

How foraging behavior influences methylmercury exposure to Common Terns (*Sterna hirundo*) breeding in the St. Louis River Estuary



Annie Bracey, Joel Hoffman, Matthew Etterson, Fred Strand, Sumner Matteson, Gerald Niemi, and Francesca Cuthbert



CameraName

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2016-07-19 20:11:48

Common Terns in the Great Lakes Region

Listed as endangered, threatened or of special concern
in most US states bordering the Great Lakes

- 1900-1960s, high of 21,000 pairs
- currently 9-10,000 pairs

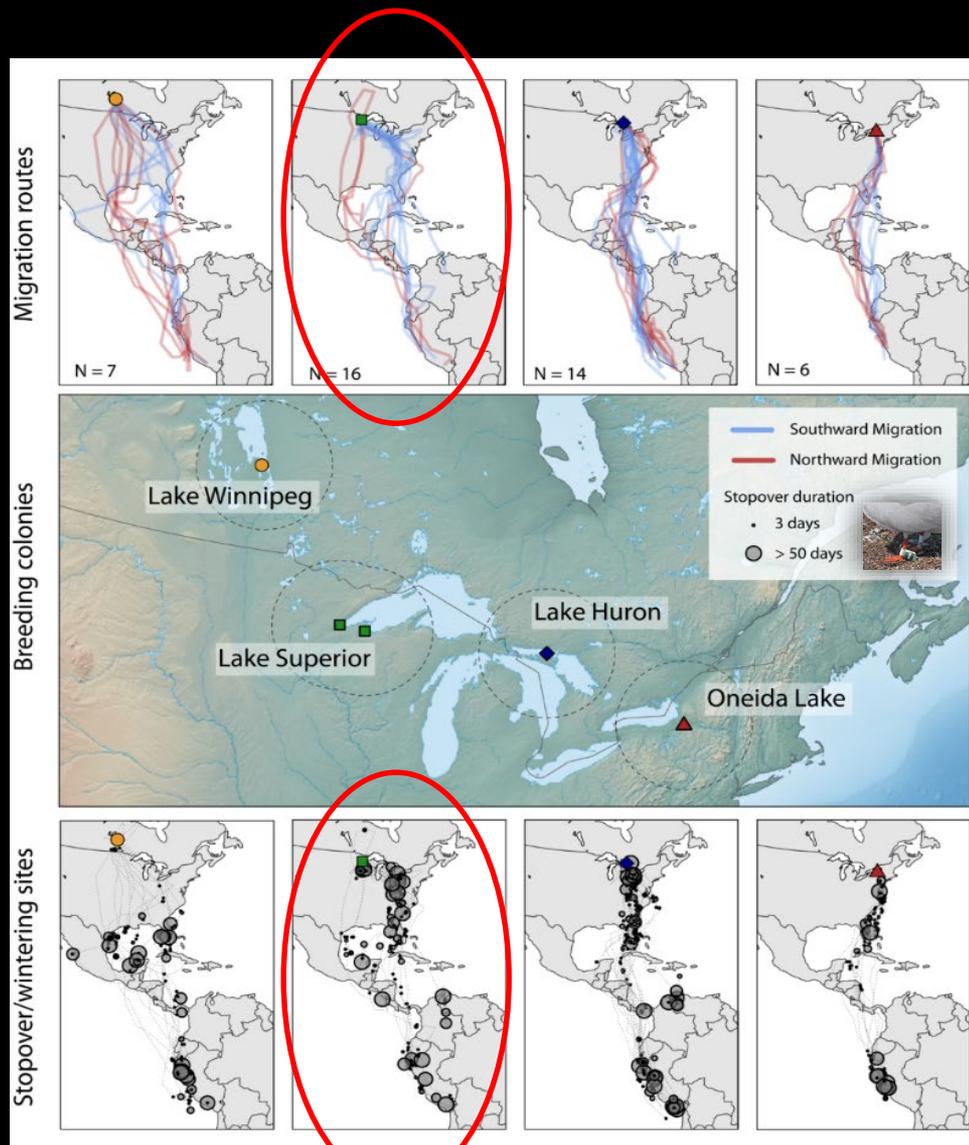
Reasons for declines:

- Human disturbance
- Predation
- Changing water levels
- Contamination



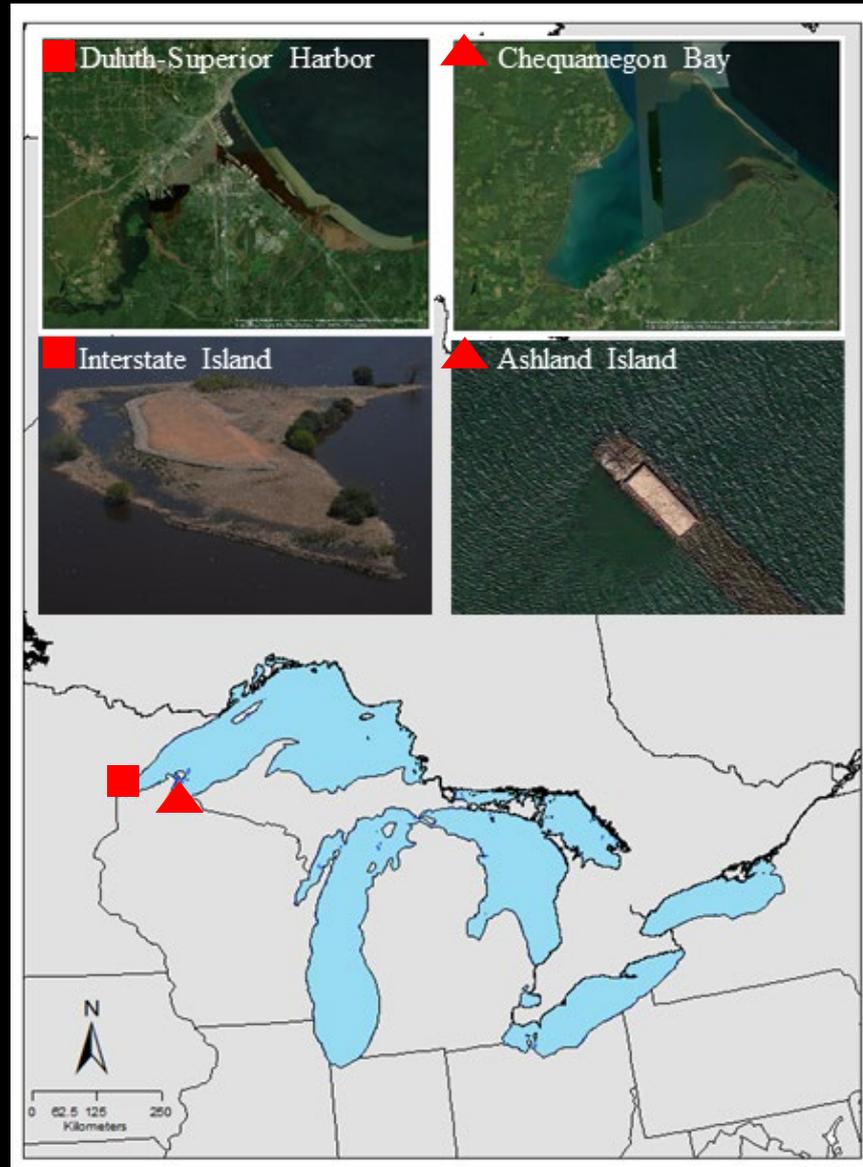


Solar Geolocation Study Summary



Tracks of adult Common Terns identified using light-level geolocation ($n=43$). Migration routes and stopover and wintering locations are specified based on breeding colony location. Figure from Bracey et al. 2018

Lake Superior Common Tern Breeding Colonies



Mercury in the Great Lakes Region

Common Tern



Fish



Zooplankton



Phytoplankton



Fish-eating birds at high risk for MeHg Exposure

Understanding food web pathways is critical

Study Objectives

- 1) Determine if geographic or seasonal variation exists in foraging habitat use by Common Terns



- 2) Determine whether differences in foraging behavior influence mercury exposure relative to age, sex, or colony location

Methods

Biological Sampling (2016-2017)

- Collected Common Tern Blood & Feathers
 - Adult blood – Interstate only ($n = 18$)
 - Chick feathers – both colonies ($n = 40$)
 - Adult feathers – both colonies ($n = 60$)
 - Prey Fish – both colonies ($n = 64$)



Tracking Devices (2013- 2018)

- Global Positioning System tags
 - ~12 days
 - Every 30 min from sunrise to sunset
- $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ Stable Isotopes (blood, feathers, & fish)

