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Mercury trends in cormorant and great blue heron eggs from Pacific Canada: a question of local and global sources

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Brown, Tanya; Elliott, John E. (John Edward); Elliott, Kyle; and Lee, Sandi, "Mercury trends in cormorant and great blue heron eggs from Pacific Canada: a question of local and global sources" (2018). *Salish Sea Ecosystem Conference*. 336.

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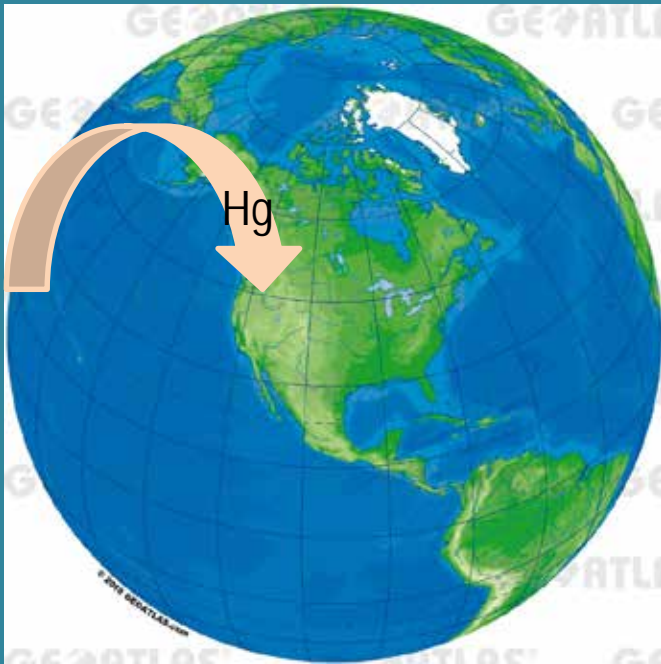
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Mercury trends in cormorant and great blue heron eggs from the NE Pacific

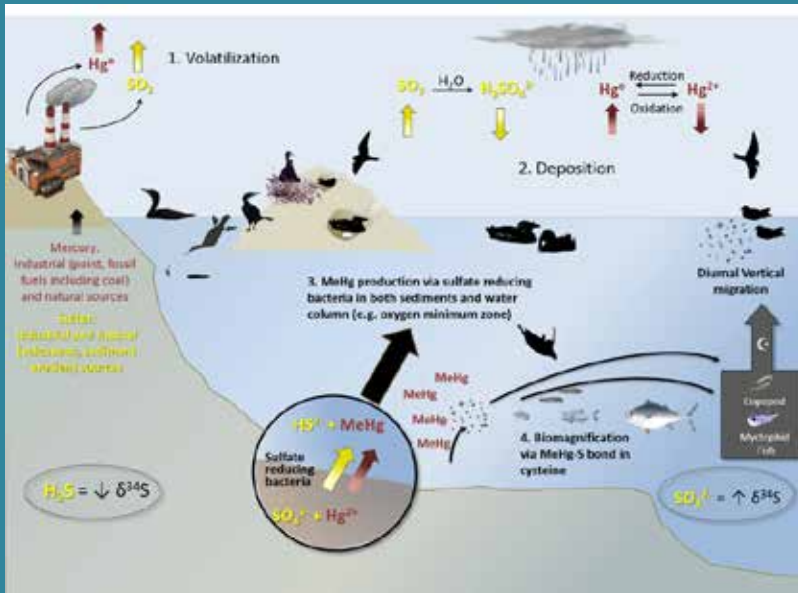
Tanya M. Brown, John E. Elliott, Kyle Elliott, Sandi Lee



Anthropogenic Hg in the NE Pacific Ocean: long-range transport vs local sources



Hg in the marine environment



Elliott & Elliott 2016, ES&T

- Airborne Hg deposits into the marine environment via rain;
- Sulfate-reducing bacteria in anaerobic regions (e.g., sediments and the water column (oxygen minimum zone) transforms inorganic Hg to MeHg;
- Bioaccumulates in invertebrates, fish, seabirds, and marine mammals;
- Biomagnifies through the food web, reaching high levels in fish-eating marine birds.

Hg trends in the North Pacific Ocean

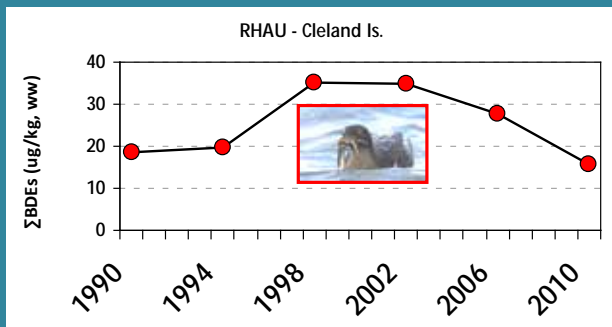
- Hg deposition rates have increased 3-5 fold since the Industrial Revolution (Laurier et al. 2004).
- Hg in seabirds has increased by less than 2-fold over that period (Vo et al. 2011).
- Hg in water has increased and is expected to double by 2050 relative to 1995 levels (Sunderland et al. 2010).
- Hg in fish have been stable over the past 50 years (Kraepiel et al. 2003).

