Pre-Deployment Monitoring of the American Lobster Fishery for a Floating Wind Installation
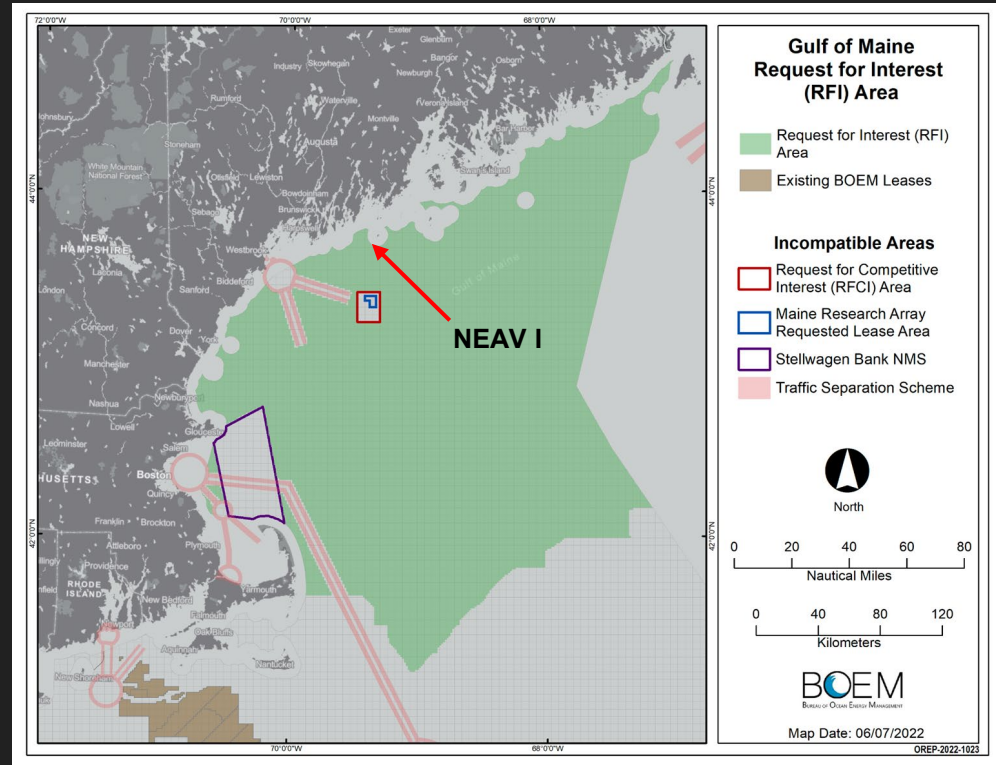
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MAINE

U.S. DEPARTMENT OF
ENERGY

Wind Development in the Gulf of Maine

- Last week BOEM released a Request for Interest for the Gulf of Maine.

- The NEAV I project has been sited for over a decade.

- The Gulf of Maine Research Array (MERA) lease application was submitted in Oct. 2021.
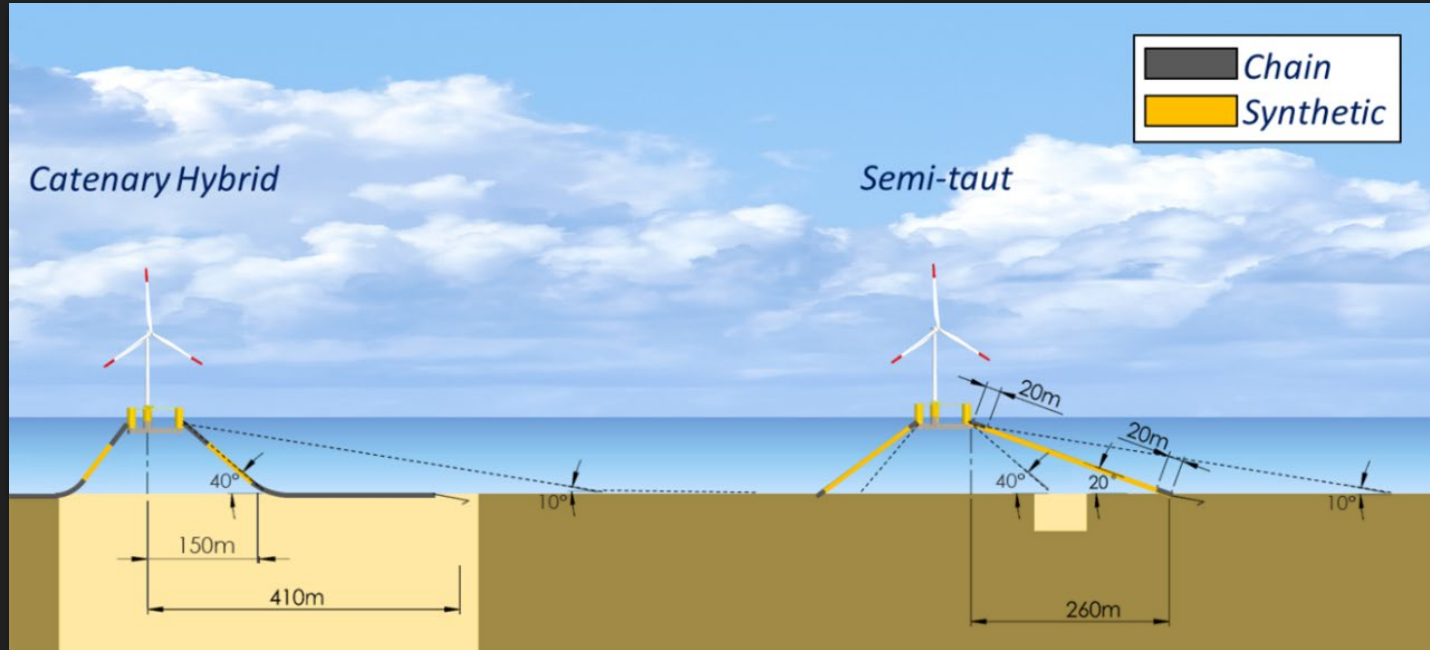