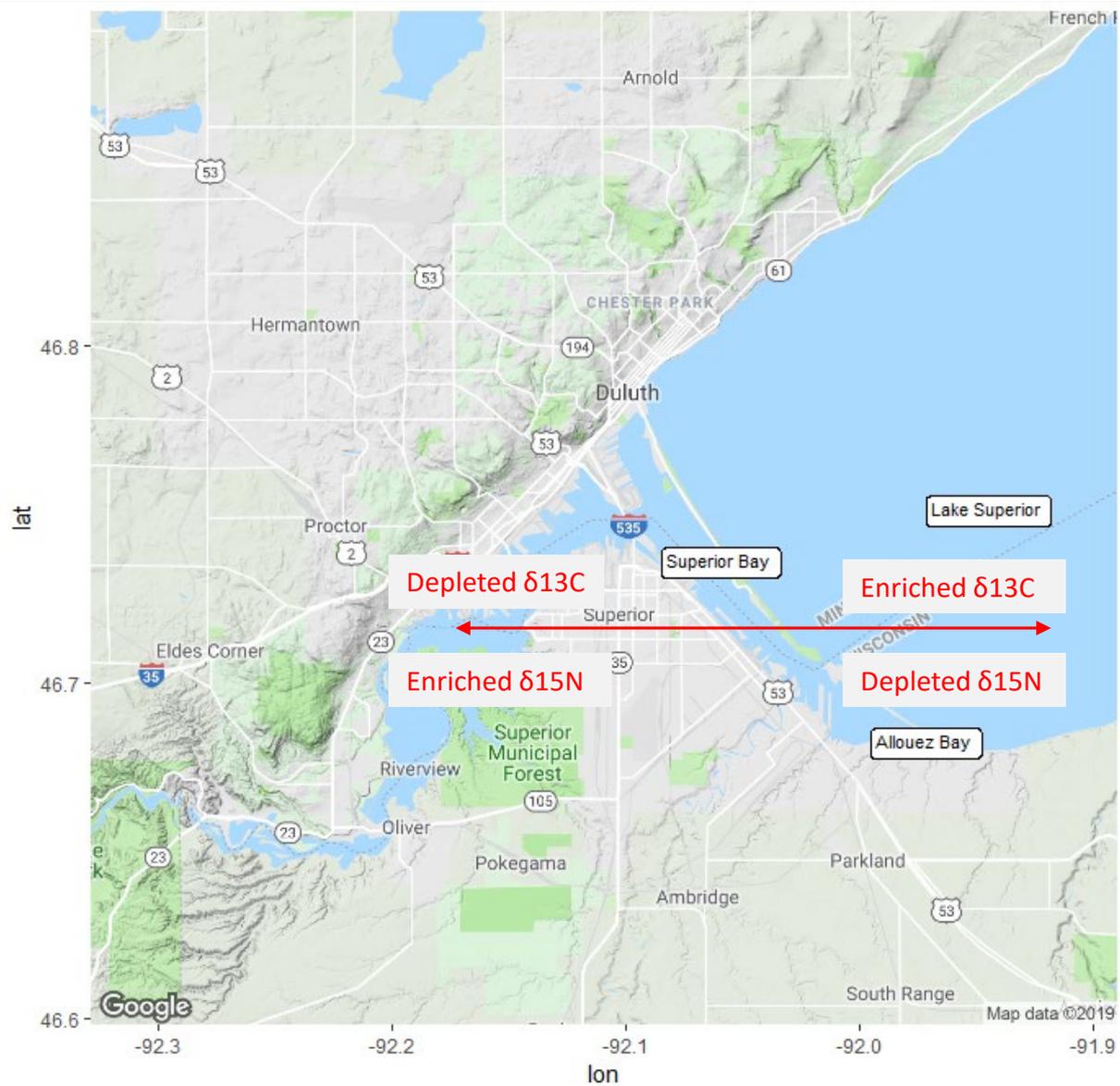


Statistical Analyses

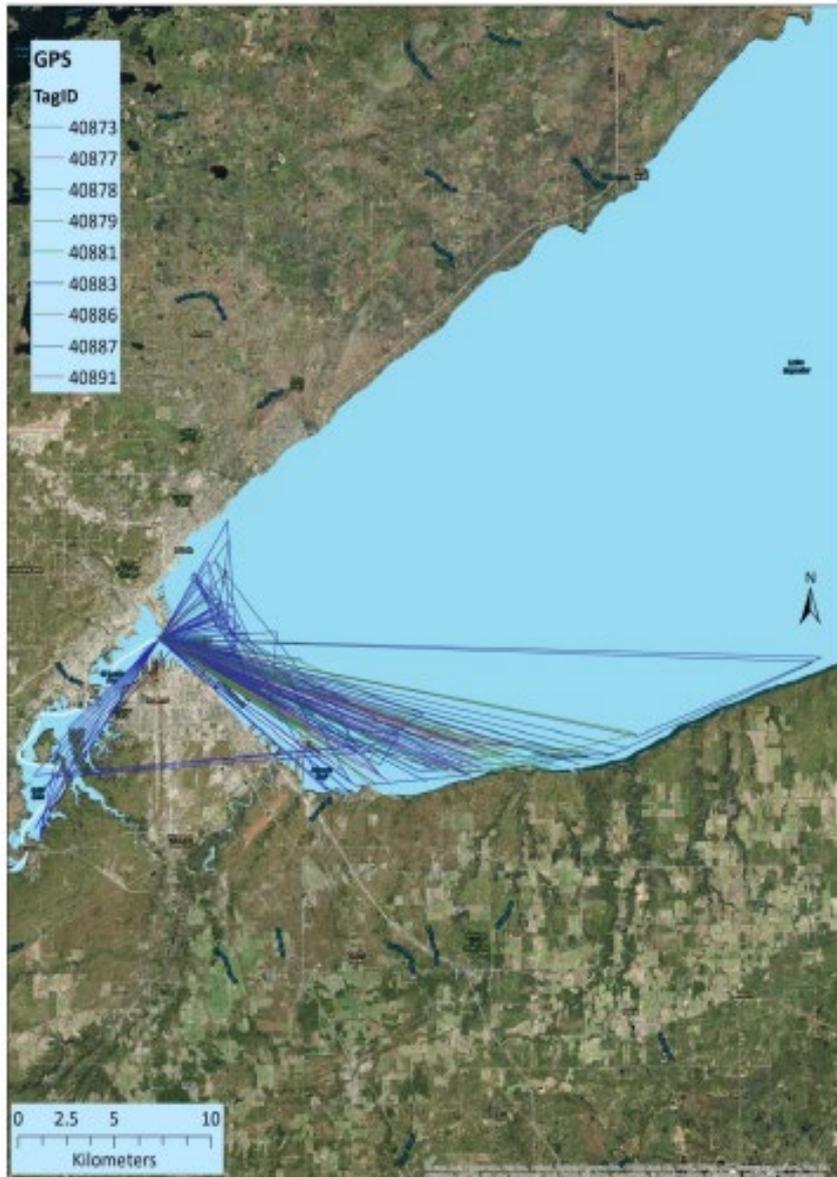
- Stable Isotope mixing model
- General Linear Models