Study design – seabird monitoring

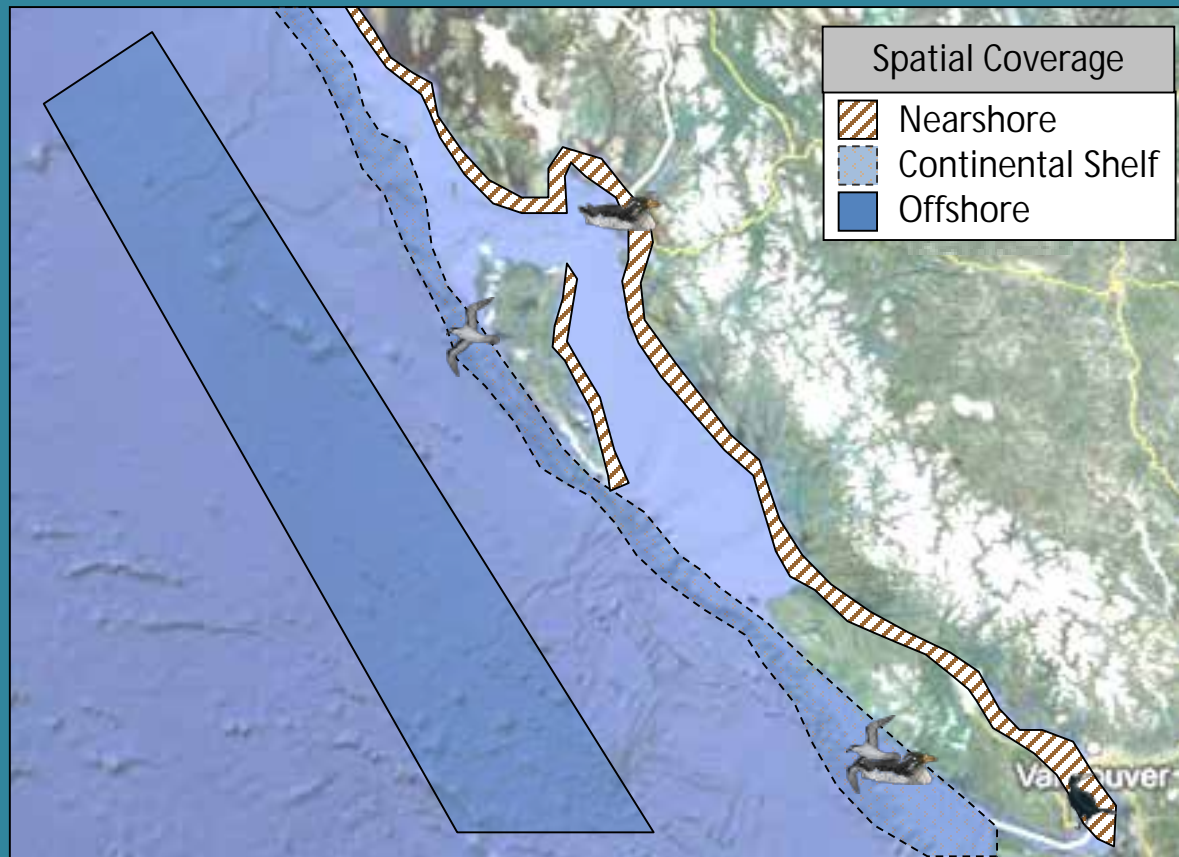
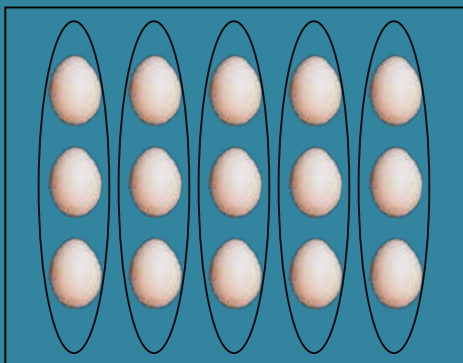
- Petrel, Auklet, Cormorant, Heron



