SPECIAL PROJECT REPORT **FY12-MEFO-2-EC**

Maine Field Office – Ecological Services **September 2013**

Contaminant Assessment of Coastal Bald Eagles at Maine Coastal Islands National Wildlife Refuge and Acadia National Park

Fish and Wildlife Service

U.S. Department of the Interior

Mission Statement
U.S. Fish and Wildlife Service

Our mission is working with others to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of the American people.

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Contaminant Assessment of Coastal Bald Eagles at Maine Coastal Islands National Wildlife Refuge and Acadia National Park

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by

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Executive Summary

Environmental contaminants including organochlorine compounds (e.g., polychlorinated biphenyls (PCBs), dichlorodiphenyldichloroethylene (DDE)), polybrominated diphenyl ether (PBDE), and mercury were measured in 16 non-viable or abandoned bald eagle *Haliaeetus leucocephalus* eggs and 65 nestling blood samples collected between 2000 and 2012 from the Maine coast. The study objectives were to compare current contaminant levels in eggs and blood to suggested toxicity threshold levels reported in the scientific literature and to two previous Maine bald eagle investigations conducted in the 1990s. The study produced the following results:

- Current levels of organochlorine compounds, specifically PCBs and p,p'-DDE, in coastal Maine bald eagles eggs and plasma are significantly lower ($p < 0.05$) than results reported in earlier Maine collections and lower than suggested toxicity effect thresholds.

- Compared to other bald eagle studies in North America, PCBs in coastal Maine bald eagle nestling plasma are on the higher end of reported concentrations ranges.

- PCBs in bald eagle nestling plasma collected from three areas along the Maine coast - the Sheepscot River estuary, Frenchman Bay, and Little Machias Bay – are elevated and warrant further investigation. Eggs from two nest territories located near Acadia National Park did not show decreases in PCB concentrations from earlier collections and also warrant further investigation.

- PBDE levels in coastal Maine bald eagle eggs do not appear elevated compared to a suggested toxicity threshold for another raptor species, the American kestrel.

- PBDE levels in coastal Maine bald eagle nestling plasma do not appear elevated compared to other bald eagle collections in North America, but toxicity thresholds for PBDE in bald eagle plasma have not been published and the significance of the detected levels is not known.

- Mercury levels in coastal Maine bald eagle eggs ($p = 0.197$) and nestling whole blood ($p = 0.335$) do not show any significant changes from earlier collections. Current levels of mercury in bald eagles along the Maine coast are not elevated compared to suggested egg toxicity effect thresholds or to whole blood exposure scales.

Keywords: bald eagle, *Haliaeetus leucocephalus*, Maine, PCBs, DDE, PBDE, mercury

PREFACE

This report provides documentation of organochlorine compounds, polybrominated diphenyl ether, and mercury in coastal bald eagles (*Haliaeetus leucocephalus*) from Maine Coastal Islands National Wildlife Refuge, Acadia National Park, and other nest territories in the mid-coast and Downeast regions of Maine. The USFWS Region 5 Project Identification Number for this study is FF05E1ME00-1261-5N46 and the USFWS Division of Environmental Quality Project Identification Number is 200950001. Analytical work was completed under the following USFWS Analytical Control Facility Catalogs:

Catalog Number	Purchase Orders	Laboratory	Analyses
5100036	94420-09-Y995	GERG	Organics
	94420-09-Y996	LET	Inorganics
5100037	94420-09-Y994	GERG	Organics
5100041	94420-09-Y024	LET	Inorganics
	94420-09-Y025	GERG	Organics
5100044	94420-B-Y204	GERG	Organics
	94420-B-Y206	LET	Inorganics
5100047	F11PX04689	GERG	Organics
	F11PX04690	TERL	Inorganics
5100049	AR 056	TERL	Inorganics

Questions, comments, and suggestions related to this report are encouraged. Written inquiries should refer to Report Number FY12-MEFO-2-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

2,3,7,8-TCDD	tetrachlorodibenzo-*p*-dioxin
ANP	Acadia National Park
BHC	benzene hexachloride (also used for HCH)
BRI	Biodiversity Research Institute
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEQ	Division of Environmental Quality (USFWS)
DMA	Direct Mercury Analyzer
ECDMS	Environmental Contaminants Database Management System
fww	fresh wet weight
GERG	Geochemical and Environmental Research Group
HCB	hexachlorobenzene
HCH	hexachlorocyclohexane (also used for BHC)
Hg	mercury
LC_{50}	lethal concentration that kills 50% of the test animals
LET	Laboratory and Environmental Testing, Inc.
MCINWR	Maine Coastal Islands National Wildlife Refuge
MEDIFW	Maine Department of Inland Fisheries and Wildlife
µg/g	micrograms per gram (parts per million)
mL	milliliter
mm	millimeter
ng/g	nanograms per gram (parts per billion)
NPS	National Park Service
NWR	National Wildlife Refuge
PBDE	polybrominated diphenyl ether
PCBs	polychlorinated biphenyls
PCDDs	polychlorinated dibenzo-*p*-dioxins
PCDFs	polychlorinated dibenzofurans
pg/g	picogram per gram (parts per trillion)
QA/QC	Quality Assurance / Quality Control
TCDD	2,3,7,8-tetrachlorodibenzo-*p*-dioxin
TCDD-TEQ	dioxin toxic equivalents
$TCDD\text{-}TEQ_{PCB}$	dioxin toxic equivalents for planar PCBs
TEF	toxic equivalency factor
TERL	Trace Element Research Laboratory
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
ww	wet weight

1. Introduction

Bald eagle (*Haliaeetus leucocephalus*) populations have increased dramatically across North America since the banning and effective management of multiple anthropogenic stressors such as the pesticide dichlorodiphenyltrichloroethane (DDT), shooting, trapping, poisoning, and habitat destruction (Buehler 2000). Population recovery is not uniformly distributed throughout the U.S., however, and some populations display conspicuously low productivity. During the early 1990s, productivity of the bald eagle population along the Maine coast was chronically below levels achieved in other North American bald eagle populations. At 0.86 young/occupied nest (Welch 1994), the productivity of Maine's coastal population appeared to be lower than the levels achieved in populations with healthy reproductive rates (i.e., 1.0 young/occupied nest; Wiemeyer *et al*. 1993, Bowerman 1993). Poor production at coastal Maine bald eagle nest sites occurred despite an increasing trend in occupied territories statewide.

Environmental contaminants, primarily polychlorinated biphenyls (PCBs), were considered possible factors associated with low eagle productivity along the Maine coast (Welch 1994, Matz 1998). These two previous Maine investigations documented notable levels of PCBs in coastal Maine bald eagle nestling blood or eggs, exceeding levels associated with reproductive impairment elsewhere in the United States (Eisler 1986, Bowerman *et al*. 2003). After sampling Maine bald eagles in 1991 and 1992, Welch (1994) reported nestling blood total PCBs (∑PCBs) levels higher than those found elsewhere in the United States. Welch (1994) also reported that Maine estuarine nestling blood contained ∑PCB levels six to 12 times higher than levels found in eagle populations along the shorelines of the Great Lakes - a population known to be impacted by contaminants (Bowerman 1993, Dykstra 1995, Bowerman *et al*. 2003).

In a follow-up Maine investigation, Matz (1998) similarly reported concentrations of ∑PCBs and dichlorodiphenyldichloroethylene (DDE, a metabolite of the pesticide DDT) in coastal eagle nestling blood and eggs at levels usually associated with reproductive impairment. In the Matz (1998) study, ∑PCBs in over 80% of the bald eagle nestling blood samples exceeded a suggested toxicity threshold level (189 ng/g wet weight, Elliott and Harris 2002; Note: Matz's whole blood data was converted to an estimated plasma concentration using a conversion factor of two, Bowerman *et al*. 1994).

Mercury exposure in coastal Maine bald eagles was examined by Welch (1994), but not by Matz (1998). Welch found lower mercury concentrations in coastal bald eagles than inland bald eagles.

In the current study, we examined contaminants in coastal Maine bald eagles to assess current exposure and to compare levels with the two aforementioned Maine investigations and other eagle studies.

2. Study Purposes

Document current levels of organic compounds and mercury in bald eagle nestlings and eggs from Maine Coastal Island National Wildlife Refuge, Acadia National Park, and other coastal areas and compare residue concentrations to suggested toxicity effect levels.

Compare current contaminant concentrations in eggs and blood to previous investigations in Maine, specifically the work by Welch (1994) and Matz (1998), and to other bald eagle studies in North America.

3. Study Area

The study area included coastal nest territories from the mid-coast region to Downeast region of Maine (Figure 1, Tables 1 and 2). Sampling priority in the current investigation was given to nest territories located on lands and easements of the U.S. Fish and Wildlife Service's Maine Coastal Islands National Wildlife Refuge and the National Park Service's Acadia National Park, and to coastal nest territories previously sampled by Welch (1994) and Matz (1998).

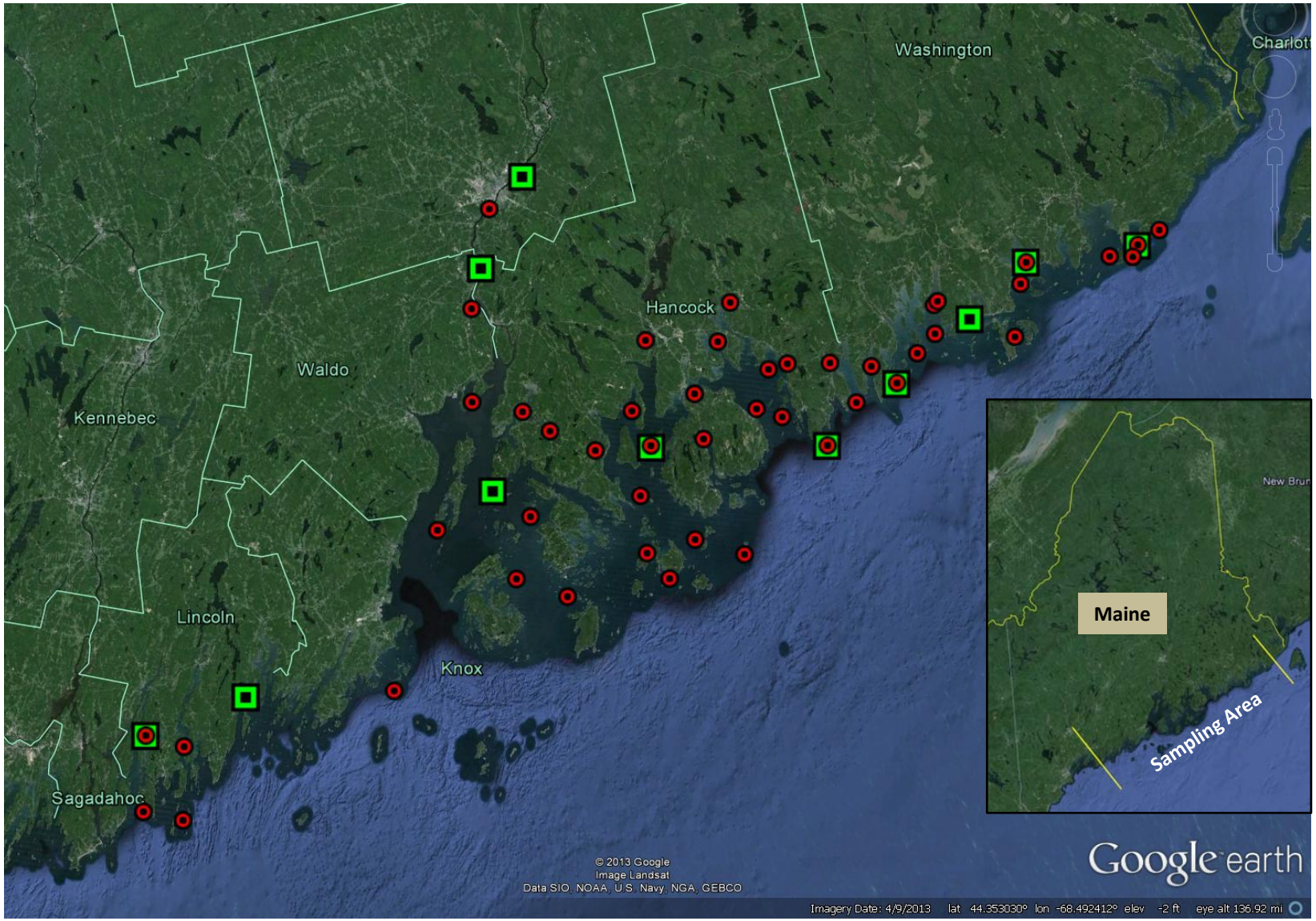


Figure 1. Locations of sampled coastal Maine bald eagle nest territories. Red circles = blood collected. Green squares = eggs. Red circles within green squares indicate both blood and egg collected. Inset = boundary of coastal sampling area.

Table 1. Coastal Maine bald eagle egg sampling locations

Territory No.	Territory Location & Township	County	Latitude	Longitude	Sample No.	Date Collected	Ownership Status	Previous Sampling
ME199A	Penobscot River, Brewer	Penobscot	44.81967	-68.70726	ME199-0001	6/28/2000		
ME371A	Western Island, Deer Isle	Hancock	44.29227	-68.82350	ME371-0201	6/4/2002		
ME325A	Penobscot River, Winterport	Waldo	44.66390	-68.82583	ME325-0501	6/15/2005		
ME027A	Bartlett Island, Mount Desert	Hancock	44.35053	-68.44714	ME027-0901	6/16/2009	NPS Easement	1996
ME043I	Schoodic Island, Winter Harbor	Hancock	44.32950	-68.03187	ME043-0901	6/14/2009	NPS	1994
ME155D	Hog Island, Bremen	Lincoln	43.97442	-69.42500	ME155-0901	4/11/2009		
ME267B	Bois Bubert Island, Milbridge	Washington	44.42580	-67.85577	ME267-0901	5/13/2009	USFWS	
ME052J	Inner Goose Island, Addison	Washington	44.52477	-67.66877	ME052-1001	6/2/2010		
ME052J	Inner Goose Island, Addison	Washington	44.52477	-67.66877	ME052-1002	6/2/2010		
ME056G	Little Ram Island, Roque Bluffs	Washington	44.61362	-67.52258	ME056-1001	6/2/2010		
ME224C	Cape Wash Island, Cutler	Washington	44.62834	-67.24983	ME224-1001	6/16/2010		
ME224C	Cape Wash Island, Cutler	Washington	44.62834	-67.24983	ME224-1002	6/16/2010		
ME240B	Tibbet Island, Boothbay	Lincoln	43.91993	-69.66160	ME240-1101	6/9/2011		
ME325A	Penobscot River, Winterport	Waldo	44.66390	-68.82583	ME325-1201	4/17/2012		
ME325A	Penobscot River, Winterport	Waldo	44.66390	-68.82583	ME325-1202	4/17/2012		
ME325A	Penobscot River, Winterport	Waldo	44.66390	-68.82583	ME325-1203	4/17/2012		

Map Datum = WGS 84. Coordinates presented in decimal degrees. NPS = National Park Service, USFWS = U.S. Fish and Wildlife Service
Previous sampling in 1994 and 1996 by Matz (1998)

Table 2. Coastal Maine bald eagle nestling sampling locations.

Territory No.	Territory Location & Township	County	Latitude	Longitude	Hg Sample ID	OC/PBDE Sample ID	Date Collected	Silver USGS Band No.	Red Color Band	Ownership Status	Previous Sampling
ME020E	Bagaduce River, Mills Point, Brooksville	Hancock	44.42193	-68.74298	none2	BLD0921	6/11/2007	629-523-24	5/A		
ME021D	Bagaduce River, Bear Head, Brooksville	Hancock	44.38649	-68.68187	**none**	BLD0922	6/9/2007	**not banded**	**not banded**		
ME544A	Ensign Island, Isleboro	Waldo	44.23271	-68.95933	AA81664	BLD0923	6/18/2007	629-523-45	2/E		
ME464A	Penobscot River, Hampden	Penobscot	44.76733	-68.79159	AA81663	BLD0924	6/14/2007	629-523-44	3/D		
ME028E	South Twinnie Island, Bar Harbor	Hancock	44.43251	-68.33586	B0180008	BLD0901	6/11/2009	629-523-61	A/2	USFWS	1992
ME026E	Bar Island, Mount Desert	Hancock	44.35547	-68.32247	B0180007	BLD0902	6/11/2009	629-523-60	A/1	NPS	1992
ME026E	Bar Island, Mount Desert	Hancock	44.35547	-68.32247	B0180006	BLD0903	6/11/2009	629-523-59	A/0	NPS	1992
ME031F	Hills Island, Hancock	Hancock	44.51761	-68.27198	B0180009	BLD0904	6/12/2009	629-523-62	B/0		1991
ME038E	Hog Island, Gouldsboro	Hancock	44.47210	-68.11157	B0180010	BLD0905	6/12/2009	629-523-63	B/1	NPS Easement	1992, 1994, 1995
ME041D	Sheep Porcupine Island, Gouldsboro	Hancock	44.39981	-68.19246	B0180020	BLD0906	6/12/2009	629-523-82	6/B	NPS	1994
ME042D	Ironbound Island, Winter Harbor	Hancock	44.38295	-68.13365	B0180021	BLD0907	6/13/2009	629-523-83	6/C	NPS Easement	
ME138H	Great Duck Island, Frenchboro	Hancock	44.15708	-68.24651	B0180011	BLD0908	6/14/2009	629-523-64	B/2	NPS Easement	1994
ME138H	Great Duck Island, Frenchboro	Hancock	44.15708	-68.24651	B0180012	**none**	6/14/2009	629-523-65	C/0	NPS Easement	1994
ME043I	Schoodic Island, Winter Harbor	Hancock	44.32950	-68.03187	B0180013	BLD0909	6/14/2009	629-523-66	C/1	NPS	1991, 1995
ME576A	Cross Island, Cutler	Washington	44.61256	-67.32055	B0180022	**none**	6/15/2009	629-523-84	6/D	USFWS	
ME576A	Cross Island, Cutler	Washington	44.61256	-67.32055	B0180023	BLD0910	6/15/2009	629-523-85	6/E	USFWS	
ME502B	Sally Island, Steuben	Washington	44.45717	-67.91325	B0180014	BLD0911	6/15/2009	629-523-67	C/2	USFWS	
ME427A	Inner Double Head Shot Island, Cutler	Washington	44.60860	-67.26492	B0180024	BLD0912	6/15/2009	629-523-86	6/H	USFWS	
ME427A	Inner Double Head Shot Island, Cutler	Washington	44.60860	-67.26492	B0180025	BLD0913	6/15/2009	629-523-87	6/K	USFWS	
ME027A	Bartlett Island, Mount Desert	Hancock	44.35053	-68.44714	B0180015	BLD0914	6/16/2009	629-523-68	D/0	NPS Easement	1995
ME024E	Placentia Island, Frenchboro	Hancock	44.18792	-68.35949	B0180016	BLD0915	6/17/2009	629-523-69	D/1	NPS Easement	1991, 1992, 1994
ME292C	Outer Heron Island, Boothbay	Lincoln	43.77593	-69.58534	B0180027	BLD0916	6/18/2009	629-523-89	6/N	USFWS	
ME292C	Outer Heron Island, Boothbay	Lincoln	43.77593	-69.58534	B0180028	BLD0917	6/18/2009	629-523-90	6/M	USFWS	
ME589A	Lower Mark Island, Southport	Lincoln	43.79365	-69.67578	B0180017	BLD0918	6/18/2009	629-523-70	D/2	USFWS Easement	
ME589A	Lower Mark Island, Southport	Lincoln	43.79365	-69.67578	B0180018	BLD0919	6/18/2009	629-523-71	E/0	USFWS Easement	
ME094A	Penobscot River, Bowden Point, Prospect	Waldo	44.60102	-68.84774	B09S0010	BLD1001	5/27/2010	629-524-00	5/V		1994
ME094A	Penobscot River, Bowden Point, Prospect	Waldo	44.60102	-68.84774	B09S0009	BLD1002	5/27/2010	629-523-99	5/U		1994
ME029H	Ellsworth	Hancock	44.52831	-68.44249	B09S0002	BLD1003	5/28/2010	629-523-74	5/X		1995
ME029H	Ellsworth	Hancock	44.52831	-68.44249	B09S0003	BLD1004	5/28/2010	629-523-75	5/W		1995
ME056G	Little Ram Island, Roque Bluffs	Washington	44.61362	-67.52258	B09S0004	BLD1005	6/2/2010	629-523-76	7/W		1991, 1992
ME183B	Roque Island, Jonesport	Washington	44.57761	-67.54087	B09S0008	BLD1006	6/2/2010	629-523-80	8/K		1991, 1995
ME183B	Roque Island, Jonesport	Washington	44.57761	-67.54087	B09S0054	BLD1007	6/2/2010	**not banded**	**not banded**		1991, 1995
ME167D	Eagle Island, Addison	Washington	44.50406	-67.75557	B09S0005	BLD1008	6/2/2010	629-523-77	5/Z		1991, 1992
ME127E	Long Cove, Pleasant River, Addison	Washington	44.55881	-67.74292	B09S0006	BLD1009	6/2/2010	629-523-78	8/M		1992
ME127E	Long Cove, Pleasant River, Addison	Washington	44.55881	-67.74292	B09S0007	BDL1010	6/2/2010	629-523-79	8/S		1992
ME037J	Calf Island, Sorrento	Hancock	44.46481	-68.15715	B09S0053	BLD1011	6/3/2010	**not banded**	**not banded**	NPS Easement	1991
ME339D	Squaw Pt. , Penobscot Bay, Stockton Springs	Waldo	44.44369	-68.86003	B09S0013	BLD1012	6/4/2010	709-004-01	8/E		
ME339D	Squaw Pt. , Penobscot Bay, Stockton Springs	Waldo	44.44369	-68.86003	B09S0014	BLD1013	6/4/2010	709-004-02	8/V		
ME339D	Squaw Pt. , Penobscot Bay, Stockton Springs	Waldo	44.44369	-68.86003	B09S0015	**none**	6/4/2010	709-004-03	8/P		
ME022A	Salt Pond, Blue Hill	Hancock	44.34880	-68.57825	B09S0016	BLD1014	6/8/2010	709-004-04	U/1		1991, 1994
ME145D	Williams Point, Gouldsboro	Hancock	44.46822	-68.01066	B09S0017	BLD1015	6/8/2010	709-004-05	V/0	USFWS	1991
ME179F	Hardwood Island, Isle Au Haut	Knox	44.10763	-68.66593	B09S0018	BLD1016	6/9/2010	709-004-06	V/1		1994
ME179F	Hardwood Island, Isle Au Haut	Knox	44.10763	-68.66593	B09S0019	**none**	6/9/2010	709-004-07	K/1		1994

Table 2 (continued). Coastal Maine bald eagle nestling sampling locations.