Isotopic Gradient within St Louis River Estuary and Lake Superior



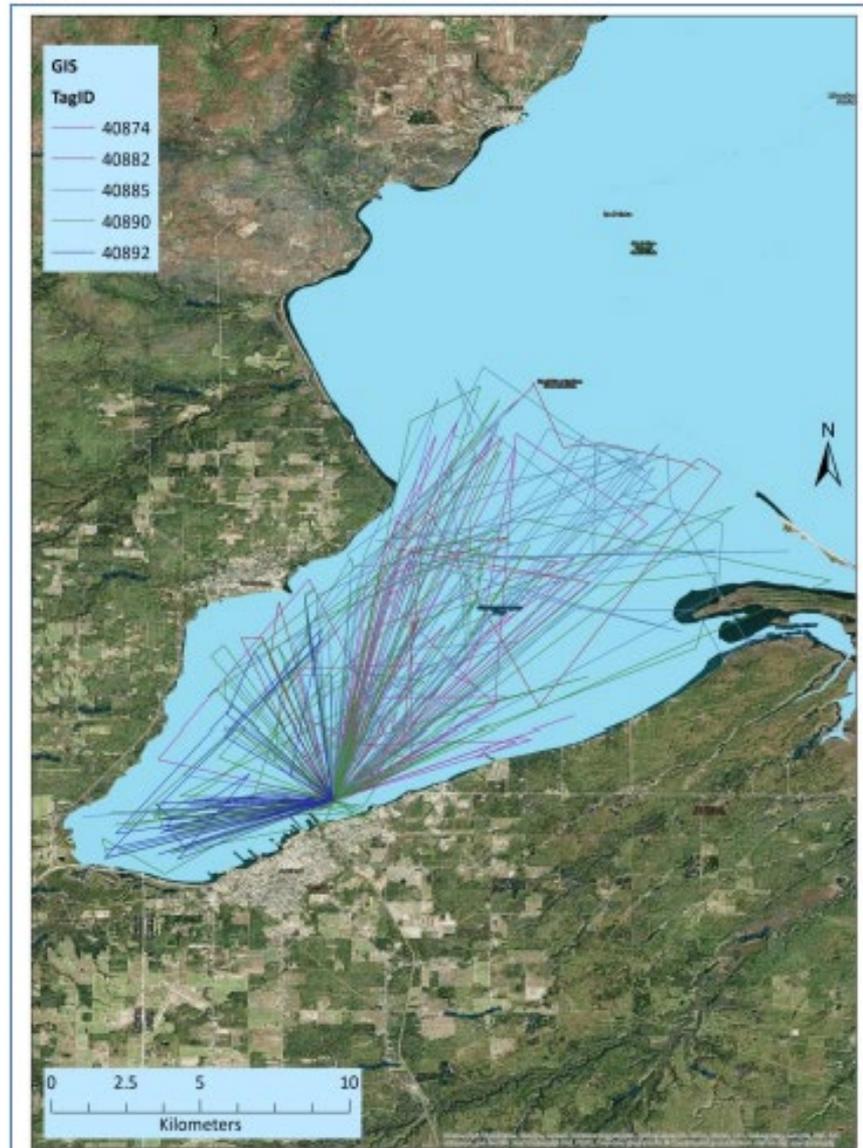
Interstate Island GPS Summary



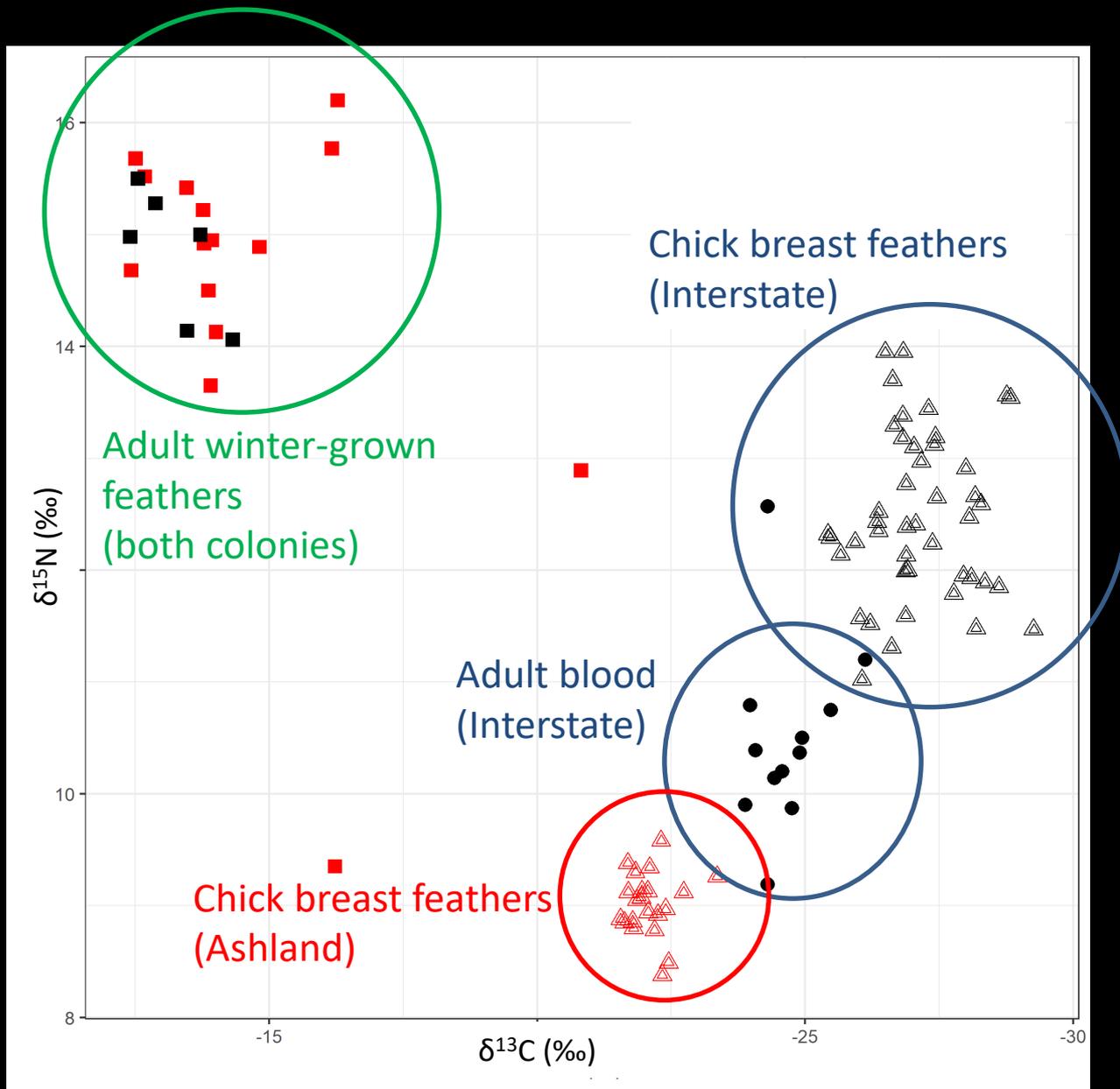
Ashland Island GPS Summary



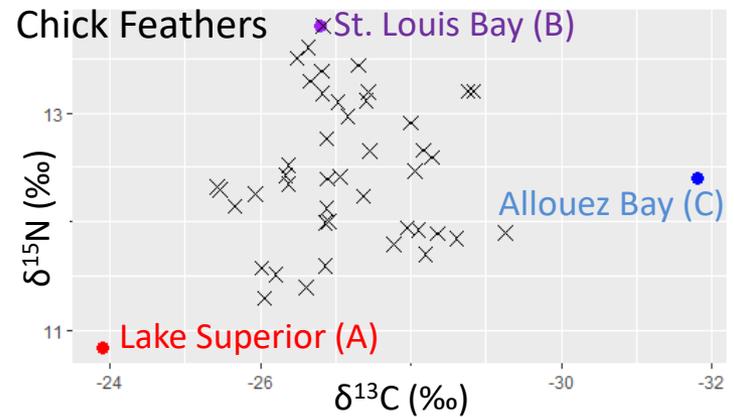
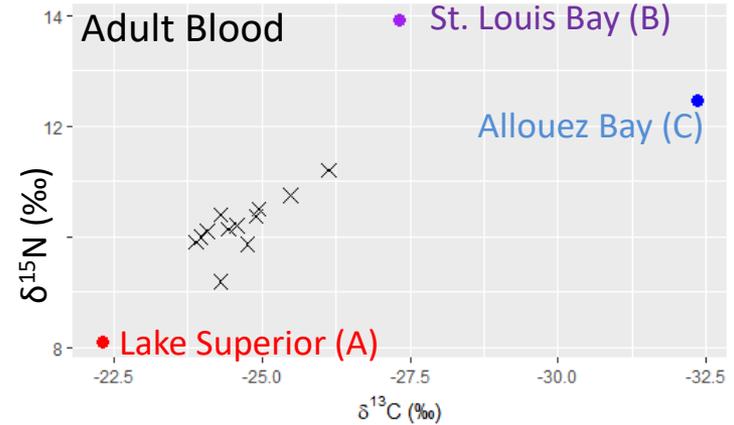
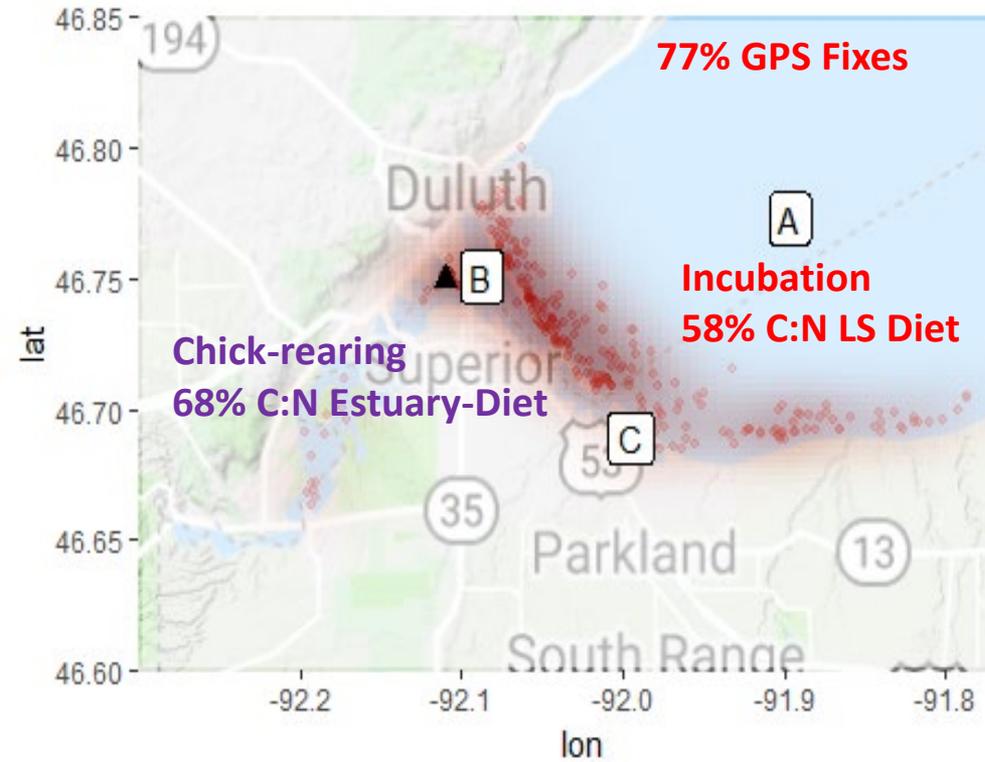
GPS tags (n = 5)