BOEM recent RFI for Gulf of Maine.

New England Aqua Ventus I

- New England Aqua Ventus I will be the first full-scale floating wind turbine in the western Hemisphere.

- The project will be monitored to determine what effects it may have on the natural environment.
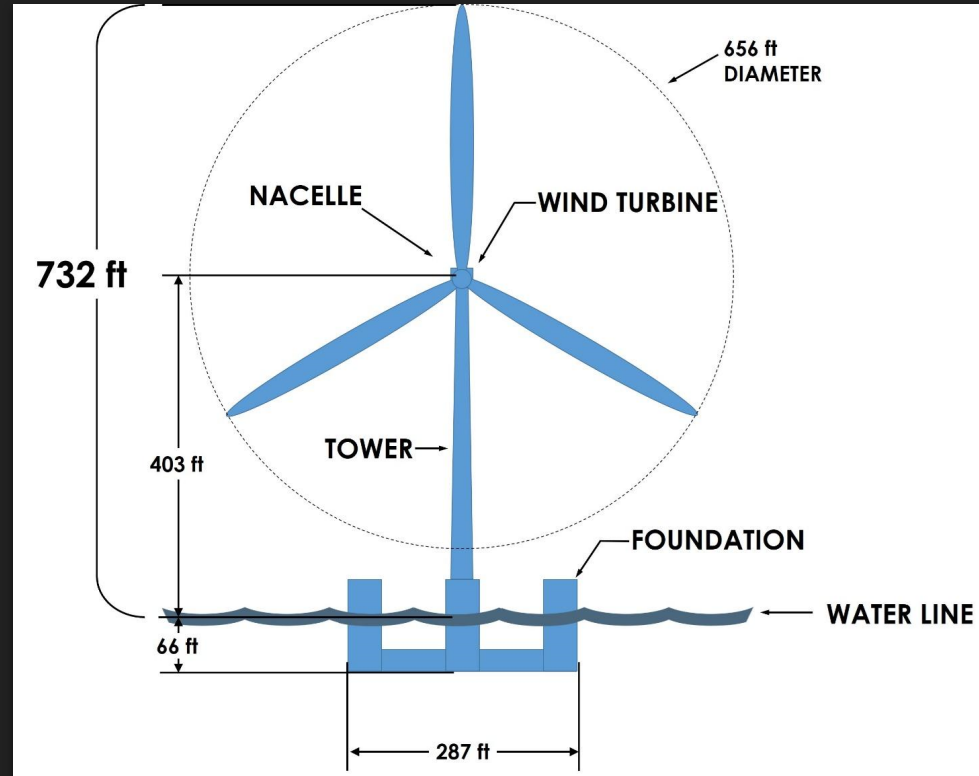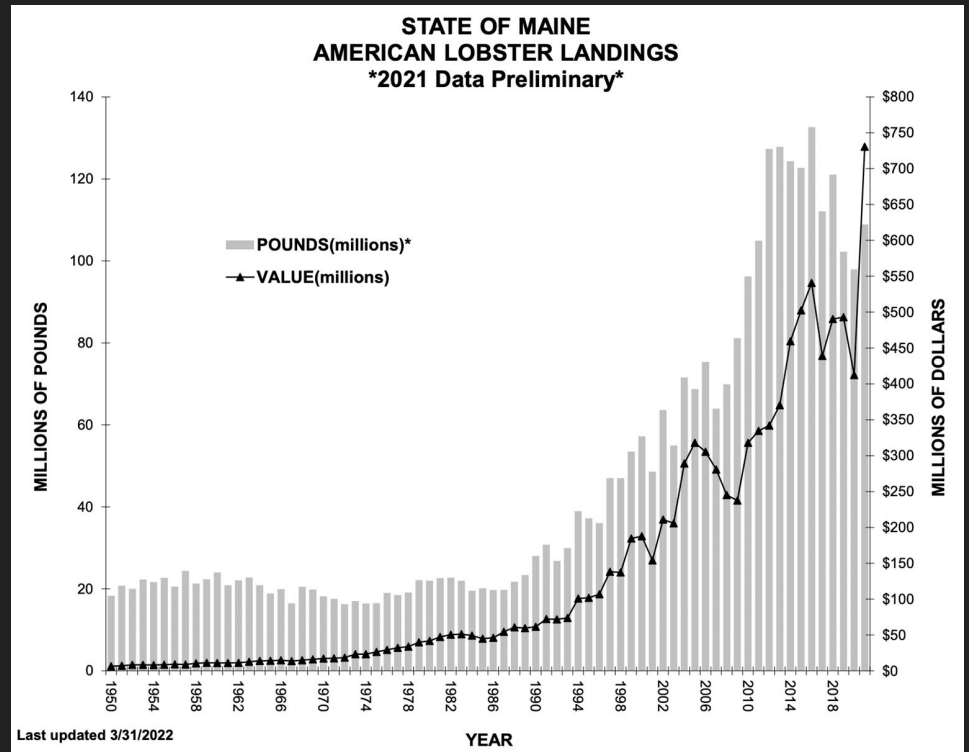

