

# Ecosystem Studies

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# Outline

- AFSC process studies that inform the stock assessment process
- SAFE Ecosystem Considerations chapter
- Stock assessments that incorporate environmental effects
- Balance of process studies and stock assessments
- Future work and integration

# AFSC process studies that inform the stock assessment process

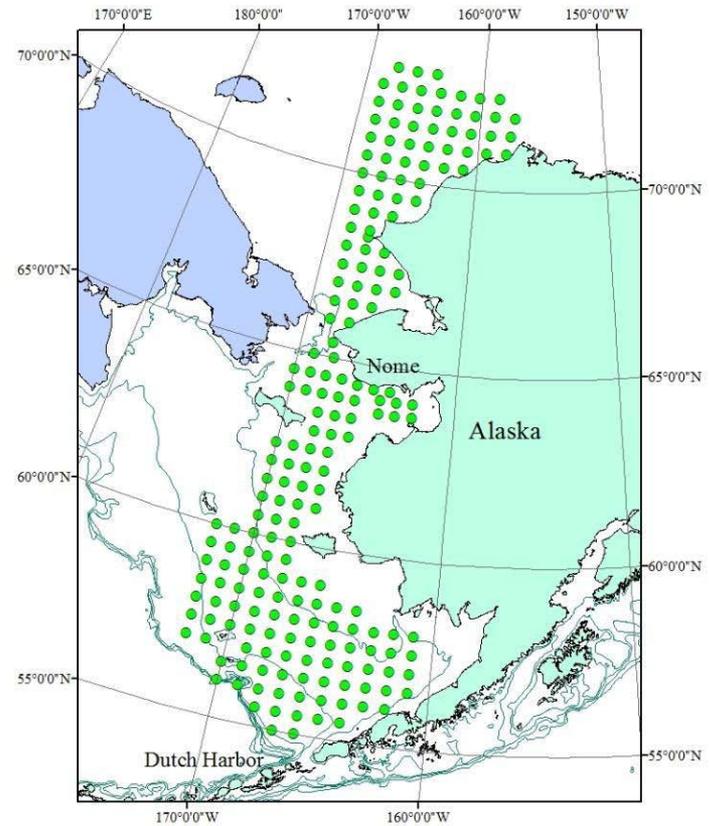
- Multidisciplinary
- Integrate AFSC and OAR Pacific Marine Environmental Lab
- Rely on partnerships, especially NPRB
- Standard AFSC fisheries-independent surveys form foundation
- Process studies provide understanding of population changes and support quota recommendations

