

# Understanding impacts of climate-induced distributional changes on the fishery landings for the inshore Maine lobster (*Homarus americanus*) fishery

## Introduction

This study connects **spatio-temporal distributions of climate driven lobster habitat** with the **distribution of fishery landings across lobster management zones**.

- The American lobster has a significant economic and social in the state of Maine.
  - Tightly coupled with Maine lobster fishery
  - Highly dependent on environmental factors
  - Increasing abundance and northeast shifts in distribution
- Warming trends in the Gulf of Maine (GoM) has increased concern for the vulnerability of the Maine lobster fishery to climate change.



Long term historical county landings (1964-present) and short term zone landings (2004-present), grouped based on delineation of zones and counties to regions (Figure 1.)

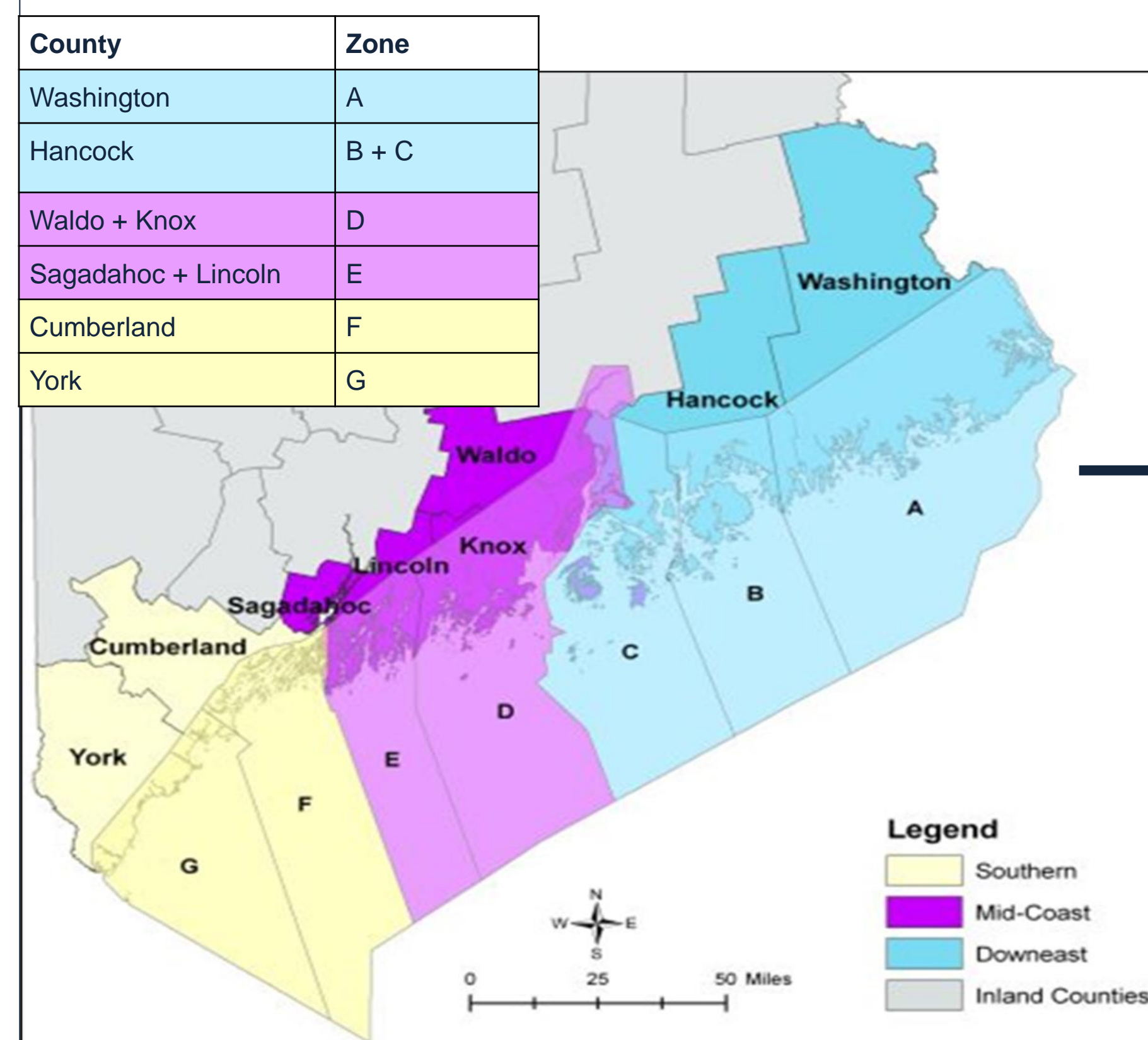
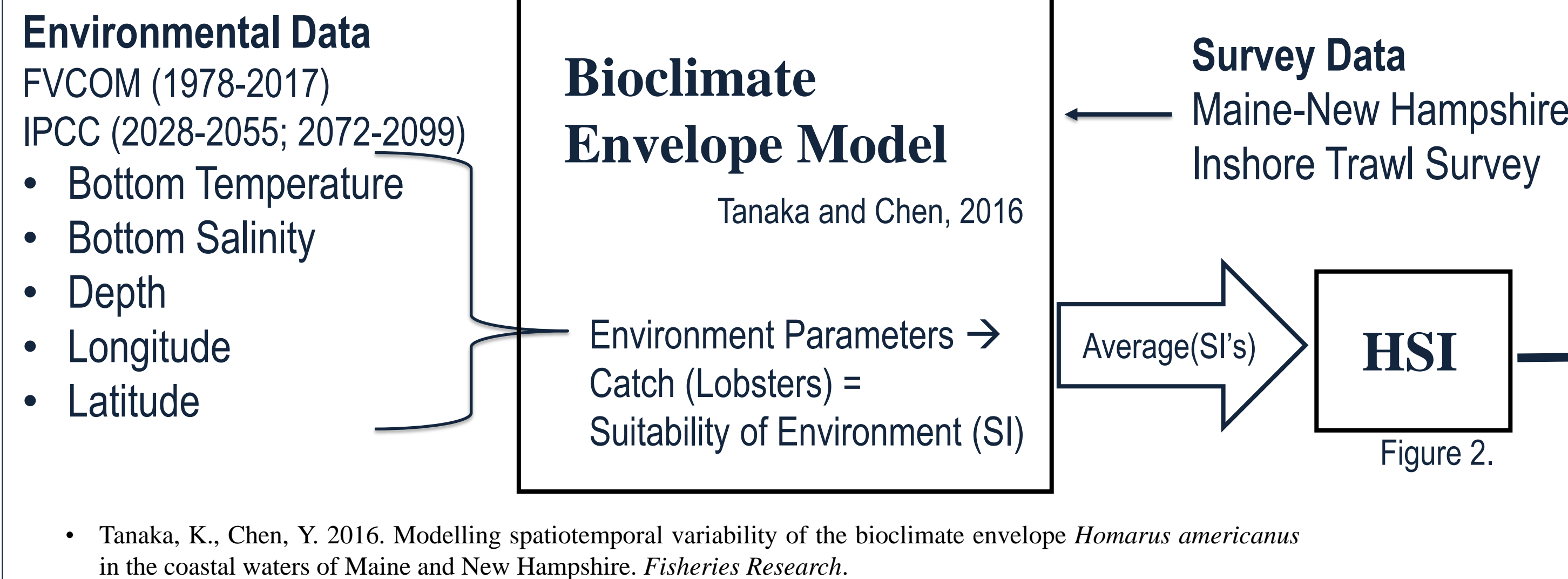
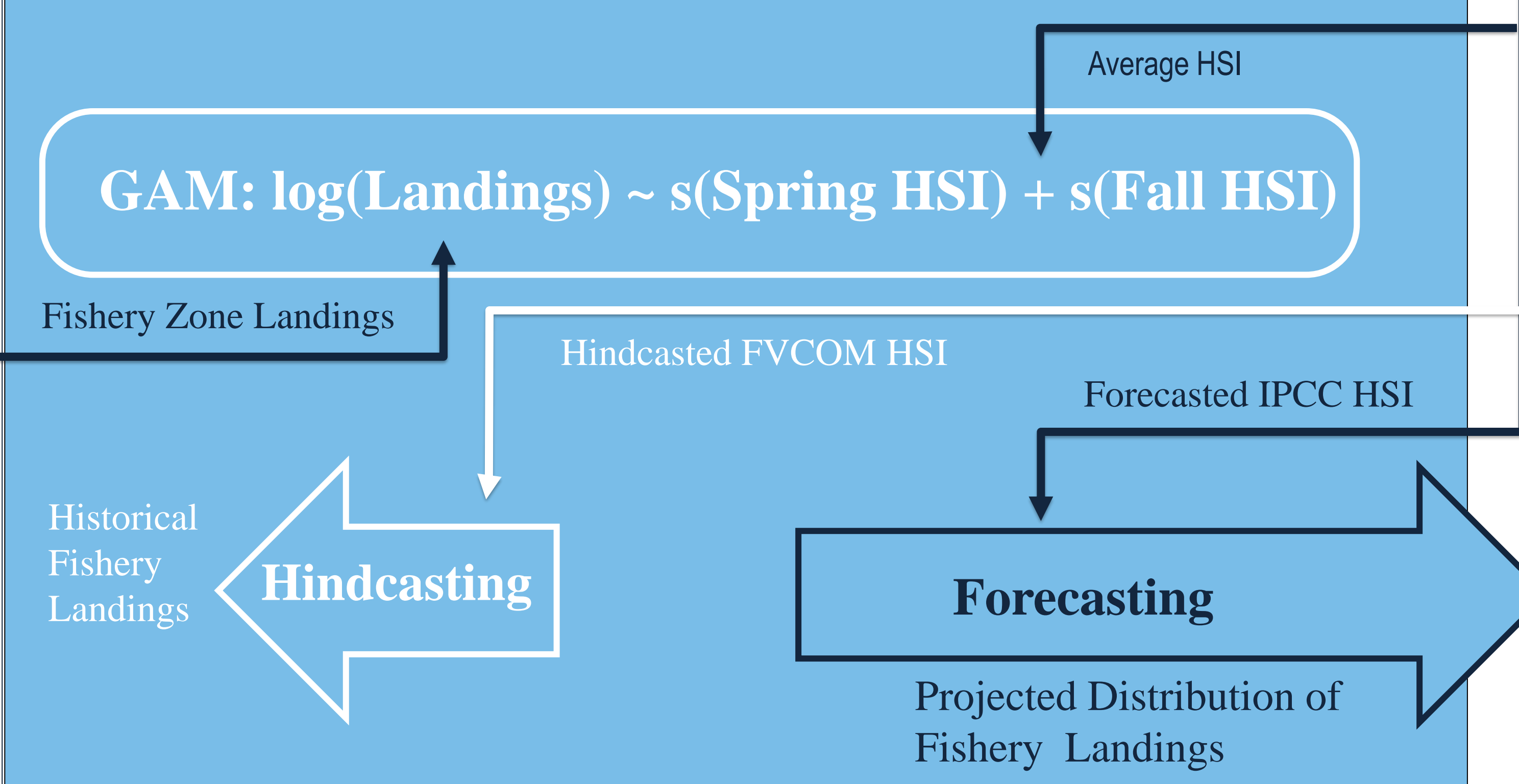


