

NNA Research Update: Ecosystem and Lobster Population Modeling

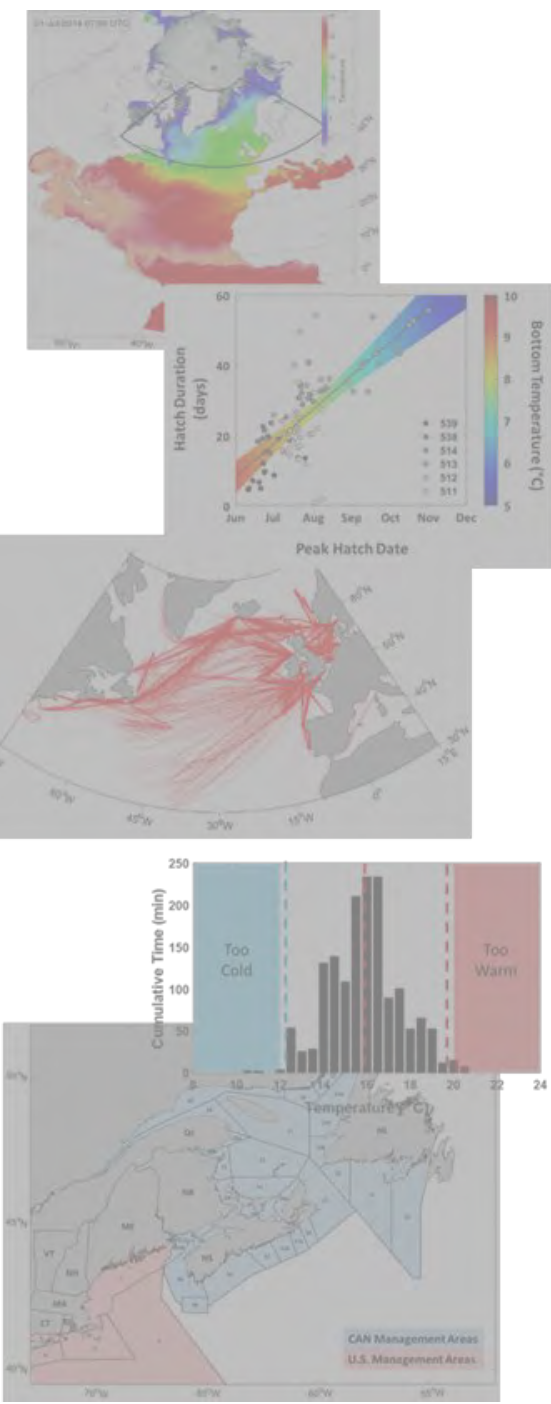
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School of Marine Sciences



NNA Hypothesis and Objectives

- **H:** Climate-driven Arctic change will affect the distribution and abundance of American lobster, and in turn, the fishing industry and coastal communities that depend on them, where resilience to change will be determined by the magnitude of change and their ability to adapt as change occurs.
- **Natural Environment group:** Evaluate, model, and forecast how changes in the Arctic cryosphere affect ocean circulation at lower latitudes in the Northwest Atlantic and the productivity of its lobster populations.
 - **Brady Lab:** Expand ecosystem monitoring through the eMOLT program, utilize an ecologically-informed larval transport model to evaluate changes to lobster populations and their downstream effects.



Advancement

Cryosphere, Resolution

SDM, Hatch Phenology

Modified Larval Mortality

Thermally Mediated Settlement

Expanded Domain

Objectives

Hydrodynamic Model

Larval Transport

Trophic Interaction

Settlement Model

Landings Forecasting

Validation

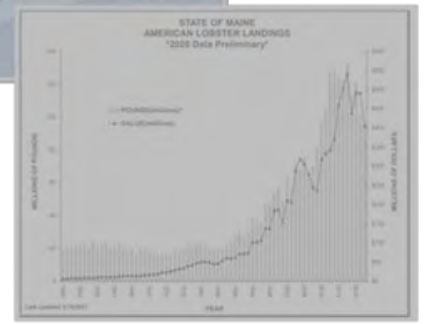
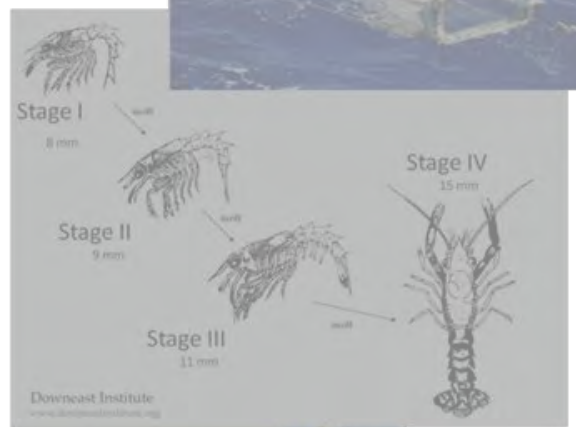
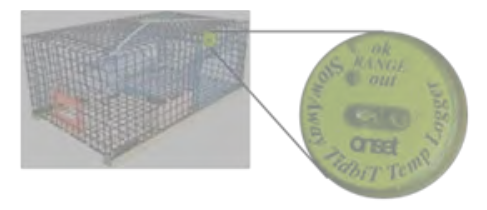
eMOLT

