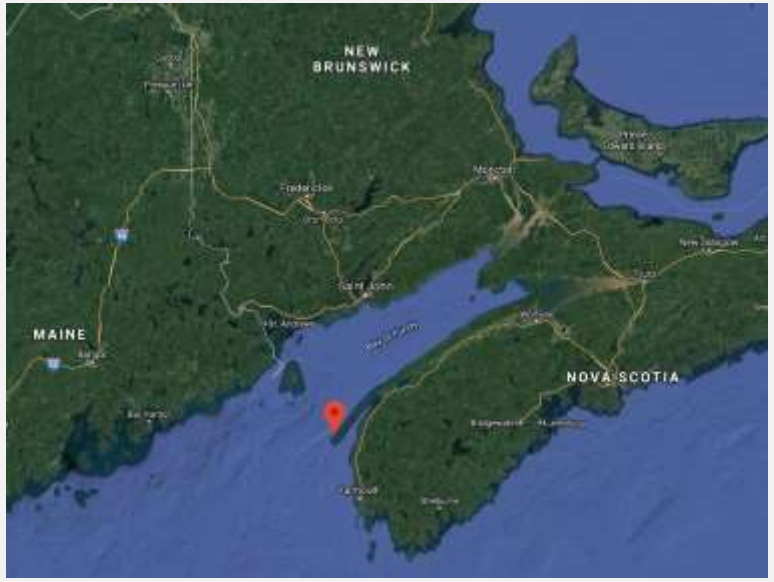
Mercury in gull (*larus argentatus*) guano samples and changes over two summers on Brier Island, Nova Scotia

Haley Geizer
Supervisors: Nelson O'Driscoll and Sara Klapstein
Acadia University



History of Big Meadow Bog

- Sample site was Big Meadow Bog (BMB) on Brier Island, Nova Scotia
- BMB was drained in the late 1950-60s
- Now arid enough for colonization of **~6000 seagulls every summer**
- Past research has shown increased MeHg and PO_4^{3-} in water samples near colony (Kickbush et al. 2018)

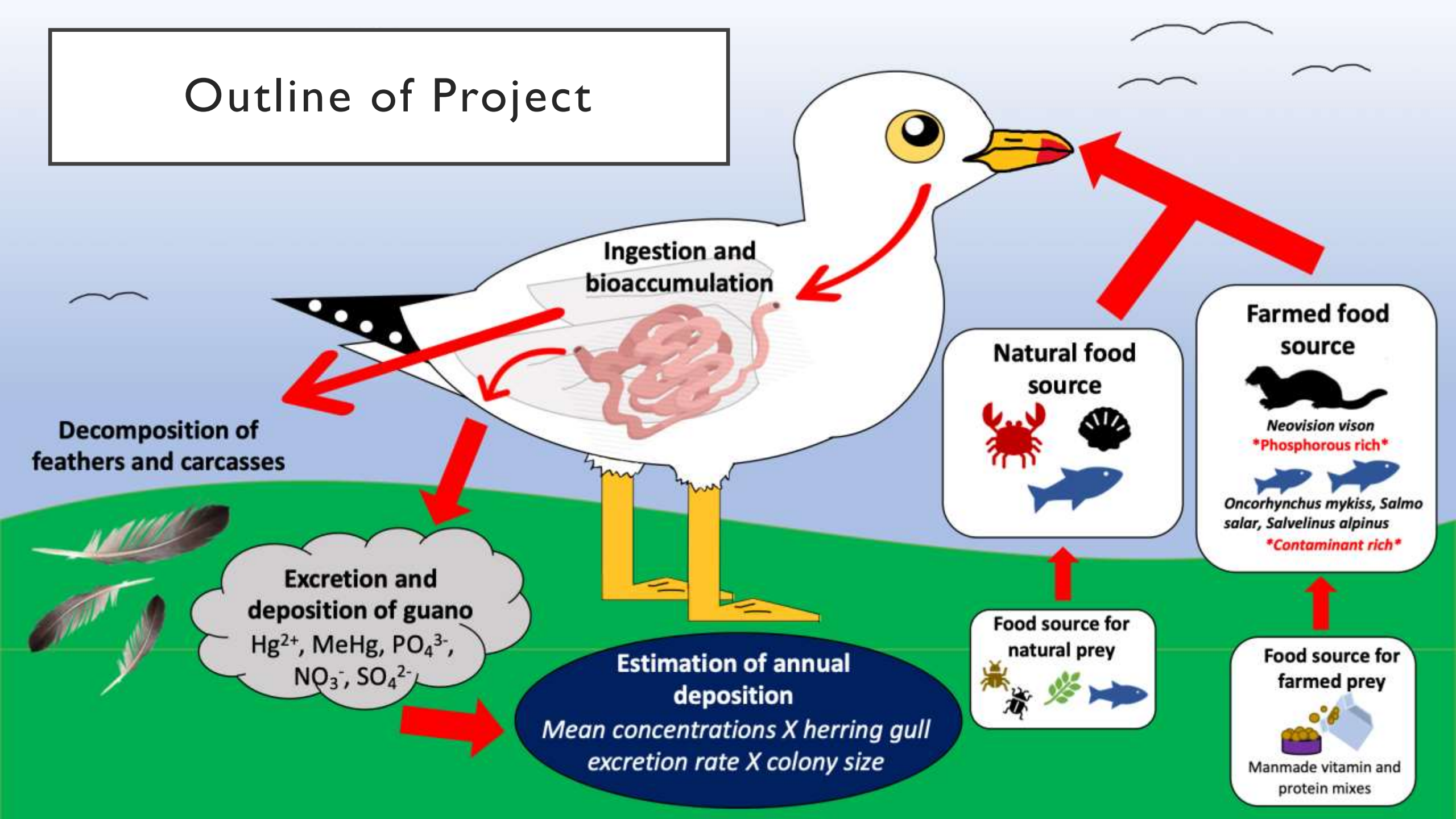
Why Study Mercury?

