DATA REPORT FOR SCREENING FOR ORGANOCHLORINE AND METAL CONTAMINANT LEVELS IN HUDSON RIVER, NEW YORK BULLFROGS *(RANA CATESBEIANA)* AND SNAPPING TURTLES *(CHELYDRA SERPENTINA SERPENTINA)*

HUDSON RIVER NATURAL RESOURCE DAMAGE ASSESSMENT

HUDSON RIVER NATURAL RESOURCE TRUSTEES

STATE OF NEW YORK

U.S. DEPARTMENT OF COMMERCE

U.S. DEPARTMENT OF THE INTERIOR

FINAL

FEBRUARY 28, 2005

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PREPARED FOR HUDSON RIVER NATURAL RESOURCE TRUSTEES

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EXECUTIVE SUMMARY

Natural resources of the Hudson River have been contaminated through past and ongoing discharges of polychlorinated biphenyls (PCBs). As a means of evaluating regional contamination of amphibians and reptiles, a screening level survey of PCB and other contamination of select amphibian and reptile species was conducted.

Bullfrogs (*Rana catesbeiana*) and snapping turtles (*Chelydra serpentina serpentina*) were collected from three geographically distinct areas of the Hudson River (Coveville, Stockport Station, and Vanderburgh Cove) during September 1998. Tissues (muscle, liver, kidney, adipose) from 13 snapping turtles and tissues (muscle) from 20 bullfrogs were analyzed for PCBs (reported as Aroclor 1260), organochlorine pesticides, and metals (mercury, lead and cadmium). All concentrations reported are on a wet weight basis.

Only one bullfrog specimen had a detectable concentration of PCBs in the muscle tissue: 23 parts per billion (ppb). The range of detections of metals in bullfrog muscle tissues was as follows: cadmium, 0.005 parts per million (ppm) to 0.021 ppm; lead, 0.024 ppm to 2.15 ppm; and, mercury, 0.014 ppm to 0.138 ppm. Pesticides were not detected in bullfrog muscle tissue samples.

All snapping turtle specimens contained PCBs. PCBs in muscle tissue ranged from 0.031 ppm to 0.770 ppm. Liver tissue PCB concentrations ranged from 0.510 ppm to 8.80 ppm. Kidney tissue PCB concentrations ranged from 0.069 ppm to 4.10 ppm. The highest concentrations of PCBs in snapping turtles were in the adipose tissue, with a range of 9.80 ppm to 610 ppm.

All of the snapping turtle specimens carried body burdens of mercury and cadmium, but lead was not detected in any of the specimens. Mercury was detected in all four tissue types that were analyzed. Liver concentrations of mercury ranged from 0.160 ppm to 2.57 ppm. Kidney tissue concentrations of mercury ranged from 0.212 ppm to 2.39 ppm. Muscle tissue concentrations of mercury ranged from 0.052 ppm to 0.419 ppm and adipose tissue concentrations of mercury ranged from non-detect to 0.042 ppm.

Cadmium was detected in all snapping turtle specimens, but only in liver and kidney tissue. The concentration of cadmium in liver tissue ranged from 0.005 ppm to 0.136 ppm, and in kidney tissue from 0.014 ppm to 0.943 ppm. Dieldrin was detected in snapping turtle liver tissue, but not in muscle, kidney, or adipose tissue samples.

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1.0 INTRODUCTION

Past and continuing discharges of polychlorinated biphenyls (PCBs) have contaminated the natural resources of the Hudson River. The Hudson River Natural Resource Trustees – New York State, the U.S. Department of Commerce, and the U.S. Department of the Interior – are conducting a natural resource damage assessment (NRDA) to assess and restore those natural resources injured by PCBs (Hudson River Natural Resource Trustees 2002). This Data Report provides the results of a screening level survey of PCB and other contamination of select Hudson River amphibian and reptile species conducted pursuant to the NRDA.

The objective of this study, "Screening for Organochlorine and Metal Contaminant Levels in Hudson River, New York, Bullfrogs (*Rana catesbeiana*) and Snapping Turtles (*Chelydra serpentina serpentina*)", is to provide the New York State and federal Natural Resource Trustees information on the body burdens of PCBs, pesticides, mercury, lead and cadmium in snapping turtles and bullfrogs along the Hudson River. The bullfrog (*Rana catesbeiana*) and the snapping turtle (*Chelydra serpentina serpentina*) were selected as subjects for this study because of their positions in the food web, because they are consumed by humans, and because of their consumption advisory status. The contaminants of concern for this investigation were PCBs, other organochlorines, mercury, lead, and cadmium. Another objective of the study was to assess the current level of PCBs in bullfrogs and snapping turtles, and, if possible, assess differences in PCB concentrations in the organisms throughout the study area. The collection of information about contaminant levels and their relation to applicable consumption guidelines constituted an additional study objective. This project involved the collection and contaminant analysis of snapping turtles and bullfrogs from three geographically distinct areas of the Hudson River during September, 1998. The areas sampled were: Coveville, upstream of the Federal Dam at Troy, New York; Stockport Station, between the Federal Dam at Troy and Catskill; and Vanderburgh Cove, upstream of the Tappan Zee Bridge. The Vanderburgh Cove location had been sampled for snapping turtles by the New York State Department of Environmental Conservation (NYSDEC) in 1977 (Stone et al.1980).