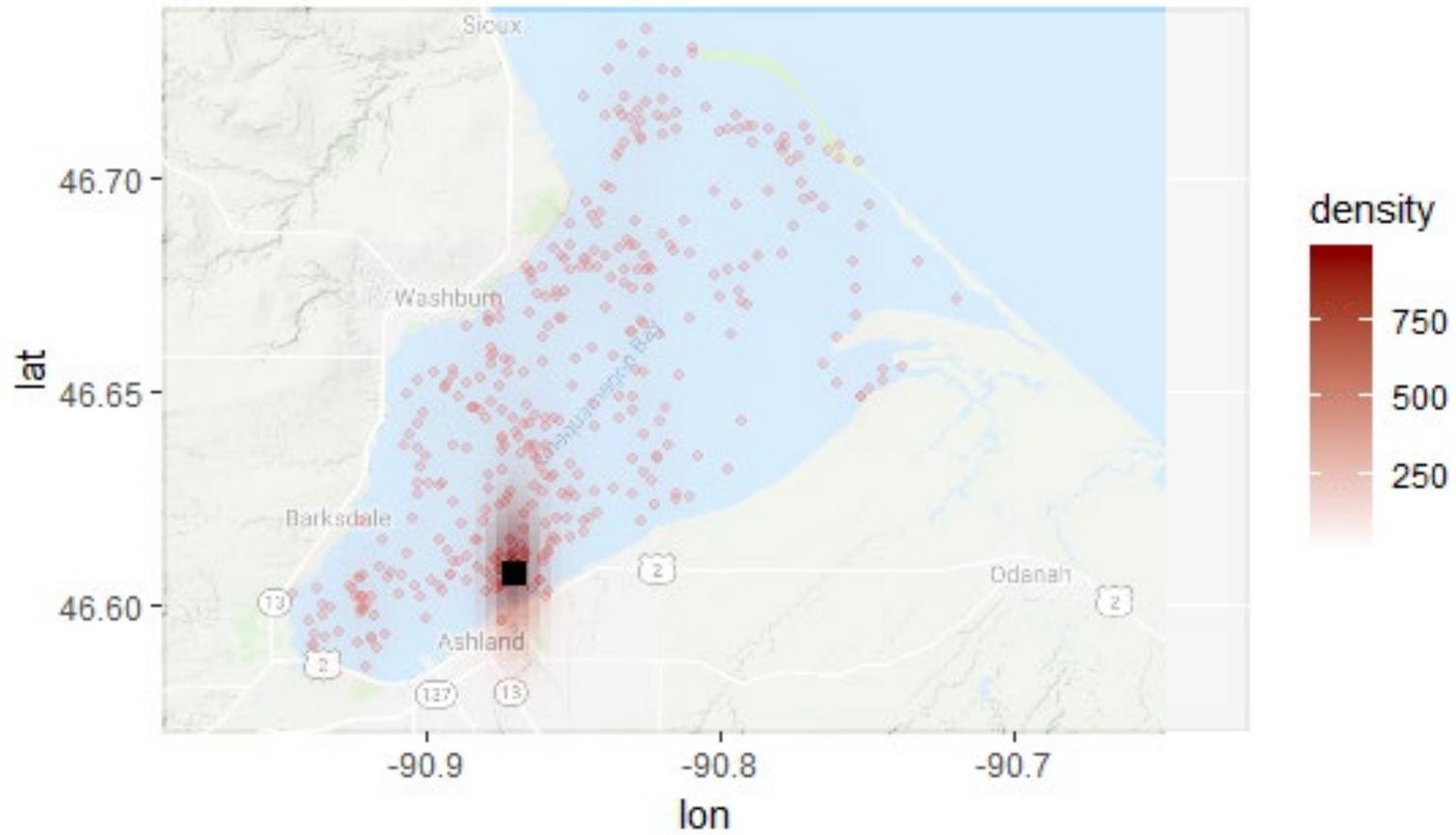
Stable Isotope Summary



GPS & Stable Isotope Summary



Ashland Island GPS Summary



MeHg Exposure Risk-Toxicity

Exposure risk defined as MeHg obtained from diet

Risk Levels (Ackerman et al. 2016; Burger and Gochfeld 1997)