- Mercury in the form of MeHg is a bioaccumulative neurotoxin
- It can cause irreversible effects on organism's nervous and reproductive systems
  - **In birds it can cause reduced hatchability, deformations, increased mortality and more**
- Research suggests production is influenced by nutrient availability (Kickbush et al. 2018)

Objectives

1. Quantify THg and PO_4^{3-} in dry guano
2. Assess temporal data to see if any trends exist over nesting period
3. Estimate annual deposition rates for THg and PO_4^{3-}

Outline of Project



Field Work

- Deployed 5 posts in most gull dense areas of bog
- **We collected 43 composite samples**
- Samples were retrieved with plastic scoopulas and 50 mL vials
- Then posts were cleaned with DI water and a plastic brush

Post prior to collection

Post after collection


N
0
250
500
750
1000 m
Town of Westport
Brier Island, Nova Scotia
Aquaculture
Northern outflow
Big Meadow
Bog (BMB)
Greatest gull density
Southern outflow
BMB Post Locations
Post 1
Post 2
Post 3
Post 4
Post 5

Sample Preparation

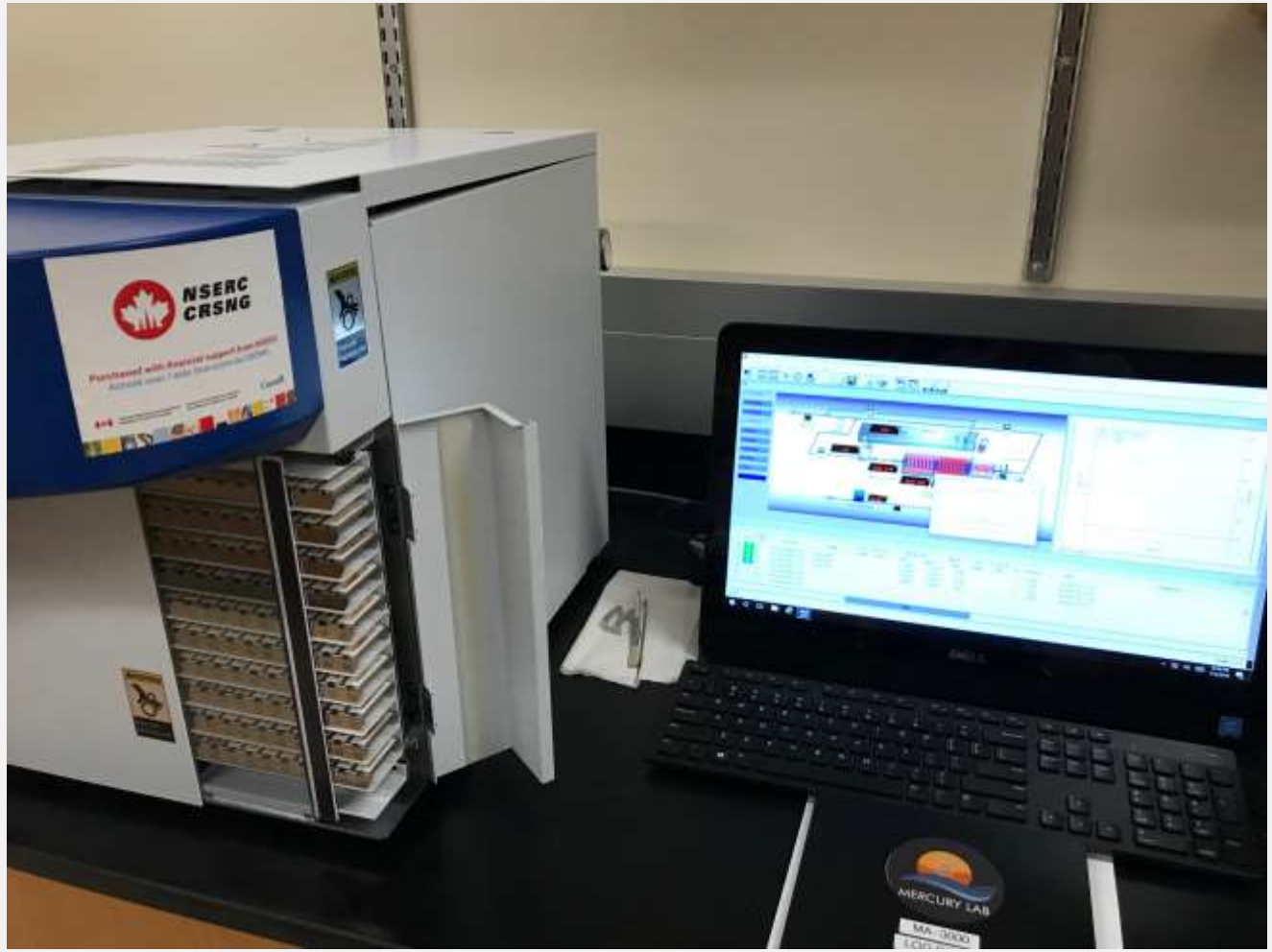
Samples were stored at -20°C

Then placed in an oven at 40°C for ~24H

Next they were crushed into a fine powder for analysis

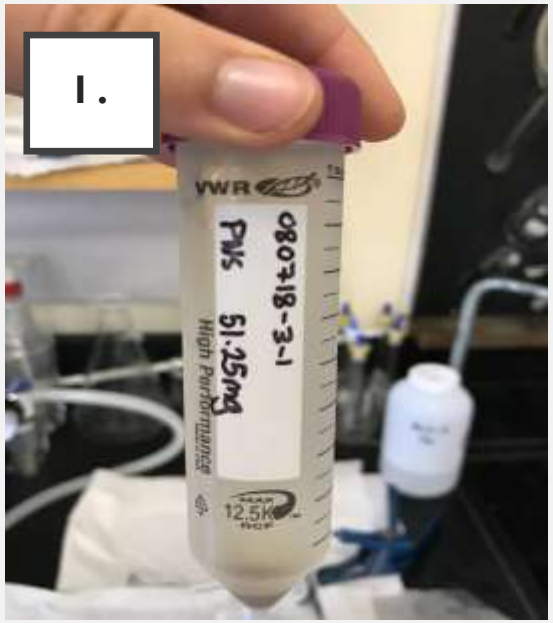
Analyzing Total Mercury (THg)

- 20 mg of dry samples were weighed into boats
- Then placed in Nippon machine
- This measured all forms of mercury within samples

