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2014 Salish Sea Ecosystem Conference (Seattle, Wash.)

Apr 30th, 1:30 PM - 3:00 PM

Brominated Flame Retardants: Spatial and Temporal Patterns and Trends in Seabird eggs from the Nearshore Pacific Coast of Canada

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Miller, Aroha; Elliott, John E. (John Edward); Elliott, Kyle; Lee, Sandi; Guigueno, Melanie; and Idrissez, Abde, "Brominated Flame Retardants: Spatial and Temporal Patterns and Trends in Seabird eggs from the Nearshore Pacific Coast of Canada" (2014). *Salish Sea Ecosystem Conference*. 15.
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Speaker
Aroha Miller, John E. (John Edward) Elliott, Kyle Elliott, Sandi Lee, Melanie Guigueno, and Abde Idrissez

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Brominated Flame Retardants: Spatial and Temporal Patterns and Trends in Seabird eggs from the Nearshore Pacific Coast of Canada

Aroha Miller, John Elliott, Kyle Elliot, Mélanie Guigueno, Laurie Wilson, Sandi Lee, Abde Idrissi

Environment Canada

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THE UNIVERSITY OF BRITISH COLUMBIA

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Outline

- The culprit - brominated flame retardants (BFR)
- The birds – 4 species, offshore & coastal
- Study design
- Results
- Summary

AIMS

1. Compare and contrast BFR temporal trends between two **offshore** feeding/breeding seabirds and two **coastal** breeding birds from British Columbia, Canada.
2. Use **stable isotopes** to examine whether contaminant changes are due to diet or regulations

Brominated Flame Retardants

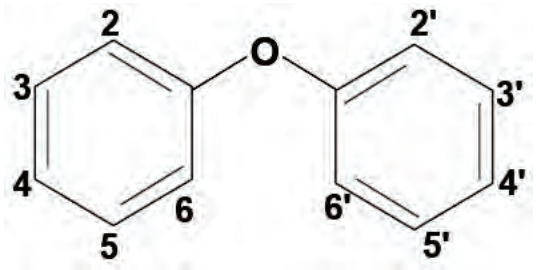
Polybrominated diphenyl ethers (PBDEs)

- Textiles, plastics, furnishings, carpets
- Penta, octa and deca

Hexabromocyclododecane (HBCD)

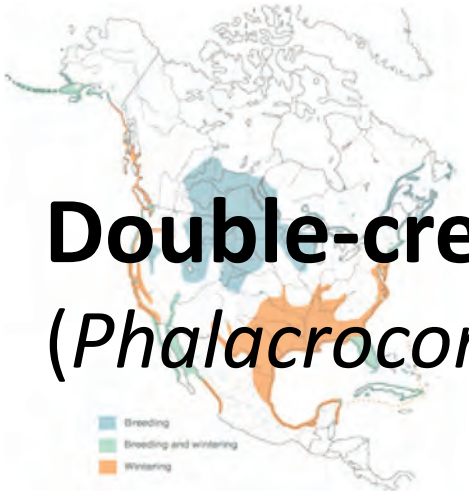
- Primarily construction materials
- α, β and γ

- Ubiquitous in environment
- Persistent, bioaccumulate, lipophilic
- Regulations and restrictions, penta, octa



