Climate variability's influence on trap survey detectability for American lobster

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Monitoring Lobster Populations

Planktonic Sampling

- Bongo or neuston nets to sample larval stages I-IV (catchability concerns?)

SCUBA Suction Sampling

- Divers use suction system to vacuum small lobsters (YoY) on the seafloor.

Trawl Surveys

- Large nets towed across the sea floor.
- BUT: Trawls can't access preferred lobster habitat (cobble, boulders, rocks, ledge) or operate in areas with static gear present.

"*a need for a standardized fishery-independent survey designed specifically to monitor lobster relative abundance and distribution*" – ASMFC, 2006

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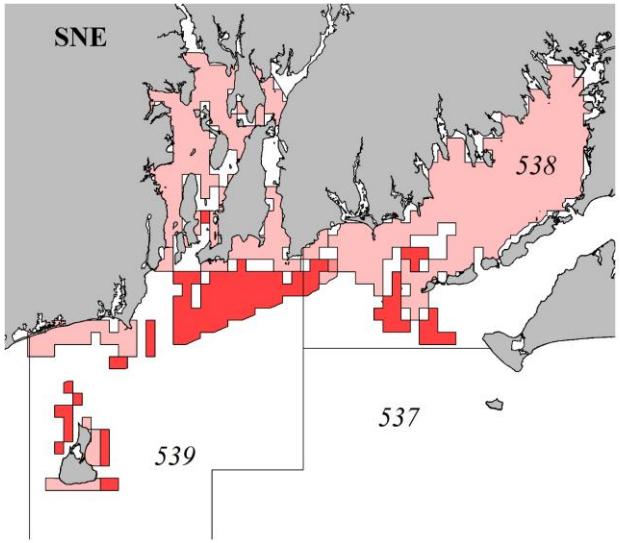
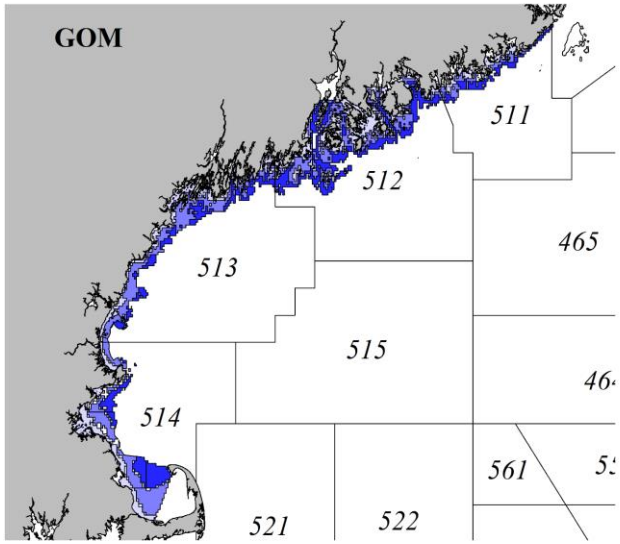
Coast-wide (RI-ME) survey using a random stratified survey design in collaboration with industry.