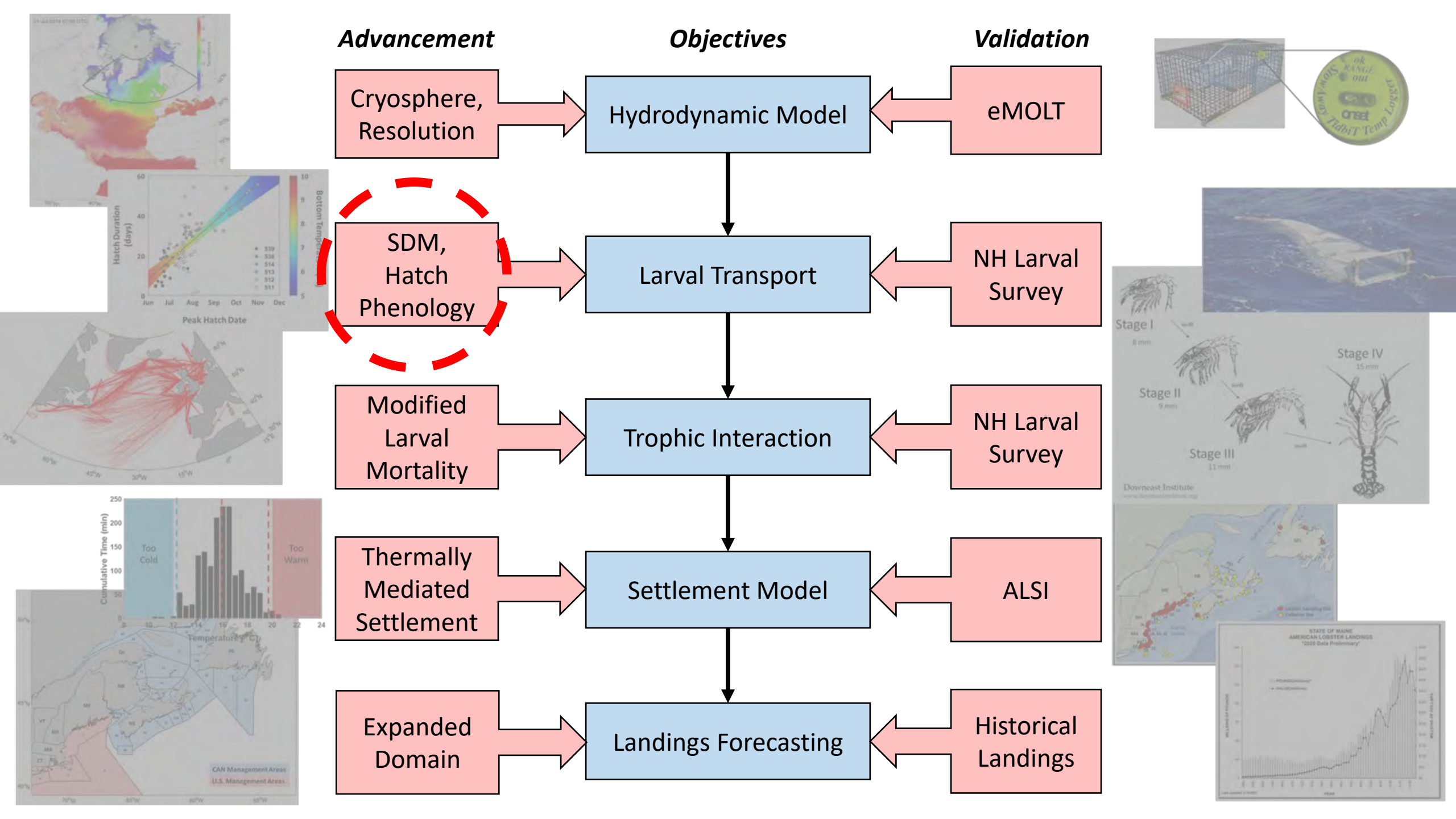
NH Larval Survey

NH Larval Survey

ALSI

Historical Landings





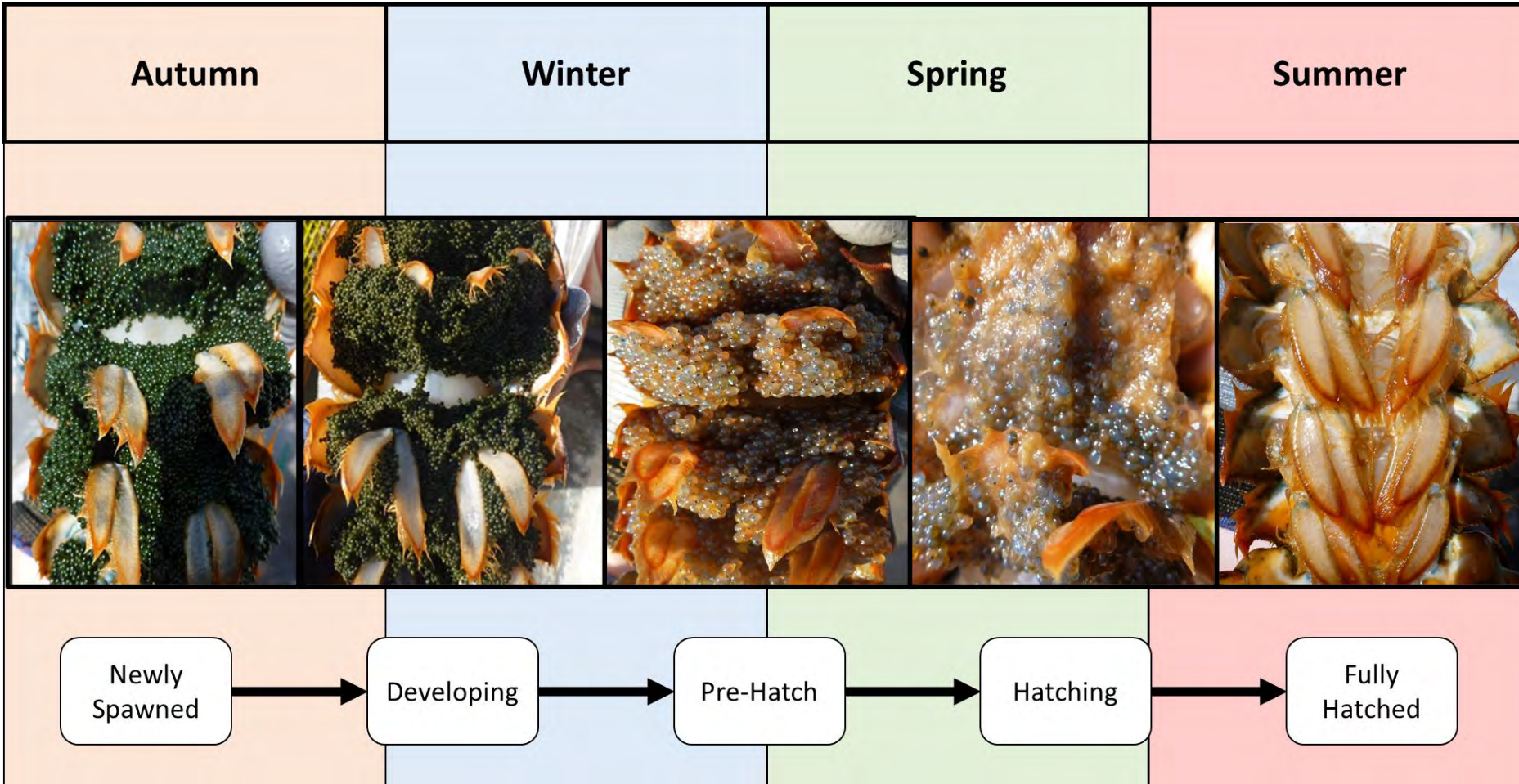


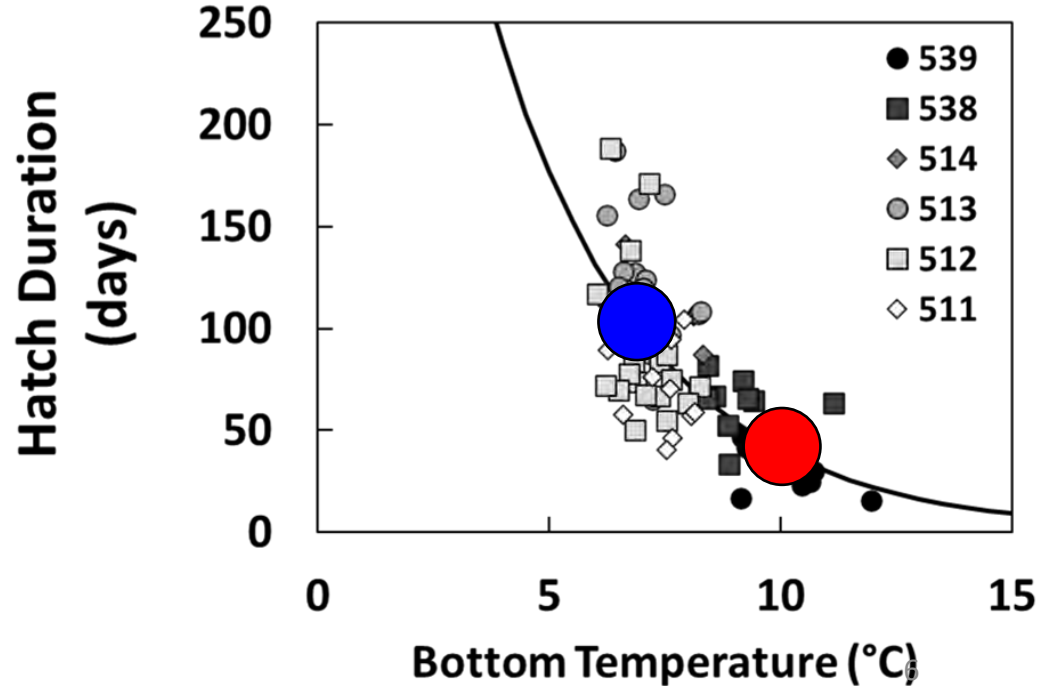
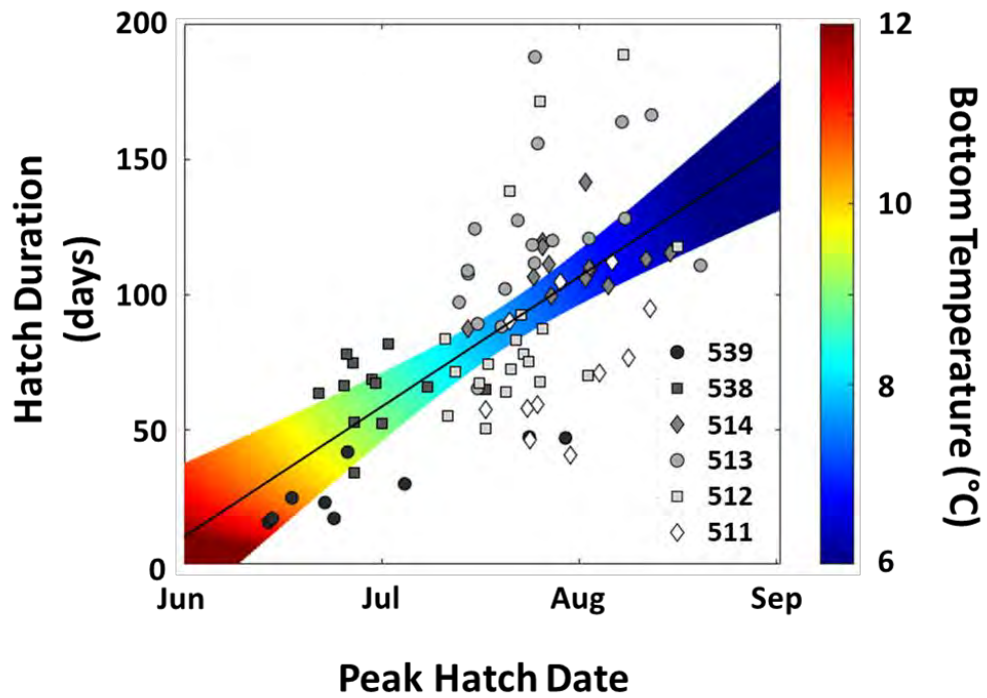
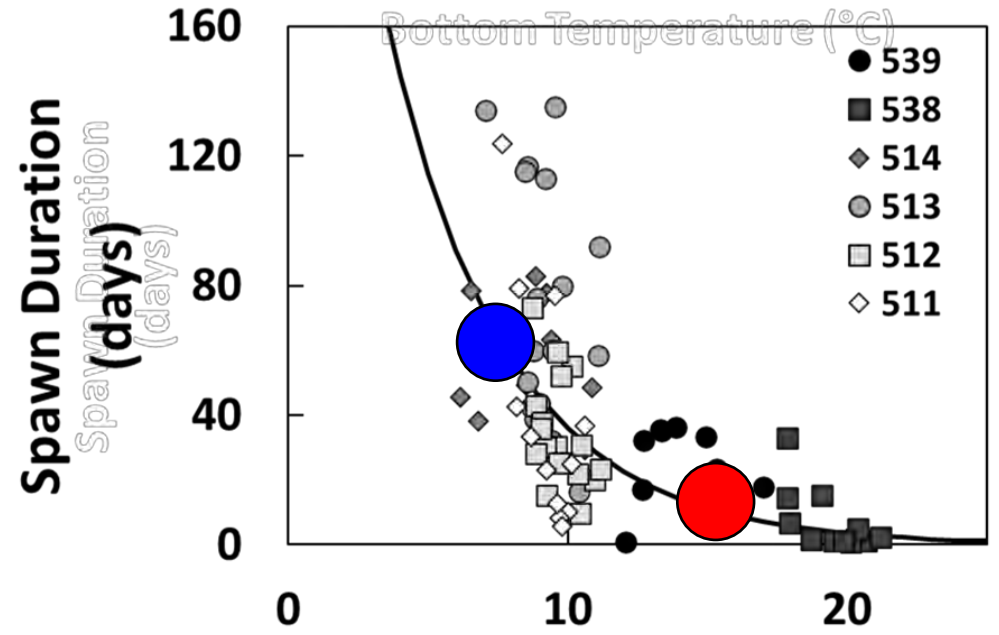
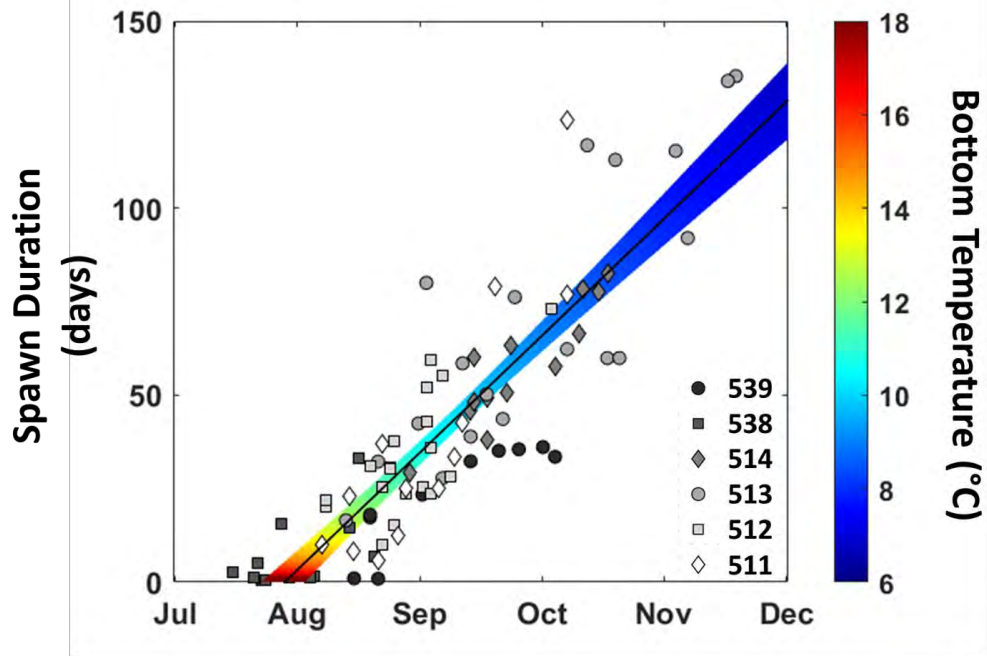
How?