Monitor: BFRs seabird eggs

Coastal

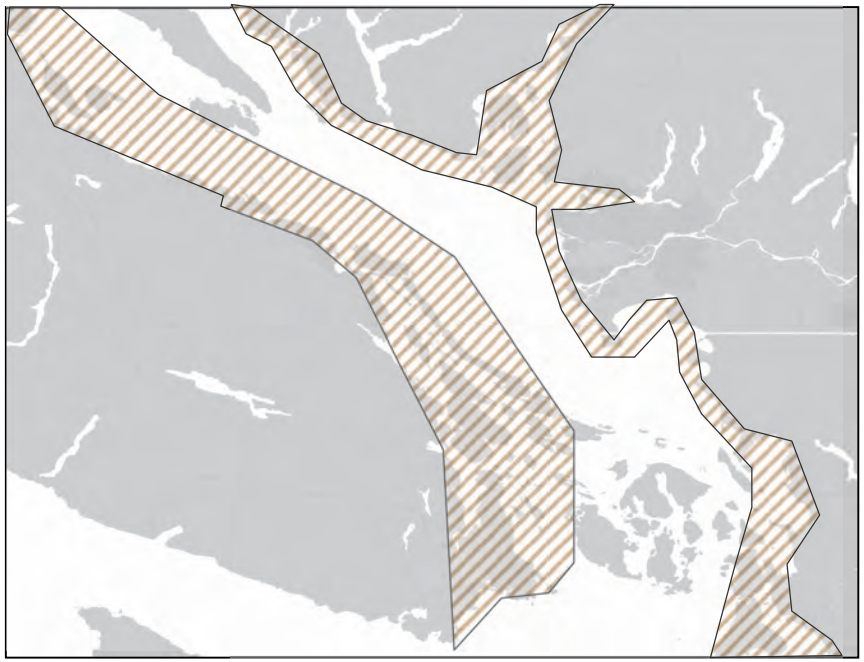


Double-crested Cormorant

(*Phalacrocorax auritus*)

Sub-surface pursuit diver

Widely distributed across North America



Coastal near shore habitat

Crescent Gunnel

Longsnout Prickleback

Seaperch

Pacific Sandlance

Piscivorous: variety of benthic & mid-water schooling fish diet

Great-blue Heron
(Ardea herodias)

Widely distributed across North America

Stealth wading in shallow water


Sculpin


Seaperch


Townsend's Vole

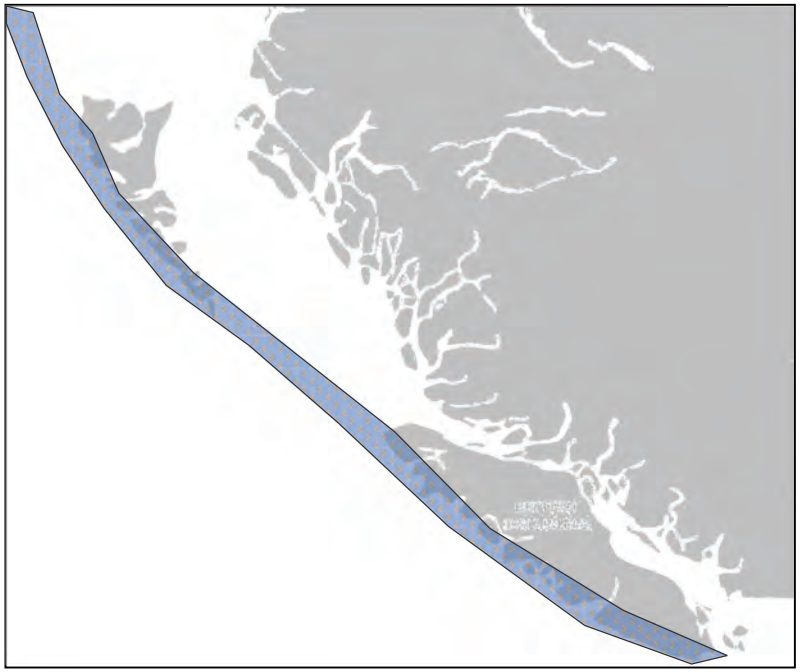
Mostly fish, but also amphibians, invertebrates, mammals

Estuarine habitat

Offshore

Rhinoceros Auklet
(Cerorhinca monocerata)