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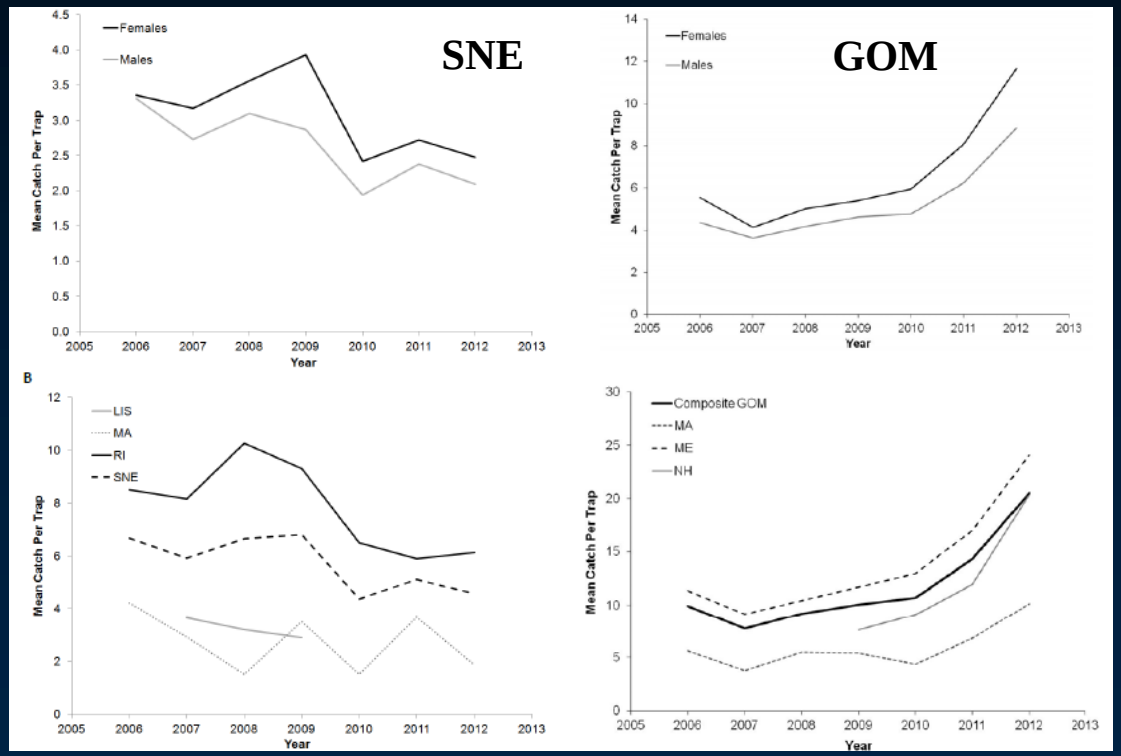
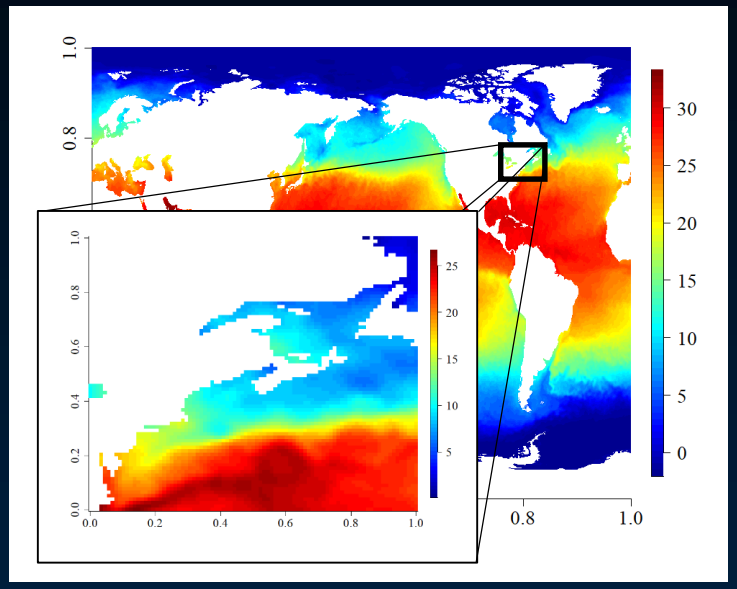
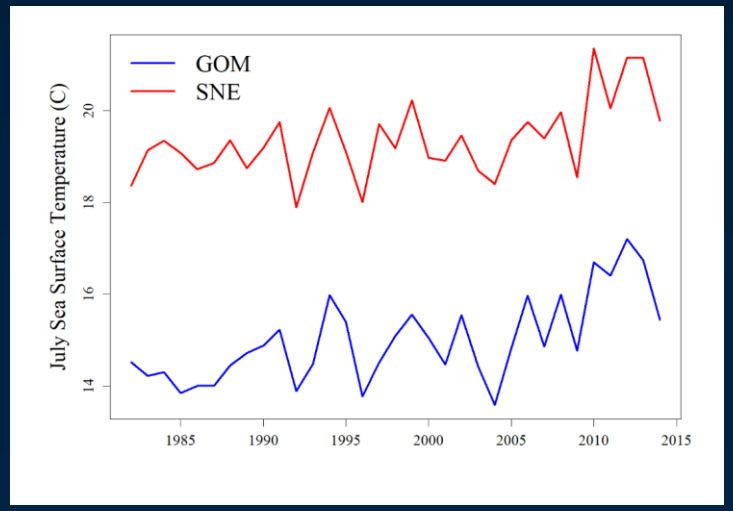
Coast-wide (RI-ME) survey using a random stratified survey design in collaboration with industry.