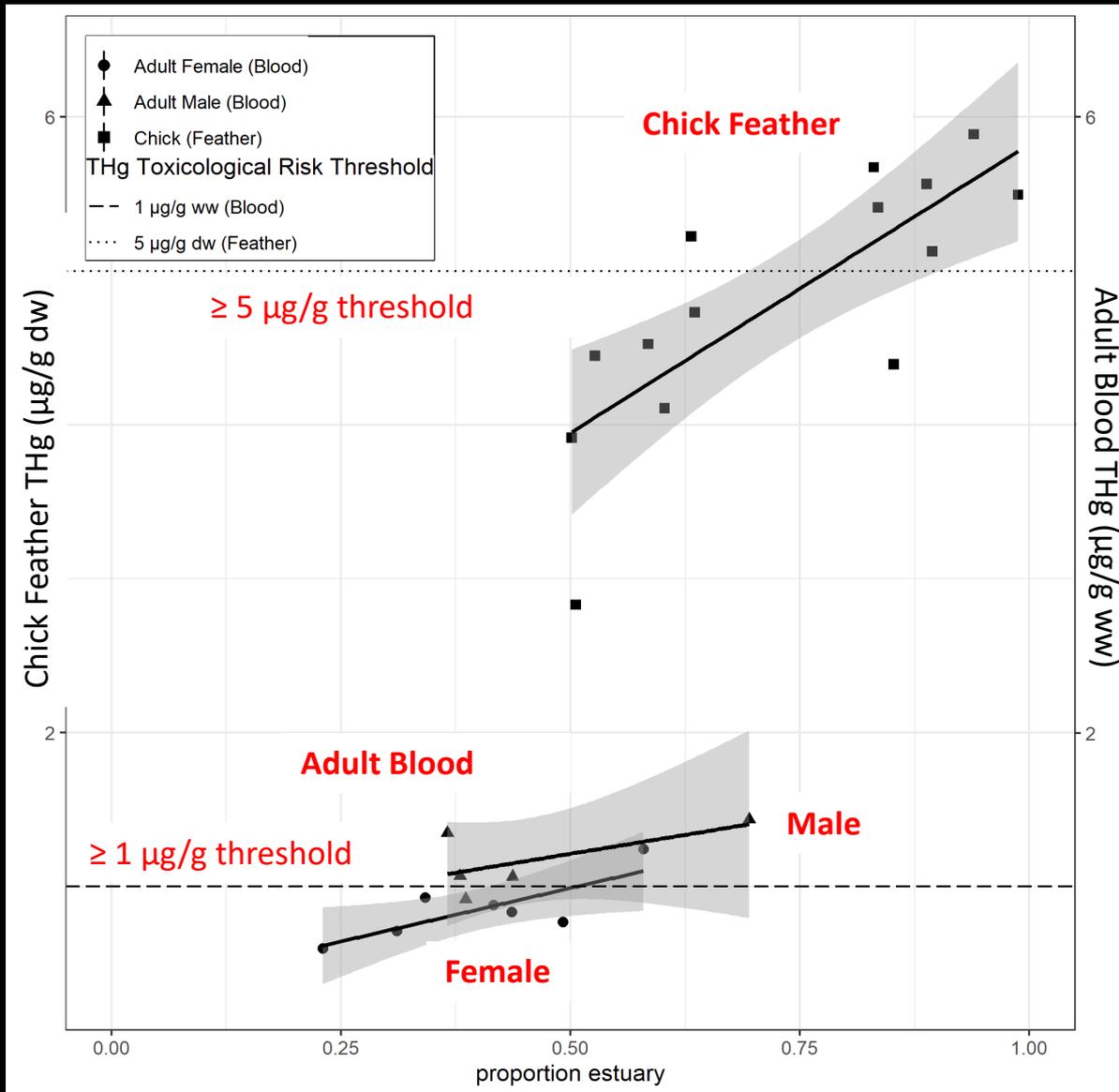
$\leq 5\mu\text{g/g dw}$ (Feathers)



$\leq 1\mu\text{g/g ww}$ (Blood)