2.0 SCOPE OF WORK

2.1 Collection of Specimens

This study was conducted under a combined sampling and analysis and quality assurance plan (Hudson River Natural Resource Trustees 1998).

2.1.1 Sampling Sites

Three sampling locations in the Hudson River were selected for sample collection (Figure 1): 1) Coveville, 2) Stockport Station, and 3) Vanderburgh Cove. The Hudson River is tidal upstream to the Federal Dam at Troy. The sampling areas were intact wetlands along the margins of the river. Site maps are included as Figures 2, 3, and 4.

The Coveville site is approximately 25 miles upstream of the Federal Dam at Troy. The sampling area was in the northwest arm of an oxbow backwater known as The Cove near the Coveville Marina (Figure 2). The area included an emergent marsh and an active beaver pond surrounded by a wooded margin. Beyond the wooded margin, the site is surrounded by hayfields and cornfields and U.S. Route 4.

The Stockport Station site is approximately 30 miles south of the Federal Dam at Troy, north of Catskill, New York. Two areas were sampled in this vicinity: wetlands at the mouth of Stockport Creek, and impoundments separated from the river by railroad tracks (Figure 3). The river is tidal in this reach and the tidal fluctuation during the sampling period was estimated to be around 5 feet, twice daily. At the mouth of Stockport Creek is an extensive tidal emergent marsh and large mud flats which are exposed at low tide. The impoundments formed by a railroad embankment also experience the tidal fluctuations and are bordered by emergent marsh and support lush submergent vegetation as well. The impoundments are surrounded by rocky, oak-sycamore woods. The river is still essentially freshwater at this point, but blue crabs, *Callinectes sapidus*, were abundant.

The Vanderburgh Cove site is approximately 60 miles south of the Federal Dam at Troy, near Staatsburg, New York, between Catskill and the Tappan Zee Bridge. The Vanderburgh Cove is separated from the main river channel by railroad tracks. The cove is fed by Landsman Kill and Fallsburg Creek (Figure 4). Two unnamed coves to the north of Vanderburgh Cove were sampled, but no specimens were collected. These tidal coves were bordered by woodland. Much of the cove is drained at low tide, and the water that remains is not near shore. The cove is subject to strong tidal currents and there is little submergent vegetation present. The nuisance plant, water chestnut, *Trapa natans*, was abundant. Blue crabs were also abundant at this location. Snapping turtles were collected by the NYSDEC at this location in 1977 (Stone et al. 1980).

Any required collection permits were obtained.

2.1.2 Sample Collection

The snapping turtles were collected using 30-inch hoop traps baited with canned sardines packed in soy oil. Eight traps were deployed per sampling event. The traps were set out in the evening and checked every 12 hours. In some instances the traps were moved after the initial setting in order to try to obtain five specimens per location. The locations of the traps are indicated on the site maps (Figures 2, 3, and 4). Turtles were tagged, weighed, and carapace measurements taken in the field. The captured turtles were maintained alive, on ice in coolers until they were delivered to the processing laboratory. Five specimens were collected at the Coveville site and five at the mouth of Stockport Creek. Despite an additional day of trapping, only three specimens were trapped in Vanderburgh Cove.

The bullfrog specimens were collected by hand along the margins of the wetland areas and on adjacent roadways. Originally, the project plan had called for the collection of green frogs, *Rana clamitans*, but the specimens collected on the first night at Coveville were small. In consideration of that, the target species was changed to bullfrog, which were larger and plentiful. Fourteen specimens were collected from the Coveville site and 13 specimens were collected from the Stockport site. More frogs were collected than the 10 specimens specified in the Quality Assurance Project Plan (Hudson River Natural Resource Trustees 1998) in order to compensate for the possibility that some specimens might die during transit. Despite repeated attempts to collect frogs at the Vanderburgh Cove sites, none were found nor collected. No frogs were heard calling at the Vanderburgh locations. Vanderburgh Cove might drain too much at low tide to provide suitable breeding habitat and lacked submergent vegetation that would provide cover for developing tadpoles. The bullfrog specimens were tagged, weighed, and snout to vent (S-V) measurements were taken in the field. The specimens were maintained in vented foam coolers for transport to the processing laboratory.

