



# WP 5: Seabirds

Hallvard Strøm  
Lech Stempniewicz

Sebastien Descamps  
Fredrik D. Haug  
Sigurd Benjaminsen  
Erlend Lorentzen

# Foraging hot-spots

A large, white iceberg floats in the ocean under a clear blue sky. Numerous birds, likely terns, are seen in flight around the iceberg and in the foreground. The scene is a natural habitat for these birds, illustrating a foraging hot-spot.

- Well known, but not well documented/understood
- Late/post-breeding period
- Temporal and spatial variation
  - Inter-annual variation
  - Not all tidewater glaciers
- Relative importance not known

# Seabirds





# Seabirds

Northern Fulmar *Fulmarus glacialis*



Black-legged kittiwake *Rissa tridactyla*



Ivory gull *Pagophila eburnea*



Glaucous gull *Larus hyperboreus*



Black guillemot *Ceppus grylle*



# What do they feed on...?

Krill *Thysanoessa inermis* (Nordenskiöldbreen)

Wingsnail *Limacina helicina* (Austfonna)

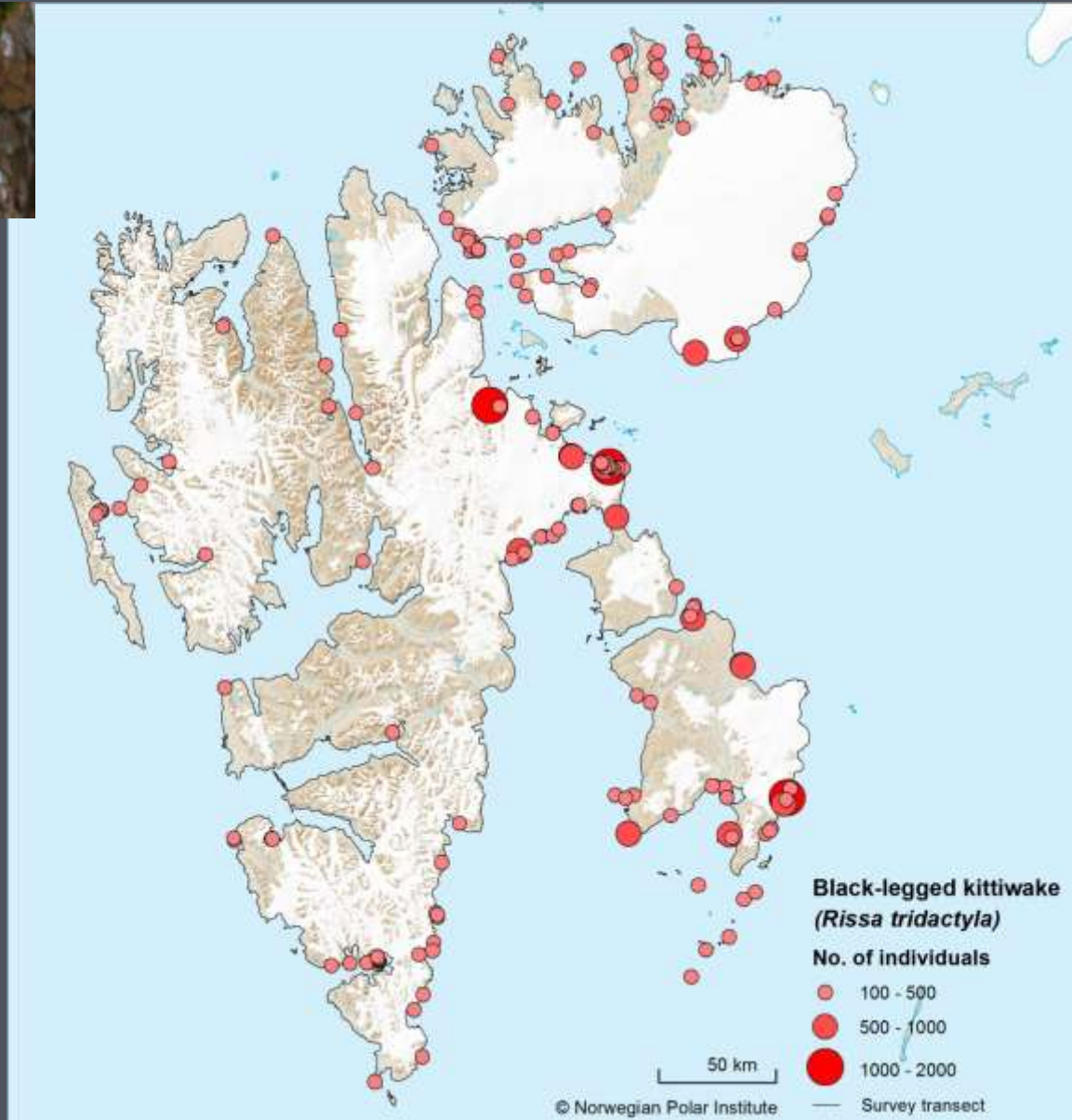
Polar Cod *Boreogadus saida* (key-species)



