Using state-space models to discriminate foraging areas in Northwest Atlantic grey seals.

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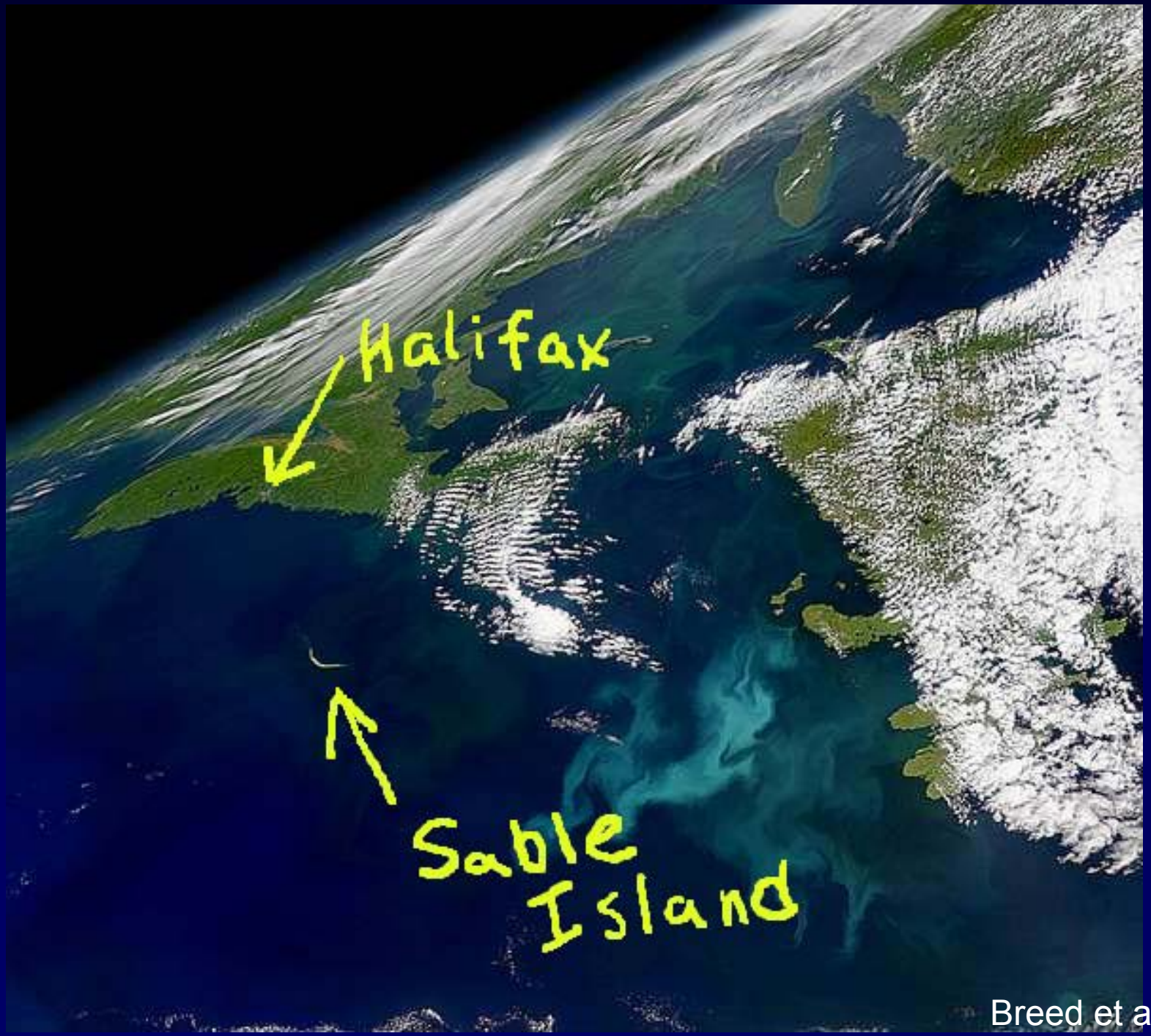

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Question:

Which areas of the Scotian Shelf are most important grey seal foraging habitat?

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State Space Models

Measurement Equation

- Relates imperfect observations to true position

Error distribution function

$$y_t = h(\alpha_t, \varepsilon_t)$$

observed location

true location

Transition Equation

- Predicts next true location via behavioral a model

$$\alpha_t = f(\alpha_{t\text{-}1}, \eta_t; \gamma)$$

movement function

parameters

Integrate using Baysian MCMC methods using **WinBUGS**

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Movement (Transition) Equation