# Recruitment Processes Alliance

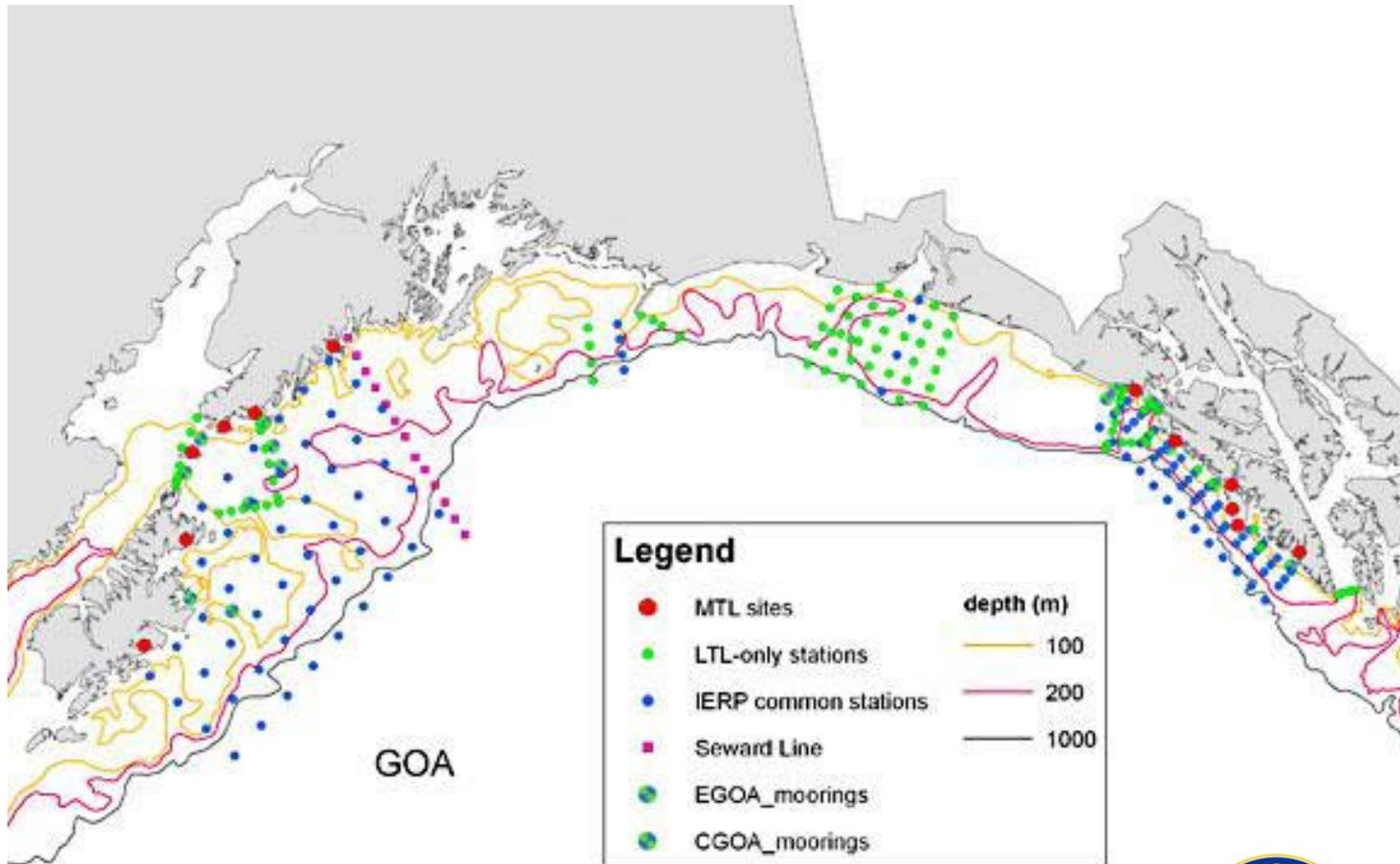
- Goals
  - Improve walleye pollock stock assessment
  - Address salmon bycatch
- Alliance of major AFSC programs
  - Eco-Fisheries Oceanography Coordinated Investigations (with Pacific Marine Environmental Laboratory)
  - Ecosystem Monitoring and Assessment
  - Resource Ecology and Ecosystem Modeling



