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MICHIGAN WILDLIFE CONTAMINANT TREND MONITORING

YEAR 2005 ANNUAL REPORT NESTLING BALD EAGLES

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Section 1.0

Executive Summary

- The bald eagle monitoring project is one component of Michigan's water quality monitoring program that was summarized by the Michigan Department of Environmental Quality (MDEQ) in the January 1997 report entitled, "A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters (Strategy)." This document serves as the seventh annual report for the bald eagle element of the Strategy. The following are the goals of the bald eagle monitoring project:

  1.) Assess the current status and condition of individual waters of the state and determine whether standards are being met.

  2.) Determine temporal and spatial trends in the quality of Michigan's surface waters.

- In 2005, 90 nestling bald eagle blood plasma samples were analyzed for organochlorine contaminants, dichlorodiphenyltrichloroethane (DDT) and its metabolites, hexachlorobenzene, *alpha*-hexachlorocyclohexane (*alpha*-HCH), *gamma*-hexachlorocyclohexane, heptachlor, heptachlor epoxide, *alpha*-chlordane, *gamma*-chlordane, dieldrin, toxaphene, and 20 polychlorinated biphenyl (PCB) congeners.

- Significant differences in total DDT and 4,4'-Dichlorodiphenyldichloroethylene (4,4'-DDE) concentrations were found between inland and Great Lakes breeding areas ($P<0.0001$) and among the inland Lower Peninsula, inland Upper Peninsula, Lake Huron, Lake Michigan, Lake Erie, and Lake Superior breeding areas ($P<0.0001$). Geometric mean total DDT concentrations were ranked in the following order by location from highest to lowest Lake Michigan > Lake Huron > Lake Erie > Lake Superior > inland Upper Peninsula > inland Lower Peninsula breeding areas. Geometric mean total 4,4'-DDE concentrations were ranked in the following order by location from highest to lowest: Lake Huron > Lake Michigan > Lake Erie > Lake Superior > inland Upper Peninsula > inland Lower Peninsula breeding areas. 4,4'-DDE was quantified in 87% of the samples and was the most common DDT metabolite found in eaglet blood plasma.

- Twenty PCB congeners were quantified and summed to determine total PCBs in nestling bald eagle blood plasma samples. At least one of the targeted PCB congeners was detected in 76 of the 90 nestlings sampled. A significant difference in total PCB concentrations was found among inland, Great Lakes, and anadromous breeding areas ($P<0.0001$), and among the inland Lower Peninsula, inland Upper Peninsula, Lake Huron, Lake Michigan, Lake Erie, and Lake Superior breeding areas ($P<0.0001$). Geometric mean PCB concentrations were ranked in the following order by location from highest to lowest Lake Erie > Lake Michigan > Lake Huron > Lake Superior > inland Lower Peninsula > inland Upper Peninsula breeding areas.

- Quantifiable concentrations of *alpha*-HCH and heptachlor were not detected in any of the 90 samples collected in 2005. Hexachlorobenzene and *gamma*-chlordane were each quantified in nine nestling eagle samples. No significant differences were found at the Category spatial scale. *gamma*-Hexachlorocyclohexane (*gamma*-HCH) was quantified in five samples ranging from 4.0-4.8 nanograms per gram (ng/g), with all but one sample coming from Great Lakes breeding areas. Due to small sample sizes statistical analysis of *gamma*-HCH was not conducted.

- Quantifiable concentrations of *alpha*-chlordane were measured in 37 blood plasma samples. A significant difference in *alpha*-chlordane concentrations was found between Great Lakes breeding areas and inland breeding areas (P<0.0001) and among the inland Lower Peninsula, inland Upper Peninsula, Lake Huron, Lake Michigan, Lake Erie, and Lake Superior breeding areas (P<0.0001).

- Quantifiable concentrations of dieldrin were measured in 45 blood plasma samples. A significant difference in dieldrin concentrations was found between Great Lakes breeding areas and inland breeding areas (P<0.0001) and among the inland Lower Peninsula, inland Upper Peninsula, Lake Huron, Lake Michigan, Lake Erie, and Lake Superior breeding areas (P<0.0002).

- Quantifiable concentrations of heptachlor epoxide were measured in 25 blood plasma samples. Significant differences in *alpha*-chlordane concentrations was found among the inland Lower Peninsula, inland Upper Peninsula, Lake Huron, Lake Michigan, Lake Erie, and Lake Superior breeding areas (P<0.0027).

- Mercury data for 2005 are available in the MDEQ report, MI/DEQ/WB-09/071.

Section 2.0

Introduction

In April 1999, the MDEQ, Water Division, began monitoring environmentally persistent and toxic contaminants in bald eagles. This study is part of the wildlife contaminant monitoring project component of the MDEQ's Strategy (MDEQ, 1997).

The November 1998 passage of the Clean Michigan Initiative-Clean Water Fund (CMI-CWF) bond proposal resulted in a substantial increase in annual funding for statewide surface water quality monitoring beginning in 2000. The CMI-CWF offers reliable funding for the monitoring of surface water quality over a period of approximately 15 years. This is important since one of the goals of the Strategy is to measure temporal and spatial trends in contaminant levels in Michigan's surface waters.

The bald eagle (*Haliaeetus leucocephalus*) was selected as a biosentinel species for monitoring contaminants in Michigan for the following reasons:

1. As a top-level predator, the bald eagle has a significant reliance on the aquatic food web and feeds primarily on fish and waterbirds. Specific dietary preferences of bald eagles include species of northern pike, suckers, bullheads, carp, catfish, bowfin, ducks, gulls, and deer (winter carrion and road-killed deer).

2. Past monitoring has shown that eagles accumulate organic and inorganic environmental contaminants and those contaminants may be quantified in blood, feather, and egg samples.

3. There is a viable population of bald eagles that provides sufficient sampling opportunities for a long-term monitoring program.

4. The large body size of nestling eagles allows monitoring to be conducted by blood sampling techniques and sufficient sample volumes are available to attain low quantification levels (QLs).

5. Mature bald eagles display great fidelity to their chosen nesting territory and often return to the same nest tree year after year. Although some eagles may move away from their nesting territories in the winter months, bald eagles generally reside within the state's waters throughout the year. Therefore, contaminants found in nestling bald eagles will represent the uptake of available contaminants within a particular territory.

The primary objectives of this project were to gather the seventh year of data on eaglets, evaluate temporal trends between these data and historical data available in the scientific literature, and evaluate spatial trends of contaminant concentrations among watersheds and the Great Lakes basins. Because the methods for sample collection required nest visits and handling nestling eagles, other biological measures were obtained. Therefore, the secondary objectives of the project included determining reproductive success and collecting nestling morphological data. Both spatial and temporal trends of reproductive success were also assessed in this project.

In accordance with one of the key principles of the CMI-CWF, the bald eagle monitoring protocol was planned and conducted in partnership with outside organizations. In 1999, this partnership included Lake Superior State University and Clemson University, and since 2000, this partnership included Michigan State University and Clemson University.

This document serves as the seventh annual report for the bald eagle element of the Strategy. The first (MDEQ, 2002), second (MDEQ, 2003), third (MDEQ, 2004a), fourth (MDEQ 2004b), fifth (MDEQ 2008a), and sixth (MDEQ 2008b) reports contained results of the samples collected in 1999, 2000, 2001, 2002, 2003, and 2004, respectively. This report contains the analytical results for organic contaminants that were measured in nestling bald eagle blood samples, and statistical, temporal, and spatial trend analyses of the data. Also included in this report are the data for reproductive success and nestling morphological measurements. Feather analyses for mercury concentrations have been conducted and the results have been submitted as a five-year (2004-2008) report (MDEQ, 2009).

SECTION 3.0

STUDY DESIGN AND METHODS

3.1 SITE SELECTION

The bald eagle monitoring project is designed to provide monitoring coverage of both the coastal Great Lakes and inland waters. Nesting eagles are found along the shorelines and on islands of each of the four Great Lakes surrounding Michigan. Further, the distribution of breeding eagles across much of Michigan provides monitoring coverage for many of the major river systems. Currently, active bald eagle breeding areas are well distributed across the Upper Peninsula and northern Lower Peninsula of Michigan.

The establishment of breeding areas in southern Michigan is relatively recent, and the number of active breeding areas continues to increase as eagles either establish new breeding areas or re-occupy historical territories. For example, the breeding areas in Arenac, Barry, Ottawa, and Wayne Counties were established in 1998 or 1999. One breeding area in Monroe County was established in 1988 and the other three breeding areas were first occupied in 1998 or 1999. The first breeding areas in Allegan and Saginaw Counties were established in 1993. At the time of writing this report there were nearly 800 breeding areas in the state of Michigan with approximately 500 active each year.

To facilitate the MDEQ's National Pollutant Discharge Elimination System permitting process, Michigan's watersheds, as delineated by eight-digit hydrologic unit codes (HUCs), are divided into 5 basin years for monitoring (Figure 1). Therefore, approximately 20% of Michigan's surface waters are assessed each year. The bald eagle sample collection schedule is consistent with the basin year delineation and complements the other monitoring activities conducted during each basin year. In addition to the basin year sampling, nests associated with the Great Lakes, the connecting channels and 12 inland territories are sampled annually. Great Lakes and connecting channel nests are sampled annually because nesting success is highly uncertain for these sites.

The following basin year watersheds were the focus of sampling in 2005: Chocolay, Cedar-Ford, Escanaba, Tacoosh-Whitefish, Fishdam-Sturgion, Upper St. Joseph, Macatawa, Pere Marquette-Pentwater, Lon Lake-Ocqueoc, Cheboygan, Black, Thunder Bay, Kawkawlin-Pine, Wiscoggin, Shiawassee, Rouge, Ottawa-Stony, St Joseph, and Tiffin (Figure 2). In addition to the basin year watersheds for 2005, nests associated with the Great Lakes and connecting channels were sampled. Great Lakes-associated nests are defined as those nests within 8.0 kilometers of the shorelines of the Great Lakes and along tributaries where anadromous fish are accessible.

3.2 FIELD METHODS

The methods used to collect blood and breast feather samples from nestling bald eagles are designed to avoid injury and undue stress to the birds. Sample collection and morphometric methods are adapted from Bortolotti (1984a, 1984b, 1984c), Henny and Meeker (1981), Henny *et al*. (1981) and Morizot *et al*. (1985). The methods are summarized below, but details of the procedures are published in a standard operating procedure (SOP) (Bowerman and Roe, 2002).

Blood and feather samples were collected from five- to nine-week old nestling bald eagles from May to June 2005. The approximate age of nestling eagles is visually estimated from two aerial survey flights that are piloted by a Michigan Department of Natural Resource (MDNR) pilot or contracted private pilot. An observer on each flight makes notes of the nest tree and location, determines an aerial latitude and longitude for the nest, and notes the reproductive status of each nest (e.g., eggs, chicks, or adult brooding behavior). From the observer's notes, field crews are directed to the nests at the appropriate time for sampling. Field staff ground truth the latitude/longitude coordinates using Global Positioning System units.

Once at the nest, a trained crewmember climbs the nest tree and secures a nestling. The nestling is placed in a restraining bag, lowered to the ground, weighed by spring scale, and prepared for sampling. Morphological measurements of the culmen, hallux claw, and bill depth are derived by using calipers. The eighth primary feather and the footpad are measured by using a ruler. Procedures developed by Bortolotti (1984b) are used to determine the age and sex of the nestlings. Sex is determined by the relationship of hallux claw length, footpad length, and bill depth. Once sex is determined, the length of the eighth primary feather is used to make a sex-specific estimation of age.

Sterile techniques are used to collect blood from the brachial vein of nestling bald eagles. Syringes fitted with 22 or 25 gauge x 1" needles are used for the veinipuncture. Up to 12 cc of blood are drawn from the brachial vein and are then transferred to heparinized vacuum tubes and placed on ice in coolers for transfer out of the field. Samples of whole blood are centrifuged within 48 hours of collection and the plasma is decanted and transferred to another vacuum tube and frozen at approximately -20^{o} C for storage. Three to four feather samples also are collected from the nestling eagles. Feathers are plucked from the breast and stored in small sealed envelopes. After sampling is completed, the nestlings are banded with a Size 9 United States Fish and Wildlife Service (USFWS) rivet band. The nestling is then placed back in the restraining bag, raised, and released to the nest.

From the field, samples are transferred to prearranged collection points at various MDNR, United States Forest Service, or USFWS field stations. At the end of the sampling effort, all samples are collected and transferred to the USFWS East Lansing Field Office, entered into sample storage through a chain-of-custody tracking system, and stored frozen at approximately -20^{o} C. Upon request to the USFWS Chain-of-Custody officer, samples are transferred to the Clemson Institute of Environmental Toxicology (CIET) for analysis. Upon receipt at the CIET, SOPs direct that samples be logged in, checked for sample integrity and again stored frozen at approximately-20^{o} C until prepared for instrumental analysis (CIET, 1996; 1999).

3.3 LABORATORY METHODS

All plasma samples were received at the CIET laboratory under chain-of-custody by January 18, 2007. All extractions and analyses were conducted according to procedures detailed in CIET SOPs. Plasma samples were extracted in six batches. Chicken plasma was used for laboratory control samples in all analytical batches. In addition to the eagle plasma samples, each analytical batch contained a reagent blank, a chicken plasma matrix blank, a chicken plasma matrix spike, and a chicken plasma matrix spike duplicate.