Figure 1. Graphic from the Maine Lobstermen's Community Alliance. Grouping of Maine coastal counties and lobster Management zones.

## Bioclimate Envelope Model (Habitat Suitability Index – HSI)



## Landings-HSI Model



## Distribution of Fishery Landings

- Decreased proportional landings in **downeast regions**
- Sustained high proportional landings in **midcoast regions**
  - Recruitment processes in response to climate change (Larval settlement)
  - Concentration of larvae in in zone D due to GoM coastal current

## Management Implications

These findings have clear implications for long term management of the Maine lobster fishery considering climate change. As a highly localized, heterogeneous fishery, understanding distributional effects of climate change **can inform policies that can build economic resilience** in areas with projected decreases in landings. These findings can serve as a basis for **linking ecological models to economic data**, which can provide greater **insight onto the socio-economic impacts of climate change in the Maine lobster fishery**.

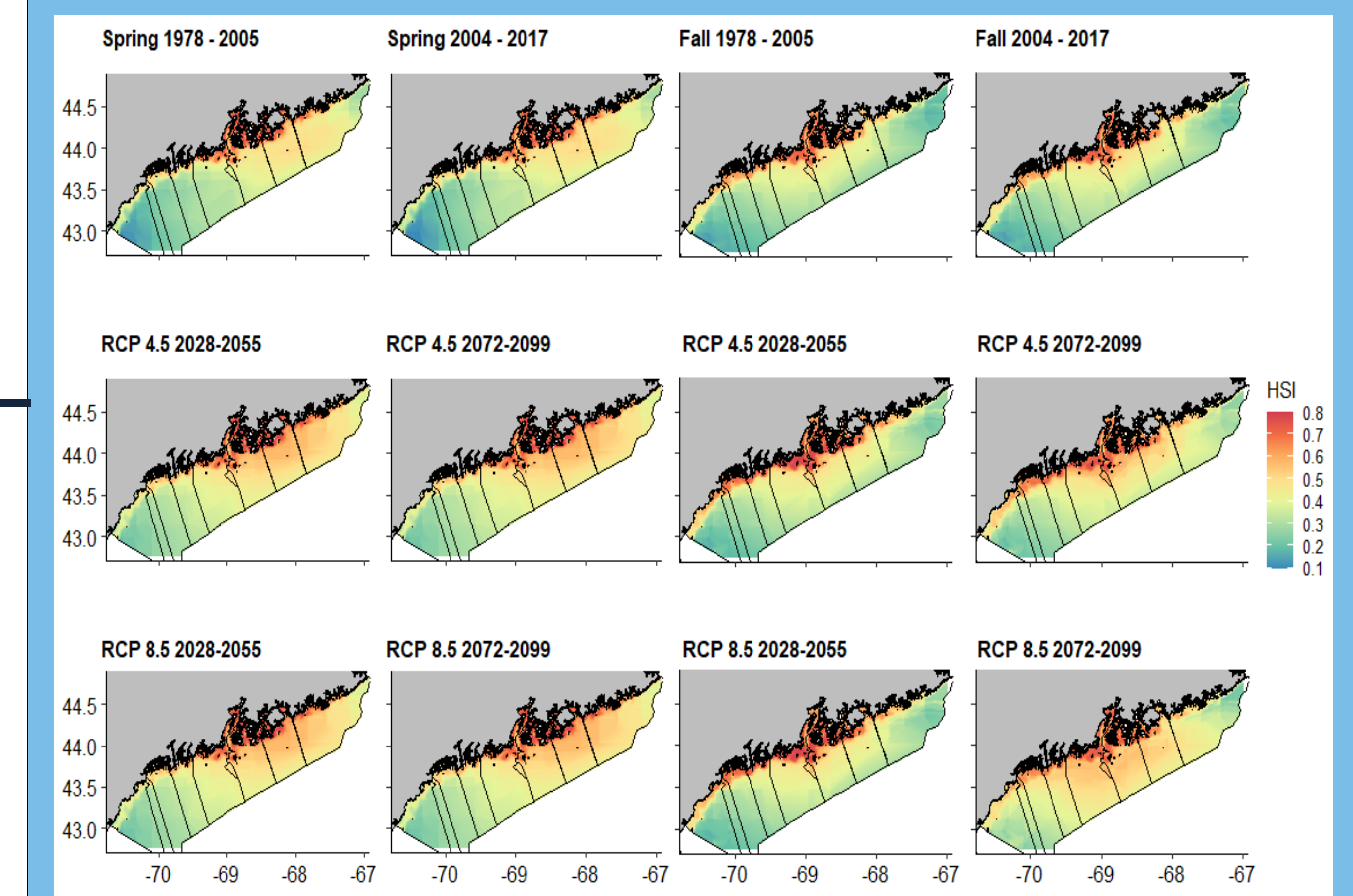


Figure 2. Averaged Habitat Suitability Index (HSI) for American lobster in the inshore Gulf of Maine in Spring (April – June) and Fall (September – November) for the time periods: Historical (1978-2005), Baseline (2004-2017), RCP 4.5 and 8.5 near future (2028-2055), and RCP 4.5 and 8.5 far future (2072-2099). HSI is ranked from 0 (least suitable) to 1 (most suitable) habitat.