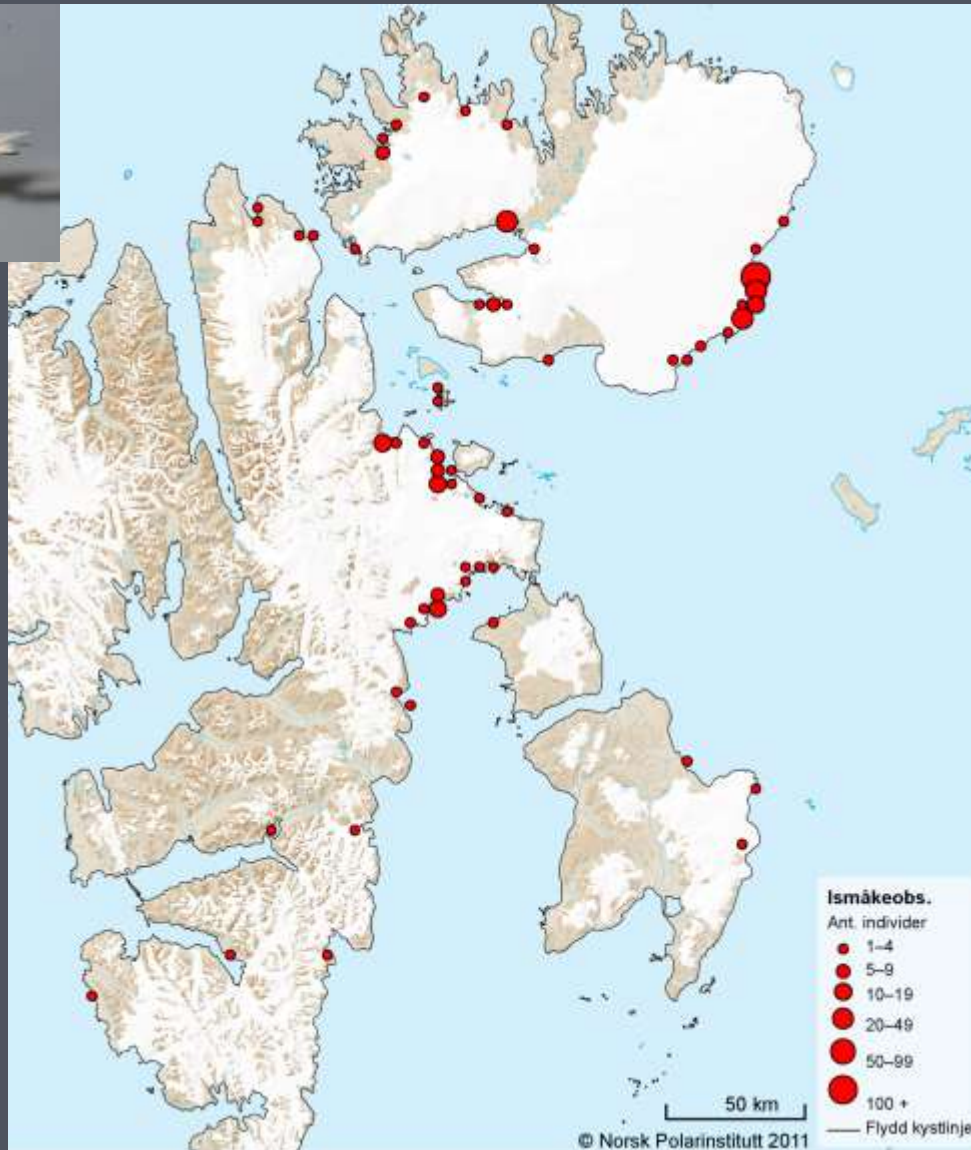
# Coastal survey 2010-2011



# Kittiwake



# Ivory gull

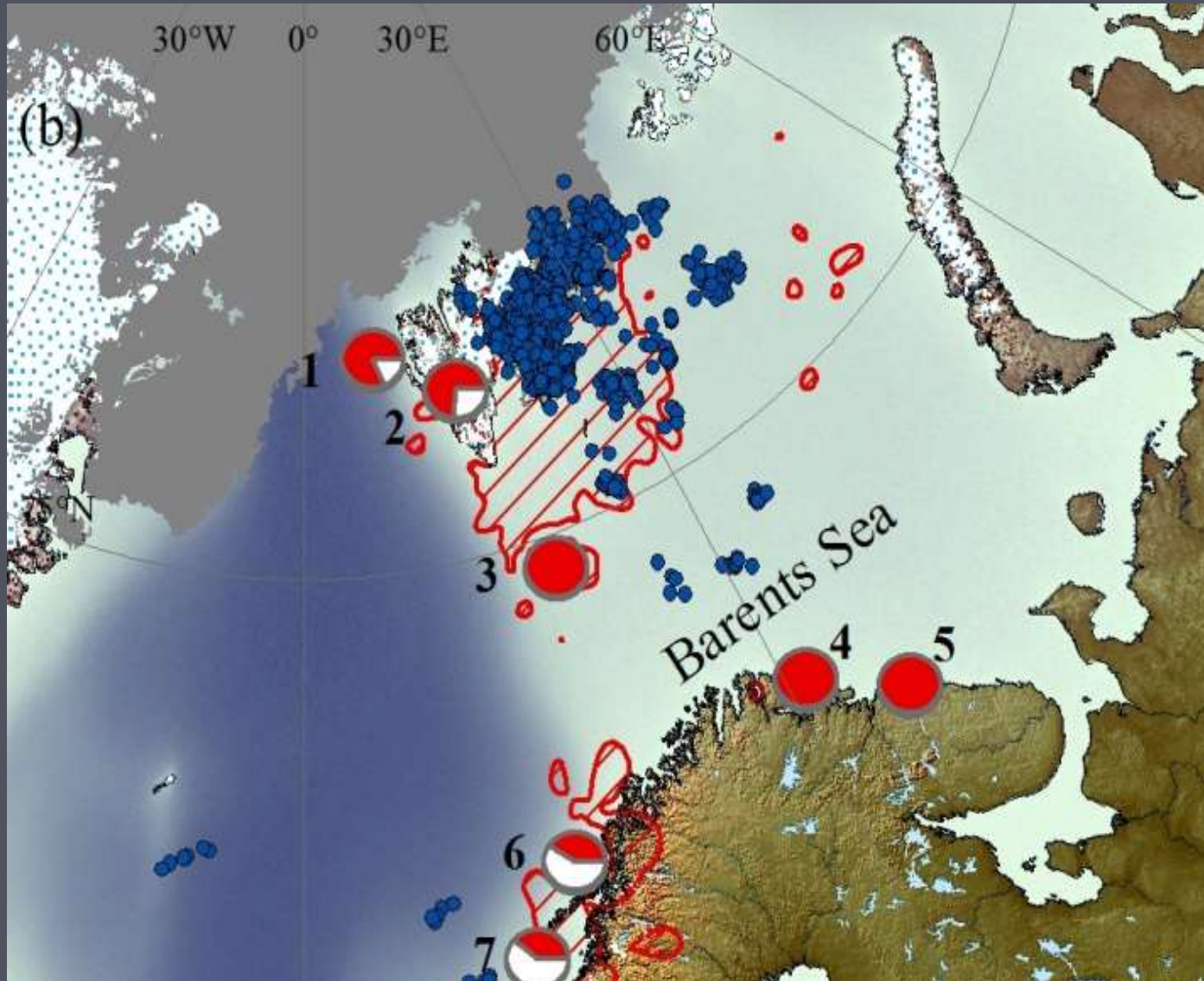




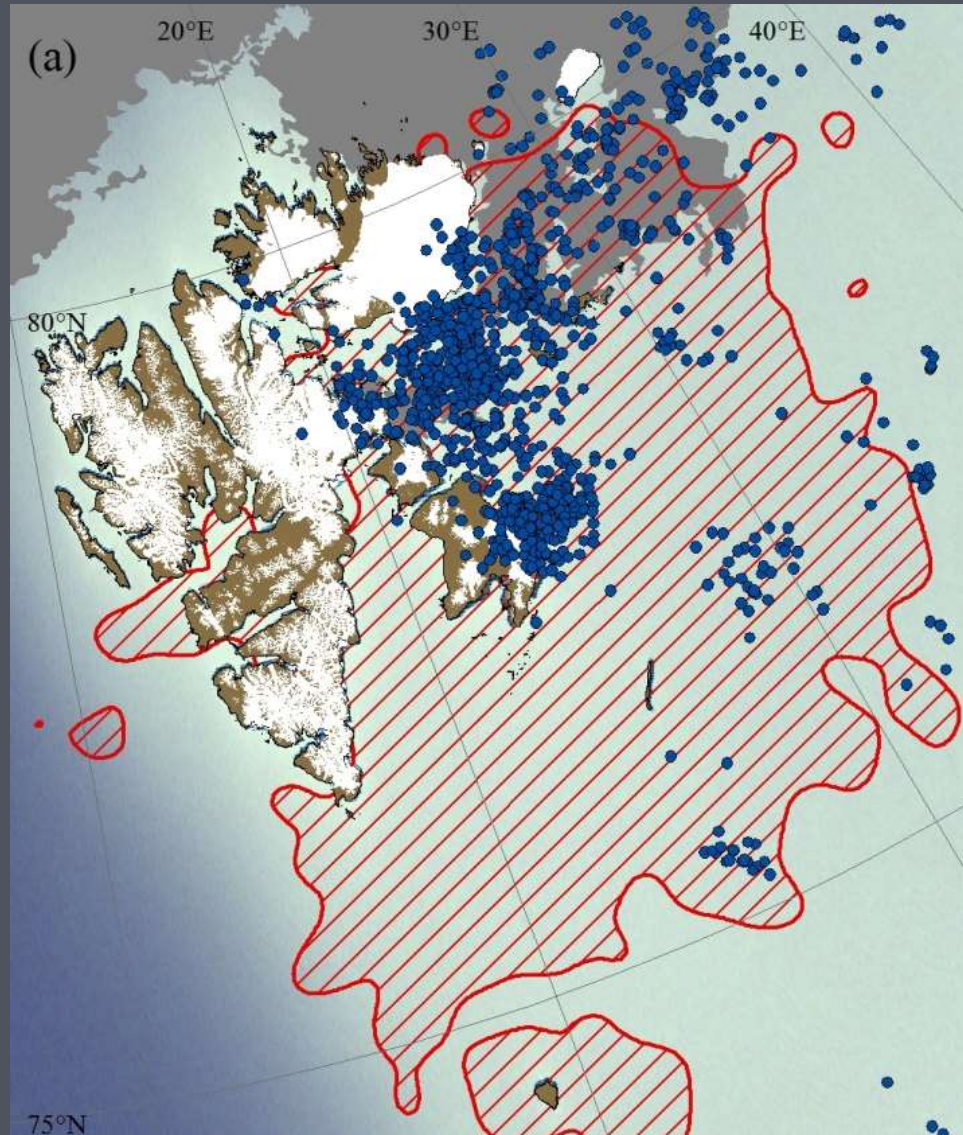
# Kittiwake geolocator study



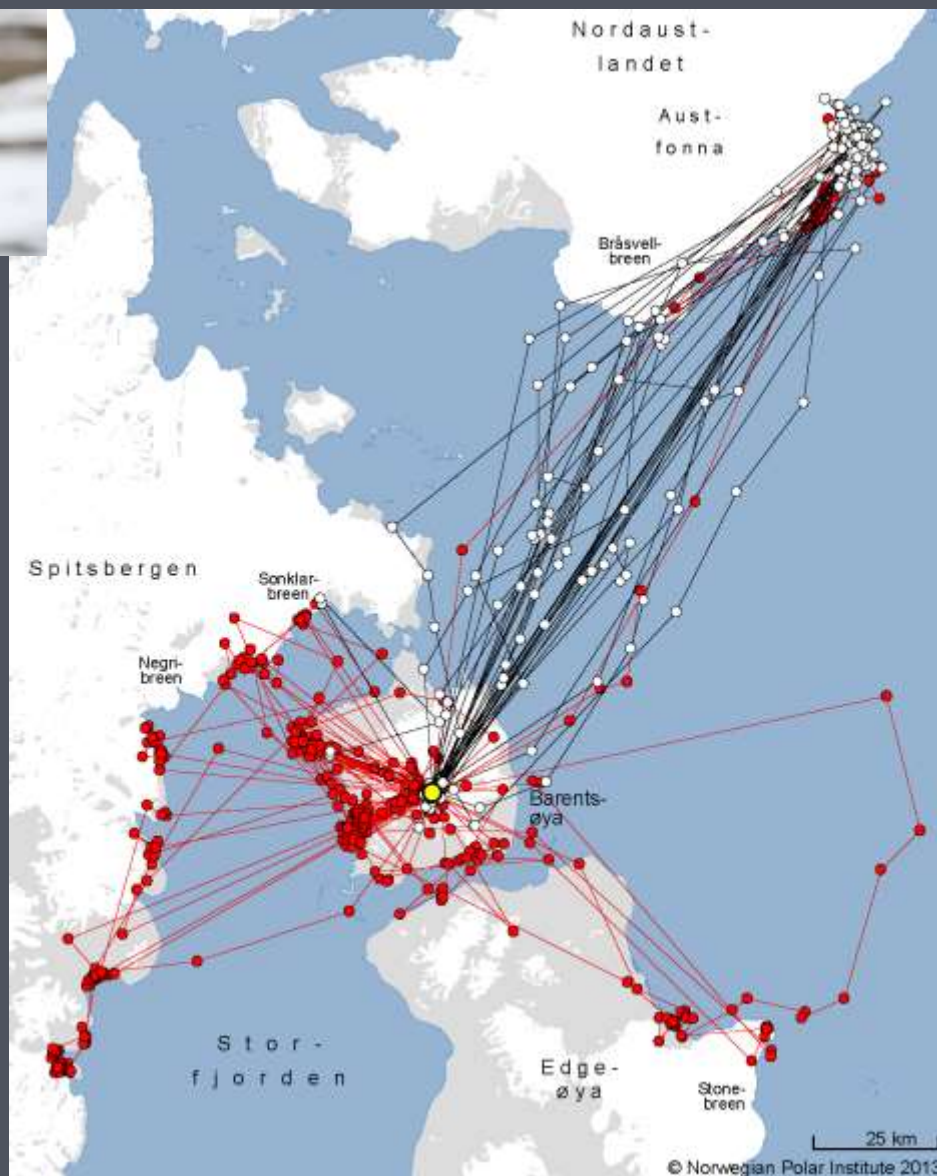
# Kittiwake geolocator study



# Kittiwake geolocator study



# Ivory gull foraging



# WP 5 Seabirds

**Key-species:** Black-legged kittiwake *Rissa tridactyla*

**Field sites:** Kongsfjorden and Hornsund

**Main goal:**

1. Assess the temporal (day/week/month) variation in the use of glacier fronts by kittiwakes and various other seabird species
2. Study how distribution and abundance of seabirds are linked to the physical properties of the glacial front system
3. Assess the relative importance of the fronts as foraging areas during the breeding season and the temporal and spatial variation in foraging patterns of the birds