Floating wind turbine schematic.

Potential Mooring Configurations

Comparison of Catenary chain and Semi-taut mooring systems.

The Maine Lobster Fishery Value

- The Maine lobster fishery is the most valuable single-species fishery in the country.

- Monitoring for potential effects on the local lobster fishery is a high priority.

Time series of Maine lobster fishery landings (grey) and value (black).

Survey Objectives

Primary Objective: Establish a baseline to determine the effect, if any, of NEAV I on commercial lobster catch rates.

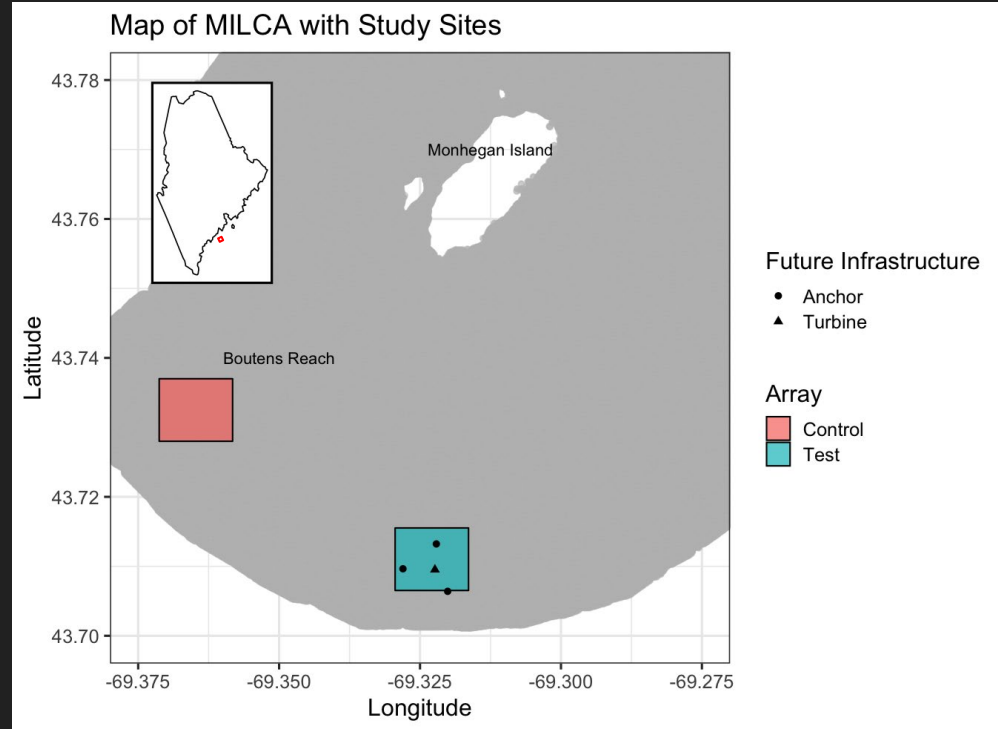Secondary objective: Estimate baseline lobster population from tagging data.