- Ventless trap and sea sampling surveys

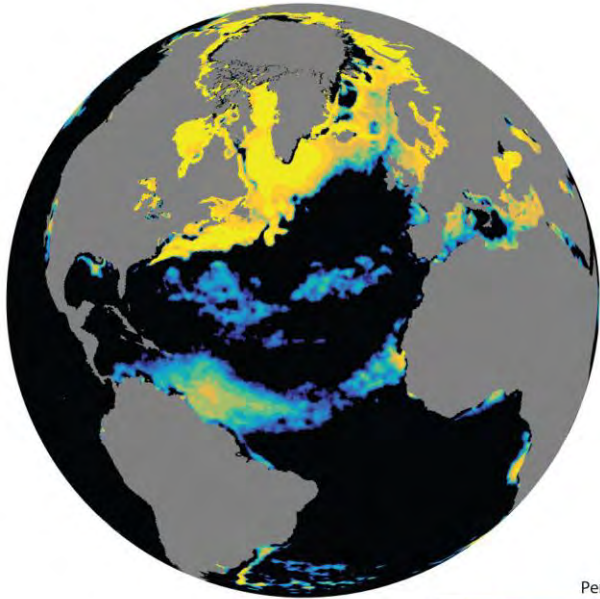
Egg release

- When?
- How long?

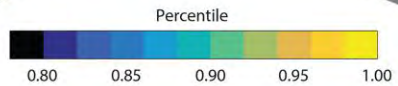
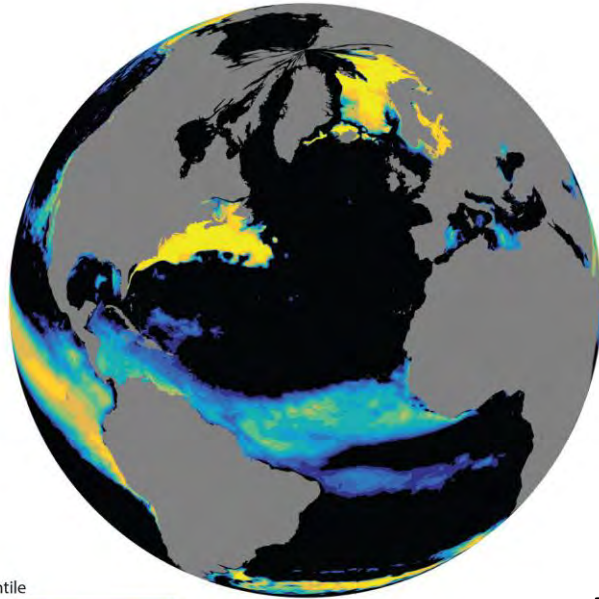




(a) 1982–2016

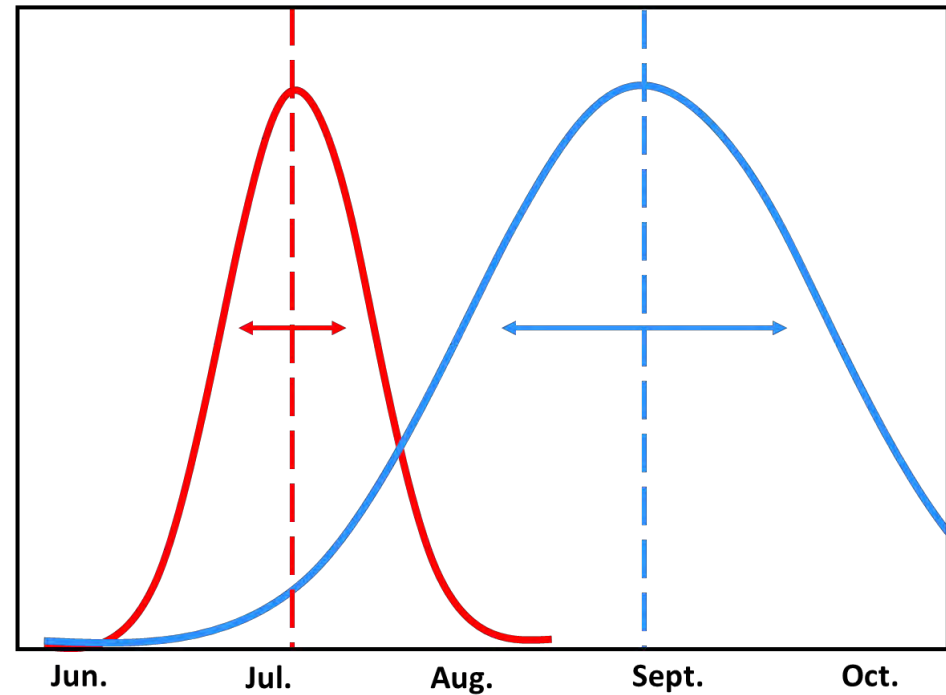


(b) Projected



*Climate Projections
Pershing et al. (2018)*

% of Lobsters Hatching Eggs



Warmer



Cooler

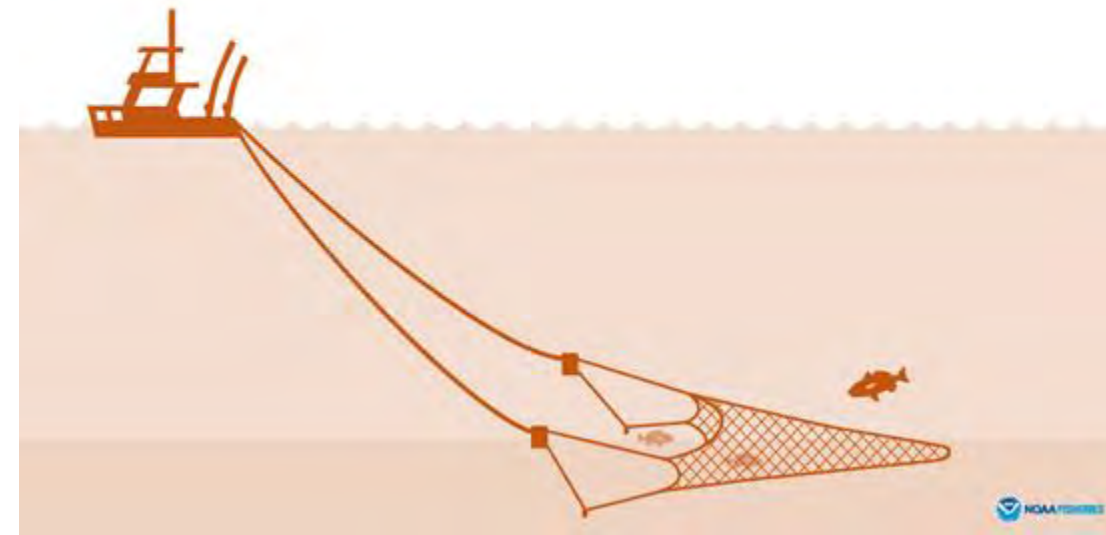
How?