- First difference correlated random walk

$$d_t = \gamma T(\theta) d_{t-1} + N_2(0,\Sigma)$$

$$\alpha_t = \alpha_{t-1} + d_t$$

Observation Equation

$$y_t = \text{t-distribution}\ (\alpha_t\ ,\ \sigma_t,\ \upsilon_t\ )$$

Plus an algorithm to regularize estimated locations in time

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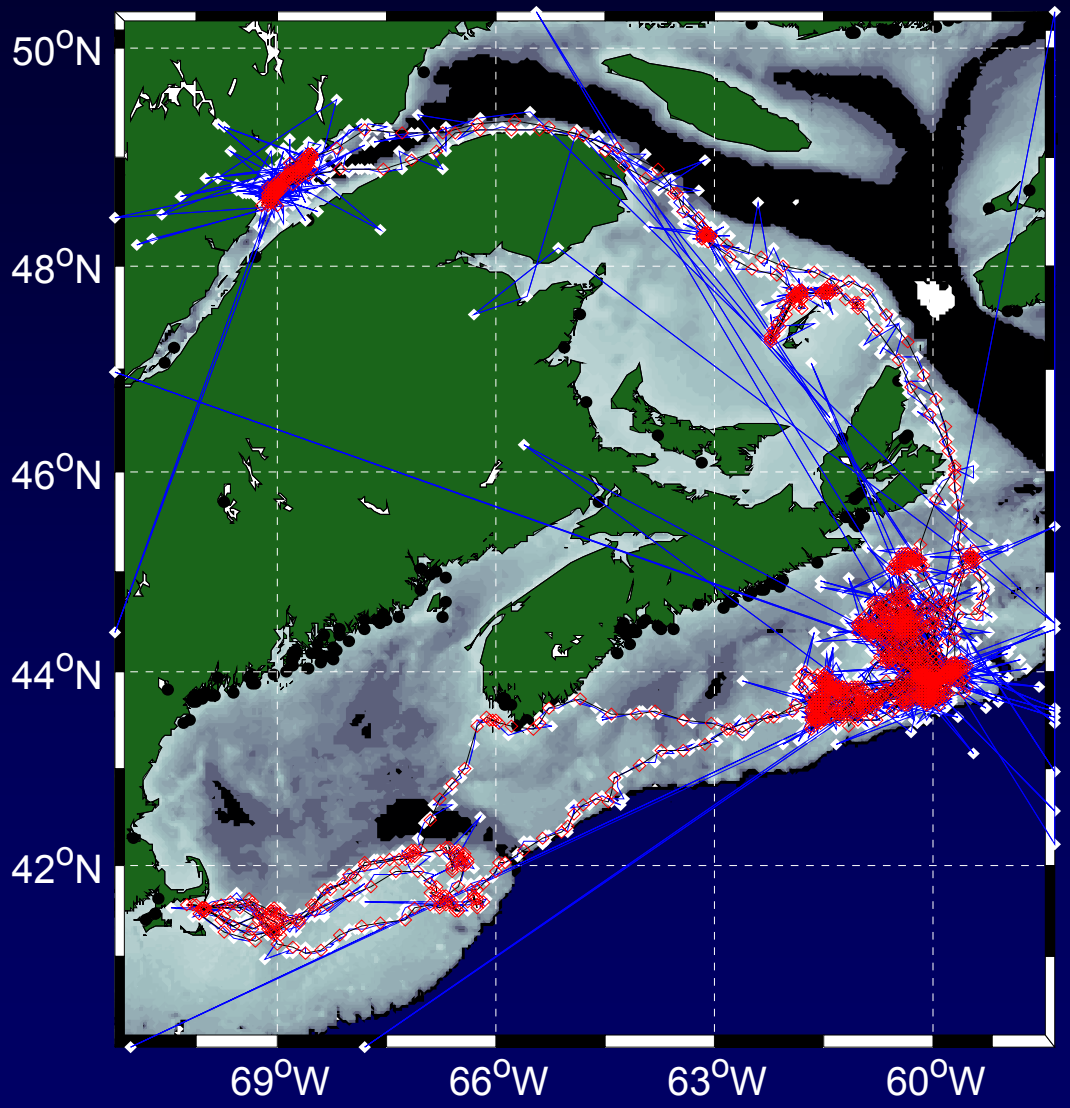
Location Estimates

- Estimate locations using first-difference CRW
- Removes error & regularizes time step
- 480 minute time step (3 d^{-1})
- First difference correlated random walk (no switching)



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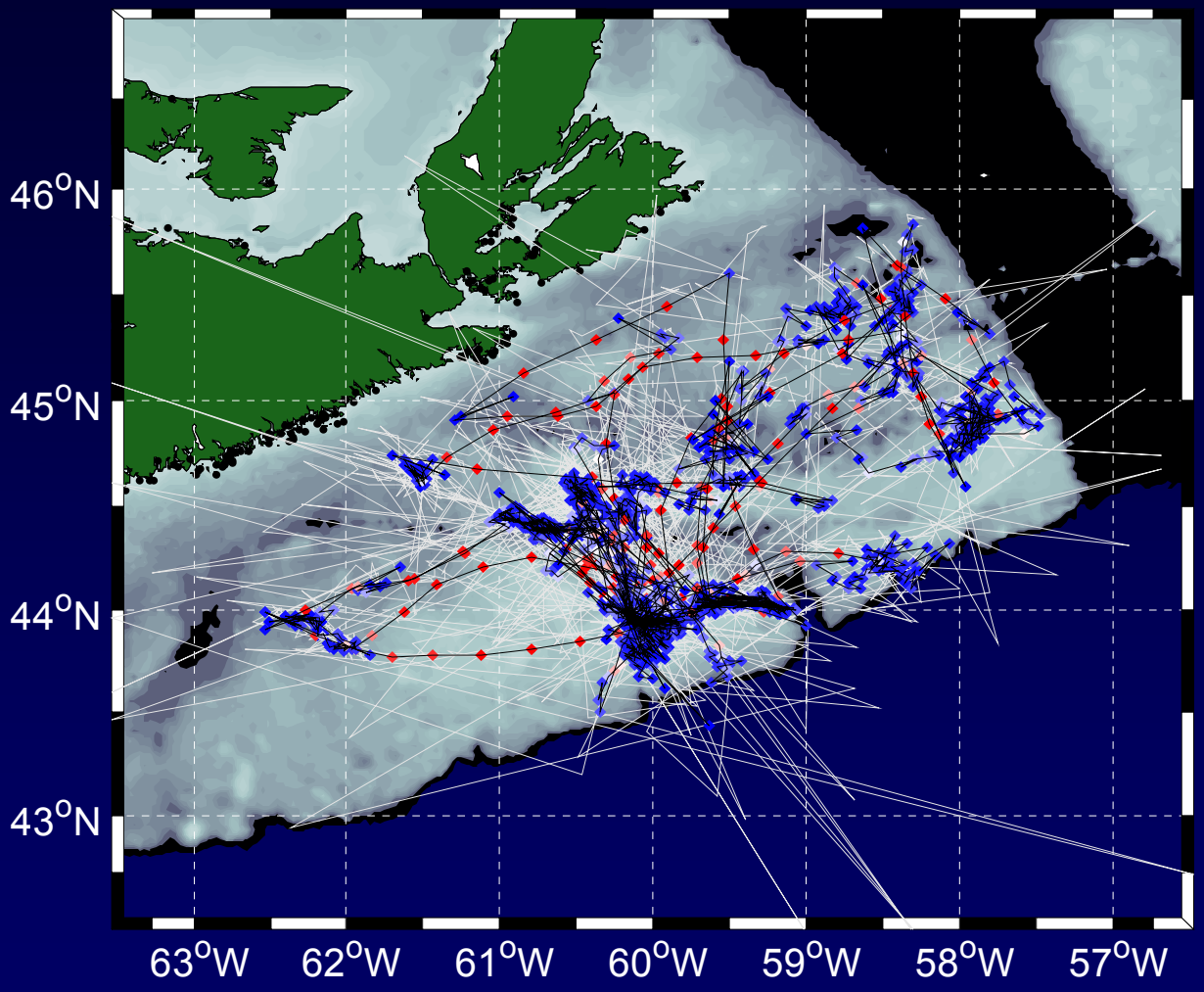