Organochlorine pesticide and PCB concentrations were quantified by capillary gas chromatography with an electron capture detector using the United States Environmental Protection Agency approved methods. All reported results were confirmed by dual column analysis. The QL for the organic compounds was 2 ng/g (parts per billion) with the exception of toxaphene which had a QL of 125 ng/g. Method validation studies were conducted on chicken plasma as a surrogate matrix to ensure that the data quality objectives of the Quality Assurance

Project Plan (CIET, 1996; 1999) were met. Average recoveries of 70-130% for matrix spikes were required under the Quality Assurance Project Plan (CIET, 1996; 1999). Correlation coefficients (r^2) for calibration curves consisting of five concentrations of standards were at least >0.99 for all target analytes in all batches. The average detector response for the instrumental calibration checks was within 20% of the initial calibration for each batch. The average Relative Percent Difference for the spiked analytes in the chicken plasma matrix spike and chicken plasma matrix spike duplicate were less than 30% for all batches.

3.4 STATISTICAL DESIGN

For the purposes of reporting and statistical analysis of the 2005 data, and in keeping with reporting conventions in the scientific literature, the data were broadly grouped by breeding area location. At the broadest level, Great Lakes and inland breeding areas were compared. The breeding areas located on anadromous rivers were examined separately from other Great Lakes breeding areas for organic contaminants to better assess the concentrations that may be affecting bald eagle productivity along the Great Lakes. The Great Lakes-associated nests were evaluated further by lake basin (Superior, Michigan, Huron, and Erie). Inland breeding areas were also evaluated further by peninsula (inland Lower and Upper Peninsulas). Lastly, breeding areas were also grouped by watershed (HUC).

Contaminants were analyzed independently or grouped as follows. Total DDTs were analyzed as the sum of all DDT and DDT metabolites found. 4,4'-DDE was analyzed independently because of its pervasiveness in samples and history of causing ecological effects. Total PCBs were examined as the sum of the 16 PCB congeners found. Heptachlor epoxide, *alpha*-Chlordane, and Dieldrin were all analyzed independently.

Statistical analyses were performed using nonparametric rank converted ANOVA tests. Nonparametric pair-wise comparisons, least significant difference, were used to determine where significant differences occurred within regions. Nonparametric statistics were employed as neither the assumptions of normality nor of linear regressions were met. All analyses were performed using SAS Institute, Inc. (1999) statistical package. A probability level = 95% ($\alpha = 0.05$) was used to determine statistical significance. Differences in order (i.e., highest concentration to lowest concentration) between rank converted ANOVA and geometric mean results were observed and are the result of a combination of factors. The two factors are; the assignment of the value of 0.0001 ng/g (see Section 4.2) to all nondetects and sample size, with the former having the greatest effect on the results. These two factors have also resulted in very large standard errors for some analysis, in these cases the later is suspected to have had the greatest effect

SECTION 4.0

RESULTS AND DISCUSSION

4.1 ORGANIC CONTAMINANTS IN NESTLING BALD EAGLE BLOOD SAMPLES

In 2005, 90 nestling bald eagle blood samples were analyzed for organochlorine contaminants. The target list of analytes included historical organochlorine pesticides such as chlordane, dieldrin, and DDT and its metabolic products, and 21 PCB congeners. The complete list of analytes and the parameter-specific Method Detection Levels and QLs are shown in Table 1. For statistical analysis, concentrations less than the QL were reported as one-half the QL (1.00 ng/g) and nondetects were set at 0.0001 ng/g.

Of the 90 samples analyzed, 42 were from breeding areas in the 2005 basin year watersheds. Regionally, the analyzed samples were from 10 inland Upper Peninsula, 28 inland Lower Peninsula, 11 Lake Superior, 23 Lake Michigan, 16 Lake Huron, and 2 Lake Erie breeding areas. The no-observable-adverse-effect levels (NOAELs) in blood of bald eagle nestlings for DDE and PCBs that are associated with a healthy bald eagle population (i.e., an average of one young per occupied nest) were determined using data from Bowerman et al., (2003). The NOAELs for DDE and PCBs in nestling blood are 11.4 and 36.4 ng/g, respectively.

4.11 DDT AND METABOLITES

Concentrations of 2,4'-DDE, 4,4'-DDE, 2,4'-DDD, 4,4'-DDD, and, 4,4'-DDT were measured in nestling bald eagle blood samples (Table 2). The most ubiquitous compound, 4,4'-DDE, was detected in 78 (87%) nestling eagle samples and on average made up 76% of the total DDT quantified. The statewide concentrations of 4,4'-DDE ranged from < 1.0-97.1 ng/g and total DDT concentrations ranged from < 1.0-101.6 ng/g.

Total DDT concentrations were calculated as the sum of 2,4'-DDE, 4,4'-DDE, 2,4'- DDD, 4,4'-DDD, and 4,4'-DDT. Of the metabolites, 4,4'-DDE contributed the most to the total DDT concentrations (Table 2). Total DDT concentrations in Great Lakes (n=51) breeding areas were greater than inland (n=38) breeding areas (Figure 3). Total DDT concentrations in Lake Michigan (n=23) breeding areas were greater than Lake Superior (n=11), inland Lower Peninsula (n=28), and inland Upper Peninsula (n=10) breeding areas. Lake Huron (n=16) and Lake Erie (n=2) breeding areas were also greater than inland Upper Peninsula and inland Lower Peninsula breeding areas.

Concentrations of 4,4'-DDE in Great Lakes (n=52) breeding areas were greater than inland (n=38) breeding areas (Figure 3). Concentrations of 4,4'-DDE in Lake Michigan (n=23) breeding areas were greater than Lake Superior (n=11), inland Lower Peninsula (n=28), and inland Upper Peninsula (n=10) breeding areas. Lake Huron (n=16) and Lake Erie (n=2) breeding areas were also greater than inland Upper Peninsula and inland Lower Peninsula breeding areas.

Geometric mean total DDT concentrations were ranked in the following order by location from highest to lowest: Lake Michigan > Lake Huron > Lake Erie > Lake Superior > inland Upper Peninsula > inland Lower Peninsula breeding areas. Geometric mean for total 4,4'-DDE concentrations were ranked in the following order by location from highest to lowest:
Lake Huron > Lake Michigan > Lake Erie > Lake Superior > inland Upper Peninsula > inland Lower Peninsula breeding areas.

The greatest total DDT concentration (101.6 ng/g) in an individual breeding area was measured in a nestling from Bonehead Club breeding area, which is located in the northeastern part of the Lower Peninsula in Montmorency County (MY-11) (Table 2). Ninety-six percent of the total DDT found in this eaglet was 4,4'-DDE.

No significant differences were found between Great Lakes watersheds for total DDT and 4,4'-DDE. Mean total DDT and 4,4'-DDE concentrations were ranked in the following order by Great Lakes watershed from highest to lowest: Lake Erie (n=2) > Lake Michigan (n=34) > Lake Huron (n=37) > Lake Superior (n=16) (Figure 4).

The NOAEL for 4,4'-DDE in the blood of nestling bald eagles was determined to be 11.4 ng/g based on data presented in Bowerman et al. (2003). Of the 90 nestling plasma samples analyzed in 2005, 31 (34%) exceeded the NOAEL. Of the eaglets exceeding the NOAEL, 28 (90%) inhabited Great Lakes breeding areas. It is therefore possible that once some of these nestlings reach breeding age, they may not be able to reproduce at a level considered to support a healthy population due to elevated concentrations of 4,4'-DDE. The finding that some nestlings have concentrations of 4,4'-DDE in their blood above the NOAEL further stresses the importance of the long-term monitoring program to track fluctuations in annual bald eagle productivity with in the state of Michigan.

4.12 PCBs

Twenty PCB congeners were quantified and summed to determine total PCBs in nestling bald eagle plasma samples (Table 3). Of these 20 congeners, all but two (PCB 008 and 018) were found in multiple eaglets. The statewide concentrations of total PCBs ranged from <1.00 ng/g-544 ng/g. At least one of the targeted PCB congeners was detected in 76 (84%) of the nestlings sampled. All 14 nestlings in which no PCB congeners were detected were from inland breeding areas. PCB congeners were detected in nestlings from inland, Great Lakes, and anadromous breeding areas (Table 4).

Total PCB concentrations in Great Lakes (n=52) breeding areas were greater than inland (n=38) breeding areas (Figure 5). Total PCB concentrations for Lake Erie (n=2), Lake Huron (n=16), and Lake Michigan (n=23) were greater than inland Upper Peninsula (n=10) and inland Lower Peninsula (n=28) breeding areas. Total PCB concentration for Lake Superior (n=11) breeding areas were also greater than inland Upper Peninsula breeding areas (Figure 5). The greatest total PCB concentration was measured in a nestling from the Bonehead Club breeding area, which is located in northeastern Lower Peninsula in Montmorency County (MY-11; Table 3).

Geometric mean PCB concentrations were ranked in the following order by location from highest to lowest: Lake Erie (n=2) > Lake Michigan (n=23) > Lake Huron (n=16) > Lake Superior (n=11) > inland Lower Peninsula (n=10) > inland Upper Peninsula (n=28) breeding areas.

The NOAEL for total PCBs in the blood of nestling bald eagles was determined to be 36.4 ng/g based on data presented in Bowerman et al., (2003). Of the 90 nestling plasma samples analyzed in 2005, 36 (40%) of the samples exceed the NOAEL. It is therefore possible that once some of these nestlings reach breeding age, they may not be able to reproduce at a level considered to support a health population due to elevated concentrations of PCBs. The finding that some nestlings have concentrations of PCBs in their blood above the NOAEL further stresses the importance of the long-term monitoring program that is needed to track fluctuations in annual bald eagle productivity within the state of Michigan.

No significant differences were found between Great Lakes watersheds for total PCB concentrations. Geometric mean total PCB concentrations were ranked in the following order by Great Lakes watershed from highest to lowest: Lake Erie (n=2) > Lake Michigan (n=34) > Lake Huron (n=37) > Lake Superior (n=17).

4.13 Other Organics

Blood samples from nestlings were also analyzed for hexachlorobenzene (HCB), *alpha*-chlordane, dieldrin, *gamma*-HCH, gamma-chlordane, and heptachlor epoxide. Concentrations of alpha-HCH and heptachlor were not detected in any of the year 2005 samples. The analytical results for HCB, *alpha*-chlordane, dieldrin, *gamma*-HCH, *gamma*-chlordane, and heptachlor epoxide are shown in Table 4.

Dieldrin was quantified in 45 samples ranging from 1.0-10.3 ng/g, with all but seven samples coming from Great Lakes breeding areas. Dieldrin concentrations were greater in Great Lakes (n=52) breeding areas than in inland (n=38) breeding areas (Figure 6). Dieldrin concentrations in Lake Erie (n=2) and Lake Michigan (n=23) were greater than inland Lower Peninsula (n=28), and inland Upper Peninsula (n=10). Dieldrin concentrations in Lake Superior (n=11) and Lake Huron (n=16) were also greater than inland Upper Peninsula (Figure 6). The greatest concentration of dieldrin (10.3 ng/g) measured in any region was found in a nestling from the Huron Islands NWR W breeding area (MQ-21) in Marquette County (Table 4).

alpha-Chlordane was quantified in 37 samples ranging from 1.0-18.0 ng/g, with all but six samples coming from Great Lakes breeding areas. *alpha*-Chlordane concentrations were greater in Great Lakes (n=52) breeding areas than in inland (n=38) breeding areas (Figure 7). *alpha*-Chlordane concentrations in Lake Huron (n=16) and Lake Erie (n=2) were greater than Lake Superior (n=11), inland Lower Peninsula (n=28), and inland Upper Peninsula (n=10; Figure 7). The greatest concentration of *alpha*-chlordane (18.0 ng/g) measured in any region was found in a nestling from the Bonehead Club breeding area (MY-11) in Montmorency County (Table 4).

Heptachlor epoxide was quantified in 25 samples ranging from 1.0-4.4 ng/g, with all but four samples coming from Great Lakes breeding areas. Heptachlor epoxide concentrations in Lake Erie (n=2) were greater than Lake Huron (n=16), Lake Superior (n=11), Lake Michigan (n=23) inland Lower Peninsula (n=28), and inland Upper Peninsula (n=10; Figure 8). The greatest concentration of heptachlor epoxide (4.4 ng/g) measured in any region was found in a nestling from the Bonehead Club breeding area (MY-11) in Montmorency County (Table 4).

gamma-HCH was quantified in five samples ranging from 4.0-4.8 ng/g, with all but one sample coming from Great Lakes breeding areas. Due to small sample sizes statistical analysis of *gamma*-HCH was not conducted. The geometric mean of *gamma*-HCH concentrations from highest to lowest were Lake Superior (n=1), inland Upper Peninsula (n=1), Lake Erie (n=1), and Lake Huron (n=2). The greatest concentration of *gamma*-HCH (4.8 ng/g) measured in any region was found in a nestling from the Huron Islands NWR W breeding area (MQ-21) in Marquette County (Table 4).

Hexachlorobenzene and *gamma*-chlordane were each quantified in nine nestling eagle samples. No significant differences were found at the Category spatial scale. The geometric mean for these substances are reported in Table 4.