# Temporal variation



# Time lapse cameras

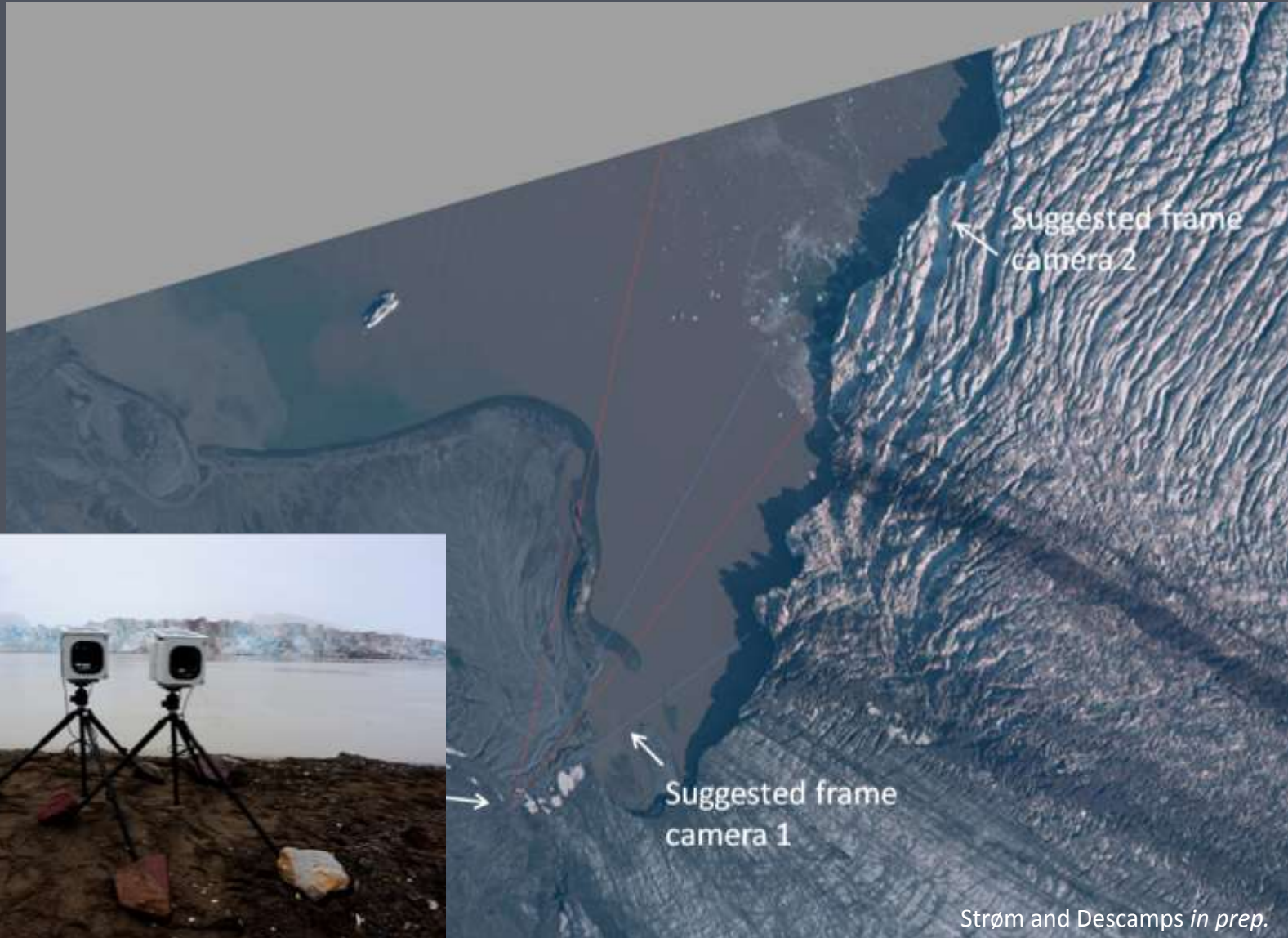


# Time lapse cameras



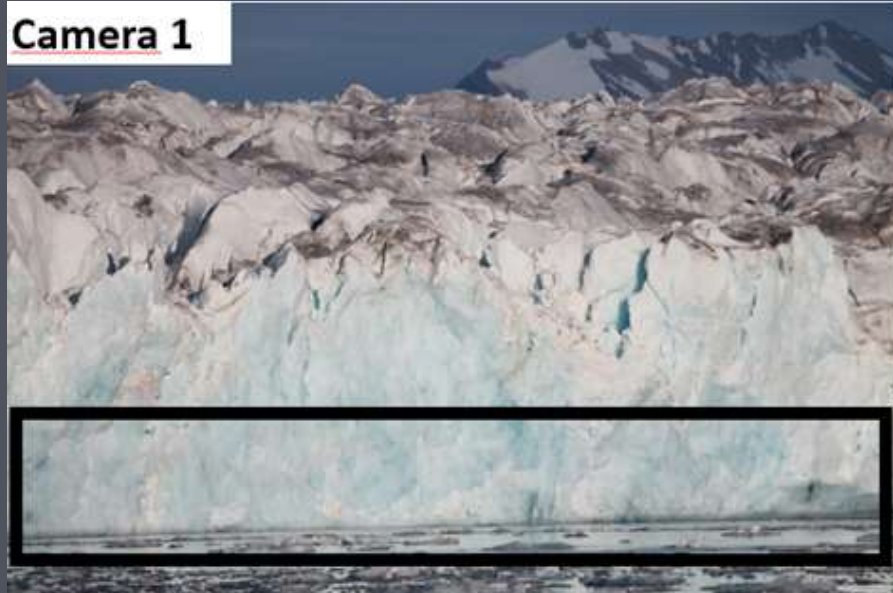


# Time lapse cameras

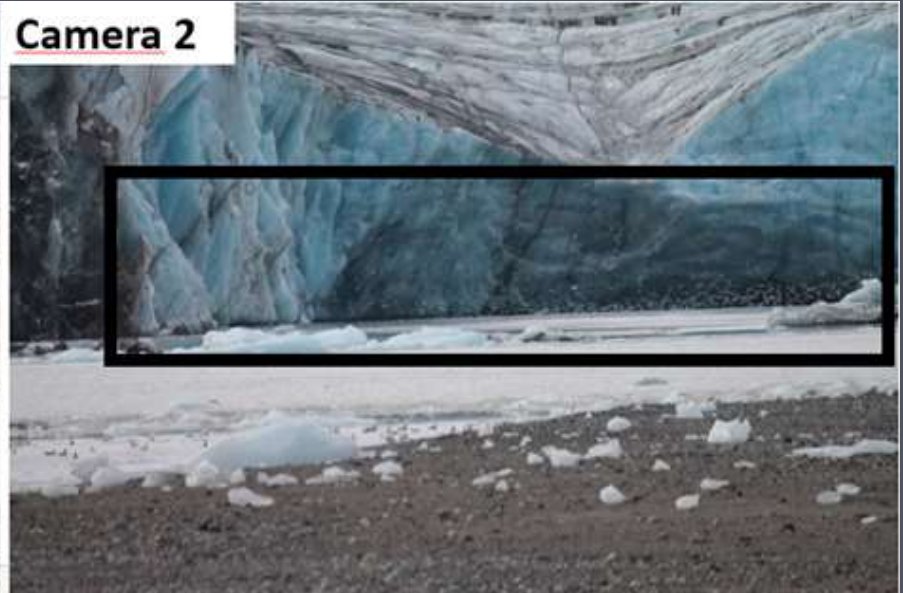


# Time lapse cameras

Camera 1



Camera 2



Strøm and Descamps *in prep.*



# Temporal variation

| Environmental variables             | Unit                | Temporal resolution | Source                         |
|-------------------------------------|---------------------|---------------------|--------------------------------|
| <i>Observed variables:</i>          |                     |                     |                                |
| Wind direction                      | degrees             | hourly              | Norwegian Meteorological Int   |
| Wind speed                          | m/s                 | "                   | "                              |
| Air temperature                     | °C                  | "                   | "                              |
| Observed tide                       | cm                  | "                   | Norwegian Hydrographic Service |
| <i>Modeled variables:</i>           |                     |                     |                                |
| Glacial meltwater                   | m <sup>3</sup> /day | daily               | Norwegian Polar Institute      |
| Glacial runoff                      | m <sup>3</sup> /day | "                   | "                              |
| <i>Visually assessed variables:</i> |                     |                     |                                |
| Sea ice coverage                    | Nominal             | hourly              | -                              |
| Sea ice density                     | "                   | "                   | -                              |
| Plume opening                       | "                   | "                   | -                              |
| Visibility                          | "                   | "                   | -                              |
| Sun on glacier                      | "                   | "                   | -                              |