Temperate waters of the N. Pacific



Continental shelf habitat

Subsurface feeder

Juvenile Rockfish

Pacific Herring

Anchovy

Pacific Sandlance

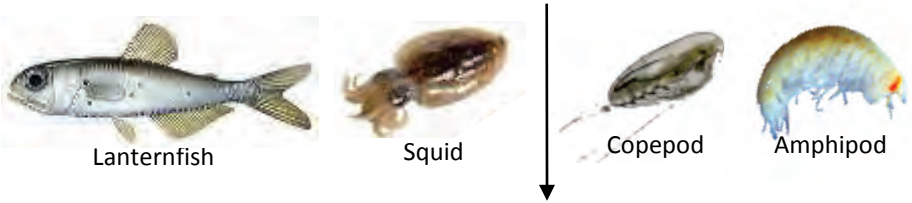
Piscivorous: Midwater schooling fish

Leach's Storm Petrel

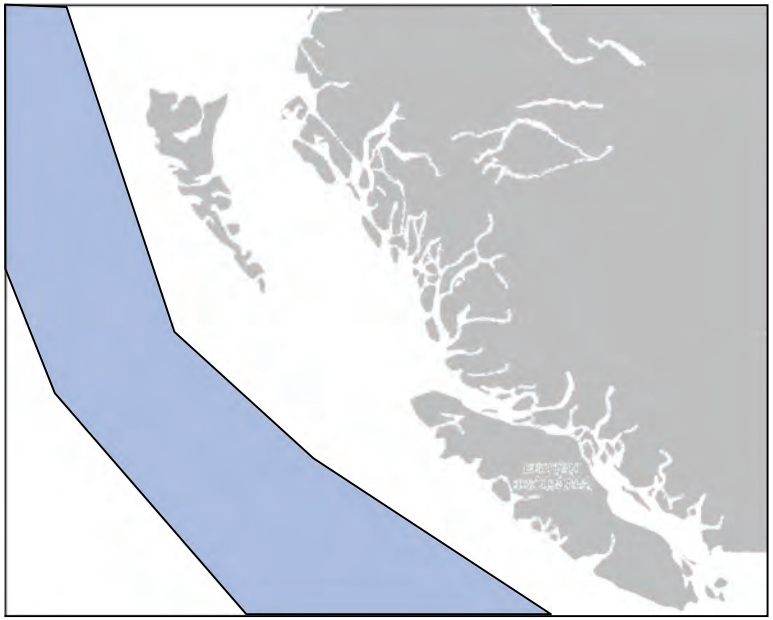
(Oceanodroma leucorhoa)

