# Variations in walleye pollock (*Theragra chalcogramma*) maturation rates in the Gulf of Alaska

Ben Williams, Gordon Kruse

University of Alaska Fairbanks, Alaska USA

Martin Dorn

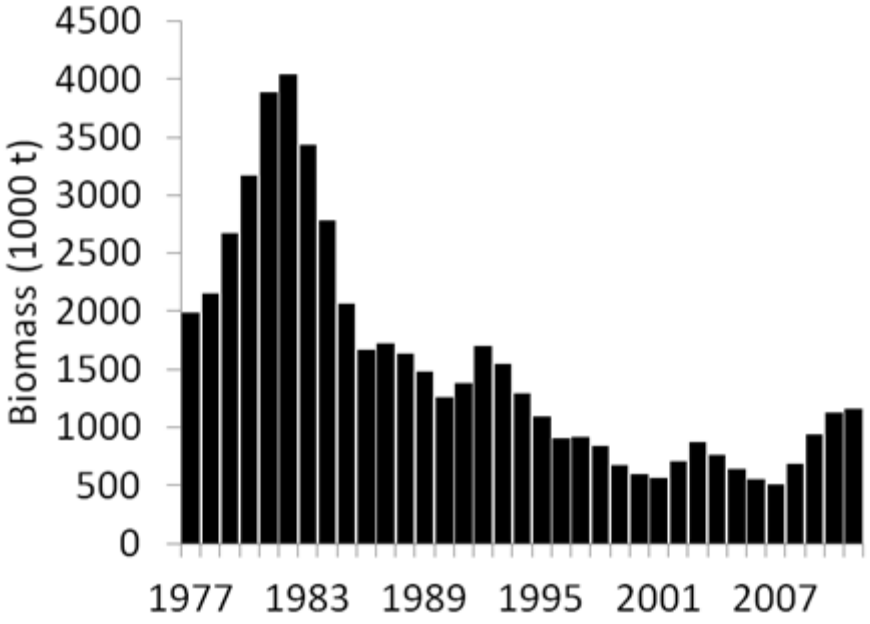
NOAA Alaska Fisheries Science Center, Washington USA

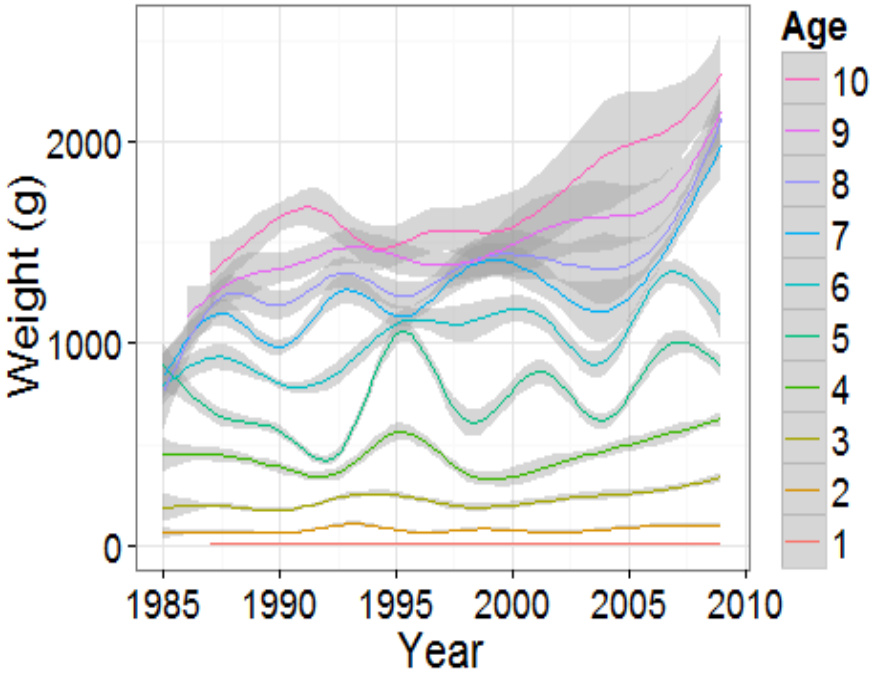
# Background

- Walleye pollock support the largest fishery in the U.S., 24% of total landings.
- GOA populations are managed by applying a harvest rate toward an assessment model estimate of spawning stock biomass (SSB), which is based on estimates of weight, fecundity and a **maturation schedule**.

# Background

Dynamic changes in stock abundance and size-at-age



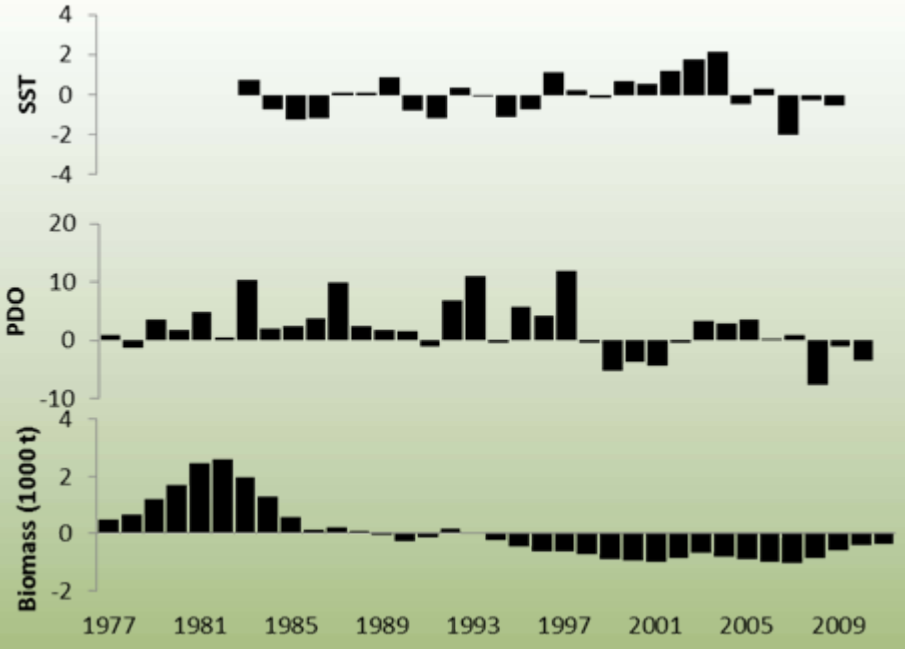
# Objectives

- Improve maturity schedule estimates.
- Examine functional relationships between maturity rates, stock abundance, environmental factors.
- Broader study examining total egg production (TEP) as it relates to environmental variability and population size.