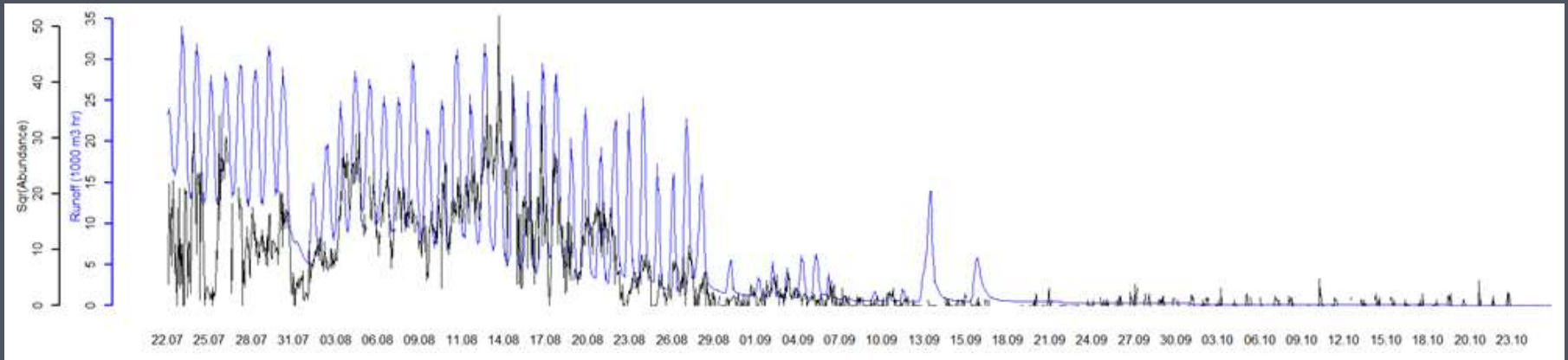
# Temporal variation

| Score                   | Description   |
|-------------------------|---|
| <b>PLUME OPENING</b>    |   |
| 2                       | Opening, clearly visible  |
| 1                       | Marginal opening, barely visible                                    |
| 0                       | No opening  |
| <b>SEA ICE COVERAGE</b> |   |
| 5                       | 0-20% ice cover   |
| 4                       | 20-40% ice cover  |
| 3                       | 40-60% ice cover  |
| 2                       | 60-80% ice cover  |
| 1                       | 80-100% ice cover   |
| <b>SEA ICE DENSITY</b>  |   |
| 3                       | Loose   |
| 2                       | Semi-packed   |
| 1                       | Packed  |
| <b>VISIBILITY</b>       |   |
| 5                       | Sharp picture and no obstacles                                      |
| 4                       | Good visibility, but slightly reduced due to sharpness or obstacles |
| 3                       | Reasonable visibility to make a fair abundance estimate             |
| 2                       | Nearly impossible to estimate abundance                             |
| 1                       | Impossible to estimate abundance                                    |
| <b>SUN ON GLACIER</b>   |   |
| 2                       | Sunny weather   |
| 1                       | Partly sunny weather  |
| 0                       | Not sunny weather   |



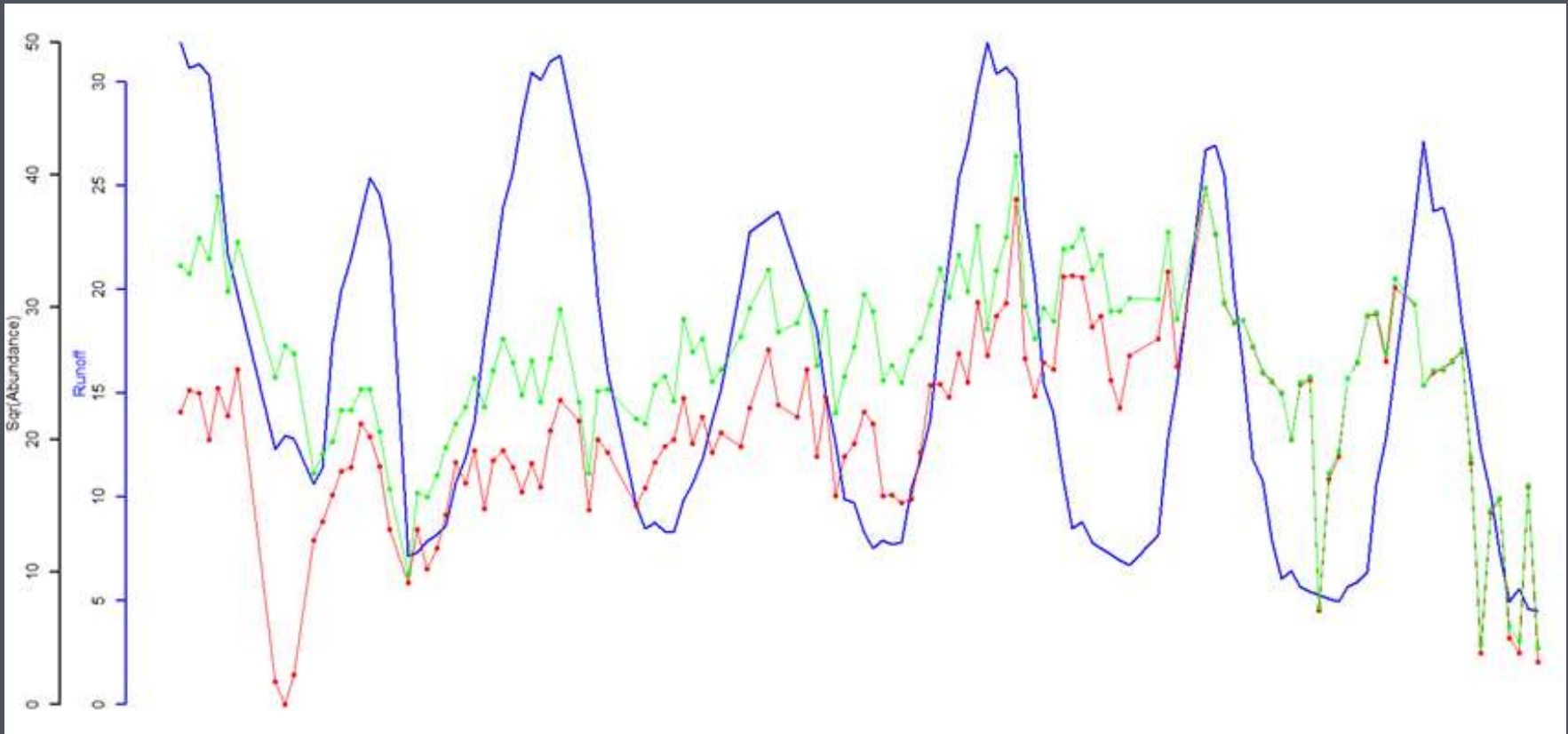
# Temporal variation 2014

Preliminary results...



