats of this alga drift into shore at locations such as Dunkirk Harbor, Olcott and Rochester where even short seine hauls are often impossible. Also, Michael Wilkinson, Region 9 Fisheries, reports that the river rudd now comprises the greatest biomass of all fishes collected during 2010 electro- fishing excursions in the Niagara River (personal communication – L. Skinner). The Project Leader reports that river rudd were not observed in any y-o-y fish collections made specifically for the near-shore N.Y.S Great Lakes Basin contaminant monitoring project dating back to 1996.

CONCLUSIONS

One hundred forty four composites of y-o-y fish were collected in September 2009 from 20 sites located in the western portion of NYS's Great Lakes Basin. Sampling locations included 14 traditional sites and 6 new locations. Traditional sites were last sampled in 2003. The new sites were added based on previous findings to help determine sources of contamination and the efficacy of site-specific remediation. The majority (60%) of the 2009 composites were comprised of bluntnose minnow. NYSDEC's Analytical Services Unit at the Hale Creek Field Station processed and analyzed all y-o-y fish composites and delivered excellent quality data. Chemical analysis of the 2009 y-o-y fish composites detected nine analytes: AR1242; AR1254/1260; p,p'-DDE; p,p'-DDD; p,p'-DDT; HCB; Mirex; and alpha and beta HCH. PCB and p,p'-DDE were nearly equally the two most common analytes. Generally, levels of PCB Aroclors and DDE have continued to decline but site specific changes are presented.

Highest levels

The two locations with highest mean total PCB levels (>300 ug/Kg wet weight) in y-o-y fish were Twomile Creek and Gill Creek at Buffalo Avenue. Composites with the two highest mean total DDT values were from Cayuga Creek at Porter Road (37.3 ug/Kg wet weight) and Twomile Creek (15.7 ug/Kg wet weight). Fish from Gill Creek at Buffalo Avenue had the greatest means for HCB (2.3ug/Kg wet weight), and two HCH isomers (25.1 and 16.3 ug/Kg wet weight), respectively. HCH was detected only in fish from Gill Creek. The highest mean Mirex concentration (27.5 ug/Kg wet weight) was for fish from Cayuga Creek at Porter Road.

Five Most Contaminated Sites

Elevated contaminant levels in y-o-y fish show three Niagara River tributaries (Twomile Creek, Gill Creek at Buffalo Avenue and Cayuga Creek at Porter Road) are in need of remediation. First, however, additional studies are recommended for Twomile Creek and Gill Creek at Buffalo Avenue to determine why previous remedial efforts have been insufficient and to determine what additional cleanup measures may be feasible. Elevated total PCB levels in fish from the upstream Bergholtz Creek site and from Gratwick-Riverside Park also suggest additional remedial measures are needed.

1. **Twomile Creek –** Twomile Creek has at least one an industrial waste site (General Electric Co.) and an industrial landfill in its drainage. As a result, Twomile Creek is one of two 2009 y-o-y fish collection sites with a high mean total PCB values greater than 300 ug/kg wet weight. This site also has the highest mean AR1254/1260 level of 205 ug/Kg wet weight. Unfortunately, fish from this Niagara River tributary also have

as much AR1242. Low levels of all three DDT metabolites were detected in all fish composites from this creek, another strong reason to suggest an upstream source. PCB was the only analyte detected in Twomile Creek fish to exceed the 110 ug/Kg criterion designed to protect PCB-sensitive mink. Little change has occurred with median total PCB and median DDE levels since 1996.

2. **Gill Creek –** In 2009 at the upstream Ferry Street site low levels of the lighter PCB Aroclor and DDE in y-o-y fish have remained about the same as in 1997 but levels of the heavier AR1254/1260 levels show a remarkable decrease from a mean of 216 to 55 ug/Kg wet weight. Changes in contaminant levels in young fish, particularly total PCB from the downstream site at Buffalo Avenue were even more dramatic. The most obvious difference was the decline in mean total PCB which decreased from 2,190 to 332(ST) and 395(BN) ug/Kg wet weight. [*It should be noted that the initial large mean total is based on only two samples.]*

The downstream Gill Creek site at Buffalo Avenue is the second 2009 y-o-y fish site with a mean total PCB greater than 300 ug/Kg wet weight. Here the mean AR1242 level (230 ug/Kg wet weight – BN) was greater than at any other site and comprised 58% of the mean total PCB. Upstream at Ferry Street, mean AR1242 comprised only 17% of the mean total PCB. Nearly all y-o-y fish composites from the downstream Buffalo Avenue site had all three DDT metabolites whereas upstream at Ferry Street all y-o-y fish composites had DDE but only a few composites had p,p'-DDD and p,p'-DDT. Gill Creek was the only stream sampled which had fish with HCH. Analysis of Ferry Street fish detected only low levels of the beta isomer whereas low levels of both isomers were detected downstream. PCB, DDT metabolites and HCH data indicate the upstream and downstream Gill Creek sites are affected by different sources but the worse contamination is downstream at Buffalo Avenue. This site is very near DuPont Chemical and has been remediated twice. Nevertheless, this area is still contaminated and in need of additional cleanup. A study should be performed to determine what additional remedial measures might be feasible. As an aside, between the two sites is a segment of Gill Creek that serves as a sediment trap following frequent high Niagara River levels. This area should be included in any future remedial plans. The mean total PCB in young fish from this downstream location exceeds the 110 ug/Kg wet weight criterion designed to protect PCB-sensitive mink.

3. Cayuga Creek at Porter Road – The 40% AR1242 and 60% AR1254/1260 composition of y-o-y fish at Porter Road is different from percentages (~30 and ~70%) for downstream fish from Bergoltz Creek, Lindberg Avenue and from the Little River sites. This difference may suggests a separate upstream PCB source to Cayuga Creek and support findings from the 2005 PISCES study which located a PCB source to Cayuga Creek from a large hanger building at the Niagara Falls Air Reserve Station located upstream from Porter Road. DDT, HCB and Mirex levels in y-o-y fish from Porter Road also indicate an upstream contaminant source. Mean total PCB and elevated mean Mirex levels in y-o-y fish from Cayuga Creek at Porter Road continue to exceed criteria designed to protect sensitive piscivorus wildlife. Mean DDE levels in y-o-y fish from this site have remained unchanged since 1997.

4. **Bergholtz Creek –** Mean total PCB (201 ug/Kg) for y-o-y fish from the upstream Bergholtz Creek site was about two times higher than at either the downstream Bergholtz Creek site or at the next downstream site in Cayuga Creek at Lindberg Avenue. However, the percentages (~30 and ~70%) of the total PCB comprised by the two Aroclors were about the same at all three locations which may indicate a common PCB source located upstream in Bergholtz Creek. Another opinion suggests that PCB levels are higher upstream because contaminated sediment in the downstream section was removed more than 20 years ago as part of the Love Canal remedial project. The slightly elevated mean p,p'-DDE level in young fish from the upstream site was comparable to that for fish from Krull Park located in the Lake Ontario Fruit Belt where DDT was used to control orchard insects prior to 1970. The detection of p'p-DDT was detected in all Bergholtz Creek fish composites and, similar to PCB, levels were higher upstream than at the downstream site or at Lindberg Avenue. The lower level downstream may also represent improved conditions due to sediment dredging. No Mirex or other OC pesticide residues were detected in y-o-y fish from this creek. Mean total PCB at the upstream site exceed the criterion designed to protect mink. The most obvious difference between the 1997 and 2009 contaminant levels in fish from Bergholtz Creek was with the AR1254/1260 level. In 1997 at Williams Road the mean AR1254/1260 level was over 500 ug/Kg wet weight, a value about 3.5 times greater than that detected downstream at the new upstream site in 2009.

5. **Gratwick-Riverside Park –** Young fish from this site had the third highest mean AR1242 level (123 ug/Kg wet weight). This mean level is nearly double that for fish from the next upstream Niagara River site located between Pettit Flume and Gratwick-Riverside Park and is about eight times greater than that of fish from Pettit Flume located further upstream. This increase indicated that the landfill adjacent to the Park is a likely PCB source to the Niagara River. The mean AR1242 level alone (without AR1254/1260) exceeds the 110 ug/Kg criterion designed to protect PCB-sensitive mink. Chemical analysis of fish from this site showed low total DDT and Mirex. Other OC pesticides were less than the respective MDLs. Data from 1986 show a very high and unexplained median AR1254/1260 level at this location which decreased markedly by 2009. The median DDE concentration was under 15 ug/Kg wet weight from 1984 – 1992 and has since declined to less than 10 ug/Kg.

PCB and OC Pesticide Residues at Other Sites

Lake Erie at Dunkirk Harbor – The Dunkirk Harbor y-o-y fish site basically serves as a traditional upstream reference site to monitor contaminants transported into the Niagara River. Low levels of AR1254/1260 (no AR1242), and DDE continue to be detected in y-o-y fish and levels of the other OC pesticides continue to be less than respective MDLs. The trend in median AR1254/1260 and DDE levels was not determined for this site due to data scatter but in spottail shiner the 2009 median was the lowest on record since 1985.

Niagara River at Beaver Island State Park and Niawanda Park – Similar to the Dunkirk Harbor sampling location, this traditional site and the new Niagara River site were also considered to be reference sites included to determine contaminant levels in y-o-y fish upstream from the heavily industrialized segment of the Niagara River from Buffalo to Niagara Falls. Beaver Island fish had no detectable PCB and very low levels of only DDE. Niawanda

Park fish had a low mean total PCB, which was 76% AR1242, and DDE levels were even lower than upstream at Beaver Island State Park. No other pesticides were detected in fish from either location. The median AR1254/1260 level in Beaver Island fish was about 20 ug/Kg wet weight in 1992 and 1997, and was less than the 30 ug/Kg MDL in 2009 which probably reflects no change. Median DDE levels continue to remain <10 ug/Kg.

Buffalo River – Mean total PCB for young fish collected at this traditional site in 2009 was low and far less than the 110 ug/KG wet weight criterion designed to protect PCB-sensitive mink. Of the DDT metabolites, only p,p'-DDE was detected near or <MDL of 2 ug/Kg. No other OC pesticide residues were detected in y-o-y fish from this site. The median AR1254/1260 level in spottail shiner was high (>400 ug/Kg wet weight) in 1985 but levels in bluntnose minnow have since (1997, 2003 and 2009) decreased to less than 75 ug/Kg wet weight. The 1985 median DDE level was at 40 ug/Kg wet weight and levels have shown a slight but continuous decline to <10 ug/Kg since 1997.

Erie Canal – The Erie Canal is a major tributary to the Niagara River but until 2009 contaminants in y-o-y fish were not monitored in this waterway. It is now known that mean total PCB (119 ug/Kg) for y-o-y fish from the Canal exceed the protective PCB criterion of 110 ug/Kg designed to protect mink. Levels of other OC pesticides in young fish from the Canal were very low or less than the respective MDLs.

Pettit Flume – This site was one of three with very low levels of HCB in y-o-y fish. The other two sites were Cayuga Creek at Porter Road and Gill Creek at Buffalo Avenue. p,p'-DDE and DDD levels were also low and no p,p'-DDT, Mirex or any other OC pesticide residues were detected in any fish composite from this site. Both PCB Aroclors were detected in all composites from this site but the mean total PCB was less than the criterion to protect mink. Despite differences in species collected in 1997 and 2009 there was no appreciable decrease in the already low mean total PCB or DDE levels that reflect the benefit of remediation. Mirex has never been detected in young fish from this site.

Between Pettit Flume and Gratwick-Riverside Park – This new site was added in 2009 primarily to help isolate a PCB source to the Niagara River suspected in 2003 to be located between Pettit Flume and Gratwick-Riverside Park. Mean total PCB in y-o-y fish from this new site was roughly three to four times that for fish from the reference site upstream at Niawanda Park and was about twice that for fish from Pettit Flume. This indicated that the "Flume" was not the source of this increase in PCB. The mean total PCB for fish from this new site also helped to determine that the increase (137 to 199 ug/Kg wet weight) in mean total PCB for y-o-y fish from the next downstream site at Gratwick-Riverside Park was likely caused by PCB from the landfill under or adjacent to the Park, or perhaps from a storm sewer. Mean total PCB in y-o-y fish from this site exceed the protective criterion to protect mink. Mean total DDT was low and was mostly DDE. Residues of other OC pesticides were undetected in y-o-y fish from this location.

Upstream Edge of 102nd Street Landfill – This new sampling location was added primarily to better assess potential PCB input from the 102nd Street Landfill. Mean total PCB for y-o-y fish from this new site was nearly the same as that for fish from the new site located between Pettit Flume and Gratwick-Riverside Park and represented a decrease from the mean total PCB for upstream fish from Gratwick-Riverside Park. Mean total PCB for fish from the upstream edge of the 102nd Street Landfill was similar to that at the next downstream site located in the upstream portion of the Little River adjacent to Cayuga Island and demonstrated no detectable increase in PCB contribution from the 102nd Street Landfill. Mean total PCB in y-o-y fish from this site exceed the criterion designed to protect mink. DDE levels in young fish at this new site were low (<4 ug/Kg wet weight) and some composites included a low level of p,p'-DDT. No other OC pesticide residues were detected in fish from this site.

Cayuga Creek at Lindberg Avenue – This site is located in the lower portion of Cayuga Creek that was not dredged during cleanup for Love Canal and as a result mean total PCB and Mirex levels in y-o-y fish still exceed the respective criteria designed to protect piscivorus wildlife. It is quite possible that some PCB and Mirex detected in fish from this site are from upstream sources in Cayuga and Bergholtz Creeks. Except for an approximate 55% decrease in AR1254/1260, there was very little difference in 1997 and 2009 contaminant levels.

Little River – PCB and Mirex levels in y-o-y fish from the upstream and downstream Little River sites were similar to those in Cayuga Creek at Lindberg Avenue. Levels of both of these chemicals continue to exceed respective criteria designed to protect wildlife. Other OC pesticides were undetected in y-o-y fish from either Little River site. Since 1997 there were no appreciable changes in total PCB or DDE levels in young fish from the upstream site. However, the 2009 median total PCB at the downstream site showed a continued decline from 1997 and 2003 levels.

Niagara River at Lewiston – This traditional site has been part of the near-shore contaminant monitoring project since the 1980s and was again included to monitor contaminant levels in y-o-y fish in the lower Niagara River below the industrial zone but upstream from Lake Ontario. Mean total PCB and mean total DDT levels in y-o-y fish from Lewiston and from the upstream site at Dunkirk were low and comparable. At Dunkirk Harbor total PCB was 100% AR1254/1260 but at Lewiston 69% of the mean total PCB was AR1242. Other OC pesticides were undetected at Lewiston. Early (1984 – 1986) spottail shiner data for Lewiston show median AR1254/1260 levels of about 80 – 115 ug/Kg wet weight. More recently (1997, 2003 and 2009) the median levels, based on bluntnose minnow, have decreased to about 25 – 40 ug/Kg wet weight. Basically median DDE levels were low (<20 ug/Kg wet weight) in 1984 and 1985, and have since declined to <10 ug/Kg wet weight.

Lake Ontario at Krull Park, Olcott – This traditional Lake Ontario site has been a part of this study since the 1980s and was again chosen to monitor PCB and DDT metabolites along the Lake Ontario shoreline between the Niagara River and Rochester. The primary reason for a site at this location was because nearby Eighteenmile Creek is a known major PCB pathway to Lake Ontario (Preddice and Spodaryk, 2000; Eighteenmile Creek Remedial Action Committee, 1997). The moderately elevated mean total PCB for y-o-y fish from this site was similar to that for fish from the Little River and Cayuga Creek at Lindberg Avenue, and was identical to the mean total PCB for fish from the Erie Canal. Ideally, this mean should have been lower and similar to that (28.7 - 51.4 ug/Kg wet weight) for fish from the lower Niagara River at Lewiston but instead was 2 to 4 times higher because of PCB input (69% AR1242) from Eighteenmile Creek. The mean total PCB level for fish from this site exceed the criterion designed to protect mink. The low total DDT level, which was almost entirely DDE, was slightly higher than that for fish from Lewiston but this was expected because of its location in the Fruit Belt along the southern Lake Ontario shoreline where DDT was applied prior to 1970.

Residues of other OC pesticides were undetected in fish from this location. In 1992, the median AR1254/1260 level based on spottail shiner composites was 136 ug/Kg wet weight. By 1997 this level in emerald shiner and spottail shiner decreased to about 50 ug/Kg and continued to decline to about 36 ug/Kg wet weight in 2009 emerald shiner composites. The 1992 median DDE level of 62 ug/Kg wet weight decreased by about one-half in 1997 and dropped further to 8.8 ug/Kg wet weight by 2009.

Contaminant Criteria to Protect Fish-Consuming Wildlife

Only total PCB and Mirex concentrations in y-o-y fish were found to exceed criteria/objectives designed to protect sensitive fish-consuming wildlife. Concentrations of other OC pesticides detected were within their respective criteria and may no longer pose a threat to sensitive consumers of small fish.

Mean total PCB concentrations in y-o-y fish were greater than the most protective criterion at 12 of 20 sites sampled (Table 9). Mean total PCB levels for fish collected from Gill Creek at Buffalo Avenue and from Twomile Creek were found to exceed the protective PCB criterion of 110 ug/Kg by a factor of about three. Mean total PCB levels for fish from upstream Bergholtz Creek and from the Niagara River at Gratwick-Riverside Park were found to exceed the criterion by a factor of about two. Mean total PCB levels for fish from the other eight sites exceeded the PCB criterion by a factor of 1.0 - 1.4.

Mirex was measured in y-o-y fish composites only from both Cayuga Creek sites and from both Little River locations (Table 9). Fish from Cayuga Creek at Porter Road had the most (mean = 27.5 ug/Kg wet weight) Mirex of any site sampled (Table 9). One composite had 52.6 ug/Kg wet weight (Table 9). Fish composites from the other three sites had mean Mirex levels of 3.63, 3.79 and 4.96 ug/Kg, and individual composite values that ranged from 2 – 7 ug/Kg wet weight. Mirex concentrations in y-o-y fish composites from these four sites exceed the protective Mirex criterion of <MDL (IJC, 1988).

Percent Lipid and PCB Concentrations in Small Fish

Total PCB concentrations were compared for composites from the same site and from year to year to determine if there was any correlation with percent lipid that would help to explain differences but there was no correlation found.

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ACKNOWLEDGEMENT

Sampling was performed by Project Leader, Timothy L. Preddice, Biologist I (Aquatic), Gloversville, with assistance from NYSDEC staff Michael Kane, Biologist I (Ecology), Albany and Benjamin Durie, Seasonal Fish and Wildlife Technician, Rome. On 9/16/09 Michael Wilkinson, Biologist I (Aquatic), Buffalo, provided a boat and assisted with Niagara River collections. Phyllis Nichols, Biostatistician I, Gloversville, generated box plots and associated statistical data for AR1254/1260 and DDE trend analyses. Project Manager, Larry Skinner, Biologist III (Ecology), Albany, prepared the initial sampling protocol and provided review of this document.

Table 1. Description of sampling locations, species and number of y-o-y fish composites from new and traditional near-shore sites within New York State's Great Lakes Basin, Dunkirk to Olcott, NY, 2009.