2.2 DISSECTION AND SAMPLE PREPARATION

All specimens were maintained alive until examination and sample preparation. The bullfrog specimens were examined within 24 hours of delivery to the processing laboratory and the snapping turtles were examined within 48 hours of delivery. All dissecting trays and dissecting instruments were washed in tap water, rinsed with distilled water, and rinsed with hexane before and after each dissection. All tissue samples for chemical analysis were placed in new, certified laboratory-cleaned amber glass sample containers. Tissue samples were frozen immediately at -20°C, and maintained frozen until delivered to the NYSDEC Hale Creek Field Station, Gloversville, New York. Refrigerator and freezer logs were kept while samples were stored at the processing laboratory. The tissue samples were homogenized and split for metals and organic analyses by the Hale Creek Field Station Laboratory. Duplicate samples were prepared from the homogenized tissues.

2.2.1 BULLFROG

The specimens were examined alive for gross external abnormalities. They were then sacrificed by pithing. The specimens were rinsed with distilled water and the internal organs were examined for gross pathology and parasites. Sex and sexual maturity were determined by internal examination. The stomach and gut were removed whole, opened, and the contents placed in a clean glass jar and covered with 70% ethanol for later examination. Only muscle tissue was analyzed from frog specimens. The target sample size for chemical analysis was 23 grams (g) of tissue. All the muscle tissue was removed from the hind legs. If this did not provide at least 23 g of tissue, additional muscle tissue was taken from the forelegs. If removal of tissue from both sets of limbs did not provide 23 g of tissue, the underweight sample was submitted. Muscle tissue from other parts of the body was not used. The twenty specimens selected for tissue analysis were the ten heaviest live specimens from each of the Coveville and Stockport sites. Specimens were not aged, but sexual maturity based on the condition of the gonads was noted. Typically, when frogs are used for human consumption, only the skinned hind legs are prepared and eaten. Therefore, analysis of muscle tissue, primarily from the hind legs, provides a representative sample for human exposure to contaminants from consumption of frog legs.

2.2.2 SNAPPING TURTLE

The 13 snapping turtles were maintained alive, on ice, to slow the reflexes and make handling easier until sacrifice . They were sacrificed by spinal dislocation. Sacrificed specimens were washed in tap water and rinsed with distilled water. The specimens were examined for external gross lesions and parasites. The body cavity was opened by removing the plastron and the internal organs were examined for gross pathology and parasites. The stomach and intestines were removed, placed in plastic bags and frozen for later examination. The sex of the specimens was determined by internal examination. Sex had been recorded on the field sheets based on the ratio of carapace length to weight, but this method did not prove to be a reliable predictor of the sex of the turtles. Tissue samples were collected from muscle, liver, kidney, and adipose tissue. The muscle samples were taken from both hind limbs and the gall bladder was separated from the liver. Both kidneys were dissected out and collected and all of the adipose tissue that could be removed from the carcass was collected. Specimens were not aged, but all specimens were sexually mature.

2.3 Chemical Analysis

The analytical methods for the analysis of PCB, organochlorine pesticides, percent lipid and percent moisture content are contained in the project quality assurance plan (Hudson River Natural Resource Trustees 1998). Tissues were soxhlet extracted with methylene chloride, concentrated, and an aliquot removed for lipid analysis. A gel permeation chromatography clean-up procedure was used on the remainder of the extract. PCBs were separated from pesticides using silica gel column chromatography. Tuna muscle tissue was used for the method blank. The PCB analytes for both species were Aroclors known to be present in the Hudson River ecosystem:

Aroclor 1016

Aroclor 1221

Aroclor 1232

Aroclor 1242

Aroclor 1248

Aroclor 1254

Aroclor 1260

The analytical methods for total mercury, total cadmium, and total lead using atomic absorption spectra (AAS) methods were as follows:

- Total mercury - HG.1998.FISH.1 (cold vapor AAS)
- Total cadmium - CD-AT-4 (furnace AAS)
- Total lead - PB-AT-3 (furnace AAS)

2.3.1 Summary of Chemical Analyses - Snapping Turtle

Tissues: Muscle, liver, kidney, adipose

Analytes: PCBs, organochlorine pesticides, mercury, cadmium, and lead

2.3.2 Summary of Chemical Analyses - Bullfrog

Tissues: Muscle

Analytes: PCBs, organochlorine pesticides, mercury, cadmium, and lead

2.4 Gut Contents Analysis

The gut contents from the bullfrog specimens were examined and identified to the lowest practical taxon. These data were recorded on the laboratory bench sheets and were later transcribed to the Specimen Record Sheets.

The snapping turtle gut packages were defrosted for ease of handling. The gut was opened and the contents examined. Identifications were made to the lowest practical taxon. Data were recorded on the laboratory bench sheets and later transcribed to the Specimen Record Sheets.

SECTION 3.0 RESULTS

A Specimen Record Sheet was prepared for each specimen (20 bullfrogs, 13 snapping turtles) to record size data and qualitative data for gross external and internal abnormalities and gut contents.

Data were tested for normality using the Lilliefors modification of the Kolmogorov-Smirnov Test (Lilliefors, 1967). The geometric mean is reported for data not normally distributed.

