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Environmental Contaminants in Blood, Feathers, and Eggs of Bald Eagles on Aberdeen Proving Ground, Maryland in 2008

Elizabeth K. Mojica
The Center for Conservation Biology, lmojica@edmlink.com

B. D. Watts
The Center for Conservation Biology, bdwatt@wm.edu

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Center for Conservation Biology
College of William and Mary
Williamsburg, VA 23187-8795

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INTRODUCTION

Bald Eagle (*Haliaeetus leucocephalus*) populations across the lower 48 states have rebounded from 417 breeding pairs in 1963 (Sprunt 1963) to an estimated 5,478 in 1998 (Millar 1999). The Chesapeake Bay population grew exponentially from 73 pairs in 1977 to 601 pairs in 2001 (Watts et al. 2008). The population has continued to grow and now is estimated at over 1,000 breeding pairs (Maryland Department of Natural Resources 2004, Watts and Byrd 2008).

The recovery of eagle populations throughout most of their range prompted the US Fish and Wildlife Service (USFWS) to remove the species from the Endangered Species List in 2007 (USFWS 2007, Watts and Byrd 2008). Eagles remain protected under the federal Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, and Lacey Act (Millar 1999). Although breeding populations have recovered, many threats continue to affect breeding and non-breeding eagles. Current threats include electrocutions, line strikes, disease, contaminants, habitat loss, and vehicle collisions (Millar 1999, Millsap et al. 2004).

Concern over Bald Eagle deaths related to the electrical infrastructure at the US Army's Aberdeen Proving Ground (APG) prompted a Biological Assessment (BA) of the species under the Endangered Species Act in 2004. As a result of recommendations in the BA, the Army contracted with The Center for Conservation Biology at the College of William and Mary to study the mortality problems at APG.

APG manufactures, stores, and tests chemicals during military programs. Improper disposal of these chemicals in the past has led to the presence of contaminants in the soil and water on base. APG is actively cleaning up contaminated sites through the federal Superfund program but many contaminants continue to persist in the environment. Bioaccumulation of contaminants in Bald Eagles can reduce productivity and hatching rates and cause death by poisoning (Henny & Elliott 2007). In spring 2008, CCB biologists conducted a preliminary study of contaminants in APG eagles while visiting eagle nests on base.

OBJECTIVES

1. To determine mercury, pesticide, and PCB contaminant levels in nestling eagles

2. To determine contaminant levels in adult females by testing levels in non-viable eggs

METHODS

Banding

Nests were accessed using standard arborist equipment when the chicks were between 32 and 45 days old. Chicks were lowered to the ground for banding, measurements, and tissue collection. The following morphometric measurements were taken on all chicks: weight, wing length, tail length, culmen length, culmen depth, hallux length, and tarsus length. Wing and tail length were measured with a ruler (± 1 mm) and culmen length, culmen depth, hallux length, and tarsus length were measured with dial calipers (± 0.1 mm). Eagles were weighed on a digital scale (± 1 g). Nestlings were marked with numeric federal bands (USGS Bird Banding Lab, Laurel, MD) on the right tarsus and purple alpha-numeric color bands (ACRAFT, Edmonton, Alberta) on the left tarsus. Banding and tissue collection was in accordance with state and federal permits.

Blood Sampling

One chick from each nest was selected for blood and feather contaminants sampling (Figure 1). Blood samples were collected from the brachial vein in the wing using 23 gauge butterfly needles and 4cc heparinized BD Vacutainers©. A maximum of 6cc of blood was collected from each eagle. Blood samples were immediately packed on ice and frozen within 4 hours of collection. Feathers were sampled from every chick handled and banded. Two feathers were pulled from the breast area and stored in a paper envelope. All samples were labeled with the eagle's band number and unique nest code. Eggs were washed with tap water and allowed to air dry, then wrapped in aluminum foil and frozen. Methodology for tissue collection was in compliance with protocols approved by the Institutional Animal Care and Use Committee at the College of William and Mary.

