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Maine Field Office – Ecological Services **May 2012**

Organochlorine compounds in bald eagle and common loon eggs from Androscoggin Lake and the Androscoggin River Watershed

Fish and Wildlife Service

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Organochlorine Compounds in Bald Eagle and Common Loon Eggs from Androscoggin Lake and the Androscoggin River Watershed

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Executive Summary

Reduced productivity has been documented in fish-eating birds inhabiting Androscoggin Lake in west-central Maine. The cause of reduced productivity of fish-eating birds at Androscoggin Lake is not known and could be related to changes in habitat (e.g., loss of nest trees or flooding), predation, harassment or other disturbances during breeding seasons, or to environmental contaminants. Dead Stream connects Androscoggin Lake to the Androscoggin River and during high flows the river will flood into the lake. Three pulp and paper mills existed on the Androscoggin River upstream from Androscoggin Lake. Previous bio-monitoring studies by the Maine Department of Environmental Protection found elevated concentrations of organic contaminants in fish tissue from Androscoggin Lake and the Androscoggin River.

To determine if organochlorine compounds were accumulating and affecting productivity of fish-eating birds, non-viable eggs of bald eagles (n = 14) and common loons (n = 8) were collected from Androscoggin Lake and the Androscoggin River watershed between 2001 and 2009. Bald eagle eggs from the Penobscot River watershed (n = 19) and common loon eggs from the Kennebec River watershed (n = 2) were collected for comparative purposes.

Eggs were analyzed for dioxins and furans, polychlorinated biphenyl (PCB), DDT metabolites, and other organochlorine compounds. Concentrations were expressed on a fresh wet weight basis. Analytical results for each species were compared between watersheds and to suggested avian egg toxicity threshold levels.

Bald Eagle

• Dioxin (2,3,7,8-TCDD) was detected in only two of 14 eagle egg samples from the Androscoggin watershed – an egg from Androscoggin Lake (7.8 ppt, parts per trillion) and an egg from Gulf Island Pond (9.3 ppt) within the Androscoggin River. Dioxin was below sample detection limits in all 19 bald eagle eggs collected from the Penobscot watershed.

• There was no significant difference in dioxin toxic equivalents (TCDD-TEQ, a method of expressing several organic contaminants relative to dioxin) concentrations in bald eagle eggs collected from the Androscoggin (average 209 ppt) and Penobscot (average 273 ppt) watersheds. Average concentrations of TCDD-TEQ in bald eagle eggs from the Androscoggin watershed and Penobscot watershed were below a No-Observable-Adverse-Effect-Level (NOAEL) for hatching in bald eagles (303 ppt). Three of 14 bald eagle eggs from the Androscoggin (max. 319 ppt) and six of 19 eggs from the Penobscot watershed (max. 1145 ppt), however, contained TCDD-TEQ concentrations above the suggested NOAEL.

• There was no significant difference in total polychlorinated biphenyl (ΣPCB) concentrations in bald eagle eggs collected from the Androscoggin (average 4.89 ppm, parts per million) and Penobscot watersheds (average 3.01 ppm). None of the bald eagle eggs from the Androscoggin or Penobscot watersheds contained ΣPCB approaching a suggested toxicity threshold level of 20

ppm, but two eggs from the Androscoggin drainage had levels that exceeded 10 ppm and could be considered elevated. One of eagle eggs from the Androscoggin drainage with an elevated ΣPCB concentration was collected in Androscoggin Lake in 2003 (13.42 ppm), but an egg collected from the same nest territory in 2007 only had a ΣPCB level of 3.21 ppm.

• Statistically significant higher levels of the DDT metabolite, p,p'-DDE, were found in bald eagle eggs from the Androscoggin watershed (average 1.15 ppm) versus the Penobscot (average 0.71 ppm) watershed. However, DDE levels in bald eagle eggs from the Androscoggin watershed (max. 3.42 ppm) and Penobscot watershed (max. 1.64 ppm) were well below the suggested 5.5 ppm threshold value associated with embryo lethality.

Common Loon

• Two common loon eggs – one from Aziscohos Lake (5.1 ppt) in the Androscoggin watershed and one from Long Pond (1.9 ppt) in the Kennebec watershed – had detectable levels of dioxin. The compound was below sample detection limits in the other eight loon eggs.

• No pattern was evident in TCDD-TEQ concentrations among ten common loon eggs (range: 11 – 388 ppt) collected from Androscoggin and Kennebec. Two of the ten loon eggs, however, had TCDD-TEQ levels that exceeded suggested toxicity thresholds for bald eagles and osprey. One egg was collected in Androscoggin Lake and the other from Aziscohos Lake.

• No pattern was evident in ΣPCB concentrations among ten common loon eggs collected from the Androscoggin and Kennebec watersheds. Among the ten common loon eggs analyzed, the highest (2.38 ppm) and lowest ΣPCB (0.48 ppm) concentrations were found in two different lakes in the Kennebec watershed. ΣPCB concentrations in common loon eggs from Maine were well below the levels associated with decreased hatching in other species.

• Among the ten common loon eggs analyzed for p,p'-DDE, the highest (1.04 ppm) and lowest (0.07 ppm) concentrations were found in two different lakes in the Kennebec watershed. Similar to ΣPCB, these common loon egg DDE levels were quite low compared to the suggested threshold levels for sensitive species.

Overall Assessment

Statistically significant higher concentrations of some organochlorine compounds were detected in bald eagle eggs from the Androscoggin versus the Penobscot watersheds. However, average organochlorine levels in bald eagle eggs did not exceed suggested toxicity threshold levels. Eagle eggs from Androscoggin Lake and certain nest territories in both watersheds contained elevated organochlorine levels, but these levels were inconsistent between years and among different compounds.

Interpretation of organochlorine analytical results in common loon eggs was hampered by the

small sample size (n = 10) and variability of organochlorine concentrations within and among areas. Three of four loon eggs collected from Androscoggin Lake during the study had low TCDD-TEQ levels (< 50 ppt), but one egg had a concentration of 388 ppt which was above the toxicity thresholds for bald eagles (303 ppt) and osprey (136 ppt).

Based on the results of this investigation, reduced productivity in fish-eating birds from Androscoggin Lake was likely related to organochlorine contamination in some years (i.e., TCDD-TEQ in one of two common loon territories in 2004). Three eagle eggs collected from the Androscoggin watershed in 2007 also contained TCDD-TEQ levels that exceeded the suggested toxicity threshold. One loon egg collected from Aziscohos Lake in the Androscoggin watershed in 2004 also contained an elevated TCDD-TEQ level.

Overall, however, for most organochlorine compounds there was no significant difference in contaminant levels in bald eagle eggs in the Androscoggin River and Penobscot River watersheds during the study period. The exceptions were concentrations of alpha chlordane, p,p'-DDD and p,p'-DDE, which were significantly higher in bald eagle eggs from the Androscoggin watershed. No apparent pattern could be discerned in organochlorine contaminant levels in common loon eggs between Androscoggin Lake, the Androscoggin watershed, and the Kennebec watershed. Again, too few samples were analyzed from the three areas to allow for statistical comparisons.

A long-term monitoring program of the fish-eating birds at Androscoggin Lake for organochlorine compounds is not recommended. State monitoring of legacy organochlorine compounds such as dioxin in fish tissue shows a decreasing trend in the Androscoggin River, but dioxin concentrations in fish continue to exceed the state's fish tissue action level. Continuing to analyze opportunistically-acquired eagle and loon eggs from Androscoggin Lake and the Androscoggin watershed for organochlorine compounds is recommended.

Keywords: bald eagle, organochlorines, Androscoggin Lake, Maine

PREFACE

This report provides documentation of organochlorine contaminants in eggs of bald eagles (*Haliaeetus leucocephalus*) and common loons (*Gavia immer*) from Androscoggin Lake and the Androscoggin River watershed in Maine. Eggs of these species from two other Maine watersheds were analyzed for comparison. The USFWS Region 5 Project Identification Number for this study is 53411-1130-5F36 and the USFWS Division of Environmental Quality Project Identification Number is 200250004. Samples were collected between 2001 and 2009. Analytical work was completed under ten USFWS Analytical Control Facility Catalogs and one Sample Delivery Group submitted by the Maine Department of Inland Fisheries and Wildlife (Appendix Table A-1).

Questions, comments, and suggestions related to this report are encouraged. Written inquiries should refer to Report Number FY07-MEFO-4-EC and be directed to:

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This report complies with the peer review and certification provisions of the Information Quality Act (Public Law 106-554, Section 515).

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List of Acronyms and Abbreviations

ALIC	Androscoggin Lake Improvement Association
BAEA	bald eagle
BHC	benzene hexachloride
COLO	common loon
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
FTAL	fish tissue action level
fww	fresh wet weight
GERG	Geochemical Environmental Research Group
HCB	hexachlorobenzene
MEDEP	Maine Department of Environmental Protection
MEDIFW	Maine Department of Inland Fisheries and Wildlife
MESPO	Maine State Planning Office
MIDAS	Maine Information Display Analysis System
µg/g	micrograms per gram (parts per million)
MPDES	Maine Pollution Discharge Elimination System
ng/g	nanograms per gram (parts per billion)
NPDES	National Pollution Discharge Elimination System
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-*p*-dioxins
PCDF	polychlorinated dibenzofurans
pg/g	picograms per gram (parts per trillion)
ppb	parts per billion (ng/g)
ppm	parts per million (µg/g)
ppt	parts per trillion (pg/g)
QA/QC	Quality Assurance / Quality Control
SDG	Sample Delivery Group
TCDD	2,3,7,8-tetrachlorodibenzo-*p*-dioxin
TEF	toxic equivalency factor
TCDD-TEQ	dioxin toxic equivalents
USFWS	U.S. Fish and Wildlife Service
ww	wet weight

1. Introduction

Reduced productivity has been documented in fish-eating birds inhabiting Androscoggin Lake in central Maine. In the past 15 years, a great blue heron (*Ardea herodias*) colony on Lothrop Island in the southern end of the lake ceased to exist. A bald eagle (*Haliaeetus leucocephalus*) pair nesting on the same island failed to produce young in 2000 and 2001 and exhibited irregular productivity over several years of monitoring (Table 1). Common loon (*Gavia immer*) productivity is also sporadic on the lake with few young being observed during annual index counts. The cause of reduced productivity at Androscoggin Lake is not known and could be related to changes in habitat (e.g., loss of nest trees or flooding), predation, harassment or other disturbances during breeding seasons, or to environmental contaminants.

At high flows, Androscoggin Lake receives water from the Androscoggin River via the Dead River. Three pulp and paper mills were located above the confluence of the Androscoggin River and Dead River. Two of these mills were included in a U.S. Fish and Wildlife Service biological opinion relating to renewal of National Pollution Discharge Elimination System (NPDES) permits and impact to bald eagles from polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) (USFWS 2000). In the biological opinion, the Service concluded from hazard assessment model predictions and existing fish tissue data that PCDD/F discharges from these mills would likely adversely affect individual bald eagles. The hazard assessment model considered fish tissue information collected by the State of Maine.

The Maine Department of Environmental Protection (MEDEP 2000) has been analyzing fish tissue for PCDD/Fs since 1988. In the MEDEP dioxin monitoring program of four major rivers, fish from the Androscoggin River had the highest levels of PCDD/Fs in the state. Levels of PCDD/Fs in fish tissue from Maine's major rivers were sufficiently elevated to warrant fish consumption advisories. These fish tissue data from other Maine rivers strongly suggested that birds in the Androscoggin River watershed may be at risk from organochlorine contamination. In 2000, four bald eagle eggs from nests along the Penobscot River, which had lower PCDD/F levels in fish than the Androscoggin River, had dioxin toxic equivalent (TCDD-TEQ) concentrations ranging from 223 to 570 pg/g, fresh wet weight (mean 385 pg/g) (Mierzykowski and Carr 2002). These TCDD-TEQs for Penobscot River eagles were above suggested toxicity threshold values for the species (Elliott *et al.* 1996, Elliott and Harris 2002, Henny and Elliott 2007). In the MEDEP surface water ambient toxic monitoring program, fish from the Penobscot River had lower organochlorine contaminant levels than fish from Androscoggin River and Androscoggin Lake. If TCDD-TEQs in eggs of fish-eating birds along the Penobscot River were higher than suggested toxicity threshold levels, it was plausible that fish-eating birds in the Androscoggin River watershed would have similar or even greater TCDD-TEQs. Based on this information and the reports of reduced eagle and loon productivity in the lake, the Androscoggin Lake Improvement Corporation (ALIC) asked the U.S. Fish and Wildlife Service's Maine Field Office to conduct a study to determine if organochlorine compounds were affecting fish-eating birds in Androscoggin Lake and the Androscoggin River watershed.

Table 1. History of bald eagle occupancy at Androscoggin Lake (Lothrop Island)

NestSite#	Year	Occupancy	Fledglings	Annual status comments
002B	1990	Breeding pair	1	Eagles enlarged and occupied a former great blue heron nest. At least one additional nestling eaglet hatched but died before fledging.
002B	1991	Breeding pair	0	Nest fell entirely during the midst of the breeding season. Nest tree was substantially damaged and is no longer usable. At least one additional nestling eaglet hatched but died before fledging.
002C	1992	Breeding pair	2	
002D	1993	Breeding pair	1	
002D	1994	Breeding pair	2	
002D	1995	Breeding pair	2	
002D	1996	Breeding pair	2	
002D	1997	Breeding pair	1	
002E	1998	Breeding pair	2	
002E	1999	Breeding pair	0	
002F	2000	Breeding pair	0	
002F	2001	Breeding pair	0	
002F	2002	Unoccupied		
002F	2003	Breeding pair	0	One unhatched egg collected.
002F	2004	Breeding pair	0	
002F	2005	Breeding pair	2	
002F	2006	Breeding pair	2	
002F	2007	Breeding pair	1	One unhatched egg collected.
002F	2008	Resident pair	0	
002F	2009	Breeding pair	2	

The eagle nest territory on Androscoggin Lake has always been located on Lothrop Island, but in five different nest trees on the island (hence, nest site codes B thru F).