3.1 CHARACTERISTICS

3.1.1 BULLFROG

The bullfrogs selected for analysis ranged in weight from 36.5 g to 289 g, with a mean (geometric) of 116 g, and ranged in S-V length between 70 millimeters (mm) to 145 mm, with a mean of 90 mm. None of the specimens showed pathological conditions in gross external morphology or internal anatomy. Ten of the 20 bullfrogs were female and the other 10 were male.

The examination of gut contents showed that the bullfrogs had been feeding mainly on insects, crayfish, snails, and small fish. Insects, both aquatic and terrestrial, were the most common food item. One bullfrog from Coveville had eaten a small chipmunk, *Tamias striatus*, and another bullfrog from Coveville had eaten a toad, *Bufo americanus*. The presence of terrestrial insects, the toad, and the chipmunk, as well as fish and crayfish, in the gut contents shows that the bullfrogs used both aquatic and the adjacent terrestrial habitats for feeding range.

3.1.2 SNAPPING TURTLE

The snapping turtles ranged in weight from 2.7 kilograms (kg) to 16.1 kg, with a mean weight of 9.5 kg, and in carapace length from 22.86 centimeters (cm) to 39.37 cm with a mean length of 32.24 cm. All of the turtles, based on carapace length greater than 200 mm, were presumed to be adults (USEPA, 1993). However, only two females were collected and only the larger one from Stockport, 5.9 kg, carried yolk sacs.

All of the turtles collected bore leeches as external parasites and all but one carried small (~ 2 cm) white nematodes in the large intestine. The mature female also carried small, dark parasites embedded in the adipose tissue that were not seen in other specimens. The largest specimen, a 16.1 kg male collected at Stockport, showed that its carapace had been damaged but had healed and was the only specimen that did not carry the nematode parasites in the large intestine. This turtle was also the only turtle that did not have any plant material in the gut. Three of the five turtles collected at Stockport had nematode parasites embedded in the fascia around the stomach and intestines. This type of parasite was not observed in specimens from Coveville or Vanderburgh Cove.

As noted above, all but one of the turtles had been feeding on plant material, especially water lily pods. One turtle taken at Coveville had only plant material in its gut. The other four from Coveville had been eating fish and large aquatic snails, family Viviparidae. The identifiable fish fragments were from sunfish, *Lepomis sp.* At Stockport fish were the main food item. Identifiable species included: longnose sucker, *Catostomus catostomus*; bass, *Micropterus sp.*; and carp, *Cyprinus carpio*. One turtle had duck bones in the stomach and large intestine, one had blue crab fragments, and one had pieces of northern water snake, *Nerodia sipedon*. The three turtles collected at Vanderburgh Cove had also been feeding on fish and crustaceans. The identifiable species were sunfish; white perch, *Morone americana*; and blue crab.

3.2 CONTAMINANT DATA ANALYSIS

All of the PCBs detected were reported as the Aroclor 1260 mixture; however, it should be noted that in environmental samples the PCB mixture has weathered and has been modified by geochemical and biological processes that modify the PCB congener mixture present in the sample.

All contaminant concentrations reported are on a wet weight basis. Values presented in parts per million units (ppm) herein are reported with three significant figures. Means calculated using data points qualified as "U" used one half the method detection limit for that data point in the calculation. All data from this preliminary investigation can be found in the NYSDEC Hudson River PCB Biota Database (NYSDEC 2002).

3.2.1 BULLFROG

3.2.1.1 PCBs

Only one bullfrog specimen had a detectable concentration of PCB contaminant in the muscle tissue: 23 parts per billion (ppb). This specimen was the largest specimen, a 280 g female, collected at Stockport.

3.2.1.2 METALS

The bullfrog muscle tissue was analyzed for cadmium, lead, and mercury. Cadmium was detected in only four specimens out of 20, all of which were males taken at Coveville. The range of detections was 0.005 parts per million (ppm) to 0.021 ppm. The highest cadmium concentration occurred in one of the smallest specimens by weight. Lead was detected in six of the 10 specimens collected at Coveville but only one of the specimens collected at Stockport. The range of detections was from 0.024 ppm to 2.15 ppm. The highest detection occurred in the same specimen that showed the highest cadmium concentration. Another specimen from Coveville was the same weight as this specimen, but contained much lower concentrations of cadmium and lead.

Mercury was detected in all specimens. The concentrations ranged from 0.014 ppm to 0.138 ppm with a mean (geometric) concentration of 0.047 ppm.

3.2.1.3 PESTICIDES

Pesticides were not detected in bullfrog muscle tissue samples.

3.2.2 SNAPPING TURTLE

3.2.2.1 PCBs

All snapping turtle specimens carried a body burden of PCBs. The analytical method characterized PCBs as Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The only Aroclor identified in the samples was Aroclor 1260. Detectable PCBs were found in all liver, kidney and adipose tissues, and in all but two muscle tissue samples; the exceptions were one turtle each from Coveville and Stockport.

PCB concentrations were lowest in muscle tissue of each specimen. The PCB concentrations detected in muscle tissue ranged from 0.031 ppm to 0.770 ppm, with a mean (geometric) of 0.074 ppm.