SECTION 5.0

FUTURE STUDIES

Several potential areas of future study were identified following the first four years of this monitoring study:

- Determine if it is possible to locate key sources of mercury contamination in bald eagles by modeling air releases.

- Conduct further investigations to determine the source of PCBs found in hotspots such as Lake Superior in northwest Marquette County.

- Examine contaminant data to assess the partitioning of contaminants between various media and biota.

- Analyze archived eagle samples to enhance our ability to assess trends.

SECTION 6.0

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SECTION 7.0

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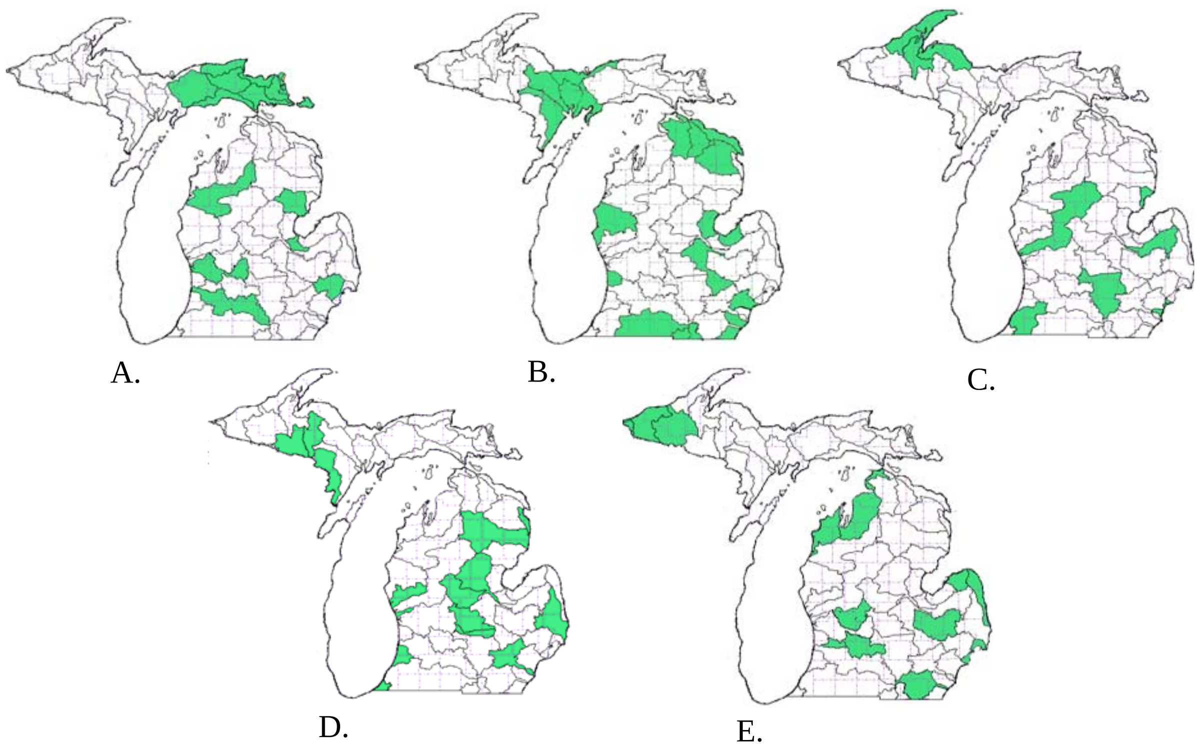
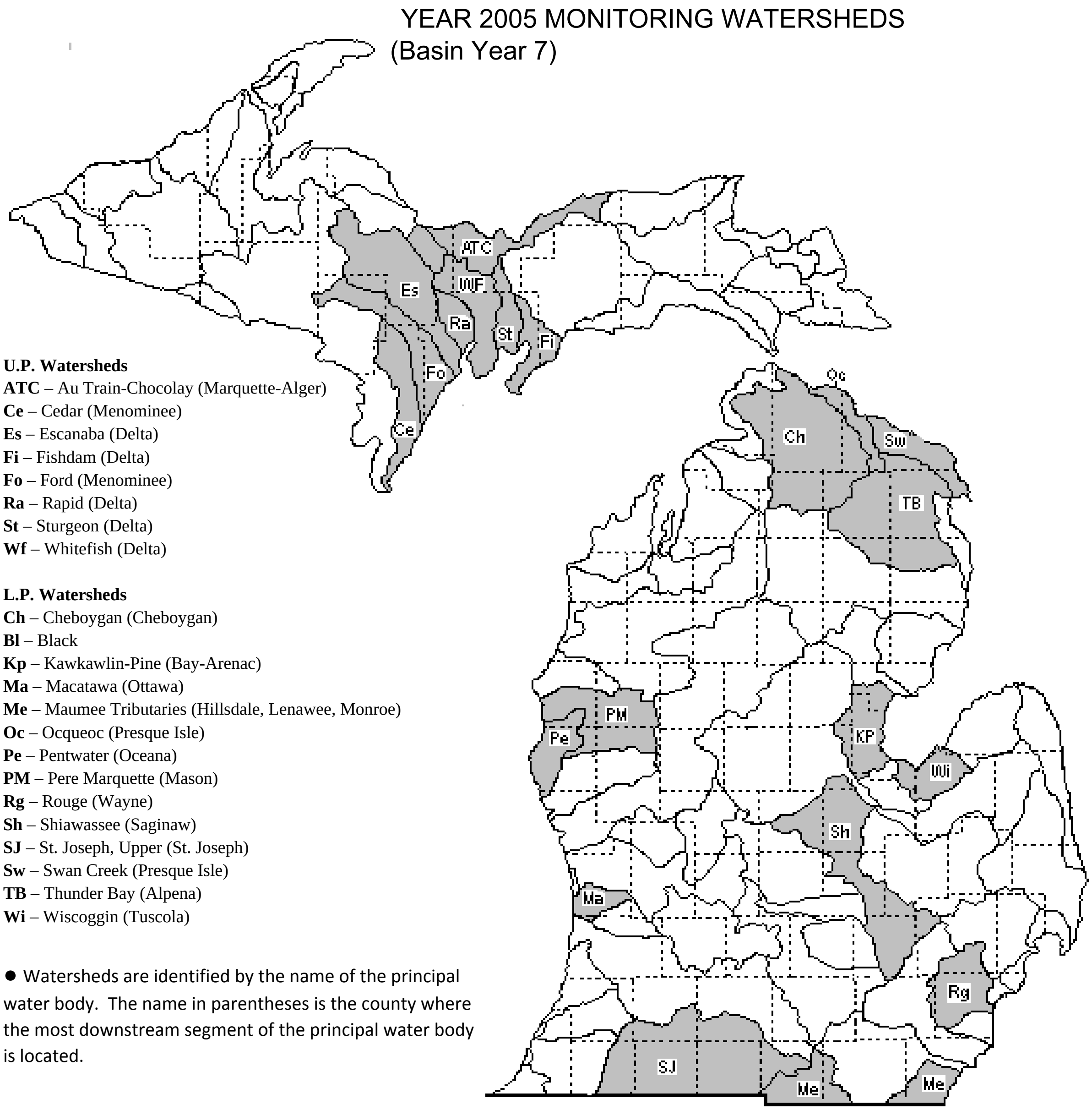


Figure 1. Michigan's watershed delineations and monitoring 'basin years'. A.) 1999, 2004 basin year watersheds (shaded); B.) 2000, 2005 basin year watersheds (shaded); C.) 2001, 2006 basin year watersheds (shaded); D.) 2002, 2007 basin year watersheds (shaded); and E.) 2003, 2008 basin year watersheds (shaded).

Figure 2. The 2005 basin year watersheds.



U.P. Watersheds
ATC – Au Train-Chocolay (Marquette-Alger)
Ce – Cedar (Menominee)
Es – Escanaba (Delta)
Fi – Fishdam (Delta)
Fo – Ford (Menominee)
Ra – Rapid (Delta)
St – Sturgeon (Delta)
Wf – Whitefish (Delta)

L.P. Watersheds
Ch – Cheboygan (Cheboygan)
Bl – Black
Kp – Kawkawlin-Pine (Bay-Arenac)
Ma – Macatawa (Ottawa)
Me – Maumee Tributaries (Hillsdale, Lenawee, Monroe)
Oc – Ocqueoc (Presque Isle)
Pe – Pentwater (Oceana)
PM – Pere Marquette (Mason)
Rg – Rouge (Wayne)
Sh – Shiawassee (Saginaw)
SJ – St. Joseph, Upper (St. Joseph)
Sw – Swan Creek (Presque Isle)
TB – Thunder Bay (Alpena)
Wi – Wiscoggin (Tuscola)

● Watersheds are identified by the name of the principal water body. The name in parentheses is the county where the most downstream segment of the principal water body is located.

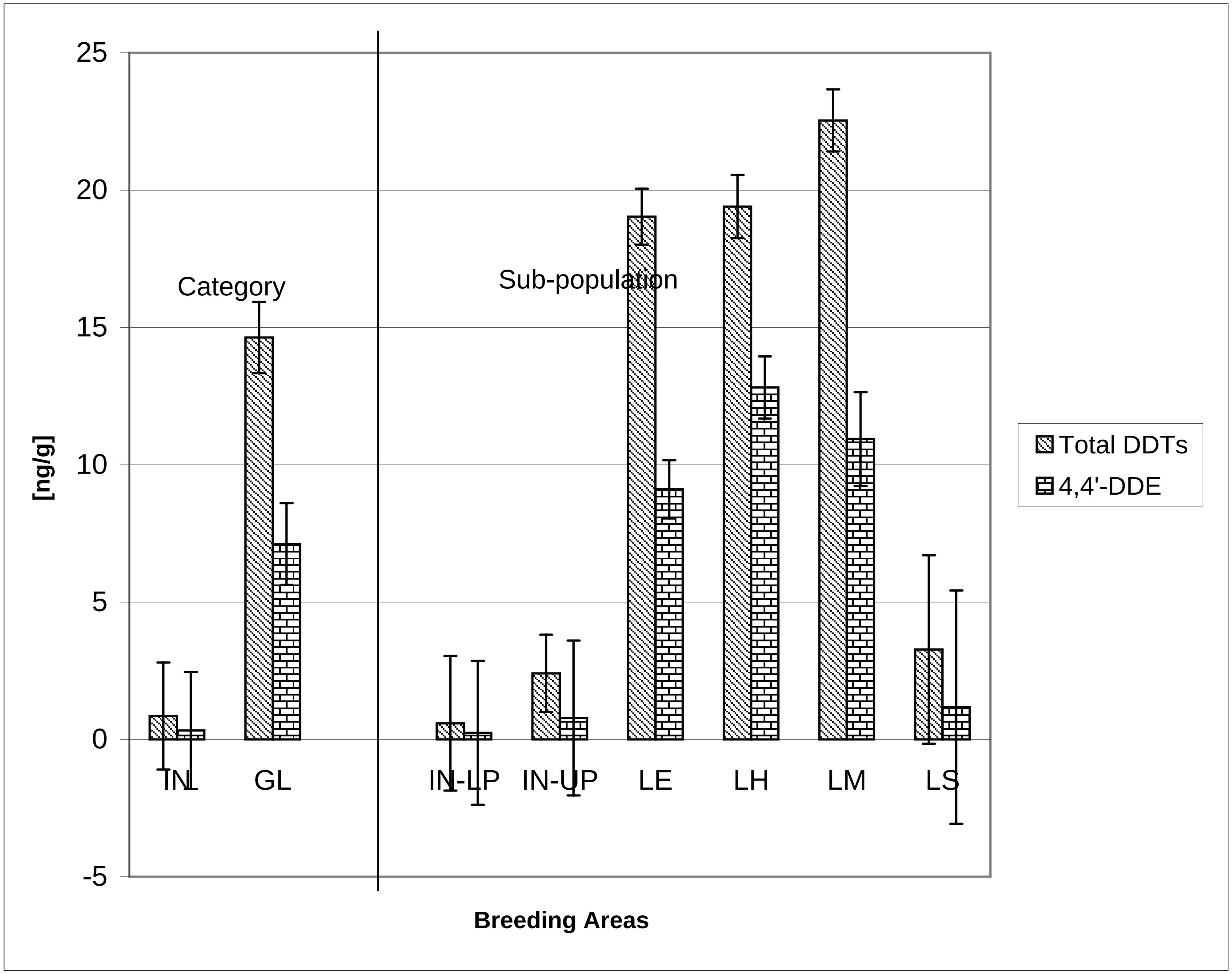


Figure 3. Geometric mean Total DDT and 4,4'-DDE concentrations (ng/g) in nestling bald eagles in 2005 by categories and subpopulations.