Eagles also nested on Lothrop Island prior to 1972, but productivity information is not available.

The territory was annually monitored but was unoccupied from 1973 to 1989.

The resident pair in 2008 were eagles that used the nest territory, but did not show any sign of breeding (e.g., nest building, low incubation posture).

2. Study Purposes

The purposes of this investigation were to: 1) determine organochlorine contaminant exposure in fish-eating birds from Androscoggin Lake and the Androscoggin River watershed, 2) compare analytical results from the Androscoggin to abandoned eggs collected during similar research in the Penobscot and Kennebec watersheds and, to 3) evaluate whether contaminant exposure levels in eggs of fish-eating birds exceed suggested biological effect or toxicity thresholds.

3. Study Area

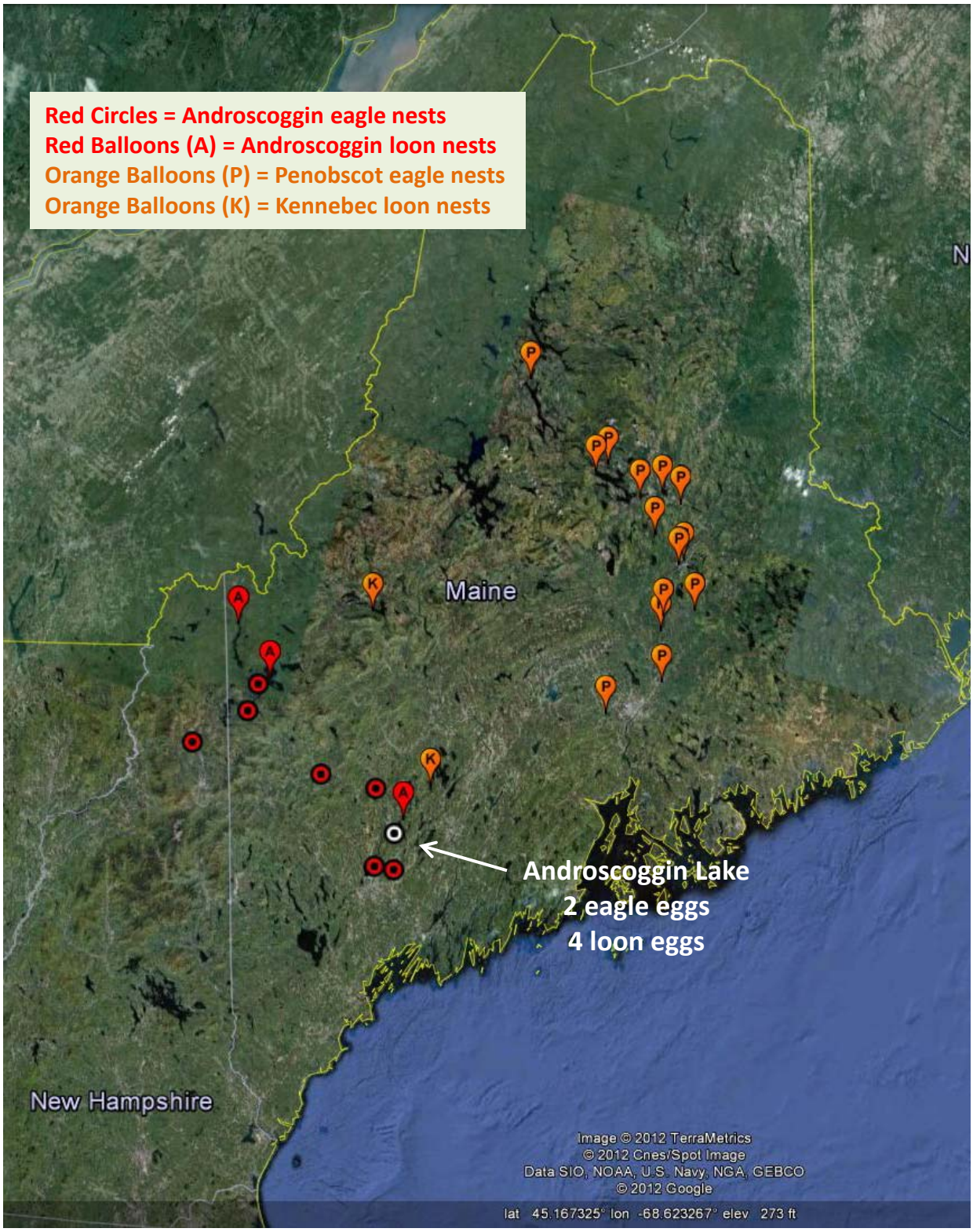
3.1 Androscoggin Lake. Androscoggin Lake is located in the Towns of Leeds and Wayne in Androscoggin and Kennebec Counties, Maine - Maine Information Display Analysis System (MIDAS) Lake Number 3836. The lake has a surface area of 1,627 hectares (4020 acres) and a drainage area of 215 square kilometers (83 square miles). The lake's maximum depth is approximately 12 meters (38 feet) with an average of 4.6 meters (15 feet) (LOM 2012). Islands on the lake include Androscoggin Island, Hog Island, Norris Island, Blodgett Island, and Lothrop Island. At low water, the smaller islands of Silver Dollar Island and Whaleback Rock are also visible. Year-round and seasonal residences occur in several coves and points, and on the two largest islands - Androscoggin Island and Norris Island. The lake is managed primarily for a warm-water fishery. Recreational boating and fishing are common on the lake and there is a high potential for wildlife disturbance. Four common loon eggs and two bald eagle eggs were recovered from Androscoggin Lake for the study.

3.2 Androscoggin River Watershed. The Androscoggin River Basin encompasses 9,065 square kilometers (3,500 sq. mi.) in northeastern New Hampshire and western Maine. The Androscoggin River flows 272 kilometers (169 mi.) from headwaters along the Canadian –New Hampshire border to its mouth at Merrymeeting Bay in Topsham, Maine (MESPO 2007). Pulp and paper mills exist along the river in the towns of Jay and Rumford, Maine, and Berlin, New Hampshire. Common loon eggs were recovered from three lakes in the watershed – Pocasset Lake (MIDAS # 3824), Aziscohos Lake (MIDAS # 3290), and Mooselookmeguntic Lake (MIDAS # 3302, also referred to as Cupsuptic Lake). Eagle eggs were recovered from seven nest territories in the watershed.

3.3 Penobscot River Watershed. The Penobscot River Basin occupies 22,196 square kilometers (8,570 sq. mi.) in central and northeastern Maine. The Penobscot River flows for 169 kilometers (105 mi.) from the confluence of the East and West Branches in Medway, south to its mouth in Penobscot Bay. The river basin is largely undeveloped, approximately 95% is forested. The Penobscot River is influenced by tides as far as Bangor, 48 kilometers (30 mi.) above the confluence with Penobscot Bay (MESPO 2007). Paper mills are located along the river in East Millinocket, Lincoln, and Old Town. Eagle eggs were recovered from 14 nest territories in the watershed.

3.4 Kennebec River Watershed. The Kennebec River Basin covers approximately 15,281 square kilometers (5,900 sq. mi.) of southwestern Maine. The upper portion of the basin is hilly and mountainous and the lower third of the basin has the gentle topography representative of a coastal drainage area. The Kennebec River originates at Moosehead Lake and flows south approximately 267 kilometers (166 mi.) to Merrymeeting Bay. The Kennebec River joins the Androscoggin River in Merrymeeting Bay before exiting to the ocean at Fort Popham. The Kennebec River is influenced by tidal processes as far as Augusta, 40 kilometers (25 mi.) above Abagadassett Point (MESPO 2007). One paper mill is located along the river in the town of Skowhegan. Common loon eggs were recovered from two lakes in the watershed – Long Pond (MIDAS # 5272) and Flagstaff Lake (MIDAS # 0038).

Figure 1. Bald eagle and common loon egg collection locations



4. Methods

4.1 Field Methods. Between 2001 and 2009, 33 bald eagle eggs and 10 common loon eggs were collected by USFWS and MEDIFW staff, cooperators, and a contractor (BioDiversity Research Institute) from three Maine watersheds (Tables 2 and 3). Fixed-wing aircraft were used by MEDIFW biologists to survey bald eagle nesting trees and monitor incubation. In addition, the Lothrop Island eagle nest site on Androscoggin Lake was closely monitored by cooperators from the Androscoggin Lake Improvement Corporation (ALIC). Loon nests were located during shoreline surveys conducted from a motorboat or canoe. Since the study occurred when the bald eagle was still listed as a threatened species by the USFWS and state of Maine, eggs were collected only after a determination by USFWS or MEDIFW endangered species specialists that the egg was abandoned (i.e., no longer incubated) or non-viable (i.e., beyond expected hatching date). Loon eggs were collected if the nest was washed out or if the egg was cold and had not been turned in 24 hours.

4.2 Sample Processing. Upon collection from the field, eagle eggs were refrigerated until processed. Processing of eagle eggs usually occurred within 48 hours after eggs were received by the USFWS Maine Field Office. Loon eggs were frozen after collection and partially thawed for processing.

After exterior egg surfaces were cleaned of all surface debris with a paper towel soaked with de-ionized water, egg length and breadth were measured in millimeters with a dial caliper. Total egg weight and egg content weight were measured to the nearest 0.1 gram with an electronic balance. Egg volume was determined from egg measurements (eagle egg, Stickel *et al*. 1973; loon egg, Hoyt 1979). Processing trays, bowls, and instruments were decontaminated with a wash of tap water and biodegradable soap (i.e., Alconox®), a tap water rinse, and a rinse with de-ionized water. Eggs were scored at the equator with dedicated, stainless-steel scalpels. Egg contents were extracted, placed in chemically-clean jars, and weighed. Samples were frozen until shipped to the analytical laboratory.

Eagle eggshells were dried for 10 days and weighed to the nearest 0.1 gram with an electronic balance. Eggshell thickness with inner membrane attached was measured in millimeters (0.001 mm) at eight points on the egg equator with a digital micrometer with rounded anvils; four equidistant measurements were taken from each half of the eggshell.

Table 2. Bald eagle and common loon eggs collected in Androscoggin Lake and the Androscoggin River watershed.

Sample Number	Nest Location	Township	Date of Collection	Coordinates		Habitat Type
				Latitude	Longitude	
Bald Eagle (n = 14)						
ME002-0301	Androscoggin Lake	Leeds	6/5/2003	44.306111	70.098333	Lacustrine
ME002-0701	Androscoggin Lake	Leeds	6/19/2007	44.306111	70.098333	Lacustrine
ME252-0501	Upper Richardson Lake	Richardsontown	6/10/2005	44.880465	70.868520	Lacustrine
ME274-0201	Gulf Island Pond, Androscoggin River	Greene	4/18/2002	44.175000	70.204722	Riverine
ME365-0801	Pond in the River	Township C	6/11/2008	44.773850	70.923073	Lacustrine
ME407-0701	Sabattus Pond	Greene	5/9/2007	44.163056	70.098611	Lacustrine
ME407-0801	Sabattus Pond	Greene	5/21/2008	44.163056	70.098611	Lacustrine
ME407-0802	Sabattus Pond	Greene	5/21/2008	44.163056	70.098611	Lacustrine
ME412-0501	Androscoggin River	Jay	6/10/2005	44.481667	70.203889	Riverine
ME412-0502	Androscoggin River	Jay	6/10/2005	44.481667	70.203889	Riverine
ME412-0701	Androscoggin River	Jay	6/12/2007	44.481667	70.203889	Riverine
ME412-0702	Androscoggin River	Jay	6/12/2007	44.481667	70.203889	Riverine
ME586-0901	Androscoggin River	Mexico	6/3/2009	44.533056	70.508056	Riverine
NH-01-0601	Pontook Reservoir, Androscoggin River	Dummer	6/12/2006	44.643333	71.226389	Lacustrine
Common Loon (n = 8)						
AND01E2	Androscoggin Lake	Leeds	7/31/2001	44.305556	70.100278	Lacustrine
ANDR02	Androscoggin Lake	Leeds	6/14/2002	44.306389	70.101667	Lacustrine
ANDR04-1	Androscoggin Lake	Leeds	5/20/2004	44.317778	70.098056	Lacustrine
ANDR04-02	Androscoggin Lake	Leeds	7/8/2004	44.305833	70.099722	Lacustrine
POCA02	Pocasset Lake	Wayne	6/24/2002	44.355833	70.056667	Lacustrine
Azisco1	Aziscohos Lake	Lynchtown TWP	6/20/2003	45.051111	71.019444	Lacustrine
AZIS04-1	Aziscohos Lake	Lynchtown TWP	7/12/2004	45.106944	70.996389	Lacustrine
Mooselk1	Mooselookmeguntic Lake	Richardsontown	7/10/2003	44.897222	70.810833	Lacustrine

Table 3. Bald eagle and common loon eggs collected in other watersheds for comparison.