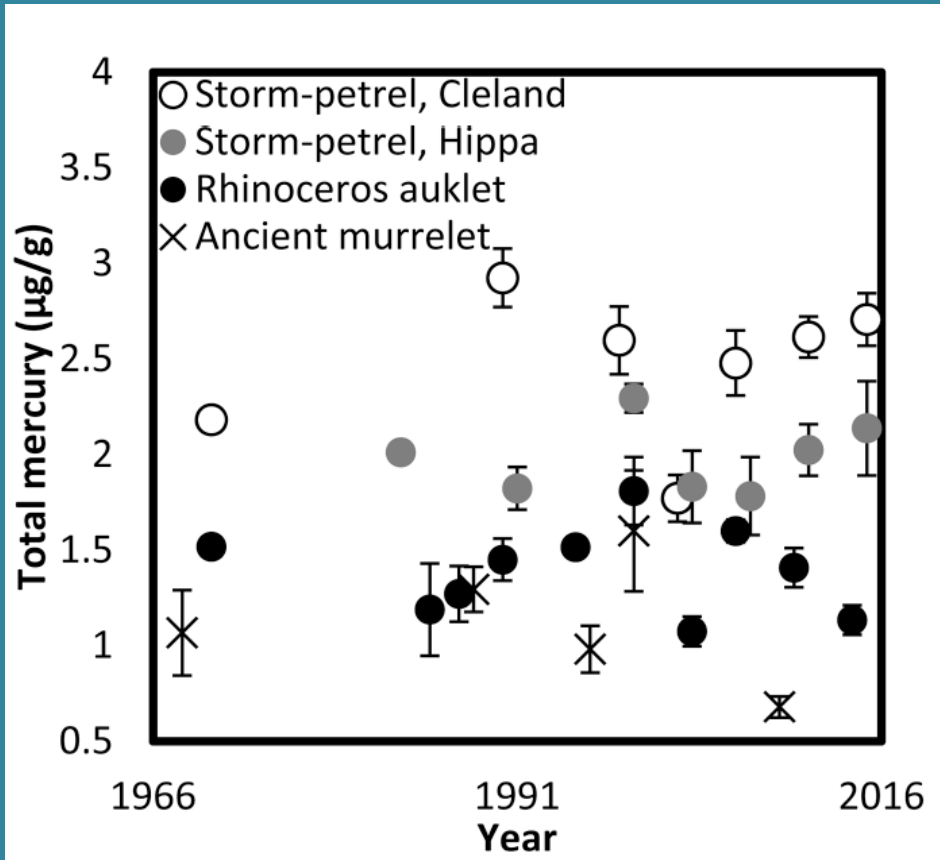
- Collect eggs every 4 years



- 15 eggs per site



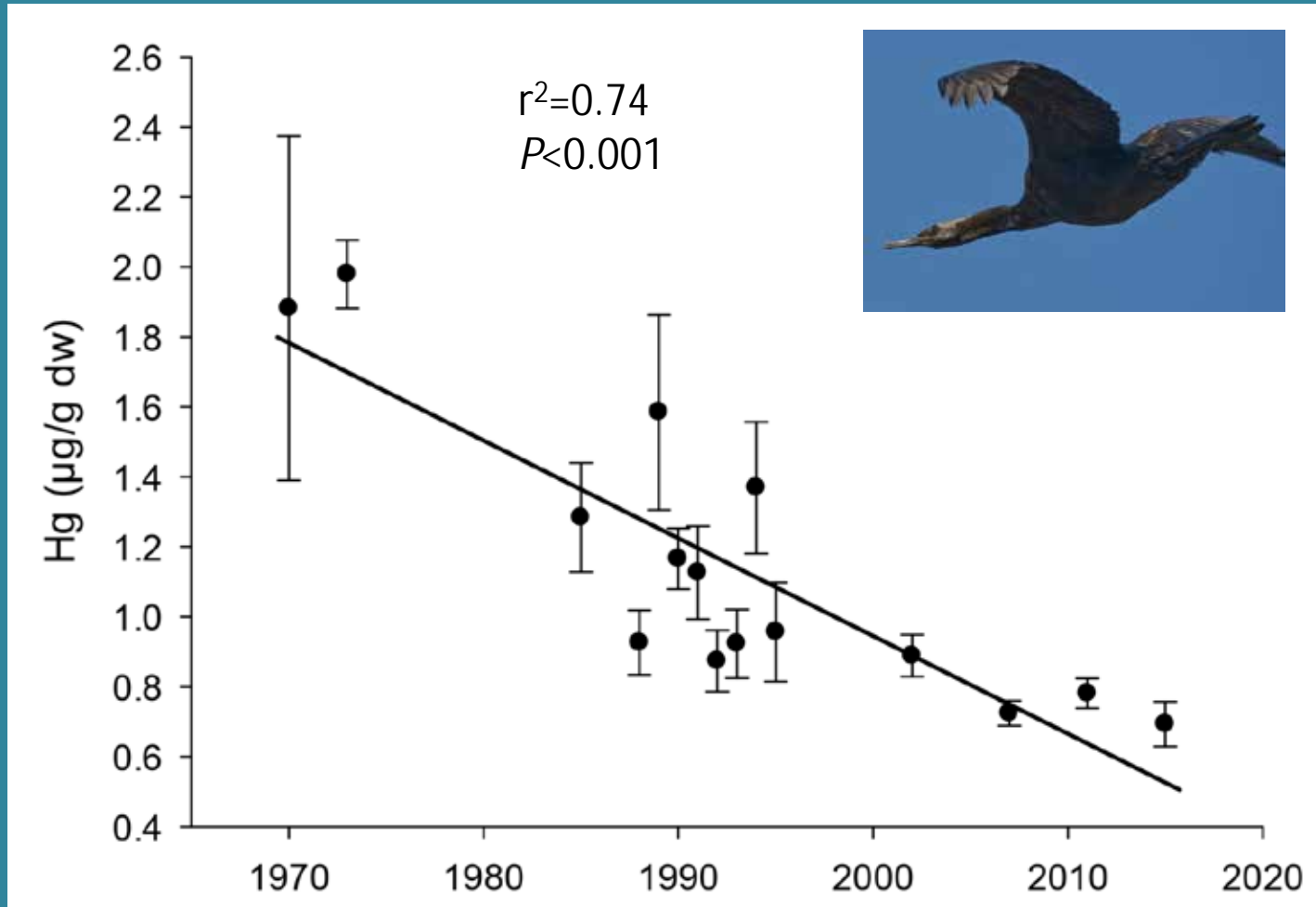
What are the recent trends in seabird eggs?