Territory No.	Territory Location & Township	County	Latitude	Longitude	Hg Sample ID	OC/PBDE Sample ID	Date Collected	Silver USGS Band No.	Red Color Band	Ownership Status	Previous Sampling
ME034D	Buckskin Island, Franklin	Hancock	44.58228	-68.23592	B09S0021	BLD1017	6/15/2010	709-004-09	P/0		1994
ME211D	Little River Island, Cutler	Washington	44.65064	-67.19434	B09S0022	BLD1018	6/16/2010	709-004-10	R/1		1995
ME224C	Cape Wash Island, Cutler	Washington	44.62834	-67.24983	B09S0023	BLD1019	6/16/2010	709-004-11	U/0		1994
ME267B	Bois Bubert Island, Milbridge	Washington	44.42580	-67.85577	B09S0024	BLD1020	6/22/2010	709-004-12	P/1	USFWS	
ME240B	Tibbet Island, Boothbay	Lincoln	43.91993	-69.66160	B1B70003	BLD1101	6/9/2011	709-004-18	D/7		
ME169E	Jed Island, Blue Hill	Hancock	44.41095	-68.48605	B1B70004	BLD1102	6/10/2011	709-004-14	A/7		
ME169E	Jed Island, Blue Hill	Hancock	44.41095	-68.48605	B1B70005	BLD1103	6/10/2011	709-004-15	B/7		
ME623A	Seavey Point, Addison	Washington	44.55318	-67.75220	B1B70006	BLD1104	6/13/2011	709-004-19	H/7		
ME508B	Hen Island, Swans Island	Hancock	44.17099	-68.47396	B1B70007	BLD1105	6/14/2011	709-004-24	R/7		
ME314G	Tinker Island, Tremont	Hancock	44.26759	-68.48001	B1B70008	BLD1106	6/14/2011	709-004-35	U/7		
ME314G	Tinker Island, Tremont	Hancock	44.26759	-68.48001	B1B70009	BLD1107	6/14/2011	709-004-36	V/7		
ME198D	Inner Baker Island, Swans Island	Hancock	44.12582	-68.42532	B1B70010	BLD1108	6/14/2011	709-004-16	C/7		1994
ME430D	Eagle Island, Swans Island	Hancock	44.21098	-68.45911	B1B70011	none	6/14/2011	709-004-17	E/7		
ME191D	Crow Island, Muscle Ridge Shoals	Knox	43.96987	-69.08173	B1B70012	BLD1109	6/15/2011	709-004-23	P/7	USFWS	
ME191D	Crow Island, Muscle Ridge Shoals	Knox	43.96987	-69.08173	B1B70013	BLD1110	6/15/2011	709-004-55	K/9	USFWS	
ME582B	Babbidge Island, North Haven	Knox	44.14277	-68.78222	B1B70014	BLD1111	6/16/2011	709-004-37	B/9		
ME157B	Crow Island, Deer Isle	Hancock	44.24533	-68.74012	B1B70015	BLD1112	6/16/2011	709-004-54	E/9		1991, 1992
ME119G	Mink Island, Beals	Washington	44.48846	-67.56570	B1B70016	BLD1113	6/17/2011	709-004-38	X/7		1991, 1992, 1994
ME052J	Inner Goose Island, Addison	Washington	44.52477	-67.66877	B1B70017	BLD1114	6/17/2011	709-004-20	K/7		1992
ME047A	Shipstern Island, Harrington	Washington	44.47349	-67.80179	B1B70018	BLD1115	6/21/2011	709-004-39	Z/7		1991
ME187E	Sheep Island, Gouldsboro	Hancock	44.39804	-67.95563	B1B70019	BLD1116	6/21/2011	709-004-40	A/8		
ME217C	Hodgsons Island, South Bristol	Lincoln	43.89796	-69.57444	B1B70024	BLD1117	6/27/2011	709-004-41	B/8		1994

Map Datum = WGS 84. Coordinates presented in decimal degrees. USFWS = U.S. Fish and Wildlife Service, NPS = National Park Service
Previous sampling in 1991 and 1992 by Welch (1994)
Previous sampling in 1994 and 1995 by Matz (1998)

4. Methods

4.1 Field Methods.

4.1.1 Aerial surveys - Active bald eagle nests were monitored during low-level aerial surveys by the Maine Department of Inland Fisheries and Wildlife (MEDIFW) using fixed-wing aircraft. Monitoring flights began in late March and continued into July. Observers documented nest occupancy and breeding activity during spring surveys. Nests with potentially abandoned eggs or nesting pairs incubating eggs past the expected hatch data were surveyed several times during some flights to validate apparent breeding failures.

4.1.2 Egg Collections - Non-viable and abandoned eggs were collected following MEDIFW aerial surveys or during nest visits for nestling sampling. On occasion during nestling captures, tree climbers would find non-viable eggs buried deep in the nest bowl. Tree climbers wrapped eggs in aluminum foil and placed them in containers. After the climber descended from the tree, ground crews placed the containers in padded coolers filled with ice for temporary transport. Appropriate state and federal scientific collection permits were obtained prior to collections.

4.1.3 Nestling Capture and Processing - Once nest-specific information on occupancy and chick age was confirmed from aerial observations, tree climbers were deployed to ascend nest trees and capture 4.5 to 8 week old eagle nestlings. Processing of nestlings followed prescribed wild bird handling guidelines (Gaunt and Oring 1999, Fair *et al*. 2010). Appropriate state and federal scientific collection permits and banding permits were obtained prior to sampling.

Tree climbers captured nestlings, placed them in a canvas bag and lowered them to the ground. A ground-based crew processed birds. Nestlings were banded with size 9 rivet USGS aluminum leg bands as well as red colored bands with silver alpha-numeric or alpha codes. Morphometric data were collected (i.e., bird weight, bill depth, bill length, bill width, hallux length, tarsus width, footpad length, length of eighth primary, length of tail feather, and crop size) in accordance with widely accepted protocols (Bortolotti 1984). Blood samples were collected from brachial veins and the birds immediately returned to the nest.

4.2 Sample Processing.

4.2.1 Eggs - 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.

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 (Stickel *et al*. 1973).

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 (I-Chem® Series 300), and weighed. Samples were frozen until shipped to the analytical laboratory.

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.

4.2.2 Nestling Blood - Four to 10 mL of whole blood was collected from the brachial vein of nestling eagles using sterile, evacuated, heparinized test tubes and 23 gauge x ¾ inch needles. Sample tubes were placed in padded coolers for temporary transport from the field. Heparinized blood samples were spun in a centrifuge for five minutes within eight hours of collection. Plasma and red blood cell fractions were separated and immediately frozen in glass test tubes following blood processing and storage procedures discussed by Wiemeyer *et al*. (1989). Heparinized whole blood samples were also collected and frozen within eight hours of collection.

4.3 Analytical Methods.

4.3.1 Eggs - Eggs were analyzed for polychlorinated dibenzo-*p*-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDF), PCB congeners, organochlorine pesticides, polybrominated diphenyl ether (PBDE), percent moisture, and percent lipids by the Geochemical and Environmental Research Group (GERG) in College Station, Texas. Metals analyses were conducted by Laboratory and Environmental Testing, Inc., in Columbia, Missouri, and by the Trace Element Research Laboratory in College Station, Texas.

PCDDs and PCDFs in eggs 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. Toxic equivalency factors were applied to PCDD and PCDF congeners and summed with *non-ortho* and *mono-ortho* PCB congeners to derive the TCDD-TEQ (Van den Berg *et al*. 1998). 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 in eggs were quantified using capillary gas chromatography with electron capture detector or capillary gas chromatography with a mass spectrometer detector. The PCB congener scan only 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. As with PCDD/Fs, toxic equivalency factors were applied to dioxin-like *non-ortho* and *mono-ortho* PCB congeners in the calculation of 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 ∑PCBs, 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 ΣPCBs, was 10 ng/g, wet weight. The toxaphene and ΣPCB method detection limit was 50 ng/g, wet weight.

PBDE analyses of eggs were performed by capillary gas chromatography with a mass spectrometer detector in the SIM mode for PBDEs. The PBDE scan of eggs included the following congeners: BDE# 1, 2, 3, 7, 8/11, 10, 12, 13, 15, 17, 25, 28, 30, 32, 33, 35, 37, 47, 49, 66, 71, 75, 77, 100, 116, 118, 119, 126, 138, 153, 154, 155, 166, 181, 183, 190, and 209. Total PBDE (ΣPBDE) was determined by the sum of BDE congeners with detectable levels. The method detection limit for BDE congeners was 10 ng/g wet weight. Actual sample detection limits for individual BDE congeners in eggs, with the exception of BDE#209, were generally less than 2 ng/g. Actual sample detection limits for BDE#209 ranged from 64 to 198 ng/g wet weight. Detection limits were high for BDE #209 on the mass spectrometer, due to its high molecular weight compared to the other BDE congeners. PBDE standards used by the analytical laboratory had approximately 10-fold higher concentrations of BDE# 209 compared to BDE# 47 so that it could be detected (T. Wade, GERG. 2013. Personal communication).

Trace element analyses were performed by inductively coupled plasma-mass spectroscopy and cold vapor atomic absorption. Method detection limits on a dry weight basis were: 0.10 µg/g for beryllium, cadmium, and mercury; 0.20 µg/g for arsenic, barium, lead, selenium, and strontium; 0.30 µg/g for copper; 0.50 µg/g for chromium, manganese, nickel, vanadium, and zinc; and 2.00 µg/g for aluminum, boron, iron, magnesium, and molybdenum.

4.3.2 Plasma - Nestling plasma samples were analyzed by the Geochemical and Environmental Research Group (GERG) in College Station, Texas, for congener-specific PCBs, ∑PCBs, OC pesticides, and for PBDEs. 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. PBDE analyses were performed by capillary gas chromatography with a mass spectrometer detector in the SIM mode for PBDEs.

The PCB scan of nestling plasma included the following congeners (*non-ortho* and *mono-ortho* congeners in **bold**, congeners connected with the / symbol indicate co-elutes): PCB# 1, 7/9, 8/5, 15, 16/32, 18/17, 22/51, 24/27, 25, 26, 28, 29, 30, 31, 33/20, 39, 40, 41/64, 42/59/37, 44, 45, 46, 47/75, 48, 49, 52, 53, 60/56, 63, 66, 67, 69, 70, 72, 74/61, **77**, **81**, 82, 83, 84, 85, 87/115, 92,

95/80, 97, 99, 101/90, **105**, 107, 110, **114**, **118**, 119, **126**, 128, 129, 130, 135, 136, 138/160, 141/179, 146, 149/**123**, 151, 153/132, **156**, **157**/173/201, 158, 166, **167**, **169**, 170/190, 171/202, 172, 174, 175, 176/137, 177, 178, 180, 183, 185, 187, **189**, 191, 193, 194, 195/208, 196, 197, 199, 200, 205, 206, 207, 209. Toxic equivalency factors were applied to the dioxin-like *non-ortho* and *mono-ortho* PCB congeners and summed to derive the TCDD-TEQ $_{PCB}$ (Van den Berg *et al*. 1998). The PCB congener method detection limit was 10 pg/g wet weight. Plasma samples were not analyzed for PCDDs and PCDFs.

The OC scan of nestling plasma included analysis of ΣPCBs, 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.

The PBDE scan of nestling plasma included the following congeners: BDE# 1, 2, 3, 7, 8/11, 10, 12, 13, 15, 17, 25, 28, 30, 32, 33, 35, 37, 47, 49, 66, 71, 75, 77, 100, 116, 118, 119, 126, 138, 153, 154, 155, 166, 181, 183, 190, and 209. ΣPBDE was determined by the sum of BDE congeners with detectable concentrations. The method detection limit for BDE congeners was 10 ng/g wet weight, but actual sample detection limits for individual BDE congeners in plasma ranged from 0.7 to 1.6 ng/g. BDE#209 had a sample detection limit of 100 ng/g wet weight (see note in previous section regarding detection limits for BDE #209).

4.3.3 Whole Blood - Whole blood analyses for mercury in bald eagle nestlings were conducted by the Biodiversity Research Institute in Gorham, Maine. Samples were analyzed for total mercury using a thermal decomposition technique with an automated direct Hg analyzer (DMA 80, Milestone Incorporated, USA) using US EPA Method 7473 (USEPA 2007). The method detection limit was 0.001 µg/g.

4.4 Quality Assurance / Quality Control (QA/QC). QA/QC procedures as specified by the USFWS Analytical Control Facility contract with analytical laboratories 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.

QA/QC procedures followed by the Biodiversity Research Institute for DMA analyses includes analyses of two standard reference materials, two methods blanks, and one sample blank after every 30 samples. In addition, a duplicate analysis is run after every 20 samples.

4.5 Data Presentations and Statistical Analyses. Contaminant data are summarized by geometric mean, geometric standard deviation, and range. Contaminant concentrations in eggs and from nestling siblings from the same territory were averaged prior to calculation of

the mean and standard deviation. In most instances when calculating the geometric mean, non-detects were assigned a value of one-half the sample detection limit. If one-half or more of the samples did not have detectable concentrations, a mean was not calculated. Statistical tests were performed with Systat® 12 and SigmaPlot® 10 (Systat Software, Inc.). Non-parametric statistical tests were used to test for significant differences when sample sizes were dissimilar or small. The acceptable level of significance was $\alpha = 0.05$. The Shapiro-Wilk test was used to determine if data were normally distributed. Data that were not normally distributed were log-transformed prior to linear regressions.

5. Results

The following analytical results are summarized below: **Eggs** - 2,3,7,8-TCDD, TCDD-TEQ, ∑PCBs, p,p'-DDE, PBDEs, and Hg (Table 3); **Nestling Plasma** - TCDD-TEQ $_{PCB}$, ∑PCBs, p,p'-DDE, and PBDEs (Table 4); and **Nestling Whole Blood** - Hg (Table 5). Egg results are presented on a fresh wet weight basis (i.e., corrected for moisture loss). Plasma results are presented on a wet weight basis. Plasma concentrations of organics on a lipid weight basis are also presented in Table 4, but not discussed. Lipid weight data are provided for researchers that may prefer this form of expression. Whole blood mercury results are presented on a wet weight basis. Analytical results for other organic compounds, specific congeners, and trace elements in individual egg or plasma samples are listed in appendix tables (Tables A-1 through A-10).

5.1 Eggs. A total of 16 coastal eggs were analyzed for the current study, but not all eggs were analyzed for the same suite of compounds. Thirteen eggs collected between 2000 and 2011 were analyzed for PCDDs, PCDFs, PCB congeners, OCs, and metals (Figure 2, Figure 4, Tables A-1, A-2, and A-4). Ten of the 13 eggs were also analyzed for PBDEs (Figure 5, Table A-3); these 10 eggs were collected between 2009 and 2011. Three eggs collected in 2012 were only analyzed for mercury and other metals (Figure 5, Table A-4).

5.1.1 Organochlorines - 2,3,7,8-TCDD was above detection limits in only three of 13 egg samples (2.4 pg/g, 5.5 pg/g and 8.7 pg/g, Table A-2). The geometric mean TCDD-TEQ concentration for 13 eggs was 189 pg/g with a range from 62 to 457 pg/g (Table 3). The greatest contributor to the TCDD-TEQ in eggs was PCB#126 (see shaded row, Table A-2).

In 13 eggs, ∑PCBs ranged from 1551.0 ng/g to 21457.8 ng/g (geometric mean 8972.3 ng/g, Table 3), while p,p'-DDE ranged from 788.8 ng/g to 3254.0 ng/g (geometric mean 1843.2 ng/g) (Table 3). Over 93% of ∑DDT was comprised of p,p'-DDE in eggs (range: 71.7 – 100%).

5.1.2 PBDE – In 10 eggs, the geometric mean ∑PBDE concentration was 607.5 ng/g (range: 308.2 – 1073.5 ng/g, Table 3). The dominant BDE congeners in eggs were BDE# 47 (see shaded row, Table A-3) followed by BDE# 99, BDE# 100, and BDE# 153.

5.1.3 Mercury – Mercury in 16 bald eagle eggs ranged from 0.069 to 0.974 µg/g (geometric mean 0.191 µg/g, Table 3; dry weight values and percent moisture shown in Table A-4).

5.2 Plasma. A total of 65 bald eagle nestlings were captured and sampled for the current study (Table 2). Whole blood samples from 64 nestlings were analyzed for mercury (Table A-10). Plasma fractions from 60 nestlings were analyzed for OCs and PBDE (Tables A-5 through A-9).

5.2.1 Organochlorines – The geometric mean TCDD-TEQ $_{PCB}$ concentration in nestling plasma was 0.50 pg/g and the range was 0.01 to 60.9 pg/g (Table 4). PCB# 118 was the only dioxin-like congener detected in all plasma samples (Table A-5). PCB# 81 and PCB# 114 were below detection limits in all plasma samples. Among the 12 dioxin-like PCB congeners, the dominant congener within the TCDD-TEQ $_{PCB}$ varied among the 60 samples. PCB#105 was the dominant congener in 25 of 60 samples and PCB#156 was dominant in 10 samples (see shaded cells in Table A-5).

∑PCBs ranged from 14.6 to 2220.0 ng/g in nestling plasma (geometric mean 114.7 ng/g). The geometric mean p,p'-DDE concentration was 14.8 ng/g and the range was 1.8 ng/g to 224.0 ng/g (Table 4, see Table A-6 for individual sample concentrations of ∑PCBs and all DDT metabolites and isomers).

5.2.2 ΣPBDE - PBDE was detected in 56 of 60 nestling plasma samples. Using one-half the detection limit for total PBDE in four samples, the geometric mean ∑PBDE concentration in nestling plasma was 5.6 ng/g wet weight (detectable range: 0.5 – 98.3 ng/g) (Table 4). The dominant congener in plasma samples was BDE# 47 followed by BDE# 99 and BDE# 100 (Table A-9). In 21 of 60 samples, 100% of ∑PBDE was comprised of BDE# 47.

5.3 Whole Blood. Mercury in bald eagle nestling whole blood ranged from 0.023 µg/g to 0.817 µg/g and the geometric mean was 0.097 µg/g (Table 5). Appendix Table A-10 lists mercury concentrations in individual nestling whole blood samples.

Table 3. Summary of organic contaminants and mercury in eggs from coastal Maine bald eagles, 2000 - 2012

Contaminant	Units	n (n > DL)	Geometric Mean	Geometric Standard Deviation	Range of Detectable Concentrations
2,3,7,8-TCDD	pg/g fww	13 (3)	NC		2.4 – 8.7
TCDD-TEQ	pg/g fww	13 (13)	189	1.9	62 – 457
∑PCBs	ng/g fww	13 (13)	8972.3	2.0	1551.0 – 21457.8
p,p'-DDE	ng/g fww	13 (13)	1843.2	1.6	788.8 – 3254.0
∑PBDE	ng/g fww	10 (10)	607.5	1.6	308.2 – 1073.5
Hg	µg/g fww	16 (16)	0.191	2.1	0.069 – 0.974

pg/g = parts per trillion, ng/g = parts per billion, µg/g = parts per million
fww = fresh wet weight (i.e., corrected for moisture loss)
n = number of samples analyzed, n > DL = number of samples with detectable concentrations
NC = not calculated, one-half or more of samples were below detection limit

Table 4. Summary of organic contaminants in plasma from coastal Maine bald eagle nestlings, 2007 - 2011

	Units	Geometric Mean	Geometric Standard Deviation	Range of Concentrations
TEQ Planar PCBs	pg/g wet weight	0.50	7.7	0.01 – 60.9
∑PCBs	ng/g wet weight	114.7	2.8	14.6 – 2220.0
p,p'-DDE	ng/g wet weight	14.8	3.0	1.8 – 224.0
∑PBDE	ng/g wet weight	5.6	3.2	0.5 – 98.3
TEQ Planar PCBs	pg/g lipid	109.1	7.8	1.4 11490.2
∑PCBs	ng/g lipid	25167.9	3.1	2754.7 – 472340.4
p,p'-DDE	ng/g lipid	3238.2	3.3	332.1 – 47659.6
∑PBDE	ng/g lipid	1251.2	3.5	111.0 – 14892.3

n = 60, pg/g = parts per trillion, ng/g = parts per billion

Table 5. Mercury in whole blood from coastal Maine bald eagle nestlings, 2007 - 2011

	Units	Geometric Mean	Geometric Standard Deviation	Range of Concentrations
Hg	µg/g wet weight	0.097	2.3	0.023 – 0.817

n = 64, µg/g = parts per million

6. Discussion

Sixteen non-viable or abandoned eggs and 65 nestling blood samples collected between 2000 and 2012 were analyzed for the investigation. The first study objective was to compare current contaminant levels in eggs and blood from coastal Maine bald eagles to suggested toxicity threshold levels reported in the scientific literature. Threshold contaminant values have been reported for bald eagles, other raptor species, and other bird species. Threshold endpoints vary for different contaminants and encompass different effects including embryo lethality, reduced probability of producing young, delayed egg laying, and reduced hatching success. If a contaminant threshold level specific to bald eagles was available, we cite the concentration. If not, we cite publications for other bird species.