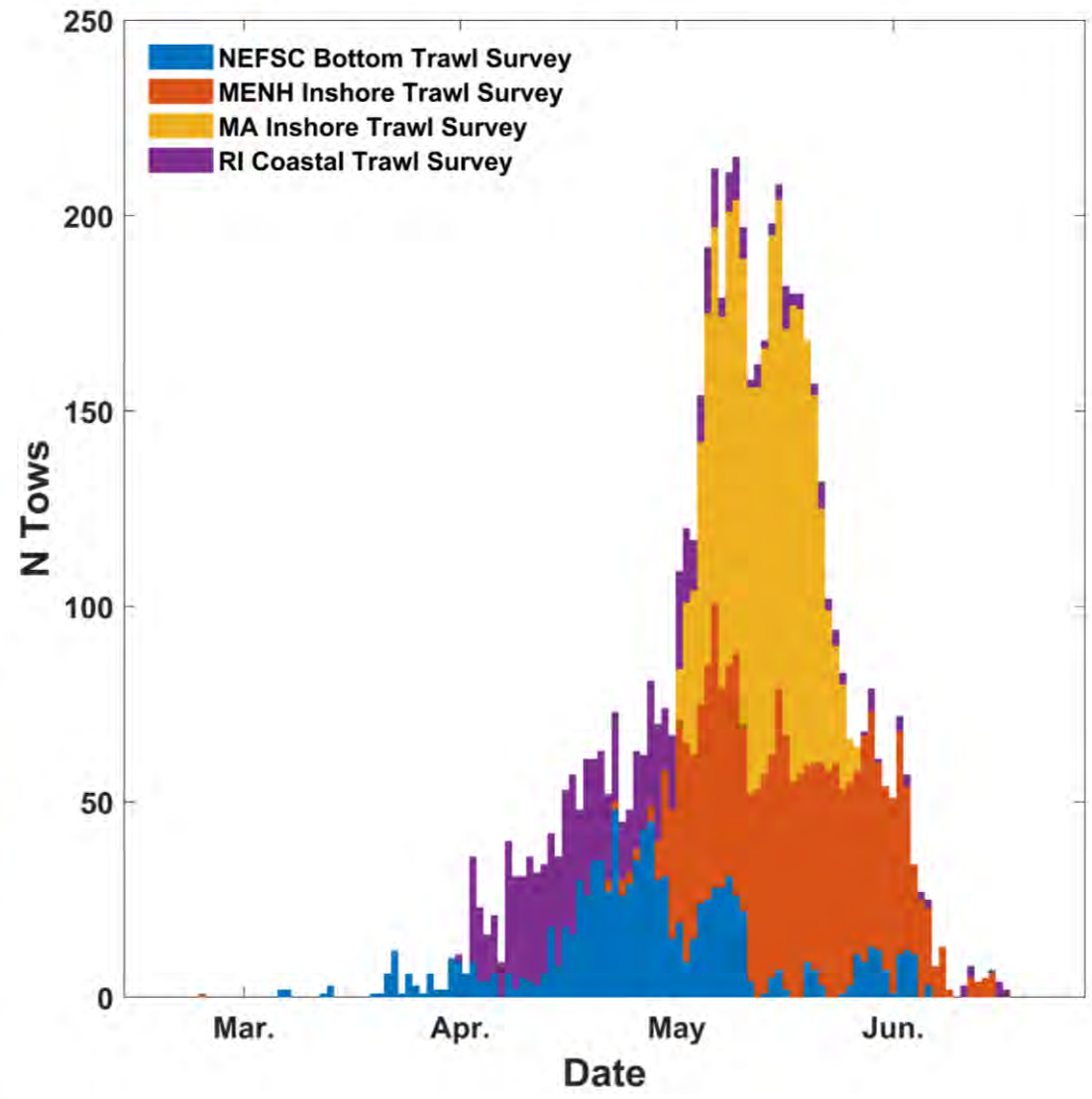
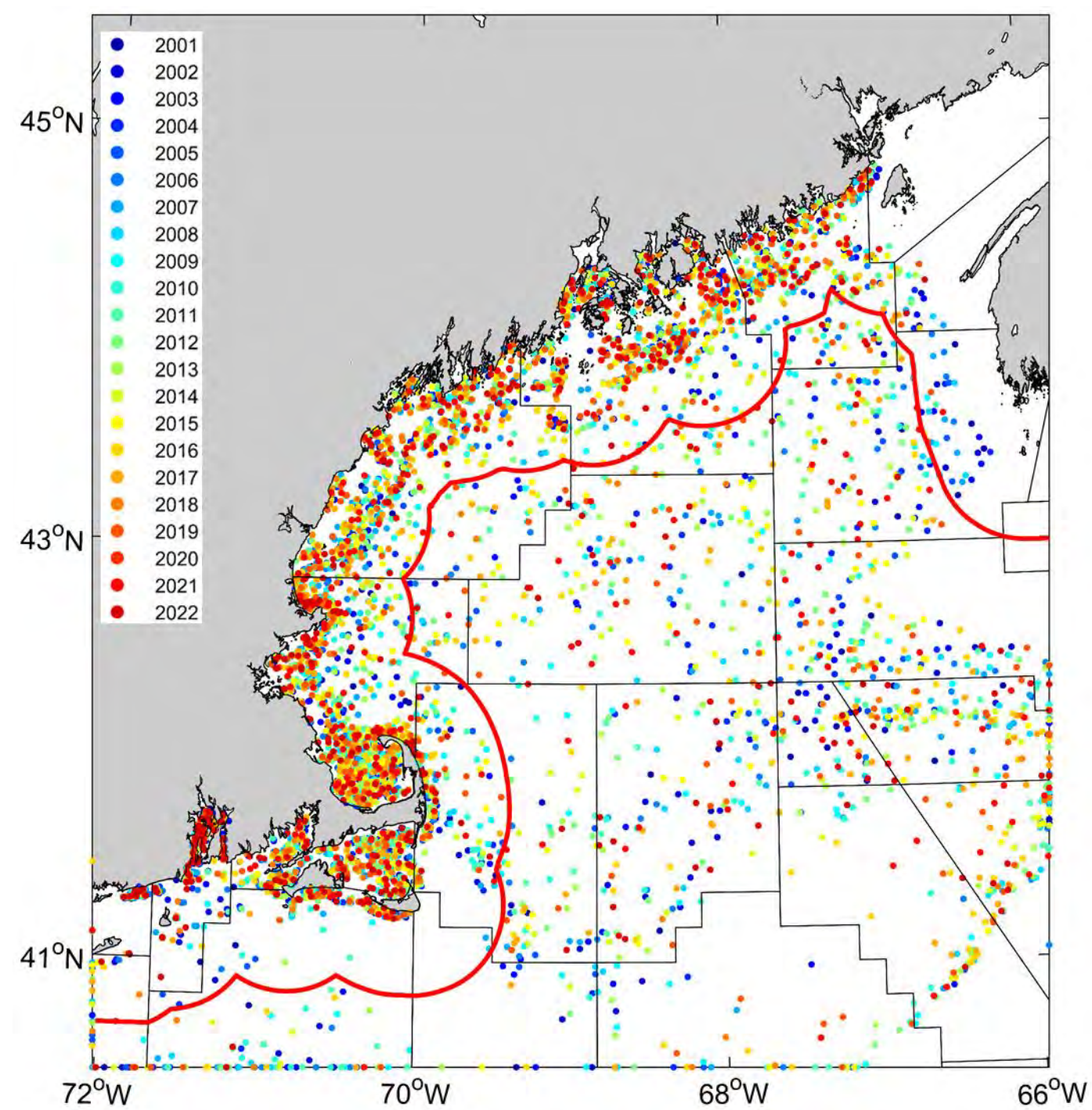
- Spring Bottom Trawl Surveys
 - State: ME-NH, MA, RI
 - Federal: NOAA