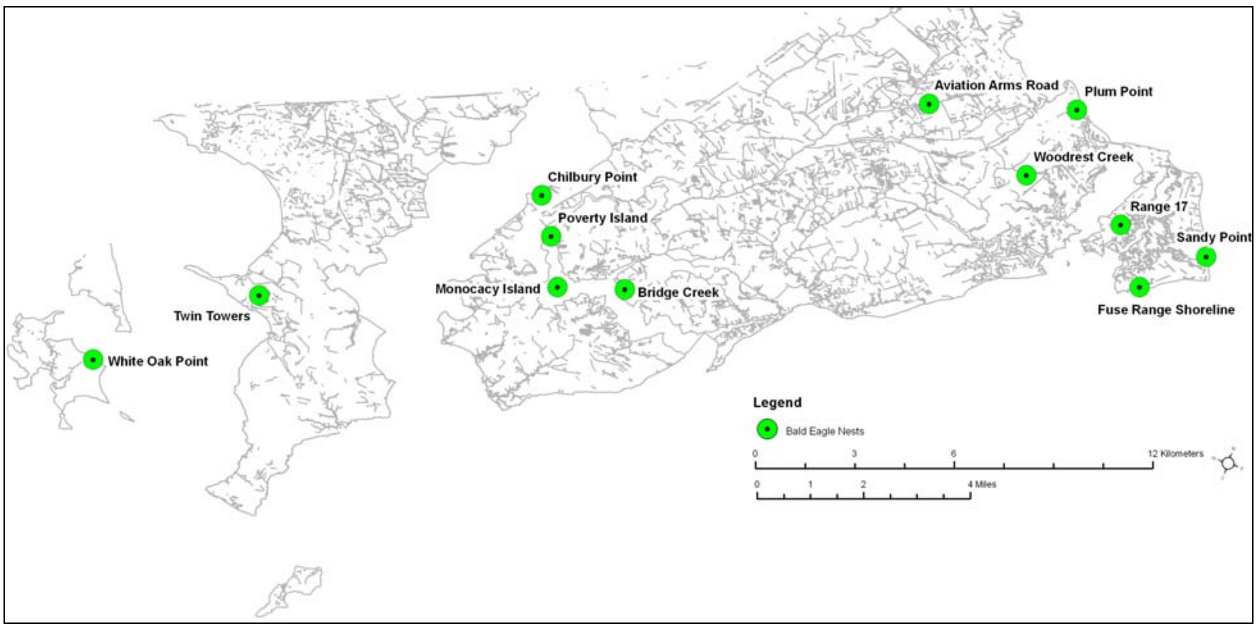


Figure 1. Bald Eagle nest climbed during the 2008 breeding season at APG.

Mercury

Mercury analysis took place in the Cristol Lab at the Department of Biology, College of William and Mary. Total mercury values of whole blood, breast feathers, and freeze-dried egg were analyzed using a Milestone® DMA 80 (direct mercury analyzer) using cold vapor atomic absorption spectroscopy (Brasso & Cristol, 2008). Two replicates from each sample were analyzed to validate homogeneity of Hg in samples. A blank was run every 20 samples to standardize equipment (Cristol *et al.*, 2008). Methyl mercury (MeHg), the form most available for uptake by birds, was assumed to compose 95% of the total Hg present in samples (Evers *et al.*, 2005) and was not analyzed separately. Feather mercury levels represent total body burden from the time of the last molt, which in nestlings was 2-3 weeks prior to sampling. Blood mercury represents recent dietary uptake (DeSorbo *et al.*, 2008). All Hg data are reported as wet or fresh weight values.

Persistent organic pollutants

Persistent organic pollutants were analyzed at the Hale Lab at the Virginia Institute of Marine Science, College of William and Mary. Whole blood and egg samples were freeze-dried for 48 hours before compound extraction. Extracts were analyzed using gas chromatography and mass spectrometry (Chen *et al.*, 2008). Blood and egg samples were analyzed the following pesticides: *trans*-chlordane, MC5, *cis*-chlordane, *trans*-nonachlor, *cis*-nonachlor, DDMU, p,p'-DDE, p,p'-DDD, p,p'-DDT. Egg samples were additionally tested for heptachlore epoxide isomer B, oxychlordane, MC6, MC8, and MC3. Samples were also tested for polychlorinated biphenyls (PCBs) including: PCB-28/31, PCB-33/20, PCB-22, PCB-52, PCB-49, PCB-47/48/75, PCB-44, PCB-42/59, PCB-71, PCB-103, PCB-100, PCB-63, PCB-74, PCB-70/95/66, PCB-91, PCB-56/60, PCB-92, PCB-84, PCB-101/90, PCB-99, PCB-119, PCB-83, PCB-97, PCB-117, PCB-87/115, PCB-85, PCB-136, PCB-110, PCB-77, PCB-151, PCB-135, PCB-144, PCB-147, PCB-107/123, PCB-149, PCB-118, PCB-134, PCB-114, PCB-165, PCB-146, PCB-153/132, PCB-105, PCB-179, PCB-141, PCB-137, PCB-176, PCB-130, PCB-164/163, PCB-138/158, PCB-178, PCB-175, PCB-187, PCB-183, PCB-128, PCB-167, PCB-185, PCB-174, PCB-177, PCB-202, PCB-171, PCB-156, PCB-201, PCB-172, PCB-197, PCB-180/193, PCB-191, PCB-200, PCB-170/190, PCB-199, PCB-203/196, PCB-189, PCB-208, PCB-195, PCB-207, PCB-194, PCB-205, PCB-206, and PCB-209.

