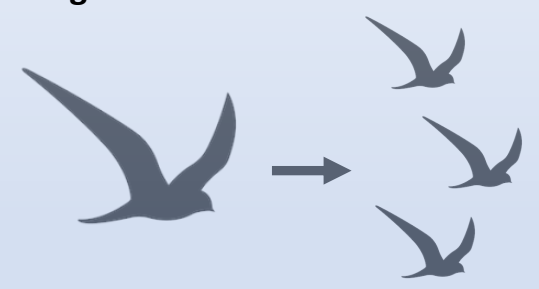


Ecological

Analytical



Population Trends



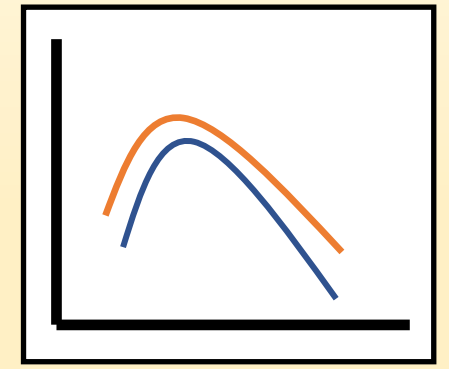
Distributions



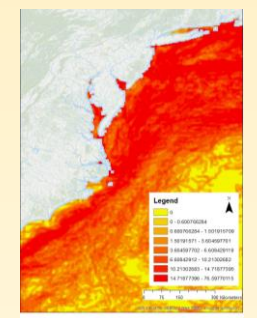
Individual



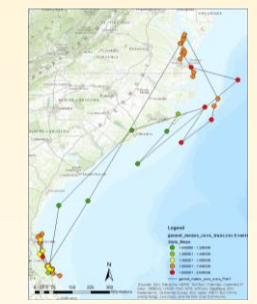
Multi-scale relationships between marine predators and the distribution of forage fish



Long-term Temporal Interactions



Spatial Dependence

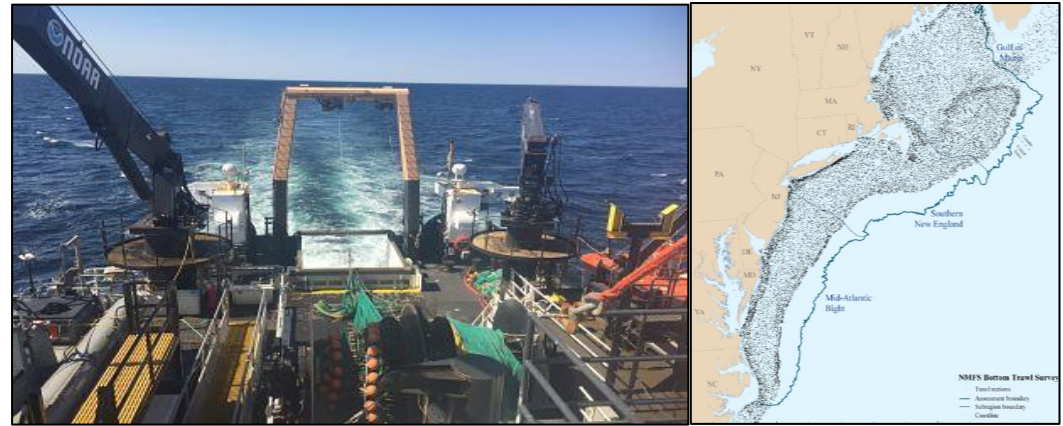


Movement Behavior

Evan Adams, Chandra Goetsch, Julia Gulka, Andrew Gilbert, Iain Stenhouse, Kate Williams, Arliss Winship, Holly Goyert, and Kevin Friedland

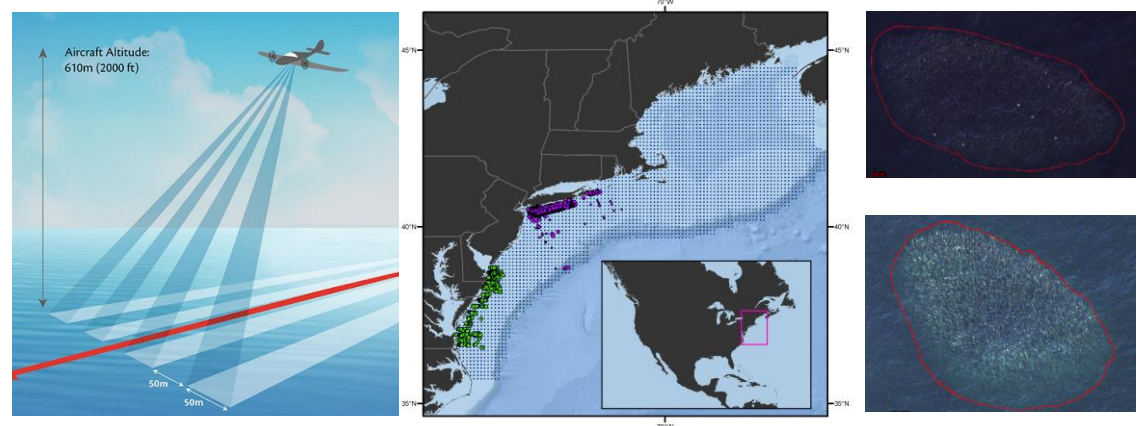
# Objective 1: Identify factors driving forage fish abundance and aggregation