Sample Number	Nest Location	Township	Date of Collection	Coordinates		Habitat Type
				Latitude	Longitude	
Penobscot Watershed - Bald Eagle (n = 19)						
ME089-0201	Debsconeag Deadwater	T1 R9 WELS	7/3/2002	45.760143	68.941684	Riverine
ME089-0202	Debsconeag Deadwater	T1 R9 WELS	7/3/2002	45.760143	68.941684	Riverine
ME095-0401	Penobscot River	Passadumkeag	5/19/2004	45.165214	68.631231	Riverine
ME141-0601	Quakish Lake	T3 Indian Purchase	6/6/2006	45.631649	68.762062	Lacustrine
ME141-0602	Quakish Lake	T3 Indian Purchase	6/6/2006	45.631649	68.762062	Lacustrine
ME141-0701	Quakish Lake	T3 Indian Purchase	6/11/2007	45.631649	68.762062	Lacustrine
ME149-0401	Penobscot River	Chester	6/16/2004	45.385416	68.517201	Riverine
ME149-0701	Penobscot River	Chester	5/4/2007	45.385416	68.517201	Riverine
ME154-0701	Penobscot River	Mattamiscontis	5/4/2007	45.365279	68.545490	Riverine
ME172-0801	Passadumkeag River	Lowell	7/15/2008	45.186842	68.456750	Riverine
ME176-0501	Mattamiscontis Lake	T3 R9 NWP	6/13/2005	45.484729	68.679109	Lacustrine
ME184-0402	Penobscot River	Argyle	5/19/2004	45.109987	68.644896	Riverine
ME186-0601	Gero Island	Chesumcook TWP	6/29/2006	46.092265	69.382544	Lacustrine
ME277-0901	Penobscot River	Old Town	5/6/2009	44.905898	68.639898	Riverine
ME289-0401	Dolby Pond	Millinocket	6/14/2004	45.649233	68.637424	Lacustrine
ME289-0701	Dolby Pond	Millinocket	6/11/2007	45.649233	68.637424	Lacustrine
ME392-0601	Hermon Pond	Hermon	6/5/2006	44.784114	68.948047	Lacustrine
ME439-0401	Pemadumcook Lake	T1 R10 WELS	7/7/2004	45.727074	69.009963	Lacustrine
ME498-0701	Penobscot River	Medway	6/22/2007	45.605785	68.534817	Riverine
Kennebec Watershed - Common Loon (n = 2)						
LongPd1	Long Pond	Belgrade	7/5/2003	44.489444	69.910000	Lacustrine
FLAG04-1	Flagstaff Lake	Dead River TWP	7/10/2004	45.173444	70.246194	Lacustrine

4.3 Analytical Methods. All eagle and loon eggs were analyzed for polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDF), polychlorinated biphenyl (PCB) congeners, organochlorine pesticides, percent moisture, and percent lipids by the Geochemical and Environmental Research Group (GERG) in College Station, Texas. Catalog[1] and sample delivery group (SDG) numbers are listed in Appendix Table A-1.

Polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDF) concentrations were determined using high resolution gas chromatography/high resolution mass spectrometry. The PCDD/F congeners included in the scan were 2,3,7,8-TCDD, 1,2,3,7,8-PentaCDD, 1,2,3,4,7,8-HexaCDD, 1,2,3,6,7,8-HexaCDD, 1,2,3,7,8,9-HexaCDD, 1,2,3,6,7,8-HeptaCDD, OctaCDD, 2,3,7,8-TCDF, 1,2,3,7,8-PentaCDF, 2,3,4,7,8-PentaCDF, 1,2,3,4,7,8-HexaCDF, 1,2,3,6,7,8-HexaCDF, 1,2,3,7,8,9-HexaCDF, 2,3,4,6,7,8-HexaCDF, 1,2,3,4,6,7,8-HeptaCDF, 1,2,3,4,7,8,9-HeptaCDF, and OctaCDF. The TCDD method detection limit was 1 pg/g, wet weight. The method detection limit for other PCDDs and PCDFs was 10 pg/g, wet weight.

PCB congeners and other organochlorine compounds were quantified using capillary gas chromatography with electron capture detector or capillary gas chromatography with a mass spectrometer detector. The PCB congener scan measured *non-ortho* and *mono-ortho* dioxin-like congeners including PCB #77, PCB #81, PCB #126, PCB #169, PCB #105, PCB #114, PCB #118, PCB #123, PCB #156, PCB #157, PCB #167, and PCB #189. Toxic equivalency factors were applied to the dioxin-like congeners and summed with PCDD/F congeners to derive the TCDD-TEQ (Van den Berg *et al*. 1998). The PCB congener method detection limit was 10 pg/g, wet weight.

The organochlorine (OC) scan included analysis of total polychlorinated biphenyl (PCB), benzene hexachloride (*alpha* BHC, *beta* BHC, *gamma* BHC, *delta* BHC; also known as hexachlorocyclohexane, HCH), chlordane compounds (heptachlor, heptachlor epoxide, *alpha* chlordane, *gamma* chlordane, *cis*-nonachlor, *trans*-nonachlor, oxychlordane), DDT metabolites and isomers (*o*,*p*'-DDD, *o*,*p*'-DDE, *o*,*p*'-DDT, *p*,*p*'-DDD, *p*,*p*'-DDE, *p*,*p*'-DDT), aldrin, endrin, dieldrin, hexachlorobenzene (HCB), endosulfan II, mirex, pentachloro-anisole and toxaphene. The method detection limit for organochlorine compounds, other than toxaphene and ΣPCB, was 10 ng/g, wet weight. The toxaphene and ΣPCB method detection limit was 50 ng/g, wet weight.

4.4 Quality Assurance/Quality Control (QA/QC). QA/QC procedures as specified by the USFWS Analytical Control Facility contract were adopted (USFWS 2007). These procedures included the use of duplicates, spikes, laboratory blanks, and certified reference material. All analytical catalogs were reviewed and approved by the USFWS Analytical Control Facility.

[1] Note: Compared to earlier and later catalogs, highly elevated organochlorine levels were reported in Catalog 5100009. A subsample of common loon eggs from Catalog 5100009 were re-analyzed in Catalog 5100028 (See Appendix Table A-1). There was no apparent differences in organochlorine levels between the two analyses.

4.5 Data presentations and statistical analyses. Analytical results in the text and tables of this report are presented in pg/g (picograms per gram or parts per trillion) for 2,3,7,8-TCDD and TCDD-TEQ, in µg/g (micrograms per gram or parts per million) for ΣPCB and p,p'-DDE, and in ng/g (nanograms per gram or parts per billion) for other organochlorine compounds. All egg data are expressed on a fresh wet weight basis. Laboratory-reported wet weight contaminant concentrations were adjusted to fresh wet weight to account for moisture loss after egg laying (Stickel *et al*. 1973). A non-parametric test (Mann-Whitney U Test) was used for bald eagle eggs to determine significant differences in contaminant concentrations or egg metrics between the Androscoggin and Penobscot watersheds. The acceptable level of significance was 0.05. Too few common loon eggs were collected from the Androscoggin and Kennebec watersheds to allow for statistical comparisons.

5. Results

Thirty-three bald eagle eggs and ten common loon eggs were collected for the investigation between 2001 and 2009. Six eggs (two eagle, four loon) were collected from Androscoggin Lake, 16 eggs (twelve eagle, four loon) from the Androscoggin River watershed, two from the Kennebec River watershed (both loon), and 19 (all eagle) from the Penobscot River watershed (Tables 2 and 3). Analytical results and summaries are listed in Tables 6, 7, 8, and 9. Organochlorine analytical results by sample number are listed in Appendix Tables A-2 thru A-5.

5.1 Egg Metrics, Percent Moisture, and Percent Lipid. Egg metrics, percent moisture, and percent lipids are listed in Table 4 for eagle eggs and Table 5 for loon eggs. In bald eagle eggs, with the exception of percent lipids, there were no significant differences in egg dimensions, eggshell characteristics, or percent moisture. Percent lipid was significantly higher in bald eagle eggs from the Androscoggin watershed, but these numbers were influenced by six eggs with late term embryos.

5.2 Dioxin (2,3,7,8-Tetrachlorodibenzo-*p*-dioxin; TCDD). TCDD was detected in two Androscoggin watershed eagle egg samples – an egg from Androscoggin Lake (7.8 pg/g) and an egg from Gulf Island Pond (9.3 pg/g) (Table 6). TCDD was below detection limits in all bald eagle egg samples from the Penobscot watershed (Table 6).

Two common loon eggs – one from Aziscohos Lake (5.1 pg/g) in the Androscoggin watershed and one from Long Pond (1.9 pg/g) in the Kennebec watershed – had detectable levels of TCDD (Table 7).

5.3 Dioxin Toxic Equivalents (TCDD-TEQs). TCDD-TEQs varied widely among bald eagle and common loon egg samples from all watersheds. There was no significant difference in TCDD-TEQ concentrations in bald eagle eggs collected from the Androscoggin (mean 209 ± 83 pg/g, range: 98 - 319) and Penobscot (mean 273 ± 281 pg/g, range: 45 – 1145 pg/g) watersheds. In the Androscoggin watershed, the dominant contributors to the TCDD-TEQ in bald eagle eggs were PCB #126 in 11 eggs and PCB #77 in three eggs (Appendix Table A-2a and b). In the

Penobscot watershed, the dominant contributors to the TCDD-TEQ in bald eagle eggs were PCB #126 in 12 eggs, PCB #81 in four eggs, 1,2,3,7,8-PeCDF in two eggs, and 2,3,4,7,8-PeCDF in one egg (Appendix Table A-2c through e).

No pattern was evident in TCDD-TEQ concentrations among ten common loon eggs (range: 11 – 388 pg/g) collected from two watersheds (Table 7). In the Androscoggin watershed, the dominant contributors to the TCDD-TEQ in common loon eggs were PCB #126 in five eggs, PCB #81 in two eggs, and PCB #77 in one egg (Appendix Table A-3). In the Kennebec watershed, the dominant contributors to the TCDD-TEQ in loon eggs was PCB #126 in one egg and PCB #81 in one egg (Appendix Table A-3).

5.4 Total Polychlorinated Biphenyl (ΣPCB). There was no significant difference in ΣPCB concentrations in bald eagle eggs collected from the Androscoggin (mean 4.89 ± 3.80 µg/g, range: 0.16 – 13.42 µg/g) and Penobscot watersheds (mean 3.01 ± 1.11 µg/g, range: 1.18 – 4.88 µg/g) (Table 6). The highest PCB concentration among bald eagle egg samples was recorded at Androscoggin Lake in 2003 (13.42 µg/g), but an egg collected from the same nest in 2007 contained only 3.21 µg/g.

No pattern was evident in ΣPCB concentrations among ten common loon eggs collected from two watersheds (mean 1.26 ± 0.63 µg/g) (Table 7). Among the ten common loon eggs analyzed, the highest (2.38 µg/g) and lowest ΣPCB (0.48 µg/g) concentrations were found in two different lakes from the reference watershed, the Kennebec.

5.5 Dichlorodiphenyldichloroethylene (p,p'-DDE). Significantly higher p,p'-DDE levels were found in bald eagle eggs from the Androscoggin watershed (mean 1.15 ± 0.85 µg/g, range: 0.01 – 3.42 µg/g) versus the Penobscot (mean 0.71 ± 0.34 µg/g, range: 0.31 – 1.64 µg/g) watershed (Table 6).

Among the ten common loon eggs analyzed for the investigation (mean 0.29 ± 0.27 µg/g), the highest (1.04 µg/g) and lowest p,p'-DDE (0.07 µg/g) concentrations were found in two different lakes from the reference watershed, the Kennebec (Table 7).

5.6 Other organochlorine compounds.

Table 8 (eagle) and Table 9 (loon) summarize concentrations in ng/g (parts per billion) fresh wet weight of other organochlorine compounds in eggs.

Benzene hexachloride (BHC), also known as hexachlorocyclohexane, was sporadically detected at low concentrations (i.e., < 5 ng/g) in bald eagle and common loon eggs.

Among seven chlordane compounds, alpha chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane were detected in all bald eagle egg samples. Alpha chlordane was significantly higher in eagle eggs from the Androscoggin watershed than the Penobscot. There was no

significant difference in levels of cis-nonachlor, trans-nonachlor or oxychlordane in eagle eggs between the two watersheds. Heptachlor was only detected in three eagle eggs from the Androscoggin and Penobscot watersheds (max. 2.4 ng/g). All 19 eagle eggs from the Penobscot watershed contained heptachlor epoxide (range: 1.2 4.4 ng/g), while 10 of 14 eggs from the Androscoggin contained the compound (range: 0.8 – 5.3 ng/g). Alpha chlordane was detected in all four eggs from Androscoggin Lake (max. 1.3 ng/g) and in two of four eggs from other lakes in the Androscoggin watershed (max. 1.3 ng/g, Aziscohos Lake). Neither loon egg from the Kennebec watershed had detectable levels of alpha chlordane. Gamma chlordane was below detection in all loon eggs. Cis-nonachlor (max. 13.7 ng/g), trans-nonachlor (max. 43.7 ng/g), and oxychlordane (max. 20.5 ng/g) were detected in all loon eggs with the highest concentrations occurring in the egg from Long Pond in the Kennebec watershed. Heptachlor was detected in only one loon egg in the Androscoggin watershed (1.1 ng/g, Pocasset Lake). Heptachlor epoxide was detected in all loon eggs with the highest concentration occurring in the Kennebec watershed (max. 6.6 ng/g, Long Pond).

Aldrin and endrin were detected sporadically and at low concentrations (i.e., < 8 ng/g) in one-third of all bald eagle eggs. Aldrin was below detection limits in all common loon eggs. Endrin was detected in four of 10 common loon eggs. The maximum endrin concentration in a loon egg was 6.9 ng/g from Long Pond in the Kennebec watershed.

Dieldrin was detected in all bald eagle eggs, but there was no significant difference in concentrations between the Androscoggin (mean 17.4 ± 13.2 ng/g) and Penobscot (mean 13.0 ± 4.4 ng/g) watersheds. Dieldrin was detected in all common loon eggs from Androscoggin Lake (mean 5.2 ± 1.1 ng/g), other sites in the Androscoggin watershed (mean 9.0 ± 7.1 ng/g), and the Kennebec watershed (mean 13.3 ng/g).

Endosulfan II was detected in three of 14 eagle eggs (range: 1.8 – 4.1 ng/g) from the Androscoggin watershed and in 10 of 19 eagle eggs (range: 0.5 – 14.8 ng/g) from the Penobscot watershed. Endosulfan II was detected in one loon egg from Androscoggin Lake (1.3 ng/g) and two eggs from other sites in the Androscoggin watershed (0.6 ng/g Aziscohos Lake, 3.5 ng/g Pocasset Lake). Neither loon egg from the Kennebec watershed contained detectable levels of endosulfan II.