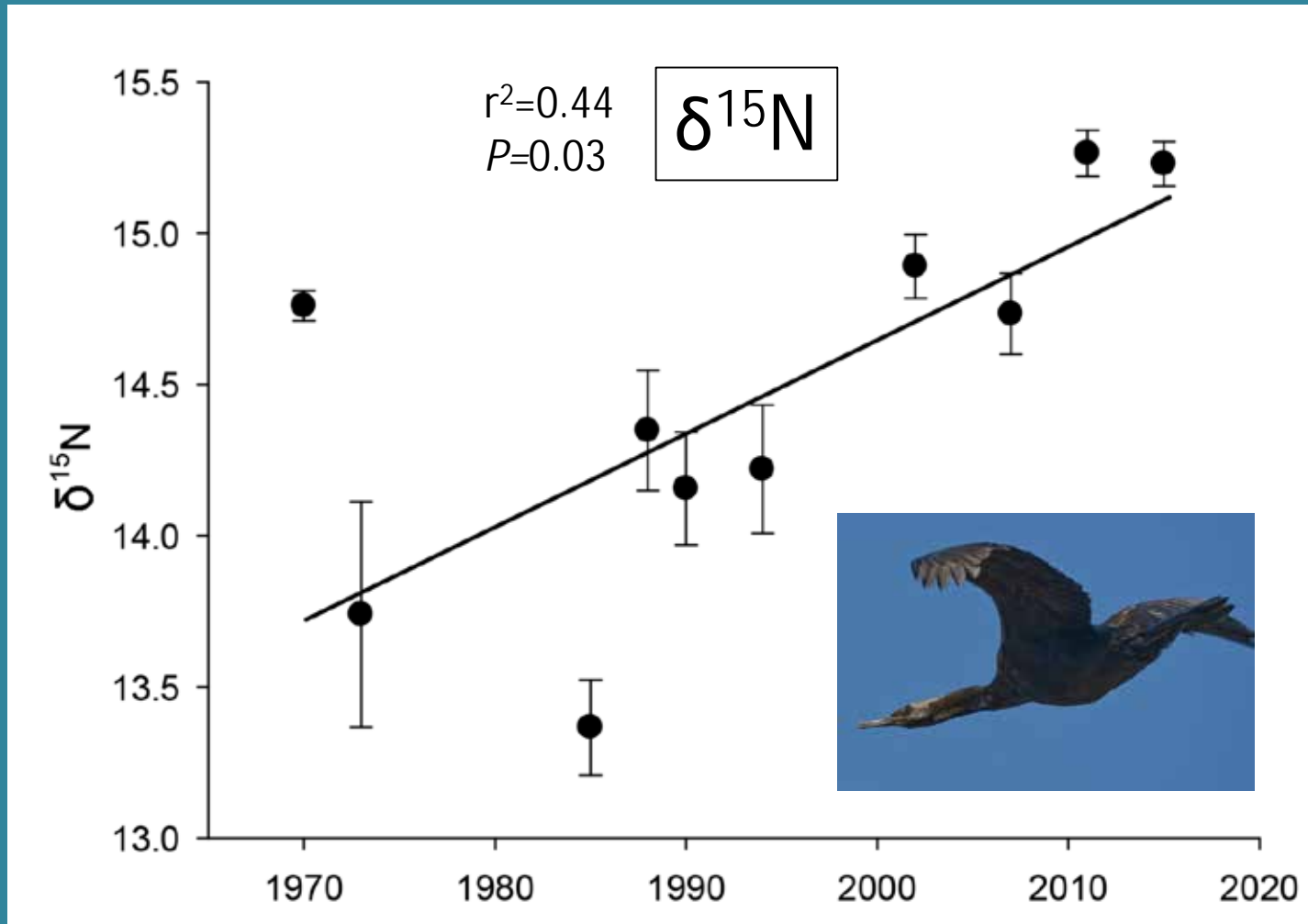
- No change with time in petrels or auklets;
- Hg levels declined with year in murrelets;
- $\delta^{13}\text{C}$ declined with year in murrelets.



