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SEABIRD TISSUE ARCHIVAL AND MONITORING PROJECT: Egg Collections and Analytical Results for 2006-2009

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Disclaimer

Any mention of commercial products is for information only; it does not imply recommendation or endorsement by NIST.

Abbreviations

AMAP	Arctic Monitoring and Assessment Programme
ANOVA	Analysis of Variance
BFR	Brominated flame retardant
C	Carbon
CH_2Cl_2; DCM	Dichloromethane (Methylene chloride)
CFIRMS	Continuous flow isotope ratio mass spectrometry
CM	Control material
COMU	Common murre, *Uria aalge*
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DOC	Dissolved organic carbon
EI	Electron impact
ESB	Environmental Specimen Bank
EPA	Environmental Protection Agency
GC	Gas chromatography
GLGU	Glaucous gull, *Larus hyperboreus*
GWGU	Glaucous-winged gull, *Larus glaucescens*
HBCDD	Hexabromocyclododecane
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
HCl	Hydrochloric acid
HDBP	Halogenated dimethyl bypyrrole
Hg	Mercury
HNO_3	Nitric acid
IAEA	International Atomic Energy Agency
ID-CV-ICPMS	Isotope dilution cold vapor inductively coupled plasma mass spectrometry
iHG	Inorganic mercury
IPREM	Institut Pluridisciplinaire de Recherche sur l'Environnement et les Materiaux
LOD	Limit of detection
LOQ	Limit of quantitation
LN_2	Liquid nitrogen
MANOVA	Multivariate analysis of variance
MDF	Mass dependent fractionation
MeHg	Monomethylymercury
MIF	Mass independent fractionation
MS	Mass spectrometry
N	Nitrogen
NCI	Negative chemical ionization
NIST	National Institute of Standards and Technology
NPRB	North Pacific Research Board
OC	Organic carbon
PBDE	Polybrominated diphenyl ether
PC	Principal component
PCA	Principal components analysis
PCB	Polychlorinated biphenyl
PFE	Pressurized fluid extraction
POPs	Persistent Organic Pollutants
PTV	Programmed temperature vaporization
RSD	Relative standard deviation
SEC	Size exclusion chromatography
SIHERL	Stable Isotope Hydrology and Ecology Research Laboratory
SIM	Selected ion monitoring
$SnCl_2$	Tin chloride

SPE	Solid phase extraction
SRM	Standard reference material
STAMP	Seabird Tissue Archival and Monitoring Project
TBMU	Thick-billed murre, *Uria lomvia*
THg	Total mercury
Tl	Thallium
TOC	Total organic carbon
UAMN	University of Alaska Museum of the North
UNMU	Unidentified murre, *Uria* spp.
USFWS-AMNWR	United States Fish and Wildlife Service - Alaska Maritime National Wildlife Refuge
VPDB	Vienna Pee Dee Belemni

Abstract

Since 1999, the Seabird Tissue Archival and Monitoring Project (STAMP) has collected, banked, and analyzed seabird eggs using established protocols to monitor chlorinated pesticides, polychlorinated biphenyls (PCBs), brominated flame retardants, and mercury in Alaska's marine environments. In 2006 and 2008-2009, 594 clutches of murre and gull eggs were obtained and banked at the Marine Environmental Specimen Bank, National Institute of Standards and Technology (NIST), using established protocols. During 2008-2010, 118 of the clutches from 13 Norton Sound – Bering Strait seabird colonies and 6 other nesting locations in the Bering and Chukchi seas and Gulf of Alaska were analyzed by NIST at the Hollings Marine Laboratory, Charleston, South Carolina for mercury and persistent organic pollutants. Mercury isotope analyses were run at the Equipe de Chimie Analytique BioInorganique et Environnement facility in Pau, France, and the Stable Isotope Hydrology and Ecology Research Laboratory in Saskatoon, Saskatchewan, ran stable carbon and nitrogen isotope analyses. Most bromated flame retardants were below detection limits. Polychlorinated biphenyl levels in the Norton Sound murre eggs were similar to levels found at other colonies in the region, but total mercury and some chlorinated pesticides were higher, compared to these locations. Most contaminant levels in Norton Sound gull eggs were also higher, but some chlorinated pesticides and polychlorinated biphenyls were lower, compared to the other colonies. Mercury and stable carbon and nitrogen isotope gradients indicated that Norton Sound has a unique mercury regime that is related to terrestrial sources of this metal. Mass independent fractionation is lower at northern latitudes, where sea-ice cover inhibits photoreduction of mercury, but it was also low in Norton Sound and the northern Bering Sea, indicating that ice was not the only factor influencing mercury fractionation patterns in these regions.

Introduction

The Seabird Tissue Archival and Monitoring Project (STAMP) is a collaborative, long-term program of the U.S. Fish and Wildlife Service Alaska Maritime National Wildlife Refuge (USFWS-AMNWR) and the National Institute of Standards and Technology (NIST) to monitor persistent organic pollutants (POPs), mercury, and other contaminants in Alaskan marine environments using seabird eggs. The purpose of STAMP is to monitor long-term trends in environmental quality by (1) collecting seabird tissues (primarily eggs) at seabird colonies without inadvertently contaminating them, (2) processing and banking the samples under conditions that ensure chemical stability during long-term (decadal) storage, and (3) analyzing subsamples of the stored material for anthropogenic contaminants. (see Roseneau *et al.* 2008 for more project history details). Eggs, collected using established protocols (Rust *et al.* 2010), are shipped to AMNWR's laboratory in Homer, Alaska, where the contents are removed, homogenized, and transferred to labeled Teflon and polypropylene containers before being frozen and shipped to NIST's Marine Environmental Specimen Bank (Marine ESB) at the Hollings Marine Laboratory in Charleston, South Carolina, for long-term (decadal) storage in stainless steel liquid nitrogen ($LN_{2)}$ vapor freezers at -150 ºC. Dried egg shells are sent to the University of Alaska Museum of the North (UAMN) in Fairbanks, Alaska, for safekeeping.

In 2002, STAMP received North Pacific Research Board (NPRB) funding to analyze a series of previously banked murre (*Uria* spp.) and gull (*Larus* spp.) eggs from several colonies in the Bering and Chukchi seas and Gulf of Alaska for chlorinated pesticides, polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs; a group of brominated flame retardants or BFRs), organotins (butyltins), and mercury (Hg). The 2002 study (NPRB Project 534) found relatively high levels of Hg in common murre (*U. aalge*) eggs from three Norton Sound colonies (Sledge Island, Bluff, and Cape Denbigh) and differences in organic contaminant patterns in this northeastern Bering Sea region (Roseneau *et al.* 2008).

Murre and gull eggs are important dietary items in northwestern Alaska, where residents of the region traditionally harvest and consume large numbers of them annually (Ahmasuk and Trigg 2007; A. Ahmasuk, pers. comm.). For example, in 1995, people living in Nome collected at least 7,404 murre and 1,259 gull eggs, and people living in Brevig Mission, White Mountain, and Unalakleet harvested 2,533 gull eggs (see the Alaska Department of Fish and Game Subsistence Division Community Subsistence Information System web site at http://www.adfg.alaska.gov/sb/CSIS/index.cfm).

Given the high Hg levels found in Norton Sound during NPRB Project 534 and the importance of murre and gull eggs to residents of the area, there was a need to obtain more information on the distribution this potentially harmful contaminant in the region. The current study, implemented in 2008, was designed to expand common murre and glaucous gull (*Larus hyperboreus*) egg sampling activities in and near Norton Sound; analyze the eggs for Hg, chlorinated pesticides, PCBs, and BFRs (PBDEs); investigate Hg isotope patterns throughout the region; and test the hypotheses that: 1) Hg levels in Norton Sound common murre eggs were high and relatively consistent over time; 2) Hg levels in Norton Sound glaucous gull eggs were higher than those found outside this region; 3) Norton Sound Hg isotope patterns differed from more distant nesting locations; and 4) POP levels in Norton Sound murre and gull eggs did not differ from colonies outside this northeastern Bering Sea embayment.

Various geologic and environmental matrices have been characterized to inventory the isotope signatures of different types of source materials, and document the ranges in Hg isotope ratios observed in these materials around the globe (Yin et al., 2010). Isotope ratios are reported using delta (δ) notation, which references all measured isotope ratios to a universally used delta standard, and provides a relative measure of the degree of Hg mass-dependent fractionation (MDF) (Blum and Bergquist, 2007). Variation in isotope ratios that is unrelated to isotope mass is termed mass-independent fractionation (MIF), reported using capital delta (Δ). Host rocks, Hg-bearing minerals, hydrothermal fields, and sediments and soils generally exhibit negative to slightly positive MDF and little to no MIF (Yin et al., 2010), with the exception of some soils and peat that were reported to have slightly negative or slightly positive MIF (Feng et al., 2010; WenFang et al., 2011). Coal also exhibits negative MDF, and negative to slightly positive MIF (Biswas et al., 2008). In contrast to terrestrial systems, measurements of aquatic biota display distinctly positive MIF, and MDF that ranges from negative to positive in freshwater systems (Bergquist and Blum, 2007; Gantner et al., 2009; Laffont et al., 2009; Perrot et al., 2010; Senn et al., 2010) and have tendencies toward more consistently positive values in marine systems (Point et al., 2011; Senn et al., 2010).

Several studies have successfully used isotope signatures to trace Hg sources and fates in the environment (Estrade et al., 2011; Feng et al., 2010; Foucher et al., 2009; Gehrke et al., 2011; Liu et al., 2011). These studies have typically focused on soils and sediments at scales of tens of kilometers in order to assess localized environmental impacts or study fluvial Hg transport. But applying a similar approach on larger scales to help inform regional and global assessments is challenging. In part, this is because Hg undergoes many different biotic and abiotic reactions that can further fractionate and alter isotope source signatures after Hg enters the environment, thereby complicating the use of Hg isotope systems for source tracking. Isotope fractionation has been observed in numerous physical, chemical, and biological transformations of Hg, including redox reactions (photolysis, microbial, or chemical pathways), evaporation/condensation, volatilization, methlyation, and absorption (Yin et al., 2010). Photoreduction of Hg species is considered to be the most important mechanism responsible for the large MIF that is observed in aquatic systems (Bergquist and Blum, 2007). Although dynamic processes of fractionation are a complicating factor for source apportionment, they provide a valuable opportunity to use fractionation patterns to trace specific transformations and reactions in the environment and estimate their rates (Sonke, 2011). More controlled experimental studies are needed to better characterize the reactions that fractionate Hg so these processes can be unraveled from native isotope source signatures.

The objective of the current work was to collect and refine information on the overall distribution of Hg and POPs in murre and gull eggs in the Norton Sound – Bering Strait region, and determine if Hg levels were correlated with estuarine wetlands, river outflows, and historical gold mining activities.

The first part of the objective was met by collecting 261 clutches of murre and gull eggs from 13 nesting colonies in the study area and 6 locations outside of it in 2008-2009, and analyzing subsets of them for Hg, PCBs, chlorinated pesticides, and BFRs (PBDEs; see Appendix 2).

The second part of the objective was met by conducting Hg isotope analyses and determining if Hg fractionation patterns differed among the Norton Sound colonies and other nesting locations.

Methods

<u>Study Area and Sampling Sites</u>

During 2008-2009, 144 murre eggs, 111 clutches of glaucous gull eggs (one is believed to be from a common eider), and 6 clutches of glaucous-winged gull (*L. glaucescens)* eggs were collected from 19 nesting colonies in the Chukchi and Bering seas and Gulf of Alaska (Table 1). Rural residents working under the direction of Kawerak Inc. in Nome obtained 87 of the murre eggs and 95 of the gull clutches from 13 sites in the Norton Sound – Bering Strait study area (Table 1 and Figs. 2 and 3), and AMNWR biologists and the St. George Traditional and Native Village of Point Hope councils collected the remaining eggs from 6 more distant nesting locations (Table 1 and Fig. 1; Cape Lisburne, the Kukpuk River delta, and St. Paul, St. George, Aiktak, and St. Lazaria islands).   Eggs were not obtained in 2007, but in 2006, 134 common murre eggs, 44 thick-billed murre eggs, 127 clutches of glaucous-winged gull eggs, and 34 clutches of glaucous gull eggs were collected at 18 Alaskan sites and 1 in Washington State (Table 2). Sampling at Middleton Island was designed to test how laying order in gull eggs and embryo development in murre eggs might affect contaminant levels. However, the 2006 samples have not been analyzed yet, and only data from a subset of the 2008-2009 eggs are summarized in this report.

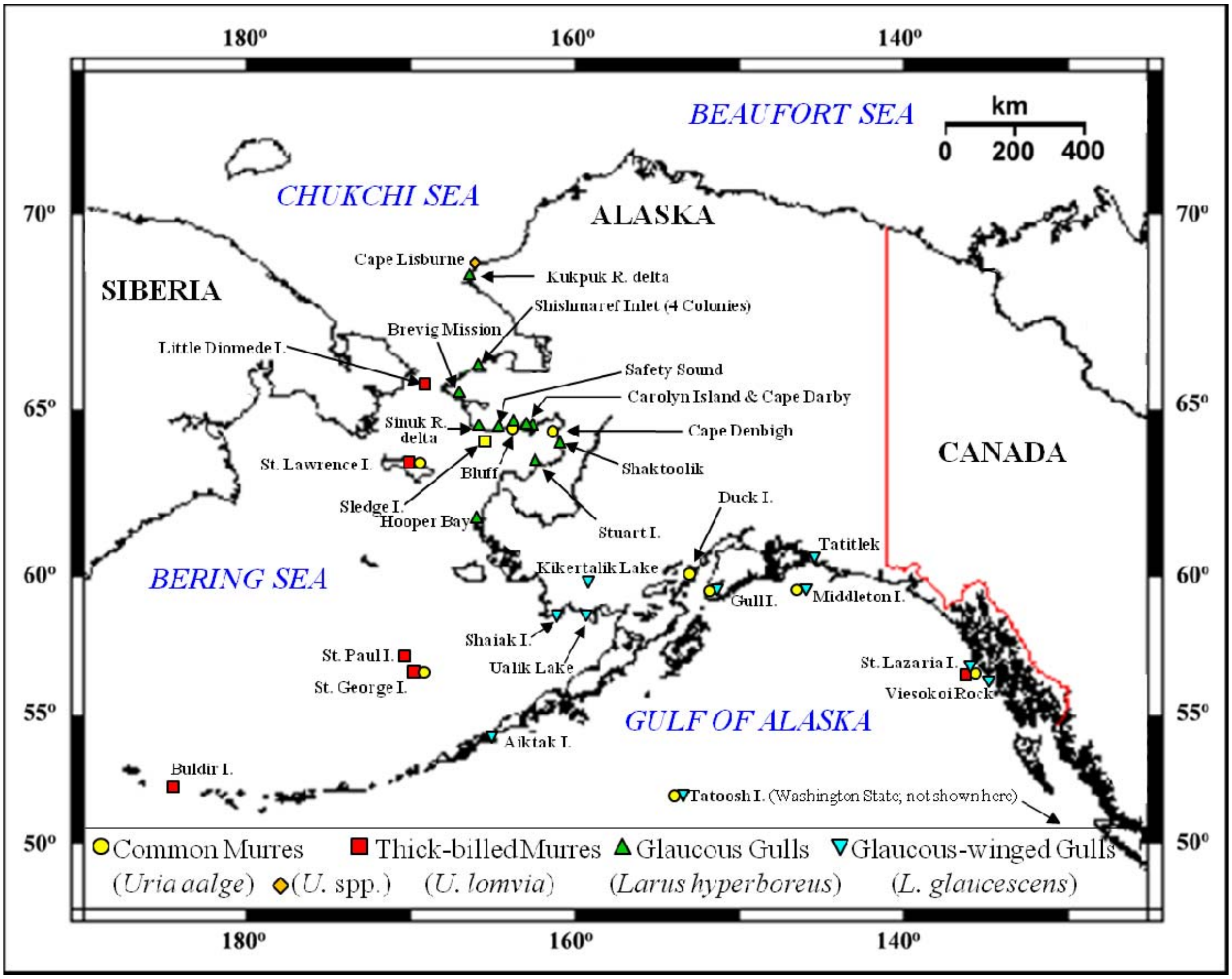

Figure 1. The 2006-2009 Seabird Tissue Archival and Monitoring Project (STAMP) seabird egg collecting sites.

Table 1. The 2008-2009 Seabird Tissue Archival and Monitoring Project (STAMP) seabird egg collecting sites (also see Figs. 1-3).

Colony	Species (eggs, clutches)
Inside the Norton Sound – Bering Strait Area	
Shishmaref Inlet	Glaucous Gull (27 eggs, 12 clutches)
Little Diomede Island	Thick-billed Murre (15 eggs, 15 clutches)
Brevig Mission	Glaucous Gull (16 eggs, 11 clutches)
Sinuk River delta	Glaucous Gull (15 eggs, 13 clutches)
Sledge Island	Common Murre (15 eggs, 15 clutches)
Safety Sound	Glaucous Gull (17 eggs, 12 clutches) *One believed to be from Common Eider!
Bluff	Common Murre (15 eggs, 15 clutches)
Bluff	Glaucous Gull (4 eggs, 4 clutches)
Carolyn Island (Golovin Bay)	Glaucous Gull (12 eggs, 12 clutches)
Cape Darby	Glaucous Gull (15 eggs,12 clutches)
Cape Denbigh	Common Murre (12 eggs, 12 clutches)
Shaktoolik	Glaucous Gull (16 eggs, 12 clutches)
Stuart Island	Glaucous Gull (10 eggs, 7 clutches)
St. Lawrence Island	Common Murre (15 eggs,15 clutches)
St. Lawrence Island	Thick-billed Murre (15 eggs,15 clutches)
Total Sampling Sites: 13	*Total Species Sampled: 3* *Total Murre Eggs: 87* *Total Gull Clutches: 95*
Outside the Norton Sound – Bering Strait Study Area	
Cape Lisburne	Unidentified Murre (7 eggs, 7 clutches)
Kukpuk River delta	Glaucous Gull (16 eggs, 16 clutches)
St. Paul Island	Thick-billed Murre (8 eggs, 8 clutches)
St. George Island	Common Murre (12 eggs, 12 clutches)
St. George Island	Thick-billed Murre (15 eggs, 15 clutches)
Aiktak Island	Glaucous-winged Gull (8 eggs, 6 clutches)
St. Lazaria Island	Common Murre (10 eggs, 10 clutches)
St. Lazaria Island	Thick-billed Murre (5 eggs, 5 clutches)
Total Sampling Sites: 6	*Total Species Sampled: 4* *Total Murre Eggs: 57* *Total Gull Clutches: 22*

Table 2. Clutches of seabird eggs banked by the Seabird Tissue Archival and Monitoring Project (STAMP) in the Marine Environmental Specimen Bank in Charleston, SC organized in a general southeast to northward pattern. Highlighted cells show the number of clutches that have been analyzed for contaminants.

Colony	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total	Water Body
Tatoosh I., WA - COMU								14				**14**	**Pacific Ocean**
Tatoosh I., WA - GWGU								11				**11**	**25**
Viesokoi Rock (Sitka) - GWGU						15	3 of 8	13				**36**	
St. Lazaria I. - COMU	10		10		10	8	7	11		5 of 10		**66**	
St. Lazaria I. - TBMU			10	6 of 8		5	6	11		5 of 5		**45**	
St. Lazaria I. - GWGU						6	8	12				**26**	
Middleton I. - BLKI			11	12	12	12						**47**	
Middleton I. - COMU					10 of 15	8 of 11	16	16				**58**	
Middleton I. - GWGU						3	3 of 7	32				**42**	
Shoup Bay - BLKI				9	12							**21**	
Tatitlek - GWGU								12				**12**	
Gull I. - COMU						8 of 15	10	15				**40**	
Gull I. - GWGU						17	11	12				**40**	
Duck I. - COMU						4	15	6				**25**	
East Amatuli I. - COMU	11			7	10 of 15							**33**	**Gulf of Alaska**
Chiniak Bay (Kodiak) - BLKI				8	12							**20**	**511**
Buldir I. - BLKI					5							**5**	
Buldir I. - TBMU					1	11	12	14				**38**	
Aiktak I. - GWGU											5 of 6	**6**	
Bogoslof I. -COMU		9				10	5 of 11					**30**	
Bogoslof I. -TBMU		10				7	11					**28**	
St. George I. - BLKI				12	12							**24**	
St. George I. - COMU	11		1			15		14			5 of 12	**53**	
St. George I. - TBMU		7	12	7 of 10			9	4		5 of 15		**57**	
St. Paul I. - TBMU											5 of 8	**8**	
Kikertalik Lake (Bristol Bay) - GWGU							12	12				**24**	
Ualik Lake (Bristol Bay) - GWGU							3 of 8	12				**20**	
Shaiak I. - GWGU						13	3 of 36	11				**60**	
Cape Pierce - COMU							5 of 14					**14**	
Triangle I. (Nunivak) - GLGU						17						**17**	
Hooper Bay - GLGU							3 of 19	12				**31**	
St. Lawrence I. - COMU				3				15		5 of 15		**33**	
St. Lawrence I. - TBMU				6 of 8	14			15		5 of 15		**52**	
Stuart I. - GLGU											5 of 7	**7**	
Shaktoolik - GLGU										4 of 4	5 of 7	**11**	
Cape Denbigh - COMU						15	5 of 15	15			5 of 12	**57**	
Cape Darby - GLGU										5 of 11		**11**	
Carolyn I. - GLGU										5 of 11		**11**	
Bluff - GLGU										4 of 8		**8**	
Bluff - BLKI				6								**6**	
Bluff -COMU				11	12		5of 14	15		5 of 15		**67**	
Safety Sound - GLGU						12	11	10		*5 of 10		**43**	
Sledge I. - COMU							5 of 14	13		5 of 14		**41**	
Sinuk River delta - GLGU							3 of 6	12		5 of 10		**28**	
Brevig Mission - GLGU											5 of 11	**11**	
King I. - TBMU							15					**15**	
Little Diomede - TBMU										5 of 15		**15**	**Bering Sea**
Little Diomede - UNMU	9											**9**	**840**
Shishmaref - Tin Creek - GLGU										5 of 5		**5**	
Shishmaref -Arctic Lagoon - GLGU										3		**3**	
Shismaref -Egg I. - GLGU										2		**2**	
Shismaref - Kividlow - GLGU										2		**2**	
Cape Deciet (Deering) - COMU						12						**12**	
Noatak River delta - GLGU							3 of 11					**11**	
Cape Thompson - UNMU				8			12					**20**	
Kukpuk River delta - GLGU										5 of 15		**15**	
Cape Lisburne - TBMU				6 of 9								**9**	**Chukchi Sea**
Cape Lisburne - UNMU						24					5 of 7	**31**	**110**
Total	**41**	**26**	**44**	**111**	**120**	**232**	**318**	**339**	**0**	**185**	**70**	**1486**	

Black-legged Kittiwakes	**123**
Common Murre	**543**
Glaucous Gull	**216**
Glaucous-winged Gull	**277**
Murre Spp.	**60**

* One of these eggs is believed to be a Common Eider

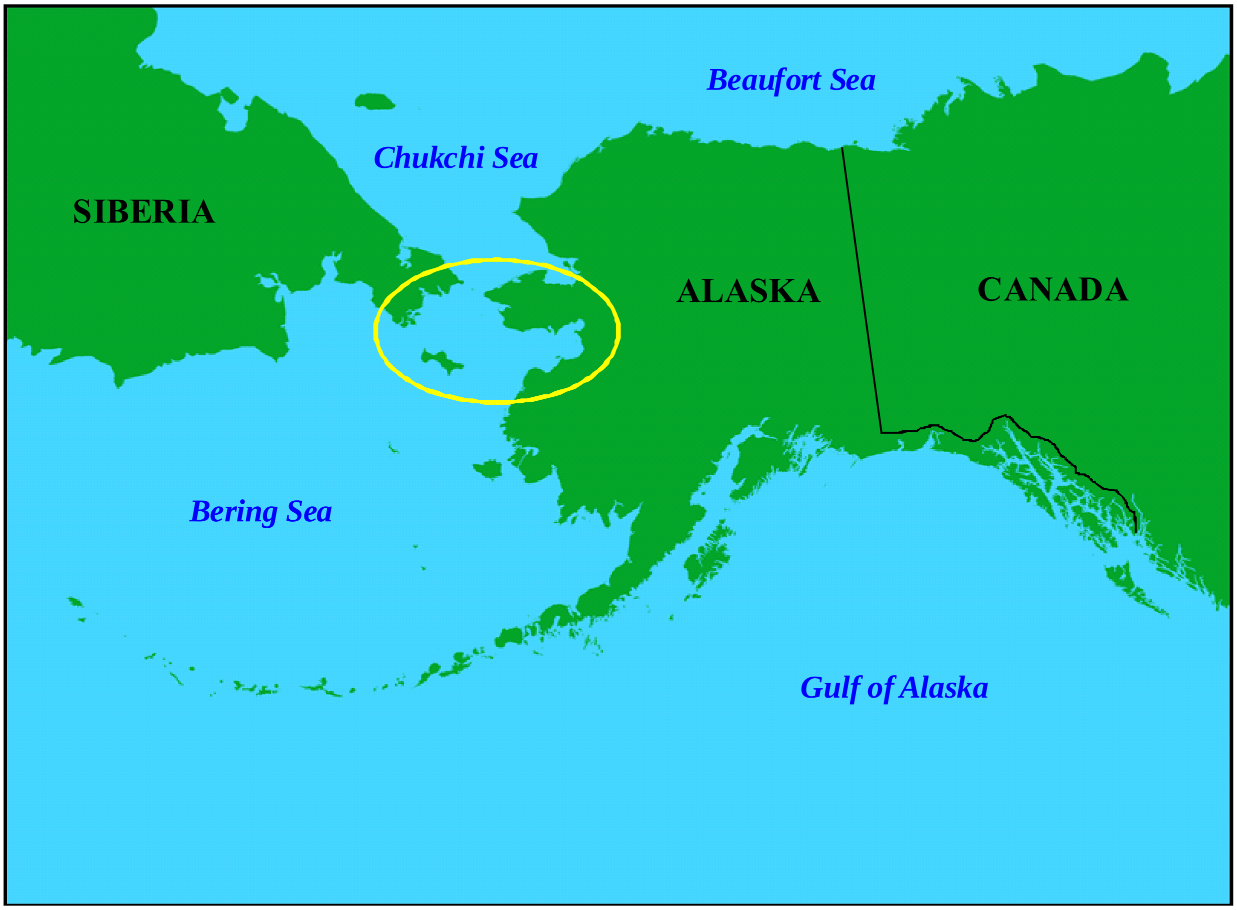

Figure 2. General location of the Norton Sound – Bering Strait study area (yellow oval).

Figure 3. The 13 nesting locations in the Norton Sound – Bering Strait study area where murre and gull eggs were collected in 2008-2009.

Sample Collecting, Processing, and Banking

All of the murre and gull eggs that we analyzed for the study were collected, processed, and banked using established STAMP protocols (Rust *et al.* 2010). Kawerak Inc. in Nome organized and coordinated the Norton Sound – Bering Strait collections. Egg collecting kits consisting of 50-quart coolers containing foam rubber layers to protect the samples, collecting supplies, shipping labels, and federal and state scientific collecting permits were mailed to participating residents in the study area (Appendix 1). Additional kits were sent to the colonies outside of the Norton Sound – Bering Strait study area.

Collectors returned the coolers containing the eggs to the AMNWR laboratory in Homer, Alaska, where the samples were refrigerated until they could be processed. Processing included cleaning the eggs with Type 1 distilled water, measuring them (length, width, whole egg mass), breaking/cutting them in half and pouring the contents into chemically cleaned glass measuring cups under a positive pressure laminar flow hood, weighing the cups containing the contents on a digital scale, covering the cups with clean UHV foil (All Foils, Cleveland OH, USA) and homogenizing the contents using a high-speed blender (VirTis, Warminster PA, USA) pipetting the contents into a series of labeled temperature resistant 15 mL Teflon jars and polypropylene cryovials (Nalgene. Rochester NY, USA), and freezing the samples until they could be shipped to the Marine ESB in Charleston, South Carolina, for long-term (decadal) storage at -150 °C in stainless steel liquid nitrogen (LN_2) vapor freezers. Murre eggs were processed individually and gull eggs from the same clutches were pooled before they were homogenized.

Processed samples were sent to the Marine ESB in LN_2 dry shippers. After they were formally entered into the specimen bank's long-term storage system, subsamples were released to NIST chemists for Hg and POP analyses. Subsamples were also sent to the Stable Isotope Hydrology and Ecology Research Laboratory (SIHERL) in Saskatoon, Saskatchewan, for ^{13}C and ^{15}N stable isotope analyses. Egg shells were rinsed with Type 1 water, dried, placed in labeled plastic bags, and mailed to the University of Alaska Museum of the North (UAMN) in Fairbanks, Alaska, for long-term storage.

Mercury (Hg) and Hg, Carbon (C) and Nitrogen (N) Isotopes

Total Hg Levels

We employed isotope dilution cold vapor inductively coupled plasma mass spectrometry (ID-CV-ICPMS) to determine total mercury (THg) levels in the egg samples. This technique has been described elsewhere (Christopher *et al.* 2001) and is only summarized here. Isotopically enriched ^{201}Hg spike solution (Oak Ridge National Laboratory, USA) was prepared and calibrated using NIST SRM 1641d Mercury in Water standard solution. The spike was added quantitatively to the sample masses to yield an isotopic ratio ($^{201}Hg/^{202}Hg$) that minimized random error propagation. The specific sequences and methods for digestion and addition of the ^{201}Hg spike solution to the 2008 and 2009 batches are described below. The resulting digestant was mixed with a $SnCl_2$ and HCl reductant solution in a gas-liquid separator that allowed cold vapor transfer of the resulting Hg^0 in a stream of argon gas to the inductively coupled plasma mass spectrometer (ICPMS) injector. We used a VG Elemental Plasma Quad 3 ICPMS (Windsford, Cheshire, United Kingdom) set at normal power and gas flow rates in its time resolved analysis mode to measure the isotope ratios.

2008 Collections, Batches 1-8: The aliquots that we digested for THg weighed about 0.5 g each and we weighed them directly into quartz microwave vessels using a three-place analytical balance (Mettler, Toledo OH, USA, Model PG603-S). The vessels contained 1.0 mL nitric acid (Optima, Fisher Scientific, Suwanee GA, USA), 0.5 mL hydrogen peroxide (Trace Select, Fluka, Germany), and 0.5 mL of high purity water. We digested the samples in a Perkin-Elmer (Shelton CT, USA) Multiwave microwave oven at the highest possible temperatures (up to 300 ºC) and pressures (up to 8 MPa) that was programmed as follows: (1) 100W to 600 W ramp up over 5 min, (2) 5 min hold at 600 W, and (3) 20 min hold at 1000 W. After digestion, we transferred the samples to clean containers, diluted them to 10.0 mL with high purity water, and blended them with aliquots of isotopically enriched mercury (^{201}Hg enriched isotopic spike, Oak Ridge National Laboratory, USA) that had been calibrated against NIST SRM 1641d Mercury in Water standard solution. As a final step before running the samples, we diluted them to about 0.5 ng/g each with high purity water and 2 % mass fraction HNO_3 and 2 % mass fraction HCl.

We ran batches 1-8 during 24 February 2010 – 5 March 2010. Each batch consisted of two rotors with a total of twelve vessels containing 10 unknown egg samples, one digest of QC04-ERM1 Egg Reference Material 1, and one method blank. QC04-ERM1 is an in-house control material that was made from pooled murre eggs (Vander Pol *et al.* 2007). It has been analyzed repeatedly for Hg and has been assigned a reference value. We ran the QC04-ERM1 digest at the beginning and end of each batch for method validation (means are reported). We also ran a mass bias correction sample at the beginning and end of each batch to capture instrumental drift in mass bias and correct the measured Hg isotopic ratios, as appropriate. Each experiment consisted of two batches run consecutively on the ICPMS.

2009 Collections, Batches 9-10: The aliquots that we digested for THg weighed between about 0.15 g and 0.3 g each. We weighed them directly into 35 mL glass microwave vessels using a five-place analytical balance (Sartorius, Model MC210S), and then spiked them with known quantities of isotopically enriched Hg (^{201}Hg enriched isotopic spike, Oak Ridge National Laboratory, USA) that had been calibrated against NIST SRM 1641d Mercury in Water standard solution. We digested the samples with 1.2 mL nitric acid (Optima, Fisher Scientific, Suwanee GA USA) and 0.3 mL hydrogen peroxide (Trace Select, Fluka, Germany) in a CEM (Matthews NC, USA) Discover open-focus microwave oven programmed at 50 W for 2 min, followed by a 50 W ramp up for 2 min, followed by a 225 W hold for 6 min (“Dolphin skin 35” method on the microwave laptop). Maximum temperatures and pressures were 250 ºC and 275 psi, respectively, with typical maximum digestion conditions of 200 ºC and 200 psi. After digestion, we transferred the samples to clean containers and diluted them to about 0.5 ng/g each with high purity water and 2 % mass fraction HNO_3 and 2 % mass fraction HCl in preparation for running them.

We ran batches 9 to 10 during 16-22 September 2010. Each batch consisted of 20 unknown egg samples, 3 digests of QC04-ERM1 Egg Reference Material 1, and two method blanks. We ran

3 digests of QC04-ERM1 and 3 mass bias correction samples at the beginning, middle, and end of each batch in order to validate the method and capture instrumental drift in mass bias and correct the measured isotopic ratios, as appropriate. The repeated QC04-ERM1 measurements and triplicate analyses of unknown seabird eggs are listed in Table 3.

Table 3. Hg measurements of QC04-ERM1 Egg Reference Material 1 and blanks (the reference value for QC04-ERM1 is 101 ng/g ± 3 ng/g wet mass).

Batch #	Sample	Measured Hg Value ± Expanded Uncertainty (ng/g)	DF	Coverage Factor	Blank (ng)
1	QC04-ERM1	100 ± 2.1	51	2.0	0.110
2	QC04-ERM1	100 ± 2.1	51	2.0	0.113
3	QC04-ERM1	95 ± 2.0	51	2.0	0.118
4	QC04-ERM1	96 ± 2.0	51	2.0	0.107
5	QC04-ERM1	101 ± 2.1	51	2.0	0.084
6	QC04-ERM1	106 ± 2.2	51	2.0	0.081
7	QC04-ERM1	97 ± 2.1	51	2.0	0.085
8	QC04-ERM1	99 ± 2.1	51	2.0	0.110
9	QC04-ERM1	95 ± 2.2	35	2.0	4.03
	QC04-ERM1	97 ± 2.2	38	2.0	
	QC04-ERM1	97 ± 2.2	37	2.0	3.93
10	QC04-ERM1	97 ± 2.1	52	2.0	0.210
	QC04-ERM1	99 ± 2.1	52	2.0	
	QC04-ERM1	97 ± 2.0	52	2.0	0.220
Seabird Egg Triplicate	ST09E1398C-1	83 ± 1.3	61	2.0	0.085
	ST09E1398C-2	84 ± 1.4	61	2.0	0.085
	ST09E1398C-3	83 ± 1.4	61	2.0	0.110
		Mean	St Dev	% RSD	
	QC04-ERM1	98	2.7	2.8	
	ST09E1398C	83 ± 1.4	0.50	0.60	

Hg Isotopes

We selected 20 thick-billed murre eggs and 25 common murre eggs from 7 representative colonies and analyzed them for Hg isotopes (Table 4). We digested 0.6 - 1.0 g aliquots of the egg samples in glass vessels using microwave assisted acid digestion (CEM Discover, Matthews NC, USA). Microwave digestion consisted of a multi-stage profile of 50 W for 2 min, 125 W for 2 min, 200 W for 2 min, and 250 W for 8 min. Maximum digestion conditions were 275 psi and 230 °C, and typical conditions were 275 psi and 175 °C. Hg stable isotopes were measured using a Nu Plasma multi-collector ICP-MS (Nu Instruments, Wrexham, United Kingdom) at the Institut Pluridisciplinaire de Recherche sur l'Environnement et les Materiaux (IPREM) facility in Pau, France. The isotopes were ^{198}Hg, ^{199}Hg, ^{200}Hg, ^{201}Hg, ^{202}Hg, and ^{204}Hg. The lightest isotope (^{198}Hg) was used as a reference for ratioing all of the other isotopes. Hg samples were introduced to the ICP as a cold vapor by mixing them with 3% $SnCl_2$/10% HCl and then letting them react in a custom quartz gas liquid separator using an argon gas flow rate of 40 mL/minute. Blank subtractions were performed using the "On Peak Zero" method for each mass. Mass bias was corrected using the ^{205}Tl/^{203}Tl ratio and the exponential mass fractionation law by simultaneously introducing Tl (NIST 997 Thallium Isotopic solution) in a dry aerosol form using a desolvating nebulizer (DSN100, Nu Instruments). We used a standard sample-bracketing system to calculate δ values (mass dependent fractionation, MDF) relative to the reference standard NIST SRM 3133 Mercury Spectrometric Solution using the following equation:

Equation 1: $\delta^{xxx}Hg(‰) = [((^{xxx}Hg/^{198}Hg)_{Sample}/(^{xxx}Hg/^{198}Hg)_{SRM3133}) - 1] * 1000$

The mass (xxx) of each isotope ratioed to (^{198}Hg, and $^{xxx}Hg/^{198}Hg)_{SRM3133}$ represented the average ratio of the two NIST SRM 3133 standards bracketing the samples. NIST SRM 3133 is the universally accepted reference standard currently being used in Hg isotopic research. As a convention (Blum and Bergquist 2007), we used δ^{202}Hg to report MDF. We reported mass independent fractionation (MIF) using the capital delta notation (Δ) and calculated it using the Biswas *et al.* (2008) formulas listed below for ranges below 10‰:

Formula 1: $\Delta^{199}Hg(‰) = \delta^{199}Hg - (\delta^{202}Hg * 0.2520)$
Formula 2: $\Delta^{200}Hg(‰) = \delta^{200}Hg - (\delta^{202}Hg * 0.5024)$
Formula 3: $\Delta^{201}Hg(‰) = \delta^{201}Hg - (\delta^{202}Hg * 0.7520)$

The Δ^{xxx}Hg notation describes the differences between measured δ^{xxx}Hg and theoretically predicted δ^{xxx}Hg using MDF laws. As a convention, we used the most abundant odd isotope (Δ^{199}Hg) to discuss MIF. Standard-sample bracketing was used and samples were run between 0.25 ng g^{-1} and 1.5 ng g^{-1} (0.25 V to 2.0 V for 202Hg).

Analytical batches of murre eggs consisted of 5 eggs followed by 1 sample of UM-Almaden intercomparison Hg Standard and either QC-04ERM01 or SRM 1947. UM-Almaden is the most widely reported secondary standard used to assess inter-laboratory results for Hg isotope measurements, and measured results agreed well with previously published values (Table 5). There are currently no biological reference materials available that are certified for Hg isotopes that can be used for matrix-matched inter-laboratory comparison and method validation. As a result, the absolute accuracy of these types of measurements in a given matrix is currently difficult to definitively confirm, and therefore data are most suitable for investigating relative trends to investigate environmental processes. To begin to address this deficiency, we measured QC-04ERM01 and SRM 1947 and compared these results to previous measurements made on these materials by other laboratories. Measured 2SD values of QC-04ERM01 and SRM 1947 overlapped with previously reported values (Table 5), supporting the validity of the analytical methodology. Measurement repeatability across batches was similar for UM-Almaden and the two biological reference materials. Complex biological matrices may induce fractionation when the matrix is concentrated enough to impair the efficiency of cold vapor generation (personal observation). To confirm that matrix-induced fractionation bias was not present in our egg samples, QC-04ERM01 was run repeatedly across a range of dilutions equal to the dilutions used for murre egg samples (70 x to 400 x; [Hg] from 0.25 ng g^{-1} to 1.5 ng g^{-1}). No systematic bias was observed in MDF or MIF, confirming that matrix-induced fractionation differences between samples did not affect trends (Table 5). There was also no systematic bias observed for SRM 1947 across the range of dilutions used for this material (250 x to 1000 x; [Hg] from 0.25 ng g^{-1} to 1.0 ng g^{-1}).

Table 4. Murre eggs from representative colonies that were analyzed for Hg isotopes.

Colony	Species (eggs)
Little Diomede Island	Thick-billed Murre (5 eggs)
Sledge Island	Common Murre (5 eggs)
Bluff	Common Murre (5 eggs)
Cape Denbigh	Common Murre (5 eggs)
St. Lawrence Island	Common Murre (5 eggs)
St. Lawrence Island	Thick-billed Murre (5 eggs)
St. George Island	Thick-billed Murre (5 eggs)
St. Lazaria Island	Common Murre (5 eggs)
St. Lazaria Island	Thick-billed Murre (5 eggs)
Total Sampling Sites: 7	*Total Common Murre Eggs: 25*
	Total Thick-billed Murre Eggs: 20

Table 5. Quality control sample mercury isotope values compared to previously reported measurements (all values are reported relative to NIST SRM 3133 Mercury Standard Solution). Data were obtained by running the samples concurrently with unknowns and reference materials and reported as mean ± 2 SD. Four digests of in-house QC-04ERM01 Murre Egg Control Material and 5 digests of NIST SRM 1947 Lake Michigan Fish Tissue were prepared. Samples sizes reflect analytical repeats prepared from digests and stock solutions. Additional quality control samples were run both before and after the batches containing the murre eggs were run to validate the methods (7 aliquots of QC-04ERM01, 5 aliquots of SRM 1947, and 15 aliquots of UM-Almaden).

Reference Material	**Hg (ng/g)**		**N**	**δ^{199}Hg (‰)**	**δ^{200}Hg (‰)**	**δ^{201}Hg (‰)**	**δ^{202}Hg (‰)**	**δ^{204}Hg (‰)**	**Δ^{199}Hg (‰)**	**Δ^{201}Hg (‰)**
Intercomparison Hg Standard (UM-Almaden)		Blum and Bergquist, 2007	*22-25*	*-0.14 ±0.06*	*-0.27 ±0.04*	*-0.44 ±0.07*	*-0.54 ±0.08*	*-0.83 ±0.11*	*-0.01 ±0.02*	*-0.04 ±0.04*
		Measured	28	-0.13 ±0.13	-0.26 ±0.15	-0.42 ±0.17	-0.52 ±0.20	-0.78 ±0.29	0.00 ±0.12	-0.03 ±0.09
SRM 1947 Lake Michigan Fish Tissue	254 ± 5	Point *et al.* 2011	9	5.23 ±0.29	0.60 ±0.19	4.65 ±0.44	0.99 ±0.28	N/A	4.97 ±0.25	3.89 ±0.29
		Measured	11	5.61 ±0.15	0.73 ±0.13	5.05 ±0.19	1.22 ±0.21	1.73 ±0.38	5.30 ±0.13	4.13 ±0.08
QC-04ERM01Murre Egg Control Material	101 ± 3	Point *et al.* 2011	7	1.50 ±0.17	0.55 ±0.24	1.78 ±0.18	0.97 ±0.26	N/A	1.25 ±0.11	1.05 ±0.10
		Measured	13	1.59 ±0.12	0.60 ±0.14	1.92 ±0.16	1.09 ±0.24	1.52 ±0.44	1.31 ±0.11	1.10 ±0.10
	ng/g each analytical batch was run	0.25	2	1.57 ±0.03	0.63 ±0.07	1.94 ±0.20	1.25 ±0.15	1.73 ±0.63	1.25 ±0.07	1.00 ±0.08
		0.5	1	1.54	0.60	2.01	1.17	1.72	1.25	1.13
		1.0	6	1.57 ±0.13	0.55 ±0.13	1.86 ±0.12	.99 ±0.15	1.35 ±0.35	1.31 ±0.10	1.11 ±0.04
		1.25	2	1.64 ±0.01	0.69 ±0.01	2.03 ±0.02	1.20 ±0.01	1.66 ±0.09	1.34 ±0.01	1.12 ±0.01
		1.5	2	1.64 ±0.10	0.62 ±0.04	1.95 ±0.03	1.09 ±0.02	1.53 ±0.13	1.36 ±0.11	1.13 ±0.04

Carbon and Nitrogen Stable Isotopes

Aliquots of the samples (Appendix 2) were sent to the SIHERL facility in LN_2 dry shippers for stable carbon and nitrogen isotope analyses using methods previously described by Hobson *et al.* (2002). After the samples were freeze-dried, lipids were extracted using a 2:1 chlorofom:methanol soak and rinse. Resulting filtrates were dried under a fume hood for 24 h before powdering and subsampling them for analysis. Carbon and nitrogen stable isotope ratios were obtained by loading about 1 mg portions of the powdered samples into tin cups and combusting them at 1200 °C using continuous-flow isotope ratio mass spectrometry (CFIRMS) on a Europa 20:20 IRMS interfaced with a Robo Prep combustion system. The ratios were expressed in delta (δ) notation relative to the Vienna Pee Dee Belemnite (VPDB) or AIR standards for carbon and nitrogen, respectively (Hobson *et al.* 1994). Analytical uncertainties were estimated at ± 0.3‰ for $\delta^{15}N$ and ± 0.1‰ for $\delta^{13}C$ using within-run replicate measurements on albumen standards. The albumen standard, manufactured in-house at the SIHERL facility, has been calibrated to International Atomic Energy Agency (IAEA) Vienna PDB and Atmospheric Air standards for $\delta^{13}C$ for $\delta^{15}N$, respectively.

Statistics

We used commercially available software to run statistical tests (SAS, JMP 9, Cary, NC, USA). One-way ANOVAs were used to identify differences among Hg levels and δ (MDF), Δ (MIF), $\delta^{15}N$, and $\delta^{13}C$ values, and pair-wise comparisons were made using Tukey-Kramer tests at the $P < 0.05$ significance level.

<u>Persistent Organic Pollutants (POPs)</u>

Sample Preparation

We selected 60 murre eggs and 58 clutches of gull eggs from the 19 sampling locations (Fig. 1 and Appendix 2) and analyzed them for chlorinated pesticides, PCBs, and BFRs (PBDEs). In each case, we weighed 3.0 g aliquots of the homogenized egg samples on a three-place analytical balance (Mettler XP1203S, Toledo OH, USA) and mixed them with about 8 g of diatomaceous earth that had been heated to 650 ºC for 12 hours and cooled in a desiccator. The mixtures were transferred to 33 mL pressurized fluid extraction cells (PFE; ASE Dionex, Salt Lake City UT, USA) and 0.5 mL of mixed internal standard solution was added to them using gas-tight syringes weighed to five places on an analytical balance (Sartorius MC210S, Elk Grove IL, USA) before and after the liquids was injected into the cells. The internal standard solution contained ^{13}C labeled PCB congeners 28, 52, 118, 153, 180, 194, and 206; ^{13}C labeled 4,4-DDE, 4,4'-DDD, 4,4'-DDT, HCB, oxychlordane, *trans*-chlordane, *trans*-nonachlor; F labeled BDE congeners 47 and 160; and BDE 104. Between 20 and 89 ng of the internal standard compounds were added to the samples, as appropriate. We prepared blanks and murre egg homogenates for quality assurance using the same techniques (Vander Pol *et al.* 2007), and we also analyzed two gull eggs twice to help verify analytical methods (Numbers 1340 and 1403; see Appendix 2).

Next, we weighed 1.0 mL aliquots of six calibration solutions (A-F) in gas-tight syringes and added them to 11.0 mL PFE cells packed with clean heat-treated diatomaceous earth. The calibration solutions were covered by small amounts of diatomaceous earth before 0.25 mL aliquots of 24 toxaphene congener calibration solutions (A-F) were added to the cells (see above and Vander Pol 2005). Small quantities of diatomaceous earth were also used to cover the solutions before the internal standards were added to the cells, and then they were filled with more diatomaceous earth. The calibration solutions contained SRMs 2257 (Brominated Diphenyl Ethers in Isooctane), 2259 (Chlorinated Biphenyl Congeners in Isooctane), 2261 (Chlorinated Pesticides in Hexane), and 2275 (Chlorinated Pesticide Solution-II in Isooctane), and solutions of HBCDs, octachlorostyrene, and pentachlorobenzene.

Because the new SRMs 2257 and 2259 contained varying levels of congeners that were typically larger than the amounts found in previously used SRMs, we created three stock solutions for (1) pentachlorobenzene, (2) SRM 2259, and (3) SRMs 2261, 2275, 2257, HBCD, and octachlorostyrene to bracket the sample levels. The highest levels of these stocks (labeled 1) were gravimetrically combined to create Cal A. Middle level stocks (labeled 2) were combined for Cal B, and the lowest level stocks (labeled 3) were combined for Cal C. A small amount of Cal A was diluted to make Cal D. Cal B was diluted to make Cal E, and Cal C was diluted to make Cal F. The masses of the compounds in the calibration curves ranged from 0.002 ng g^{-1} to 555 ng g^{-1}.

The samples, calibration solutions, and control materials were extracted with CH_2Cl_2 using the PFE. Conditions were as follows: cell temperatures 100 °C, equilibration times 5 min, static times 5 min, and cell pressures 13.8 MPa. Three cycles were run using one-third of the solvent each time. The PFE tubing was rinsed with 8.0 mL of CH_2Cl_2 between every sample by selecting the "rinse" option and instructing the instrument to alternate between the solvent A and B channels (both vessels contained CH_2Cl_2).

We reduced the sample extracts to about 10 mL using a Turbovap II (Zymark, Hopkinton, MA, USA) and evaporating them in a stream of purified N_2. Then we ran nonvolatile solvent extractable material ("lipid") analyses on the extracts and reference materials by gravimetrically weighing 2.0 mL portions of the extracts and putting them into preweighed aluminum dishes and allowing the solvents to evaporate before reweighing the dishes. After analyzing the sample extracts for lipids, we reduced them to 1.0 mL in the Turbovap. High molecular mass compounds were removed from the extracts using size exclusion chromatography (SEC; Accuprep, J2 Scientific, Columbia, MO, USA) consisting of a PLGel 110 mm x 25 mm i.d; 10 µm particle size guard column (Polymer Labs, Amherst, MA, USA) coupled to a 600 mm x 25 mm (10 µm particle size with 100 Å diameter pores) PLGel column (Polymer Labs, Amherst, MA, USA). A CH_2Cl_2 solvent was delivered at 10.0 mL/min. Absorbance was monitored at 254 nm using the internal UV/VIS detector (Linear, model 200, San Jose, CA, USA). Samples were automatically injected and the first 180.1 mL of CH_2Cl_2 containing high molecular mass material was discarded. The next 73.4 mL, containing the analytes of interest, was collected and retained. After transferring the fractions to Turbovap tubes, we begin reducing their volume and changed the solvent to hexane, and then continued reducing them down to 0.5 mL before transferring them to amber GC autosampler vials.

We cleaned the sample extracts with an automated solid phase extraction (SPE) Rapid Trace (Caliper Technologies, Hopkinton, MA, USA) using 3.0 mL SPE cartridges. Alumina (50 µm to 200 µm; Arcōs Organics, Trenton, NJ, USA) was activated by baking it at 650 °C overnight and allowing it to cool in a desiccator. The alumina was partially deactivated by adding 5% hexane-rinsed, deionized water (mass fraction) to it. Resulting substrates were packed between two frits in a 3.0 mL Bond Elut reservoir (Varian, Palo Alto, CA, USA) to about 3.9 cm bed height. This gave us a mass of about 1.8 g alumina. Sample extracts were passed through the alumina columns and eluted with 9.0 mL of 35:65 CH_2Cl_2:hexane (volume fraction) at 1.0 mL/min. The columns were pre-eluted with 6.0 mL 50:50 CH_2Cl_2:hexane and 8.0 mL of hexane at 1.2 mL/min before adding the samples. The Rapid Trace performed clean up steps using CH_2Cl_2 and hexane between each sample run. After transferring the fractions to Turbovap tubes, we began reducing their volume and changed the solvent to hexane, and then continued reducing them down to 0.5 mL before transferring them to amber GC autosampler vials.

GC/MS Analyses

We analyzed the samples with an electron impact (EI) GC/MS (Agilent, Palo Alto, CA, USA) operating in the selected ion monitoring mode (SIM) for selected chlorinated pesticides and all of the PCB and PBDE congeners. The instrument was equipped with a 30.0 m x 0.18 mm x 0.18 µm i.d. DB-5MS column (J&W Scientific, Folsom, CA, USA) with a 5.0 m x 0.25 mm retention gap added to the beginning of the column. A PTV injector (Agilent 6850) injected the samples in 20.0 µL (4 x 5 µL) amounts after the solvent vent flow rate set at 65.0 mL/min of nitrogen and the unit's inlet was cooled to 10 °C for 1.5 min with liquid nitrogen. After injection, the inlet was heated to a final transfer temperature of 250 °C at a rate of 720 °C/min with no hold time, and then the temperature was ramped up to 280 °C at a rate of 20 °C/min and held for 10 min to bake off any remaining compounds from the liner.

The GC oven was held at 80 °C for 1.5 min and then the temperature was ramped up to 170 °C at a rate of 25 °C/min, then ramped up to 270 °C at a rate of 2 °C/min, and then ramped up one more time to 325 °C at a rate of 25 °C/min before it was held isothermally for 10 min (total run time 67.3 min). We used helium as the carrier gas set at a constant flow rate at 0.7 mL/min, and maintained the quadrupole, source, and transfer line at 150 °C, 250 °C, and 300 °C, respectively.

We set the GC/MS in the negative chemical ionization (NCI) mode using SIM equipped with a 30.0 m x 0.18 mm x 0.18 µm i.d. DB-XLB column (J&W Scientific, Folsom, CA, USA) that had a 5.0 m x 0.25 mm retention gap fitted to one end. Methane was used as the reaction gas and samples were injected using a PTV, as described above. The GC oven was held at 120 °C for 1 min, then ramped up to 230 °C at a rate of 30 °C/min, then ramped up to 260 °C at a rate of 10 °C/min, then ramped to 284 °C at a rate of 4.8 °C/min, and then ramped up one more time to 300 °C at a rate of 9.6 °C/min before it was held isothermally for 1.67 min (total run time 16.0 min). The carrier gas was helium set at a flow rate of 1.5 mL/min for 4.5 min. Gas flow was then ramped up to 0.7 mL/min at a rate of 50.0 mL/min for 8.5 min, and then ramped up to 1.4 mL/min at a rate of 50.0 mL/min for 3.0 min. All other conditions were the same as the EI run. The 2008 and 2009 samples were analyzed separately in four batches. Glaucous gull samples were analyzed alone, and the murres and glaucous-winged gull eggs were analyzed together.

Statistics

We quantified the data using at least 3 calibration points that bracketed the samples and allowed the intercept to float. Limits of detection (LODs) were calculated as the lowest observable calibration solutions divided by the sample masses, and limits of quantitation (LOQs) were calculated as the average blank values plus 3 times the standard deviations and then divided by the sample masses.