RESULTS

Banding

A total of 19 nestlings from 12 eagle nests were banded and processed during the 2008 breeding season (Appendix A). The single chick in the Fuze Range Shoreline nest (ATC 72, MDDNR HA-08-06) exhibited symptoms of poor nutrition or health. All 19 chicks survived to fledging age (60-75 days old; EA Engineering pers. comm.).

Contaminants

Mercury

Mercury levels were subacute in all eagles sampled. Individual Hg blood values ranged from 0.0149-0.0369 ($\bar{x}$ = 0.0288) mg/kg (ppm). Individual feather mercury values ranged from 0.4761-1.1925 ($\bar{x}$ = 0.8163) mg/kg (Appendix B). The single addled egg had a mercury value of 0.0995 mg/kg (Table 2).

Table 2. Mean mercury values sampled from Bald Eagle chicks by nest territory. Values are in mg/kg (ppm) fresh wet weight.

Nest Territory	ATC	MD DNR	*n*	Feather Hg	*n*	Blood Hg	*n*	Egg Hg
Bridge Creek	69	HA-08-03	2	0.7365	1	0.0300	0	------
White Oak Point	59	BA-07-03	3	0.7454	1	0.0223	0	------
Chilbury Point	67	HA-07-07	2	0.5589	1	0.0149	0	------
Poverty Island	19	HA-03-08	2	1.1828	1	0.0363	0	------
Monocacy Tower	65	HA-07-03	1	0.9460	0	------	0	------
Range 17	73	HA-08-07	2	0.9228	1	0.0255	0	------
Fuze Range	72	HA-08-06	1	0.7103	1	0.0302	0	------
Towner Cove	10	HA-00-05	1	0.5290	1	0.0332	0	------
Plumb Point	55	HA-06-01	1	0.8408	1	0.0303	0	------
Woodrest Creek	13	HA-96-02	2	0.8406	1	0.0280	0	------
Aviation Arms	17	HA-95-07	1	0.7570	1	0.0287	0	------
Twin Towers	41	HA-99-08	1	1.0080	1	0.0369	1	0.0995

Persistent organic pollutants

Total PCB levels (sum of all congeners) in nestling blood ranged from 0.037-0.106 ($\bar{x}$ = 0.055) µg/g (ppm) wet weight (Table 3, Appendix C). Total Chlordane levels in blood ranged from 0.007-0.017 ($\bar{x}$ = 0.010) µg/g (ppm) wet weight (Appendix D). DDE values ranged 0.009-0.300 ($\bar{x}$ = 0.016) µg/g (ppm) wet weight. Egg levels were higher with total PCB levels at 33.69 ppm (Figure 2) and DDE at 8.10 ppm (Table 4).