The second study objective of the investigation was to compare contaminant concentrations to previous Maine investigations. Primarily, egg and blood contaminant data were compared to the Master's thesis by Welch (1994) and the Ph.D. dissertation by Matz (1998). Raw analytical data for these studies were obtained from the USFWS Environmental Contaminants Database Management System (ECDMS), accessed through the USFWS Environmental Conservation Online System. Welch's data are included in ECDMS Catalogs 5030005 and 5030015. Matz's data are included in ECDMS Catalogs 5030034, 5030037, 5030043, and 5030057. Egg data were also compared to even earlier collections of coastal Maine bald eagles by Krantz *et al*. 1970, Wiemeyer *et al*. 1972, Wiemeyer *et al*. 1984, and Wiemeyer *et al*. 1993.

In selecting sampling locations for the current investigation, nest territories that were previously sampled by Welch (1994) and Matz (1998) were given priority. Ultimately, we were able to collect two eggs and 18 nestling blood samples from nest territories sampled in the 1990s. However, a direct comparison of past and current analytical results raises some issues related to analytical methods, detection limits, sample preparation, and comparability of data. For example, analytical methods and instruments have greatly improved since the 1990s and lower detection limits are now possible. Non-detects of PCB and DDE in nestling blood reported by Matz (1998) may today be well within the range of reportable concentrations. Welch (1994) had whole blood samples analyzed for mercury using cold vapor atomic absorption. In the current study, BRI analyzed for total mercury in whole blood using a thermal decomposition technique with an automated direct mercury analyzer (DMA). Welch (1994) and Matz (1998) measured organochlorines in whole blood and preserved their samples with 5% formalin, shipping the samples cold but unfrozen to analytical laboratories. In contrast, immediately after returning from the field we spun nestling whole blood to obtain plasma fractions and froze plasma samples. Plasma samples were temporarily stored frozen and shipped frozen to the laboratories for organic analyses. These differences in laboratory methods and sample preparation must be taken into consideration. Moreover, since Welch and Matz reported organochlorine concentrations in whole blood, we had to adjust their concentrations to an estimated plasma value. Bowerman *et al*. (1994) applied a 2X conversion factor to bald eagle whole blood data to derive an estimated plasma value. This whole blood to plasma conversion factor has been rarely cited in the scientific literature, but appears reasonable. For example, in a study of PCBs in gray seal pups *Halichoerus grypus*, Jenssen *et al*.

(2003) found higher lipid values in plasma than whole blood and higher PCB concentrations in plasma than whole blood – by a factor of 1.47. Consequently, we applied Bowerman's 2X conversion factor to the Welch and Matz nestling whole blood organics data to derive estimated plasma values.

Finally, it should be noted that the analysis of addled and abandoned bald eagle eggs collected in Maine represent a biased sample. The concentrations in these eggs may not be representative of contaminant residues in all Maine bald eagle eggs. The contaminant residue burdens would not be known for viable eggs that successfully hatched or non-viable eggs that were not available for collection (e.g., inaccessible nest trees or lost to predation).

6.1 Eggs

6.1.1 Organochlorines – Three of 13 coastal bald eagle eggs had TCDD-TEQ concentrations in excess of the suggested toxicity threshold of 303 pg/g (Elliott and Harris 2002). Two bald eagle eggs, one from Hog Island in Bremen and one from Bois Bubert Island in Milbridge, exceeded suggested ΣPCBs toxicity threshold levels (20,000 ng/g, Elliott and Harris 2002; 26,000 ng/g Best *et al*. 2010), while five eggs with concentrations of greater than 10,000 ng/g would be considered elevated. None of the 13 coastal eggs had levels above suggested threshold concentrations for p,p'-DDE (4,500 ng/g Best *et al*. 2010; 5,500 ng/g, Henny and Elliott 2007).

∑PCBs and p,p'-DDE have been measured in coastal Maine bald eagle eggs since the 1960s (Figure 2, Krantz *et al*. 1970, Wiemeyer *et al*. 1972, Wiemeyer *et al*. 1984, Wiemeyer *et al*. 1993, Welch 1994, Matz 1998). ∑PCB and p,p'-DDE levels in 13 coastal eggs collected between 2000 and 2011 are significantly lower ($p < 0.05$, Mann-Whitney U Test) than egg contaminant levels reported in the 1990s (Welch 1994, Matz 1998). In a recent report on toxic chemical contaminants in the Gulf of Maine (Harding and Burbidge 2013), monitoring data suggest a downward trend in legacy organochlorine contaminant concentrations. While coast-wide bald eagle egg data in the current study indicate a declining organochlorine trend, a comparison of two individual nest territories near Acadia National Park that were sampled in the 1990s and in 2009 do not show a decline in ∑PCBs levels (Figure 3). DDE egg levels in these two territories, however, do show a decline (Figure 3). The reason for the increase in egg PCBs at these two territories is not known and warrants further investigation.

Welch (1994) reported that contaminant levels in Maine bald eagles differed whether territories were located in coastal or inland habitats. In an earlier Maine study, Todd *et al*. (1982) analyzed food remains in bald eagle breeding and wintering areas. Eagles feeding in inland areas had a diet dominated by fish, while coastal eagles fed primarily on birds. Welch (1994) attributed differences in contaminant levels between coastal and inland eagle territories to dietary uptake of prey species from lower (e.g., fish) or higher (e.g., birds) trophic levels. Using a larger bald eagle egg dataset collected throughout Maine (i.e., including inland nest territories) between 2000 and 2011 (USFWS, unpublished data), current concentrations of organochlorine contaminants were compared between habitat types. As in the Welch (1994)

study, ΣPCBs and p,p'-DDE levels in eggs were significantly higher at coastal bald eagle territories than inland territories ($p < 0.001$, Mann-Whitney U Test, Figure 4). There was no significant difference in TCDD-TEQs egg concentrations between inland and coastal nest territories ($p = 0.789$).

6.1.2 PBDE – Among 10 coastal bald eagle eggs, none had ∑PBDE levels above a suggested threshold concentration for the American kestrel *Falco sparverius* (1,800 ng/g, McKernan *et al*. 2009). PBDE was not measured in previous Maine investigations of bald eagle eggs, so historical comparisons are not possible. There was no significant difference in ΣPBDE levels in 49 eggs collected statewide between 2005 and 2011 based on territory habitat type - coastal vs. inland ($p = 0.063$, Mann-Whitney U Test; Figure 5, includes unpublished USFWS data).

6.1.3 Mercury – A generally accepted toxic threshold concentration or reproductive effect endpoint for mercury in bird eggs has not been established. Some researchers have suggested 0.80 µg/g as an endpoint (Heinz 1979, Henny *et al*. 2002), while other investigators have suggested 1.00 µg/g as an ecological effect threshold (Scheuhammer *et al*. 2007). A dosing study of several avian species by Heinz *et al*. (2009) categorized two raptor species (American kestrel and osprey *Pandion haliaetus*) as highly sensitive to methylmercury[1] with LC_{50}s less than 0.25 µg/g. The geometric mean mercury concentration in 16 coastal Maine bald eagle eggs was 0.191 µg/g (Table 3), a concentration below all the suggested effect levels mentioned above.

Mercury concentrations in 83 eggs collected statewide between 2000 and 2012 were significantly higher at inland bald eagle territories than coastal territories ($p < 0.05$, Mann-Whitney U Test; Figure 5, includes unpublished USFWS data), a finding previously reported by Welch (1994). Mercury has been measured in coastal Maine bald eagle eggs since the 1960s (Figure 2, Krantz *et al*. 1970, Wiemeyer *et al*. 1972, Wiemeyer *et al*. 1984, Wiemeyer *et al*. 1993, Welch 1994, Matz 1998). Mercury concentrations in 16 coastal eggs collected between 2000 and 2012, however, were not significantly different ($p = 0.197$, Mann-Whitney U Test) than egg contaminant levels reported in the 1990s (Welch 1994, Matz 1998).

[1] Methylmercury may account for nearly all of the total mercury in bird eggs (Schwarzbach *et al*. 2006).

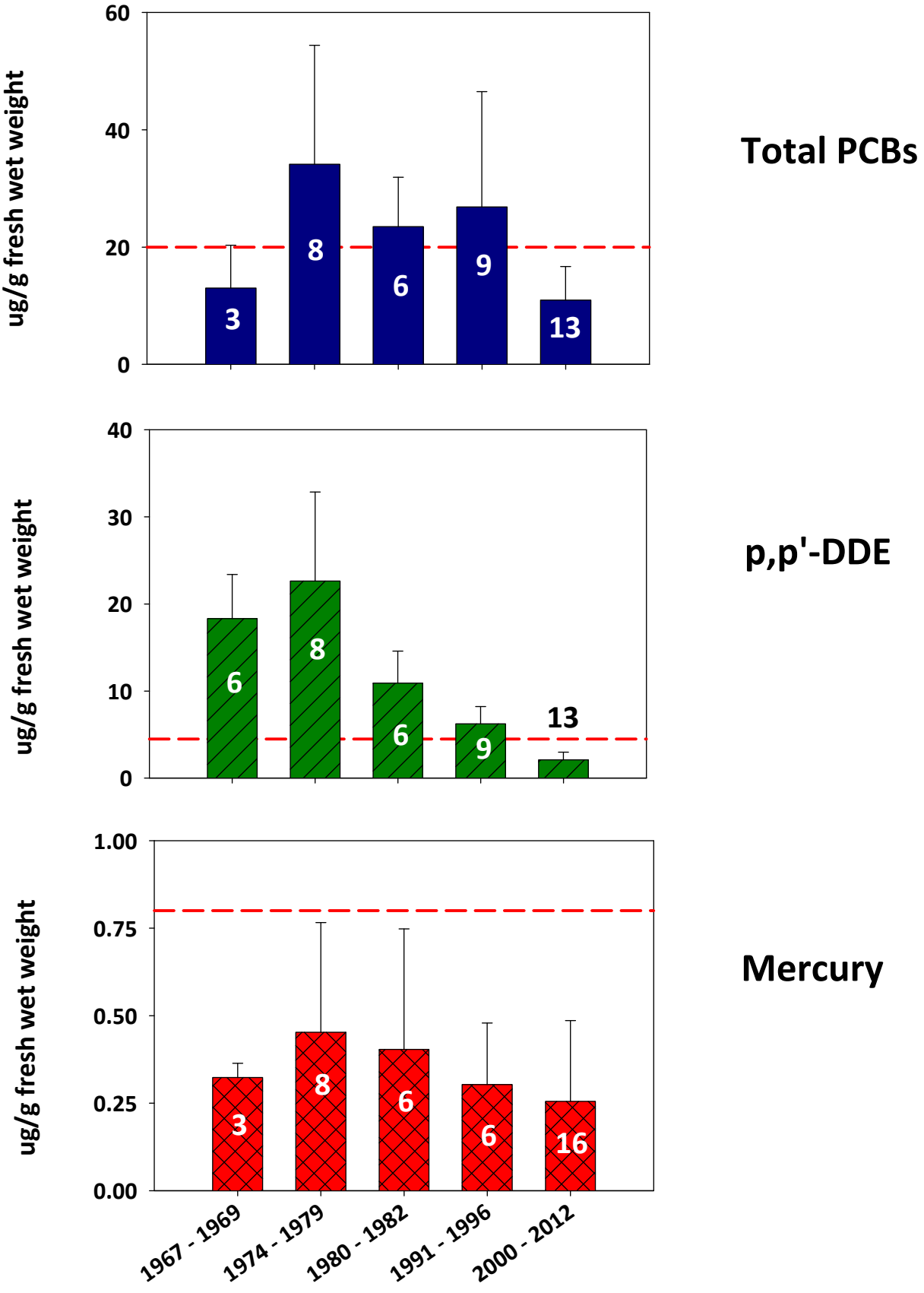


Figure 2. Total PCBs, DDE, and mercury in coastal Maine bald eagle eggs by collection period. Bars represent arithmetic mean, whiskers represent standard deviation, and number of eggs listed within bars. Red dashed lines represent suggested toxicity threshold levels (20 ug/g PCB, Henny & Elliott 2007; 4.5 ug/g DDE, Best *et al*. 2010; 0.80 ug/g Hg, Henny *et al*. 2002). Three eggs collected in 2012 not analyzed for PCBs or DDE.

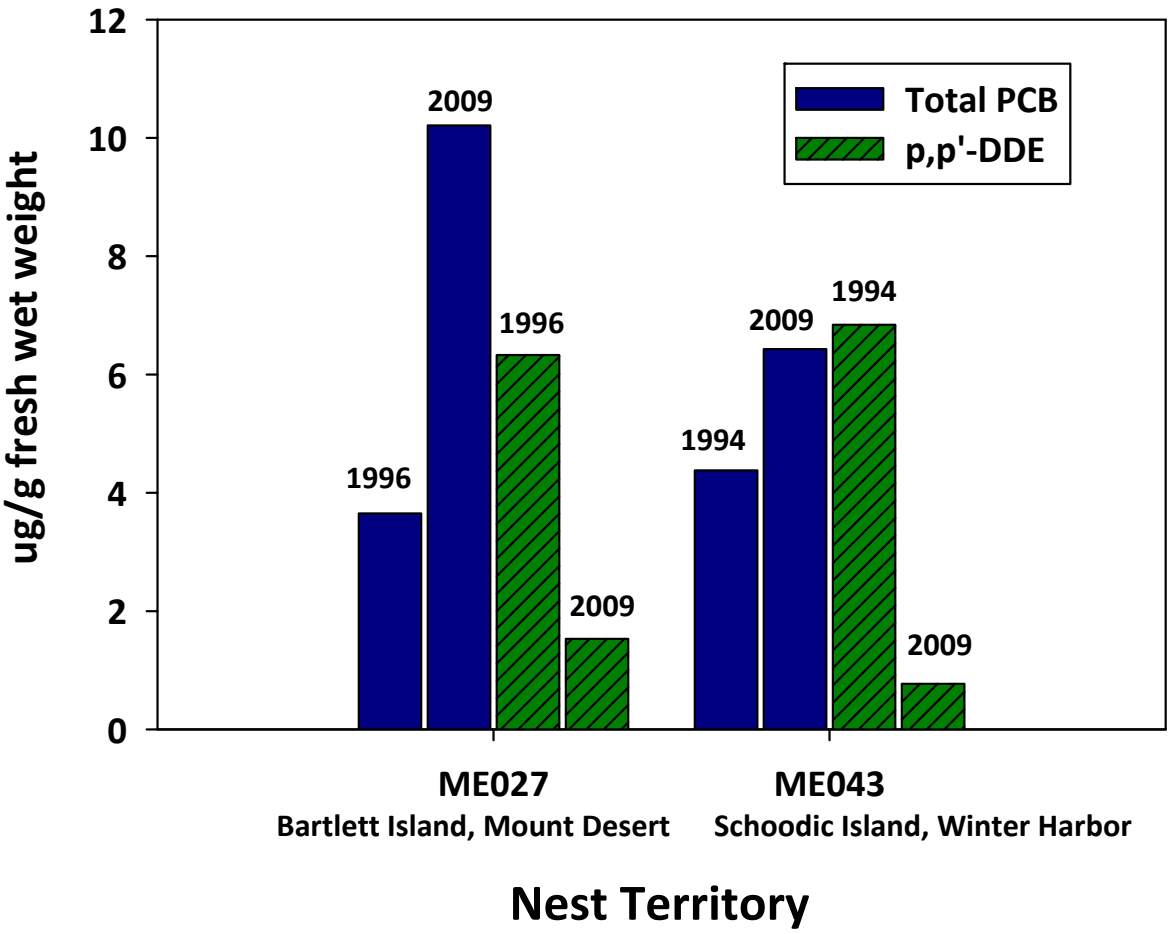


Figure 3. Change in concentrations of Total PCB and DDE in bald eagle eggs from two coastal Maine nest territories. Year of collection listed over bar. One egg from each territory each sampling year.

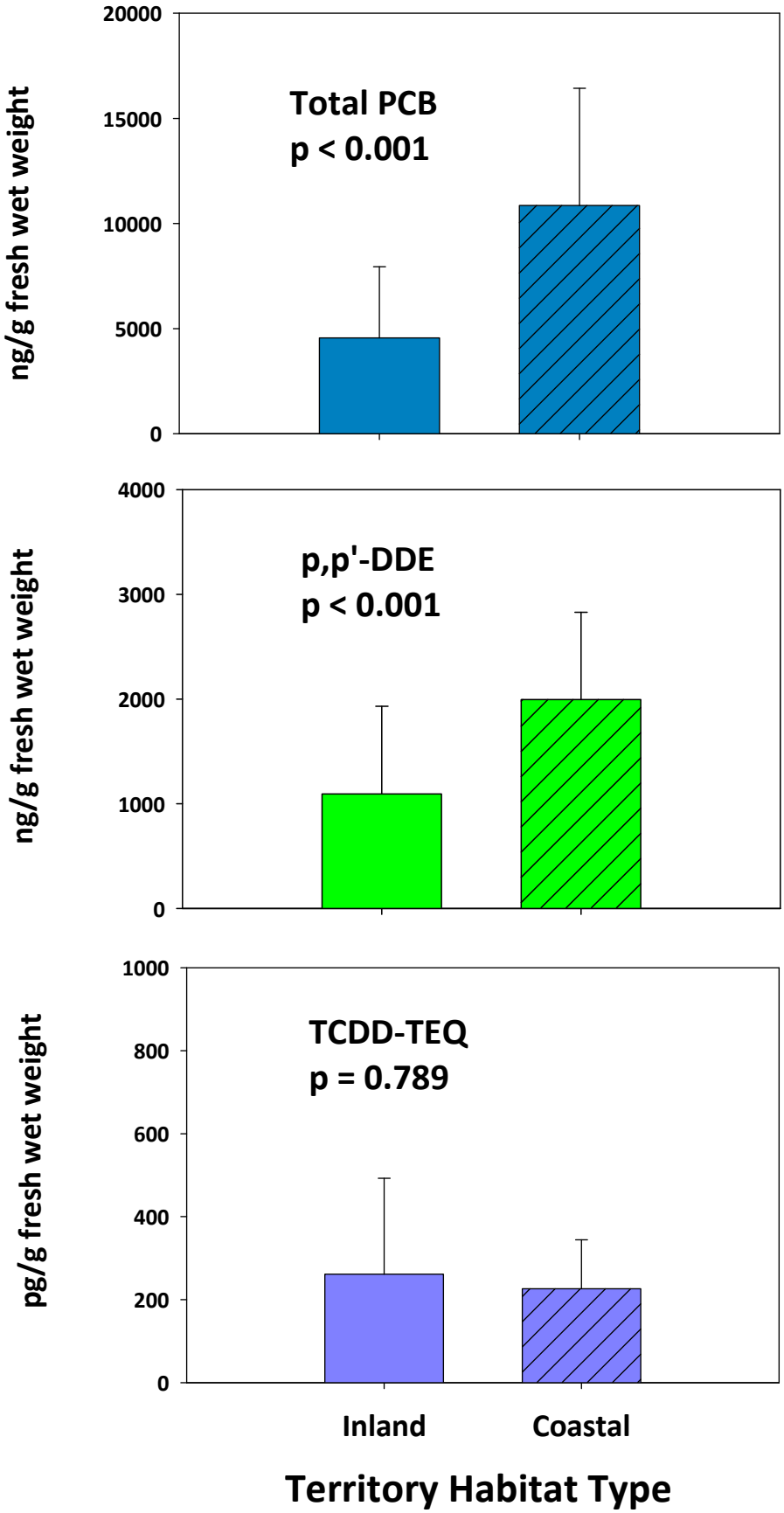


Figure 4. PCB, DDE, and TCDD-TEQ concentrations in bald eagle eggs - inland (n = 67, USFWS unpublished data) vs. coastal (n = 13, current study) nest territories. Solid bars = inland, Hached bars = coastal. Bars represent arithmetic mean, whiskers represent standard deviation. Mann-Whitney U Test p values. Eggs collected from 2000 to 2011.