Sampling Site	No. of Composites and Species[1]	Description of Location
Lake Erie, Dunkirk Harbor	7 ST + (1 extra composite)	Traditional Lake Erie/ Dunkirk Harbor site adjacent to the electric generating station, across the road from the Lake Erie Fishery Research Station
Niagara River, Beaver Island State Park	5 RC 2 BN + (1 extra composite)	Traditional Niagara River site at the south end of Grand Island, located in backwater / tributary adjacent to dock at Beaver Island State Park Marina
Buffalo River	7 BN + (1 extra composite)	Traditional Buffalo River site on the north shore opposite upstream edge of the Cargill grain silo (boat needed to access site)
Niagara River, Tonawanda	7 ES + (1 extra composite)	New site in 5-bay boat slip at Niawanda Park, upstream from the Erie Canal
Niagara River, upstream from Twomile Creek	No composites	New Niagara River site in small park with double boat slip just upstream from Twomile Creek and Erie Canal
Twomile Creek	3 CS, 1 ST, 7 ES + (1 extra ES composite)	Traditional Twomile Creek site, 30 - 70 yards downstream from Fletcher Street crossing
Erie Canal, upstream from junction with Ellicott Creek	7 BN + (1 extra composite)	New Erie Canal site at a small single boat slip opposite corner of Service Road and Sweeney Avenue, ~1200 yards from junction with Ellicott Creek
at mouth of Pettit Flume	7 BN + (1 extra composite)	Traditional site inside the East Pier Marina (River Road) walkway along north and south shores of Pettit Flume
Niagara River, between Pettit Flume and Gratwick- Riverside Park	6 BN	New Niagara River site in a small bay in front of Ziphany Co. at 940 River Road, downstream from small treatment plant (boat site)
Niagara River, Gratwick-Riverside Park (GRP)	7 BN + (1extra composite)	Traditional Niagara River site inside rock barrier wall, downstream ~75 yards from driveway entrance to GRP
Niagara River, bay at upstream edge of 102nd St. Landfill	7 BN + (1extra composite)	New Niagara River site in small bay located at upstream edge of 102nd St. Landfill (boat site)
Niagara River/ Little River, upstream from Cayuga Creek	7 BN + (1extra composite)	Traditional Little River site on the west side of river, ~200 yards upstream from boat launch near 102nd St. Landfill (boat site)

Table 1. (continued)

Sampling Site	Number of Composites and Species[1]	Description of Location
upstream Cayuga Creek, Lockport Rd.	No composites	Semi-traditional site ~25 yards upstream and ~50 yards downstream from Lockport Road crossing
Cayuga Creek, Porter Rd.	1 CC, 4 CS	Traditional Cayuga Creek site, downstream and within ~75 yards from the Porter Road crossing
upstream Bergholtz Creek, Williams Road	No composites	Traditional site, downstream and within 50 - 300 yards of Williams Road
Bergholtz Creek, upstream from old Black Creek)	7 GS + (1 extra composite)	New Bergholtz Creek site, downstream from Williams Road but upstream from mouth of old Black Creek at power line crossing near Mueller Court (boat site)
old Black Creek	No composites	New Black Creek site, ~30 yards upstream from junction with Bergholtz Creek (boat site)
Bergholtz Creek, downstream from old Black Creek	7 GS + (1 extra GS composite), 1 BN	New Bergholtz Creek site, downstream from mouth of old Black Creek between 90th and 92nd Streets (boat site)
Cayuga Creek, Lindberg Ave. Bridge	7 BN	Traditional Cayuga Creek site ~100 yards upstream from Lindberg Ave. Bridge near small stone boat pier on east shore (boat site)
Niagara River/ Little River, downstream from Cayuga Creek	7 BN + (1 extra composite)	Traditional Little River site 250 – 300 yards downstream from Cayuga Creek (boat site)
upstream Gill Creek	No composites	New Gill Creek site located upstream from Hyde Park Lake at Route 182 crossing
mid-Gill Creek, (former Sta. 15a)	7 BN + (1 extra composite)	Traditional Gill Creek site adjacent to parking lot for vacated Police Dept. and Traffic Court Building
downstream Gill Creek, (former Sta. 15b)	7 BN + (1 extra BN composite), 2 ST	Traditional Gill Creek site 20 - 50 yards upstream from the Buffalo Avenue (Route 384) crossing
Niagara River, Lewiston	7 BN + (1 extra composite)	Traditional Niagara River site downstream on the east side of river within ~¼ mile of the Lewiston boat launch (boat site)
Lake Ontario, Olcott	7 ES + (1 extra composite	Traditional Lake Ontario site at Krull Park Beach in Olcott, just east of Eighteenmile Creek

Table 1. (continued)

Sampling Site	**Number of Composites and Species**[1]	**Description of Location**
Lake Ontario, Rochester	No composites	Traditional Lake Ontario site east of the mouth of Genesee River in front of the USCG Station
Sodus Bay, Sodus	No composites	Traditional site within Sodus Bay near the Wayne County Water Quality Committee/ NYSDEC boat launch and also at private boat launch on way to Sodus Pt.
Lake Ontario, Sodus Point	No composites	New Lake Ontario beach site just west of the mouth to Sodus Bay

[1] Species: ST – spottail shiner, BN – bluntnose minnow, ES – emerald shiner, CS – common shiner, CC – creek chub, GS – golden shiner and RC – river chub

Table 2. NYSDEC method detection limits (MDL) and estimated quantitation limits (EQL) for PCBs and organochlorine pesticides. [values as ug/Kg]

Analyte	MDL	EQL[1]
Polychlorinated biphenyls		
Aroclor 1242	10	50
Aroclor 1254	}30	}100
Aroclor 1260		
p,p'-DDT	2	20
p,p'-DDE	2	20
p,p'-DDD	2	20
o,p'-DDT	5	10
o,p'-DDE	5	10
o,p'-DDD	5	10
Aldrin	5	20
a-HCH	5	20
b-HCH	5	20
g-HCH	5	20
cis-Chlordane	5	20
trans-Chlordane	5	20
Oxychlordane	5	20
cis-Nonachlor	5	20
trans-Nonachlor	5	20
Dieldrin	5	20
Heptachlor	5	20
Heptachlor epoxide	5	20
Hexachlorobenzene	2	10
Mirex	2	10
Photomirex	5	20

[1] NYSDEC minimum level of reliable quantification

Table 3. Individual length (mm) and composite weight (g) field data for young-of-year fish from near-shore areas within New York State's Great Lakes Basin, Dunkirk to Olcott, NY, 2009.

Site	Comp.	Lab. No.	No. & Species[1]	Length				Composite Weight
				Minimum	Maximum	Mean	Stnd. Dev.[2]	
Lake Erie at Dunkirk Harbor	a	09-0203-H	15 ST	38	48	42.5	2.56	10.7
	b	09-0204-H	15 ST	37	50	43.8	4.06	12.1
	c	09-0205-H	15 ST	41	52	46.9	3.26	14.8
	d	09-0206-H	15 ST	40	54	45.4	3.74	13.1
	e	09-0207-H	15 ST	40	47	43.9	1.94	12.2
	f	09-0208-H	15 ST	37	46	42.3	2.69	11.1
	g	09-0209-H	15 ST	41	47	44.1	1.81	12.5
Niagara River at Beaver Island State Park	a	09-0210-H	15 RC	32	55	45.7	5.56	16.1
	b	09-0211-H	15 RC	30	47	41.0	4.67	10.8
	c	09-0212-H	15 RC	35	53	43.7	4.80	13.4
	d	09-0213-H	15 RC	33	47	38.9	4.10	9.1
	e	09-0214-H	15 RC	30	48	35.7	5.46	6.9
	f	09-0215-H	30 BN	25	35	29.7	2.31	7.8
	g	090216-H	30 BN	24	32	27.9	1.86	5.7
Buffalo River	a	09-0217-H	15 BN	38	45	42.8	2.08	10.9
	b	09-0218-H	15 BN	40	46	42.7	2.13	10.3
	c	09-0219-H	15 BN	41	47	43.4	1.88	10.9
	d	09-0220-H	15 BN	39	47	43.5	2.45	12.6
	e	09-0221-H	15 BN	40	49	43.2	2.24	12.2
	f	09-0222-H	15 BN	39	50	43.9	2.77	13.2
	g	09-0223-H	15 BN	39	47	43.6	2.82	11.2

Table 3. (continued)

Site	Comp.	Lab. No.	No. & Species[1]	Length				Composite Weight
				Minimum	Maximum	Mean	Stnd. Dev.[2]	
Niagara River, Niawanda Park, Tonawanda	a	09-0224-H	25 ES	27	42	36.0	4.31	8.3
	b	09-0225-H	25 ES	26	45	34.9	5.80	7.8
	c	09-0226-H	25 ES	26	45	32.4	3.95	6.3
	d	09-0227-H	25 ES	27	49	34.3	4.41	7.1
	e	09-0228-H	25 ES	26	44	31.7	3.95	5.6
	f	09-0229-H	25 ES	25	43	32.8	3.44	6.0
	g	09-0230-H	25 ES	29	38	33.5	2.45	6.5
Twomile Creek	a	09-0231-H	15 CS	36	47	41.7	3.19	11.2
	b	09-0232-H	15 CS	37	48	40.7	2.87	10.5
	c	09-0233-H	14 CS	31	43	36.8	3.47	6.9
	d	09-0234-H	5 ST	45	55	49.8	3.56	5.9
	e	09-0235-H	15 ES	36	40	37.8	1.42	6.1
	f	09-0236-H	15 ES	33	44	37.8	2.80	6.4
	g	09-0237-H	15 ES	30	43	35.9	3.55	5.8
	h	09-0238-H	15 ES	30	42	35.6	3.16	5.6
	i	09-0239-H	15 ES	32	40	36.0	2.62	5.6
	j	09-0240-H	15 ES	32	43	36.1	2.91	5.5
	k	09-0241-H	15 ES	32	37	34.9	1.68	4.9

Table 3. (continued)

Site	Comp.	Lab. No.	No. & Species[1]	Length				Composite Weight
				Minimum	Maximum	Mean	Stnd. Dev.[2]	
Erie Canal	a	09-0242-H	15 BN	38	49	42.8	3.17	11.1
	b	09-0243-H	15 BN	38	46	41.6	2.13	9.6
	c	09-0244-H	15 BN	32	48	42.7	4.04	10.8
	d	09-0245-H	15 BN	34	44	41.1	3.00	9.6
	e	09-0246-H	15 BN	37	47	40.2	2.45	8.9
	f	09-0247-H	15 BN	37	43	39.0	1.93	8.1
	g	09-0248-H	15 BN	39	44	40.8	1.78	9.1
Pettit Flume	a	09-0249-H	15 BN	35	48	40.5	4.19	9.0
	b	09-0250-H	15 BN	34	42	39.1	2.42	8.3
	c	09-0251-H	15 BN	35	46	39.6	3.68	8.5
	d	09-0252-H	15 BN	32	47	39.6	3.64	8.5
	e	09-0253-H	15 BN	33	42	39.5	2.75	7.9
	f	09-0254-H	15 BN	34	43	38.1	2.76	7.3
	g	09-0255-H	15 BN	34	42	37.9	2.19	6.7
Niagara River between Pettit Flume and Gratwick Riverside Park	a	09-0256-H	15 BN	32	49	41.6	6.08	9.7
	b	09-0257-H	15 BN	30	52	39.5	7.40	8.6
	c	09-0258-H	15 BN	34	49	40.0	5.41	8.6
	d	09-0259-H	15 BN	30	50	41.4	4.47	10.2
	e	09-0260-H	15 BN	32	56	41.5	6.71	10.0
	f	09-0261-H	15 BN	32	53	43.9	7.12	12.4

Table 3. (continued)

Site	Comp.	Lab. No.	No. & Species[1]	Length				Composite Weight
				Minimum	Maximum	Mean	Stnd. Dev.[2]	
Niagara River at Gratwick-Riverside Park	a	09-0262-H	15 BN	40	53	45.9	3.47	13.9
	b	09-0263-H	15 BN	33	49	43.5	3.87	11.5
	c	09-0264-H	15 BN	38	46	42.4	2.41	10.2
	d	09-0265-H	15 BN	37	44	40.9	1.88	9.3
	e	09-0266-H	15 BN	34	43	39.3	2.09	8.5
	f	09-0267-H	15 BN	34	45	39.5	2.95	8.5
	g	09-0268-H	15 BN	35	41	37.8	1.86	7.2
Niagara River at upstream edge of 102nd Street Landfill	a	09-0269-H	15 BN	38	47	44.4	2.85	11.4
	b	09-0270-H	15 BN	37	47	41.9	3.41	10.3
	c	09-0271-H	15 BN	37	48	41.4	3.56	9.7
	d	09-0272-H	15 BN	37	46	40.7	2.37	8.9
	e	09-0273-H	15 BN	34	44	39.5	2.87	8.3
	f	09-0274-H	15 BN	32	41	38.7	2.19	7.5
	g	09-0275-H	15 BN	34	48	39.3	3.10	8.2
Niagara River/ Little River upstream from Cayuga Creek	a	09-0276-H	15 BN	41	52	45.3	3.11	13.1
	b	09-0277-H	15 BN	37	43	39.5	2.29	8.3
	c	09-0278-H	15 BN	33	44	36.7	2.94	6.8
	d	09-0279-H	15 BN	28	41	37.1	3.61	7.0
	e	09-0280-H	15 BN	31	41	35.6	2.72	5.9
	f	09-0281-H	15 BN	30	38	34.3	2.16	5.8
	g	09-0282-H	25 BN	29	36	32.0	1.86	7.0

Table 3. (continued)

Site	Comp.	Lab. No.	No. & Species[1]	Length				Composite Weight
				Minimum	Maximum	Mean	Stnd. Dev.[2]	
Cayuga Creek at Porter Road	a	-	4 BN	sample discarded – insufficient sample size				
	b	09-0283-H	6 CC	44	50	47.0	2.00	6.1
	c	09-0284-H	10 CS	44	54	50.2	2.78	10.9
	d	09-0285-H	10 CS	45	55	50.8	3.36	11.2
	e	09-0286-H	5 CS	36	58	50.6	8.82	6.1
	f	09-0287-H	10 CS	46	59	51.1	4.46	10.6
Bergholtz Creek, upstream from old Black Creek	a	09-0288-H	25 GS	27	41	33.2	3.21	8.7
	b	09-0289-H	25 GS	29	36	32.0	1.81	6.6
	c	09-0290-H	25 GS	26	37	32.0	2.21	7.0
	d	09-0291-H	25 GS	27	35	32.2	1.58	7.0
	e	09-0292-H	25 GS	28	37	32.9	2.12	7.1
	f	09-0293-H	25 GS	26	33	30.6	1.85	6.1
	g	09-0294-H	25 GS	29	37	32.7	2.17	7.1
Bergholtz Creek, downstream from old Black Creek	a	09-0295-H	15 BN	32	42	36.7	3.26	6.6
	b	09-0296-H	25 GS	25	36	30.4	2.51	5.8
	c	09-0297-H	25 GS	28	34	31.0	1.69	6.0
	d	09-0298-H	25 GS	28	36	31.5	2.43	6.4
	e	09-0299-H	25 GS	25	37	31.4	3.01	6.3
	f	09-0300-H	25 GS	25	37	31.0	2.92	6.1
	g	09-0301-H	25 GS	27	38	30.5	2.29	5.8
	h	09-0302-H	25 GS	27	33	30.3	1.79	5.4

Table 3. (continued)

Site	Comp.	Lab. No.	No. & Species[1]	Length				Composite Weight
				Minimum	Maximum	Mean	Stnd. Dev.[2]	
Cayuga Creek at Lindberg Avenue	a	09-0303-H	15 BN	30	40	33.7	2.64	5.3
	b	09-0304-H	25 BN	29	38	31.4	2.29	7.0
	c	09-0305-H	25 BN	27	37	30.2	1.94	6.3
	d	09-0306-H	25 BN	24	40	28.8	3.10	5.4
	e	09-0307-H	30 BN	25	30	27.1	1.40	5.3
	f	09-0308-H	40 BN	24	32	27.1	1.98	6.7
	g	09-0309-H	40BN	22	29	25.3	1.63	5.5
Niagara River/ Little River, downstream from Cayuga Creek	a	09-0310-H	15 BN	37	43	39.5	1.73	9.0
	b	09-0311-H	15 BN	35	41	37.8	1.90	7.7
	c	09-0312-H	15 BN	34	41	37.0	1.85	7.3
	d	09-0313-H	15 BN	32	39	35.7	2.25	6.4
	e	09-0314-H	15 BN	32	42	36.9	2.47	7.0
	f	09-0315-H	15 BN	33	40	35.7	1.72	6.2
	g	09-0316-H	15 BN	32	38	34.2	1.86	5.5
Gill Creek, Ferry St. and Hyde Park Blvd. (former Sta. 15a)	a	09-0317-H	15 BN	32	45	37.7	3.22	7.3
	b	09-0318-H	15 BN	29	46	37.5	4.98	7.1
	c	09-0319-H	15 BN	30	43	37.1	4.21	6.7
	d	09-0320-H	15 BN	28	46	36.6	5.14	7.1
	e	09-0321-H	15 BN	32	40	37.7	2.22	7.0
	f	09-0322-H	15 BN	32	47	40.5	3.96	9.3
	g	09-0323-H	15 BN	36	47	40.2	3.32	9.0

Table 3. (continued)

Site	Comp.	Lab. No.	No. & Species[1]	Length				Composite Weight
				Minimum	Maximum	Mean	Stnd. Dev.[2]	
Gill Creek, Buffalo Avenue (former Sta. 15b)	a	09-0324-H	10 ST	49	52	54.8	2.10	15.7
	b	09-0325-H	10 ST	58	61	53.9	3.84	14.7
	c	09-0326-H	15 BN	38	52	43.0	4.24	10.8
	d	09-0327-H	15 BN	39	52	44.5	3.72	12.0
	e	09-0328-H	15 BN	34	51	42.8	4.35	10.5
	f	09-0329-H	15 BN	37	47	40.6	3.07	8.9
	g	09-0330-H	15 BN	36	44	40.1	2.61	8.4
	h	09-0331-H	15 BN	36	44	38.4	2.13	7.7
	i	09-0332-H	15 BN	35	42	38.1	2.07	7.3
Niagara River at Lewiston	a	09-0333-H	15 BN	31	49	39.7	5.33	8.9
	b	09-0334-H	15 BN	31	45	39.3	4.03	8.5
	c	09-0335-H	15 BN	33	45	40.2	3.38	8.8
	d	09-0336-H	15 BN	31	47	39.3	4.38	7.6
	e	09-0337-H	15 BN	31	49	40.3	5.34	8.8
	f	09-0338-H	15 BN	32	47	39.3	4.25	8.1
	g	09-0339-H	15 BN	33	47	42.3	4.18	10.0
Lake Ontario at Olcott	a	09-0340-H	25 ES	33	48	41.3	4.79	12.4
	b	09-0341-H	25ES	30	49	39.0	5.46	11.4
	c	09-0342-H	25 ES	30	48	39.0	4.79	10.5
	d	09-0343-H	25 ES	30	48	38.0	4.66	9.9
	e	09-0344-H	25 ES	29	54	39.8	5.46	11.1
	f	09-0345-H	25 ES	35	47	40.4	3.65	10.6
	g	09-0346-H	25 ES	35	46	39.5	3.16	10.2

[1] Species: ST – spottail shiner, BN – bluntnose minnow, ES – emerald shiner, CS – common shiner, CC – creek chub, GS – golden shiner and RC – river chub

[2]Stnd. Dev. – standard deviation

Table 4. Summary of length and weight field data, by sampling location, for young-of-year fish from near-shore areas within New York State's Great Lakes Basin, Dunkirk to Olcott, NY, 2009.

Site	Species[1]	No. Composites	Total Length (mm)			Weight (g)
			Minimum	Maximum	Mean	Mean
Lake Erie, Dunkirk Harbor	ST	7	37	54	44.1(3.25)[2]	12.3(1.35)
Niagara. River, Beaver Is. St. Park	RC	5	30	55	41.0(4.92)	11.26(3.660)
	BN	2	24	35	28.8(2.09)	6.75(1.48)
Buffalo River	BN	7	38	50	43.3(2.33)	11.6(1.07)
Niagara River, Niawanda Park	ES	7	25	49	33.7(4.31)	6.8(0.98)
Twomile Creek, Fletcher Street	CS	3	31	48	39.8(3.76)	9.5(2.31)
	ST	1	45	55	49.8(3.56)	5.9(0.00)
	ES	7	30	44	36.3(2.81)	5.7(0.48)
Erie Canal	BN	7	32	49	41.2(2.95)	9.6(1.06)
Pettit Flume	BN	7	32	48	39.2(3.19)	8.0(0.79)
Niagara River, between Pettit Flume & GRP	BN	6	30	56	41.3(6.60)	9.9(1.40)
Niagara River, Gratwick-Riverside Park (GRP)	BN	7	34	53	41.4(3.64)	9.9(2.30)
Niagara River, upstream edge of 102nd St. Landfill	BN	7	32	48	40.9(3.39)	9.2(1.36)
Little River, upstream from Cayuga Creek	BN	7	28	52	36.7(4.83)	7.7(2.52)
Cayuga Creek, Porter Road	CC	1	44	50	47.0(2.0)	6.1(0.00)
	CS	4	36	59	50.7(4.42)	9.7(2.41)
Bergholtz Creek, upstream from old Black Creek	GS	7	26	41	32.5(2.29)	7.1(0.80)
Bergholtz Creek, downstream from old Black Creek	BN	1	32	42	36.7(3.26)	6.6(0.00)
	GS	7	25	38	30.9(2.43)	6.0(0.34)
Cayuga Creek, Lindberg Avenue	BN	7	22	40	28.4(3.23)	5.9(0.72)
Little River downstream from Cayuga Creek	BN	7	32	43	36.7(2.0)	7.0(1.14)
Gill Creek, Ferry St. (Site 15a)	BN	7	28	47	38.2(4.12)	7.6(1.05)
Gill Creek, Buffalo Ave. (Site 15b)	ST	2	49	61	54.4(3.05)	15.2(0.71)
	BN	7	34	52	41.1(3.91)	9.4(1.75)

Table 4. (continued)

Site	Species[1]	No. Composites	Total Length (mm)			Weight (g)
			Minimum	Maximum	Mean	Mean
Niagara River, Lewiston	BN	7	31	49	40.0(4.44)	8.7(0.75)
Lake Ontario, Krull Park, Olcott	ES	7	29	54	39.6(4.67)	10.9(0.84)

[1] Species: ST – spottail shiner, BN – bluntnose minnow, ES – emerald shiner, CS – common shiner, CC – creek chub, GS – golden shiner and RC – river chub

[2] (standard deviation)

Table 5. Aroclor 1242 and Aroclor 1254/ 1260 concentrations (wet weight and lipid adjusted) in young-of-year fish composites from near-shore areas within New York State's Great Lakes Basin, Dunkirk to Olcott, NY, 2009.