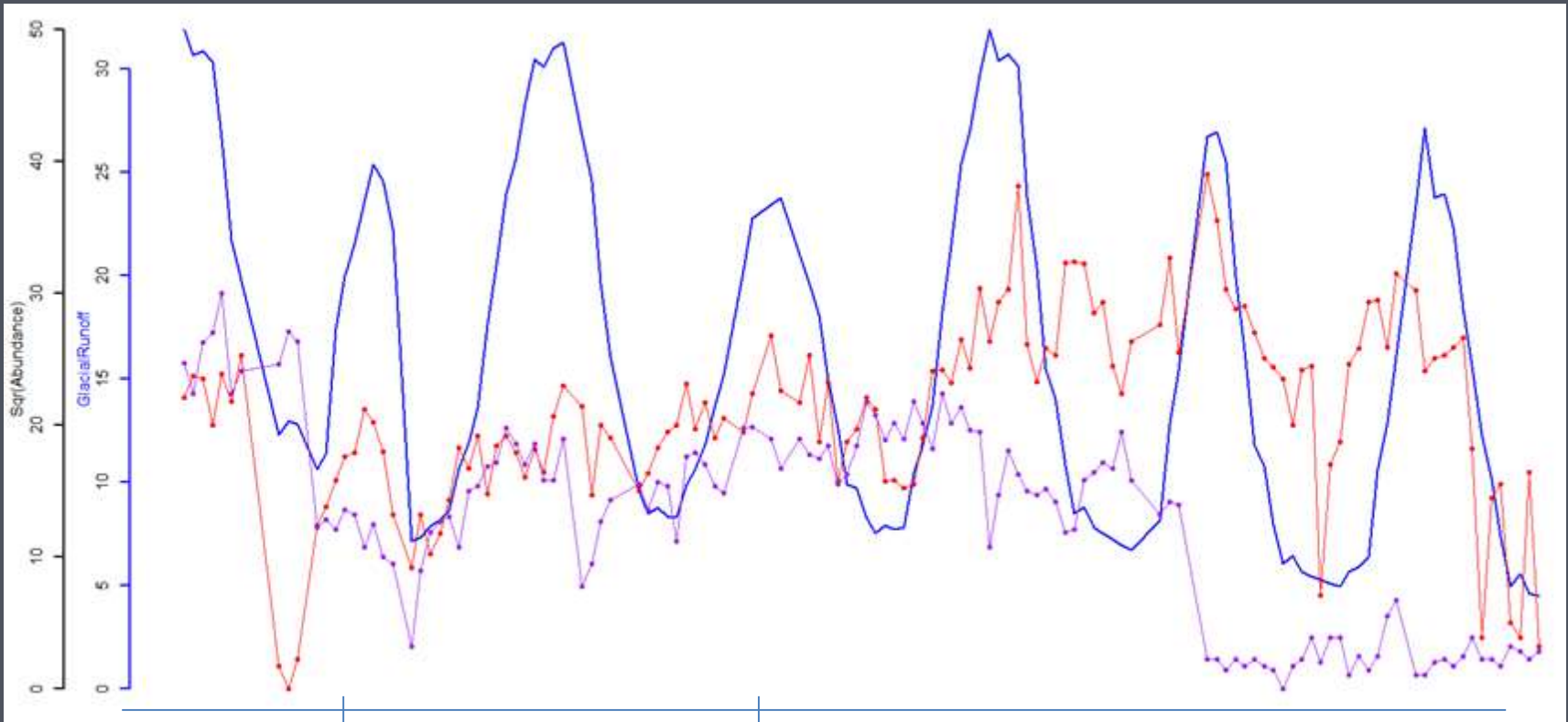
Strøm and Descamps *in prep.*

# Temporal variation 2014



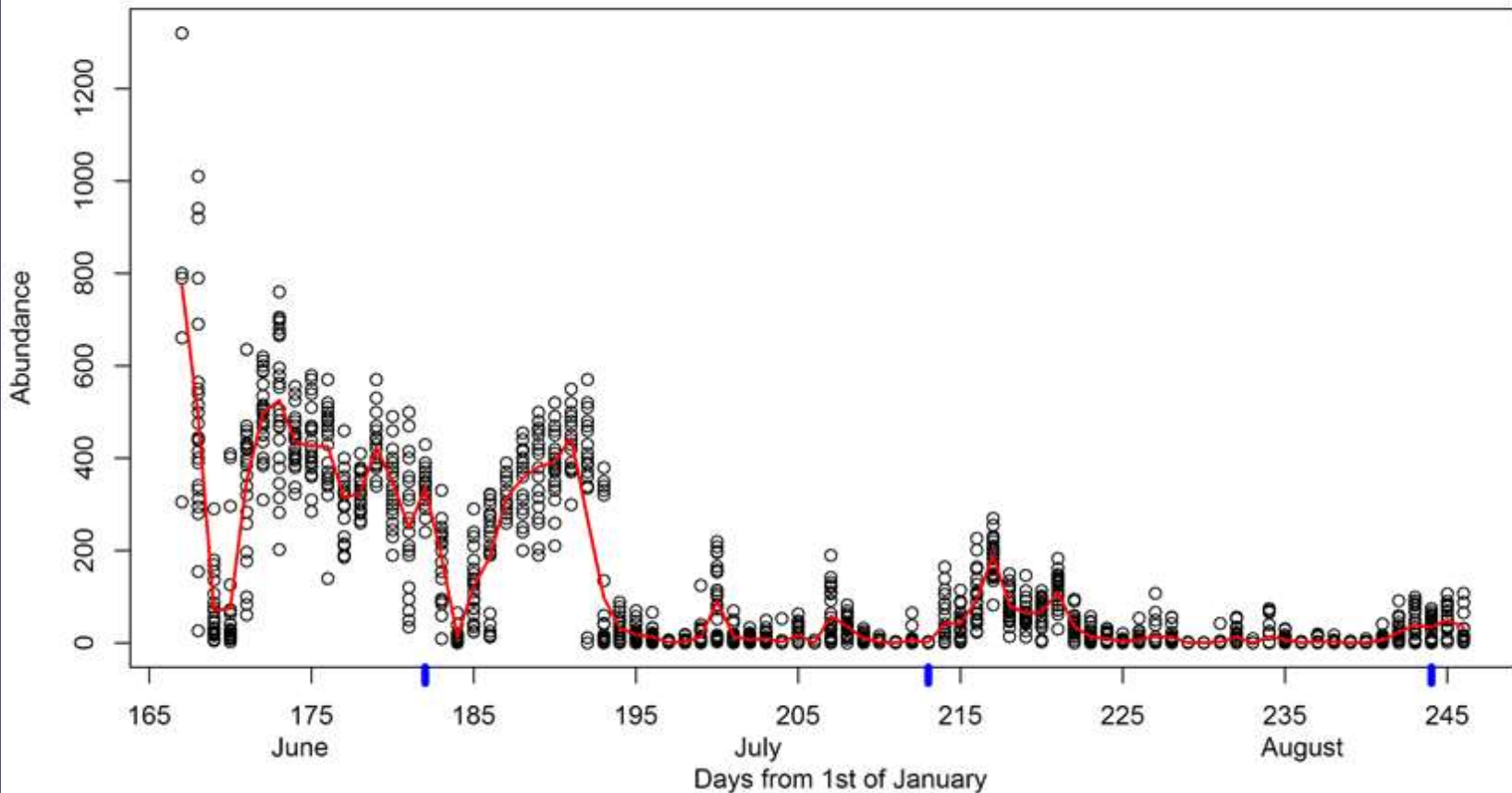


# Temporal variation 2014



Strøm and Descamps *in prep.*

# Temporal variation 2015





# Kittiwake foraging





Strøm and Descamps *in prep.*