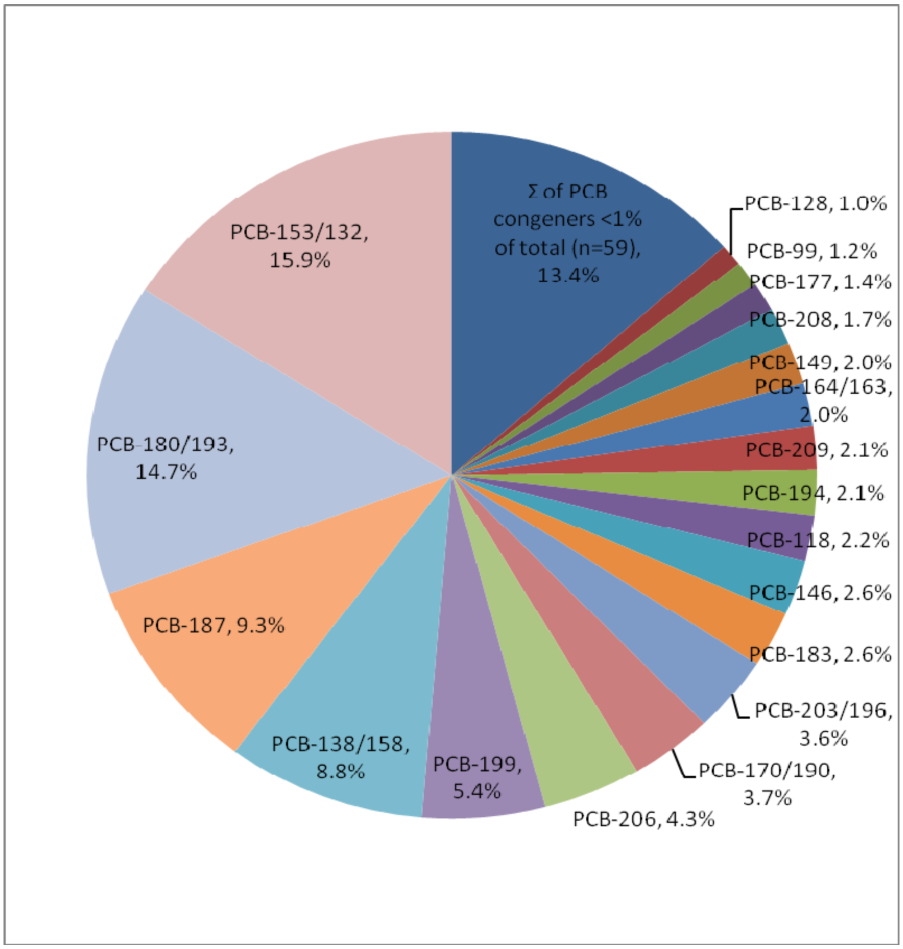
Table 3. Organic pollutant values in nestling Bald Eagle blood by nest territory. Values in µg/g (ppm) wet weight.

Nest Territory	*n*	ATC	MD DNR	Σ PCBs	Σ Chlordane	Σ DDT
Aviation Arms	1	17	HA-95-07	0.0451	0.0084	0.0118
Chilbury Point	1	67	HA-07-07	0.1060	0.0173	0.0356
Fuze Range	1	72	HA-08-06	0.0568	0.0079	0.0180
Plumb Point	1	55	HA-06-01	0.0614	0.0098	0.0207
Poverty Island	1	19	HA-03-08	0.0636	0.0090	0.0164
Range 17	1	73	HA-08-07	0.0450	0.0091	0.0123
Towner Cove	1	10	HA-00-05	0.0367	0.0065	0.0196
Twin Towers	1	41	HA-99-08	0.0547	0.0089	0.0162
White Oak Point	1	59	BA-07-03	0.0422	0.0115	0.0214
Woodrest Creek	1	13	HA-96-02	0.0382	0.0089	0.0189

Table 4. Organochloride contaminants detected in a single Bald Eagle egg from the Twin Towers nest during the 2008 breeding season.

Contaminant	µg/g ww
Heptachlore epoxide isomer B	0.041
MC3	0.144
MC5	0.690
MC6	0.038
MC8	0.029
Oxychlordane	0.152
Cis-chlordane	0.285
Trans-chlordane	0.041
Cis-nonachlor	0.345
Trans-nonachlor	1.580
Σ Chlordane	**3.345**
DDMU	0.688
p,p'-DDE	8.070
p,p'-DDD	0.602
p,p'-DDT	0.108
Σ DDT	**9.468**
Σ PCBs	**33.693**

Figure 2. PCB congeners in a Bald Eagle egg collected from Twin Towers nest, Aberdeen Proving Ground, MD in May 2008.



DISCUSSION

Mercury

Contaminant levels in eagle blood represent a short-term view of overall contaminant exposure because nestling eagles deposit ingested contaminants into growing feathers, organs, and other tissues (DeSorbo *et al.*, 2008). Mercury contamination in nestling blood and feathers was minimal and less than values reported from other nestling studies in North America (Table 5). The single egg had a mercury level of 0.09 ppm, less than the 0.5-1.5 ppm historically thought to reduce productivity rates in eagles (Wiemeyer *et al.*, 1984). Toxicity thresholds are unknown for nestling eagles based on blood and feathers and the threshold is uncertain in adult eagles. A recent Bald Eagle study near a mercury mine in British Columbia, observed no reproductive effects or signs of MeHg toxicity in adults with blood concentrations near 10 µg/ml (ppm) (Weech *et al.*, 2006). A similar study in the Great Lakes did not find a relationship between elevated mercury levels (3.7-66.0 mg/kg) in adult eagle feathers and reproduction, productivity rates or nesting success (Bowerman *et al.*, 1994). The egg from APG had a mercury level of <0.1 mg/kg, suggesting the adult female also had low levels of mercury at the time of laying.