SST (Annual)

PDO (Annual)

Biomass

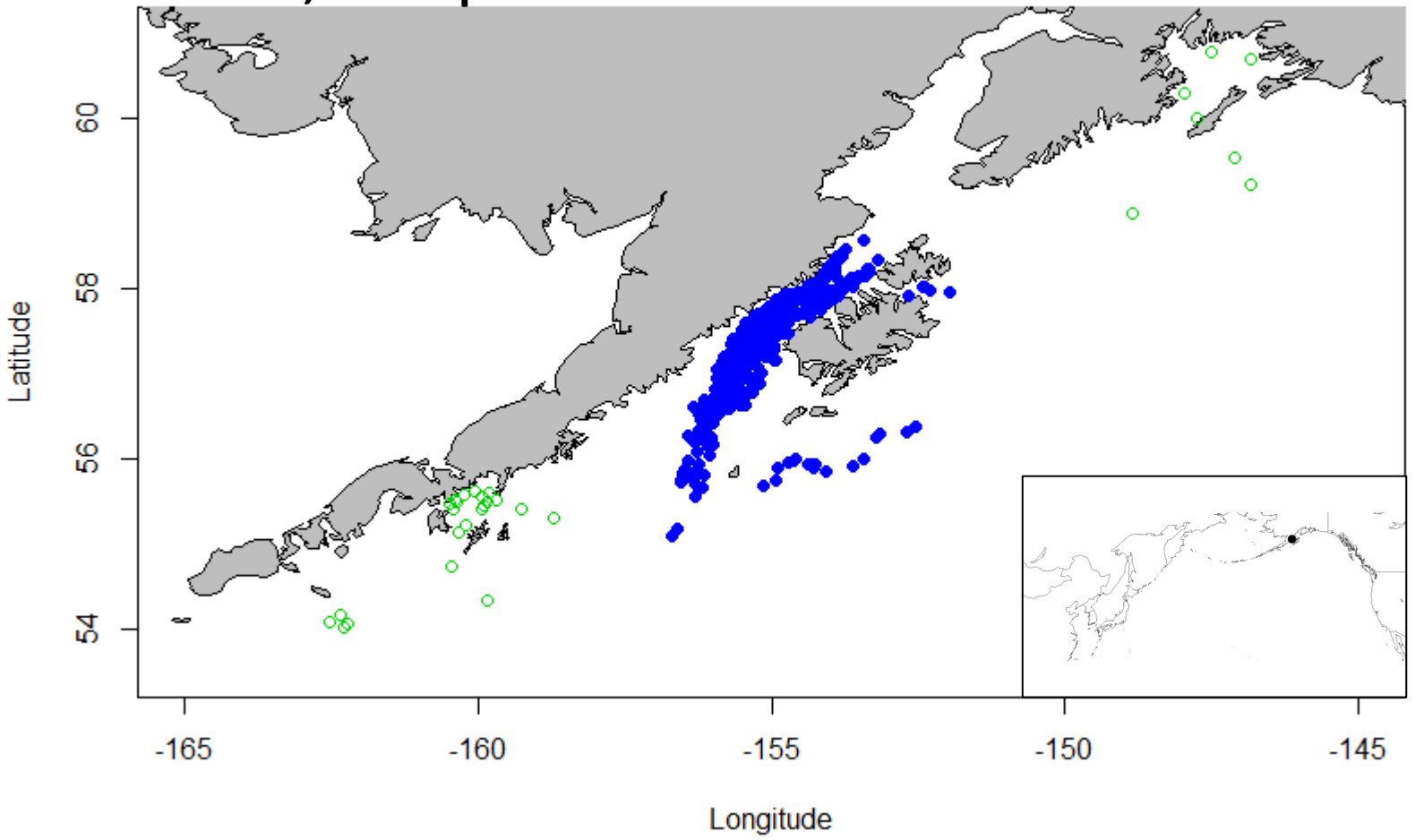


AFSC

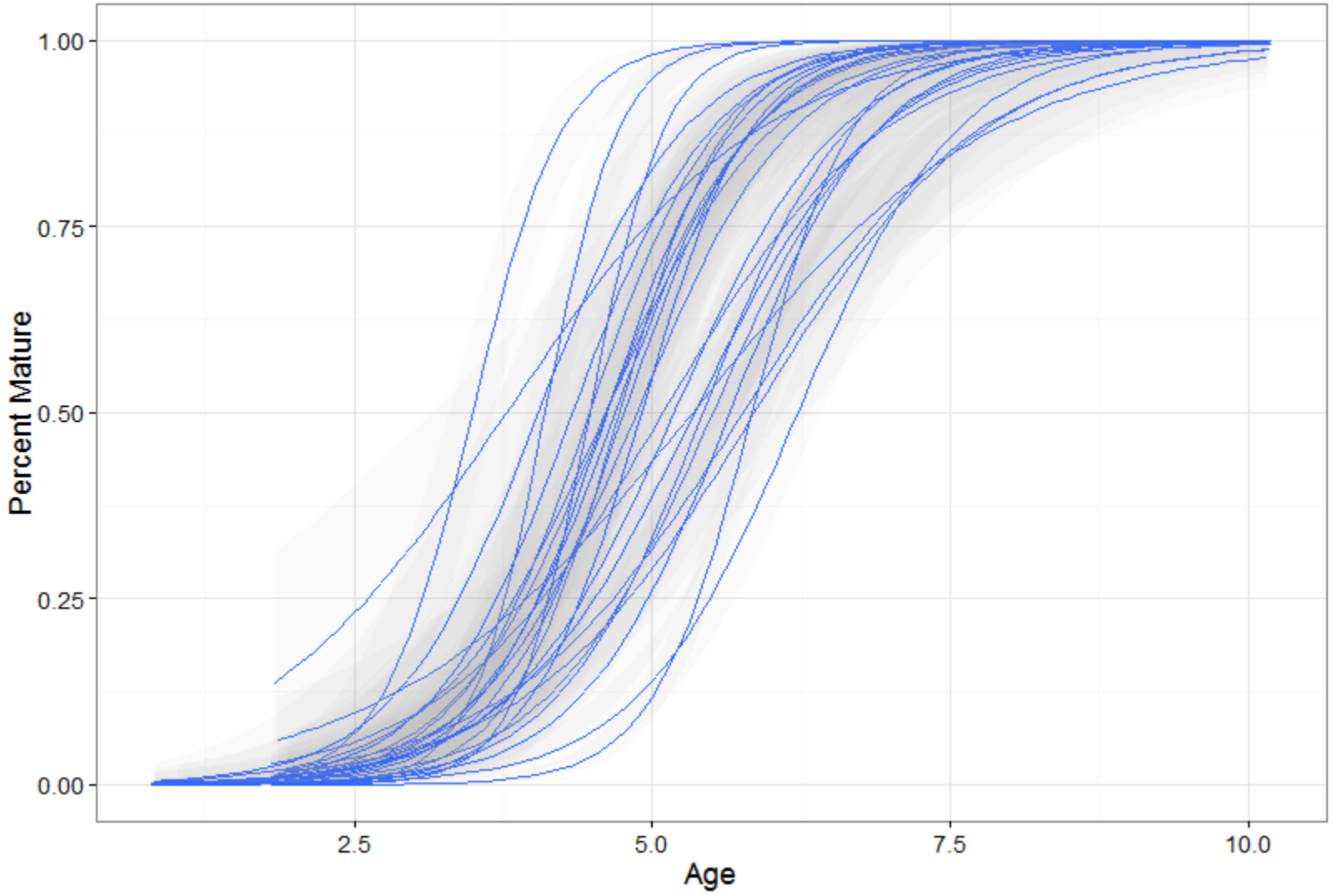
# Methods

## Visual maturity estimates

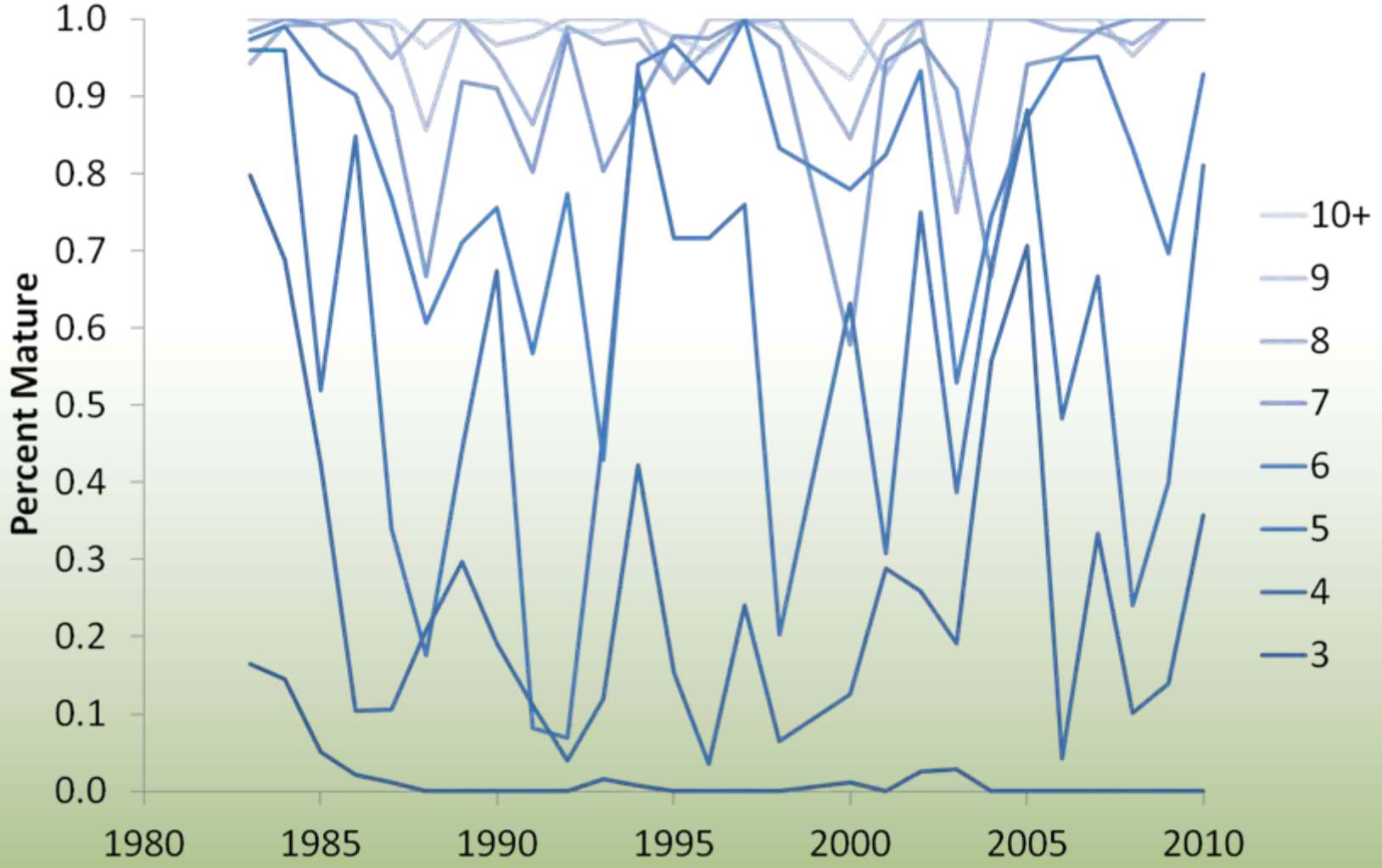
## 10,344 pollock from 1983 - 2009



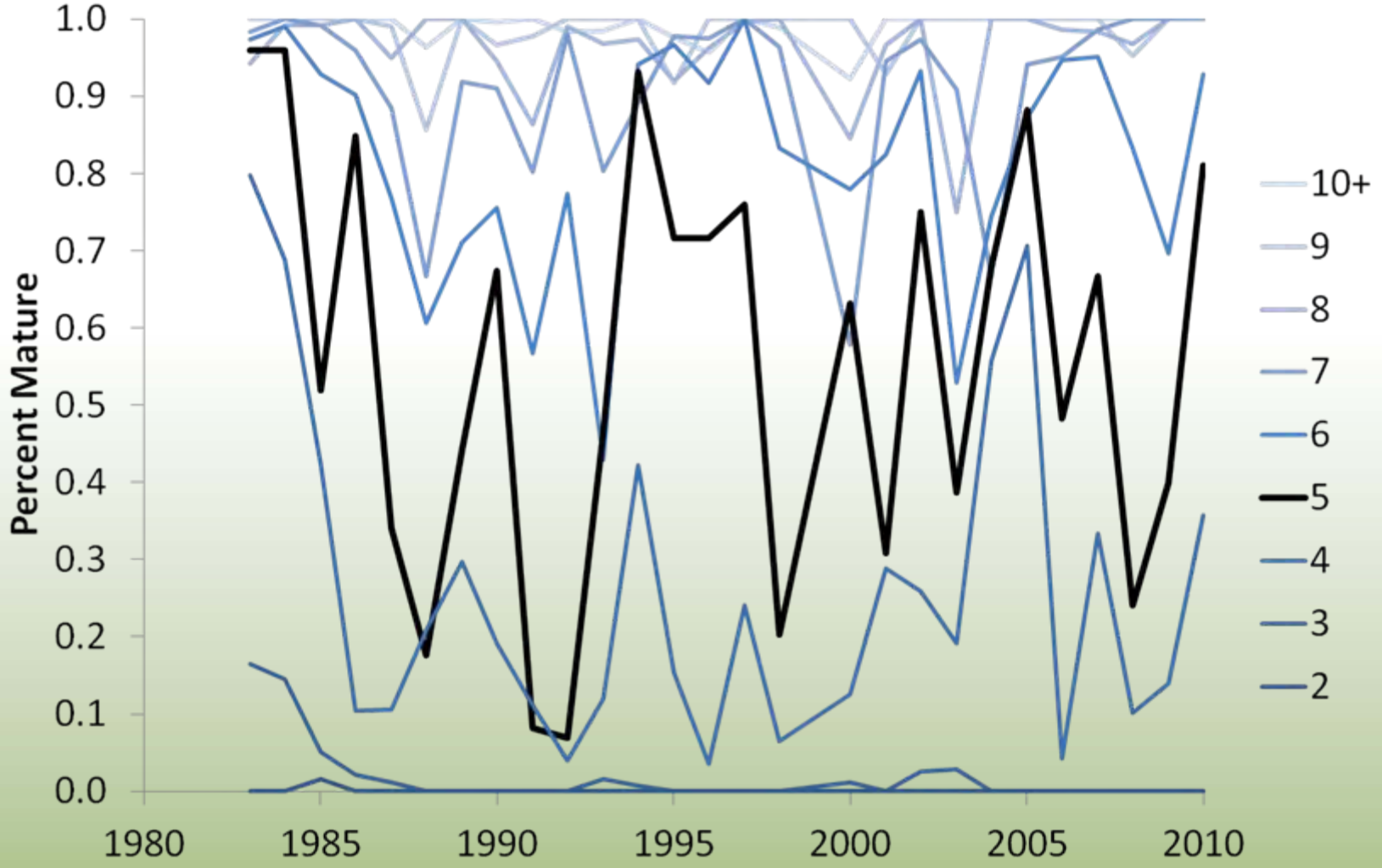