Effect End Point- Lowered Reproductive Success

Total Mercury (THg) – Stable Isotope GLM Summary

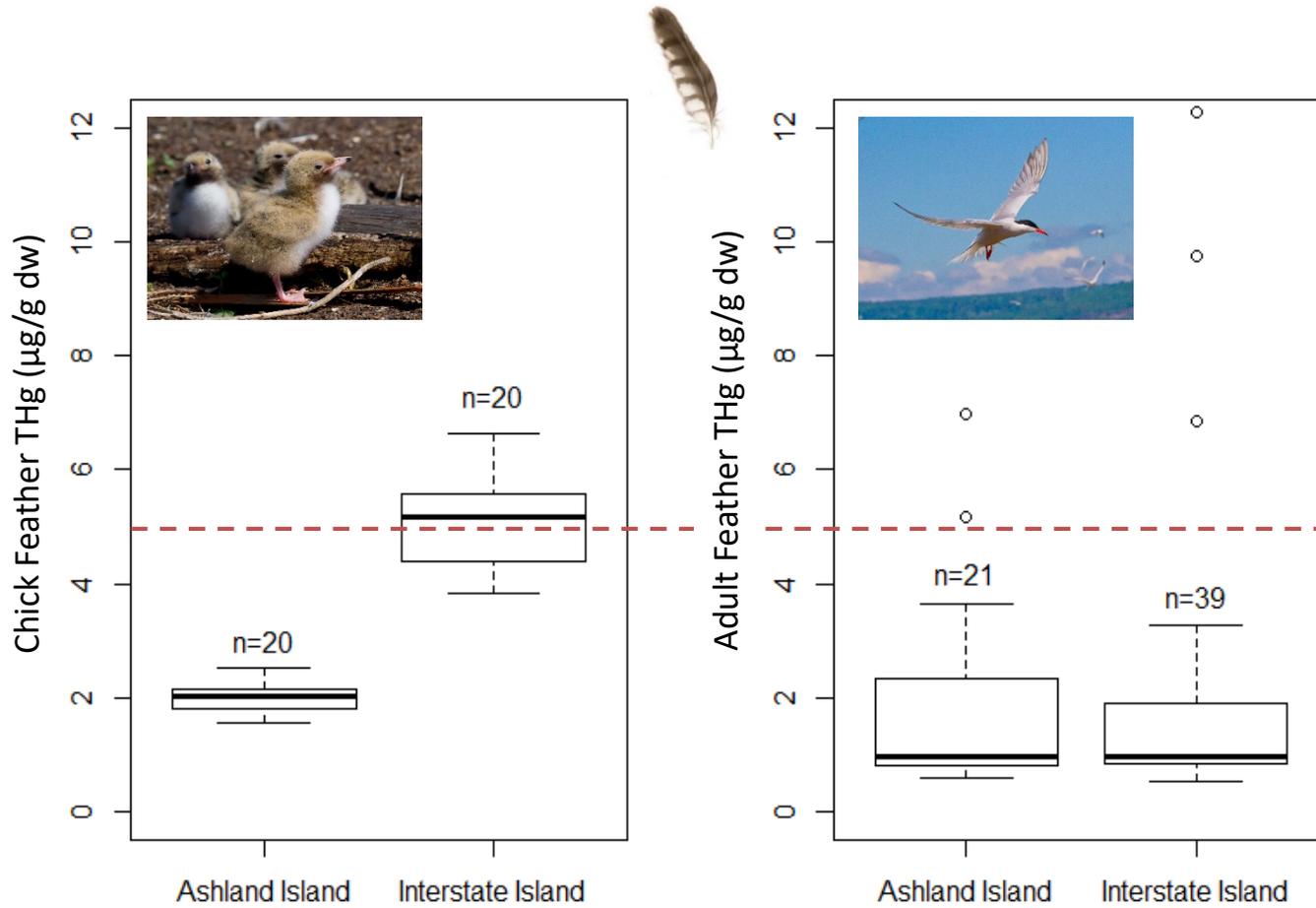


Lake Superior

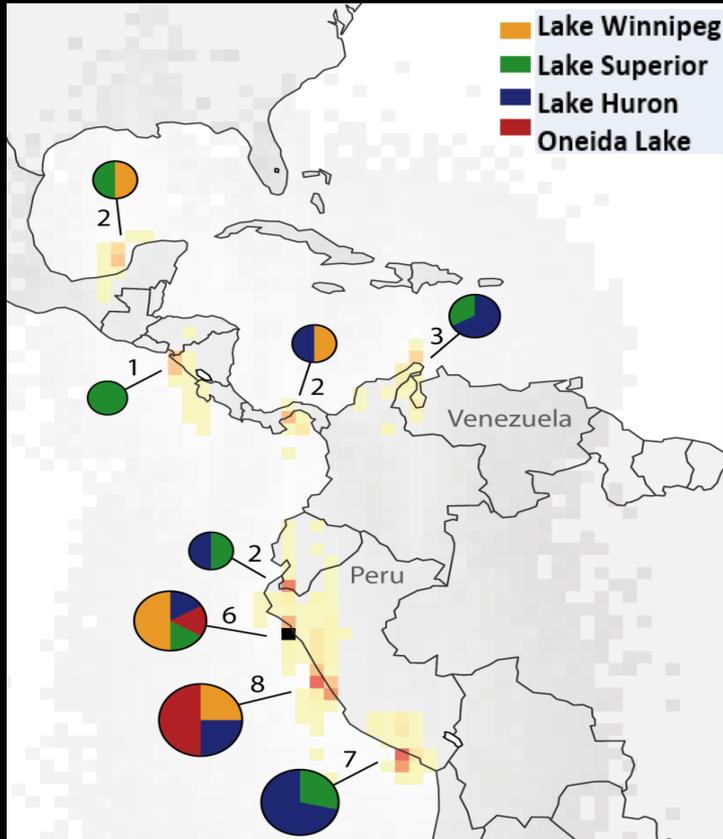


St. Louis River Estuary

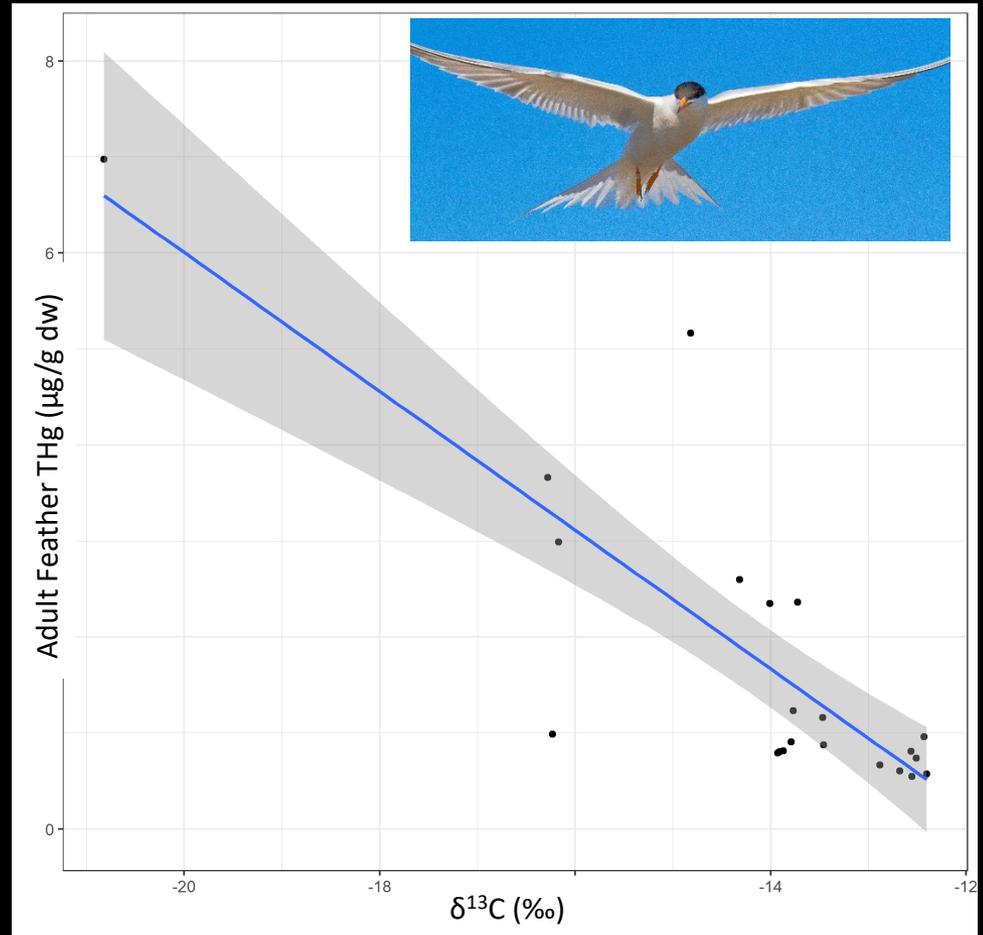
THg Summary

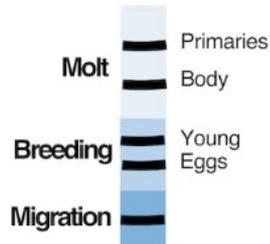
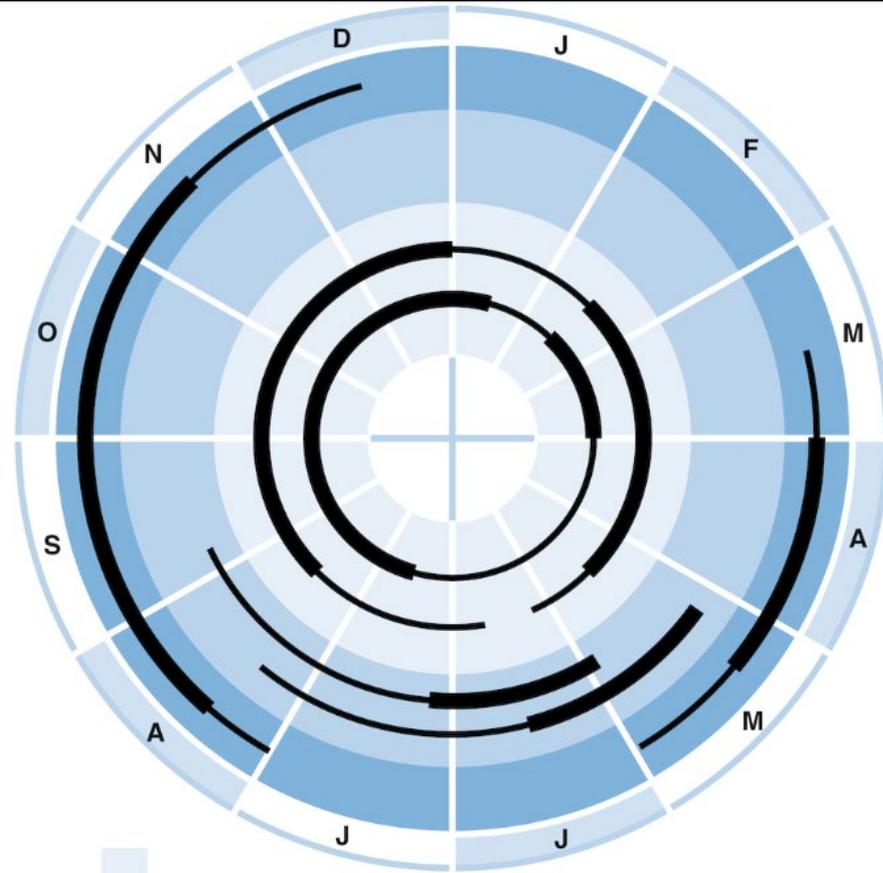


THg – Stable Isotope Summary



Median wintering locations of adult Common Terns based on location estimates occurring between Dec 15 and Mar 31 ($n=31$). Shaded areas indicate 95% CI. Figure from Bracey et al. 2018.