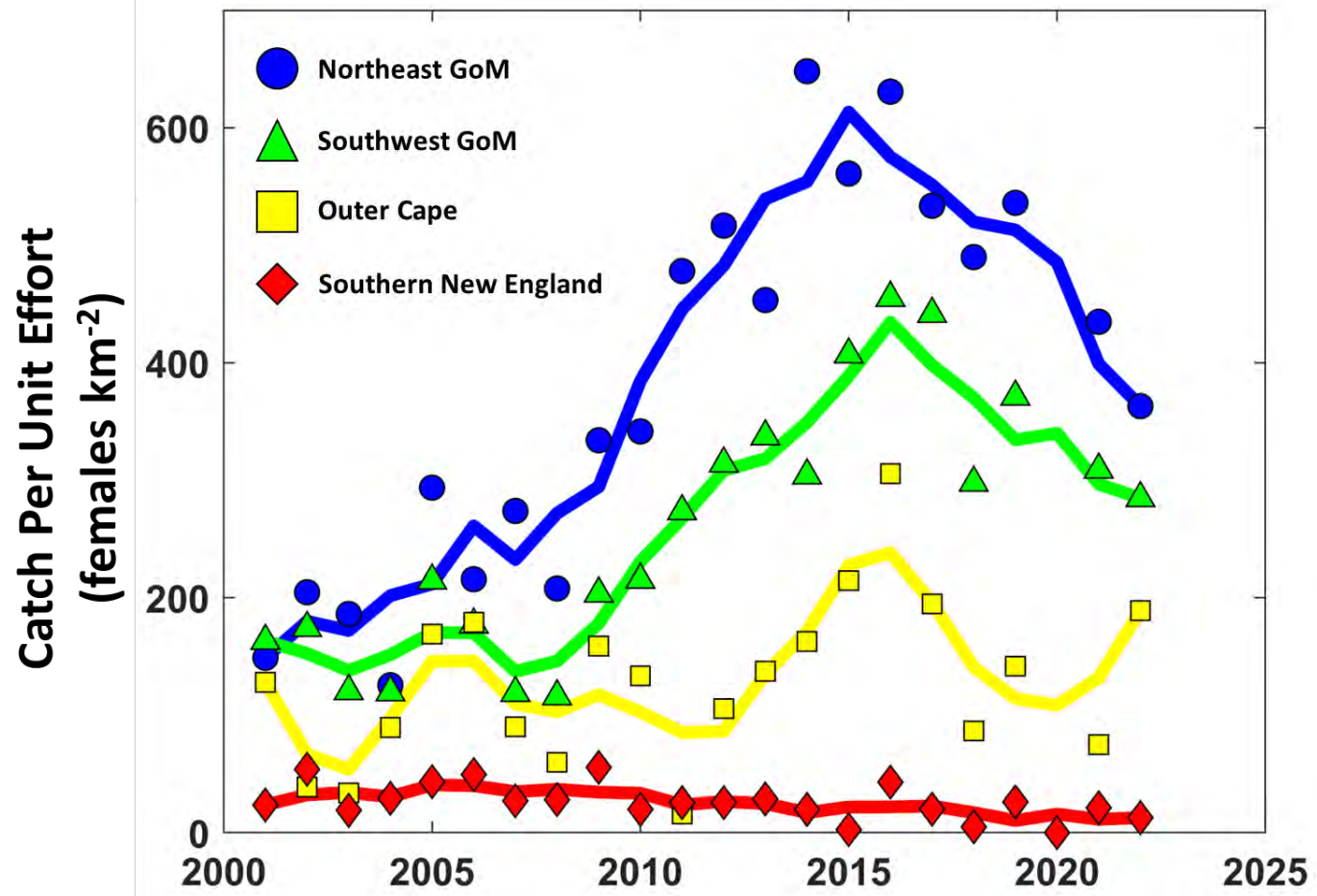
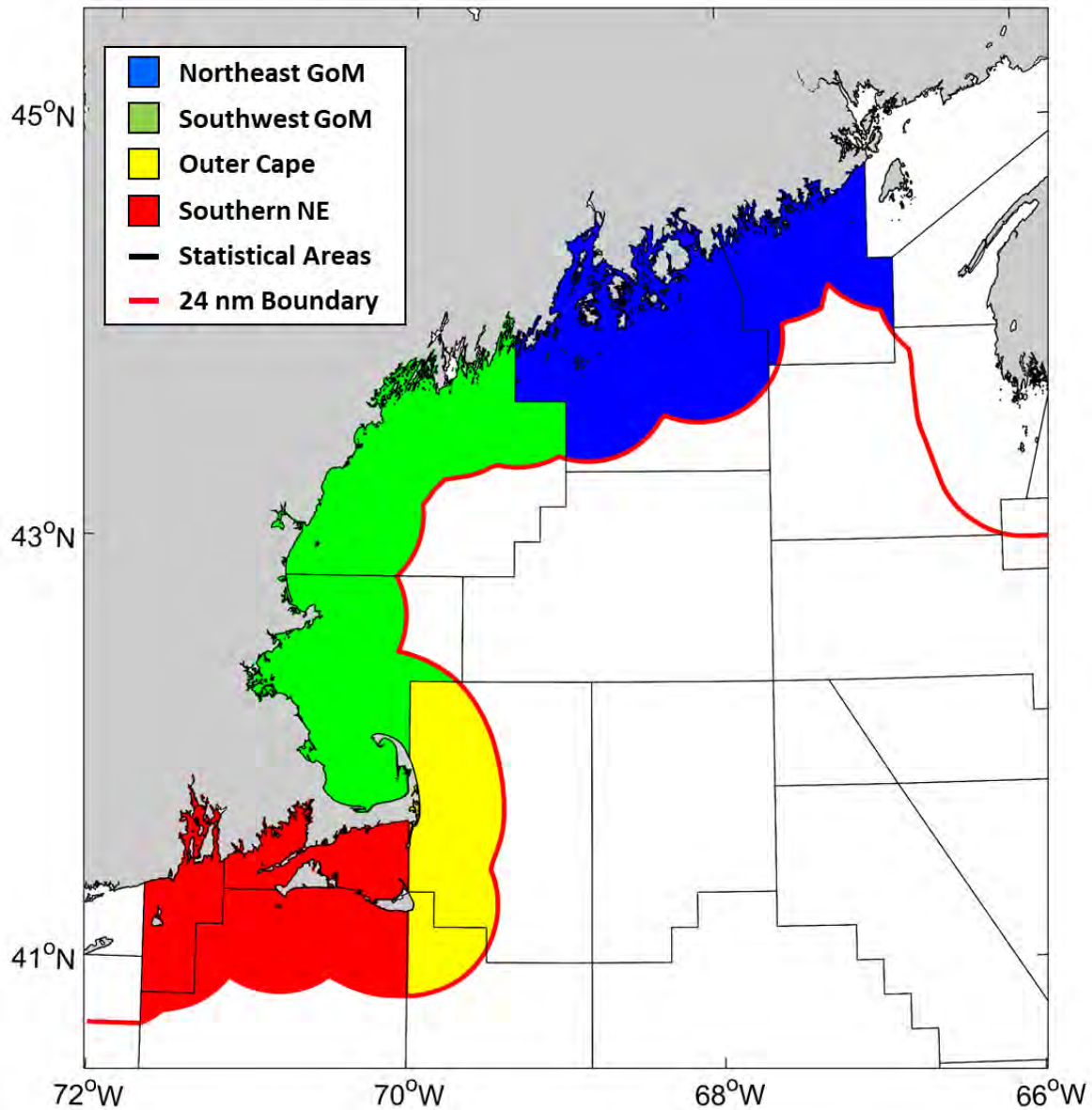


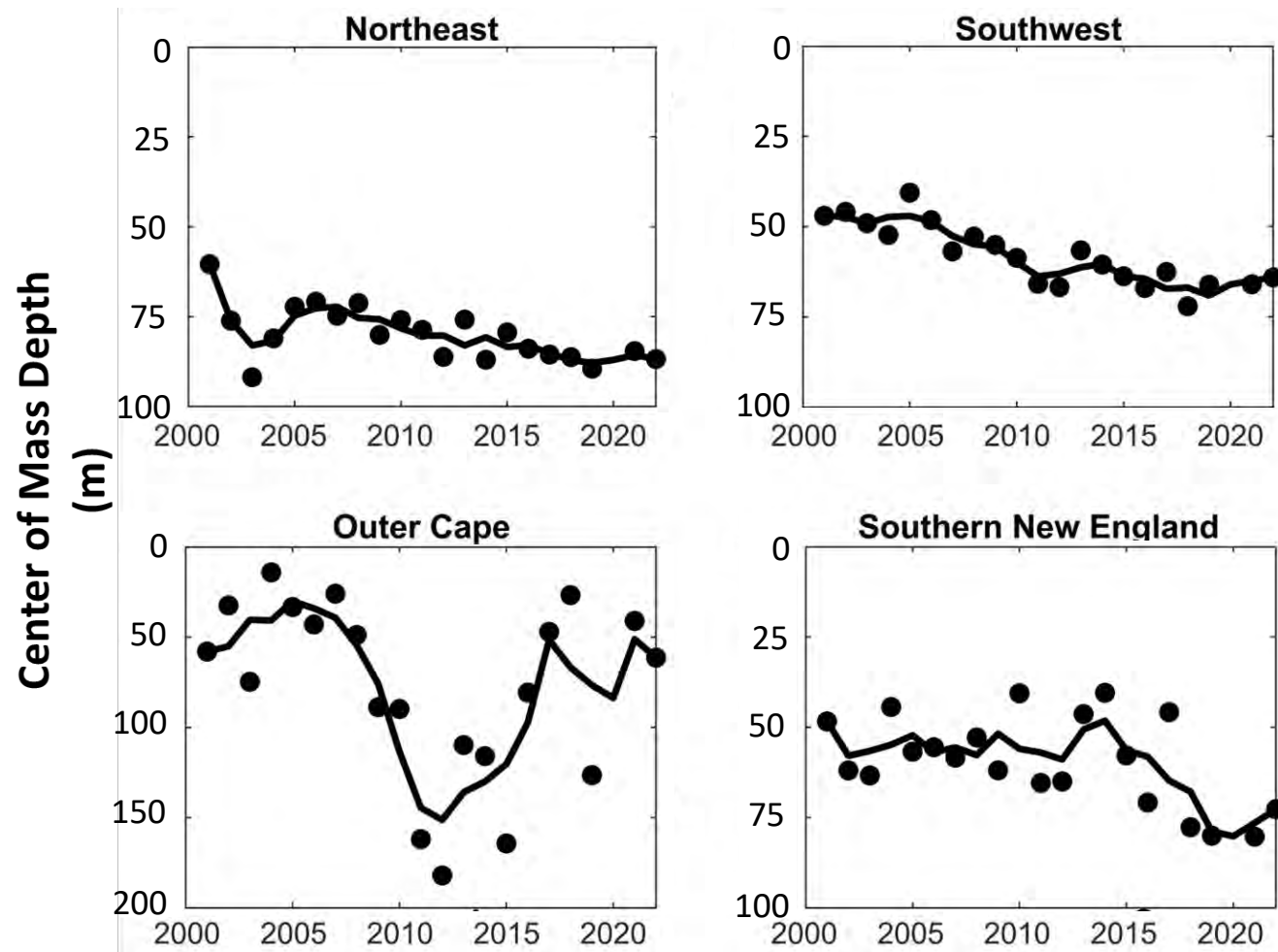
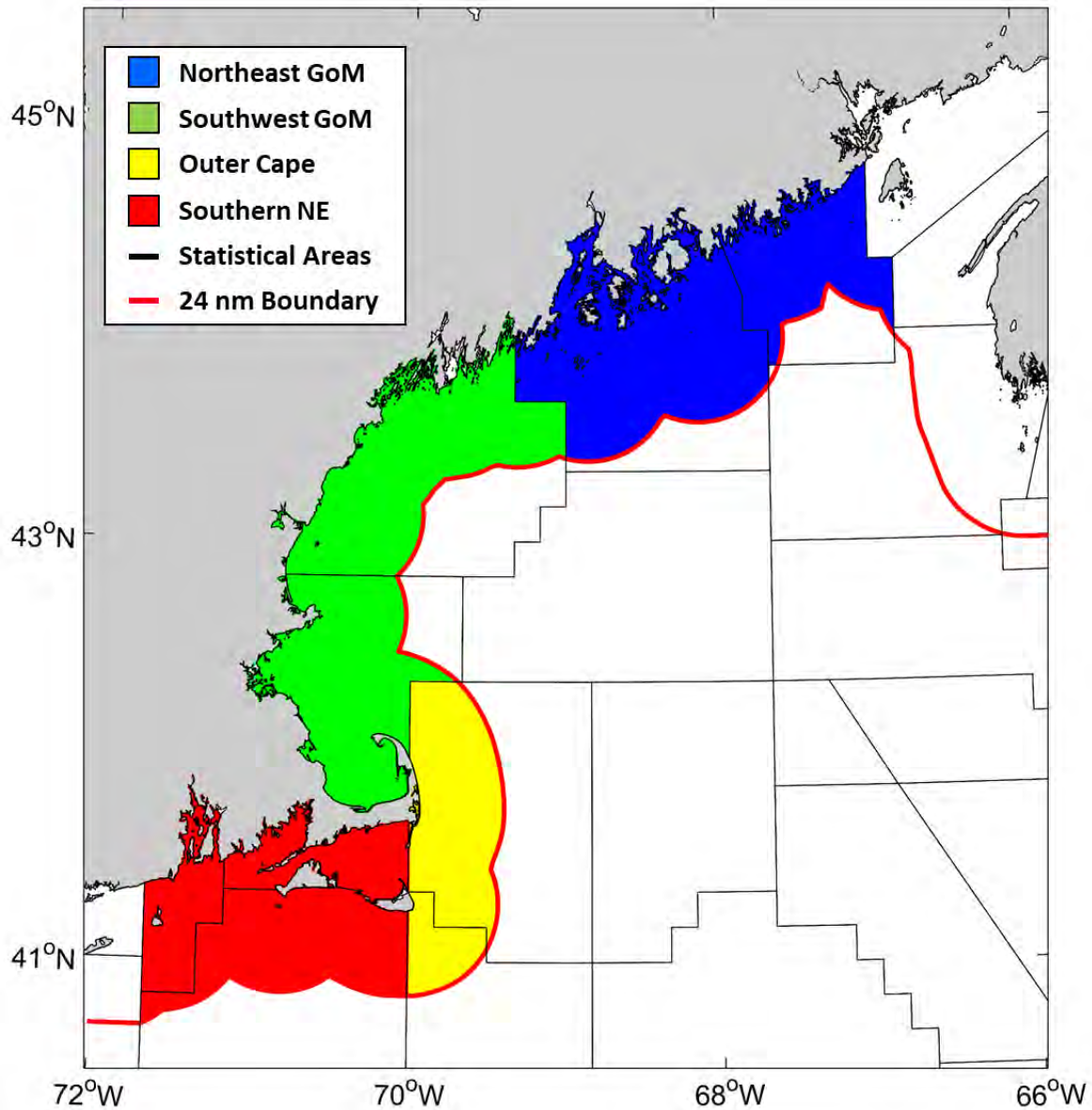
Spawner Distribution