North Atlantic and Pacific distribution

Surface dabbling

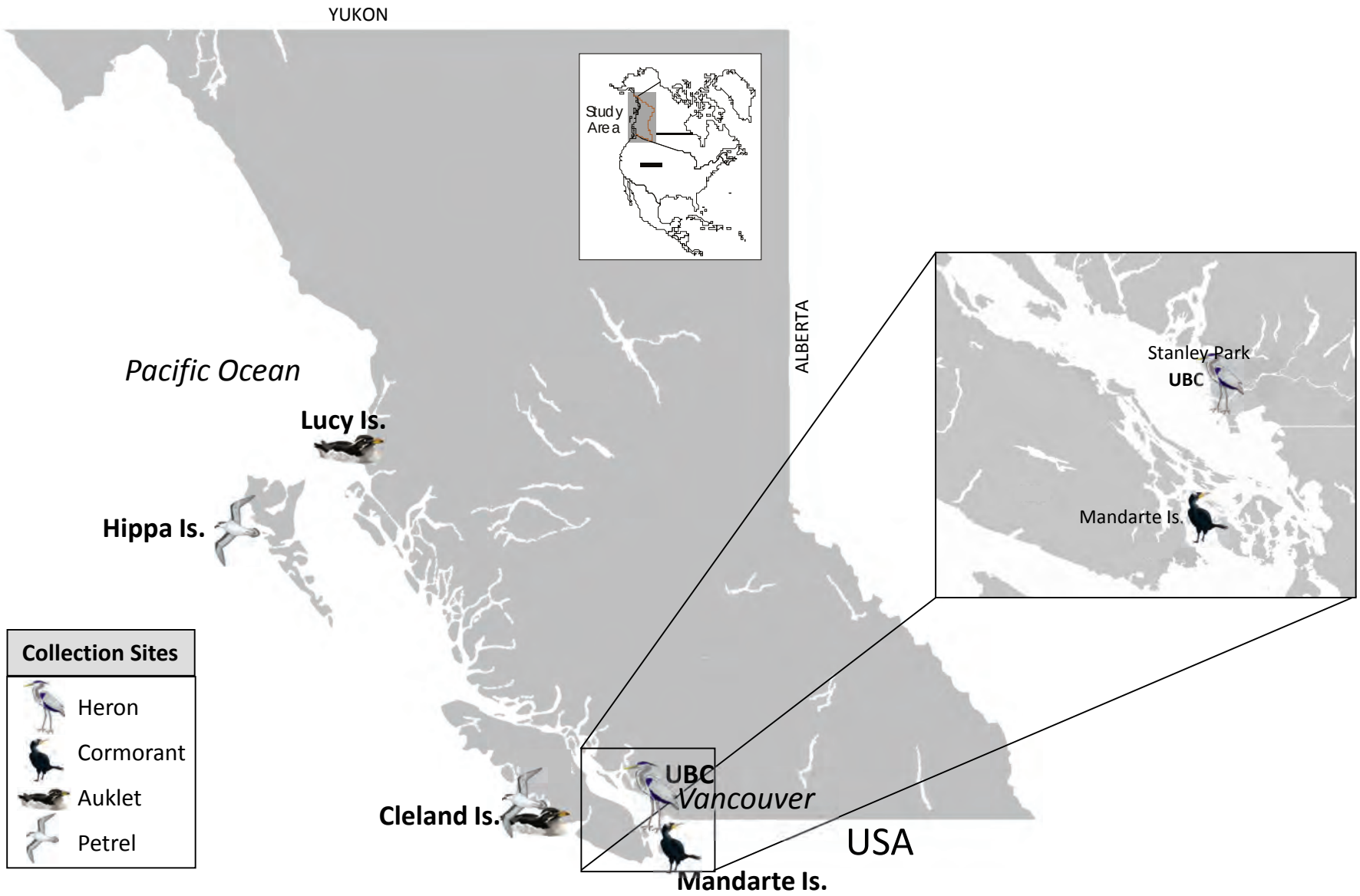


Omnivorous: Pelagic plankton & myctophid fish



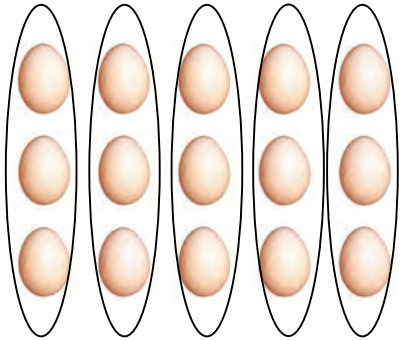
Offshore/Oceanic habitat

Monitoring Sites



Sampling Design

- Bird eggs collected – offshore sp every 4 years, coastal sp usually more frequent
- Offshore, approx 15 eggs p/yr =



- Coastal, ranged yr to yr
  - herons 1 pool 5 eggs since mid-90s, >#s earlier yrs
  - cormorants 5x3 most recent yrs, earlier varied

Retrospectively:

- 1.5 g ww homogenized egg sent for chemical analysis
- 1 mg samples, same eggs, sent for SIA

Biology

Moisture and lipid content ± SEM for each species at each site over time.