Location	Species[1]	Composite	% Lipid	AR1242		AR1254/ 1260		Total PCB	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
L. Erie, Dunkirk Harbor	BN	A	1.73	0[2]	0	0	0	0	0
		B	1.84	0	0	33.8	1837	33.8	1837
		C	1.65	0	0	32.3	1957	32.3	1957
		D	1.51	0	0	0	0	0	0
		E	1.79	0	0	31.0	1732	31.0	1732
		F	1.62	0	0	0	0	0	0
		G	2.02	0	0	43.9	2173	43.9	2173
		mean[4]	1.74	0	0	20.1(19.3)[3] – 35.3(5.9)	1100(1037) – 1925(189)	20.1(19.3) – 35.3(5.9)	1100(1109) - 1925(189)
Niagara River, Beaver Island State Park	RC	A	4.92	0	0	0	0	0	0
		B	3.72	0	0	0	0	0	0
		C	4.40	0	0	0	0	0	0
		C-dupl.[5]	4.40	0	0	0	0	0	0
		D	3.61	0	0	0	0	0	0
		E	3.32	0	0	0	0	0	0
		mean	3.99	0	0	0	0	0	0
	BN	F	1.63	0	0	0	0	0	0
		G	1.34	0	0	0	0	0	0
		mean	1.49	0	0	0	0	0	0
Buffalo River	BN	A	1.96	14.7	750	31.3	1597	46.0	2347
		B	1.81	16.5	912	0	0	16.5	912
		C	1.98	16.3	823	0	0	16.3	823
		D	2.01	12.3	612	30.4	1512	42.7	2124
		E	1.69	15.3	905	0	0	15.3	905
		F	1.98	15.4	778	0	0	15.4	778
		G	1.92	16.9	880	30.1	1568	47.0	2448
		mean[4]	1.91	15.3(1.6)	809(107)	13.1(16.4) – 30.6(0.6)	668(834) - 1559(43)	28.5(15.7) – 45.9(2.2)	1477(783) – 2368(150)

Table 5. (continued)

Location	**Species**[1]	**Composite**	**% Lipid**	**AR1242**		**AR1254/ 1260**		**Total PCB**	
				Wet Wt.	**Lipid Adj.**	**Wet Wt.**	**Lipid Adj.**	**Wet Wt.**	**Lipid Adj.**
Niagara River, Niawanda Park, Tonawanda	ES	A	1.86	14.9	801	0	0	14.9	801
		B	1.66	12.7	765	0	0	12.7	765
		C	2.02	16.3	807	0	0	16.3	807
		D	1.71	12.1	708	32.2	1883	44.3	2591
		E	2.21	17.4	787	0	0	17.4	787
		F	2.06	13.1	636	0	0	13.1	636
		G	1.99	15.1	759	0	0	15.1	759
		mean[4]	1.93	14.5(2.0)	752(60.9)	4.6(12.2) – 32.2(0)	269(712) – 1883(0)	19.1(11.2) – 46.7(14.2)	1021(695) – 2635(60.9)
Twomile Creek	CS	A	2.57	180	7004	206	8015	386	15019
		A-dupl.	2.57	174	6770	198	7704	372	14474
		B	2.42	183	7562	214	8843	396	15248
		C	2.63	166	6312	196	7452	362	13765
		mean	2.54	176(9.1)	6959(626)	205(9.0)	8104(700)	381(17.5)	14677(798)
	ST	D	3.46	216	6243	216	6243	432	12486
	ES	E	3.50	199	5686	168	4800	367	10486
		F	3.72	209	5618	165	4435	374	10053
		G	2.98	144	4832	128	4295	272	9127
		H	3.27	187	5719	154	4709	341	10429
		I	3.04	162	5329	142	4671	304	10000
		J	3.62	195	5387	156	4309	351	9696
		K	3.13	179	5719	163	5208	342	10927
		mean	3.34	182(22.6)	5470(323)	154(14.3)	4632(323)	336(36.1)	10103(586)
Erie Canal	BN	A	2.39	75.0	3138	58.5	2448	133	5586
		B	1.95	61.0	3128	61.1	3133	122	6261
		C	2.40	70.8	2950	60.7	2529	131	5479
		C-dupl.	2.40	69.7	2904	60.4	2517	130	5421
		D	2.18	64.9	2977	66.3	3041	131	6018
		E	1.95	52.4	2687	52.6	2697	105	5384
		F	1.98	54.8	2768	52.2	2636	107	5404
		G	1.85	50.7	2741	52.9	2859	104	5601
		mean	2.10	61.3(9.4)	2913(184)	57.7(5.4)	2763(257)	119(13.3)	5676(334)

Table 5. (continued)

Location	Species[1]	Composite	% Lipid	AR1242		AR1254/ 1260		Total PCB	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
Pettit Flume	BN	A	1.92	12.3	641	44.4	2313	56.7	2954
		B	1.85	15.0	811	44.3	2395	59.3	3205
		C	2.13	17.7	831	56.8	2667	74.5	3498
		D	2.02	18.3	906	51.9	2569	70.2	3475
		E	1.73	15.8	913	43.2	2497	59.0	3410
		F	1.78	14.5	815	51.4	2888	65.9	3703
		G	1.72	14.1	820	44.7	2599	58.8	3419
		mean	1.88	15.4(2.1)	820(89.7)	48.1(5.2)	2561(188)	63.5(6.8)	3381(239)
Niagara River, between Pettit Flume and GRP	BN	A	3.97	79.6	2005	67.7	1705	147	3710
		B	3.36	61.9	1842	60.8	1810	123	3651
		C	3.51	64.1	1826	60.1	1712	124	3538
		D	4.09	78.2	1912	65.3	1597	143	3509
		E	3.50	76.5	2186	65.3	1866	142	4052
		F	3.94	76.8	1949	68.8	1746	146	3695
		mean	3.73	72.9(7.7)	1953(132)	64.7(3.6)	1739(93)	137(11.0)	3693(194)
Niagara River, Gratwick-Riverside Park	BN	A	3.80	160	4211	83.7	2203	244	6414
		B	3.37	131	3887	80.1	2377	211	6264
		C	2.66	110	4135	73.0	2744	182	6879
		D	3.36	156	4643	82.7	2461	239	7104
		E	2.73	101	3670	72.1	2641	173	6311
		F	2.82	82.2	2915	68.2	2418	150	5333
		G	2.98	123	4128	73.0	2450	196	6578
		mean	3.10	123(28.4)	3941(543)	76.1(6.0)	2471(177)	199(34.5)	6412(566)
Niagara River, upstream edge of 102nd St. Landfill.	BN	A	2.52	70.4	2794	85.3	3385	156	6179
		B	2.75	78.2	2844	89.7	3262	168	6103
		C	2.73	74.1	2714	77.7	2846	152	5560
		D	2.31	66.6	2883	87.7	3796	154	6679
		E	2.11	53.3	2526	64.7	3066	118	5592
		F	2.16	58.2	2694	59.2	2741	117	5435
		G	2.37	65.2	2751	70.0	2954	135	5705
		mean	2.42	66.6(8.7)	2744(117)	76.3(12.0)	3150(363)	143(19.8)	5893(445)

Table 5. (continued)

Location	Species[1]	Composite	% Lipid	AR1242		AR1254/ 1260		Total PCB	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
Niagara River, upstream Little River	BN	A	2.92	97.1	3325	67.7	2319	165	5643
		A-dupl.	2.92	101	3459	71.1	2435	172	5894
		B	2.07	67.0	3237	54.5	2633	121	5870
		C	1.60	44.5	2781	50.5	3156	95.0	5937
		D	1.90	63.0	3316	55.2	2905	118	6221
		E	2.11	53.3	2526	53.3	2526	107	5052
		F	2.13	60.9	2859	66.3	3113	127	5972
		G	1.70	37.0	2176	48.8	2871	85.8	5047
		mean	2.06	60.4(19.4)	2889(437)	56.6(7.4)	2789(309)	117(25.7)	5677(461)
Cayuga Creek, Porter Road	BN	A	Insufficient number to analyze						
	CC	B	3.27	40.7	1245	71.6	2190	112	3435
	CS	C	4.17	39.1	938	57.9	1388	97.0	2327
		C-dupl.	4.17	42.2	1012	66.4	1592	109	2604
		D	3.92	37.8	964	56.4	1439	94.2	2403
		E	3.71	39.7	1070	60.1	1620	99.8	2690
		F	3.93	47.1	1208	63.2	1621	110	2829
	mean		3.79	40.9(3.6)	1085(139)	59.4(2.9)	1652(319)	100(6.9)	2737(441)
Upstream Bergholtz Creek	GS	A	2.19	60.4	2758	143	6530	203	9288
		B	2.83	63.8	2254	162	5724	226	7978
		C	2.55	54.0	2118	139	5451	193	7569
		D	2.36	51.6	2186	126	5339	178	7525
		E	2.72	65.1	2393	156	5735	221	8128
		E-dupl.	2.72	58.9	2165	140	5147	199	7312
		F	2.64	58.3	2208	140	5303	198	7511
		G	2.56	55.8	2180	130	5078	186	7258
		mean	2.55	58.4(5.0)	2300(220)	142(13.0)	5594(474)	201(17.6)	7894(683)
downstream Bergholtz Creek	BN	A	1.82	34.6	1901	68.8	3780	103	5681
	GS	B	1.85	30.3	1638	74.0	4000	104	5638
		C	1.82	32.4	1780	66.2	3637	98.6	5417
		D	2.22	32.3	1455	70.0	3153	102	4608
		E	2.02	27.5	1361	58.1	2876	85.6	4237
		F	1.96	31.3	1597	59.7	3046	91.0	4643
		G	1.66	28.0	1687	62.4	3759	90.4	5446
		H	2.04	34.1	1672	68.6	3363	103	5035
		mean	1.92	30.8(2.4)	1599(144)	65.6(5.8)	3405(410)	96.4(7.3)	5003(523)

Table 5. (continued)

Location	Species[1]	Composite	% Lipid	AR1242		AR1254/ 1260		Total PCB	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adt.
Cayuga Creek, Lindberg Ave.	BN	A	1.72	42.1	2448	82.2	4779	124	7227
		B	1.51	36.1	2391	91.2	6040	127	8431
		C	1.54	35.1	2279	87.3	5669	122	7948
		D	1.55	36.8	2374	80.8	5213	118	7587
		E	1.50	31.9	2127	81.9	5460	114	7587
		F	1.51	29.6	1960	80.6	5338	110	7298
		G	1.61	34.9	2168	78.1	4851	113	7019
		mean	1.56	35.2(3.9)	2250(174)	83.2(4.5)	5336(444)	118(6.3)	7585(479)
Niagara River, downstream Little River	BN	A	1.79	48.8	2726	74.2	4145	123	6871
		A-dupl.	1.79	48.6	2715	73.0	4078	122	6793
		B	1.75	49.9	2851	77.0	4400	127	7251
		C	1.98	41.6	2101	59.8	3020	101	5121
		D	1.81	40.1	2215	62.5	3453	103	5668
		E	1.66	44.2	2663	68.2	4108	112	6771
		F	1.68	43.3	2577	65.7	3911	109	6488
		G	1.71	38.6	2257	75.0	4386	114	6643
		mean	1.77	43.8(4.2)	2784(290)	68.9(6.7)	3918(510)	113(9.6)	6402(744)
Gill Creek, Ferry St. (Sta.15a)	BN	A	1.85	0	0	43.9	2373	43.9	2373
		B	1.93	22.7	1176	57.5	2979	80.2	4155
		C	1.81	10.5	580	67.1	3707	77.6	4287
		D	2.23	10.3	462	50.0	2242	60.3	2704
		E	1.98	12.5	631	56.5	2853	69.0	3484
		F	2.30	11.6	504	54.8	2383	66.4	2887
		G	2.42	11.0	455	55.4	2289	66.4	2744
		mean	2.07	11.2(6.6)	544(347)	55.0(7.1)	2689(532)	66.3(12.0)	3233(753)
Gill Creek, Buffalo Avenue (Sta. 15b)	ST	A	2.50	198	7920	133	5320	331	13240
		A-dupl.	2.50	200	8000	133	5320	333	13320
		B	2.54	197	7756	135	5315	332	13071
		mean	2.52	197(0.7)	7838(116)	134(0.7)	5317(3.5)	332(0.7)	13156(120)
	BN	C	2.57	205	7977	155	6031	360	14008
		D	1.92	349	18177	213	11094	562	29271
		E	2.02	188	9307	155	7673	343	16980
		F	2.28	180	7895	145	6360	325	14255
		G	2.07	209	10097	160	7729	369	17809
		H	2.02	275	13614	181	8960	456	22574
		I	2.12	202	9528	149	7028	351	16557
		mean	2.14	230(61.9)	10942(3718)	165(23.9)	7839(1732)	395(84.7)	18779(5429)

Table 5. (continued)

Location	Species[1]	Composite	% Lipid	AR1242		AR1254/ 1260		Total PCB	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
Niagara River, Lewiston	BN	A	2.69	18.6	691	0	0	18.6	691
		B	2.92	27.4	938	33.1	1133	60.5	2072
		C	2.87	21.1	735	0	0	21.1	735
		D	2.96	18.0	608	0	0	18.0	608
		E	2.98	17.4	584	30.2	1013	47.6	1597
		F	2.97	19.5	657	0	0	19.5	657
		G	2.68	15.8	590	0	0	15.8	590
		mean[4]	2.87	19.7(3.8)	686(124)	9.1(15.5) – 31.7(2.1)	307(525) – 1073(84.9)	28.7(17.8) – 51.4(5.9)	993(593) – 1759(209)
L. Ontario, Krull Park, Olcott	ES	A	4.02	67.6	1681	36.2	901	104	2582
		B	3.59	87.5	2437	35.3	983	123	3420
		C	3.30	69.9	2118	32.8	994	103	3112
		D	3.80	95.7	2518	41.2	1084	137	3602
		E	3.70	88.1	2381	39.9	1078	128	3459
		F	3.69	88.5	2398	38.8	1051	127	3449
		F-dupl.	3.69	92.0	2493	40.4	1095	132	3588
		G	3.30	80.3	2433	34.0	1030	114	3463
		mean	3.63	82.5(10.4)	2281(293)	36.9(3.1)	1019(65.6)	119(12.8)	3298(349)

[1] Species: ST – spottail shiner, BN – bluntnose minnow, ES – emerald shiner, CS – common shiner, CC – creek chub, GS – golden shiner and RC – river chub

[2] zero implies the values is less than the method detection limit

[3] numbers in parentheses are standard deviations

[4] where a range in values is shown the values represent a range in means calculated with and without zeros
[5] duplicate values were not used to calculate means

Table 6. Total DDT and metabolites concentrations (ug/Kg wet weight and lipid adjusted) in young-of-year fish composites from near-shore areas within New York State's Great Lakes Basin, Dunkirk to Olcott, NY, 2009.

Location	Species[1]	Comp.	% Lipid	p,p'-DDE		p,p'-DDD		p,p'-DDT		Total DDT	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
L. Erie, Dunkirk Harbor	BN	A	1.73	3.34	193	0[2]	0	0	0	3.34	193
		B	1.84	4.72	257	0	0	0	0	4.72	257
		C	1.65	4.27	259	0	0	0	0	4.27	259
		D	1.51	4.08	270	0	0	0	0	4.08	270
		E	1.79	4.31	241	0	0	0	0	4.31	241
		F	1.62	3.70	228	0	0	0	0	3.70	228
		G	2.02	4.92	244	0	0	2.82	140	7.44	384
		mean[4]	1.74	4.19(0.5)[3]	242(25.5)	0	0	0.40(1.07)-2.82	20.0(52.9)-140	4.55(1.3)-7.01(0.5)	262(60)-382(25)
Niagara River, Beaver Island State Park	RC	A	4.92	3.30	67.0	0	0	0	0	3.30	67.0
		B	3.72	2.99	80.4	0	0	0	0	2.99	80.4
		C	4.40	3.32	75.5	0	0	0	0	3.32	75.5
		C-dupl.[5]	4.40	3.24	73.6	0	0	0	0	3.24	73.6
		D	3.61	3.08	85.3	0	0	0	0	3.08	85.3
		E	3.32	2.50	75.3	0	0	0	0	2.5	75.3
		mean	3.99	3.04(0.3)	76.7(6.8)	0	0	0	0	3.04(0.3)	76.7(6.8)
	BN	F	1.63	0	0	0	0	0	0	0	0
		G	1.34	0	0	0	0	0	0	0	0
		mean	1.49	0	0	0	0	0	0	0	0
Buffalo River	BN	A	1.96	2.17	111	0	0	0	0	2.17	111
		B	1.81	0	0	0	0	0	0	0	0
		C	1.98	0	0	0	0	0	0	0	0
		D	2.01	2.22	110	0	0	0	0	2.22	110
		E	1.69	0	0	0	0	0	0	0	0
		F	1.98	2.04	103	0	0	0	0	2.04	103
		G	1.92	2.53	132	0	0	0	0	2.53	132
		mean[4]	1.91	1.28(1.21)-2.24(0.21)	65.1(61.6)-114(12.5)	0	0	0	0	1.28(1.21)-2.24(0.21)	65.1(61.6)-114(13)

Table 6. (continued)

Location	Species[1]	Comp.	% Lipid	p,p'-DDE		p,p'-DDD		p,p'-DDT		Total DDT	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
Niagara River, Niawanda Park, Tonawanda	ES	A	1.86	2.53	136	0	0	0	0	2.53	136
		B	1.66	0	0	0	0	0	0	0	0
		C	2.02	0	0	0	0	0	0	0	0
		D	1.71	2.04	119	0	0	0	0	2.04	119
		E	2.21	0	0	0	0	0	0	0	0
		F	2.06	0	0	0	0	0	0	0	0
		G	1.99	0	0	0	0	0	0	0	0
		mean[4]	1.93	0.65(1.12)-2.29(0.35)	36.4(62.4)-128(12)	0	0	0	0	0.65(1.12)-2.29(0.35)	36.4(62.4)-128(12)
Twomile Creek	CS	A	2.57	8.82	343	5.21	203	4.84	188	18.9	734
		A-dupl.	2.57	8.52	332	4.95	193	4.75	185	18.2	710
		B	2.42	8.82	364	5.81	240	4.74	196	19.4	800
		C	2.63	8.01	305	4.92	187	4.83	184	17.8	676
		mean	2.54	8.55(0.5)	337(30)	5.31(0.5)	210(27)	4.80(0.0)	189(6)	18.7(0.8)	737(62)
	ST	D	3.46	8.05	233	6.84	198	5.64	163	20.5	593
	ES	E	3.50	7.62	218	5.92	169	4.57	131	18.1	517
		F	3.72	6.69	180	5.58	150	4.42	119	16.7	449
		G	2.98	5.44	183	4.20	141	3.54	119	13.2	442
		H	3.27	6.06	185	4.76	145	4.24	130	15.1	461
		J	3.04	5.53	182	4.63	152	3.94	130	14.1	464
		I	3.62	6.59	182	5.32	147	4.33	120	16.2	449
		K	3.13	7.09	227	5.18	165	4.31	138	16.6	530
		mean	3.34	6.43(0.8)	194(20)	5.08(0.6	153(10)	4.19(0.3)	127(7)	15.7(1.7)	473(35)
Erie Canal	BN	A	2.39	7.70	322	2.54	106	0	0	10.2	428
		B	1.95	7.24	371	0	0	2.00	103	9.24	474
		C	2.40	7.92	330	2.31	96.3	0	0	10.2	426
		C-dupl.	2.40	7.82	326	2.41	100	0	0	10.2	426
		D	2.18	8.37	384	2.27	104	2.01	92.2	12.7	580
		E	1.95	5.75	295	0	0	0	0	5.75	295
		F	1.98	6.34	320	0	0	0	0	6.34	320
		G	1.85	6.24	337	0	0	0	0	6.24	337
		mean[4]	2.10	7.08(1.0)	337(30.8)	1.02(1.3)-2.37(0.1)	43.8(54.7)-102(5.1)	0.57(1.0)-2.00(0.0)	27.9(47.7)-97.6(7.6)	8.67(2.6)-11.5(1.1)	408(100)-537(43)

Table 6. (continued)