Hexachlorobenzene (HCB) was detected in all bald eagle eggs, but there was no significant difference in concentrations between the Androscoggin (mean 4.4 ± 2.5 ng/g) and Penobscot (mean 2.8 ± 0.8 ng/g) watersheds. HCB was detected in all but one of the ten common loon eggs. A loon egg from Aziscohos Lake had the highest HCB concentration, 6.6 ng/g.

Mirex was detected in all bald eagle eggs, but there was no significant difference in concentrations between the Androscoggin (mean 6.5 ± 5.0 ng/g) and Penobscot (mean 9.2 ± 6.1 ng/g) watersheds. Eight of ten common loon eggs contained mirex. The loon egg collected from Long Pond in the Kennebec watershed exhibited the highest mirex level (8.2 ng/g).

Pentachloro-anisole was detected in six of 14 bald eagle eggs from the Androscoggin watershed (max. 18.0 ng/g) and in 14 of 19 eggs from the Penobscot watershed (max. 1.2 ng/g). Pentachloro-anisole was detected in four of 10 common loon eggs. The highest pentachloro-anisole concentration occurred in a loon egg from Androscoggin Lake (1.3 ng/g).

Toxaphene was below sample detection limits in 25 bald eagle eggs (Note: Toxaphene was not analyzed in eight eagle eggs) and in all ten common loon eggs.

Table 4. Bald eagle egg metrics, percent moisture and percent lipids

Metric	Unit	All Eggs (Both Watersheds) n = 33		Androscoggin Watershed n = 14		Penobscot Watershed n = 19		Significant Difference Between Watersheds?
		Mean ± Standard Deviation	Range	Mean ± Standard Deviation	Range	Mean ± Standard Deviation	Range	($p < 0.05$)
Total Egg Weight	(g)	113.4 ± 13.8	86.0 — 139.8	116.1 ± 14.4	86.0 — 139.8	111.4 ± 13.4	86.0 — 135.3	No
Egg Length	(mm)	74.0 ± 3.4	68.7 — 86.2	74.8 ± 4.4	68.7 — 86.2	73.4 ± 2.5	68.8 — 78.3	No
Mean Egg Breadth	(mm)	56.6 ± 1.8	53.2 — 60.5	56.9 ± 2.0	53.6 — 60.5	56.4 ± 1.6	53.2 — 58.7	No
Egg Content Weight	(g)	97.1 ± 13.0	67.8 — 122.3	100.1 ± 12.6	76.6 — 122.3	95.0 ± 13.2	67.8 — 117.5	No
Calculated Egg Volume	(ml)	121.1 ± 10.6	104.1 — 140.6	123.6 ± 12.4	104.1 — 140.6	119.3 ± 9.0	104.2 — 132.2	No
Eggshell Thickness	(mm)	0.548 ± 0.042	0.465 — 0.647	0.534 ± 0.041	0.465 — 0.622	0.558 ± 0.040	0.494 — 0.647	No
Eggshell Weight	(g)	12.9 ± 1.4	10.4 — 15.6	12.8 ± 1.7	10.4 — 15.6	13.0 ± 1.0	11.2 — 14.9	No
Ratcliffe Index		3.07 ± 0.22	2.69 — 3.52	3.00 ± 0.26	2.69 — 3.49	3.13 ± 0.17	2.79 — 3.52	No
Percent Moisture	(%)	82.5 ± 2.7	70.5 — 86.2	82.0 ± 3.7	70.5 — 86.2	82.8 ± 1.6	80.5 — 85.7	No
Percent Lipid	(%)	6.5 ± 6.5	1.6 — 26.8	9.9 ± 7.8	1.6 — 26.8	3.9 ± 3.7	1.6 — 18.3	**Yes**

Significant difference determined with the Mann-Whitney U Test.

Table 5. Common loon egg metrics, percent moisture and percent lipids.

Sample No.	Total Egg Weight (g)	Length (mm)	Mean Breadth (mm)	Egg Content Weight (g)	Calculated Egg Volume (ml)	Percent Moisture (%)	Percent Lipid (%)
Androscoggin Lake (n = 4)							
AND01E2	130.7	95.2	61.1	102.0	181.3	75.5	7.9
ANDR02	190.4	96.8	60.9	162.0	183.1	79.8	7.4
ANDR04-1	184.3	93.0	58.7	158.2	163.2	76.8	6.0
ANDR04-2	82.3	96.8	61.9	58.9	188.9	60.3	9.7
Mean	146.9	95.5	60.6	120.3	179.1	73.1	7.8
Standard Deviation	50.7	1.8	1.4	49.3	11.1	8.7	1.5
Androscoggin Watershed (n = 4)							
POCA02	183.3	93.4	60.2	144.0	172.6	77.9	6.0
Azisco1	143.0	89.9	54.6	119.0	136.7	78.2	8.0
Azisc04-1	145.6	90.1	57.1	122.0	149.6	76.2	5.9
Mooselk1	172.0	94.7	60.0	156.0	173.9	75.8	7.5
Mean	161.0	92.0	58.0	135.3	158.2	77.0	6.9
Standard Deviation	19.8	2.4	2.7	17.8	18.2	1.2	1.1
Kennebec Watershed (n = 2)							
LongPd1	151.0	91.2	56.5	133.0	148.5	76.5	9.2
FLAG04-1	160.5	88.7	59.6	133.8	160.7	76.3	6.1
Mean	155.8	90.0	58.1	133.4	154.6	76.4	7.7

Table 6. TCDD, TCDD-TEQ, ΣPCB, and DDE in bald eagle eggs from the Androscoggin and Penobscot watersheds

Nest No.	Location	Habitat	Year	2,3,7,8-TCDD pg/g	TCDD-TEQ pg/g	ΣPCB µg/g	p,p'-DDE µg/g
Androscoggin Watershed							
ME002-0301	Androscoggin Lake, Leeds	Lacustrine	2003	7.8	215	13.42	3.42
ME002-0701	Androscoggin Lake, Leeds	Lacustrine	2007	<9.71	213	3.21	0.70
ME252-0501	Richardson Lake, Richardsontown Twp	Lacustrine	2005	<5.71	292	6.67	0.97
ME274-0201	Androscoggin River, Greene	Riverine	2002	9.3	184	12.87	2.40
ME365-0801	Pond in the River, Township C	Lacustrine	2008	<16.30	98	3.53	0.67
ME407-0701	Sabattus Pond, Greene	Lacustrine	2007	<9.43	313	3.79	1.27
ME407-0801	Sabattus Pond, Greene	Lacustrine	2008	<9.52	231	2.78	0.99
ME407-0802	Sabattus Pond, Greene	Lacustrine	2008	<9.61	221	2.57	1.01
ME412-0501	Androscoggin River, Jay	Riverine	2005	<8.18	98	3.23	0.52
ME412-0502	Androscoggin River, Jay	Riverine	2005	<7.50	105	3.92	0.59
ME412-0701	Androscoggin River, Jay	Riverine	2007	<9.26	318	4.69	1.24
ME412-0702	Androscoggin River, Jay	Riverine	2007	<9.71	319	5.25	1.36
ME586-0901	Androscoggin River, Mexico	Riverine	2009	<9.90	212	2.35	1.01
NH-01-0601	Androscoggin River, Pontook Reservoir	Lacustrine	2006	<9.90	103	0.16	0.01
n = 14			Mean	NC	209	4.89	1.15
			Standard Deviation		83	3.80	0.85

pg/g = parts-per-trillion, µg/g = parts-per-million
NC = not calculated. Value in red preceded by < symbol indicates non-detect and detection limit

Table 6 (continued). TCDD, TCDD-TEQ, ΣPCB, and DDE in bald eagle eggs from the Androscoggin and Penobscot watersheds

Nest No.	Location	Habitat	Year	2,3,7,8-TCDD pg/g	TCDD-TEQ pg/g	ΣPCB µg/g	p,p'-DDE µg/g
Penobscot Watershed							
ME089-0201	Debsconeag Deadwater, T1 R9 WELS	Riverine	2002	<1.81	62	1.28	0.36
ME089-0202	Debsconeag Deadwater, T1 R9 WELS	Riverine	2002	<1.88	48	1.21	0.33
ME095-0401	Penobscot River, Passadumkeag	Riverine	2004	<4.78	547	3.23	0.60
ME141-0601	Quakish Lake, T3 Indian Purchase	Lacustrine	2006	<9.71	45	1.18	0.68
ME141-0602	Quakish Lake, T3 Indian Purchase	Lacustrine	2006	<9.80	50	1.48	0.86
ME141-0701	Quakish Lake, T3 Indian Purchase	Lacustrine	2007	<7.92	72	2.60	0.86
ME149-0401	Penobscot River, Chester	Riverine	2004	<4.93	671	2.90	0.53
ME149-0701	Penobscot River, Chester	Riverine	2007	<15.90	219	4.31	0.70
ME154-0701	Penobscot River, Mattamiscontis	Riverine	2007	<10.50	196	4.88	0.91
ME172-0801	Passadumkeag River, Lowell	Riverine	2008	<9.35	335	3.84	0.57
ME176-0501	Mattamiscontis Lake, T3 R9 NWP	Lacustrine	2005	<8.77	92	3.34	0.46
ME184-0402	Penobscot River, Argyle	Riverine	2004	<4.85	404	2.82	0.31
ME186-0601	Gero Island, Chesuncook TWP	Lacustrine	2006	<9.26	155	2.87	1.64
ME277-0901	Penobscot River, Old Town	Riverine	2009	<9.17	234	2.83	0.80
ME289-0401	Dolby Pond, Millinocket	Lacustrine	2004	<4.88	1145	4.21	1.37
ME289-0701	Dolby Pond, Millinocket	Lacustrine	2007	<3.60	144	4.23	0.58
ME392-0601	Hermon Pond, Hermon	Lacustrine	2006	<9.71	69	2.92	0.52
ME439-0401	Pemadumcook Lake, T1 R10 WELS	Lacustrine	2004	<5.08	492	3.02	1.00
ME498-0701	Penobscot River, Medway	Riverine	2007	<3.92	211	4.01	0.50
n = 19			Mean	BDL	273	3.01	0.71
			Standard Deviation		281	1.11	0.34

pg/g = parts-per-trillion, µg/g = parts-per-million
BDL = below detection limit. Value in red preceded by < symbol indicates non-detect and detection limit

Table 7. TCDD, TCDD-TEQ, ΣPCB, and DDE in common loon eggs from the Androscoggin and Kennebec watersheds

Sample No.	Location	Year	2,3,7,8-TCDD pg/g	TCDD-TEQ pg/g	ΣPCB µg/g	p,p'-DDE µg/g
Androscoggin Lake						
AND01E2	Androscoggin Lake	2001	< 1.46	35	0.82	0.19
ANDR02	Androscoggin Lake	2002	< 1.77	47	1.15	0.29
ANDR04-1	Androscoggin Lake	2004	< 4.57	388	1.75	0.33
ANDR04-02	Androscoggin Lake	2004	< 20.00	16	0.98	0.18
Androscoggin Watershed						
POCA02	Pocasset Lake	2002	< 1.87	37	0.76	0.23
Azisco1	Aziscohos Lake	2003	5.1	45	1.73	0.19
AZIS04-1	Aziscohos Lake	2004	< 5.43	346	1.88	0.20
Mooselk1	Mooselookmeguntic Lake	2003	< 1.72	11	0.65	0.14
Kennebec Watershed						
LongPd1	Long Pond	2003	1.9	115	2.38	1.04
FLAG04-1	Flagstaff Lake	2004	< 5.00	103	0.48	0.07
Mean (All samples combined)				114	1.26	0.29
Standard Deviation				138	0.63	0.27

pg/g = parts-per-trillion, µg/g = parts-per-million
Value in red preceded by < symbol indicates non-detect and detection limit

6. Discussion

6.1 Bald Eagle. One pair of bald eagles currently nests on Lothrop Island at the southern end of Androscoggin Lake. Bald eagles regularly nested on the lake between 1968 and 1972, but the territory went vacant for 17 years (Table 1). From 1990 to 2000, the Lothrop Island eagles fledged 13 eaglets over an 11 year span for a productivity rate of 1.18. During the study period (2001 - 2009), nest success was lower and only seven eaglets were produced at the territory over the nine-year period for a productivity rate of 0.88.

Dioxin or 2,3,7,8-TCDD was above detection limits in only two eagle eggs – one from Androscoggin Lake (7.8 pg/g) and one from Gulf Island Pond (9.3 pg/g) in the Androscoggin River. TCDD-TEQ levels in bald eagle eggs were not significantly different between the Androscoggin and Penobscot watersheds. Mean concentrations of TCDD-TEQ in bald eagle eggs from the Androscoggin watershed (209 pg/g) and Penobscot watershed (273 pg/g) were below the no-observable-adverse-effect level, NOAEL, for hatching in bald eagles (303 pg/g, Elliott and Harris 2002, Henny and Elliott 2007). However, three of 14 bald eagle eggs from the Androscoggin and six of 19 eggs from the Penobscot watershed contained TCDD-TEQ concentrations above the suggested NOAEL of 303 pg/g.

ΣPCB concentrations between 8 and 25 µg/g have been associated with decreased hatching success in terns, cormorants, and eagles (Hoffman *et al*. 1996). Henny and Elliott (2007) suggested a toxicity threshold value based on reduced probability of producing young of 20 µg/g for ΣPCB in bald eagles. None of the bald eagle eggs from the Androscoggin or Penobscot watersheds contained ΣPCB approaching 20 µg/g, but two eggs from the Androscoggin drainage had levels that exceeded 10 µg/g and could be considered elevated. There was no significant difference in ΣPCB concentrations in bald eagle eggs collected from the Androscoggin (mean 4.89 ± 3.80 µg/g) and Penobscot watersheds (mean 3.01 ± 1.11 µg/g).