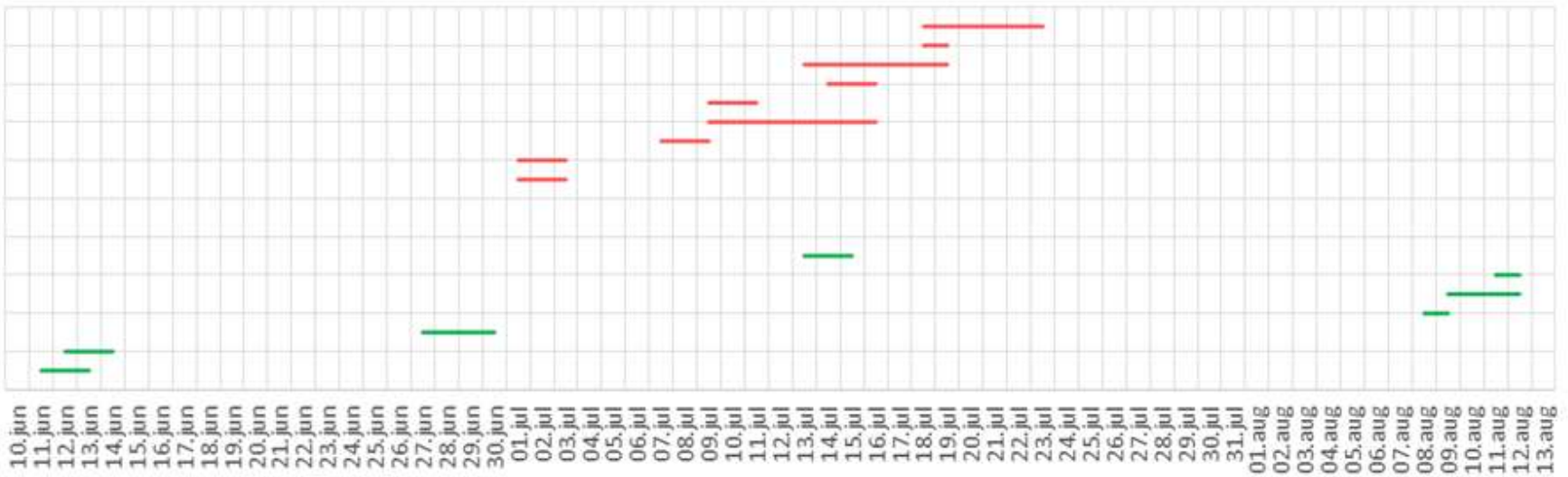
# Kittiwake foraging



Strøm and Descamps *in prep.*



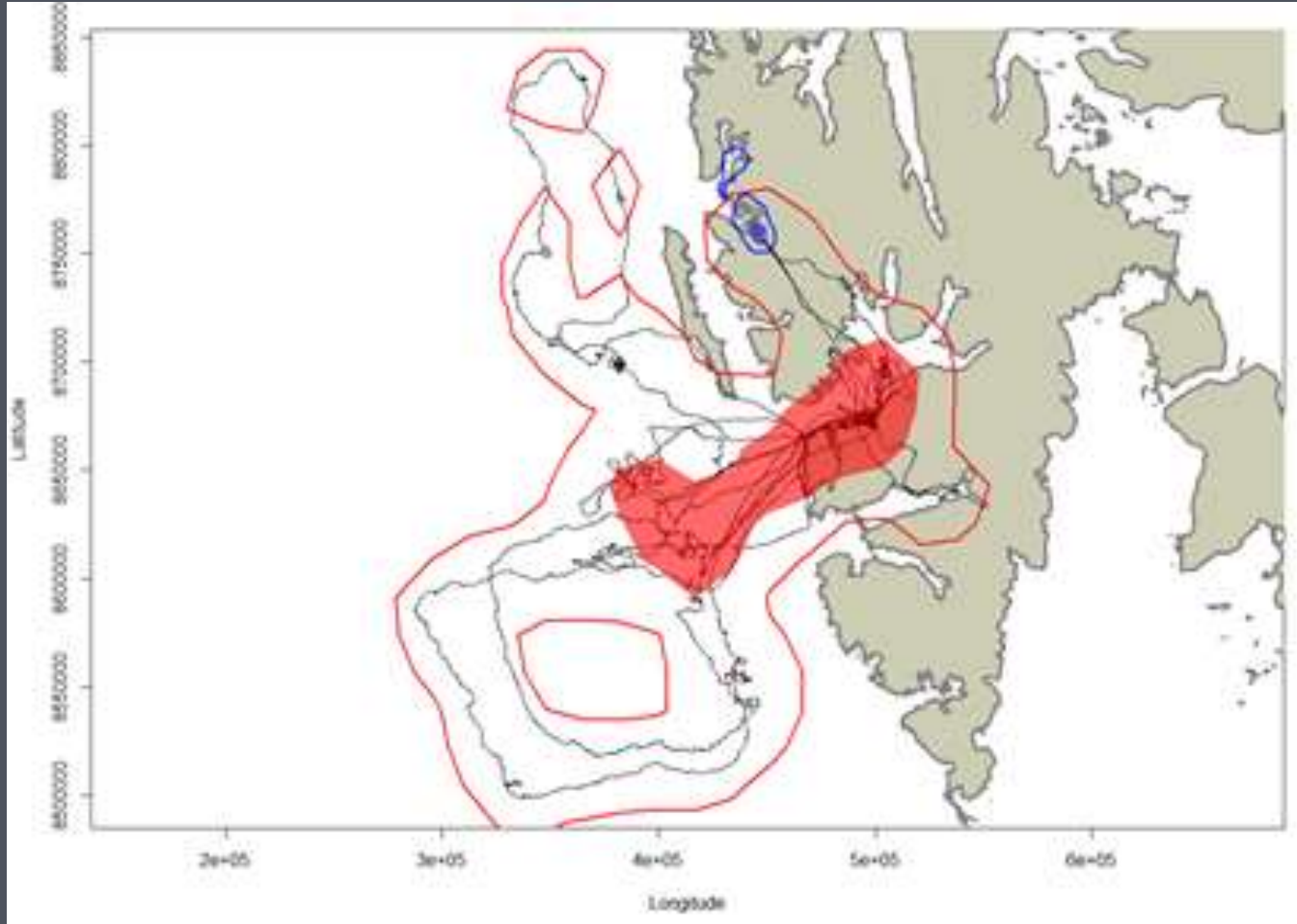
# Kittiwake foraging 2014



Strøm and Descamps *in prep.*



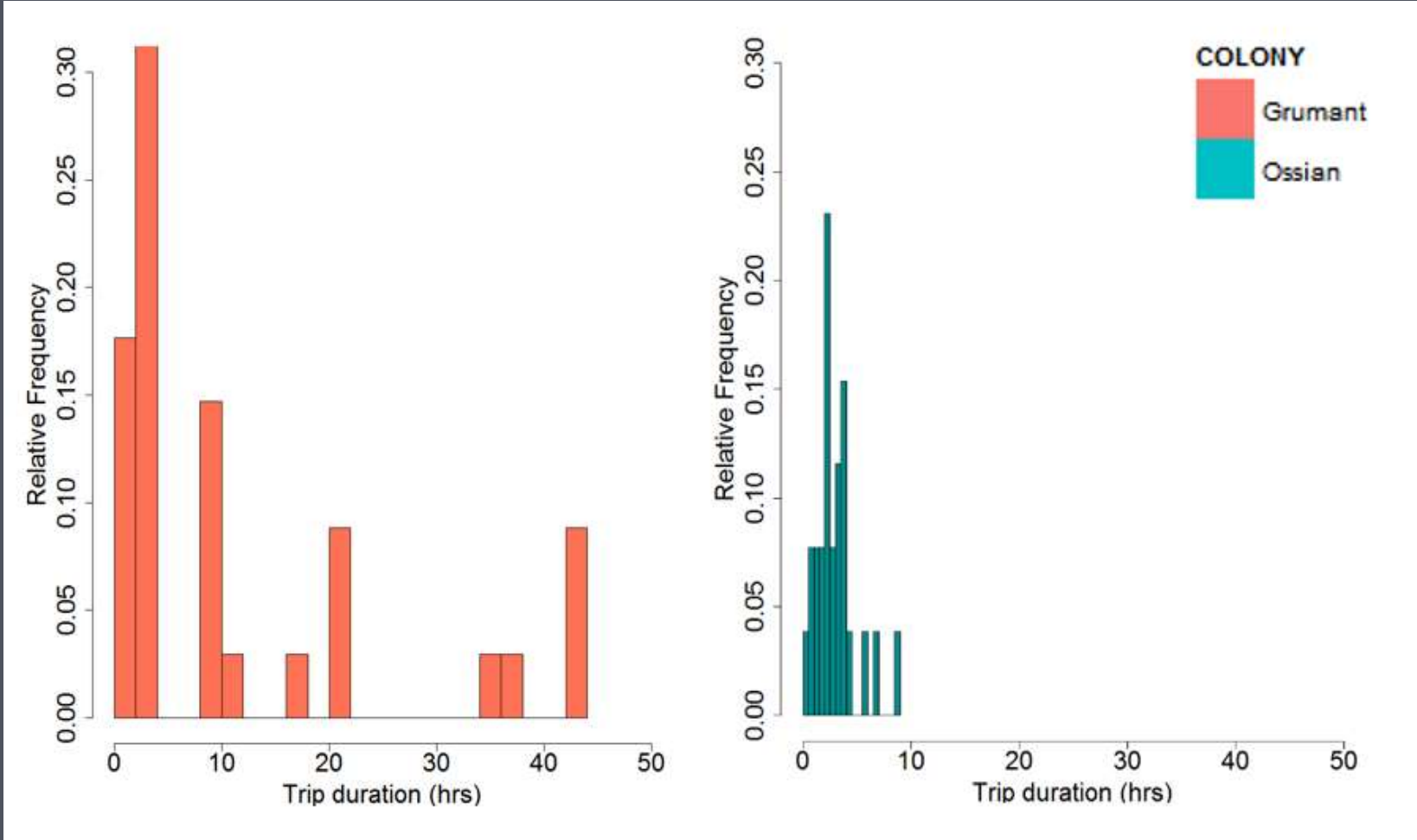
# Kittiwake foraging 2014



Strøm and Descamps *in prep.*