Tagging tool, tag clip, and calipers.

Tagged lobster.
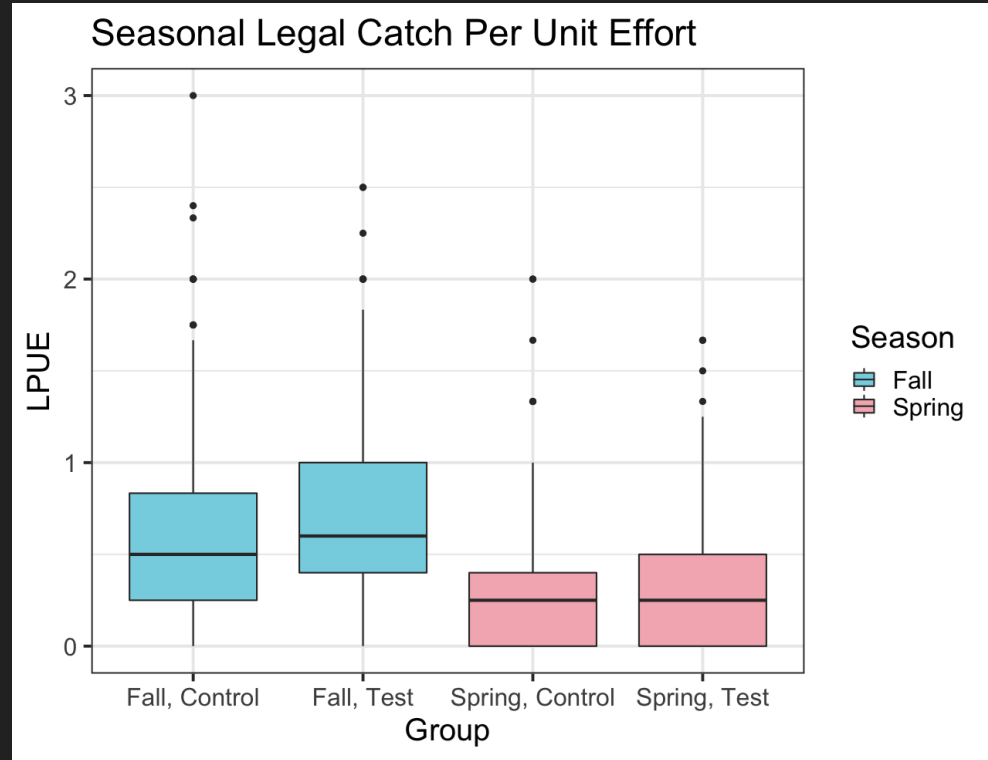
Survey Design and Methods

- A Before-After Control-Impact approach is taken.

- The Before portion of the survey was completed in Fall 2021 / Spring 2022.

Map with study sites.

Interseasonal Comparison

- To standardize legal catch rates, legal catch per trap is divided by the # of nights a trap soaked before haul.

- Legal catch per unit effort is lower in the spring.

Boxplot comparing legal catch per unit effort between Fall and Spring.

Probability of Catch > 0

- The response variable *presence* is predicted using habitat and survey design covariates.

- When used in a predictive capacity the model yields probabilities of observing a present value.