First difference
w/ 2 behavioural states

- Switches on

  - Turning angle ($\theta_{1,2}$)
    - 0 ° for ‘migratory’
    - 180° for ‘foraging’

  - Direction & velocity correlation to (d_{t-1})

    $\gamma_{1,2}$

    - 1 for ‘migratory’
    - (-1) for ‘foraging’

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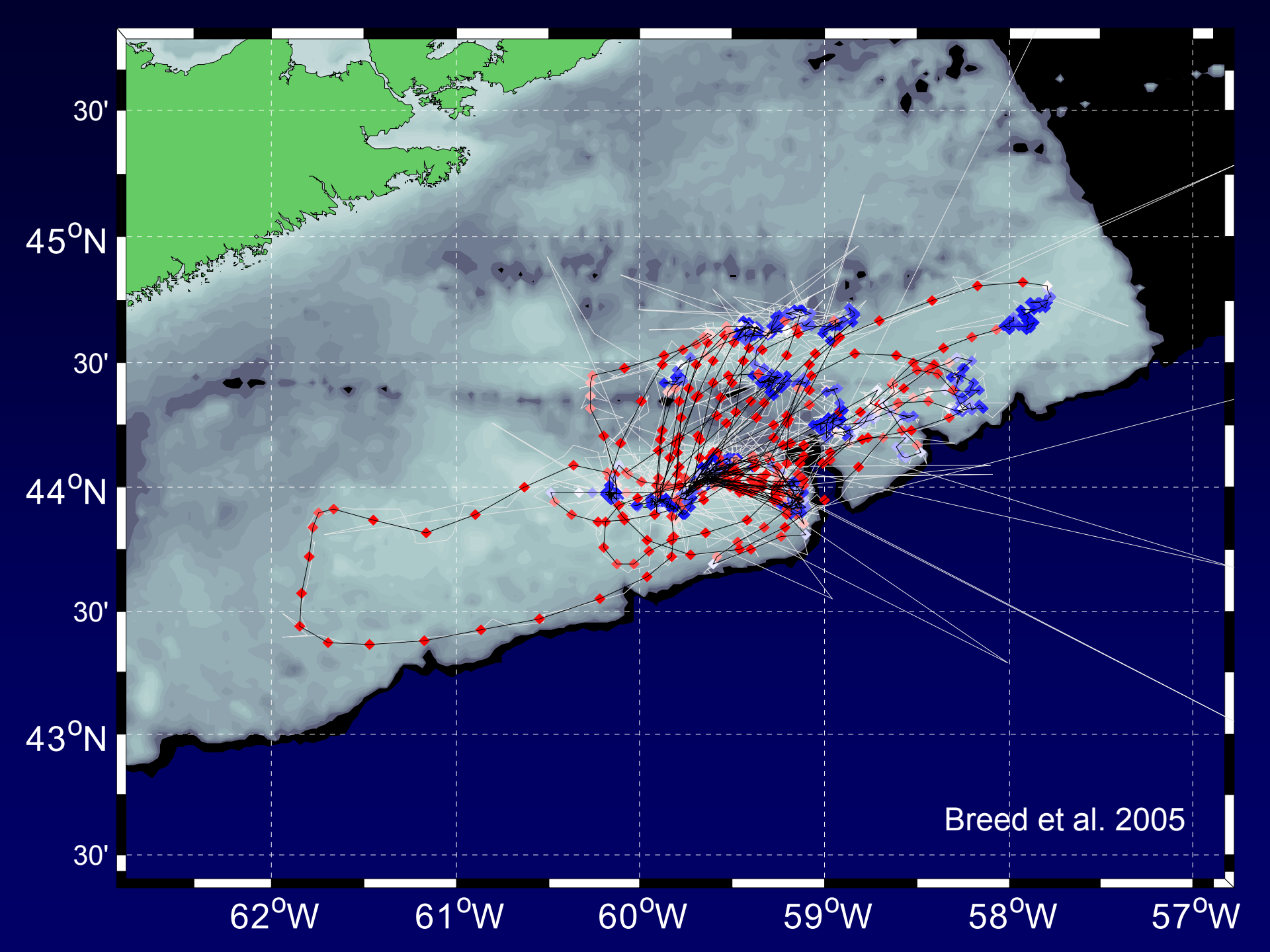
30'
45°N
30'
44°N
30'
43°N
30'
62°W
61°W
60°W
59°W
58°W
57°W
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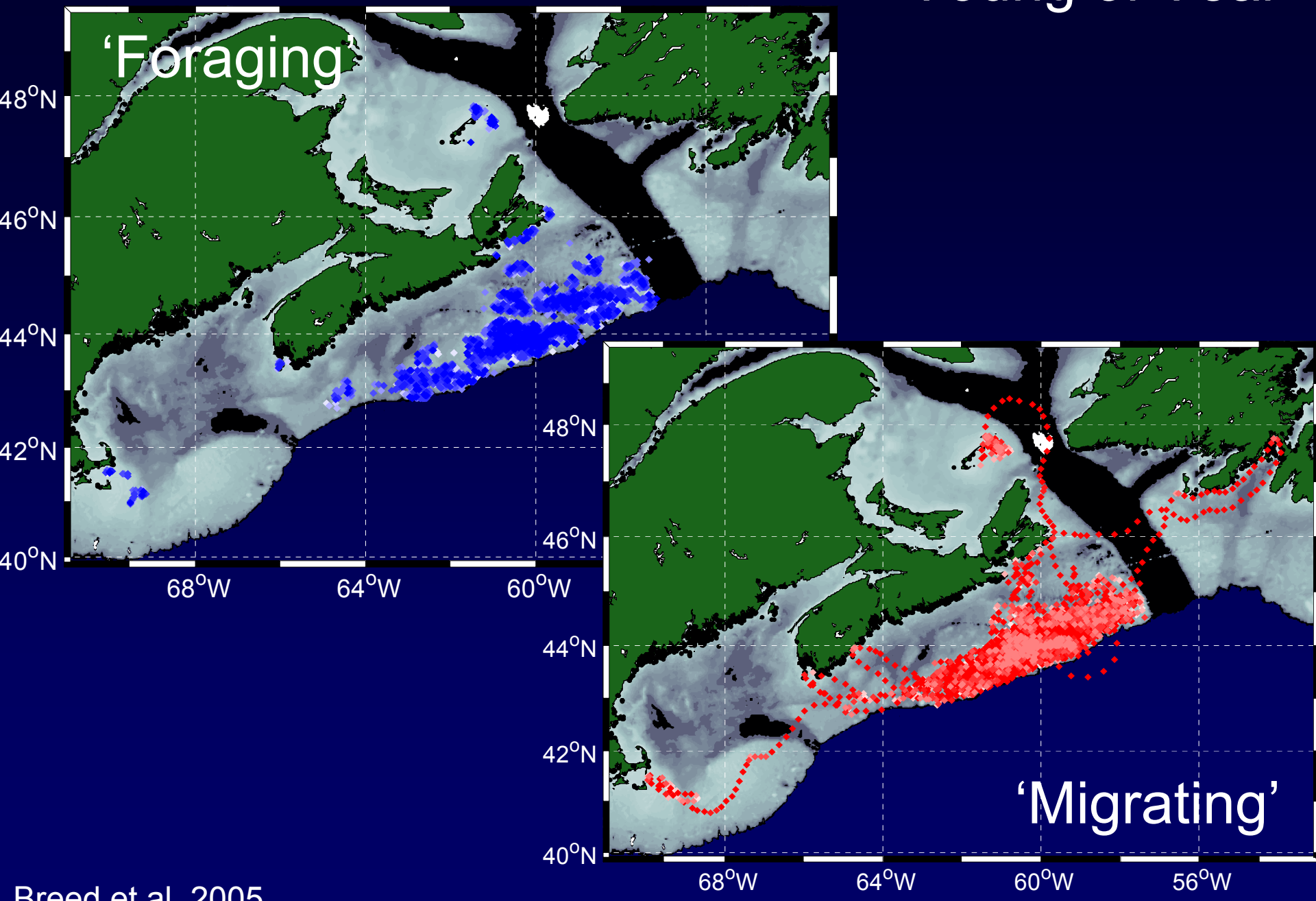
Young of Year