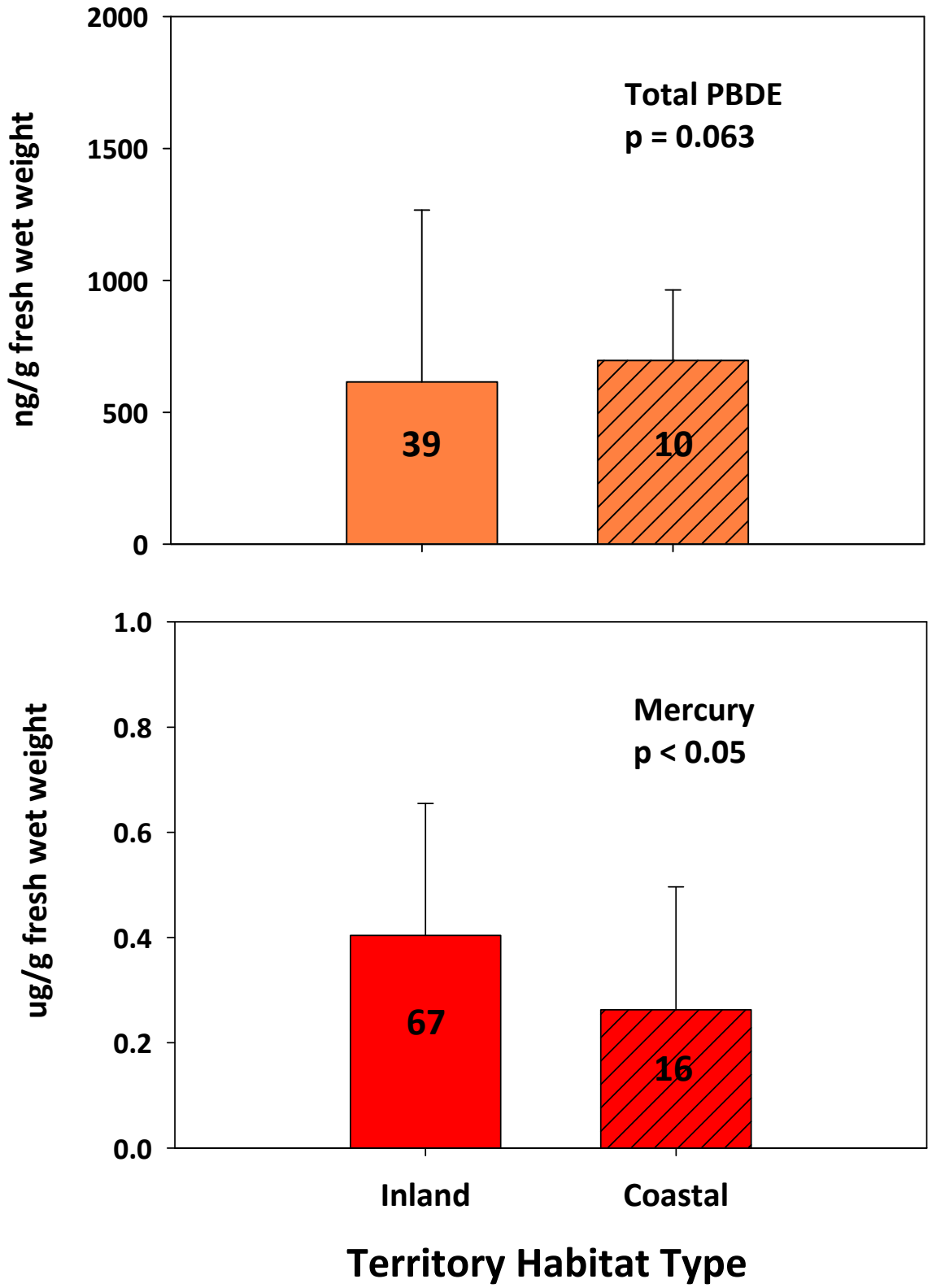


Figure 5. PBDE and mercury concentrations in bald eagle eggs - inland (USFWS unpublished data) vs. coastal nest territories (current study). Number of egg samples listed within bars. Solid bars = inland, Hached bars = coastal. Bars represent arithmetic mean, whiskers represent standard deviation. Mann-Whitney U Test p values. Inland eggs analyzed for PBDE collected from 2005 to 2011, coastal eggs between 2009 and 2011. Eggs analyzed for mercury collected from 2000 to 2012.

6.2 Plasma

6.2.1 Organochlorines – The geometric mean concentration of ΣPCB in nestling plasma (114.7 ng/g) was not elevated compared to a suggested toxicity effect threshold (> 189 ng/g, Elliott and Harris 2002). However, 30% of the samples had plasma ΣPCB levels above the toxicity threshold level. Similarly, while the mean concentration of p,p'-DDE in nestling plasma (14.8 ng/g) was below a suggested effect threshold (41 ng/g, Henny and Elliott 2007), 18% of the samples had concentrations above the suggested toxicity threshold. Concentrations of ∑PCBs and p,p'-DDE in coastal Maine bald eagle nestling plasma were closely related (r^2 = 0.919, Figure 6) and similar to results in bald eagles from coastal British Columbia and California (Elliott *et al*. 2009).

In 18 nest territories where blood was collected in other Maine investigations, current PCB levels in nestling plasma are two orders of magnitude lower than the plasma levels estimated from Welch (1994) and approximately one order of magnitude lower than the plasma levels estimated from Matz (1998) (Figure 8). The same magnitude of difference among collections is also evident for p,p'-DDE in nestling plasma (Figure 8). Nestling plasma PCB levels in the current study are significantly lower than collections from 1994 and 1995 (n = 50, Matz 1998, $p < 0.05$, Mann-Whitney U Test). Current nestling plasma p,p'-DDE levels are also significantly lower ($p < 0.001$, Mann-Whitney U Test) than the levels estimated from Matz (1998).

Compared to other bald eagle studies in North America, the current mean PCB level in coastal Maine nestling plasma is not the highest report, but generally is higher than other studies (Table 6). The current mean DDE level in coastal Maine nestling plasma is within the ranges reported in other studies (Table 6).

Among the nest territories sampled between 2007 and 2011, nestling plasma data suggest that three potential hot-spots of PCB contamination may exist along the Maine coast - the Sheepscot River estuary (max. 2220 ng/g), Frenchman Bay (max. 1160 ng/g), and Little Machias Bay (336 ng/g). These areas warrant further investigation.

6.2.2 Polybrominated Diphenyl Ether (PBDE) – The geometric mean ΣPBDE level (5.6 ng/g) in coastal Maine nestling plasma samples was within ranges reported in other bald eagle studies in the U.S. and Canada (Table 6). The maximum ∑PBDE nestling plasma level detected in Maine (98.3 ng/g), however, was higher than any of the maximums reported in other studies. Log-transformed ∑PBDE nestling plasma concentrations were moderately related with ∑PCB or p,p'-DDE (r^2 = 0.63, Figure 7). In bald eagle blood from the Great Lakes region, Venier *et al*. (2010) found a positive, statistically significant correlation between PBDE and PCB ($r = 0.851$, $p < 0.001$) and between PBDE and DDE ($r = 0.902$, $p < 0.001$). Toxicity threshold levels for ∑PBDE in bird plasma have not been established and the potential significance of the levels found in the current study is not known.

Monitoring data for the Gulf of Maine suggest a downward trend in legacy organochlorine contaminant concentrations such as PCB and DDE, but an exponential increase of PBDEs in the

marine environment since the introduction of flame retardants in the 1970s (Harding and Burbidge 2013). Along the coast of Maine, PBDEs have been measured in teleost whole fish that comprise the prey base of seals and in the blubber of harbor seals *Phoca vitulina* (Shaw *et al*. 2008, Shaw *et al*. 2009). Shaw *et al*. (2008) found PBDEs in harbor seal blubber that were orders of magnitude higher than level found in stranded marine mammals and at the high end of the concentration range reported for PBDEs in marine mammals around the world. During the winter months in Maine, bald eagles have been observed aggressively feeding on gray seal placenta and dead seal pups during the pupping season. Similar opportunistic foraging activity also occurs during the harbor seal pupping season in late May and June.

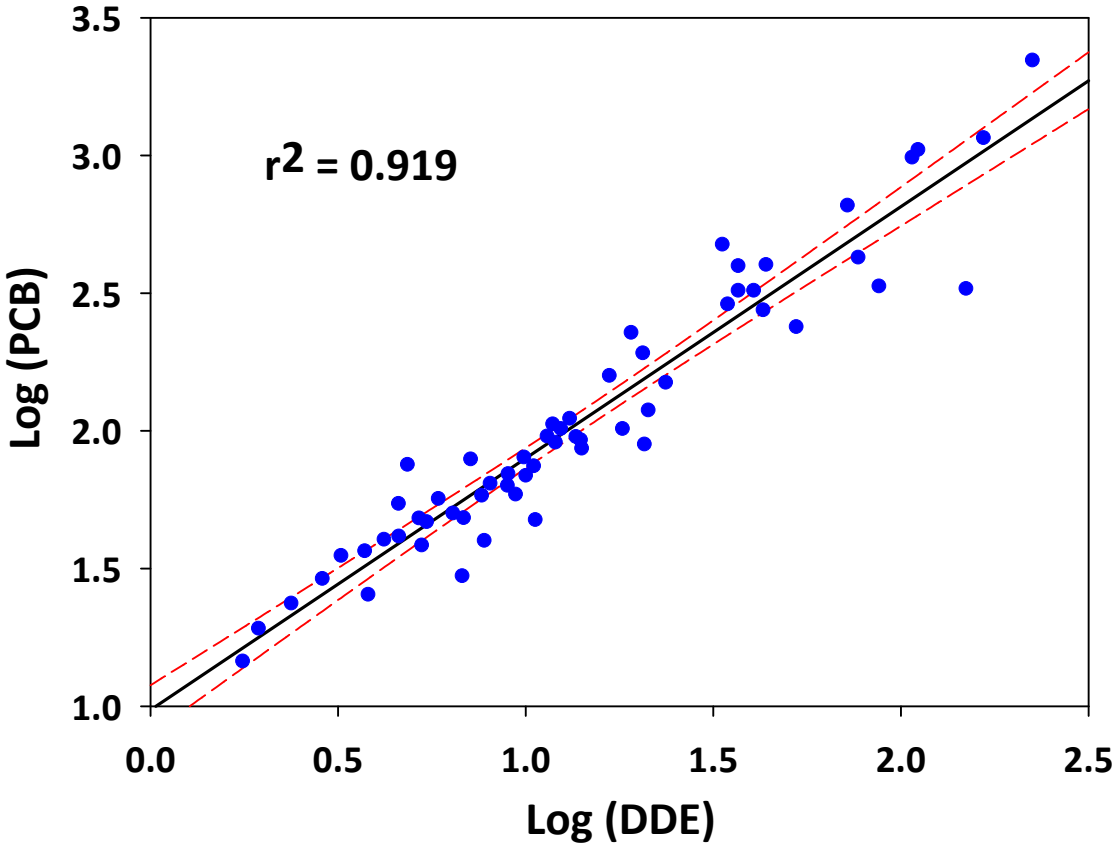


Figure 6. Linear regression of Log (PCB) and Log (DDE) in nestling plasma, ng/g wet weight. Dashed lines = 95% confidence intervals

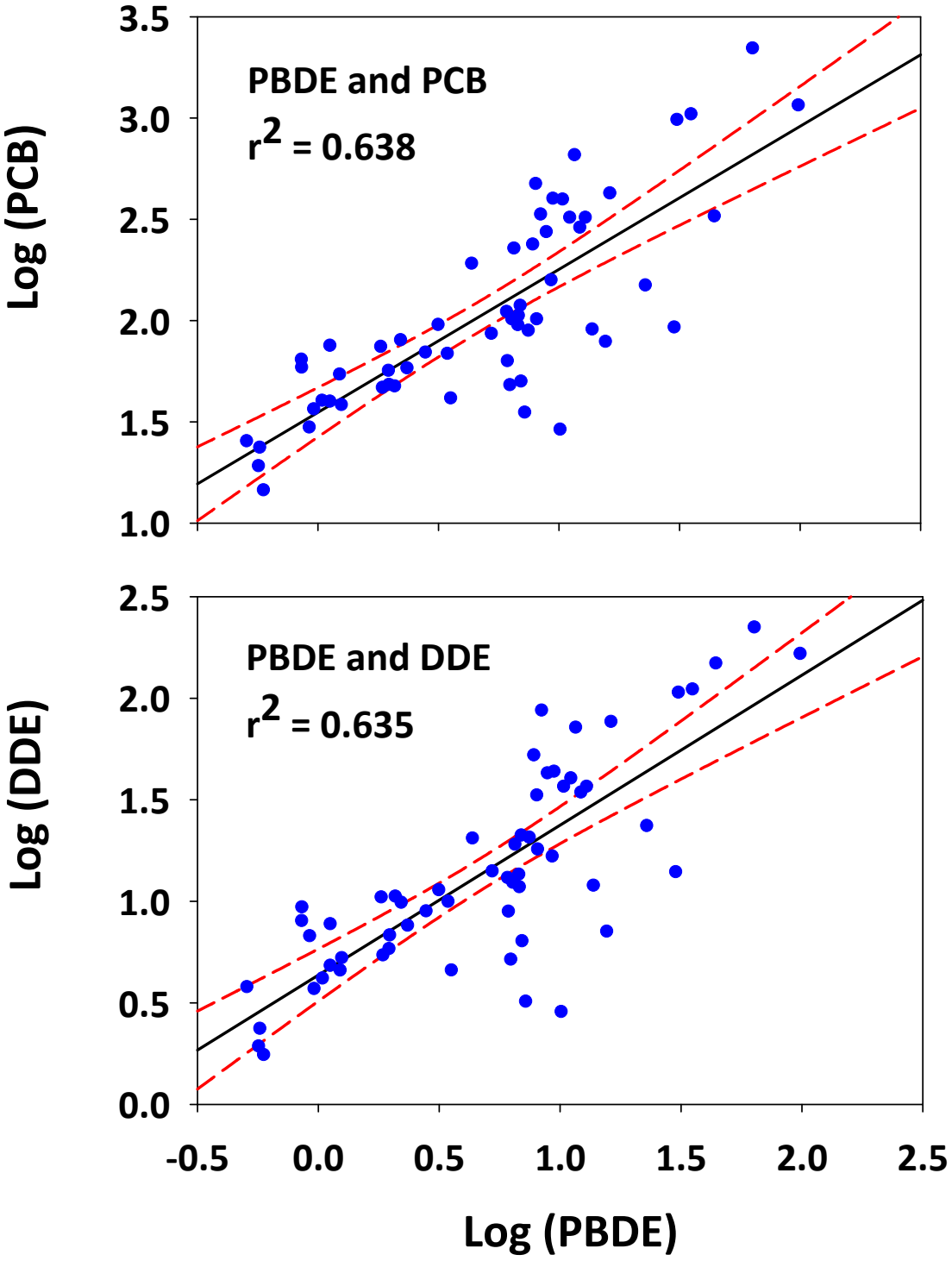


Figure 7. Linear regressions of Log (PBDE) vs. Log (PCB) and Log (PBDE) vs. Log (DDE) In nestling plasma, ng/g wet weight. Dashed lines = 95% confidence intervals.

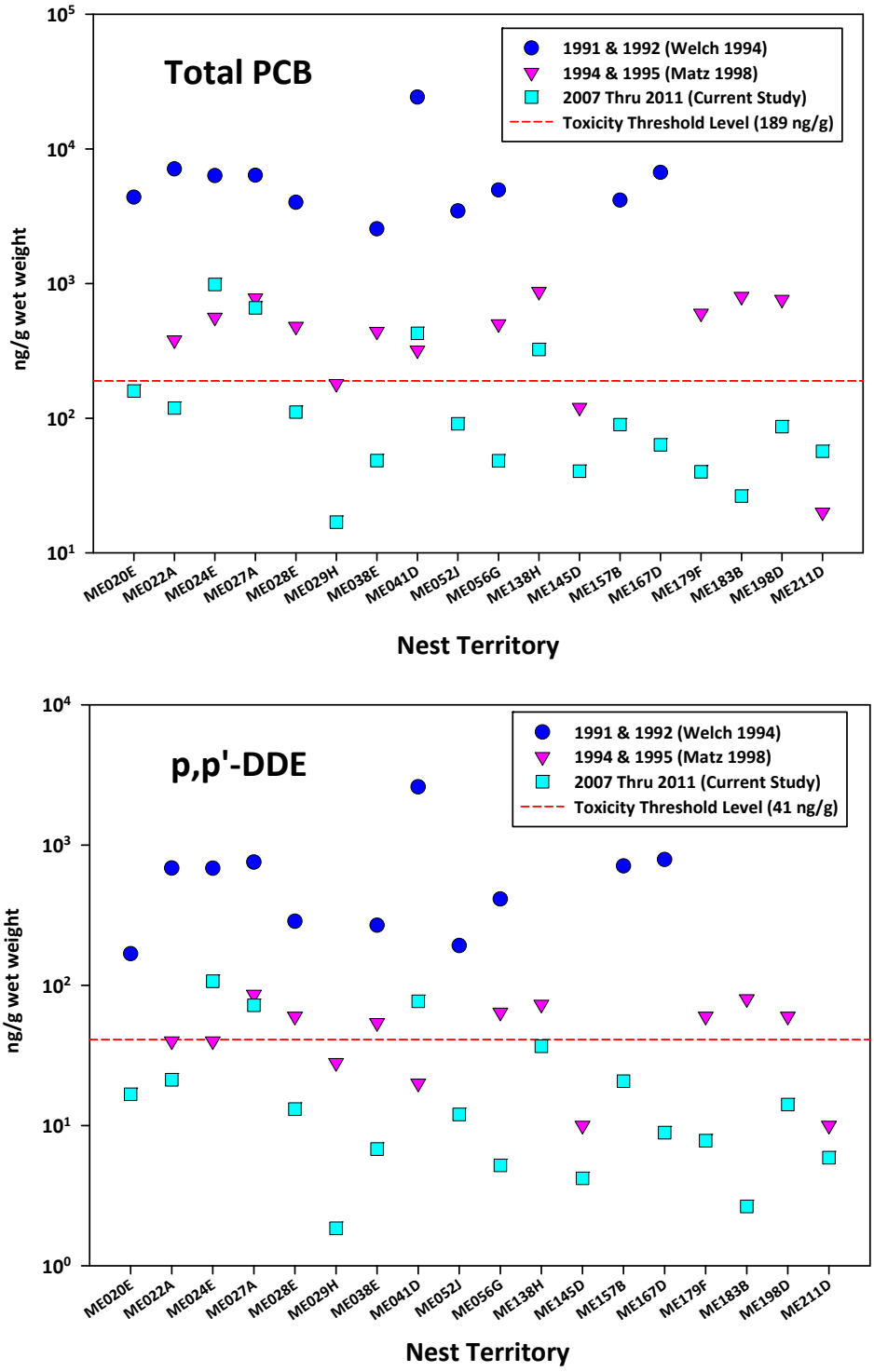


Figure 8. Total PCB and p,p'-DDE in coastal Maine bald eagle nestling plasma – comparisons among collections from same territories. Welch (1994) and Matz (1998) whole blood data changed to estimated plasma values using a 2X conversion factor (Bowerman 1994). Suggested toxicity threshold levels from Henny and Elliott (2007).

Table 6. Geometric means and ranges of ∑PCBs, p,p'-DDE, and ∑PBDE in coastal Maine bald eagle nestling plasma compared to other studies, ng/g wet weight

Region Year(s) of Collections	n	∑PCB	p,p'-DDE	∑PBDE	Data Source
Coastal Maine 2007 - 2011	60	114.7 (14.6 - 2220.0)	14.8 (1.8 - 224.0)	5.6 (0.5 - 98.3)	Current Study
Great Lakes 2005	15	73.8 [a] (5.46 - 254.0)	19.9 [a] (2.85 - 62.6)	5.7 [a] (0.35 - 29.3)	Venier *et al* . 2010
Lake Superior, Wisconsin 2000 - 2001	5			7.9 (6.1 - 13.6)	Dykstra *et al* . 2005
Michigan 1999 - 2002	398	7.9 - 122.0 [b] (< 10.0 - 368.0)	4.0 - 37.0 [b] (< 5.0 - 257.0)		Roe 2004
British Columbia 2001 - 2003	31	2.6 - 28.9 [b] (1.0 - 97.0)	3.0 - 19.1 [b] (0.7 - 57.7)	0.40 - 8.49 [c] (BDL - 18.87)	McKinney *et al* . 2006 (PBDE) Cesh *et al* . 2008 (PCB, DDE)
California 2003	3	10.7 (6.5 - 21.9)	41.3 (18.0 - 123.4)	30.9 [a]	McKinney *et al* . 2006 (PBDE) Cesh *et al* . 2008 (PCB, DDE)

ng/g = parts per billion
Ranges of detections in parentheses
[a] Arithmetic mean, [b] Range of geometric means, [c] Range of arithmetic means
BDL = below detection limits

6.3 Whole Blood

In the current study, mercury in whole blood from coastal bald eagle nestlings was not elevated. Only two of 64 samples contained mercury concentrations greater than a suggested background exposure level (< 0.40 µg/g, adapted from an exposure scale developed for the common loon *Gavia immer* - Burgess and Meyer 2008 and Evers *et al*. 2008). Nestling whole blood samples with mercury levels greater than background were found in two siblings (0.644 µg/g and 0.817 µg/g) from the same nest territory, ME339D in Stockton Springs, where the Penobscot River enters into Penobscot Bay. A third sibling in the nest had a whole blood concentration of 0.337 µg/g.

There was no significant difference (p = 0.881, Mann-Whitney U Test, Figure 9) in nestling whole blood mercury concentrations between collections by Welch (1994) and the current study. There was no apparent pattern in nestling whole blood between collections where samples were collected from the same nest territories. Among twenty territories where mercury was measured in 1991 and 1992 and again between 2007 and 2011, blood samples from eight territories exhibited an increase in mercury levels, eight were lower, and four were unchanged (Figure 10).

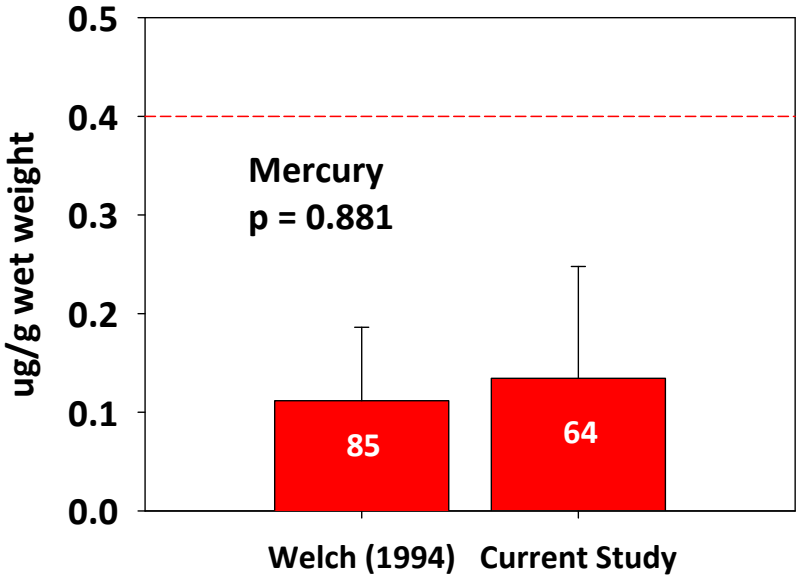


Figure 9. Mercury in nestling whole blood – comparison between Welch (1994) and the current study. Number of samples listed within bars. Bars represent arithmetic mean and whiskers represent standard deviation. Mann-Whitney U Test p value. Dashed line = suggested background level.