Table 5. Comparable mercury values from Bald Eagle nestlings and eggs in North America. All values in mg/kg (ppm) wet weight.

Tissue	Region	n	Mean	Range
Feathers				
	APG	**19**	**0.82**	**0.47-1.19**
	NSF Indian Head, MD[a]	18	1.22	0.84-1.80
	Klamath River Basin[b]	5	2.17	------
	South Carolina[c]	34	3.08	0.61-6.67
	Florida[d]	61	4.05	0.76-14.3
	Great Lakes[e]	115	9	1.50-27.0
Blood	**APG**	**10**	**0.03**	**0.01-0.04**
	NSF Indian Head, MD	18	0.05	0.03-0.07
	South Carolina[c]	34	0.10	0.02-0.25
	Florida[d]	48	0.17	0.02-0.61
	Klamath River Basin[b]	9	0.23	0.08-0.65
	Columbia River[f]	15	0.47	0.19-1.40
	New York[g]	16	0.52	0.12-1.19
	Oregon[h]	82	1.2	nd - 4.20
Egg	**APG**	**1**	**0.10**	------
	NSF Indian Head, MD[a]	1	0.09	------
	Chesapeake Bay[i]	26	0.07	0.00 - 0.17
	Columbia River[f]	13	0.2	0.13-0.36
	Toxicity threshold[i]		*0.5-1.5*	

nd = contaminant not detected

[a] Mojica & Watts 2008, [b] Frenzel & Anthony, 1989, [c] Jagoe *et al.*, 2002, [d] Wood *et al.*, 1996, [e] Bowerman *et al.*, 1994, [f] Anthony *et al.*, 1993, [g] DeSorbo *et al.*, 2008, [h] Wiemeyer *et al.*, 1989, [i] Wiemeyer *et al.*, 1984

Persistent organic pollutants

Organochloride blood levels at APG were within the range of values reported by other eagle nestling studies (Table 6) and below toxicity thresholds for the species (Elliott & Harris, 2002; Henny & Elliott, 2007). The single addled egg collected from the Twin Towers nest, however, had levels above toxicity thresholds for both DDE and PCBs (Elliott & Harris, 2002; Henny & Elliott, 2007). Levels were above the embryo lethality level for DDE (5.5 mg/kg) and reproductive impairment level for PCB (20 ppm) (Elliott & Harris, 2002; Henny & Elliott, 2007).

Table 6. Comparable organochloride contaminant levels in Bald Eagle nestling blood and eggs. All values in ppm wet weight.

Tissue	Region	*n*	DDE Mean	DDE Range	*n*	PCB Mean	PCB Range
Blood	**APG**	10	**0.016**	**0.009-0.300**	**10**	**0.055**	**0.037-0.106**
	NSF Indian Head, MD[a]	18	0.013	0.01-0.02	18	0.043	0.021-0.080
	Newfoundland[b]	23	0.005	0.002-0.041	23	0.025	0.008-0.133
	British Columbia[c]	31	0.014	0.003-0.057	31	0.029	0.001-0.097
	Oregon[d]	75	0.015	nd-0.15			
	California[c]	3	0.041	0.018-0.123	3	0.011	0.065-0.021
	Columbia River[e]	15	0.050	0.01-0.24	15	0.040	nd-0.130
	Great Lakes[f]				30	0.130	0.009-0.326
	Toxicity threshold[g]		41.000			189.000	
Egg	**APG**	**1**	**8.1**	------	**1**	**33.69**	------
	NSF Indian Head, MD[a]	1	3.8	------	1	18.43	------
	Florida[h]	15	4.7	2.0-18.0	8	7.89	5.7-22.0
	Columbia River[e]	17	9.7	4.0-20.0	17	12.70	4.8-26.7
	Great Lakes[f]	6	10.8	2.7-22.2	6	26.40	11.7-43.7
	Chesapeake Bay[j]	26	11.9	3.3-26.0	26	25.00	8.9-218.0
	Toxicity threshold[g]		*5.5*			*20.00*	

nd = contaminant not detected

[a]Mojica & Watts 2008; [b]Dominguez *et al.* 2003; [c]Cesh *et al.* 2008; [d]Wiemeyer *et al.* 1989; [e]Anthony *et al.* 1993; [f]Donaldson *et al.* 1999; [g]Elliott & Harris 2002, Henny & Elliott, 2007; [h]Forrester & Spalding 2003; [i]Wiemeyer *et al.* 1984

