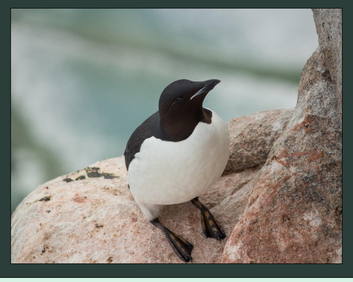

# Linking foraging flexibility, energetic physiology, and environmental variability in an Arctic seabird

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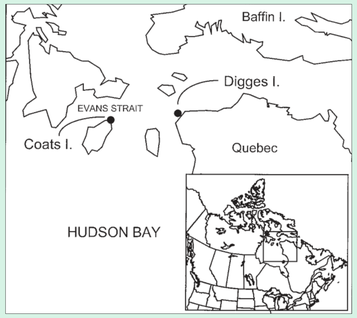
## Introduction

- Climate change is increasing variability of sea ice conditions and concentrations in the Arctic[1-3]
  - Impacts release of sea ice algal and phytoplankton blooms[1]
  - Leading to changes in abundance and distribution of fish and invertebrate species[2,4,5]
- Thick-billed murre (*Uria lomvia*) are an Arctic breeding seabird
  - Prey include pelagic and benthic fish, and invertebrates[1-3]
- **Can thick-billed murres adapt to a rapidly changing climate?**
- Using GPS tracking and measures of energetic physiology we are comparing foraging trips of thick-billed murres at different sized colonies in response to environmental variability




- Digges Island, Nunavut
  - 400,000 breeding pairs[6]
  - Data from 2014-2016
- Coats Island, Nunavut
  - 30,000 breeding pairs[6]
  - Data from 2015, 2017, 2018 and 2019

**Figure 1**. Map of northern Hudson Bay showing the location of Coats and Digges Island, Nunavut, Canada murre colonies.[2]

## Methods

### Fieldwork

- Capture adult murres with noose pole at nest sites
- Attach GPS/GPS accelerometer
  - CatTrack and Technosmart
  - Remove 2-5 days later
- Blood sampling before and after foraging trip
- Monitor nest sites to determine nesting phenology

### Physiological Metrics

- Use energetic physiology to examine foraging success
  - Baseline corticosterone
  - Beta-hydroxybutyrate
  - Non-esterified fatty acids
  - Plasma triglycerides
- Use blood stable isotopes to examine foraging niche[7]
  - $\delta^{13}C$ & $\delta^{15}N$

### Environmental Conditions

- Determine the level of environmental variability at each colony
- Using remote sensing images in ArcGIS measure:
  - Sea ice concentration
  - Chlorophyll-a concentration
  - Sea surface temperature
  - Bathymetry

## Results

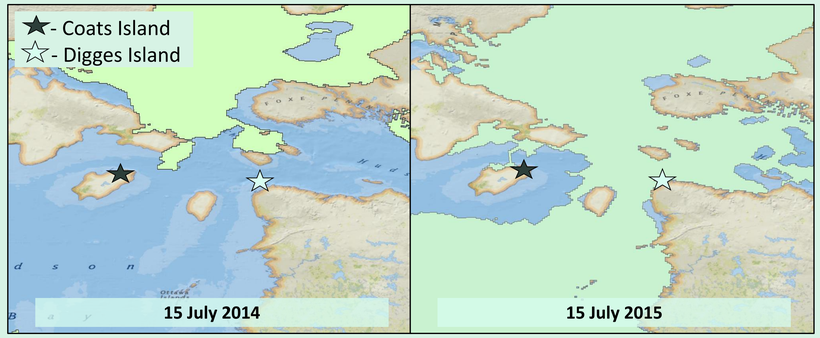



**Figure 2.** Sea ice concentration surrounding Coats Island, Nunavut and Digges Island, Nunavut in 2014 and 2015 on July 15th – late incubation/early chick-rearing period. [8]