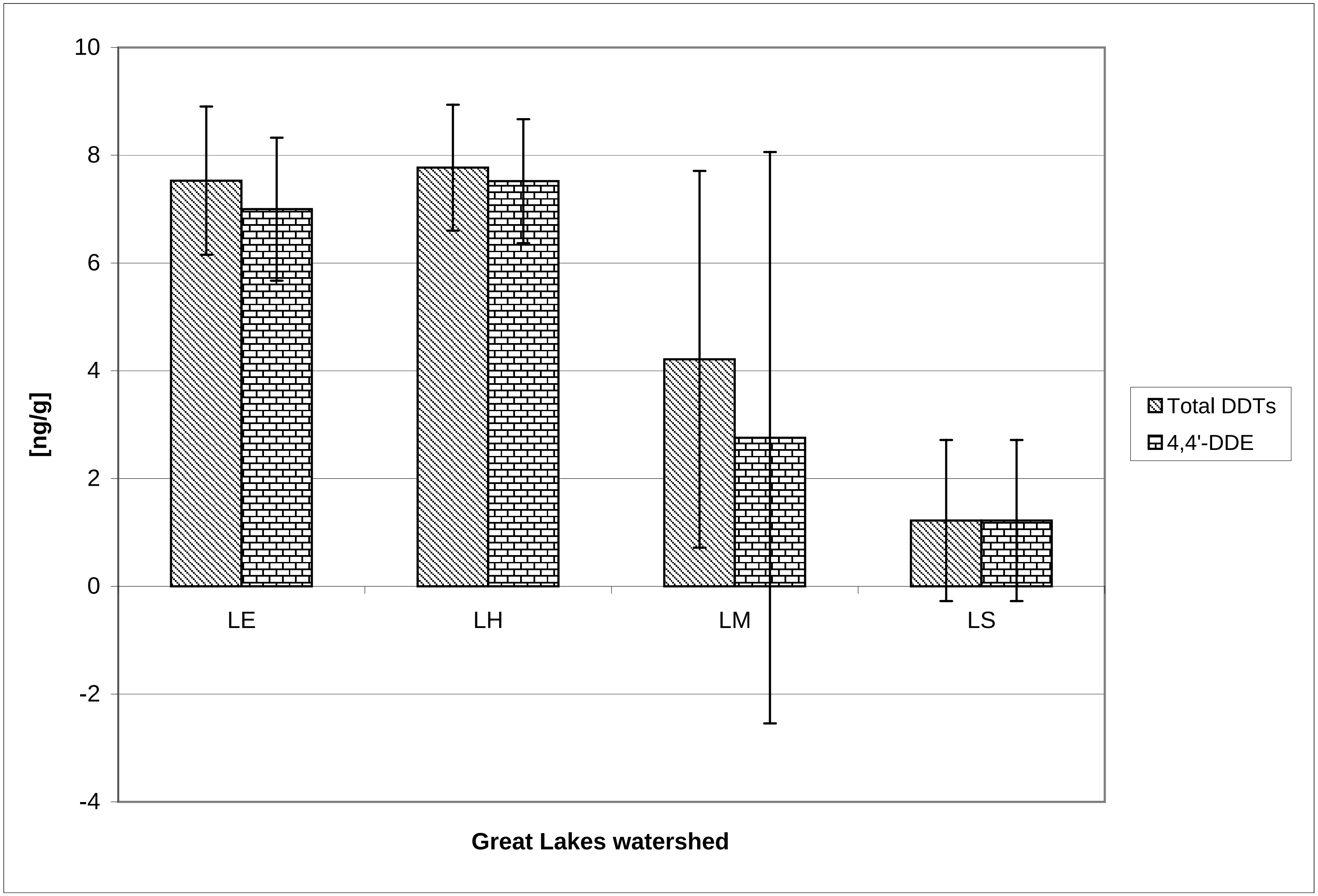


Figure 4. Geometric mean Total DDT and 4,4'-DDE concentrations (ng/g) in nestling bald eagles in 2005 by Great Lakes watersheds.

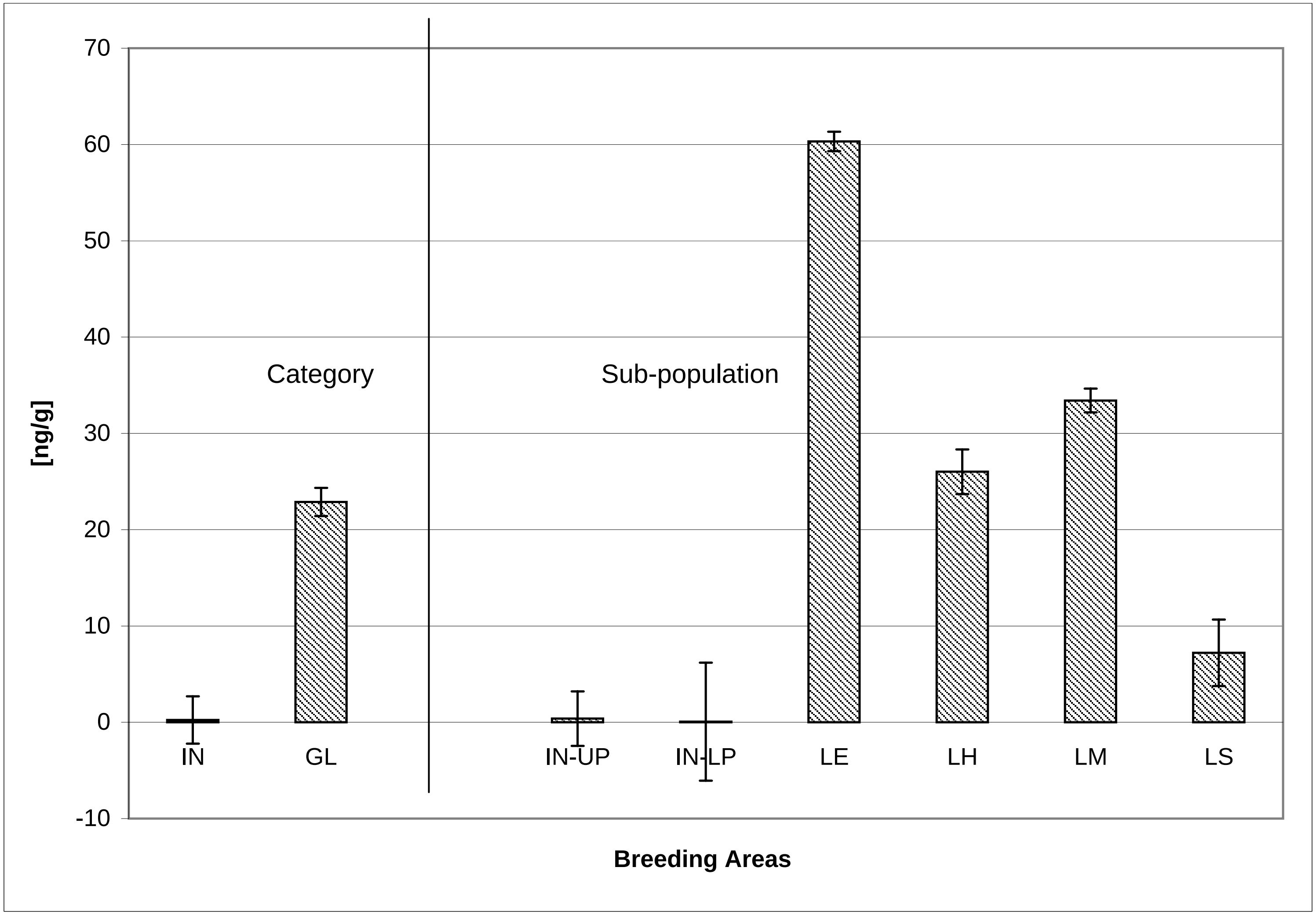


Figure 5. Geometric mean Total PCB concentrations (ng/g) in nestling bald eagles in 2005 by categories and subpopulations.

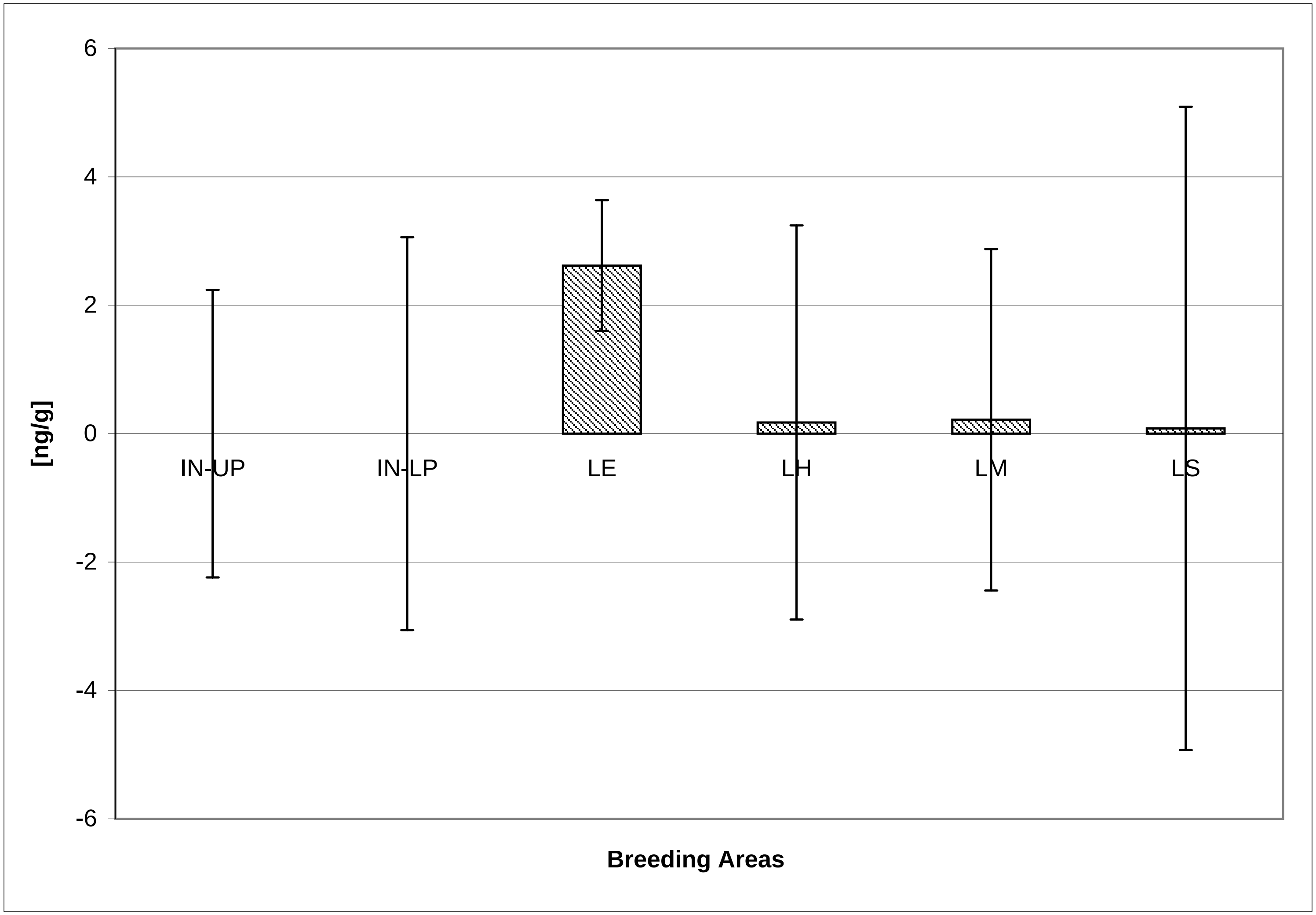


Figure 6. Geometric mean Dieldrin concentrations (ng/g) in nestling bald eagles in 2005 by subpopulations.

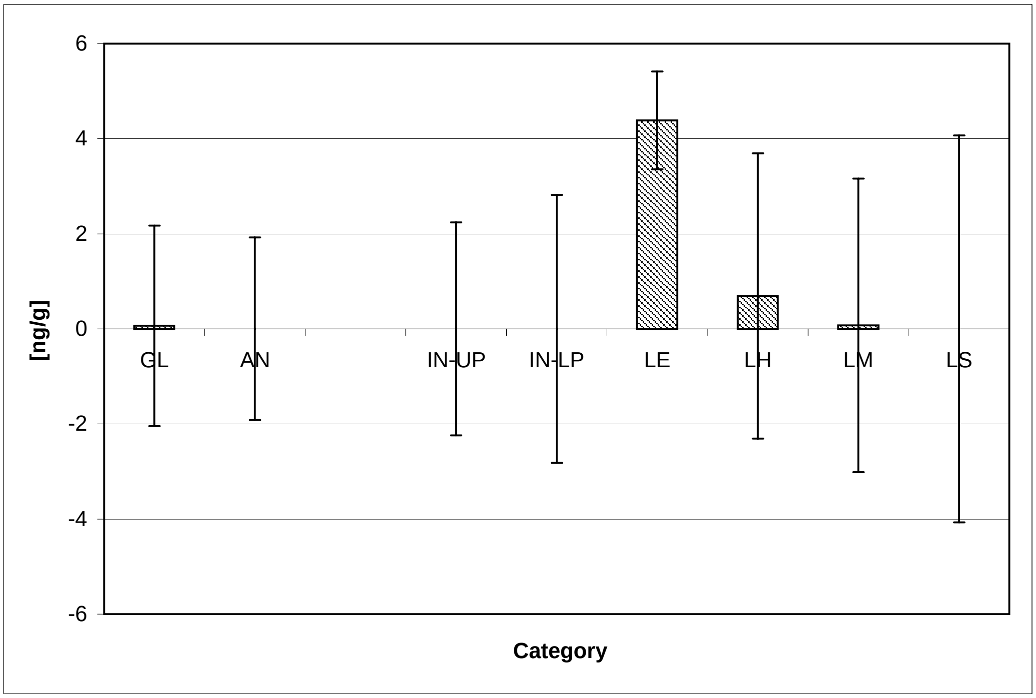


Figure 7. Geometric mean *alpha*-chlordane concentrations (ng/g) in nestling bald eagles in 2005 by Category and Subpopulation breeding areas.