We ran a multivariate analyses of variance (MANOVA) on a lipid-mass basis on the compounds that had all values above detection limits and the control materials fell within the reference range (**4,4'-DDE**, β-HCH, *cis*-nonachlor, **HCB**, pentachlorobenzene, heptachlor epoxide, **mirex**, octachlorostyrene, **oxychlordane**, and the sum of 16 PCB congeners because of limited degrees of freedom—**28+31**, **105**, **118**, 119, 128, 137, **138**, **146**, 149, **153+132**, 156, **170**, 177, **180+193**, 194, and 207) to compare the Norton Sound common murre and glaucous gull eggs with eggs from nesting locations outside of it. One exception was made; BDE 47 was included in the MANOVA even though one unidentified murre egg from Cape Lisburne I. was below the detection limit (Egg ID 1454 was 0.08732 ng g^{-1} vs its LOQ of 0.08734 ng g^{-1}) We also ran MANOVAs on eggs from all of the colonies for further geographical comparisons, and on the St. Lawrence, St. George, and St. Lazaria island common and thick-billed murre samples to check for species differences. If MANOVAs differed statistically ($P < 0.05$), we used individual ANOVAs and Tukey-Kramer post-hoc tests to find out which colonies were different. We also conducted principal components analyses (PCAs) on total compound percentages to help visualize patterns, and ran regressions on the compounds shown in bold (see above) to check the multiyear St. George Island thick-billed murre and St. Lazaria Island common and thick-billed murre data sets for temporal changes. Correlations on a lipid-mass basis were conducted with the stable carbon and nitrogen isotopes. We used commercially available software to run all statistical tests (SAS, JMP 9, Cary, NC, USA).

Results

Mercury (Hg) and Hg, Carbon (C), and Nitrogen (N) Isotopes

Because the Hg levels found in the murre and gull eggs were >84 % methylmercury (Davis *et al.* 2004), only total Hg values are reported here. Hg levels and $\delta^{15}N$ and $\delta^{13}C$ isotope values are listed in Appendix 3.

Taxonomic Groupings

This data set contained 30 common murre, 25 thick-billed murre, 5 unidentified murre, 53 glaucous gull, and 5 glaucous-winged gull eggs. Glaucous and glaucous-winged gulls have similar foraging strategies and occupy similar ecological niches within their arctic (glaucous gulls) and subarctic-temperate ranges (glaucous-winged gulls; see Vander Pol *et al.* 2009). However, because these species do not nest together, we could not directly compare Hg levels in their eggs, and because glaucous-winged gull eggs were only obtained from a single colony

(Aiktak Island in the Aleutians), we elected to refer to these birds collectively as "gulls". Common and thick-billed murres are also ecologically similar species, but they use different foraging strategies. Both species are deep-diving fish-eaters capable of exploiting marine environments up to 170 km from their colonies (Ainley *et al.* 2002). However, common murres tend to feed closer to shore and at shallower depths, compared to thick-billed murres, and thick-bills typically take more benthic fish and invertebrates than commons (Swartz 1966, Springer *et al.* 1984, Springer *et al.* 1986, Springer *et al.* 1987, Dragoo 1991, Barrett *et al.* 1997, Gaston and Jones 1998, Roseneau *et al.* 2000, Vander Pol *et al.* 2004). These species typically nest close to one another at many Alaskan colonies, but almost all of the birds (~90%) occupying the three Norton Sound nesting locations targeted in this study (i.e., Sledge Island, Bluff, and Cape Denbigh) were common murres (e.g., see Sowls *et al*. 1978, Murphy *et al.* 1985).

Given this information, we compared common and thick-billed eggs from two colonies where they nested together (St. Lawrence and St. Lazaria islands; see Fig. 1) to see how interchangeable these species might be as biointegrators of Hg in their local marine environments. Although total Hg levels did not differ significantly at St. Lazaria Island (ANOVA on log Hg), common murre values were higher than thick-billed murre levels at St. Lawrence Island ($P = 0.05$; see Fig. 4). However, isotope fractionation patterns for δ^{202}Hg and Δ^{199}Hg, and δ^{15}N and δ^{13}C values did not differ at either colony ($P > 0.218$; see Fig. 5). Although there was a significant difference in Hg levels between these species at St. Lawrence Island, the difference was small relative to the geographic trends seen across the study area (Figs. 4 and 6). This information indicated that either species could be used to represent regional Hg patterns. All of the Hg isotope and δ^{15}N and δ^{13}C data were also similar between the species. Given this information, we elected to treat these birds as just "murres" at the colonies where they nested together.

Taxonomic Comparisons of Hg Levels and δ^{15}N and δ^{13}C

Hg levels ranged from 2 ng g^{-1} to 644 ng g^{-1}, with a grand mean of 118 ng g^{-1} (n = 118) and an overall relative standard deviation (RSD) of 71 %. The average RSD among replicate eggs in each sampling event (n = 5) was 39 %. Murres eggs varied between 2 ng g^{-1} and 262 ng g^{-1}, with a mean and standard error of 83 ng g^{-1} ± 9.8 ng g^{-1}, and gull eggs ranged from 55 ng g^{-1} to 644 ng g^{-1}, with a mean and standard error of 154 ng g^{-1} ± 10.0 ng g^{-1}. Overall, Hg levels were significantly higher in the gull eggs than they were in the murres eggs (ANOVA, $P < 0.0001$), and δ^{15}N was also significantly higher ($P = 0.008$) in these samples (16.3 ‰ ± 0.28 ‰), compared to the murre eggs (15.2 ‰ ± 0.28 ‰). In contrast, δ^{13}C was significantly lower ($P = 0.0003$) in the gull eggs (-21.8 ‰ ± 0.23 ‰) than it was in the murre eggs (-20.6 ‰ ± 0.23 ‰). When we compared murre and gull eggs within regions, the results were the same as the overall comparisons ($P < 0.05$), with the following exceptions: in the northern Bering and Chukchi seas, there was no difference in δ^{15}N values; in Norton Sound, the murres had higher δ^{15}N levels than the gulls did ($P = 0.002$) and there was no difference in δ^{13}C values; and in the southern Bering Sea, gull δ^{13}C levels were higher than the murre values ($P = 0.05$).

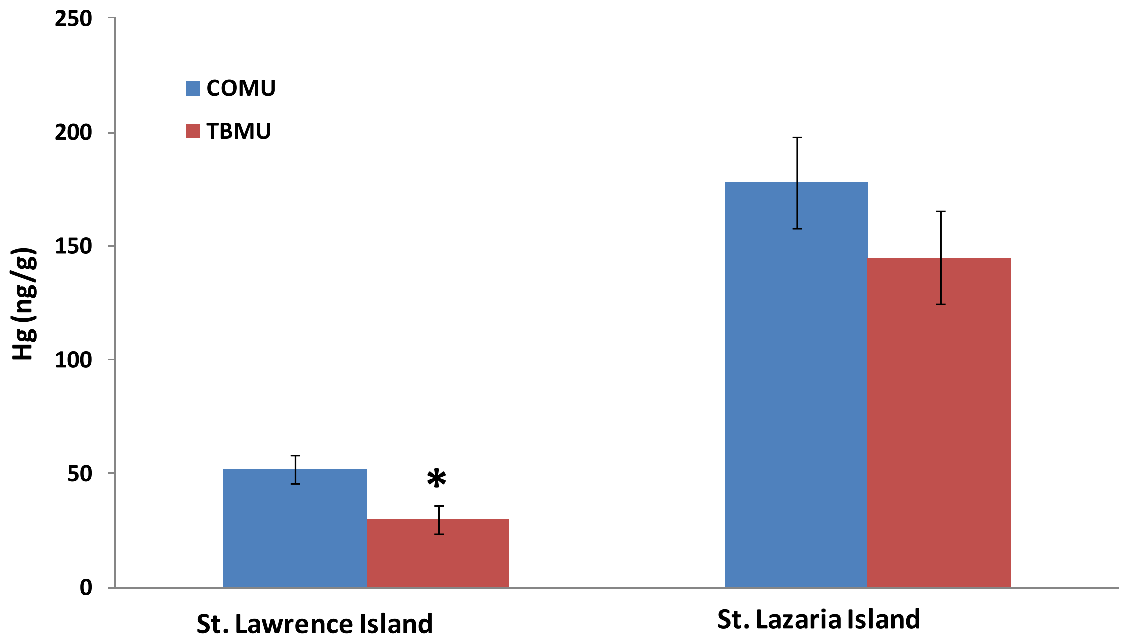

Figure 4. Hg levels in common murre and thick-billed murre eggs from St. Lawrence (northern Bering Sea) and St. Lazaria (southern Gulf of Alaska) islands. Species differences were only present at St. Lawrence Island ($P = 0.05$). Bars = mean ± standard error.

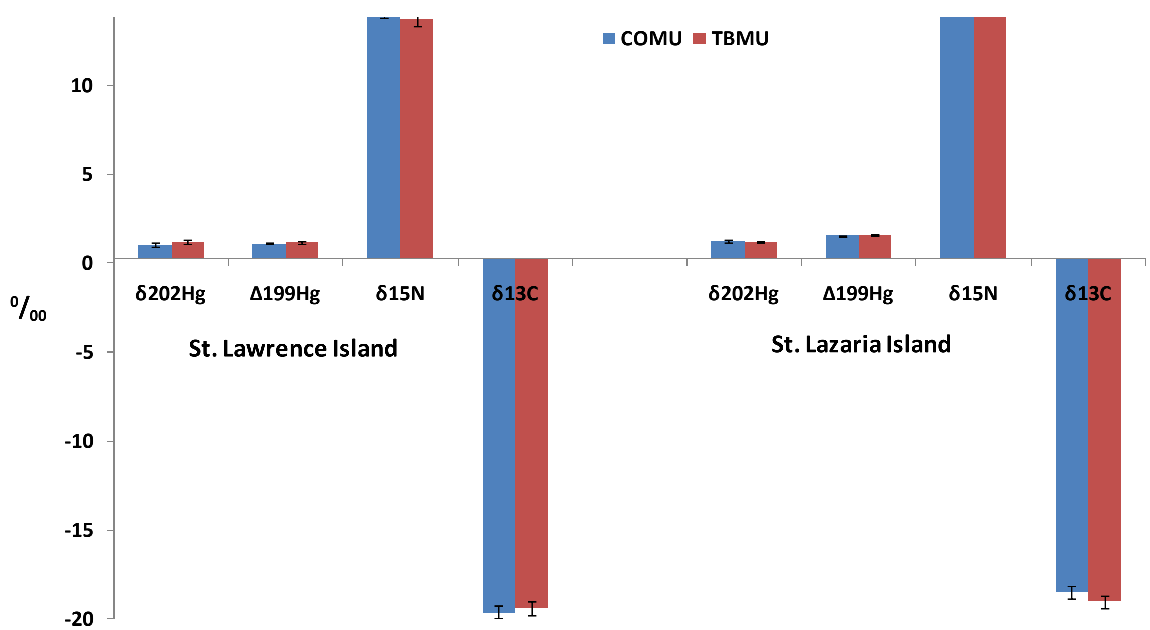

Figure 5. Hg isotope patterns in common murre and thick-billed murre eggs from St. Lawrence (northern Bering Sea) and St. Lazaria (southern Gulf of Alaska) islands. Species differences were not present at either colony. Bars = mean ± standard error.

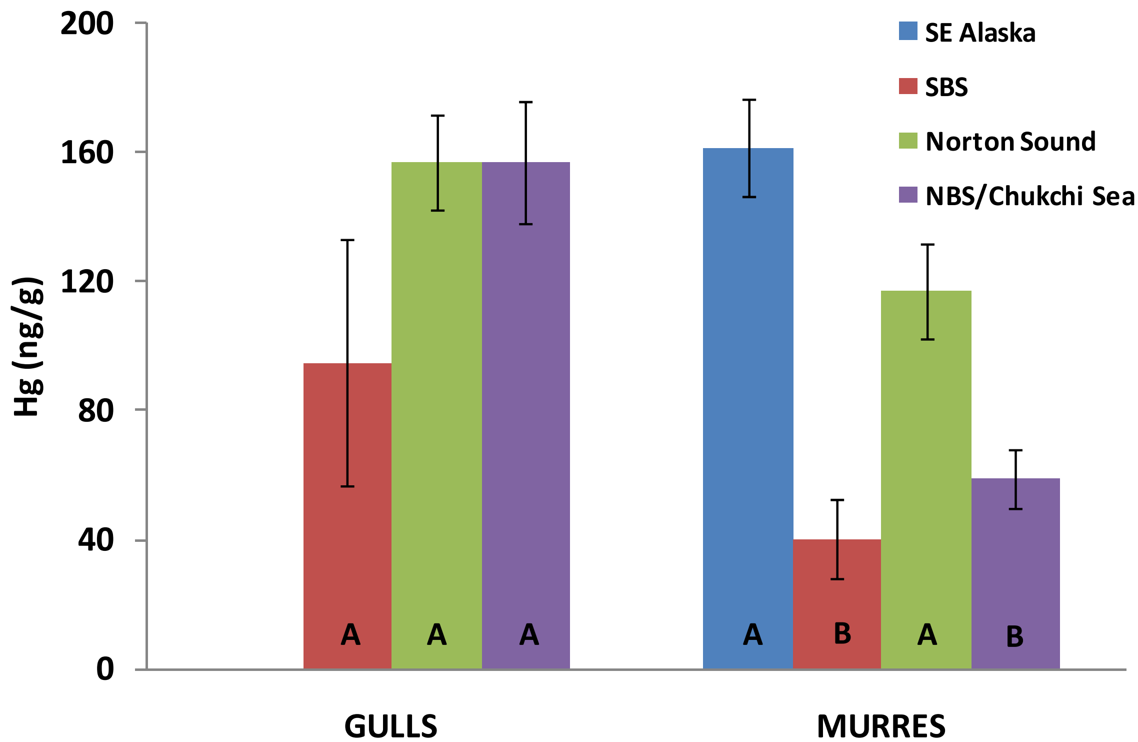

Figure 6. Hg levels in murre and gull eggs among regions. Bars = mean ± standard error, and different letters indicate significant differences based on 1-way ANOVA and Tukey tests. SE Alaska = southeastern Alaska, SBS = southeastern Bering Sea, and NBS/Chukchi Sea = northern Bering and Chukchi seas.

Regional Comparisons of Hg Levels and $\delta^{15}N$ and $\delta^{13}C$

We initially checked the entire data set for geographic patterns in Hg levels to identify large-scale trends and lay the groundwork for Hg isotope analyses. To make the comparisons, we grouped the colonies into four regions: southeastern Alaska (SE Alaska); the southern Bering Sea (SBS); the northern Bering and Chukchi seas (NBS/Chukchi Sea); and Norton Sound. Significant regional variation was not detected in the gull eggs (1-way ANOVA, $P > 0.05$), although Hg levels in the SBS were lower than in the NBS/Chukchi Sea and Norton Sound (Fig. 6). Also, $\delta^{15}N$ was significantly higher in the Norton Sound gull eggs, compared to the SBS and NBS/Chukchi Sea (Fig. 7). The SBS gull eggs had the highest $\delta^{13}C$ levels and the NBS/Chukchi Sea eggs had the lowest, while eggs from Norton Sound contained intermediate amounts (Fig. 8). When we compared all of the gull eggs together, we found a significant negative correlation between Hg and $\delta^{13}C$ ($P = 0.03$), but did not find a correlation between Hg and $\delta^{15}N$. We also compared the individual colonies to check geographic variability in Hg, $\delta^{15}N$, $\delta^{13}C$ at a higher spatial resolution (Fig. 9). Murre eggs clearly had the most distinct geographic Hg pattern, with significantly higher levels in Norton Sound and SE Alaska than in the NBS/Chukchi Sea and SBS (1-way ANOVA, $P < 0.05$; see Fig. 6). $\delta^{15}N$ was also higher in the Norton Sound murre eggs, compared to the other regions, while the SBS had the lowest levels, and SE Alaska and NBS/Chukchi Sea had intermediate values (Fig. 7). $\delta^{13}C$ also varied geographically, with the lowest levels in Norton Sound and the SBS, intermediate values in the NBS/Chukchi Sea, and the highest levels in SE Alaska (Fig. 8). When we compared all of the murre eggs together, no correlation was present between Hg and $\delta^{13}C$, but we did find a significant positive correlation between Hg and $\delta^{15}N$ ($P = 0.005$).

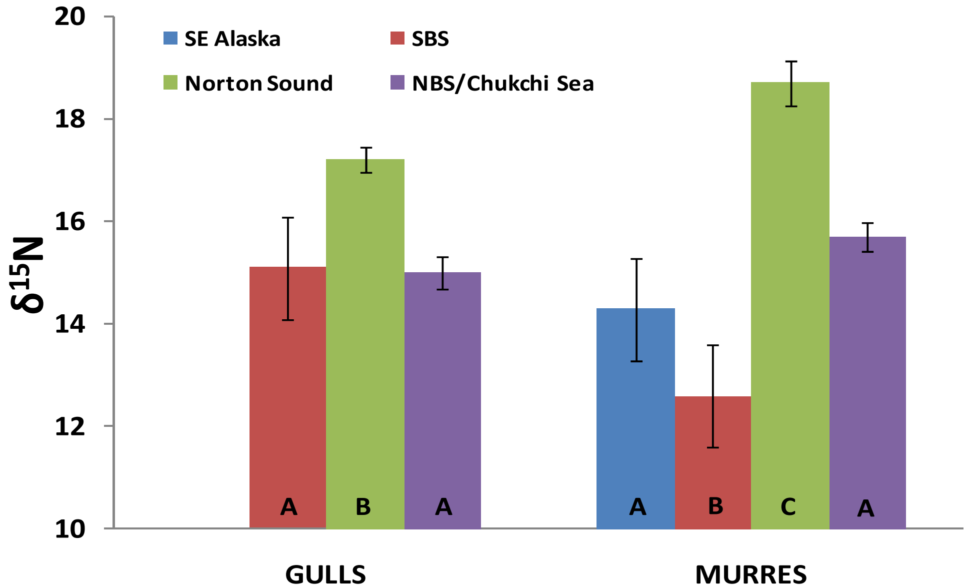

Figure 7. $\delta^{15}N$ in murre and gull eggs among regions. Bars = mean ± standard error, and different letters indicate significant differences based on 1-way ANOVA and Tukey tests. SE Alaska = southeastern Alaska, SBS = southeastern Bering Sea, and NBS/Chukchi Sea = northern Bering and Chukchi seas.

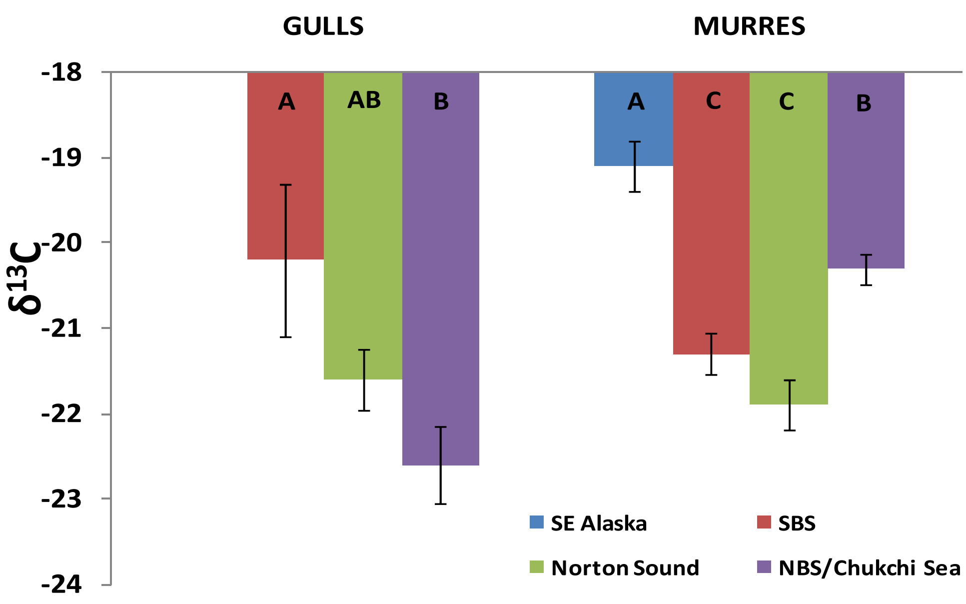

Figure 8. $\delta^{13}C$ in murre and gull eggs among regions. Bars = mean ± standard error, and different letters indicate significant differences based on 1-way ANOVA and Tukey tests. SE Alaska = southeastern Alaska, SBS = southeastern Bering Sea, and NBS/Chukchi Sea = northern Bering and Chukchi seas.

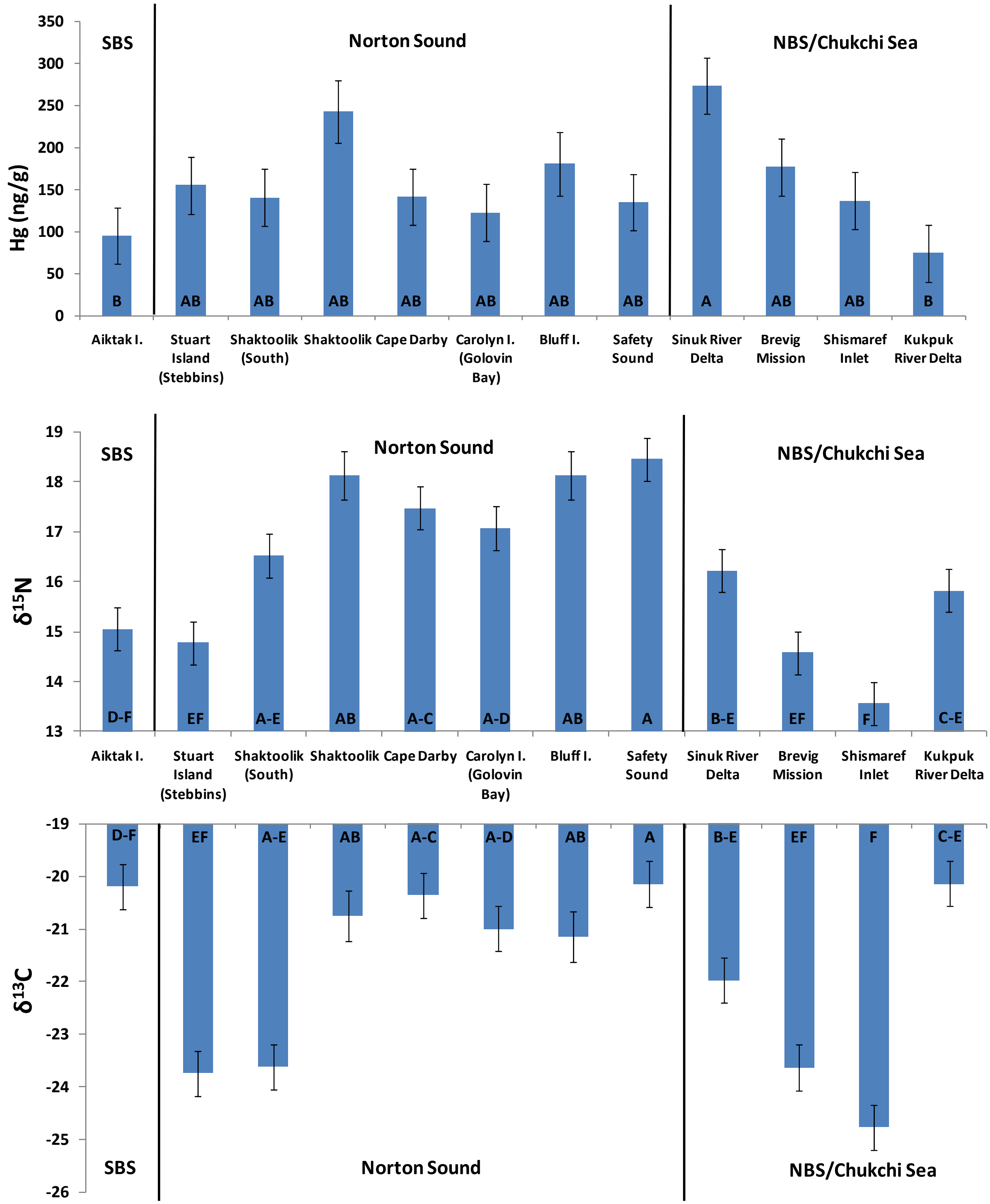

Figure 9. Hg, δ^{15}N, and δ^{13}C in gull eggs compared among colonies. Colonies are grouped by region, starting in the southern Bering Sea (SBS) and progressing northward into Norton Sound and the northern Bering and Chukchi seas (NBS/Chukchi Sea). Bars = mean ± standard error, and different letters indicate significant differences based on 1-way ANOVA and Tukey tests.

Hg Isotopes

The Hg levels that we found in the gull eggs suggested that these seabirds did not have any spatially explicit patterns like the murres did. In particular, the gulls in Norton Sound where this study was focused did not display consistently different Hg levels, compared to the northern Bering and Chukchi sea colonies (Fig. 9). This indicates they are not good biointegrators of sources and cycling of Hg. This outcome was not surprising, because gulls are highly migratory and have diverse, opportunistic foraging behaviors that include feeding on surface fish, intertidal invertebrates, eggs and small chicks, berries and seaweed, and scavenging on terrestrial and marine carrion and human refuse (Roseneau *et al.* 2008, Vander Pol *et al.* 2009). These factors make interpreting contaminant patterns in their eggs much more difficult than it is for murres. Given our knowledge of gull biology and the varying amounts of Hg in their eggs, we decided to focus the Hg isotope analyses on murres, and exclude gulls from this part of the study. Results of the analytical work on the 25 common murre and 20 thick-billed murre eggs from the seven representative nesting locations, including the three Norton Sound colonies, are shown in Appendix 4. We grouped the data by colony to make it easier to identify geographic patterns in Hg isotopic fractionation and compare Hg levels and δ^{15}N and δ^{13}C isotopes in the samples.

The quality control samples for the Hg isotope analyses agreed with previously published values (Table 5), validating our analytical methods. All of the murre eggs showed significant positive mass dependent fractionation (MDF) for all of the measured isotopes, and they also displayed significant positive mass independent fractionation (MIF) for all measured odd isotopes (Fig. 10). We plotted Δ^{199}Hg and δ^{202}Hg values against one another to help illustrate separation of isotopic patterns among colonies (Fig. 11), and we also summarized the data to statistically compare the colonies by calculating their means and checking them with 1-way ANOVA and Tukey tests. Hg levels, MIF, and MDF all displayed gradients running from deep within Norton Sound (i.e., at Cape Denbigh) westward toward the northern Bering Sea (Fig. 12). Hg levels were highest in Norton Sound and lowest in the northern Bering Sea, while Δ^{199}Hg and δ^{202}Hg were lowest in Norton Sound and highest in the northern Bering Sea. δ^{15}N and δ^{13}C also displayed this gradient, with δ^{15}N highest in Norton Sound and δ^{13}C lowest at its eastern end (i.e., at Cape Denbigh; see Fig. 13). We also analyzed samples from two of the more distant colonies, St. Lazaria Island in the Gulf of Alaska and St. George Island in the southeastern Bering Sea, for comparative purposes. These nesting locations had their own individual patterns of Hg, δ^{202}Hg, Δ^{199}Hg, δ^{15}N, and δ^{13}C that differed from the Norton Sound and northern Bering Sea colonies (Figs. 12 and 13). We also found significant positive pair-wise correlations ($P < 0.05$) between δ^{202}Hg-Δ^{199}Hg, Hg-δ^{15}N, δ^{13}C-δ^{202}Hg, and δ^{13}C-Δ^{199}Hg at the Norton Sound and northern Bering Sea nesting locations. In contrast, significant negative pair-wise correlations were found between Hg-δ^{202}Hg, Hg-Δ^{199}Hg, δ^{15}N-δ^{202}Hg, δ^{15}N-Δ^{199}Hg, δ^{13}C-Hg, and δ^{13}C-δ^{15}N. Some researchers have used the slope of linear regressions between Δ^{199}Hg and Δ^{199}Hg to infer the chemical species of Hg undergoing photoreduction (Bergquist and Blum 2007, Point *et al.* 2011). The overall slope in this study was 1.08 (Fig. 14), which is closer to the experimentally derived value for inorganic Hg photoreduction (1.0) than for MeHg photoreduction (1.3).

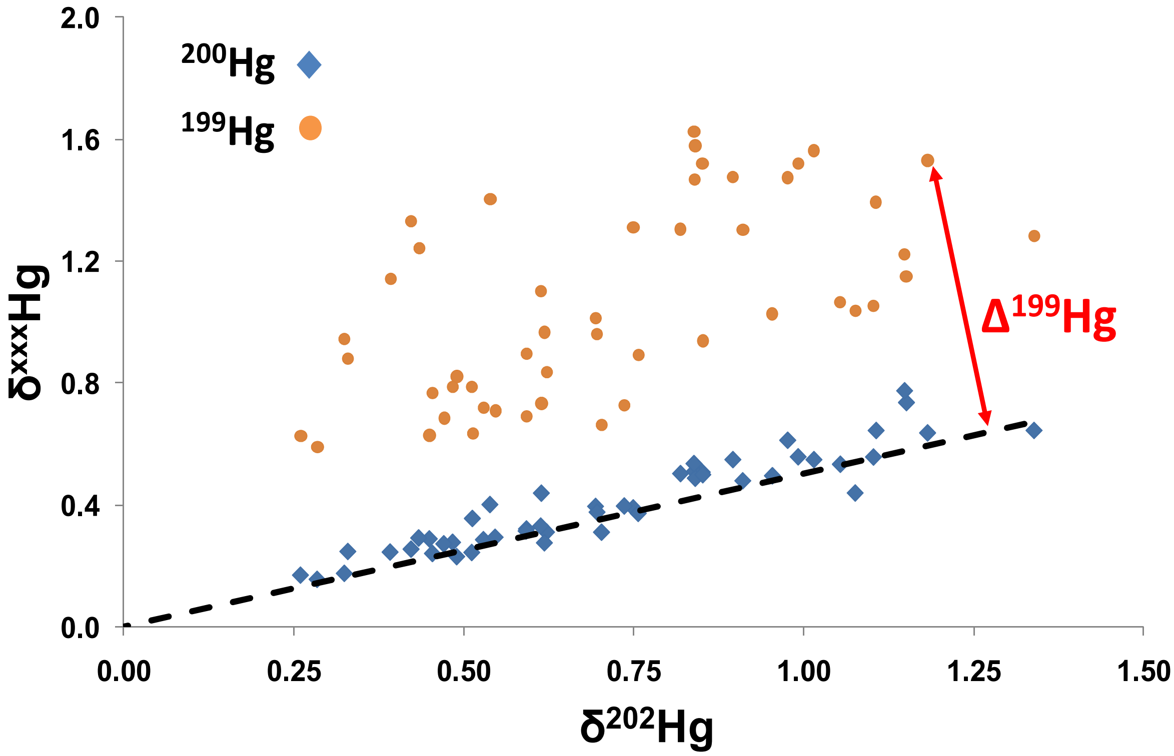

Figure 10. $\delta^{200}Hg$ and $\delta^{199}Hg$ vs. $\delta^{202}Hg$ for all murre and gull eggs showing measured values relative to theoretical values based on mass dependent kinetic isotope fractionation. The measured values for $\delta^{200}Hg$ *vs* $\delta^{202}Hg$ were in agreement with the theoretical values, indicating all of the fractionation was mass dependent fractionation (MDF), as suggested by the models. However, $\delta^{199}Hg$ deviated significantly from the theoretical MDF line, indicating that mass independent fractionation (MIF, denoted by $\Delta^{199}Hg$) was present in the eggs for odd isotopes.

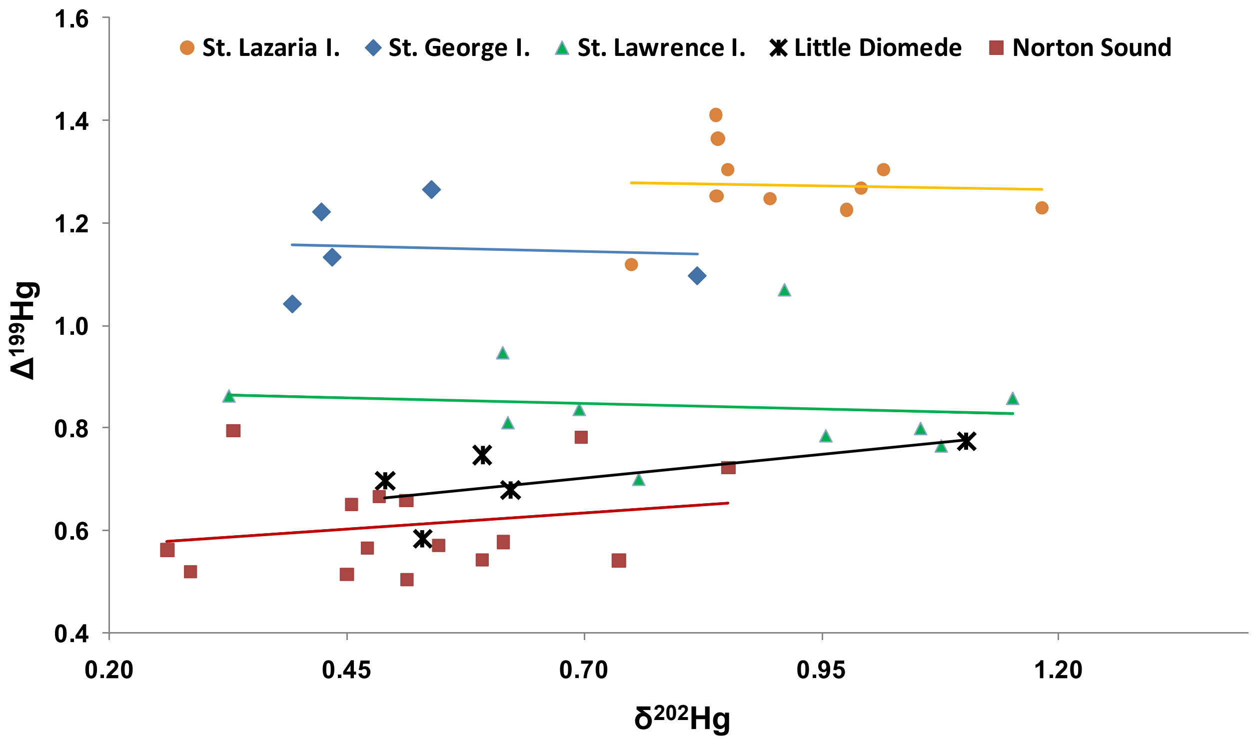

Figure 11. A three Hg isotope diagram showing colony separations by their Δ^{199}Hg *vs* δ^{202}Hg signatures.

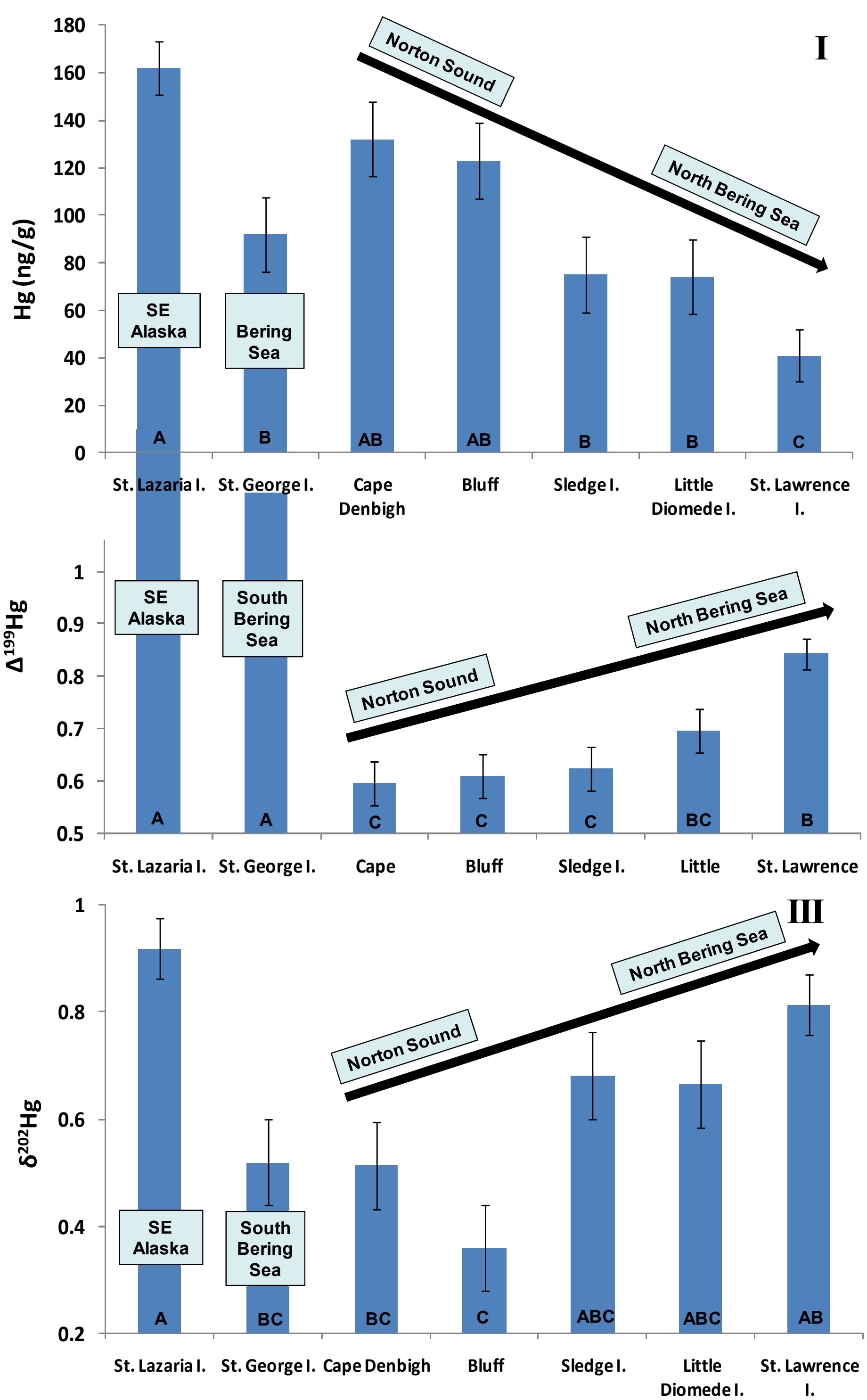

Figure 12. Hg (I), MIF (II), and MDF (III) gradients between the Norton Sound and northern Bering Sea regions. Bars = mean ± standard error, and different letters indicate significant differences based on 1-way ANOVA and Tukey tests.

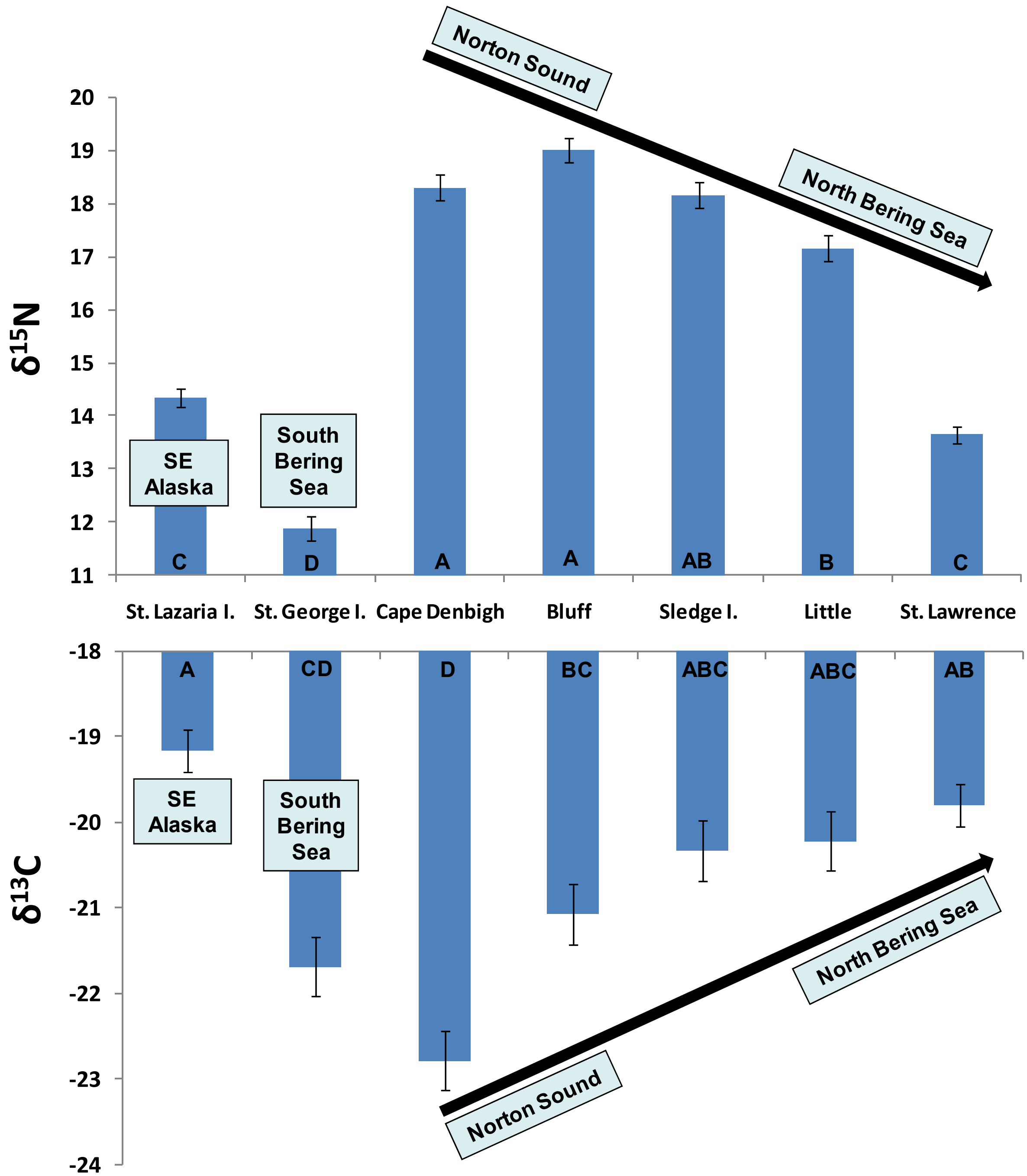

Figure 13. $\delta^{15}N$ and $\delta^{13}C$ gradients between the Norton Sound and northern Bering Sea regions. Bars = mean ± standard error, and different letters indicate significant differences based on 1-way ANOVA and Tukey tests.

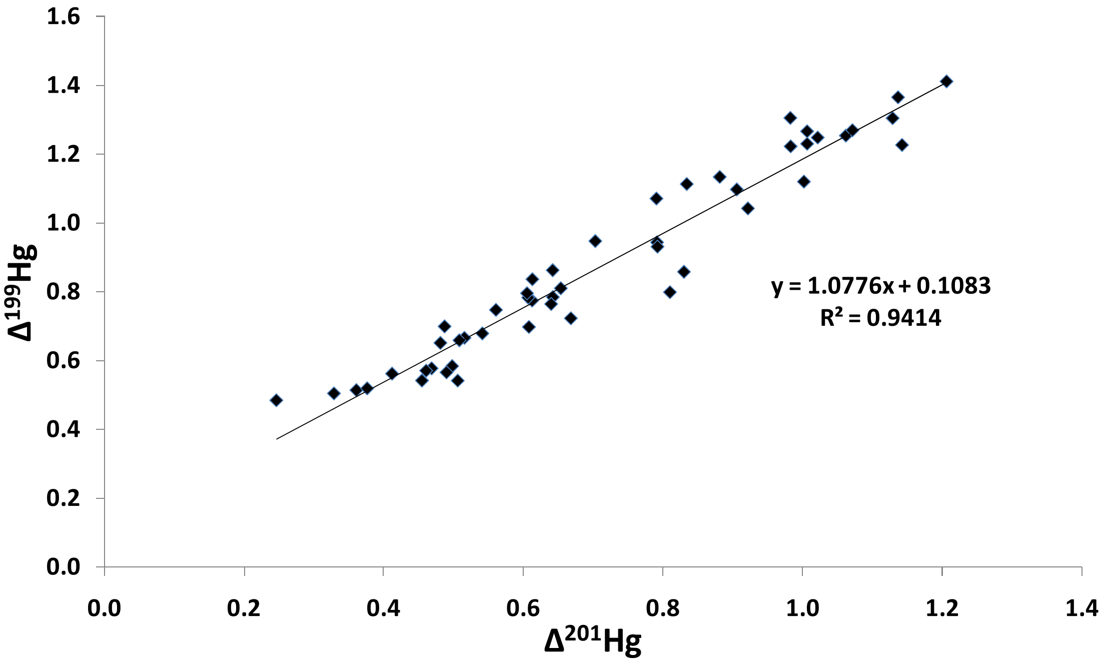

Figure 14. Slope of the linear regression between Δ^{199}Hg and Δ^{201}Hg. This slope is sometimes used to infer the chemical species of Hg undergoing photoreduction (e.g., see Blum and Berquist 2007, Point *et al.* 2011). The overall slope of this relationship in this study was 1.08, which is closer to the experimentally derived value for inorganic Hg photoreduction (1.0) than for MeHg photoreduction (1.3).

<u>Persistent Organic Pollutants (POPs)</u>

QA/QC and General Results

Percent lipid and mass fractions of organochlorine pesticides, and mass fractions of PBDEs and PCBs in the murre egg control material are listed in Appendices 5 and 6, and colony, species, and year results are summarized in Appendices 7-30 and 31-54, respectively. Values for organochlorine contaminants varied from below detection limits (< 0.00117 ng g^{-1}) to 391 ng g^{-1} wet mass for 4,4'-DDE in one glaucous gull egg from Stuart Island in Norton Sound (egg number 1420; see Appendices 2 and 29). RSDs at the colonies varied between 0.99 % and 210 % (mean = 39.5 %).

While most control material levels were within consensus value ranges (Appendices 5 and 6), many of the PCBs levels were lower, as reported by an earlier study (Vander Pol 2007). Also, as reported before, PCB congeners 199 and 201 were above consensus values because of interfering peaks. The duplicate analyses of gull eggs 1340 and 1403 (see above and Appendix 2) resulted in differences of less that 10 %, indicating our fresh homogenization procedures produced well-mixed samples (Appendices 22, 27, 46, and 51).

Although percent lipids were significantly different among colonies (MANOVA $F_{15,62} = 26.1$, $P < 0.0001$), they did not differ among the murre nesting locations (Fig. 15). Gulls were lower than murres, and the Safety Sound gull eggs contained the lowest lipid levels.

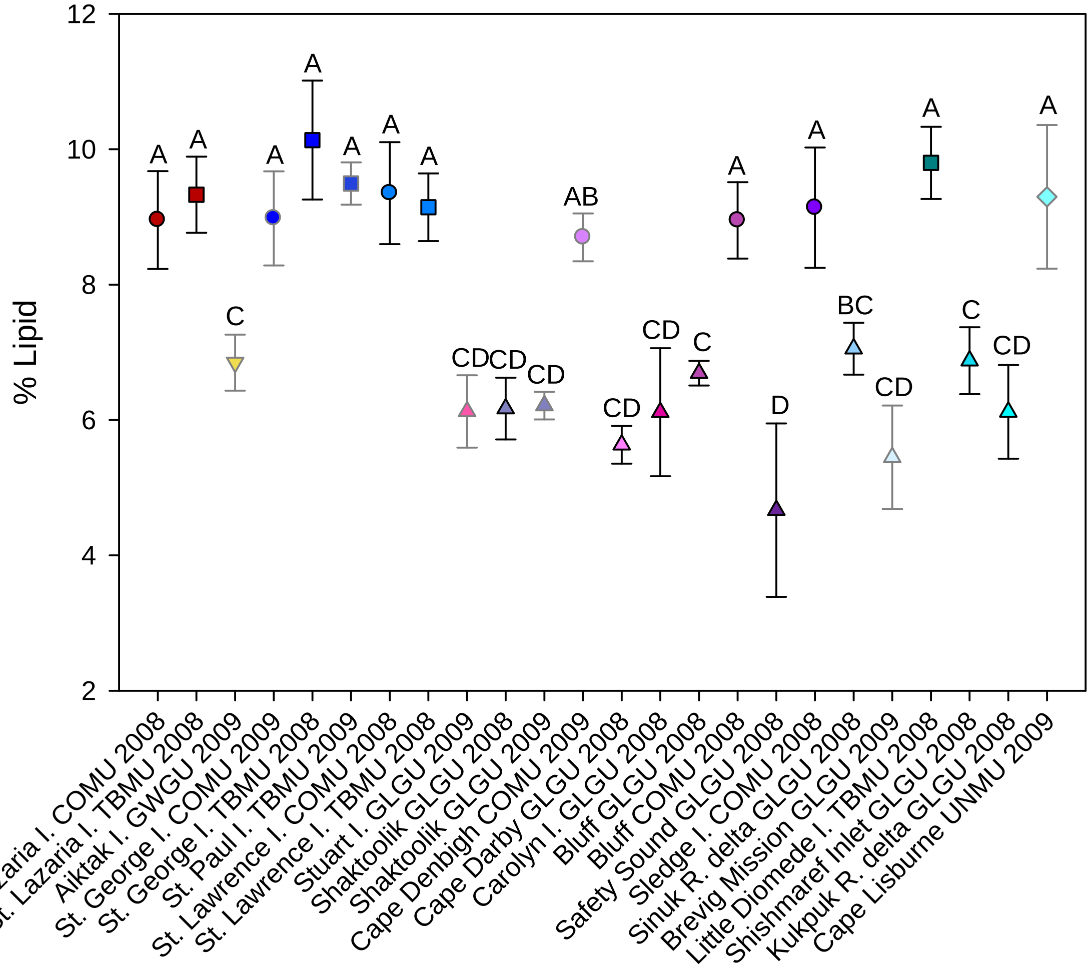

Figure 15. Percent lipid in common murre (COMU), thick-billed murre (TBMU), glaucous gull (GLGU), and glaucous-winged gull (GWGU) eggs collected at 19 Alaskan colonies in 2008-2009. Significant differences ($P < 0.05$) among sites are shown by different letters (e.g., Bluff GLGU 2008 [C] differed from Safety Sound GLGU 2008 [D]).

Regional Comparisons

The Norton Sound common murre eggs from Sledge Island, Bluff, and Cape Denbigh were significantly different from the St. Lawrence and St. George island common murre eggs (Fig. 16; MANOVA $F_{11,18}$ = 7.12, P < 0.0001). Although the Norton Sound *cis*-nonachlor, HCB, mirex, octacholorstyrene, and BDE 47 levels were higher than those found in the Bering Sea, the remaining compounds did not differ between these regions (P > 0.05). However, the Norton Sound (Sinuk River delta, Safety Sound, Bluff, Cape Darby, Shaktoolik, and Carolyn and Stuart islands) and Bering and Chukchi sea (Brevig Mission, Shishmaref Inlet, and Kukpuk River delta) gull eggs contained lower levels of β-HCH, *cis*-nonachlor, HCB, heptachlor epoxide, mirex, oxychlordane, ΣPCBs, and BDE 47 than the Bering and Chukchi sea eggs did (Fig. 16; MANOVA $F_{11,40}$ = 5.25, P < 0.0001).

We ran a MANOVA on all of the colonies and it was also significant ($F_{253,855}$= 5.94, P < 0.0001), as were all of the ANOVAs run on individual compounds (P < 0.0001; see Table 6).

The first two principal components (PC) of the PCA accounted for 65.0 % of the total variation (Fig. 17). The first PC explained 48.1 % of the variation and was separated by the organochlorine pesticides: octachlorostyrene, HCB, pentachlorobenzene, and β-HCH on the lower end, and the penta- to hepta-PCB congeners on the upper end. The second PC explained another 16.9 % of the variation and had higher proportions of heptachlor epoxide, mirex, oxychlordane, *cis*-nonachlor, and penta-PCB congeners on the higher end, and 4,4'-DDE and hexa- to octa-PCB congeners on the lower end.

Species Comparisons

Species differences were significant (MANOVA $F_{11,18}$ = 2.62, P = 0.0339), with levels of heptachlor epoxide, pentachlorobenzene, and β-HCH higher in the common murre eggs than in the thick-billed murre eggs. We checked to see if this pattern was also present among the colonies, but only the St. George Island eggs differed between species. However, these eggs were collected in different years (2008 and 2009), and when we removed this location from our calculations, the MANOVA was no longer significant ($F_{11,8}$ = 2.46, P = 0.106).

Temporal Comparisons

Temporal variations at St. George and St. Lazaria islands are shown in Fig. 18. Declines in the levels of 4,4'-DDE and mirex in the St. Lazaria common and thick-billed murre eggs and HCB, and oxychlordane in the St. George and St. Lazaria island thick-billed murre eggs were significant, and the increase in mirex in the St. George Island thick-billed murre eggs was also significant.

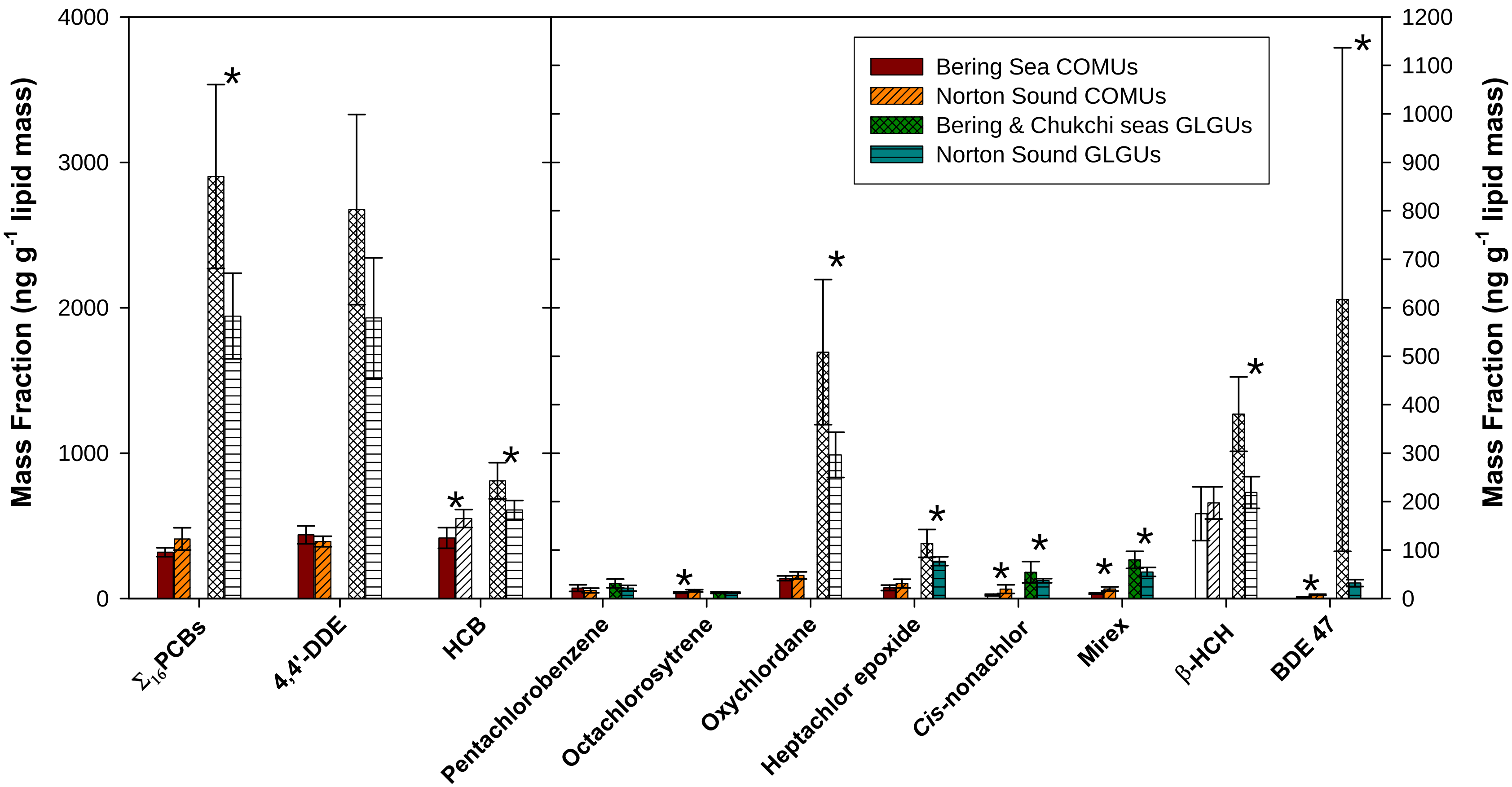

Figure 16. Geographic comparisons (means ± 95 % confidence intervals) for common murre (COMU) eggs collected from Bering Sea (St. George and St. Lawrence islands) and Norton Sound (Bluff, Cape Denbigh, and Sledge Island) colonies, and glaucous gull (GLGU) eggs collected from Chukchi Sea (Kukpuk River delta, Shishmaref Inlet), Bering Sea (Brevig Mission), and Norton Sound (Sinuk River delta, Safety Sound, Bluff, Cape Darby, Shaktoolik, and Carolyn and Stuart islands) nesting locations. Asterisks (*) indicate the MANOVAs were significant ($P < 0.05$).