Abundance indices used in the American Lobster Stock Assessment (ASMFC 2015).



Climate Influence on Coastal Lobster Abundance?





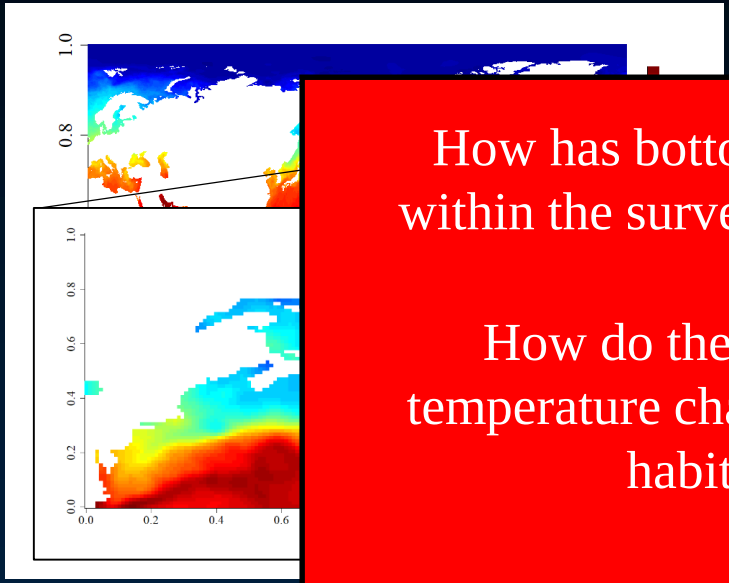
Sea temperatures have increased throughout the Northeast U.S. Shelf.

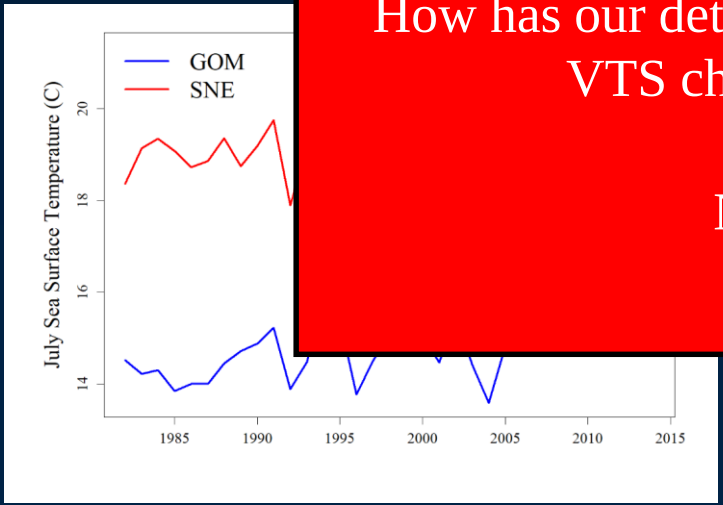
Temperature has been found to influence species abundance *and phenology*.

How might coastal thermal habitat availability for lobsters influence VTS catch rates?

Could changes in the thermal field within the survey area be causing catchability issues and contributing to the trends that we see?

Climate Influence on Coastal Lobster Abundance?





How has bottom temperature changed within the survey domain over the years?

How do these interannual bottom temperature changes translate to thermal habitat for lobsters?

How has our detectability of lobsters in the VTS changed over time?

Next steps.