Species and Site	Moisture (%)	Lipid (%)
Rhinoceros auklet, Cleland Island	69.4 ± 0.4	10.3 ± 1.5
Rhinoceros auklet, Lucy Island	68.1 ± 1.3	11.2 ± 0.4
Leach's storm-petrel, Cleland Island	71.7 ± 0.3	10.0 ± 1.4
Leach's storm-petrel, Hippa Island	71.4 ± 0.6	11.0 ± 0.5
Double crested cormorant	83.8 ± 0.1	4.6 ± 0.3
Great blue heron	81.5 ± 0.2	6.1 ± 0.1

p<0.01

No significant changes over time except…

Dominant Congeners

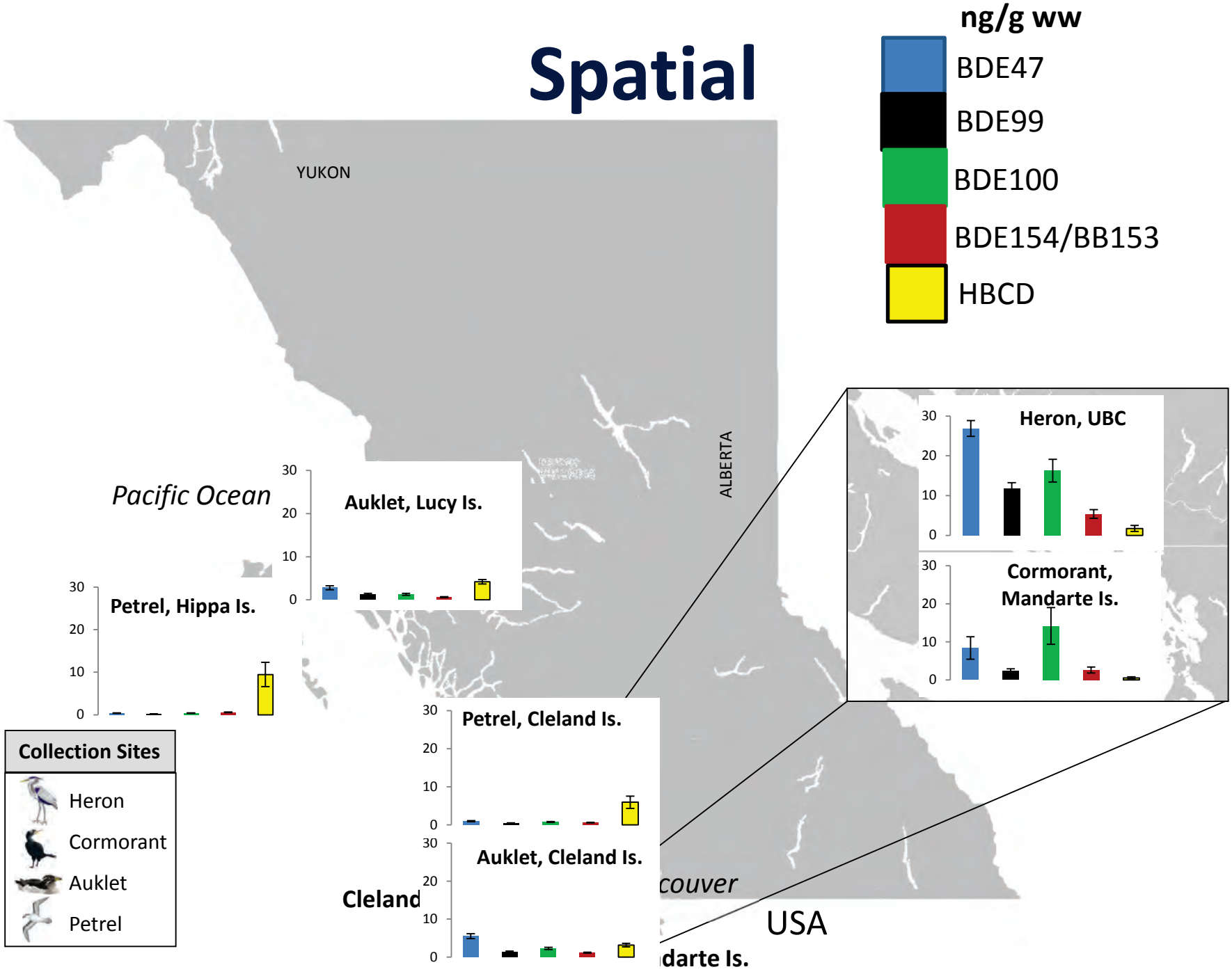
Offshore

- Pentas > BDE154/BB153
- HBCD

Coastal