# Annual Logistic Regressions



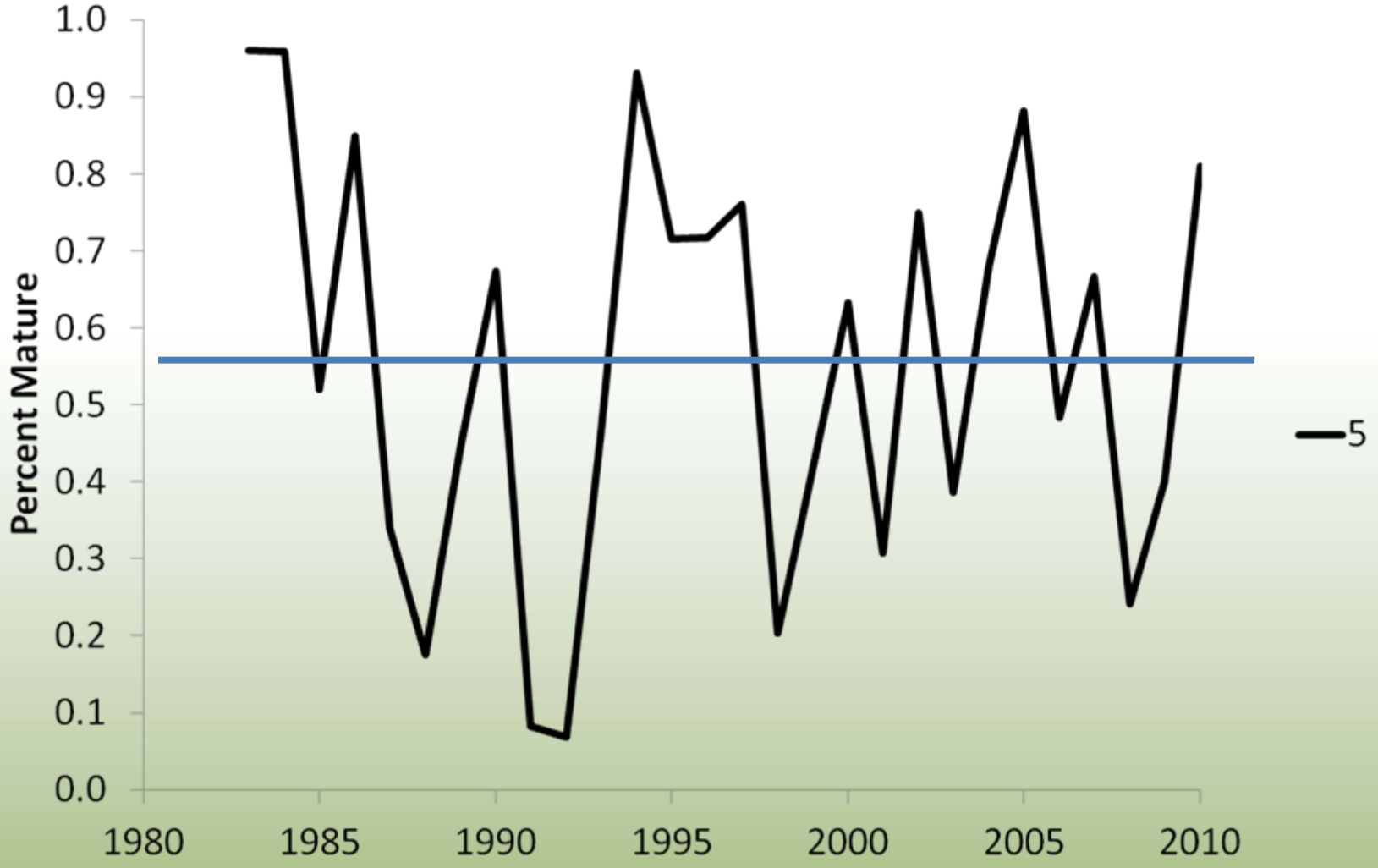
# Annual maturity by age



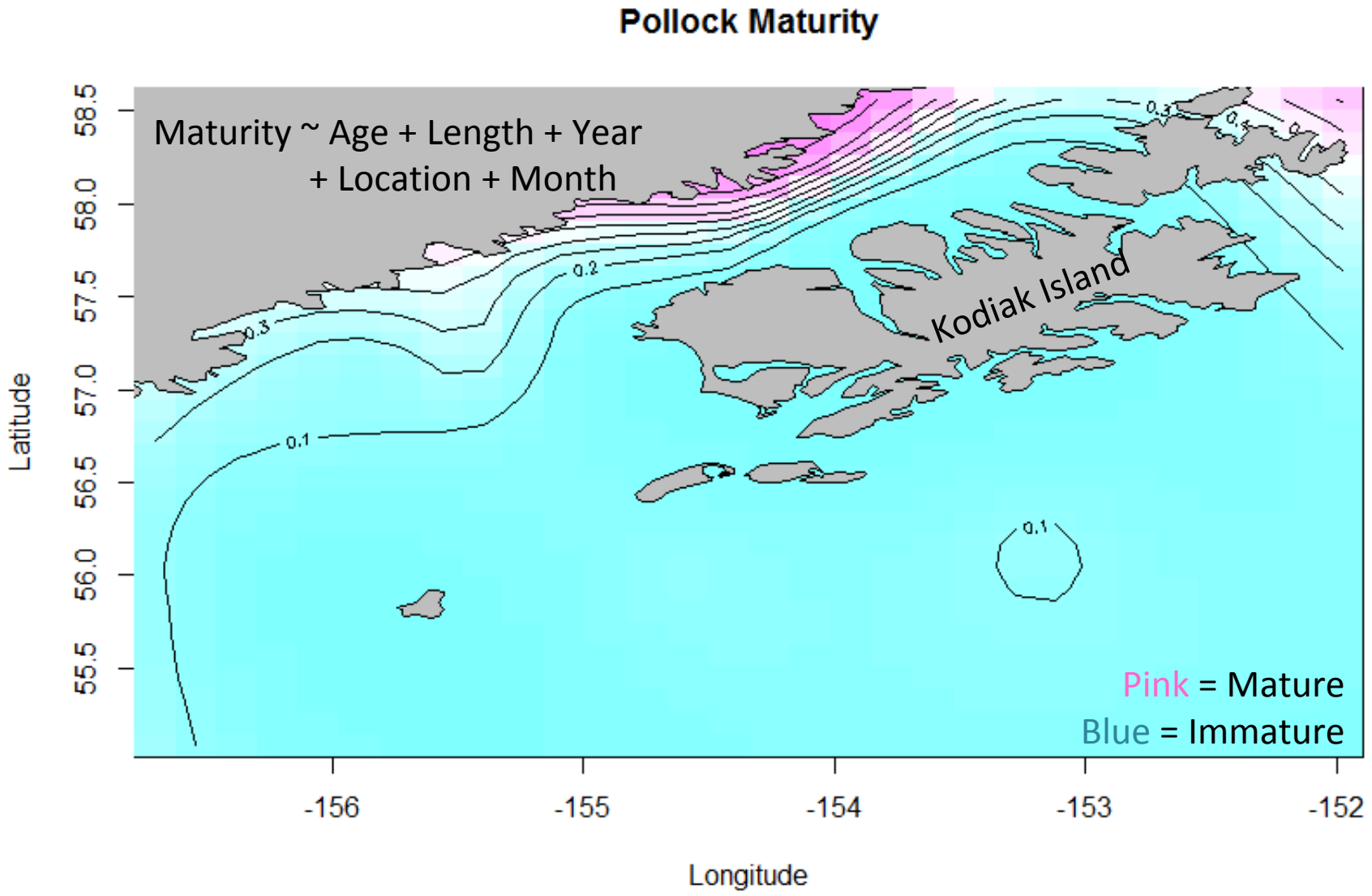
# Annual maturity by age



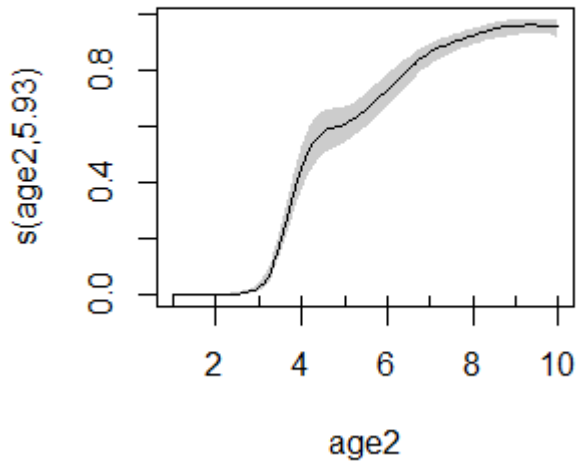
# Annual maturity by age

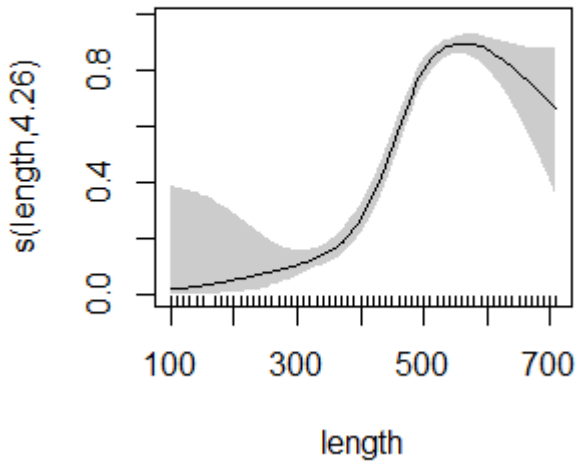