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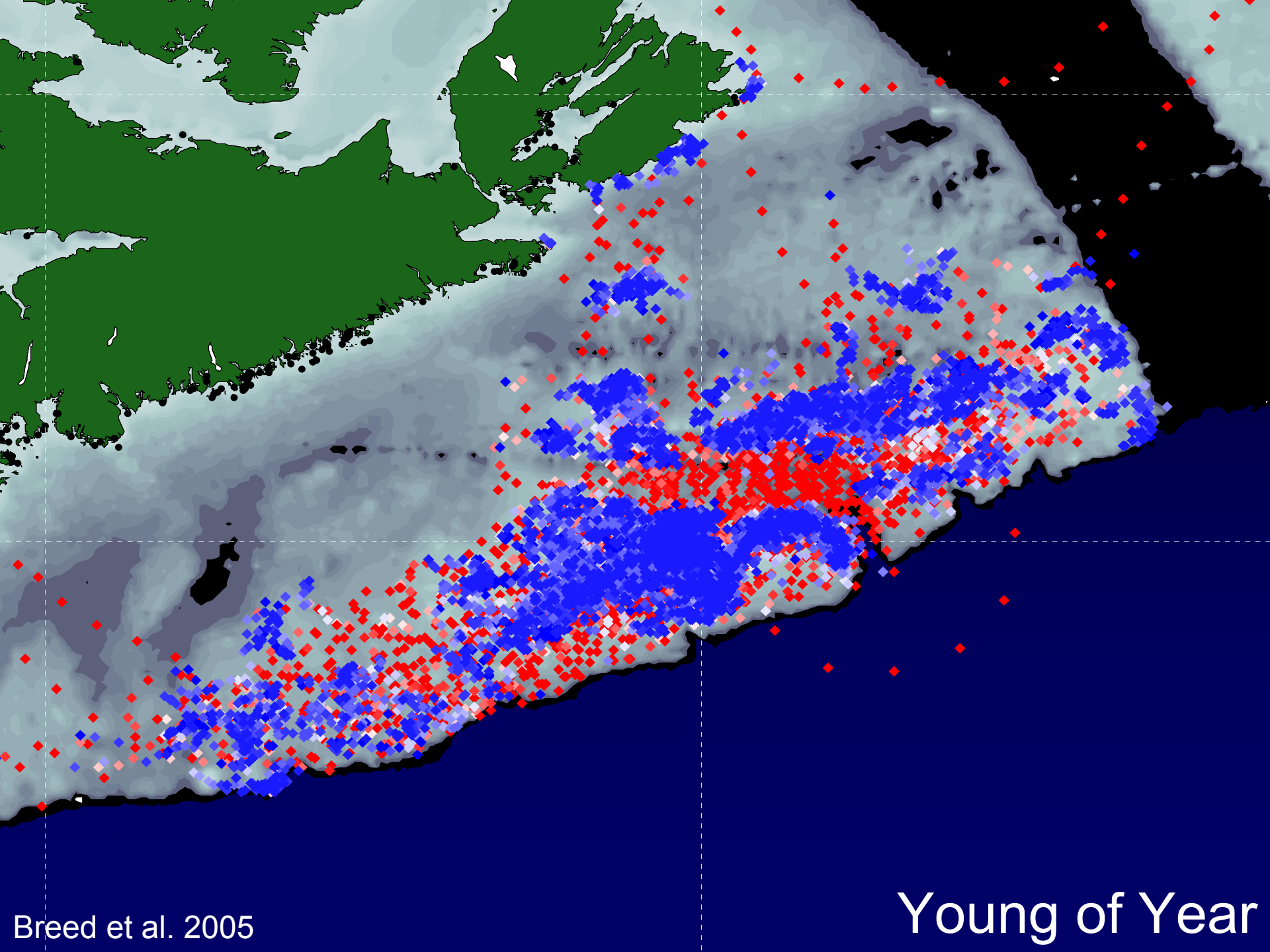
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