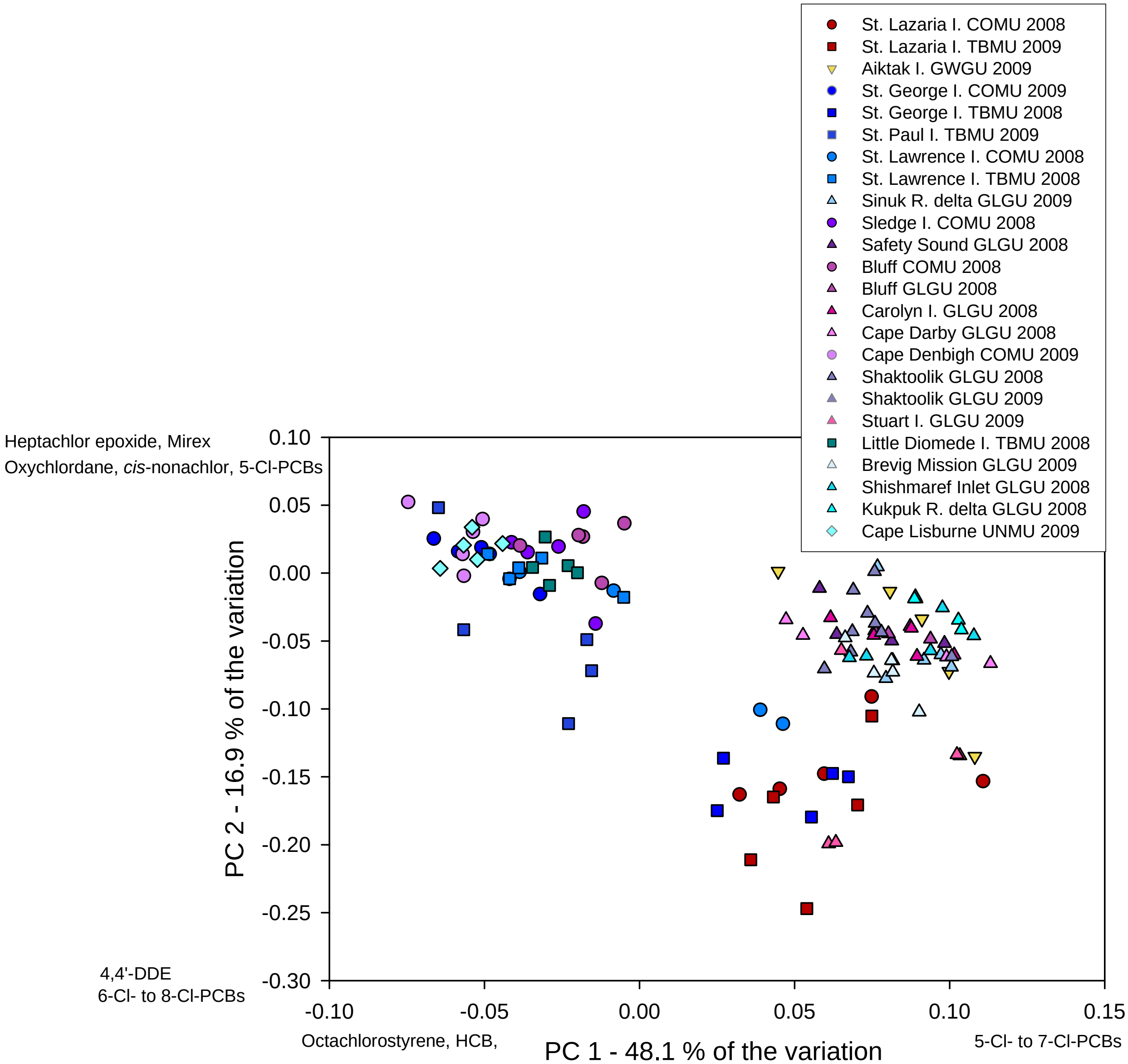

Figure 17. Principal components analyses for organochlorine pesticides and polychlorinated biphenyls (PCBs) in common murre (COMU), thick-billed murre (TBMU), glaucous gull (GLGU), and glaucous-winged gull (GWGU) eggs collected at 19 Alaskan colonies in 2008-2009. Compounds that contribute to the loadings are shown along the axes.

Table 6. Mass fractions (ng g^{-1} lipid mass) of major contaminants in murre and gull eggs (means ± confidence intervals and ranges are shown in parentheses; colonies not sharing letters differed significantly based on Tukey-Kramer Post-hoc tests).

	BDE 47		Σ_{16}PCBs		4,4'-DDE		β-HCH		HCB		Pentachlorobenzene	
F-Ratio	5.25		7.34		4.88		4.53		6.84		15.4	
P	<0.0001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001	
St. Lazaria I. COMU 2008	159 ± 176 (39.8 - 515)	B	1051 ± 778 (408 - 2565)	B-F	1580 ± 810 (938 - 3180)	AB	144 ± 40 (81.9 - 210)	C	280 ± 53 (214 - 370)	F-G	7.34 ± 1.3 (6.06 - 9.65)	H
St. Lazaria I. TBMU2008	159 ± 176 (39.8 - 515)	B	648 ± 255 (345 - 1035)	C-F	1490 ± 370 (1110 - 2140)	AB	107 ± 27 (66.8 - 151)	C	280 ± 14 (267 - 308)	F-G	8.30 ± 2.0 (5.48 - 11.1)	H
Aiktak I. GWGU 2009	31.8 ± 25 (6.78 - 79.0)	B	1510 ± 1092 (343 - 3578)	B-F	1720 ± 1800 (249 - 5230)	AB	209 ± 110 (62.0 - 406)	BC	299 ± 110 (90.8 - 390)	E-G	18.4 ± 7.6 (8.42 - 28.1)	D-H
St. George I. COMU 2009	3.63 ± 1.3 (1.22 - 5.20)	B	280 ± 21 (240 - 296)	E-F	389 ± 33 (335 - 441)	B	245 ± 60 (175 - 341)	A-C	457 ± 28 (418 - 504)	C-G	28.7 ± 9.7 (12.7 - 41.3)	C-F
St. George I. TBMU 2008	3.89 ± 1.9 (1.80 - 6.63)	B	415 ± 99 (294 - 581)	D-F	1000 ± 110 (867 - 1170)	B	82.6 ± 17 (59.3 - 108)	C	234 ± 50 (175 - 292)	G	6.47 ± 2.8 (1.55 - 9.81)	H
St. Paul I. TBMU 2009	2.20 ± 1.2 (0.847 - 3.79)	B	220 ± 63 (120 - 296)	F	497 ± 170 (303 - 809)	B	160 ± 55 (84.7 - 256)	C	376 ± 87 (261 - 524)	D-G	31.8 ± 11 (16.1 - 45.6)	C-E
St. Lawrence I. COMU 2008	3.18 ± 0.58 (2.44 - 3.93)	B	357 ± 28 (327 - 402)	EF	488 ± 110 (378 - 631)	B	105 ± 29 (65.6 - 136)	C	376 ± 140 (205 - 558)	D-G	14.3 ± 4.5 (9.95 - 21.0)	E-H
St. Lawrence I. TBMU 2008	3.78 ± 1.9 (1.80 - 6.25)	B	384 ± 79 (256 - 461)	EF	412 ± 81 (280 - 523)	B	117 ± 67 (0.920 - 205)	C	536 ± 57 (452 - 623)	A-G	13.8 ± 2.9 (10.1 - 18.9)	E-H
Sinuk R. delta GLGU 2008	24.7 ± 4.8 (15.8 - 30.2)	B	1837 ± 460 (1370 - 2565)	A-F	1580 ± 410 (1030 - 2160)	AB	199 ± 78 (111 - 327)	C	513 ± 86 (376 - 632)	B-G	9.85 ± 3.3 (3.37 - 12.8)	F-H
Sledge I. COMU 2008	9.06 ± 1.8 (6.68 - 11.2)	B	448 ± 135 (314 - 658)	D-F	426 ± 46 (360 - 469)	B	202 ± 70 (121 - 332)	C	557 ± 120 (390 - 726)	A-G	11.7 ± 2.1 (7.96 - 13.9)	F-H
Safety Sound GLGU 2008	31.6 ± 8.3 (20.1 - 39.7)	B	2256 ± 818 (1139 - 2900)	A-E	1990 ± 840 (867 - 2800)	AB	297 ± 190 (142 - 559)	A-C	832 ± 320 (564 - 1240)	A-C	12.8 ± 5.6 (8.16 - 20.9)	E-H
Bluff COMU 2008	8.01 ± 2.8 (3.78 - 12.5)	B	490 ± 146 (311 - 762)	D-F	405 ± 79 (316 - 555)	B	203 ± 58 (106 - 263)	C	536 ± 160 (385 - 846)	A-G	9.76 ± 2.4 (7.33 - 14.2)	GH
Bluff GLGU 2008	72.4 ± 37 (19.4 - 106)	B	1702 ± 486 (1195 - 2357)	A-F	1430 ± 360 (1050 - 1900)	AB	182 ± 53 (125 - 241)	C	533 ± 84 (453 - 654)	A-G	14.1 ± 2.9 (10.9 - 17.6)	E-H
Carolyn I.GLGU 2008	21.8 ± 7.7 (13.1 - 35.6)	B	1811 ± 406 (1144 - 2295)	A-F	1580 ± 360 (986 - 1960)	AB	188 ± 49 (107 - 244)	C	580 ± 120 (380 - 714)	A-G	9.64 ± 5.5 (3.77 - 17.9)	GH
Cape Darby GLGU 2008	21.4 ± 6.0 (12.1 -29.7)	B	1863 ± 817 (982 - 3393)	A-F	1720 ± 570 (990 - 2740)	AB	186 ± 25 (138 - 208)	C	582 ± 62 (488 - 682)	A-G	10.7 ± 1.6 (7.58 - 12.3)	F-H
Cape Denbigh COMU 2009	6.06 ± 1.7 (3.51 - 8.95)	B	292 ± 40 (256 - 344)	EF	343 ± 42 (269 - 386)	B	187 ± 55 (92.3 - 241)	C	558 ± 35 (493 - 596)	A-G	28.3 ± 5.2 (19.6 - 33.7)	C-G
Shaktoolik GLGU 2008	27.5 ± 5.6 (20.2 - 34.2)	B	2103 ± 627 (1384 - 2827)	A-F	1600 ± 590 (1040 - 2260)	AB	271 ± 43 (231 - 330)	A-C	784 ± 190 (555 - 981)	A-C	18.9 ± 5.2 (12.8 - 25.2)	D-H
Shaktoolik GLGU 2009	33.8 ± 27 (14.2 - 86.8)	B	1750 ± 451 (1124 - 2519)	A-F	1870 ± 440 (1440 - 2510)	AB	212 ± 78 (77.9 - 315)	BC	654 ± 81 (515 - 765)	A-E	56.2 ± 14 (38.9 - 78.3)	A
Stuart I. GLGU 2009	29.6 ± 11 (17.5 - 44.1)	B	2267 ± 1853 (353 - 4635)	A-D	3520 ± 2600 (1020 - 6960)	A	235 ± 150 (54.3 - 416)	A-C	466 ± 260 (133 - 696)	C-G	35.2 ± 16 (12.9 - 53.2)	B-D
Little Diomede I. TBMU 2008	5.43 ± 0.82 (4.18 - 6.76)	B	486 ± 54 (420 - 555)	D-F	496 ± 30 (448 - 531)	B	196 ± 19 (166 - 221)	C	623 ± 83 (478 - 713)	A-F	16.9 ± 4.2 (12.3 - 24.2)	D-H
Brevig Mission GLGU 2009	38.1 ± 6.8 (26.0 - 46.1)	B	2844 ± 659 (1751 - 3676)	AB	3470 ± 1100 (1990 - 4970)	A	448 ± 120 (229 - 619)	A	876 ± 190 (527 - 1090)	AB	53.7 ± 7.7 (46.3 - 68.1)	AB
Shismaref Inlet GLGU 2008	284 ± 505 (20.6 - 1314)	B	2405 ± 632 (1655 - 3497)	A-C	2000 ± 330 (1600 - 2400)	AB	271 ± 30 (225 - 319)	A-C	667 ± 61 (582 - 745)	A-D	19.8 ± 5.0 (11.3 - 25.8)	D-H
Kukpuk R. delta GLGU 2008	1529 ± 1162 (81.1 - 2700)	A	3457 ± 1679 (1975 - 5737)	A	2560 ± 1500 (1280 - 4660)	AB	421 ± 170 (273 - 655)	AB	886 ± 310 (597 - 1290)	A	20.4 ± 8.0 (11.3 - 34.6)	D-H
Cape Lisburne UNMU 2009	2.98 ± 1.6 (1.15 - 6.05)	B	333 ± 72 (268 - 477)	EF	437 ± 65 (322 - 504)	B	216 ± 60 (154 - 322)	BC	627 ± 110 (470 - 799)	A-F	41.5 ± 9.4 (31.8 - 57.1)	A-C

Table 6. (Continued).

	Cis-nonachlor	Heptachlor epoxide	Mirex	Octachlorosytrene	Oxychlordane
F-Ratio	3.69	12.6	6.42	4.77	8.72
P	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
St. Lazaria I. COMU 2008	22.2 ± 28 A-C (3.25 - 78.7)	27.2 ± 16 D-H (11.1 - 57.4)	14.0 ± 5.2 BC (7.60 - 23.1)	8.86 ± 1.7 CD (6.63 - 11.6)	49.1 ± 13 D (28.0 - 70.6)
St. Lazaria I. TBMU2008	4.61 ± 3.0 C (0.768 - 9.18)	14.2 ± 5.1 GH (8.95 - 23.4)	13.9 ± 2.3 BC (10.1 - 16.7)	9.66 ± 1.4 CD (8.30 - 11.5)	33.8 ± 3.9 D (29.0 - 41.0)
Aiktak I. GWGU 2009	19.0 ± 6.7 BC (11.4 - 29.5)	72.9 ± 27 B-E (36.8 - 121)	58.8 ± 42 A-C (10.2 - 136)	6.38 ± 2.9 D (2.05 - 11.3)	219 ± 140 CD (51.1 - 481)
St. George I. COMU 2009	9.63 ± 1.7 BC (6.82 - 11.4)	30.4 ± 2.3 C-H (26.7 - 33.5)	10.8 ± 1.5 C (8.08 - 12.7)	12.6 ± 0.56 A-D (12.0 - 13.6)	42.8 ± 5.9 D (34.5 - 49.2)
St. George I. TBMU 2008	4.67 ± 2.6 C (1.41 - 7.52)	12.7 ± 1.6 H (10.5 - 15.0)	12.4 ± 1.9 C (9.85 - 15.3)	9.54 ± 1.2 CD (8.03 - 11.4)	40.7 ± 7.7 D (31.6 - 55.2)
St. Paul I. TBMU 2009	8.62 ± 2.2 C (5.94 - 12.4)	25.9 ± 8.5 E-H (18.1 - 41.2)	8.43 ± 2.1 C (4.39 - 10.5)	9.04 ± 1.3 CD (7.66 - 11.1)	36.6 ± 10 D (22.0 - 49.8)
St. Lawrence I. COMU 2008	5.27 ± 1.4 C (2.84 - 7.19)	13.8 ± 2.4 GH (10.4 - 16.9)	9.83 ± 1.9 C (7.28 - 12.7)	11.8 ± 3.0 A-D (8.47 - 15.8)	40.7 ± 8.8 D (24.8 - 50.8)
St. Lawrence I. TBMU 2008	6.09 ± 2.1 C (3.07 - 8.64)	16.0 ± 5.9 F-H (10.3 - 26.3)	13.3 ± 2.3 C (10.4 - 16.9)	16.1 ± 2.3 A-C (12.4 - 18.4)	49.1 ± 13 D (30.4 - 63.0)
Sinuk R. delta GLGU 2008	30.0 ± 8.0 A-C (18.9 - 43.1)	56.4 ± 9.7 B-H (44.2 - 70.1)	48.2 ± 13 A-C (31.7 - 70.8)	10.3 ± 1.5 B-D (8.24 - 12.6)	247 ± 64 CD (157 - 338)
Sledge I. COMU 2008	20.5 ± 18 BC (9.33 - 58.0)	35.1 ± 23 C-H (17.9 - 82.0)	17.7 ± 5.5 BC (12.2 - 27.2)	16.3 ± 4.2 A-C (12.2 - 23.3)	52.7 ± 13 D (39.6 - 77.8)
Safety Sound GLGU 2008	40.5 ± 13 A-C (27.0 - 58.0)	88.9 ± 26 BC (65.6 - 120)	59.7 ± 20 A-C (37.1 - 82.2)	16.0 ± 5.3 A-C (10.4 - 21.8)	324 ± 100 A-D (176 - 415)
Bluff COMU 2008	23.1 ± 21 A-C (5.08 - 65.0)	31.0 ± 16 C-H (9.21 - 57.1)	26.4 ± 8.7 BC (15.7 - 42.3)	16.4 ± 6.1 A-C (10.7 - 28.0)	52.1 ± 13 D (36.9 - 72.6)
Bluff GLGU 2008	31.0 ± 4.8 A-C (26.0 - 37.7)	67.8 ± 16 B-H (55.2 - 89.3)	48.6 ± 17 A-C (32.0 - 71.3)	10.4 ± 1.4 A-D (8.86 - 12.3)	261 ± 83 B-D (181 - 352)
Carolyn I.GLGU 2008	45.1 ± 12 A-C (30.7 - 64.5)	69.6 ± 16 B-G (48.2 - 90.7)	45.2 ± 11 A-C (25.2 - 57.2)	12.4 ± 3.1 A-D (8.22 - 17.2)	260 ± 80 CD (158 - 402)
Cape Darby GLGU 2008	38.4 ± 11 A-C (26.4 - 52.2)	67.4 ± 7.5 B-H (57.2 - 80.8)	52.4 ± 22 A-C (27.1 - 92.7)	12.3 ± 2.4 A-D (10.3 - 16.8)	248 ± 70 CD (154 - 359)
Cape Denbigh COMU 2009	14.2 ± 4.7 BC (8.68 - 22.3)	26.6 ± 6.4 E-H (17.2 - 33.6)	15.4 ± 3.9 BC (10.1 - 20.4)	15.0 ± 1.1 A-C (13.2 - 16.2)	37.9 ± 9.5 D (28.0 - 54.7)
Shaktoolik GLGU 2008	43.2 ± 15 A-C (27.3 - 64.7)	87.1 ± 6.8 BC (81.0 - 96.3)	63.0 ± 13 A-C (43.8 - 71.3)	14.2 ± 3.0 A-D (11.2 - 17.5)	287 ± 37 B-D (250 - 322)
Shaktoolik GLGU 2009	31.9 ± 11 A-C (15.6 - 49.8)	99.0 ± 23 B (62.0 - 126)	53.6 ± 16 A-C (28.9 - 80.9)	12.2 ± 1.9 A-D (10.0 - 14.8)	391 ± 120 A-C (200 - 564)
Stuart I. GLGU 2009	34.5 ± 19 A-C (11.3 - 58.4)	83.0 ± 51 B-D (21.1 - 138)	69.4 ± 63 AB (5.70 - 148)	10.0 ± 5.3 CD (3.37 - 15.7)	349 ± 290 A-D (18.7 - 701)
Little Diomede I. TBMU 2008	12.5 ± 3.4 BC (7.82 - 17.9)	25.1 ± 5.6 E-H (18.7 - 34.1)	15.8 ± 2.4 BC (12.3 - 19.5)	17.9 ± 3.2 AB (11.7 - 20.7)	56.7 ± 8.2 D (48.3 - 69.9)
Brevig Mission GLGU 2009	57.2 ± 30 AB (30.1 - 110)	169 ± 50 A (80.3 - 233)	98.7 ± 29 A (51.8 - 143)	15.3 ± 1.9 A-C (11.6 - 17.2)	584 ± 170 AB (325 - 854)
Shismaref Inlet GLGU 2008	35.3 ± 6.7 A-C (26.0 - 44.9)	71.7 ± 7.8 B-F (57.4 - 81.0)	55.4 ± 8.8 A-C (43.0 - 64.2)	11.1 ± 2.0 A-D (9.16 - 13.8)	305 ± 70 B-D (203 - 381)
Kukpuk R. delta GLGU 2008	69.7 ± 60 A (19.0 - 150)	99.5 ± 36 B (66.6 - 150)	85.8 ± 37 A (52.1 - 134)	10.0 ± 2.7 CD (7.17 - 13.5)	637 ± 370 A (310 - 1140)
Cape Lisburne UNMU 2009	13.3 ± 2.1 BC (10.3 - 16.2)	33.4 ± 5.9 C-H (27.9 - 44.7)	13.3 ± 4.2 C (8.37 - 20.9)	18.4 ± 2.8 A (14.5 - 21.9)	61.2 ± 11 D (43.0 - 78.0)

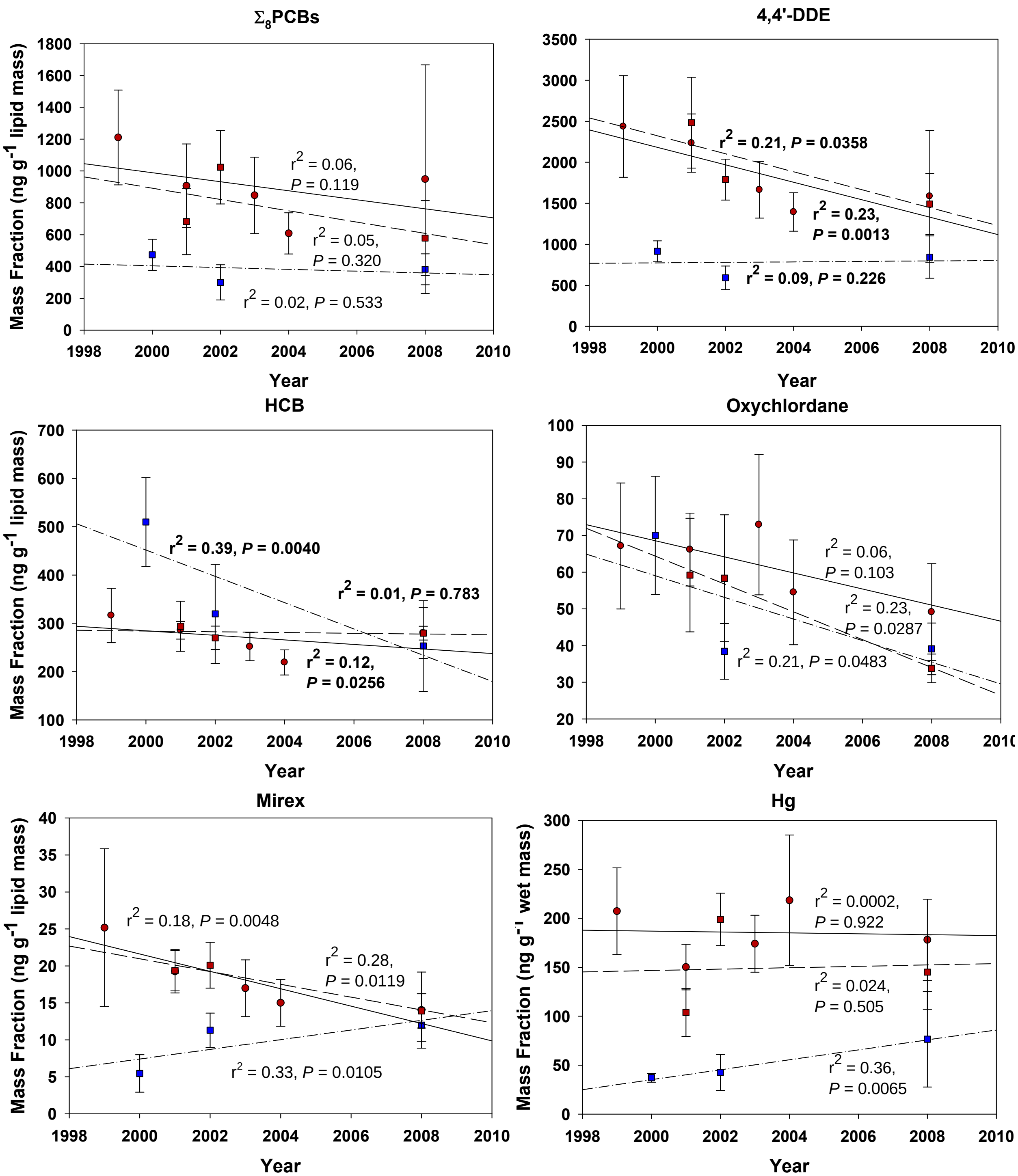

Figure 18. Temporal comparisons (means ± 95 % confidence intervals) for St. Lazaria Island common murre (red circles and solid regression lines) and thick-billed murre (red squares and dashed regression lines) eggs and St. George thick-billed murre eggs (blue squares and dashed-dot regression lines).

Discussion

Mercury (Hg) and Hg, Carbon (C), and Nitrogen (N) Isotopes

Taxonomic Comparisons of Hg Levels and $\delta^{15}N$ and $\delta^{13}C$

The Hg levels found in the Norton Sound, northern Bering Sea, southeastern Bering Sea, and southeastern Gulf of Alaska murre and gull eggs were consistent with the previously reported values from these regions (e.g., see Roseneau *et al.* 2008, Day *et al.* 2006, and Day *et al*. in prep.). Gulls had higher Hg values than murres did across the entire sampling area, and also within the regions where we obtained both kinds of eggs. Foraging differences between these taxa (see Results above) expose them to different environmental reservoirs of Hg, which affects assimilation rates. The complementary $\delta^{15}N$ and $\delta^{13}C$ data, which reflect the nitrogen and carbon pools that the birds were relying on, support this scenario.

Because many species are euryphagic or have poorly characterized feeding habits, measuring $\delta^{15}N$ is often the most effective method for determining trophic levels of organisms. Numerous food web studies have documented positive relationships between Hg levels in organisms and the trophic levels (calculated from $\delta^{15}N$) they were feeding at (e.g., see Jarman *et al.* 1996, Atwell *et al.* 1998, Campbell *et al.* 2005, Chasar *et al.* 2009, Chumchal and Hambright 2009, Dietz *et al.* 2009, and Jaegar *et al.* 2009). This technique of identifying trophic levels is based on the sequential enrichment of ^{15}N relative to ^{14}N by 3 ‰ to 5 ‰ at each increasing level. Higher levels of $\delta^{15}N$ in the gull eggs indicated these birds were foraging on higher trophic level prey, which typically bioaccumulate more Hg. This trend was present in the southern Bering Sea, but not in the northern Bering and Chukchi Sea, and in Norton Sound, the murre eggs actually had higher average $\delta^{15}N$ values than the gull eggs did, indicating that the higher Hg levels found in these regions were related to other factors, not trophic levels.

$\delta^{13}C$ has been used to differentiate between terrestrial/benthic and oceanic/pelagic carbon sources. Carbon from terrestrial/benthic sources is typically more depleted (i.e., it has lower, more negative $\delta^{13}C$ signatures) than carbon from oceanic/pelagic sources (e.g. ,see Fernandes and Sicre 2000, Guo *et al.* 2004, Dunton *et al.* 2006). Like nitrogen data, $\delta^{13}C$ signatures can help identify differences in foraging habits of species. However, the relative Hg uptake by consumers in different habitats is not always well-characterized, and likely varies between given ecosystems and sites. Some studies have shown that benthic habitats can often be more enriched in MeHg than the overlying water columns, and it is also generally accepted that estuarine and coastal environments are efficient at methylating Hg and may be sources of MeHg for more oceanic offshore areas (Fitzgerald *et al.* 2007). This information suggests that, all other things being equal, more depleted terrestrial/benthic $\delta^{13}C$ signatures should be associated with higher Hg levels. This is consistent with the trend found in the 2008-2009 data sets, which showed that the higher Hg levels in the gull eggs were accompanied by more depleted terrestrial $\delta^{13}C$ signatures than the ones associated with the murre eggs. The exception was the southern Bering Sea, but the gull eggs from this region contained much higher $\delta^{15}N$ values, and consequently still had higher Hg levels than the murre eggs did. The combination of trophic levels and habitat/prey selections appear to influence Hg patterns in taxa, reinforcing the importance of including $\delta^{15}N$ and $\delta^{13}C$ analyses in long-term contaminant monitoring programs.

Regional Comparisons of Hg Levels and $\delta^{15}N$ and $\delta^{13}C$

Gull eggs did not exhibit any definitive regional Hg trend in Norton Sound, and levels were similar to values found in the northern Bering and Chukchi sea eggs (Fig. 9). As mentioned earlier (see the section on taxonomic comparisons above), gulls are opportunistic, foraging on a broad range of prey, and the abundance and availability of potential food items can also vary markedly among nesting locations. For example, birds nesting at one colony might feed on a combination surface fish in open ocean waters and invertebrates in estuaries and intertidal zones, and birds breeding at another might forage on terrestrial berries and bird eggs and also consume human refuse at a nearby community dump site. These factors almost certainly cause inconsistencies in the integration of Hg, confounding analyses. $\delta^{15}N$ was significantly higher in the Norton Sound gull eggs than it was in the northern Bering – Chukchi Sea and southern Bering Sea eggs, but trophic levels did not appear to be related to the Hg levels in these samples. This was further supported by the fact that these variables did not appear to be related in the gull data set. However, we did find significant negative correlations between $\delta^{13}C$ and Hg, again suggesting that terrestrial/benthic carbon sources were associated with the higher Hg levels found in these eggs.

The correlation between Hg and $\delta^{13}C$ in the gull eggs was subtle in the colony-by-colony data. The most prominent relationships occurred at Aiktak Island and the Kukpuk River delta, where low Hg and high $\delta^{13}C$ levels were found in the eggs. Aiktak Island is located just south of the eastern entrance to Unimak Pass near the trajectory of the south-flowing, oceanic Alaskan Stream (e.g., see Reed 1968, Mundy *et al.* 2010), so it was not surprising that the eggs from this site displayed the most pelagic/oceanic $\delta^{13}C$ signatures.

The Kukpuk River delta gull colony is located near the base of the Point Hope Spit on a broad expanse of land jutting out into the eastern Chukchi Sea. This nesting location is surrounded by wetlands, but the $\delta^{13}C$ data suggested the birds breeding at it were relying on more oceanic carbon sources with relatively low Hg levels. The gull colonies that produced eggs with the most depleted, terrestrial/benthic $\delta^{13}C$ values were located in Shishmaref Inlet about 120 km north of Bering Strait along the eastern Chukchi Sea shore; near Brevig Mission on the southwestern side of the Seward Peninsula, about 65 km east of Bering Strait; in the Sinuk River delta near the northwestern entrance to Norton Sound, about 40 km west of Nome; on the southern side of Stuart Island in southern Norton Sound, about 65 km east of the Yukon River's northern mouth; and at Shaktoolik South at the eastern end of Norton Sound, about 20 km southeast of Cape Denbigh (Fig. 3). The Shishmaref, Brevig Mission, and Shaktoolik South colonies are all located near coastal lagoons and bays that provide estuarine foraging habitats for the nesting birds. Eggs from the other nesting locations along the northern shores of Norton Sound east of Nome (i.e., at Safety Sound, Bluff, Cape Darby, and Carolyn Island in Golovin Bay; see Fig. 3) had intermediate to low $\delta^{13}C$ values. Eggs from these colonies also had high $\delta^{15}N$ signatures (Fig. 9), indicating the birds breeding in this part of the sound were feeding at higher trophic levels, compared to birds nesting at the other locations. However, murre eggs from this same area also had elevated $\delta^{15}N$ signatures, suggesting the presence of a locally elevated $\delta^{15}N$ source in this part of the embayment's marine ecosystem.

Gull eggs from the Sinuk River delta and Shaktoolik South colonies had the highest Hg levels (Figs. 3 and 9). However, these samples did not have distinctive $\delta^{15}N$ or $\delta^{13}C$ signatures, indicating there may be localized sources of Hg in their vicinities. Although the Sinuk River drains part of the Seward Peninsula where some placer gold mining has occurred, we are not aware of any historical or present day efforts to extract this resource from the Shaktoolik area. More information is required to identify the sources of contamination in these widely separated locales.

The international Arctic Monitoring and Assessment Programme (AMAP) recommended that murre eggs should be used to monitor heavy metals in circumpolar environments because of the distribution and life history traits of these seabirds (AMAP 1998, 1999). Previous studies by STAMP have confirmed that these tissues can be used to identify geographic and temporal differences in Hg levels in Alaskan marine environments (Day *et al.* 2006 and Roseneau *et al.* 2008; also see Day *et al.* in prep). During this project, we collected murre eggs from several previously sampled locations both inside and outside of the Norton Sound – Bering Strait study area to reconfirm the presence of the large-scale geographic pattern reported in 2008 (Roseneau *et al*. 2008) and better describe Hg distribution in this northeastern Bering Sea region. Regional comparisons encompassing all of the sampled murre locations and higher resolution colony-by-colony Hg isotope information are discussed below.

We previously reported that Gulf of Alaska common and thick-billed murre eggs had higher Hg levels than Bering Sea eggs (Day *et al.* 2006), and we suggested these regional trends resulted from different Hg deposition and/or methylation regimes. However, we were not able to eliminate potential food web effects and the possibility of a sampling artifact introduced by a bias toward the presence of more oceanic insular colonies in the Bering Sea and more coastal colonies in the Gulf of Alaska. We recently began addressing these issues by analyzing eggs from more sampling sites in Norton Sound and the Bering and Chukchi seas and Gulf of Alaska, and measuring the $\delta^{15}N$ and $\delta^{13}C$ signatures in them to help clarify the effects of trophic position and habitat utilization on Hg exposure (Day *et al.* in prep). During this work, we were able to confirm that trophic levels influenced the geographic pattern, and we also discovered that the Gulf of Alaska was apparently richer in Hg than the Bering Sea. Furthermore, these finding appeared to be independent of the inshore/offshore locations of the colonies, with one exception—Norton Sound. Murre eggs from this northeastern Bering Sea embayment contained higher Hg levels than the eggs from the other northern Bering and Chukchi sea nesting locations (Fig. 6). We hypothesized that the higher Norton Sound values might be the result of the Yukon River outflow and the inputs from some of the smaller rivers draining the south side of the Seward Peninsula, and/or the historical placer gold mining activities that occurred along these smaller drainages and the northern shores of this coastal embayment.

The geographic patterns in the murres eggs collected for this study corroborated the findings of Day *et al.* (2006) and Day *et al*. (in prep.). Eggs from St. Lazaria Island in the Gulf of Alaska and Cape Denbigh, Bluff, and Sledge Island in Norton Sound had the highest Hg levels, and eggs from the southern Bering Sea and northern Bering and Chukchi sea colonies had the lowest levels (Fig. 6). Mean Hg values in the 2005 Cape Denbigh, Bluff, and Sledge Island eggs were 185 ng g^{-1}, 163 ng g^{-1}, and 122 ng g^{-1}, respectively. Eggs collected from these same nesting locations in 2008-2009 had only slightly lower levels (132 ng g^{-1}, 123 ng g^{-1}, and 75 ng g^{-1}, respectively), and they displayed the same progressively declining east-to-west trends in values (Fig. 13). Correlations between Hg and δ^{15}N levels were significant across all regions, indicating that trophic positions were influencing the geographic pattern. Eggs from the southern Bering Sea not only had the lowest Hg levels, but they also had the lowest δ^{15}N values (Figs. 6 and 7). This was consistent with information suggesting murres tend to feed more heavily on invertebrates in this area (Coyle *et al.* 1992), and this was also supported by the relatively depleted δ^{13}C levels, which indicated the presence of more benthic sources of carbon near the insular colonies. This same trophic information might also explain the higher Hg levels in the Norton Sound eggs, which also had the highest δ^{15}N values (Fig. 7 and Appendix 3). However, Schell *et al.* (1998) reported a geographic gradient in baseline zooplankton δ^{15}N levels ranging from 5.8 ‰ in the southern Bering Sea to 10.5 ‰ in the Chukchi Sea. We cannot quantitatively adjust the Norton Sound δ^{15}N values because there are no corresponding zooplankton data currently available from this region. However, some evidence suggests that the elevated δ^{15}N levels in Norton Sound may be caused by different baseline nitrogen sources, which may in turn mean the elevated Hg values are not entirely a function of the trophic level. This possibility is supported by the fact that the nearby colonies in the northern Bering and Chukchi seas also have higher δ^{15}N values and lower Hg levels, relative to the Gulf of Alaska (Figs. 6 and 7). Furthermore, the Norton Sound eggs also contained the highest δ^{15}N values (Fig. 7), indicating that there was an ecosystem-wide elevation in δ^{15}N levels. This broad-scale regional information lends additional confidence to our conclusion that Hg values are higher in Norton Sound than in the nearby northern Bering and Chukchi sea regions.

The murre egg δ^{13}C signatures also displayed distinct regional trends (Fig. 8). As mentioned above, samples from the southern Bering Sea colonies had surprisingly depleted δ^{13}C levels, given their proximity to the Bering Shelf break (Fig. 8 and Appendix 3; also see Fig. 1 in Springer and Roseneau 1985). These low values are probably related to the amounts and types of invertebrates taken by murres nesting at these locations. The highest δ^{13}C sig natures were found in the St. Lazaria Island eggs in southeastern Alaska, where the dominant oceanographic features are the Alaska Current and a narrow band of continental shelf that only extends about 20 km offshore (e.g., see Mundy *et al*. 2010). The northern Bering and Chukchi sea murre eggs had intermediate δ^{13}C values (Fig. 8 and Appendix 3). Colonies in these regions are exposed to Anadyr Current waters, which are cold, saline, and nutrient rich (e.g., see Springer *et al.* 1987, Woodgate *et al.* 1995, Schell *et al.* 1998), and Alaska Coastal Current waters, which are relatively warm, fresh, and poor in nutrients (e.g., see Coachman *et al.* 1975, Springer *et al.* 1987, Elphick and Hunt 1993). In contrast, Norton Sound receives more direct carbon inputs from the Yukon River and some of the smaller drainages within the embayment (Zou *et al.* 2006). In summary, the combined δ^{13}C, δ^{15}N, and Hg data provide strong evidence that Norton Sound has a unique Hg regime, and this information helped us select which colonies to check for Hg isotopes and explore the mechanisms behind these patterns.

Hg Isotopes

NPRB Project 822 was designed to improve understanding of the distribution of Hg contamination in Norton Sound and the environmental factors that might be contributing to the elevated levels of this potentially harmful pollutant that was found in the region's murre eggs during a previous study (Roseneau *et al.* 2008).

Based on the Hg levels and stable carbon and nitrogen isotope signatures, it was evident that Norton Sound differed oceanographically from other regions in the study area (i.e., the northern Bering and Chukchi seas). We analyzed the murre eggs from the seven representative colonies for stable Hg isotopes to find out if Hg fractionation patterns could be used to help identify unique Hg signatures in the study area (Table 4 and Appendix 4). Given the potential that historical and current gold mining activities and outflows from the Yukon River and some of the smaller drainages might have influenced isotope levels in the Norton Sound, we chose eggs from nesting locations that would give us gradients running westward and northward from the eastern end of the sound into the northern Bering Sea and Bering Strait area. The colonies included Cape Denbigh at Norton Sound's eastern end; Bluff at its mid-point along its northern shore; Sledge Island near its northwestern entrance, where the Yukon River outflow becomes entrained in the northward flowing Alaska Coastal Current (e.g., see Springer *et al.* 1984, Roseneau *et al.* 2000; Little Diomede Island, where the waters from Norton Sound become diluted by the Alaska Coastal Current and pass through Bering Strait (e.g., see Coachman *et al.* 1975); and St. Lawrence Island, which is at the same latitude as Norton Sound, but lies about 200 km offshore near the more oceanic, nutrient-rich waters of the Anadyr Current (Schell *et al.* 1998). We also included murre eggs from St. George Island in the southeastern Bering Sea and St. Lazaria Island in the southeastern Gulf of Alaska in the Hg isotope analyses to increase geographic coverage (Figs. 1 and 3).

The magnitude and pattern of δ^{202}Hg and Δ^{199}Hg that we found at these colonies was similar to recently published information on eggs obtained at St. Lazaria, St. George, and St. Lawrence island in 1999-2002 (Point *et al.* 2011). This was encouraging, because it demonstrated that the Hg isotope patterns reflected the general conditions found in these marine environments annually. Point *et al.* (2011) reported that δ^{202}Hg increased with trophic level at these and other colonies. Other author also reported that δ^{202}Hg was positively correlated with trophic level or δ^{15}N, and suggested that there may be physiological preferences for the assimilation or excretion of Hg isotopes by mass (e.g., see Bergquist and Blum 2007, Laffont *et al.* 2009, Perrot *et al.* 2010). Based on this information, it appears that the heavier Hg isotopes like δ^{202}Hg may become enriched in nitrogen, making them useful for tracing the flow of Hg through food webs. We did not find this correlation in the 2008-2009 data set, but when we included the 1999-2002 information from the three previously studied nesting locations, we found a significant difference between δ^{202}Hg and δ^{15}N (P = 0.003), which confirmed earlier findings. We also discovered a significant negative relationship between δ^{202}Hg and δ^{15}N (P = 0.002) at the Norton Sound colonies, which are closely associated with coastal regimes. This negative relationship may be the result of geographically variable sources of MDF that are stronger than, and contrary to, trophic-related fractionations.

MDF can be induced by photoreduction of Hg^{+2} or MeHg, microbial reduction of Hg^{+2}, or microbial degradation of MeHg (e.g., see Bergquist and Blum 2007, Kritee *et al.* 2007, Yang and Sturgeon 2009). Gradients in water chemistry parameters such as dissolved organic carbon and nitrogen, salinity, temperature, turbidity, and irradiance are likely candidates that may also contribute to in-situ differences in MDF fractionation among areas. If in-situ fractionation was involved in the negative relationship between δ^{202}Hg and δ^{15}N in coastal Norton Sound, the ex-vivo and in-vivo MDF processes may prove to be equally important considerations when using birds or fish for biomonitoring purposes. Although it is possible to generalize about the processes that the δ^{202}Hg signatures might actually represent, the real value of these data may simply be the knowledge of their directions and magnitudes in varying circumstances.

Δ^{199}Hg followed a similar pattern, but it displayed an even more distinctive geographic gradient, with low values deep in Norton Sound at Cape Denbigh that became progressively higher as one moved westward toward the more oceanic waters of the northern Bering Sea (Fig. 12). Δ^{199}H was also negatively correlated to δ^{15}N, which was contrary to evidence in the literature indicating that MIF is not altered by trophic processes (e.g., see Bergquist and Blum 2007, Laffont *et al.* 2009, Perrot *et al.* 2010, Point *et al.* 2011). This suggests that the negative correlations between δ^{15}N and δ^{202}Hg and Δ^{199}Hg are circumstantial and that covariates instead of trophic factors are more likely to be the causative factors. As mentioned above, there are many processes known to induce Hg MDF (e.g., see Bergquist and Blum 2007, Kritee *et al.* 2007, Yang and Sturgeon 2009), or cause other inorganic reactions, including changes in state, valency, complexity, and covalent bonding, which may also be enhanced by organic interactions (Ridley and Stetson 2006). However a combination of laboratory and field observations indicate photoreduction is most likely to be the primary mechanism responsible for MIF in aquatic and atmospheric reservoirs (e.g., see Bergquist and Blum 2007, Carignan *et al.* 2009, Laffont *et al.* 2009, Senn *et al.* 2010, Point *et al.* 2011). If covariates related to differences in water chemistry are considered (e.g., turbidity, dissolved organic carbon and nitrogen, salinity, temperature, irradiance), turbidity appears to stand out as the only factor that could contribute to the trend we found in Norton Sound. Turbid coastal waters in this shallow embayment could inhibit light penetration, and therefore photoreduction-mediated MIF. This situation has been documented in the Gulf of Mexico (Senn *et al.* 2010). Samples of coastal fish caught in waters influenced by the Mississippi River plume were compared to samples from offshore species and both Δ^{199}Hg and δ^{202}Hg were significantly lower in the coastal fish. The lower Δ^{199}Hg and δ^{202}Hg levels were thought to have resulted from offshore sources of MeHg becoming methylated in oceanic waters that had undergone more extensive photochemical degradation because of better water clarity and light penetration before becoming part of the oceanic food web.

The Gulf of Mexico scenario might explain the Δ^{199}Hg and δ^{202}Hg levels that we found in Norton Sound, but other factors might also be involved. Although turbidity could certainly affect the degree of light penetration and photoreduction in this embayment, the amount of irradiance reaching its surface waters would be just as important. Point *et al.* (2011) reported lower MIF in murre eggs from northern Bering and Chukchi sea colonies, compared to eggs from southern Bering Sea and Gulf of Alaska colonies. These authors attributed the lower MIF in the northern eggs to the presence of seasonal sea-ice at these nesting locations, where birds typically arrive well before local ice cover dissipates and forage in open leads for several weeks before laying eggs. The ice cover serves as an effective barrier to sunlight and prevents photoreduction and ocean-atmosphere processes. We also discovered significantly lower MIF in the Norton Sound and northern Bering Sea murre eggs than in the eggs from the southern Bering Sea and Gulf of Alaska colonies. Although this large scale pattern conforms to the Point *et al.* (2011) sea-ice hypothesis, the Δ^{199}Hg patterns at the northern nesting locations did not. Ice cover typically breaks up and dissipates in Norton Sound before it does at either St. Lawrence or Little Diomede islands (Grebmeier *et al.* 2006 and Zhou *et al.* 2007). Given this information, it appears that ice cover alone cannot explain the lower MIF in the Norton Sound and northern Bering Sea murre eggs.

Dissolved organic carbon (DOC) is another factor influencing photoreduction that appears to conflict with the Δ^{199}Hg patterns that we found at the northern murre colonies. Considerable evidence is available suggesting that DOC levels should be higher in Norton Sound than in more offshore areas influenced by oceanic waters. Water samples taken along a southeastern Bering Sea transect showed that DOC and salinity had an inverse relationship and that values were higher in inner shelf waters than in outer shelf waters (Guo *et al.* 2004). Several studies support the possibility that Norton Sound DOC is derived from fluvial sources, because arctic rivers typically flush humic substances from the peat and soil deposits they drain (Fernandes and Sicre 2000). In the Yukon River, levels of total organic carbon (TOC) peak during spring snowmelt (Zou *et al.* 2006) and total annual export flux is about 2 x 10^{12} g (Guo and Macdonald 2006). As a consequence, it is not surprising that most organic carbon (OC) found in the coastal sediments is derived from fluvial organic matter. Sediment studies in several of Alaska's major river basins and oceanic environments have shown that Norton Sound's total *n*-alkane levels are higher than they are in the southeastern Bering Sea, the Navarin Basin, the Gulf of Alaska, and Cook Inlet, suggesting that this coastal embayment receives consistently higher OC inputs than other parts of the study area (Venkatesan and Kaplan 1982; *n*-alkanes are strongly correlated with OC). Also, organic materials containing MeHg and Hg facilitate Hg MIF reactions induced by photoreduction in aquatic systems, and laboratory experiments have demonstrated that when Hg and MeHg are incubated at higher DOC levels, they exhibit higher MIF (Berquist and Blum 2007). Given this information, if organic-mediated photoreduction really was the key driver behind the Norton Sound Δ^{199}Hg values, the higher DOC in this embayment should have enhanced MIF, instead of suppressing it relative to the offshore colonies.

The authors of most recent studies have focused on process-related causes like the ones mentioned above when attempting to explain fractionation patterns in the environment. However, they rarely discuss the potential influences of different source signatures unless they were able to identify discrete Hg point sources. This seems remiss, because Hg isotope data can help identify contaminant sources and this information can play important roles in management and remediation planning and decision making. As stated above, the 2008-2009 analyses identified an increasing east-west trend in δ^{202}Hg and Δ^{199}Hg, with the lowest values at Norton Sound's eastern end and the highest values in the northern Bering Sea (Fig. 12). These analyses also revealed that δ^{13}C was positively correlated with δ^{202}Hg and Δ^{199}Hg, which implied that a terrestrial carbon source was probably present in Norton Sound where the MDF and MIF were the lowest. These data helped confirm that the outflows from the Yukon River and some of the embayment's smaller drainages dominate its water chemistry. The Yukon River alone contributes about 8 % of the total freshwater entering the Arctic Ocean (Aagaard and Carmack 1989), and it is also the source of about 50 % of Norton Sound's sediments (Atlas *et al.* 1983). The annual discharge from this major drainage also contains about 4400 kg of total Hg and 16 kg of MeHg (Schuster *et al.* 2010), and more than 40 ng/L of these contaminants have been found in water samples taken at its highest flow rates, which is 3 times higher than the Environmental Protection Agency (EPA) aquatic life Hg standard for adverse chronic effects to biota. Four other northern rivers were 5 % to 31 % lower, indicating that the Yukon is clearly the largest single point source of Hg in the region and should be recognized as the major source of this contaminant in western Alaska's marine environments. This information, combined with data on currents and the east-west gradient in Norton Sound's Hg values show that coastal systems can be important sources of MeHg in marine environments.

However, it should be noted that cinnabar deposits on the southern Seward Peninsula help elevate Hg levels in nearshore sediments near the Norton Sound murre colonies (Nelson *et al.* 1975). Also, historical gold mining operations that used large quantities of Hg were located in many of the smaller drainages flowing into the sound near these nesting locations and these activities are likely to have contributed in some measure to the elevated sediment levels found in the coastal zone between Sledge Island and Cape Denbigh (e.g., the Daniels Creek drainage near Bluff was heavily mined after its discovery in 1905—see Harrison 1905; old corroding 45 kg iron flasks of liquid mercury were still present in this area in 1968-1971—D.G. Roseneau, pers. obs.). When this information is combined with data on $\delta^{13}C$ and Hg and MeHg levels in the Yukon River outflow, it provides compelling evidence that terrestrial sources are responsible for Norton Sound's elevated Hg values and for the east-to-west gradient that we found in this coastal embayment.

The fact that the $\delta^{202}Hg$ and $\Delta^{199}Hg$ levels also followed this same declining east-to-west trend strongly suggests that the gradient really represents a progression between terrestrial and marine Hg isotope signatures. We would expect the oceanic and atmospheric reservoirs of Hg to be well-mixed, and "old" in the sense that they would have had plenty of time for various forms of Hg reactivity to have taken place (see above). In aquatic biota, fractionation typically has a "heavy" isotope signature—i.e., positive $\delta^{202}Hg$—particularly in marine species (e.g., see Senn *et al.* 2010, Point *et al.* 2011). Lake and coastal studies have reported mixtures of positive and negative $\delta^{202}Hg$ (Bergquist and Blum 2007, Laffont *et al.* 2009, Perrot *et al.* 2010). In contrast, $\Delta^{199}Hg$ signatures in aquatic systems have almost invariably been positive anomalies (e.g., see Bergquist and Blum 2007, Laffont *et al.* 2009, Perrot *et al.* 2010, Senn *et al.* 2010, Point *et al.* 2011), and atmospheric Hg contains the complementary negative $\Delta^{199}Hg$ (Carignan *et al.* 2009) that presumably functions as the opposing end member in ocean-atmosphere exchanges. Hg isotope patterns in terrestrial geological samples differ from the mobile, reactive Hg patterns characteristic of aquatic and atmospheric reservoirs. Cinnabar and other ores, rocks, and geothermal deposits characteristically display negative $\delta^{202}Hg$ signatures ranging as low as -4 ‰ (e.g., see Hintelmann and Lu 2003, Smith *et al.* 2005, Smith *et al.* 2008). Most sediments and coals also have negative $\delta^{202}Hg$ signatures and negative to slightly positive $\Delta^{199}Hg$ signatures (Foucher and Hintelmann 2006, and Biswas *et al.* 2008).

The characteristically negative delta values that are normally found in many terrestrial geological samples support our contention that the higher Hg levels and lower $\delta^{202}Hg$ and $\Delta^{199}Hg$ values in the Norton Sound murres eggs are produced by terrestrial sources of Hg. We believe that erosion in the Yukon River drainage and some of the smaller river systems entering the sound supply newly mobilized Hg to the embayment's water column and sediments. When this terrestrially derived Hg enters the marine environment, it is in a reactive state and becomes available for fractionation. Norton Sound waters eventually mix with Alaska Coastal Current waters and are advected northward into Bering Strait, where the high Hg and low fractionation source signatures become diluted and mix with the lower Hg and more highly fractionated oceanic Hg reservoirs.

Persistent Organic Pollutants (POPs)

General Results

Organochlorine contaminant levels in the murre and gull eggs were similar to the values we found during our previous study (i.e., NPRB Project 534; see Roseneau *et al.* 2008). The Kukpuk River delta glaucous gull eggs had the highest contaminant levels, except for pentachlorobenzene and octachlorostyrene, which were higher in the Norton Sound gull eggs (Table 6). BDE 47 in the Kukpuk eggs was an order of a magnitude higher than in the Shishmaref Inlet eggs, the next most contaminated colony. This information suggests that monitoring flame retardants in gull eggs from colonies north of Bering Strait has the potential to provide valuable data on the distribution and temporal changes in this compound in this region of the state.