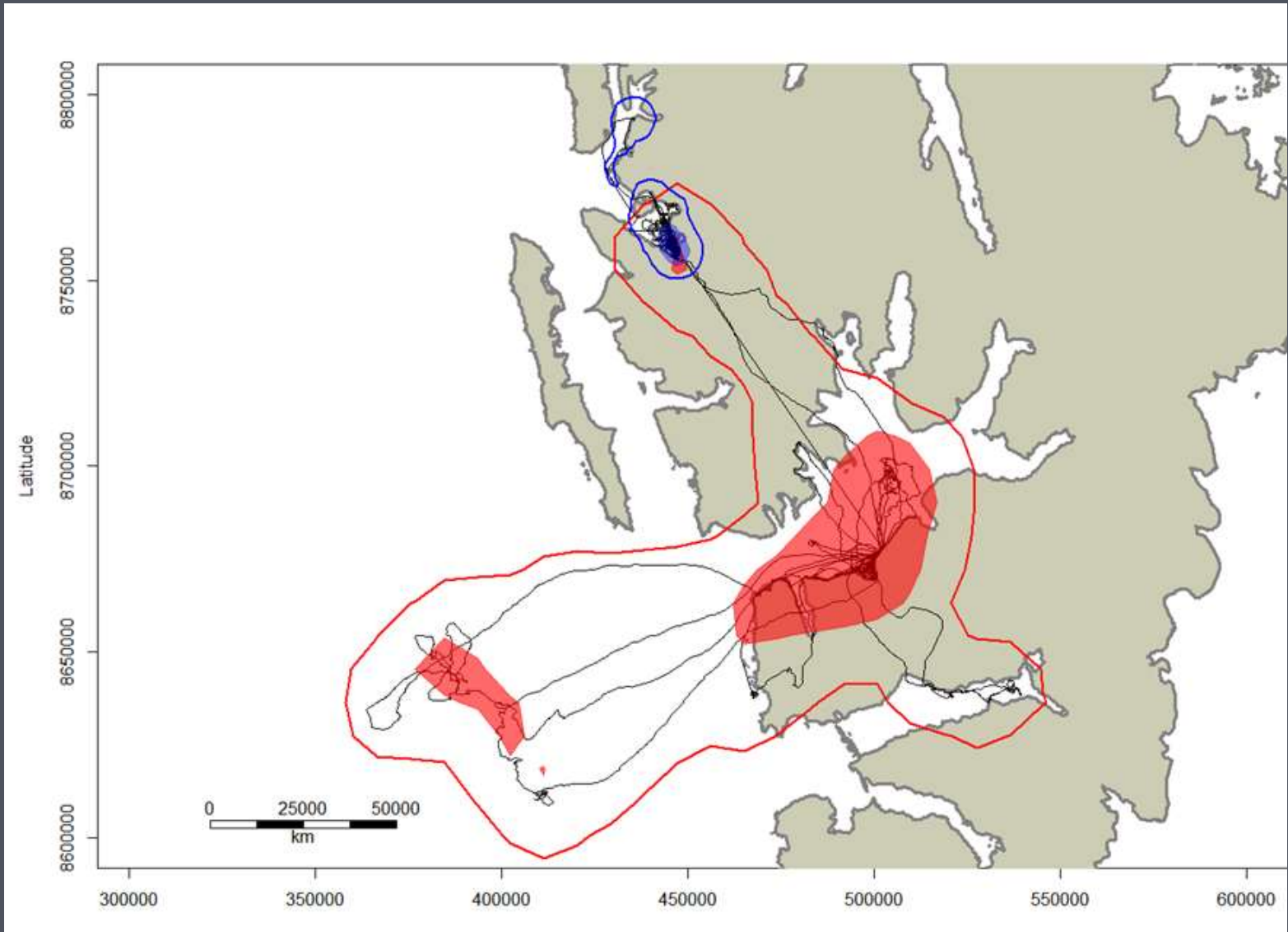


# Kittiwake foraging 2014



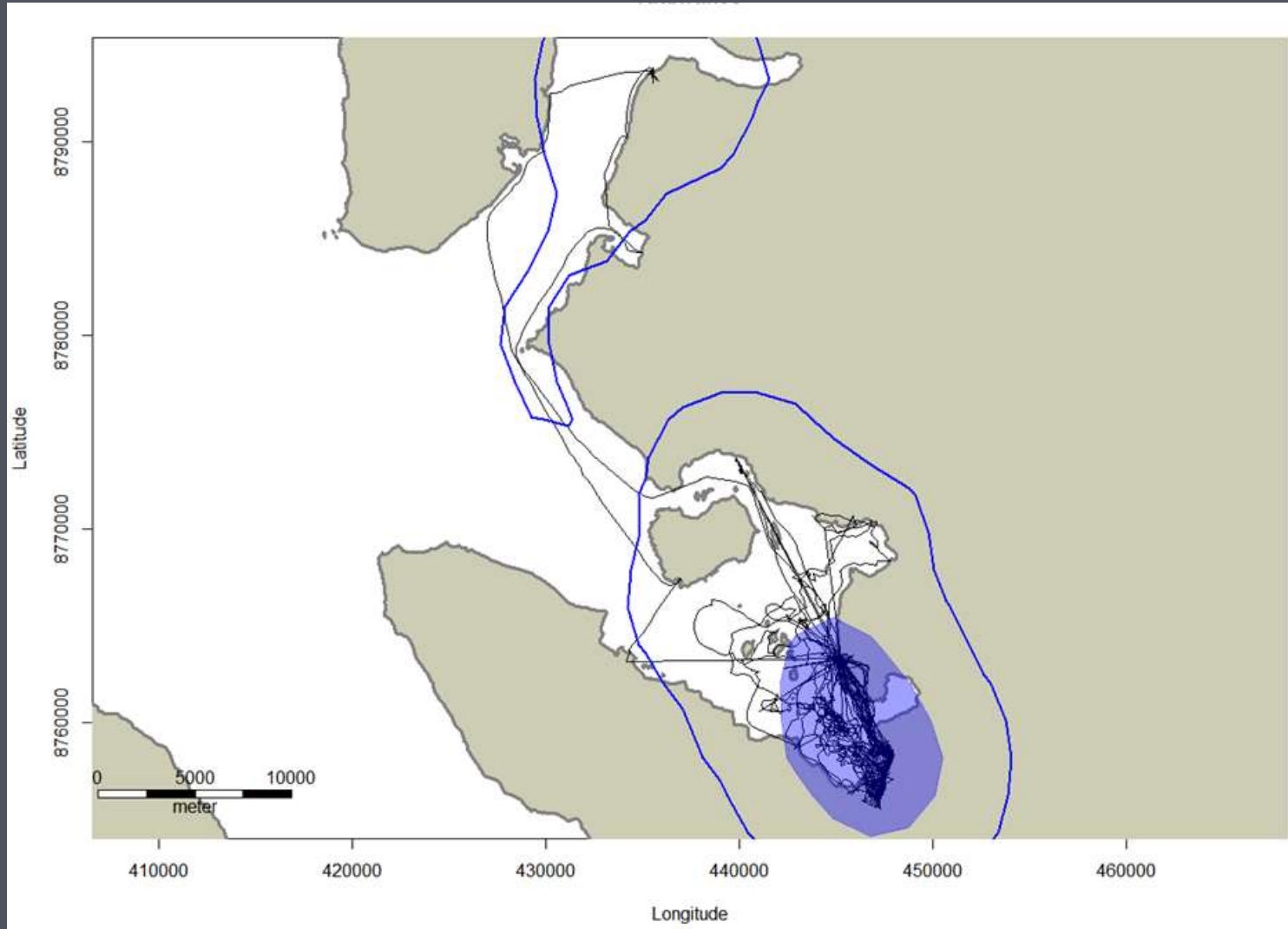


# Kittiwake foraging 2014





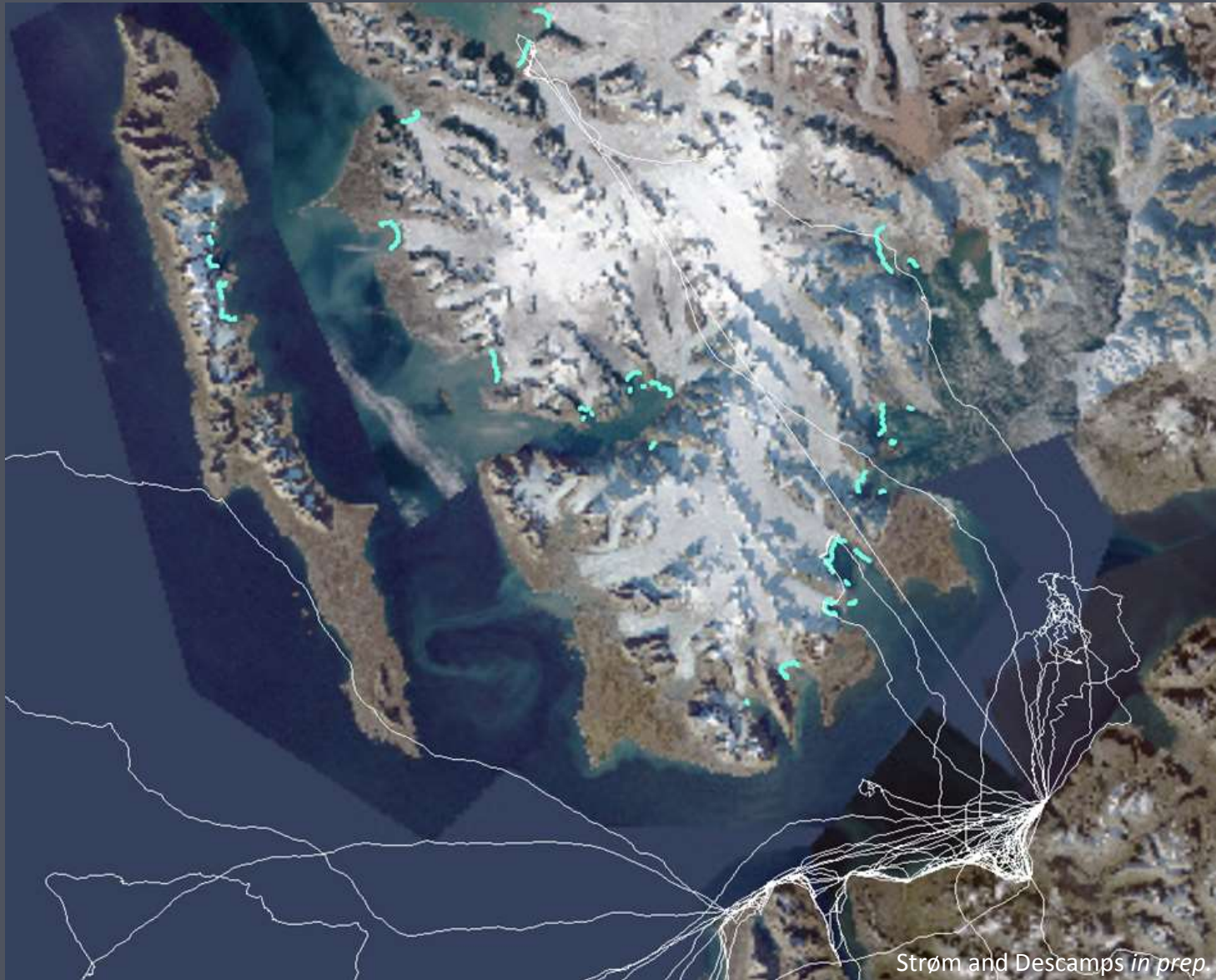
# Kittiwake foraging 2014







# Kittiwake foraging 2014



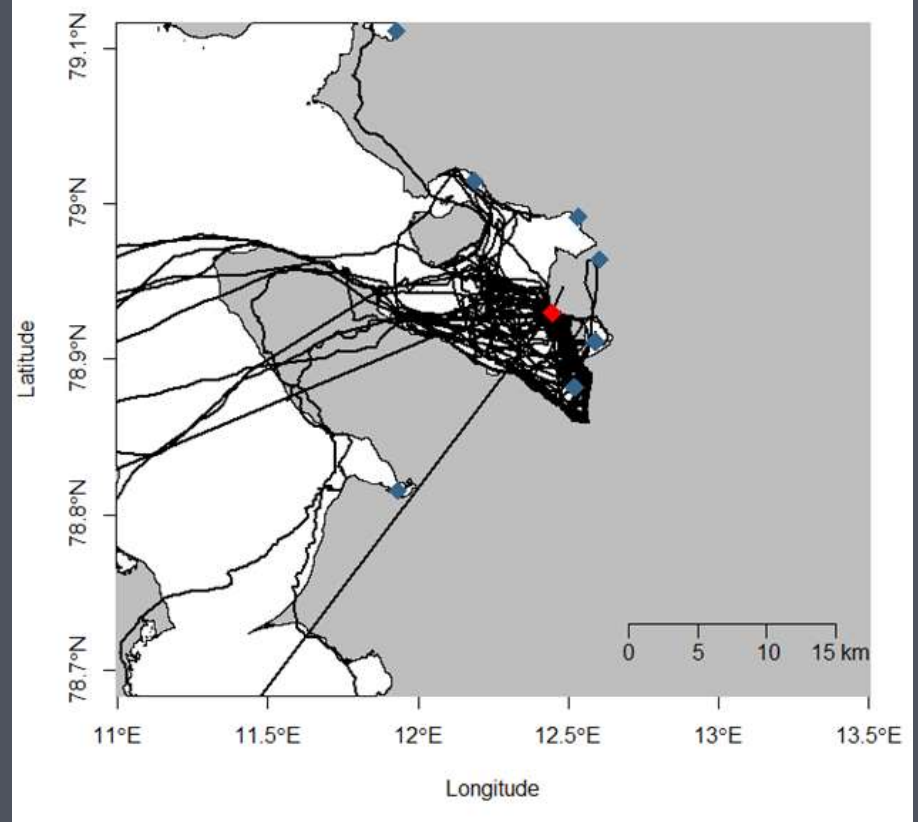