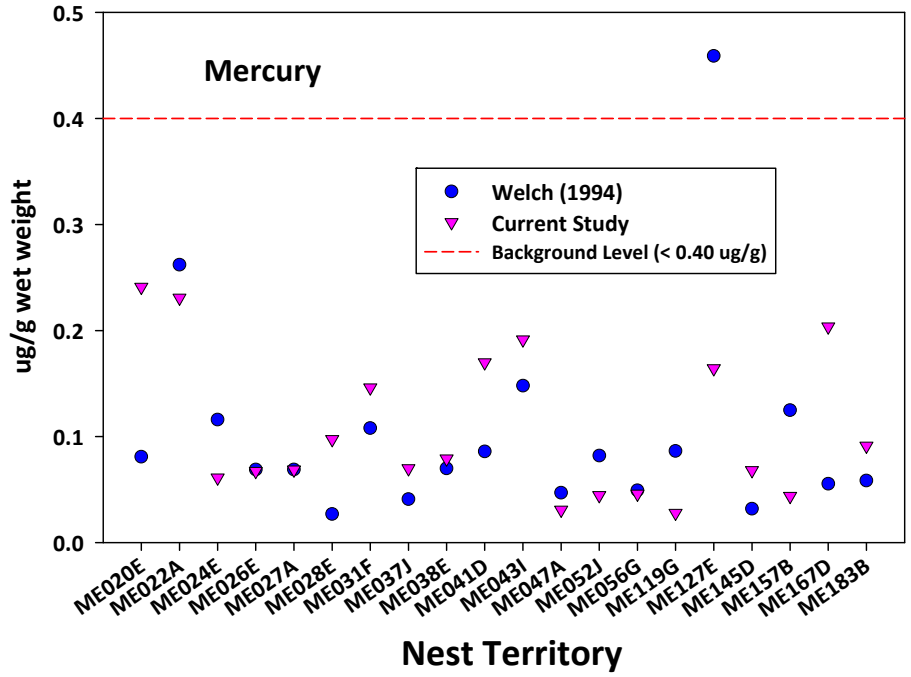


Figure 10. Mercury in nestling whole blood – comparison between collections from same territories. Dashed line = suggested background level (based on common loon, Burgess and Meyer 2008, Evers *et al*. 2008).

7. Summary of Results and Management Action Recommendation

Current levels of organochlorine compounds, specifically ∑PCBs and p,p'-DDE, in coastal Maine bald eagles eggs (Figure 2) and plasma ($p < 0.05$) are significantly lower than results reported in earlier Maine collections (Welch 1994, Matz 1998) and lower than suggested toxicity effect thresholds (Elliott and Harris 2002, Henny and Elliott 2007). Three of 13 coastal bald eagle eggs (Tables A-1 and A-2) had TCDD-TEQ concentrations in excess of the suggested toxicity threshold of 303 pg/g (Elliott and Harris 2002).

Compared to other bald eagle studies in North American, ∑PCBs in coastal Maine bald eagle nestling plasma are on the higher end of reported concentrations ranges (Table 6). In the current study, ∑PCBs in bald eagle nestling plasma collected from three areas along the Maine coast - the Sheepscot River estuary (max. 2220 ng/g), Frenchman Bay (max. 1160 ng/g), and Little Machias Bay (336 ng/g) – were elevated and warrant further investigation. Eggs from two nest territories located near Acadia National Park did not show decreases in PCB concentrations from earlier collections and also warrant further investigation (Figure 3).

∑PBDE levels in coastal Maine bald eagle eggs do not appear elevated compared to a suggested toxicity threshold for American kestrel (McKernan *et al*. 2009). ∑PBDE levels in coastal Maine bald eagle plasma do not appear elevated compared to other bald eagle collections in North America (Table 6), but toxicity thresholds for bald eagles have not been published and the significance of the detected levels is not known. Numerous factors, including the extent of landscape urbanization, and feeding habits have been found to affect PBDE exposure and congener distribution patterns in predatory birds (Chen *et al*. 2007, 2010). Given short PBDE doubling times reported in the literature (Chen *et al*. 2008), and the lack of established or low effect thresholds for many species (McKernan *et al*. 2009, Chen *et al*. 2010), further efforts may be warranted to establish PBDE baselines in poorly represented areas and habitats of interest, such as sites adjacent to seal pupping areas and eagles nesting near urban areas.

Mercury levels in coastal Maine bald eagle eggs ($p = 0.197$) and whole blood ($p = 0.881$, Figure 9) do not show any significant changes from earlier collections. Current levels of mercury in bald eagles along the Maine coast are not elevated compared to suggested egg toxicity effect thresholds (Henny *et al*. 2002, Heinz *et al*. 2009) or to whole blood exposure scales (based on the common loon - Burgess and Meyer 2008, Evers *et al*. 2008).

Annual monitoring of statewide bald eagle productivity in Maine ceased in 2008. In 2008, eagle productivity in the coastal portion of Maine was 0.86 young/occupied nest, which was the same rate reported by Welch (1994) for estuarine and marine habitats in 1991 and 1992. Recent coastal bald eagle productivity rates over a longer time period (e.g., 2000 – 2008), however, varied widely (0.57 – 1.00 young/occupied nest, nine-year average = 0.79). Although coastal Maine bald eagle productivity can be low in some years, it is likely that legacy contaminants like PCBs and DDE are not driving factor influencing productivity. Exceptions exist in coastal nest territories where elevated concentrations of ∑PCBs persist in eggs or plasma.

8. Literature Cited

Best D.A., K.H. Elliott, W.W. Bowerman, M. Shieldcastle, S.J. Postupalsky, T.J. Kubiak, D.E. Tillitt and J.E. Elliott. 2010. Productivity, embryo and eggshell characteristics, and contaminants in bald eagles from the Great Lakes, USA, 1986 to 2000. Environ. Toxicol. Chem. 29(7):1581-1592.

Bortolotti G.R. 1984. Criteria for determining age and sex of nestling bald eagles. J. Field Ornith. 55:467-481.

Bowerman W.W. 1993. Regulation of bald eagle (*Haliaeetus leucocephalus*) productivity in the Great Lakes Basin: an ecological and toxicological approach. Ph.D. Dissertation. Michigan State University. Lansing, MI.

Bowerman W.W., T.J. Kubiak, J.B. Holt, D.L. Evans, R.G. Eckstein, C.R. Sindelar, D.A. Best and K.D. Kozie. 1994. Observed abnormalities in mandibles of nestling bald eagles *Haliaeetus leucocephalus*. Bull. Environ. Contam. Toxicol. 53:450-457.

Bowerman W.W., D.A. Best, J.P. Giesy, M.C. Shieldcastle, M.W. Meyer, S. Postupalsky and J.G. Sikarskie. 2003. Associations between regional differences in polychlorinated biphenyls and dichlorodiphenyldichloroethylene in blood of nestling bald eagles and reproductive productivity. Environ. Toxic. Chem. 22(2):371-376.

Buehler D.A. 2000. Bald eagle (*Haliaeetus leucocephalus*). *In* The Birds of North America, No. 506. A. Poole and F. Gill (eds.). The Birds of North America, Inc. Philadelphia, PA. 40 pp.

Burgess N.M and M.W. Meyer. 2008. Methylmercury exposure associated with reduced productivity in common loons. Ecotoxicology 17:83-91.

Cesh L.S., T.D. Williams, D.K. Garcelon and J.E. Elliott. 2008. Patterns and trends of chlorinated hydrocarbons in nestling bald eagle (*Haliaeetus leucocephalus*) plasma in British Columbia and southern California. Arch. Environ. Contam. Toxicol. 55:496-502.

Chen D., R.C. Hale, B.D. Watts, M.J. La Guardia, E. Harvey and E. K. Mojica. 2010. Species-specific accumulation of polybrominated diphenyl ether flame retardants in birds of prey from the Chesapeake Bay region, USA. Environ. Pollut. 158:1883–1889.

Chen D., M.J. La Guardia, E. Harvey, M. Amaral, K. Wohlfort and R. C. Hale. 2008. Polybrominated diphenyl ethers in peregrine falcon (*Falco peregrinus*) eggs from the northeastern U.S. Environ. Sci. Tech. 42:7594–7600.

Chen D., B. Mai, J. Song, Q. Sun, Y. Luo, X. Luo, E.Y. Zeng and R. C. Hale. 2007. Polybrominated diphenyl ethers in birds of prey from Northern China. Environ. Sci. Tech. 41:1828–1833.

Dykstra C.R. 1995. Effects of contaminants, food availability, and weather on the reproductive rate of Lake Superior bald eagles (*Haliaeetus leucocephalus*). Ph.D. dissertation. University of Wisconsin. Madison, WI. 247 pp.

Dykstra C.R., M.W. Meyer, P.W. Rasmussen and D.K. Warnke. 2005. Contaminant concentrations and reproductive rate of Lake Superior bald eagles, 1989 0 2001. J. Great Lakes Res. 31:227-235.

Eisler R. 1986. Polychlorinated biphenyl hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Dept. Interior. Fish and Wildlife Service. Biol. Rep. 85 (1.7). 72 pp.

Elliott J.E. and M.L. Harris. 2002. An ecotoxicological assessment of chlorinated hydrocarbon effects on bald eagle populations. Rev. Toxicol. 4:1-60.

Elliott K.H., L.S. Cesh, J.A. Dooley, R.J. Letcher and J.E. Elliott. 2009. PCBs and DDE, but not PBDEs, increase with trophic level and marine input in nestling bald eagles. Sci. Total Environ. 407:3867-3875.

Evers D.C., L.J. Savoy, C.R. DeSorbo, D.E. Yates, W. Hanson, K.M. Taylor, L.S. Siegel, J.H. Cooley Jr., M.S. Bank, A. Major, K. Munney, B.F. Mower, H.S. Vogel, N. Schoch, M. Pokras, M.W. Goodale and J. Fair. 2008. Adverse effects from environmental mercury loads on breeding common loons. Ecotoxicology 17:69-81.

Fair J., E. Paul and J. Jones (eds.). 2010. Guidelines to the use of wild birds in research. Spec. Pub. (3rd Edition 2010). The Ornithological Council. Washington, DC.

Gaunt A.S. and L.W. Oring (eds.). 1999. Guidelines to the use of wild birds in research. Spec. Pub. (2nd Edition 1999). The Ornithological Council. Washington, DC.

Harding G. and C. Burbidge. 2013. State of the Gulf of Maine Report – toxic chemical contaminants. Gulf of Maine Council on the Marine Environment. 28 pp. http://www.gulfofmaine.org/2/resources/state-of-the-gulf-of-maine-report/contaminants/

Heinz G.H. 1979. Methymercury: reproductive and behavioral effects on three generations of mallard ducks. J. Wildl. Manage. 43(2):394-401.

Heinz G.H., D.J. Hoffman, J.D. Klimstra, K.R. Stebbins, S.L. Kondrad and C.A. Erwin. 2009. Species differences in the sensitivity of avian embryos to methymercury. Arch. Environ. Contam. Toxicol. 56:129-138.

Henny C.J., E.F. Hill, D.J. Hoffman, M.G. Spaulding and R.A. Grove. 2002. Ninteenth century mercury: hazards to wading birds and cormorants of the Carson River, Nevada. Ecotoxicology 11(4):213-231.

Henny C.J. and J.E. Elliott. 2007. Toxicology. Pages 329-350 *in* Bird D.M. and K. Bildstein (eds.). Raptor research and management techniques. Hancock House Publ. Blaine, WA. 462 pp.

Jenssen B.M., O. Haugen, E.G. Sormo and J.U. Skaare. 2003. Negative relationship between PCBs and plasma retinol in low-contaminated free-ranging gray seal pups (*Halichoerus grypus*). Environ. Res. 93:79-87.

Krantz W.C., B.M. Mulhern, G.E. Bagley, A. Sprunt IV, F.J. Ligas and W.B. Robertson Jr. 1970. Organochlorine and heavy metal residues in bald eagle eggs. Pest. Monit. J. 3(3):136-140.

Matz A. 1998. Organochlorine contaminants and bald eagles (*Haliaeetus leucocephalus*) in Maine: investigations at three ecological scales. Ph.D. Dissertation. University of Maine. Orono, ME.

McKernan M.A., B.A. Rattner, R.C. Hale and M. Ottinger. 2009. Toxicity of polybrominated diphenyl ethers (DE-71) in chicken (*Gallus gallus*), mallard (*Anas platyrynchos*), and American kestrel (*Falco sparverius*) embryos and hatchlings. Environ. Tox. Chem. 28(5):1007-1017.

McKinney M.A., L.S. Cesh, J.E. Elliott, T.D. Williams, D.K. Garcelon and R.J. Letcher. 2006. Brominated flame retardants and halogenated phenolic compounds in North American west coast bald eaglet (*Haliaeetus leucocephalus*) plasma. Environ. Sci. Tech. 40:6275-6281.

Roe A.S. 2004. Spatial and temporal analyses of environmental contaminants and trophic status of bald eagles in the Great Lakes region. Ph.D. Dissertation. Clemson University. Clemson, SC.

Scheuhammer A.M., M.W. Meyer, M.B. Sandheinrich and M.W. Murray. 2007. Effects of environmental methylmercury on the health of wild birds, mammals, and fish. Ambio 36(1):12-18.

Schwarzbach S.E., J.D. Albertson and C.M. Thomas. 2006. Effects of predation, flooding, and contamination on reproductive success of California clapper rails (*Rallus longirostris obsoletus*) in San Francisco Bay. Auk 123:45-60.

Shaw S.D., D. Brenner, M.L. Berger, F. Fang, C. Hong, R. Addink and D. Hilker. 2008. Bioaccumulation of polybrominated diphenyl ether in harbor seals from the northwest Atlantic. Chemosphere 73:1773-1780.

Shaw S.D., M.L. Berger, D. Brenner, K. Kannan, N. Lohmann and O. Papke. 2009. Bioaccumulation of polybrominated diphenyl ethers and hexabromocyclododecane in the northwest Atlantic marine food web. Sci. Total Environ. 407:3323-3329.

Stickel L.F., S.N. Wiemeyer and L.J. Blus. 1973. Pesticide residues in eggs of wild birds: adjustment for loss of moisture and lipid. Bull. Environ. Contam. Toxicol. 9(4):193-196.

Todd C.S., L.S. Young, R.B. Owen Jr. and F.J. Gramlich. 1982. Food habits of bald eagles in Maine. J. Wildl. Manage. 46:636-645.

USEPA (U.S. Environmental Protection Agency). 2007. Method 7473 – Mercury in solids and solutions by thermal decomposition, amalgamation, and atomic absorption spectrophotometry. http://www.epa.gov/osw/hazard/testmethods/sw846/pdfs/7473.pdf

USFWS (U.S. Fish and Wildlife Service). 2007. Analytical Control Facility – Quality Assurance and Quality Control. USFWS. Shepherdstown, WV. 7 pp.

Van den Berg M., L. Birnbaum, A.T.C. Bosveld, B. Brunstrom, P. Cook, M. Feeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X. Rolaf van Leewen, A.K.D. Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Waern and T. Zacharewski. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ. Health Persp. 106(12):775-792.

Venier M., M. Wierda, W.W. Bowerman and R.A. Hites. 2010. Flame retardants and organochlorine pollutants in bald eagle plasma from the Great Lakes region. Chemosphere 80:1234-1240.

Welch L.J. 1994. Contaminant burdens and reproductive rates of bald eagles breeding in Maine. M.S. Thesis. University of Maine. Orono, ME. 86 pp.

Wiemeyer S.N., B.M. Mulhern, F.J. Ligas, R.J. Hensel and J.E. Mathisen. 1972. Residues of organochlorine pesticides, polychlorinated biphenyls, and mercury in bald eagle eggs and changes in shell thickness – 1969 and 1970. Pest. Monit. J. 6:50-55.

Wiemeyer S.N., T.G. Lamont, C.M. Bunck, J.D. Fraser and M.A. Byrd. 1984. Organochlorine pesticide, polychlorinated biphenyl, and mercury residues in bald eagle eggs – 1969 – 1979 – and their relationship to shell thinning and reproduction. Arch. Environ. Contam. Toxicol. 13:529-549.

Wiemeyer S.N., W. Frenzel, R.G. Anthony, B.R. McClelland and R.L. Knight. 1989. Environmental contaminants in blood of western bald eagles. J. Raptor Res. 23:140-146.

Wiemeyer S.N., C.M. Bunck and C.J. Stafford. 1993. Environmental contaminants in bald eagle eggs – 1980 – 1984 – and further interpretations of relationships to productivity and shell thickness. Arch. Environ. Contam. Toxicol. 24:213-227.

Table A-1. Organics in individual bald eagle eggs, 2000 - 2011

Sample Number	Units	ME199-0001	ME371-0201	ME325-0501	ME027-0901	ME043-0901	ME155-0901	ME267-0901	ME052-1001	ME052-1002	ME056-1001	ME224-1001	ME224-1002	ME240-1101
2,3,7,8-TCDD	pg/g fww	8.7	2.4	5.5	<9.66	<8.37	<9.71	<9.17	<3.22	<3.37	<4.68	<3.64	<4.45	<3.68
TCDD-TEQ	pg/g fww	457	75	62	150	131	352	363	227	236	132	202	271	282
∑PCBs	ng/g fww	11110.4	8769.6	1551.0	10210.2	6552.6	20861.3	21457.8	13626.0	13743.3	6930.0	8003.2	10848.0	7498.4
alpha BHC	ng/g fww	< 19.6	< 2.87	n/a	0.5	< 0.495	0.6	< 0.490	< 0.161	< 0.168	< 0.234	0.2	0.2	< 0.184
beta BHC	ng/g fww	< 19.6	3.6	n/a	4.1	4.2	9.8	13.4	0.4	0.3	< 0.234	< 0.182	5.3	< 0.184
gamma BHC	ng/g fww	< 19.6	< 2.87	BDL	< 0.495	< 0.495	5.7	4.4	< 0.161	< 0.168	< 0.234	< 0.182	< 0.222	< 0.184
delta BHC	ng/g fww	< 19.6	< 2.87	n/a	< 0.495	< 0.495	< 0.481	< 0.490	< 0.161	< 0.168	< 0.234	< 0.182	< 0.222	< 0.184
alpha chlordane	ng/g fww	6.1	< 2.87	n/a	2.6	2.8	3.9	5.5	< 0.161	< 0.168	< 0.234	< 0.182	< 0.222	6.2
gamma chlordane	ng/g fww	< 19.6	< 2.87	n/a	5.0	10.9	14.1	18.8	13.2	14.9	9.4	12.9	11.0	5.0
cis-nonachlor	ng/g fww	52.2	16.0	n/a	8.6	12.6	27.1	46.6	25.7	26.1	7.0	23.0	24.9	17.8
trans-nonachlor	ng/g fww	266.2	154.5	n/a	128.7	117.2	364.8	514.8	232.4	244.8	83.8	168.6	244.1	115.4
oxychlordane	ng/g fww	< 19.6	68.6	n/a	66.4	64.8	174.6	202.8	114.3	104.4	56.1	97.7	135.6	28.6
heptachlor	ng/g fww	< 19.6	< 2.87	BDL	0.5	< 0.495	0.7	0.6	0.4	< 0.168	< 0.234	0.2	< 0.222	< 0.184
heptachlor epoxide	ng/g fww	15.5	8.4	BDL	6.3	8.0	30.7	36.1	10.3	9.5	7.8	9.0	18.2	5.4
o,p'-DDD	ng/g fww	21.3	31.3	n/a	42.6	31.5	77.7	95.1	39.8	40.0	19.7	38.7	51.3	22.8
o,p'-DDE	ng/g fww	< 19.6	< 2.87	n/a	1.7	3.2	1.8	3.0	< 0.161	< 0.168	< 0.234	< 0.182	< 0.222	< 0.184
o,p'-DDT	ng/g fww	53.0	50.7	n/a	57.1	31.4	114.9	76.2	107.5	107.4	43.2	58.2	74.9	53.6
p,p'-DDD	ng/g fww	111.6	33.8	BDL	17.7	22.3	49.3	71.0	23.9	25.8	10.6	25.9	31.3	24.4
p,p'-DDE	ng/g fww	3200.0	2115.8	2538.4	1527.2	788.8	3170.6	3254.0	1990.9	1922.6	1062.6	1417.0	1799.0	1168.0
p,p'-DDT	ng/g fww	< 19.6	< 2.87	BDL	2.1	5.5	6.9	15.6	2.6	1.7	< 0.234	0.2	4.9	< 0.184
aldrin	ng/g fww	< 19.6	< 2.87	n/a	< 0.495	< 0.495	< 0.481	< 0.490	< 0.161	< 0.168	< 0.234	< 0.182	< 0.222	3.5
endrin	ng/g fww	< 19.6	31.9	n/a	< 0.495	< 0.495	< 0.481	< 0.490	< 0.161	< 0.168	< 0.234	< 0.182	< 0.222	< 0.184
dieldrin	ng/g fww	< 19.6	34.7	BDL	26.9	35.7	83.6	127.3	48.0	47.1	30.2	36.4	47.4	5.0
endosulfan II	ng/g fww	< 19.6	< 2.87	n/a	< 0.495	< 0.495	< 0.481	< 0.490	< 0.161	< 0.168	< 0.234	< 0.182	7.3	< 0.184
HCB	ng/g fww	14.3	3.7	19.4	3.5	7.1	21.4	22.0	13.3	14.9	8.8	19.0	18.8	7.6
mirex	ng/g fww	88.6	< 2.87	60.8	46.8	39.9	90.1	80.2	53.0	53.2	23.3	36.8	46.4	36.1
pentachloro-anisole	ng/g fww	6.8	< 2.87	BDL	< 0.495	< 0.495	0.6	0.5	0.3	0.9	0.8	7.0	2.7	< 0.184
toxaphene	ng/g fww	< 98.0	< 28.7	n/a	< 9.90	< 9.90	< 9.62	< 9.80	< 3.22	< 3.37	< 4.67	< 3.64	< 4.44	< 3.68
∑PBDE	ng/g fww	n/a	n/a	n/a	409.4	556.3	993.3	1073.5	786.1	785.1	376.5	806.5	869.4	308.2

pg/g = parts per trillion, ng/g = parts per billion, fresh wet weight = corrected for moisture loss
Values in red preceded by < symbol indicate non-detects and sample detection limits, n/a = not analyzed, BDL = below detection limit (detection limit not reported)
In the TCDD-TEQ calculations, dioxin,furan, and planar PCB congeners were adjusted with toxic equivalency factors from Van den Berg *et al* . (1998)