Mean p,p'-DDE in bald eagle eggs from the Androscoggin watershed (1.15 µg/g) and Penobscot watershed (0.71 µg/g) were well below the 3.6 µg/g threshold associated with eggshell thinning suggested by Wiemeyer *et al*. (1993) and the 5.5 µg/g threshold value associated with embryo lethality suggested by Henny and Elliott (2007). Significantly higher p,p'-DDE levels were found in bald eagle eggs from the Androscoggin watershed (mean 1.15 ± 0.85 µg/g) versus the Penobscot (mean 0.71 ± 0.34 µg/g) watershed, but the difference is likely not biologically relevant.

Levels of other organochlorine compounds including benzene hexachloride, chlordane compounds, cyclodiene pesticides, and other compounds were below detection limits or found only in the low ng/g range in bald eagle eggs from the Androscoggin and Penobscot watersheds. Typically, adverse effects of these compounds to eggs of raptors and other bird species occur in the µg/g range (Peakall 1996, Wiemeyer 1996, Blus 2003).

6.2 Common Loon. Androscoggin Lake supports up to six pairs of common loons. Androscoggin

Lake is annually surveyed for common loons by volunteers as part of the Maine Audubon Society Loon Project (Maine Audubon 2009). The index count of common loons is conducted on the 3rd Saturday of July. As many as 39 adult birds have been observed on the lake during the annual count, but chick observations are typically less than five.

Two common loon eggs – one from Aziscohos Lake (5.1 pg/g) in the Androscoggin watershed and one from Long Pond (1.9 pg/g) in the Kennebec watershed – had detectable levels of 2,3,7,8-TCDD.

No pattern was evident in TCDD-TEQ concentrations among ten common loon eggs (range: 11 – 388 pg/g) collected from Androscoggin and Kennebec. A TCDD-TEQ toxicity threshold for common loon eggs has not been proposed. Two of the ten loon eggs, however, had TCDD-TEQ levels that exceeded suggested toxicity thresholds for bald eagles (303 pg/g, Elliott and Harris 2002) and osprey (136 pg/g, Woodford *et al*. 1998).

No pattern was evident in ΣPCB concentrations among ten common loon eggs collected from the Androscoggin and Kennebec watersheds (mean 1.26 ± 0.63 µg/g). Among the ten common loon eggs analyzed, the highest (2.38 µg/g) and lowest ΣPCB (0.48 µg/g) concentrations were found in two different lakes in the Kennebec watershed. A ΣPCB toxicity threshold for common loon eggs has not been proposed. As noted earlier, ΣPCB concentrations between 8 and 25 µg/g have been associated with decreased hatching success in terns, cormorants, and eagles (Hoffman *et al*. 1996). ΣPCB concentrations in ten common loon eggs from Maine were below the decreased hatching success range listed by Hoffman *et al*. (1996).

Among the ten common loon eggs analyzed for p,p'-DDE (mean 0.29 ± 0.27 µg/g), the highest (1.04 µg/g) and lowest (0.07 µg/g) concentrations were found in two different lakes in the Kennebec watershed. These common loon egg DDE levels were quite low compared to the suggested threshold levels for sensitive species (3.0 µg/g in brown pelican, Blus 2011).

Like the bald eagle eggs collected for this investigation, levels of other organochlorine compounds including benzene hexachloride, chlordane compounds, cyclodiene pesticides, and other compounds were below detection limits or found only in the low ng/g range in common loon eggs from the Androscoggin and Kennebec watersheds.

6.3 Overall Assessment. Statistically significant higher concentrations of some organochlorine compounds were detected in bald eagle eggs from the Androscoggin versus the Penobscot watersheds. However, mean organochlorine levels in bald eagle eggs did not exceed suggested toxicity threshold levels.

Eagle eggs from certain nest territories in both watersheds contained elevated organochlorine levels, but these levels were inconsistent between different years and for different compounds. For example, ΣPCB in an egg from eagle territory ME002 in Androscoggin Lake was elevated in 2003 (13.42 µg/g), but ΣPCB in an egg collected from the same nest in 2007 was lower (3.21

µg/g). In contrast, TCDD-TEQ levels in eggs collected from eagle territory ME002 in 2003 (215 pg/g) and 2007 (213 pg/g) were essentially identical.

Similarly, interpretation of organochlorine analytical results in common loon eggs are hampered by the small sample size (n = 10) and variability of concentrations within and among areas. Three of four loon eggs from Androscoggin Lake had low TCDD-TEQ levels (< 50 pg/g), but one had a concentration of 388 pg/g. Two loon eggs from Aziscohos Lake had TCDD-TEQ concentrations of 45 and 346 pg/g.

Previous investigations have reported elevated levels of mercury, and to a lesser extent, PCB in Androscoggin Lake biota (Evers and Lane 2004. Note: USFWS shared its Androscoggin Lake PCB avian egg data from 2001 to 2003 with the authors).

In a 2008 report by state toxicologists (Smith and Frohmberg 2008), levels of dioxins and furans in the Androscoggin River and Androscoggin Lake remained at or above the state fish tissue action level (FTAL) of 0.4 pg/g at virtually all sampling locations for sport fish, and exceeded the FTAL when coplanar PCBs were added. White suckers remained above the cancer FTAL of 1.5 pg/g for most locations on the Androscoggin River. Levels of dioxins in furans also remained above the 0.4 pg/g FTAL in white perch collected from Androscoggin Lake, and exceeded this level in both perch and smallmouth bass when coplanar PCBs are included.

Table 8. Organochlorine compounds in bald eagle eggs, ng/g fresh wet weight

	Androscoggin Watershed (n = 14)			Penobscot Watershed (n = 19)			Significant Difference Between Watersheds? (p < 0.05)
	No. of Detections	Mean ± Std Dev	Range	No. of Detections	Mean ± Std Dev	Range	
PCB-TOTAL	14	4889.2 ± 3801.0	158.6 — 13419.6	19	3007.3 ± 1108.0	1181.9 — 4876.3	No
alpha BHC	2		0.4 — 2.4	6		0.2 — 3.9	
beta BHC	3		0.3 — 1.2	5		0.2 — 1.1	
gamma BHC	4		1.2 — 2.6	2		0.5 — 1.1	
delta BHC	1		0.7	0			
alpha chlordane	14	4.8 ± 3.1	1.6 — 11.1	19	2.5 ± 1.4	0.5 — 6.3	**Yes**
gamma chlordane	7		0.3 — 11.2	14		0.3 — 5.3	
cis-nonachlor	14	15.7 ± 11.7	0.1 — 48.7	19	12.2 ± 7.0	4.2 — 26.6	No
trans-nonachlor	14	50.0 ± 35.9	1.0 — 151.1	19	37.4 ± 15.8	14.8 — 73.3	No
oxychlordane	14	14.8 ± 10.1	1.1 — 40.1	19	12.8 ± 6.1	6.3 — 27.4	No
heptachlor	3		0.3 — 2.3	3		0.2 — 2.4	
heptachlor epoxide	10		0.8 — 5.3	19	1.9 ± 0.9	1.2 — 4.4	
o,p'-DDD	14	12.4 ± 10.4	0.3 — 38.7	19	7.6 ± 4.4	1.7 — 16.8	No
o,p'-DDE	6		0.2 — 1.6	9		0.2 — 3.6	
o,p'-DDT	13		0.7 — 47.5	19	7.7 ± 4.8	1.0 — 17.4	
p,p'-DDD	14	54.9 ± 27.4	0.9 — 106.3	19	29.2 ± 14.1	9.0 — 65.6	**Yes**
p,p'-DDE	14	1154.1 ± 845.8	10.5 — 3418.2	19	716.1 ± 343.5	312.0 — 1642.3	**Yes**
p,p'-DDT	9		0.7 — 9.2	11		1.0 — 13.1	
aldrin	1		2.9	3		0.7 — 1.4	
endrin	3		1.7 — 11.3	4		0.5 — 8.4	
dieldrin	14	17.4 ± 13.2	0.1 — 51.8	19	13.0 ± 4.4	7.6 — 24.8	No
endosulfan II	3		1.8 — 4.1	10		0.5 — 14.8	
HCB	14	4.4 ± 2.5	0.5 — 8.7	19	2.8 ± 0.8	1.5 — 5.1	No
mirex	14	6.5 ± 5.0	0.1 — 15.5	19	9.2 ± 6.1	1.9 — 23.8	No
pentachloro-anisole	6		0.6 — 18.0	14		0.5 — 1.2	
toxaphene	0			0			

Significant difference determined with Mann-Whitney U Test
Significant difference was only determined for compounds that were detected in all egg samples.

Table 9. Other organochlorine compounds in common loon eggs, ng/g fresh wet weight

	Androscoggin Lake (n = 4)			Androscoggin Watershed (n = 4)			Kennebec Watershed (n =2)		
	No. of Detections	Mean ± StdDev	Range	No. of Detections	Mean ± StdDev	Range	No. of Detections	Mean	Range
PCB-TOTAL	4	1155.6 ± 425.5	748.8 — 1746.0	4	1261.8 ± 637.3	647.6 — 1885.0	2	1433.7	484.0 — 2383.4
alpha BHC	2		0.6 — 1.4	0			0		
beta BHC	2		1.2 — 1.9	1		0.5	1		0.4
gamma BHC	1		1.1	0			0		
delta BHC	0			0			0		
alpha chlordane	4	0.8 ± 0.4	0.4 — 1.3	2		1.2 — 1.3	0		
gamma chlordane	0			0			0		
cis-nonachlor	4	4.4 ± 1.6	2.9 — 5.9	4	4.3 ± 1.3	2.5 — 5.4	2	7.7	1.7 — 13.7
trans-nonachlor	4	9.7 ± 3.6	6.4 — 14.0	4	13.2 ± 2.4	11.4 — 16.7	2	25.7	7.8 — 43.7
oxychlordane	4	4.9 ± 2.6	1.8 — 7.2	4	9.5 ± 3.2	6.4 — 12.7	2	13.1	5.6 — 20.5
heptachlor	0			1		1.1	0		
heptachlor epoxide	4	1.4 ± 0.4	0.9 — 1.9	2		1.7 — 2.0	2	4.1	1.7 — 6.6
o,p'-DDD	2		3.4 — 5.6	4	5.2 ± 1.4	3.3 — 6.6	2	9.6	2.1 — 17.1
o,p'-DDE	1		2.0	1		0.5	0		
o,p'-DDT	4	3.0 ± 2.9	1.2 — 7.3	3		2.6 — 8.4	2	6.6	2.0 — 11.1
p,p'-DDD	4	5.0 ± 1.6	3.7 — 7.3	3		4.8 — 13.5	2	5.5	0.8 — 10.3
p,p'-DDE	4	244.0 ± 78.4		4	191.1 ± 36.7	143.5 — 232.7	2	555.9	72.5 — 1039.4
p,p'-DDT	3		0.7 — 1.6	2		1.2 — 4.1	1		7.8
aldrin	0			0			0		
endrin	1		6.6	2		1.2 — 3.1	1		6.9
dieldrin	4	5.2 ± 1.1	3.6 — 6.1	4	9.0 ± 7.1	1.3 — 17.0	2	13.3	3.8 — 22.8
endosulfan II	1		1.3	2		0.6 — 3.5	0		
HCB	4	2.7 ± 0.6	1.9 — 3.2	3		4.3 — 6.6	2	3.8	2.4 — 5.3
mirex	3		1.0 — 1.8	3		2.2 — 5.0	2	4.7	1.3 — 8.2
pentachloro-anisole	1		1.3	2		0.6 — 1.1	1		0.4
toxaphene	0			0			0		

ng/g = parts-per-billion.

7. Summary of Results and Management Action Recommendation

Statistically significant higher concentrations of some organochlorine compounds were detected in bald eagle eggs from the Androscoggin versus the Penobscot watersheds. However, average organochlorine levels in bald eagle eggs did not exceed suggested toxicity threshold levels.

Eagle eggs from certain nest territories in both watersheds contained elevated organochlorine levels, but these levels were inconsistent between different years and for different compounds. For example, ΣPCB in an egg from territory ME002 in Androscoggin Lake was elevated in 2003 (13.42 µg/g), but ΣPCB in an egg collected from the same nest in 2007 was lower (3.21 µg/g). In contrast, TCDD-TEQ levels in eggs collected from territory ME002 in 2003 (214 pg/g) and 2007 (213 pg/g) were essentially identical.

Similarly, interpretation of organochlorine analytical results in common loon eggs are hampered by the small sample size (n = 10) and variability of concentrations within and among areas. Three of four loon eggs from Androscoggin Lake had low TCDD-TEQ levels (< 50 pg/g), but one had a concentration of 388 pg/g. Two loon eggs from Aziscohos Lake had TCDD-TEQ concentrations of 45 and 346 pg/g.

Organochlorine analytical results by species are summarized below:

Bald Eagle

• TCDD was detected in only two of 14 samples from the Androscoggin watershed – an egg from Androscoggin Lake (7.8 pg/g) and an egg from Gulf Island Pond (9.3 pg/g) within the Androscoggin River. TCDD was below sample detection limits in all 19 bald eagle eggs collected from the Penobscot watershed.

• There was no significant difference in TCDD-TEQ concentrations in bald eagle eggs collected from the Androscoggin (mean 209 ± 83 pg/g) and Penobscot (mean 273 ± 281 pg/g) watersheds. Mean concentrations of TCDD-TEQ in bald eagle eggs from the Androscoggin watershed and Penobscot watershed were below the NOAEL for hatching in bald eagles (303 pg/g, Henny and Elliott 2007). Three of 14 bald eagle eggs from the Androscoggin (max. 319 pg/g) and six of 19 eggs from the Penobscot watershed (max. 1145 pg/g), however, contained TCDD-TEQ concentrations above the suggested NOAEL.

• There was no significant difference in ΣPCB concentrations in bald eagle eggs collected from the Androscoggin (mean 4.89 ± 3.80 µg/g) and Penobscot watersheds (mean 3.01 ± 1.11 µg/g). None of the bald eagle eggs from the Androscoggin or Penobscot watersheds contained ΣPCB approaching 20 µg/g (Henny and Elliott 2007), but two eggs from the Androscoggin drainage had levels that exceeded 10 µg/g and could be considered elevated. One of eagle eggs from the Androscoggin drainage with an elevated ΣPCB concentration was collected in Androscoggin

Lake in 2003 (13.42 µg/g), but an egg collected from the same nest territory in 2007 only had a ΣPCB level of 3.21 µg/g.