DDE and PCBs bioaccumulate over time in adipose tissue and are deposited during egg formation. Because these contaminants bioaccumulate over time, it is unknown whether the Twin Towers adult female ingested the contaminants near the nest or elsewhere. The egg from Twin Towers had over 1.5 times higher PCB levels than the average level recorded in eagle eggs collected from the Chesapeake Bay in the 1970s (Wiemeyer *et al.*, 1984). DDE levels were comparable to the 1970s levels. The toxic PCB and DDE levels found in the Twin Towers egg likely contributed to reproductive failure.

Several PCB congeners are present in APG eagle blood and egg tissue that are not present in eagles sampled from another Maryland military base (Figure 3). These PCBs may have originated from past chemical manufacturing on APG. A larger sample size of addled eggs and nestling blood is required to determine how widespread the contamination is among APG eagle nests and determine their affects on reproduction rates.

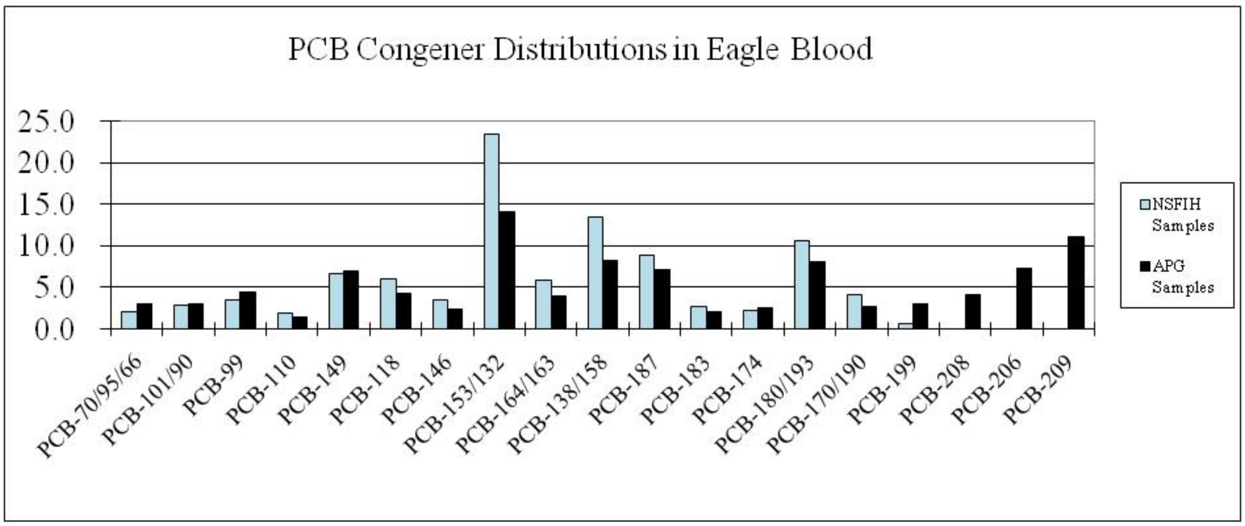


Figure 3. Comparison of PCB congeners in Bald Eagle nestling blood from Aberdeen Proving Ground, MD and Naval Support Facility Indian Head, MD. Data values in ng/g fresh weight (PPB).

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APPENDIX A.

Morphometrics of Bald Eagle nestlings banded at Aberdeen Proving Ground, Harford Co, MD during the 2008 breeding season.