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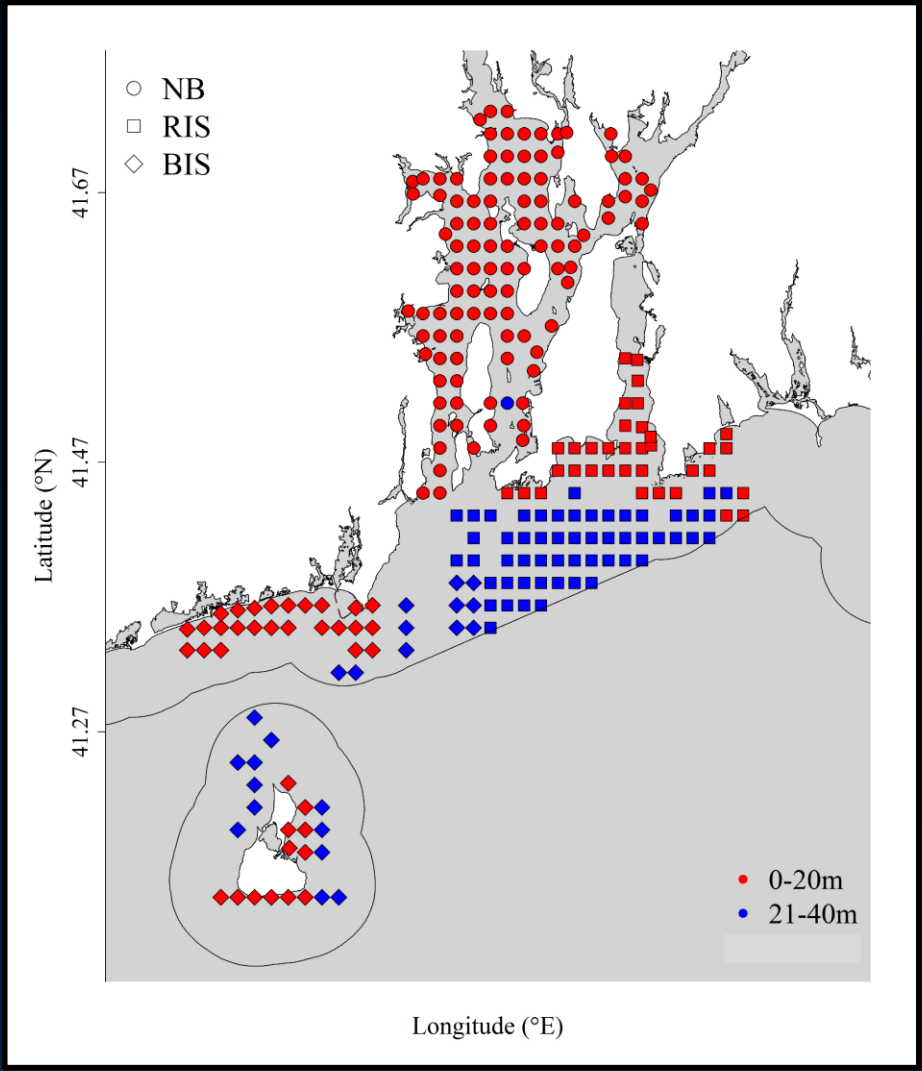

Bottom Temperatures evaluated within the RIVTS area using two temperature data sources:

(1) RIDEM Bottom Trawl Survey temperature data with a generalized additive model to predict temperature in space and time.
(2) Large scale ocean model predictions of temperature (FVCOM).

Bottom temperatures predicted and matched for every possible station selection through the sampling season and through time.