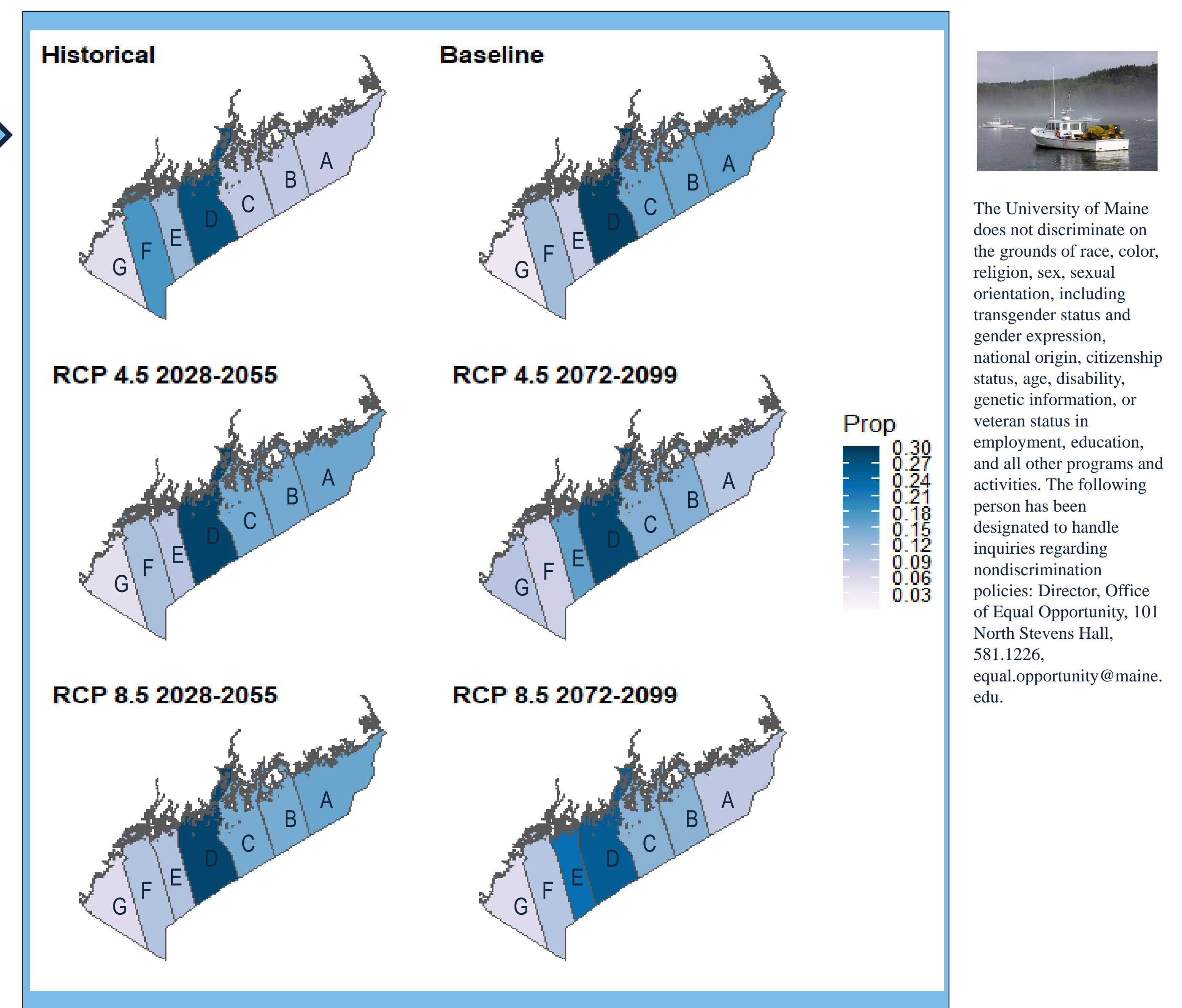


Figure 3. Projected proportional landings of Maine lobster management zones for the time periods: Historical (1978-2005), Baseline (2004-2017), RCP 4.5 and 8.5 near future (2028-2055), and RCP 4.5 and 8.5 far future (2072-2099). Proportions are listed 0 (lowest) to 0.3 (highest).

## Acknowledgements

The Chen lab at the University of Maine, most notably Jamie Behan for her contribution to the code. The Maine Department of Marine Resources for providing survey and fishery data. The Chen lab at the University of Massachusetts Dartmouth for FVCOM data. NOAA COCA grant #2741085 for funding. RARGOM for the opportunity to present our research.



The University of Maine does not discriminate on the grounds of race, color, religion, sex, sexual orientation, including transgender status and gender expression, national origin, citizenship status, age, disability, genetic information, or veteran status in employment, education, and all other programs and activities. The following person has been designated to handle inquiries regarding nondiscrimination policies: Director, Office of Equal Opportunity, 101 North Stevens Hall, 581.1226, equal.opportunity@maine.edu.