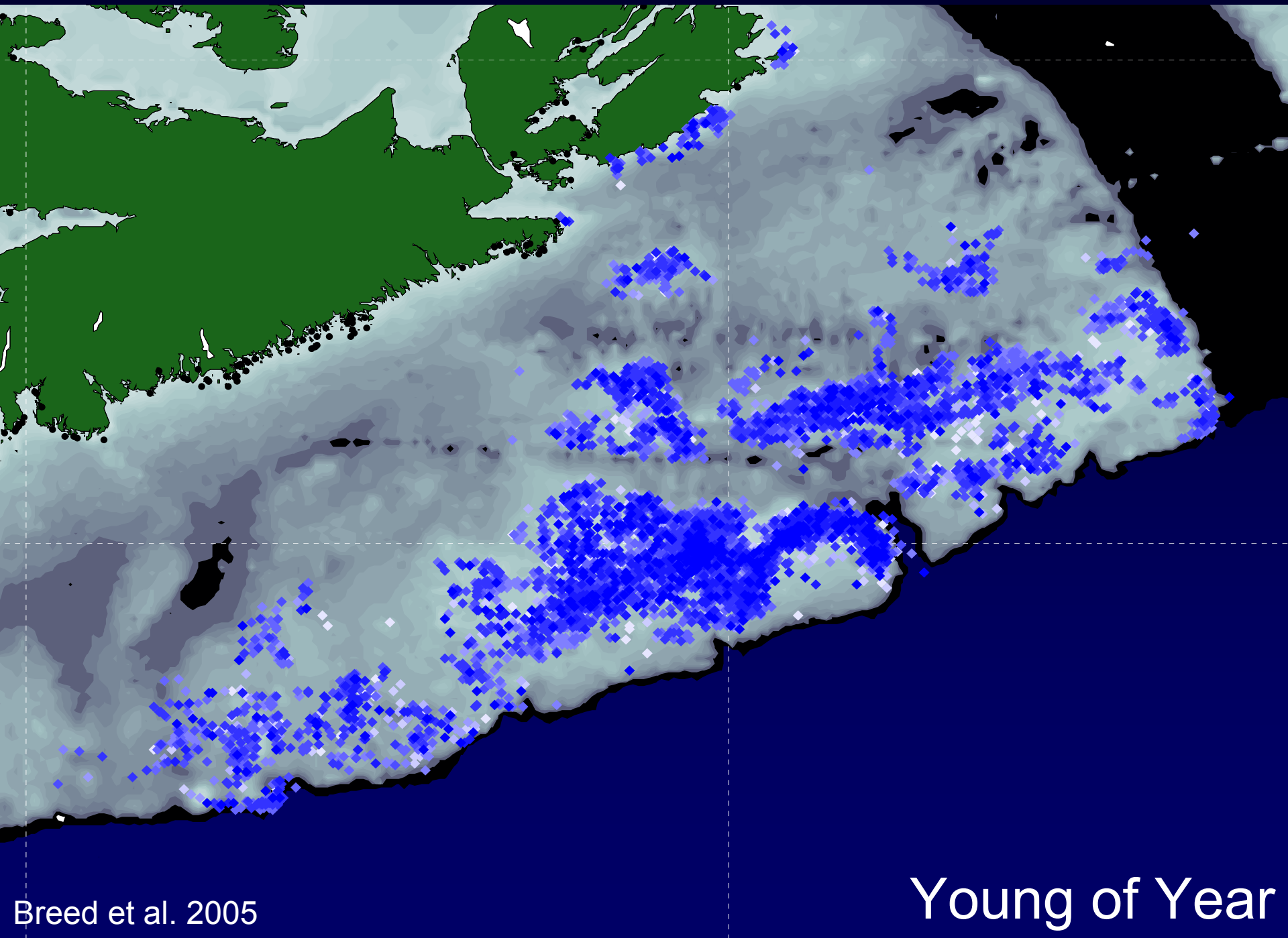
Young of Year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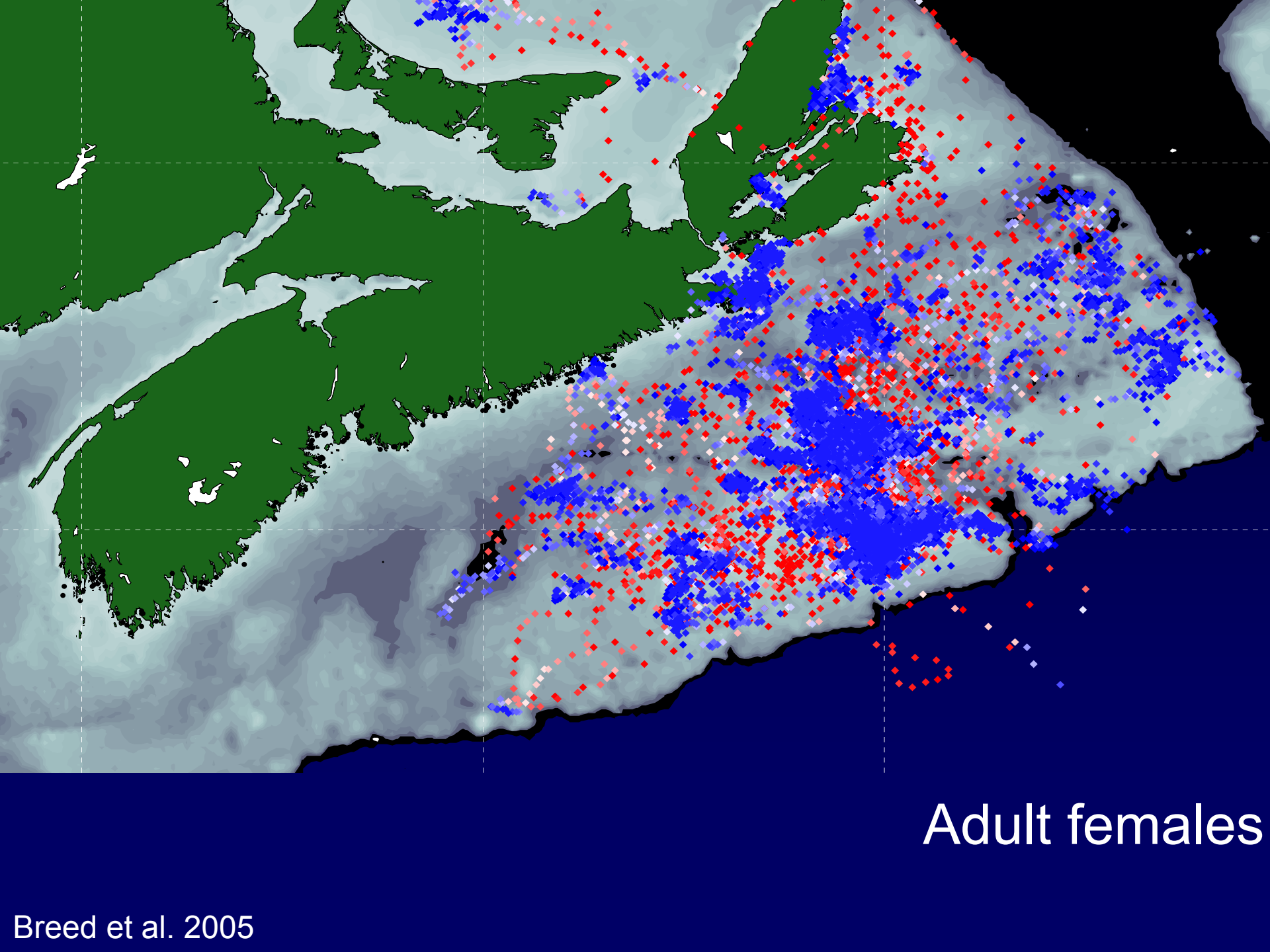
Young of Year