The liver tissue concentrations ranged from 0.510 ppm to 8.80 ppm, with a mean (geometric) of 2.27 ppm. The kidney tissue concentrations ranged from 0.069 ppm to 4.10 ppm, with a mean (geometric) concentration of 0.356 ppm. The highest concentrations of PCBs were in adipose tissue, with a range of 9.80 ppm to 610 ppm, with a mean (geometric) of 42.8 ppm.

The maximum PCB concentrations for all four tissue types were reported for the same specimen, a 14.1 kg male taken at Coveville. The liver of this specimen appeared abnormal, with white marbling throughout the tissue. It was the second largest specimen collected. The liver tissue from this specimen had the lowest percent lipid, 1.8 %, but the PCB concentration on a lipid weight basis was also the highest reported.

3.2.2.2 Metals

All of the specimens carried body burdens of mercury and cadmium, but lead was not detected in any of the specimens.

Mercury was detected in all four tissue types that were analyzed. Liver and kidney tissues showed the highest mercury concentrations. Liver mercury concentrations ranged from 0.160 ppm to 2.57 ppm, with a mean (geometric) of 0.68 ppm. Kidney tissue mercury concentrations ranged from 0.212 ppm to 2.39 ppm, with a mean (geometric) of 0.601 ppm. The mercury concentrations in muscle and adipose tissue were much lower. Muscle tissue mercury concentrations ranged from 0.052 ppm to 0.419 ppm, with a mean of 0.175 ppm, and adipose tissue mercury concentrations ranged from non-detect to 0.042 ppm, with a mean of 0.015 ppm. The large specimen from Coveville that had the highest PCB tissue concentrations, also had the highest mercury concentrations in muscle, kidney, and adipose tissue and the second highest concentration in liver tissue.

Cadmium was detected in all specimens, but only in liver and kidney tissue. The concentration in liver tissue ranged from 0.005 ppm to 0.136 ppm, with a mean (geometric) of 0.020 ppm, and in kidney tissue from 0.014 ppm to 0.943 ppm, with a mean (geometric) of 0.097 ppm.

3.2.2.3 Pesticides

Dieldrin was detected at low levels in liver tissue from three of the five turtle specimens collected at Stockport and all three turtle specimens collected from Vanderburgh Cove. Sample detection limits ranged from five to 130 ppb. Some pesticide detection limits were elevated in samples because PCBs co-elute with the chlorinated pesticides. At Stockport one detection was below the quantitation limit and the other two had concentrations of 12 ppb. All three detections at Vanderburgh Cove were below the quantitation limit of 10 ppb. Dieldrin was not detected in muscle, kidney, or adipose tissue samples.

4.0 DISCUSSION

4.1 SNAPPING TURTLE

As Stone et al. (1980), Helwig and Hora (1983) and Olafsson et al. (1983) report, snapping turtles have the potential to accumulate significant amounts of PCBs, organochlorine pesticides and certain metals. This study concurs with this finding. The presence of these contaminants in snapping turtles indicates that these contaminants are present in the food web of the Hudson River.

4.1.1 METALS

All turtles analyzed had detectable levels of mercury and cadmium, however none had detectable levels of lead.

The specimen that exhibited the highest concentrations of cadmium in liver and kidney was a 5.9 kg female collected at Stockport. The cadmium concentrations for both liver (0.136 ppm) and kidney (0.943 ppm) were more than double the next highest tissue concentration. Another 5.9 kg turtle was collected at Stockport and the cadmium levels for this specimen were liver (0.004 ppm) and kidney (0.032 ppm).

The U.S. Food and Drug Administration mercury advisory level for fish tissue for human consumption is 1 ppm. Mercury levels in turtle muscle tissue in this study -- ranging from 0.052 ppm to 0.419 ppm with a mean of 0.175 ppm -- were well below this level. There are no regulatory criteria for cadmium or lead in tissues that are consumed by humans. The measurements of metals concentrations in snapping turtle tissues from this study are the first reported for the Hudson River.

4.1.2 PCBs

The consideration of human health implications due to the consumption of frogs and turtles served as an impetus for this study. In 1985, New York State issued consumption advisories for snapping turtle based on the PCB concentration results of earlier sampling. The current advisory recommends that women of childbearing age, infants and children under the age of 15 avoid eating snapping turtles or soups made with their meat; the contaminant of concern is PCBs (NYSDOH 2004). The muscle tissue concentrations in this study were all well below the U.S. Food and Drug Administration (USFDA) level of 2.0 ppm PCBs in fish tissue. However, the adipose tissue PCB levels were much greater than the USFDA level of 3.0 ppm for PCBs in the fat of chicken and beef.

4.2 BULLFROG

Bullfrog muscle tissue samples showed detectable levels of mercury in all specimens.