Location	Species[1]	Comp.	% Lipid	p,p'-DDE		p,p'-DDD		p,p'-DDT		Total DDT	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
Pettit Flume	BN	A	1.92	3.20	167	0	0	0	0	3.20	167
		B	1.85	3.11	168	0	0	0	0	3.11	168
		C	2.13	4.04	190	2.81	132	0	0	6.85	322
		D	2.02	3.42	169	0	0	0	0	3.42	169
		E	1.73	2.97	172	0	0	0	0	2.97	172
		F	1.78	3.46	194	0	0	0	0	3.46	194
		G	1.72	2.75	160	0	0	0	0	2.75	160
		mean[4]	1.88	3.28(0.4)	174(12.7)	0.40(1.1)-2.8	18.9(49.9)-132	0	0	3.68(1.4)-6.08(0.4)	193(58)-306(13)
Niagara River, between Pettit Flume and GRP	BN	A	3.97	3.83	96.5	0	0	2.06	51.9	5.89	148
		B	3.36	3.47	104	0	0	0	0	3.47	104
		C	3.51	3.75	107	0	0	0	0	3.75	107
		D	4.09	3.88	94.9	0	0	0	0	3.88	94.9
		E	3.50	3.46	98.9	0	0	0	0	3.46	98.9
		F	3.94	4.03	102	0	0	0	0	4.03	102
		mean[4]	3.73	3.74 (0.2)	100(4.7)	0	0	0.3(0.8) – 2.06	8.7(21.2) – 51.9	4.08(0.9)-5.8(0.2)	109(19.5)-152(4.7)
Niagara River, Gratwick–Riverside Park	BN	A	3.80	4.20	111	0	0	2.25	59.2	6.45	170
		B	3.37	3.81	113	0	0	2.34	69.4	6.15	182
		C	2.66	3.39	127	0	0	0	0	3.39	127
		D	3.36	4.30	128	0	0	2.22	66.1	6.52	194
		E	2.73	3.45	126	0	0	0	0	3.45	126
		F	2.82	3.77	134	0	0	0	0	3.77	134
		G	2.98	3.50	117	0	0	0	0	3.50	117
		mean[4]	3.10	3.77(0.4)	123(8.6)	0	0	0.97(1.2) – 2.27(0.1)	27.8(34.8)– 64.9(5.2)	4.75(1.5)-6.04(0.5)	150(31)-188(14)
Niagara River, upstream edge of 102nd Street Landfill.	BN	A	2.52	3.44	187	0	0	2.24	88.9	6.68	276
		B	2.75	3.68	134	0	0	2.40	87.3	6.08	221
		C	2.73	3.23	118	0	0	2.14	78.4	5.37	196
		D	2.31	3.98	172	0	0	2.34	101	6.32	273
		E	2.11	3.13	148	0	0	0	0	3.13	148
		F	2.16	2.90	134	0	0	0	0	2.90	134
		G	2.37	2.91	123	0	0	0	0	2.91	123
		mean[4]	2.42	3.32(0.4)	145(26)	0	0	1.30(1.2) – 2.28(0.1)	50.8(48.0)– 88.9(9.3)	4.77(1.7)-5.6(0.5)	196(64)-234(35)

Table 6. (continued)

Location	Species[1]	Comp.	% Lipid	p,p'-DDE		p,p'-DDD		p,p'-DDT		Total DDT	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
Niagara.River, upstream Little River	BN	A	2.92	4.23	145	2.36	80.8	2.06	70.5	8.65	296
		A-dupl.	2.92	4.50	154	2.53	86.6	2.12	72.6	9.15	313
		B	2.07	3.45	167	0	0	0	0	3.45	167
		C	1.60	3.03	189	0	0	0	0	3.03	189
		D	1.90	3.23	170	0	0	0	0	3.23	170
		E	2.11	2.70	128	0	0	0	0	2.70	128
		F	2.13	3.52	165	2.40	113	2.06	96.7	7.98	375
		G	1.70	2.24	132	0	0	0	0	2.24	132
		mean[4]	2.06	3.2(0.6)	157(22)	0.68(1.16)-2.38(0.03)	27.7(48.2)-96.9(22.8)	0.59(1.0)-2.06(0)	23.9(41.5)-83.6(18.5)	4.47(2.7)-7.64(0.6)	208(93)-338(63)
Cayuga Creek at Porter Road	BN	A	Insufficient numbers to analyze								
	CC	B	3.27	18.6	569	7.75	237	0	0	26.3	806
	CS	C	4.17	23.1	554	12.0	288	0	0	35.1	842
		C-dupl.	4.17	25.1	602	13.6	326	0	0	38.7	928
		D	3.92	21.7	553	12.4	316	0	0	34.1	869
		E	3.71	22.4	604	13.3	358	0	0	35.7	962
		F	3.90	30.0	769	14.4	369	0	0	44.4	1138
		mean	3.93	24.3(3.8)	620(102)	13.0(1.1)	333(38)	0	0	37.3(4.8)	953(134)
Upstream Bergholtz Creek	GS	A	2.19	10.6	484	0	0	3.75	171	14.3	655
		B	2.83	11.9	421	0	0	4.49	159	16.4	580
		C	2.55	9.76	383	0	0	3.89	153	13.7	536
		D	2.36	8.46	359	0	0	3.51	149	12.0	508
		E	2.72	10.9	401	0	0	4.48	165	15.4	566
		E-dupl.	2.72	9.90	364	0	0	4.09	150	14.0	514
		F	2.64	9.42	357	0	0	4.02	152	13.4	509
		G	2.56	9.27	362	0	0	3.75	146	13.0	508
		mean	2.55	10.04(1.2)	395(46)	0	0	3.98(0.38)	156(9)	14.0(1.5)	552(54)

Table 6. (continued)

Location	Species[1]	Comp.	% Lipid	p,p'-DDE		p,p'-DDD		p,p'-DDT		Total DDT	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
downstream Bergholtz Creek	BN	A	1.82	6.70	368	2.25	124	0	0	8.95	492
	GS	B	1.85	6.18	334	0	0	2.12	115	8.30	449
		C	1.82	6.12	336	0	0	2.04	112	8.16	448
		D	2.22	6.52	294	0	0	2.12	95.5	8.64	390
		E	2.02	5.16	255	0	0	2.08	103	7.24	358
		F	1.96	5.59	285	0	0	2.08	106	7.67	391
		G	1.66	5.66	341	0	0	2.11	127	7.77	468
		H	2.04	5.75	282	0	0	2.45	120	8.20	402
		mean	1.92	5.85(0.5)	304(33)	0	0	2.14(0.1)	111(11)	8.0(0.5)	415(40)
Cayuga Creek, Lindberg Avenue	BN	A	1.72	7.76	451	4.37	254	2.56	149	14.7	854
		B	1.51	7.40	490	4.06	269	2.59	172	14.0	931
		C	1.54	7.94	516	3.70	240	2.60	169	14.2	925
		D	1.55	7.13	460	3.77	243	2.52	163	13.4	866
		E	1.50	7.03	469	3.91	261	2.55	170	13.5	900
		F	1.51	7.03	466	3.62	240	2.53	167	13.2	873
		G	1.61	6.66	414	3.47	216	2.51	156	12.6	786
		mean	1.56	7.28(0.4)	467(32)	3.84(0.3)	246(17)	2.55(0.03)	164(8)	13.7(0.7)	876(50)
Niagara River, downstream Little River	BN	A	1.79	6.53	365	2.29	128	2.43	136	11.3	629
		A-dupl.	1.79	6.42	359	2.24	125	2.31	129	11.0	613
		B	1.75	6.49	371	2.12	121	2.49	142	11.1	634
		C	1.98	5.31	268	2.03	103	0	0	7.34	371
		D	1.81	5.17	286	0	0	2.08	115	7.25	401
		E	1.66	5.24	316	0	0	2.27	137	7.51	453
		F	1.68	5.30	315	2.17	129	2.18	130	9.65	574
		G	1.71	5.18	303	0	0	2.03	119	7.21	422
		mean[4]	1.77	5.6(0.6)	318(38)	1.23(1.15)-2.15(0.1)	68.7(64.8)-120(12)	1.93(0.9)	111(50)	8.77(1.9)-9.68(1.6)	498(112)-549(100)
Gill Creek, Ferry St. (Sta. 15a)	BN	A	1.85	3.54	191	0	0	0	0	3.54	191
		B	1.93	4.27	221	0	0	2.03	105	6.30	326
		C	1.81	3.51	194	0	0	0	0	3.51	194
		D	2.23	4.74	213	2.23	100	0	0	6.97	313
		E	1.98	4.21	213	0	0	0	0	4.21	213
		F	2.30	4.80	209	2.03	88.3	0	0	6.83	297
		G	2.42	5.28	218	2.39	98.8	0	0	7.67	317
		mean[4]	2.07	4.35(0.7)	208(12)	0.95(1.2) – 2.22(0.2)	41.0(51.3)-95.7(6.4)	0.29(0.8) – 2.03	15(39.7) – 105	5.57(1.8)-8.6(0.9)	264(62)-409(18)

Table 6. (continued)

Location	Species[1]	Comp.	% Lipid	p,p'-DDE		p,p'-DDD		p,p'-DDT		Total DDT	
				Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.	Wet Wt.	Lipid Adj.
Gill Creek, Buffalo Avenue (Sta.15b)	ST	A	2.50	8.26	330	3.50	140	5.52	221	17.3	691
		A-dupl.	2.50	8.24	330	3.51	140	5.51	220	17.3	690
		B	2.54	8.43	332	3.81	150	5.60	221	17.8	702
		mean	2.52	8.35(0.12)	331(0.7)	3.65(0.22)	145(7.1)	5.56(0.1)	221(0)	17.5(0.4)	697(8)
	BN	C	2.57	5.52	215	2.78	108	6.10	237	14.4	560
		D	1.92	4.57	238	0	0	7.28	379	11.9	617
		E	2.02	4.70	233	0	0	5.72	283	10.4	516
		F	2.28	4.60	202	2.10	92.1	5.50	241	12.2	535
		G	2.07	4.69	227	2.10	101	5.90	285	12.7	613
		H	2.02	2.82	140	0	0	2.82	140	5.64	279
		I	2.12	3.35	158	2.32	109	5.73	270	11.4	538
		mean[4]	2.14	4.32(0.91)	202(38)	1.33(1.26)-2.33(0.32)	58.6(55.1)-103(8)	5.65(1.5)	262(71)	11.2(2.7)-12.3(2.7)	523(114)-567(117)
Niagara River, Lewiston	BN	A	2.69	3.34	124	0	0	0	0	3.34	124
		B	2.92	3.96	136	0	0	0	0	3.96	136
		C	2.87	2.84	99.0	0	0	0	0	2.84	99.0
		D	2.96	3.72	126	0	0	0	0	3.72	126
		E	2.98	3.54	119	0	0	0	0	3.54	119
		F	2.97	3.31	111	0	0	0	0	3.31	111
		G	2.68	2.96	110	0	0	0	0	2.96	110
		mean	2.87	3.38(0.40)	118(12)	0	0	0	0	3.38(0.40)	118(12)
L. Ontario, Krull Park, Olcott	ES	A	4.02	8.75	218	0	0	0	0	8.75	218
		B	3.59	8.29	231	0	0	0	0	8.29	231
		C	3.30	7.75	235	0	0	0	0	7.75	235
		D	3.80	9.53	251	0	0	0	0	9.53	251
		E	3.70	12.1	327	0	0	2.07	55.9	14.2	383
		F	3.69	9.89	268	0	0	0	0	9.89	268
		F-dupl.	3.69	10.3	279	0	0	0	0	10.3	279
		G	3.30	8.61	261	0	0	0	0	8.61	261
		mean[4]	3.63	9.24(1.5)	256(36)	0	0	0.29(0.8)-2.07	7.99(21.1)-55.9	9.57(2.2)-11.31(1.5)	264(55)-312(92)

[1] Species: ST – spottail shiner, BN – bluntnose minnow, ES – emerald shiner, CS – common shiner, CC – creek chub, GS – golden shiner and RC – river chub
[2] zero implies the values is less than the method detection limit
[3] numbers in parentheses are standard deviations
[4] where a range in values is shown the values represent a range in means calculated with and without zeros
[5] duplicate values were not used to calculate means

Table 7. **HCB, mirex, and alpha and beta HCH concentrations (ug/Kg wet weight and lipid adjusted) in young-of-year fish composites from near-shore areas within New York State's Great Lakes Basin, Dunkirk to Olcott, NY, 2009.**

Location	Comp.	% Lipid	HCB		Mirex		Alpha HCH		Beta HCH	
			Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted
Pettit Flume	A	1.92	0[1]	106	0	0	0	0	0	0
	B	1.85	0	111	0	0	0	0	0	0
	C	2.13	3.90	183	0	0	0	0	0	0
	D	2.02	0	0	0	0	0	0	0	0
	E	1.73	0	0	0	0	0	0	0	0
	F	1.78	2.40	135	0	0	0	0	0	0
	G	1.72	2.21	129	0	0	0	0	0	0
	mean[4]	1.88	0.66 (1.1)[2]- 2.31(0.13)	63.9(81.5- 149(30)	0	0	0	0	0	0
upstream Little River	A	2.92	0	0	2.03	69	0	0	0	0
	A-dupl.[3]	2.92	0	0	2.16	74	0	0	0	0
	B	2.07	0	0	3.08	149	0	0	0	0
	C	1.60	0	0	2.18	136	0	0	0	0
	D	1.90	0	0	2.39	126	0	0	0	0
	E	2.11	0	0	3.14	149	0	0	0	0
	F	2.13	0	0	7.10	333	0	0	0	0
	G	1.70	0	0	5.50	323	0	0	0	0
	mean	2.06	0	0	3.63(1.9)	184(102)	0	0	0	0
Cayuga Creek, Porter Road	B	3.27	0	0	52.6	1609	0	0	0	0
	C	4.17	2.19	53	27.7	664	0	0	0	0
	C-dupl.	4.17	2.39	57	30.4	729	0	0	0	0
	D	3.92	0	0	27.5	702	0	0	0	0
	E	3.71	0	0	23.8	642	0	0	0	0
	F	3.90	2.39	61	30.9	792	0	0	0	0
	mean[4]	3.93	1.15(1.3) - 2.29(0.1)	28.5(33.1)- 57(5.7)	27.5(2.6)	700(66)	0	0	0	0

Table 7. (continued)

Location	Comp.	% Lipid	HCB		Mirex		Alpha HCH		Beta HCH	
			Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted
Cayuga Creek, Lindberg Ave.	A	1.72	0	0	3.78	210	0	0	0	0
	B	1.51	0	0	4.15	275	0	0	0	0
	C	1.54	0	0	4.12	267	0	0	0	0
	D	1.55	0	0	3.75	242	0	0	0	0
	E	1.50	0	0	3.48	232	0	0	0	0
	F	1.51	0	0	3.86	256	0	0	0	0
	G	1.61	0	0	3.40	211	0	0	0	0
	mean	1.56	0	0	3.79(0.3)	242(26)	0	0	0	0
downstream Little River	A	1.79	0	0	5.02	280	0	0	0	0
	A-dupl.	1.79	0	0	4.95	277	0	0	0	0
	B	1.75	0	0	5.18	296	0	0	0	0
	C	1.98	0	0	4.28	216	0	0	0	0
	D	1.81	0	0	4.40	243	0	0	0	0
	E	1.66	0	0	4.95	298	0	0	0	0
	F	1.68	0	0	5.40	321	0	0	0	0
	G	1.71	0	0	5.51	322	0	0	0	0
	mean	1.77	0	0	4.96(0.5)	282(40)	0	0	0	0
Gill Creek, Ferry Street (Sta 15A)	A	1.85	0	0	0	0	0	0	5.16	279
	B	1.93	0	0	0	0	0	0	5.48	284
	C	1.81	0	0	0	0	0	0	0	0
	D	2.23	0	0	0	0	0	0	7.15	321
	E	1.98	0	0	0	0	0	0	5.39	272
	F	2.30	0	0	0	0	0	0	6.71	292
	G	2.42	0	0	0	0	0	0	7.90	326
	mean	2.07	0	0	0	0	0	0	5.40(2.6)	253(114)

Table 7. (continued)

Location	Comp.	% Lipid	HCB		Mirex		Alpha HCH		Beta HCH	
Gill Creek, Buffalo Avenue (Sta. 15b)			Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted	Wet Wt.	Lipid Adjusted
	A	2.50	2.84	114	0	0	36.5	1460	19.7	788
	A-dupl.	2.50	2.90	116	0	0	37.0	1480	20.0	800
	B	2.54	2.58	102	0	0	38.2	1504	21.8	858
	mean	2.52	2.71(0.2)	108(8)	0	0	37.3(1.2)	1482(31)	20.8(1.5)	823(49)
	C	2.57	3.34	130	0	0	42.5	1654	22.4	872
	D	1.92	2.20	115	0	0	18.1	943	13.3	693
	E	2.02	0	0	0	0	16.4	812	13.7	678
	F	2.28	2.62	115	0	0	22.5	987	15.3	671
	G	2.07	2.32	112	0	0	25.8	1246	15.8	763
	H	2.02	2.81	139	0	0	19.4	960	14.9	738
	I	2.12	2.47	117	0	0	31.2	1472	19.0	896
	mean	2.14	2.30(1.1)	104(47)	0	0	25.1(9.2)	1153(313)	16.3(3.3)	759(92)

[1] Only values greater than the MDL are represented. Where zeros are shown the concentrations were less than the MDLs. Data for sites not listed were less than the MDLs.

[2] standard deviations are in parenthesis

[3] duplicate values were not used to calculate means

[4] where a range in values is shown the values represent a range in means calculated with and without zeros

Table 8. Mean concentrations (ug/Kg wet weight) of PCBs (Aroclors and total), p,p'-DDE and Mirex for young-of-year fish composites from Twomile Creek, Pettit Flume, upstream Little River, Cayuga Creek, Bergholtz Creek and Gill Creek, New York State's near-shore Great Lakes Basin, 1997 and 2009.

Location	Year	Species[2]	No. Comp's	AR1242/ 1248 [3]	AR1254/ 1260 [3]	Total PCB	p,p'-DDE [3]	Mirex [3]
Twomile Creek	1996[1]	ES	5	109 [1](23) [4]	220(23)	329(46)	13(2)	<MDL [5] of 2
	2009	CS	3	176(9.1)	205(9.0)	381(17.5)	8.55(0.5)	<MDL of 2
		ST	1	216	216	432	8.05	<MDL of 2
		ES	7	182(22.6)	154(14.3)	336(36.1)	6.43(0.8)	<MDL of 2
Pettit Flume	1997[1]	ST	7	14.0(6.9)	49.1(7.9)	63.1(14.8)	3.9(0.4)	0 - 2
	2009	BN	7	15.4(2.1)	48.1(5.2)	63.5(6.8)	3.28(0.4)	<MDL of 2
Niagara River, upstream Little River	1997[1]	BN	6	26(9.1)	79.5(12.4)	105(21)	3.8(0.7)	1.7 – 7.0
	2009	BN	7	60.4(8.7)	56.6(7.4)	117(25.7)	3.2(0.6)	3.63(1.9)
Bergholtz Creek, Williams Road	1997[1]	BN	6	88.5(7.2)	505(17.5)	593(24.7)	5.8(0.7)	<MDL of 2
Bergholtz Creek, above Black Creek	2009	GS	7	58.4(5.0)	142(13)	201(17.6)	10.04(1.2)	<MDL of 2
Bergholtz Creek, below Black Creek	2009	GS	7	30.8(2.4)	65.6(5.8)	96.4(7.3)	5.85(0.5)	<MDL of 2
Cayuga Creek, Porter Road	1997[1]	BN	4	62(13.7)	129(33.7)	191(47.4)	20.5(4.5)	97(5.3)
		CC	1	52	117	169	17	74
		CS	1	42	140	182	27	68
	2005[6]	CS	3	40.3	125	165(23.8)	20.5	43.1
		CC (1+yr.[7])	1	23	133	156	16.5	58.4
	2009	CC	1	40.7	71.6	112	18.6	52.6
		CS	4	40.9(3.6)	59.4(2.9)	100(6.9)	24.3(3.8)	27.5(2.6)
Cayuga Creek, Lindberg Ave.	1997[1]	BN	6	32.2(6.1)	152(22.2)	184(28.3)	9.9(0.7)	12.3(7.2)
	2009	BN	7	35.2(3.9)	83.2(4.5)	118(6.3)	7.28(0.4)	3.79(0.3)
Gill Creek, Sta15a, Ferry Street	1997[1]	BN	1	<MDL of 2.0	216	226	11	2
	2009	BN	7	11.2(6.6)	55.0(7.1)	66.3(12.0)	4.35(0.7)	<MDL of 2
Gill Creek, Sta15b, Buffalo Avenue	1997[1]	ST	2	1250(640)	937(343)	2187(983)	17.7(0.4)	2.5
	2009	ST	2	197(0.7)	134(0.7)	332(0.7)	8.35(0.12)	<MDL of 2
		BN	7	230(61.9)	165(23.9)	395(84.7)	4.32(0.9)	<MDL of 2

Table 8 (continued)

[1] In 1996 and 1997, the lighter PCB Aroclor was measured as AR1016/1248 and in 2009 it was measured as AR1242

[2] Species: ST – spottail shiner, BN – bluntnose minnow, ES – emerald shiner, CS – common shiner, CC – creek chub, GS – golden shiner and RC – river chub

[3] Quantitation Limits (wet weight): 1996/ 1997 and 2005 - 20 ug/Kg for Aroclors, 2ug/Kg for p,p'-DDE and Mirex; 2009 – 10ug/Kg for AR1242, 30 ug/Kg for AR1254/AR1260, 2ug/Kg for p,p'-DDE and Mirex

[4] (Standard Deviation)

[5] <MDL - less than method detection limit

[6] The 2005 Cayuga Creek data were included in Table 8 with the 1997 and 2009 data to facilitate a better comparison. The 2005 data were part of a separate but related contaminant track-down study with PISCES.

[7] Larger fish were kept for this composite due to the lack of smaller y-o-y fish. These may have been one-year-old fish instead of y-o-y individuals

Table 9. Sampling locations where total PCB and Mirex concentrations (ug/Kg wet weight) in young-of -year fish composites exceed criteria designed to protect sensitive fish-consuming wildlife within New York State's Great Lakes Basin, Dunkirk to Olcott, NY, 2009.