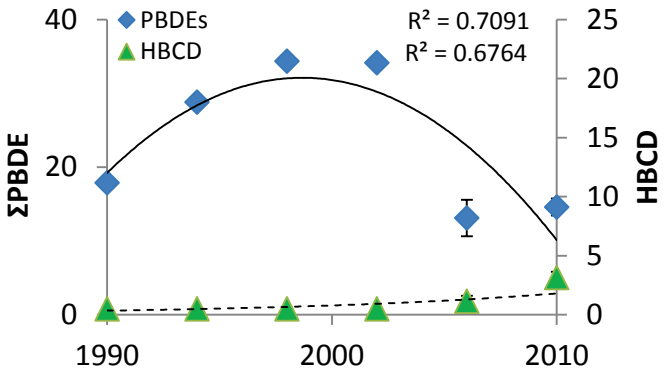
- Pentas > BDE154/BB153 > 153

Spatial

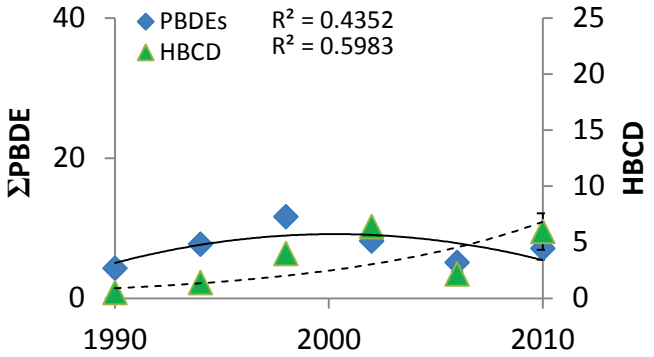

ng/g ww
BDE47
BDE99
BDE100
BDE154/BB153
HBCD
YUKON
ALBERTA
Pacific Ocean
Auklet, Lucy Is.
Petrel, Hippa Is.
Heron, UBC
Cormorant, Mandarte Is.
Petrel, Cleland Is.
Auklet, Cleland Is.
Cleland
USA
Collection Sites
Heron
Cormorant
Auklet
Petrel

Temporal – ΣPBDE, HBCD

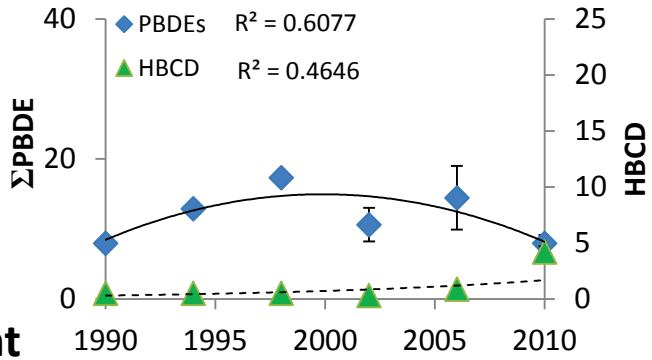
Auklet, Cleland Is.



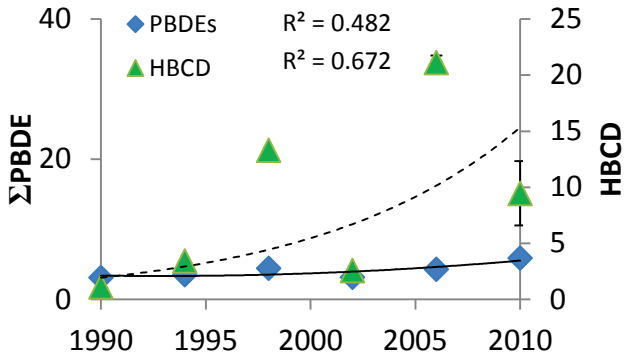
Petrel, Cleland Is.