Lead was detected in six out of 10 samples from the Coveville site and from only one sample from the Stockport site. The highest lead concentration, 2.15 ppm, is probably an anomalous reading not reflecting the sample's true lead level (Per. Comm. Stone 2000). A concentration this high would be expected to cause severe damage (or death) to the individual, but no such pathological response was observed.

Cadmium was only detected in four out of the 20 tissue samples, and all of these were from Coveville. This would be consistent with the presence of a source condition that is closer to Coveville than Stockport.

The largest bullfrog specimen was the only one that had detectable levels of PCBs, and the concentration was very low. Because bullfrog leg muscle is very lean, it is expected that lipid soluble compounds such as PCBs and organochlorine pesticide concentrations would be at low or non-detectable concentrations. If other portions of the frog had been analyzed (e.g., whole frog or liver), greater concentrations of lipid would be expected to be present, therefore, it is likely that PCB and other lipid soluble compounds would be detected with greater frequency.

The presence of these contaminants in bullfrogs indicates that these contaminants are present in the food web of the Hudson River.

5.0 SUMMARY AND CONCLUSION

This study collected and analyzed a total of 13 snapping turtles from Coveville, Stockport and Vanderburg Cove, New York, as well as a total of 20 bullfrogs from the Coveville and Stockport locations. The turtle tissues analyzed were adipose, liver, kidney, and muscle. Only muscle tissue was analyzed in bullfrogs. The analytes for these tissues were heavy metals, (mercury, cadmium, and lead), total PCBs, and organochlorine pesticides. The findings of this study are as follows:

FOR BULLFROGS:

- Coveville bullfrogs had higher lead and cadmium levels than did bullfrogs from Stockport.
- Mercury was found in all bullfrogs. Observed mercury levels (which ranged from 0.014 ppm to 0.138 ppm with a mean (geometric) of 0.047 ppm) were below the USFDA mercury action level for fish tissue for human consumption.
- PCBs were detected in only the largest specimen of the 20 bullfrogs that were analyzed; the detection was at 23 ppb.
- The presence of these contaminants in bullfrogs indicates that these contaminants are present in the food web of the Hudson River.

FOR SNAPPING TURTLES:

- Mercury and cadmium were detected in all snapping turtles.
- Observed mercury levels (which ranged from 0.052 ppm to 0.419 ppm with a mean of 0.175 ppm) were below the USFDA mercury action level for fish tissue for human consumption.
- Lead was not detected in any of the snapping turtles.
- PCB adipose tissue levels found by this study exceed the USFDA Action Levels for fat in chicken and beef.