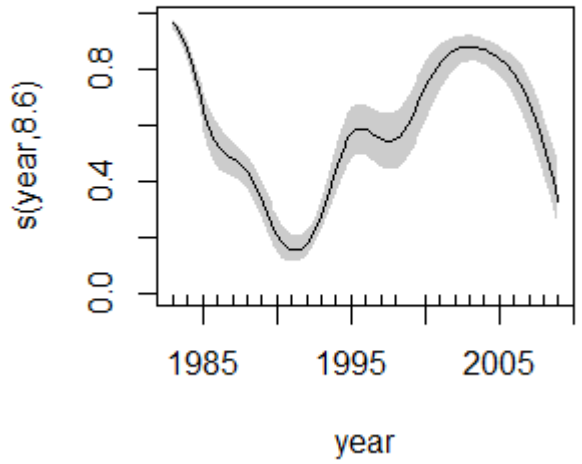
# Generalized Additive Model

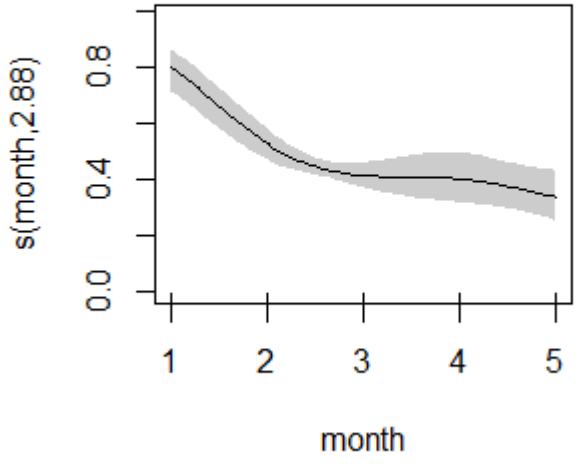


# GAM Partial Effects

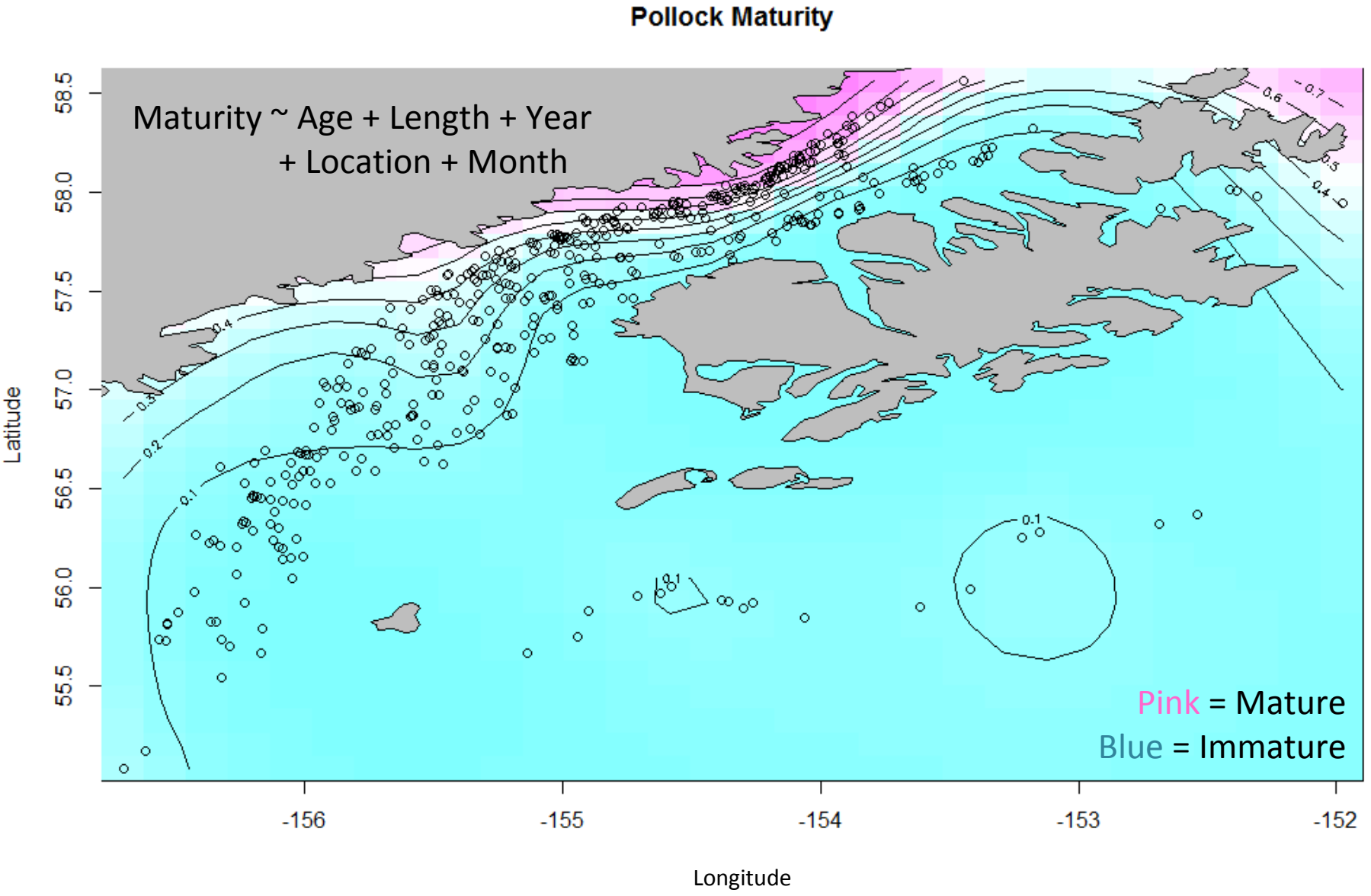


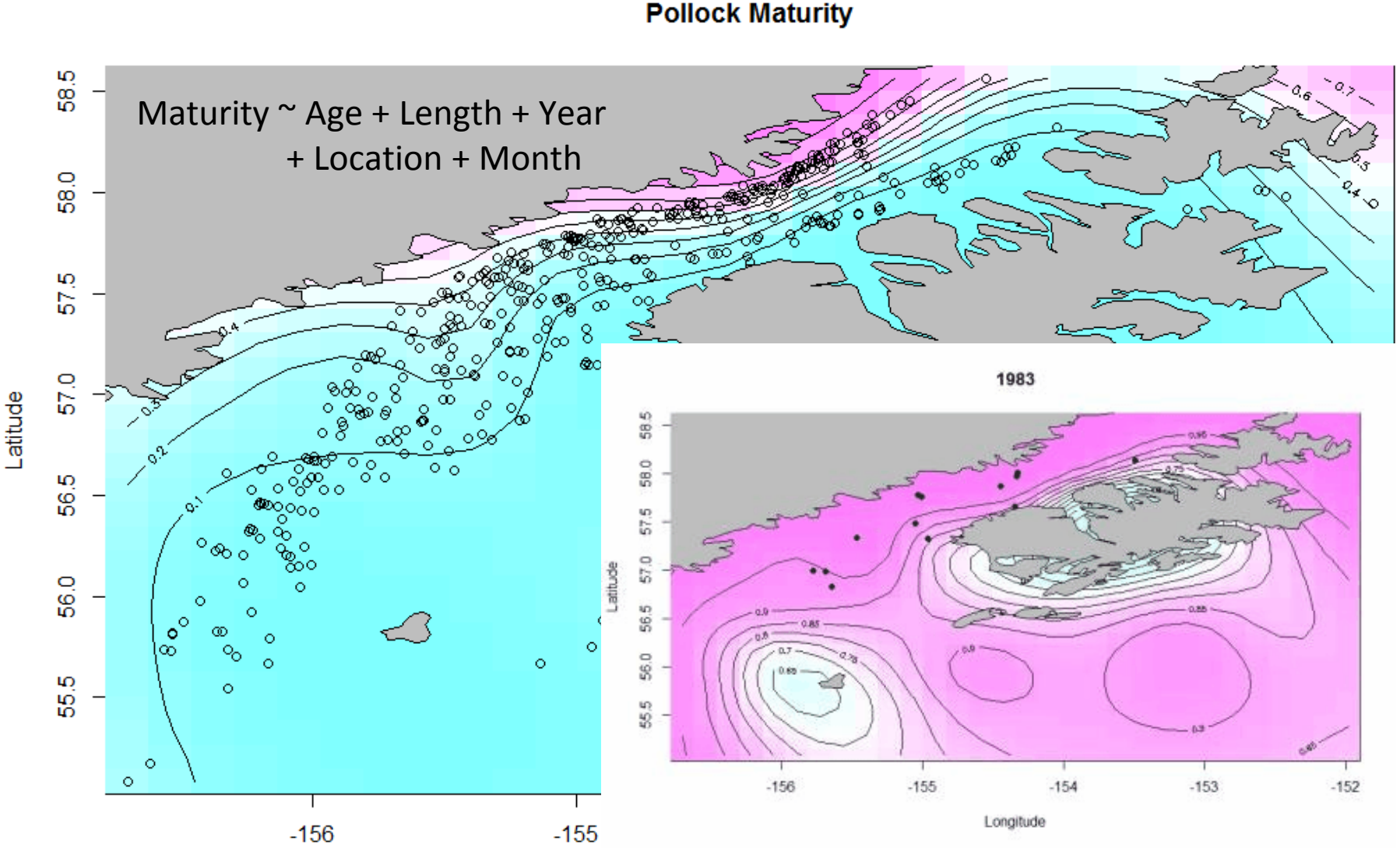



# Generalized Additive Model

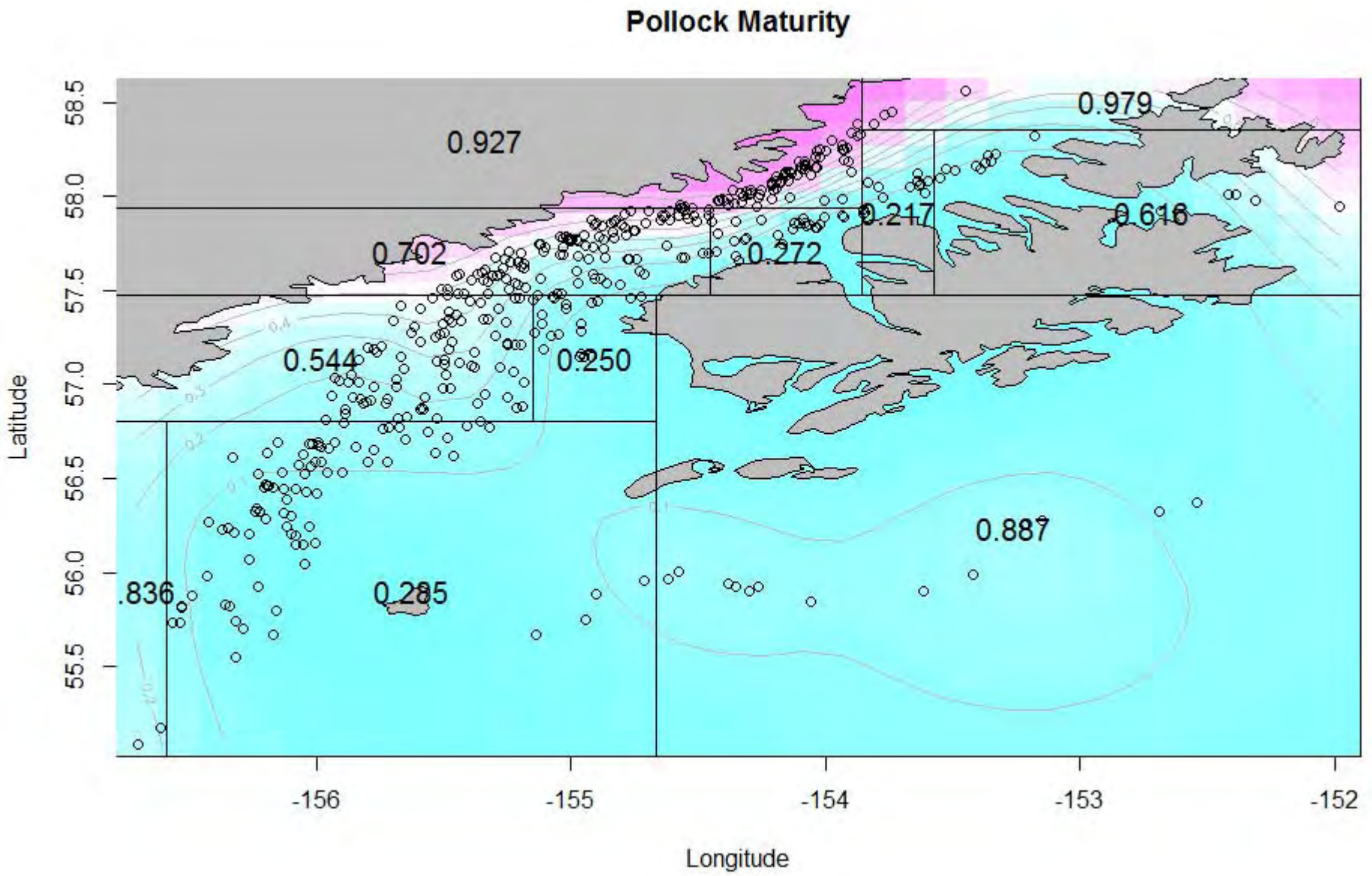