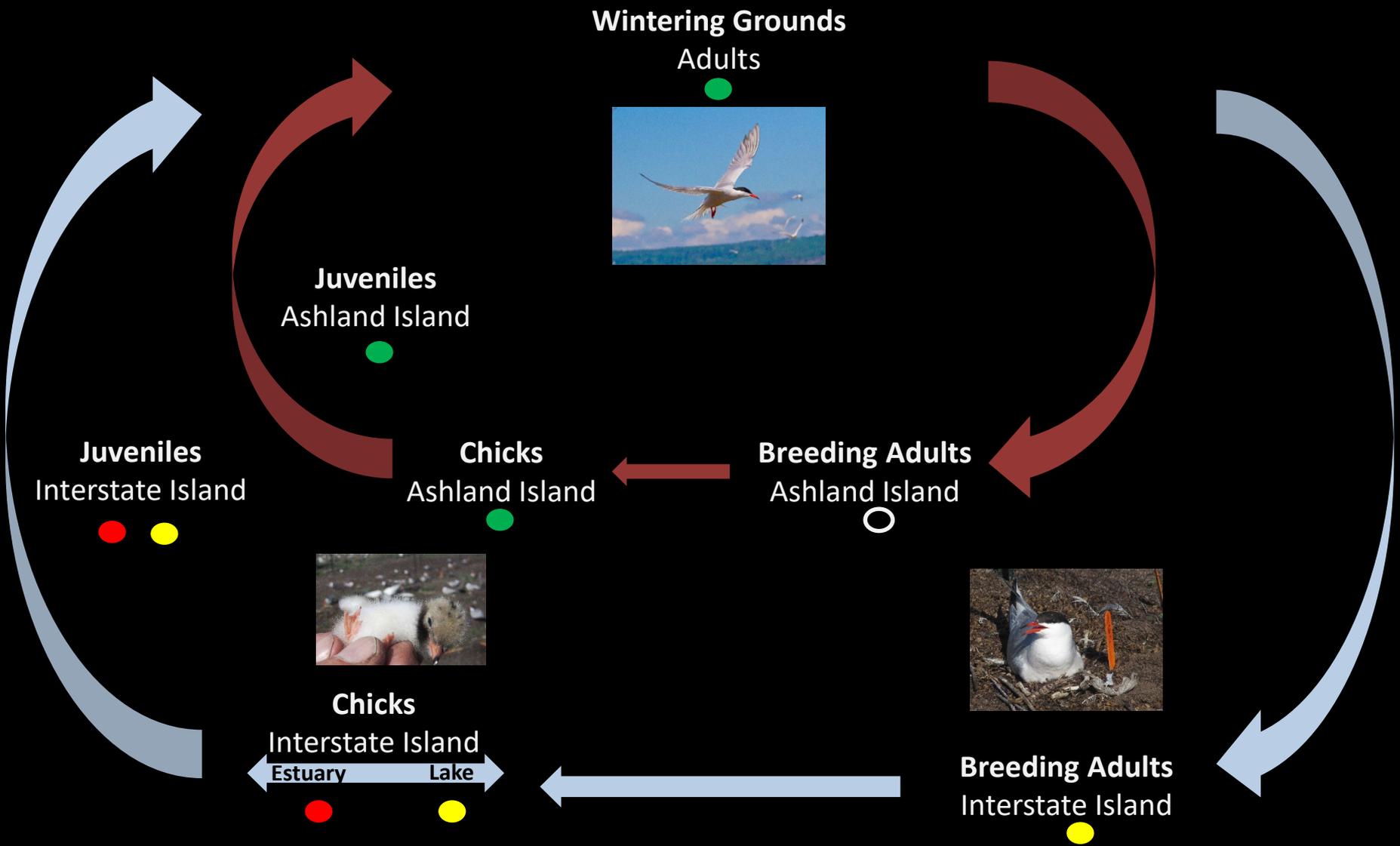




* Timing pertains to North American populations

Figure 2. Annual cycle of breeding, migration and molt of the Common Tern.

Dates are given for Atlantic coast populations from New York to Massachusetts; for phenology of other populations, see Breeding: Phenology, and Appendix 2.





Common Tern
Sterna hirundo



Support & Partnerships

Francie Cuthbert (UMN)
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