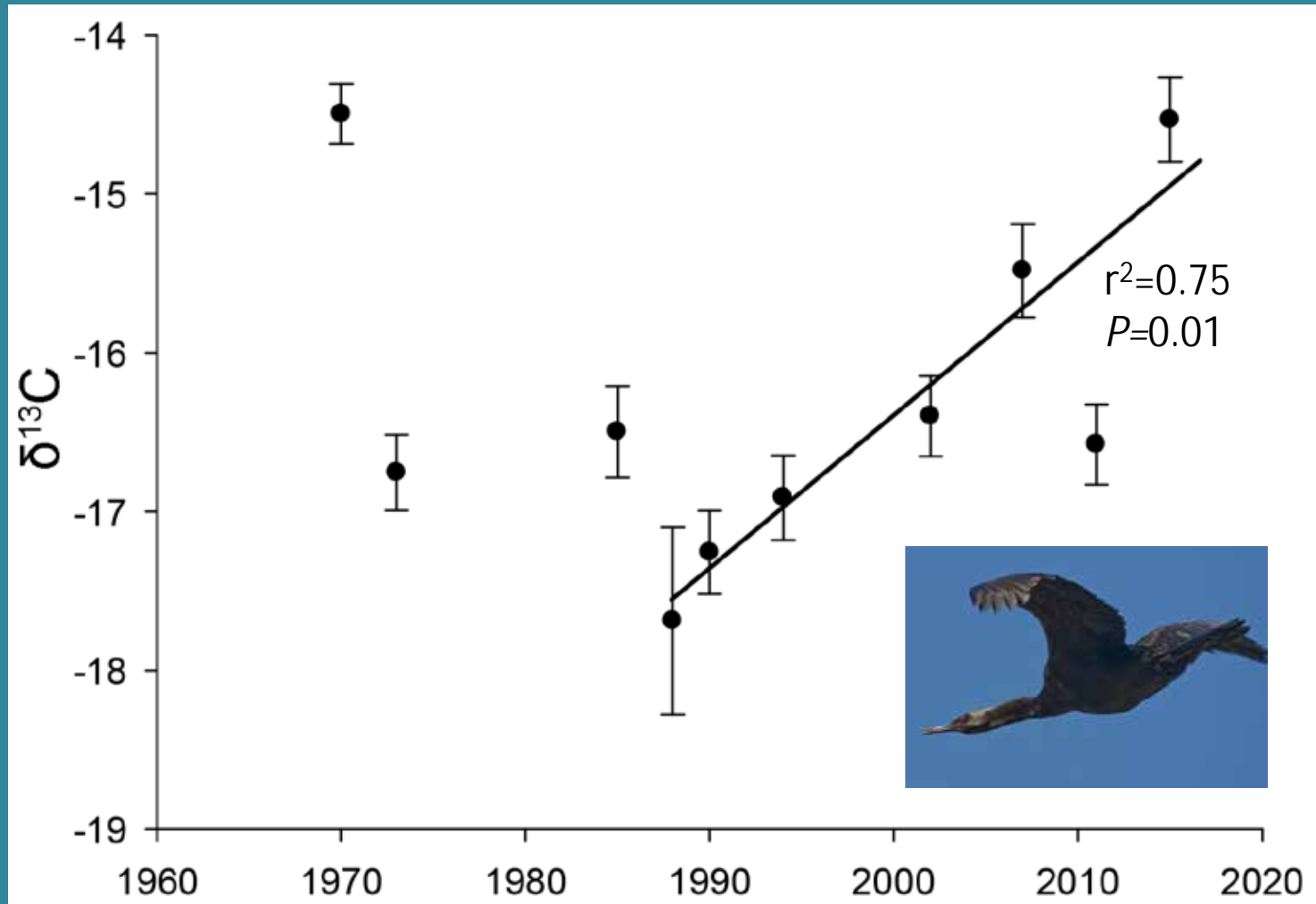
Hg concentrations in pelagic cormorant eggs in the Salish Sea have decreased over time