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Figures

FIGURE 1 HUDSON RIVER WATESHED

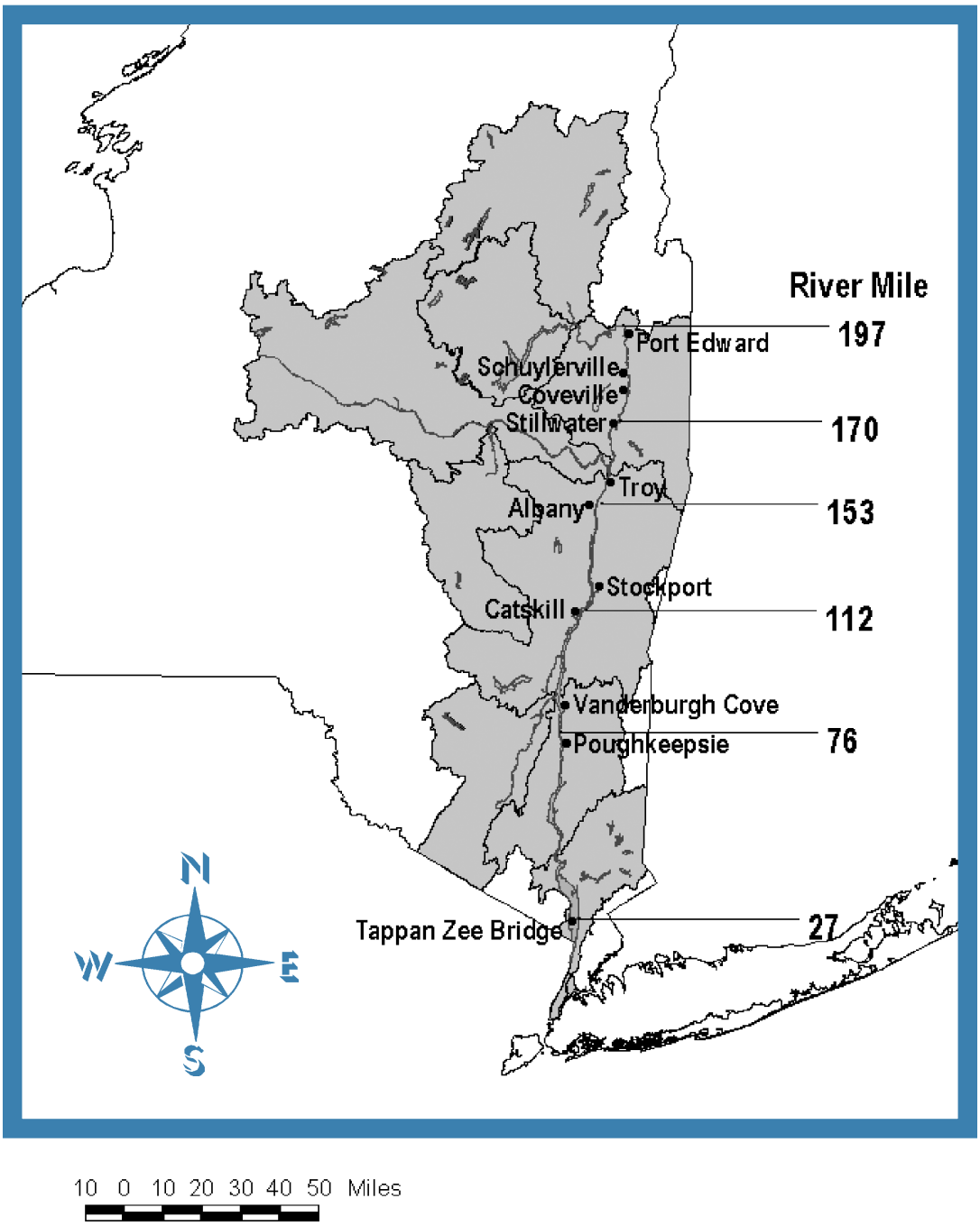
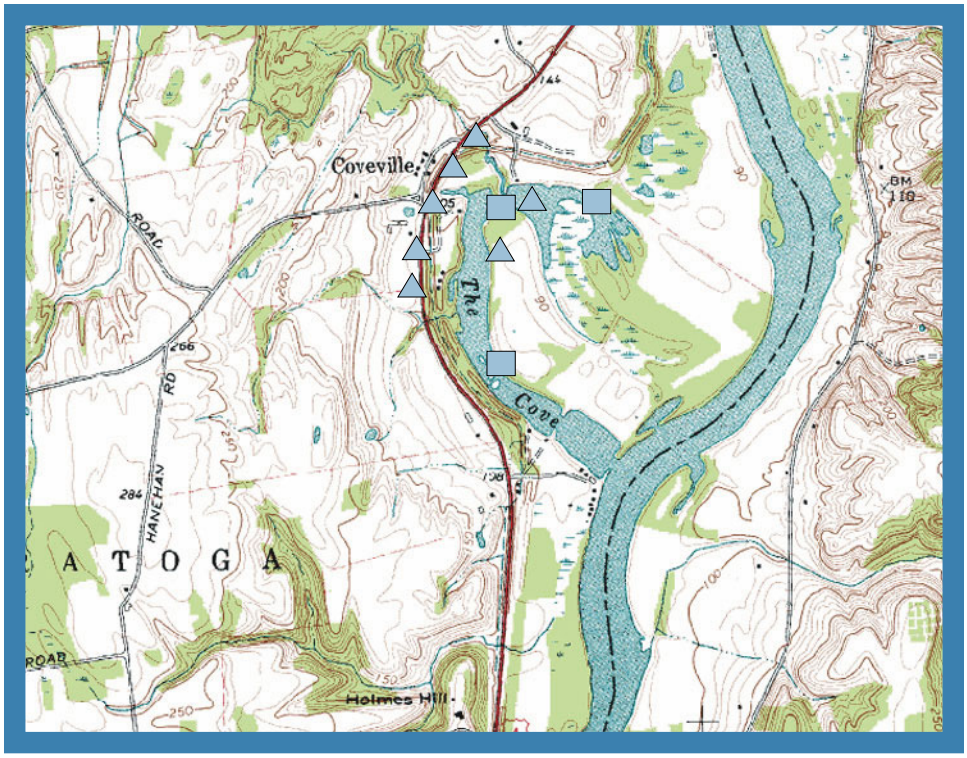