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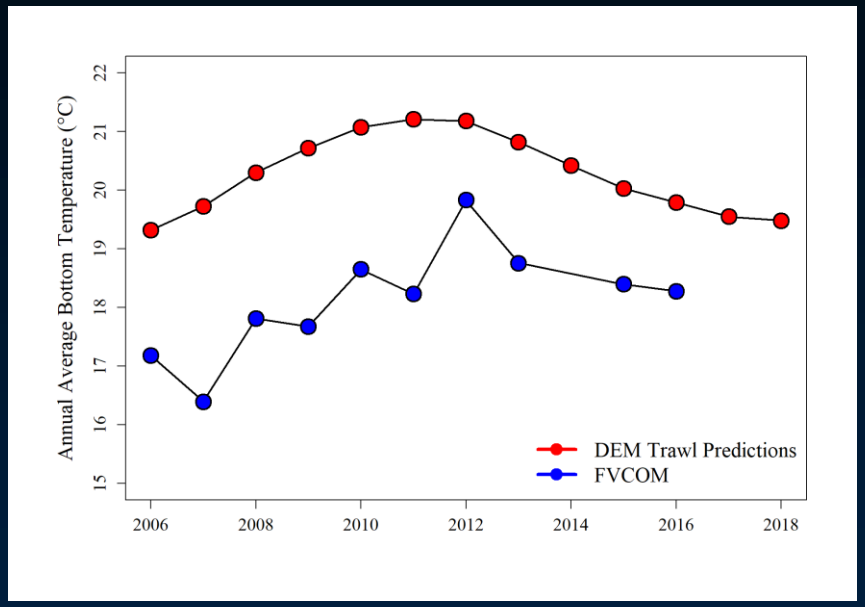
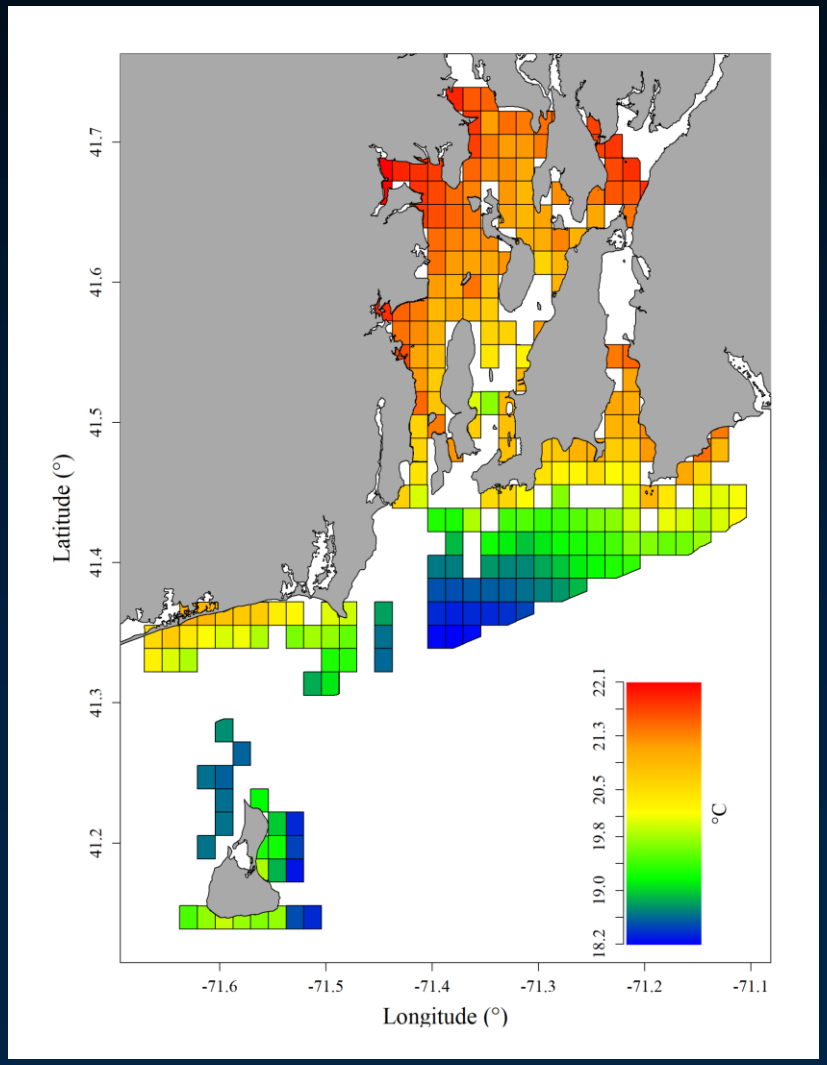
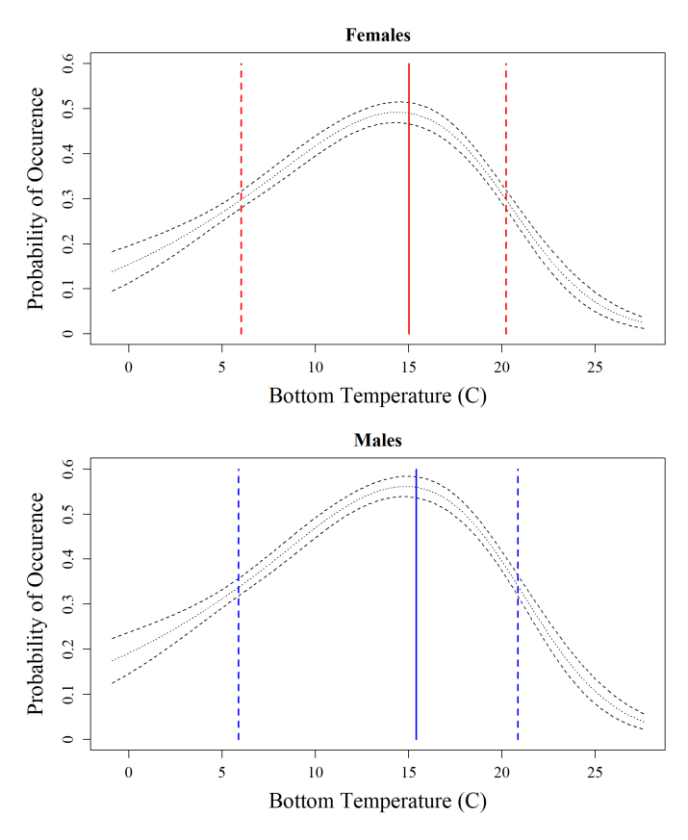


Bottom temperature variable through time, with methods differing in magnitude.