Regional Comparisons

Organic contaminant levels in common murre eggs tended to be higher in Norton Sound than in the other sectors of our study area, based on significant differences in HCB, octachlorosytrene, *cis*-nonachlor, mirex, and BDE 47 values (Fig. 16). In contrast, the Norton Sound gull eggs contained lower levels of organic contaminants than eggs from locations outside this coastal embayment (only 4,4'-DDE, octachlorostyrene, and pentachlorobenzene did not differ significantly). However, these apparent differences may be more complex than the data suggest. $\delta^{15}N$ values were significantly higher in the Norton Sound gull and murre eggs than in the eggs from other regions (Fig. 7), which suggest the Norton Sound birds are foraging at higher trophic levels that were exposing them to higher levels of contaminants. $\delta^{13}C$ values, which normally suggest near-shore versus off-shore foraging strategies, also confuse the picture because they did not differ significantly between the taxa (Fig. 8).

Correlations between stable carbon and nitrogen isotopes and organochlorine contaminants are shown in Table 7. Because we expected contaminant levels to increase with trophic level (as indicated by $\delta^{15}N$), we were surprised by the significantly negative correlations between pentachlorobenzene in the glaucous gull eggs and heptachlor epoxide in the Bering Sea common murre eggs. However, negative correlations have also been found in thick-billed murre eggs (Vander Pol *et al.* 2011). Possible explanations for these findings include decoupling between $\delta^{15}N$ and $\delta^{13}C$ and the contaminant data sets, given the fact that the isotope data represented protein fractions of the diets and the contaminant information was based on lipid fractions. If the birds obtained most of their lipids, and hence most of their contaminant loads, from the same prey types they acquired protein from, then close coupling between $\delta^{15}N$ and the contaminants that accumulate at the various trophic levels would be one of the expected outcomes. However, these kinds of couplings are not always present, and if the lipid components of the eggs are primarily derived from body stores obtained from lower trophic level prey, and the protein components are derived from higher trophic level prey (or vice versa), then negative correlations would be the expected outcome. Before we can interpret these data correctly, we need more information on nutrient allocation strategies and their effects on contaminant burdens.

We conducted a second PCA that combined the Hg and $\delta^{15}N$ and $\delta^{13}C$ values (Fig. 19). The Bering and Chukchi sea murre and gull eggs still tended to separate, but the gull eggs did not cluster together as well as they did before (Fig. 17). However, lower proportions of Hg and $\delta^{13}C$ carbon stable isotopes helped separate the Norton Sound and Bering – Chukchi Sea samples (see the Hg section above).

Species Comparisons

A previous study reported that common and thick-billed murre eggs from the same colonies contained different organochlorine contaminant levels (Vander Pol *et al.* 2004). However, the only differences we found in the 2008-2009 samples were in the heptachlor epoxide, pentachlorobenzene, and β-HCH values in the St. George Island eggs (these eggs were collected in different years; thick-bills in 2008 and commons in 2009; see Appendix 2). Pentachlorobenzene levels in the 2008 and 2009 Shaktoolik glaucous gull eggs were also different (MANOVA $F_{1,7} = 18.7$, $P < 0.0034$).

Table 7. Correlations between major contaminants (on a lipid mass basis) and carbon and nitrogen isotope ratios found in common murre (COMU) and glaucous gull (GLGU) eggs collected in 2008-2009. Significant correlations (*P* < 0.05) are shown in bold.

	All Data n=117		All COMUs n=30		Norton Sound COMUs n=15		Bering Sea COMUs n=10		All GLGUs n=52		Norton Sound GLGUs n=37		Bering/Chukchi seas GLGUs n=15	
Pairwise Correlations	r^2	*P*	r^2	*P*	r^2	*P*	r^2	*P*	r^2	*P*	r^2	*P*	r^2	*P*
δ13C-δ15N	0.1429	0.1243	-0.2453	0.1914	0.2751	0.321	**0.8534**	**0.0017**	**0.7254**	**<.0001**	**0.6972**	**<.0001**	**0.9265**	**<.0001**
BDE 47-δ15N	0.0067	0.9426	-0.1362	0.473	0.1559	0.5791	-0.0076	0.9834	-0.0869	0.5402	0.0986	0.5616	**0.5721**	**0.0258**
∑16PCBs-δ15N	0.1275	0.1708	-0.0343	0.8572	**0.5143**	**0.0498**	0.4168	0.2308	-0.1823	0.1959	0.0774	0.6488	0.0924	0.7433
4,4'-DDE-δ15N	-0.0223	0.811	-0.2275	0.2267	0.2436	0.3816	0.168	0.6426	-0.2636	0.059	-0.1856	0.2714	0.0056	0.9841
β-HCH-δ15N	0.1269	0.1726	0.1256	0.5084	0.1895	0.4989	-0.5563	0.0949	-0.2563	0.0666	0.0847	0.6183	0.1394	0.6202
HCB-δ15N	**0.3613**	**<.0001**	**0.5683**	**0.0011**	0.2567	0.3557	0.1949	0.5895	-0.0458	0.7471	**0.3409**	**0.0389**	0.0613	0.8281
Pentachlorobenzene-δ15N	-0.0863	0.3549	-0.1625	0.3908	-0.3016	0.2746	-0.3448	0.3292	**-0.3856**	**0.0048**	**-0.3923**	**0.0163**	-0.0355	0.9002
Cis-nonachlor-δ15N	**0.2215**	**0.0164**	0.2458	0.1905	0.1851	0.509	-0.4358	0.208	-0.1062	0.4537	0.0826	0.6268	0.1579	0.5741
Heptachlor epoxide-δ15N	0.164	0.0772	0.2067	0.273	0.1328	0.6371	**-0.6692**	**0.0343**	-0.218	0.1206	0.0461	0.7863	0.019	0.9463
Mirex-δ15N	0.1657	0.0743	**0.6145**	**0.0003**	**0.7139**	**0.0028**	-0.189	0.601	-0.1656	0.2407	0.0609	0.7202	0.0628	0.824
Oxychlordane-δ15N	0.1125	0.2273	0.2289	0.2237	0.3032	0.272	0.2834	0.4276	-0.2076	0.1397	0.0025	0.9882	0.2319	0.4055
Octachlorosytrene-δ15N	**0.3563**	**<.0001**	0.5388	0.0021	0.3441	0.2091	0.4188	0.2284	0.1467	0.2993	**0.336**	**0.042**	-0.3664	0.1792
BDE 47-δ13C	0.1007	0.2801	0.3081	0.0977	0.3698	0.1749	-0.4266	0.2189	0.2325	0.0973	-0.1474	0.384	**0.6195**	**0.0138**
∑16PCBs-δ13C	**-0.3228**	**0.0004**	0.3716	0.0432	**0.5521**	**0.0328**	0.3508	0.3204	-0.1442	0.3077	-0.228	0.1747	0.1988	0.4775
4,4'-DDE-δ13C	**-0.3605**	**<.0001**	**0.4921**	**0.0057**	**0.6039**	**0.0171**	0.0767	0.8332	-0.3273	0.0179	**-0.4111**	**0.0115**	-0.0457	0.8716
β-HCH-δ13C	**-0.3451**	**0.0001**	**-0.3712**	**0.0435**	0.0679	0.81	**-0.7166**	**0.0197**	-0.1814	0.1982	-0.1892	0.2622	0.1141	0.6856
HCB-δ13C	**-0.2826**	**0.002**	-0.3356	0.0698	0.1519	0.5888	0.0526	0.8853	-0.0717	0.6134	0.0105	0.9509	0.0675	0.8111
Pentachlorobenzene-δ13C	**-0.5481**	**<.0001**	**-0.6208**	**0.0003**	**-0.7024**	**0.0035**	-0.6248	0.0535	**-0.5766**	**<.0001**	**-0.7294**	**<.0001**	-0.2261	0.4178
Cis-nonachlor-δ13C	**-0.2208**	**0.0168**	0.0026	0.989	0.1075	0.703	-0.6072	0.0626	0.0191	0.8932	-0.0707	0.6777	0.2172	0.4368
Heptachlor epoxide-δ13C	**-0.4381**	**<.0001**	-0.115	0.5452	0.1587	0.5722	**-0.6459**	**0.0437**	**-0.3063**	**0.0272**	**-0.369**	**0.0246**	-0.1101	0.6961
Mirex-δ13C	**-0.3788**	**<.0001**	-0.057	0.7647	0.3446	0.2085	-0.0362	0.921	-0.2159	0.1243	-0.27	0.106	0.0647	0.8187
Oxychlordane-δ13C	**-0.3634**	**<.0001**	0.2679	0.1524	0.4213	0.1178	0.3717	0.2902	-0.1645	0.2438	**-0.425**	**0.0087**	0.2719	0.3269
Octachlorosytrene-δ13C	-0.0743	0.426	-0.2056	0.2758	0.2794	0.3132	0.3454	0.3283	-0.1171	0.4085	0.018	0.9158	-0.4162	0.1228

Temporal Comparisons

The 2008 St. Lazaria Island common murre eggs showed a slight increase in 4,4'-DDE, Σ_8PCBs, and HCB levels, compared to previous values (Vander Pol *et al.* 2004). Because this colony is one of STAMP's annual long-term monitoring sites, we will continue collecting data on the status of these contaminants at this location in upcoming years.

We did not expect to find increased levels of mirex in the 2008 St. George Island thick-billed murre eggs (Fig. 18) because this pesticide is a legacy compound that was banned by the Stockholm Convention on Persistent Organic Pollutants in May 2004 (http://chm.pops.int/). The increase indicates there is a lag in the system that may persist for some time. An increase in this contaminant was also found in the Bogoslof Island 2000-2005 common murre eggs (Vander Pol 2007). Given the combined information from these sampling sites, we believe this pesticide should be monitored in the southern Bering Sea for several more years. Because St. George Island is another one of STAMP's long-term monitoring sites, we will also continue to collect data on this contaminant at this location in future years. It is worth noting that an exemption from the 2004 Stockholm Convention allows China to produce 10-30 tons of this compound annually to help control termites. Also, because Russia and the United States (USA) did not sign the treaty, information is not available from these countries. However, the EPA banned the use of this pesticide in the US in 1978 (http://www.epa.gov/pbt/pubs/mirex.htm). The mirex trend was similar to that for mercury (Fig. 18) collaborating the possible Asian influence to this region of the Southern Bering Sea.

In 1999-2002, organic contaminant levels differed between the St. Lazaria and St. George island murre colonies (see Fig. 6 in Roseneau *et al.* 2008), but in 2008, these differences were much smaller (Fig.18). This change over the years may explain in part some of the overlap we found between the St. Lawrence Island murre and Stuart Island gull eggs. Although the first PC still tended to separate most of the Bering and Chukchi sea glaucous gull eggs from the murre eggs (Fig. 17), the separation between this region and the Gulf of Alaska was not as distinct as it was during our earlier study when it was complete (see Figs. 8 and 10 in Roseneau *et al.* 2008; also see Vander Pol 2007).

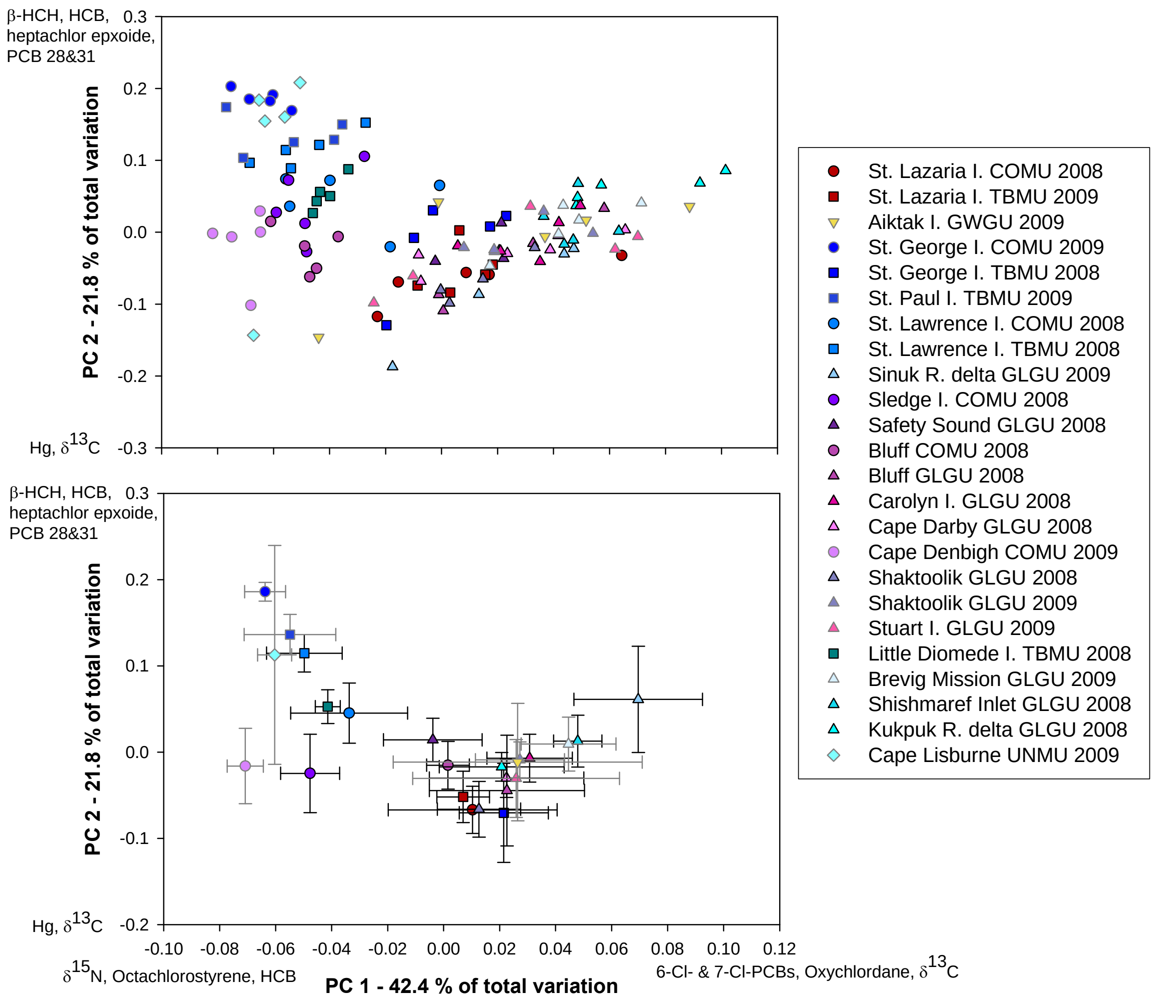

Figure 19. Principal components analyses (means and standard errors) for organic compounds, mercury (Hg), and stable carbon and nitrogen isotopes in common murre (COMU), thick-billed murre (TBMU), glaucous gull (GLGU), and glaucous-winged gull (GWGU) eggs collected at 19 Alaskan colonies in 2008-2009. Compounds contributing to the loadings are shown along the axes (individual samples at top and colony means at bottom).

Conclusions

Mercury (Hg) and Hg, Carbon (C), and Nitrogen (N) Isotopes

1. Hg levels in murre eggs were consistently higher in Norton Sound, compared to the Bering and Chukchi seas.

2. Combined Hg and $\delta^{13}C$ and $\delta^{15}N$ data indicate Norton Sound has a unique mercury regime and that the highest levels of this contaminant are found at its eastern end and along its northern shores between Cape Denbigh and the Sledge Island vicinity.

3. Combined $\delta^{13}C$, $\delta^{202}Hg$, and $\Delta^{199}Hg$ data provide compelling evidence that terrestrial sources of Hg are responsible for the elevated levels in Norton Sound and for the declining east-to-west gradient in this coastal embayment.

4. The Yukon River is the largest single point source of Hg in the Norton Sound region and should be recognized as the major source of this contaminant in western northwestern Alaska's marine environments.

5. Differences between common and thick-billed murre Hg levels were relatively small in relation to the geographic trends across the study area indicating that either species can be used to determine regional patterns of this contaminant.

6. Hg, $\delta^{13}C$, and $\delta^{15}N$ isotope patterns did not differ significantly among common and thick-billed murre eggs collected from the same nesting locations.

7. Gull egg Hg levels varied among the Norton Sound colonies, but were not unique to the study area.

8. Overall, gull eggs contained higher levels of Hg and $\delta^{15}N$, and lower levels of $\delta^{13}C$, compared to murre eggs, indicating that the differences in Hg contamination between these taxa were probably the result of differences in foraging behavior.

9. Norton Sound murre and gull eggs contained higher levels of $\delta^{15}N$, compared to other regions, and this difference may have been caused by the Norton Sound birds feeding at higher trophic levels, or by an ecosystem-wide higher $\delta^{15}N$ baseline level.

10. Norton Sound murre eggs had significantly lower $\delta^{13}C$ levels relative to the northern Bering and Chukchi seas, indicating that the carbon sources in this embayment are probably terrestrial in origin.

11. Norton Sound murre eggs had significantly lower $\delta^{202}Hg$ and $\Delta^{199}Hg$ levels relative to the northern Bering and Chukchi seas, indicating lower levels of mass dependent and mass independent fractionation that may have resulted from:

    a. Suppression of fractionation processes because of increased turbidity; or

b. Inputs of terrestrially derived Hg from geological sources, which are typically characterized by low or negative fractionation; or

c. Both of these factors.

12. Sea-ice cover alone cannot explain the lower MIF found in the Norton Sound and northern Bering Sea murre eggs.

13. Because trophic levels and habitat/prey selections appear to influence Hg patterns in taxa, $\delta^{15}N$ and $\delta^{13}C$ analyses should be included in long-term contaminants monitoring programs.

Persistent Organic Pollutants (POPs)

1. The geographic organic contaminant patterns found in the Bering Sea and Gulf of Alaska during NPRB Project 534 are still present, but they may be weakening.

2. There are clear differences in organic contaminant levels between murre and gull eggs.

3. Organic contaminant levels appear to be stable or decreasing, with the exception of mirex at St. George Island, where it has increased in thick-billed murre eggs since 2002.

4. The increase in mirex at St. George Island, coupled with a similar increase previously documented in Bogoslof Island common murre eggs, indicates this pesticide should be monitored in the southern Bering Sea for several more years.

5. The variable POP and Hg levels found in the gull eggs clearly reflect differences in prey availability among sampling locations and the opportunistic feeding habits of these birds indicating they are not good candidates for contaminants monitoring programs.

6. Monitoring POPs in Bering and Chukchi seas and Gulf of Alaska murre eggs can help identify a variety of physical and chemical factors that may be affecting these environments in different ways.

Recommendations

1. There is a need to clarify what effects the Yukon River sediments and suspended particulates entering Norton Sound have on the embayment's Hg isotope signatures.

2. There is a need to measure $\delta^{15}N$ and $\delta^{13}C$ isotope levels in Norton Sound zooplankton so that quantitative corrections can be made across regions and Hg loading can be compared among sampling sites more accurately.

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Appendix 1. A typical egg collecting kit used to mail supplies and safely transport murre and gull eggs for this study.

Appendix 2. Murre and gull egg samples banked in the Marine ESB in Charleston, South Carolina, that were used for polybrominated diphenyl ether (PBDE), polychlorinated biphenyl (PCB), organochlorine pesticide, total mercury (Hg), and carbon and nitrogen stable isotope analyses.

ID			Species	Colony	Collection	Mass (g)			Length (cm)	Width (cm)	Notes
Number	Storage	Field		Location	Date	Whole Egg	Contents	Eggshell			
1234	ST09E1234C	STLA03COMU08	Uria aalge	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	119.2	99.6	18.8	not measured	not measured	
1235	ST09E1235C	STLA04COMU08	Uria aalge	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	116.2	96.6	19.4	not measured	not measured	
1236	ST09E1236C	STLA05COMU08	Uria aalge	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	124.0	101.6	18.2	not measured	not measured	
1238	ST09E1238C	STLA07COMU08	Uria aalge	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	116.2	95.9	19.9	not measured	not measured	
1240	ST09E1240C	STLA09COMU08	Uria aalge	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	106.5	88.4	17.9	not measured	not measured	
1242	ST09E1242C	STLA01TBMU08	Uria lomvia	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	99.6	82.1	16.9	not measured	not measured	
1243	ST09E1243C	STLA02TBMU08	Uria lomvia	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	111.6	92.7	18.6	not measured	not measured	
1244	ST09E1244C	STLA03TBMU08	Uria lomvia	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	113.7	96.2	16.8	not measured	not measured	
1245	ST09E1245C	STLA04TBMU08	Uria lomvia	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	92.4	74.9	16.9	not measured	not measured	
1246	ST09E1246C	STLA05TBMU08	Uria lomvia	SE Gulf of Alaska, St. Lazaria I.	7/9/2008	94.4	80.3	13.7	not measured	not measured	
1250	ST09E1250C	DIOM04TBMU08	Uria lomvia	Bering Strait, Little Diomede I.	7/2/2008	129.8	104.1	21.3	not measured	not measured	
1256	ST09E1256C	DIOM10TBMU08	Uria lomvia	Bering Strait, Little Diomede I.	7/2/2008	118.5	98.5	19.7	not measured	not measured	
1257	ST09E1257C	DIOM11TBMU08	Uria lomvia	Bering Strait, Little Diomede I.	7/2/2008	111.5	90.3	20.8	not measured	not measured	
1260	ST09E1260C	DIOM14TBMU08	Uria lomvia	Bering Strait, Little Diomede I.	7/2/2008	125.0	101.9	22.0	not measured	not measured	
1261	ST09E1261C	DIOM15TBMU08	Uria lomvia	Bering Strait, Little Diomede I.	7/2/2008	120.2	98.3	21.5	not measured	not measured	
1265	ST09E1265C	STLW04COMU08	Uria aalge	N Bering Sea, St. Lawrence I.	6/29/2008	126.5	104.9	17.2	not measured	not measured	
1266	ST09E1266C	STLW05COMU08	Uria aalge	N Bering Sea, St. Lawrence I.	6/29/2008	106.0	84.3	21.1	not measured	not measured	
1267	ST09E1267C	STLW06COMU08	Uria aalge	N Bering Sea, St. Lawrence I.	6/29/2008	129.5	99.5	29.0	not measured	not measured	
1268	ST09E1268C	STLW07COMU08	Uria aalge	N Bering Sea, St. Lawrence I.	6/29/2008	122.0	100.9	20.6	not measured	not measured	
1275	ST09E1275C	STLW14COMU08	Uria aalge	N Bering Sea, St. Lawrence I.	6/29/2008	137.0	107.2	29.1	not measured	not measured	
1278	ST09E1278C	STLW02TBMU08	Uria lomvia	N Bering Sea, St. Lawrence I.	6/29/2008	130.3	108.9	21.2	not measured	not measured	
1279	ST09E1279C	STLW03TBMU08	Uria lomvia	N Bering Sea, St. Lawrence I.	6/29/2008	117.2	98.1	18.5	not measured	not measured	
1281	ST09E1281C	STLW05TBMU08	Uria lomvia	N Bering Sea, St. Lawrence I.	6/29/2008	127.1	104.9	22.0	not measured	not measured	
1284	ST09E1284C	STLW08TBMU08	Uria lomvia	N Bering Sea, St. Lawrence I.	6/29/2008	123.6	100.1	19.8	not measured	not measured	
1287	ST09E1287C	STLW11TBMU08	Uria lomvia	N Bering Sea, St. Lawrence I.	6/29/2008	123.8	104.3	19.0	not measured	not measured	
1292	ST09E1292C	SLED01COMU08	Uria aalge	Norton Sound, Sledge I.	6/21/2008	121.7	94.0	24.1	7.92	4.75	
1295	ST09E1295C	SLED05COMU08	Uria aalge	Norton Sound, Sledge I.	6/21/2008	126.3	100.9	22.8	7.80	4.18	
1301	ST09E1301C	SLED11COMU08	Uria aalge	Norton Sound, Sledge I.	6/21/2008	123.3	103.1	18.1	7.62	4.26	
1303	ST09E1303C	SLED13COMU08	Uria aalge	Norton Sound, Sledge I.	6/21/2008	113.0	92.6	17.9	7.17	4.13	
1305	ST09E1305C	SLED15COMU08	Uria aalge	Norton Sound, Sledge I.	6/21/2008	121.2	100.6	19.3	7.28	4.30	
1307	ST09E1307C	BLUF02COMU08	Uria aalge	Norton Sound, Bluff	6/20/2008	116.2	97.8	18.1	not measured	not measured	
1309	ST09E1309C	BLUF04COMU08	Uria aalge	Norton Sound, Bluff	6/20/2008	132.0	110.1	21.5	not measured	not measured	
1314	ST09E1314C	BLUF09COMU08	Uria aalge	Norton Sound, Bluff	6/20/2008	122.1	101.2	19.8	not measured	not measured	
1319	ST09E1319C	BLUF14COMU08	Uria aalge	Norton Sound, Bluff	6/20/2008	117.8	97.8	19.9	not measured	not measured	
1320	ST09E1320C	BLUF15COMU08	Uria aalge	Norton Sound, Bluff	6/20/2008	121.3	100.1	20.8	not measured	not measured	
1321	ST09E1321C	STGE01TBMU08	Uria lomvia	SE Bering Sea, St. George I.	7/11/2008	90.4	73.4	12.1	6.99	4.31	Egg contained a developing embryo about 2.5 cm in diameter.
1331	ST09E1331C	STGE11TBMU08	Uria lomvia	SE Bering Sea, St. George I.	7/11/2008	106.0	89.1	16.1	6.94	4.22	The egg contained an embryo that was about 2 cm in diameter.
1333	ST09E1333C	STGE13TBMU08	Uria lomvia	SE Bering Sea, St. George I.	7/11/2008	116.2	97.9	18.1	7.04	4.37	The egg contained a developing embryo.
1334	ST09E1334C	STGE14TBMU08	Uria lomvia	SE Bering Sea, St. George I.	7/11/2008	101.0	88.0	12.9	7.23	4.02	
1335	ST09E1335C	STGE15TBMU08	Uria lomvia	SE Bering Sea, St. George I.	7/11/2008	107.3	91.9	14.9	7.05	4.14	

Appendix 2 (continued).

ID			Species	Colony	Collection	Mass (g)					Notes
Number	Storage	Field		Location	Date	Whole Egg	Contents	Eggshell	Length (cm)	Width (cm)	
1339	ST09E1339C	SINU05GLGU08	Larus hyperboreus	Norton Sound, Sinuk River Delta	6/6/2008	98.3	87.1	11.0	6.86	5.15	
1340	ST09E1340C	SINU06GLGU08	Larus hyperboreus	Norton Sound, Sinuk River Delta	6/6/2008	92.5	80.8	11.4	7.21	4.96	
1343	ST09E1343C	SINU11GLGU08	Larus hyperboreus	Norton Sound, Sinuk River Delta	6/6/2008	96.2	87.8	8.2	7.12	5.19	
1344	ST09E1344C	SINU12GLGU08	Larus hyperboreus	Norton Sound, Sinuk River Delta	6/6/2008	95.6	85.6	9.9	7.05	5.12	
1345	ST09E1345C	SINU13GLGU08	Larus hyperboreus	Norton Sound, Sinuk River Delta	6/6/2008	115.8	104.3	11.2	7.51	5.40	
1349	ST09E1349C	KUKP04GLGU08	Larus hyperboreus	E Chukchi Sea, Kukpuk River Delta	7/5/2008	106.0	94.1	11.3	7.90	5.14	
1351	ST09E1351C	KUKP06GLGU08	Larus hyperboreus	E Chukchi Sea, Kukpuk River Delta	7/5/2008	94.6	83.4	10.9	6.23	4.65	
1354	ST09E1354C	KUKP10GLGU08	Larus hyperboreus	E Chukchi Sea, Kukpuk River Delta	7/5/2008	95.8	85.7	10.1	6.51	4.55	
1357	ST09E1357C	KUKP13GLGU08	Larus hyperboreus	E Chukchi Sea, Kukpuk River Delta	7/5/2008	108.3	96.5	11.5	7.31	4.68	
1358	ST09E1358C	KUKP14GLGU08	Larus hyperboreus	E Chukchi Sea, Kukpuk River Delta	7/5/2008	109.0	96.1	11.2	7.45	5.30	
1365	ST09E1365C	SAFE06GLGU08	Larus hyperboreus	Norton Sound, Safety Sound	6/12/2008	101.6	88.1	11.1	7.27	5.13	
1367	ST09E1367C	SAFE08GLGU08	Somateria mollissima?	Norton Sound, Safety Sound	6/12/2008	100.3	88.5	11.6	6.93	5.14	
1368	ST09E1368C	SAFE09GLGU08	Larus hyperboreus	Norton Sound, Safety Sound	6/12/2008	112.6	100.2	12.3	7.72	5.19	
1369	ST09E1369C	SAFE10GLGU08	Larus hyperboreus	Norton Sound, Safety Sound	6/12/2008	117.4	100.9	11.8	7.73	5.39	
1370	ST09E1370C	SAFE12GLGU08	Larus hyperboreus	Norton Sound, Safety Sound	6/12/2008	113.5	96.2	16.5	7.17	5.44	
1371	ST09E1371C	CDAR01GLGU08	Larus hyperboreus	Norton Sound, Cape Darby	6/12/2008	91.9	75.8	15.9	7.40	4.96	
1374	ST09E1374C	CDAR04GLGU08	Larus hyperboreus	Norton Sound, Cape Darby	6/12/2008	101.7	91.3	9.6	7.28	5.09	
1377	ST09E1377C	CDAR07GLGU08	Larus hyperboreus	Norton Sound, Cape Darby	6/12/2008	111.3	99.1	11.8	7.58	5.22	
1379	ST09E1379C	CDAR09GLGU08	Larus hyperboreus	Norton Sound, Cape Darby	6/12/2008	115.5	102.8	12.5	7.59	5.35	
1380	ST09E1380C	CDAR10GLGU08	Larus hyperboreus	Norton Sound, Cape Darby	6/12/2008	122.2	110.6	10.5	7.79	5.39	
1384	ST09E1384C	BLUF06GLGU08	Larus hyperboreus	Norton Sound, Bluff	6/9/2008	103.3	85.7	17.1	6.63	4.78	Several grams of contents remained in the shell.
1385	ST09E1385C	BLUF07GLGU08	Larus hyperboreus	Norton Sound, Bluff	6/9/2008	108.4	81.8	25.5	7.18	4.68	Several grams of contents remained in the shell.
1388	ST09E1388C	BLUF10GLGU08	Larus hyperboreus	Norton Sound, Bluff	6/9/2008	104.4	92.6	11.0	7.47	4.57	
1389	ST09E1389C	BLUF11GLGU08	Larus hyperboreus	Norton Sound, Bluff	6/9/2008	113.7	102.3	10.7	7.28	4.88	The egg contained a small embryo.
1390	ST09E1390C	GOBA01GLGU08	Larus hyperboreus	Norton Sound, Carolyn I. (Golovin Bay)	6/12/2008	97.1	87.2	9.8	7.37	4.97	
1393	ST09E1393C	GOBA04GLGU08	Larus hyperboreus	Norton Sound, Carolyn I. (Golovin Bay)	6/12/2008	115.2	104.6	10.2	6.71	4.98	
1394	ST09E1394C	GOBA06GLGU08	Larus hyperboreus	Norton Sound, Carolyn I. (Golovin Bay)	6/12/2008	120.7	106.3	13.9	7.44	4.83	
1397	ST09E1397C	GOBA09GLGU08	Larus hyperboreus	Norton Sound, Carolyn I. (Golovin Bay)	6/12/2008	123.5	108.0	14.1	7.10	5.00	
1398	ST09E1398C	GOBA10GLGU08	Larus hyperboreus	Norton Sound, Carolyn I. (Golovin Bay)	6/12/2008	98.1	88.3	9.5	6.69	4.50	
1401	ST09E1401C	SHAK02GLGU08	Larus hyperboreus	Norton Sound, Shaktoolik South	6/8/2008	100.4	83.1	17.0	7.50	4.96	Two egg clutch, 1 egg broken
1402	ST09E1402C	SHAK03GLGU08	Larus hyperboreus	Norton Sound, Shaktoolik South	6/8/2008	115.4	92.4	15.0	7.74	5.27	Two egg clutch, 1 egg broken
1403	ST09E1403C	SHAK04GLGU08	Larus hyperboreus	Norton Sound, Shaktoolik South	6/8/2008	110.5	95.8	14.5	7.52	5.23	Two egg clutch, 1 egg broken
1404	ST09E1404C	SHAK05GLGU08	Larus hyperboreus	Norton Sound, Shaktoolik South	6/8/2008	97.2	88.4	9.2	7.58	4.87	Two egg clutch, 1 egg broken
1407	ST09E1407C	TINC01GLGU08	Larus hyperboreus	NW Seward Peninsula, Tin Creek (SE of Shishmaref)	6/17/2008	100.2	88.7	11.4	6.96	4.80	
						89.9	79.8	9.8	6.79	4.61	
1411	ST09E1411C	TINC05GLGU08	Larus hyperboreus	NW Seward Peninsula, Tin Creek (SE of Shishmaref)	6/17/2008	90.8	81.6	9.2	6.75	4.70	
						93.0	83.7	9.2	6.82	4.67	
						88.6	68.2	16.3	6.51	4.56	
1414	ST09E1414C	SHFB03GLGU08	Larus hyperboreus	NW Seward Peninsula, Arctic Lagoon (SSE of Shishmaref)	6/16/2008	99.9	90.0	8.8	7.19	4.77	
						111.3	98.8	11.7	7.81	4.78	
						95.4	84.7	10.6	7.61	4.74	
1415	ST09E1415C	SHFB04GLGU08	Larus hyperboreus	NW Seward Peninsula, Arctic Lagoon (SSE of Shishmaref)	6/16/2008	97.0	87.0	9.6	6.85	4.70	
						103.8	90.5	9.8	6.64	4.89	
						73.8	58.8	14.3	6.42	4.34	
1416	ST09E1416C	SHFB05GLGU08	Larus hyperboreus	NW Seward Peninsula, Arctic Lagoon (SSE of Shishmaref)	6/16/2008	85.8	76.2	9.1	6.32	4.58	Three egg clutch, 1 egg broken
						88.8	79.9	8.3	6.48	4.58	

Appendix 2 (continued).

ID			Species	Colony	Collection	Mass (g)			Length (cm)	Width (cm)	Notes
Number	Storage	Field		Location	Date	Whole Egg	Contents	Eggshell			
1419	ST10E1419C	STUA03GLGU09	Larus hyperboreus	Norton Sound, Stuart Island (South River A)	6/8/2009	88.64	78.8	9.73	7.6	4.7	Egg had a small, 2cm embryo.
1420	ST10E1420C	STUA04GLGU09	Larus hyperboreus	Norton Sound, Stuart Island (South River A)	6/8/2009	103.93	90.51	12.86	7.44	5.26	Egg A had a small, 2cm embryo and Egg B had a 1.5cm embryo.
						99.47	86.31	12.16	7.29	5.15	
1421	ST10E1421C	STUA05GLGU09	Larus hyperboreus	Norton Sound, Stuart Island (South River A)	6/8/2009	95.25	81.65	12.92	7.82	4.83	Egg had a small, 2cm embryo.
1422	ST10E1422C	STUA06GLGU09	Larus hyperboreus	Norton Sound, Stuart Island (South River A)	6/8/2009	105.49	91.14	13.57	7.62	5.2	Egg A had a small, 2cm embryo,Egg B was broken and discarded.
1423	ST10E1423C	STUA07GLGU09	Larus hyperboreus	Norton Sound, Stuart Island (South River A)	6/8/2009	99.33	87.9	10.94	7.38	5.28	Egg had a 2.5-3.0cm embryo with large developing veins and arteries.
1424	ST10E1424C	SHAK01GLGU09	Larus hyperboreus	Norton Sound, Shaktoolik South	6/2/2009	116.26	101.92	11.16	7.81	5.25	
						113.54	101.75	8.88	7.62	5.27	
1426	ST10E1426C	SHAK03GLGU09	Larus hyperboreus	Norton Sound, Shaktoolik South	6/2/2009	129.91	110.47	13.17	7.89	5.56	
1427	ST10E1427C	SHAK04GLGU09	Larus hyperboreus	Norton Sound, Shaktoolik South	6/2/2009	115.19	99.81	11.69	7.45	5.37	
1428	ST10E1428C	SHAK05GLGU09	Larus hyperboreus	Norton Sound, Shaktoolik South	6/2/2009	113.43	99.23	10.17	7.99	5.12	
						107.93	91.58	11.71	7.61	5.17	
1429	ST10E1429C	SHAK06GLGU09	Larus hyperboreus	Norton Sound, Shaktoolik South	6/2/2009	104.68	93.18	8.52	7.31	5.17	
						101.53	90.35	9.35	7.35	5.08	
1433	ST10E1433C	BREV03GLGU09	Larus hyperboreus	Norton Sound, Brevig Mission KTS	5/30/2009	102.89	94.59	10.48	7.48	5.05	
						110.83	98.14	10.9	7.87	5.16	
1435	ST10E1435C	BREV05GLGU09	Larus hyperboreus	Norton Sound, Brevig Mission KTS	5/30/2009	128.16	111	12.15	7.84	5.53	
1436	ST10E1436C	BREV06GLGU09	Larus hyperboreus	Norton Sound, Brevig Mission KTS	5/30/2009	103.12	89.6	13.52	7.21	5.19	
						91.85	81.55	10.3	7.07	4.95	
1439	ST10E1439C	BREV09GLGU09	Larus hyperboreus	Norton Sound, Brevig Mission KTS	5/30/2009	107.52	95.81	11.55	7.18	5.29	
						106.08	91.64	10.37	7.81	5.07	
1441	ST10E1441C	BREV11GLGU09	Larus hyperboreus	Norton Sound, Brevig Mission KTS	5/30/2009	101.91	86.92	11.75	7.09	5.23	
1443	ST10E1443C	CDEN02COMU09	Uria aalge	Norton Sound, Cape Denbigh	6/19/2009	115.9	95.61	18.39	8.56	5.07	
1446	ST10E1446C	CDEN05COMU09	Uria aalge	Norton Sound, Cape Denbigh	6/19/2009	119.28	99.4	17.89	8.26	5.28	
1448	ST10E1448C	CDEN07COMU09	Uria aalge	Norton Sound, Cape Denbigh	6/19/2009	123.21	102.02	18.81	8.86	5.17	
1449	ST10E1449C	CDEN08COMU09	Uria aalge	Norton Sound, Cape Denbigh	6/19/2009	113.68	95.48	15.75	8.41	5.07	
1452	ST10E1452C	CDEN11COMU09	Uria aalge	Norton Sound, Cape Denbigh	6/19/2009	119.68	98.91	18.63	8.34	5.22	
1454	ST10E1454C	CLIS01UNMU09	Uria spp.	E Chukchi Sound, Cape Lisburne	7/5/2009	106.84	86.22	17.62	7.3	5.91	
1455	ST10E1455C	CLIS02UNMU09	Uria spp.	E Chukchi Sound, Cape Lisburne	7/5/2009	109.48	90.29	17.1	8.24	5.11	
1457	ST10E1457C	CLIS04UNMU09	Uria spp.	E Chukchi Sound, Cape Lisburne	7/5/2009	109.51	94.73	13.94	8.13	5.26	
1458	ST10E1458C	CLIS05UNMU09	Uria spp.	E Chukchi Sound, Cape Lisburne	7/5/2009	86	73.64	12.04	7.77	4.74	Egg had a 1.4 cm embryo with developing blood vessels.
1460	ST10E1460C	CLIS07UNMU09	Uria spp.	E Chukchi Sound, Cape Lisburne	7/5/2009	94.28	78.94	13.24	7.56	4.94	Egg had a 1.5 cm embryo with developing blood vessels.
1463	ST10E1463C	STGE03COMU09	Uria aalge	SE Bering Sea, St. George Island	6/24/2009	118.52	97.85	17.6	8.54	5.15	
1466	ST10E1466C	STGE06COMU09	Uria aalge	SE Bering Sea, St. George Island	6/24/2009	107.55	90.22	16.04	8.11	5.11	
1469	ST10E1469C	STGE09COMU09	Uria aalge	SE Bering Sea, St. George Island	6/24/2009	117.69	97.05	16.48	8.59	5.19	
1470	ST10E1470C	STGE10COMU09	Uria aalge	SE Bering Sea, St. George Island	6/24/2009	119.21	100.59	16.8	8.88	5.07	
1472	ST10E1472C	STGE12COMU09	Uria aalge	SE Bering Sea, St. George Island	6/24/2009	97.44	82.02	13.67	7.73	4.92	
1473	ST10E1473C	AIKT01GWGU09	Larus glaucescens	E. Aleutian Islands, Aiktak Island	6/21/2009	111.52	96.28	11.18	7.53	5.24	Egg B was rotten and thrown out.
1474	ST10E1474C	AIKT02GWGU09	Larus glaucescens	E. Aleutian Islands, Aiktak Island	6/21/2009	99.65	85.92	12.46	7.39	5.04	
						98.08	86.31	11.77	7	5.1	
1475	ST10E1475C	AIKT03GWGU09	Larus glaucescens	E. Aleutian Islands, Aiktak Island	6/21/2009	103.36	89.3	13.59	7.16	5.18	Egg B was rotten and thrown out.
1477	ST10E1477C	AIKT05GWGU09	Larus glaucescens	E. Aleutian Islands, Aiktak Island	6/21/2009	95.66	84.46	9.7	7.43	4.93	Egg B was rotten and thrown out.
1478	ST10E1478C	AIKT06GWGU09	Larus glaucescens	E. Aleutian Islands, Aiktak Island	6/21/2009	91.9	82.34	9.4	7.08	4.99	Egg B was rotten and thrown out.
1479	ST10E1479C	STPA01TBMU09	Uria lomvia	SE Bering Sea, St. Paul Island	6/24/2009	123.82	98.98	21.06	8.41	5.31	
1480	ST10E1480C	STPA02TBMU09	Uria lomvia	SE Bering Sea, St. Paul Island	6/24/2009	105.5	83.22	15.13	7.61	5.09	
1482	ST10E1482C	STPA04TBMU09	Uria lomvia	SE Bering Sea, St. Paul Island	6/24/2009	114.3	92.18	18.49	8.61	5.06	
1485	ST10E1485C	STPA07TBMU09	Uria lomvia	SE Bering Sea, St. Paul Island	6/24/2009	107.52	90.54	16.64	7.94	5.07	
1486	ST10E1486C	STPA08TBMU09	Uria lomvia	SE Bering Sea, St. Paul Island	6/24/2009	121.1	96.97	19.86	8.18	5.35	

Appendix 3. Hg levels (ng g^{-1}, wet mass) and stable $\delta^{15}N$, $\delta^{13}C$ isotopes in murre and gull eggs.

NIST ID	Field ID	Species	Colony	Region	Hg (ng/g)	$\delta^{15}N$	$\delta^{13}C$
ST09E1234C	STLA03COMU08	Common Murre	St. Lazaria I.	SE Alaska	205	14.30	-18.71
ST09E1235C	STLA04COMU08	Common Murre	St. Lazaria I.	SE Alaska	113	13.81	-19.27
ST09E1236C	STLA05COMU08	Common Murre	St. Lazaria I.	SE Alaska	153	15.14	-17.20
ST09E1238C	STLA07COMU08	Common Murre	St. Lazaria I.	SE Alaska	236	14.49	-19.46
ST09E1240C	STLA09COMU08	Common Murre	St. Lazaria I.	SE Alaska	183	14.60	-19.25
ST09E1242C	STLA01TBMU08	Thick-billed Murre	St. Lazaria I.	SE Alaska	158	13.29	-19.06
ST09E1243C	STLA02TBMU08	Thick-billed Murre	St. Lazaria I.	SE Alaska	190	15.14	-19.62
ST09E1244C	STLA03TBMU08	Thick-billed Murre	St. Lazaria I.	SE Alaska	76	13.29	-19.40
ST09E1245C	STLA04TBMU08	Thick-billed Murre	St. Lazaria I.	SE Alaska	166	14.92	-18.78
ST09E1246C	STLA05TBMU08	Thick-billed Murre	St. Lazaria I.	SE Alaska	135	14.30	-19.80
ST09E1250C	DIOM04TBMU08	Thick-billed Murre	Little Diomede	NBS/Chukchi Sea	75	17.13	-20.49
ST09E1256C	DIOM10TBMU08	Thick-billed Murre	Little Diomede	NBS/Chukchi Sea	56	17.41	-19.57
ST09E1257C	DIOM11TBMU08	Thick-billed Murre	Little Diomede	NBS/Chukchi Sea	75	16.94	-20.19
ST09E1260C	DIOM14TBMU08	Thick-billed Murre	Little Diomede	NBS/Chukchi Sea	97	17.30	-20.10
ST09E1261C	DIOM15TBMU08	Thick-billed Murre	Little Diomede	NBS/Chukchi Sea	69	17.00	-20.76
ST09E1265C	STLW04COMU08	Common Murre	St. Lawrence I.	NBS/Chukchi Sea	69	13.64	-20.47
ST09E1266C	STLW05COMU08	Common Murre	St. Lawrence I.	NBS/Chukchi Sea	36	12.85	-20.93
ST09E1267C	STLW06COMU08	Common Murre	St. Lawrence I.	NBS/Chukchi Sea	68	15.06	-18.69
ST09E1268C	STLW07COMU08	Common Murre	St. Lawrence I.	NBS/Chukchi Sea	40	12.80	-20.00
ST09E1275C	STLW14COMU08	Common Murre	St. Lawrence I.	NBS/Chukchi Sea	49	14.98	-19.42
ST09E1278C	STLW02TBMU08	Thick-billed Murre	St. Lawrence I.	NBS/Chukchi Sea	31	13.29	-19.12
ST09E1279C	STLW03TBMU08	Thick-billed Murre	St. Lawrence I.	NBS/Chukchi Sea	41	13.29	-19.46
ST09E1281C	STLW05TBMU08	Thick-billed Murre	St. Lawrence I.	NBS/Chukchi Sea	36	13.62	-20.86
ST09E1284C	STLW08TBMU08	Thick-billed Murre	St. Lawrence I.	NBS/Chukchi Sea	31	13.45	-20.02
ST09E1287C	STLW11TBMU08	Thick-billed Murre	St. Lawrence I.	NBS/Chukchi Sea	12	13.42	-19.01
ST09E1292C	SLED01COMU08	Common Murre	Sledge I.	Norton Sound	71	17.90	-20.36
ST09E1295C	SLED05COMU08	Common Murre	Sledge I.	Norton Sound	92	18.39	-20.34

Appendix 3 (Continued).

ST09E1301C	SLED11COMU08	Common Murre	Sledge I.	Norton Sound	102	17.79	-20.89
ST09E1303C	SLED13COMU08	Common Murre	Sledge I.	Norton Sound	58	18.12	-20.31
ST09E1305C	SLED15COMU08	Common Murre	Sledge I.	Norton Sound	52	18.61	-19.76
ST09E1307C	BLUF02COMU08	Common Murre	Bluff	Norton Sound	143	19.07	-20.99
ST09E1309C	BLUF04COMU08	Common Murre	Bluff	Norton Sound	136	18.72	-21.89
ST09E1314C	BLUF09COMU08	Common Murre	Bluff	Norton Sound	144	19.23	-19.97
ST09E1319C	BLUF14COMU08	Common Murre	Bluff	Norton Sound	82	18.80	-21.61
ST09E1320C	BLUF15COMU08	Common Murre	Bluff	Norton Sound	112	19.23	-20.92
ST09E1321C	STGE01TBMU08	Thick-billed Murre	St. George I.	SBS	56	12.20	-21.09
ST09E1331C	STGE11TBMU08	Thick-billed Murre	St. George I.	SBS	55	12.28	-20.60
ST09E1333C	STGE13TBMU08	Thick-billed Murre	St. George I.	SBS	91	11.49	-23.14
ST09E1334C	STGE14TBMU08	Thick-billed Murre	St. George I.	SBS	192	11.51	-23.13
ST09E1335C	STGE15TBMU08	Thick-billed Murre	St. George I.	SBS	67	11.92	-20.48
ST09E1339C	SINU05GLGU08	Glaucous Gull	Sinuk River Delta	NBS/Chukchi Sea	185	17.52	-20.59
ST09E1340C	SINU06GLGU08	Glaucous Gull	Sinuk River Delta	NBS/Chukchi Sea	213	14.05	-23.72
ST09E1343C	SINU11GLGU08	Glaucous Gull	Sinuk River Delta	NBS/Chukchi Sea	644	15.14	-24.81
ST09E1344C	SINU12GLGU08	Glaucous Gull	Sinuk River Delta	NBS/Chukchi Sea	200	16.15	-21.03
ST09E1345C	SINU13GLGU08	Glaucous Gull	Sinuk River Delta	NBS/Chukchi Sea	125	18.25	-19.72
ST09E1349C	KUKP04GLGU08	Glaucous Gull	Kukpuk River Delta	NBS/Chukchi Sea	77	16.40	-19.54
ST09E1351C	KUKP06GLGU08	Glaucous Gull	Kukpuk River Delta	NBS/Chukchi Sea	107	15.42	-20.86
ST09E1354C	KUKP10GLGU08	Glaucous Gull	Kukpuk River Delta	NBS/Chukchi Sea	70	15.33	-20.05
ST09E1357C	KUKP13GLGU08	Glaucous Gull	Kukpuk River Delta	NBS/Chukchi Sea	63	16.40	-19.46
ST09E1358C	KUKP14GLGU08	Glaucous Gull	Kukpuk River Delta	NBS/Chukchi Sea	55	15.55	-20.78
ST09E1365C	SAFE06GLGU08	Glaucous Gull	Safety Sound	Norton Sound	132	17.19	-19.96
ST09E1367C	SAFE08GLGU08	Common Eider?	Safety Sound	Norton Sound	157	18.88	-19.48
ST09E1368C	SAFE09GLGU08	Glaucous Gull	Safety Sound	Norton Sound	165	19.21	-19.58
ST09E1369C	SAFE10GLGU08	Glaucous Gull	Safety Sound	Norton Sound	104	18.93	-20.37
ST09E1370C	SAFE12GLGU08	Glaucous Gull	Safety Sound	Norton Sound	117	18.03	-21.31

Appendix 3 (Continued).

ST09E1371C	CDAR01GLGU08	Glaucous Gull	Cape Darby	Norton Sound	142	17.65	-22.17
ST09E1374C	CDAR04GLGU08	Glaucous Gull	Cape Darby	Norton Sound	140	17.32	-19.50
ST09E1377C	CDAR07GLGU08	Glaucous Gull	Cape Darby	Norton Sound	134	17.02	-19.40
ST09E1379C	CDAR09GLGU08	Glaucous Gull	Cape Darby	Norton Sound	175	17.49	-21.07
ST09E1380C	CDAR10GLGU08	Glaucous Gull	Cape Darby	Norton Sound	116	17.87	-19.66
ST09E1384C	BLUF06GLGU08	Glaucous Gull	Bluff	Norton Sound	145	19.32	-20.37
ST09E1385C	BLUF07GLGU08	Glaucous Gull	Bluff	Norton Sound	195	17.87	-21.28
ST09E1388C	BLUF10GLGU08	Glaucous Gull	Bluff	Norton Sound	285	18.17	-22.48
ST09E1389C	BLUF11GLGU08	Glaucous Gull	Bluff	Norton Sound	98	17.16	-20.45
ST09E1390C	GOBA01GLGU08	Glaucous Gull	Carolyn I. (Golovin Bay)	Norton Sound	165	17.73	-20.35
ST09E1393C	GOBA04GLGU08	Glaucous Gull	Carolyn I. (Golovin Bay)	Norton Sound	150	16.78	-21.24
ST09E1394C	GOBA06GLGU08	Glaucous Gull	Carolyn I. (Golovin Bay)	Norton Sound	96	16.78	-21.10
ST09E1397C	GOBA09GLGU08	Glaucous Gull	Carolyn I. (Golovin Bay)	Norton Sound	120	17.32	-22.22
ST09E1398C	GOBA10GLGU08	Glaucous Gull	Carolyn I. (Golovin Bay)	Norton Sound	83	16.75	-20.05
ST09E1401C	SHAK02GLGU08	Glaucous Gull	Shaktoolik	Norton Sound	209	18.25	-20.28
ST09E1402C	SHAK03GLGU08	Glaucous Gull	Shaktoolik	Norton Sound	290	19.04	-19.32
ST09E1403C	SHAK04GLGU08	Glaucous Gull	Shaktoolik	Norton Sound	250	17.87	-21.48
ST09E1404C	SHAK05GLGU08	Glaucous Gull	Shaktoolik	Norton Sound	222	17.32	-21.90
ST09E1407C	TINC01GLGU08	Glaucous Gull	Shishmaref-Tin Creek	NBS/Chukchi Sea	107	13.42	-26.24
ST09E1411C	TINC05GLGU08	Glaucous Gull	Shishmaref-Tin Creek	NBS/Chukchi Sea	180	13.23	-25.13
ST09E1414C	SHFB03GLGU08	Glaucous Gull	Shishmaref-Egg I.	NBS/Chukchi Sea	157	13.72	-22.51
ST09E1415C	SHFB04GLGU08	Glaucous Gull	Shishmaref-Egg I.	NBS/Chukchi Sea	172	13.53	-24.96
ST09E1416C	SHFB05GLGU08	Glaucous Gull	Shishmaref-Egg I.	NBS/Chukchi Sea	68	13.89	-24.99
ST10E1419C	STUA03GLGU09	Glaucous Gull	Stuart Island (Stebbins)	Norton Sound	94	14.49	-22.01
ST10E1420C	STUA04GLGU09	Glaucous Gull	Stuart Island (Stebbins)	Norton Sound	227	15.88	-24.76
ST10E1421C	STUA05GLGU09	Glaucous Gull	Stuart Island (Stebbins)	Norton Sound	108	14.68	-21.67
ST10E1422C	STUA06GLGU09	Glaucous Gull	Stuart Island (Stebbins)	Norton Sound	260	14.90	-24.93
ST10E1423C	STUA07GLGU09	Glaucous Gull	Stuart Island (Stebbins)	Norton Sound	87	13.92	-25.34

Appendix 3 (Continued).