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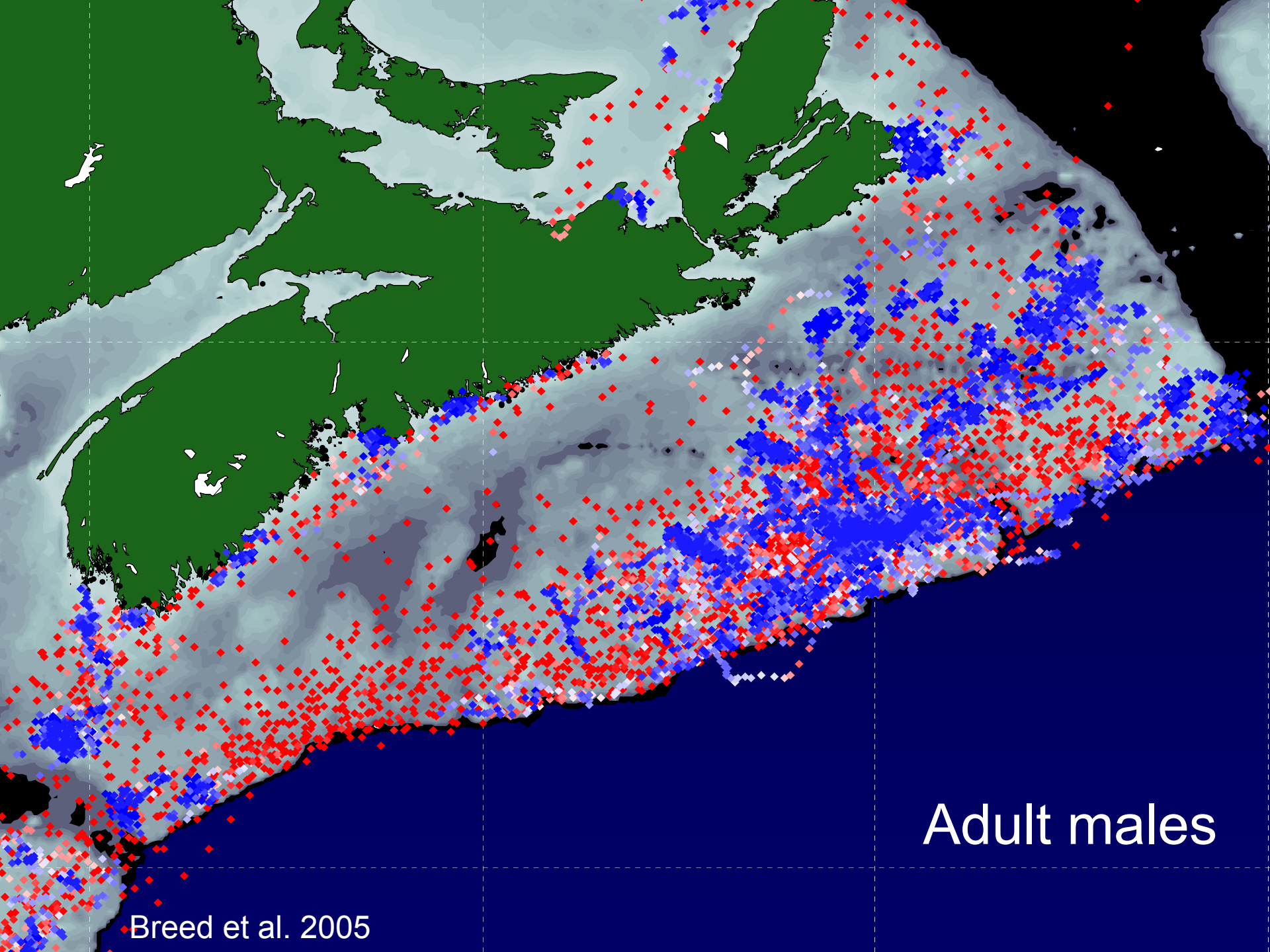
Adult males
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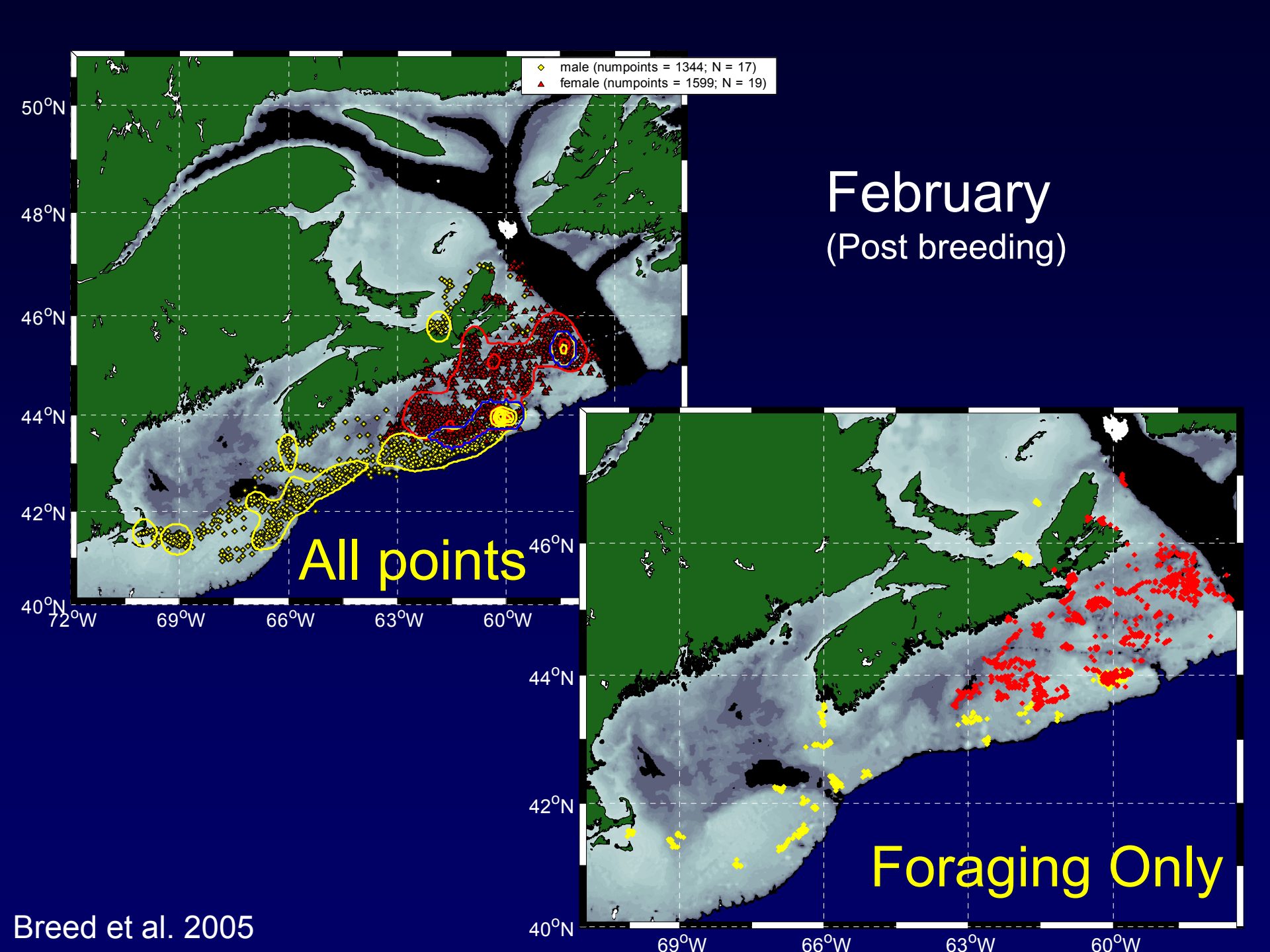