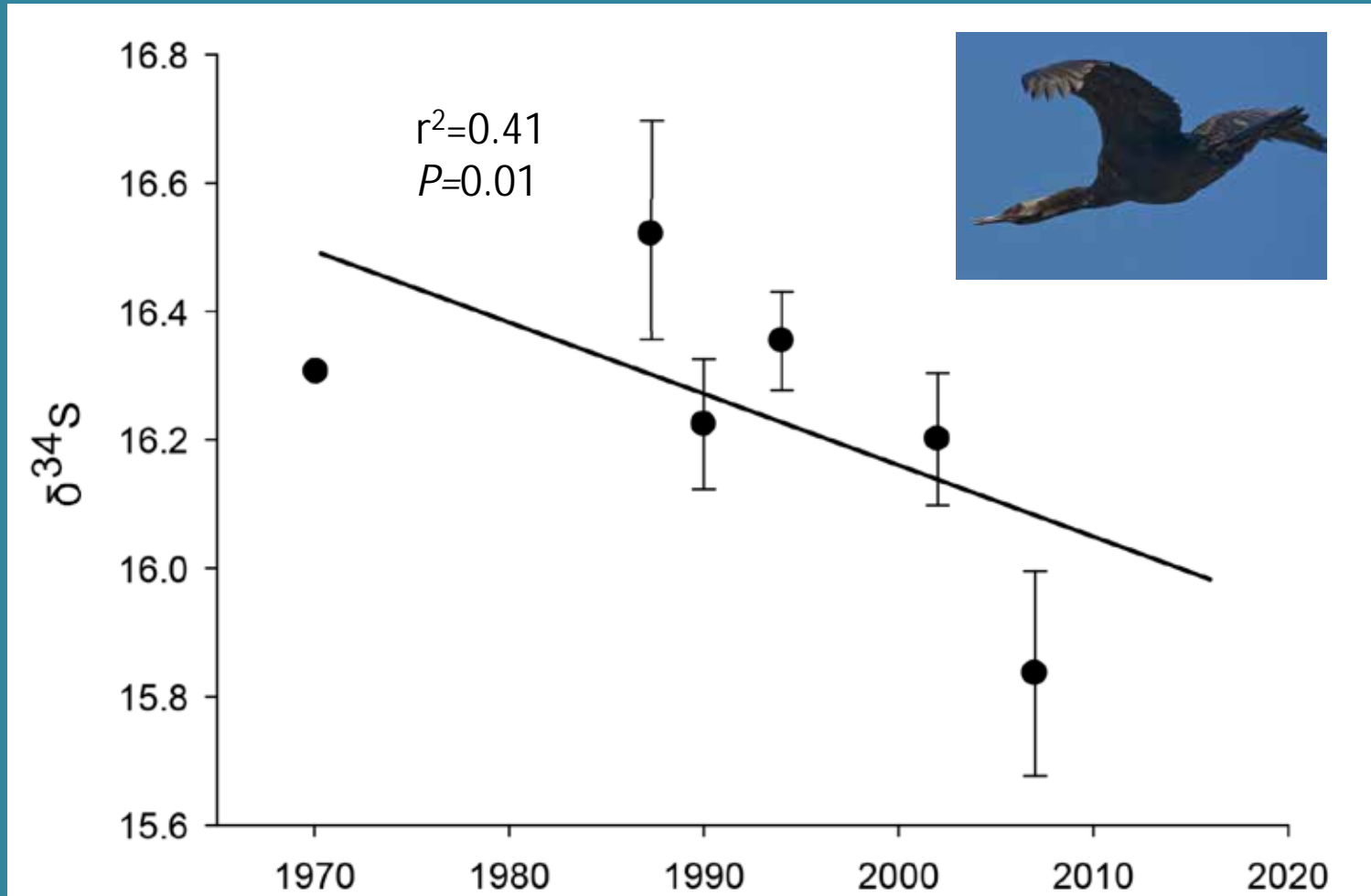
However, changes in three isotopic signatures over time appear to suggest an influence of diet on Hg trends



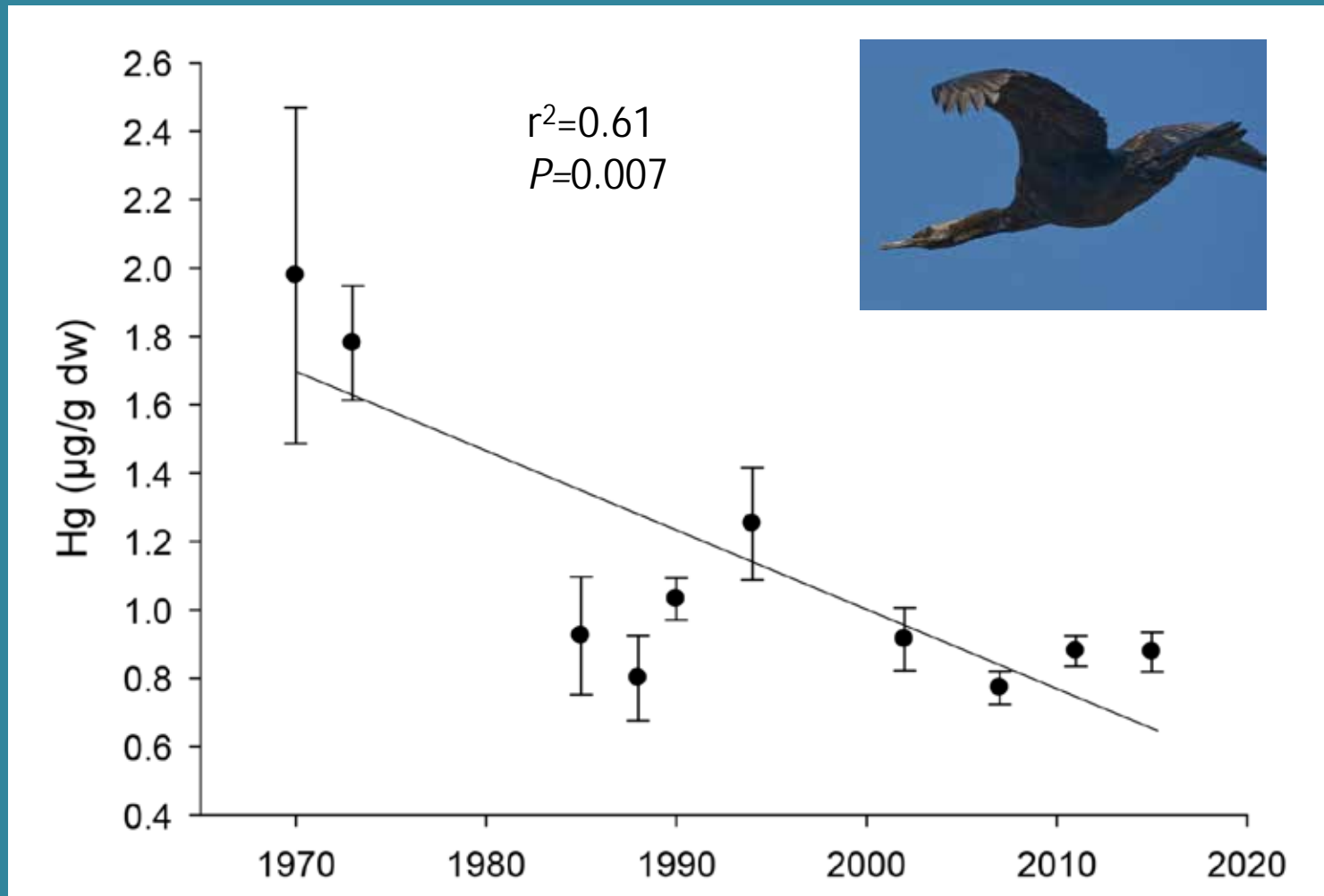
$\delta^{13}\text{C}$ increased over time after 1990