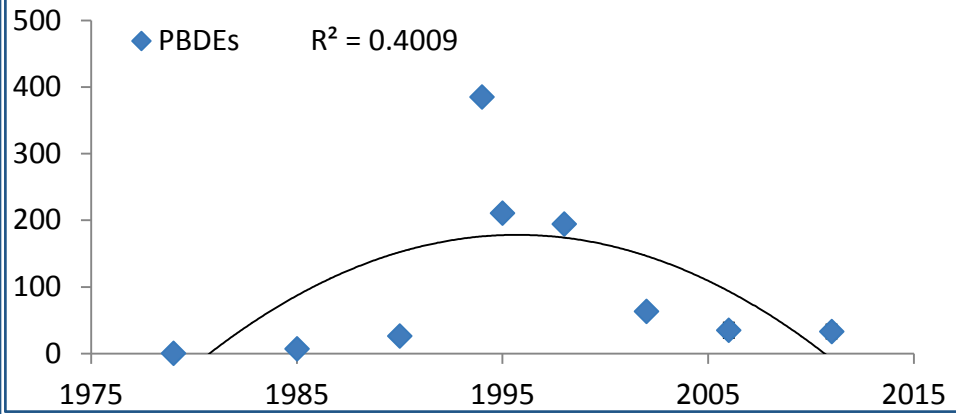
Auklet, Lucy Is.



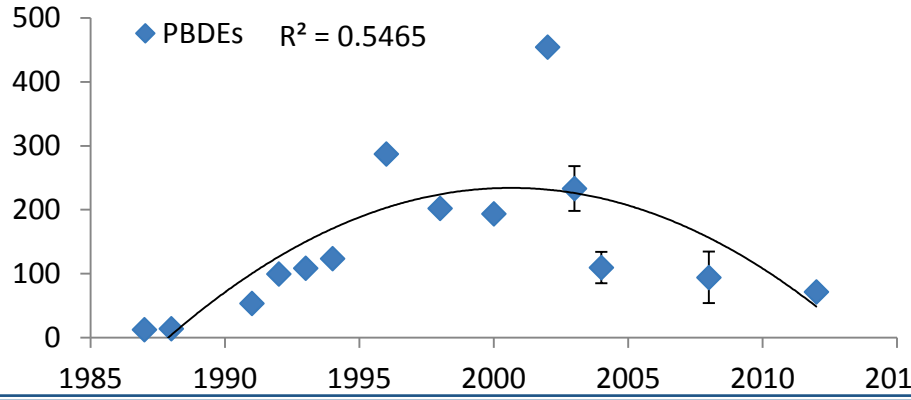
Petrel, Hippa Is.