## Species-level: Bottom Trawl Data



NOAA NEFSC/Wesley Rand

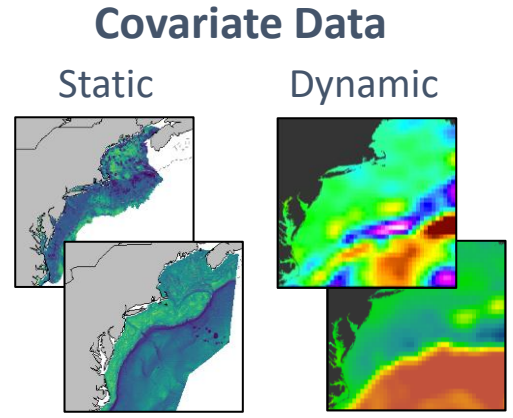
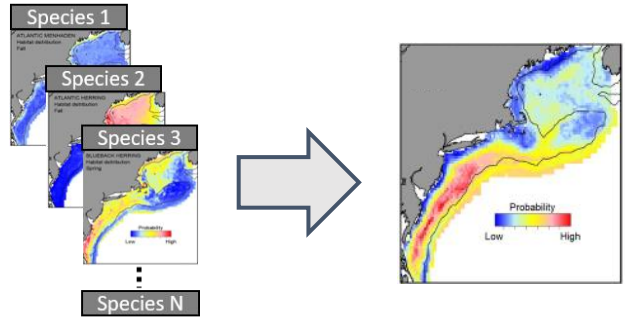
## Community-level: Aerial Survey Data