ST10E1424C	SHAK01GLGU09	Glaucous Gull	Shaktoolik (South)	Norton Sound	104	13.92	-25.18
ST10E1426C	SHAK03GLGU09	Glaucous Gull	Shaktoolik (South)	Norton Sound	158	18.61	-22.12
ST10E1427C	SHAK04GLGU09	Glaucous Gull	Shaktoolik (South)	Norton Sound	123	15.28	-23.88
ST10E1428C	SHAK05GLGU09	Glaucous Gull	Shaktoolik (South)	Norton Sound	154	17.38	-23.95
ST10E1429C	SHAK06GLGU09	Glaucous Gull	Shaktoolik (South)	Norton Sound	164	17.41	-22.98
ST10E1433C	BREV03GLGU09	Glaucous Gull	Brevig Mission	NBS/Chukchi Sea	246	13.53	-26.15
ST10E1435C	BREV05GLGU09	Glaucous Gull	Brevig Mission	NBS/Chukchi Sea	191	15.85	-20.62
ST10E1436C	BREV06GLGU09	Glaucous Gull	Brevig Mission	NBS/Chukchi Sea	162	15.63	-22.31
ST10E1439C	BREV09GLGU09	Glaucous Gull	Brevig Mission	NBS/Chukchi Sea	160	14.57	-23.70
ST10E1441C	BREV11GLGU09	Glaucous Gull	Brevig Mission	NBS/Chukchi Sea	125	13.29	-25.39
ST10E1443C	CDEN02COMU09	Common Murre	Cape Denbigh	Norton Sound	156	18.28	-23.16
ST10E1446C	CDEN05COMU09	Common Murre	Cape Denbigh	Norton Sound	92	18.03	-23.33
ST10E1448C	CDEN07COMU09	Common Murre	Cape Denbigh	Norton Sound	100	18.09	-23.34
ST10E1449C	CDEN08COMU09	Common Murre	Cape Denbigh	Norton Sound	122	18.47	-22.20
ST10E1452C	CDEN11COMU09	Common Murre	Cape Denbigh	Norton Sound	189	18.63	-21.92
ST10E1454C	CLIS01UNMU09	Unknown Murre	Cape Lisburne	NBS/Chukchi Sea	262	17.84	-21.06
ST10E1455C	CLIS02UNMU09	Unknown Murre	Cape Lisburne	NBS/Chukchi Sea	2	15.61	-21.32
ST10E1457C	CLIS04UNMU09	Unknown Murre	Cape Lisburne	NBS/Chukchi Sea	11	15.58	-21.63
ST10E1458C	CLIS05UNMU09	Unknown Murre	Cape Lisburne	NBS/Chukchi Sea	20	15.47	-22.52
ST10E1460C	CLIS07UNMU09	Unknown Murre	Cape Lisburne	NBS/Chukchi Sea	18	15.80	-20.31
ST10E1463C	STGE03COMU09	Common Murre	St. George I.	SBS	7	11.95	-22.65
ST10E1466C	STGE06COMU09	Common Murre	St. George I.	SBS	8	12.39	-21.59
ST10E1469C	STGE09COMU09	Common Murre	St. George I.	SBS	10	12.31	-20.50
ST10E1470C	STGE10COMU09	Common Murre	St. George I.	SBS	10	12.52	-21.70
ST10E1472C	STGE12COMU09	Common Murre	St. George I.	SBS	10	12.39	-21.06
ST10E1473C	AIKT01GWGU09	Glaucous-Winged Gull	Aiktak I.	SBS	125	15.28	-19.89
ST10E1474C	AIKT02GWGU09	Glaucous-Winged Gull	Aiktak I.	SBS	98	14.82	-22.15
ST10E1475C	AIKT03GWGU09	Glaucous-Winged Gull	Aiktak I.	SBS	55	15.01	-19.03

Appendix 3 (Continued).

ST10E1477C	AIKT05GWGU09	Glaucous-Winged Gull	Aiktak I.	SBS	117	15.17	-20.52
ST10E1478C	AIKT06GWGU09	Glaucous-Winged Gull	Aiktak I.	SBS	80	14.98	-19.38
ST10E1479C	STPA01TBMU09	Thick-billed Murre	St. Paul I.	SBS	12	12.96	-20.56
ST10E1480C	STPA02TBMU09	Thick-billed Murre	St. Paul I.	SBS	16	13.67	-21.57
ST10E1482C	STPA04TBMU09	Thick-billed Murre	St. Paul I.	SBS	9	12.50	-20.80
ST10E1485C	STPA07TBMU09	Thick-billed Murre	St. Paul I.	SBS	44	15.77	-20.90
ST10E1486C	STPA08TBMU09	Thick-billed Murre	St. Paul I.	SBS	16	12.66	-19.94

Appendix 4. Hg isotopes measured in common and thick-billed murre eggs.

NIST ID	**Species**	**Colony**	**Hg (ng g^{-1})**	**δ^{199}Hg (‰)**	**δ^{200}Hg (‰)**	**δ^{201}Hg (‰)**	**δ^{202}Hg (‰)**	**δ^{204}Hg (‰)**	**Δ^{199}Hg (‰)**	**Δ^{201}Hg (‰)**
ST09E1234C	Common Murre	St. Lazaria I.	205	1.56	0.55	1.89	1.02	1.45	1.3	1.13
ST09E1235C	Common Murre	St. Lazaria I.	113	1.52	0.51	1.62	0.85	1.12	1.30	0.98
ST09E1236C	Common Murre	St. Lazaria I.	153	1.47	0.55	1.70	0.90	1.25	1.25	1.02
ST09E1238C	Common Murre	St. Lazaria I.	236	1.53	0.64	1.9	1.18	1.73	1.23	1.01
ST09E1240C	Common Murre	St. Lazaria I.	183	1.31	0.39	1.57	0.75	1.03	1.12	1.00
ST09E1242C	Thick-billed Murre	St. Lazaria I.	158	1.47	0.51	1.69	0.84	1.24	1.25	1.06
ST09E1243C	Thick-billed Murre	St. Lazaria I.	190	1.58	0.49	1.77	0.84	1.07	1.36	1.14
ST09E1244C	Thick-billed Murre	St. Lazaria I.	76	1.62	0.54	1.84	0.84	1.07	1.41	1.21
ST09E1245C	Thick-billed Murre	St. Lazaria I.	166	1.47	0.61	1.88	0.98	1.41	1.23	1.14
ST09E1246C	Thick-billed Murre	St. Lazaria I.	135	1.52	0.56	1.82	0.99	1.36	1.27	1.07
ST09E1250C	Thick-billed Murre	Little Diomede	75	0.84	0.31	1.01	0.62	0.93	0.68	0.54
ST09E1256C	Thick-billed Murre	Little Diomede	56	0.82	0.23	0.98	0.49	0.68	0.70	0.61
ST09E1257C	Thick-billed Murre	Little Diomede	75	1.05	0.56	1.44	1.10	1.58	0.77	0.61
ST09E1260C	Thick-billed Murre	Little Diomede	97	0.72	0.29	0.90	0.53	0.84	0.58	0.50

Appendix 4 (Continued).

ST09E1261C	Thick-billed Murre	Little Diomede	69	0.90	0.32	1.01	0.59	0.85	0.75	0.56
ST09E1265C	Common Murre	St. Lawrence I.	69	0.97	0.28	1.12	0.62	0.77	0.81	0.65
ST09E1266C	Common Murre	St. Lawrence I.	36	1.10	0.33	1.17	0.61	0.73	0.95	0.70
ST09E1267C	Common Murre	St. Lawrence I.	68	1.03	0.50	1.36	0.95	1.32	0.78	0.64
ST09E1268C	Common Murre	St. Lawrence I.	40	1.01	0.40	1.14	0.69	0.88	0.84	0.61
ST09E1275C	Common Murre	St. Lawrence I.	49	0.89	0.37	1.06	0.76	1.07	0.70	0.49
ST09E1278C	Thick-billed Murre	St. Lawrence I.	31	0.94	0.18	0.89	0.32	0.68	0.86	0.64
ST09E1279C	Thick-billed Murre	St. Lawrence I.	41	1.15	0.74	1.69	1.15	1.63	0.86	0.83
ST09E1281C	Thick-billed Murre	St. Lawrence I.	36	1.07	0.54	1.60	1.05	1.57	0.80	0.81
ST09E1284C	Thick-billed Murre	St. Lawrence I.	31	1.04	0.44	1.45	1.08	1.49	0.76	0.64
ST09E1287C	Thick-billed Murre	St. Lawrence I.	12	1.30	0.48	1.48	0.91	1.25	1.07	0.79
ST09E1292C	Common Murre	Sledge I.	71	0.94	0.50	1.31	0.85	1.13	0.72	0.67
ST09E1295C	Common Murre	Sledge I.	92	0.73	0.44	0.93	0.61	1.01	0.58	0.47
ST09E1301C	Common Murre	Sledge I.	102	0.96	0.38	1.13	0.70	1.09	0.78	0.61
ST09E1303C	Common Murre	Sledge I.	58	0.73	0.4	1.06	0.74	1.06	0.54	0.51

Appendix 4 (Continued).

ST09E1305C	Common Murre	Sledge I.	52	0.63	0.36	0.72	0.51	0.76	0.5	0.33
ST09E1307C	Common Murre	Bluff I.	143	0.63	0.17	0.61	0.26	0.32	0.56	0.41
ST09E1309C	Common Murre	Bluff I.	136	0.79	0.28	0.88	0.48	0.68	0.67	0.52
ST09E1314C	Common Murre	Bluff I.	144	0.63	0.29	0.7	0.45	0.65	0.51	0.36
ST09E1319C	Common Murre	Bluff I.	82	0.88	0.25	0.85	0.33	0.46	0.79	0.61
ST09E1320C	Common Murre	Bluff I.	112	0.59	0.16	0.59	0.28	0.44	0.52	0.38
ST09E1321C	Thick-billed Murre	St. George I.	56	1.4	0.4	1.41	0.54	0.72	1.27	1.01
ST09E1331C	Thick-billed Murre	St. George I.	55	1.24	0.29	1.21	0.43	0.43	1.13	0.88
ST09E1333C	Thick-billed Murre	St. George I.	91	1.14	0.25	1.22	0.39	0.56	1.04	0.92
ST09E1334C	Thick-billed Murre	St. George I.	192	1.3	0.5	1.52	0.82	1.01	1.1	0.91
ST09E1335C	Thick-billed Murre	St. George I.	67	1.33	0.26	1.3	0.42	0.55	1.22	0.98
ST10E1443C	Common Murre	Cape Denbigh	156	0.69	0.32	0.9	0.59	0.95	0.54	0.45
ST10E1446C	Common Murre	Cape Denbigh	92	0.79	0.25	0.89	0.51	0.74	0.66	0.51
ST10E1448C	Common Murre	Cape Denbigh	100	0.77	0.24	0.82	0.45	0.59	0.65	0.48
ST10E1449C	Common Murre	Cape Denbigh	122	0.71	0.3	0.87	0.55	0.8	0.57	0.46
ST10E1452C	Common Murre	Cape Denbigh	189	0.68	0.27	0.85	0.47	0.69	0.56	0.49

Appendix 5. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass, mean ± standard deviation) in murre egg control material compared to consensus values and maximum limits of detection.

	Murre Egg CM					Max LOD or LOQ			
Compound	**Consensus Values**	**2008 Batch**		**2009 Batch**		**2008 Batch**		**2009 Batch**	
% lipid	10.7 ± 0.643	10.9		8.77 ± 0.17					
2,4'-DDD	<0.100	<LOQ		<LOD		0.197		0.0825	
2,4'-DDT	0.108 ± 0.10	<LOD		<LOQ		0.196		0.393	
4,4,'-DDD		<LOD		<LOD		0.199		0.0833	
4,4'-DDE	69.5 ± 6.3	67.7		66.3 ± 0.16		0.242		0.381	
4,4'-DDT	<0.100	<LOQ		<LOD		0.197		0.0823	
HCB	34.0 ± 5.3	38.7		39.3 ± 0.26		0.0741		0.0823	
α-HCH	1.16 ± 0.18	1.20		1.10 ± 0.028		0.202		0.0846	
β-HCH	24.9 ± 4.3	24.0		25.7 ± 1.4		0.201		0.0841	
γ-HCH	0.342 ± 0.024	0.363		0.341 ± 0.0074		0.400		0.0761	
Octachlorosytrene	0.913 ± 0.087	0.915		0.971 ± 0.010		0.178		0.0662	
Oxychlordane	7.16 ± 0.7	6.55		6.71 ± 0.027		0.193		0.0807	
Pentachlorobenzene	1.93 ± 0.5	2.09		2.44 ± 0.031		0.0650		0.0569	
Mirex	1.58 ± 0.16	1.62		1.60 ± 0.028		0.199		0.0768	
Compound	**Consensus Values**	**Gulls**	**Murres**	**GLGUs**	**Murres & GWGUs**	**Gulls**	**Murres**	**GLGUs**	**Murres & GWGUs**
Cis -chlordane	0.254 ± 0.024	0.177	0.257	0.241 ± 0.012	0.238 ± 0.012	0.0742	0.156	0.0883	0.0761
Cis -nonachlor	1.94 ± 0.48	1.90	2.03	2.19 ± 0.015	2.38 ± 0.064	0.0746	0.0667	0.121	0.465
Trans -chlordane	<0.100	0.145	0.149	<LOD	<LOD	0.0750	0.0671	0.0769	0.0769
Trans -nonachlor	0.481 ± 0.1	0.402	0.400	0.437 ± 0.0055	0.418 ± 0.0065	0.0748	0.0669	0.0869	0.0767
Heptachlor epoxide	4.41 ± 0.3	3.47	3.97	4.34 ± 0.10	4.64 ± 0.16	1.30	0.177	0.516	1.09

Appendix 6. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass-fractions (ng g^{-1} wet mass, mean ± standard deviation) in murre egg control material compared to consensus values and maximum limits of detection (compounds shown in red and blue were above and below reference value ranges, respectively).

	Murre Egg Control Material			Max LOD or LOQ	
Compound	**Consensus Values**	**2008**	**2009**	**2008**	**2009**
BDE47	0.771 ± 0.14	0.817	0.733 ± 0.023	0.147	0.0874
BDE99	0.530 ± 0.21	<LOQ	0.267 ± 0.022	0.956	0.0797
BDE100	0.310 ± 0.13	0.479	0.288 ± 0.017	0.518	0.0873
PCB 8	<0.100	<LOD	<LOD	0.0256	0.00709
PCB 18	<0.100	<LOD	<LOD	0.0234	0.00650
PCB 28+31	2.49 ± 0.51	2.95	2.02 ± 0.011	0.0737	0.0204
PCB 29	<0.100	<LOQ	<LOD	0.0194	0.00117
PCB 44	<0.100	0.0577	0.0754 ± 0.0032	0.0445	0.0605
PCB 45	<0.100	0.00950	0.0306 ± 0.0023	0.00700	0.00905
PCB 49	<0.100	0.106	0.0902 ± 0.0023	0.0566	0.0341
PCB 52	0.234 ± 0.095	0.161	0.192 ± 0.0020	0.0580	0.100
PCB 56	0.746 ± 0.059	0.707	0.585 ± 0.023	0.0491	0.145
PCB 63	0.500 ± 0.043	0.190	0.170 ± 0.00098	0.205	0.0324
PCB 66	2.41 ± 0.12	2.32	1.87 ± 0.069	0.346	0.146
PCB 70	0.205 ± 0.018	0.121	0.124 ± 0.0050	0.0260	0.0491
PCB 74	1.92 ± 0.061	1.97	1.44 ± 0.041	0.275	0.0969
PCB 79	0.165 ± 0.026	0.0221	0.0294 ± 0.0025	0.00740	0.0273
PCB 82	<0.100	0.0284	0.0363 ± 0.0018	0.0104	0.0306
PCB 87	0.106 ± 0.0051	0.0880	0.105 ± 0.0024	0.0437	0.0121
PCB 92	<0.100	0.0772	0.0942 ± 0.0017	0.0264	0.0886
PCB 95+121	<0.100	<LOD	0.0608 ± 0.0032	0.0732	0.0203
PCB 99	3.93 ± 0.17	5.03	4.02 ± 0.10	0.151	0.0418
PCB 101	0.835 ± 0.7	0.261	0.420 ± 0.011	0.0868	0.142
PCB 105	1.84 ± 0.47	1.86	1.72 ± 0.016	0.0715	0.152
PCB 106	<0.100	0.0279	0.0175 ± 0.0012	0.0102	0.0169
PCB 107	0.472 ± 0.022	0.478	0.414 ± 0.012	0.0226	0.0493
PCB 110	<0.100	<LOD	0.0367 ± 0.0023	0.100	0.0278
PCB 112		<LOD	0.0196 ± 0.0013	0.00650	0.00692
PCB 114	0.271 ± 0.017	0.254	0.186 ± 0.0019	0.0197	0.0338
PCB 118	6.53 ± 1.1	7.28	5.89 ± 0.091	0.258	0.497
PCB 119	<0.100	0.0850	0.0870 ± 0.0060	0.00480	0.0101
PCB 127	<0.100	<LOD	<LOQ	0.0104	0.0293
PCB 128	0.809 ± 0.077	0.895	0.749 ± 0.013	0.0660	0.0850
PCB 130	0.298 ± 0.018	0.362	0.297 ± 0.012	0.126	0.0386
PCB 137	1.12 ± 2.2	0.280	0.207 ± 0.00095	0.0116	0.0350
PCB 138	5.76 ± 1.5	5.22	4.88 ± 0.16	0.372	0.753
PCB 146	2.47 ± 0.022	2.74	2.21 ± 0.0094	0.0865	0.212
PCB 149	0.403 ± 0.1	0.450	0.409 ± 0.019	0.226	0.200

Appendix 6 (Continued).

	Murre Egg Control Material			Max LOD or LOQ	
Compound	**Consensus Values**	**2008**	**2009**	**2008**	**2009**
PCB 151	<0.100	0.0812	0.0152 ± 0.00036	0.0814	0.0155
PCB 153+132	11.0 ± 0.26	12.8	11.1 ± 0.045	0.670	1.26
PCB 154	<0.100	0.0994	0.0945 ± 0.00078	0.0725	0.0601
PCB 156	0.557 ± 0.12	0.694	0.461 ± 0.0086	0.0896	0.0848
PCB 157	0.210 ± 0.014	0.195	0.129 ± 0.0011	0.0415	0.0354
PCB 158	0.317 ± 0.063	0.344	0.221 ± 0.014	0.0181	0.0562
PCB 159	<0.100	<LOQ	0.00319 ± 0.00034	0.00740	0.00257
PCB 163	2.00 ± 0.16	2.41	1.94 ± 0.0098	0.0852	0.205
PCB 165	0.117 ± 0.0090	0.0476	0.0406 ± 0.0022	0.00600	0.0360
PCB 166	0.253 ± 0.023	0.0602	0.117 ± 0.0050	0.00940	0.0281
PCB 167	0.468 ± 0.037	0.361	0.359 ± 0.012	0.0232	0.0542
PCB 170	1.47 ± 0.72	1.25	1.01 ± 0.039	0.0848	0.245
PCB 172	0.371 ± 0.028	0.397	0.313 ± 0.0021	0.0206	0.0505
PCB 174	<0.100	0.0831	0.0922 ± 0.00078	0.0317	0.0693
PCB 175	0.266 ± 0.019	0.0669	0.0872 ± 0.0037	0.0122	0.0350
PCB 176	0.171 ± 0.024	0.0329	0.0345 ± 0.0030	0.00930	0.0339
PCB 177	0.395 ± 0.092	0.304	0.340 ± 0.016	0.0371	0.105
PCB 178	0.418 ± 0.019	0.301	0.424 ± 0.0077	0.0301	0.0878
PCB 180+193	2.28 ± 0.18	2.48	2.28 ± 0.017	0.252	0.632
PCB 183	0.838 ± 0.094	0.712	0.721 ± 0.019	0.0407	0.156
PCB 185	<0.100	0.0251	0.0229 ± 0.00053	0.0115	0.0149
PCB 187	2.94 ± 0.09	2.63	2.89 ± 0.037	0.198	0.151
PCB 188	0.194 ± 0.019	0.0370	0.0350 ± 0.0020	0.00510	0.0197
PCB 189	<0.100	0.0214	<LOQ	0.0196	0.0121
PCB 191	<0.100	0.0298	<LOQ	0.0129	0.0270
PCB 194	0.316 ± 0.029	0.332	0.314 ± 0.011	0.0370	0.0775
PCB 195	0.148 ± 0.019	0.139	0.131 ± 0.0023	0.0450	0.0506
PCB 196	0.724 ± 0.061	0.758	0.558 ± 0.025	0.462	0.336
PCB 197	0.148 ± 0.011	0.0654	0.0492 ± 0.0021	0.00610	0.0265
PCB 199	0.631 ± 0.022	2.99	2.07 ± 0.071	0.732	0.543
PCB 200	<0.100	<LOD	<LOQ	0.00490	0.0222
PCB 201	0.198 ± 0.017	0.948	0.839 ± 0.022	0.0345	0.207
PCB 202	<0.100	0.0564	<LOQ	0.0371	0.147
PCB 205	<0.100	0.0257	0.0419 ± 0.0034	0.00520	0.0304
PCB 206	<0.100	0.169	<LOQ	0.0352	0.238
PCB 207	<0.100	0.0725	0.0844 ± 0.0037	0.0137	0.0424
PCB 208	<0.100	0.0598	<LOQ	0.0249	0.0886
PCB 209	<0.100	0.166	0.0835 ± 0.0053	0.0379	0.0609

Appendix 7. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in unidentified murre eggs collected at Cape Lisburne, Alaska in 2009.

Compound	**1454**	**1455**	**1457**	**1458**	**1460**	**Mean**	**SD**	**RSD**
% Lipid	7.61	9.56	9.19	11.0	9.12	**9.31**	1.2	13
-								
4,4'-DDE	37.6	48.2	37.9	49.7	29.4	**40.6**	8.4	21
HCB	53.4	76.4	52.7	65.1	42.9	**58.1**	13	22
α-HCH	<LOD	0.699	0.483	0.665	0.467	**0.579**	0.12	21
β-HCH	12.6	30.8	22.0	22.1	14.0	**20.3**	7.3	36
γ-HCH	0.574	0.160	<LOD	0.167	0.110	**0.253**	0.22	85
Octachlorosytrene	1.63	2.09	1.49	1.98	1.32	**1.70**	0.33	19
Oxychlordane	4.95	7.46	5.37	6.78	3.92	**5.70**	1.4	25
Pentachlorobenzene	2.81	5.46	3.11	5.28	2.90	**3.91**	1.3	34
Mirex	1.10	2.00	1.05	1.27	0.763	**1.24**	0.46	37
Cis-chlordane	0.0794	0.134	<LOD	0.135	0.0889	**0.109**	0.029	27
Cis-nonachlor	1.23	1.47	1.09	1.42	0.935	**1.23**	0.22	18
Trans-nonachlor	0.165	0.149	0.0940	0.125	0.116	**0.130**	0.028	21
Heptachlor epoxide	2.17	4.27	3.08	3.58	2.54	**3.13**	0.83	27

Appendix 8. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at Little Diomede Island, Alaska in 2008.

Compound	1250	1256	1257	1260	1261	Mean	SD	RSD
% Lipid	8.84	10.3	9.77	9.74	10.3	**9.80**	0.61	6.2
-								
4,4'-DDE	41.6	54.7	49.8	50.5	46.4	**48.6**	4.9	10
HCB	63.0	65.9	57.6	67.7	49.5	**60.7**	7.4	12
α-HCH	0.836	0.705	0.387	0.396	0.514	**0.568**	0.20	35
β-HCH	19.5	21.7	16.2	17.8	20.5	**19.1**	2.2	11
Octachlorosytrene	1.76	2.02	1.72	2.02	1.21	**1.75**	0.33	19
Oxychlordane	6.18	6.46	4.83	5.16	5.00	**5.52**	0.74	13
Pentachlorobenzene	2.14	1.97	1.20	1.43	1.47	**1.64**	0.40	24
Mirex	1.72	1.75	1.20	1.52	1.49	**1.54**	0.22	14
Cis-chlordane	0.275	0.305	0.197	0.245	0.303	**0.265**	0.045	17
Cis-nonachlor	1.58	1.40	0.764	0.945	1.41	**1.22**	0.35	28
Trans-chlordane	0.0673	0.0869	<LOD	<LOD	0.0669	**0.0737**	0.011	15
Trans-nonachlor	0.157	0.243	0.0721	0.0816	0.183	**0.148**	0.072	49
Heptachlor epoxide	3.01	2.88	1.83	1.87	2.64	**2.44**	0.56	23

Appendix 9. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in common murre eggs collected at St. Lawrence Island, Alaska in 2008.

Compound	**1265**	**1266**	**1267**	**1268**	**1275**	**Mean**	**SD**	**RSD**
% Lipid	8.29	10.6	9.58	9.13	9.11	**9.35**	0.86	9.2
-								
4,4'-DDE	52.3	64.6	37.3	34.5	39.8	**45.7**	13	27
HCB	17.0	26.3	49.0	32.7	50.8	**35.1**	15	42
α-HCH	0.539	0.528	0.658	0.798	0.658	**<LOQ**	0.11	17
β-HCH	5.93	6.98	12.0	11.5	12.4	**<LOQ**	3.1	31
Octachlorosytrene	0.702	0.912	1.51	1.03	1.37	**1.11**	0.33	30
Oxychlordane	3.11	2.64	4.28	4.18	4.63	**3.77**	0.85	22
Pentachlorobenzene	0.825	1.26	2.01	0.926	1.71	**1.35**	0.51	38
Mirex	0.728	0.775	0.879	1.16	1.02	**0.912**	0.18	19
Cis-chlordane	0.215	0.257	0.199	0.220	0.217	**0.222**	0.021	9.7
Cis-nonachlor	0.407	0.302	0.531	0.538	0.655	**0.487**	0.14	28
Trans-nonachlor	0.0944	0.110	0.0665	0.0952	<LOD	**0.0914**	0.018	20
Heptachlor epoxide	0.865	1.22	1.43	1.54	1.40	**1.29**	0.26	20

Appendix 10. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at St. Lawrence Island, Alaska in 2008.

Compound	**1278**	**1279**	**1281**	**1284**	**1287**	**Mean**	**SD**	**RSD**
% Lipid	8.55	9.67	9.83	8.87	8.79	**9.14**	0.57	6.2
2,4'-DDT	0.197	0.173	0.387	0.133	<LOD	**0.223**	0.11	51
-								
4,4'-DDE	44.7	35.4	27.5	38.8	39.9	**37.2**	6.4	17
HCB	47.2	48.0	44.4	55.3	49.0	**48.8**	4.0	8.2
α-HCH	0.576	0.709	0.471	0.724	0.871	**0.670**	0.15	23
β-HCH	17.5	12.6	9.23	13.9	0.0808	**10.7**	6.6	62
Octachlorosytrene	1.49	1.39	1.22	1.63	1.58	**1.46**	0.17	11
Oxychlordane	5.39	3.68	2.99	4.73	5.34	**4.43**	1.1	24
Pentachlorobenzene	1.21	1.37	0.998	1.68	1.03	**1.26**	0.28	22
Mirex	1.11	1.11	1.02	1.50	1.31	**1.21**	0.19	16
Cis-chlordane	0.206	0.188	0.185	0.220	0.200	**0.200**	0.014	7.2
Cis-nonachlor	0.739	0.415	0.302	0.597	0.680	**0.547**	0.18	34
Trans-nonachlor	<LOD	0.0732	<LOD	0.0790	0.110	**0.0875**	0.020	23
Heptachlor epoxide	2.25	1.33	1.06	1.66	0.901	**1.44**	0.53	37

Appendix 11. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in common murre eggs collected at Sledge Island, Alaska in 2008.

Compound	**1292**	**1295**	**1301**	**1303**	**1305**	**Mean**	**SD**	**RSD**
% Lipid	8.66	7.57	9.66	9.95	9.83	**9.14**	1.0	11
4,4,'-DDD	<LOD	<LOD	0.105	0.0777	0.155	**0.113**	0.039	35
4,4'-DDE	31.2	34.6	45.3	37.8	45.8	**38.9**	6.5	17
4,4'-DDT	<LOQ	<LOQ	0.174	0.142	0.128	**0.148**	0.023	16
HCB	42.7	54.9	37.7	51.5	64.6	**50.3**	11	21
α-HCH	0.526	0.449	0.657	0.676	0.497	**0.561**	0.10	18
β-HCH	15.1	12.5	11.7	21.9	32.6	**18.8**	8.7	47
Octachlorosytrene	1.12	1.76	1.18	1.38	1.88	**1.46**	0.34	23
Oxychlordane	3.75	4.10	3.83	4.85	7.65	**4.83**	1.6	34
Pentachlorobenzene	0.690	1.04	1.14	1.38	1.07	**1.06**	0.25	23
Mirex	1.06	1.55	1.20	1.59	2.67	**1.61**	0.63	39
Cis-chlordane	0.282	0.223	0.278	0.336	0.686	**0.361**	0.19	52
Cis-nonachlor	1.01	0.706	0.923	1.41	5.70	**1.95**	2.1	110
Trans-chlordane	<LOD	<LOD	0.112	0.0868	0.832	**0.344**	0.42	120
Trans-nonachlor	0.129	0.0742	0.197	0.261	3.86	**0.904**	1.7	180
Heptachlor epoxide	2.08	1.49	1.73	3.16	8.06	**3.30**	2.7	83

Appendix 12. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in common murre eggs collected at Bluff, Alaska in 2008.

Compound	**1307**	**1309**	**1314**	**1319**	**1320**	**Mean**	**SD**	**RSD**
% Lipid	8.58	8.48	9.45	9.82	8.41	**8.95**	0.64	7.2
-								
4,4'-DDE	47.6	30.9	38.5	31.0	32.3	**36.1**	7.1	20
HCB	72.6	32.7	46.3	44.4	42.4	**47.7**	15	31
α-HCH	0.537	0.318	0.224	0.299	0.330	**0.342**	0.12	34
β-HCH	22.6	21.3	10.0	16.1	19.3	**17.9**	5.0	28
Octachlorosytrene	2.40	0.972	1.57	1.05	1.27	**1.45**	0.58	40
Oxychlordane	6.23	5.05	3.49	3.75	4.46	**4.60**	1.1	24
Pentachlorobenzene	1.22	0.622	0.763	1.03	0.730	**0.872**	0.24	28
Mirex	3.63	1.85	2.34	1.54	2.31	**2.34**	0.80	34
Cis-chlordane	0.234	0.318	0.167	0.200	0.200	**0.224**	0.058	26
Cis-nonachlor	1.35	5.51	0.480	1.05	1.61	**2.00**	2.0	100
Trans-nonachlor	0.153	1.94	<LOD	0.144	0.129	**0.592**	0.90	150
Heptachlor epoxide	2.76	4.84	0.870	2.10	2.94	**2.70**	1.4	53

Appendix 13. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in common murre eggs collected at Cape Denbigh, Alaska in 2009.

Compound	**1443**	**1446**	**1448**	**1449**	**1452**	**Mean**	**SD**	**RSD**
% Lipid	8.11	8.48	8.92	9.12	8.86	**8.70**	0.40	4.6
-								
4,4'-DDE	21.8	28.6	30.3	35.2	34.0	**30.0**	5.3	18
HCB	47.2	41.8	49.1	51.8	52.8	**48.5**	4.4	9.0
β-HCH	17.4	13.0	21.5	8.42	20.7	**16.2**	5.5	34
Octachlorosytrene	1.26	1.12	1.39	1.48	1.27	**1.30**	0.14	11
Oxychlordane	2.82	2.54	4.88	2.55	3.74	**3.31**	1.0	30
Pentachlorobenzene	1.59	2.86	2.21	2.86	2.84	**2.47**	0.56	23
Mirex	1.27	0.993	1.70	0.918	1.81	**1.34**	0.40	30
Cis-chlordane	0.0782	<LOD	0.157	0.255	0.128	**0.154**	0.074	48
Cis-nonachlor	1.14	0.860	1.42	0.792	1.98	**1.24**	0.48	39
Trans-nonachlor	0.0826	<LOD	0.171	<LOD	0.267	**0.173**	0.092	53
Heptachlor epoxide	2.26	1.79	3.00	1.57	2.94	**2.31**	0.65	28

Appendix 14. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at St. Paul Island Alaska in 2009.

Compound	**1479**	**1480**	**1482**	**1485**	**1486**	**Mean**	**SD**	**RSD**
% Lipid	9.46	9.55	10.0	9.45	9.00	**9.50**	0.36	3.8
-								
4,4'-DDE	52.2	77.3	39.4	28.6	38.3	**47.2**	19	40
HCB	33.2	39.7	32.6	49.5	23.5	**35.7**	9.6	27
α-HCH	0.648	0.571	0.361	0.413	0.466	**0.492**	0.12	24
β-HCH	16.0	13.3	15.0	24.2	7.62	**15.2**	6.0	39
γ-HCH	0.215	0.165	0.178	0.171	0.197	**0.185**	0.021	11
Octachlorosytrene	0.788	0.972	0.791	1.05	0.689	**0.859**	0.15	17
Oxychlordane	4.35	3.47	2.90	4.71	1.98	**3.48**	1.1	32
Pentachlorobenzene	3.98	2.47	1.61	4.31	2.62	**3.00**	1.1	37
Mirex	0.855	1.00	0.873	0.899	0.395	**0.805**	0.24	29
Cis-nonachlor	0.889	0.635	0.874	1.17	0.535	**0.821**	0.25	30
Trans-nonachlor	<LOD	0.235	<LOD	0.120	<LOD	**0.178**	0.081	46
Heptachlor epoxide	2.81	1.85	2.13	3.89	1.63	**2.46**	0.92	37

Appendix 15. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at St. George Island, Alaska in 2008.

Compound	**1321**	**1331**	**1333**	**1334**	**1335**	**Mean**	**SD**	**RSD**
% Lipid	10.0	10.8	11.5	9.45	8.97	**10.1**	1.0	9.9
2,4'-DDT	0.186	0.0895	<LOD	<LOD	<LOD	**0.138**	0.068	49
4,4,'-DDD	0.285	0.185	<LOD	0.163	<LOD	**0.211**	0.065	31
4,4'-DDE	117	98.1	99.4	91.6	98.9	**101**	9.3	9.2
4,4'-DDT	0.167	0.373	<LOQ	<LOQ	0.222	**0.254**	0.11	42
HCB	28.8	19.0	33.5	16.5	21.4	**23.8**	7.1	30
α-HCH	0.782	1.42	0.954	0.998	1.15	**1.06**	0.24	23
β-HCH	10.8	7.40	10.6	5.61	7.59	**8.40**	2.2	27
Octachlorosytrene	1.14	0.865	1.05	0.834	0.922	**0.962**	0.13	14
Oxychlordane	5.52	4.16	4.61	2.99	3.39	**4.13**	1.0	24
Pentachlorobenzene	0.981	0.167	0.948	0.712	0.467	**0.655**	0.34	52
Mirex	1.53	1.23	1.13	1.09	1.23	**1.24**	0.17	14
Cis-chlordane	0.296	0.375	0.219	0.190	0.224	**0.261**	0.075	29
Cis-nonachlor	0.694	0.810	0.162	0.135	0.541	**0.468**	0.31	66
Trans-nonachlor	0.120	0.180	0.0754	0.0951	0.0700	**0.108**	0.045	41
Heptachlor epoxide	1.50	1.24	1.42	0.997	1.25	**1.28**	0.20	15

Appendix 16. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in common murre eggs collected at St. George Island, Alaska in 2009.

Compound	**1463**	**1466**	**1469**	**1470**	**1472**	**Mean**	**SD**	**RSD**
% Lipid	8.23	9.39	8.25	8.92	10.1	**8.97**	0.78	8.7
2,4'-DDT	<LOQ	<LOQ	<LOQ	0.436	0.580	**0.508**	0.10	20
-								
4,4'-DDE	32.7	36.2	36.4	34.5	33.8	**34.7**	1.6	4.5
HCB	41.5	42.1	34.5	41.5	45.1	**40.9**	3.9	9.5
α-HCH	0.932	1.10	0.448	1.05	0.744	**0.854**	0.26	31
β-HCH	28.1	26.6	14.4	20.8	19.4	**21.8**	5.6	26
γ-HCH	0.253	0.387	0.133	0.245	0.340	**0.272**	0.098	36
Octachlorosytrene	1.02	1.15	1.07	1.21	1.21	**1.13**	0.083	7.4
Oxychlordane	2.84	4.48	4.06	4.07	3.71	**3.83**	0.62	16
Pentachlorobenzene	3.40	2.21	1.05	3.17	3.08	**2.58**	0.97	37
Mirex	0.920	1.08	1.05	0.931	0.816	**0.958**	0.11	11
Cis-nonachlor	0.840	1.04	0.563	1.02	0.867	**0.867**	0.19	22
Heptachlor epoxide	2.42	3.15	2.51	2.84	2.70	**2.72**	0.29	11

Appendix 17. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in common murre eggs collected at St. Lazaria Island Alaska in 2008.

Compound	**1234**	**1235**	**1236**	**1238**	**1240**	**Mean**	**SD**	**RSD**
% Lipid	8.86	8.24	8.11	9.52	10.0	**8.95**	0.82	9.2
-								
4,4'-DDE	99.9	77.3	124	303	115	**144**	91	63
4,4'-DDT	<LOQ	<LOQ	0.173	0.168	0.246	**0.196**	0.044	23
HCB	24.7	19.5	30.0	28.6	21.5	**24.9**	4.5	18
α-HCH	0.478	0.815	1.38	0.966	1.66	**1.06**	0.47	44
β-HCH	12.2	6.75	11.1	14.7	21.1	**13.2**	5.3	40
Octachlorosytrene	0.672	0.546	0.791	1.10	0.882	**0.799**	0.21	27
Oxychlordane	4.21	2.31	4.02	6.72	5.01	**4.45**	1.6	36
Pentachlorobenzene	0.564	0.499	0.783	0.774	0.653	**0.655**	0.13	19
Mirex	0.998	0.626	0.984	2.20	1.61	**1.28**	0.62	48
Cis-chlordane	0.211	0.154	0.201	0.248	0.511	**0.265**	0.14	53
Cis-nonachlor	0.967	0.268	0.483	1.15	7.90	**2.15**	3.2	150
Trans-nonachlor	0.118	<LOD	<LOD	0.107	3.08	**1.10**	1.7	160
Heptachlor epoxide	2.17	0.913	1.29	2.57	5.76	**2.54**	1.9	76

Appendix 18. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at St. Lazaria Island Alaska in 2008.

Compound	**1242**	**1243**	**1244**	**1245**	**1246**	**Mean**	**SD**	**RSD**
% Lipid	9.92	8.98	9.98	9.30	8.46	**9.33**	0.64	6.9
4,4'-DDE	144	192	112	103	139	**138**	35	25
4,4'-DDT	<LOQ	<LOQ	<LOQ	0.172	0.146	**0.159**	0.018	11
HCB	27.1	24.3	26.6	28.6	23.7	**26.1**	2.1	7.9
α-HCH	0.644	0.300	0.547	0.869	0.561	**0.584**	0.20	35
β-HCH	9.44	6.00	11.1	14.0	9.24	**9.96**	2.9	29
Octachlorosytrene	0.841	1.03	0.856	0.772	0.970	**0.895**	0.11	12
Oxychlordane	3.40	2.60	3.19	3.81	2.76	**3.15**	0.49	15
Pentachlorobenzene	0.655	0.492	0.921	1.03	0.771	**0.774**	0.21	28
Mirex	1.42	1.50	1.01	1.17	1.34	**1.29**	0.20	15
Cis-chlordane	<LOQ	<LOQ	<LOQ	0.248	0.224	**0.236**	0.017	7.0
Cis-nonachlor	0.494	0.165	0.0766	0.854	0.532	**0.424**	0.31	74
Trans-nonachlor	<LOD	<LOD	<LOD	0.115	0.0768	**0.0960**	0.027	28
Heptachlor epoxide	1.02	0.803	1.57	2.18	1.06	**1.33**	0.55	42

Appendix 19. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at the Kukpuk River delta, Alaska in 2008.

Compound	**1349**	**1351**	**1354**	**1357**	**1358**	**Mean**	**SD**	**RSD**
% Lipid	5.22	6.76	6.99	5.41	6.22	**6.09**	0.91	15
2,4'-DDT	<LOD	0.325	0.209	<LOD	<LOD	**0.267**	0.083	31
4,4,'-DDD	0.109	0.453	0.474	0.110	0.133	**0.256**	0.19	74
4,4'-DDE	75.5	277	326	69.2	80.6	**166**	130	76
4,4'-DDT	1.21	8.75	9.25	1.14	1.25	**4.32**	4.3	99
HCB	36.2	84.6	90.0	32.3	37.4	**56.1**	29	51
α-HCH	0.217	0.222	0.185	0.174	0.245	**0.209**	0.029	14
β-HCH	15.2	41.0	45.8	15.2	17.0	**26.8**	15	57
Octachlorosytrene	0.418	0.898	0.941	0.439	0.446	**0.629**	0.27	42
Oxychlordane	18.1	72.2	79.5	17.3	19.3	**41.3**	32	77
Pentachlorobenzene	0.848	2.34	1.68	0.610	0.992	**1.29**	0.71	55
Mirex	3.07	8.84	9.36	2.89	3.24	**5.48**	3.3	60
Cis-chlordane	0.405	1.07	1.13	0.387	0.371	**0.673**	0.39	58
Cis-nonachlor	1.10	9.41	10.5	1.03	1.18	**4.65**	4.9	110
Trans-chlordane	0.526	1.88	2.14	0.518	0.568	**1.13**	0.81	72
Trans-nonachlor	3.55	46.5	49.6	3.32	3.92	**21.4**	24	110
Heptachlor epoxide	3.82	9.37	10.5	3.60	4.27	**6.31**	3.3	53

Appendix 20. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Shishmaref Inlet Alaska in 2008.

Compound	**1407**	**1411**	**1414**	**1415**	**1416**	**Mean**	**SD**	**RSD**
% Lipid	7.42	6.79	6.31	6.37	7.49	**6.72**	0.51	7.7
4,4,'-DDD	1.31	0.501	0.573	0.713	0.328	**0.685**	0.38	55
4,4'-DDE	122	163	101	148	151	**137**	25	18
4,4'-DDT	3.86	4.63	1.63	7.80	4.47	**4.48**	2.2	49
HCB	45.1	48.0	36.7	44.2	55.8	**46.0**	6.9	15
β-HCH	16.7	19.3	16.8	16.7	23.9	**18.7**	3.1	17
Octachlorosytrene	0.680	0.914	0.627	0.877	0.697	**0.759**	0.13	17
Oxychlordane	15.1	22.6	24.0	23.6	17.7	**20.6**	4.0	19
Pentachlorobenzene	1.36	1.66	0.715	1.21	1.93	**1.38**	0.46	34
Mirex	3.19	4.02	4.04	4.09	3.48	**3.77**	0.41	11
Cis-chlordane	0.420	0.803	0.567	1.68	0.356	**0.766**	0.54	71
Cis-nonachlor	2.39	3.05	1.64	2.63	2.42	**2.43**	0.51	21
Trans-chlordane	1.62	2.61	1.72	2.18	2.11	**2.05**	0.39	19
Trans-nonachlor	4.61	7.72	6.61	6.85	5.39	**6.24**	1.2	20
Heptachlor epoxide	4.26	5.50	4.45	4.71	5.68	**4.92**	0.64	13

Appendix 21. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Brevig Mission Alaska, in 2009.

Compound	**1433**	**1435**	**1436**	**1439**	**1441**	**Mean**	**SD**	**RSD**
% Lipid	4.89	4.46	5.40	5.75	6.74	**5.45**	0.87	16
4,4,'-DDD	0.0998	0.313	0.392	1.96	0.0787	**0.569**	0.79	140
4,4'-DDE	165	88.7	237	286	177	**191**	75	39
4,4'-DDT	0.591	3.95	2.22	3.37	0.691	**2.16**	1.5	70
HCB	44.4	23.5	58.8	49.3	67.3	**48.7**	17	34
β-HCH	24.3	10.2	33.4	24.9	31.2	**24.8**	9.1	37
Octachlorosytrene	0.755	0.517	0.877	0.924	1.16	**0.846**	0.24	28
Oxychlordane	32.0	14.5	46.1	34.1	33.3	**32.0**	11	35
Pentachlorobenzene	2.38	2.22	3.68	2.66	3.74	**2.94**	0.73	25
Mirex	5.48	2.31	5.42	8.22	5.83	**5.45**	2.1	39
Cis-chlordane	0.362	0.518	0.563	1.73	0.305	**0.696**	0.59	85
Cis-nonachlor	1.47	1.50	3.97	6.30	2.63	**3.17**	2.0	64
Trans-chlordane	1.83	1.01	2.41	2.02	2.97	**2.05**	0.72	35
Trans-nonachlor	3.89	2.48	11.5	37.9	5.30	**12.2**	15	120
Heptachlor epoxide	8.54	3.58	12.6	11.4	10.8	**9.38**	3.6	38

Appendix 22. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at the Sinuk River delta, Alaska in 2008.

Compound	**1339**	**1340**	**1340-2**	**1340 Mean**	**% difference**	**1343**	**1344**	**1345**	**Mean**	**SD**	**RSD**
% Lipid	7.23	-	7.04	-	-	7.45	7.22	6.32	**7.24**	0.17	2.4
4,4,'-DDD	0.328	0.405	0.413	**0.409**	-1.9	0.105	0.419	0.231	**0.298**	0.13	44
4,4'-DDE	141	93.8	89.1	**91.4**	5.1	76.6	156	93.9	**112**	35	31
4,4'-DDT	4.73	6.43	6.14	**6.28**	4.6	1.77	4.70	3.10	**4.12**	1.7	42
HCB	36.8	26.3	26.7	**26.5**	-1.4	43.1	45.6	29.8	**36.4**	8.2	23
β-HCH	12.0	8.13	7.54	**7.84**	7.6	24.4	18.1	8.89	**14.2**	6.9	49
Octachlorosytrene	0.912	0.677	0.672	**0.674**	0.75	0.614	0.702	0.704	**0.721**	0.11	16
Oxychlordane	17.6	14.2	13.6	**13.9**	4.3	25.2	21.5	9.92	**17.6**	6.0	34
Pentachlorobenzene	0.738	0.719	0.778	**0.749**	-8.0	0.956	0.880	0.213	**0.707**	0.29	41
Mirex	3.51	2.67	2.59	**2.63**	2.9	3.92	5.11	2.00	**3.43**	1.2	35
Cis-chlordane	0.449	1.05	1.06	**1.06**	-1.0	0.202	0.637	0.605	**0.590**	0.31	53
Cis-nonachlor	3.12	2.45	2.39	**2.42**	2.3	1.41	1.97	1.66	**2.12**	0.68	32
Trans-chlordane	1.76	1.23	1.16	**1.20**	5.5	0.972	1.44	1.45	**1.36**	0.30	22
Trans-nonachlor	4.61	6.76	6.46	**6.61**	4.6	1.59	3.56	4.66	**4.21**	1.8	44
Heptachlor epoxide	3.69	3.12	3.09	**3.11**	0.70	4.91	5.06	3.21	**4.00**	0.93	23

Appendix 23. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Safety Sound, Alaska in 2008. Egg 1367 is believed to be a common eider.

Compound	**1365**	**1367**	**1368**	**1369**	**1370**	**Mean**	**SD**	**RSD**
% Lipid	6.07	4.95	3.88	3.27	5.44	**4.54**	1.2	27
2,4'-DDT	0.157	<LOD	<LOD	<LOD	0.111	**0.134**	0.032	24
4,4,'-DDD	0.274	0.0985	0.0709	<LOD	0.312	**0.189**	0.12	64
4,4'-DDE	52.6	185	96.4	91.5	98.0	**105**	48	46
4,4'-DDT	0.932	0.195	3.24	0.387	3.31	**1.61**	1.5	96
HCB	34.2	65.3	37.1	40.5	31.1	**41.6**	14	33
β-HCH	10.5	24.0	12.2	18.3	7.75	**14.5**	6.5	45
Octachlorosytrene	0.628	1.15	0.750	0.713	0.690	**0.786**	0.21	26
Oxychlordane	10.7	34.6	12.9	13.6	20.3	**18.4**	9.7	53
Pentachlorobenzene	0.766	1.28	0.810	0.267	0.525	**0.729**	0.37	51
Mirex	2.25	7.49	3.19	2.34	2.61	**3.57**	2.2	62
Cis-chlordane	0.640	0.505	0.606	0.293	0.780	**0.565**	0.18	32
Cis-nonachlor	1.64	2.46	2.25	1.39	1.89	**1.93**	0.44	23
Trans-chlordane	1.27	1.52	1.63	1.16	0.887	**1.29**	0.30	23
Trans-nonachlor	4.13	3.40	6.13	2.43	2.53	**3.73**	1.5	41
Heptachlor epoxide	3.98	7.05	4.02	3.92	3.64	**4.52**	1.4	31

Appendix 24. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Bluff, Alaska in 2008.

Compound	**1384**	**1385**	**1388**	**1389**	**Mean**	**SD**	**RSD**
% Lipid	6.65	6.51	6.95	6.65	**6.69**	0.19	2.8
2,4'-DDT	0.785	<LOD	<LOD	0.0723	**0.429**	0.50	120
4,4,'-DDD	0.423	<LOD	<LOD	0.471	**0.447**	0.034	7.6
4,4'-DDE	101	68.4	87.1	126	**95.6**	24	26
4,4'-DDT	5.30	0.448	0.563	3.03	**2.33**	2.3	99
HCB	34.0	29.5	35.7	43.5	**35.7**	5.8	16
β-HCH	16.0	8.16	10.3	14.1	**12.1**	3.6	29
Octachlorosytrene	0.589	0.684	0.855	0.672	**0.700**	0.11	16
Oxychlordane	23.4	11.8	13.8	20.9	**17.5**	5.6	32
Pentachlorobenzene	0.842	0.707	1.05	1.17	**0.942**	0.21	22
Mirex	3.40	2.08	2.78	4.74	**3.25**	1.1	35
Cis-chlordane	1.54	0.501	0.535	0.693	**0.818**	0.49	60
Cis-nonachlor	2.06	1.69	2.05	2.51	**2.08**	0.34	16
Trans-chlordane	1.07	1.35	1.76	1.45	**1.41**	0.29	20
Trans-nonachlor	3.49	4.01	4.85	8.73	**5.27**	2.4	45
Heptachlor epoxide	4.66	3.59	3.93	5.94	**4.53**	1.0	23

Appendix 25. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Carolyn Island, Alaska in 2008.

Compound	**1390**	**1393**	**1394**	**1397**	**1398**	**Mean**	**SD**	**RSD**
% Lipid	7.65	5.53	5.20	6.84	5.35	**6.30**	1.1	18
4,4,'-DDD	0.152	0.326	0.342	0.185	0.197	**0.240**	0.087	36
4,4'-DDE	105	93.7	102	67.4	102	**94.1**	15	16
4,4'-DDT	0.403	4.07	5.34	2.95	3.98	**3.35**	1.9	55
HCB	29.1	37.9	31.9	34.5	38.2	**34.3**	3.9	11
α-HCH	0.222	<LOQ	<LOQ	0.219	<LOQ	**0.221**	0.0022	0.99
β-HCH	8.22	13.5	9.82	11.1	12.6	**11.0**	2.1	19
Octachlorosytrene	0.629	0.675	0.895	0.690	0.758	**0.729**	0.10	14
Oxychlordane	17.8	12.4	14.8	10.8	21.5	**15.5**	4.3	28
Pentachlorobenzene	0.454	0.988	0.196	1.02	0.306	**0.592**	0.39	65
Mirex	3.95	2.41	2.51	1.72	3.06	**2.73**	0.83	31
Cis-chlordane	0.611	0.995	0.909	0.630	0.694	**0.768**	0.17	23
Cis-nonachlor	2.35	2.52	3.35	2.37	2.68	**2.65**	0.41	16
Trans-chlordane	1.17	1.92	1.81	1.37	1.45	**1.54**	0.31	20
Trans-nonachlor	3.35	8.05	6.70	5.07	4.27	**5.49**	1.9	34
Heptachlor epoxide	3.69	5.01	3.49	3.91	4.54	**4.13**	0.63	15

Appendix 26. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Cape Darby, Alaska in 2008.

Compound	**1371**	**1374**	**1377**	**1379**	**1380**	**Mean**	**SD**	**RSD**
% Lipid	5.65	6.04	5.30	5.33	5.84	**5.58**	0.34	6.2
4,4,'-DDD	0.180	0.231	0.371	0.211	0.277	**0.254**	0.074	29
4,4'-DDE	155	104	93.1	72.7	57.8	**96.7**	37	39
4,4'-DDT	2.74	0.414	2.51	0.986	1.36	**1.60**	1.0	62
HCB	34.0	9.5	30.5	36.4	32.7	**32.6**	2.8	8.4
α-HCH	0.182	0.209	<LOQ	0.174	<LOQ	**0.188**	0.019	9.9
β-HCH	11.7	8.36	10.3	11.1	10.7	**10.4**	1.3	12
Octachlorosytrene	0.731	0.621	0.604	0.894	0.605	**0.691**	0.13	18
Oxychlordane	20.3	17.0	13.4	10.2	9.02	**14.0**	4.7	34
Pentachlorobenzene	0.640	0.458	0.571	0.656	0.679	**0.601**	0.089	15
Mirex	5.24	3.37	2.58	2.02	1.58	**2.96**	1.4	49
Cis-chlordane	1.01	0.769	0.458	0.497	0.407	**0.629**	0.26	41
Cis-nonachlor	2.95	2.27	1.40	2.61	1.57	**2.16**	0.66	31
Trans-chlordane	1.84	1.23	0.875	1.38	0.787	**1.22**	0.42	35
Trans-nonachlor	7.94	3.66	1.85	4.70	1.94	**4.02**	2.5	62
Heptachlor epoxide	4.57	3.95	3.61	3.50	3.34	**3.79**	0.49	13

Appendix 27. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Shaktoolik, Alaska in 2008.

Compound	**1401**	**1402**	**1403**	**1403-2**	**1403 Mean**	**% difference**	**1404**	**Mean**	**SD**	**RSD**
% Lipid	6.24	6.34	5.52	5.49	**5.50**	0.55	6.58	**6.39**	0.18	2.8
4,4,'-DDD	0.175	0.207	0.244	0.257	**0.251**	-5.4	0.115	**0.187**	0.057	31
4,4'-DDE	64.8	72.5	106	109	**107**	-3.0	149	**98.5**	39	39
4,4'-DDT	2.24	2.38	2.94	2.98	**2.96**	-1.5	1.04	**2.15**	0.81	37
HCB	34.6	44.5	49.0	49.8	**49.4**	-1.5	64.6	**48.3**	13	26
β-HCH	14.4	15.5	15.6	15.1	**15.3**	3.1	21.7	**16.7**	3.4	20
Octachlorosytrene	0.699	0.768	0.881	0.894	**0.888**	-1.5	1.15	**0.877**	0.20	23
Oxychlordane	15.6	20.4	17.7	17.3	**17.5**	2.2	17.0	**17.6**	2.0	11
Pentachlorobenzene	0.801	1.07	1.17	1.12	**1.14**	4.4	1.66	**1.17**	0.36	31
Mirex	2.73	4.30	3.89	3.95	**3.92**	-1.6	4.55	**3.88**	0.81	21
Cis-chlordane	0.336	1.48	0.362	0.369	**0.365**	-1.9	0.508	**0.671**	0.54	81
Cis-nonachlor	1.70	2.39	2.41	2.32	**2.37**	3.9	4.26	**2.68**	1.1	41
Trans-chlordane	1.15	1.76	1.70	1.75	**1.73**	-3.2	3.53	**2.04**	1.0	51
Trans-nonachlor	4.36	7.56	3.76	3.82	**3.79**	-1.6	13.9	**7.41**	4.7	63
Heptachlor epoxide	5.05	5.24	4.89	4.86	**4.88**	0.56	6.34	**5.38**	0.66	12

Appendix 28. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Shaktoolik, Alaska in 2009.