Cormorant



Heron

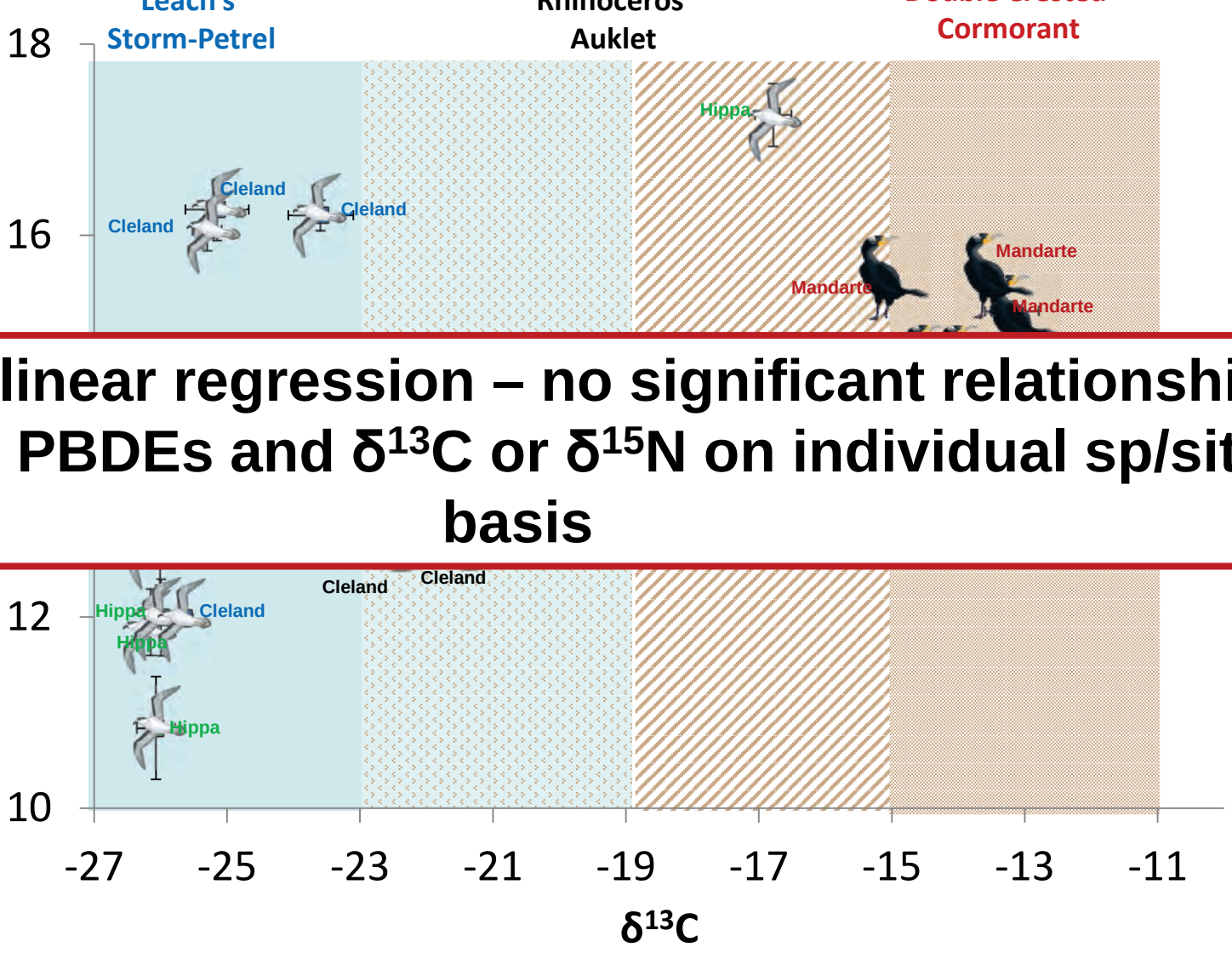


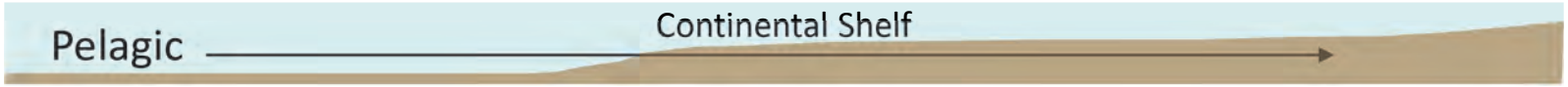
Leach's Storm-Petrel

Rhinoceros Auklet

Double Crested Cormorant

Multiple linear regression – no significant relationship between PBDEs and $\delta^{13}C$ or $\delta^{15}N$ on individual sp/site basis





Summary

- ΣPBDEs increase/decrease offshore & coastal in line with phase outs and regulations on PBDEs
  - HBCD increasing offshore sp., trace conc coastal sp.
- Offshore sp lower conc. cf. coastal sp
- No influence of $\delta^{15}N$ on ΣPBDE or dominant congeners

PBDEs local sources

HBCD offshore/Asian sources

Regulations worked – HBCD?


THANK YOU

- Co-authors
- Environment Canada and some NSERC funding
- Today's audience