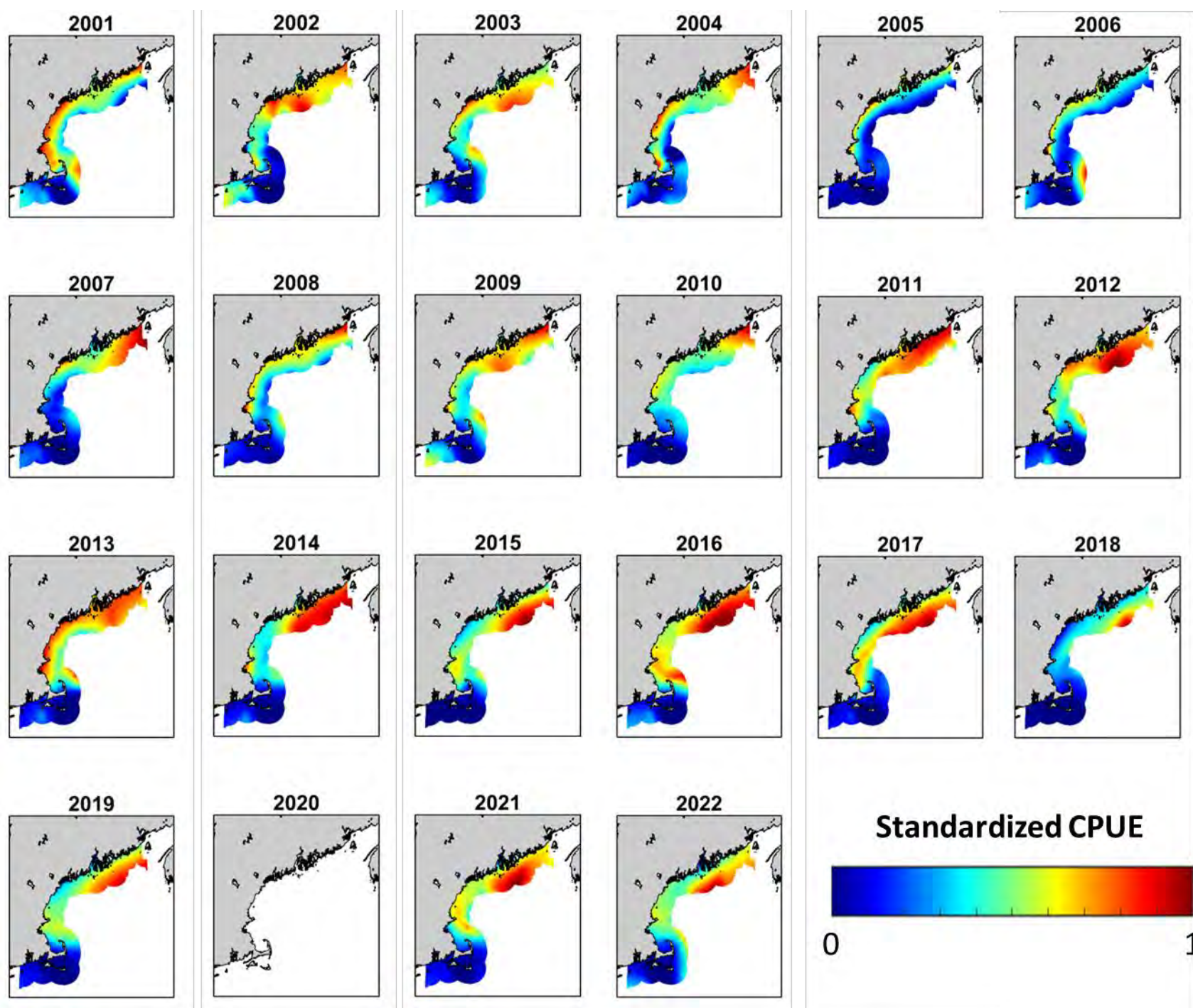
- Where are females located prior to egg release in the Spring?
 - Females ≥ 75 mm carapace length