# Generalized Additive Model

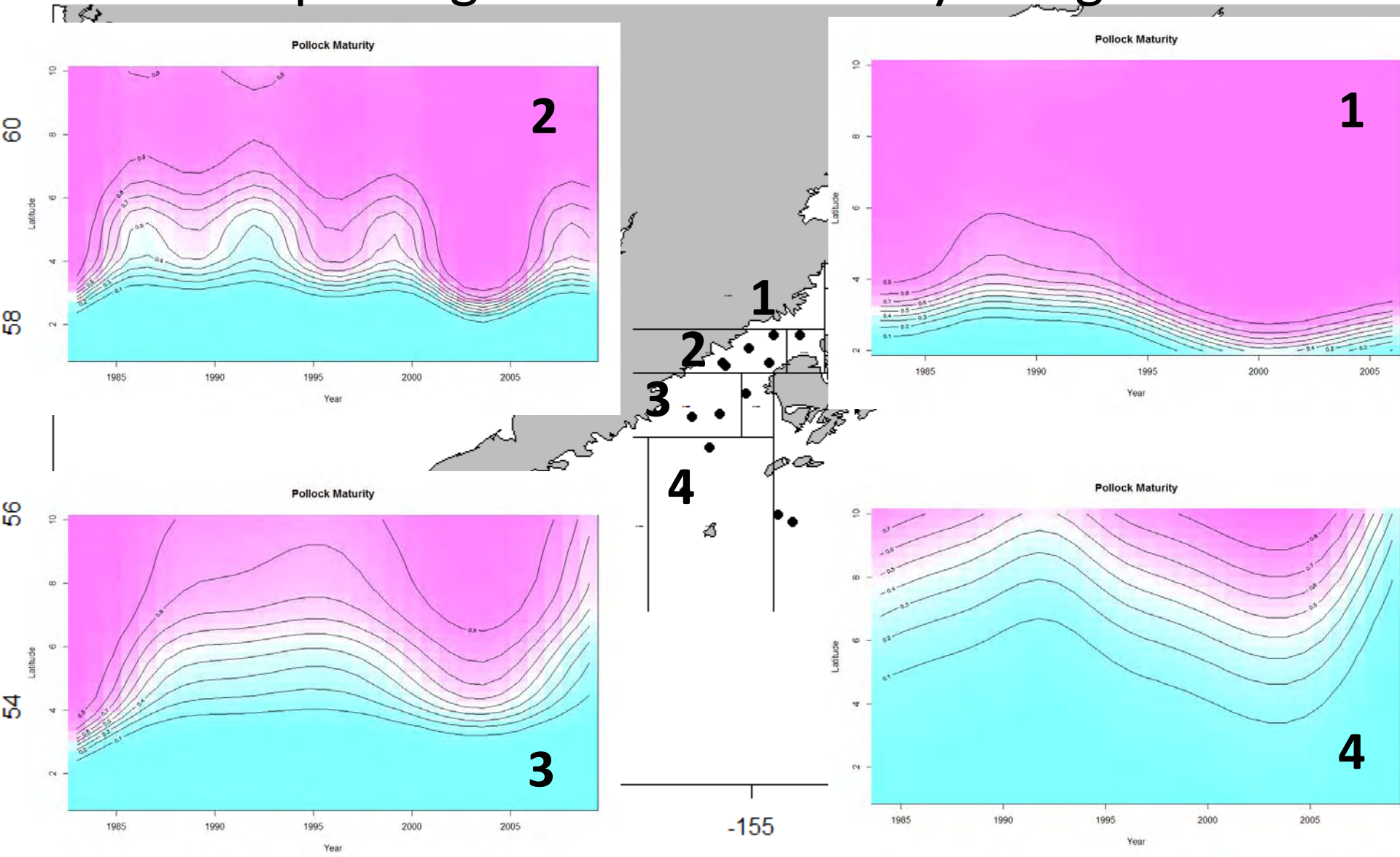



Longitude

# CART Model

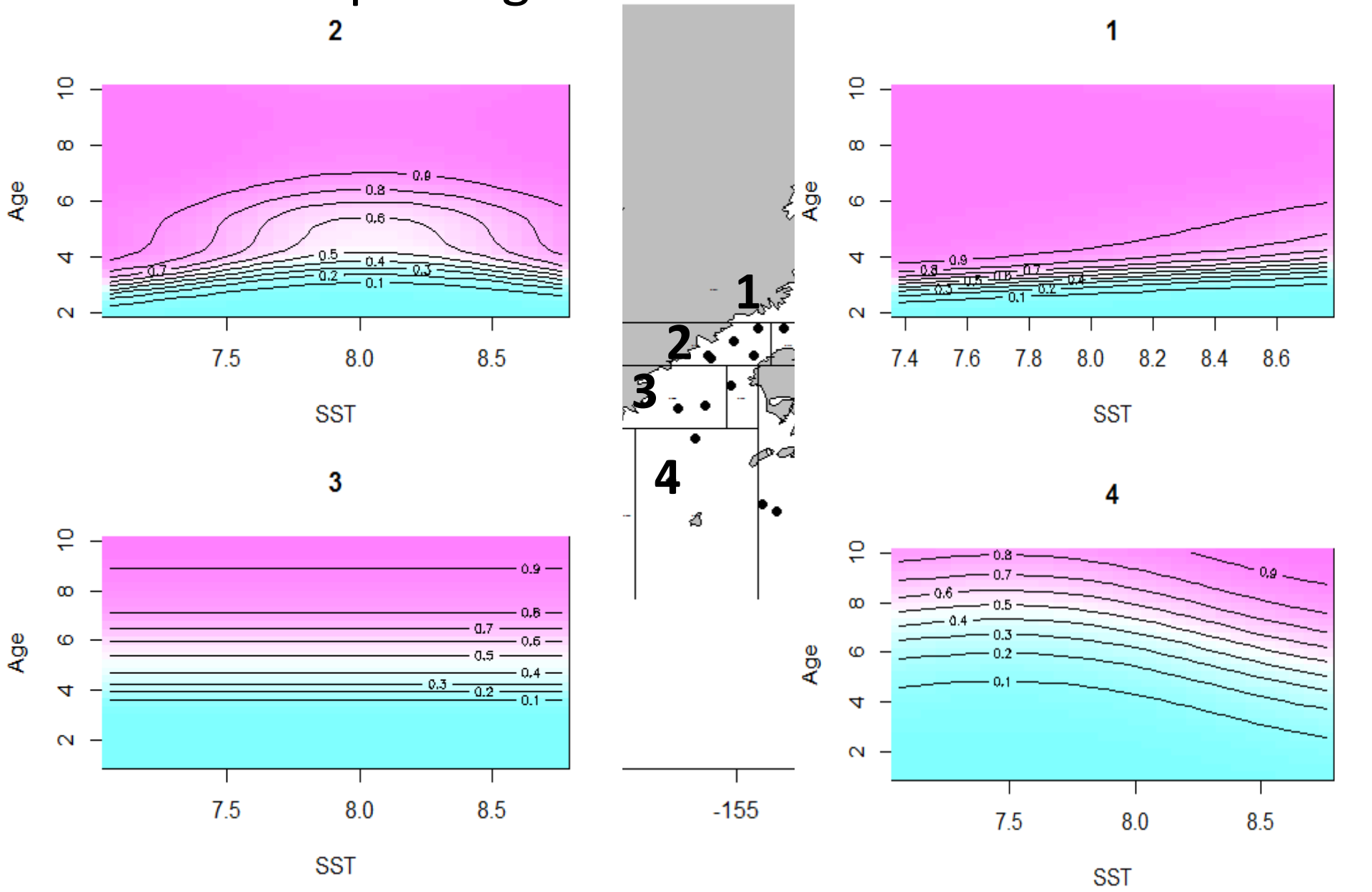

Pollock Maturity
0.927
0.979
0.217
0.616
0.702
0.272
0.544
0.250
0.887
.836
0.285
58.5
58.0
57.5
57.0
56.5
56.0
55.5
Latitude
-156
-155
-154
-153
-152