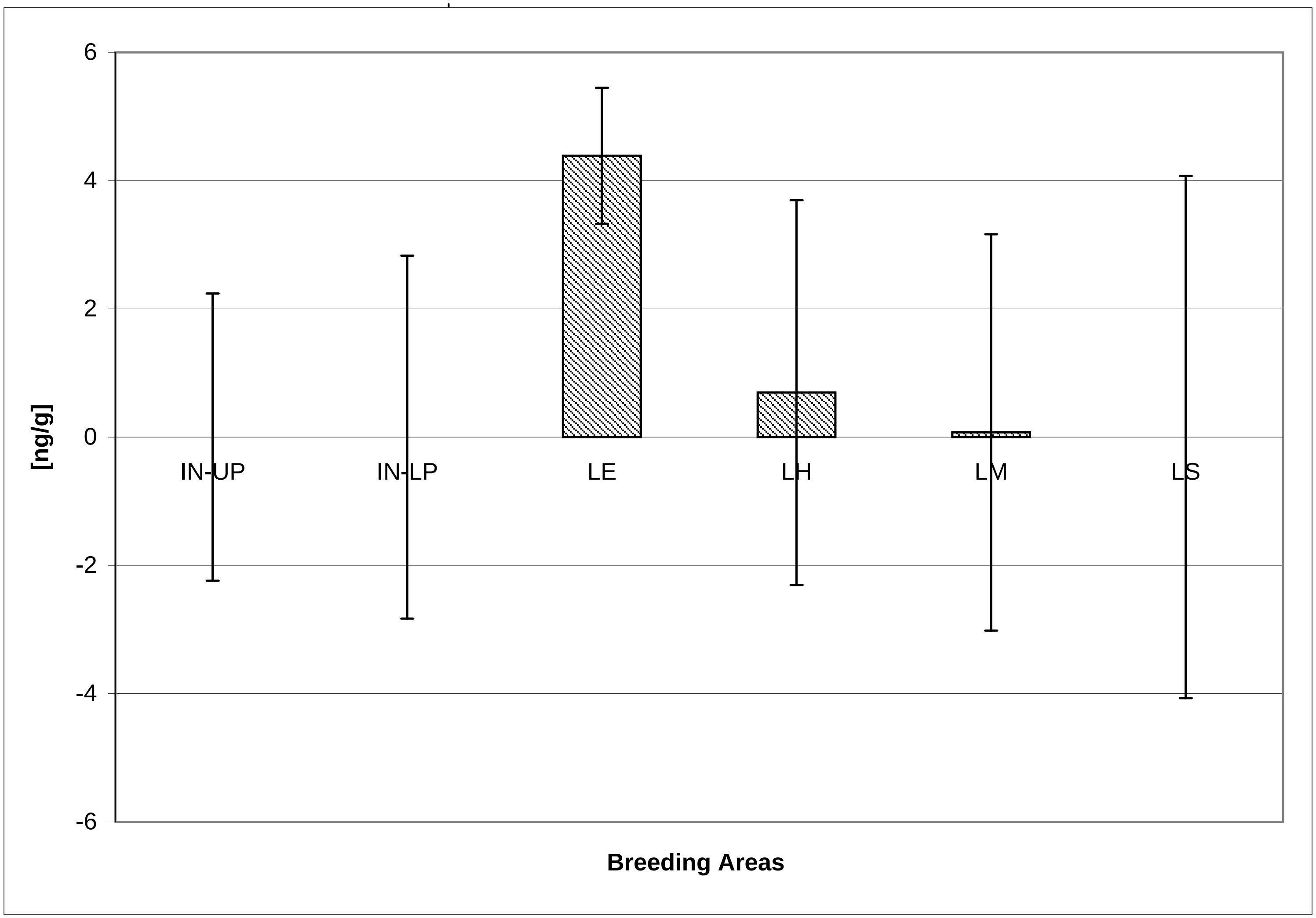


Figure 8. Geometric mean hepatochlor epoxide concentrations (ng/g) in nestling bald eagles in 2005 by subpopulations.

Table 1. Organochlorine contaminant analytes measured in nestling bald eagle blood samples in 2005, with parameter-specific Method Detection Levels (MDLs) and Quantification Levels (QLs).

Organochlorine Contaminant Analyte List	Method Detection Level (MDL)	Quantification Level (QL)
Hexachlorobenzene	0.54	2.01
alpha -Hexachlorocyclohexane	1.94	2.01
gamma -Hexachlorocyclohexane (Lindane)	1.84	2.01
Heptachlor	1.74	2.00
Heptachlor Epoxide	0.77	2.00
alpha -Chlordane	0.75	2.01
gamma -Chlordane	0.55	2.01
Dieldrin	0.97	2.01
Toxaphene	---	125.0
2,4'-Dichlorodiphenyldichloroethylene (2,4'-DDE)	0.86	2.01
4,4'-DDE	0.61	2.01
2,4'-Dichlorodiphenyldichloroethane (2,4'-DDD)	1.55	2.01
4,4'-DDD	1.18	2.00
2,4'-Dichlorodiphenyltrichloroethane (2,4'-DDT)	1.57	2.01
4,4'-DDT	1.95	2.01
PCB Congener 8	1.94	1.98
PCB Congener 18	1.21	1.98
PCB Congener 28	1.23	1.99
PCB Congener 44	1.52	1.98
PCB Congener 52	0.64	1.98
PCB Congener 66	0.87	2.00
PCB Congener 101	0.38	2.00
PCB Congener 105	1.44	1.98
PCB Congener 110	1.91	2.01
PCB Congener 118	0.58	1.99
PCB Congener 128	0.75	1.99
PCB Congener 138	0.65	2.00
PCB Congener 153	0.57	1.99
PCB Congener 156	1.84	2.01
PCB Congener 170	1.28	1.98
PCB Congener 180	1.62	2.00
PCB Congener 187	1.12	1.98
PCB Congener 195	1.03	2.00
PCB Congener 206	1.19	1.98
PCB Congener 209	1.03	1.99

Table 2. Concentrations of DDE, DDD, and Total DDT compounds (ng/g wet weight (ppb)) in nestling bald eagle plasma samples analyzed in 2005. Breeding areas were located in either inland lower peninsula (LP), inland upper peninsula (UP), Lake Huron (LH), Lake Michigan (LM), or Lake Superior (LS) watersheds. Territories were associated with either inland (IN) or Great Lakes (GL) waterbodies.

Territory	Breeding Area Location	Territory Location	Blood Sample Number	Breeding Area Name	2,4'-DDD	2,4'-DDE	2,4' DDT	4,4'-DDD	4,4'-DDE	4,4'-DDT	DDE+DDT +DDD
AR-05a	LH	GL	BAEA-MI-2005-A-01	Pt. AuGres	ND	4.8	ND	2.8	19.8	2.5	29.8
AR-05a	LH	GL	BAEA-MI-2005-A-02	Pt. AuGres	ND	4.5	ND	3.0	19.4	2.4	29.3
AR-03a	LH	GL	BAEA-MI-2005-A-03	Santiago	ND	3.8	ND	3.1	11.4	2.4	20.6
NE-01j	LM	GL	BAEA-MI-2005-A-04	Anderson Bayou	ND	3.8	ND	3.4	32.8	2.5	42.6
NE-01j	LM	GL	BAEA-MI-2005-A-05	Anderson Bayou	ND	5.2	ND	3.9	44.0	2.6	55.7
LA-05a	LP	IN	BAEA-MI-2005-A-06	Bray	ND	4.1	ND	2.4	14.0	ND	20.5
LA-05a	LP	IN	BAEA-MI-2005-A-07	Bray	ND	ND	ND	2.1	8.2	ND	10.3
MD-01b	LH	GL	BAEA-MI-2005-A-08	Sanford L	ND	ND	ND	5.4	10.3	ND	15.6
OS-10a	LP	IN	BAEA-MI-2005-A-09	Rhoads L	ND	ND	ND	ND	ND	ND	ND
OS-10a	LP	IN	BAEA-MI-2005-A-10	Rhoads L	ND	ND	ND	ND	ND	ND	ND
AL-04 c	LP	IN	BAEA-MI-2005-A-11	McCollum L	ND	ND	ND	ND	7.7	ND	7.7
OS-06b	LP	IN	BAEA-MI-2005-A-12	Shamrock L	ND	ND	ND	ND	3.3	ND	3.3
IO-04c	LH	GL	BAEA-MI-2005-A-13	Allen L	ND	3.0	ND	2.5	10.3	ND	15.8
IO-04c	LH	GL	BAEA-MI-2005-A-14	Allen L	ND	4.5	ND	3.0	20.3	ND	27.8
AL-08c	LM	GL	BAEA-MI-2005-A-15	Black R-Negwegon S	ND	3.7	ND	2.6	10.4	ND	16.8
AL-08c	LM	GL	BAEA-MI-2005-A-16	Black R-Negwegon S	ND	4.3	ND	3.3	21.2	ND	28.8
OT-09a	LP	IN	BAEA-MI-2005-A-17	Olund L	ND	3.2	ND	ND	29.7	ND	32.9
MN-10a	LM	GL	BAEA-MI-2005-A-18	Little Manistee R	ND	ND	5.0	3.7	ND	ND	8.6
OL-01b	LP	IN	BAEA-MI-2005-A-19	Evart	ND	ND	ND	ND	ND	ND	ND
OL-01b	LP	IN	BAEA-MI-2005-A-20	Evart	ND	ND	ND	ND	ND	ND	ND
OS-03e	LP	IN	BAEA-MI-2005-A-21	McKinley	ND	ND	ND	ND	ND	ND	ND
IO-08b	LP	IN	BAEA-MI-2005-A-22	Loud dam pt W	ND	ND	ND	ND	4.1	ND	4.1
MY-01i	LP	IN	BAEA-MI-2005-A-23	Valentine L	ND	ND	ND	ND	3.2	ND	3.2
AP-02m	LP	IN	BAEA-MI-2005-A-24	Flecher Pd NE	3.5	ND	ND	ND	ND	2.3	5.8
GT-08a	LM	GL	BAEA-MI-2005-A-25	Cherry city airport	ND	ND	ND	ND	13.3	ND	13.3
CX-02	LM	GL	BAEA-MI-2005-A-36	Beaver Island-Fox lake	ND	ND	ND	ND	20.2	ND	20.2
CX-03	LM	GL	BAEA-MI-2005-A-37	Beaver Island-Fox lake	ND	ND	ND	ND	9.9	ND	9.9
CX-04	LM	GL	BAEA-MI-2005-A-38	High Island	ND	ND	ND	ND	13.6	ND	13.6
CX-04	LM	GL	BAEA-MI-2005-A-39	High Island	ND	ND	ND	ND	10.3	ND	10.3
CX-01	LP	IN	BAEA-MI-2005-A-40	East Jordan	1.0	ND	2.2	ND	24.8	2.2	30.3
MS-06a	LM	GL	BAEA-MI-2005-B-01	Walhalla West	ND	ND	ND	3.8	6.5	ND	10.4
MS-05a	LM	GL	BAEA-MI-2005-B-02	Walhalla East	ND	ND	ND	3.1	18.8	2.1	24.1
AL-01b	LP	IN	BAEA-MI-2005-B-03	Comstock Ck	ND	ND	ND	ND	1.0	ND	1.0
AL-01b	LP	IN	BAEA-MI-2005-B-04	Comstock Ck	ND	ND	ND	ND	2.8	ND	2.8
MN-12a	LP	IN	BAEA-MI-2005-B-05	Lower Red Bridge N	ND	ND	ND	ND	4.0	ND	4.0
MN-05e	LM	GL	BAEA-MI-2005-B-06	Manistee R SGA	ND	ND	1.0	ND	27.0	2.3	30.2
MN-05e	LM	GL	BAEA-MI-2005-B-07	Manistee R SGA	ND	ND	ND	ND	19.3	2.1	21.4
MN-05e	LM	GL	BAEA-MI-2005-B-08	Manistee R SGA	ND	5.4	1.0	ND	26.0	2.2	34.7
MN-02b	LM	GL	BAEA-MI-2005-B-09	Carlson's/Horseshoe Bend	5.4	5.0	2.2	ND	45.4	2.8	60.7
MN-02b	LM	GL	BAEA-MI-2005-B-10	Carlson's/Horseshoe Bend	ND	ND	1.0	ND	17.3	ND	18.3
MN-04c	LM	GL	BAEA-MI-2005-B-11	Tippy Dam	ND	ND	ND	3.1	26.3	2.4	31.8
MT-06a	LP	IN	BAEA-MI-2005-B-12	Jenson Lk. 5/25/05	ND	ND	ND	ND	2.0	ND	2.0
MT-06a	LP	IN	BAEA-MI-2005-B-13	Jenson Lk.	ND	ND	ND	ND	5.1	ND	5.1
MU-03a	LM	GL	BAEA-MI-2005-B-14	Mona Lk	ND	ND	ND	7.4	10.8	ND	18.2
MY-05e	LP	IN	BAEA-MI-2005-B-15	Black R Ranch	ND	ND	ND	2.5	3.3	ND	5.8
MY-10b	LP	IN	BAEA-MI-2005-B-16	Tomahawk creek flooding	ND	ND	ND	ND	5.4	ND	5.4

Table 2. Continued.