February
(Post breeding)

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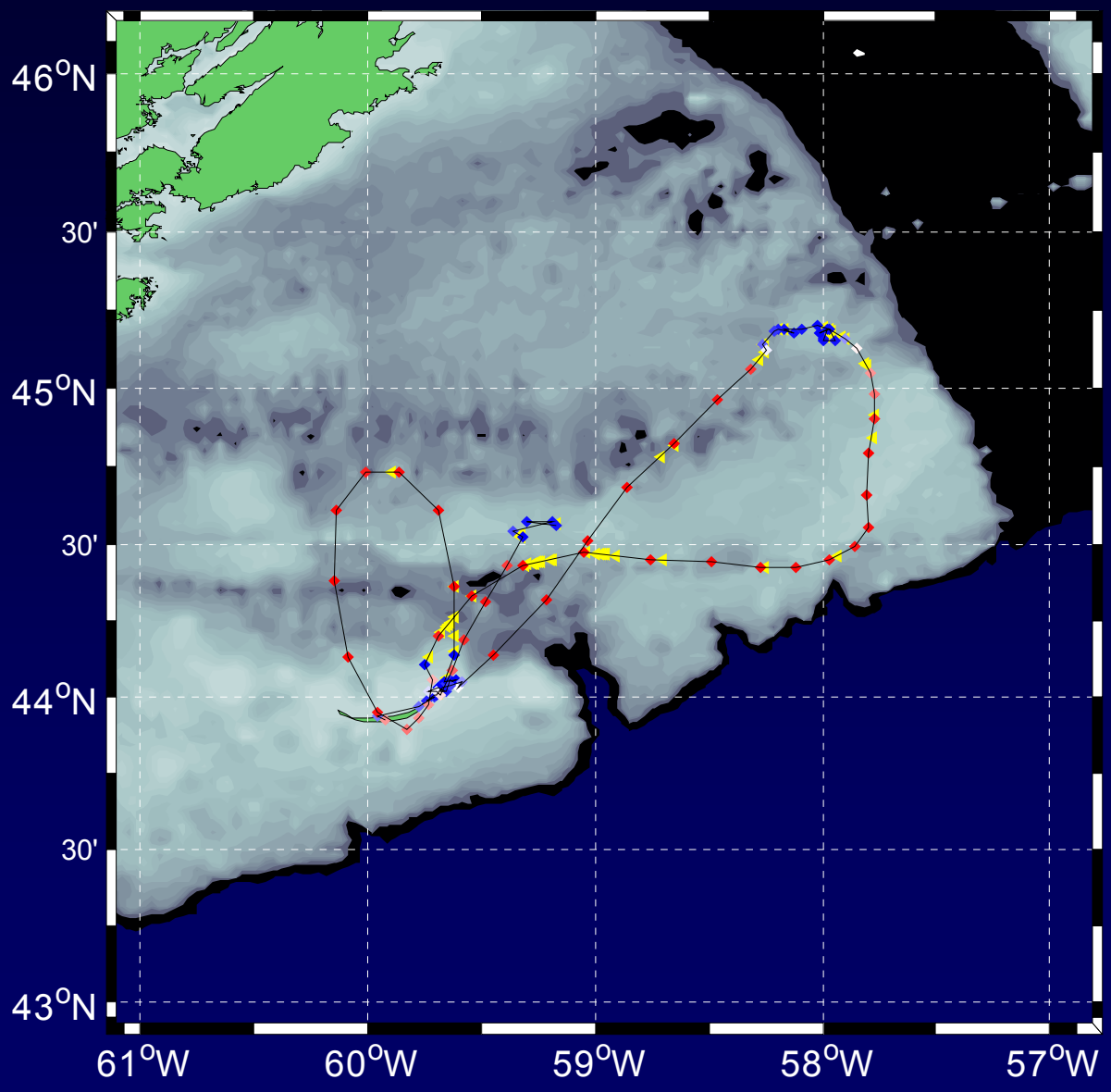
Stomach temperature validation