• Significantly higher p,p'-DDE levels were found in bald eagle eggs from the Androscoggin watershed (mean 1.15 ± 0.85 µg/g) versus the Penobscot (mean 0.71 ± 0.34 µg/g) watershed, but the difference is likely not biologically relevant. DDE in bald eagle eggs from the Androscoggin watershed (max. 3.42 µg/g) and Penobscot watershed (max. 1.64 µg/g) were below the 5.5 µg/g threshold value associated with embryo lethality suggested by Henny and Elliott (2007).

Common Loon

• Two common loon eggs – one from Aziscohos Lake (5.1 pg/g) in the Androscoggin watershed and one from Long Pond (1.9 pg/g) in the Kennebec watershed – had detectable levels of TCDD.

• No pattern was evident in TCDD-TEQ concentrations among ten common loon eggs (range: 11 – 388 pg/g) collected from Androscoggin and Kennebec. Two of the ten loon eggs, however, had TCDD-TEQ levels that exceeded suggested toxicity thresholds for bald eagles (303 pg/g, Elliott and Harris 2002) and osprey (136 pg/g, Woodford *et al*. 1998). A TCDD-TEQ toxicity threshold for common loon eggs has not been established.

• No pattern was evident in ΣPCB concentrations among ten common loon eggs collected from the Androscoggin and Kennebec watersheds (mean 1.26 ± 0.63 µg/g). Among the ten common loon eggs analyzed, the highest (2.38 µg/g) and lowest ΣPCB (0.48 µg/g) concentrations were found in two different lakes in the Kennebec watershed. These loon egg PCB levels were lower than a decreased hatching effect range for other avian species (Hoffman *et al*. 1996).

• Among the ten common loon eggs analyzed for p,p'-DDE (mean 0.29 ± 0.27 µg/g), the highest (1.04 µg/g) and lowest (0.07 µg/g) concentrations were found in two different lakes in the Kennebec watershed. These loon egg DDE levels were low compared to the suggested threshold levels for sensitive species (3.0 µg/g in brown pelican, Blus 2011).

Management Action Recommendation

A long-term monitoring program of the fish-eating birds at Androscoggin Lake for organochlorine compounds is not recommended. State monitoring of legacy organochlorine compounds such as dioxin in fish tissue show a decreasing trend in the Androscoggin River, but dioxin concentrations in fish continue to exceed the state's fish tissue action level (MEDEP 2011). Continuing to analyze opportunistically-acquired eagle and loon eggs from Androscoggin Lake and the Androscoggin watershed for organochlorine compounds is recommended.

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Table A-1. Sample numbers and corresponding catalogs or sample delivery groups

Sample No.	Location	Catalog	
Bald Eagle (n = 33)			
ME274-0201	Androscoggin River, Greene	Catalog 5100001	
ME089-0201	Debsconeag Deadwater, T1 R9 WELS	Catalog 5100003	
ME089-0202	Debsconeag Deadwater, T1 R9 WELS	Catalog 5100003	
ME002-0301	Androscoggin Lake, Leeds	Catalog 5100004	
ME095-0401	Penobscot River, Passadumkeag	Catalog 5100009	
ME149-0401	Penobscot River, Chester	Catalog 5100009	
ME184-0402	Penobscot River, Argyle	Catalog 5100009	
ME289-0401	Dolby Pond, Millinocket	Catalog 5100009	
ME439-0401	Pemadumcook Lake, T1 R10 WELS	Catalog 5100009	
ME176-0501	Mattamiscontis Lake, T3 R9 NWP	Catalog 5100015	
ME252-0501	Richardson Lake, Richardsontown Twp	Catalog 5100015	
ME412-0501	Androscoggin River, Jay	Catalog 5100015	
ME412-0502	Androscoggin River, Jay	Catalog 5100015	
ME141-0601	Quakish Lake, T3 Indian Purchase	Catalog 5100018	
ME141-0602	Quakish Lake, T3 Indian Purchase	Catalog 5100018	
ME186-0601	Gero Island, Chesuncook TWP	Catalog 5100018	
ME392-0601	Hermon Pond, Hermon	Catalog 5100018	
NH-01-0601	Androscoggin River, Pontook Reservoir	Catalog 5100018	
ME289-0701	Dolby Pond, Millinocket	Catalog 5100026	
ME498-0701	Penobscot River, Medway	Catalog 5100026	
ME154-0701	Penobscot River, Mattamiscontis	Catalog 5100029	
ME141-0701	Quakish Lake, T3 Indian Purchase	Catalog 5100035	
ME149-0701	Penobscot River, Chester	Catalog 5100035	
ME365-0801	Pond in the River, Township C	Catalog 5100035	
ME002-0701	Androscoggin Lake, Leeds	GERG SDG K2729	
ME172-0801	Passadumkeag River, Lowell	GERG SDG K2729	
ME277-0901	Penobscot River, Old Town	GERG SDG K2729	
ME407-0701	Sabattus Pond, Greene	GERG SDG K2729	
ME407-0801	Sabattus Pond, Greene	GERG SDG K2729	
ME407-0802	Sabattus Pond, Greene	GERG SDG K2729	
ME412-0701	Androscoggin River, Jay	GERG SDG K2729	
ME412-0702	Androscoggin River, Jay	GERG SDG K2729	
ME586-0901	Androscoggin River, Mexico	GERG SDG K2729	
Common Loon (n = 10)			
AND01E2	Androscoggin Lake	Catalog 5100001	
ANDR02	Androscoggin Lake	Catalog 5100003	
ANDR04-1	Androscoggin Lake	Catalog 5100009	Catalog 5100028
ANDR04-02	Androscoggin Lake	Catalog 5100016	
POCA02	Pocasset Lake	Catalog 5100003	
Azisco1	Aziscohos Lake	Catalog 5100004	
AZIS04-1	Aziscohos Lake	Catalog 5100009	Catalog 5100028
Mooselk1	Mooselookmeguntic Lake	Catalog 5100004	
LongPd1	Long Pond	Catalog 5100004	
FLAG04-1	Flagstaff Lake	Catalog 5100009	Catalog 5100028

GERG = Geochemical and Environmental Research Group. SDG = Sample Delivery Group.

Appendix Table A-2a. TCDD-TEQs in bald eagle eggs by sample number, pg/g fresh wet weight

	TEF	ME002-0301 TEF Adjusted pg/g FWW	ME002-0701 TEF Adjusted pg/g FWW	ME252-0501 TEF Adjusted pg/g FWW	ME274-0201 TEF Adjusted pg/g FWW	ME365-0801 TEF Adjusted pg/g FWW	ME407-0701 TEF Adjusted pg/g FWW	ME407-0801 TEF Adjusted pg/g FWW	ME407-0802 TEF Adjusted pg/g FWW
2,3,7,8-TCDD	1	7.765	BDL	BDL	9.282	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDD	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8-HxCDD	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,6,7,8-HxCDD	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDD	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDD	< 0.001	BDL	BDL	BDL	0.031	BDL	BDL	BDL	BDL
OCDD	0.0001	0.020	0.036	BDL	0.073	BDL	0.004	BDL	BDL
2,3,7,8-TCDF	1	9.959	BDL	BDL	7.168	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDF	0.1	BDL	BDL	BDL	BDL	19.430	BDL	BDL	BDL
2,3,4,7,8-PeCDF	1	31.566	BDL	BDL	13.050	BDL	BDL	BDL	BDL
1,2,3,4,7,8-HxCDF	0.1	BDL	34.162	BDL	BDL	BDL	29.653	26.404	24.674
1,2,3,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	18.335	BDL	BDL
2,3,4,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8,9-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
OCDF	0.0001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-77	0.05	37.094	18.366	118.695	17.783	23.112	76.675	33.671	35.195
PCB-81	0.1	BDL	5.966	37.280	16.174	8.197	17.457	13.941	10.515
PCB-126	0.1	97.060	148.240	113.981	96.495	41.517	159.218	148.386	143.661
PCB-169	0.001	0.103	0.116	0.268	0.092	BDL	0.200	0.156	0.149
PCB-105	0.0001	10.128	2.053	10.198	5.385	2.194	4.581	3.443	2.971
PCB-114	0.0001	BDL	0.156	0.824	BDL	0.313	0.323	0.246	0.218
PCB-118	0.00001	3.781	0.715	1.174	5.091	0.744	1.660	1.231	1.084
PCB-123	0.00001	2.574	0.015	0.147	1.535	0.021	0.027	0.019	0.018
PCB-156	0.0001	14.010	2.478	7.387	11.396	1.943	3.648	3.033	2.355
PCB-157	0.0001	nr	0.369	1.217	na	0.371	0.600	0.475	0.391
PCB-167	0.00001	0.555	0.169	0.459	0.533	0.114	0.200	0.178	0.141
PCB-189	0.00001	0.135	0.015	0.145	0.003	0.033	0.016	0.027	0.010
TCDD-TEQ		**215**	**213**	**292**	**184**	**98**	**313**	**231**	**221**

pg/g = parts per trillion, FWW = fresh wet weight (i.e., adjusted for moisture loss), TEF = toxic equivalency factor (Van den Berg et al. 1998),nr = not reported, BDL = below detection limit

Appendix Table A-2b. TCDD-TEQs in bald eagle eggs by sample number, pg/g fresh wet weight

	TEF	ME412-0501 TEF Adjusted pg/g FWW	ME412-0502 TEF Adjusted pg/g FWW	ME412-0701 TEF Adjusted pg/g FWW	ME412-0702 TEF Adjusted pg/g FWW	ME586-0901 TEF Adjusted pg/g FWW	NH-01-0601 TEF Adjusted pg/g FWW
2,3,7,8-TCDD	1	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDD	1	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8-HxCDD	0.05	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,6,7,8-HxCDD	0.01	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDD	0.1	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDD	< 0.001	BDL	BDL	BDL	BDL	BDL	BDL
OCDD	0.0001	BDL	BDL	BDL	0.033	BDL	BDL
2,3,7,8-TCDF	1	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL
2,3,4,7,8-PeCDF	1	BDL	BDL	29.546	BDL	41.153	BDL
1,2,3,4,7,8-HxCDF	0.1	BDL	BDL	34.594	32.108	22.034	BDL
1,2,3,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	7.284	BDL
2,3,4,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDF	0.01	BDL	BDL	9.404	BDL	BDL	BDL
1,2,3,4,7,8,9-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL
OCDF	0.0001	BDL	BDL	0.002	BDL	BDL	BDL
PCB-77	0.05	41.410	46.170	51.648	53.995	14.388	31.725
PCB-81	0.1	10.414	10.260	11.982	13.405	5.944	7.968
PCB-126	0.1	36.326	38.714	170.614	205.855	115.234	55.044
PCB-169	0.001	0.103	0.115	0.136	0.167	0.087	0.155
PCB-105	0.0001	3.329	3.441	3.610	4.825	2.359	3.173
PCB-114	0.0001	0.268	0.291	0.251	0.343	0.191	0.210
PCB-118	0.00001	1.492	1.607	1.506	2.023	0.947	1.513
PCB-123	0.00001	0.041	0.054	0.024	0.032	0.014	0.025
PCB-156	0.0001	3.387	3.687	3.726	4.845	1.700	2.230
PCB-157	0.0001	0.494	0.531	0.485	0.596	0.315	0.394
PCB-167	0.00001	0.203	0.226	0.200	0.253	0.098	0.162
PCB-189	0.00001	0.075	0.084	0.018	0.024	0.008	0.041
TCDD-TEQ		**98**	**105**	**318**	**319**	**212**	**103**

pg/g = parts per trillion, FWW = fresh wet weight (i.e., adjusted for moisture loss), TEF = toxic equivalency factor (Van den Berg et al. 1998),nr = not reported, BDL = below detection limit

Appendix Table A-2c. TCDD-TEQs in bald eagle eggs by sample number, pg/g fresh wet weight

	TEF	ME089-0201 TEF Adjusted pg/g FWW	ME089-0202 TEF Adjusted pg/g FWW	ME095-0401 TEF Adjusted pg/g FWW	ME141-0601 TEF Adjusted pg/g FWW	ME141-0602 TEF Adjusted pg/g FWW	ME141-0701 TEF Adjusted pg/g FWW	ME149-0401 TEF Adjusted pg/g FWW	ME149-0701 TEF Adjusted pg/g FWW
2,3,7,8-TCDD	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDD	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8-HxCDD	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,6,7,8-HxCDD	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDD	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDD	< 0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
OCDD	0.0001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
		BDL							
2,3,7,8-TCDF	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDF	0.1	BDL	BDL	9.710	BDL	BDL	13.057	9.928	35.515
2,3,4,7,8-PeCDF	1	BDL	BDL	BDL	BDL	BDL	BDL	83.950	113.680
1,2,3,4,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,3,4,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8,9-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
OCDF	0.0001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-77	0.05	11.240	6.780	201.144	13.105	13.892	12.530	121.910	22.893
PCB-81	0.1	17.675	13.225	119.136	3.128	3.493	2.060	335.070	3.975
PCB-126	0.1	29.258	24.775	204.816	25.808	28.747	38.441	55.334	35.907
PCB-169	0.001	0.142	0.118	0.211	0.097	0.097	0.097	0.287	BDL
PCB-105	0.0001	0.752	0.629	3.207	1.270	1.654	2.173	3.643	2.956
PCB-114	0.0001	BDL	BDL	BDL	0.061	0.088	BDL	BDL	0.392
PCB-118	0.00001	0.444	0.413	1.599	0.426	0.618	0.597	1.139	0.770
PCB-123	0.00001	0.074	0.069	0.309	0.009	0.013	0.013	0.594	0.020
PCB-156	0.0001	2.617	2.201	5.459	0.852	1.229	2.052	4.249	2.305
PCB-157	0.0001	nr	nr	0.987	0.191	0.255	0.422	0.986	0.474
PCB-167	0.00001	0.142	0.131	0.295	0.054	0.076	0.138	0.191	0.110
PCB-189	0.00001	0.030	0.029	0.045	0.015	0.019	0.046	0.043	0.029
TCDD-TEQ		**62**	**48**	**547**	**45**	**50**	**72**	**617**	**219**

pg/g = parts per trillion, FWW = fresh wet weight (i.e., adjusted for moisture loss), TEF = toxic equivalency factor (Van den Berg et al. 1998),nr = not reported, BDL = below detection limit