Location	Species[1]	No. Comp.'s	Total PCB (110^3, 130^2)		Mirex (< MDL[4], 330^2, 373^3)	
			Comp. Range	Mean	Comp. Range	Mean
Gill Creek, Buffalo Avenue	ST	2	331 -332	332		
	BN	7	325 - 562	395		
Twomile Creek	CS	3	362 - 396	381		
	ST	1	432	-		
	ES	7	272 - 374	336		
upstream Bergholtz Creek	GS	7	178 - 226	201		
Niagara River, Gratwick-Riverside Park	BN		150 - 244	199		
Niagara River, upstream edge of 102nd Street Landfill	BN	7	117 - 168	143		
Niagara River, between Pettit Flume and GRP	BN	7	123 - 147	137		
Cayuga Creek, Lindberg Avenue	BN	7	110 - 127	118	3.40 – 4.15	3.79
Erie Canal	BN	7	104 - 133	119		
Lake Ontario, Krull Park,Olcott	ES	7	103 - 132	119		
Niagara River, upstream Little River	BN	7	85.8 - 172	117	2.03 – 7.10	3.63
Niagara River, downstream Little River	BN	7	101 - 123	113	4.28 – 5.51	4.96
Cayuga Creek, Porter Road	CC	1	112	-	23.8 – 52.6	27.5
	CS	4	94.2 - 110	103		
downstream Bergholtz Creek	BN	1	103	-		
	GS	7	85.6 - 104	96.4		

[1] Species: ST – spottail shiner, BN – bluntnose minnow, ES – emerald shiner, CS – common shiner, CC – creek chub and GS – golden shiner

[2] NYSDEC non-carcinogenic criterion for the protection of piscivorus wildlife (Newell et al, 1987)

[3] NYSDEC 1:100 dietary cancer risk for mink (Newell et al, 1987)

[4] <MDL- less than method detection limit of 2ug/Kg which is designed to protect piscivorus wildlife (IJC, 1988)

Table 10. Percent recovery (%R), percent relative standard deviation (RSD) and method detection limits (MDLs) for PCB Aroclors and organochlorine pesticides in nine matrix spikes, nine reference material samples and nine pairs of replicate analyses, all pertinent to the analysis of young-of-year fish composites from near-shore areas in NYS's Great Lakes Basin, 2009.

Analyte	Matrix Spike (without fish oil)		Matrix Spike (with fish oil)		Reference Material[1]		Laboratory Replicates[2] (dupl.)		MDL (ug/Kg
	Mean %R	Mean % RSD	Mean %R	Mean % RSD	Mean %R	Mean % RSD	# Pairs	Mean % RSD	
AR1242[3]	108.35	3.59	105.59	5.35	116	4.17	8	2.81	10
AR1254/1260[3]	116.41	2.55	113.15	513	105	5.35	8	3.49	30
p,p'-DDE[3]	94.09	7.13	98.61	5.41	99.0	6.67	9	2.93	2
p,p'-DDD	103.63	5.26	104.94	3.13	-	-	6	3.69	2
p,p'-DDT	107.60	12.42	98.30	15.26	-	-	5	2.70	2
o,p'-DDE	104.49	2.84	101.52	5.49	-	-	1	0.26	5
o,p'-DDT	115.04	11.30	108.85	9.88	-	-	-	-	5
Heptachlor	78.08	14.28	87.79	8.98	-	-	-	-	5
Heptachlor epoxide	99.80	9.16	95.41	3.06	-	-	1	0.25	5
trans-Chlordane	122.78	2.99	111.68	8.10	-	-	-	-	5
cis-Chlordane	112.21	4.11	102.24	8.70	-	-	-	-	5
trans-nonachlor	109.13	2.87	100.42	6.35	-	-	-	-	5
cis-Nnonachlor	108.32	5.52	102.86	5.36	-	-	-	-	5
Oxychlordane	111.15	2.92	106.16	4.90	-	-	1	0.16	5
Aldrin	95.63	2.28	92.07	8.56	-	-	-	-	5
Photomirex	101.14	5.39	92.86	8.51	-	-	-	-	5
Mirex[3]	106.33	4.54	99.71	5.85	98.5	6.10	2	3.78	2
alphaBHC	84.51	15.69	99.26	4.01	-	-	1	0.96	5
beta-BHC	97.15	5.21	98.09	3.96	-	-	1	1.07	5
gamma-BHC	94.40	6.85	99.14	3.74	-	-	-	-	5
HCB	82.31	12.80	90.06	2.94	-	-	3	4.01	2

[1] The reference material was coho salmon collected 10/18/2000 from NYS Salmon River Fish Hatchery.

[2] RSDs for laboratory replicates were calculated only for pairs with levels greater than the MDL.

[3] AR1242; AR1254/1260; p,p'-DDE and mirex were the only analytes present at levels high enough to evaluate accuracy.

Table 11. PCB Aroclor and organochlorine pesticide residue data (ug/Kg wet weight) for young-of-year fish composites (15 fish/ composite) collected from Cayuga and Bergholtz Creeks in the vicinity of the Niagara Falls Air Reserve Station and the Niagara Falls International Airport, Niagara Co., NY, Sept., 2005. (blank spaces represent values less than detection that were considered zero for calculating means) [data from Preddice and Trometer, 2007]

Site	Sample No.	Comp.	Species[1]	AR1242	AR1254/1260	4,4'-DDE	4,4'-DDD	4,4'-DDT	Mirex
Upstream Cayuga Creek at Lockport Road	046	a	CC	13.0	30.0	19.6	2.8		
	047	b		12.0	39.0	22.4	3.0		
	048	c		16.0		20.1	2.9		
	049	d		20.0		18.8	2.5		
	050	e		18.0		19.0	2.2		
	mean			15.8(3.3)[2]	13.8(19.1)	20.0(1.4)	2.7(0.3)		
Downstream Cayuga Creek at Porter Road	051	a	CS	37.0	107.0	16.8	6.5		37.4
	052	b	CC[3]	23.0	133.0	16.5	7.2		58.4
	053	c	CS	50.0	134.0	27.4	7.9		54.1
	054	d	CS	34.0	133.0	17.4	5.8		37.9
	mean			36.0(11.1)	127.0(13.2)	19.5(5.3)	6.9(0.9)		46.9(10.9)
Bergholtz Creek at Walmore Road	055	a	BN	257.0	719.0	14.6	3.2	11.4	

[1] Species: CC-creek chub, CS – common shiner, BN – bluntnose minnow

[2] ( ) – standard deviation

[3] may be 1+ year class

Table 12. NYSDEC analytical data selected to determine temporal trends for AR1254/1260 and p,p'-DDE measured in young-of-year fish composites collected from near-shore locations in the western portion of NYS's Great Lakes Basin, 1984 - 1987, 1992, 1997, 2003 and 2009.

Location	Year	AR1254/1260	p,p'-DDE
Lake Erie, Dunkirk Harbor	1984	X	X
	1985	X	X
	1986	X	X
	1992	X	X
	1997	X	X
	2003	X	X
	2009	X	X
Niagara River, Beaver Is. State Park	1987	X	X
	1992	X	X
	1997	X	X
	2009	X	X
Buffalo River	1985	X	X
	1997	X	X
	2003	X	X
	2009	X	X
Niagara River, Gratwick-Riverside Park	1984	X	X
	1985	X	X
	1986	X	X
	1992	X	X
	2003	X	X
	2009	X	X

Location	Year	AR1254/1260	p,p'-DDE
Niagara River, downstream Little River	1997	X	X
	2003	X	X
	2009	X	X
Niagara River, Lewiston	1997	X	X
	2003	X	X
	2009	X	X
Lake Ontario, Krull Park, Olcott	1992	X	X
	1997	X	X
	2003	X	X
	2009	X	X

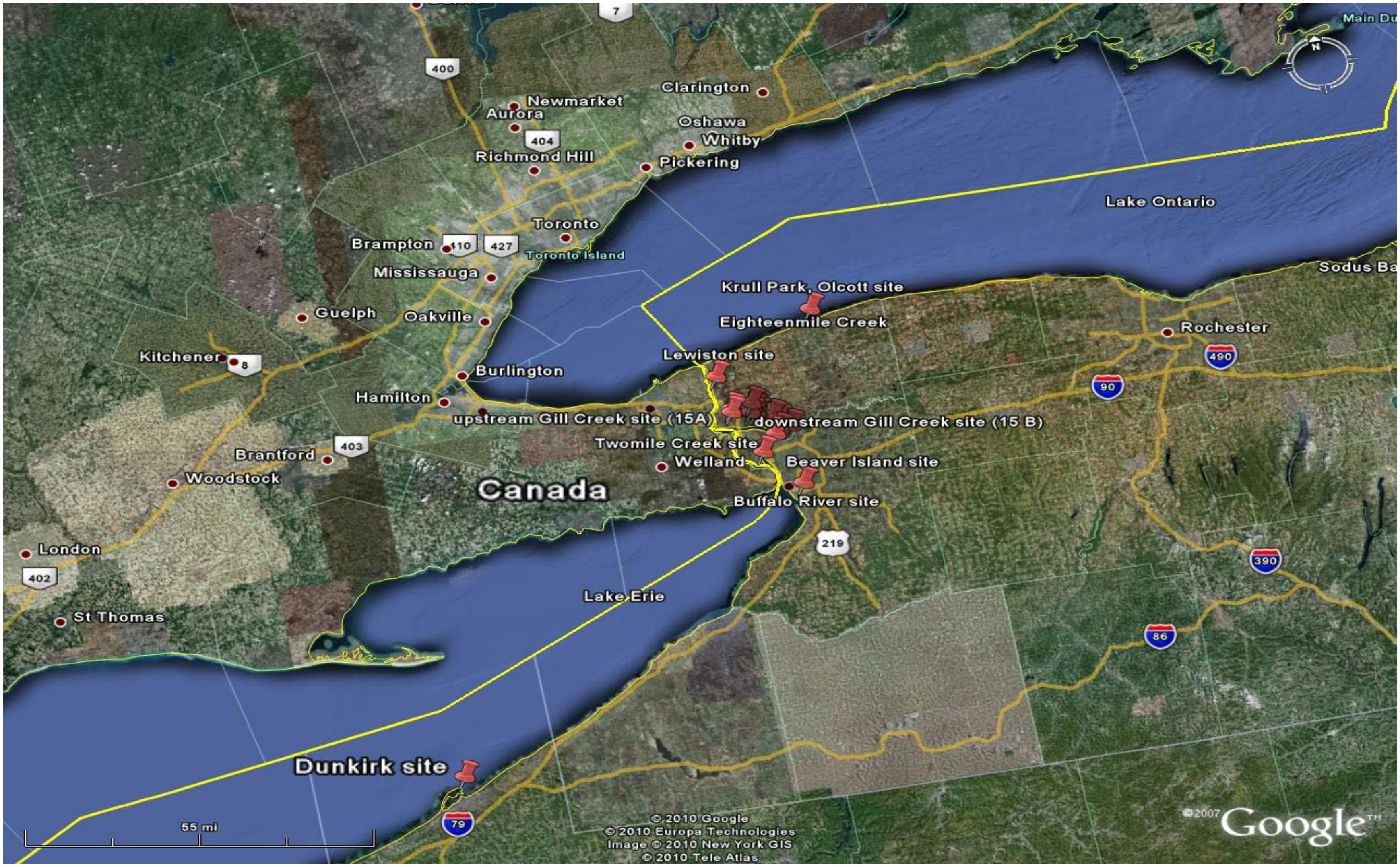


Figure 1. Overview of Lake Erie and Lake Ontario showing the general area from Dunkirk to Olcott where young-of-year fish samples were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

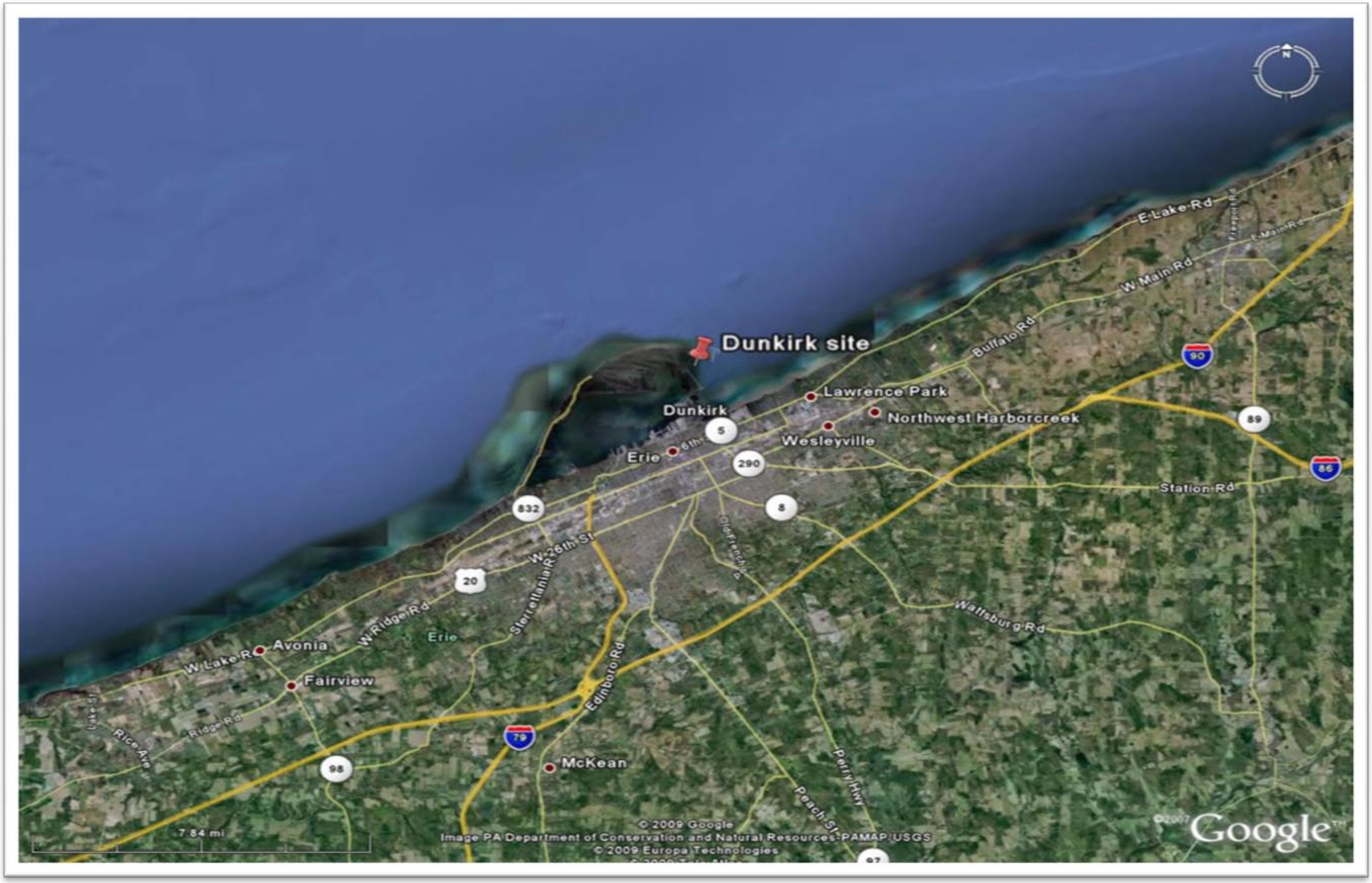


Figure 2. Location of the Lake Erie site at Dunkirk Harbor where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

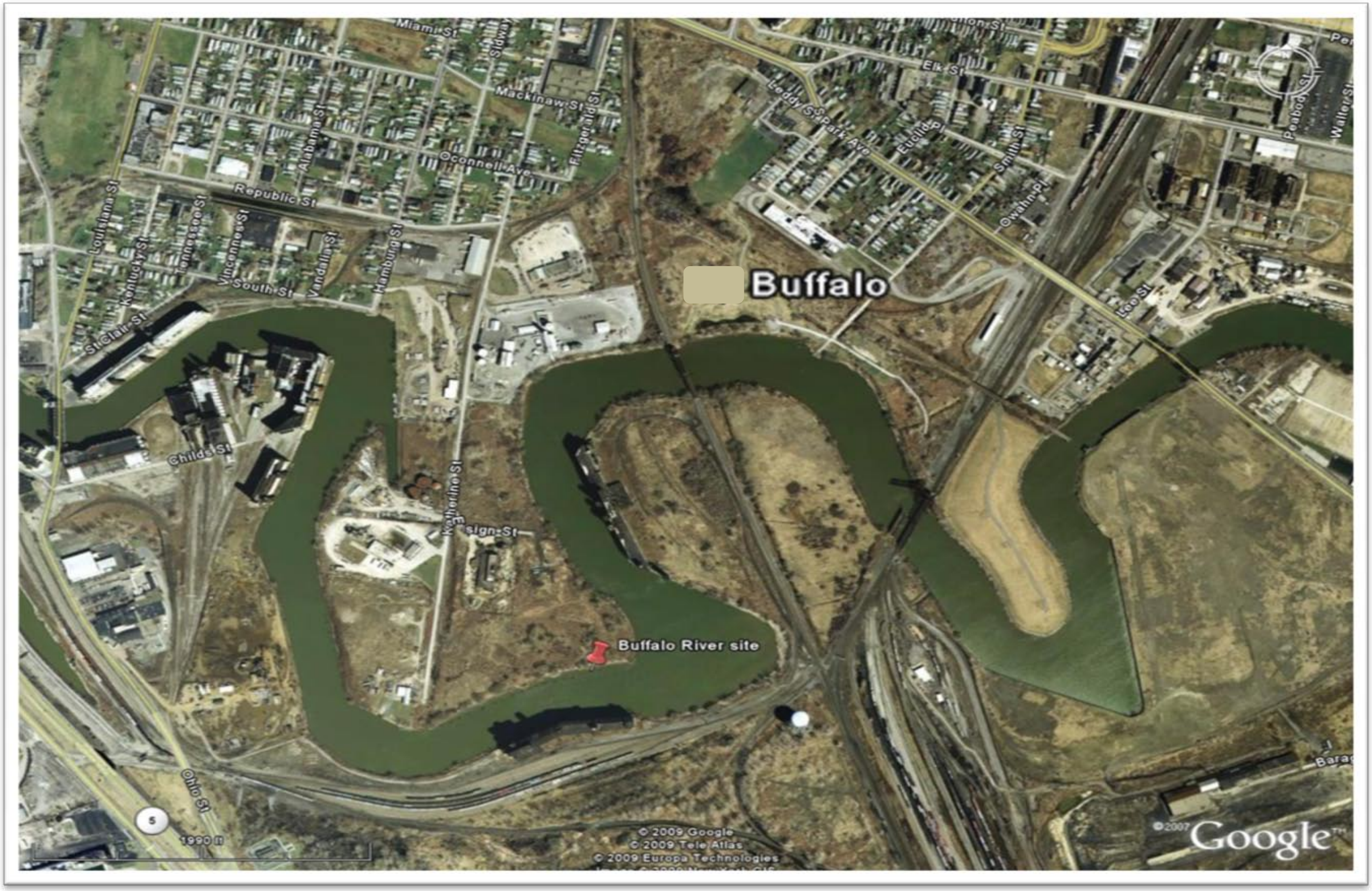


Figure 3. Location of the Buffalo River site where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