- The higher Fall temperature regime has a higher probability of present legal lobsters.
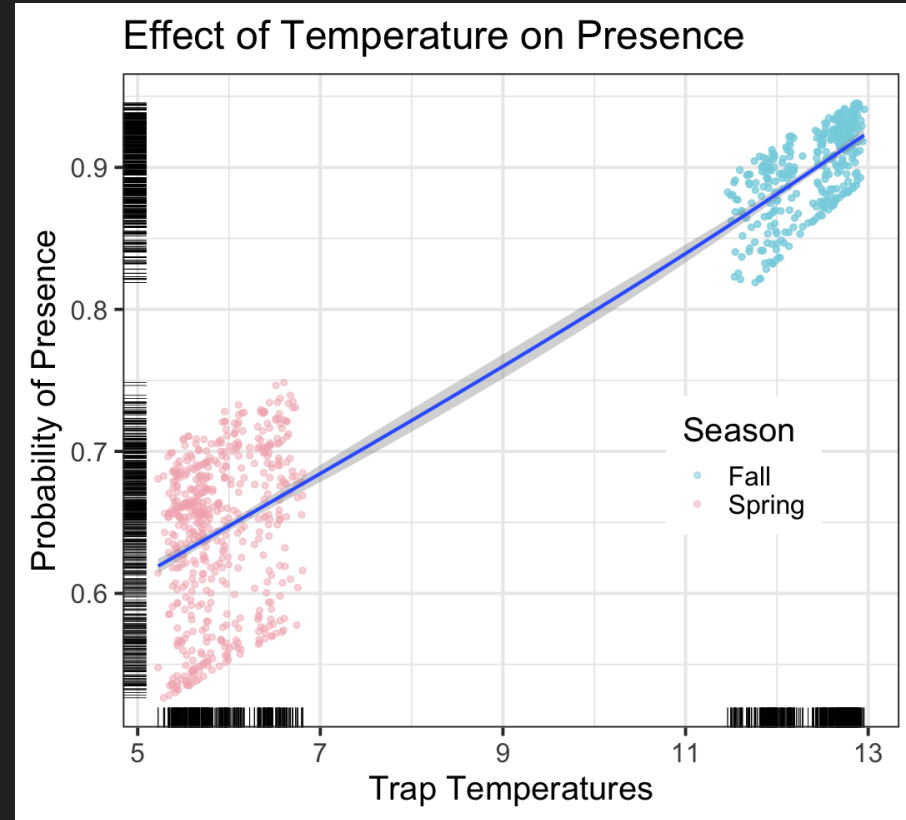
Probability of catch presence modeled as a function of temperature.

Modeling Legal Catch

- The effects of *temperature*, *sex ratio, trap type, soak time*, *molt status*, and *temperature anomaly* were found to have significant effects on the *catch* of legal lobsters.

- Temperature increases result in catch increases, but catch responses are more sensitive to a higher temperature regime.

Effect of Temperature on Legal Catch
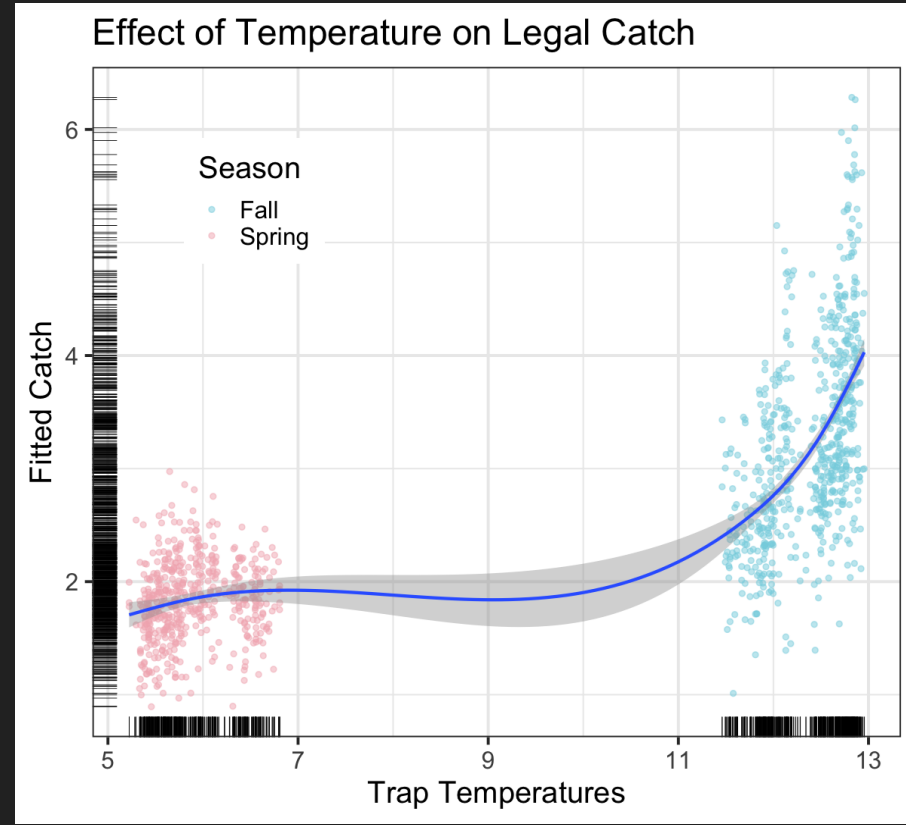
Legal catch per trap modeled as a function of temperature.

Conclusions

1. Seasonal differences are due *in part* to the higher Fall temperature regime.
2. The control site is viable with similar legal catch rates and does not require an adjustment in the baseline GAMs.
3. Developing a GAM allows for environmental, biological and survey design covariates to be factored into analysis of legal catch per trap before investigating for a spatial difference.