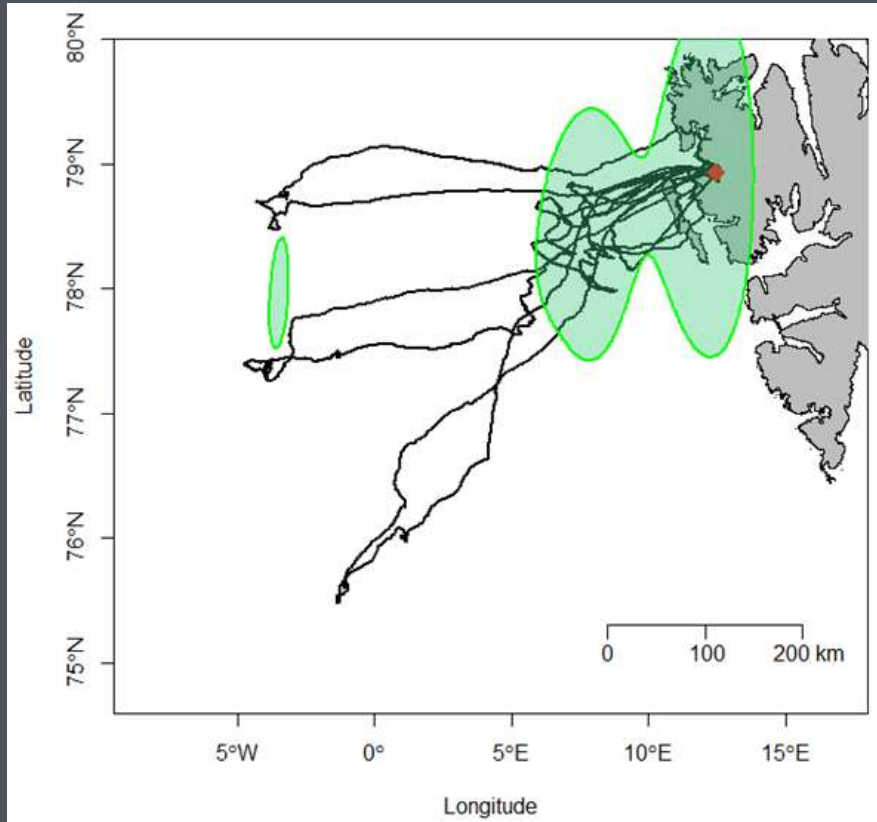
Strøm and Descamps *in prep.*

# Kittiwake foraging 2014





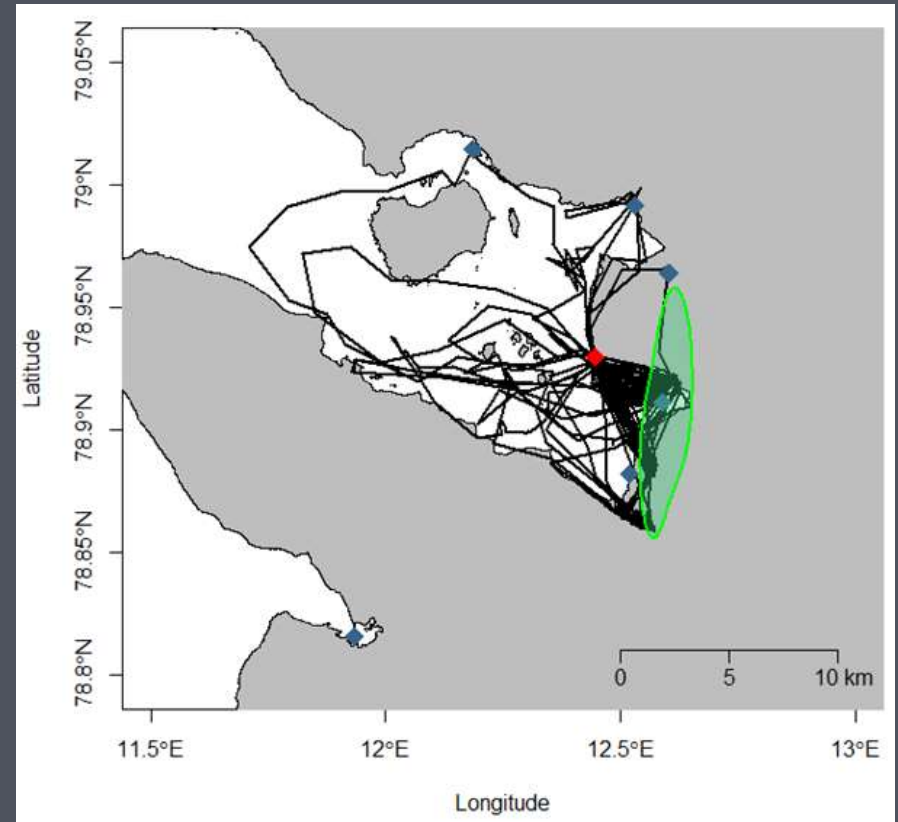
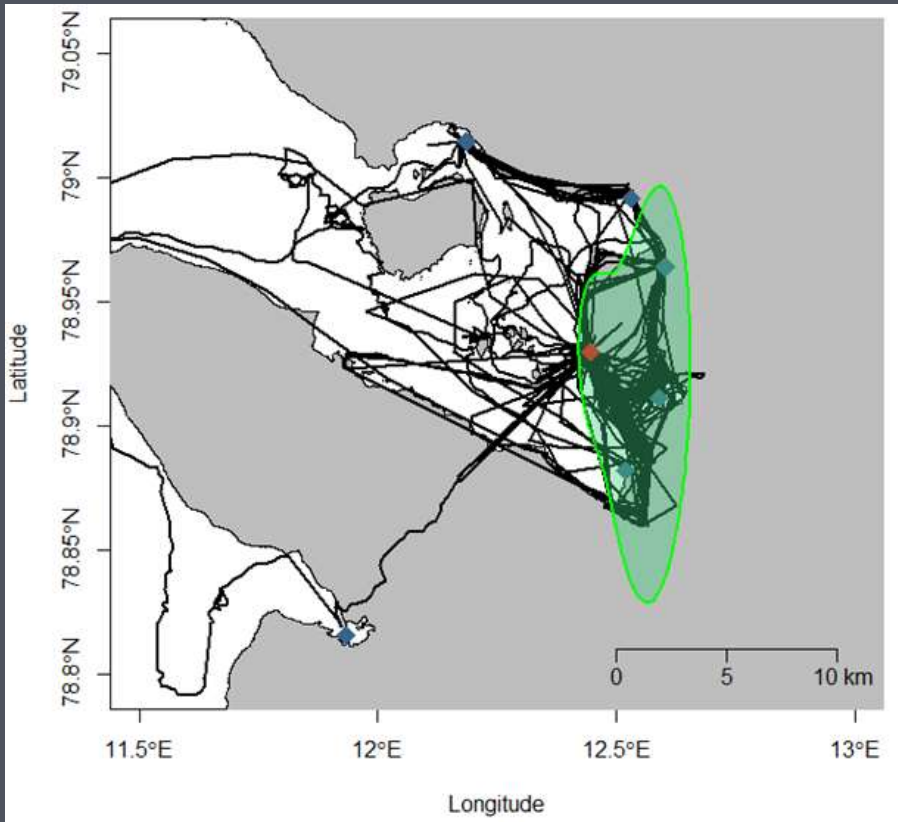
# Kittiwake foraging 2015



Strøm and Descamps *in prep.*



# Kittiwake foraging 2015



Strøm and Descamps *in prep.*