Community-level SDM

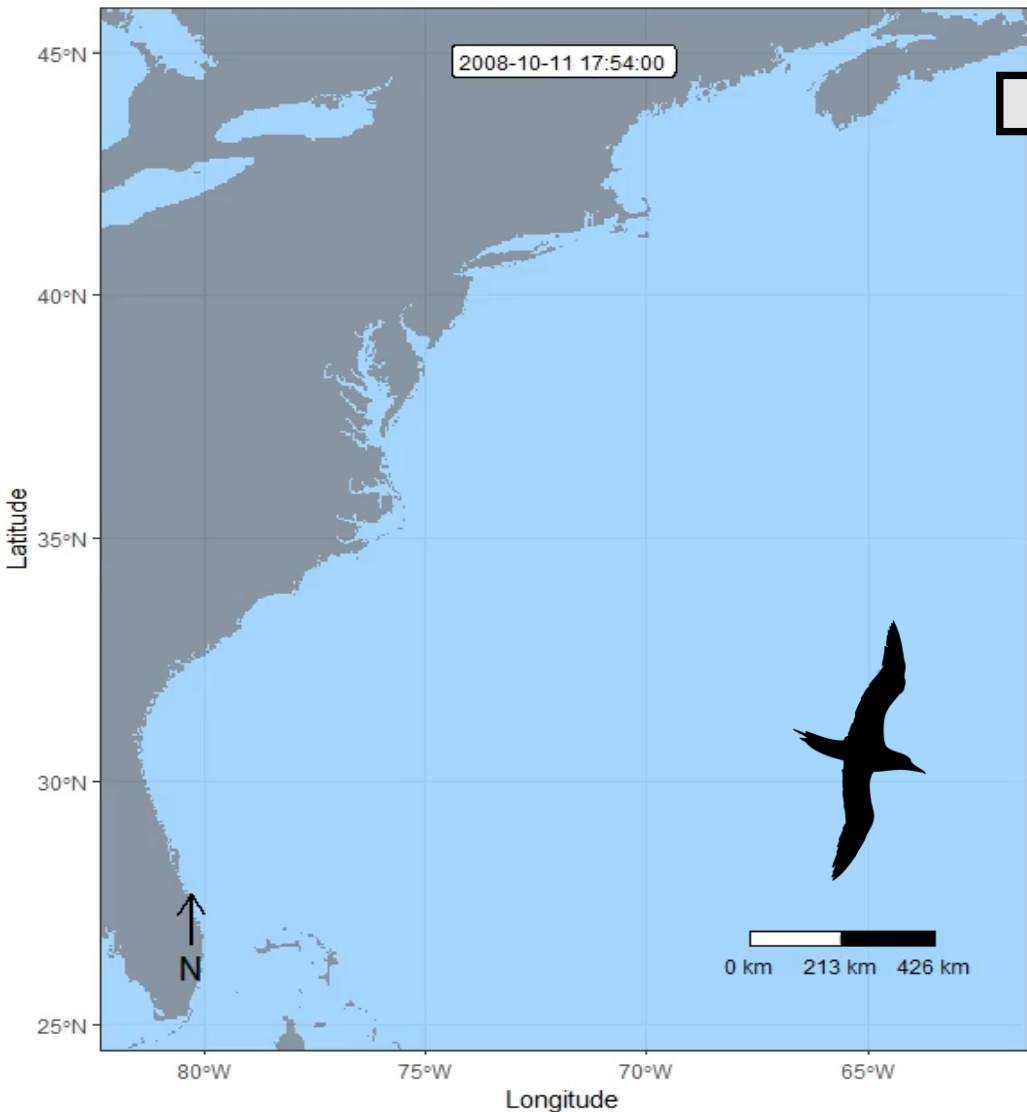
Forage Fish Aggregations

Aggregation/Availability Model

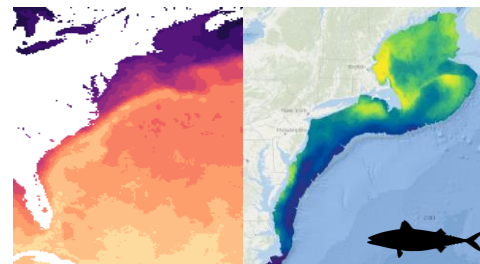
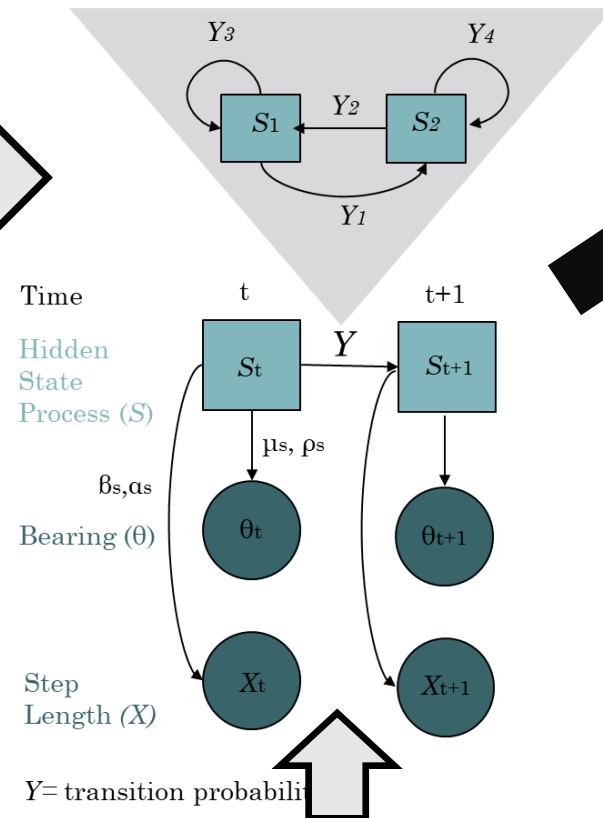


# Objective 2: Understanding the factors driving marine predator movements

Tracking Data of Northern Gannets



## Hidden Markov Model



Environmental Covariates Forage Fish Distributions

## State assignment

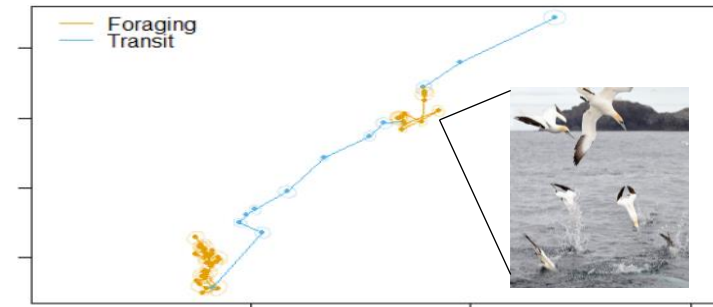
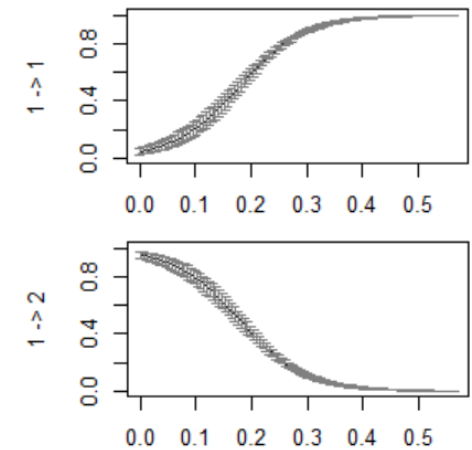


Photo: Richard Shucksmith

## State transitions



How important is forage fish information compared with environmental covariates in influencing movement behavior?