Table A-2. PCDD, PCDF, and PCB congeners in individual bald eagle eggs, pg/g fresh wet weight, 2000 - 2011

Sample Number		ME199-0001	ME371-0201	ME325-0501	ME027-0901	ME043-0901	ME155-0901	ME267-0901	ME052-1001	ME052-1002	ME056-1001	ME224-1001	ME224-1002	ME240-1101
	TEF													
PCDDs														
2,3,7,8-TCDD	1	8.704	2.366	5.478	< 9.66	< 8.37	< 9.71	< 9.17	< 3.22	< 3.37	< 4.68	< 3.64	< 4.45	< 3.68
1,2,3,7,8-PeCDD	1	< 9.52	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	< 18.4
1,2,3,4,7,8-HxCDD	0.05	< 9.52	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	< 18.4
1,2,3,6,7,8-HxCDD	0.01	0.241	<9.33	0.144	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	< 18.4
1,2,3,7,8,9-HxCDD	0.1	0.320	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	< 18.4
1,2,3,4,6,7,8-HpCDD	<0.001	< 9.52	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	0.383
OCDD	0.0001	0.035	0.002	BDL	< 96.6	< 83.7	< 97.1	< 91.7	< 32.2	< 33.7	< 46.8	< 36.4	< 44.5	< 36.8
PCDFs														
2,3,7,8-TCDF	1	3.866	1.949	5.017	< 9.66	< 8.37	< 9.71	< 9.17	< 3.22	< 3.37	< 4.68	< 3.64	< 4.45	< 3.68
1,2,3,7,8-PeCDF	0.1	22.349	<9.33	BDL	48.563	< 41.8	73.061	65.474	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	6.568
2,3,4,7,8-PeCDF	1	< 9.52	<9.33	7.949	< 48.3	< 41.8	46.318	57.614	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	26.389
1,2,3,4,7,8-HxCDF	0.1	< 9.52	<9.33	BDL	11.326	9.528	23.526	29.082	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	2.487
1,2,3,6,7,8-HxCDF	0.1	< 9.52	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	61.166	53.922	35.508	46.445	51.890	< 18.4
1,2,3,7,8,9-HxCDF	0.1	< 9.52	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	< 18.4
2,3,4,6,7,8-HxCDF	0.1	< 9.52	<9.33	0.401	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	2.660
1,2,3,4,6,7,8-HpCDF	0.01	3.277	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	< 18.4
1,2,3,4,7,8,9-HpCDF	0.01	0.200	<9.33	BDL	< 48.3	< 41.8	< 48.5	< 45.9	< 16.1	< 16.8	< 23.4	< 18.2	< 22.3	< 18.4
OCDF	0.0001	0.001	<19.0	BDL	< 96.6	< 83.7	< 97.1	< 91.7	< 32.2	< 33.7	< 46.8	< 36.4	< 44.5	0.003
Planar PCBs														
PCB# 77	0.05	79.104	10.684	2.027	21.407	25.148	46.869	48.339	40.878	43.558	31.020	51.496	76.840	56.238
PCB# 81	0.1	16.077	< 115	BDL	3.218	4.663	7.867	8.410	< 0.640	< 0.670	< 0.930	< 0.730	< 0.890	< 0.740
PCB# 126	0.1	286.720	43.709	35.805	51.480	76.772	124.984	124.974	110.522	122.413	57.420	91.184	125.656	180.250
PCB# 169	0.001	0.512	< 115	BDL	0.134	0.205	0.289	0.244	0.204	0.249	0.195	0.188	0.233	0.169
PCB# 105	0.0001	7.526	2.554	1.649	3.775	6.389	9.741	10.847	4.330	4.882	2.251	4.684	6.183	1.730
PCB# 114	0.0001	< 392	< 115	0.176	0.336	0.410	0.785	0.833	0.385	0.476	0.250	0.346	0.438	0.198
PCB# 118	0.00001	5.171	2.032	0.861	1.604	1.390	2.876	2.743	1.105	1.862	1.201	1.765	2.278	0.231
PCB# 123	0.00001	0.596	0.545	0.062	0.011	0.026	0.035	0.027	< 0.640	< 0.670	< 0.930	0.021	0.035	0.125
PCB# 156	0.0001	19.968	9.118	1.612	6.212	5.334	12.590	11.397	6.238	6.782	2.878	3.936	5.071	3.670
PCB# 157	0.0001	1.416	1.851	0.350	1.167	1.203	2.463	2.759	1.612	1.780	0.733	1.253	1.618	0.981
PCB# 167	0.00001	0.694	0.313	0.109	0.259	0.347	0.543	0.351	0.263	0.295	0.149	0.203	0.255	0.288
PCB# 189	0.00001	0.159	0.076	0.029	0.109	0.154	0.278	0.185	0.083	0.097	0.048	0.070	0.081	0.071
TCDD - TEQ		457	75	62	150	131	352	363	227	236	132	202	271	282

pg/g = parts per trillion, fresh wet weight (i.e., adjusted for moisture loss)
Values in red preceded by < symbol indicate non-detects and sample detection limits. BDL = below detection limit (detection limits not reported)
TEF = toxic equilvalency factors from Van den Berg *et al* . 1998
TCDD-TEQ is the sum of TEF-adjusted congeners. Non-detects not included in the summation.
Shaded row indicates dominant congener in the TCDD-TEQ

Table A-3. ∑PBDE and BDE congeners in individual bald eagle eggs, ng/g fresh wet weight, 2009 - 2011.

	ME027-0901	ME043-0901	ME155-0901	ME267-0901	ME052-1001	ME052-1002	ME056-1001	ME224-1001	ME224-1002	ME240-1101
BDE# 1	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 2	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 3	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 7	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 8/11	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 10	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 12	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 13	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 15	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 17	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	0.82
BDE# 25	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 28	2.00	2.89	5.83	6.91	< 0.402	< 0.421	1.72	5.14	< 0.556	5.48
BDE# 30	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 32	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 33	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 35	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 37	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 47	186.19	215.56	436.53	494.39	347.46	351.47	162.36	364.08	418.55	134.11
BDE# 49	< 1.24	< 1.24	< 1.20	< 1.23	1.25	1.37	0.72	1.75	2.10	< 0.460
BDE# 66	1.69	2.51	3.65	3.65	3.34	3.18	1.60	4.30	4.29	2.93
BDE# 71	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 75	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	0.90
BDE# 77	< 1.24	< 1.24	< 1.20	< 1.23	< 0.402	< 0.421	< 0.584	< 0.455	< 0.556	< 0.460
BDE# 85	< 1.86	< 1.86	< 1.80	2.30	1.66	1.49	1.02	1.73	1.93	< 0.689
BDE# 99	62.81	135.11	189.31	238.94	152.16	147.95	73.92	200.74	210.63	40.45
BDE# 100	60.40	86.69	126.82	120.26	121.12	120.16	56.30	108.90	118.42	59.12
BDE# 116	< 1.86	< 1.86	< 1.80	< 1.84	< 0.603	< 0.631	< 0.876	< 0.682	< 0.833	< 0.689
BDE# 118	1.73	2.17	3.23	3.24	1.96	2.13	1.15	1.82	2.15	1.80
BDE# 119	< 1.86	< 1.86	< 1.80	< 1.84	< 0.603	< 0.631	< 0.876	< 0.682	< 0.833	< 0.689
BDE# 126	< 1.86	< 1.86	< 1.80	< 1.84	< 0.603	< 0.631	< 0.876	< 0.682	< 0.833	< 0.689
BDE# 138	< 2.48	3.09	3.36	3.96	1.76	1.80	1.93	3.12	2.78	2.62
BDE# 153	62.55	69.74	151.64	122.62	113.55	113.40	48.51	80.03	73.59	32.81
BDE# 154	22.91	26.16	52.84	51.64	31.49	30.57	19.21	24.53	23.14	22.21
BDE# 155	5.76	4.30	9.93	18.94	5.45	5.48	2.60	5.46	5.86	4.96
BDE# 166	< 2.48	< 2.48	< 2.40	< 2.45	< 0.804	< 0.842	< 1.17	< 0.909	< 1.11	< 0.919
BDE# 181	< 3.09	< 3.09	< 3.00	< 3.06	< 1.00	< 1.05	< 1.46	< 1.14	< 1.39	< 1.15
BDE# 183	3.37	8.04	10.20	6.61	4.84	6.08	5.45	4.85	5.96	< 1.15
BDE# 190	< 3.09	< 3.09	< 3.00	< 3.06	< 1.00	< 1.05	< 1.46	< 1.14	< 1.39	< 1.15
BDE# 209	< 198	< 198	< 192	< 196	< 64.3	< 67.3	< 93.5	< 72.7	< 88.9	< 73.5
∑PBDE	409.40	556.28	993.34	1073.46	786.05	785.07	376.48	806.45	869.40	308.20

ng/g = parts per billion. Values in red preceded by < symbol indicate non-detects and sample detection limit. Dominant congener shaded.

DRY WEIGHT

Table A-4. Trace metals in individual bald eagle eggs, µg/g dry weight, 2000 - 2012

Sample Number	Percent Moisture	Al	As	B	Ba	Be	Cd	Cr	Cu	Fe	Hg	Mg	Mn	Mo	Ni	Pb	Se	Sr	V	Zn
ME027-0901	82.3	4.00	0.30	< 2.00	< 0.200	< 0.100	0.20	< 0.500	2.60	48	0.90	566	0.70	< 2.00	< 0.500	< 0.200	2.70	4.10	< 0.500	41.0
ME043-0901	81.2	4.00	< 0.200	< 2.00	< 0.200	< 0.100	< 0.100	< 0.500	2.80	66	1.60	667	< 0.500	< 2.00	< 0.500	< 0.200	2.50	12.00	< 0.500	31.0
ME052-1001	81.0	< 2.00	0.20	< 2.00	< 0.200	0.10	< 0.100	< 0.500	3.50	110	0.48	450	0.90	< 2.00	< 0.500	< 0.200	2.70	4.90	< 0.500	41.0
ME052-1002	80.7	< 2.00	0.20	< 2.00	< 0.200	< 0.100	< 0.100	< 0.500	4.20	86	0.57	525	0.80	< 2.00	< 0.500	< 0.200	2.60	5.60	< 0.500	40.0
ME056-1001	79.8	< 2.00	< 0.200	< 2.00	< 0.200	< 0.100	< 0.100	< 0.500	3.20	78	0.78	687	0.60	< 2.00	< 0.500	< 0.200	3.30	7.60	< 0.500	47.0
ME155-0901	82.5	2.00	< 0.200	< 2.00	0.30	< 0.100	< 0.100	< 0.500	5.30	99	2.20	527	1.60	< 2.00	< 0.500	< 0.200	2.80	5.30	< 0.500	49.0
ME199-0001	64.6	n/a	< 0.500	n/a	n/a	n/a	< 0.100	n/a	n/a	n/a	1.77	n/a	n/a	n/a	n/a	< 0.500	2.16	n/a	n/a	n/a
ME224-1001	84.6	< 2.00	< 0.200	< 2.00	0.84	< 0.100	< 0.100	< 0.500	4.10	120	0.69	714	1.90	< 2.00	< 0.500	< 0.200	4.20	15.00	< 0.500	62.9
ME224-1002	82.6	< 2.00	< 0.200	< 2.00	0.30	< 0.100	< 0.100	< 0.500	2.60	120	0.61	497	1.00	< 2.00	< 0.500	< 0.200	2.20	7.10	< 0.500	54.6
ME240-1101	80.3	2.18	< 0.176	< 0.879	< 0.439	< 0.00879	< 0.00879	< 0.176	3.96	67	1.27	434	0.80	0.21	0.18	< 0.0439	2.08	3.31	< 0.0439	44.6
ME267-0901	83.9	2.00	< 0.200	< 2.00	0.40	< 0.100	< 0.100	< 0.500	4.70	120	1.40	623	1.90	< 2.00	< 0.500	0.30	2.70	8.90	< 0.500	72.7
ME325-0501	80.3	0.14	0.21	0.77	0.65	BDL	BDL	2.04	2.93	78	1.73	401	0.99	0.86	BDL	BDL	4.34	0.98	BDL	50.7
ME325-1201	80.3	2.31	0.06	< 0.512	0.41	< 0.0512	< 0.0102	< 0.0512	4.31	88	2.73	641	1.70	0.15	3.35	0.42	1.99	4.17	< 0.512	53.6
ME325-1202	81.8	< 0.992	< 0.0496	< 0.496	0.14	< 0.0496	< 0.00992	< 0.0496	2.98	62	3.18	513	1.11	< 0.0992	< 0.0496	< 0.0496	2.43	2.22	< 0.496	40.6
ME325-1203	83.5	1.37	< 0.0509	< 0.509	0.34	< 0.0509	< 0.0102	< 0.0509	3.06	105	2.68	640	1.28	0.16	0.08	0.09	1.77	4.38	< 0.509	52.6
ME371-0201	81.6	< 3.00	< 0.200	< 2.00	< 0.200	< 0.100	0.10	< 0.500	5.10	31	7.40	472	3.30	< 2.00	< 0.500	< 0.200	3.90	2.90	< 0.500	40.0
Average	80.7	NC	NC	NC	NC	NC	NC	NC	3.69	85	1.87	557	1.33	NC	NC	NC	2.77	5.90	NC	48.1

µg/g = parts per million. Values in red preceded by < symbol indicate non-detects and detection limit
n/a = not analyzed, BDL = below detection limit (detection limit not provided), NC = not calculatec

Table A-5. TCDD-TEQ $_{PCBs}$, *non-ortho* and *mono-ortho* PCB congeners in individual bald eagle nestling plasma, TEF-adjusted pg/g wet weight

Sample Number	TCDD-TEQ PCBs	*Non-ortho* PCB Congeners				*Mono-ortho* PCB Congeners							
		PCB# 77	PCB# 81	PCB# 126	PCB# 169	PCB# 105	PCB# 114	PCB# 118	PCB# 123	PCB# 156	PCB# 157	PCB# 167	PCB# 189
BLD0921	3.68	3.350	< 63.7	< 63.7	< 63.7	0.131	< 63.7	0.050	0.027	0.062	0.059	0.005	0.001
BLD0922	0.08	< 63.3	< 63.3	< 63.3	< 63.3	0.039	< 63.3	0.018	0.006	0.007	0.008	0.002	< 63.3
BLD0923	3.25	2.600	< 51.8	< 51.8	< 51.8	0.307	< 51.8	0.098	0.027	0.144	0.065	0.011	0.002
BLD0924	0.16	< 94.3	< 94.3	< 94.3	< 94.3	0.077	< 94.3	0.026	0.013	0.017	0.024	0.006	< 94.3
BLD0901	0.38	< 47.2	< 47.2	< 47.2	< 47.2	0.178	< 47.2	0.047	0.008	0.099	0.040	0.005	0.001
BLD0902	0.10	< 47.6	< 47.6	< 47.6	< 47.6	0.052	< 47.6	0.011	0.007	0.018	0.008	0.001	< 47.6
BLD0903	0.15	< 48.1	< 48.1	< 48.1	< 48.1	0.082	< 48.1	0.018	0.013	0.012	0.021	0.002	< 48.1
BLD0904	1.26	< 40.5	< 40.5	< 40.5	< 40.5	0.521	< 40.5	0.408	0.016	0.199	0.102	0.016	0.002
BLD0905	0.11	< 43.5	< 43.5	< 43.5	< 43.5	0.052	< 43.5	0.017	0.008	0.009	0.020	0.002	< 43.5
BLD0906	12.03	2.950	< 43.7	7.900	< 43.7	0.410	< 43.7	0.332	0.015	0.234	0.168	0.020	0.002
BLD0907	17.30	6.700	< 45.0	6.000	< 45.0	2.620	< 45.0	0.734	0.132	0.705	0.359	0.050	0.004
BLD0908	0.81	< 47.2	< 47.2	< 47.2	< 47.2	0.303	< 47.2	0.222	0.009	0.194	0.068	0.013	0.002
BLD0909	4.14	3.200	< 44.8	< 44.8	< 44.8	0.376	< 44.8	0.249	0.012	0.218	0.076	0.012	0.001
BLD0910	0.49	< 41.2	< 41.2	< 41.2	< 41.2	0.173	< 41.2	0.069	0.015	0.120	0.105	0.011	0.002
BLD0911	0.44	< 42.6	< 42.6	< 42.6	< 42.6	0.154	< 42.6	0.067	0.006	0.118	0.078	0.010	0.002
BLD0912	3.80	3.300	< 48.5	< 48.5	< 48.5	0.200	< 48.5	0.086	0.010	0.121	0.075	0.010	0.001
BLD0913	0.45	< 45.9	< 45.9	< 45.9	< 45.9	0.172	< 45.9	0.077	0.012	0.119	0.064	0.009	0.002
BLD0914	1.11	< 46.7	< 46.7	< 46.7	< 46.7	0.349	< 46.7	0.381	0.050	0.188	0.126	0.012	0.002
BLD0915	5.73	4.300	< 48.8	< 48.8	< 48.8	0.373	< 48.8	0.479	0.043	0.373	0.139	0.018	0.002
BLD0916	9.50	< 43.9	< 43.9	< 43.9	< 43.9	6.430	< 43.9	1.680	0.057	0.944	0.332	0.047	0.006
BLD0917	2.33	< 38.8	< 38.8	< 38.8	< 38.8	0.720	< 38.8	0.897	0.035	0.459	0.194	0.027	0.003
BLD0918	3.50	2.650	< 45.2	< 45.2	< 45.2	0.202	< 45.2	0.399	0.011	0.137	0.089	0.013	0.001
BLD0919	3.41	2.800	< 41.7	< 41.7	< 41.7	0.188	< 41.7	0.204	0.010	0.124	0.076	0.012	0.001
BLD1001	0.05	< 38.6	< 38.6	< 38.6	< 38.6	< 38.6	< 38.6	0.019	0.004	< 38.6	0.024	< 38.6	< 38.6
BLD1002	0.16	< 96.2	< 96.2	< 96.2	< 96.2	0.069	< 96.2	0.031	0.005	< 96.2	0.056	< 96.2	< 96.2
BLD1003	0.03	< 44.4	< 44.4	< 44.4	< 44.4	< 44.4	< 44.4	0.003	0.002	0.022	< 44.4	< 44.4	< 44.4
BLD1004	0.03	< 32.4	< 32.4	< 32.4	< 32.4	< 32.4	< 32.4	0.003	0.001	0.029	< 32.4	< 32.4	< 32.4
BLD1005	0.01	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0	< 50.0	0.007	0.001	< 50.0	< 50.0	< 50.0	< 50.0
BLD1006	0.05	< 44.0	< 44.0	< 44.0	< 44.0	0.007	< 44.0	0.003	0.000	0.034	0.009	< 44.0	< 44.0
BLD1007	0.05	< 80.6	< 80.6	< 80.6	< 80.6	< 80.6	< 80.6	0.003	< 80.6	0.050	< 80.6	< 80.6	< 80.6
BLD1008	0.06	< 92.6	< 92.6	< 92.6	< 92.6	0.041	< 92.6	0.016	< 92.6	< 92.6	< 92.6	0.002	< 92.6
BLD1009	0.02	< 34.8	< 34.8	< 34.8	< 34.8	0.012	< 34.8	0.005	0.002	< 34.8	< 34.8	0.001	< 34.8

Table A-5 (continued). TCDD-TEQ $_{PCB}$, *non-ortho* and *mono-ortho* PCB congeners in individual bald eagle nestling plasma, TEF-adjusted pg/g wet weight