Bottom temperature varies substantially over the survey domain.

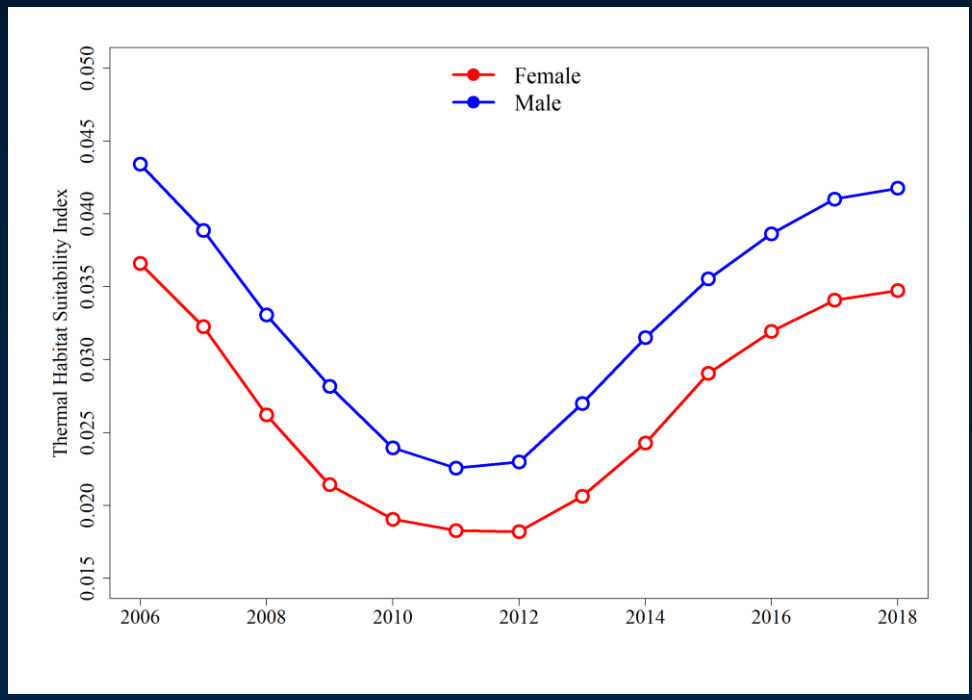


How do these interannual bottom temperature changes translate to thermal habitat for lobsters?



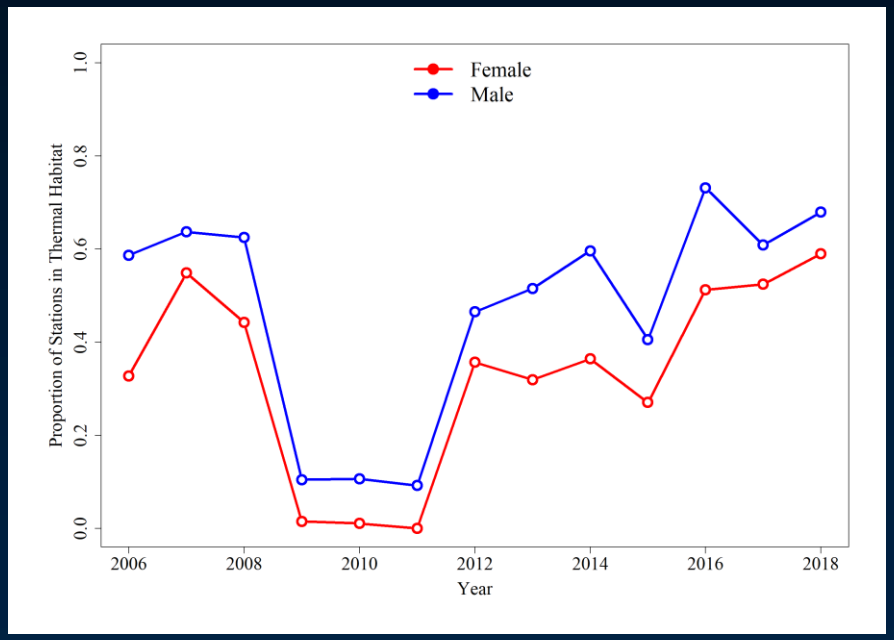
Bottom temperature predictions within the thermal window scored 1, and outside 0.