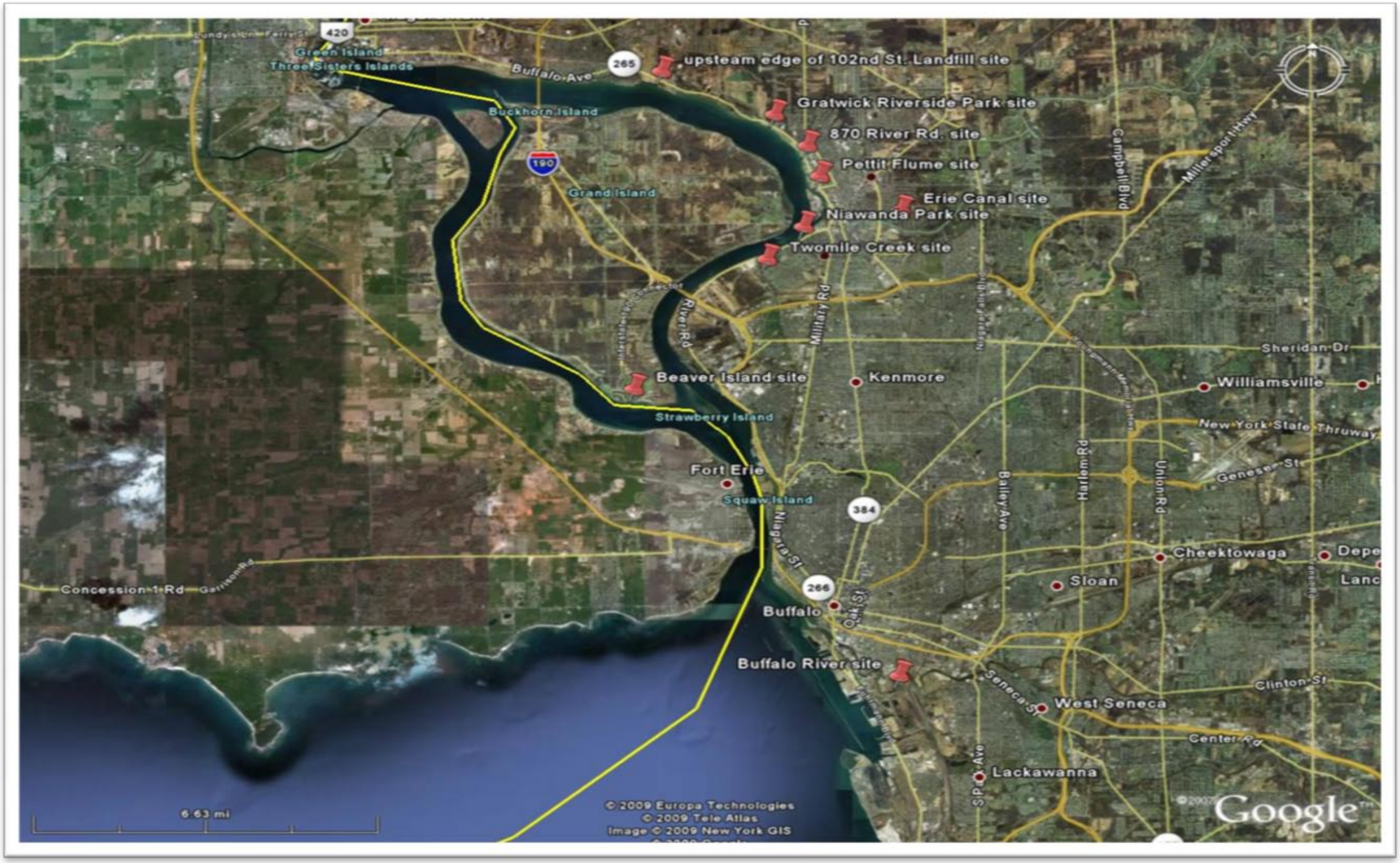


Figure 4. Locations of the Buffalo River, Twomile Creek, Erie Canal, and Niagara River sites at Beaver Island, Niawanda Park, Pettit Flume, between Pettit Flume and GRP, Gratwick-Riverside Park and upstream edge of the 102nd Street Landfill sites where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

Figure 5. Locations for the upstream edge of the 102 Street Landfill site, and for the upstream and downstream Little River sites where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

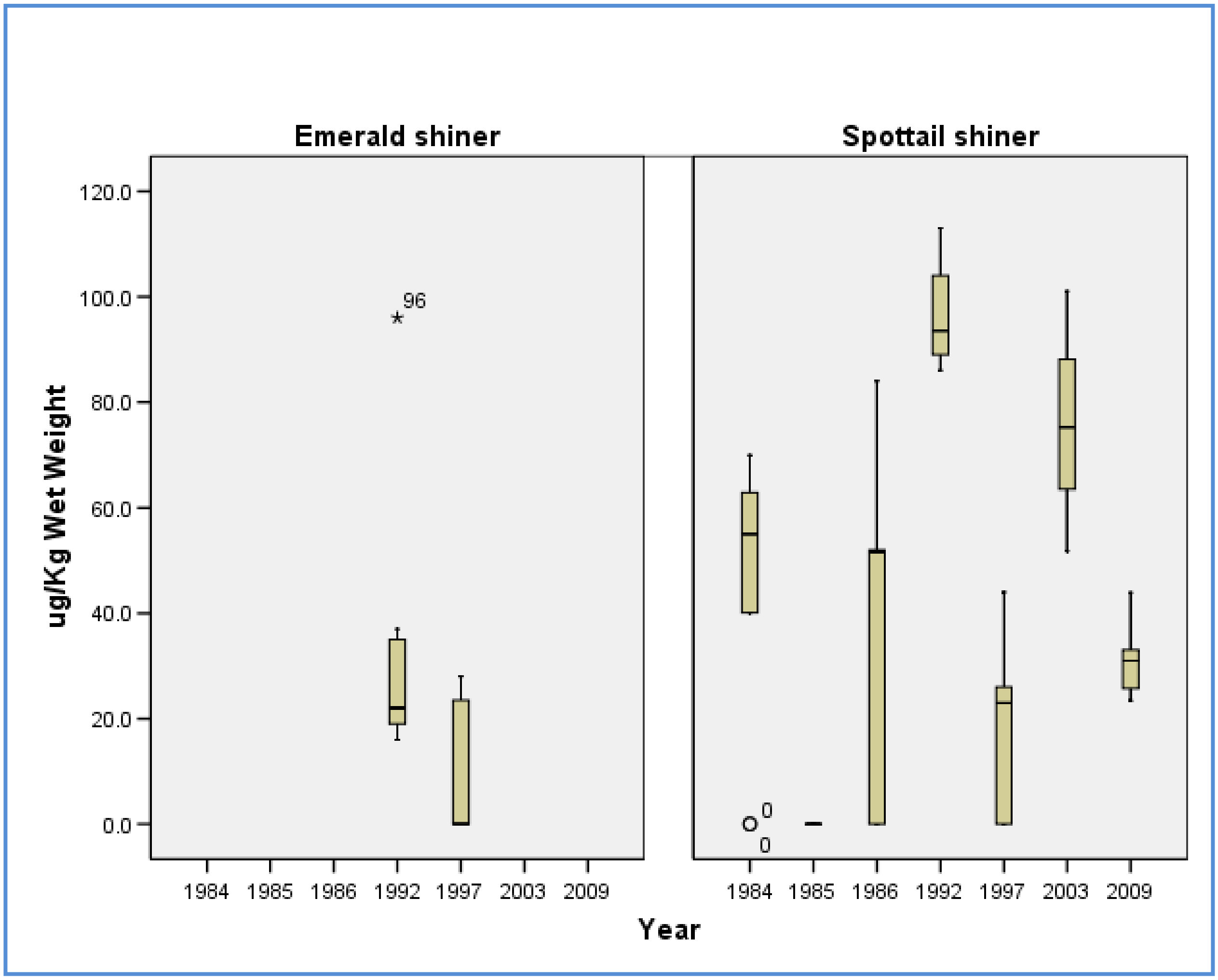
Figure 6. Locations for the Cayuga Creek sites at Porter Road and Lindberg Avenue, and for the upstream and downstream Bergholtz Creek sites where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

Figure 7. Locations for the upstream and downstream Gill Creek sites where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

Figure 8. Location of the Niagara River site at Lewiston where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

Figure 9. Location of the Lake Ontario site in Krull Park, Olcott where young-of-year fish were collected from near-shore areas within New York State's Great Lakes Basin, 2009.

Figure 10. Boxplot (by species) and descriptive statistics for Aroclor 1254/1260 concentrations (ug/Kg) for young-of-year fish samples collected from Dunkirk Harbor, Lake Erie, New York State's Great Lakes Basin.

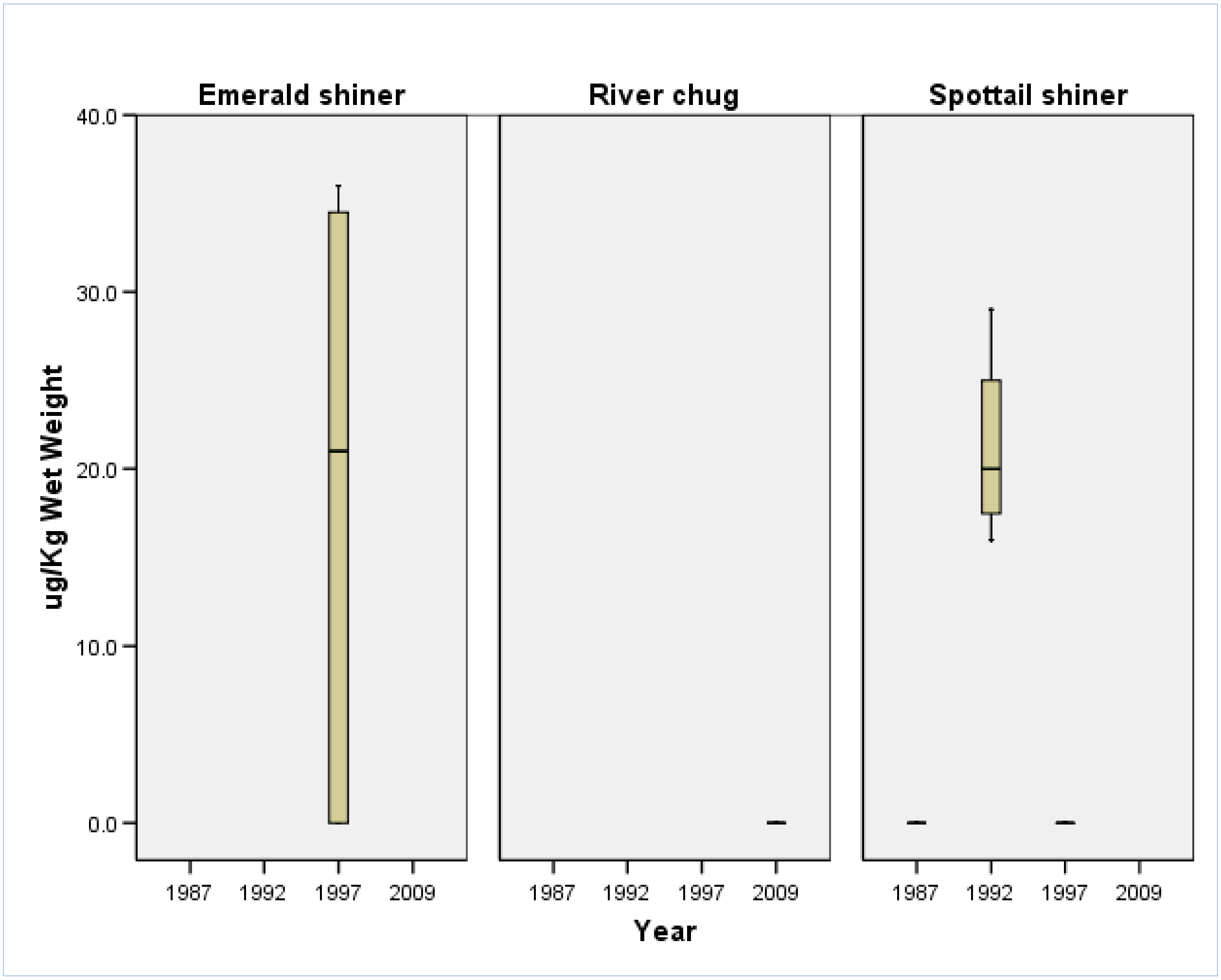


○ = mild outliers; ★= severe outliers; — = all samples were < MDL (value = 0)

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1992	ES	7	20	34.6	22.0	28.2	16.0	96.0	80.0
1997	ES	7	20	≥10.7; <22.1	<20.0	>3.2; ≤13.5	<20.0	28.0	≤28.0
1984	ST	9	20	≥45.1; <49.5	55.0	>18.8; ≤27.0	<20.0	69.9	≤69.9
1986	ST	9	20	≥34.9; <43.7	51.7	>25.0; ≤34.8	<20.0	84.0	≤84.0
1992	ST	4	20	96.5	93.5	11.6	86.0	113.0	27.0
1997	ST	7	20	≥17.0; <25.6	23.0	>8.6; ≤17.3	<20.0	44.0	≤44.0
2003	ST	3	30	76.0	75.2	24.6	51.8	101	49.2
2009	ST	7	30	30.8	31.0	6.9	23.4	43.9	20.5

ES=Emerald shiner; ST=Spottail shiner

Figure 11. Boxplot (by species) and descriptive statistics for Aroclor 1254/1260 concentration (ug/Kg wet weight) for young-of-year fish samples collected from Beaver Island State Park, Niagara River, New York State's Near-shore Great Lakes Basin.

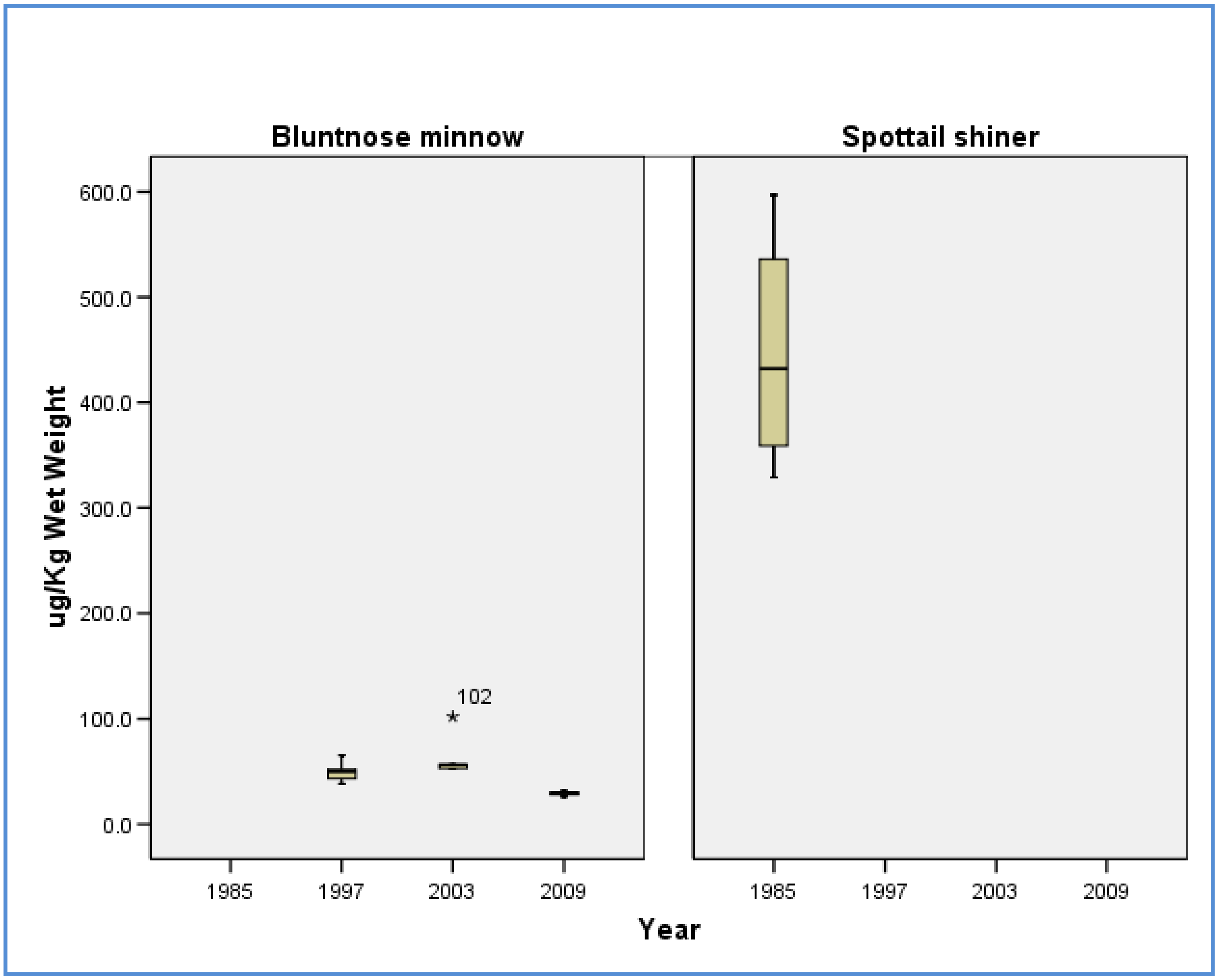


__ = all samples were < MDL (value = 0)

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-Min	x-MAX	RANGE
2009	RC	5	20	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
1997	ES	7	20	≥18.0; <26.6	21.0	>8.0; ≤17.6	<20.0	36.0	≤36.0
1992	ST	7	20	21.4	20.0	5.1	16.0	29.0	13.0

RC=River chug; ES=Emerald shiner; ST=Spottail shiner

Figure 12._Boxplot (by species) and descriptive statistics for Aroclor 1254/1260 concentrations (ug/Kg) for young-of-year fish samples collected from Buffalo River, New York State's Great Lakes Basin.

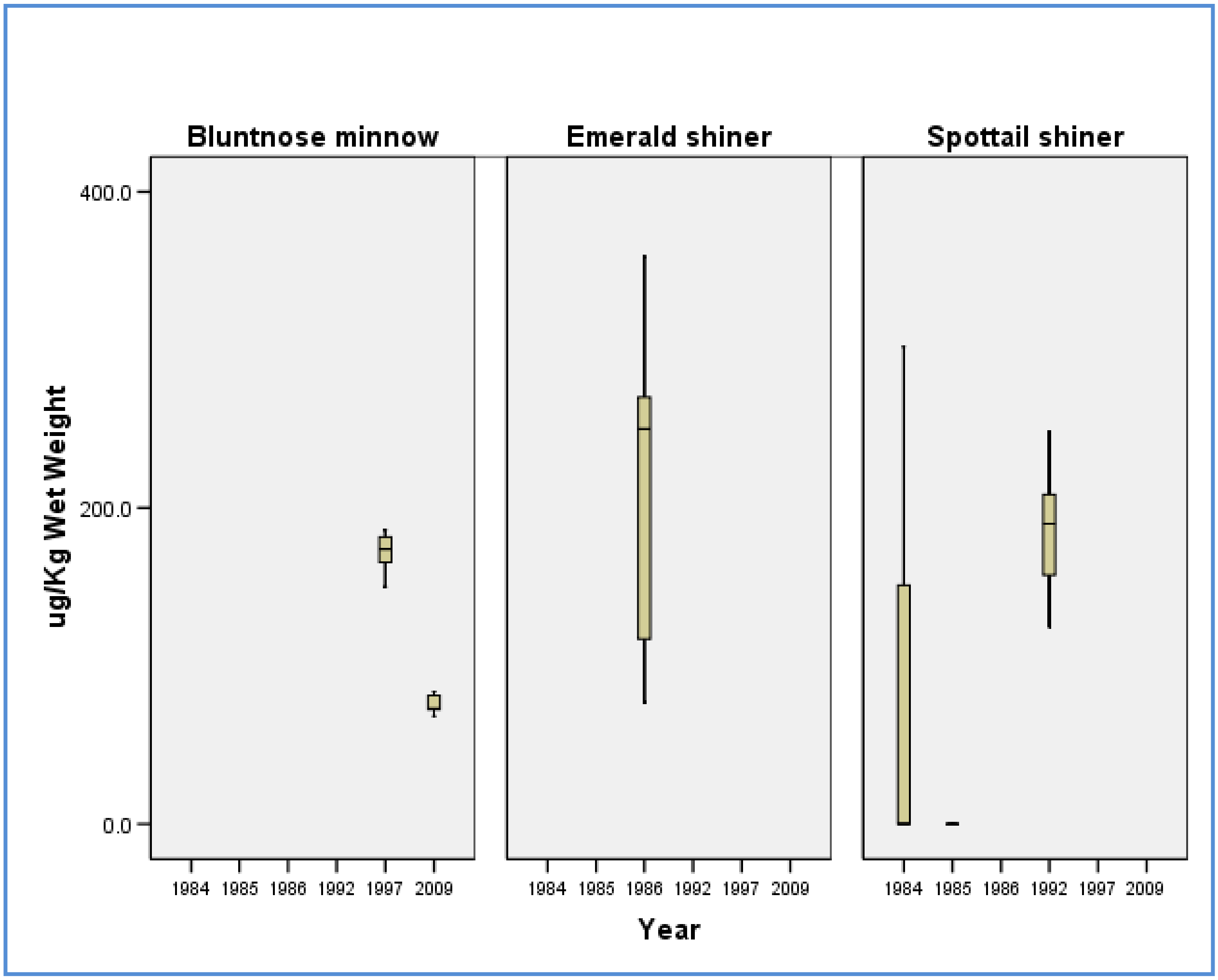


★= severe outliers; — = all samples were < MDL (value = 0)

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	7	20	49.0	50.0	8.9	38.0	65.0	27.0
2003	BN	5	30	64.1	56.3	21.2	52.7	102.0	49.3
2009	BN	7	30	29.2	29.9	1.9	26.2	31.3	5.1
1985	ST	4	20	448	432	116	329	597	268

BN=Bluntnose minnow; ST=Spottail shiner

Figure 13. Boxplot (by species) and descriptive statistics for Aroclor 1254/1260 concentrations (ug/Kg) for young-of-year fish samples collected from Gratwick-Riverside Park, Niagara River, New York State's Great Lakes Basin.