Territory	Breeding Area Location	Territory Location	Blood Sample Number	Breeding Area Name	2,4'-DDD	2,4'-DDE	2,4' DDT	4,4'-DDD	4,4'-DDE	4,4'-DDT	DDE+DDT +DDD
MY-11b	LP	IN	BAEA-MI-2005-B-17	Bonehead Club	10.4	5.3	ND	4.1	ND	5.0	24.7
MY-11b	LP	IN	BAEA-MI-2005-B-18	Bonehead Club	ND	ND	ND	3.8	97.8	ND	101.6
MY-02k	LP	IN	BAEA-MI-2005-B-19	Turtle Lake (Flecher SW)	ND	ND	ND	ND	ND	ND	ND
MY-02k	LP	IN	BAEA-MI-2005-B-20	Turtle Lake (Flecher SW)	ND	ND	ND	ND	1.0	ND	1.0
PI-03c	LH	GL	BAEA-MI-2005-B-21	False Presque Isle	ND	ND	ND	ND	11.4	ND	11.4
MY-04f	LP	IN	BAEA-MI-2005-B-22	Grass Lake	ND	ND	ND	ND	5.4	ND	5.4
MY-04f	LP	IN	BAEA-MI-2005-B-23	Grass Lake	ND	ND	ND	ND	1.0	ND	1.0
AP-13a	LH	GL	BAEA-MI-2005-B-24	N Pt Grasslake	ND	ND	ND	2.6	12.7	ND	15.2
AP-13a	LH	GL	BAEA-MI-2005-B-25	N Pt Grasslake	3.9	ND	ND	4.3	41.7	2.99	52.9
MQ-08b	LS	GL	BAEA-MI-2005-B-26	L Kawbawgam	ND	ND	ND	ND	ND	ND	ND
MQ-15g	LS	GL	BAEA-MI-2005-B-27	Saux Head LK	ND	ND	ND	2.0	8.0	ND	10.0
DI-09c	UP	IN	BAEA-MI-2005-B-28	Genes Pond	ND	ND	ND	ND	3.6	ND	3.6
DI-09c	UP	IN	BAEA-MI-2005-B-29	Genes Pond	ND	ND	ND	ND	1.0	ND	1.0
MQ-02g	LS	GL	BAEA-MI-2005-B-30	Conway L-Salmon Troute	ND	ND	ND	ND	3.6	ND	3.6
MQ-02g	LS	GL	BAEA-MI-2005-B-31	Conway L-Salmon Troute	ND	ND	ND	ND	5.5	ND	5.5
MQ-01h	LS	GL	BAEA-MI-2005-B-32	Huron River Pt	ND	ND	ND	ND	1.0	ND	1.0
MQ-04d	LS	GL	BAEA-MI-2005-B-33	Partridge Isd	ND	ND	ND	2.3	32.3	ND	34.5
MQ-21b	LS	GL	BAEA-MI-2005-B-34	Huron Isd NWR W.	6.7	ND	ND	3.8	62.6	ND	73.1
MQ-21b	LS	GL	BAEA-MI-2005-B-35	Huron Isd NWR W.	4.4	ND	ND	2.7	66.9	ND	74.0
BG-12d	LS	GL	BAEA-MI-2005-B-36	Pequaming PT	ND	ND	ND	ND	4.3	ND	4.3
MQ-25b	UP	IN	BAEA-MI-2005-B-37	Ford River/Margarette Rapids	ND	ND	ND	2.4	11.1	ND	13.5
AG-20	UP	IN	BAEA-MI-2005-B-38	Hovey Lake	ND	ND	ND	ND	1.0	ND	1.0
AG-18	UP	IN	BAEA-MI-2005-B-40	Forest Lake	ND	ND	ND	ND	5.4	ND	5.4
AG-18	UP	IN	BAEA-MI-2005-B-41	Forest Lake	ND	ND	ND	ND	3.0	ND	3.0
AG-18	UP	IN	BAEA-MI-2005-B-42	Forest Lake	ND	ND	ND	ND	1.0	ND	1.0
AG-13b	LS	GL	BAEA-MI-2005-B-43	AuSable Pt	ND	ND	ND	ND	1.0	ND	1.0
AG-17b	LS	GL	BAEA-MI-2005-B-45	Grand Sable Lake	ND	ND	ND	2.6	6.4	ND	9.0
LU-12a	UP	IN	BAEA-MI-2005-B-46	Long Lake	ND	ND	ND	ND	ND	ND	ND
LU-12a	UP	IN	BAEA-MI-2005-B-47	Long Lake	ND	ND	ND	ND	1.0	ND	1.0
LU-13	UP	IN	BAEA-MI-2005-B-49	Dollarville	ND	ND	ND	2.8	ND	ND	2.8
MO-04e	LE	GL	BAEA-MI-2005-C-01	Erie Shooting Club	ND	3.9	ND	2.9	6.9	2.2	15.8
WA-03b	LE	GL	BAEA-MI-2005-C-02	Campau Rd	ND	3.8	ND	3.9	9.6	2.1	19.4
SG-02c	LH	AN	BAEA-MI-2005-C-03	Shiawassee NWR #1	ND	3.3	1.0	3.6	8.6	2.1	18.7
SG-06a	LH	AN	BAEA-MI-2005-C-04	Shiawassee SGA-Rookery	ND	4.2	2.1	2.9	11.6	2.1	22.9
IA-02b	LM	AN	BAEA-MI-2005-C-05	Webber Dam	ND	3.8	1.0	3.7	14.7	ND	23.2
BY-03d	LH	GL	BAEA-MI-2005-C-06	Nayanquing Pt	3.4	3.3	2.1	2.8	12.8	2.5	27.0
SG-01f	LH	AN	BAEA-MI-2005-C-07	Shiawassee NWR #1	ND	ND	ND	2.9	7.8	2.1	12.9
NE-03j	LP	IN	BAEA-MI-2005-C-08	Croton Prairie	ND	ND	ND	ND	4.2	ND	4.2
HU-05a	LH	GL	BAEA-MI-2005-C-09	Wildfowl Bay	ND	ND	2.1	2.6	9.1	2.1	15.9
BY-01d	LH	AN	BAEA-MI-2005-C-10	Skull/Stoney Isd	1.0	3.9	2.0	3.8	10.2	2.3	23.1
HU-04c	LH	GL	BAEA-MI-2005-C-11	Sand Pt	1.0	ND	2.2	4.1	11.3	2.2	20.9
CX-07a	LM	GL	BAEA-MI-2005-C-13	Beaver Isd-St James	ND	4.1	2.5	2.2	14.5	2.2	25.5
CX-07a	LM	GL	BAEA-MI-2005-C-14	Beaver Isd-St James	ND	ND	2.4	2.1	12.3	1.0	17.8
CX-08a	LM	GL	BAEA-MI-2005-C-15	Whiskey Isd	1.0	3.6	2.7	2.1	33.8	2.3	45.5

Table 3. Concentrations of individual PCB congeners and Total PCBs (ng/g wet weight (ppb)) in nestling bald eagle plasma samples analyzed in 2005. Breeding areas were located in either inland lower peninsula (LP), inland upper peninsula (UP), Lake Huron (LH), Lake Michigan (LM), or Lake Superior (LS) watersheds. Territories were associated with either inland (IN) or Great Lakes (GL) waterbodies.

Territory	Breeding Area Location	Territory Location	Blood Sample Number	Breeding Area Name	# 008	# 018	# 028	# 044	# 052	# 066	# 101	# 105	# 110	# 118	# 128	# 138	# 153	# 156	# 170	# 180	# 187	# 195	# 206	# 209	SUM PCBs
AR-05a	LH	GL	BAEA-MI-2005-A-01	Pt. AuGres	ND	ND	ND	ND	ND	7.8	8.6	5.8	5.6	10.9	3.8	23.4	28.3	3.4	8.1	26.2	10.2	2.2	1.0	3.6	149.0
AR-05a	LH	GL	BAEA-MI-2005-A-02	Pt. AuGres	ND	ND	ND	3.3	ND	9.2	9.9	5.9	7.3	11.8	3.6	20.6	21.6	3.1	5.3	15.9	7.4	1.0	ND	3.2	129.1
AR-03a	LH	GL	BAEA-MI-2005-A-03	Santiago	ND	ND	ND	2.5	ND	6.5	5.9	4.7	7.7	8.6	2.4	13.6	11.1	ND	2.5	6.2	3.7	ND	ND	1.0	76.3
NE-01j	LM	GL	BAEA-MI-2005-A-04	Anderson Bayou	ND	ND	ND	ND	ND	4.3	4.7	4.1	3.2	7.3	3.1	15.9	16.8	ND	2.7	7.3	4.8	ND	ND	ND	74.2
NE-01j	LM	GL	BAEA-MI-2005-A-05	Anderson Bayou	ND	ND	ND	ND	ND	6.0	9.1	5.3	4.1	10.3	4.2	23.5	25.5	ND	4.0	11.7	7.8	ND	ND	ND	111.5
LA-05a	LP	IN	BAEA-MI-2005-A-06	Bray	ND	ND	ND	ND	ND	4.4	ND	2.9	ND	3.8	ND	7.4	8.0	ND	ND	3.7	1.0	ND	ND	ND	31.2
LA-05a	LP	IN	BAEA-MI-2005-A-07	Bray	ND	ND	ND	ND	ND	ND	ND	2.4	ND	2.7	ND	4.0	4.5	ND	ND	2.1	ND	ND	ND	ND	15.6
MD-01b	LH	GL	BAEA-MI-2005-A-08	Sanford L	ND	ND	ND	ND	ND	4.5	ND	ND	1.0	5.8	ND	8.0	7.3	ND	ND	4.4	ND	ND	ND	ND	31.0
OS-10a	LP	IN	BAEA-MI-2005-A-09	Rhoads L	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	2.3	ND	ND	ND	ND	ND	ND	1.0	ND	4.3
OS-10a	LP	IN	BAEA-MI-2005-A-10	Rhoads L	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND	2.0
AL-04 c	LP	IN	BAEA-MI-2005-A-11	McCollum L	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND	2.8	3.2	ND	ND	2.3	ND	ND	ND	ND	11.0
OS-06b	LP	IN	BAEA-MI-2005-A-12	Shamrock L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	2.1	ND	3.1
IO-04c	LH	GL	BAEA-MI-2005-A-13	Allen L	ND	ND	ND	ND	ND	3.9	ND	3.0	ND	4.3	ND	6.1	6.5	ND	ND	2.8	ND	ND	ND	ND	26.7
IO-04c	LH	GL	BAEA-MI-2005-A-14	Allen L	ND	ND	ND	ND	ND	4.8	6.7	4.0	2.7	7.2	1.0	12.1	13.0	ND	2.3	6.1	3.1	ND	ND	ND	62.9
AL-08c	LM	GL	BAEA-MI-2005-A-15	Black R-Negwegon S	ND	ND	ND	ND	ND	4.8	ND	3.2	ND	4.9	ND	6.5	6.9	ND	ND	3.2	ND	ND	ND	ND	29.4
AL-08c	LM	GL	BAEA-MI-2005-A-16	Black R-Negwegon S	ND	ND	ND	ND	ND	5.8	ND	4.7	3.9	8.7	2.6	12.9	13.2	ND	2.9	7.2	3.9	ND	ND	ND	65.8
OT-09a	LP	IN	BAEA-MI-2005-A-17	Olund L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MN-10a	LM	GL	BAEA-MI-2005-A-18	Little Manistee R	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.8	ND	16.7	ND	ND	ND	ND	ND	ND	ND	ND	24.5
OL-01b	LP	IN	BAEA-MI-2005-A-19	Evart	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OL-01b	LP	IN	BAEA-MI-2005-A-20	Evart	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	1.0
OS-03e	LP	IN	BAEA-MI-2005-A-21	McKinley	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
IO-08b	LP	IN	BAEA-MI-2005-A-22	Loud dam pt W	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	1.0	2.3	ND	ND	ND	ND	ND	ND	ND	5.8
MY-01i	LP	IN	BAEA-MI-2005-A-23	Valentine L	ND	ND	ND	ND	ND	3.2	ND	ND	ND	ND	ND	1.0	1.0	ND	ND	ND	ND	ND	ND	ND	5.2
AP-02m	LP	IN	BAEA-MI-2005-A-24	Flecher Pd NE	ND	ND	ND	ND	ND	4.3	ND	4.5	ND	9.1	3.5	20.9	31.4	3.3	8.7	27.3	13.1	ND	3.9	2.6	132.6
GT-08a	LM	GL	BAEA-MI-2005-A-25	Cherry city airport	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.2	ND	4.5	ND	ND	ND	2.4	ND	ND	ND	ND	10.2
CX-02	LM	GL	BAEA-MI-2005-A-36	Beaver Island-Fox lake	ND	ND	ND	ND	ND	4.3	ND	3.4	ND	4.8	ND	9.0	9.3	ND	2.3	5.7	2.7	ND	ND	ND	41.5
CX-03	LM	GL	BAEA-MI-2005-A-37	Beaver Island-Fox lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9	ND	4.0	4.7	ND	ND	3.0	ND	ND	ND	ND	14.6
CX-04	LM	GL	BAEA-MI-2005-A-38	High Island	ND	ND	ND	ND	ND	ND	ND	2.3	ND	3.4	ND	6.1	6.1	ND	ND	3.6	1.0	ND	ND	ND	22.6
CX-04	LM	GL	BAEA-MI-2005-A-39	High Island	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND	4.0	4.7	ND	ND	2.7	ND	ND	ND	ND	14.1
CX-01	LP	IN	BAEA-MI-2005-A-40	East Jordan	ND	ND	ND	ND	ND	4.9	5.4	3.5	2.3	5.8	ND	10.5	10.4	ND	2.4	6.9	3.3	ND	ND	ND	55.3
MS-06a	LM	GL	BAEA-MI-2005-B-01	Walhalla West	ND	ND	ND	ND	ND	3.8	2.5	ND	ND	2.4	ND	3.1	2.9	ND	ND	ND	ND	ND	ND	ND	14.7
MS-05a	LM	GL	BAEA-MI-2005-B-02	Walhalla East	ND	ND	ND	ND	ND	4.8	6.7	3.4	2.5	4.7	1.0	9.4	8.5	2.5	2.1	4.5	2.6	ND	ND	ND	52.8
AL-01b	LP	IN	BAEA-MI-2005-B-03	Comstock Ck	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AL-01b	LP	IN	BAEA-MI-2005-B-04	Comstock Ck	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MN-12a	LP	IN	BAEA-MI-2005-B-05	Lower Red Bridge N	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	1.0	ND	ND	ND	ND	ND	ND	ND	2.0
MN-05e	LM	GL	BAEA-MI-2005-B-06	Manistee R SGA	ND	ND	ND	ND	ND	6.5	7.1	3.6	3.2	5.5	2.3	11.7	11.2	ND	2.9	6.9	ND	ND	ND	ND	60.8
MN-05e	LM	GL	BAEA-MI-2005-B-07	Manistee R SGA	ND	ND	ND	ND	ND	5.4	6.0	3.0	2.3	3.9	ND	8.9	8.7	ND	2.1	5.5	ND	ND	ND	ND	45.8
MN-05e	LM	GL	BAEA-MI-2005-B-08	Manistee R SGA	ND	ND	ND	ND	ND	5.6	7.9	3.4	2.6	5.2	2.2	11.4	11.3	ND	2.6	6.9	ND	ND	ND	ND	59.1
MN-02b	LM	GL	BAEA-MI-2005-B-09	Carlson's/Horseshoe Bend	ND	ND	ND	ND	ND	6.6	9.9	4.9	7.8	8.6	3.1	21.8	18.8	3.5	4.2	10.8	ND	ND	ND	ND	100.1
MN-02b	LM	GL	BAEA-MI-2005-B-10	Carlson's/Horseshoe Bend	ND	ND	ND	ND	ND	4.6	4.1	3.0	ND	3.9	ND	7.6	6.7	ND	ND	3.5	ND	ND	ND	ND	33.4
MN-04c	LM	GL	BAEA-MI-2005-B-11	Tippy Dam	ND	ND	ND	ND	ND	6.2	7.3	4.2	4.4	6.6	3.2	13.5	12.2	2.7	2.5	6.1	3.6	ND	ND	ND	72.4
MT-06a	LP	IN	BAEA-MI-2005-B-12	Jenson Lk. 5/25/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	1.0
MT-06a	LP	IN	BAEA-MI-2005-B-13	Jenson Lk.	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	1.0	2.1	ND	ND	1.0	ND	ND	ND	ND	5.1
MU-03a	LM	GL	BAEA-MI-2005-B-14	Mona Lk	ND	ND	ND	2.7	3.1	5.6	6.1	2.5	1.0	2.9	ND	4.0	3.3	ND	ND	ND	ND	ND	ND	ND	31.2
MY-05e	LP	IN	BAEA-MI-2005-B-15	Black R Ranch	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	2.1	ND	ND	ND	ND	ND	ND	ND	3.1
MY-10b	LP	IN	BAEA-MI-2005-B-16	Tomahawk creek flooding	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	1.0	2.5	ND	ND	1.0	ND	ND	ND	ND	5.5