Longitude

# Spatial gradient in maturity-at-age

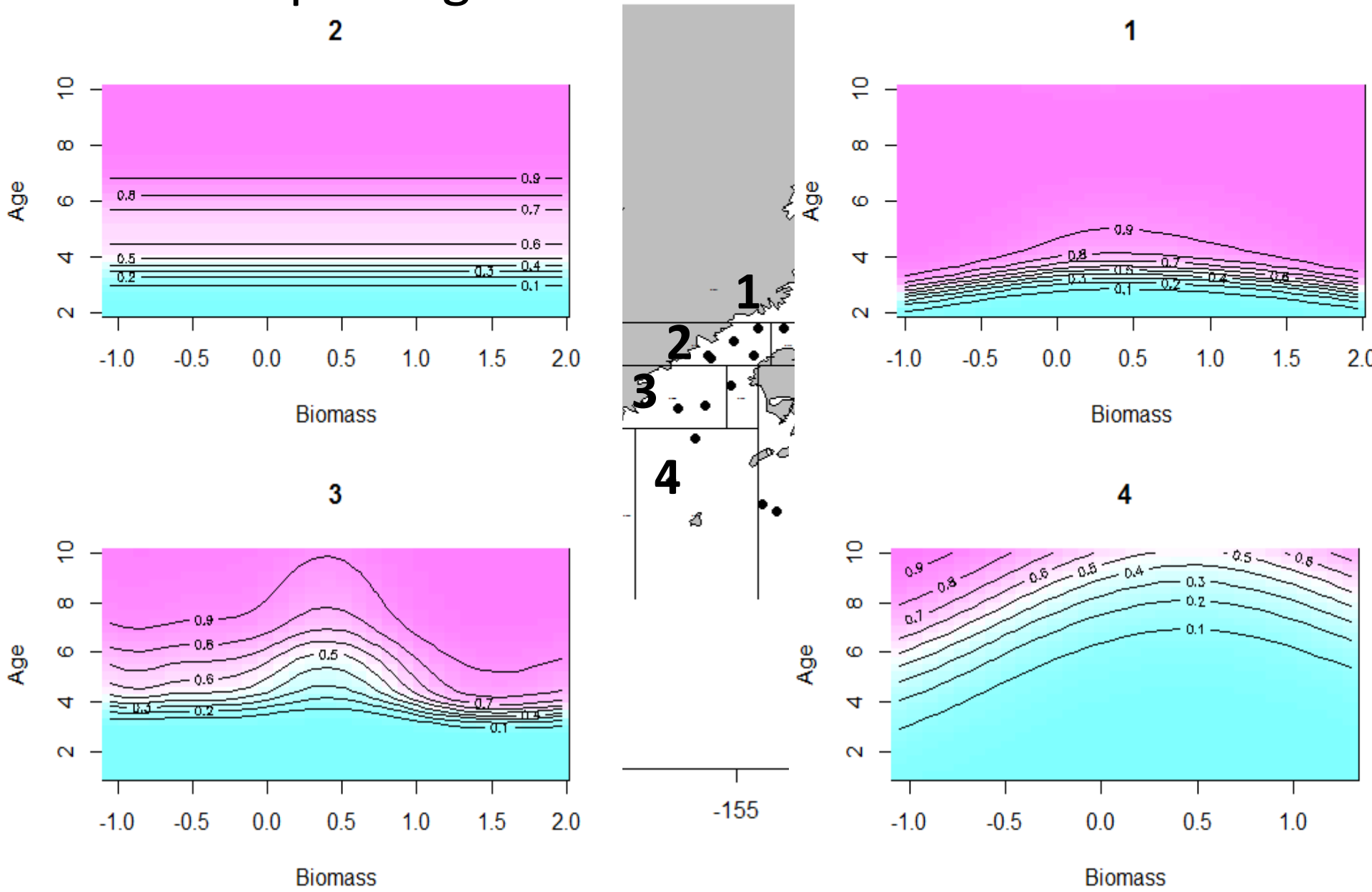



Maturity ~ Age + Length + Year + Month

# Spatial gradient in SST effects



# Spatial gradient in Biomass effects



# Conclusions

- Spatial considerations will improve estimates of SSB