CPUE

- Use CPUE to scale larval density of initial release

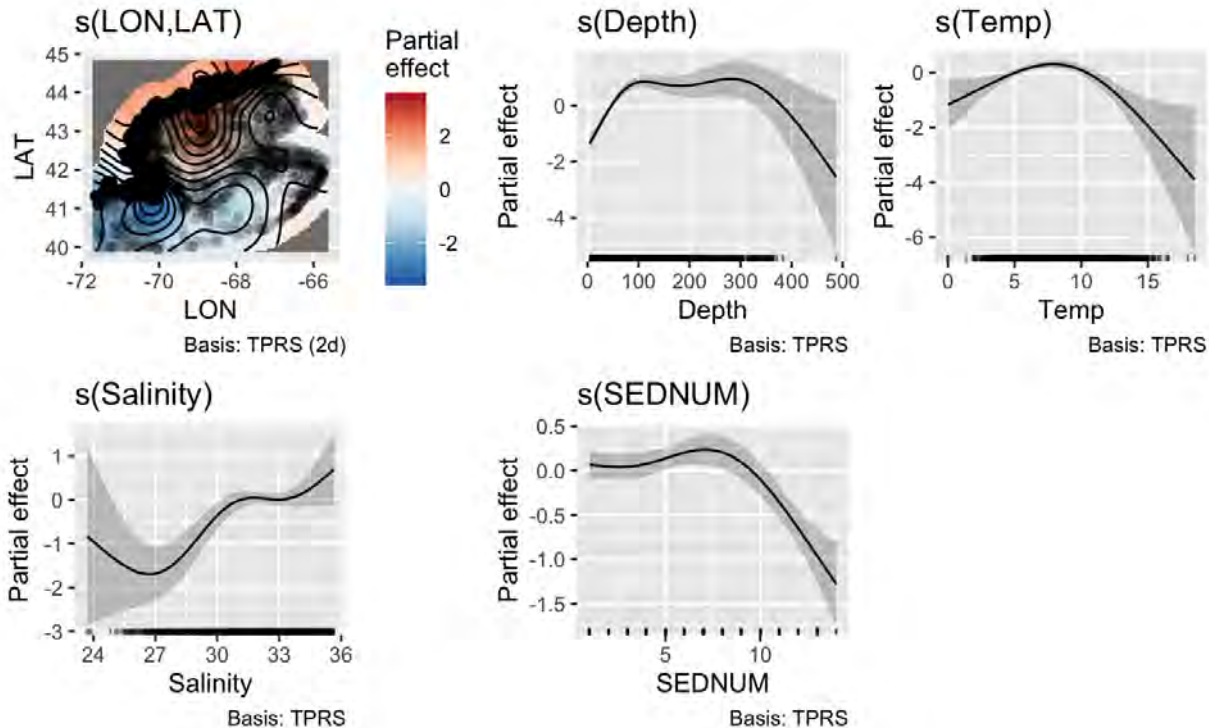
Egg release

- Regionally-specific egg release timing and duration

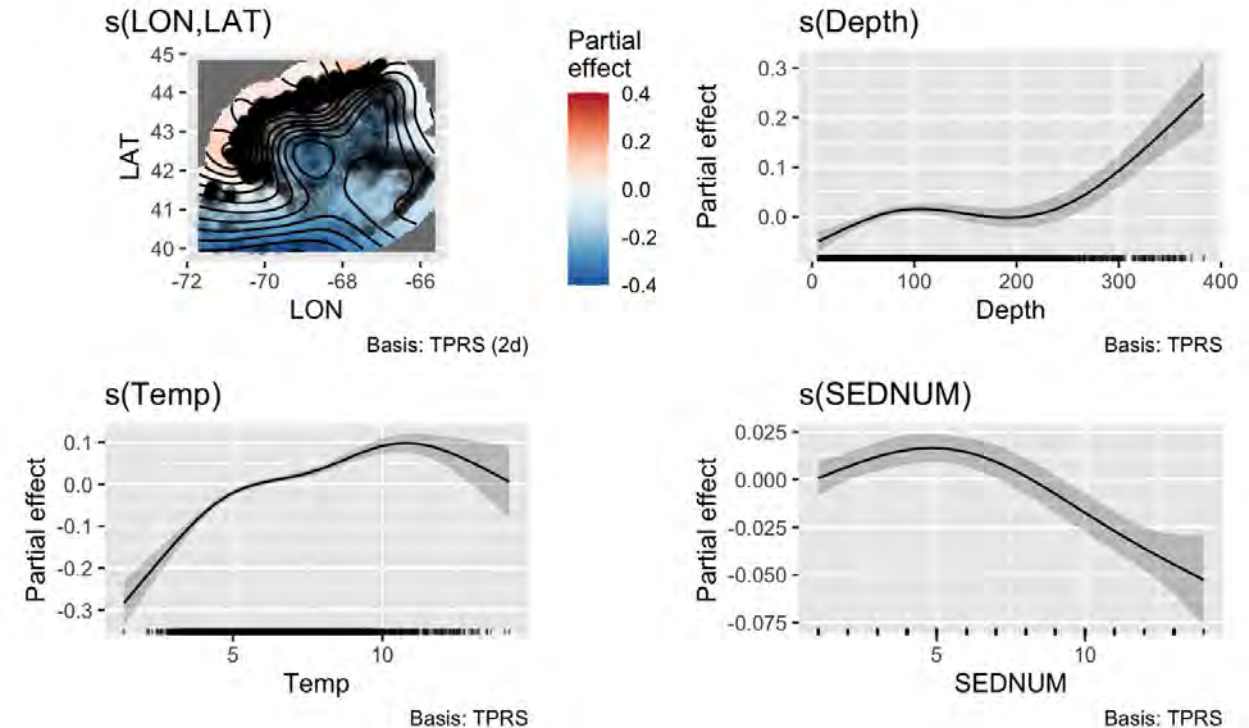
CPUE Relationship to Environmental Conditions

- Generalized additive models to use environmental data (LAT, LON, temperature, salinity, depth, sediment) to explain CPUE patterns and model future distributions.

Presence



log(CPUE)