Sample Number	TCDD-TEQ PCBs	*Non-ortho* PCB Congeners				*Mono-ortho* PCB Congeners							
		PCB# 77	PCB# 81	PCB# 126	PCB# 169	PCB# 105	PCB# 114	PCB# 118	PCB# 123	PCB# 156	PCB# 157	PCB# 167	PCB# 189
BLD1010	0.08	< 50.0	< 50.0	< 50.0	< 50.0	0.027	< 50.0	0.010	0.002	0.041	< 50.0	0.001	< 50.0
BLD1011	0.03	< 57.5	< 57.5	< 57.5	< 57.5	0.019	< 57.5	0.006	0.003	< 57.5	< 57.5	< 57.5	< 57.5
BLD1012	0.11	< 55.6	< 55.6	< 55.6	< 55.6	0.046	< 55.6	0.022	0.004	0.037	< 55.6	0.002	< 55.6
BLD1013	0.23	< 55.9	< 55.9	< 55.9	< 55.9	0.062	< 55.9	0.026	0.006	0.111	0.022	0.003	< 55.9
BLD1014	0.42	< 55.9	< 55.9	< 55.9	< 55.9	0.155	< 55.9	0.049	0.018	0.130	0.062	0.007	< 55.9
BLD1015	0.12	< 56.2	< 56.2	< 56.2	< 56.2	0.023	< 56.2	0.007	0.004	0.071	0.012	< 56.2	< 56.2
BLD1016	0.08	< 55.6	< 55.6	< 55.6	< 55.6	0.075	< 55.6	0.004	< 55.6	< 55.6	< 55.6	< 55.6	< 55.6
BLD1017	0.10	< 50.8	< 50.8	< 50.8	< 50.8	0.043	< 50.8	0.012	0.009	0.019	0.018	0.004	< 50.8
BLD1018	0.19	< 52.9	< 52.9	< 52.9	< 52.9	0.058	< 52.9	0.017	0.004	0.093	0.022	< 52.9	< 52.9
BLD1019	0.34	< 37.3	< 37.3	< 37.3	< 37.3	0.120	< 37.3	0.037	0.009	0.120	0.052	< 37.3	< 37.3
BLD1020	0.17	< 90.1	< 90.1	< 90.1	< 90.1	0.085	< 90.1	0.023	0.003	0.058	< 90.1	< 90.1	< 90.1
BLD1101	0.19	< 48.5	< 48.5	< 48.5	< 48.5	0.048	< 48.5	0.007	0.003	0.062	0.074	< 48.5	< 48.5
BLD1102	0.27	< 44.8	< 44.8	< 44.8	0.140	0.028	< 44.8	0.017	0.009	0.075	< 44.8	< 44.8	< 44.8
BLD1103	1.02	< 88.5	< 88.5	< 88.5	< 88.5	0.586	< 88.5	0.100	0.030	0.205	0.086	0.011	< 88.5
BLD1104	0.12	< 47.8	< 47.8	< 47.8	< 47.8	0.054	< 47.8	0.010	0.004	0.050	< 47.8	< 47.8	< 47.8
BLD1105	0.16	< 48.1	< 48.1	< 48.1	< 48.1	0.054	< 48.1	0.027	< 48.1	0.075	< 48.1	< 48.1	< 48.1
BLD1106	0.43	< 47.6	< 47.6	< 47.6	< 47.6	0.348	< 47.6	0.014	0.012	0.058	< 47.6	< 47.6	< 47.6
BLD1107	15.13	< 43.7	< 43.7	15.000	0.050	0.048	< 43.7	0.009	0.001	0.025	< 43.7	< 43.7	< 43.7
BLD1108	28.39	< 62.9	< 62.9	28.000	0.140	0.113	< 62.9	0.046	0.005	0.088	< 62.9	< 62.9	< 62.9
BLD1109	30.46	8.000	< 39.7	22.000	0.130	0.121	< 39.7	0.054	0.016	0.130	< 39.7	0.005	< 39.7
BLD1110	25.42	6.000	< 48.5	19.000	0.160	0.118	< 48.5	0.043	0.010	0.085	< 48.5	0.005	< 48.5
BLD1111	60.90	< 41.5	< 41.5	59.000	0.950	0.495	< 41.5	0.242	0.011	< 41.5	0.200	< 41.5	< 41.5
BLD1112	0.36	< 46.5	< 46.5	< 46.5	0.230	0.085	< 46.5	0.041	0.009	< 46.5	< 46.5	< 46.5	< 46.5
BLD1113	0.32	< 44.6	< 44.6	< 44.6	0.200	0.058	< 44.6	0.020	0.004	0.041	< 44.6	< 44.6	< 44.6
BLD1114	0.26	< 84.0	< 84.0	< 84.0	< 84.0	0.099	< 84.0	0.032	< 84.0	0.128	< 84.0	0.004	< 84.0
BLD1115	0.41	< 44.0	< 44.0	< 44.0	< 44.0	0.185	< 44.0	0.087	0.015	0.127	< 44.0	< 44.0	< 44.0
BLD1115	0.17	< 44.8	< 44.8	< 44.8	< 44.8	0.082	< 44.8	0.033	0.007	0.049	< 44.8	0.003	< 44.8
BLD1117	0.45	< 42.6	< 42.6	< 42.6	0.200	0.113	< 42.6	0.035	0.013	0.087	< 42.6	0.004	< 42.6

pg/g = parts per trillion, TEF adjusted (i.e., congener concentrations adjusted with toxic equivalency factors from Van den Berg *et al* . 1998)
Values in red preceded by < symbol indicate non-detects and sample detection limits (unadjusted with TEFs). Samples collected between 2007 and 2011.
Shaded values indicate dominant congener within the TCDD-TEQ $_{PCBs}$ for the sample

Table A-6. ∑PCBs and DDT metabolites in individual bald eagle nestling plasma samples, ng/g wet weight, 2007 - 2011

Sample No.	∑PCBs	o,p'-DDD	o,p'-DDE	o,p'-DDT	p,p'-DDD	p,p'-DDE	p,p'-DDT	∑DDT
BLD0921	159.0	0.57	< 0.318	< 0.318	1.87	16.70	< 0.318	19.14
BLD0922	41.5	< 0.316	< 0.316	< 0.316	0.43	4.59	0.38	5.39
BLD0923	289.0	0.81	< 0.259	0.31	1.08	34.50	< 0.259	36.70
BLD0924	79.0	< 0.472	< 0.472	< 0.472	0.50	7.13	0.48	8.10
BLD0901	111.0	0.53	< 0.236	0.50	0.52	13.10	< 0.236	14.66
BLD0902	38.5	< 0.238	< 0.238	< 0.238	0.35	5.28	< 0.238	5.63
BLD0903	69.9	0.31	< 0.240	< 0.240	0.63	8.97	< 0.240	9.90
BLD0904	476.0	1.97	< 0.202	0.97	0.58	33.40	< 0.202	36.91
BLD0905	48.4	< 0.217	< 0.217	< 0.217	0.39	6.83	< 0.217	7.22
BLD0906	427.0	1.22	< 0.218	0.55	0.48	76.90	< 0.218	79.15
BLD0907	1160.0	4.49	< 0.225	2.92	3.02	166.00	0.65	177.08
BLD0908	324.0	0.96	< 0.236	0.82	0.60	36.80	< 0.236	39.17
BLD0909	324.0	0.93	< 0.224	0.55	0.60	40.50	< 0.224	42.58
BLD0910	398.0	1.62	< 0.206	0.37	< 0.206	36.80	< 0.206	38.79
BLD0911	192.0	0.58	< 0.213	< 0.213	< 0.213	20.50	< 0.213	21.08
BLD0912	239.0	0.64	< 0.243	0.27	0.26	52.60	< 0.243	53.77
BLD0913	336.0	0.52	< 0.229	< 0.229	< 0.229	87.40	< 0.229	87.92
BLD0914	660.0	1.63	0.28	0.92	2.78	72.00	0.58	78.19
BLD0915	985.0	1.93	< 0.244	1.34	0.77	107.00	0.37	111.41
BLD0916	2220.0	4.21	< 0.219	3.12	1.66	224.00	0.66	233.65
BLD0917	1050.0	2.69	< 0.194	1.36	0.81	111.00	< 0.194	115.86
BLD0918	402.0	0.70	< 0.226	0.57	< 0.226	43.70	< 0.226	44.97
BLD0919	228.0	0.54	< 0.208	0.36	< 0.208	19.10	< 0.208	20.00
BLD1001	47.6	< 0.193	0.29	0.45	0.36	10.60	< 0.193	11.70
BLD1002	95.7	< 0.481	< 0.481	< 0.481	< 0.481	11.40	< 0.481	11.40
BLD1003	14.6	< 0.222	< 0.222	< 0.222	< 0.222	1.76	< 0.222	1.76
BLD1004	19.2	< 0.162	< 0.162	< 0.162	< 0.162	1.94	< 0.162	1.94
BLD1005	48.3	< 0.250	0.30	< 0.250	< 0.250	5.19	< 0.250	5.49
BLD1006	23.7	< 0.220	< 0.220	0.33	< 0.220	2.37	< 0.220	2.70
BLD1007	29.1	< 0.403	< 0.403	< 0.403	< 0.403	2.87	< 0.403	2.87
BLD1008	63.4	< 0.463	< 0.463	< 0.463	< 0.463	8.94	< 0.463	8.94
BLD1009	25.5	< 0.174	< 0.174	< 0.174	0.36	3.80	< 0.174	4.16
BLD1010	58.9	< 0.250	< 0.250	< 0.250	< 0.250	9.39	< 0.250	9.39

Table A-6 (continued). ∑PCBs and DDT metabolites in individual bald eagle nestling plasma samples, ng/g wet weight, 2007 - 2011

Sample No.	∑PCBs	o,p'-DDD	o,p'-DDE	o,p'-DDT	p,p'-DDD	p,p'-DDE	p,p'-DDT	∑DDT
BLD1011	35.3	< 0.287	< 0.287	< 0.287	0.32	3.22	< 0.287	3.54
BLD1012	50.3	< 0.278	< 0.278	< 0.278	0.71	6.39	< 0.278	7.10
BLD1013	64.5	< 0.279	< 0.279	< 0.279	0.28	8.04	< 0.279	8.32
BLD1014	119.0	0.73	< 0.279	0.46	0.48	21.20	0.31	23.18
BLD1015	40.4	< 0.281	< 0.281	< 0.281	< 0.281	4.19	< 0.281	4.19
BLD1016	40.0	< 0.278	< 0.278	< 0.278	< 0.278	7.75	< 0.278	7.75
BLD1017	54.5	< 0.254	< 0.254	< 0.254	1.24	4.58	0.57	6.39
BLD1018	56.8	< 0.265	< 0.265	< 0.265	< 0.265	5.85	< 0.265	5.85
BLD1019	102.0	0.55	< 0.187	0.43	< 0.187	18.10	< 0.187	19.08
BLD1020	80.4	< 0.450	< 0.450	< 0.450	< 0.450	9.89	< 0.450	9.89
BLD1101	36.7	0.32	< 0.243	< 0.243	< 0.243	3.72	0.70	4.73
BLD1102	68.9	< 0.224	< 0.224	< 0.224	< 0.224	10.00	< 0.224	10.00
BLD1103	275.0	1.06	< 0.442	2.46	1.58	42.90	< 0.442	48.00
BLD1104	46.8	< 0.239	< 0.239	< 0.239	< 0.239	5.44	< 0.239	5.44
BLD1105	74.6	< 0.240	< 0.240	< 0.240	< 0.240	10.50	< 0.240	10.50
BLD1106	75.5	< 0.238	< 0.238	< 0.238	0.56	4.84	< 0.238	5.40
BLD1107	29.8	< 0.218	< 0.218	< 0.218	< 0.218	6.77	< 0.218	6.77
BLD1108	86.5	0.48	< 0.314	< 0.314	< 0.314	14.10	< 0.314	14.58
BLD1109	95.4	0.60	< 0.198	1.36	< 0.198	13.60	< 0.198	15.56
BLD1110	106.0	0.32	< 0.243	1.97	< 0.243	11.80	< 0.243	14.09
BLD1111	329.0	0.91	< 0.207	1.19	< 0.207	149.00	4.75	155.85
BLD1112	89.6	0.74	< 0.233	< 0.233	< 0.233	20.70	1.29	22.73
BLD1113	102.0	0.33	< 0.223	0.51	1.02	12.40	< 0.223	14.26
BLD1114	90.9	0.87	< 0.420	0.44	2.24	12.00	< 0.420	15.55
BLD1115	150.0	1.10	< 0.220	< 0.220	0.36	23.60	< 0.220	25.06
BLD1116	58.4	0.55	< 0.224	0.69	< 0.224	7.63	< 0.224	8.87
BLD1117	92.9	0.56	< 0.213	0.96	< 0.213	14.00	< 0.213	15.52

ng/g = parts per billion, ∑DDT is the sum of all metabolites and isomers.
Values in red preceded by the < symbol indicated non-detects and sample detection limits.
Non-detects not included in sum for ∑DDT

Table A-7. BHCs and chlordane compounds in individual bald eagle nestling plasma samples, ng/g wet weight, 2007 - 2011

Sample No.	alpha BHC	beta BHC	gamma BHC	delta BHC	alpha chlordane	gamma chlordane	cis-nonachlor	trans-nonachlor	oxy chlordane	heptachlor	heptachlor epoxide
BLD0921	< 0.318	< 0.318	< 0.318	< 0.318	< 0.318	< 0.318	0.97	1.77	0.87	< 0.318	< 0.318
BLD0922	< 0.316	< 0.316	< 0.316	< 0.316	< 0.316	< 0.316	0.64	0.95	< 0.316	< 0.316	< 0.316
BLD0923	< 0.259	< 0.259	< 0.259	< 0.259	< 0.259	< 0.259	0.81	1.94	1.69	< 0.259	0.29
BLD0924	< 0.472	< 0.472	< 0.472	< 0.472	< 0.472	< 0.472	1.33	0.93	< 0.472	< 0.472	< 0.472
BLD0901	< 0.236	< 0.236	1.22	< 0.236	< 0.236	< 0.236	0.53	0.98	0.62	< 0.236	< 0.236
BLD0902	< 0.238	< 0.238	0.66	< 0.238	< 0.238	< 0.238	0.36	0.99	0.25	< 0.238	< 0.238
BLD0903	< 0.240	< 0.240	< 0.240	< 0.240	0.38	0.28	0.79	1.78	0.29	< 0.240	0.24
BLD0904	< 0.202	< 0.202	< 0.202	< 0.202	< 0.202	< 0.202	0.38	1.32	1.16	< 0.202	< 0.202
BLD0905	< 0.217	< 0.217	< 0.217	< 0.217	< 0.217	< 0.217	0.56	1.00	0.43	< 0.217	< 0.217
BLD0906	< 0.218	< 0.218	< 0.218	< 0.218	< 0.218	< 0.218	0.86	1.94	1.99	< 0.218	0.33
BLD0907	< 0.225	< 0.225	< 0.225	< 0.225	0.55	2.60	2.82	13.10	8.31	< 0.225	1.56
BLD0908	< 0.236	< 0.236	< 0.236	< 0.236	< 0.236	0.28	0.74	2.44	1.99	< 0.236	0.29
BLD0909	< 0.224	< 0.224	< 0.224	< 0.224	0.40	< 0.224	0.62	2.29	2.55	< 0.224	0.23
BLD0910	< 0.206	< 0.206	< 0.206	< 0.206	< 0.206	< 0.206	0.62	1.18	1.16	< 0.206	< 0.206
BLD0911	< 0.213	< 0.213	< 0.213	< 0.213	0.34	< 0.213	0.42	0.71	1.02	< 0.213	0.41
BLD0912	< 0.243	< 0.243	< 0.243	< 0.243	< 0.243	< 0.243	0.96	1.68	0.98	< 0.243	< 0.243
BLD0913	< 0.229	< 0.229	< 0.229	< 0.229	0.36	< 0.229	0.74	1.60	0.92	0.60	0.25
BLD0914	< 0.234	< 0.234	< 0.234	< 0.234	0.64	0.42	2.65	7.92	2.40	< 0.234	0.45
BLD0915	< 0.244	< 0.244	< 0.244	< 0.244	0.70	0.30	1.17	6.51	4.14	< 0.244	0.43
BLD0916	< 0.219	< 0.219	< 0.219	< 0.219	0.70	0.55	2.06	8.63	7.84	< 0.219	0.86
BLD0917	< 0.194	< 0.194	< 0.194	< 0.194	0.65	0.36	1.32	5.88	4.81	< 0.194	0.60
BLD0918	< 0.226	< 0.226	< 0.226	< 0.226	0.47	< 0.226	0.74	1.14	1.41	< 0.226	0.25
BLD0919	< 0.208	< 0.208	< 0.208	< 0.208	0.31	< 0.208	0.53	0.87	1.03	< 0.208	< 0.208
BLD1001	< 0.193	< 0.193	< 0.193	< 0.193	< 0.193	< 0.193	< 0.193	0.45	0.24	< 0.193	< 0.193
BLD1002	< 0.481	< 0.481	< 0.481	0.49	< 0.481	< 0.481	< 0.481	0.88	< 0.481	< 0.481	< 0.481
BLD1003	< 0.222	< 0.222	< 0.222	< 0.222	< 0.222	< 0.222	< 0.222	0.43	< 0.222	< 0.222	< 0.222
BLD1004	< 0.162	< 0.162	< 0.162	< 0.162	< 0.162	< 0.162	< 0.162	0.37	< 0.162	< 0.162	< 0.162
BLD1005	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	0.61	0.28	< 0.250	< 0.250
BLD1006	< 0.220	< 0.220	< 0.220	0.29	< 0.220	< 0.220	< 0.220	0.48	< 0.220	< 0.220	< 0.220
BLD1007	< 0.403	< 0.403	< 0.403	0.82	< 0.403	< 0.403	< 0.403	0.76	< 0.403	< 0.403	< 0.403
BLD1008	< 0.463	< 0.463	< 0.463	0.48	< 0.463	< 0.463	< 0.463	1.40	< 0.463	< 0.463	< 0.463
BLD1009	< 0.174	< 0.174	< 0.174	< 0.174	< 0.174	< 0.174	< 0.174	0.74	< 0.174	< 0.174	< 0.174
BLD1010	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	< 0.250	1.14	< 0.250	< 0.250	< 0.250

Table A-7 (continued). BHCs and chlordane compounds in individual bald eagle nestling plasma samples, ng/g wet weight, 2007 - 2011

Sample No.	alpha BHC	beta BHC	gamma BHC	delta BHC	alpha chlordane	gamma chlordane	cis-nonachlor	trans-nonachlor	oxy chlordane	heptachlor	heptachlor epoxide
BLD1011	< 0.287	< 0.287	< 0.287	0.35	< 0.287	< 0.287	< 0.287	0.83	< 0.287	< 0.287	< 0.287
BLD1012	< 0.278	< 0.278	< 0.278	0.44	< 0.278	< 0.278	0.30	1.31	< 0.278	< 0.278	0.38
BLD1013	< 0.279	< 0.279	< 0.279	1.27	< 0.279	< 0.279	0.37	1.55	< 0.279	< 0.279	0.34
BLD1014	< 0.279	< 0.279	< 0.279	< 0.279	< 0.279	0.39	1.05	2.90	2.78	< 0.279	1.49
BLD1015	< 0.281	< 0.281	< 0.281	0.35	< 0.281	< 0.281	< 0.281	1.07	< 0.281	< 0.281	0.31
BLD1016	< 0.278	< 0.278	< 0.278	< 0.278	< 0.278	< 0.278	< 0.278	0.76	< 0.278	< 0.278	< 0.278
BLD1017	< 0.254	< 0.254	0.65	1.29	0.35	< 0.254	0.36	1.26	< 0.254	0.70	< 0.254
BLD1018	< 0.265	< 0.265	< 0.265	< 0.265	< 0.265	< 0.265	< 0.265	1.08	< 0.265	< 0.265	< 0.265
BLD1019	< 0.187	< 0.187	< 0.187	0.37	< 0.187	< 0.187	0.57	2.69	1.10	< 0.187	0.53
BLD1020	< 0.450	< 0.450	< 0.450	0.70	< 0.450	< 0.450	< 0.450	1.42	0.61	< 0.450	< 0.450
BLD1101	< 0.243	0.48	< 0.243	< 0.243	0.29	< 0.243	< 0.243	0.81	< 0.243	< 0.243	< 0.243
BLD1102	< 0.224	0.26	< 0.224	< 0.224	< 0.224	< 0.224	0.23	3.74	0.30	< 0.224	< 0.224
BLD1103	< 0.442	< 0.442	< 0.442	< 0.442	< 0.442	< 0.442	1.04	6.27	4.37	< 0.442	0.99
BLD1104	< 0.239	0.25	< 0.239	< 0.239	< 0.239	< 0.239	< 0.239	0.32	< 0.239	< 0.239	< 0.239
BLD1105	< 0.240	0.46	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240
BLD1106	< 0.238	< 0.238	< 0.238	< 0.238	0.49	< 0.238	1.58	0.39	< 0.238	< 0.238	< 0.238
BLD1107	< 0.218	0.58	< 0.218	< 0.218	< 0.218	< 0.218	< 0.218	< 0.218	< 0.218	< 0.218	< 0.218
BLD1108	< 0.314	0.96	< 0.314	< 0.314	< 0.314	< 0.314	< 0.314	< 0.314	< 0.314	< 0.314	< 0.314
BLD1109	< 0.198	< 0.198	< 0.198	< 0.198	1.25	< 0.198	0.34	1.38	0.27	< 0.198	< 0.198
BLD1110	< 0.243	0.71	< 0.243	< 0.243	< 0.243	< 0.243	1.56	0.31	< 0.243	< 0.243	< 0.243
BLD1111	< 0.207	0.54	< 0.207	< 0.207	1.34	< 0.207	< 0.207	2.65	3.01	< 0.207	1.28
BLD1112	< 0.233	0.45	< 0.233	< 0.233	1.27	< 0.233	< 0.233	2.77	1.56	< 0.233	0.24
BLD1113	< 0.223	0.36	< 0.223	< 0.223	0.28	< 0.223	1.00	1.97	< 0.223	< 0.223	< 0.223
BLD1114	< 0.420	0.68	< 0.420	< 0.420	< 0.420	< 0.420	0.68	0.43	< 0.420	< 0.420	< 0.420
BLD1115	< 0.220	0.33	< 0.220	< 0.220	0.56	0.22	0.54	2.55	1.31	< 0.220	0.47
BLD1116	< 0.224	< 0.224	< 0.224	< 0.224	0.24	< 0.224	0.35	0.41	< 0.224	< 0.224	< 0.224
BLD1117	< 0.213	0.32	< 0.213	< 0.213	0.43	< 0.213	0.50	2.12	< 0.213	< 0.213	< 0.213

ng/g = parts per billion. BHC = benzene hexachloride (sometimes shown as HCH, hexachlorocyclohexane).
Values in red preceded by the < symbol indicated non-detects and sample detection limits.