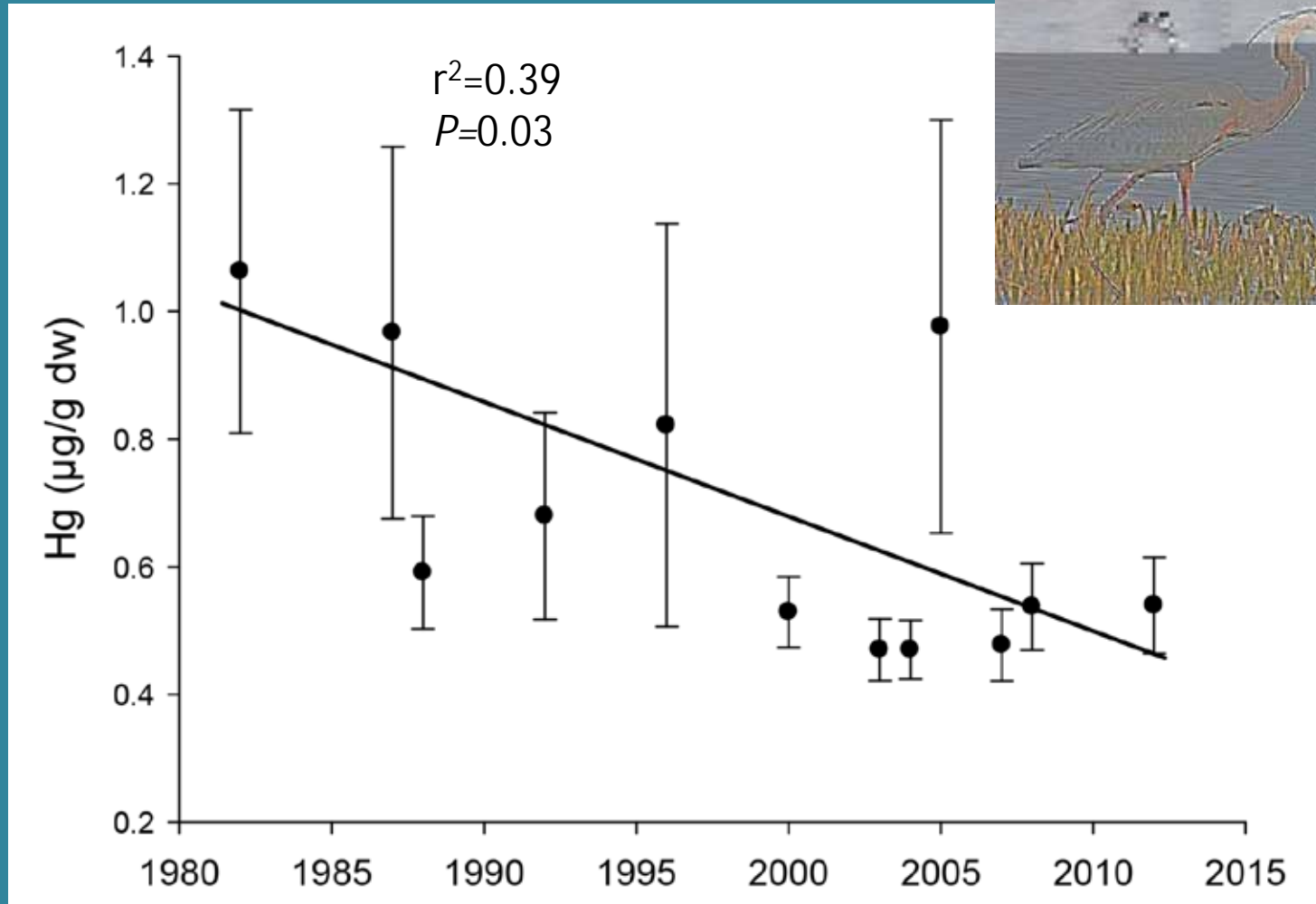
$\delta^{34}\text{S}$ decreased over time with increasing Hg