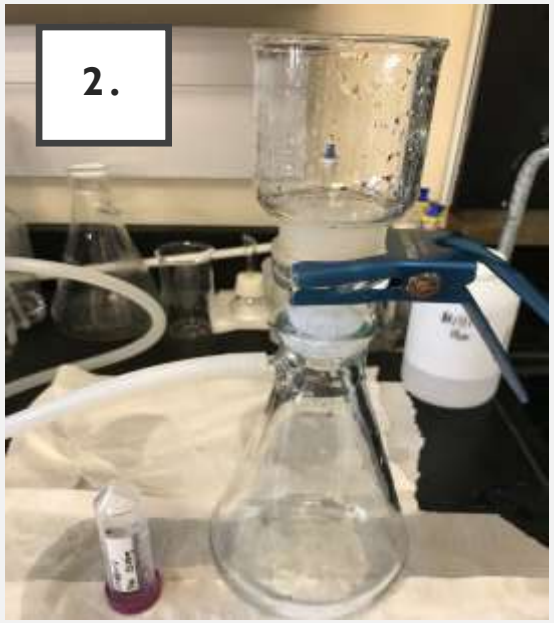


Nippon MA-5000 Total Mercury Analyzer

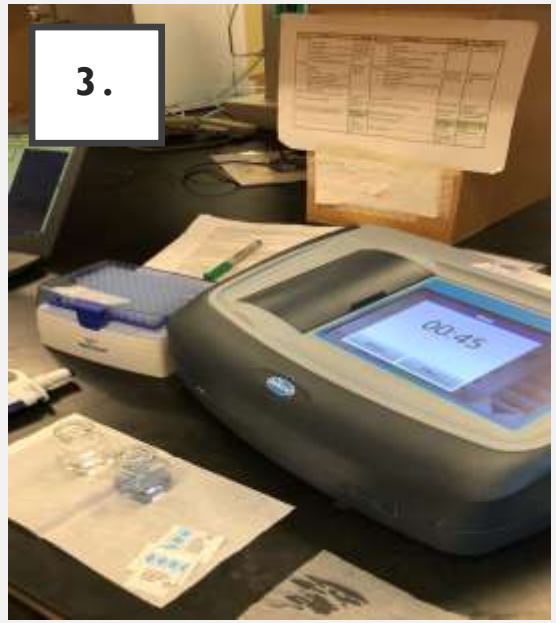
Measuring Nutrient Content



50 mg of samples were dissolved in 50 mL of water



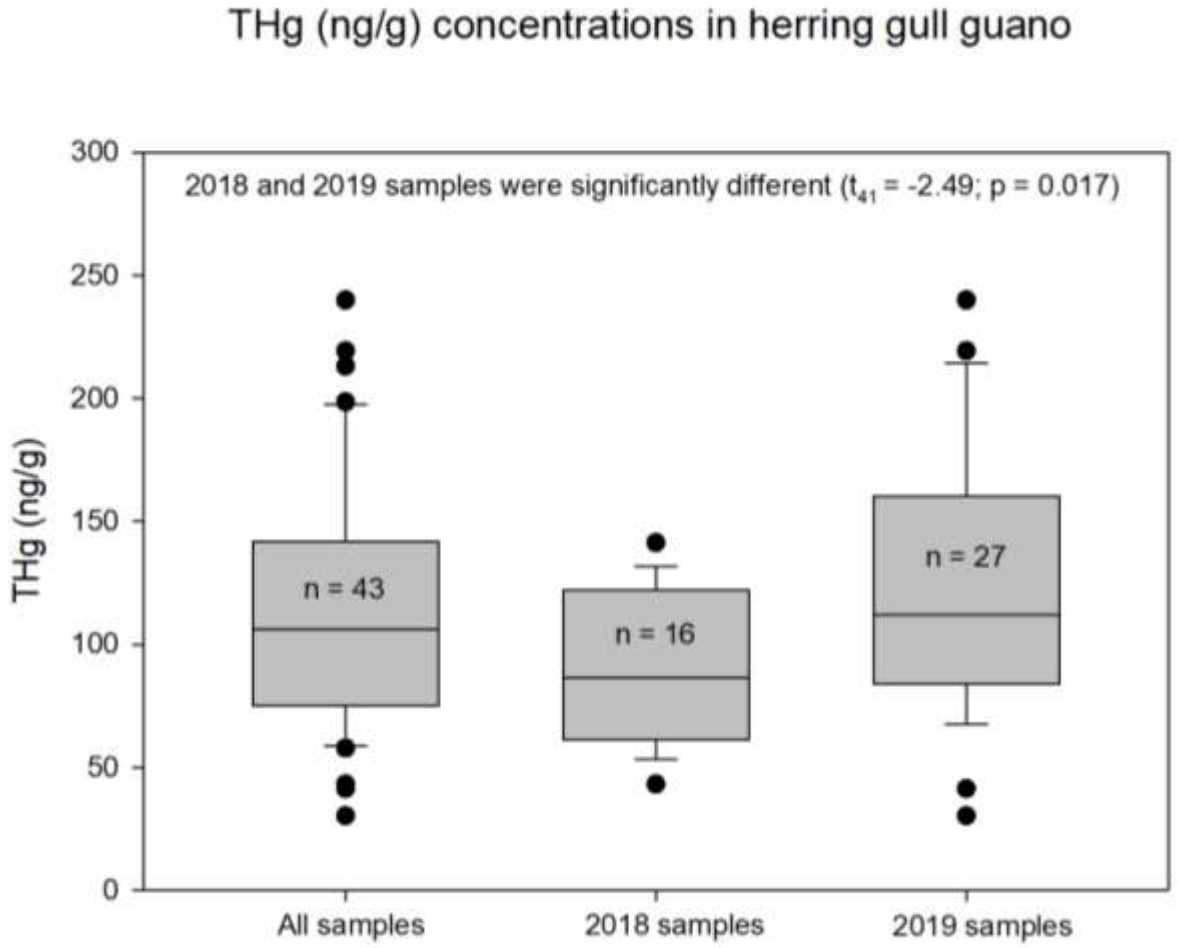
Solution was filtered using 0.45µm filters