Acknowledgements

Thank you

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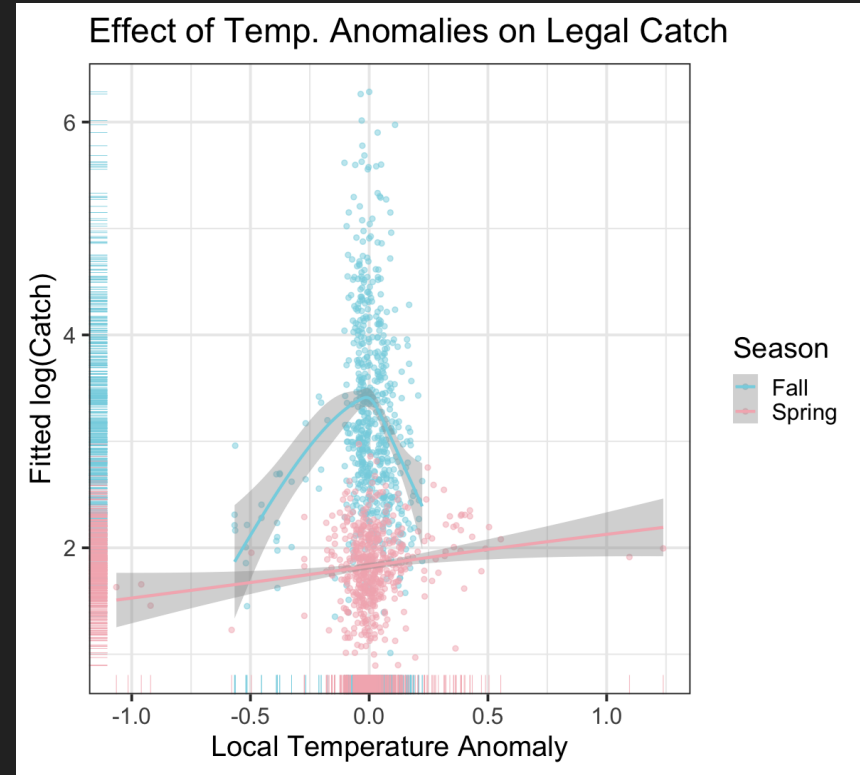& Damian C. Brady, UMaine

References

BOEM. (2020). Request for Interest (RFI) in Commercial Leasing for Wind Energy Development on the Gulf of Maine Outer Continental Shelf (OCS). https://www energy/state-activities/maine/gulf-maine.

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# Questions?

Local Temperature Preferences

- When fit by each season we can see that temperature anomaly effects Fall and Spring differently.

Partial effect of temperature anomaly on legal catch values.

Trap Saturation

- The effect of soak time shows catch increases with soak time, however in the fall a saturation point was reached.
  - This may occur due to actual saturation or a lack of observations > 5 days.
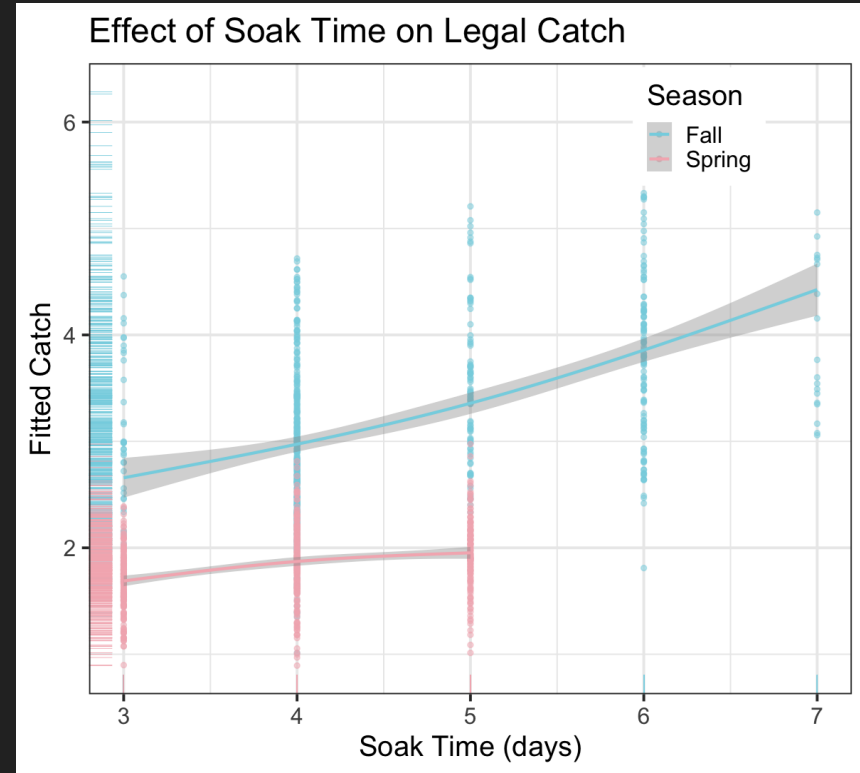
Partial effect of soak time on legal catch values.