Table A-8. Other organchlorine compounds in individual bald eagle nestling plasma samples, ng/g wet weight, 2007 - 2011

Sample No.	aldrin	endrin	dieldrin	endosulfan II	HCB	mirex	pentachloro-anisole	toxaphene
BLD0921	< 0.318	< 0.318	0.86	< 0.318	0.42	< 0.318	< 0.318	< 6.37
BLD0922	0.45	< 0.316	0.54	< 0.316	< 0.316	< 0.316	< 0.316	< 6.33
BLD0923	0.32	< 0.259	1.32	< 0.259	0.90	0.83	< 0.259	< 5.18
BLD0924	1.24	< 0.472	< 0.472	< 0.472	< 0.472	< 0.472	< 0.472	< 9.43
BLD0901	0.42	< 0.236	1.24	< 0.236	< 0.236	< 0.236	< 0.236	< 4.72
BLD0902	0.40	< 0.238	0.32	< 0.238	0.28	< 0.238	< 0.238	< 4.76
BLD0903	0.95	< 0.240	0.70	< 0.240	0.51	< 0.240	0.37	< 4.81
BLD0904	0.43	< 0.202	0.76	< 0.202	0.39	0.57	< 0.202	< 4.05
BLD0905	0.99	< 0.217	0.55	0.23	0.35	< 0.217	0.25	< 4.35
BLD0906	1.01	< 0.218	1.95	< 0.218	1.17	1.07	0.25	< 4.37
BLD0907	0.51	< 0.225	5.97	< 0.225	1.68	2.03	< 0.225	< 4.50
BLD0908	< 0.236	< 0.236	1.52	0.25	1.41	0.73	< 0.236	< 4.72
BLD0909	0.29	< 0.224	1.60	< 0.224	1.44	0.49	< 0.224	< 4.48
BLD0910	0.65	< 0.206	0.59	< 0.206	0.61	1.69	0.22	< 4.12
BLD0911	0.92	< 0.213	0.44	< 0.213	0.39	0.76	< 0.213	< 4.26
BLD0912	1.39	< 0.243	1.04	< 0.243	1.10	0.32	< 0.243	< 4.85
BLD0913	0.84	< 0.229	0.93	0.48	0.91	0.42	< 0.229	< 4.59
BLD0914	0.84	< 0.234	4.84	0.83	2.92	0.82	0.34	< 4.67
BLD0915	1.23	< 0.244	2.26	< 0.244	1.01	1.13	0.34	< 4.88
BLD0916	1.01	< 0.219	5.29	1.04	4.06	2.68	< 0.219	< 4.39
BLD0917	0.81	< 0.194	4.31	0.73	2.89	1.49	< 0.194	< 3.88
BLD0918	1.06	< 0.226	1.24	< 0.226	0.88	0.36	< 0.226	< 4.52
BLD0919	0.87	< 0.208	0.73	< 0.208	0.58	0.28	< 0.208	< 4.17
BLD1001	< 0.193	< 0.193	0.26	< 0.193	21.80	< 0.193	0.47	< 3.86
BLD1002	< 0.481	< 0.481	< 0.481	< 0.481	< 0.481	< 0.481	2.32	< 9.62
BLD1003	< 0.222	< 0.222	0.25	< 0.222	81.00	< 0.222	1.29	< 4.44
BLD1004	< 0.162	< 0.162	< 0.162	< 0.162	39.50	< 0.162	0.80	< 3.24
BLD1005	< 0.250	< 0.250	< 0.250	< 0.250	97.00	< 0.250	1.06	< 5.00
BLD1006	< 0.220	< 0.220	< 0.220	< 0.220	43.30	< 0.220	< 0.220	< 4.41
BLD1007	< 0.403	< 0.403	< 0.403	< 0.403	55.60	< 0.403	< 0.403	< 8.06
BLD1008	< 0.463	< 0.463	< 0.463	< 0.463	108.00	< 0.463	< 0.463	< 9.26
BLD1009	< 0.174	< 0.174	1.25	< 0.174	71.70	< 0.174	0.87	< 3.48
BLD1010	< 0.250	< 0.250	2.37	< 0.250	191.00	< 0.250	1.76	< 5.00
BLD1011	< 0.287	< 0.287	0.40	< 0.287	167.00	< 0.287	1.56	< 5.75

Table A-8 (continued). Other organchlorine compounds in individual bald eagle nestling plasma samples, ng/g wet weight, 2007 - 2011

Sample No.	aldrin	endrin	dieldrin	endosulfan II	HCB	mirex	pentachloro-anisole	toxaphene
BLD1012	< 0.278	< 0.278	0.76	< 0.278	139.00	< 0.278	0.76	< 5.56
BLD1013	< 0.279	< 0.279	0.87	< 0.279	143.00	< 0.279	2.36	< 5.59
BLD1014	< 0.279	< 0.279	1.53	< 0.279	35.50	0.50	0.94	< 5.59
BLD1015	< 0.281	< 0.281	0.33	< 0.281	45.10	< 0.281	1.50	< 5.62
BLD1016	< 0.278	< 0.278	< 0.278	< 0.278	69.80	< 0.278	< 0.278	< 5.56
BLD1017	1.12	0.52	1.49	< 0.254	49.60	< 0.254	1.12	< 5.08
BLD1018	< 0.265	< 0.265	0.29	< 0.265	119.00	< 0.265	< 0.265	< 5.29
BLD1019	< 0.187	< 0.187	1.23	0.35	16.90	0.56	< 0.187	< 3.73
BLD1020	< 0.450	< 0.450	0.84	< 0.450	123.00	< 0.450	< 0.450	< 9.01
BLD1101	< 0.243	< 0.243	< 0.243	< 0.243	< 0.243	< 0.243	< 0.243	< 4.85
BLD1102	< 0.224	< 0.224	1.04	< 0.224	< 0.224	< 0.224	0.40	< 4.48
BLD1103	< 0.442	< 0.442	3.51	< 0.442	0.69	1.00	< 0.442	< 8.85
BLD1104	< 0.239	< 0.239	0.42	< 0.239	0.34	< 0.239	< 0.239	< 4.78
BLD1105	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240	< 0.240	< 4.81
BLD1106	< 0.238	< 0.238	< 0.238	< 0.238	< 0.238	1.39	1.44	< 4.76
BLD1107	< 0.218	< 0.218	0.64	< 0.218	< 0.218	< 0.218	< 0.218	< 4.37
BLD1108	< 0.314	< 0.314	0.51	< 0.314	< 0.314	< 0.314	< 0.314	< 6.29
BLD1109	0.21	< 0.198	0.50	< 0.198	< 0.198	< 0.198	< 0.198	< 3.97
BLD1110	< 0.243	< 0.243	0.52	< 0.243	< 0.243	< 0.243	< 0.243	< 4.85
BLD1111	0.74	< 0.207	2.10	< 0.207	1.39	0.82	< 0.207	< 4.15
BLD1112	< 0.233	< 0.233	1.14	< 0.233	< 0.233	< 0.233	< 0.233	< 4.65
BLD1113	< 0.223	< 0.223	0.58	< 0.223	0.38	0.47	< 0.223	< 4.46
BLD1114	< 0.420	< 0.420	1.82	< 0.420	< 0.420	< 0.420	< 0.420	< 8.40
BLD1115	< 0.220	< 0.220	0.87	< 0.220	1.30	0.50	< 0.220	< 4.41
BLD1116	< 0.224	< 0.224	0.41	< 0.224	0.59	0.41	< 0.224	< 4.48
BLD1117	< 0.213	< 0.213	0.56	< 0.213	0.44	0.83	< 0.213	< 4.26

ng/g = parts per billion. HCB = hexachlorobenzene.
Values in red preceded by the < symbol indicated non-detects and sample detection limits.

Table A-9. ∑PBDE and BDE congeners in individual bald eagle nestling plasma samples, ng/g wet weight, 2007 - 2011

Sample Number	∑PBDE	BDE# 7	BDE# 28	BDE# 33	BDE# 47	BDE# 66	BDE# 85	BDE# 99	BDE# 100	BDE# 138	BDE# 153	BDE# 154
BLD0921	9.3	< 0.796	< 0.796	< 0.796	5.7	< 0.796	< 1.19	2.0	1.6	< 1.59	< 1.59	< 1.59
BLD0922	3.6	< 0.791	< 0.791	< 0.791	2.3	< 0.791	< 1.19	1.2	< 1.19	< 1.58	< 1.58	< 1.58
BLD0923	12.2	< 0.648	< 0.648	< 0.648	7.0	< 0.648	< 0.972	3.1	2.1	< 1.30	< 1.30	< 1.30
BLD0924	15.6	< 1.18	< 1.18	< 1.18	8.9	< 1.18	< 1.77	4.2	2.5	< 2.36	< 2.36	< 2.36
BLD0901	6.1	< 0.590	< 0.590	< 0.590	2.9	< 0.590	< 0.884	2.0	1.2	< 1.18	< 1.18	< 1.18
BLD0902	1.3	< 0.595	< 0.595	< 0.595	1.3	< 0.595	< 0.893	< 0.893	< 0.893	< 1.19	< 1.19	< 1.19
BLD0903	2.8	< 0.601	< 0.601	< 0.601	2.8	< 0.601	< 0.901	< 0.901	< 0.901	< 1.20	< 1.20	< 1.20
BLD0904	8.0	< 0.506	< 0.506	< 0.506	4.7	< 0.506	< 0.759	1.7	1.7	< 1.01	< 1.01	< 1.01
BLD0905	2.0	< 0.543	< 0.543	< 0.543	2.0	< 0.543	< 0.815	< 0.815	< 0.815	< 1.09	< 1.09	< 1.09
BLD0906	16.2	< 0.546	< 0.546	< 0.546	8.4	< 0.546	< 0.819	4.7	3.1	< 1.09	< 1.09	< 1.09
BLD0907	98.3	< 0.563	0.6	< 0.563	42.2	0.7	< 0.845	34.5	11.9	< 1.13	4.1	4.2
BLD0908	12.9	< 0.590	< 0.590	< 0.590	8.8	< 0.590	< 0.884	2.1	2.0	< 1.18	< 1.18	< 1.18
BLD0909	11.1	< 0.561	< 0.561	< 0.561	6.1	< 0.561	< 0.841	3.5	1.6	< 1.12	< 1.12	< 1.12
BLD0910	10.3	< 0.514	< 0.514	< 0.514	5.3	< 0.514	< 0.772	3.1	1.9	< 1.03	< 1.03	< 1.03
BLD0911	4.3	< 0.532	< 0.532	< 0.532	2.1	< 0.532	< 0.798	1.1	1.2	< 1.06	< 1.06	< 1.06
BLD0912	7.8	< 0.607	< 0.607	< 0.607	4.8	< 0.607	< 0.910	1.5	1.5	< 1.21	< 1.21	< 1.21
BLD0913	8.4	< 0.573	< 0.573	< 0.573	5.2	< 0.573	< 0.860	1.6	1.6	< 1.15	< 1.15	< 1.15
BLD0914	11.6	< 0.584	< 0.584	< 0.584	7.4	< 0.584	< 0.876	2.0	2.2	< 1.17	< 1.17	< 1.17
BLD0915	30.8	< 0.610	< 0.610	< 0.610	14.9	< 0.610	< 0.915	9.2	4.1	< 1.22	2.7	< 1.22
BLD0916	63.5	< 0.548	< 0.548	< 0.548	37.0	< 0.548	< 0.822	10.5	10.0	< 1.10	3.2	2.8
BLD0917	35.3	< 0.484	< 0.484	< 0.484	20.6	< 0.484	< 0.727	6.5	5.3	< 0.969	1.4	1.5
BLD0918	9.4	< 0.566	< 0.566	< 0.566	4.3	< 0.566	< 0.848	3.6	1.6	< 1.13	< 1.13	< 1.13
BLD0919	6.5	< 0.521	< 0.521	< 0.521	3.0	< 0.521	< 0.781	2.3	1.2	< 1.04	< 1.04	< 1.04
BLD1001	2.1	< 0.483	< 0.483	< 0.483	2.1	< 0.483	< 0.724	< 0.724	< 0.724	< 0.965	< 0.965	< 0.965
BLD1002	3.2	< 1.20	< 1.20	< 1.20	3.2	< 1.20	< 1.80	< 1.80	< 1.80	< 2.40	< 2.40	< 2.40
BLD1003	0.6	< 0.556	< 0.556	< 0.556	0.6	< 0.556	< 0.833	< 0.833	< 0.833	< 1.11	< 1.11	< 1.11
BLD1004	0.6	< 0.405	< 0.405	< 0.405	0.6	< 0.405	< 0.607	< 0.607	< 0.607	< 0.809	< 0.809	< 0.809
BLD1005	6.3	< 0.625	< 0.625	< 0.625	< 0.625	< 0.625	< 0.938	< 0.938	< 0.938	< 1.25	< 1.25	< 1.25
BLD1006	0.6	< 0.551	< 0.551	< 0.551	0.6	< 0.551	< 0.826	< 0.826	< 0.826	< 1.10	< 1.10	< 1.10
BLD1007	10.1	< 1.01	< 1.01	< 1.01	< 1.01	< 1.01	< 1.51	< 1.51	< 1.51	< 2.02	< 2.02	< 2.02
BLD1008	6.1	< 1.16	< 1.16	< 1.16	4.1	< 1.16	< 1.74	< 1.74	2.0	< 2.31	< 2.31	< 2.31
BLD1009	0.5	< 0.436	< 0.436	< 0.436	0.5	< 0.436	< 0.653	< 0.653	< 0.653	< 0.871	< 0.871	< 0.871
BLD1010	0.9	< 0.625	< 0.625	< 0.625	0.9	< 0.625	< 0.938	< 0.938	< 0.938	< 1.25	< 1.25	< 1.25
BLD1011	7.2	< 0.718	< 0.718	< 0.718	< 0.718	< 0.718	< 1.08	< 1.08	< 1.08	< 1.44	< 1.44	< 1.44
BLD1012	7.0	< 0.694	< 0.694	< 0.694	< 0.694	< 0.694	< 1.04	< 1.04	< 1.04	< 1.39	< 1.39	< 1.39
BLD1013	0.9	< 0.698	< 0.698	< 0.698	0.9	< 0.698	< 1.05	< 1.05	< 1.05	< 1.40	< 1.40	< 1.40
BLD1014	6.9	< 0.698	< 0.698	< 0.698	5.0	< 0.698	< 1.05	< 1.05	1.9	< 1.40	< 1.40	< 1.40
BLD1015	1.0	< 0.702	< 0.702	< 0.702	1.0	< 0.702	< 1.05	< 1.05	< 1.05	< 1.40	< 1.40	< 1.40
BLD1016	1.1	< 0.694	< 0.694	< 0.694	1.1	< 0.694	< 1.04	< 1.04	< 1.04	< 1.39	< 1.39	< 1.39
BLD1017	1.2	< 0.635	< 0.635	< 0.635	1.2	< 0.635	< 0.952	< 0.952	< 0.952	< 1.27	< 1.27	< 1.27
BLD1018	2.0	< 0.661	< 0.661	< 0.661	2.0	< 0.661	< 0.992	< 0.992	< 0.992	< 1.32	< 1.32	< 1.32
BLD1019	8.1	< 0.466	< 0.466	< 0.466	5.1	< 0.466	< 0.700	0.8	2.1	< 0.933	< 0.933	< 0.933
BLD1020	2.2	< 1.13	< 1.13	< 1.13	2.2	< 1.13	< 1.69	< 1.69	< 1.69	< 2.25	< 2.25	< 2.25
BLD1101	1.0	< 0.607	< 0.607	< 0.607	1.0	< 0.607	< 0.910	< 0.910	< 0.910	< 1.21	< 1.21	< 1.21
BLD1102	3.4	< 0.561	< 0.561	< 0.561	2.3	< 0.561	< 0.841	1.1	< 0.841	< 1.12	< 1.12	< 1.12
BLD1103	8.9	< 1.11	< 1.11	< 1.11	6.7	< 1.11	< 1.66	2.2	< 1.66	< 2.21	< 2.21	< 2.21
BLD1104	1.9	< 0.598	< 0.598	< 0.598	1.9	< 0.598	< 0.897	< 0.897	< 0.897	< 1.20	< 1.20	< 1.20
BLD1105	1.8	< 0.601	< 0.601	< 0.601	1.8	< 0.601	< 0.901	< 0.901	< 0.901	< 1.20	< 1.20	< 1.20
BLD1106	1.1	< 0.595	< 0.595	< 0.595	1.1	< 0.595	< 0.893	< 0.893	< 0.893	< 1.19	< 1.19	< 1.19
BLD1107	0.9	< 0.546	< 0.546	< 0.546	0.9	< 0.546	< 0.819	< 0.819	< 0.819	< 1.09	< 1.09	< 1.09
BLD1108	5.2	< 0.786	< 0.786	< 0.786	3.1	< 0.786	< 1.18	2.2	< 1.18	< 1.57	< 1.57	< 1.57
BLD1109	6.7	< 0.496	< 0.496	< 0.496	3.6	< 0.496	< 0.744	2.3	0.9	< 0.992	< 0.992	< 0.992
BLD1110	6.8	< 0.607	< 0.607	< 0.607	3.3	< 0.607	< 0.910	2.4	1.1	< 1.21	< 1.21	< 1.21
BLD1111	44.1	< 0.519	< 0.519	< 0.519	15.5	< 0.519	< 0.778	16.7	7.3	< 1.04	2.9	1.6
BLD1112	7.5	< 0.581	< 0.581	< 0.581	4.8	< 0.581	< 0.872	1.4	1.2	< 1.16	< 1.16	< 1.16
BLD1113	6.4	< 0.558	< 0.558	< 0.558	3.1	< 0.558	< 0.837	2.4	0.9	< 1.12	< 1.12	< 1.12
BLD1114	13.7	< 1.05	< 1.05	< 1.05	6.8	< 1.05	2.1	3.0	1.8	< 2.10	< 2.10	< 2.10
BLD1115	22.8	< 0.551	< 0.551	< 0.551	9.7	< 0.551	< 0.826	7.6	3.5	< 1.10	2.0	< 1.10
BLD1116	2.3	< 0.561	< 0.561	< 0.561	1.3	< 0.561	< 0.841	1.1	< 0.841	< 1.12	< 1.12	< 1.12
BLD1117	30.0	5.0	2.2	3.1	5.6	1.9	1.9	2.6	2.3	1.8	1.9	1.8

ng/g = parts per billion. Shaded cells indicate one-half the total PBDE detection limit.
Only BDE congeners with detectable concentrations listed. 28 BDE congeners were below detection limits.
Values in red preceded by < symbol indicate non-detects and sample detection limits.

Table A-10. Mercury in individual bald eagle nestling whole blood samples, µg/g wet weight

Territory No.	Territory Location & Township	Hg µg/g ww
ME020E	Bagaduce River, Mills Point, Brooksville	0.241
ME544A	Ensign Island, Isleboro	0.273
ME464A	Penobscot River, Hampden	0.222
ME028E	South Twinnie Island, Bar Harbor	0.097
ME026E	Bar Island, Mount Desert	0.069
ME026E	Bar Island, Mount Desert	0.065
ME031F	Hills Island, Hancock	0.146
ME038E	Hog Island, Gouldsboro	0.079
ME041D	Sheep Porcupine Island, Gouldsboro	0.170
ME042D	Ironbound Island, Winter Harbor	0.288
ME138H	Great Duck Island, Frenchboro	0.236
ME138H	Great Duck Island, Frenchboro	0.276
ME043I	Schoodic Island, Winter Harbor	0.191
ME576A	Cross Island, Cutler	0.153
ME576A	Cross Island, Cutler	0.222
ME502B	Sally Island, Steuben	0.198
ME427A	Inner Double Head Shot Island, Cutler	0.187
ME427A	Inner Double Head Shot Island, Cutler	0.170
ME027A	Bartlett Island, Mount Desert	0.069
ME024E	Placentia Island, Frenchboro	0.061
ME292C	Outer Heron Island, Boothbay	0.298
ME292C	Outer Heron Island, Boothbay	0.251
ME589A	Lower Mark Island, Southport	0.275
ME589A	Lower Mark Island, Southport	0.327
ME094A	Penobscot River, Bowden Point, Prospect	0.243
ME094A	Penobscot River, Bowden Point, Prospect	0.324
ME029H	Ellsworth	0.124
ME029H	Ellsworth	0.114
ME056G	Little Ram Island, Roque Bluffs	0.046
ME183B	Roque Island, Jonesport	0.104
ME183B	Roque Island, Jonesport	0.078
ME167D	Eagle Island, Addison	0.204
ME127E	Long Cove, Pleasant River, Addison	0.166
ME127E	Long Cove, Pleasant River, Addison	0.163
ME037J	Calf Island, Sorrento	0.070
ME339D	Squaw Pt. , Penobscot Bay, Stockton Springs	0.644
ME339D	Squaw Pt. , Penobscot Bay, Stockton Springs	0.337
ME339D	Squaw Pt. , Penobscot Bay, Stockton Springs	0.817
ME022A	Salt Pond, Blue Hill	0.231
ME145D	Williams Point, Gouldsboro	0.068
ME179F	Hardwood Island, Isle Au Haut	0.113
ME179F	Hardwood Island, Isle Au Haut	0.149
ME034D	Buckskin Island, Franklin	0.079
ME211D	Little River Island, Cutler	0.031
ME224C	Cape Wash Island, Cutler	0.313
ME267B	Bois Bubert Island, Milbridge	0.075
ME240B	Tibbet Island, Boothbay	0.048
ME169E	Jed Island, Blue Hill	0.049
ME169E	Jed Island, Blue Hill	0.048
ME623A	Seavey Point, Addison	0.050
ME508B	Hen Island, Swans Island	0.027
ME314G	Tinker Island, Tremont	0.036
ME314G	Tinker Island, Tremont	0.049
ME198D	Inner Baker Island, Swans Island	0.043
ME430D	Eagle Island, Swans Island	0.042
ME191D	Crow Island, Muscle Ridge Shoals	0.026
ME191D	Crow Island, Muscle Ridge Shoals	0.023
ME582B	Babbidge Island, North Haven	0.048
ME157B	Crow Island, Deer Isle	0.044
ME119G	Mink Island, Beals	0.028
ME052J	Inner Goose Island, Addison	0.045
ME047A	Shipstern Island, Harrington	0.031
ME187E	Sheep Island, Gouldsboro	0.044
ME217C	Hodgsons Island, South Bristol	0.079

µg/g = parts per million. Samples collected between 2007 and 2011
Rows shaded in sequence indicate siblings.