Compound	**1424**	**1426**	**1427**	**1428**	**1429**	**Mean**	**SD**	**RSD**
% Lipid	5.84	6.17	6.29	6.29	6.47	**6.21**	0.23	3.7
4,4,'-DDD	1.10	0.108	0.146	3.28	0.496	**1.03**	1.3	130
4,4'-DDE	134	91.7	90.4	158	105	**116**	29	25
4,4'-DDT	3.89	0.963	1.82	0.861	1.76	**1.86**	1.2	65
HCB	44.7	39.0	32.4	43.6	43.1	**40.6**	5.1	13
β-HCH	18.4	15.2	11.5	4.90	15.4	**13.1**	5.2	40
Octachlorosytrene	0.803	0.617	0.634	0.773	0.957	**0.757**	0.14	18
Oxychlordane	26.2	24.8	12.6	35.5	22.1	**24.2**	8.2	34
Pentachlorobenzene	4.57	2.40	2.89	4.28	3.23	**3.47**	0.93	27
Mirex	3.19	3.25	1.82	5.09	3.28	**3.33**	1.2	35
Cis-chlordane	0.618	0.269	0.294	0.482	0.457	**0.424**	0.14	34
Cis-nonachlor	2.91	0.962	1.61	2.03	2.33	**1.97**	0.74	37
Trans-chlordane	2.17	0.843	1.69	1.53	1.52	**1.55**	0.47	31
Trans-nonachlor	14.3	1.88	3.63	5.41	3.41	**5.73**	5.0	87
Heptachlor epoxide	7.27	5.89	3.90	7.90	5.66	**6.13**	1.6	25

Appendix 29. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Stuart Island, Alaska in 2009.

Compound	**1419**	**1420**	**1421**	**1422**	**1423**	**Mean**	**SD**	**RSD**
% Lipid	6.87	5.62	6.35	5.38	6.40	**6.12**	0.61	10
4,4,'-DDD	0.106	0.265	0.116	0.193	1.25	**0.386**	0.49	130
4,4'-DDE	83.9	391	64.9	356	113	**202**	160	78
4,4'-DDT	0.676	4.06	0.519	3.98	5.34	**2.92**	2.2	75
HCB	10.9	39.1	8.42	37.3	41.5	**27.4**	16	60
β-HCH	4.77	23.4	3.45	20.8	15.8	**13.7**	9.2	67
Octachlorosytrene	0.278	0.877	0.214	0.843	0.729	**0.588**	0.32	54
Oxychlordane	1.49	39.4	1.19	36.3	21.2	**19.9**	18	92
Pentachlorobenzene	1.29	2.67	0.819	2.86	2.78	**2.08**	0.96	46
Mirex	0.492	8.34	0.362	7.85	2.54	**3.92**	3.9	100
Cis-chlordane	0.389	0.351	0.359	0.382	0.629	**0.422**	0.12	28
Cis-nonachlor	0.938	3.28	0.715	2.89	2.26	**2.02**	1.1	57
Trans-chlordane	0.847	2.19	0.583	1.92	2.62	**1.63**	0.88	54
Trans-nonachlor	4.08	7.53	3.15	7.02	5.57	**5.47**	1.9	34
Heptachlor epoxide	1.53	7.78	1.34	7.28	6.26	**4.84**	3.2	65

Appendix 30. Lipids (%) and organochlorine pesticide mass fractions (ng g^{-1} wet mass) in glaucous-winged gull eggs collected at Aiktak Island, Alaska in 2009.

Compound	**1473**	**1474**	**1475**	**1477**	**1478**	**Mean**	**SD**	**RSD**
% Lipid	7.03	6.20	6.51	7.32	7.17	**6.85**	0.47	6.8
4,4,'-DDD	0.0886	<LOD	<LOD	0.328	0.0883	**0.168**	0.14	82
4,4'-DDE	17.5	324	39.8	84.4	98.4	**113**	120	110
4,4'-DDT	0.125	<LOD	0.256	0.218	0.134	**0.183**	0.064	35
HCB	6.38	21.6	25.4	28.0	20.4	**20.3**	8.4	41
β-HCH	4.36	25.2	13.9	14.7	11.5	**13.9**	7.5	54
Octachlorosytrene	0.144	0.699	0.443	0.396	0.456	**0.428**	0.20	46
Oxychlordane	3.59	29.8	9.06	17.3	13.6	**14.7**	9.9	67
Pentachlorobenzene	0.592	1.74	1.64	1.45	0.749	**1.24**	0.53	43
Mirex	0.718	8.46	2.17	4.24	4.03	**3.93**	2.9	74
Cis-chlordane	0.334	0.556	0.557	0.516	0.314	**0.456**	0.12	27
Cis-nonachlor	0.803	1.51	1.92	1.11	1.03	**1.28**	0.44	35
Trans-chlordane	0.141	1.60	1.00	0.571	0.946	**0.851**	0.54	64
Trans-nonachlor	1.03	3.06	3.04	1.23	1.06	**1.89**	1.1	57
Heptachlor epoxide	2.59	7.51	4.33	5.74	4.41	**4.91**	1.8	37

Appendix 31. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in unidentified murre eggs collected at Cape Lisburne, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1454	1455	1457	1458	1460	Mean	SD	RSD
BDE47	<LOQ	0.267	0.556	0.306	0.193	**0.331**	0.16	48
BDE99	<LOQ	<LOQ	0.0902	<LOQ	<LOQ	**<LOQ**		
BDE100	<LOD	0.150	0.169	0.164	0.100	**0.146**	0.032	22
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	1.94	3.50	2.50	2.79	1.81	**2.51**	0.68	27
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0336	0.0679	0.0432	0.0405	0.0463	**0.0463**	0.013	28
PCB 52	0.0999	0.197	0.147	0.136	0.141	**0.144**	0.035	24
PCB 56	<LOQ	0.178	0.152	0.191	0.185	**0.176**	0.017	9.7
PCB 63	0.106	0.182	0.150	0.211	0.152	**0.160**	0.039	25
PCB 66	1.50	2.20	1.64	2.01	1.49	**1.77**	0.32	18
PCB 70	0.0494	2.07	0.0527	0.0482	0.0573	**0.456**	0.90	200
PCB 74	1.04	1.76	1.23	1.59	1.13	**1.35**	0.31	23
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOQ	0.0309	0.0291	0.0401	0.0296	**0.0324**	0.0052	16
PCB 87	0.0491	0.159	0.0950	0.166	0.105	**0.115**	0.048	42
PCB 92	0.0812	0.0965	0.0833	0.0915	0.0847	**0.0874**	0.0064	7.3
PCB 95+121	<LOD	0.0568	0.0199	<LOD	<LOD	**0.0383**	0.026	68
PCB 99	1.88	7.71	3.97	4.38	3.86	**4.36**	2.1	48
PCB 101	0.142	0.248	0.162	0.345	0.188	**0.217**	0.082	38
PCB 105	1.32	2.03	1.33	2.05	1.33	**1.61**	0.39	24
PCB 106	0.0200	0.104	0.0151	0.0367	0.0176	**0.0387**	0.037	97
PCB 107	0.256	0.337	0.212	0.379	0.331	**0.303**	0.067	22
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	<LOQ	0.0161	0.0178	0.0258	0.0101	**0.0175**	0.0065	37
PCB 114	0.148	0.235	0.142	0.244	0.134	**0.181**	0.054	30
PCB 118	4.02	7.29	4.40	5.83	4.50	**5.21**	1.3	26
PCB 119	0.0283	0.151	0.0926	0.135	0.0797	**0.0974**	0.049	50
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	0.278	0.856	0.512	0.807	0.524	**0.595**	0.24	40
PCB 130	0.127	0.329	0.233	0.367	0.210	**0.253**	0.096	38
PCB 137	0.0592	0.257	0.169	0.187	0.158	**0.166**	0.071	43
PCB 138	2.18	6.54	4.05	4.41	4.22	**4.28**	1.5	36
PCB 146	1.64	3.14	1.91	2.29	1.83	**2.16**	0.60	28
PCB 149	0.224	0.366	0.307	0.354	0.273	**0.305**	0.058	19

Appendix 31 (Continued).

Compound	1454	1455	1457	1458	1460	Mean	SD	RSD
PCB 151	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 153+132	6.12	16.2	9.57	11.4	9.48	**10.6**	3.7	35
PCB 154	<LOQ	0.0924	0.0883	0.0912	0.0717	**0.0859**	0.0096	11
PCB 156	0.375	0.461	0.339	0.520	0.342	**0.407**	0.080	20
PCB 157	0.0934	0.139	0.0972	0.142	0.0962	**0.113**	0.024	22
PCB 158	0.178	0.434	0.209	0.292	0.249	**0.272**	0.10	37
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	1.29	2.54	1.56	2.39	1.62	**1.88**	0.55	29
PCB 165	<LOQ	0.0366	0.0340	0.0363	0.0339	**0.0352**	0.0015	4.1
PCB 166	0.0342	0.0459	0.0342	0.0316	0.0370	**0.0366**	0.0055	15
PCB 167	0.248	0.395	0.264	0.314	0.243	**0.293**	0.064	22
PCB 170	0.689	1.20	0.782	1.03	0.686	**0.877**	0.23	26
PCB 172	0.269	0.380	0.269	0.336	0.203	**0.291**	0.068	23
PCB 174	<LOQ	0.0689	<LOQ	0.0652	<LOQ	**0.0670**	0.0026	3.8
PCB 175	0.0614	0.117	0.0790	0.0994	0.0527	**0.0818**	0.026	32
PCB 176	0.0302	0.0314	0.0312	0.0391	0.0301	**0.0324**	0.0038	12
PCB 177	0.119	0.332	0.268	0.317	0.240	**0.255**	0.085	33
PCB 178	0.372	0.530	0.394	0.509	0.304	**0.422**	0.096	23
PCB 180+193	1.09	2.79	1.82	2.02	1.57	**1.86**	0.62	34
PCB 183	0.595	0.893	0.616	0.782	0.503	**0.678**	0.16	23
PCB 185	<LOQ	0.0220	<LOQ	0.0138	<LOQ	**0.0179**	0.0058	33
PCB 187	1.60	4.35	2.55	3.59	2.34	**2.88**	1.1	38
PCB 188	0.0321	0.0442	0.0425	0.0440	0.0301	**0.0386**	0.0069	18
PCB 189	0.0397	0.0516	0.0203	0.0151	0.0358	**0.0325**	0.015	46
PCB 191	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 194	0.271	0.396	0.321	0.307	0.182	**0.296**	0.078	26
PCB 195	0.101	0.136	0.103	0.126	0.0700	**0.107**	0.025	24
PCB 196	0.452	0.735	0.515	0.577	0.435	**0.543**	0.12	22
PCB 197	0.0337	0.0556	0.0459	0.0841	0.0346	**0.0508**	0.021	41
PCB 199	1.91	3.14	2.18	2.35	1.45	**2.21**	0.63	28
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	0.582	1.24	0.802	0.928	0.530	**0.816**	0.29	35
PCB 202	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 205	0.0350	0.0364	0.0415	0.0516	0.0278	**0.0385**	0.0088	23
PCB 206	<LOQ	0.254	0.233	<LOQ	<LOQ	**0.244**	0.015	6.0
PCB 207	0.0492	0.0975	0.0577	0.0660	0.0531	**0.0647**	0.019	30
PCB 208	0.106	0.146	0.129	0.111	0.0870	**0.116**	0.023	19
PCB 209	<LOQ	0.139	0.0764	0.0731	0.0566	**0.0864**	0.036	42

Appendix 32. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at Little Diomede Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1250	1256	1257	1260	1261	Mean	SD	RSD
BDE47	0.597	0.589	0.408	0.520	0.536	**0.530**	0.076	14
BDE99	<LOQ	<LOQ	<LOQ	<LOQ	0.870	**<LOQ**		
BDE100	0.565	0.564	0.610	0.532	0.604	**0.575**	0.032	5.6
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	4.25	5.12	4.02	5.09	3.28	**4.35**	0.77	18
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0826	0.0577	0.0569	0.0806	0.0689	**0.0693**	0.012	18
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0981	0.127	0.0779	0.0778	0.125	**0.101**	0.024	24
PCB 52	0.244	0.252	0.118	0.131	0.219	**0.193**	0.064	33
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	0.250	0.241	0.238	0.257	0.194	**0.236**	0.025	10
PCB 66	2.91	3.37	2.83	3.31	2.36	**2.96**	0.41	14
PCB 70	0.101	0.103	0.0394	0.0498	0.111	**0.0807**	0.033	41
PCB 74	2.42	2.73	2.23	2.60	2.00	**2.40**	0.29	12
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.00533	<LOD	<LOD	<LOD	0.0167	**0.0110**	0.0081	73
PCB 87	0.151	0.175	0.0790	0.126	0.149	**0.136**	0.036	27
PCB 92	0.0783	0.113	0.0579	0.0650	0.0847	**0.0798**	0.021	27
PCB 95+121	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 99	7.28	8.14	6.19	7.29	6.17	**7.01**	0.83	12
PCB 101	0.129	0.220	<LOD	0.0500	0.196	**0.149**	0.076	51
PCB 105	2.00	2.55	1.97	2.46	1.73	**2.14**	0.35	16
PCB 106	0.0168	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 107	0.468	0.524	0.489	0.520	0.399	**0.480**	0.051	11
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.224	0.292	0.243	0.272	0.224	**0.251**	0.030	12
PCB 118	7.76	9.23	7.19	8.25	7.00	**7.89**	0.90	11
PCB 119	0.171	0.191	0.146	0.167	0.148	**0.165**	0.018	11
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	1.13	1.14	0.766	0.945	0.804	**0.957**	0.18	18
PCB 130	0.353	0.433	0.272	0.330	0.315	**0.340**	0.059	17
PCB 137	0.365	0.372	0.261	0.296	0.309	**0.321**	0.047	15
PCB 138	7.45	7.79	5.56	6.59	6.18	**6.71**	0.91	14
PCB 146	3.23	3.71	3.03	3.34	3.03	**3.27**	0.28	8.7
PCB 149	0.483	0.524	0.400	0.373	0.479	**0.452**	0.063	14

Appendix 32 (Continued).

Compound	1250	1256	1257	1260	1261	Mean	SD	RSD
PCB 151	0.0861	0.0834	<LOQ	<LOQ	<LOQ	**0.0847**	0.0019	2.2
PCB 153+132	17.0	18.7	13.7	15.2	15.4	**16.0**	1.9	12
PCB 154	0.127	0.126	0.0871	0.0962	0.122	**0.112**	0.019	17
PCB 156	0.575	0.749	0.599	0.619	0.536	**0.615**	0.081	13
PCB 157	0.196	0.241	0.187	0.182	0.151	**0.191**	0.033	17
PCB 158	0.379	0.371	0.200	0.218	0.302	**0.294**	0.083	28
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	2.83	3.04	2.54	2.77	2.64	**2.76**	0.19	7.0
PCB 165	0.0297	0.0248	0.0287	0.0319	0.0148	**0.0260**	0.0068	26
PCB 166	0.0591	0.0574	0.0599	0.0543	0.0485	**0.0558**	0.0047	8.3
PCB 167	0.365	0.418	0.304	0.346	0.311	**0.349**	0.046	13
PCB 170	1.12	1.35	1.11	1.18	1.11	**1.18**	0.10	8.8
PCB 172	0.384	0.439	0.380	0.402	0.345	**0.390**	0.034	8.8
PCB 174	0.0367	0.0665	0.0340	0.0595	0.0500	**0.0493**	0.014	29
PCB 175	0.0930	0.100	0.0613	0.0795	0.0768	**0.0821**	0.015	18
PCB 176	0.00649	<LOQ	0.00896	0.00890	0.00802	**0.00809**	0.0012	14
PCB 177	0.278	0.288	0.171	0.207	0.261	**0.241**	0.050	21
PCB 178	0.530	0.430	0.194	0.384	0.267	**0.361**	0.13	37
PCB 180+193	2.87	3.17	2.35	2.61	2.81	**2.76**	0.31	11
PCB 183	0.793	0.918	0.754	0.834	0.763	**0.812**	0.067	8.2
PCB 185	0.0377	0.0419	0.0268	0.0423	0.0367	**0.0371**	0.0062	17
PCB 187	3.53	3.80	2.77	3.14	3.21	**3.29**	0.39	12
PCB 188	0.0259	0.0263	0.0194	0.0240	0.0191	**0.0229**	0.0035	15
PCB 189	0.0500	0.0266	<LOQ	<LOQ	<LOQ	**0.0383**	0.017	43
PCB 191	0.0280	0.0223	0.0381	0.0369	0.0288	**0.0308**	0.0066	21
PCB 194	0.336	0.409	0.340	0.380	0.296	**0.352**	0.044	12
PCB 195	0.175	0.186	0.144	0.166	0.160	**0.166**	0.016	9.6
PCB 196	0.898	0.859	0.773	0.862	0.811	**0.841**	0.049	5.8
PCB 197	0.0652	0.0688	0.0503	0.0513	0.0440	**0.0560**	0.011	19
PCB 199	3.34	3.47	3.17	3.55	3.08	**3.32**	0.20	5.9
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	1.34	1.08	0.922	1.23	0.932	**1.10**	0.18	17
PCB 202	0.0663	0.0705	0.0639	0.0488	0.0533	**0.0606**	0.0091	15
PCB 205	0.0215	0.0336	0.0259	0.0296	0.0290	**0.0279**	0.0045	16
PCB 206	0.266	0.210	0.242	0.325	0.221	**0.253**	0.046	18
PCB 207	0.0755	0.0857	0.0546	0.0680	0.0632	**0.0694**	0.012	17
PCB 208	0.121	0.0865	0.0896	0.154	0.148	**0.120**	0.031	26
PCB 209	0.134	0.115	0.125	0.185	0.140	**0.140**	0.027	19

Appendix 33. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in common murre eggs collected at St. Lawrence Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1265	1266	1267	1268	1275	Mean	SD	RSD
BDE47	0.326	0.297	0.278	0.223	0.348	**0.294**	0.048	16
BDE99	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
BDE100	0.579	0.495	0.538	0.542	0.585	**0.548**	0.037	6.7
PCB 8	0.154	<LOD	0.0908	0.0182	0.116	**0.0948**	0.057	60
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	1.77	2.51	3.63	2.57	3.23	**2.74**	0.72	26
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0613	0.0727	0.0853	0.0604	0.0724	**0.0704**	0.010	14
PCB 45	0.519	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0792	0.0723	0.0636	0.0903	0.0899	**0.0791**	0.011	15
PCB 52	0.130	0.148	0.0801	0.130	0.135	**0.125**	0.026	21
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 66	2.27	2.77	2.47	2.16	2.29	**2.39**	0.24	10
PCB 70	0.0543	0.0662	0.0292	0.0664	0.0560	**0.0544**	0.015	28
PCB 74	1.87	2.25	2.01	1.82	1.85	**1.96**	0.18	9.0
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 87	0.0454	0.108	0.0766	0.0665	0.0526	**0.0698**	0.024	35
PCB 92	0.0485	0.0642	0.0375	0.0435	0.0589	**0.0505**	0.011	22
PCB 95+121	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 99	4.59	5.79	5.00	4.49	4.18	**4.81**	0.62	13
PCB 101	<LOD	0.0397	<LOD	<LOD	<LOD	**<LOD**		
PCB 105	1.63	2.34	1.59	1.34	1.44	**1.67**	0.39	24
PCB 106	0.0124	<LOQ	<LOQ	0.0128	0.0125	**0.0126**	0.00021	1.7
PCB 107	0.219	0.371	0.341	0.232	0.296	**0.292**	0.066	23
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.181	0.260	0.175	0.181	0.174	**0.194**	0.037	19
PCB 118	6.36	8.44	5.71	5.61	5.23	**6.27**	1.3	20
PCB 119	0.109	0.140	0.108	0.108	0.0925	**0.111**	0.017	15
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	0.679	0.795	0.645	0.611	0.551	**0.656**	0.091	14
PCB 130	0.328	0.324	0.231	0.363	0.188	**0.287**	0.074	26
PCB 137	0.248	0.343	0.207	0.253	0.189	**0.248**	0.060	24
PCB 138	4.62	6.27	4.15	4.15	3.80	**4.60**	0.98	21
PCB 146	2.06	2.85	2.33	2.18	2.18	**2.32**	0.31	13
PCB 149	0.326	0.373	0.325	0.314	0.351	**0.338**	0.024	7.1

Appendix 33 (Continued).

Compound	1265	1266	1267	1268	1275	Mean	SD	RSD
PCB 151	0.0784	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 153+132	10.2	13.9	9.99	10.6	9.30	**10.8**	1.8	17
PCB 154	0.100	0.0918	0.0714	0.0927	0.0847	**0.0882**	0.011	12
PCB 156	0.508	0.664	0.472	0.430	0.446	**0.504**	0.094	19
PCB 157	0.158	0.182	0.141	0.123	0.124	**0.146**	0.025	17
PCB 158	0.176	0.360	0.271	0.229	0.188	**0.245**	0.074	30
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	1.84	2.33	1.75	1.81	1.68	**1.88**	0.26	14
PCB 165	0.0259	0.0359	0.0228	0.0268	0.0174	**0.0258**	0.0068	26
PCB 166	0.0374	0.0471	0.0410	0.0358	0.0511	**0.0425**	0.0065	15
PCB 167	0.241	0.401	0.222	0.220	0.212	**0.259**	0.080	31
PCB 170	0.787	1.09	0.739	0.789	0.782	**0.837**	0.14	17
PCB 172	0.279	0.383	0.282	0.281	0.324	**0.310**	0.045	14
PCB 174	0.0399	0.0410	0.0477	0.0376	0.0344	**0.0401**	0.0049	12
PCB 175	0.0358	0.0844	0.0519	0.0526	0.0566	**0.0563**	0.018	31
PCB 176	<LOQ	<LOQ	0.00496	0.0106	<LOQ	**0.00777**	0.0040	51
PCB 177	0.157	0.203	0.137	0.162	0.125	**0.157**	0.030	19
PCB 178	0.145	0.279	0.183	0.159	0.119	**0.177**	0.062	35
PCB 180+193	1.87	2.58	1.68	1.95	1.77	**1.97**	0.35	18
PCB 183	0.394	0.617	0.517	0.393	0.500	**0.484**	0.094	19
PCB 185	0.0180	0.0128	0.0176	0.0179	0.0169	**0.0166**	0.0022	13
PCB 187	1.41	2.74	1.69	1.74	1.69	**1.85**	0.51	28
PCB 188	0.00784	0.0314	0.0197	0.0151	0.0200	**0.0188**	0.0086	46
PCB 189	<LOQ	0.0211	0.0548	0.0627	0.0574	**0.0490**	0.019	39
PCB 191	0.0258	0.0195	0.0177	0.0229	0.0255	**0.0223**	0.0036	16
PCB 194	0.133	0.220	0.218	0.143	0.251	**0.193**	0.052	27
PCB 195	0.108	0.119	0.140	0.121	0.134	**0.124**	0.013	10
PCB 196	0.612	0.699	0.683	0.652	0.751	**0.679**	0.052	7.6
PCB 197	0.0483	0.0408	0.0547	0.0469	0.0557	**0.0493**	0.0061	12
PCB 199	1.91	2.68	2.71	2.49	2.83	**2.52**	0.37	15
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.491	0.614	0.835	0.847	0.806	**0.719**	0.16	22
PCB 202	0.0388	0.0620	<LOQ	0.0548	0.0405	**0.0490**	0.011	23
PCB 205	0.0216	0.0185	0.0258	0.0307	0.0316	**0.0256**	0.0057	22
PCB 206	0.170	0.364	0.199	0.321	0.216	**0.254**	0.084	33
PCB 207	0.0508	0.0611	0.0631	0.0898	0.0718	**0.0673**	0.015	22
PCB 208	0.111	0.203	0.164	0.208	0.130	**0.163**	0.043	26
PCB 209	0.106	0.151	0.138	0.182	0.183	**0.152**	0.032	21

Appendix 34. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at St. Lawrence Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1278	1279	1281	1284	1287	Mean	SD	RSD
BDE47	0.501	0.174	0.282	0.187	0.549	**0.339**	0.18	52
BDE99	0.875	<LOQ	<LOQ	<LOQ	0.929	**0.902**	0.038	4.2
BDE100	0.513	0.511	0.460	0.585	0.746	**0.563**	0.11	20
PCB 8	0.0344	<LOD	0.0400	<LOD	<LOD	**0.0372**	0.0039	11
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	3.73	3.15	2.65	3.33	3.34	**3.24**	0.39	12
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0548	0.0489	0.0541	0.0549	0.0592	**0.0544**	0.0037	6.7
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0617	0.0586	0.0538	0.0734	0.0827	**0.0661**	0.012	18
PCB 52	0.0909	0.0821	0.0668	0.0876	0.118	**0.0891**	0.019	21
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	0.213	<LOQ	<LOQ	0.191	<LOQ	**0.202**	0.016	7.7
PCB 66	2.63	2.29	1.87	2.60	2.56	**2.39**	0.32	13
PCB 70	0.0298	0.0335	0.0161	0.0271	0.0511	**0.0315**	0.013	40
PCB 74	2.24	1.90	1.50	2.14	2.20	**2.00**	0.31	15
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 87	0.0935	0.0408	0.0296	0.0767	0.0797	**0.0641**	0.027	43
PCB 92	0.0371	0.0333	0.0450	0.0645	0.0636	**0.0487**	0.015	30
PCB 95+121	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 99	6.17	4.36	3.97	5.81	5.43	**5.15**	0.94	18
PCB 101	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 105	1.78	1.65	1.22	1.97	1.36	**1.60**	0.30	19
PCB 106	0.00986	0.0264	0.0298	<LOQ	0.00971	**0.0189**	0.011	56
PCB 107	0.363	0.308	0.288	0.358	0.332	**0.330**	0.032	9.7
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.220	0.183	0.145	0.225	0.183	**0.191**	0.033	17
PCB 118	6.81	5.49	4.59	7.13	6.08	**6.02**	1.0	17
PCB 119	0.156	0.0828	0.0896	0.117	0.134	**0.116**	0.030	26
PCB 127	2.18	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	0.818	0.593	0.506	0.804	0.824	**0.709**	0.15	21
PCB 130	0.334	0.221	0.170	0.304	0.334	**0.273**	0.073	27
PCB 137	0.295	0.192	0.142	0.245	0.308	**0.236**	0.070	30
PCB 138	5.74	4.13	3.29	5.32	5.56	**4.81**	1.1	22
PCB 146	2.60	2.32	1.83	3.01	2.54	**2.46**	0.43	18
PCB 149	0.359	0.297	0.256	0.331	0.368	**0.322**	0.046	14

Appendix 34 (Continued).

Compound	1278	1279	1281	1284	1287	Mean	SD	RSD
PCB 151	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 153+132	13.0	10.2	7.97	13.4	13.0	**11.5**	2.3	20
PCB 154	0.106	0.0703	0.0741	0.0775	0.117	**0.0890**	0.021	24
PCB 156	0.493	0.432	0.385	0.572	0.444	**0.465**	0.071	15
PCB 157	0.138	0.124	0.114	0.175	0.130	**0.136**	0.024	17
PCB 158	0.254	0.126	0.133	0.207	0.242	**0.192**	0.060	31
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	2.16	1.73	1.42	2.39	2.27	**1.99**	0.41	20
PCB 165	0.0164	0.0263	0.0274	0.0253	0.0133	**0.0217**	0.0064	29
PCB 166	0.0405	0.0439	0.0470	0.0529	0.0381	**0.0445**	0.0058	13
PCB 167	0.268	0.252	0.168	0.296	0.246	**0.246**	0.048	19
PCB 170	0.846	0.718	0.582	0.904	0.856	**0.781**	0.13	17
PCB 172	0.292	0.315	0.197	0.313	0.285	**0.281**	0.048	17
PCB 174	0.0303	0.0311	0.0324	0.0454	0.0401	**0.0358**	0.0066	18
PCB 175	0.0712	0.0625	0.0406	0.0714	0.0668	**0.0625**	0.013	20
PCB 176	0.00714	0.00913	0.0118	0.00763	0.00537	**0.00821**	0.0024	29
PCB 177	0.272	0.126	0.118	0.203	0.299	**0.204**	0.082	40
PCB 178	0.278	0.136	0.122	0.299	0.220	**0.211**	0.081	38
PCB 180+193	2.26	1.70	1.35	2.20	2.44	**1.99**	0.45	23
PCB 183	0.571	0.562	0.373	0.627	0.510	**0.529**	0.096	18
PCB 185	0.0323	0.0263	0.0210	0.0253	0.0296	**0.0269**	0.0043	16
PCB 187	2.45	2.28	1.41	2.89	2.63	**2.33**	0.56	24
PCB 188	0.0214	0.0245	0.0189	0.0131	0.0147	**0.0185**	0.0047	25
PCB 189	0.0606	0.0518	0.0199	0.0636	0.0607	**0.0513**	0.018	35
PCB 191	0.0301	0.0221	0.0187	0.0170	0.0354	**0.0247**	0.0078	32
PCB 194	0.182	0.162	0.155	0.268	0.232	**0.200**	0.049	24
PCB 195	0.0823	0.0983	0.0763	0.121	0.110	**0.0976**	0.019	19
PCB 196	0.698	0.687	0.610	0.787	0.734	**0.703**	0.065	9.2
PCB 197	0.0617	0.0680	0.0336	0.0510	0.0648	**0.0558**	0.014	25
PCB 199	2.56	2.60	2.06	3.15	2.72	**2.62**	0.39	15
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.747	0.896	0.648	1.12	0.786	**0.839**	0.18	21
PCB 202	0.0530	0.0420	0.0504	0.0368	0.0378	**0.0440**	0.0073	17
PCB 205	0.0320	0.0492	0.0426	0.0248	0.0475	**0.0392**	0.010	27
PCB 206	0.183	0.178	0.314	0.174	0.356	**0.241**	0.087	36
PCB 207	0.0582	0.0615	0.0510	0.0824	0.0660	**0.0638**	0.012	18
PCB 208	0.0855	0.119	0.166	0.105	0.171	**0.129**	0.038	29
PCB 209	0.102	0.133	0.0873	0.230	0.118	**0.134**	0.056	42

Appendix 35. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in common murre eggs collected at Sledge Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1292	1295	1301	1303	1305	Mean	SD	RSD
BDE47	0.739	0.839	0.753	0.665	1.10	**0.819**	0.17	20
BDE99	<LOQ	<LOQ	<LOQ	0.988	1.25	**1.12**	0.18	17
BDE100	0.600	0.601	0.635	0.679	0.845	**0.672**	0.10	15
PCB 8	<LOD	0.0401	0.0316	0.0955	0.0945	**0.0654**	0.034	52
PCB 18	<LOD	<LOD	0.0103	<LOD	<LOD	**<LOD**		
PCB 28+31	2.21	3.02	2.37	3.10	4.06	**2.95**	0.73	25
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0622	0.0643	0.110	0.0989	0.0633	**0.0797**	0.023	29
PCB 45	<LOQ	<LOQ	0.0683	<LOQ	0.0645	**0.0664**	0.0027	4.0
PCB 49	0.0892	0.0726	0.138	0.163	0.351	**0.163**	0.11	68
PCB 52	0.188	0.105	0.234	0.284	0.318	**0.226**	0.084	37
PCB 56	<LOQ	<LOQ	0.0229	<LOQ	<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	0.201	<LOQ	0.227	**0.214**	0.018	8.4
PCB 66	1.88	2.58	2.07	2.28	2.98	**2.36**	0.43	18
PCB 70	0.0894	0.0478	0.147	0.159	0.198	**0.128**	0.060	46
PCB 74	1.57	2.08	1.66	1.90	2.66	**1.98**	0.43	22
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOD	<LOD	0.0580	0.00375	0.0162	**0.0260**	0.028	110
PCB 87	0.0700	0.0451	0.113	0.137	0.361	**0.145**	0.13	87
PCB 92	0.0657	0.0434	0.132	0.101	0.103	**0.0891**	0.035	39
PCB 95+121	<LOD	<LOD	0.0709	<LOD	<LOD	**<LOD**		
PCB 99	3.64	5.56	3.69	4.88	8.51	**5.26**	2.0	38
PCB 101	0.0700	<LOD	0.146	0.199	2.13	**0.635**	1.0	160
PCB 105	1.10	2.01	1.30	1.36	2.03	**1.56**	0.43	28
PCB 106	0.0254	0.0239	0.0681	0.0310	0.0125	**0.0322**	0.021	66
PCB 107	0.233	0.305	0.366	0.236	0.468	**0.321**	0.099	31
PCB 110	<LOD	<LOD	<LOD	<LOD	0.672	**<LOD**		
PCB 112	<LOD	<LOD	0.0528	<LOD	<LOD	**<LOD**		
PCB 114	0.154	0.230	0.224	0.188	0.263	**0.212**	0.042	20
PCB 118	4.54	7.13	4.88	5.57	8.85	**6.20**	1.8	29
PCB 119	0.0956	0.113	0.124	0.123	0.244	**0.140**	0.059	42
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	0.626	0.919	0.641	0.757	1.56	**0.901**	0.39	43
PCB 130	0.200	0.268	0.322	0.299	0.837	**0.385**	0.26	67
PCB 137	0.249	0.287	0.265	0.271	0.659	**0.346**	0.18	51
PCB 138	4.38	6.27	4.11	4.97	10.1	**5.97**	2.5	41
PCB 146	2.02	2.97	2.10	2.42	3.73	**2.65**	0.71	27
PCB 149	0.361	0.309	0.401	0.497	1.34	**0.582**	0.43	74

Appendix 35 (Continued).

Compound	1292	1295	1301	1303	1305	Mean	SD	RSD
PCB 151	0.0781	0.0763	0.126	0.0898	0.102	**0.0946**	0.021	22
PCB 153+132	10.3	14.8	9.97	12.4	23.8	**14.3**	5.7	40
PCB 154	0.102	0.0955	0.154	0.126	0.387	**0.173**	0.12	70
PCB 156	0.383	0.615	0.471	0.421	0.620	**0.502**	0.11	22
PCB 157	0.121	0.175	0.195	0.141	0.197	**0.166**	0.034	20
PCB 158	0.236	0.398	0.350	0.343	0.904	**0.446**	0.26	59
PCB 159	<LOQ	<LOQ	0.0570	<LOQ	<LOQ	**<LOQ**		
PCB 163	1.66	2.17	1.83	1.98	3.13	**2.15**	0.58	27
PCB 165	0.0208	0.0213	0.0574	0.0144	0.0366	**0.0301**	0.017	58
PCB 166	0.0397	0.0496	0.135	0.0388	0.0776	**0.0681**	0.041	60
PCB 167	0.192	0.325	0.335	0.241	0.428	**0.304**	0.091	30
PCB 170	0.888	1.07	0.888	0.931	1.65	**1.09**	0.33	30
PCB 172	0.251	0.314	0.345	0.318	0.432	**0.332**	0.066	20
PCB 174	0.0431	0.0539	0.103	0.0686	0.122	**0.0781**	0.033	43
PCB 175	0.0635	0.0872	0.150	0.0753	0.140	**0.103**	0.039	38
PCB 176	0.0167	0.0138	0.0869	0.0151	0.0221	**0.0309**	0.031	100
PCB 177	0.206	0.155	0.203	0.266	0.970	**0.360**	0.34	95
PCB 178	0.191	0.370	0.207	0.216	0.695	**0.336**	0.21	63
PCB 180+193	2.15	2.64	2.14	2.40	4.57	**2.78**	1.0	37
PCB 183	0.526	0.706	0.583	0.591	1.79	**0.839**	0.53	64
PCB 185	0.0273	0.0175	0.0905	0.0229	0.0488	**0.0414**	0.030	72
PCB 187	1.93	2.78	1.91	2.48	5.65	**2.95**	1.6	53
PCB 188	0.0141	0.0289	0.0738	0.0171	0.0347	**0.0337**	0.024	71
PCB 189	0.0458	<LOQ	0.108	0.0200	0.0205	**0.0486**	0.041	85
PCB 191	0.0135	0.0381	0.0544	0.0197	0.0521	**0.0355**	0.019	52
PCB 194	0.225	0.339	0.353	0.237	0.409	**0.312**	0.079	25
PCB 195	0.147	0.159	0.227	0.132	0.211	**0.175**	0.042	24
PCB 196	0.715	0.863	0.790	0.826	1.00	**0.839**	0.11	13
PCB 197	0.0409	0.0531	0.121	0.0579	0.0698	**0.0686**	0.031	46
PCB 199	2.41	3.29	2.69	2.92	3.64	**2.99**	0.49	16
PCB 200	<LOD	<LOD	0.00357	<LOD	<LOD	**<LOD**		
PCB 201	0.899	1.08	1.39	0.924	1.19	**1.10**	0.20	19
PCB 202	<LOQ	0.0608	0.104	0.0587	0.217	**0.110**	0.074	67
PCB 205	0.0104	0.0605	0.0927	0.0232	0.0488	**0.0471**	0.032	69
PCB 206	0.121	0.436	0.321	0.285	0.385	**0.310**	0.12	39
PCB 207	0.0378	0.0685	0.0866	0.0490	0.0874	**0.0659**	0.022	34
PCB 208	0.0620	0.137	0.122	0.140	0.184	**0.129**	0.044	34
PCB 209	0.0938	0.160	0.196	0.110	0.196	**0.151**	0.048	32

Appendix 36. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in common murre eggs collected at Bluff, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1307	1309	1314	1319	1320	Mean	SD	RSD
BDE47	0.801	0.641	0.357	0.676	1.05	**0.704**	0.25	36
BDE99	1.06	<LOQ	<LOQ	<LOQ	0.935	**0.998**	0.089	8.9
BDE100	0.818	0.570	0.538	0.595	0.740	**0.652**	0.12	19
PCB 8	<LOD	0.0445	0.0310	0.0625	0.0313	**0.0423**	0.015	35
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	4.20	2.52	2.66	2.27	2.64	**2.86**	0.76	27
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0553	<LOQ	<LOQ	0.0455	0.0461	**0.0490**	0.0055	11
PCB 45	<LOQ	<LOQ	0.0294	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0848	0.207	0.0617	0.0696	0.0848	**0.102**	0.060	59
PCB 52	0.0929	0.120	0.0564	0.102	0.0801	**0.0903**	0.024	27
PCB 56	1.10	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	0.230	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 66	3.27	1.93	2.35	1.72	2.10	**2.27**	0.60	27
PCB 70	0.0132	0.103	0.0265	0.0438	0.0269	**0.0427**	0.035	83
PCB 74	2.70	1.66	1.87	1.43	1.82	**1.90**	0.48	25
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOD	0.00448	0.00513	<LOD	<LOD	**0.00480**	0.00046	9.6
PCB 87	0.141	0.244	0.0476	0.0877	0.105	**0.125**	0.074	59
PCB 92	0.0423	0.0511	0.0468	0.0798	0.0588	**0.0558**	0.015	26
PCB 95+121	0.0247	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 99	8.73	5.18	4.96	4.04	5.38	**5.66**	1.8	32
PCB 101	0.0383	1.52	<LOD	0.0843	0.0612	**0.426**	0.73	170
PCB 105	2.47	1.18	1.83	0.964	1.21	**1.53**	0.62	40
PCB 106	0.0417	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 107	0.519	0.272	0.338	0.262	0.376	**0.353**	0.10	29
PCB 110	<LOD	0.123	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.262	0.150	0.246	0.141	0.171	**0.194**	0.056	29
PCB 118	9.77	5.36	6.57	4.47	5.63	**6.36**	2.0	32
PCB 119	0.221	0.145	0.0966	0.107	0.136	**0.141**	0.049	35
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	1.44	0.972	0.812	0.713	0.902	**0.968**	0.28	29
PCB 130	0.570	0.459	0.241	0.260	0.376	**0.381**	0.14	36
PCB 137	0.455	0.402	0.240	0.231	0.339	**0.333**	0.098	30
PCB 138	9.81	6.51	5.33	4.28	6.01	**6.39**	2.1	33
PCB 146	4.45	2.33	3.00	2.03	2.50	**2.86**	0.96	33
PCB 149	0.417	0.755	0.289	0.388	0.377	**0.445**	0.18	40

Appendix 36 (Continued).

Compound	1307	1309	1314	1319	1320	Mean	SD	RSD
PCB 151	0.0971	<LOQ	<LOQ	0.0781	<LOQ	**0.0876**	0.013	15
PCB 153+132	23.9	15.1	13.9	10.8	14.8	**15.7**	4.9	31
PCB 154	0.158	0.256	0.0966	0.108	0.144	**0.153**	0.063	41
PCB 156	0.816	0.373	0.658	0.401	0.444	**0.538**	0.19	36
PCB 157	0.271	0.105	0.180	0.117	0.128	**0.160**	0.068	43
PCB 158	0.429	0.564	0.164	0.280	0.319	**0.351**	0.15	43
PCB 159	0.0136	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	3.67	2.06	2.42	1.73	2.35	**2.45**	0.74	30
PCB 165	0.0339	0.0190	0.0286	0.0196	0.0206	**0.0243**	0.0066	27
PCB 166	0.0815	0.0468	0.0655	0.0374	0.0379	**0.0538**	0.019	36
PCB 167	0.499	0.256	0.336	0.192	0.251	**0.307**	0.12	39
PCB 170	1.88	0.999	1.27	0.974	1.07	**1.24**	0.38	30
PCB 172	0.533	0.254	0.419	0.274	0.309	**0.358**	0.12	33
PCB 174	0.0951	0.126	0.0694	0.0463	0.0443	**0.0762**	0.034	45
PCB 175	0.0958	0.105	0.0839	0.0637	0.0830	**0.0862**	0.015	18
PCB 176	<LOQ	0.0101	0.0129	0.0102	<LOQ	**0.0111**	0.0016	14
PCB 177	0.449	0.644	0.152	0.235	0.380	**0.372**	0.19	52
PCB 178	0.427	0.295	0.284	0.223	0.343	**0.314**	0.076	24
PCB 180+193	4.34	2.96	2.66	2.32	2.95	**3.05**	0.77	25
PCB 183	1.17	1.08	0.814	0.571	0.698	**0.867**	0.25	29
PCB 185	0.0347	0.0432	0.0274	0.0334	0.0457	**0.0369**	0.0075	20
PCB 187	5.14	3.17	2.83	2.10	2.82	**3.21**	1.1	36
PCB 188	0.0460	0.0116	0.0267	0.0206	0.0178	**0.0245**	0.013	54
PCB 189	0.0266	<LOQ	0.0713	<LOQ	<LOQ	**0.0490**	0.032	64
PCB 191	0.0534	0.0405	0.0328	0.0246	0.0213	**0.0345**	0.013	37
PCB 194	0.627	0.242	0.507	0.296	0.293	**0.393**	0.17	42
PCB 195	0.283	0.104	0.225	0.151	0.148	**0.182**	0.071	39
PCB 196	1.28	0.666	0.969	0.730	0.844	**0.897**	0.24	27
PCB 197	0.135	0.0572	0.0808	0.0784	0.0807	**0.0864**	0.029	33
PCB 199	5.14	2.32	4.01	2.56	3.09	**3.43**	1.2	34
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	1.73	0.693	1.26	1.01	1.01	**1.14**	0.38	34
PCB 202	0.0826	0.0966	0.0630	0.0639	0.0837	**0.0780**	0.014	18
PCB 205	0.0485	0.0147	0.0281	0.0313	0.0344	**0.0314**	0.012	39
PCB 206	0.370	0.197	0.361	0.179	0.767	**0.375**	0.24	63
PCB 207	0.143	0.0498	0.116	0.0599	0.0642	**0.0866**	0.041	47
PCB 208	0.187	0.116	0.127	0.0427	0.0806	**0.111**	0.054	49
PCB 209	0.262	0.106	0.200	0.0923	0.135	**0.159**	0.071	45

Appendix 37. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in common murre eggs collected at Cape Denbigh, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1443	1446	1448	1449	1452	Mean	SD	RSD
BDE47	0.726	0.458	0.524	0.320	0.580	**0.522**	0.15	29
BDE99	0.141	<LOQ	0.0993	<LOQ	0.163	**0.134**	0.032	24
BDE100	0.210	0.165	0.190	0.124	0.240	**0.186**	0.044	24
PCB 8	<LOD	0.00688	0.0375	0.0147	<LOD	**0.0197**	0.016	81
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	1.27	1.60	2.07	1.70	1.74	**1.67**	0.29	17
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0661	0.0500	0.0700	0.0455	0.0429	**0.0549**	0.012	23
PCB 52	0.154	0.149	0.196	0.125	0.196	**0.164**	0.031	19
PCB 56	0.151	0.180	0.196	0.197	0.177	**0.180**	0.019	10
PCB 63	0.0796	0.0992	0.125	0.0680	0.109	**0.0962**	0.023	24
PCB 66	1.00	1.29	1.46	1.45	1.29	**1.30**	0.19	14
PCB 70	0.0708	0.0663	0.0735	0.0509	0.0694	**0.0662**	0.0089	13
PCB 74	0.791	0.920	1.13	1.01	1.14	**0.999**	0.15	15
PCB 79	0.0254	<LOQ	<LOQ	0.0287	0.0370	**0.0304**	0.006	20
PCB 82	0.0303	0.0353	0.0300	<LOQ	<LOQ	**0.0319**	0.0029	9.3
PCB 87	0.0256	0.0637	0.110	0.0228	0.0832	**0.0611**	0.037	61
PCB 92	0.0936	0.0897	0.114	0.0886	0.0859	**0.0943**	0.011	12
PCB 95+121	<LOD	<LOD	0.0243	<LOD	<LOD	**<LOD**		
PCB 99	2.75	2.74	4.32	3.03	3.97	**3.36**	0.73	22
PCB 101	0.227	0.197	0.287	0.155	0.263	**0.226**	0.052	23
PCB 105	0.849	0.974	1.22	1.31	1.11	**1.09**	0.18	17
PCB 106	0.0206	0.0167	0.0211	0.0272	0.0173	**0.0206**	0.0042	20
PCB 107	0.153	0.176	0.241	0.148	0.198	**0.183**	0.038	21
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	0.00984	0.0105	0.0130	0.00982	0.0157	**0.0118**	0.0025	22
PCB 114	0.0904	0.109	0.131	0.131	0.113	**0.115**	0.017	15
PCB 118	3.01	3.25	4.52	3.80	4.09	**3.74**	0.62	16
PCB 119	0.0643	0.0598	0.105	0.0613	0.106	**0.0792**	0.024	30
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	0.460	0.419	0.658	0.423	0.702	**0.532**	0.14	26
PCB 130	0.144	0.156	0.228	0.129	0.249	**0.181**	0.054	30
PCB 137	0.153	0.121	0.228	0.133	0.256	**0.178**	0.060	34
PCB 138	3.46	3.27	4.80	3.39	4.93	**3.97**	0.82	21
PCB 146	1.21	1.39	1.78	1.58	1.69	**1.53**	0.23	15
PCB 149	0.247	0.267	0.316	0.238	0.298	**0.273**	0.033	12

Appendix 37 (Continued).

Compound	1443	1446	1448	1449	1452	Mean	SD	RSD
PCB 151	<LOQ	0.0142	0.0204	<LOQ	0.0225	**0.0190**	0.0043	22
PCB 153+132	7.68	7.43	11.2	7.74	11.0	**9.01**	1.9	21
PCB 154	0.0842	0.0700	0.0930	0.0682	0.113	**0.0856**	0.018	21
PCB 156	0.246	0.274	0.301	0.343	0.336	**0.300**	0.041	14
PCB 157	0.0805	0.0883	0.0939	0.105	0.100	**0.0936**	0.0097	10
PCB 158	0.135	0.181	0.326	0.165	0.176	**0.197**	0.075	38
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	1.02	1.19	1.51	1.13	1.48	**1.27**	0.22	17
PCB 165	<LOQ	0.0369	0.0341	0.0372	<LOQ	**0.0361**	0.0017	4.6
PCB 166	0.0293	0.0280	0.0311	0.0338	0.0296	**0.0304**	0.0022	7.3
PCB 167	0.206	0.210	0.262	0.258	0.244	**0.236**	0.026	11
PCB 170	0.669	0.674	0.810	0.713	0.895	**0.752**	0.098	13
PCB 172	0.155	0.213	0.209	0.234	0.202	**0.203**	0.029	14
PCB 174	0.0698	0.0630	0.0714	0.0696	0.0667	**0.0681**	0.0033	4.9
PCB 175	0.0528	0.0580	0.0703	0.0645	0.0709	**0.0633**	0.0078	12
PCB 176	0.0320	0.0305	0.0333	0.0326	0.0312	**0.0319**	0.0011	3.5
PCB 177	0.199	0.177	0.275	0.140	0.305	**0.219**	0.069	32
PCB 178	0.295	0.281	0.445	0.242	0.317	**0.316**	0.077	24
PCB 180+193	1.63	1.52	2.10	1.53	2.32	**1.82**	0.37	20
PCB 183	0.473	0.530	0.606	0.582	0.603	**0.559**	0.057	10
PCB 185	0.0164	0.0152	0.0173	<LOQ	0.0186	**0.0169**	0.0015	8.6
PCB 187	1.51	1.73	2.44	1.71	2.21	**1.92**	0.39	20
PCB 188	0.0261	0.0269	0.0278	0.0355	0.0271	**0.0287**	0.0039	13
PCB 189	0.0313	0.0314	0.0405	0.0520	0.0491	**0.0409**	0.0097	24
PCB 191	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 194	0.245	0.257	0.266	0.262	0.295	**0.265**	0.019	7.0
PCB 195	0.0949	0.0811	0.0980	0.106	0.109	**0.0979**	0.011	11
PCB 196	0.430	0.415	0.468	0.525	0.528	**0.473**	0.052	11
PCB 197	0.0378	0.0376	0.0487	0.0349	0.0453	**0.0409**	0.0059	14
PCB 199	1.18	1.49	1.45	1.77	1.61	**1.50**	0.22	14
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	0.489	0.588	0.820	0.709	0.608	**0.643**	0.13	20
PCB 202	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 205	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 206	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 207	0.0553	0.0601	0.0669	0.0640	0.0639	**0.0620**	0.0045	7.2
PCB 208	0.0941	0.102	0.113	0.120	0.105	**0.107**	0.0099	9.2
PCB 209	0.0733	0.0756	0.115	0.118	0.0830	**0.0930**	0.022	24

Appendix 38. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in common murre eggs collected at St. Paul Island, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1479	1480	1482	1485	1486	Mean	SD	RSD
BDE47	0.313	0.0809	0.101	0.358	0.184	**0.207**	0.12	60
BDE99	0.0847	<LOQ	<LOQ	0.0722	<LOQ	**0.0785**	0.0088	11
BDE100	0.152	0.106	<LOD	0.162	0.0977	**0.129**	0.032	25
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	1.85	2.17	1.41	2.38	1.41	**1.84**	0.44	24
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	0.0698	<LOQ	0.0563	0.0850	<LOQ	**0.0704**	0.014	20
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0405	<LOQ	0.0306	0.0802	0.0362	**0.0469**	0.023	48
PCB 52	0.131	0.0936	0.106	0.222	0.112	**0.133**	0.052	39
PCB 56	0.234	0.163	0.158	0.197	0.173	**0.185**	0.031	17
PCB 63	0.124	0.139	0.0982	0.156	0.117	**0.127**	0.022	17
PCB 66	1.55	1.70	1.01	1.65	1.26	**1.43**	0.29	21
PCB 70	0.0551	<LOQ	0.0492	0.103	0.0495	**0.0641**	0.026	40
PCB 74	1.19	1.20	0.670	1.26	0.908	**1.05**	0.25	24
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.0337	0.0367	0.0319	0.0314	0.0337	**0.0335**	0.0021	6.2
PCB 87	0.0679	0.0343	0.0270	0.0972	0.0173	**0.0488**	0.033	68
PCB 92	0.0910	<LOQ	0.0826	0.116	<LOQ	**0.0964**	0.017	18
PCB 95+121	<LOD	<LOD	<LOD	0.0332	0.0195	**0.0263**	0.0097	37
PCB 99	3.38	1.55	0.632	4.10	2.27	**2.39**	1.4	58
PCB 101	0.166	<LOQ	0.145	0.298	0.146	**0.189**	0.074	39
PCB 105	1.35	1.49	0.839	1.25	1.01	**1.19**	0.26	22
PCB 106	0.0178	0.0155	0.0154	0.0167	0.0153	**0.0161**	0.0011	6.6
PCB 107	0.227	0.274	0.183	0.236	0.231	**0.230**	0.032	14
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	0.00848	<LOQ	<LOQ	0.00933	0.00671	**0.00818**	0.0013	16
PCB 114	0.143	0.182	0.115	0.138	0.114	**0.138**	0.028	20
PCB 118	4.77	4.57	2.65	4.33	3.31	**3.92**	0.91	23
PCB 119	0.0769	0.0208	0.0180	0.105	0.0436	**0.0529**	0.038	71
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	0.521	0.227	0.155	0.581	0.308	**0.359**	0.19	52
PCB 130	0.203	0.122	0.0830	0.239	0.104	**0.150**	0.067	45
PCB 137	0.178	0.0486	0.0457	0.188	0.0986	**0.112**	0.068	61
PCB 138	4.05	1.79	1.09	4.31	2.45	**2.74**	1.4	51
PCB 146	1.70	1.59	0.960	1.73	1.18	**1.43**	0.34	24
PCB 149	0.256	0.191	0.186	0.311	0.207	**0.230**	0.053	23

Appendix 38 (Continued).