Band No.	Sex	Nest Territory	Weight	Culmen length with cere	Culmen length without cere	Culmen depth	Halux Length	Wing chord	Tail	Age (days)
0679-01239	F	Bridge Creek	4110	62.7	47.9	32.2	36.6	39.0	18.7	45
0679-01240	M	Bridge Creek	3200	57.4	41.7	28.8	32.7	34.5	17.0	45
0679-01245	M	White Oak Point	3073	58.1	43.2	29.4	33.6	36.5	16.1	45
0679-01246	M	White Oak Point	3044	56.6	41.6	29.0	32.2	30.4	12.0	45
0679-01247	F	White Oak Point	3642	57.2	44.1	30.7	34.9	29.5	9.0	45
0679-01248	F	Chilbury Point	4385	62.7	49.4	31.2	38.5	40.5	19.9	52
0679-01249	M	Chilbury Point	3480	58.6	46.4	30.3	36.3	42.1	20.8	52
0679-01250	F	Poverty Island	4250	62.3	47.4	33.0	39.0	41.9	22.0	56
0679-01301	F	Poverty Island	3795	59.8	44.9	31.8	37.2	37.1	15.5	52
0679-01306	M	Monocacy Tower	3170	58.9	44.2	30.0	33.1	42.7	21.6	60
0679-01307	F	Range 17	4390	60.2	45.6	31.2	35.6	38.0	17.1	52
0679-01308	F	Range 17	3630	57.9	44.1	29.6	34.1	39.8	20.5	52
0679-01312	F	Fuze Range	4510	62.7	49.3	32.8	37.2	44.3	20.5	53
0679-01313	M	Towner Cove	3825	58.8	45.3	30.3	36.5	38.0	17.5	55
0679-01314	M	Plumb Point	3490	58.9	46.9	29.3	36.3	43.2	23.0	55
0679-01315	M	Woodrest Creek	3190	55.3	44.1	29.4	35.4	42.5	21.5	56
0679-01316	M	Woodrest Creek	2980	56.5	43.1	28.6	35.3	43.8	23.1	56
0679-01317	M	Aviation Arms	3650	61.7	45.6	28.7	34.3	44.7	23.9	65
0679-01318	F	Twin Towers	4558	65.7	50.7	33.6	38.3	49.5	25.4	56

APPENDIX B.

Mercury levels sampled from Bald Eagle nestlings at Aberdeen Proving Ground, Harford Co, MD during the 2008 breeding season. All values in mg/kg (ppm) wet weight.

Band	Nest	Feather Hg	Blood Hg
0679-01239	Bridge Creek	0.7109	
0679-01240	Bridge Creek	0.7622	0.0300
0679-01245	White Oak Point	0.7102	
0679-01246	White Oak Point	0.6850	
0679-01247	White Oak Point	0.8409	0.0223
0679-01248	Chilbury Point	0.6416	
0679-01249	Chilbury Point	0.4761	0.0149
0679-01250	Poverty Island	1.1925	
0679-01301	Poverty Island	1.1730	0.0363
0679-01306	Monocacy Tower	0.9460	
0679-01307	Range 17	0.8872	
0679-01308	Range 17	0.9583	0.0255
0679-01312	Fuze Range	0.7103	0.0302
0679-01313	Towner Cove	0.5290	0.0332
0679-01314	Plumb Point	0.8408	0.0303
0679-01315	Woodrest Creek	0.7803	
0679-01316	Woodrest Creek	0.9009	0.0280
0679-01317	Aviation Arms	0.7570	0.0287
0679-01318	Twin Towers	1.0080	0.0369

APPENDIX C.

PCB contaminant data for Bald Eagle nestlings sampled during the 2008 breeding season at Aberdeen Proving Ground, Harford Co, MD. Values in µg/g (ppm) wet weight.