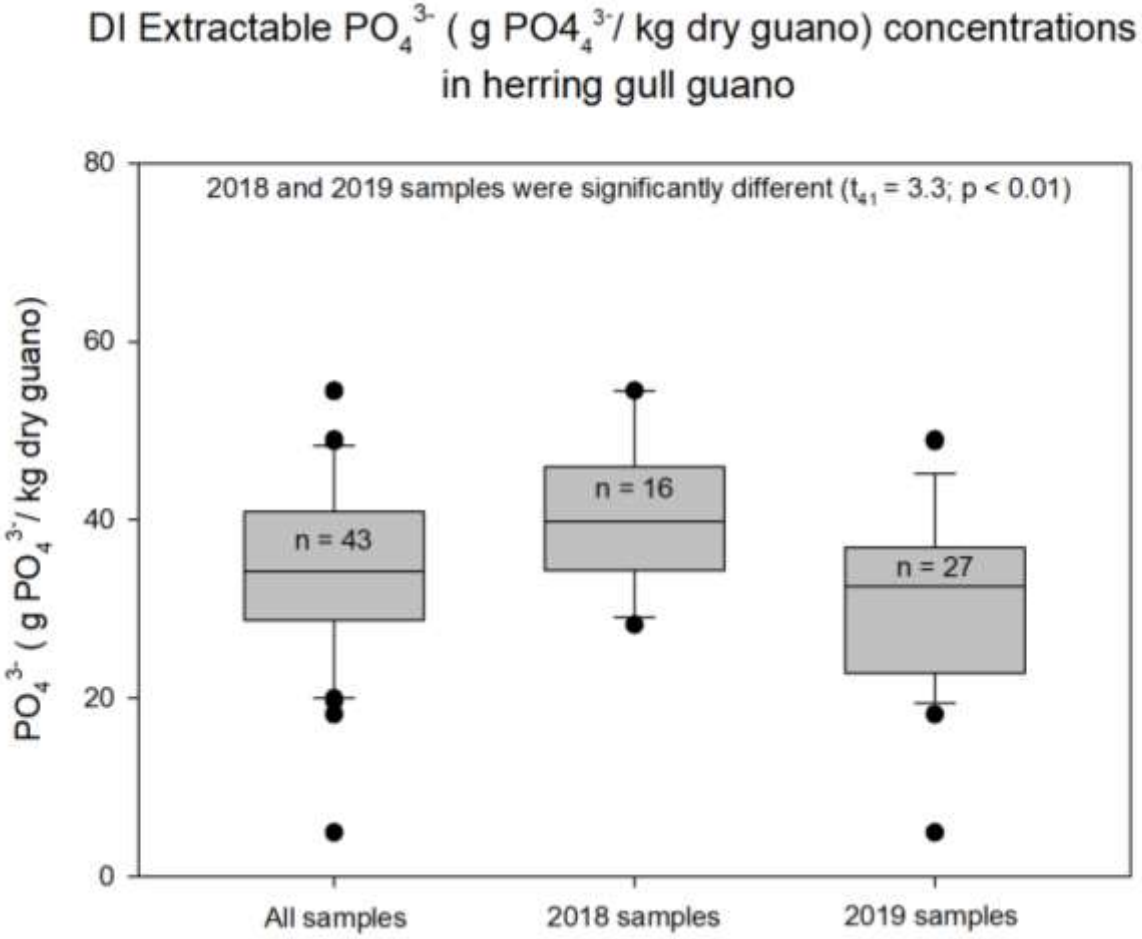
HACH DR 3900 measured nutrients in solution