Compound	1479	1480	1482	1485	1486	Mean	SD	RSD
PCB 151	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 153+132	8.79	4.80	2.76	9.53	5.38	**6.25**	2.8	45
PCB 154	0.0774	<LOQ	<LOQ	0.0878	0.0600	**0.0751**	0.014	19
PCB 156	0.348	0.434	0.267	0.263	0.266	**0.316**	0.075	24
PCB 157	0.0974	0.100	0.0723	0.0910	0.0752	**0.0873**	0.013	15
PCB 158	0.225	0.129	0.0693	0.176	0.120	**0.144**	0.059	41
PCB 159	<LOQ	0.00400	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	1.36	1.31	0.725	1.45	0.914	**1.15**	0.32	27
PCB 165	0.0325	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 166	0.0289	0.0454	0.0278	0.0439	0.0299	**0.0352**	0.0087	25
PCB 167	0.284	0.285	0.171	0.266	0.193	**0.240**	0.054	22
PCB 170	0.589	0.706	0.453	0.673	0.471	**0.578**	0.11	20
PCB 172	0.228	0.292	0.200	0.196	0.169	**0.217**	0.047	22
PCB 174	0.0953	0.0818	0.0736	0.0752	0.0782	**0.0808**	0.0087	11
PCB 175	0.0525	0.0680	0.0565	0.0811	0.0442	**0.0605**	0.014	24
PCB 176	0.0347	<LOQ	0.0318	0.0368	<LOQ	**0.0344**	0.0025	7.4
PCB 177	0.212	0.116	0.111	0.269	0.133	**0.168**	0.069	41
PCB 178	0.279	0.323	0.251	0.393	0.197	**0.289**	0.074	26
PCB 180+193	1.90	1.11	0.719	1.75	1.13	**1.32**	0.49	37
PCB 183	0.462	0.545	0.360	0.518	0.360	**0.449**	0.086	19
PCB 185	<LOQ	<LOQ	0.0199	0.0147	<LOQ	**0.0173**	0.0037	21
PCB 187	1.88	1.64	0.680	2.32	1.20	**1.54**	0.63	41
PCB 188	0.0277	0.0269	0.0210	0.0364	0.0247	**0.0274**	0.0057	21
PCB 189	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 191	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 194	0.250	0.296	0.273	0.206	0.170	**0.239**	0.051	21
PCB 195	0.0945	0.103	0.0712	0.103	0.0488	**0.0840**	0.024	28
PCB 196	0.415	0.440	0.309	0.456	0.336	**0.391**	0.065	17
PCB 197	0.0360	0.0469	0.0251	0.0411	0.0309	**0.0360**	0.0085	24
PCB 199	1.44	1.90	1.31	1.68	1.27	**1.52**	0.26	17
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	0.500	0.534	0.432	0.825	0.380	**0.534**	0.17	32
PCB 202	<LOQ	<LOQ	<LOQ	0.132	<LOQ	**<LOQ**		
PCB 205	0.0298	0.0456	0.0353	0.0292	<LOQ	**0.0350**	0.0076	22
PCB 206	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 207	0.0615	0.0624	0.0499	0.0643	0.0468	**0.0570**	0.0080	14
PCB 208	0.0854	0.102	0.0995	0.107	<LOQ	**0.0987**	0.0094	9.6
PCB 209	0.0805	0.132	0.0955	0.0936	<LOQ	**0.101**	0.022	22

Appendix 39. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at St. George Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1321	1331	1333	1334	1335	Mean	SD	RSD
BDE47	0.325	0.618	0.206	0.193	0.595	**0.388**	0.21	53
BDE99	<LOQ	<LOQ	<LOQ	<LOQ	0.932	**<LOQ**		
BDE100	0.510	0.500	0.467	0.478	0.573	**0.506**	0.041	8.1
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	2.18	1.88	2.66	1.78	2.28	**2.15**	0.35	16
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0873	0.126	0.0491	0.0397	0.0665	**0.0737**	0.035	47
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0515	0.129	<LOQ	0.0514	0.0970	**0.0821**	0.038	46
PCB 52	0.0561	0.288	0.0436	0.0514	0.176	**0.123**	0.11	87
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	0.276	<LOQ	0.200	<LOQ	0.192	**0.223**	0.047	21
PCB 66	2.38	3.02	3.17	2.43	3.19	**2.84**	0.40	14
PCB 70	<LOD	0.125	<LOD	<LOD	0.0708	**0.0981**	0.039	39
PCB 74	2.19	2.53	2.80	2.23	2.79	**2.51**	0.29	12
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOD	0.0173	<LOD	0.00450	<LOD	**0.0109**	0.0091	83
PCB 87	0.135	0.185	0.115	0.0941	0.0966	**0.125**	0.037	30
PCB 92	0.0304	0.0953	0.0367	0.0452	0.0729	**0.0561**	0.027	49
PCB 95+121	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 99	1.70	6.85	4.94	3.75	7.05	**4.86**	2.2	46
PCB 101	0.145	0.143	0.164	<LOD	<LOD	**0.151**	0.012	7.7
PCB 105	2.98	2.66	2.62	2.30	2.54	**2.62**	0.24	9.3
PCB 106	<LOQ	<LOQ	<LOQ	<LOQ	0.0287	**<LOQ**		
PCB 107	0.634	0.385	0.583	0.345	0.586	**0.507**	0.13	26
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.360	0.311	0.289	0.276	0.279	**0.303**	0.035	11
PCB 118	6.91	9.98	9.39	8.11	10.2	**8.93**	1.4	16
PCB 119	0.139	0.153	0.103	0.0739	0.158	**0.125**	0.036	29
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	1.20	1.16	1.11	0.991	1.17	**1.13**	0.083	7.4
PCB 130	0.580	0.480	0.495	0.447	0.497	**0.500**	0.049	9.9
PCB 137	0.133	0.490	0.245	0.223	0.450	**0.308**	0.15	50
PCB 138	1.33	8.05	5.59	5.05	8.12	**5.63**	2.8	49
PCB 146	2.35	3.42	2.95	2.67	3.45	**2.97**	0.48	16
PCB 149	0.378	0.459	0.344	0.284	0.417	**0.376**	0.067	18

Appendix 39 (Continued).

Compound	1321	1331	1333	1334	1335	Mean	SD	RSD
PCB 151	<LOQ	<LOQ	<LOQ	0.0879	0.0810	**0.0844**	0.0049	5.8
PCB 153+132	7.12	17.3	10.8	9.33	17.4	**12.4**	4.7	38
PCB 154	0.0705	0.108	0.0926	0.0878	0.109	**0.0936**	0.016	17
PCB 156	0.824	0.670	0.706	0.633	0.695	**0.706**	0.072	10
PCB 157	0.252	0.207	0.201	0.184	0.216	**0.212**	0.025	12
PCB 158	0.305	0.297	0.288	0.237	0.365	**0.299**	0.046	15
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	3.07	2.49	2.61	2.71	2.54	**2.68**	0.23	8.5
PCB 165	0.0328	0.0354	0.0183	0.0291	0.0269	**0.0285**	0.0066	23
PCB 166	0.0770	0.0760	0.0492	0.0563	0.0595	**0.0636**	0.012	19
PCB 167	0.277	0.504	0.330	0.296	0.438	**0.369**	0.098	27
PCB 170	1.39	1.26	1.24	1.07	1.29	**1.25**	0.11	9.1
PCB 172	0.472	0.426	0.423	0.415	0.377	**0.422**	0.034	8.0
PCB 174	0.0513	0.0569	0.0445	0.0514	0.0430	**0.0494**	0.0057	11
PCB 175	0.0974	0.105	0.0972	0.0941	0.0667	**0.0920**	0.015	16
PCB 176	<LOQ	0.0167	<LOQ	0.00721	<LOQ	**0.0120**	0.0067	56
PCB 177	0.350	0.350	0.368	0.309	0.292	**0.334**	0.032	9.6
PCB 178	0.513	0.442	0.403	0.447	0.360	**0.433**	0.057	13
PCB 180+193	1.75	3.22	2.11	1.88	3.32	**2.46**	0.75	31
PCB 183	0.839	0.747	0.575	0.520	0.633	**0.663**	0.13	20
PCB 185	0.0410	0.0427	0.0198	0.0208	0.0226	**0.0294**	0.011	39
PCB 187	3.96	3.49	3.00	2.92	3.19	**3.31**	0.43	13
PCB 188	0.0326	0.0226	0.0276	0.0190	0.0214	**0.0246**	0.0054	22
PCB 189	0.0762	0.0721	0.0239	0.0724	0.0656	**0.0620**	0.022	35
PCB 191	0.0279	0.0145	0.0290	0.0330	0.0188	**0.0246**	0.0077	31
PCB 194	0.344	0.222	0.315	0.248	0.262	**0.278**	0.050	18
PCB 195	0.162	0.136	0.114	0.130	0.168	**0.142**	0.022	16
PCB 196	0.700	0.651	0.716	0.613	0.766	**0.689**	0.059	8.6
PCB 197	0.0508	0.0712	0.0568	0.0263	0.0459	**0.0502**	0.016	33
PCB 199	3.14	2.70	3.19	2.50	2.97	**2.90**	0.29	10
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.968	0.818	1.08	0.742	0.796	**0.880**	0.14	16
PCB 202	0.0383	0.0472	0.0545	0.0595	<LOQ	**0.0499**	0.0092	18
PCB 205	0.0324	0.0278	0.0197	0.0234	0.0214	**0.0249**	0.0051	21
PCB 206	0.200	0.139	0.248	0.271	0.172	**0.206**	0.054	26
PCB 207	0.0475	0.0475	0.0598	0.0466	0.0712	**0.0545**	0.011	20
PCB 208	0.129	0.0731	0.120	0.166	0.149	**0.127**	0.035	28
PCB 209	0.0927	0.0852	0.120	0.117	0.140	**0.111**	0.022	20

Appendix 40. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in common murre eggs collected at St. George Island, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1463	1466	1469	1470	1472	Mean	SD	RSD
BDE47	0.319	0.426	0.101	0.464	0.336	**0.329**	0.14	43
BDE99	0.0955	0.116	<LOQ	0.139	0.110	**0.115**	0.018	16
BDE100	0.221	0.147	<LOD	0.299	0.212	**0.220**	0.062	28
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	1.86	2.42	1.93	1.85	2.12	**2.03**	0.24	12
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	0.0553	0.0603	0.0682	0.0776	0.0672	**0.0657**	0.0085	13
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0441	0.0535	0.0372	0.0626	0.0885	**0.0572**	0.020	35
PCB 52	0.137	0.156	0.114	0.162	0.164	**0.147**	0.021	14
PCB 56	0.140	0.159	0.146	0.150	0.147	**0.148**	0.0068	4.6
PCB 63	0.0749	0.130	0.107	0.116	0.140	**0.113**	0.025	22
PCB 66	0.878	1.66	1.52	1.69	1.54	**1.46**	0.33	23
PCB 70	0.0489	0.0588	0.0458	0.0871	0.0751	**0.0631**	0.018	28
PCB 74	0.729	1.26	1.16	1.25	1.23	**1.12**	0.22	20
PCB 79	0.0248	0.0296	0.0303	0.0331	0.0431	**0.0322**	0.0068	21
PCB 82	0.0292	0.0408	0.0376	0.0444	0.0387	**0.0381**	0.0056	15
PCB 87	0.0140	0.102	0.0574	0.0966	0.0897	**0.0719**	0.037	51
PCB 92	0.105	0.272	0.0866	0.101	0.0959	**0.132**	0.079	60
PCB 95+121	0.0188	0.0617	<LOD	0.0384	0.0453	**0.0411**	0.018	43
PCB 99	5.67	4.02	3.10	3.60	3.30	**3.94**	1.0	26
PCB 101	0.199	0.203	0.152	0.211	0.191	**0.191**	0.023	12
PCB 105	1.05	1.25	1.14	1.24	1.12	**1.16**	0.084	7.3
PCB 106	0.0229	0.0493	0.0237	0.0274	0.0186	**0.0284**	0.012	43
PCB 107	0.193	0.258	0.241	0.187	0.251	**0.226**	0.033	15
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	0.00695	0.0106	0.00818	0.0119	0.0129	**0.0101**	0.0025	25
PCB 114	0.136	0.141	0.138	0.137	0.140	**0.138**	0.0023	1.7
PCB 118	4.00	4.51	4.14	4.30	3.89	**4.17**	0.24	5.9
PCB 119	0.103	0.103	0.0417	0.100	0.0927	**0.0881**	0.026	30
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	0.481	0.553	0.422	0.517	0.468	**0.488**	0.049	10
PCB 130	0.189	0.237	0.200	0.228	0.215	**0.214**	0.020	9.1
PCB 137	0.151	0.193	0.131	0.171	0.184	**0.166**	0.025	15
PCB 138	3.59	4.13	3.51	3.96	3.61	**3.76**	0.27	7.2
PCB 146	1.53	1.69	1.53	1.69	1.52	**1.59**	0.090	5.6
PCB 149	0.239	0.262	0.227	0.280	0.262	**0.254**	0.021	8.3

Appendix 40 (Continued).

Compound	1463	1466	1469	1470	1472	Mean	SD	RSD
PCB 151	<LOQ	<LOQ	<LOQ	<LOQ	0.0170	**<LOQ**		
PCB 153+132	7.96	9.13	7.07	8.79	7.76	**8.14**	0.82	10
PCB 154	0.0707	0.0810	0.0660	0.0861	0.0838	**0.0775**	0.0087	11
PCB 156	0.193	0.303	0.311	0.293	0.298	**0.280**	0.049	18
PCB 157	0.0632	0.0814	0.0813	0.0943	0.0975	**0.0835**	0.014	16
PCB 158	0.175	0.199	0.212	0.245	0.216	**0.209**	0.025	12
PCB 159	<LOQ	0.00628	0.00381	0.00261	0.0273	**0.0100**	0.012	120
PCB 163	1.23	1.36	1.40	1.42	1.27	**1.34**	0.083	6.2
PCB 165	0.0333	0.0375	0.0390	0.0325	0.0486	**0.0382**	0.0064	17
PCB 166	0.0354	0.0394	0.0288	0.0689	0.0473	**0.0440**	0.015	35
PCB 167	0.168	0.265	0.250	0.269	0.282	**0.247**	0.046	18
PCB 170	0.381	0.741	0.590	0.699	0.578	**0.598**	0.14	23
PCB 172	0.188	0.223	0.224	0.220	0.224	**0.216**	0.016	7.2
PCB 174	0.0627	0.0798	0.0690	0.0649	0.0949	**0.0742**	0.013	18
PCB 175	0.0578	0.0747	0.0542	0.0653	0.0970	**0.0698**	0.017	25
PCB 176	<LOQ	0.0318	0.0328	0.0307	0.0573	**0.0381**	0.013	33
PCB 177	0.221	0.262	0.257	0.276	0.257	**0.255**	0.020	7.9
PCB 178	0.386	0.366	0.330	0.291	0.256	**0.326**	0.053	16
PCB 180+193	1.62	1.87	1.50	1.88	1.72	**1.72**	0.16	9.6
PCB 183	0.442	0.490	0.460	0.502	0.464	**0.472**	0.024	5.2
PCB 185	<LOQ	0.0232	0.0146	0.0178	0.0378	**0.0234**	0.010	44
PCB 187	2.02	2.26	2.35	2.24	2.03	**2.18**	0.15	6.8
PCB 188	0.0294	0.0359	0.0378	0.0332	0.0482	**0.0369**	0.0071	19
PCB 189	<LOQ	0.0415	0.0330	<LOQ	<LOQ	**0.0372**	0.0060	16
PCB 191	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 194	0.222	0.281	0.271	0.317	0.247	**0.268**	0.036	13
PCB 195	0.0560	0.100	0.0797	0.0539	0.0840	**0.0748**	0.020	26
PCB 196	0.444	0.448	0.455	0.459	0.439	**0.449**	0.0079	1.7
PCB 197	0.0466	0.0309	0.0453	0.0269	0.0741	**0.0448**	0.019	41
PCB 199	1.72	1.66	1.85	1.88	1.65	**1.75**	0.11	6.1
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	0.667	0.779	0.604	0.856	0.749	**0.731**	0.098	13
PCB 202	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 205	<LOQ	0.0640	0.0398	0.0346	0.0599	**0.0496**	0.015	29
PCB 206	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 207	0.0683	0.0778	0.0537	0.0752	0.0773	**0.0704**	0.010	14
PCB 208	0.0999	0.137	0.124	0.109	0.126	**0.119**	0.015	12
PCB 209	0.0976	0.127	0.117	0.108	0.119	**0.114**	0.011	10

Appendix 41. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass Fractions (ng g^{-1} wet mass) in common murre eggs collected at St. Lazaria Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1234	1235	1236	1238	1240	Mean	SD	RSD
BDE47	4.50	3.28	7.92	49.0	9.19	**14.8**	19	130
BDE99	1.52	1.02	2.90	6.39	4.34	**3.23**	2.2	68
BDE100	1.77	0.972	2.26	14.2	3.38	**4.51**	5.5	120
PCB 8	0.0315	0.0245	<LOD	0.0116	<LOD	**0.0225**	0.010	45
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	1.66	1.56	2.41	3.56	2.92	**2.42**	0.85	35
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0482	0.0613	0.0885	0.0733	0.0805	**0.0703**	0.016	23
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0544	0.0664	0.0966	0.120	0.441	**0.156**	0.16	100
PCB 52	<LOD	0.0987	0.196	0.229	0.543	**0.267**	0.19	72
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	0.191	<LOQ	<LOQ	0.475	0.202	**0.289**	0.16	56
PCB 66	1.56	1.90	2.61	5.64	2.83	**2.91**	1.6	55
PCB 70	<LOD	0.0305	0.0847	0.103	0.453	**0.168**	0.19	120
PCB 74	1.37	1.36	1.97	4.72	2.33	**2.35**	1.4	59
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOD	<LOD	<LOD	0.00448	0.0288	**0.0166**	0.017	100
PCB 87	0.105	<LOD	0.134	0.643	0.598	**0.370**	0.29	78
PCB 92	0.0298	0.0631	0.109	0.0861	0.150	**0.0876**	0.046	52
PCB 95+121	<LOD	<LOD	<LOD	<LOD	0.188	**<LOD**		
PCB 99	1.48	3.35	6.47	21.4	8.72	**8.28**	7.8	95
PCB 101	<LOD	<LOD	0.166	0.184	4.01	**1.45**	2.2	150
PCB 105	2.14	1.63	2.89	10.9	2.80	**4.08**	3.9	95
PCB 106	<LOQ	<LOQ	<LOQ	0.0272	<LOQ	**<LOQ**		
PCB 107	0.552	0.285	0.509	2.14	0.751	**0.847**	0.74	87
PCB 110	<LOD	<LOD	<LOD	<LOD	0.624	**<LOD**		
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.233	0.161	0.262	0.856	0.267	**0.356**	0.28	79
PCB 118	5.12	5.29	9.74	30.8	11.2	**12.4**	11	85
PCB 119	0.120	0.0739	0.161	0.546	0.288	**0.238**	0.19	80
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	1.31	0.612	1.29	6.25	2.25	**2.34**	2.3	97
PCB 130	0.641	0.296	0.594	2.63	1.21	**1.07**	0.93	87
PCB 137	0.103	0.150	0.308	1.43	0.751	**0.549**	0.56	100
PCB 138	1.89	4.46	9.85	41.4	15.7	**14.7**	16	110
PCB 146	3.00	2.62	5.35	16.5	5.69	**6.62**	5.7	85
PCB 149	0.502	0.318	0.666	0.927	2.64	**1.01**	0.94	93

Appendix 41 (Continued).

Compound	1234	1235	1236	1238	1240	Mean	SD	RSD
PCB 151	0.0755	<LOQ	0.142	0.202	0.381	**0.200**	0.13	66
PCB 153+132	9.12	10.6	23.0	85.9	34.4	**32.6**	32	97
PCB 154	0.116	0.0787	0.140	0.294	0.509	**0.227**	0.18	78
PCB 156	0.979	0.645	1.33	3.13	1.06	**1.43**	0.98	69
PCB 157	0.238	0.154	0.290	0.845	0.296	**0.365**	0.27	75
PCB 158	0.585	0.155	0.564	2.29	1.17	**0.954**	0.83	87
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	4.49	2.26	4.42	15.1	5.51	**6.35**	5.0	79
PCB 165	0.0430	0.0294	0.0356	0.150	0.0641	**0.0645**	0.050	77
PCB 166	0.0474	0.0327	0.0512	0.164	0.0807	**0.0752**	0.053	70
PCB 167	0.232	0.286	0.660	1.74	0.684	**0.720**	0.61	84
PCB 170	3.63	1.67	3.14	10.7	4.10	**4.65**	3.5	75
PCB 172	0.909	0.512	1.17	2.51	0.889	**1.20**	0.77	64
PCB 174	0.0735	0.0412	0.118	0.156	0.494	**0.176**	0.18	100
PCB 175	0.151	0.0876	0.174	0.501	0.238	**0.230**	0.16	70
PCB 176	<LOQ	0.00515	0.00503	0.0213	0.0544	**0.0215**	0.023	110
PCB 177	0.738	0.137	0.631	2.86	2.50	**1.37**	1.2	89
PCB 178	0.653	0.141	0.517	3.48	1.00	**1.16**	1.3	120
PCB 180+193	3.97	3.31	7.90	24.1	11.2	**10.1**	8.5	84
PCB 183	1.84	0.952	2.22	6.54	3.16	**2.94**	2.2	73
PCB 185	<LOQ	0.0160	0.0636	0.122	0.136	**0.0844**	0.055	66
PCB 187	6.90	2.56	6.47	31.1	9.47	**11.3**	11	100
PCB 188	0.0174	0.0148	0.0344	0.0906	0.0361	**0.0386**	0.031	79
PCB 189	0.181	0.102	<LOQ	0.412	0.0222	**0.179**	0.17	94
PCB 191	0.0679	0.0147	0.0619	0.158	0.151	**0.0908**	0.062	68
PCB 194	1.73	0.826	2.50	5.02	1.60	**2.33**	1.6	69
PCB 195	0.571	0.304	0.653	1.37	0.479	**0.676**	0.41	61
PCB 196	1.60	0.985	1.86	4.58	1.70	**2.15**	1.4	65
PCB 197	0.115	0.0471	0.0965	0.323	0.191	**0.154**	0.11	70
PCB 199	8.04	4.35	9.08	24.0	6.96	**10.5**	7.7	74
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	1.87	1.09	2.01	5.57	1.88	**2.48**	1.8	71
PCB 202	0.0649	<LOQ	0.0529	0.120	0.295	**0.133**	0.11	84
PCB 205	0.0918	0.0278	0.101	0.206	0.0700	**0.0993**	0.066	67
PCB 206	0.609	0.434	0.747	2.15	0.651	**0.918**	0.70	76
PCB 207	0.0868	0.0796	0.136	0.302	0.140	**0.149**	0.090	60
PCB 208	0.213	0.0654	0.182	0.681	0.179	**0.264**	0.24	91
PCB 209	0.316	0.298	0.376	1.12	0.346	**0.490**	0.35	72

Appendix 42. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in thick-billed murre eggs collected at St. Lazaria Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1242	1243	1244	1245	1246	Mean	SD	RSD
BDE47	0.806	1.17	0.877	10.7	6.82	**4.09**	4.5	110
BDE99	0.994	1.48	1.07	3.26	3.17	**1.99**	1.1	57
BDE100	0.734	0.703	0.501	2.94	1.98	**1.37**	1.1	77
PCB 8	0.0126	0.0222	<LOD	<LOD	<LOD	**0.0174**	0.0067	39
PCB 18	<LOD	<LOD	<LOD	<LOD	0.0324	**<LOD**		
PCB 28+31	2.11	1.60	1.97	2.26	2.32	**2.05**	0.29	14
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	<LOQ	<LOQ	<LOQ	0.0960	0.0740	**0.0850**	0.016	18
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	<LOQ	<LOQ	<LOQ	0.124	0.121	**0.122**	0.0019	1.6
PCB 52	0.0380	0.0317	0.0227	0.281	0.246	**0.124**	0.13	100
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	<LOQ	0.196	<LOQ	**0.196**		
PCB 66	2.36	2.11	2.11	2.64	3.34	**2.51**	0.51	20
PCB 70	0.0227	<LOD	<LOD	0.155	0.120	**0.0992**	0.069	69
PCB 74	1.69	1.55	1.71	2.04	2.49	**1.90**	0.38	20
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 87	0.0387	0.0524	0.0865	0.190	0.131	**0.0997**	0.062	62
PCB 92	0.0333	0.0335	0.0281	0.0951	0.100	**0.0581**	0.036	62
PCB 95+121	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 99	2.12	1.80	3.29	7.14	7.35	**4.34**	2.7	62
PCB 101	<LOD	<LOD	<LOD	0.228	0.262	**0.245**	0.024	9.6
PCB 105	2.27	2.94	2.40	3.19	3.28	**2.82**	0.46	16
PCB 106	0.0216	<LOQ	0.0207	0.0163	<LOQ	**0.0196**	0.0029	15
PCB 107	0.468	0.641	0.680	0.699	0.598	**0.617**	0.092	15
PCB 110	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.277	0.351	0.232	0.299	0.394	**0.310**	0.063	20
PCB 118	7.12	8.34	7.80	11.1	11.0	**9.07**	1.9	20
PCB 119	0.0390	0.0508	0.0772	0.203	0.192	**0.113**	0.079	70
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	0.466	0.699	1.27	1.82	1.55	**1.16**	0.57	49
PCB 130	0.345	0.545	0.657	0.875	0.610	**0.606**	0.19	32
PCB 137	0.0447	0.0729	0.166	0.419	0.427	**0.226**	0.19	82
PCB 138	2.78	3.49	5.99	13.9	10.4	**7.32**	4.8	65
PCB 146	3.17	4.36	4.10	6.44	5.37	**4.69**	1.3	27
PCB 149	0.263	0.348	0.294	0.747	0.681	**0.467**	0.23	49

Appendix 42 (Continued).

Compound	1242	1243	1244	1245	1246	Mean	SD	RSD
PCB 151	<LOQ	0.0810	<LOQ	0.159	0.169	**0.136**	0.048	35
PCB 153+132	8.37	10.0	12.4	32.3	23.1	**17.2**	10	59
PCB 154	<LOQ	0.0719	0.109	0.151	0.160	**0.123**	0.041	33
PCB 156	1.00	1.55	1.00	1.39	1.31	**1.25**	0.24	19
PCB 157	0.213	0.302	0.248	0.330	0.320	**0.283**	0.050	18
PCB 158	0.156	0.282	0.340	0.763	0.536	**0.415**	0.24	57
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	0.0324	**<LOQ**		
PCB 163	2.24	3.99	4.35	6.03	4.37	**4.19**	1.3	32
PCB 165	0.0355	0.0669	0.0428	0.0593	0.0613	**0.0532**	0.013	25
PCB 166	0.0536	0.0817	0.0410	0.0592	0.0747	**0.0620**	0.016	26
PCB 167	0.447	0.529	0.379	0.819	0.860	**0.607**	0.22	36
PCB 170	2.09	4.24	3.19	5.85	3.53	**3.78**	1.4	37
PCB 172	0.983	1.60	0.899	1.51	1.25	**1.25**	0.31	25
PCB 174	0.0519	0.0784	0.0515	0.104	0.0987	**0.0769**	0.025	32
PCB 175	0.106	0.171	0.161	0.236	0.193	**0.173**	0.047	27
PCB 176	<LOQ	0.00780	0.00801	0.0210	0.0309	**0.0169**	0.011	66
PCB 177	0.139	0.326	0.810	1.03	0.712	**0.603**	0.36	60
PCB 178	0.431	1.14	0.732	0.934	0.819	**0.811**	0.26	32
PCB 180+193	2.57	4.51	4.19	12.2	7.39	**6.17**	3.8	61
PCB 183	1.39	2.01	1.31	3.03	2.36	**2.02**	0.71	35
PCB 185	0.0254	0.0339	0.0107	0.0537	0.0741	**0.0395**	0.025	63
PCB 187	2.17	4.65	6.74	10.7	7.18	**6.29**	3.2	50
PCB 188	0.0311	0.0400	0.0223	0.0297	0.0440	**0.0334**	0.0086	26
PCB 189	0.181	0.345	0.0258	0.310	0.236	**0.219**	0.13	57
PCB 191	<LOQ	0.0382	0.0524	0.0733	0.0651	**0.0573**	0.015	27
PCB 194	1.67	3.36	1.94	3.22	2.09	**2.46**	0.78	32
PCB 195	0.487	0.980	0.516	0.851	0.682	**0.703**	0.21	30
PCB 196	1.16	1.88	1.35	2.44	1.83	**1.73**	0.50	29
PCB 197	0.0889	0.110	0.0887	0.170	0.118	**0.115**	0.033	29
PCB 199	6.14	11.7	7.42	11.9	9.11	**9.24**	2.5	27
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.938	2.00	1.48	2.97	1.98	**1.87**	0.75	40
PCB 202	0.0501	0.155	0.0697	0.0628	0.0771	**0.0829**	0.041	50
PCB 205	0.103	0.153	0.0634	0.138	0.117	**0.115**	0.035	30
PCB 206	0.556	1.13	0.680	1.18	0.773	**0.863**	0.28	32
PCB 207	0.0791	0.128	0.0857	0.163	0.130	**0.117**	0.035	30
PCB 208	0.167	0.323	0.194	0.360	0.203	**0.249**	0.086	34
PCB 209	0.277	0.547	0.296	0.608	0.385	**0.423**	0.15	35

Appendix 43. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at the Kukpuk River delta, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1349	1351	1354	1357	1358	Mean	SD	RSD
BDE47	141	5.48	6.12	126	152	**86.0**	74	86
BDE99	156	5.42	5.29	134	147	**89.5**	77	86
BDE100	30.0	2.03	2.03	25.9	28.5	**17.7**	14	81
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	1.72	3.78	3.96	1.53	1.70	**2.53**	1.2	48
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0593	0.325	0.259	0.0939	0.0606	**0.159**	0.12	78
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.370	1.77	1.82	0.331	0.376	**0.933**	0.79	84
PCB 52	0.762	15.8	17.0	0.705	0.789	**7.02**	8.6	120
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 66	2.30	6.94	7.15	2.32	2.40	**4.22**	2.6	61
PCB 70	<LOD	0.0676	0.0247	0.0237	<LOD	**0.0387**	0.025	65
PCB 74	2.26	8.04	8.44	2.22	2.34	**4.66**	3.3	70
PCB 79	<LOQ	0.0144	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.0190	0.0939	0.0409	<LOD	<LOD	**0.0513**	0.039	75
PCB 87	0.546	3.48	3.29	0.452	0.504	**1.65**	1.6	96
PCB 92	0.152	5.49	5.52	0.147	0.157	**2.29**	2.9	130
PCB 95+121	0.162	3.80	3.58	0.0995	0.188	**1.56**	1.9	120
PCB 99	14.8	48.8	48.3	12.9	16.2	**28.2**	19	66
PCB 101	2.56	18.7	18.5	2.20	2.68	**8.92**	8.8	99
PCB 105	2.93	12.1	14.3	2.58	3.10	**7.00**	5.7	82
PCB 106	0.0172	<LOQ	0.0871	<LOQ	<LOQ	**0.0521**	0.049	95
PCB 107	0.0697	0.388	0.445	0.0389	0.0642	**0.201**	0.20	98
PCB 110	1.83	7.39	8.35	1.58	1.90	**4.21**	3.4	80
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.336	1.11	1.29	0.301	0.316	**0.670**	0.49	73
PCB 118	13.0	48.8	55.3	11.8	13.9	**28.5**	22	76
PCB 119	0.324	1.19	1.18	0.292	0.342	**0.666**	0.47	71
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	2.38	9.37	10.1	2.33	2.56	**5.35**	4.0	75
PCB 130	0.780	2.57	2.69	0.693	0.732	**1.49**	1.0	70
PCB 137	1.37	4.25	4.64	1.22	1.35	**2.57**	1.7	67
PCB 138	19.8	68.3	76.4	18.4	21.6	**40.9**	29	71
PCB 146	4.79	15.4	16.9	4.49	5.07	**9.33**	6.3	67
PCB 149	1.82	13.7	14.3	1.66	1.91	**6.67**	6.7	100

Appendix 43 (Continued).

Compound	1349	1351	1354	1357	1358	Mean	SD	RSD
PCB 151	0.209	4.41	4.64	0.231	0.238	**1.95**	2.4	120
PCB 153+132	48.8	138	154	44.4	51.0	**87.3**	54	62
PCB 154	0.445	1.45	1.59	0.392	0.487	**0.872**	0.59	68
PCB 156	1.29	3.38	3.58	1.13	1.29	**2.14**	1.2	58
PCB 157	0.463	1.10	1.14	0.424	0.462	**0.718**	0.37	51
PCB 158	1.14	5.30	5.04	1.37	1.18	**2.81**	2.2	77
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	4.47	15.2	16.7	4.52	5.22	**9.22**	6.2	67
PCB 165	0.0482	0.112	0.125	0.0307	0.0377	**0.0707**	0.044	63
PCB 166	0.102	0.284	0.315	0.0879	0.0902	**0.176**	0.11	65
PCB 167	0.651	2.80	3.14	0.551	0.691	**1.57**	1.3	82
PCB 170	4.75	10.4	11.2	4.35	4.78	**7.11**	3.4	48
PCB 172	0.520	1.74	1.74	0.511	0.556	**1.01**	0.66	65
PCB 174	0.276	1.74	1.85	0.230	0.255	**0.870**	0.85	97
PCB 175	0.188	0.675	0.721	0.179	0.193	**0.391**	0.28	72
PCB 176	0.0133	0.115	0.121	0.0306	0.0324	**0.0624**	0.051	82
PCB 177	0.392	1.78	1.92	0.351	0.385	**0.966**	0.81	84
PCB 178	0.322	3.57	4.01	0.260	0.394	**1.71**	1.9	110
PCB 180+193	11.9	28.8	30.6	10.8	12.0	**18.8**	10	53
PCB 183	3.04	10.2	11.3	2.64	3.07	**6.06**	4.3	71
PCB 185	0.0238	0.220	0.267	<LOQ	<LOQ	**0.170**	0.13	76
PCB 187	4.51	20.8	23.2	3.79	4.48	**11.4**	9.7	86
PCB 188	0.0154	0.0602	0.0817	0.00323	0.0134	**0.0348**	0.034	98
PCB 189	0.147	0.0501	0.0224	<LOQ	0.0448	**0.0659**	0.055	83
PCB 191	0.104	0.349	0.356	0.124	0.138	**0.214**	0.13	59
PCB 194	1.64	2.51	2.69	1.43	1.71	**2.00**	0.57	28
PCB 195	0.272	0.611	0.606	0.250	0.265	**0.401**	0.19	47
PCB 196	1.36	3.22	3.24	1.27	1.38	**2.10**	1.0	50
PCB 197	0.131	0.307	0.286	0.137	0.117	**0.195**	0.093	47
PCB 199	3.69	9.78	10.1	3.17	3.25	**6.01**	3.6	60
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.706	3.28	2.85	0.799	0.648	**1.66**	1.3	78
PCB 202	0.181	1.07	1.12	0.185	0.191	**0.550**	0.50	91
PCB 205	0.0923	0.102	0.124	0.0644	0.0631	**0.0891**	0.026	29
PCB 206	0.357	0.636	0.636	0.350	0.291	**0.454**	0.17	37
PCB 207	0.0885	0.176	0.214	0.0819	0.0932	**0.131**	0.060	46
PCB 208	0.0757	0.152	0.224	0.0261	0.0597	**0.107**	0.080	74
PCB 209	0.118	0.250	0.256	0.101	0.125	**0.170**	0.076	45

Appendix 44. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Shishmaref Inlet, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1407	1411	1414	1415	1416	Mean	SD	RSD
BDE47	1.53	2.16	82.9	1.95	1.66	**18.0**	36	200
BDE99	1.06	1.12	86.8	1.40	1.32	**18.3**	38	210
BDE100	0.741	0.824	19.7	0.920	0.835	**4.59**	8.4	180
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	0.0869	<LOD	0.157	<LOD	**0.122**	0.050	41
PCB 28+31	4.20	5.82	4.19	5.11	4.26	**4.72**	0.73	15
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0576	0.102	0.130	0.345	0.0736	**0.142**	0.12	83
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.381	0.252	0.392	0.889	0.395	**0.462**	0.25	53
PCB 52	2.65	4.00	2.65	4.04	3.68	**3.40**	0.70	21
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	<LOQ	0.218	<LOQ	0.250	<LOQ	**0.234**	0.023	9.7
PCB 66	4.45	7.41	3.95	5.72	5.10	**5.33**	1.3	25
PCB 70	0.380	0.423	0.644	0.639	0.148	**0.447**	0.21	46
PCB 74	3.99	6.49	4.28	5.26	4.54	**4.91**	1.0	20
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.109	0.0713	0.0574	0.230	0.0563	**0.105**	0.073	70
PCB 87	0.834	1.29	0.762	1.61	1.02	**1.10**	0.35	32
PCB 92	0.887	1.86	1.02	1.84	1.28	**1.38**	0.45	33
PCB 95+121	0.336	0.541	0.397	0.919	0.369	**0.512**	0.24	47
PCB 99	16.6	31.2	19.2	20.0	19.8	**21.3**	5.7	27
PCB 101	4.88	5.73	4.32	7.10	6.71	**5.75**	1.2	21
PCB 105	4.45	11.4	4.47	6.37	5.23	**6.39**	2.9	46
PCB 106	0.0923	0.345	0.0523	0.0855	<LOQ	**0.144**	0.14	94
PCB 107	0.364	0.683	0.433	0.540	0.267	**0.458**	0.16	35
PCB 110	3.77	6.36	2.50	4.76	3.93	**4.27**	1.4	33
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.452	0.915	0.399	0.632	0.494	**0.578**	0.21	36
PCB 118	17.7	40.1	17.0	23.4	21.1	**23.8**	9.4	40
PCB 119	0.365	0.776	0.375	0.484	0.465	**0.493**	0.17	34
PCB 127	<LOD	<LOD	<LOD	0.0156	<LOD	**<LOD**		
PCB 128	3.12	6.67	3.25	4.04	3.71	**4.16**	1.4	35
PCB 130	1.02	1.86	0.995	1.52	1.22	**1.32**	0.37	28
PCB 137	1.38	3.12	1.26	2.01	1.54	**1.86**	0.76	41
PCB 138	22.7	45.6	27.7	31.1	26.5	**30.7**	8.8	29
PCB 146	5.68	9.88	6.47	8.36	6.89	**7.45**	1.7	22
PCB 149	3.05	4.52	2.50	4.29	3.36	**3.55**	0.85	24

Appendix 44 (Continued).

Compound	1407	1411	1414	1415	1416	Mean	SD	RSD
PCB 151	0.373	0.787	0.575	1.19	0.460	**0.677**	0.33	48
PCB 153+132	44.3	82.2	60.5	63.3	52.6	**60.6**	14	23
PCB 154	0.589	1.06	0.657	0.805	0.693	**0.761**	0.19	24
PCB 156	1.29	3.08	1.38	1.63	1.40	**1.76**	0.75	43
PCB 157	0.379	0.911	0.472	0.497	0.462	**0.544**	0.21	39
PCB 158	1.58	2.85	1.77	2.32	1.72	**2.05**	0.53	26
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	5.72	9.45	5.94	6.84	6.02	**6.79**	1.5	23
PCB 165	0.0493	0.0620	0.0489	0.0762	0.0516	**0.0576**	0.012	20
PCB 166	0.0813	0.180	0.0848	0.147	0.0952	**0.118**	0.044	37
PCB 167	0.826	2.16	0.810	1.33	0.953	**1.22**	0.57	47
PCB 170	3.31	5.90	3.96	4.33	3.49	**4.20**	1.0	25
PCB 172	0.728	1.09	0.659	0.903	0.771	**0.829**	0.17	20
PCB 174	0.382	0.430	0.253	0.502	0.377	**0.389**	0.091	23
PCB 175	0.228	0.335	0.178	0.267	0.229	**0.248**	0.058	24
PCB 176	<LOQ	0.0332	<LOQ	0.0443	0.0477	**0.0417**	0.0076	18
PCB 177	0.755	0.920	0.644	0.859	0.653	**0.766**	0.12	16
PCB 178	0.672	1.28	0.825	1.27	0.919	**0.993**	0.27	27
PCB 180+193	9.62	15.9	11.2	12.9	10.3	**12.0**	2.5	21
PCB 183	3.34	5.48	3.96	5.25	3.72	**4.35**	0.95	22
PCB 185	0.0565	0.0613	0.0430	0.0626	0.0336	**0.0514**	0.013	25
PCB 187	6.44	9.40	6.26	9.87	7.16	**7.83**	1.7	22
PCB 188	0.0172	0.0241	0.0145	0.0175	0.0214	**0.0189**	0.0038	20
PCB 189	0.0934	0.189	0.103	0.147	0.0414	**0.115**	0.056	49
PCB 191	0.117	0.216	0.0932	0.157	0.113	**0.139**	0.049	35
PCB 194	0.845	1.33	1.01	0.991	0.890	**1.01**	0.19	19
PCB 195	0.316	0.338	0.312	0.338	0.277	**0.316**	0.025	7.9
PCB 196	1.49	1.93	1.64	1.78	1.44	**1.66**	0.21	12
PCB 197	0.110	0.152	0.120	0.163	0.125	**0.134**	0.022	17
PCB 199	4.50	5.23	3.91	5.14	4.28	**4.61**	0.56	12
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.947	0.964	0.741	0.899	0.846	**0.879**	0.090	10
PCB 202	0.269	0.395	0.380	0.389	0.291	**0.345**	0.060	17
PCB 205	0.0749	0.0670	0.0199	0.0471	0.0311	**0.0480**	0.023	48
PCB 206	0.436	0.346	0.311	0.414	0.266	**0.355**	0.070	20
PCB 207	0.0906	0.139	0.108	0.107	0.101	**0.109**	0.018	17
PCB 208	0.322	0.119	0.0576	0.0622	0.0787	**0.128**	0.11	87
PCB 209	0.0889	0.137	0.161	0.143	0.0888	**0.124**	0.033	27

Appendix 45. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Brevig Mission, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1433	1435	1436	1439	1441	Mean	SD	RSD
BDE47	1.86	1.16	2.49	2.51	2.47	**2.10**	0.59	28
BDE99	0.404	0.241	0.376	0.524	0.407	**0.391**	0.10	26
BDE100	0.462	0.295	0.558	0.527	0.548	**0.478**	0.11	23
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	2.72	1.93	3.88	3.03	4.72	**3.26**	1.1	33
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	0.0682	0.114	0.0792	0.298	0.0624	**0.124**	0.099	80
PCB 45	<LOQ	<LOQ	<LOQ	0.00832	0.00864	**<LOQ**		
PCB 49	0.0499	0.304	0.314	0.689	0.0581	**0.283**	0.26	92
PCB 52	0.574	1.77	1.45	6.15	1.38	**2.27**	2.2	98
PCB 56	0.338	0.143	0.250	0.253	0.347	**0.266**	0.083	31
PCB 63	0.0733	0.0855	0.115	0.122	0.182	**0.115**	0.042	37
PCB 66	4.41	2.75	5.98	5.39	6.20	**4.95**	1.4	28
PCB 70	0.0498	0.141	0.0931	0.161	0.0939	**0.108**	0.044	41
PCB 74	4.01	2.25	5.62	5.45	5.57	**4.58**	1.5	32
PCB 79	<LOQ	<LOQ	0.0297	0.0263	0.0267	**0.0276**	0.0018	6.6
PCB 82	0.0362	0.0469	0.0426	0.162	0.0279	**0.0632**	0.056	88
PCB 87	0.524	0.753	1.08	1.51	0.701	**0.915**	0.39	43
PCB 92	0.476	0.824	1.07	2.51	0.600	**1.10**	0.82	75
PCB 95+121	0.164	0.194	0.209	2.38	0.0605	**0.601**	0.99	170
PCB 99	20.5	11.7	30.0	29.1	27.0	**23.6**	7.6	32
PCB 101	1.86	4.38	3.73	11.0	2.39	**4.67**	3.7	79
PCB 105	5.12	3.38	7.66	6.92	6.94	**6.01**	1.7	29
PCB 106	<LOQ	<LOQ	0.0297	0.0445	0.0710	**0.0484**	0.021	43
PCB 107	0.240	0.163	0.250	0.465	0.386	**0.301**	0.12	41
PCB 110	1.49	2.24	2.84	3.27	2.69	**2.51**	0.68	27
PCB 112	0.0333	0.0305	0.0643	0.0388	0.0458	**0.0425**	0.013	32
PCB 114	0.504	0.319	0.661	0.638	0.605	**0.545**	0.14	26
PCB 118	20.0	12.3	27.0	26.1	25.3	**22.1**	6.1	28
PCB 119	0.462	0.279	0.684	0.634	0.628	**0.537**	0.17	31
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	3.87	2.11	4.86	5.42	4.56	**4.16**	1.3	31
PCB 130	1.04	0.542	1.41	1.73	1.24	**1.19**	0.44	37
PCB 137	1.64	0.868	2.07	2.47	1.93	**1.80**	0.60	33
PCB 138	26.9	13.9	33.2	36.9	30.3	**28.2**	8.8	31
PCB 146	6.66	3.50	8.17	9.36	7.83	**7.10**	2.2	31
PCB 149	2.25	1.91	4.50	9.33	2.53	**4.10**	3.1	75

Appendix 45 (Continued).

Compound	1433	1435	1436	1439	1441	Mean	SD	RSD
PCB 151	0.178	0.328	0.578	2.93	0.142	**0.831**	1.2	140
PCB 153+132	55.5	27.6	64.3	78.7	61.6	**57.5**	19	33
PCB 154	0.664	0.388	0.857	0.966	0.820	**0.739**	0.22	30
PCB 156	1.35	0.836	1.81	1.77	1.71	**1.49**	0.41	28
PCB 157	0.395	0.238	0.471	0.558	0.482	**0.429**	0.12	28
PCB 158	0.992	0.619	1.49	1.76	1.54	**1.28**	0.46	36
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	5.82	2.84	7.96	9.01	6.68	**6.46**	2.4	37
PCB 165	0.0723	0.0400	0.0694	0.0912	0.0774	**0.0700**	0.019	27
PCB 166	0.0555	0.0688	0.169	0.130	0.177	**0.120**	0.056	47
PCB 167	1.07	0.664	1.23	1.43	1.29	**1.14**	0.29	26
PCB 170	4.28	2.21	4.24	6.17	4.40	**4.26**	1.4	33
PCB 172	0.822	0.412	0.914	1.29	0.855	**0.858**	0.31	36
PCB 174	0.357	0.271	0.575	1.48	0.342	**0.605**	0.50	83
PCB 175	0.327	0.163	0.354	0.472	0.354	**0.334**	0.11	33
PCB 176	0.0341	0.0422	0.0487	0.183	0.0385	**0.0694**	0.064	92
PCB 177	0.882	0.422	1.43	2.23	0.948	**1.18**	0.68	58
PCB 178	0.981	0.501	1.54	2.49	1.12	**1.33**	0.75	56
PCB 180+193	12.9	6.25	13.9	19.9	12.9	**13.2**	4.9	37
PCB 183	4.39	2.08	4.31	6.32	4.51	**4.32**	1.5	35
PCB 185	0.0146	0.0291	0.0303	0.175	0.0170	**0.0532**	0.069	130
PCB 187	8.82	3.86	10.4	14.8	9.48	**9.47**	3.9	41
PCB 188	0.0346	0.0264	0.0500	0.0687	0.0388	**0.0437**	0.016	38
PCB 189	0.133	0.0820	0.0143	0.203	0.169	**0.120**	0.074	62
PCB 191	0.144	0.0680	0.147	0.195	0.165	**0.144**	0.047	33
PCB 194	1.24	0.536	1.46	2.13	1.15	**1.31**	0.58	44
PCB 195	0.295	0.183	0.303	0.311	0.293	**0.277**	0.053	19
PCB 196	2.12	0.928	2.07	3.29	1.96	**2.07**	0.84	40
PCB 197	0.170	0.0748	0.164	0.242	0.151	**0.160**	0.060	37
PCB 199	6.11	2.26	7.24	12.4	5.70	**6.74**	3.7	54
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	1.34	0.537	1.92	3.50	1.31	**1.72**	1.1	64
PCB 202	0.481	0.238	0.721	1.34	0.510	**0.658**	0.42	64
PCB 205	0.0622	0.0319	0.0689	0.0737	0.0547	**0.0583**	0.016	28
PCB 206	0.443	<LOQ	0.435	0.747	0.371	**0.499**	0.17	34
PCB 207	0.168	0.0822	0.171	0.309	0.149	**0.176**	0.083	47
PCB 208	0.222	0.0952	0.232	0.474	0.197	**0.244**	0.14	57
PCB 209	0.264	0.0797	0.284	0.615	0.180	**0.285**	0.20	71

Appendix 46. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at the Sinuk River delta, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1339	1340	1340-2	1340 Mean	% difference	1343	1344	1345	Mean	SD	RSD
BDE47	1.74	1.83	1.81	**1.82**	0.98	2.06	2.18	0.997	**1.76**	0.46	26
BDE99	0.941	1.60	1.64	**1.62**	-2.3	1.02	1.28	1.02	**1.18**	0.28	24
BDE100	0.731	0.955	0.937	**0.946**	1.9	0.913	1.14	0.660	**0.877**	0.19	21
PCB 8	<LOD	<LOD	<LOD	**<LOD**		<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	**<LOD**		<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	3.82	3.38	3.22	**3.30**	4.8	3.59	4.35	2.81	**3.57**	0.58	16
PCB 29	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0695	0.140	0.142	**0.141**	-1.4	0.0830	0.171	0.165	**0.126**	0.047	37
PCB 45	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.202	0.545	0.527	**0.536**	3.3	0.168	0.697	0.264	**0.373**	0.23	62
PCB 52	1.29	2.71	2.59	**2.65**	4.5	1.86	3.48	2.41	**2.34**	0.82	35
PCB 56	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	0.0284	0.0258	**<LOQ**		
PCB 63	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 66	5.36	4.01	3.80	**3.91**	5.4	3.49	5.58	3.80	**4.43**	0.97	22
PCB 70	0.196	0.760	0.753	**0.756**	0.89	0.419	0.378	0.184	**0.387**	0.23	60
PCB 74	0.381	3.51	3.29	**3.40**	6.5	3.36	4.77	3.19	**3.02**	1.6	53
PCB 79	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.0847	0.289	0.288	**0.288**	0.14	0.0140	0.145	0.0848	**0.123**	0.10	84
PCB 87	0.739	0.814	0.846	**0.830**	-3.8	0.522	1.28	0.566	**0.787**	0.30	38
PCB 92	0.386	0.903	0.864	**0.884**	4.4	0.739	1.14	0.884	**0.806**	0.28	34
PCB 95+121	0.230	0.567	0.578	**0.572**	-1.9	0.197	0.729	0.530	**0.452**	0.23	51
PCB 99	19.7	12.7	12.4	**12.6**	2.4	14.7	19.9	11.7	**15.7**	3.9	25
PCB 101	4.81	4.76	4.53	**4.64**	4.8	2.46	6.28	2.59	**4.16**	1.6	39
PCB 105	6.98	3.99	3.72	**3.86**	7.0	4.10	6.45	4.13	**5.10**	1.5	29
PCB 106	0.107	<LOQ	<LOQ	**<LOQ**		0.104	0.0430	<LOQ	**<LOQ**		
PCB 107	0.307	0.515	0.506	**0.510**	1.9	0.520	0.365	0.279	**0.396**	0.11	29
PCB 110	4.87	3.92	3.80	**3.86**	3.4	2.64	3.97	2.56	**3.58**	0.98	27
PCB 112	<LOD	<LOD	<LOD	**<LOD**		<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.596	0.379	0.383	**0.381**	-0.99	0.376	0.628	0.372	**0.471**	0.13	28
PCB 118	25.2	15.5	14.8	**15.1**	5.0	16.7	25.5	14.5	**19.4**	5.5	28
PCB 119	0.503	0.319	0.317	**0.318**	0.68	0.370	0.478	0.328	**0.399**	0.086	22
PCB 127	<LOD	<LOD	<LOD	**<LOD**		<LOD	<LOD	<LOD	**<LOD**		
PCB 128	4.36	2.73	2.61	**2.67**	4.6	2.93	4.61	2.41	**3.40**	1.0	30
PCB 130	1.40	0.817	0.791	**0.804**	3.2	0.848	1.62	0.892	**1.11**	0.37	34
PCB 137	2.01	1.13	1.12	**1.12**	0.25	1.24	2.12	1.05	**1.51**	0.51	34
PCB 138	30.5	18.4	17.5	**17.9**	4.9	21.8	33.2	16.1	**23.9**	7.6	32
PCB 146	7.18	4.27	4.09	**4.18**	4.4	5.60	8.92	4.27	**6.03**	2.0	34
PCB 149	3.64	3.68	3.55	**3.61**	3.5	2.04	3.36	1.99	**2.93**	0.84	29

Appendix 46 (Continued).

Compound	1339	1340	1340-2	1340 Mean	% difference	1343	1344	1345	Mean	SD	RSD
PCB 151	0.327	0.584	0.585	**0.584**	-0.17	0.300	0.571	0.423	**0.441**	0.13	30
PCB 153+132	55.2	33.7	32.1	**32.9**	4.9	51.3	69.3	29.4	**47.6**	17	35
PCB 154	0.732	0.498	0.493	**0.496**	1.1	0.551	0.864	0.479	**0.624**	0.17	27
PCB 156	1.80	1.10	1.07	**1.09**	3.0	1.32	2.00	0.949	**1.43**	0.45	32
PCB 157	0.540	0.333	0.324	**0.328**	3.0	0.366	0.545	0.277	**0.411**	0.12	30
PCB 158	1.89	1.18	1.19	**1.18**	-1.5	1.42	2.11	1.01	**1.52**	0.47	31
PCB 159	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	6.70	4.00	3.88	**3.94**	3.0	5.10	7.23	3.57	**5.31**	1.6	31
PCB 165	0.0357	0.0360	0.0358	**0.0359**	0.70	0.0449	0.0676	0.0382	**0.0445**	0.013	30
PCB 166	0.113	0.0833	0.0800	**0.0817**	4.0	0.0783	0.126	0.0654	**0.0929**	0.026	28
PCB 167	1.21	0.749	0.723	**0.736**	3.5	0.877	1.61	0.771	**1.04**	0.37	36
PCB 170	3.91	2.43	2.34	**2.38**	3.8	3.65	5.51	2.07	**3.50**	1.4	39
PCB 172	0.810	0.470	0.451	**0.461**	4.0	0.693	1.16	0.436	**0.712**	0.30	42
PCB 174	0.473	0.382	0.369	**0.376**	3.6	0.230	0.430	0.207	**0.343**	0.12	35
PCB 175	0.290	0.162	0.171	**0.167**	-5.6	0.183	0.388	0.168	**0.239**	0.098	41
PCB 176	0.0348	0.0262	0.0300	**0.0281**	-14	0.0333	0.0365	<LOQ	**0.0332**	0.0036	11
PCB 177	0.851	0.666	0.650	**0.658**	2.4	0.554	1.00	0.500	**0.713**	0.21	29
PCB 178	0.850	0.547	0.531	**0.539**	3.1	0.910	1.18	0.617	**0.819**	0.25	31
PCB 180+193	11.0	6.95	6.60	**6.78**	5.3	9.82	16.7	5.77	**10.0**	4.3	43
PCB 183	3.90	2.33	2.25	**2.29**	3.4	3.38	5.92	2.20	**3.54**	1.5	43
PCB 185	0.0691	0.0610	0.0586	**0.0598**	4.1	0.0360	0.0604	0.0509	**0.0553**	0.013	23
PCB 187	8.01	4.58	4.27	**4.42**	6.9	5.30	10.4	4.26	**6.48**	2.7	41
PCB 188	0.0175	0.0201	0.0201	**0.0201**	0.41	0.0158	0.0207	0.0128	**0.0174**	0.0032	19
PCB 189	0.147	0.0955	0.0947	**0.0951**	0.87	0.133	0.229	0.0451	**0.130**	0.068	52
PCB 191	0.127	0.0824	0.0822	**0.0823**	0.33	0.103	0.195	0.0756	**0.116**	0.048	41
PCB 194	0.813	0.478	0.477	**0.477**	0.17	1.09	1.53	0.500	**0.883**	0.44	50
PCB 195	0.278	0.226	0.222	**0.224**	1.9	0.311	0.418	0.180	**0.282**	0.091	32
PCB 196	1.40	1.18	1.14	**1.16**	3.5	1.51	2.24	1.03	**1.47**	0.47	32
PCB 197	0.107	0.111	0.110	**0.110**	0.79	0.0938	0.191	0.0764	**0.116**	0.044	38
PCB 199	4.30	3.22	3.21	**3.21**	0.47	4.06	6.50	2.66	**4.15**	1.5	35
PCB 200	<LOD	<LOD	<LOD	**<LOD**		<LOD	<LOD	<LOD	**<LOD**		
PCB 201	1.20	0.777	0.794	**0.785**	-2.1	0.704	1.08	0.589	**0.873**	0.26	30
PCB 202	0.293	0.266	0.272	**0.269**	-2.0	0.408	0.378	0.201	**0.310**	0.084	27
PCB 205	0.0403	0.0369	0.0356	**0.0362**	3.6	0.0405	0.0409	0.0465	**0.0409**	0.0037	9.0
PCB 206	0.201	0.310	0.323	**0.316**	-4.0	0.366	0.314	0.232	**0.286**	0.068	24
PCB 207	0.0961	0.0937	0.0965	**0.0951**	-3.0	0.0930	0.134	0.0582	**0.0952**	0.027	28
PCB 208	0.0800	0.0949	0.0955	**0.0952**	-0.62	0.110	0.109	0.0287	**0.0844**	0.033	40
PCB 209	0.190	0.192	0.202	**0.197**	-5.0	0.127	0.172	0.112	**0.160**	0.038	24

Appendix 47. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Safety Sound, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively). Egg 1367 is believed to be a common eider.