Table 3. Continued.

Territory	Breeding Area Location	Territory Location	Blood Sample Number	Breeding Area Name	# 008	# 018	# 028	# 044	# 052	# 066	# 101	# 105	# 110	# 118	# 128	# 138	# 153	# 156	# 170	# 180	# 187	# 195	# 206	# 209	SUM PCBs
MY-11b	LP	IN	BAEA-MI-2005-B-17	Bonehead club	ND	ND	5.0	ND	ND	13.9	10.4	17.2	ND	44.7	20.7	100.8	137.7	11.9	35.7	95.1	45.8	5.5	ND	ND	544.4
MY-11b	LP	IN	BAEA-MI-2005-B-18	Bonehead club	ND	ND	ND	ND	ND	4.8	3.7	4.6	ND	8.8	2.6	17.5	23.0	3.2	5.9	15.7	7.2	ND	ND	ND	96.9
MY-02k	LP	IN	BAEA-MI-2005-B-19	Turtle Lake (Flecher SW)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MY-02k	LP	IN	BAEA-MI-2005-B-20	Turtle Lake (Flecher SW)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PI-03c	LH	GL	BAEA-MI-2005-B-21	False Presque Isle	ND	ND	ND	ND	ND	4.1	4.4	3.0	ND	3.8	ND	6.2	6.3	ND	ND	4.4	1.0	ND	ND	ND	33.1
MY-04f	LP	IN	BAEA-MI-2005-B-22	Grass Lake	ND	ND	ND	ND	ND	3.4	3.3	ND	ND	1.0	ND	2.5	3.1	ND	ND	2.3	ND	ND	ND	ND	15.5
MY-04f	LP	IN	BAEA-MI-2005-B-23	Grass Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AP-13a	LH	GL	BAEA-MI-2005-B-24	N Pt Grasslake	ND	ND	ND	ND	3.6	7.1	7.4	3.4	ND	5.2	ND	7.2	7.0	ND	2.1	4.7	2.0	ND	ND	ND	49.7
AP-13a	LH	GL	BAEA-MI-2005-B-25	N Pt Grasslake	ND	ND	ND	5.7	7.4	14.2	19.1	7.2	7.0	14.5	5.1	24.7	22.6	4.0	6.4	16.5	9.1	ND	ND	ND	163.5
MQ-08b	LS	GL	BAEA-MI-2005-B-26	L Kawbawgam	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND	1.0
MQ-15g	LS	GL	BAEA-MI-2005-B-27	Saux Head LK	ND	ND	ND	ND	ND	4.0	ND	2.6	ND	4.1	1.0	8.8	11.0	ND	3.3	8.6	3.9	ND	ND	ND	47.2
DI-09c	UP	IN	BAEA-MI-2005-B-28	Genes Pond	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	1.0	ND	ND	ND	ND	ND	ND	ND	2.0
DI-09c	UP	IN	BAEA-MI-2005-B-29	Genes Pond	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MQ-02g	LS	GL	BAEA-MI-2005-B-30	Conway L-Salmon Troute	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	2.8	3.9	ND	ND	2.2	ND	ND	ND	ND	9.9
MQ-02g	LS	GL	BAEA-MI-2005-B-31	Conway L-Salmon Troute	ND	ND	ND	ND	ND	ND	8.4	ND	ND	2.1	ND	4.0	5.8	ND	ND	3.6	ND	ND	ND	ND	23.9
MQ-01h	LS	GL	BAEA-MI-2005-B-32	Huron River Pt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	1.0	ND	ND	ND	ND	ND	ND	ND	2.0
MQ-04d	LS	GL	BAEA-MI-2005-B-33	Partridge Isd	ND	ND	ND	ND	ND	5.3	5.1	4.3	ND	7.6	3.4	19.1	21.5	3.2	5.2	15.5	ND	ND	ND	ND	90.2
MQ-21b	LS	GL	BAEA-MI-2005-B-34	Huron Isd NWR W.	ND	ND	ND	ND	ND	6.2	ND	6.1	ND	14.5	9.1	48.6	62.7	7.2	19.9	72.8	ND	4.1	3.2	ND	254.3
MQ-21b	LS	GL	BAEA-MI-2005-B-35	Huron Isd NWR W.	ND	ND	ND	ND	ND	7.5	ND	7.0	2.9	16.3	10.0	56.6	63.7	6.8	18.8	64.7	ND	3.7	ND	ND	258.1
BG-12d	LS	GL	BAEA-MI-2005-B-36	Pequaming PT	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	3.0	3.8	ND	ND	2.2	ND	ND	ND	ND	10.1
MQ-25b	UP	IN	BAEA-MI-2005-B-37	Ford River/Margarette rapids	ND	ND	ND	ND	ND	5.9	ND	2.7	ND	4.0	ND	4.5	5.9	ND	ND	3.4	ND	ND	ND	ND	26.4
AG-20	UP	IN	BAEA-MI-2005-B-38	Hovey Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AG-18	UP	IN	BAEA-MI-2005-B-40	Forest Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	1.0	2.1	ND	ND	ND	ND	ND	ND	ND	4.1
AG-18	UP	IN	BAEA-MI-2005-B-41	Forest Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	2.2	ND	ND	1.0	ND	ND	ND	ND	4.2
AG-18	UP	IN	BAEA-MI-2005-B-42	Forest Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	1.0
AG-13b	LS	GL	BAEA-MI-2005-B-43	AuSable Pt	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	1.0
AG-17b	LS	GL	BAEA-MI-2005-B-45	Grand Sable Lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	5.6	6.3	ND	ND	5.2	ND	ND	1.0	ND	20.6
LU-12a	UP	IN	BAEA-MI-2005-B-46	Long lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LU-12a	UP	IN	BAEA-MI-2005-B-47	Long lake	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LU-13	UP	IN	BAEA-MI-2005-B-49	Dollarville	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MO-04e	LE	GL	BAEA-MI-2005-C-01	Erie Shooting Club	ND	2.8	3.7	5.2	ND	7.0	6.8	2.7	5.9	3.5	1.0	8.2	7.9	ND	2.5	6.0	3.6	ND	ND	ND	66.9
WA-03b	LE	GL	BAEA-MI-2005-C-02	Campau Rd	ND	ND	3.6	3.3	ND	6.4	5.8	2.5	4.1	3.6	1.0	8.3	7.7	ND	2.5	6.9	4.0	ND	ND	ND	59.7
SG-02c	LH	AN	BAEA-MI-2005-C-03	Shiawassee NWR #1	ND	ND	3.7	4.4	ND	6.6	6.0	3.6	5.3	6.2	1.0	8.0	7.2	ND	1.0	4.6	2.3	ND	ND	1.0	60.9
SG-06a	LH	AN	BAEA-MI-2005-C-04	Shiawassee SGA-Rookery	ND	ND	ND	2.3	ND	6.0	7.1	3.3	2.7	5.8	1.0	7.5	7.4	ND	1.0	4.9	2.6	ND	ND	1.0	52.6
IA-02b	LM	AN	BAEA-MI-2005-C-05	Webber Dam	ND	ND	ND	ND	ND	4.6	5.9	3.3	4.3	4.8	1.0	9.5	8.7	2.4	1.0	4.7	1.0	ND	ND	ND	51.2
BY-03d	LH	GL	BAEA-MI-2005-C-06	Nayanquing Pt	ND	ND	ND	2.6	ND	7.2	7.8	4.2	5.9	7.9	1.0	10.1	9.8	2.9	2.9	8.3	4.1	ND	ND	2.9	77.7
SG-01f	LH	AN	BAEA-MI-2005-C-07	Shiawassee NWR #1	ND	ND	ND	4.4	ND	7.8	8.7	2.9	2.3	4.7	ND	5.4	5.7	ND	1.0	4.1	1.0	ND	3.2	ND	51.4
NE-03j	LP	IN	BAEA-MI-2005-C-08	Croton Prairie	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HU-05a	LH	GL	BAEA-MI-2005-C-09	Wildfowl Bay	ND	ND	ND	1.0	ND	5.3	4.5	3.3	3.8	5.2	1.0	6.9	5.7	ND	ND	3.6	1.0	ND	ND	ND	41.3
BY-01d	LH	AN	BAEA-MI-2005-C-10	Skull/Stoney Isd	ND	ND	ND	3.3	ND	6.2	6.0	3.6	4.8	6.5	1.0	8.0	7.4	1.0	1.0	4.7	2.4	ND	ND	ND	56.0
HU-04c	LH	GL	BAEA-MI-2005-C-11	Sand Pt	ND	ND	ND	3.3	ND	7.9	8.0	4.0	4.2	7.2	1.0	9.3	8.9	2.7	2.3	5.4	3.0	ND	ND	ND	67.2
CX-07a	LM	GL	BAEA-MI-2005-C-13	Beaver Isd-St James	ND	ND	ND	ND	ND	ND	5.4	3.3	ND	5.2	1.0	7.5	8.0	2.4	1.0	5.1	2.2	ND	ND	ND	41.2
CX-07a	LM	GL	BAEA-MI-2005-C-14	Beaver Isd-St James	ND	ND	ND	ND	ND	4.1	2.5	3.0	ND	4.1	1.0	5.3	5.7	ND	ND	2.9	ND	ND	ND	ND	28.6
CX-08a	LM	GL	BAEA-MI-2005-C-15	Whiskey Isd	ND	ND	ND	ND	ND	ND	4.2	3.5	ND	6.8	2.8	13.1	16.7	ND	4.0	11.3	5.3	ND	ND	ND	67.8

Table 4. Concentrations of individual organochlorine compounds (ng/g wet weight (ppb)) in nestling bald eagle plasma samples analyzed in 2005. Breeding areas were located in either inland lower peninsula (LP), inland upper peninsula (UP), Lake Huron (LH), Lake Michigan (LM), or Lake Superior (LS) watersheds. Territories were associated with either inland (IN), Great Lakes (GL), or anadromous (AN) water bodies.