RESULTS

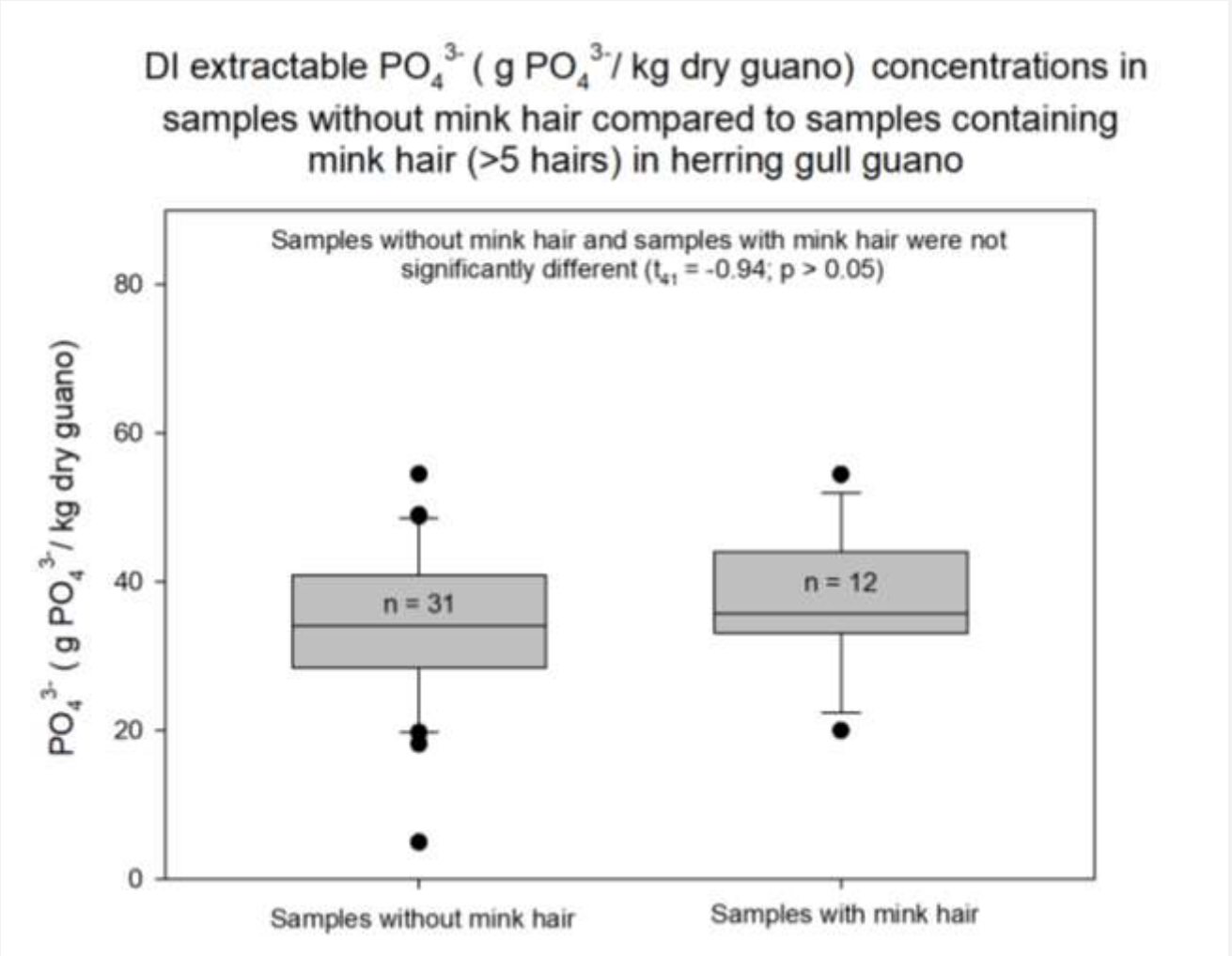
Quantifying THg



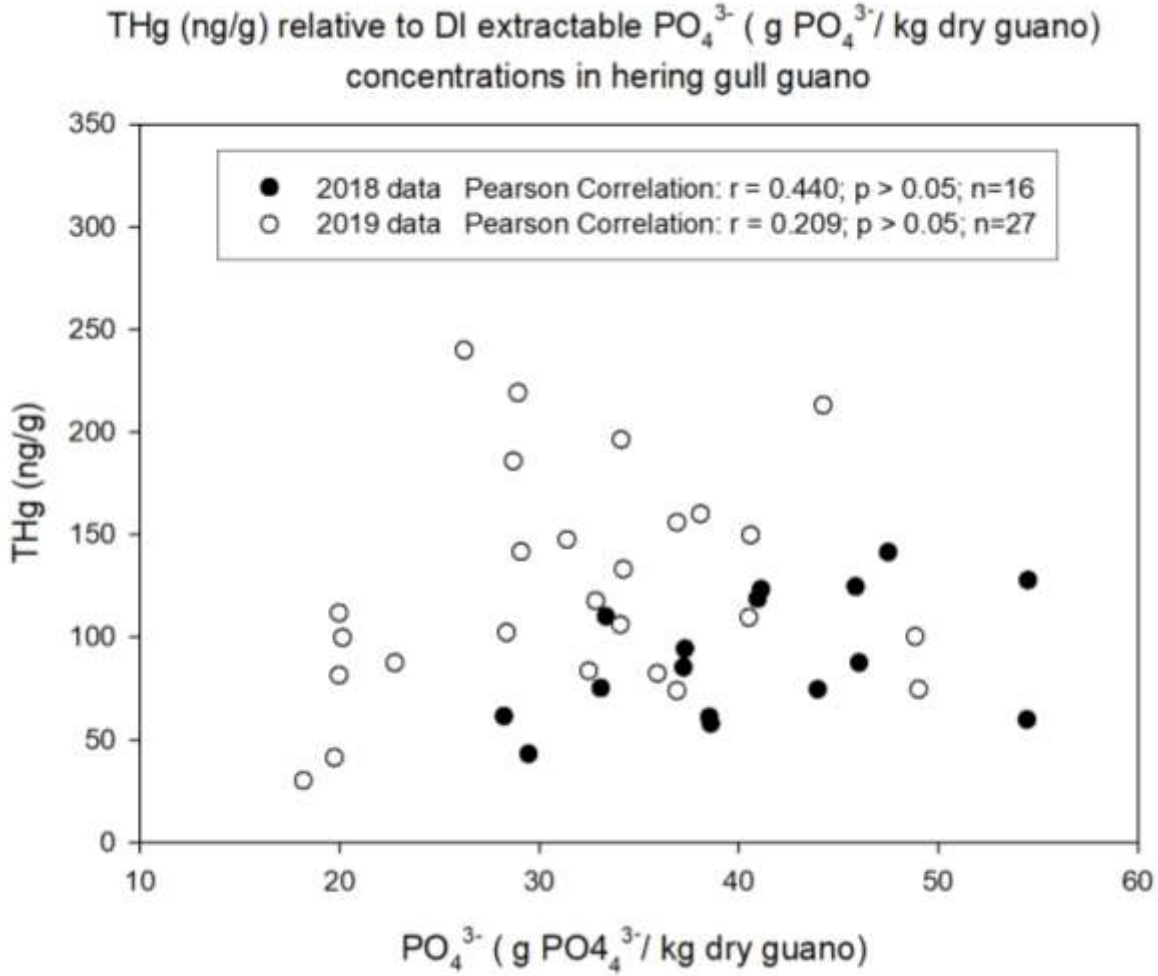
Quantifying PO_4^{3-}



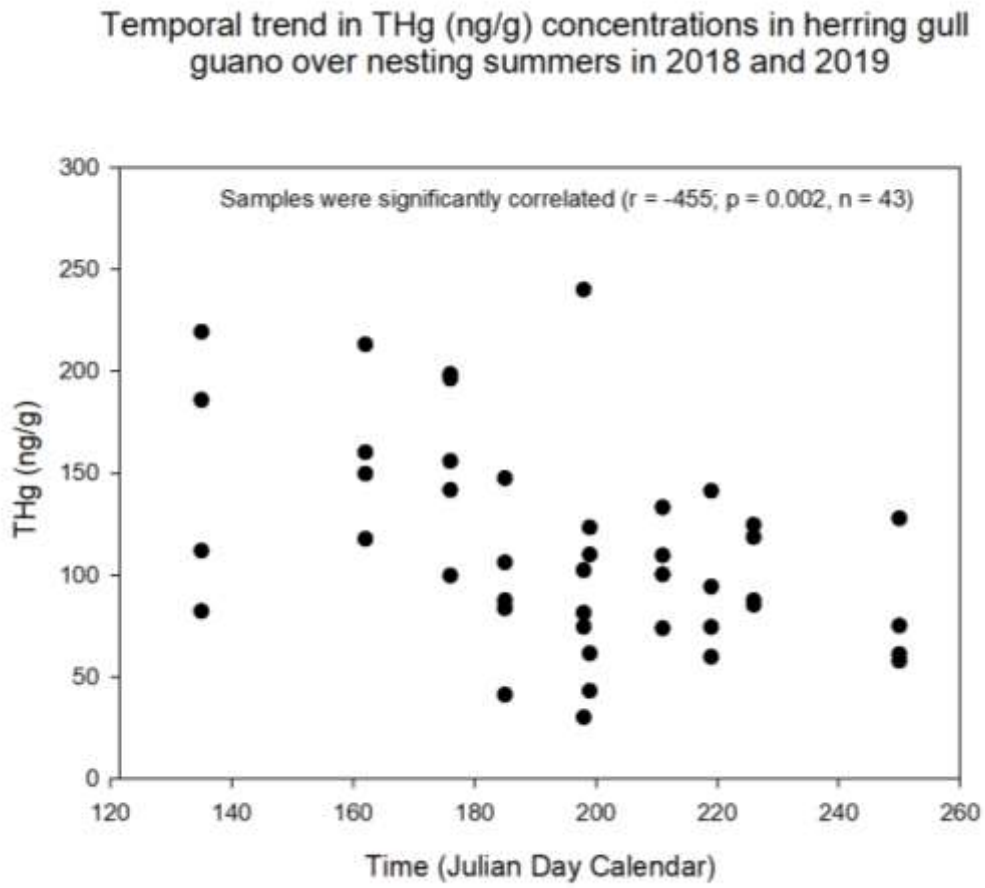
Mink Influence on PO_4^{3-}



THg vs PO_4^{3-}


THg (ng/g) relative to DI extractable PO4 3- (g PO4 3-/ kg dry guano) concentrations in hering gull guano
2018 data Pearson Correlation: r = 0.440; p > 0.05; n=16
2019 data Pearson Correlation: r = 0.209; p > 0.05; n=27
THg (ng/g)
0
50
100
150
200
250
300
350
10
20
30
40
50
60
PO4 3- (g PO4 3-/ kg dry guano)

Temporal Trend in THg Data



Estimation of Annual Deposition Rates

$$Annual\ Depostion\ rate = Mean\ concentration \times Excretion\ rate \times Colony\ count \times Sampling\ months$$

THg (kg/ nesting season)	PO_4^{3-} (kg/ nesting season)
3.92×10^{-3}	1191.38

Research Take Away

THg is significantly decreasing through gull nesting season

Gulls are depositing THg and considerable amounts of PO_4^{3-}

THg and PO_4^{3-} do not significantly correlate

Significance

- Conservation of eastern mountain avens (*Geum peckii*)
- Deposited contaminants from gulls can migrate to the ocean through outflows
- Global implication as migratory seabirds deposit nutrients and contaminants worldwide

Future Work

- This study completed all objectives that were set
- Identifying mink hair and observing NO_3^- concentrations would be beneficial
- This is simply one side of the story
- **MeHg concentrations will be analyzed in the near future**

Acknowledgments

- Thank you Dr. O'Driscoll and Dr. Klapstein for allowing me to see a new side of science
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QUESTIONS?