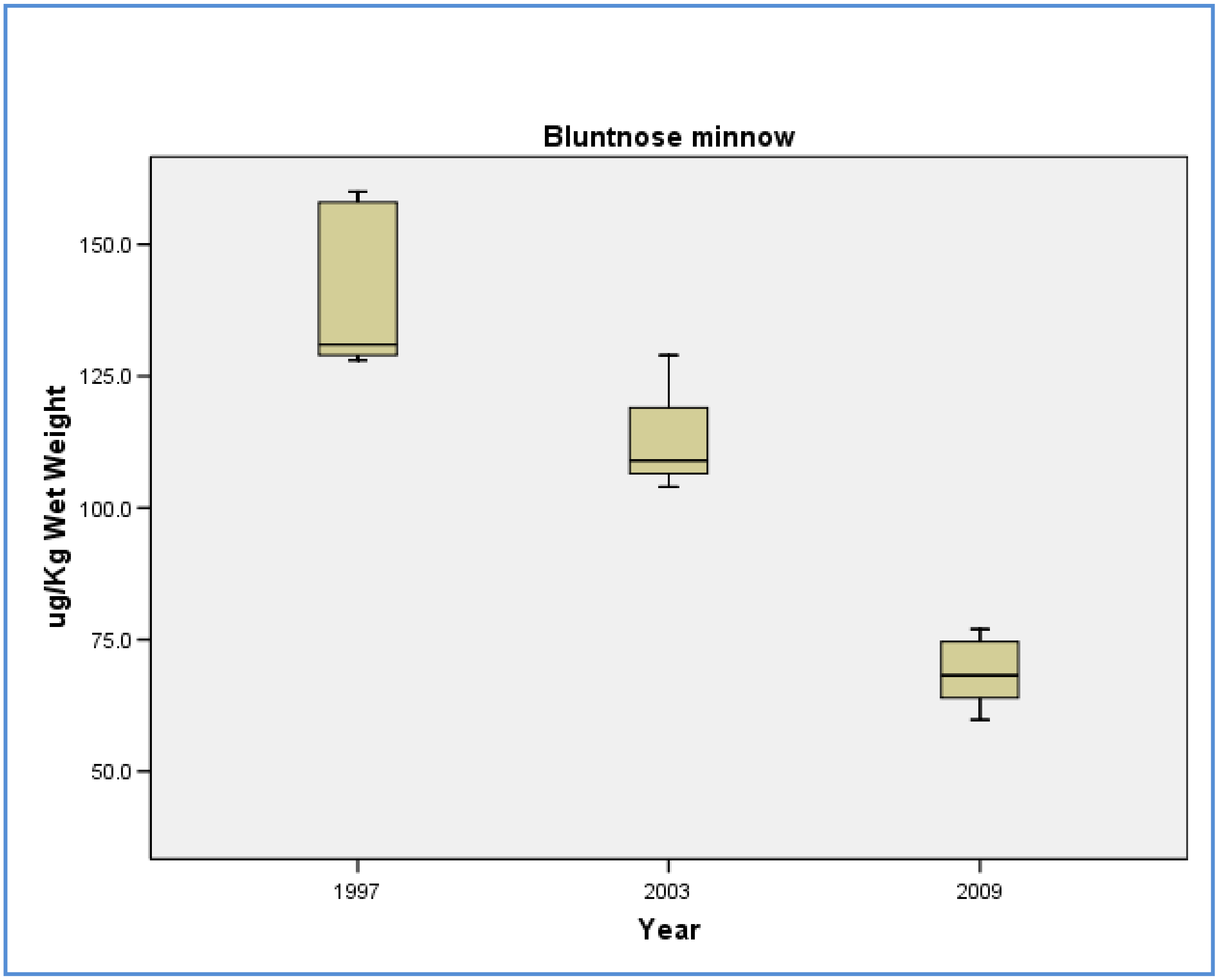


- = all samples were < MDL (value = 0)

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	7	20	172	174	12.8	150	186	36.0
2009	BN	7	30	76.1	73.0	6.0	68.2	83.7	15.5
1986	ES	9	20	219	250	96.6	77	359	282
1984	ST	3	20	≥101; <114	<20.0	>163; ≤174	<20.0	302	≤302
1992	ST	7	20	185	190	43.4	125	248	123

BN=Bluntnose minnow; ES=Emerald shiner; ST=Spottail shiner

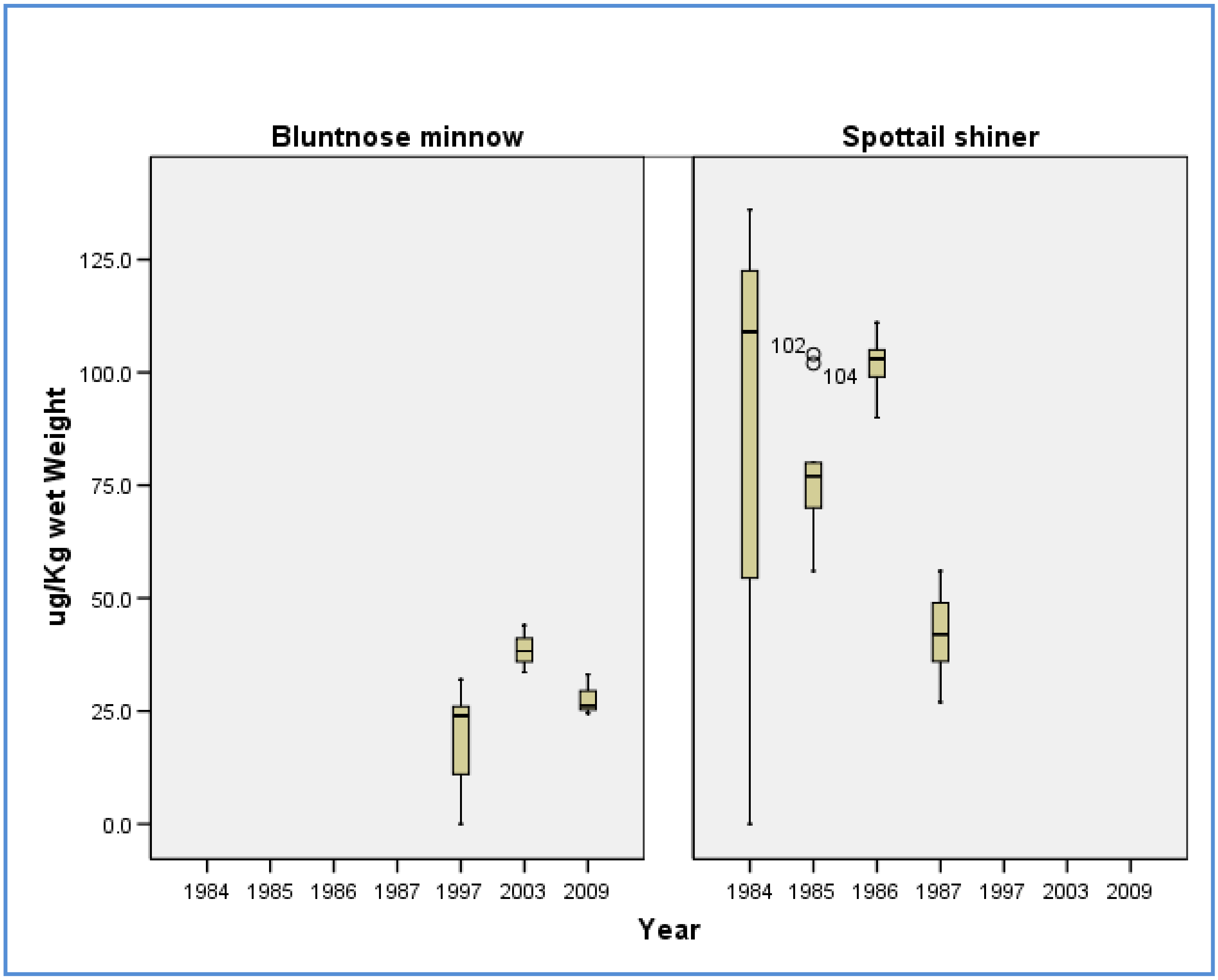
Figure 14. Boxplot (by species) and descriptive statistics for Aroclor 1254/1260 concentrations (ug/Kg) for young-of-year fish samples collected from downstream Little River, Niagara River, New York State's Great Lakes Basin.



YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	6	20	140	131	15.2	128	160	32.0
2003	BN	3	30	114	109	13.2	104	129	25.0
2009	BN	7	30	68.9	68.2	6.7	59.8	77.0	17.2

BN=Bluntnose minnow

Figure 15. Boxplot (by species) and descriptive statistics for Aroclor 1254/1260 concentrations (ug/Kg) for young-of-year fish samples collected from Lewiston, Niagara River, New York State's Great Lakes Basin.

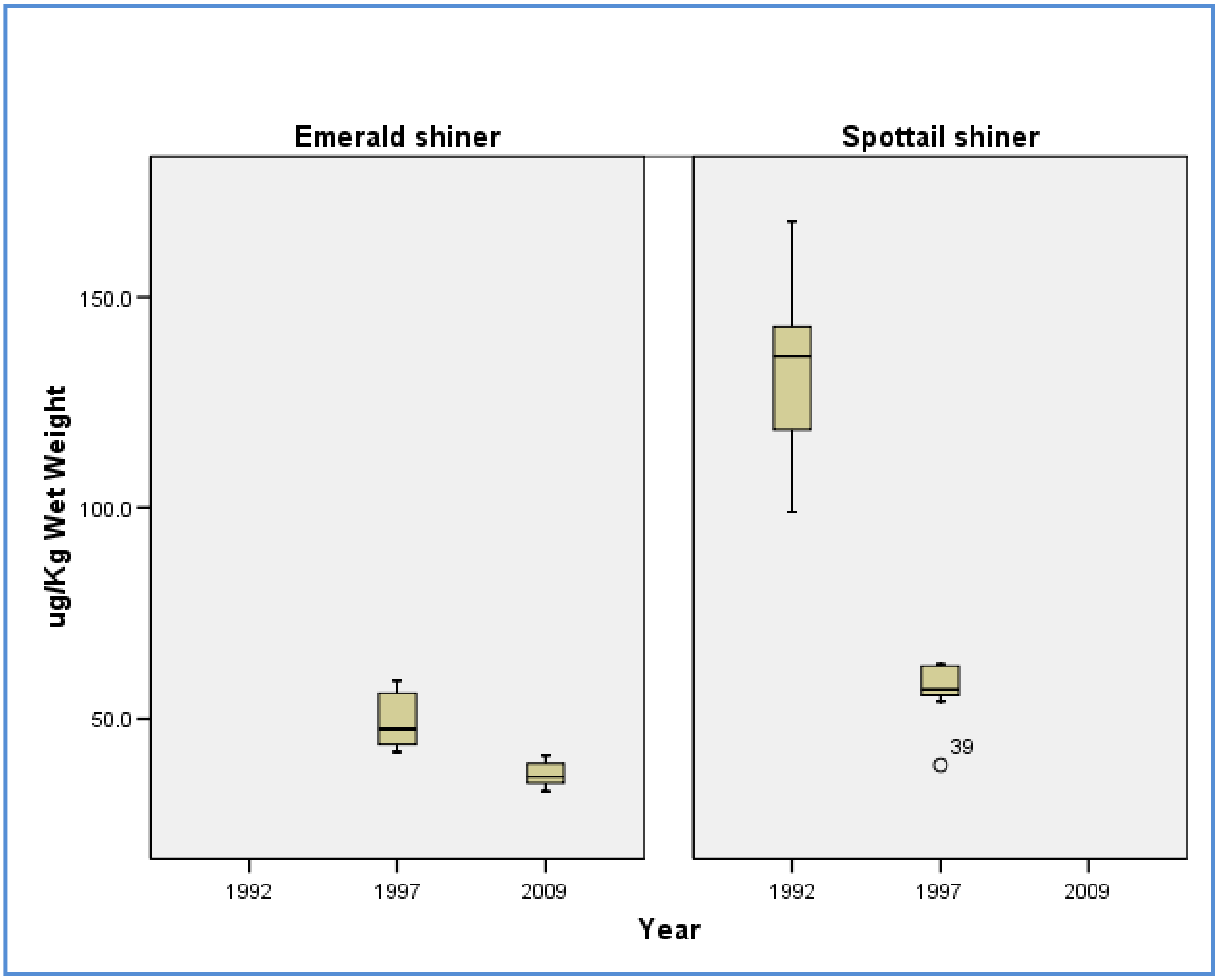


○ = mild outliers

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	7	20	≥18.6; <24.3	24.0	>4.3; ≤13.1	<20.0	32.0	≤32.0
2003	BN	3	30	38.6	38.3	5.2	33.6	44.0	10.4
2009	BN	7	30	27.6	26.2	3.2	24.5	33.1	8.6
1984	ST	3	20	≥81.7; <88.3	109	>60.7; ≤72.0	<20.0	136	≤136
1985	ST	9	20	77.7	77.0	16.5	56.0	104	48
1986	ST	9	20	102	103	6.4	90.0	111	21.0
1987	ST	10	20	42.2	42.0	9.0	27.0	56.0	29.0

BN=Bluntnose minnow; ST=Spottail shiner

Figure 16. Boxplot (by species) and descriptive statistics for Aroclor 1254/1260 concentrations (ug/Kg) for young-of-year fish samples collected from Krull Park, Lake Ontario, New York State's Great Lakes Basin.

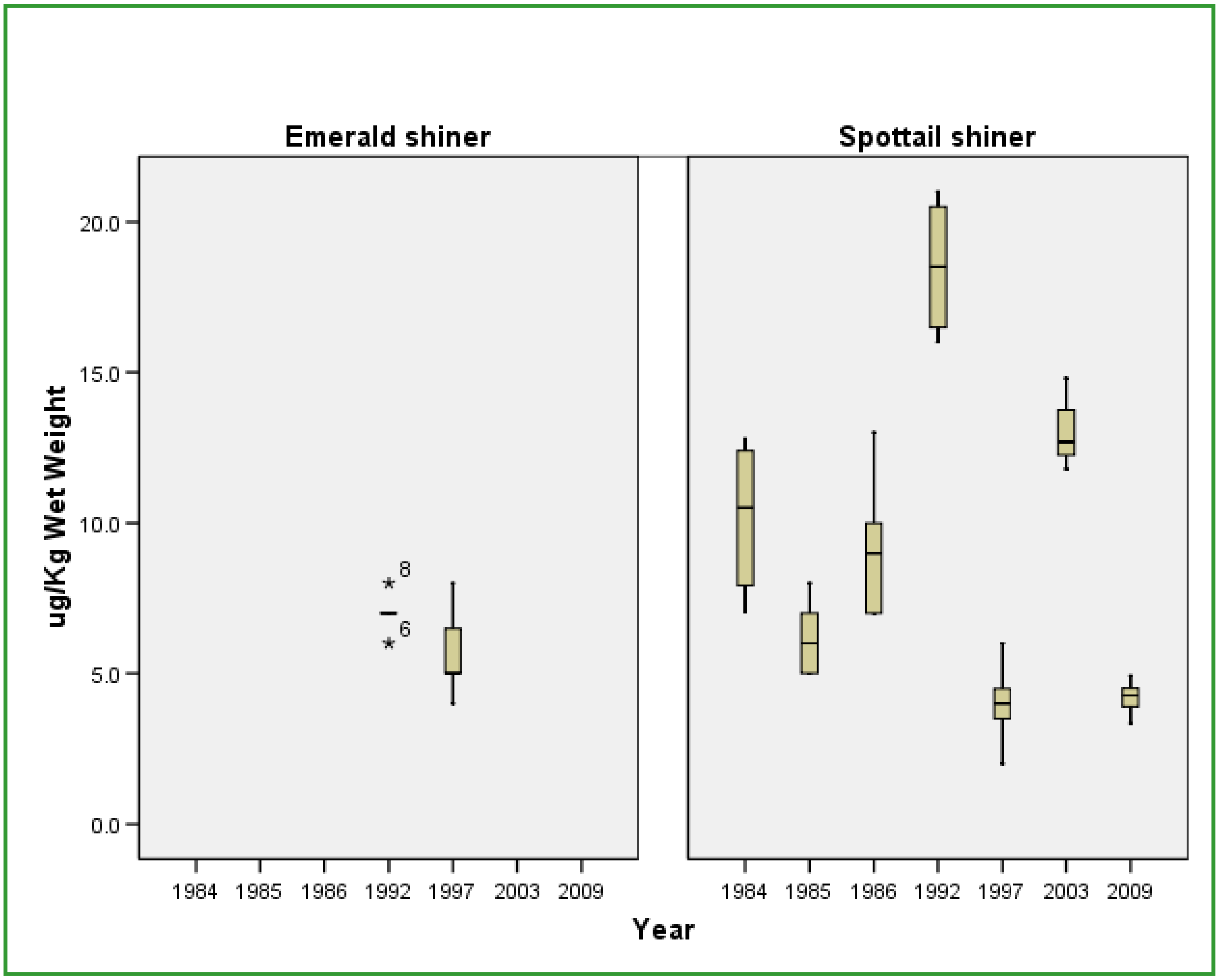


○ = mild outliers

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	ES	10	20	49.7	47.5	6.2	42.0	59.0	17.0
2009	ES	7	30	36.9	36.2	3.1	32.8	41.2	8.4
1992	ST	7	20	132	136	23.5	99.0	168	69.0
1997	ST	7	20	56.4	57.0	8.4	39.0	63.0	24.0

ES=Emerald shiner; ST=Spottail shiner

Figure 17. Boxplot (by species) and descriptive statistics for DDE concentrations (ug/Kg) for young-of-year fish samples collected from Dunkirk Harbor, Lake Erie, New York State's Great Lakes Basin.

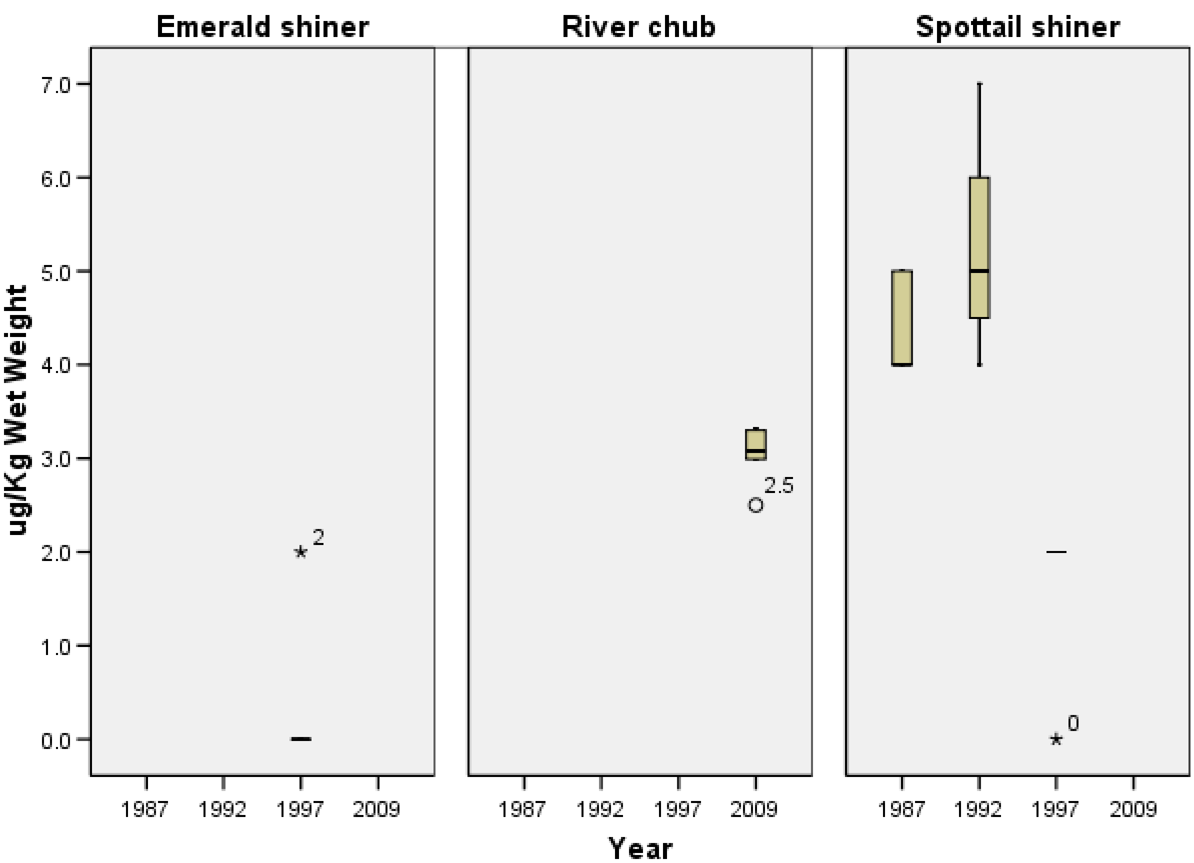


○ = mild outliers; — = all samples were < MDL (value = 0)

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1992	ES	7	2	7.0	7.0	0.6	6.0	8.0	2.0
1997	ES	7	2	5.7	5.0	1.4	4.0	8.0	4.0
1984	ST	9	2	10.2	10.5	2.3	7.0	12.8	5.8
1985	ST	9	2	6.1	6.0	1.2	5.0	8.0	3.0
1986	ST	9	2	9.2	9.0	2.4	7.0	13.0	6.0
1992	ST	4	2	18.5	18.5	2.4	16.0	21.0	5.0
1997	ST	7	2	4.0	4.0	1.7	2.0	6.0	4.0
2003	ST	3	2	13.1	12.7	1.5	11.8	14.8	3.0
2009	ST	7	2	4.2	4.3	0.5	3.3	4.9	1.6

ES=Emerald shiner; ST=Spottail shiner

Figure 18. Boxplot (by species) and descriptive statistics for DDE concentrations (ug/Kg) for young-of-year fish samples collected from Beaver Island State Park, Niagara River, New York State's Great Lakes Basin.