Molt Cycle and Catchability

- Previous studies have shown catchability to be highest post-molt and there is a skewed effect on catch showing catch is higher when molt status is increased.
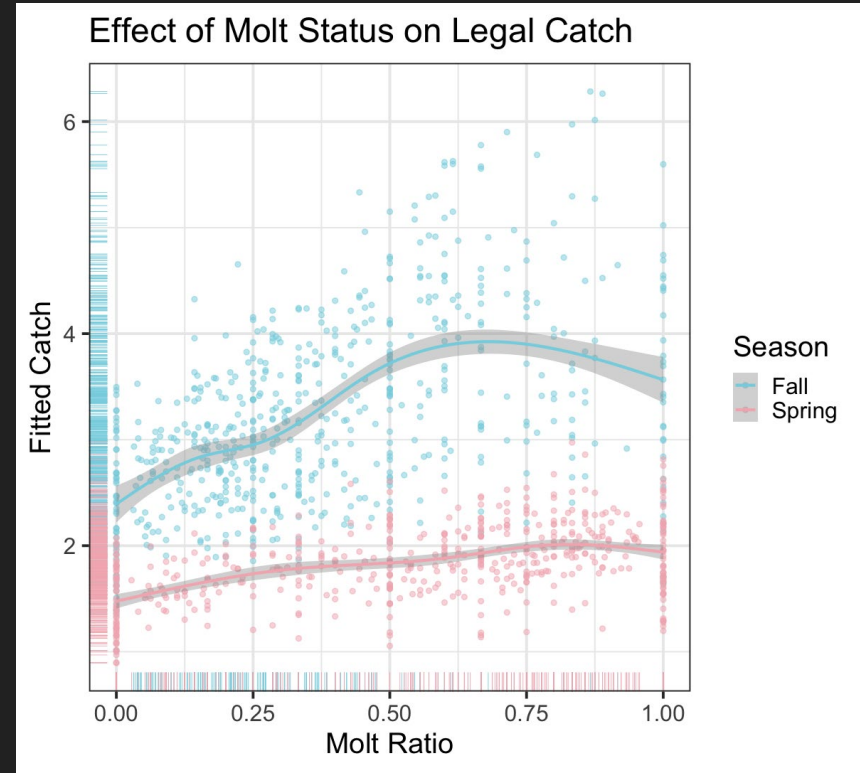
Partial effect of molt status on legal catch values.

Intersex Differences

- Male and female lobsters have different timings in their molt cycles.

- Differing cycles of catchability can create local sex skews as lobsters are removed at different times of the year.
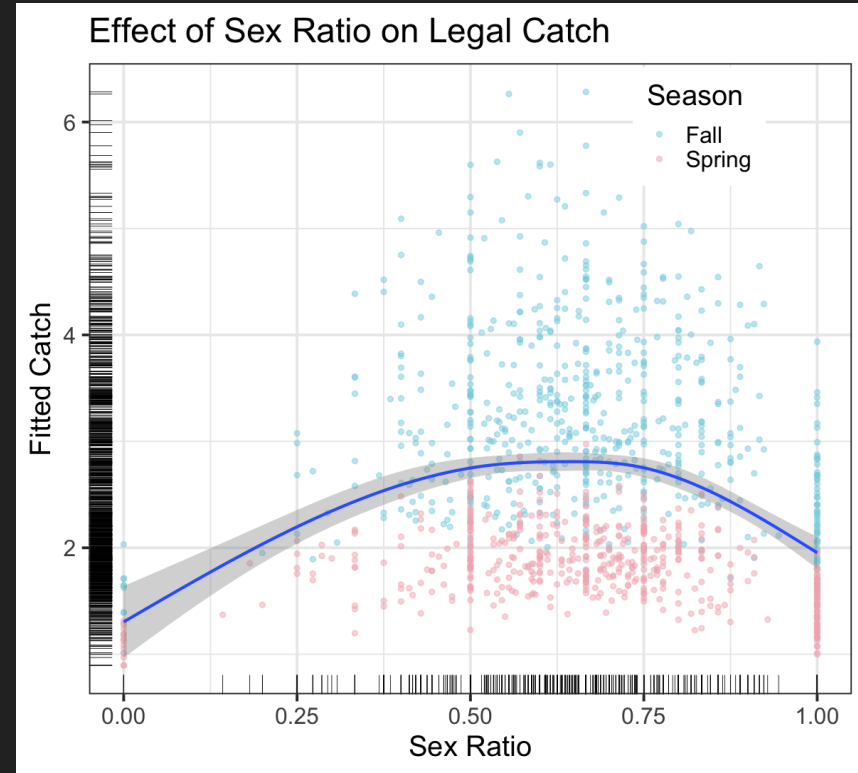
Partial effect of sex ratio on legal catch values.