Territory	Breeding Area Location	Territory Location	Blood Sample Number	Breeding Area Name	a-Chlordane	Dieldrin	g-Chlordane	g-HCH	HCB	Heptachlor epoxide
AR-05a	LH	GL	BAEA-MI-2005-A-01	Pt. AuGres	6.6	2.2	ND	ND	ND	2.7
AR-05a	LH	GL	BAEA-MI-2005-A-02	Pt. AuGres	6.9	4.4	ND	ND	ND	ND
AR-03a	LH	GL	BAEA-MI-2005-A-03	Santiago	4.7	3.7	ND	4.0	ND	3.2
NE-01j	LM	GL	BAEA-MI-2005-A-04	Anderson Bayou	4.5	2.2	ND	ND	ND	ND
NE-01j	LM	GL	BAEA-MI-2005-A-05	Anderson Bayou	6.5	4.2	ND	ND	2.5	ND
LA-05a	LP	IN	BAEA-MI-2005-A-06	Bray	4.4	3.3	ND	ND	ND	ND
LA-05a	LP	IN	BAEA-MI-2005-A-07	Bray	3.9	1.0	ND	ND	ND	ND
MD-01b	LH	GL	BAEA-MI-2005-A-08	Sanford L	ND	ND	4.0	ND	ND	ND
OS-10a	LP	IN	BAEA-MI-2005-A-09	Rhoads L	ND	ND	ND	ND	ND	ND
OS-10a	LP	IN	BAEA-MI-2005-A-10	Rhoads L	ND	ND	ND	ND	ND	ND
AL-04 c	LP	IN	BAEA-MI-2005-A-11	McCollum L	ND	ND	ND	ND	2.2	ND
OS-06b	LP	IN	BAEA-MI-2005-A-12	Shamrock L	ND	ND	ND	ND	ND	ND
IO-04c	LH	GL	BAEA-MI-2005-A-13	Allen L	3.9	ND	ND	ND	ND	ND
IO-04c	LH	GL	BAEA-MI-2005-A-14	Allen L	4.9	4.8	ND	ND	ND	ND
AL-08c	LM	GL	BAEA-MI-2005-A-15	Black R-Negwegon S	4.3	ND	ND	ND	ND	ND
AL-08c	LM	GL	BAEA-MI-2005-A-16	Black R-Negwegon S	5.2	4.4	ND	ND	ND	ND
OT-09a	LP	IN	BAEA-MI-2005-A-17	Olund L	ND	ND	ND	ND	ND	ND
MN-10a	LM	GL	BAEA-MI-2005-A-18	Little Manistee R	6.6	ND	ND	ND	ND	ND
OL-01b	LP	IN	BAEA-MI-2005-A-19	Evart	ND	ND	ND	ND	ND	ND
OL-01b	LP	IN	BAEA-MI-2005-A-20	Evart	ND	ND	ND	ND	ND	ND
OS-03e	LP	IN	BAEA-MI-2005-A-21	McKinley	ND	ND	ND	ND	ND	ND
IO-08b	LP	IN	BAEA-MI-2005-A-22	Loud dam pt W	ND	ND	ND	ND	ND	ND
MY-01i	LP	IN	BAEA-MI-2005-A-23	Valentine L	ND	ND	ND	ND	2.6	ND
AP-02m	LP	IN	BAEA-MI-2005-A-24	Flecher Pd NE	ND	ND	ND	ND	ND	ND
GT-08a	LM	GL	BAEA-MI-2005-A-25	Cherry city airport	ND	3.1	ND	ND	ND	ND
CX-02	LM	GL	BAEA-MI-2005-A-36	Beaver Island-Fox lake	ND	4.4	ND	ND	ND	ND
CX-03	LM	GL	BAEA-MI-2005-A-37	Beaver Island-Fox lake	ND	ND	ND	ND	ND	ND
CX-04	LM	GL	BAEA-MI-2005-A-38	High Island	ND	ND	ND	ND	ND	ND
CX-04	LM	GL	BAEA-MI-2005-A-39	High Island	ND	ND	ND	ND	ND	ND
CX-01	LP	IN	BAEA-MI-2005-A-40	East Jordan	4.8	4.3	ND	ND	ND	ND
MS-06a	LM	GL	BAEA-MI-2005-B-01	Walhalla West	ND	1.0	ND	ND	ND	ND
MS-05a	LM	GL	BAEA-MI-2005-B-02	Walhalla East	4.7	2.8	4.3	ND	ND	ND
AL-01b	LP	IN	BAEA-MI-2005-B-03	Comstock Ck	ND	ND	ND	ND	ND	ND
AL-01b	LP	IN	BAEA-MI-2005-B-04	Comstock Ck	ND	ND	ND	ND	ND	ND
MN-12a	LP	IN	BAEA-MI-2005-B-05	Lower Red Bridge N	ND	ND	ND	ND	ND	ND
MN-05e	LM	GL	BAEA-MI-2005-B-06	Manistee R SGA	5.5	5.2	ND	ND	ND	ND
MN-05e	LM	GL	BAEA-MI-2005-B-07	Manistee R SGA	4.8	4.8	ND	ND	ND	ND
MN-05e	LM	GL	BAEA-MI-2005-B-08	Manistee R SGA	5.1	4.6	ND	ND	ND	ND
MN-02b	LM	GL	BAEA-MI-2005-B-09	Carlson's/Horseshoe Bend	6.2	5.5	ND	ND	ND	ND
MN-02b	LM	GL	BAEA-MI-2005-B-10	Carlson's/Horseshoe Bend	ND	ND	ND	ND	ND	ND
MN-04c	LM	GL	BAEA-MI-2005-B-11	Tippy Dam	5.3	5.0	ND	ND	ND	2.8
MT-06a	LP	IN	BAEA-MI-2005-B-12	Jenson Lk. 5/25/05	ND	ND	ND	ND	ND	ND
MT-06a	LP	IN	BAEA-MI-2005-B-13	Jenson Lk.	ND	ND	ND	ND	ND	ND
MU-03a	LM	GL	BAEA-MI-2005-B-14	Mona Lk	4.5	2.4	4.8	ND	ND	2.7
MY-05e	LP	IN	BAEA-MI-2005-B-15	Black R Ranch	ND	ND	ND	ND	ND	ND
MY-10b	LP	IN	BAEA-MI-2005-B-16	Tomahawk creek flooding	ND	ND	ND	ND	ND	ND

Table 4. Continued.

Territory	Breeding Area Location	Territory Location	Blood Sample Number	Breeding Area Name	a-Chlordane	Dieldrin	g-Chlordane	g-HCH	HCB	Heptachlor epoxide
MY-11b	LP	IN	BAEA-MI-2005-B-17	Bonehead club	18.0	8.6	6.2	ND	ND	4.4
MY-11b	LP	IN	BAEA-MI-2005-B-18	Bonehead club	ND	2.8	3.9	ND	ND	2.9
MY-02k	LP	IN	BAEA-MI-2005-B-19	Turtle Lake (Flecher SW)	ND	ND	ND	ND	ND	ND
MY-02k	LP	IN	BAEA-MI-2005-B-20	Turtle Lake (Flecher SW)	ND	ND	ND	ND	ND	ND
PI-03c	LH	GL	BAEA-MI-2005-B-21	False Presque Isle	ND	ND	ND	ND	ND	ND
MY-04f	LP	IN	BAEA-MI-2005-B-22	Grass Lake	ND	ND	ND	ND	3.4	ND
MY-04f	LP	IN	BAEA-MI-2005-B-23	Grass Lake	ND	ND	ND	ND	ND	ND
AP-13a	LH	GL	BAEA-MI-2005-B-24	N Pt Grasslake	6.0	1.0	ND	ND	ND	ND
AP-13a	LH	GL	BAEA-MI-2005-B-25	N Pt Grasslake	10.0	5.0	5.4	ND	ND	3.0
MQ-08b	LS	GL	BAEA-MI-2005-B-26	L Kawbawgam	ND	ND	ND	ND	ND	ND
MQ-15g	LS	GL	BAEA-MI-2005-B-27	Saux Head LK	ND	4.0	ND	ND	ND	3.1
DI-09c	UP	IN	BAEA-MI-2005-B-28	Genes Pond	ND	ND	ND	ND	ND	ND
DI-09c	UP	IN	BAEA-MI-2005-B-29	Genes Pond	ND	ND	ND	ND	ND	ND
MQ-02g	LS	GL	BAEA-MI-2005-B-30	Conway L-Salmon Troute	ND	ND	ND	ND	ND	ND
MQ-02g	LS	GL	BAEA-MI-2005-B-31	Conway L-Salmon Troute	ND	1.0	ND	ND	ND	ND
MQ-01h	LS	GL	BAEA-MI-2005-B-32	Huron River Pt	ND	ND	ND	ND	ND	ND
MQ-04d	LS	GL	BAEA-MI-2005-B-33	Partridge Isd	ND	3.7	ND	ND	2.4	3.0
MQ-21b	LS	GL	BAEA-MI-2005-B-34	Huron Isd NWR W.	9.9	7.3	ND	ND	2.5	3.6
MQ-21b	LS	GL	BAEA-MI-2005-B-35	Huron Isd NWR W.	10.0	10.3	4.7	4.8	ND	3.9
BG-12d	LS	GL	BAEA-MI-2005-B-36	Pequaming PT	ND	2.1	3.8	ND	ND	ND
MQ-25b	UP	IN	BAEA-MI-2005-B-37	Ford River/Margarette rapids	ND	ND	ND	ND	ND	ND
AG-20	UP	IN	BAEA-MI-2005-B-38	Hovey Lake	ND	ND	ND	ND	ND	ND
AG-18	UP	IN	BAEA-MI-2005-B-40	Forest Lake	ND	ND	3.6	ND	ND	ND
AG-18	UP	IN	BAEA-MI-2005-B-41	Forest Lake	ND	ND	ND	ND	ND	ND
AG-18	UP	IN	BAEA-MI-2005-B-42	Forest Lake	ND	ND	ND	ND	ND	ND
AG-13b	LS	GL	BAEA-MI-2005-B-43	AuSable Pt	ND	ND	ND	ND	ND	ND
AG-17b	LS	GL	BAEA-MI-2005-B-45	Grand Sable Lake	ND	4.8	3.7	ND	ND	2.9
LU-12a	UP	IN	BAEA-MI-2005-B-46	Long lake	ND	ND	ND	ND	ND	ND
LU-12a	UP	IN	BAEA-MI-2005-B-47	Long lake	ND	ND	ND	ND	ND	ND
LU-13	UP	IN	BAEA-MI-2005-B-49	Dollarville	ND	ND	ND	ND	ND	ND
MO-04e	LE	GL	BAEA-MI-2005-C-01	Erie Shooting Club	3.3	7.2	ND	4.2	ND	2.9
WA-03b	LE	GL	BAEA-MI-2005-C-02	Campau Rd	4.1	2.6	ND	ND	ND	2.8
SG-02c	LH	AN	BAEA-MI-2005-C-03	Shiawassee NWR #1	4.7	2.7	ND	4.2	ND	3.1
SG-06a	LH	AN	BAEA-MI-2005-C-04	Shiawassee SGA-Rookery	4.6	1.0	ND	ND	2.1	3.2
IA-02b	LM	AN	BAEA-MI-2005-C-05	Webber Dam	4.0	3.2	ND	ND	ND	ND
BY-03d	LH	GL	BAEA-MI-2005-C-06	Nayanquing Pt	5.5	1.0	ND	ND	ND	3.4
SG-01f	LH	AN	BAEA-MI-2005-C-07	Shiawassee NWR #1	5.4	1.0	ND	ND	ND	3.4
NE-03j	LP	IN	BAEA-MI-2005-C-08	Croton Prairie	ND	ND	ND	ND	ND	ND
HU-05a	LH	GL	BAEA-MI-2005-C-09	Wildfowl Bay	4.4	1.0	ND	ND	ND	2.9
BY-01d	LH	AN	BAEA-MI-2005-C-10	Skull/Stoney Isd	4.7	1.0	ND	4.2	ND	3.2
HU-04c	LH	GL	BAEA-MI-2005-C-11	Sand Pt	6.0	1.0	ND	ND	ND	3.2
CX-07a	LM	GL	BAEA-MI-2005-C-13	Beaver Isd-St James	4.3	2.6	ND	ND	ND	2.6
CX-07a	LM	GL	BAEA-MI-2005-C-14	Beaver Isd-St James	3.9	2.7	ND	ND	ND	2.6
CX-08a	LM	GL	BAEA-MI-2005-C-15	Whiskey Isd	ND	4.2	ND	ND	2.2	2.8