Band No.	0679-01247	0679-01249	0679-01301	0679-01308	0679-01312	0679-01313	0679-01314	0679-01316	0679-01317	0679-01318
PCB-70/95/66	0.0011	0.0027	0.0023	0.0008	0.0011	0.0012	0.0010	0.0015	0.0016	0.0018
PCB-101/90	0.0011	0.0031	0.0022	0.0012	0.0012	0.0013	0.0019	0.0011	0.0023	0.0012
PCB-99	0.0013	0.0031	0.0019	0.0021	0.0026	0.0016	0.0027	0.0032	0.0033	0.0029
PCB-110	0.0008	0.0031	0.0019	0.0005	0.0006	0.0005	0.0009	0.0002	0.0006	0.0005
PCB-149	0.0026	0.0075	0.0044	0.0028	0.0031	0.0026	0.0048	0.0028	0.0034	0.0032
PCB-118	0.0013	0.0044	0.0019	0.0011	0.0030	0.0021	0.0021	0.0019	0.0020	0.0027
PCB-146	0.0009	0.0025	0.0014	0.0018	0.0014	0.0007	0.0015	0.0010	0.0012	0.0013
PCB-153/132	0.0049	0.0145	0.0090	0.0064	0.0079	0.0049	0.0092	0.0062	0.0067	0.0076
PCB-164/163	0.0019	0.0041	0.0026	0.0019	0.0022	0.0013	0.0027	0.0014	0.0022	0.0017
PCB-138/158	0.0034	0.0086	0.0053	0.0038	0.0049	0.0024	0.0052	0.0030	0.0041	0.0039
PCB-187	0.0027	0.0086	0.0043	0.0032	0.0042	0.0026	0.0049	0.0029	0.0029	0.0038
PCB-183	0.0009	0.0030	0.0015	0.0009	0.0012	0.0007	0.0015	0.0006	0.0008	0.0012
PCB-174	0.0011	0.0033	0.0018	0.0010	0.0008	0.0009	0.0017	0.0006	0.0011	0.0013
PCB-180/193	0.0035	0.0115	0.0053	0.0038	0.0044	0.0028	0.0055	0.0027	0.0032	0.0041
PCB-170/190	0.0012	0.0040	0.0020	0.0012	0.0014	0.0009	0.0018	0.0010	0.0010	0.0014
PCB-199	0.0010	0.0049	0.0027	0.0013	0.0020	0.0008	0.0018	0.0000	0.0014	0.0014
PCB-208	0.0020	0.0038	0.0026	0.0024	0.0030	0.0015	0.0024	0.0017	0.0014	0.0023
PCB-206	0.0036	0.0063	0.0039	0.0034	0.0048	0.0027	0.0045	0.0025	0.0023	0.0045
PCB-209	0.0070	0.0072	0.0067	0.0052	0.0070	0.0052	0.0055	0.0035	0.0038	0.0081
Total PCBs	0.0422	0.1060	0.0636	0.0450	0.0568	0.0367	0.0614	0.0382	0.0451	0.0547

APPENDIX D.

Organochloride contaminant data for Bald Eagle nestlings sampled during the 2008 breeding season at Aberdeen Proving Ground, Harford Co, MD. Values in µg/g (ppm) wet weight.

Band No	Nest Territory	MC5	*Trans-* chlordane	*Cis-* chlordane	*Trans-* nonachlor	*Cis-* nonachlor	Σ chlordane
0679-01247	White Oak Point	0.0033	0.0026	0.0020	0.0026	0.0010	0.0115
0679-01249	Chilbury Point	0.0042	0.0028	0.0036	0.0054	0.0014	0.0173
0679-01301	Poverty Island	0.0021	0.0017	0.0019	0.0024	0.0010	0.0090
0679-01308	Range 17	0.0028	0.0022	0.0010	0.0024	0.0008	0.0091
0679-01312	Fuze Range	0.0023	0.0012	0.0012	0.0024	0.0006	0.0079
0679-01313	Towner Cove	0.0023	0.0011	0.0011	0.0015	0.0005	0.0065
0679-01314	Plumb Point	0.0026	0.0011	0.0018	0.0036	0.0007	0.0098
0679-01316	Woodrest Creek	0.0029	0.0027	0.0006	0.0022	0.0004	0.0089
0679-01317	Aviation Arms	0.0019	0.0018	0.0016	0.0024	0.0007	0.0084
0679-01318	Twin Towers	0.0025	0.0011	0.0019	0.0024	0.0011	0.0089

Band No	p,p'-DDT	p,p'-DDE	p,p'-DDD	DDMU	Σ DDT
0679-01247	0.0010	0.0089	0.0012	0.0007	0.0118
0679-01249	0.0000	0.0297	0.0045	0.0014	0.0356
0679-01301	0.0013	0.0142	0.0017	0.0009	0.0180
0679-01308	0.0000	0.0178	0.0018	0.0010	0.0207
0679-01312	0.0009	0.0129	0.0012	0.0013	0.0164
0679-01313	0.0009	0.0094	0.0013	0.0009	0.0123
0679-01314	0.0012	0.0156	0.0018	0.0011	0.0196
0679-01316	0.0000	0.0134	0.0013	0.0015	0.0162
0679-01317	0.0000	0.0173	0.0028	0.0012	0.0214
0679-01318	0.0000	0.0159	0.0020	0.0009	0.0189