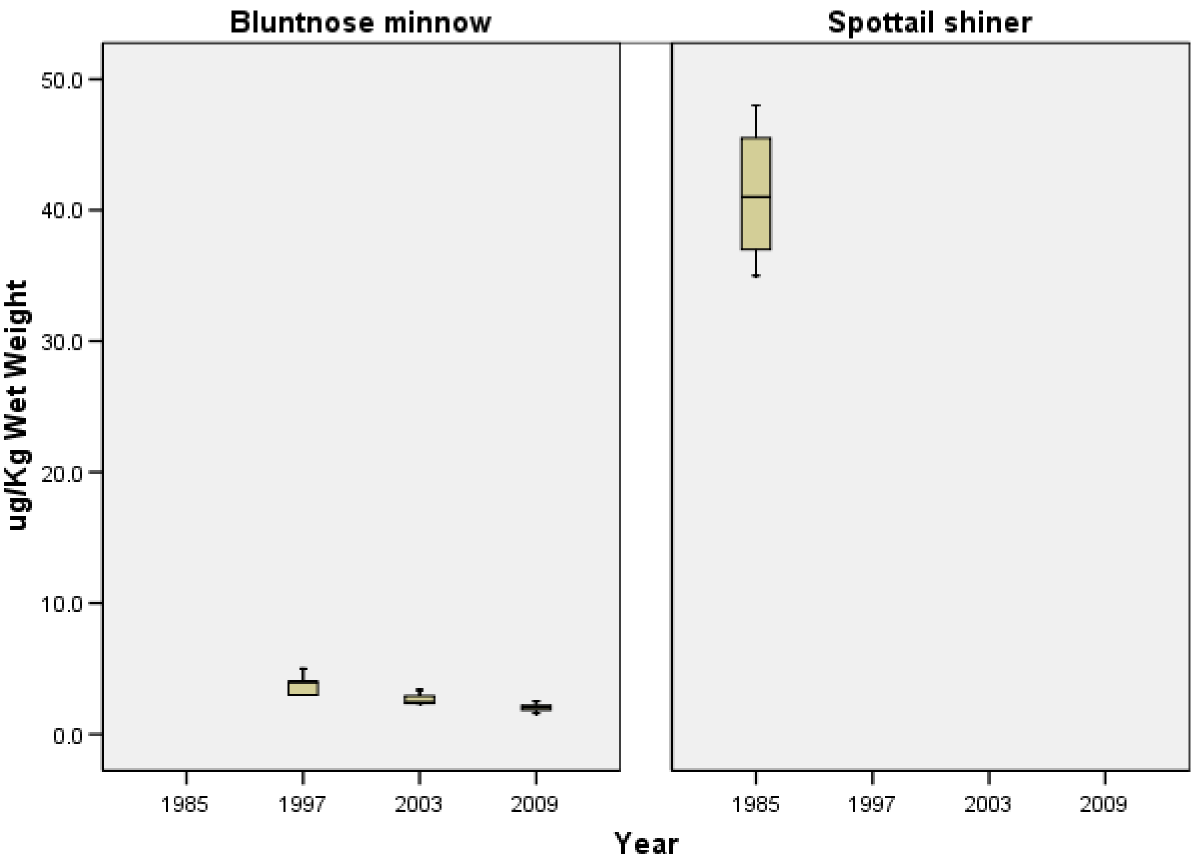


○ = mild outliers; ★ = severe outliers; — = all samples were < MDL (value = 0)

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	ES	7	2	≥ .3; < 2.0	<2.0	<.8	<2.0	2.0	≤2.0
2009	RC	5	2	3.0	3.1	0.3	2.5	3.3	0.8
1987	ST	9	2	4.3	4.0	0.5	4.0	5.0	1.0
1992	ST	7	2	5.3	5.0	1.1	4.0	7.0	3.0
1997	ST	7	2	≥ 1.7 ; < 2.0	2.0	<.8	<2.0	2.0	≤2.0

ES=Emerald shiner; RC=River chub; ST=Spottail shiner

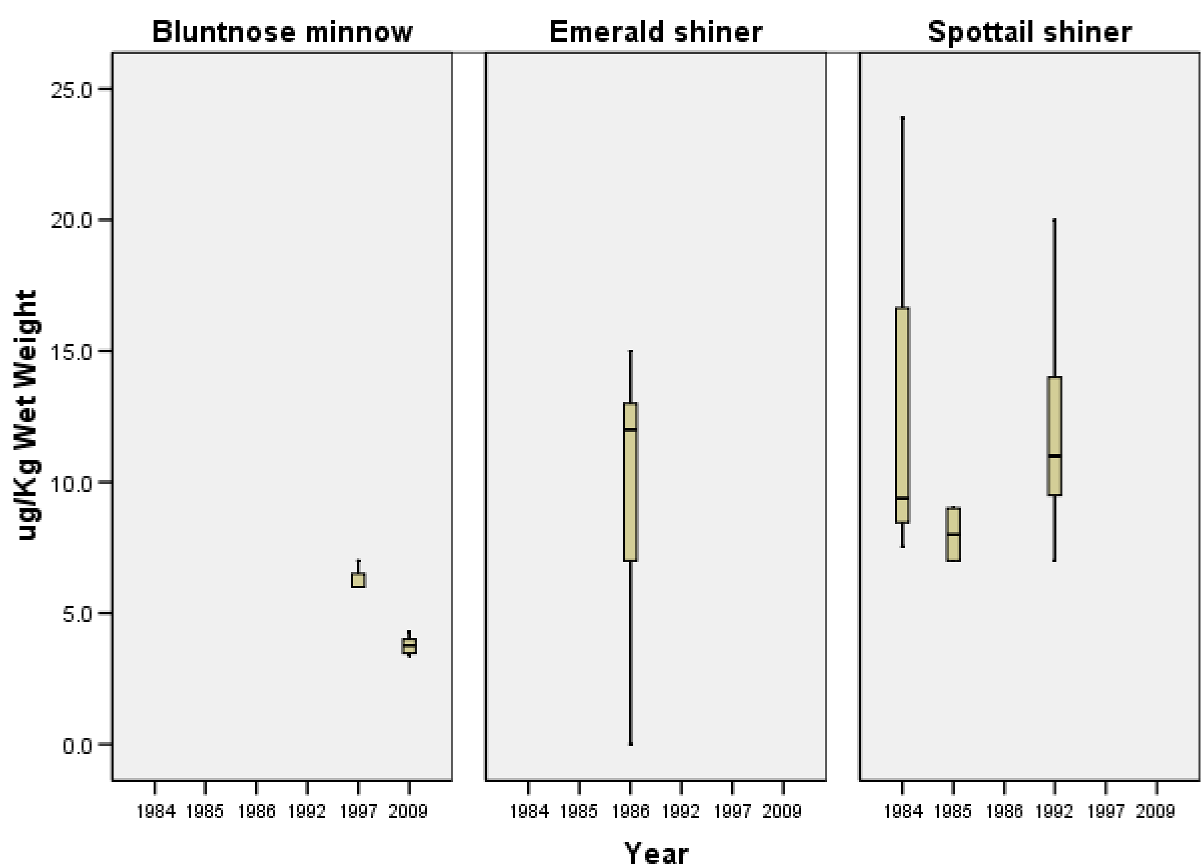
Figure 19. Boxplot (by species) and descriptive statistics for DDE concentrations (ug/Kg) for young-of-year fish samples collected from Buffalo River, New York State's Great Lakes Basin.



YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	7	2	3.7	4.0	0.8	3.0	5.0	2.0
2003	BN	5	2	2.7	2.4	0.4	2.4	3.4	1.0
2009	BN	7	2	2.0	2.0	0.3	1.6	2.5	0.9
1985	ST	4	2	41.2	41.0	5.6	35.0	48.0	13.0

BN=Bluntnose minnow; ST=Spottail shiner

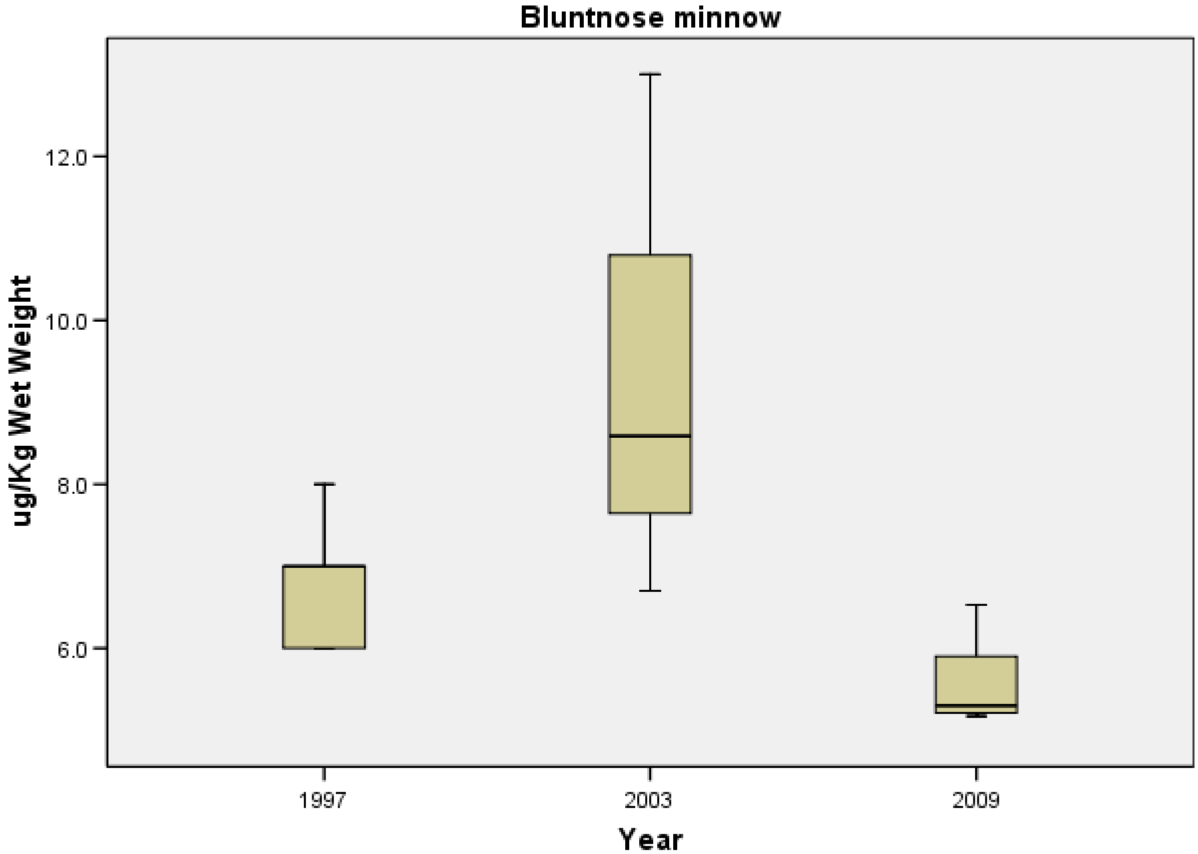
Figure 20. Boxplot (by species) and descriptive statistics for DDE concentrations (ug/Kg) for young-of-year fish samples collected from Gratwick-Riverside Park, Niagara River, New York State's Great Lakes Basin.



YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	7	2	6.3	6.0	0.5	6.0	7.0	1.0
2009	BN	7	2	3.8	3.8	0.4	3.4	4.3	0.9
1986	ES	9	2	≥ 9.9; <10.1	12	>4.3; ≤4.8	<2.0	15.0	≤15.0
1984	ST	3	2	14	9.4	9.0	7.5	23.9	16.4
1985	ST	10	2	8.0	8.0	0.8	7.0	9.0	2.0
1992	ST	7	2	12.1	11.0	4.4	7.0	20.0	13.0

BN=Bluntnose minnow; ES=Emerald shiner; ST=Spottail shiner

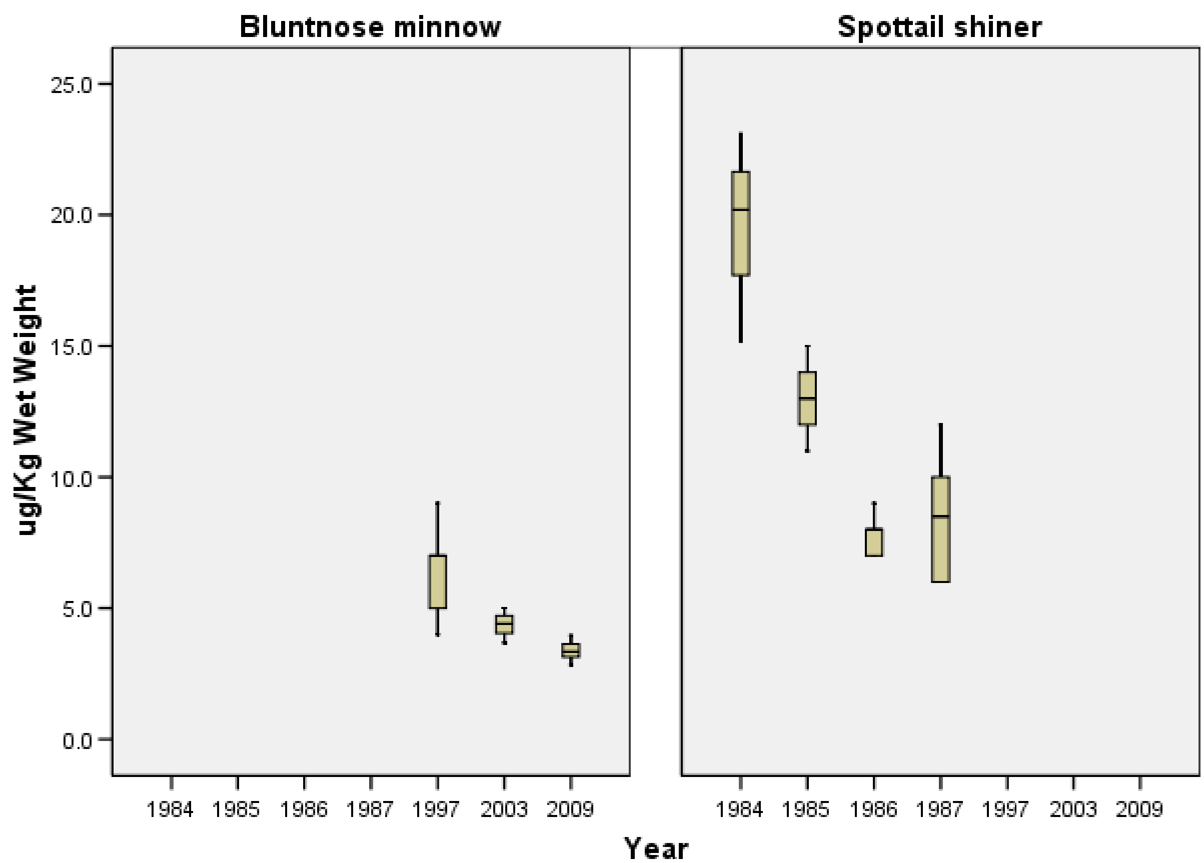
Figure 21. Boxplot (by species) and descriptive statistics for DDE concentrations (ug/Kg) for young-of-year fish samples collected from downstream Little River, Niagara River, New York State's Great Lakes Basin.



YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	6	2	6.8	7.0	0.8	6.0	8.0	2.0
2003	BN	3	2	9.4	10.5	3.2	6.7	13.0	6.3
2009	BN	7	2	5.6	5.3	0.6	5.2	6.5	1.4

BN=Bluntnose minnow

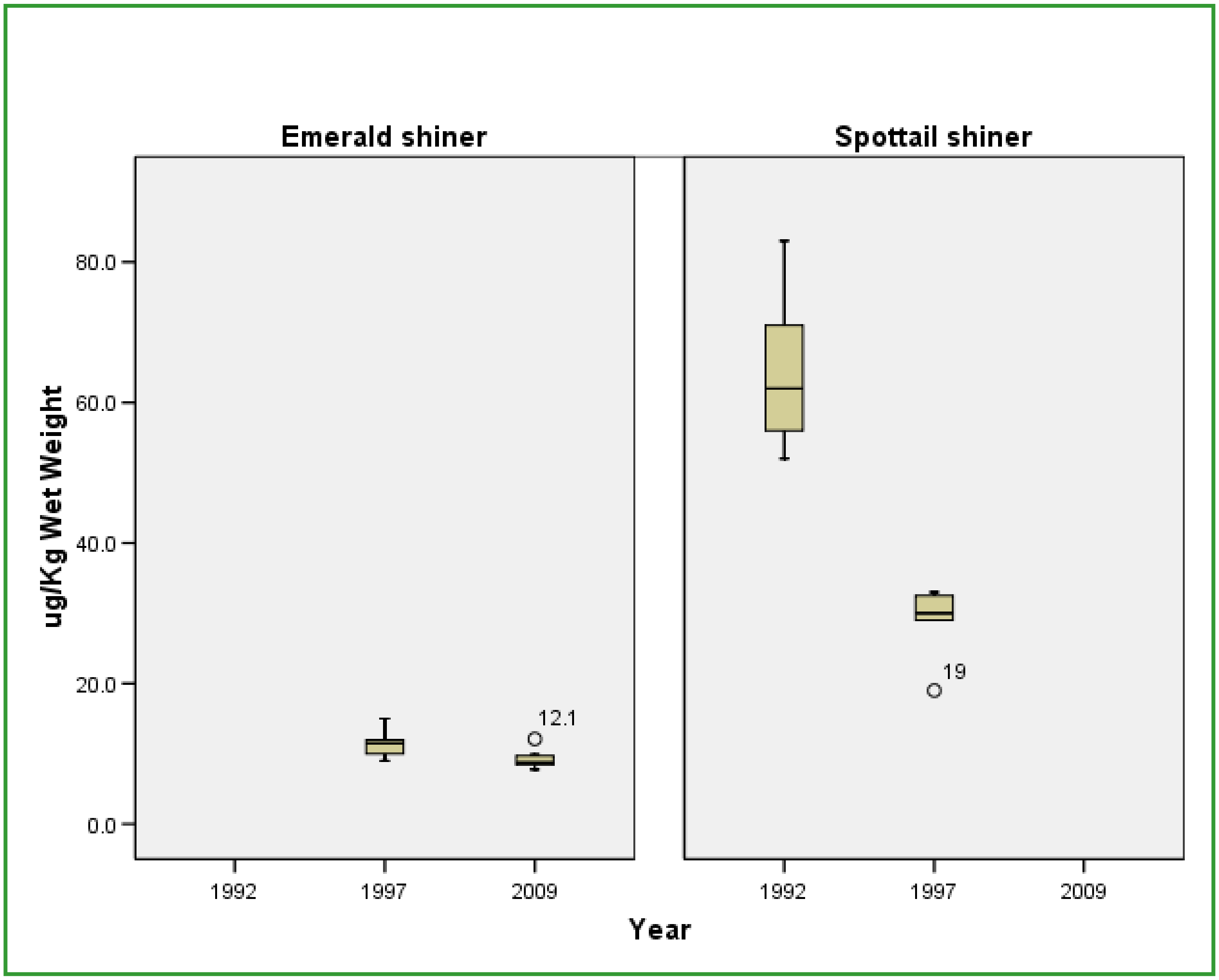
Figure 22. Boxplot (by species) and descriptive statistics for DDE concentrations (ug/Kg) for young-of-year fish samples collected from Lewiston, Niagara River, New York State's Great Lakes Basin.



YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	BN	7	2	6.3	7.0	1.7	4.0	9.0	5.0
2003	BN	3	2	4.4	4.4	0.7	3.7	5.0	1.3
2009	BN	7	2	3.4	3.3	0.4	2.8	4.0	1.1
1984	ST	3	2	19.5	20.2	4.0	15.2	23.1	7.9
1985	ST	9	2	12.9	13.0	1.9	11.0	15.0	4.0
1986	ST	9	2	7.9	8.0	0.8	7.0	9.0	2.0
1987	ST	10	2	8.5	8.5	2.1	6.0	12.0	6.0

BN=Bluntnose minnow; ST=Spottail shiner

Figure 23. Boxplot (by species) and descriptive statistics for DDE concentrations (ug/Kg) for young-of-year fish samples collected from Krull Park, Lake Ontario, New York State's Great Lakes Basin.



○ = mild outliers

YEAR	SPECIES	n	MDL	MEAN	MEDIAN	STDEV	x-MIN	x-MAX	RANGE
1997	ES	10	2	11.5	11.5	1.7	9.0	15.0	6.0
2009	ES	7	2	9.3	8.8	1.4	7.8	12.1	4.4
1992	ST	7	2	64.4	62.0	11.4	52.0	83.0	31.0
1997	ST	7	2	29.3	30.0	4.9	19.0	33.0	14.0

ES=Emerald shiner; ST=Spottail shiner