Compound	1365	1367	1368	1369	1370	Mean	SD	RSD
BDE47	1.22	2.62	1.54	1.17	1.68	**1.65**	0.58	36
BDE99	1.11	1.10	0.987	1.06	1.07	**1.06**	0.047	4.4
BDE100	0.725	0.993	0.722	0.838	0.794	**0.814**	0.11	14
PCB 8	<LOD	<LOD	0.0189	<LOD	0.0537	**0.0363**	0.025	68
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	2.38	4.12	3.77	2.65	2.92	**3.17**	0.75	24
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.146	0.0637	0.103	0.0453	0.124	**0.0963**	0.042	43
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.257	0.0553	0.269	0.0915	0.146	**0.164**	0.096	59
PCB 52	1.89	0.652	3.36	0.765	2.28	**1.79**	1.1	63
PCB 56	<LOQ	<LOQ	<LOQ	0.0256	<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	0.198	<LOQ	<LOQ	**<LOQ**		
PCB 66	2.54	7.66	4.87	3.69	4.49	**4.65**	1.9	41
PCB 70	0.0943	0.0462	0.263	0.0397	0.207	**0.130**	0.10	77
PCB 74	2.30	6.91	4.26	3.27	3.80	**4.11**	1.7	42
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.0397	0.0239	0.0277	0.00762	0.247	**0.0692**	0.10	150
PCB 87	0.437	0.938	0.601	0.289	0.504	**0.554**	0.24	44
PCB 92	0.857	0.410	1.13	0.381	0.922	**0.740**	0.33	45
PCB 95+121	0.283	0.249	0.372	<LOD	0.441	**0.336**	0.087	26
PCB 99	10.1	33.0	15.2	11.9	15.1	**17.1**	9.2	54
PCB 101	2.81	0.431	3.74	0.394	2.20	**1.92**	1.5	77
PCB 105	2.33	9.05	4.63	2.94	4.64	**4.72**	2.6	56
PCB 106	0.0248	0.0231	0.235	0.0431	0.0603	**0.0773**	0.090	120
PCB 107	0.141	0.110	0.479	0.175	0.307	**0.243**	0.15	63
PCB 110	2.16	1.76	3.23	0.845	3.38	**2.27**	1.1	46
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.253	0.843	0.428	0.267	0.423	**0.443**	0.24	54
PCB 118	10.2	36.1	18.0	12.9	17.8	**19.0**	10	53
PCB 119	0.261	0.838	0.396	0.292	0.388	**0.435**	0.23	53
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	1.80	6.61	3.01	2.36	3.18	**3.39**	1.9	55
PCB 130	0.411	1.62	0.862	0.794	0.971	**0.932**	0.44	47
PCB 137	0.753	2.90	1.40	1.17	1.48	**1.54**	0.81	53
PCB 138	12.7	50.3	20.4	17.3	22.4	**24.6**	15	60
PCB 146	3.31	12.8	5.03	4.72	5.40	**6.26**	3.8	60
PCB 149	1.50	2.53	2.51	1.37	2.94	**2.17**	0.70	32

Appendix 47 (Continued).

Compound	1365	1367	1368	1369	1370	Mean	SD	RSD
PCB 151	0.400	0.262	0.448	0.180	0.581	**0.374**	0.16	42
PCB 153+132	25.8	104	39.2	37.1	39.9	**49.3**	31	64
PCB 154	0.414	1.31	0.572	0.504	0.624	**0.685**	0.36	52
PCB 156	0.758	2.89	1.33	0.986	1.36	**1.46**	0.83	57
PCB 157	0.215	0.764	0.400	0.307	0.403	**0.418**	0.21	50
PCB 158	0.942	4.05	1.70	1.31	1.31	**1.86**	1.3	67
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	3.11	10.5	4.54	4.31	4.95	**5.49**	2.9	53
PCB 165	0.0315	0.104	0.0542	0.0557	0.0418	**0.0575**	0.028	48
PCB 166	0.0733	0.177	0.0862	0.0903	0.0999	**0.105**	0.041	39
PCB 167	0.413	2.14	0.927	0.669	0.886	**1.01**	0.67	66
PCB 170	1.71	8.60	2.97	2.63	2.75	**3.73**	2.8	74
PCB 172	0.336	1.58	0.538	0.537	0.602	**0.719**	0.49	69
PCB 174	0.154	0.308	0.200	0.149	0.304	**0.223**	0.078	35
PCB 175	0.0814	0.509	0.247	0.199	0.182	**0.244**	0.16	66
PCB 176	0.0161	<LOQ	0.0421	<LOQ	0.0296	**0.0292**	0.013	44
PCB 177	0.278	1.16	0.470	0.507	0.576	**0.599**	0.33	56
PCB 178	0.409	1.80	0.635	0.631	0.553	**0.806**	0.56	70
PCB 180+193	4.89	23.0	8.24	7.32	7.68	**10.2**	7.2	71
PCB 183	1.70	8.29	2.80	2.67	2.72	**3.64**	2.6	73
PCB 185	0.0519	0.0316	0.0440	<LOQ	0.0139	**0.0354**	0.017	47
PCB 187	2.56	15.1	4.53	4.51	4.97	**6.33**	5.0	79
PCB 188	0.0119	0.0596	0.0122	0.0198	0.0202	**0.0248**	0.020	80
PCB 189	0.0749	0.281	0.141	0.111	0.0990	**0.141**	0.082	58
PCB 191	0.0808	0.277	0.114	0.138	0.111	**0.144**	0.077	53
PCB 194	0.398	2.35	0.768	0.612	0.544	**0.934**	0.80	86
PCB 195	0.168	0.764	0.241	0.259	0.223	**0.331**	0.24	74
PCB 196	1.01	3.22	1.31	1.14	1.19	**1.57**	0.92	59
PCB 197	0.0968	0.258	0.141	0.0804	0.116	**0.138**	0.070	51
PCB 199	2.27	9.94	3.35	3.26	3.26	**4.41**	3.1	71
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.472	1.94	0.945	1.23	0.728	**1.06**	0.56	53
PCB 202	0.213	0.567	0.224	0.284	0.193	**0.296**	0.16	52
PCB 205	0.0434	0.123	0.0892	0.117	0.0868	**0.0919**	0.032	34
PCB 206	0.183	0.721	0.277	0.374	0.195	**0.350**	0.22	63
PCB 207	0.0495	0.234	0.0969	0.0922	0.101	**0.115**	0.070	61
PCB 208	0.0790	0.233	0.0605	0.0867	0.0521	**0.102**	0.074	73
PCB 209	0.0987	0.173	0.188	0.115	0.118	**0.138**	0.039	28

Appendix 48. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Bluff, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1384	1385	1388	1389	Mean	SD	RSD
BDE47	1.29	4.92	6.17	7.03	**4.85**	2.5	52
BDE99	1.01	4.62	6.82	7.35	**4.95**	2.9	58
BDE100	0.811	1.39	1.92	2.21	**1.58**	0.62	39
PCB 8	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	3.79	2.85	3.77	3.32	**3.43**	0.45	13
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.199	0.0605	<LOQ	0.116	**0.125**	0.070	56
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.171	0.0656	0.0866	0.531	**0.214**	0.22	100
PCB 52	2.94	0.546	0.668	2.45	**1.65**	1.2	74
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	0.203	<LOQ	**<LOQ**		
PCB 66	3.74	3.50	4.22	4.31	**3.94**	0.39	9.8
PCB 70	0.583	0.0595	0.109	0.167	**0.230**	0.24	100
PCB 74	3.43	3.11	3.74	3.88	**3.54**	0.34	9.6
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.190	0.0528	0.0496	0.0737	**0.0916**	0.067	73
PCB 87	0.533	0.286	0.401	0.716	**0.484**	0.18	38
PCB 92	1.19	0.332	0.448	0.759	**0.681**	0.38	56
PCB 95+121	0.915	0.0425	0.0652	0.400	**0.356**	0.41	110
PCB 99	14.7	10.2	13.4	17.3	**13.9**	2.9	21
PCB 101	2.72	0.188	0.214	4.42	**1.89**	2.1	110
PCB 105	4.36	3.49	4.81	5.90	**4.64**	1.0	22
PCB 106	0.0102	0.117	0.0655	0.116	**0.0772**	0.051	66
PCB 107	0.524	0.344	0.530	0.326	**0.431**	0.11	26
PCB 110	3.79	1.54	2.16	3.91	**2.85**	1.2	42
PCB 112	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.429	0.324	0.428	0.585	**0.442**	0.11	24
PCB 118	17.6	12.6	16.5	21.7	**17.1**	3.7	22
PCB 119	0.373	0.282	0.380	0.404	**0.360**	0.054	15
PCB 127	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	2.96	2.17	2.83	3.75	**2.93**	0.65	22
PCB 130	0.851	0.569	0.722	1.15	**0.824**	0.25	30
PCB 137	1.26	0.946	1.21	1.60	**1.26**	0.27	21
PCB 138	20.6	14.1	18.7	28.1	**20.4**	5.8	29
PCB 146	5.36	3.51	4.64	8.01	**5.38**	1.9	36
PCB 149	3.28	1.63	2.00	3.37	**2.57**	0.88	34

Appendix 48 (Continued).

Compound	1384	1385	1388	1389	Mean	SD	RSD
PCB 151	0.837	0.227	0.273	0.469	**0.452**	0.28	62
PCB 153+132	43.7	27.1	36.2	58.7	**41.4**	13	32
PCB 154	0.540	0.400	0.509	0.614	**0.516**	0.089	17
PCB 156	1.36	0.942	1.18	1.92	**1.35**	0.42	31
PCB 157	0.367	0.284	0.342	0.521	**0.378**	0.10	27
PCB 158	1.69	0.904	0.949	1.90	**1.36**	0.51	37
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	4.50	3.03	3.57	6.42	**4.38**	1.5	34
PCB 165	0.0324	0.0307	0.0399	0.0435	**0.0366**	0.0061	17
PCB 166	0.0958	0.0814	0.0999	0.153	**0.107**	0.031	29
PCB 167	0.897	0.538	0.901	1.48	**0.954**	0.39	41
PCB 170	2.98	1.85	2.55	4.64	**3.01**	1.2	39
PCB 172	0.592	0.391	0.529	1.13	**0.660**	0.32	49
PCB 174	0.342	0.174	0.225	0.401	**0.285**	0.10	37
PCB 175	0.180	0.147	0.166	0.319	**0.203**	0.079	39
PCB 176	0.0331	<LOQ	0.0105	0.0310	**0.0249**	0.012	50
PCB 177	0.535	0.286	0.433	0.688	**0.486**	0.17	35
PCB 178	0.703	0.360	0.627	0.773	**0.616**	0.18	29
PCB 180+193	8.56	5.52	7.39	13.0	**8.61**	3.2	37
PCB 183	2.81	1.94	2.85	4.70	**3.07**	1.2	38
PCB 185	0.0141	<LOQ	<LOQ	0.0367	**0.0254**	0.016	63
PCB 187	5.04	2.86	4.78	10.2	**5.72**	3.1	55
PCB 188	0.00794	0.00551	0.0195	0.0299	**0.0157**	0.011	72
PCB 189	<LOQ	0.103	<LOQ	0.208	**0.156**	0.075	48
PCB 191	0.121	0.0779	0.0856	0.139	**0.106**	0.029	27
PCB 194	0.818	0.406	0.665	1.49	**0.846**	0.46	55
PCB 195	0.235	0.163	0.197	0.348	**0.236**	0.080	34
PCB 196	1.24	0.964	1.19	1.98	**1.35**	0.44	33
PCB 197	0.0852	0.0753	0.0924	0.164	**0.104**	0.041	39
PCB 199	3.47	2.41	3.13	6.75	**3.94**	1.9	49
PCB 200	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	0.735	0.477	0.695	1.66	**0.891**	0.52	59
PCB 202	0.299	0.188	0.205	0.229	**0.230**	0.049	21
PCB 205	0.0553	0.0155	0.0378	0.0786	**0.0468**	0.027	57
PCB 206	0.834	0.0247	0.217	0.394	**0.367**	0.35	94
PCB 207	0.0714	0.0610	0.0804	0.148	**0.0902**	0.039	44
PCB 208	<LOQ	0.0500	0.0409	0.115	**0.0685**	0.040	59
PCB 209	0.167	0.0541	0.135	0.192	**0.137**	0.060	44

Appendix 49. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Carolyn Island, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1390	1393	1394	1397	1398	Mean	SD	RSD
BDE47	1.29	1.06	1.85	0.894	1.31	**1.28**	0.36	28
BDE99	0.958	0.922	1.38	0.896	0.928	**1.02**	0.20	20
BDE100	0.725	0.717	0.825	0.672	0.675	**0.723**	0.062	8.6
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	2.68	3.74	3.65	3.70	4.11	**3.57**	0.53	15
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.0954	0.192	0.177	0.142	0.183	**0.158**	0.040	25
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0896	0.366	0.293	0.412	0.551	**0.342**	0.17	50
PCB 52	0.626	2.74	3.96	3.75	3.78	**2.97**	1.4	47
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	0.209	<LOQ	0.182	**0.196**	0.019	9.8
PCB 66	4.20	4.15	4.37	3.72	5.15	**4.32**	0.52	12
PCB 70	0.101	0.256	0.376	0.395	0.335	**0.292**	0.12	41
PCB 74	3.73	3.72	3.91	3.20	4.51	**3.81**	0.47	12
PCB 79	<LOQ	<LOQ	0.00943	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.0120	0.0205	0.0275	0.0703	0.0335	**0.0328**	0.022	69
PCB 87	0.408	0.721	0.637	0.805	1.15	**0.743**	0.27	36
PCB 92	0.346	1.23	1.67	1.02	1.36	**1.13**	0.50	44
PCB 95+121	0.180	0.560	0.633	0.699	0.572	**0.529**	0.20	38
PCB 99	15.1	14.9	14.4	11.6	16.6	**14.5**	1.8	13
PCB 101	0.258	3.65	4.04	4.84	6.05	**3.77**	2.2	57
PCB 105	4.31	4.51	4.78	3.70	5.29	**4.52**	0.59	13
PCB 106	0.0828	0.0513	0.125	0.0588	0.0103	**0.0656**	0.042	64
PCB 107	0.365	0.387	0.692	0.332	0.440	**0.443**	0.14	33
PCB 110	1.60	2.99	4.41	3.27	4.15	**3.28**	1.1	34
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.407	0.438	0.427	0.352	0.507	**0.426**	0.056	13
PCB 118	17.5	17.0	17.5	13.1	19.7	**17.0**	2.4	14
PCB 119	0.399	0.370	0.353	0.288	0.424	**0.367**	0.052	14
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	3.12	2.81	3.11	2.07	3.18	**2.86**	0.46	16
PCB 130	0.881	0.873	0.679	0.579	0.875	**0.778**	0.14	18
PCB 137	1.34	1.24	1.33	0.847	1.41	**1.23**	0.22	18
PCB 138	22.1	20.0	20.4	13.9	22.8	**19.8**	3.5	18
PCB 146	5.85	4.96	4.72	3.53	5.70	**4.95**	0.93	19
PCB 149	2.25	2.70	3.49	2.51	3.35	**2.86**	0.54	19

Appendix 49 (Continued).

Compound	1390	1393	1394	1397	1398	Mean	SD	RSD
PCB 151	0.256	0.592	0.810	0.546	0.720	**0.585**	0.21	36
PCB 153+132	44.7	37.6	37.7	26.0	43.1	**37.8**	7.3	19
PCB 154	0.656	0.531	0.559	0.453	0.599	**0.559**	0.076	14
PCB 156	1.30	1.16	1.39	0.925	1.42	**1.24**	0.20	16
PCB 157	0.383	0.333	0.431	0.243	0.427	**0.363**	0.078	21
PCB 158	1.24	1.04	1.74	0.811	1.44	**1.25**	0.36	29
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	4.77	4.18	4.29	3.16	4.89	**4.26**	0.69	16
PCB 165	0.0406	0.0315	0.0386	0.0360	0.0324	**0.0358**	0.0039	11
PCB 166	0.103	0.0804	0.0792	0.0648	0.0879	**0.0831**	0.014	17
PCB 167	0.914	0.795	0.797	0.529	0.948	**0.796**	0.16	21
PCB 170	3.10	2.47	2.80	1.85	2.83	**2.61**	0.48	18
PCB 172	0.699	0.505	0.502	0.357	0.578	**0.528**	0.12	24
PCB 174	0.248	0.268	0.313	0.233	0.335	**0.279**	0.043	15
PCB 175	0.206	0.147	0.132	0.141	0.217	**0.169**	0.040	23
PCB 176	0.0140	0.0130	0.0304	0.0216	0.0358	**0.0229**	0.010	44
PCB 177	0.636	0.556	0.481	0.336	0.598	**0.521**	0.12	23
PCB 178	0.624	0.754	0.758	0.464	0.608	**0.642**	0.12	19
PCB 180+193	8.96	7.11	7.97	4.93	8.21	**7.44**	1.5	21
PCB 183	3.21	2.60	2.70	1.66	2.98	**2.63**	0.59	23
PCB 185	0.0185	0.0281	0.0284	0.0250	0.0392	**0.0278**	0.0075	27
PCB 187	6.42	4.94	4.65	3.03	5.51	**4.91**	1.2	25
PCB 188	0.0109	0.00976	0.0175	0.0125	0.0185	**0.0138**	0.0040	29
PCB 189	0.162	0.107	0.114	0.0800	0.122	**0.117**	0.030	25
PCB 191	0.118	0.0821	0.103	0.0997	0.102	**0.101**	0.013	13
PCB 194	0.944	0.488	0.664	0.469	0.644	**0.642**	0.19	30
PCB 195	0.316	0.161	0.197	0.166	0.243	**0.216**	0.065	30
PCB 196	1.60	1.10	1.17	0.966	1.16	**1.20**	0.24	20
PCB 197	0.143	0.114	0.121	0.0580	0.113	**0.110**	0.032	29
PCB 199	4.70	3.04	3.16	1.99	3.26	**3.23**	0.97	30
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	1.08	0.848	0.913	0.454	0.760	**0.810**	0.23	28
PCB 202	0.312	0.228	0.254	0.203	0.272	**0.254**	0.042	16
PCB 205	0.0439	0.0373	0.0463	0.0437	0.0554	**0.0453**	0.0065	14
PCB 206	0.369	0.254	0.253	0.301	0.209	**0.277**	0.061	22
PCB 207	0.151	0.0751	0.0680	0.0604	0.0961	**0.0902**	0.037	41
PCB 208	0.133	0.176	0.0782	0.0511	0.0741	**0.103**	0.051	50
PCB 209	0.199	0.0907	0.131	0.103	0.155	**0.136**	0.043	32

Appendix 50. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Cape Darby, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1371	1374	1377	1379	1380	Mean	SD	RSD
BDE47	1.68	1.23	1.38	0.996	0.704	**1.20**	0.37	31
BDE99	0.909	0.971	1.30	0.869	0.897	**0.989**	0.18	18
BDE100	0.810	0.797	0.744	0.758	0.697	**0.761**	0.045	5.9
PCB 8	<LOD	<LOD	0.00957	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 28+31	4.33	2.64	2.74	2.73	2.23	**2.93**	0.81	28
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 44	0.154	0.110	0.116	0.122	0.136	**0.128**	0.018	14
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.238	0.0984	0.290	0.194	0.227	**0.210**	0.071	34
PCB 52	2.64	0.745	0.697	2.43	2.08	**1.72**	0.93	54
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 63	0.364	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 66	5.04	3.96	3.39	3.23	2.72	**3.67**	0.88	24
PCB 70	1.25	0.0978	0.197	0.0648	0.111	**0.343**	0.51	150
PCB 74	5.06	3.54	3.11	2.86	2.38	**3.39**	1.0	30
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.0293	0.0172	0.00894	0.0158	<LOD	**0.0178**	0.0085	48
PCB 87	0.921	0.364	0.657	0.359	0.381	**0.537**	0.25	46
PCB 92	0.897	0.393	0.154	0.838	0.625	**0.582**	0.31	53
PCB 95+121	0.784	0.310	0.196	0.273	0.272	**0.367**	0.24	65
PCB 99	23.9	15.2	12.4	9.41	8.45	**13.9**	6.2	45
PCB 101	2.92	0.411	4.00	1.94	2.43	**2.34**	1.3	56
PCB 105	6.39	4.28	3.24	2.57	2.14	**3.72**	1.7	46
PCB 106	0.313	0.209	0.0108	<LOQ	<LOQ	**0.177**	0.15	86
PCB 107	1.23	0.350	0.316	0.203	0.153	**0.450**	0.44	98
PCB 110	3.45	1.68	2.49	2.19	2.12	**2.39**	0.66	28
PCB 112	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 114	0.621	0.442	0.330	0.250	0.228	**0.374**	0.16	43
PCB 118	27.3	17.4	13.2	10.4	9.02	**15.5**	7.3	47
PCB 119	0.566	0.360	0.309	0.265	0.225	**0.345**	0.13	39
PCB 127	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 128	5.01	3.05	2.28	1.84	1.54	**2.74**	1.4	51
PCB 130	1.43	0.872	0.780	0.458	0.418	**0.793**	0.41	52
PCB 137	2.28	1.30	1.11	0.780	0.654	**1.22**	0.64	52
PCB 138	36.2	21.4	16.8	12.8	10.6	**19.6**	10	52
PCB 146	9.26	5.91	4.20	3.00	2.61	**5.00**	2.7	54
PCB 149	3.59	2.35	2.46	1.69	1.75	**2.37**	0.77	32

Appendix 50. (Continued).

Compound	1371	1374	1377	1379	1380	Mean	SD	RSD
PCB 151	0.572	0.289	0.250	0.371	0.286	**0.353**	0.13	37
PCB 153+132	71.7	43.5	34.1	24.3	20.2	**38.8**	21	53
PCB 154	0.995	0.600	0.480	0.397	0.357	**0.566**	0.26	45
PCB 156	2.04	1.29	0.971	0.757	0.617	**1.13**	0.57	50
PCB 157	0.582	0.387	0.308	0.223	0.197	**0.340**	0.15	46
PCB 158	2.31	0.935	0.917	1.04	0.591	**1.16**	0.66	57
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	8.29	4.63	3.64	2.96	2.34	**4.37**	2.3	54
PCB 165	0.0775	0.0267	0.0234	0.0348	0.0281	**0.0381**	0.022	59
PCB 166	0.138	0.104	0.0643	0.0598	0.0429	**0.0817**	0.038	47
PCB 167	1.50	0.879	0.562	0.432	0.329	**0.740**	0.47	64
PCB 170	5.35	2.91	2.36	1.70	1.35	**2.73**	1.6	58
PCB 172	1.04	0.680	0.493	0.344	0.263	**0.563**	0.31	55
PCB 174	0.362	0.228	0.273	0.154	0.194	**0.242**	0.080	33
PCB 175	0.355	0.202	0.152	0.129	0.0954	**0.187**	0.10	55
PCB 176	0.0205	0.0173	0.0191	0.0183	0.0160	**0.0182**	0.0017	9.5
PCB 177	1.05	0.587	0.579	0.331	0.309	**0.572**	0.30	52
PCB 178	1.17	0.602	0.426	0.455	0.271	**0.585**	0.35	60
PCB 180+193	15.3	8.12	6.98	4.86	3.80	**7.81**	4.5	58
PCB 183	5.46	3.08	2.39	1.65	1.28	**2.77**	1.7	60
PCB 185	0.0597	<LOQ	0.0512	0.0250	0.0707	**0.0517**	0.019	38
PCB 187	10.9	5.99	4.11	2.69	1.97	**5.13**	3.6	70
PCB 188	0.0300	0.0245	0.0225	0.0204	0.0131	**0.0221**	0.0062	28
PCB 189	0.202	0.150	<LOQ	0.0672	0.0490	**0.117**	0.072	61
PCB 191	0.154	0.0841	0.114	0.0913	0.0518	**0.0991**	0.038	38
PCB 194	1.32	0.751	0.606	0.447	0.234	**0.671**	0.41	61
PCB 195	0.328	0.243	0.184	0.214	0.128	**0.219**	0.074	34
PCB 196	1.96	1.37	1.13	0.946	0.807	**1.24**	0.45	36
PCB 197	0.159	0.134	0.0901	0.0920	0.0632	**0.108**	0.038	36
PCB 199	5.87	4.15	3.26	2.58	1.95	**3.56**	1.5	43
PCB 200	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 201	1.26	1.03	0.516	0.572	0.507	**0.777**	0.35	45
PCB 202	0.396	0.252	0.220	0.241	0.148	**0.252**	0.090	36
PCB 205	0.0953	0.0475	0.0532	0.0357	0.0252	**0.0514**	0.027	52
PCB 206	0.317	0.177	0.222	0.127	0.0144	**0.171**	0.11	65
PCB 207	0.149	0.104	0.0804	0.0772	0.0538	**0.0928**	0.036	39
PCB 208	0.116	0.0754	0.0441	0.0611	<LOQ	**0.0742**	0.031	42
PCB 209	0.148	0.135	0.140	0.140	0.0521	**0.123**	0.040	32

Appendix 51. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Shaktoolik South, Alaska in 2008 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1401	1402	1403	1403-2	1403 Mean	% difference	1404	Mean	SD	RSD
BDE47	1.26	1.72	1.59	1.55	**1.57**	2.6	2.25	**1.70**	0.42	24
BDE99	0.937	0.880	0.963	0.992	**0.978**	-3.0	0.988	**0.946**	0.049	5.2
BDE100	0.740	0.714	0.906	0.897	**0.901**	0.97	0.884	**0.810**	0.097	12
PCB 8	<LOD	<LOD	<LOD	<LOD	**<LOD**		<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	**<LOD**		<LOD	**<LOD**		
PCB 28+31	2.73	3.05	4.52	4.66	**4.59**	-3.2	5.68	**4.01**	1.4	34
PCB 29	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	**<LOQ**		
PCB 44	0.0660	0.163	0.0898	0.0931	**0.0915**	-3.6	0.0607	**0.0954**	0.047	50
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	**<LOQ**		
PCB 49	0.232	0.182	0.393	0.396	**0.394**	-0.79	0.0704	**0.220**	0.13	61
PCB 52	0.928	2.11	3.53	3.64	**3.58**	-3.3	2.51	**2.28**	1.1	48
PCB 56	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	**<LOQ**		
PCB 63	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	**<LOQ**		
PCB 66	3.03	3.43	5.23	5.28	**5.26**	-1.1	6.65	**4.59**	1.7	37
PCB 70	0.138	0.125	0.264	0.266	**0.265**	-0.69	0.0715	**0.150**	0.082	55
PCB 74	2.92	3.30	4.46	4.50	**4.48**	-0.77	5.71	**4.10**	1.3	31
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	**<LOQ**		
PCB 82	0.0159	0.0104	0.0119	<LOD	**<LOD**		0.0213	**0.0149**	0.0049	33
PCB 87	0.448	0.445	0.835	0.850	**0.843**	-1.8	0.624	**0.590**	0.19	32
PCB 92	0.249	1.05	1.20	1.21	**1.20**	-0.30	1.33	**0.959**	0.49	51
PCB 95+121	0.0859	0.610	0.319	0.321	**0.320**	-0.44	0.287	**0.326**	0.22	66
PCB 99	11.4	15.6	17.6	17.3	**17.4**	2.0	24.0	**17.1**	5.2	31
PCB 101	2.38	2.27	5.28	5.12	**5.20**	3.0	1.74	**2.90**	1.6	54
PCB 105	2.62	3.64	5.50	5.80	**5.65**	-5.3	7.91	**4.95**	2.3	47
PCB 106	<LOQ	0.333	0.130	0.131	**0.131**	-0.87	0.227	**0.230**	0.10	44
PCB 107	0.299	0.162	0.397	0.409	**0.403**	-3.0	0.306	**0.293**	0.099	34
PCB 110	1.85	2.29	4.19	4.32	**4.25**	-3.0	4.86	**3.32**	1.5	44
PCB 112	<LOD	<LOD	0.0105	<LOD	**<LOD**		<LOD	**<LOD**		
PCB 114	0.271	0.372	0.592	0.602	**0.597**	-1.6	0.718	**0.489**	0.20	42
PCB 118	11.6	15.0	20.8	21.2	**21.0**	-1.9	29.9	**19.4**	8.0	41
PCB 119	0.296	0.301	0.451	0.441	**0.446**	2.1	0.582	**0.406**	0.14	34
PCB 127	<LOD	<LOD	<LOD	<LOD	**<LOD**		<LOD	**<LOD**		
PCB 128	2.14	2.70	3.54	3.64	**3.59**	-2.6	4.96	**3.35**	1.2	37
PCB 130	0.548	0.658	0.973	1.01	**0.990**	-3.6	1.30	**0.873**	0.34	39
PCB 137	0.969	1.18	1.51	1.56	**1.53**	-3.1	2.24	**1.48**	0.56	38
PCB 138	15.6	20.6	24.8	24.3	**24.6**	2.2	34.8	**23.9**	8.1	34
PCB 146	3.98	5.04	6.04	6.33	**6.19**	-4.6	8.04	**5.81**	1.7	30
PCB 149	1.86	2.22	2.90	2.91	**2.90**	-0.13	3.73	**2.68**	0.82	31

Appendix 51 (Continued).

Compound	1401	1402	1403	1403-2	1403 Mean	% difference	1404	Mean	SD	RSD
PCB 151	0.311	0.688	0.480	0.480	**0.480**	0.034	0.504	**0.496**	0.15	31
PCB 153+132	33.7	46.9	45.6	46.4	**46.0**	-1.7	64.9	**47.9**	13	27
PCB 154	0.448	0.553	0.685	0.672	**0.679**	1.9	0.899	**0.644**	0.19	30
PCB 156	0.939	1.10	1.54	1.55	**1.54**	-0.74	2.19	**1.44**	0.56	39
PCB 157	0.295	0.357	0.460	0.451	**0.455**	2.0	0.661	**0.442**	0.16	36
PCB 158	1.04	1.45	1.62	1.60	**1.61**	1.3	2.57	**1.67**	0.65	39
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		<LOQ	**<LOQ**		
PCB 163	3.55	4.64	5.29	5.12	**5.20**	3.3	6.89	**5.07**	1.4	27
PCB 165	0.0401	0.0392	0.0488	0.0488	**0.0488**	-0.13	0.0695	**0.0494**	0.014	29
PCB 166	0.0857	0.0775	0.100	0.103	**0.101**	-2.6	0.132	**0.0990**	0.024	24
PCB 167	0.553	0.672	1.08	1.11	**1.10**	-2.7	1.64	**0.990**	0.49	50
PCB 170	2.21	2.77	3.33	3.33	**3.33**	0.12	4.93	**3.31**	1.2	35
PCB 172	0.475	0.542	0.650	0.652	**0.651**	-0.29	0.902	**0.642**	0.19	29
PCB 174	0.180	0.216	0.301	0.290	**0.296**	3.8	0.387	**0.270**	0.092	34
PCB 175	0.126	0.144	0.243	0.239	**0.241**	1.6	0.293	**0.201**	0.079	39
PCB 176	0.0222	0.0105	0.0234	0.0242	**0.0238**	-3.5	0.0137	**0.0176**	0.0064	37
PCB 177	0.425	0.373	0.600	0.602	**0.601**	-0.29	0.732	**0.533**	0.16	31
PCB 178	0.429	0.737	0.753	0.768	**0.761**	-2.0	1.22	**0.787**	0.33	42
PCB 180+193	6.56	8.15	9.49	9.55	**9.52**	-0.64	14.0	**9.55**	3.2	33
PCB 183	2.23	2.91	3.26	3.37	**3.31**	-3.5	4.72	**3.29**	1.1	32
PCB 185	0.0303	0.0199	0.0319	0.0311	**0.0315**	2.6	0.0172	**0.0247**	0.0072	29
PCB 187	3.50	4.53	6.00	6.54	**6.27**	-8.5	8.85	**5.79**	2.3	40
PCB 188	0.0561	0.0206	0.0192	0.0192	**0.0192**	0.29	0.0415	**0.0343**	0.018	52
PCB 189	0.0772	0.0188	<LOQ	0.0593	**<LOQ**		0.217	**0.0930**	0.086	92
PCB 191	0.0946	0.0911	0.151	0.145	**0.148**	3.9	0.185	**0.130**	0.045	35
PCB 194	0.580	0.663	0.887	0.864	**0.876**	2.6	1.41	**0.882**	0.37	42
PCB 195	0.257	0.187	0.260	0.265	**0.263**	-2.1	0.312	**0.255**	0.052	20
PCB 196	1.18	1.18	1.49	1.50	**1.49**	-0.45	1.88	**1.43**	0.33	23
PCB 197	0.0720	0.0804	0.122	0.118	**0.120**	3.2	0.130	**0.101**	0.029	28
PCB 199	2.84	3.46	3.87	3.86	**3.87**	0.22	5.25	**3.85**	1.0	26
PCB 200	<LOD	<LOD	<LOD	<LOD	**<LOD**		<LOD	**<LOD**		
PCB 201	0.815	0.766	0.740	0.752	**0.746**	-1.6	1.14	**0.867**	0.19	21
PCB 202	0.242	0.311	0.254	0.261	**0.257**	-2.6	0.386	**0.299**	0.065	22
PCB 205	0.0577	0.0498	0.0264	0.0244	**0.0254**	8.0	0.0761	**0.0523**	0.021	40
PCB 206	0.0923	0.242	0.439	0.431	**0.435**	1.9	0.433	**0.300**	0.17	55
PCB 207	0.0900	0.0767	0.0969	0.0943	**0.0956**	2.7	0.136	**0.0996**	0.026	26
PCB 208	0.0299	0.0360	0.0576	0.0582	**0.0579**	-0.92	0.0807	**0.0511**	0.023	45
PCB 209	0.0892	0.137	0.206	0.201	**0.204**	2.8	0.191	**0.155**	0.053	34

Appendix 52. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Shaktoolik South, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1424	1426	1427	1428	1429	Mean	SD	RSD
BDE47	1.72	0.875	0.941	5.46	1.54	**2.11**	1.9	91
BDE99	0.641	0.167	0.200	6.09	0.230	**1.46**	2.6	180
BDE100	0.522	0.230	0.370	1.65	0.387	**0.631**	0.58	91
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	2.58	1.83	2.27	2.46	2.81	**2.39**	0.37	15
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	0.176	0.0654	0.0698	0.132	0.0988	**0.108**	0.046	43
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.730	0.0635	0.0529	0.151	0.184	**0.236**	0.28	120
PCB 52	3.68	0.856	1.79	1.14	1.13	**1.72**	1.1	67
PCB 56	0.170	0.150	0.162	0.193	0.162	**0.167**	0.016	9.6
PCB 63	0.128	0.138	0.124	0.203	0.120	**0.143**	0.034	24
PCB 66	3.53	2.60	2.91	2.12	3.80	**2.99**	0.68	23
PCB 70	0.102	0.0553	0.0647	0.139	0.121	**0.0965**	0.036	37
PCB 74	3.21	2.50	2.50	1.76	3.20	**2.63**	0.60	23
PCB 79	0.0295	0.0321	0.0272	0.0440	0.0268	**0.0319**	0.0071	22
PCB 82	0.0613	0.0280	0.0329	0.0337	0.0278	**0.0367**	0.014	38
PCB 87	1.08	0.364	0.378	0.625	0.567	**0.602**	0.29	48
PCB 92	1.40	0.273	0.650	0.315	0.607	**0.649**	0.45	70
PCB 95+121	0.750	0.0692	0.141	0.0710	0.284	**0.263**	0.29	110
PCB 99	19.1	14.0	11.9	25.0	15.3	**17.1**	5.2	30
PCB 101	6.49	1.34	1.29	1.71	3.17	**2.80**	2.2	79
PCB 105	4.67	3.31	3.38	5.25	4.31	**4.18**	0.83	20
PCB 106	0.0296	0.0286	<LOQ	0.0282	0.0445	**0.0327**	0.0079	24
PCB 107	0.342	0.173	0.173	0.261	0.276	**0.245**	0.073	30
PCB 110	4.07	1.46	1.57	3.82	2.72	**2.73**	1.2	45
PCB 112	0.0207	0.00838	0.0112	0.0241	0.0176	**0.0164**	0.0065	40
PCB 114	0.456	0.326	0.319	0.549	0.403	**0.411**	0.096	23
PCB 118	17.4	13.7	12.3	21.8	16.0	**16.2**	3.7	23
PCB 119	0.502	0.319	0.301	0.592	0.374	**0.418**	0.13	30
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	3.03	2.29	2.00	3.69	2.71	**2.74**	0.66	24
PCB 130	0.789	0.483	0.519	1.08	0.706	**0.717**	0.24	34
PCB 137	1.21	0.912	0.742	1.66	1.12	**1.13**	0.35	31
PCB 138	20.9	16.8	12.6	28.2	17.9	**19.3**	5.8	30
PCB 146	5.08	4.05	3.19	7.49	4.75	**4.91**	1.6	33
PCB 149	4.23	1.15	1.44	2.49	2.57	**2.38**	1.2	51

Appendix 52 (Continued).

Compound	1424	1426	1427	1428	1429	Mean	SD	RSD
PCB 151	0.921	0.0870	0.115	0.171	0.340	**0.327**	0.35	110
PCB 153+132	39.7	42.3	24.7	66.3	38.7	**42.4**	15	36
PCB 154	0.601	0.411	0.378	0.781	0.503	**0.535**	0.16	30
PCB 156	1.09	0.817	0.719	1.56	1.07	**1.05**	0.33	31
PCB 157	0.308	0.244	0.214	0.390	0.306	**0.292**	0.068	23
PCB 158	1.31	1.11	0.620	1.13	1.12	**1.06**	0.26	24
PCB 159	<LOQ	<LOQ	<LOQ	0.0124	<LOQ	**<LOQ**		
PCB 163	4.19	3.54	3.05	5.77	4.04	**4.12**	1.0	25
PCB 165	0.0446	0.0426	0.0359	0.0455	0.0489	**0.0435**	0.0048	11
PCB 166	0.231	0.0321	0.0350	0.0993	0.144	**0.108**	0.083	77
PCB 167	0.857	0.653	0.576	1.00	0.855	**0.789**	0.17	22
PCB 170	2.35	2.14	1.62	3.68	2.80	**2.52**	0.77	31
PCB 172	0.529	0.435	0.304	0.778	0.562	**0.522**	0.18	34
PCB 174	0.501	0.106	0.157	0.302	0.385	**0.290**	0.16	56
PCB 175	0.220	0.153	0.131	0.277	0.212	**0.199**	0.058	29
PCB 176	0.0734	0.0349	0.0362	0.0424	0.0478	**0.0469**	0.016	33
PCB 177	0.743	0.311	0.486	0.849	0.586	**0.595**	0.21	36
PCB 178	0.910	0.690	0.588	0.875	0.734	**0.759**	0.13	18
PCB 180+193	7.67	6.53	4.52	11.5	8.16	**7.68**	2.6	33
PCB 183	2.82	2.40	1.62	3.89	2.86	**2.72**	0.82	30
PCB 185	0.0431	<LOQ	<LOQ	<LOQ	0.0360	**0.0395**	0.0050	13
PCB 187	6.08	3.74	3.66	8.09	5.82	**5.48**	1.8	34
PCB 188	0.0386	0.0247	0.0288	0.0443	0.0374	**0.0348**	0.0079	23
PCB 189	<LOQ	<LOQ	<LOQ	0.0257	<LOQ	**<LOQ**		
PCB 191	0.0961	0.0796	0.0651	0.136	0.0957	**0.0945**	0.026	28
PCB 194	0.541	0.578	0.348	0.778	0.690	**0.587**	0.16	28
PCB 195	<LOQ	0.138	0.118	0.0529	0.200	**0.127**	0.061	48
PCB 196	1.11	0.887	0.662	1.69	1.26	**1.12**	0.39	35
PCB 197	0.0999	0.0732	0.0591	0.139	0.100	**0.0942**	0.030	32
PCB 199	3.14	2.49	1.60	5.38	3.44	**3.21**	1.4	44
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	1.04	0.387	0.537	1.42	0.904	**0.857**	0.41	48
PCB 202	0.374	0.391	0.234	0.504	0.348	**0.370**	0.097	26
PCB 205	0.0415	0.0429	0.0400	0.0442	0.0493	**0.0436**	0.0036	8.2
PCB 206	<LOQ	0.239	<LOQ	0.345	0.265	**0.283**	0.056	20
PCB 207	0.0870	0.0761	0.0671	0.120	0.0926	**0.0886**	0.020	23
PCB 208	<LOQ	0.139	0.0845	0.168	0.144	**0.134**	0.035	26
PCB 209	0.0901	0.104	0.0689	0.120	0.110	**0.0987**	0.020	20

Appendix 53. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous gull eggs collected at Stuart Island, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1419	1420	1421	1422	1423	Mean	SD	RSD
BDE47	1.33	2.48	1.11	2.21	1.67	**1.76**	0.58	33
BDE99	0.801	0.934	0.526	0.539	0.301	**0.620**	0.25	40
BDE100	2.01	1.03	1.15	0.613	0.420	**1.04**	0.62	59
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	0.416	2.70	0.310	2.65	3.30	**1.88**	1.4	75
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	0.0598	0.0592	0.0606	0.0577	0.0763	**0.0627**	0.0077	12
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.0878	0.0722	0.0767	0.0699	0.519	**0.165**	0.20	120
PCB 52	0.110	0.757	0.117	0.725	1.93	**0.728**	0.74	100
PCB 56	0.142	0.277	0.132	0.185	0.297	**0.207**	0.076	37
PCB 63	0.0526	0.0786	0.0421	0.0946	0.151	**0.0838**	0.043	51
PCB 66	0.640	4.89	0.533	4.80	4.37	**3.05**	2.3	74
PCB 70	0.0774	0.0589	0.0859	0.0834	0.172	**0.0955**	0.044	46
PCB 74	0.496	4.80	0.401	4.66	3.51	**2.77**	2.2	79
PCB 79	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 82	0.0381	0.0430	0.0321	0.0284	0.0522	**0.0387**	0.0094	24
PCB 87	0.154	0.779	0.129	0.691	0.573	**0.465**	0.30	65
PCB 92	0.368	0.346	0.317	0.339	0.704	**0.415**	0.16	39
PCB 95+121	0.170	0.202	0.156	0.199	0.196	**0.185**	0.020	11
PCB 99	2.45	35.6	1.76	32.1	13.7	**17.1**	16	94
PCB 101	0.260	2.80	0.240	2.66	5.07	**2.21**	2.0	92
PCB 105	0.937	6.94	0.761	6.44	4.40	**3.90**	2.9	75
PCB 106	0.0189	0.201	0.0361	0.0224	0.0215	**0.0600**	0.079	130
PCB 107	0.165	0.270	0.128	0.361	0.272	**0.239**	0.093	39
PCB 110	<LOD	3.01	<LOD	2.79	3.81	**3.20**	0.54	17
PCB 112	0.0106	0.109	0.00782	0.0336	0.0218	**0.0366**	0.042	110
PCB 114	0.0690	0.720	0.0621	0.686	0.388	**0.385**	0.32	83
PCB 118	3.47	30.4	2.84	28.0	15.9	**16.1**	13	81
PCB 119	0.0225	0.716	0.0224	0.655	0.363	**0.356**	0.33	93
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	0.656	6.83	0.528	6.28	2.70	**3.40**	3.0	89
PCB 130	0.127	2.29	0.110	2.13	0.586	**1.05**	1.1	100
PCB 137	0.162	3.24	0.139	3.01	1.03	**1.52**	1.5	100
PCB 138	4.01	52.1	3.23	45.4	17.4	**24.4**	23	94
PCB 146	1.27	12.8	1.00	11.8	4.31	**6.24**	5.7	91
PCB 149	0.540	4.81	0.455	4.46	2.41	**2.53**	2.1	82

Appendix 53 (Continued).

Compound	1419	1420	1421	1422	1423	Mean	SD	RSD
PCB 151	0.244	0.0945	0.201	0.0901	0.0635	**0.139**	0.079	57
PCB 153+132	10.7	98.7	8.44	90.4	33.8	**48.4**	43	90
PCB 154	0.138	1.33	0.115	1.20	0.460	**0.649**	0.58	90
PCB 156	0.304	2.46	0.259	2.24	1.10	**1.27**	1.0	82
PCB 157	0.0888	2.29	0.0801	2.22	0.306	**0.999**	1.2	120
PCB 158	0.185	2.41	0.220	2.16	1.01	**1.20**	1.1	88
PCB 159	<LOQ	0.00278	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	1.07	10.4	0.880	9.73	3.32	**5.08**	4.7	92
PCB 165	0.0390	0.109	0.0368	0.0916	0.317	**0.119**	0.12	97
PCB 166	0.104	0.303	0.0579	0.337	0.0751	**0.175**	0.13	76
PCB 167	0.260	1.96	0.204	1.83	0.875	**1.03**	0.84	82
PCB 170	1.07	8.61	0.915	7.83	2.51	**4.19**	3.7	89
PCB 172	0.189	1.80	0.158	1.68	0.479	**0.862**	0.81	94
PCB 174	0.155	0.690	0.127	0.660	0.333	**0.393**	0.27	69
PCB 175	0.0598	0.739	0.0481	0.686	0.185	**0.344**	0.34	99
PCB 176	0.0384	0.0449	0.0369	0.0393	0.0391	**0.0397**	0.0031	7.7
PCB 177	0.491	2.46	0.377	2.34	0.379	**1.21**	1.1	90
PCB 178	0.451	1.66	0.336	1.57	0.524	**0.907**	0.65	71
PCB 180+193	3.39	25.7	2.67	24.0	7.37	**12.6**	11	90
PCB 183	0.949	8.90	0.707	8.39	2.47	**4.28**	4.0	94
PCB 185	<LOQ	0.0231	<LOQ	0.0207	0.0241	**0.0226**	0.0018	7.7
PCB 187	1.91	20.0	1.36	18.9	4.66	**9.38**	9.3	99
PCB 188	0.0197	0.0617	0.0193	0.0586	0.0255	**0.0369**	0.021	58
PCB 189	<LOQ	<LOQ	<LOQ	0.245	0.105	**0.175**	0.099	56
PCB 191	0.0401	0.264	0.0390	0.246	0.0916	**0.136**	0.11	81
PCB 194	0.509	1.82	0.422	1.70	0.642	**1.02**	0.68	67
PCB 195	0.0526	0.543	0.0504	0.519	0.197	**0.272**	0.24	89
PCB 196	0.754	3.24	0.609	3.18	1.17	**1.79**	1.3	73
PCB 197	0.0467	0.263	0.0457	0.259	0.0858	**0.140**	0.11	80
PCB 199	2.05	12.6	1.56	12.2	2.88	**6.26**	5.6	90
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	0.523	2.82	0.373	2.84	0.631	**1.44**	1.3	89
PCB 202	0.194	0.702	0.181	0.691	0.228	**0.399**	0.27	68
PCB 205	<LOQ	0.0801	<LOQ	0.0967	0.0398	**0.0722**	0.029	41
PCB 206	0.248	0.456	0.212	0.477	0.233	**0.326**	0.13	40
PCB 207	0.0591	0.214	0.0542	0.219	0.0921	**0.128**	0.082	65
PCB 208	0.101	0.176	0.104	0.291	0.126	**0.160**	0.080	50
PCB 209	0.119	0.220	0.0713	0.239	0.0822	**0.146**	0.078	53

Appendix 54. Brominated diphenyl ether (BDE) and polychlorinated biphenyl (PCB) mass fractions (ng g^{-1} wet mass) in glaucous-winged gull eggs collected at Aiktak Island, Alaska in 2009 (compounds shown in red and blue were above and below reference value ranges, respectively).

Compound	1473	1474	1475	1477	1478	Mean	SD	RSD
BDE47	0.477	4.90	0.906	2.52	1.78	**2.12**	1.7	82
BDE99	0.0797	0.990	0.328	0.353	0.200	**0.390**	0.35	90
BDE100	0.231	1.32	0.431	0.653	0.471	**0.620**	0.42	67
PCB 8	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 18	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB28+31	0.419	1.44	1.02	2.04	1.75	**1.33**	0.64	48
PCB 29	<LOD	<LOD	<LOD	<LOD	<LOD	**<LOD**		
PCB 44	0.122	0.0581	0.103	0.167	0.0846	**0.107**	0.041	38
PCB 45	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 49	0.134	0.0844	0.134	0.187	0.0649	**0.121**	0.048	40
PCB 52	0.436	0.584	1.07	0.725	0.412	**0.645**	0.27	42
PCB 56	0.149	0.228	0.195	0.212	0.213	**0.199**	0.030	15
PCB 63	0.0722	0.168	0.0955	0.106	0.0613	**0.101**	0.042	41
PCB 66	0.556	4.14	1.38	2.94	2.92	**2.39**	1.4	59
PCB 70	0.0783	0.0686	0.0614	0.0759	0.0767	**0.0722**	0.0071	9.8
PCB 74	0.428	3.28	1.02	2.40	2.17	**1.86**	1.1	61
PCB 79	0.0287	0.0275	0.0256	0.0294	0.0250	**0.0272**	0.0019	7.1
PCB 82	0.0295	0.0284	0.0336	0.0293	0.0314	**0.0304**	0.0021	6.9
PCB 87	0.153	0.600	0.214	0.500	0.352	**0.364**	0.19	52
PCB 92	0.184	0.224	0.356	0.424	0.168	**0.271**	0.11	42
PCB 95+121	0.162	0.135	0.204	0.240	0.113	**0.171**	0.051	30
PCB 99	2.65	25.6	5.99	14.6	12.5	**12.3**	8.9	72
PCB 101	0.754	0.573	1.56	2.23	0.600	**1.14**	0.73	64
PCB 105	0.645	6.42	1.48	3.56	3.13	**3.05**	2.2	73
PCB 106	<LOQ	0.0195	0.0385	0.0230	0.0183	**0.0248**	0.0093	38
PCB 107	0.0783	0.106	0.0868	0.0966	0.112	**0.0960**	0.014	14
PCB 110	0.325	0.634	1.01	0.902	0.573	**0.689**	0.27	40
PCB 112	0.00844	0.0212	0.0115	0.0329	0.0150	**0.0178**	0.0097	54
PCB 114	0.0737	0.733	0.147	0.348	0.335	**0.327**	0.26	78
PCB 118	2.84	28.1	6.14	14.5	13.2	**13.0**	9.8	75
PCB 119	0.0506	0.635	0.157	0.383	0.325	**0.310**	0.22	72
PCB 127	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 128	0.535	5.35	1.11	2.65	2.33	**2.39**	1.9	78
PCB 130	0.243	0.740	0.375	0.656	0.646	**0.532**	0.21	40
PCB 137	0.235	2.34	0.446	0.973	0.966	**0.992**	0.82	83
PCB 138	4.62	37.6	8.46	19.3	18.9	**17.8**	13	72
PCB 146	1.18	7.08	2.57	5.40	4.79	**4.20**	2.3	56
PCB 149	0.558	1.36	1.34	1.23	0.875	**1.07**	0.35	33

Appendix 54 (Continued).

Compound	1473	1474	1475	1477	1478	Mean	SD	RSD
PCB 151	0.100	0.138	0.223	0.165	0.0694	**0.139**	0.059	43
PCB 153+132	9.48	94.9	19.9	43.3	39.8	**41.5**	33	80
PCB 154	0.146	1.17	0.279	0.642	0.512	**0.550**	0.40	72
PCB 156	0.180	2.17	0.439	0.909	0.948	**0.928**	0.76	82
PCB 157	0.0725	0.618	0.127	0.266	0.249	**0.267**	0.21	80
PCB 158	0.299	2.15	0.576	1.37	1.18	**1.12**	0.72	65
PCB 159	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 163	0.881	5.80	1.98	3.89	3.28	**3.17**	1.9	59
PCB 165	0.0337	0.105	0.0457	0.0706	0.0698	**0.0649**	0.027	42
PCB 166	0.0276	0.0404	0.0340	0.0316	0.0359	**0.0339**	0.0048	14
PCB 167	0.184	1.94	0.419	0.876	0.872	**0.858**	0.67	79
PCB 170	0.715	6.74	1.08	2.82	2.97	**2.87**	2.4	83
PCB 172	0.138	1.22	0.325	0.572	0.601	**0.572**	0.41	72
PCB 174	0.0788	0.165	0.195	0.209	0.121	**0.154**	0.054	35
PCB 175	0.0657	0.521	0.123	0.225	0.224	**0.232**	0.18	76
PCB 176	0.0333	0.0317	0.0423	0.0386	0.0462	**0.0384**	0.0061	16
PCB 177	0.207	0.757	0.469	0.498	0.384	**0.463**	0.20	43
PCB 178	0.219	1.37	0.346	0.713	0.496	**0.628**	0.45	72
PCB 180+193	2.15	24.3	4.53	8.41	9.33	**9.75**	8.7	89
PCB 183	0.719	7.66	1.54	3.19	3.04	**3.23**	2.7	83
PCB 185	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 187	1.36	8.35	3.57	5.99	5.05	**4.86**	2.6	54
PCB 188	0.0196	0.0449	0.0256	0.0270	0.0312	**0.0297**	0.0095	32
PCB 189	<LOQ	0.0116	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 191	0.0263	0.264	0.0455	0.105	0.113	**0.111**	0.093	84
PCB 194	0.255	2.37	0.475	0.787	1.01	**0.979**	0.83	85
PCB 195	0.0665	0.572	0.140	0.257	0.274	**0.262**	0.19	74
PCB 196	0.468	3.62	0.829	1.45	1.50	**1.57**	1.2	78
PCB 197	0.0302	0.283	0.0723	0.120	0.102	**0.121**	0.096	79
PCB 199	0.918	11.2	2.18	2.95	3.38	**4.12**	4.0	98
PCB 200	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**<LOQ**		
PCB 201	0.218	1.91	0.680	0.788	0.671	**0.854**	0.63	74
PCB 202	0.148	0.567	0.203	0.322	0.233	**0.295**	0.16	56
PCB 205	0.0273	0.103	0.0369	0.0298	0.0720	**0.0539**	0.033	61
PCB 206	<LOQ	0.768	<LOQ	0.333	0.339	**0.480**	0.25	52
PCB 207	0.0624	0.268	0.0799	0.139	0.141	**0.138**	0.081	58
PCB 208	0.0970	0.306	0.108	0.142	0.138	**0.158**	0.085	53
PCB 209	0.0601	0.361	0.0795	0.201	0.193	**0.179**	0.12	67