Aggregate total scores across the area and season by year to understand how thermal habitat (not temperature) has changed within the survey domain.



Using ecological modeling techniques (HOF), we can understand the thermal niche of lobsters in Rhode Island, and how those dynamics may vary between males and females.

How has our detectability of lobsters in the VTS changed over time?



VTS uses a random stratified design, where stations to sample are annually selected at random to capture changes in the population over time.

With dynamically changing bottom temperature and thermal habitat, how have drawn stations compared to the predicted thermal habitat?

Proportion of stations that fell within thermal window of lobsters has changed through time, but has similar trends to the overall thermal habitat area estimates.

Next Steps

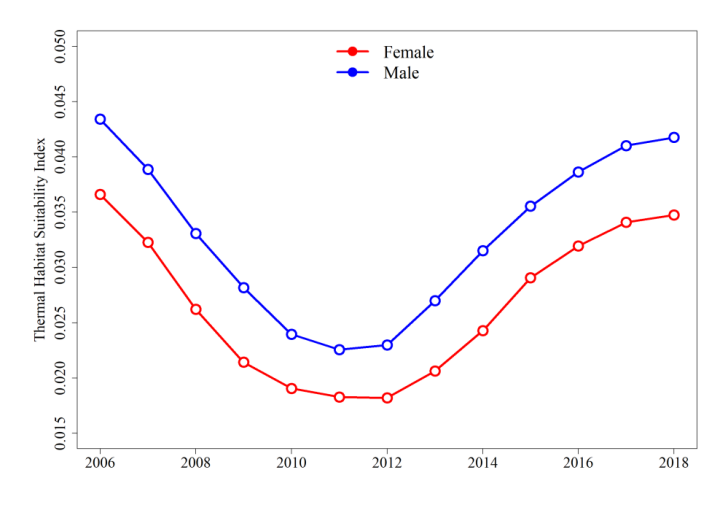
Include additional bottom temperature data (GSO-DEM buoys, eMolt data)

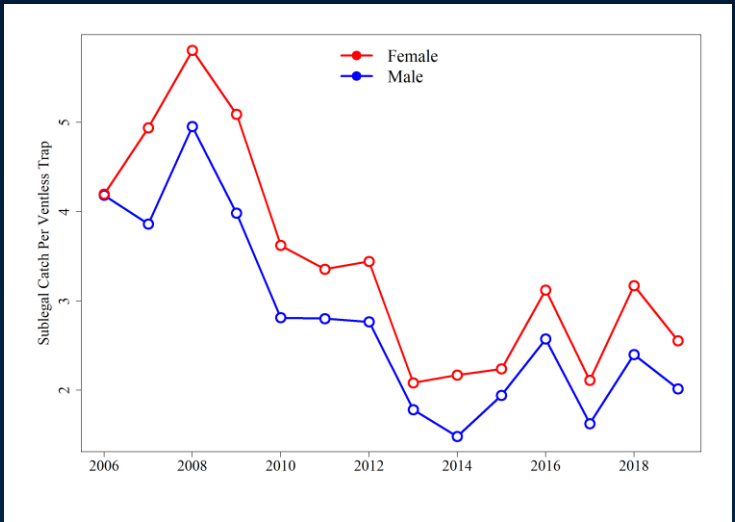
Expand analysis to the larger VST region by stock.

Compare abundance indices to the thermal suitability/catchability time series.

Currently building feature into stock assessment model to enable capturing theses features in survey catchability (environmental drivers are inducing noise and / or trends in the indices.)

$$\textit{Survey Index}_{Yi} = q * \textit{Population Abundance}_{Yi} * \underline{\textit{Thermal Catchability}_{Yi}}^{g}$$





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DEM RHODE ISLAND

Questions?

ATLANTIC STATES MARINE FISHERIES COMMISSION