Appendix Table A-2d. TCDD-TEQs in bald eagle eggs by sample number, pg/g fresh wet weight

	TEF	ME154-0701 TEF Adjusted pg/g FWW	ME172-0801 TEF Adjusted pg/g FWW	ME176-0501 TEF Adjusted pg/g FWW	ME184-0402 TEF Adjusted pg/g FWW	ME186-0601 TEF Adjusted pg/g FWW	ME277-0901 TEF Adjusted pg/g FWW	ME289-0401 TEF Adjusted pg/g FWW	ME289-0701 TEF Adjusted pg/g FWW
2,3,7,8-TCDD	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDD	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8-HxCDD	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,6,7,8-HxCDD	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDD	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDD	< 0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
OCDD	0.0001	BDL	BDL	BDL	BDL	BDL	BDL	0.029	0.018
2,3,7,8-TCDF	1	BDL	24.281	BDL	BDL	BDL	BDL	BDL	4.207
1,2,3,7,8-PeCDF	0.1	BDL	BDL	BDL	11.169	BDL	BDL	5.525	47.700
2,3,4,7,8-PeCDF	1	58.670	BDL	BDL	BDL	BDL	BDL	BDL	18.324
1,2,3,4,7,8-HxCDF	0.1	BDL	44.930	BDL	BDL	BDL	41.342	BDL	BDL
1,2,3,6,7,8-HxCDF	0.1	BDL	12.022	BDL	BDL	BDL	14.191	BDL	BDL
2,3,4,6,7,8-HxCDF	0.1	24.254	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8,9-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
OCDF	0.0001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.006
PCB-77	0.05	31.854	77.233	27.391	102.583	52.181	21.164	214.335	27.165
PCB-81	0.1	BDL	11.483	9.116	188.777	23.623	7.419	779.400	5.348
PCB-126	0.1	69.345	156.544	44.376	92.264	69.979	142.508	127.302	35.294
PCB-169	0.001	BDL	0.229	0.142	0.426	0.057	0.159	0.788	0.068
PCB-105	0.0001	4.338	2.795	3.466	2.446	3.042	2.435	5.568	2.339
PCB-114	0.0001	0.531	0.239	0.303	BDL	0.293	0.158	BDL	0.332
PCB-118	0.00001	1.230	1.036	1.806	0.643	2.654	0.734	1.031	0.327
PCB-123	0.00001	0.035	0.023	0.052	0.271	0.065	0.022	1.325	0.018
PCB-156	0.0001	4.372	3.676	4.119	4.504	2.613	2.923	7.041	2.317
PCB-157	0.0001	0.701	0.448	0.625	0.765	0.474	0.346	1.836	0.557
PCB-167	0.00001	0.261	0.324	0.288	0.220	0.213	0.189	0.289	0.174
PCB-189	0.00001	0.069	0.020	0.068	0.043	0.030	0.019	0.065	0.099
TCDD-TEQ		**196**	**335**	**92**	**404**	**155**	**234**	**1145**	**144**

pg/g = parts per trillion, FWW = fresh wet weight (i.e., adjusted for moisture loss), TEF = toxic equivalency factor (Van den Berg et al. 1998),nr = not reported, BDL = below detection limit

Appendix Table A-2e. TCDD-TEQs in bald eagle eggs by sample number, pg/g fresh wet weight

	TEF	ME392-0601 TEF Adjusted pg/g FWW	ME439-0401 TEF Adjusted pg/g FWW	ME498-0701 TEF Adjusted pg/g FWW
2,3,7,8-TCDD	1	BDL	BDL	BDL
1,2,3,7,8-PeCDD	1	BDL	BDL	BDL
1,2,3,4,7,8-HxCDD	0.05	BDL	BDL	BDL
1,2,3,6,7,8-HxCDD	0.01	BDL	BDL	BDL
1,2,3,7,8,9-HxCDD	0.1	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDD	< 0.001	BDL	BDL	BDL
OCDD	0.0001	0.072	BDL	0.017
2,3,7,8-TCDF	1	BDL	BDL	9.339
1,2,3,7,8-PeCDF	0.1	BDL	9.012	84.232
2,3,4,7,8-PeCDF	1	BDL	BDL	39.602
1,2,3,4,7,8-HxCDF	0.1	BDL	1.661	BDL
1,2,3,6,7,8-HxCDF	0.1	BDL	BDL	BDL
2,3,4,6,7,8-HxCDF	0.1	BDL	BDL	BDL
1,2,3,7,8,9-HxCDF	0.1	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDF	0.01	BDL	BDL	BDL
1,2,3,4,7,8,9-HpCDF	0.01	BDL	BDL	BDL
OCDF	0.0001	BDL	BDL	0.004
PCB-77	0.05	23.528	30.039	26.491
PCB-81	0.1	BDL	310.403	7.040
PCB-126	0.1	38.373	129.580	36.189
PCB-169	0.001	0.104	0.654	0.081
PCB-105	0.0001	2.307	2.474	3.305
PCB-114	0.0001	0.185	BDL	0.355
PCB-118	0.00001	1.199	1.037	0.472
PCB-123	0.00001	0.021	0.133	0.021
PCB-156	0.0001	2.870	5.266	3.385
PCB-157	0.0001	0.560	1.119	0.418
PCB-167	0.00001	0.150	0.369	0.202
PCB-189	0.00001	0.037	0.056	0.135
TCDD-TEQ		**69**	**492**	**211**

pg/g = parts per trillion, FWW = fresh wet weight (i.e., adjusted for moisture loss), TEF = toxic equivalency factor (Van den Berg et al. 1998),nr = not reported, BDL = below detection limit

Appendix Table A-3. TCDD-TEQs in common loon eggs by sample number, pg/g fresh wet weight

		AND01E2 TEF Adjusted pg/g FWW	ANDR02 TEF Adjusted pg/g FWW	ANDR04-1 TEF Adjusted pg/g FWW	ANDR04-02 TEF Adjusted pg/g FWW	POCA02 TEF Adjusted pg/g FWW	Azisco1 TEF Adjusted pg/g FWW	AZIS04-1 TEF Adjusted pg/g FWW	Mooselk1 TEF Adjusted pg/g FWW	LongPd1 TEF Adjusted pg/g FWW	FLAG04-1 TEF Adjusted pg/g FWW
2,3,7,8-TCDD	1	BDL	BDL	BDL	BDL	BDL	4.442	BDL	BDL	1.702	BDL
1,2,3,7,8-PeCDD	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	10.035	BDL
1,2,3,4,7,8-HxCDD	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,6,7,8-HxCDD	0.01	BDL	BDL	BDL	BDL	BDL	0.110	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDD	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDD	< 0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
OCDD	0.0001	0.009	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,3,7,8-TCDF	1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8-PeCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,3,4,7,8-PeCDF	1	11.458	13.806	BDL	BDL	BDL	9.929	BDL	BDL	17.203	BDL
1,2,3,4,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,3,4,6,7,8-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,7,8,9-HxCDF	0.1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,6,7,8-HpCDF	0.01	0.063	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2,3,4,7,8,9-HpCDF	0.01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
OCDF	0.0001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
PCB-77	0.05	1.448	3.186	42.971	3.900	BDL	BDL	37.577	8.297	BDL	31.696
PCB-81	0.1	2.895	BDL	251.230	BDL	6.172	BDL	172.176	BDL	BDL	43.566
PCB-126	0.1	18.234	27.878	88.367	10.639	28.273	24.562	126.480	BDL	79.296	25.573
PCB-169	0.001	BDL	0.059	0.226	BDL	0.056	0.176	0.849	BDL	BDL	0.256
PCB-105	0.0001	0.548	0.664	1.513	0.646	1.309	4.059	3.615	0.896	2.688	0.780
PCB-114	0.0001	BDL	BDL	BDL	0.037	BDL	BDL	BDL	BDL	BDL	BDL
PCB-118	0.00001	0.189	0.306	0.527	0.249	0.420	0.793	1.151	0.414	1.514	0.276
PCB-123	0.00001	0.111	0.258	0.331	0.004	0.116	0.066	0.268	0.005	0.097	0.013
PCB-156	0.0001	0.473	0.671	1.688	0.587	0.614	1.132	2.954	0.840	2.204	0.473
PCB-157	0.0001	na	nr	0.703	0.114	nr	nr	0.906	nr	nr	0.271
PCB-167	0.00001	0.034	0.058	0.099	0.036	0.065	0.082	0.150	0.060	0.152	0.041
PCB-189	0.00001	0.002	0.015	0.023	0.011	0.011	0.015	0.024	0.007	0.025	0.004
TCDD-TEQ		**35**	**47**	**388**	16	**37**	45	**346**	11	115	**103**

Appendix Table A-4a. Organochlorine compounds in bald eagle eggs by sample number, ng/g fresh wet weight

	Androscoggin Lake		Androscoggin Watershed											
Sample Number	ME002-0301	ME002-0701	ME252-0501	ME274-0201	ME365-0801	ME407-0401	ME407-0801	ME407-0802	ME412-0501	ME412-0502	ME412-0701	ME412-0702	ME586-0901	NH-01-0601
Polychlorinated Biphenyl														
PCB-TOTAL	13419.6	3209.1	6650.3	12866.0	3529.4	3793.4	2780.8	2570.4	3230.8	3946.7	4690.3	5252.2	2351.3	158.6
Benzene Hexachloride														
alpha BHC	< 2.91	BDL	0.4	< 4.81	2.4	BDL	BDL	BDL	< 0.410	< 0.376	BDL	BDL	BDL	< 0.239
beta BHC	< 2.91	BDL	1.2	< 4.81	< 0.980	BDL	BDL	BDL	0.6	< 0.376	BDL	BDL	BDL	0.3
gamma BHC	< 2.91	BDL	2.6	< 4.81	< 0.980	BDL	BDL	BDL	1.5	1.2	BDL	BDL	BDL	1.2
delta BHC	< 2.91	BDL	0.7	< 4.81	< 0.980	BDL	BDL	BDL	< 0.410	< 0.376	BDL	BDL	BDL	< 0.239
ΣBHC	BDL	BDL	4.8	BDL	2.4	BDL	BDL	BDL	2.2	1.2	BDL	BDL	BDL	1.5
Chlordane Compounds														
alpha chlordane	9.5	1.6	11.1	6.3	8.1	2.9	2.5	2.7	5.2	6.6	1.9	1.9	2.3	3.9
gamma chlordane	< 2.91	BDL	11.2	< 4.81	< 0.980	3.5	2.2	0.4	< 0.410	< 0.376	BDL	0.3	1.3	1.8
cis-nonachlor	48.7	8.9	29.0	23.8	17.2	14.9	12.6	10.6	12.5	11.1	8.6	10.8	11.7	< 0.239
trans-nonachlor	151.1	22.9	90.8	71.1	48.3	52.9	39.9	35.1	33.5	40.8	30.3	35.6	47.1	1.0
oxychlordane	24.0	2.4	40.1	26.1	10.6	15.2	6.7	8.5	14.4	17.0	12.1	14.5	14.5	1.1
ΣChlordane	233.3	35.9	182.3	127.4	84.2	89.5	64.0	57.1	65.5	75.5	52.9	63.1	77.0	7.7
heptachlor	< 2.91	BDL	2.0	< 4.81	< 0.980	BDL	BDL	BDL	2.3	< 0.376	BDL	BDL	BDL	0.3
heptachlor epoxide	< 2.91	BDL	5.3	5.0	0.8	2.3	BDL	1.2	2.6	4.2	2.4	2.0	2.2	< 0.239
DDT Metabolites and Isomers														
o,p'-DDD	38.7	10.7	7.1	28.5	20.8	11.4	10.6	2.5	12.7	8.7	7.6	9.0	5.3	0.3
o,p'-DDE	< 2.91	BDL	1.0	< 4.81	1.6	0.2	BDL	BDL	1.4	1.1	0.0	0.0	BDL	1.0
o,p'-DDT	47.5	BDL	17.7	34.6	14.4	13.4	7.6	8.3	10.9	8.2	10.0	12.7	5.3	0.7
p,p'-DDD	106.3	31.8	76.9	56.3	38.0	48.1	37.7	31.8	48.1	53.5	79.2	87.9	71.8	0.9
p,p'-DDE	3418.2	701.2	968.4	2398.6	668.7	1273.6	987.3	1008.1	524.0	596.4	1235.0	1360.5	1006.2	10.5
p,p'-DDT	< 2.91	0.7	6.8	< 4.81	< 0.980	1.8	BDL	1.2	5.6	9.2	0.9	BDL	0.9	5.0
ΣDDT	3610.7	744.4	1077.9	2518.0	743.4	1348.4	1043.2	1051.9	602.6	677.1	1332.7	1470.0	1089.4	18.5
Other organochlorines														
aldrin	< 2.91	BDL	< 0.286	< 4.81	2.9	BDL	BDL	BDL	< 0.410	< 0.376	BDL	BDL	BDL	< 0.239
endrin	11.3	BDL	< 0.286	< 4.81	< 0.980	BDL	BDL	BDL	1.7	3.1	BDL	BDL	BDL	< 0.239
dieldrin	51.8	7.7	32.7	32.2	12.2	14.5	11.1	7.9	15.1	15.3	11.8	13.5	17.1	< 0.239
endosulfan II	4.1	BDL	< 0.286	< 4.81	< 0.980	0.0	BDL	BDL	1.8	2.1	BDL	BDL	BDL	< 0.239
HCB	3.9	1.5	8.7	7.2	7.4	3.6	2.1	2.0	7.3	6.3	4.0	4.3	3.1	0.5
mirex	15.5	1.6	14.9	11.9	6.4	4.0	5.0	4.1	9.6	9.6	3.7	2.9	2.2	< 0.239
pentachloro-anisole	< 2.91	1.5	0.8	< 4.81	18.0	BDL	BDL	BDL	1.2	1.1	BDL	BDL	BDL	0.6
toxaphene	< 29.1	NA	< 5.71	< 24.0	< 19.6	NA	NA	NA	< 8.20	< 7.52	NA	NA	NA	< 4.78

ng/g = parts-per-billion. Values in red preceded by < symbol indicate non-detects and detection limit. NA = not analyzed. BDL = below detection limit.