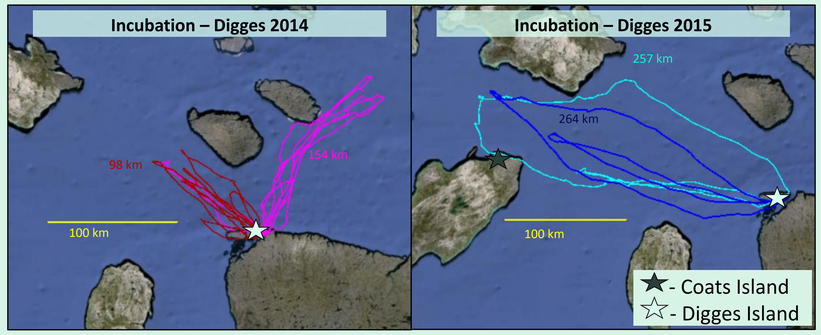



**Figure 3.** Sample GPS tracks from thick-billed on Digges Island, Nunavut during the incubation period in 2014 and 2015.

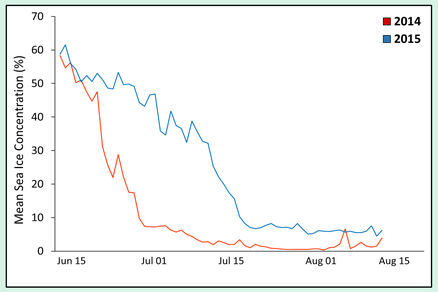



**Figure 4.** Mean sea ice concentration within 300 km of Digges Island, Nunavut in 2014 and 2015.[9]

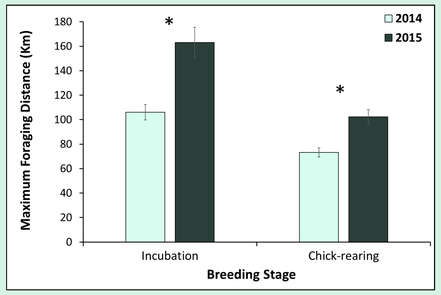



**Figure 5.** Maximum foraging distance was lower in both incubation and chick-rearing stages during the low-ice year at Digges Island, Nunavut.[9]

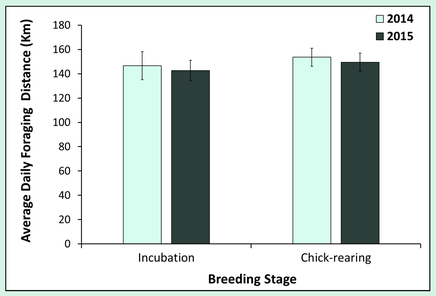



**Figure 6.** Average daily foraging distance did not differ between years during incubation or chick-rearing at Digges Island, Nunavut.[9]

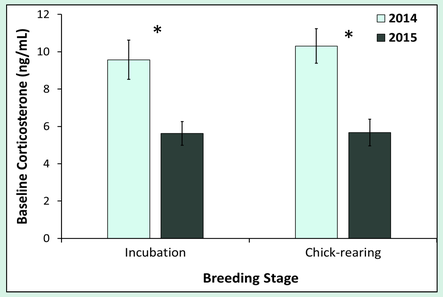



**Figure 7.** Baseline corticosterone was higher in both incubation and chick-rearing stages during the low-ice year at Digges Island, Nunavut.[9]

## Conclusions

- At Digges Island sea ice concentration varied between years
  - Lowest ice concentration observed in 2014
- In a low ice year murres made shorter foraging trips
- However, murres made more foraging trips overall
- Baseline corticosterone was higher in 2014, suggesting an increase in energetic demand associated with decreased sea ice concentration



## Future Directions

- Analyze Digges Island data from 2016 and Coats Island data from 2015 and 2017-2019
- Compare foraging flexibility of murres on Digges Island to Coats Island in relation to environmental conditions
- Relate foraging strategies and physiology to fitness as predictors of inter-colony variation in success

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