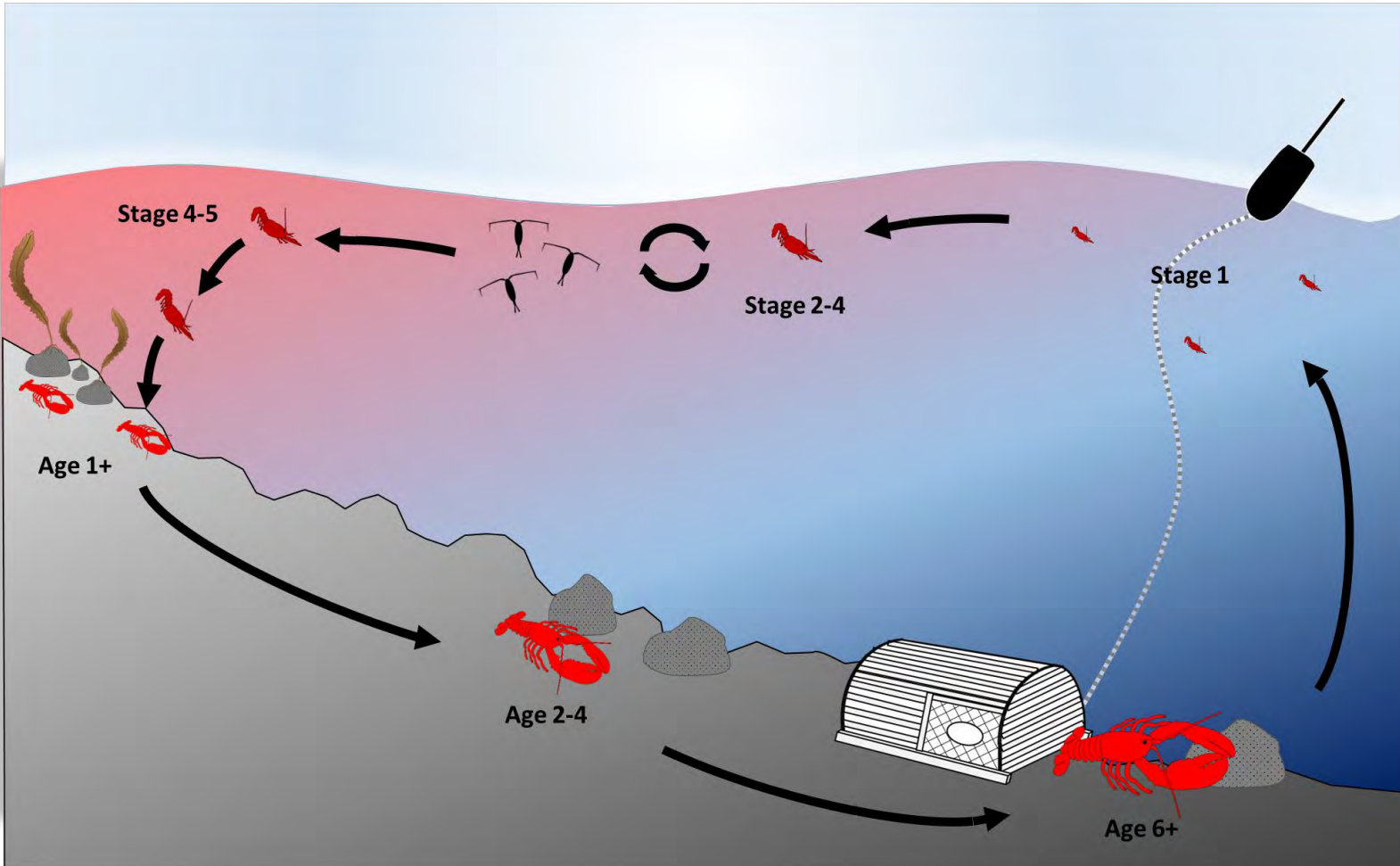


Changes

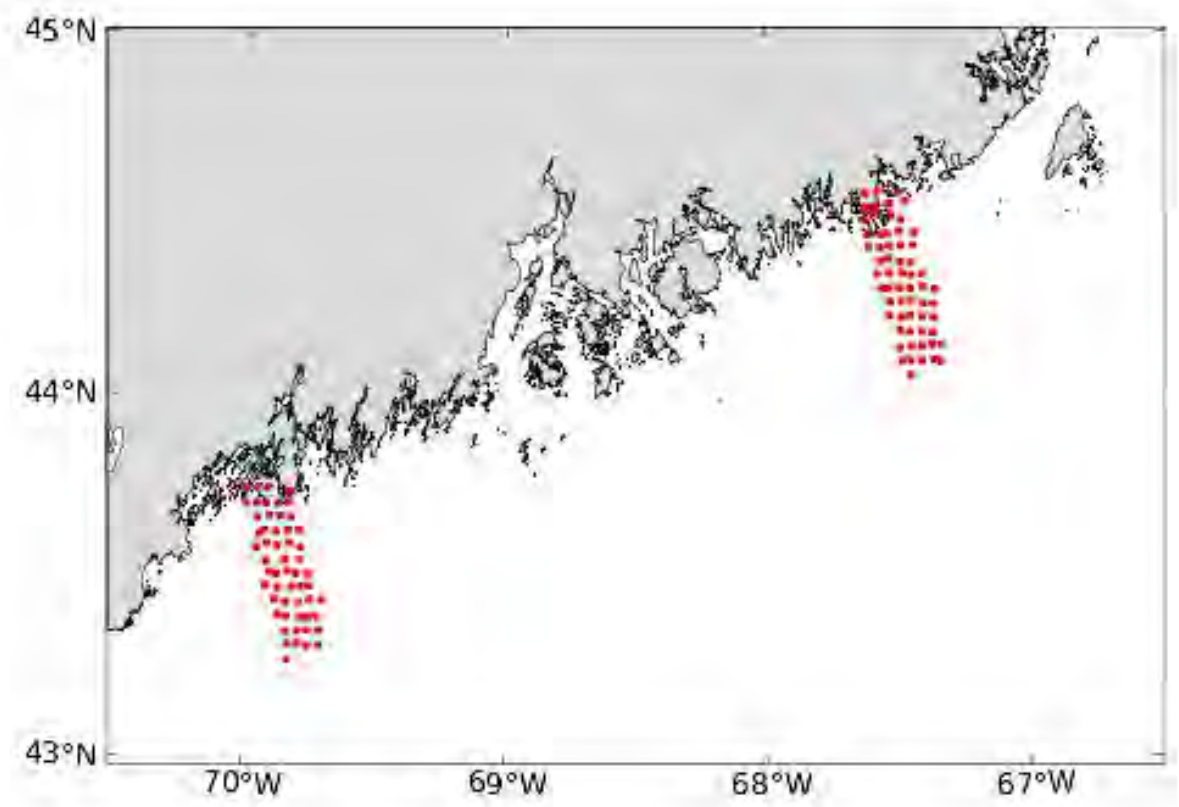
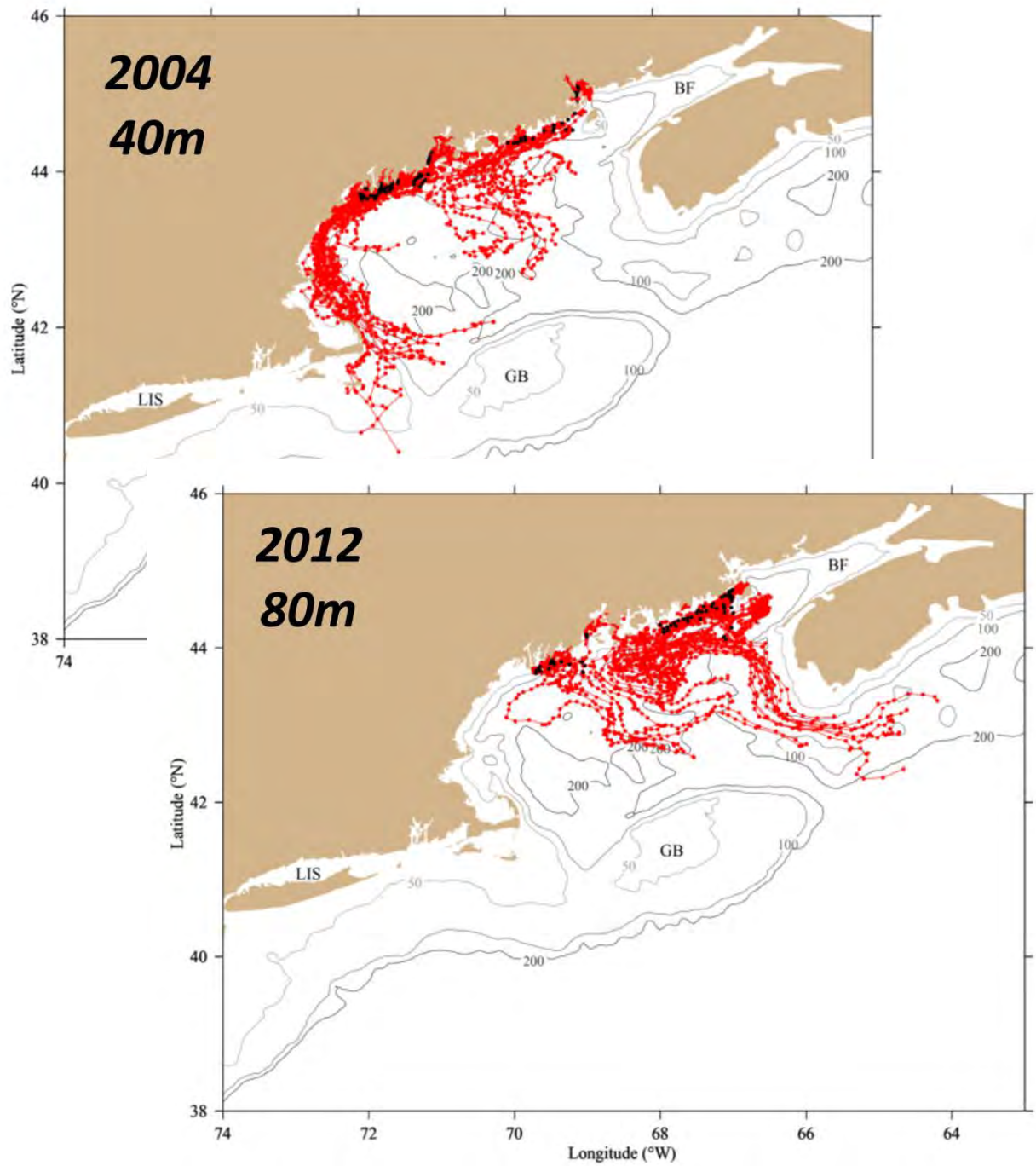
Abundance
Distribution
Timing

Downstream Effects

Connectivity
Dispersal
Mortality
Location at Competency



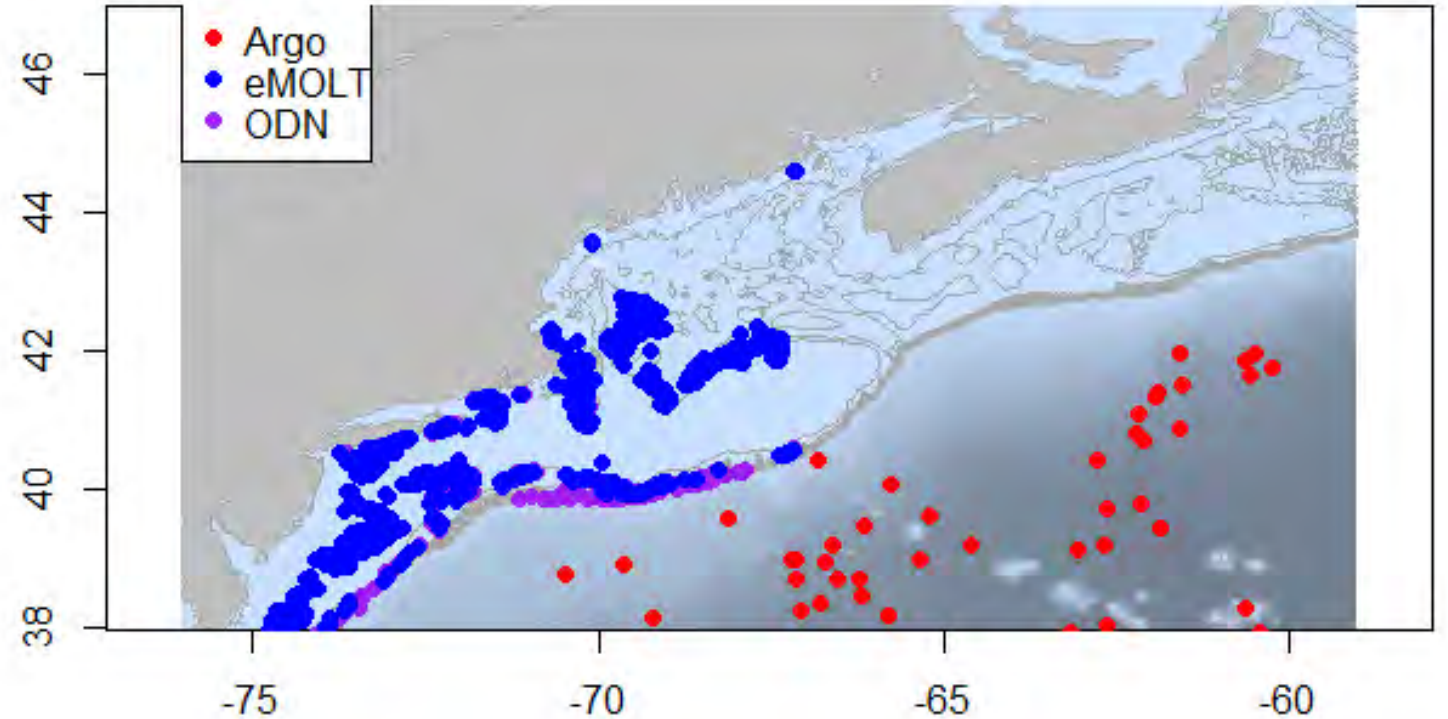
Lobster life history
Adapted from McManus et al. (2023)



eMOLT

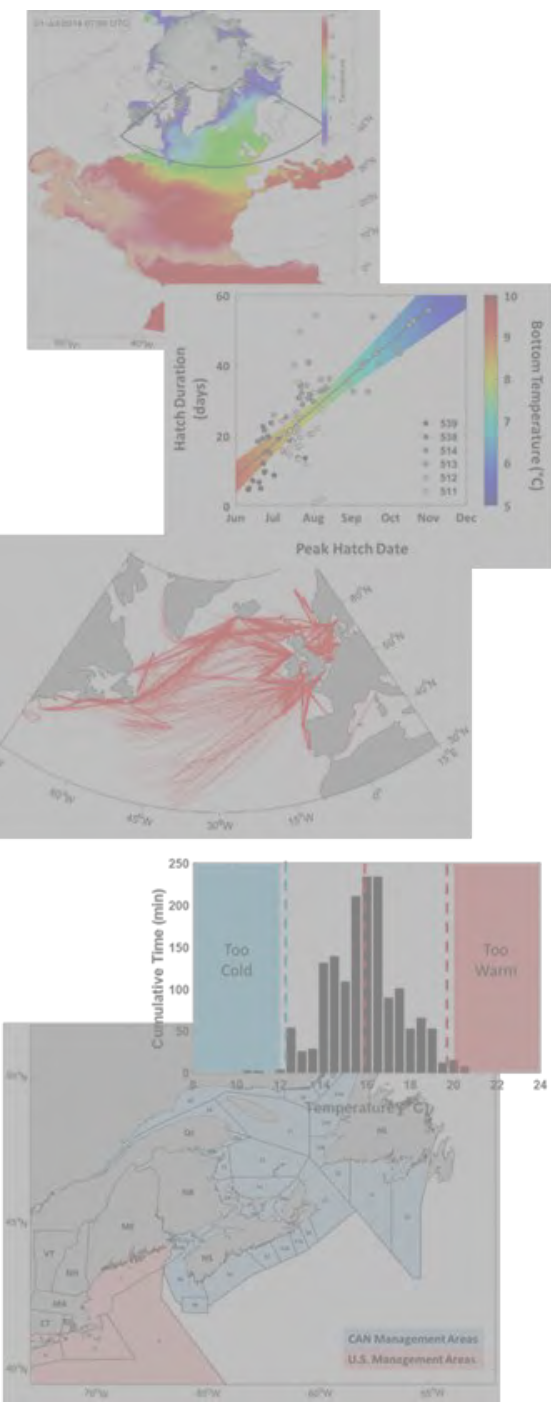
- 8 new vessels added

- 1 Zone E
- 1 Zone C
- 2 Zone B
- 4 Zone A



- New funding leveraged through the Broad Reach Fund

- \$100k for new instrumentation and 20 participants in 2024-2025



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