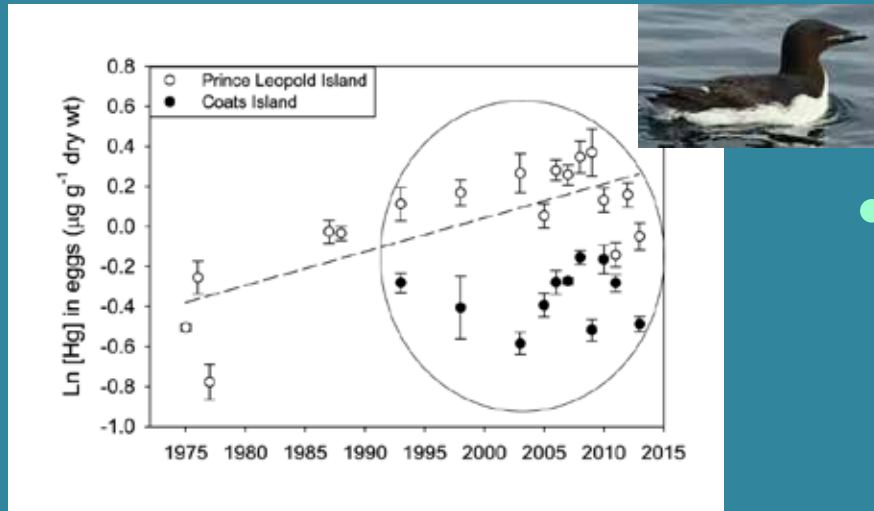
When adjusted for diet, Hg concentrations in pelagic cormorant eggs in the Salish Sea have decreased over time



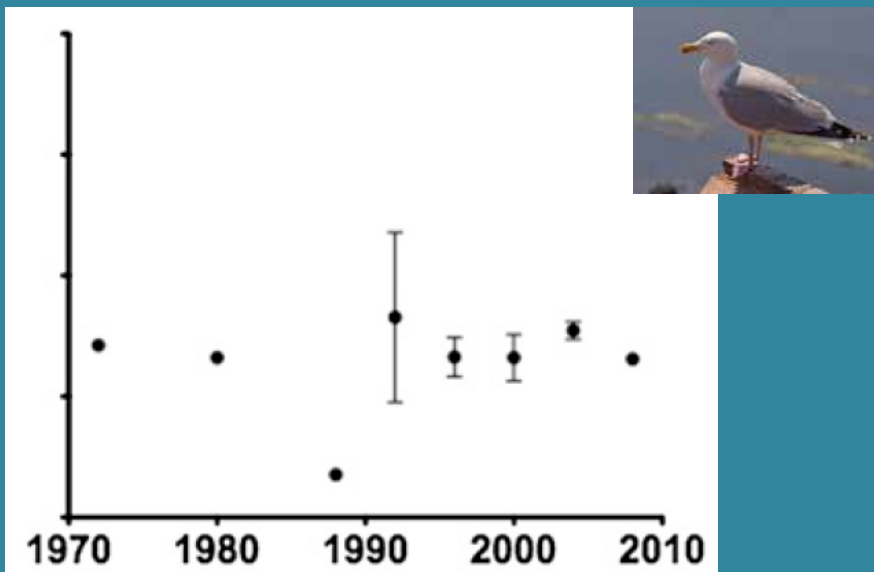
Hg concentrations in great blue heron eggs in the NE Pacific have also decreased over time



What are the recent trends in seabird eggs in the Canadian Arctic and Atlantic?



- After accounting for diet, Hg levels in seabird eggs:
 - increased with year in the Arctic;



- showed no clear trend in the Atlantic.

Summary

- Hg levels have declined over time in the open ocean pelagic environment (e.g., murrelets), but remain stable in auklets and petrels (Elliott & Elliott 2016);
- Hg levels have declined over time in nearshore Salish Sea pelagic cormorants and great blue herons;
- Diet has shifted over time in pelagic cormorants, possibly because of feeding:
 - lower in the food web;
 - more benthically; and
 - In more sulfate-depleted environments

Summary

- Regulations and source control appear to have reduced the release of Hg from point sources (e.g., forestry-related industry) over recent decades.

Acknowledgments

To the many in lab and field support who made this happen over the years.

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Lab: Henry Won, Abde Idrissez, Peggy Dunlop, Francois Cyr, Suzanne Trudeau

Why is Hg declining in pelagic cormorants in the NE Pacific

- 1) Change in food web structure
- 2) Change in diet
- 3) Reduced emissions in North America because of regulations and source control