

The Value of Simple Mechanistic Models

and

How to Use their Squishy Data

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Three Major Factors Control Recruitment and Natural Mortality

- Predation
- Food availability
- Temperature
 - Can in part be offset by food availability

Predation

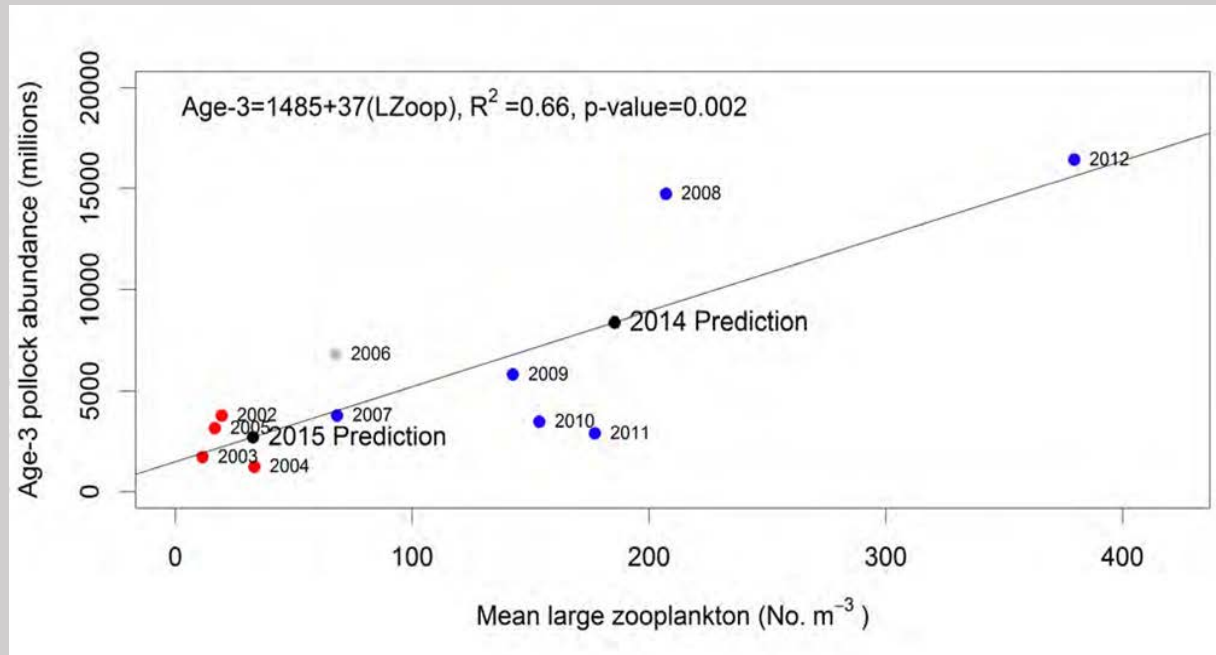
- May be hard to model
- Need to know:
 - Biomass of predators
 - Consumption rates of predators
 - Availability of alternative prey
 - Spatial overlap

Food Availability

- May also be hard to model
- Need to know:
 - Biomass of species of interest
 - Consumption rates of species
 - Consumption rates of competitors and their biomass
 - Availability of alternative prey
 - Spatial overlap of consumer and prey

Food Availability II

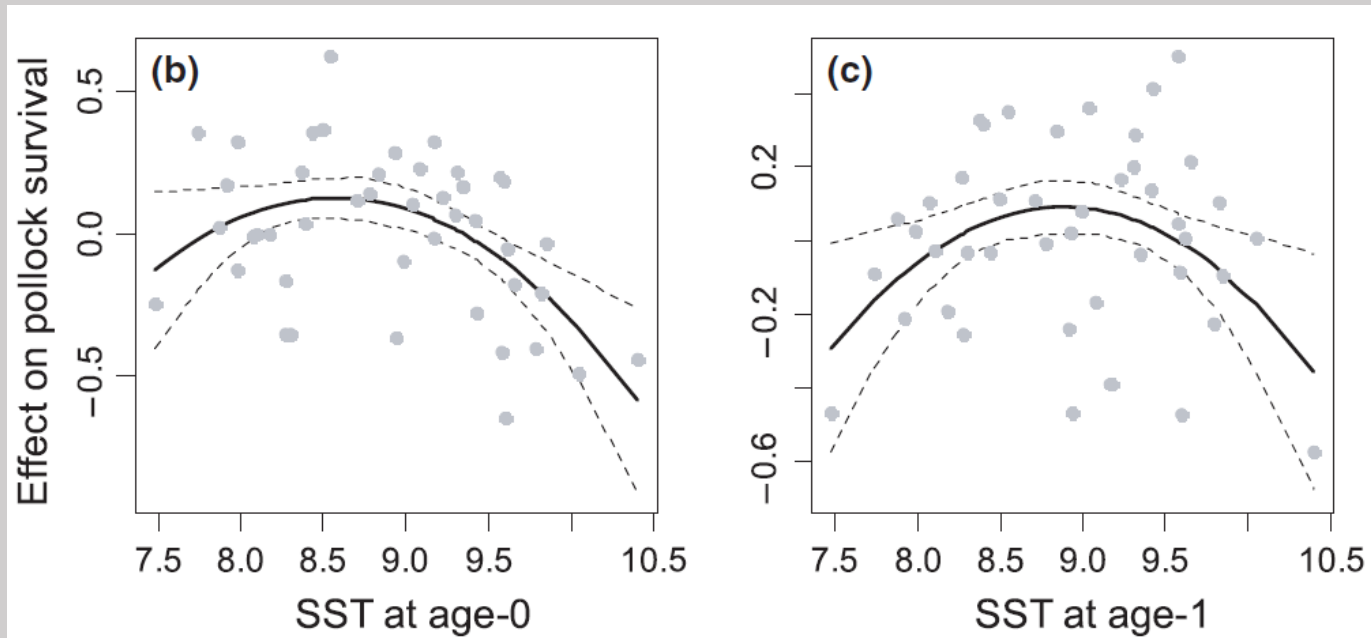
- Eisner and Yasumiichi 2017:



- Simple model, considerable explanatory and predictive value
- Possible to add effect of bottom temperature (Coyle & Gibson, 2017), spawner biomass

Temperature

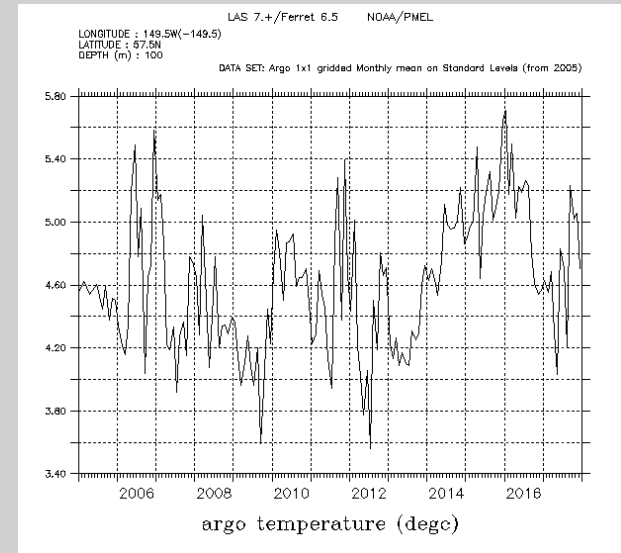
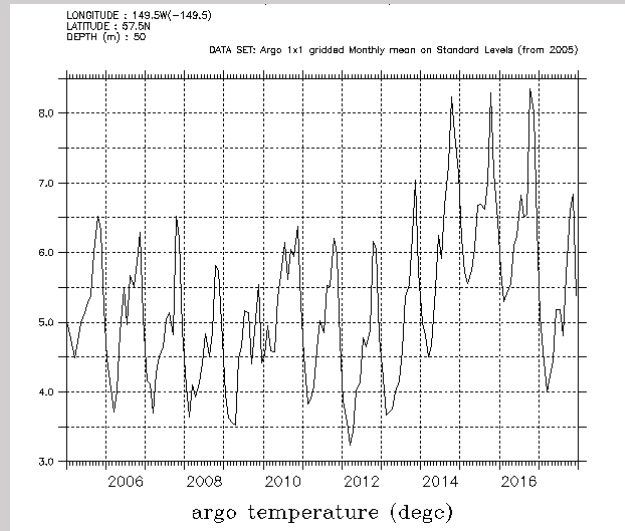
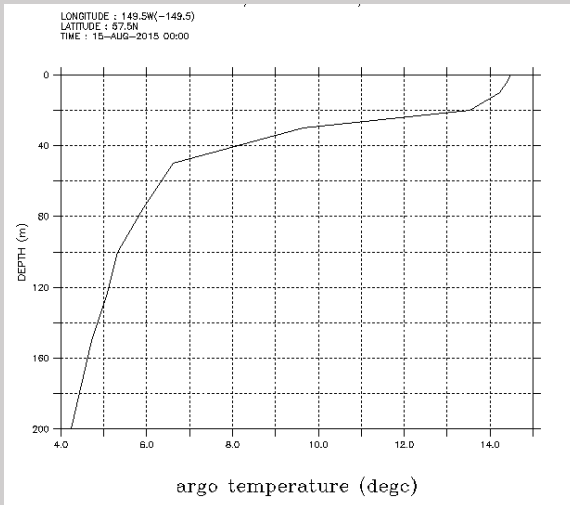
- Dome-shaped impact on pollock survival (Coyle et al. 2011):



- Very warm and very cold temperatures bad
 - Cold hits eggs and larvae, freezing of adults(?)
 - Warm speeds metabolism; depletes lipids

Temperature in a Context

- Gulf of Alaska Blob in 2015-2017 Courtesy Nick Bond)



- Temperature responses of Pacific cod
 - Chung, Kim & Kang (2013): most cod caught 0°C - 8°C; top temp. 12.8°C
 - Hanna et al. (2008): 4 -11°C; metabolic rate 28% higher at 11°C
- Ecosystem Context
 - Prey status important

How to Incorporate Information in Assessment and TAC setting Processes

- Unconventional data
 - Seabird diets and reproductive success
 - Zooplankton abundance
- Sometimes hard to quantify
 - What is abundance or availability of forage fish?
- Insufficient history to assess reliability
 - How many years are enough?