- SST has different influence on maturity, in different locations
- Biomass has a similar trend by location
- Greater environmental and population effects on the periphery of the spawning area

# Future Directions

- Overlay maturity model on spatial biomass estimates
- Examine influence of environmental and biological effects on fecundity
- Incorporate variability of maturity and fecundity into a MSE

# Acknowledgements


## AFSC

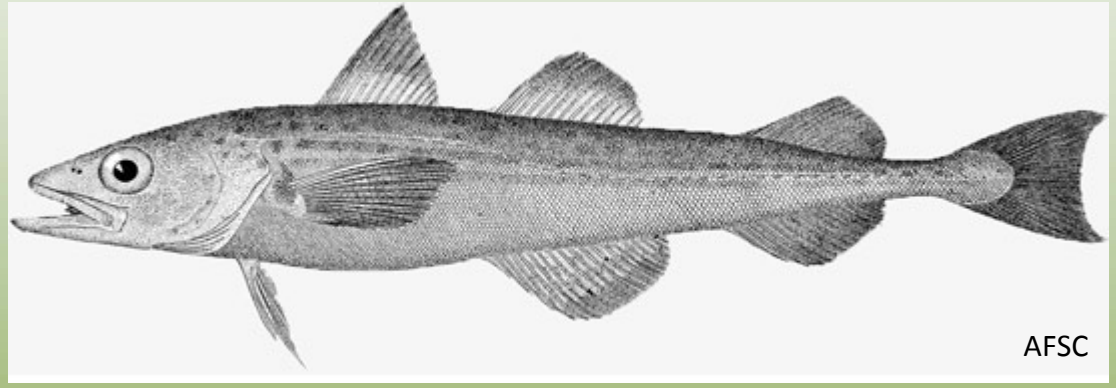
Mike Guttormsen

Neal Williamsen

Libby Loggerwell

Susanne McDermott

## UAF

Franz Mueter

Vanessa von Biela