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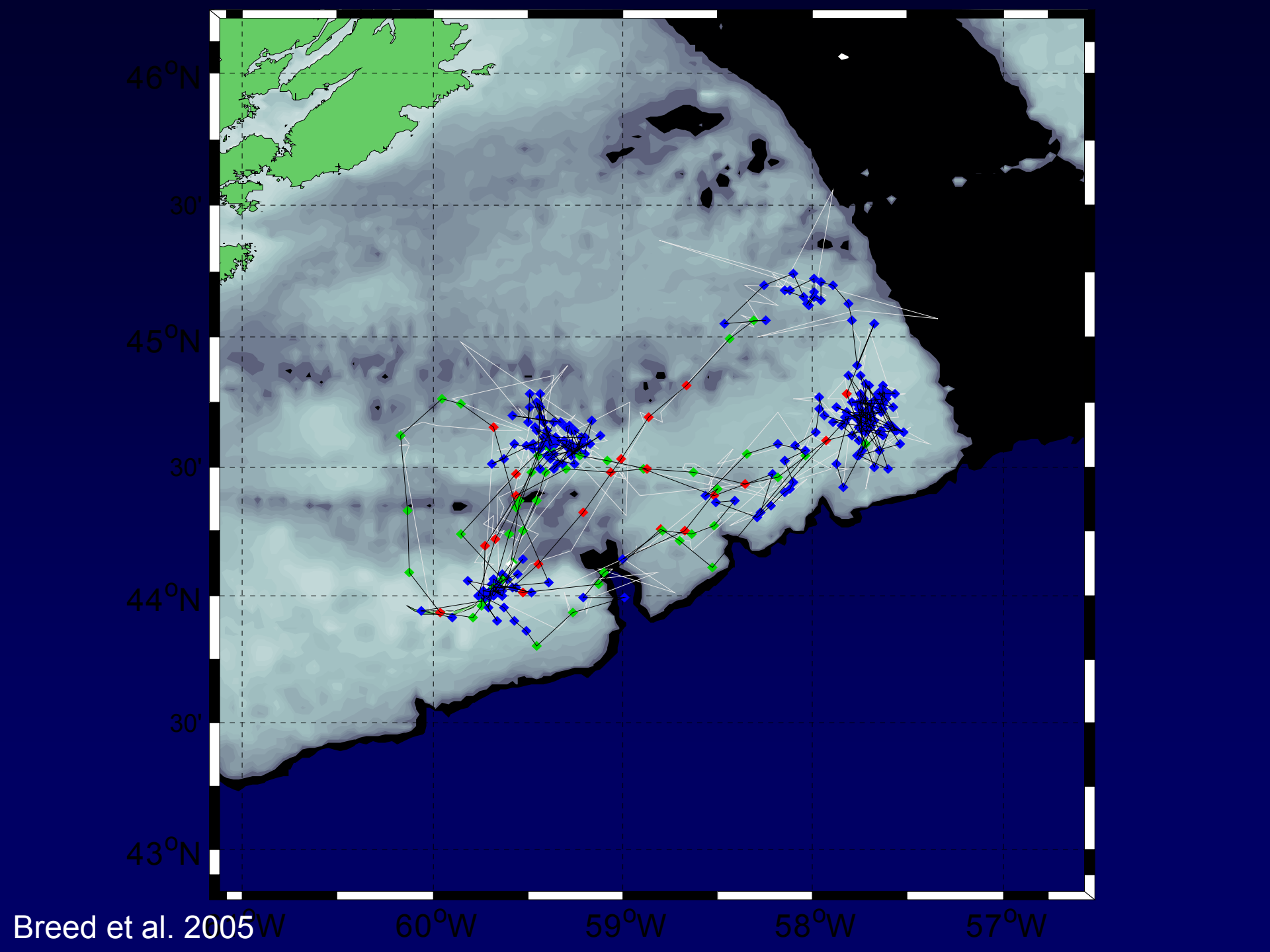

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