Trap Type Saturation Effect

- Trap type was included in the model as a linear effect.
- The difference in trap type catch rates may occur because ventless traps can saturate with sublegal lobsters which doesn't occur in vented traps where the lobsters can use the escape vents.
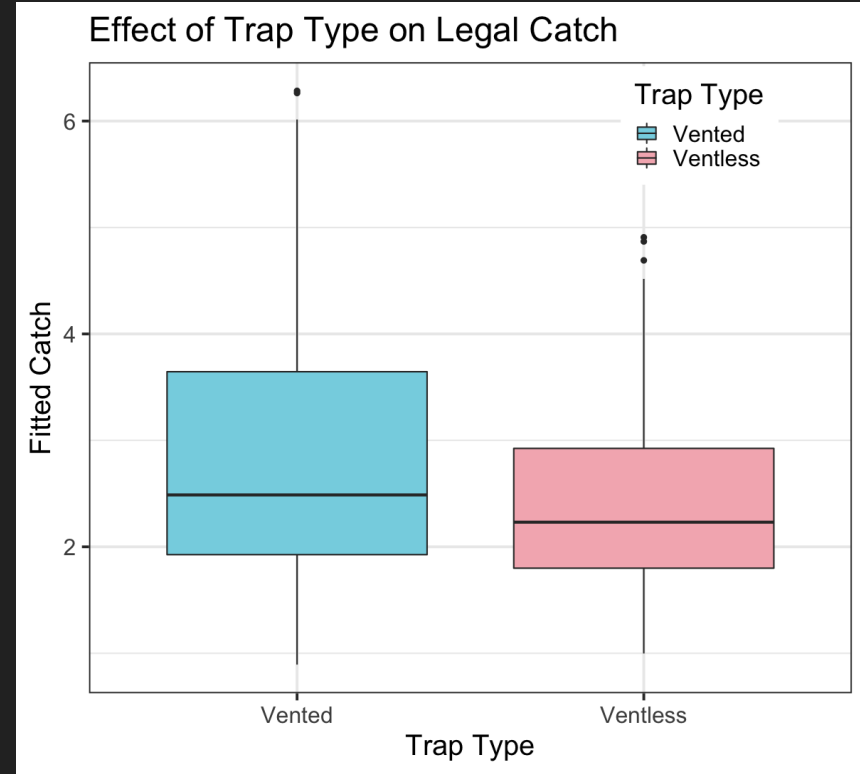
Partial effect of trap type on legal catch values.

2 Stage GAM

- Generalized additive models (GAMs) describe potentially non-linear relationships.

- A two-stage GAM uses 2 models, 1) predicts the presence and absence of data, or occurrence of zeroes; 2) predicts values of present data.
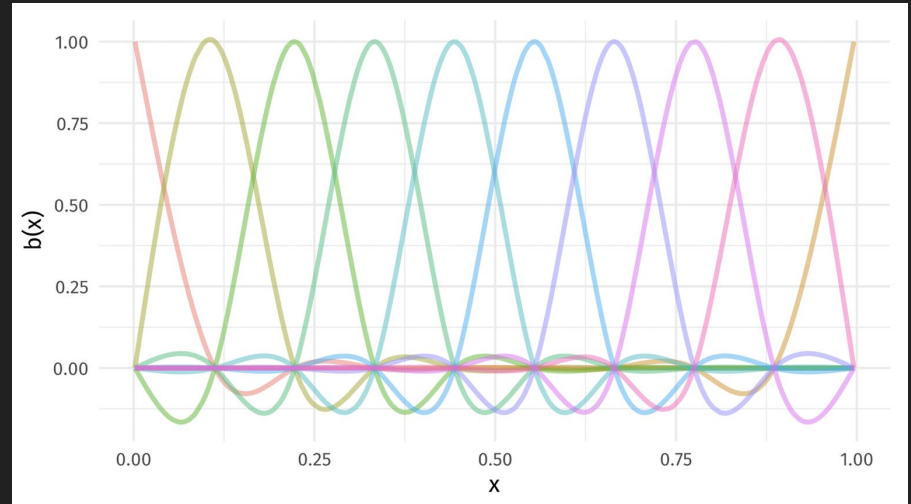
Using spline functions to describe non-linear data (Simpson, 2020).