FIGURE 2 SITE LOCATION MAP - COVEVILLE



= SNAPPING TURTLE

= BULLFROG

N
W
E
S

FIGURE 3 SITE LOCATION MAP - STOCKPORT

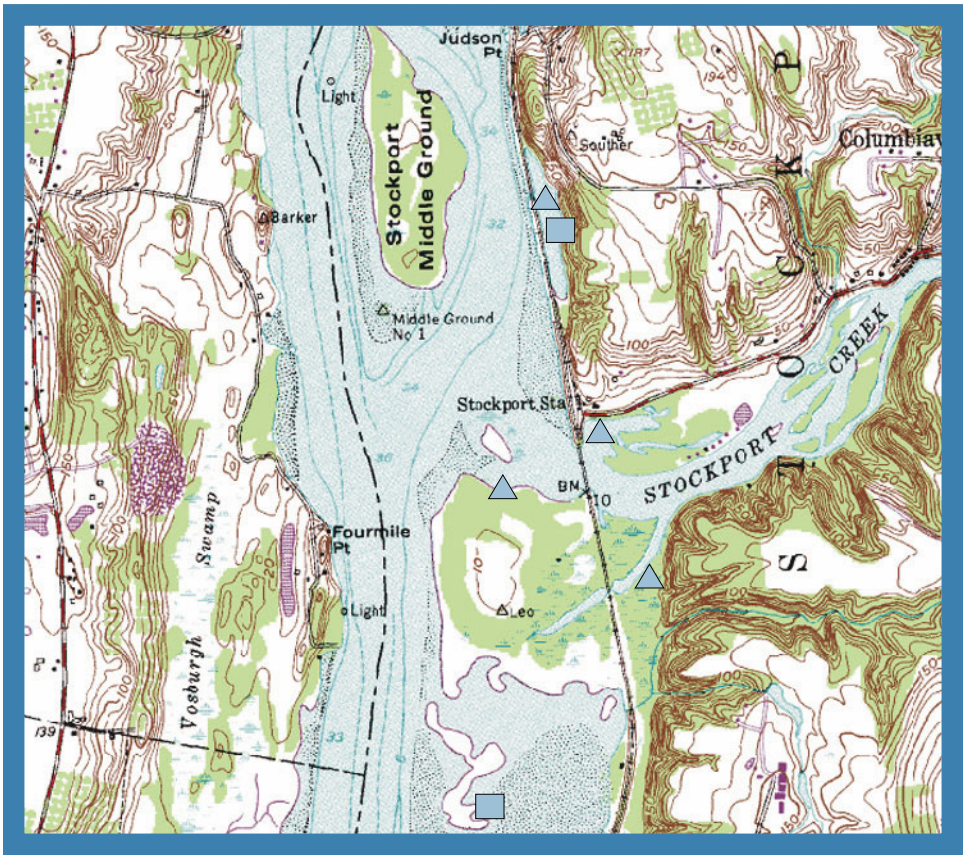
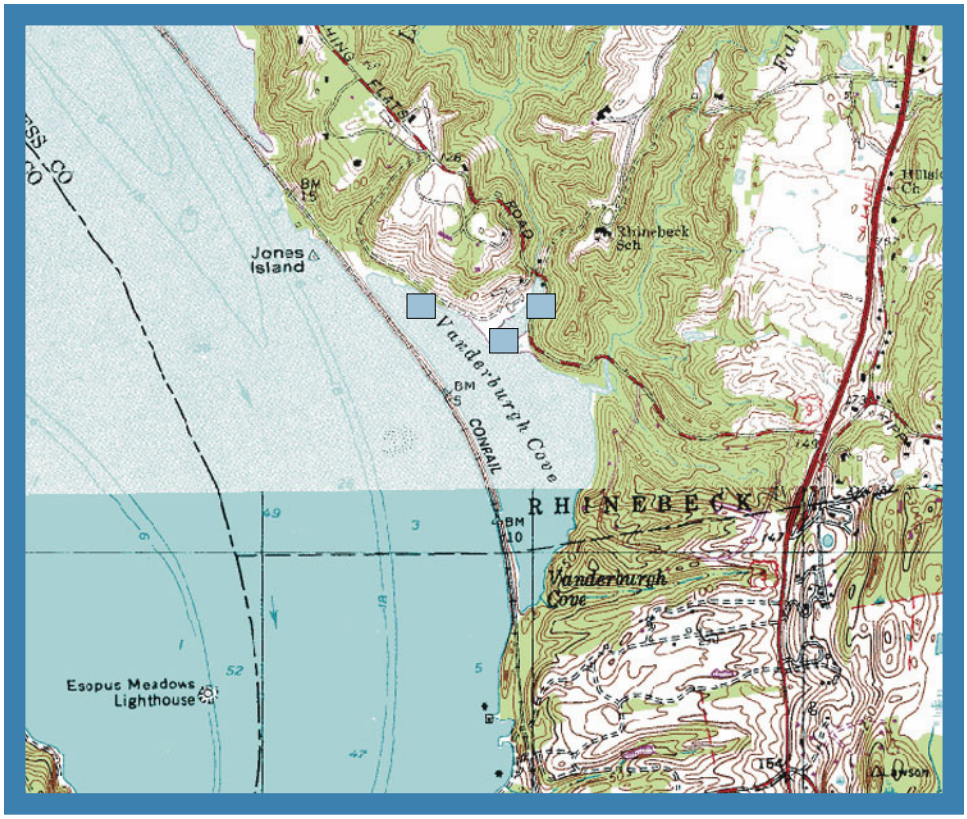
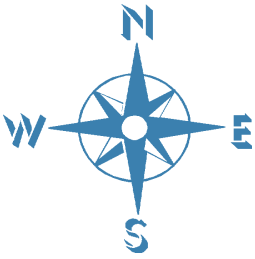


FIGURE 4 SITE LOCATION MAP - VANDERBURGH COVE



= SNAPPING TURTLE

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