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

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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.
Methods

Visual maturity estimates

10,344 pollock from 1983 - 2009
Annual Logistic Regressions
Annual maturity by age

Percent Mature


3  4  5  6  7  8  9  10+
Annual maturity by age
Annual maturity by age

Percent Mature

Generalized Additive Model

Maturity ~ Age + Length + Year + Location + Month

Pink = Mature
Blue = Immature

Kodiak Island
GAM Partial Effects

- $s(\text{age2})$
  - $y$ vs. $x$
- $s(\text{length})$
  - $y$ vs. $x$
- $s(\text{year})$
  - $y$ vs. $x$
- $s(\text{month})$
  - $y$ vs. $x$
Generalized Additive Model

Pollock Maturity

Maturity ~ Age + Length + Year + Location + Month

Pink = Mature
Blue = Immature
Generalized Additive Model

Pollock Maturity

Maturity ~ Age + Length + Year + Location + Month
CART Model

Pollock Maturity
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
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