Appendix Table A-4b. Organochlorine compounds in bald eagle eggs by sample number, ng/g fresh wet weight

	Penobscot Watershed									
Sample Number	ME089-0201	ME089-0202	ME095-0401	ME141-0601	ME141-0602	ME141-0701	ME149-0401	ME149-0701	ME154-0701	ME172-0801
Polychlorinated Biphenyl										
PCB-TOTAL	1278.4	1213.7	3231.4	1181.9	1485.6	2603.3	2898.1	4312.0	4876.3	3835.8
Benzene Hexachlorides										
alpha BHC	< 1.57	< 1.52	< 0.478	< 0.350	0.2	3.1	< 0.493	1.1	3.9	BDL
beta BHC	< 1.57	< 1.52	< 0.478	0.7	< 0.178	< 0.877	0.7	< 0.893	< 0.943	BDL
gamma BHC	< 1.57	< 1.52	< 0.478	< 0.350	0.5	< 0.877	< 0.493	< 0.893	< 0.943	BDL
delta BHC	< 1.57	< 1.52	< 0.478	< 0.350	< 0.178	< 0.877	< 0.493	< 0.893	< 0.943	BDL
ΣBHC	BDL	BDL	BDL	0.7	0.6	3.1	0.7	1.1	3.9	BDL
Chlordane Compounds										
alpha chlordane	2.8	4.6	1.1	2.4	3.3	2.5	2.1	1.6	< 0.943	2.2
gamma chlordane	< 1.57	1.4	< 0.478	< 0.350	0.3	3.9	0.5	5.3	< 0.943	0.5
cis-nonachlor	6.5	6.1	5.3	12.1	13.6	26.6	8.3	23.4	22.0	10.2
trans-nonachlor	23.2	21.9	18.0	32.5	41.0	56.6	29.9	34.1	55.9	40.4
oxychlordane	9.1	8.9	8.1	6.5	6.3	12.0	11.5	16.5	27.4	7.4
ΣChlordane	41.6	43.0	32.4	53.6	64.5	101.6	52.3	81.0	105.3	60.6
Heptachlor	< 1.57	< 1.52	< 0.478	< 0.350	0.2	< 0.877	< 0.493	< 0.893	< 0.943	BDL
heptachlor epoxide	1.6	1.5	1.3	1.4	1.8	3.3	1.5	1.5	1.2	1.8
DDT Metabolites and Isomers										
o,p'-DDD	1.7	1.8	5.0	2.3	2.5	12.4	5.9	16.8	6.2	6.2
o,p'-DDE	< 1.57	< 1.52	< 0.478	< 0.350	0.2	0.8	0.4	1.9	1.8	BDL
o,p'-DDT	2.5	3.1	10.0	4.6	3.1	1.0	10.9	1.2	7.5	9.3
p,p'-DDD	10.0	9.0	22.3	27.3	30.8	37.2	28.3	49.0	43.0	29.7
p,p'-DDE	364.7	334.8	603.0	687.4	867.2	859.7	529.3	697.0	913.8	566.9
p,p'-DDT	< 1.57	< 1.52	< 0.478	< 0.350	1.3	10.9	< 0.493	5.0	7.0	BDL
ΣDDT	378.9	348.8	640.3	721.6	905.1	921.9	574.7	770.9	979.3	612.2
Other organochlorines										
aldrin	< 1.57	< 1.52	< 0.478	< 0.350	< 0.178	0.8	< 0.493	1.4	< 0.943	BDL
endrin	< 1.57	< 1.52	< 0.478	< 0.350	< 0.178	< 0.877	< 0.493	< 0.893	< 0.943	BDL
dieldrin	8.2	7.6	10.7	10.1	13.0	12.6	11.4	14.3	11.0	13.8
endosulfan II	< 1.57	< 1.52	1.0	0.5	0.7	< 0.877	1.3	< 0.893	< 0.943	BDL
HCB	2.6	2.5	2.3	2.8	3.7	3.3	2.8	2.2	3.0	2.3
mirex	7.1	6.7	8.5	4.4	5.7	6.6	6.1	5.8	13.1	7.9
pentachloro-anisole	< 1.57	< 1.52	1.0	0.7	0.5	1.0	0.8	< 0.893	1.1	BDL
toxaphene	< 19.7	< 18.9	< 4.78	< 6.99	< 3.56	< 17.5	< 4.93	< 17.9	< 18.9	NA

ng/g = parts-per-billion. Values in red preceded by < symbol indicate non-detects and detection limit. NA = not analyzed. BDL = below detection limit.

Appendix Table A-4c. Organochlorine compounds in bald eagle eggs by sample number, ng/g fresh wet weight

	Penobscot Watershed								
Sample Number	ME176-0501	ME184-0402	ME186-0601	ME277-0901	ME289-0401	ME289-0701	ME392-0601	ME439-0401	ME498-0701
Polychlorinated Biphenyl									
PCB-TOTAL	3336.8	2816.5	2863.9	2829.8	4208.8	4228.1	2911.0	3021.6	4005.1
Benzene Hexachlorides									
alpha BHC	< 0.439	< 0.485	0.5	BDL	< 0.488	< 0.239	0.4	< 0.508	< 0.237
beta BHC	< 0.439	< 0.485	0.3	BDL	1.1	0.2	< 0.450	< 0.508	< 0.237
gamma BHC	1.1	< 0.485	< 0.360	BDL	< 0.488	< 0.239	< 0.450	< 0.508	< 0.237
delta BHC	< 0.439	< 0.485	< 0.360	BDL	< 0.488	< 0.239	< 0.450	< 0.508	< 0.237
ΣBHC	1.1	BDL	0.8	BDL	1.1	0.2	0.4	BDL	BDL
Chlordane Compounds									
alpha chlordane	6.3	0.9	3.0	1.0	3.2	3.8	1.9	2.1	2.9
gamma chlordane	< 0.439	0.3	0.6	2.3	0.8	3.5	0.8	0.5	2.9
cis-nonachlor	13.2	4.2	24.5	7.8	14.4	6.5	6.4	13.0	8.4
trans-nonachlor	51.6	14.8	73.3	26.3	48.6	23.2	54.3	40.0	26.1
oxychlordane	12.1	7.2	26.4	15.7	16.3	11.6	18.1	13.1	9.0
ΣChlordane	83.3	27.4	127.8	53.1	83.3	48.6	81.5	68.7	49.3
Heptachlor	2.4	1.4	< 0.360	BDL	< 0.488	< 0.239	< 0.450	< 0.508	< 0.237
heptachlor epoxide	2.2	1.2	4.4	2.3	2.9	2.7	1.2	1.4	1.7
DDT Metabolites and Isomers									
o,p'-DDD	12.2	4.9	9.4	7.4	9.9	6.4	14.6	11.4	7.6
o,p'-DDE	1.3	< 0.485	< 0.360	BDL	0.7	1.2	< 0.450	< 0.508	3.6
o,p'-DDT	9.2	9.0	11.3	5.2	16.3	5.0	17.4	12.8	7.1
p,p'-DDD	23.4	20.5	30.3	47.8	65.6	17.8	23.5	22.9	17.2
p,p'-DDE	463.5	312.0	1642.3	794.8	1368.3	581.8	521.0	1001.3	497.5
p,p'-DDT	13.1	< 0.485	1.0	4.0	< 0.488	5.3	1.5	1.5	1.6
ΣDDT	522.8	346.4	1694.3	859.0	1460.7	617.5	578.1	1049.9	534.5
Other organochlorines									
aldrin	< 0.439	< 0.485	< 0.360	BDL	< 0.488	< 0.239	< 0.450	< 0.508	0.7
endrin	8.4	< 0.485	< 0.360	BDL	< 0.488	0.7	0.5	< 0.508	1.0
dieldrin	18.8	11.4	24.8	15.5	21.2	11.2	9.4	11.9	10.9
endosulfan II	8.2	1.0	< 0.360	BDL	3.3	14.8	2.4	0.5	< 0.237
HCB	3.1	2.0	4.1	2.9	5.1	2.1	1.5	2.8	2.8
mirex	15.2	4.3	23.8	10.5	6.3	1.9	21.9	15.4	2.8
pentachloro-anisole	1.0	0.9	0.5	BDL	1.2	0.5	0.9	0.5	0.8
toxaphene	< 8.77	< 4.85	< 7.19	NA	< 4.88	< 4.78	< 9.01	< 5.08	< 4.74

ng/g = parts-per-billion. Values in red preceded by < symbol indicate non-detects and detection limit. NA = not analyzed. BDL = below detection limit.

Appendix Table A-5. Organochlorine compounds in common loon eggs by sample number, ng/g fresh wet weight

	Androscoggin Lake				Androscoggin Watershed				Kennebec Watershed	
Sample Number	AND01E2	ANDR02	ANDR04-1	ANDR04-02	POCA02	Azisco1	AZIS04-1	Mooselk1	LongPd1	FLAG04-1
Polychlorinated Biphenyl										
PCB-TOTAL	748.8	1141.7	1746.0	985.9	781.5	1733.3	1885.0	647.6	2383.4	484.0
Benzene Hexachlorides										
alpha BHC	1.4	< 1.24	< 0.457	0.6	< 1.26	< 3.52	< 0.543	< 3.05	< 3.97	< 0.500
beta BHC	1.9	< 1.24	< 0.457	1.2	< 1.26	< 3.52	0.5	< 3.05	< 3.97	0.4
gamma BHC	< 1.68	< 1.24	< 0.457	1.1	< 1.26	< 3.52	< 0.543	< 3.05	< 3.97	< 0.500
delta BHC	< 1.68	< 1.24	< 0.457	< 1.00	< 1.26	< 3.52	< 0.543	< 3.05	< 3.97	< 0.500
ΣBHC	3.3	BDL	BDL	2.9	BDL	BDL	0.5	BDL	BDL	0.4
Chlordane Compounds										
alpha chlordane	1.0	1.3	0.5	0.4	1.2	< 3.52	1.3	< 3.05	< 3.97	< 0.500
gamma chlordane	< 1.68	< 1.24	< 0.457	< 1.00	< 1.26	< 3.52	< 0.543	< 3.05	< 3.97	< 0.500
cis-nonachlor	3.2	5.7	5.9	2.9	2.5	5.2	5.4	4.0	13.7	1.7
trans-nonachlor	7.0	11.5	14.0	6.4	11.4	12.1	16.7	12.7	43.7	7.8
oxychlordane	3.7	6.7	7.2	1.8	7.1	12.7	11.8	6.4	20.5	5.6
ΣChlordane	14.8	25.2	27.6	11.5	22.2	30.0	35.2	23.2	78.0	15.1
heptachlor	< 1.68	< 1.24	< 0.457	< 1.00	1.1	< 3.52	< 0.543	< 3.05	< 3.97	< 0.500
heptachlor epoxide	1.2	1.5	1.9	0.9	1.7	< 3.52	2.3	< 3.05	6.6	1.7
DDT Metabolites and Isomers										
o,p'-DDD	< 1.68	3.4	5.6	< 1.00	3.3	6.6	5.4	5.4	17.1	2.1
o,p'-DDE	2.0	< 1.24	< 0.457	< 1.00	< 1.26	< 3.52	0.5	< 3.05	< 3.97	< 0.500
o,p'-DDT	2.0	1.6	7.3	1.2	2.6	8.4	6.8	< 3.05	11.1	2.0
p,p'-DDD	4.2	3.7	4.9	7.3	8.6	4.8	13.5	< 3.05	10.3	0.8
p,p'-DDE	177.3	291.2	329.8	177.5	232.7	189.9	198.3	143.5	1039.4	72.5
p,p'-DDT	< 1.68	1.3	0.7	1.6	1.2	< 3.52	< 0.543	4.1	7.8	< 0.500
ΣDDT	185.5	301.2	348.3	187.6	248.3	209.7	224.6	153.0	1085.7	77.4
Other organochlorines										
aldrin	< 1.68	< 1.24	< 0.457	< 1.00	< 1.26	< 3.52	< 0.543	< 3.05	< 3.97	< 0.500
endrin	< 1.68	< 1.24	< 0.457	6.6	1.2	3.1	< 0.543	< 3.05	6.9	< 0.500
dieldrin	3.6	6.1	5.5	5.8	1.3	12.5	17.0	5.1	22.8	3.8
endosulfan II	< 1.68	< 1.24	< 0.457	1.3	3.5	< 3.52	0.6	< 3.05	< 3.97	< 0.500
HCB	2.7	1.9	2.9	3.2	4.7	< 3.52	6.6	4.3	5.3	2.4
mirex	1.0	1.8	1.8	< 1.00	2.2	< 3.52	3.2	5.0	8.2	1.3
pentachloro-anisole	< 1.68	< 1.24	< 0.457	1.3	1.1	< 3.52	0.6	< 3.05	< 3.97	0.4
toxaphene	< 8.39	< 15.5	< 4.57	< 20.0	< 15.7	< 35.2	< 5.43	< 30.5	< 39.7	< 5.00

ng/g = parts-per-billion. Values in red preceded by < symbol indicate non-detects and detection limit. NA = not analyzed. BDL = below detection limit.