# Fisheries Oceanography Research



# Gulf of Alaska IERP

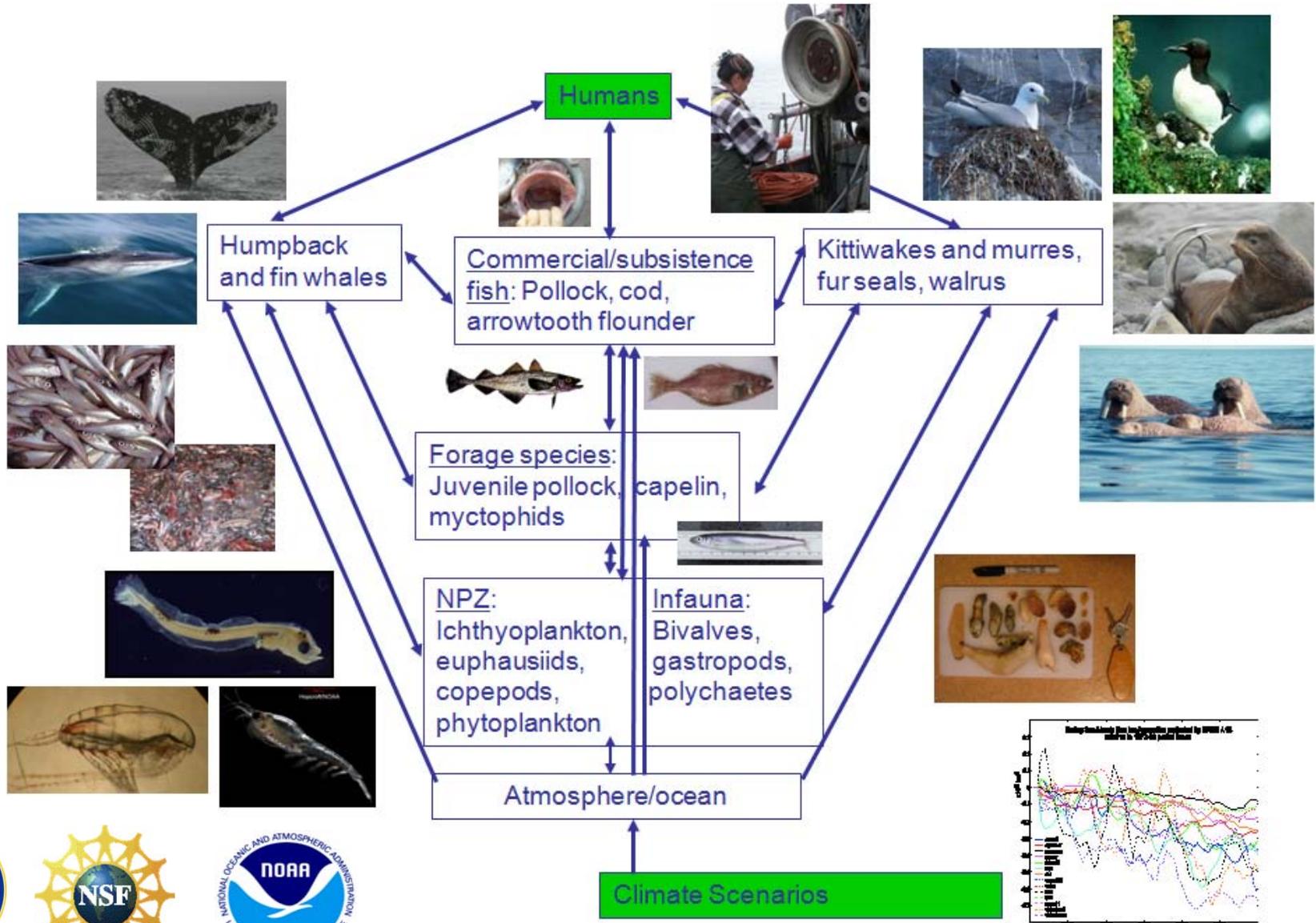


Comparative approach

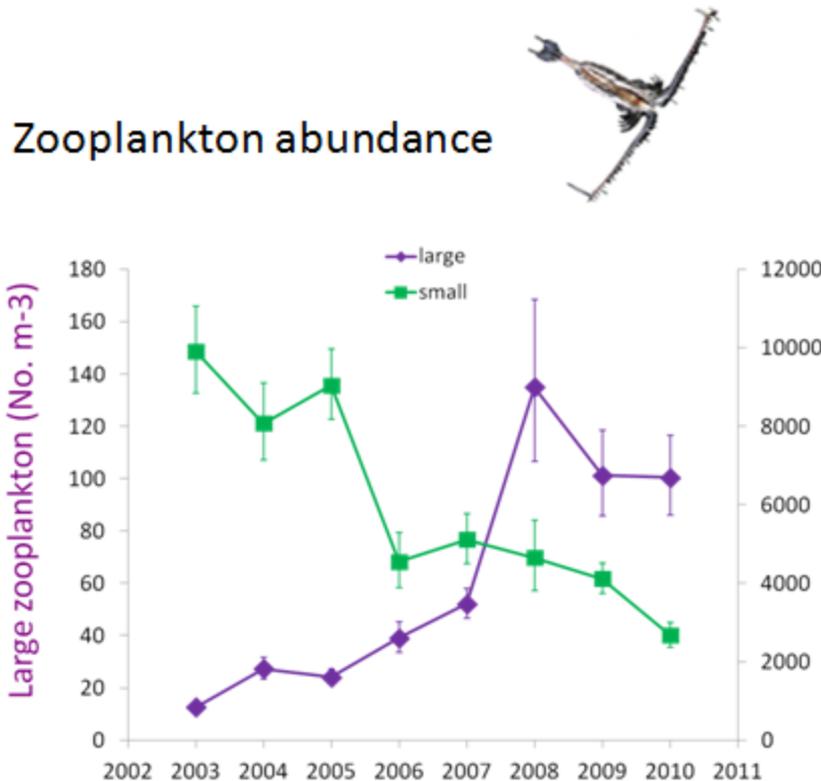


# Bering Sea IERP

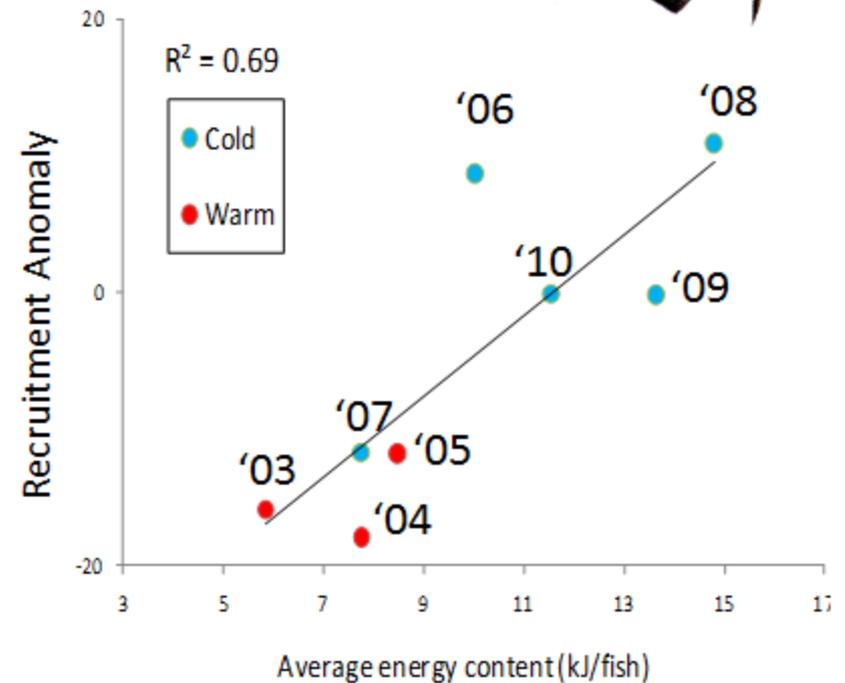
## Ecosystem approach



# An integrated ecosystem research project explained recent abundance changes in the largest US commercial fishery



### Pollock recruitment



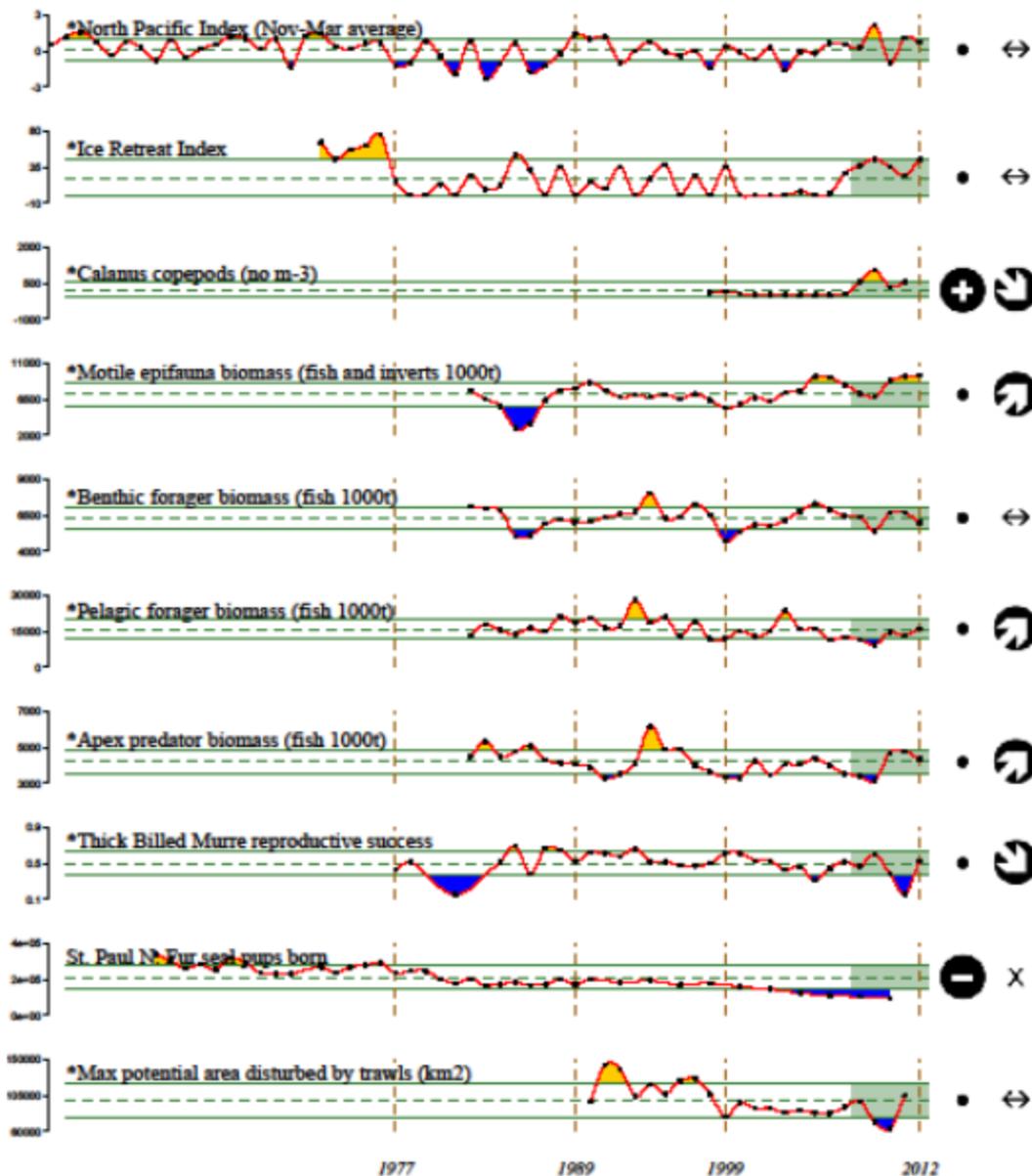
Cold years favor the increases in abundance of large zooplankton at the expense of small zooplankton.

Cold years generally enhance survivorship

# Ecosystems Considerations

- Chapter of annual Stock Assessment and Fisheries Evaluation (SAFE)
- Consists of:
  - Subject-based reports (e.g., Eastern Bering Sea climate [Overland])
  - Indicator time series (e.g., next slide)
- Ecosystem indicators form bridge between process studies and stock assessments

# EBS Indicator Time Series



1. North Pacific Index
2. Eastern Bering Sea ice retreat
3. Zooplankton - euphausiid hydroacoustic data and copepod index
4. Motile epifauna aggregate biomass
5. Benthic foragers aggregate biomass
6. Pelagic foragers aggregate biomass
7. Fish apex predators aggregate biomass
8. Thick-billed murre reproductive success on St. George Island
9. St. Paul Island fur seal pup production
10. Maximum potential trawl area disturbed

2008-2012 Mean

- ⊕ 1 s.d. above mean
- ⊖ 1 s.d. below mean
- within 1 s.d. of mean

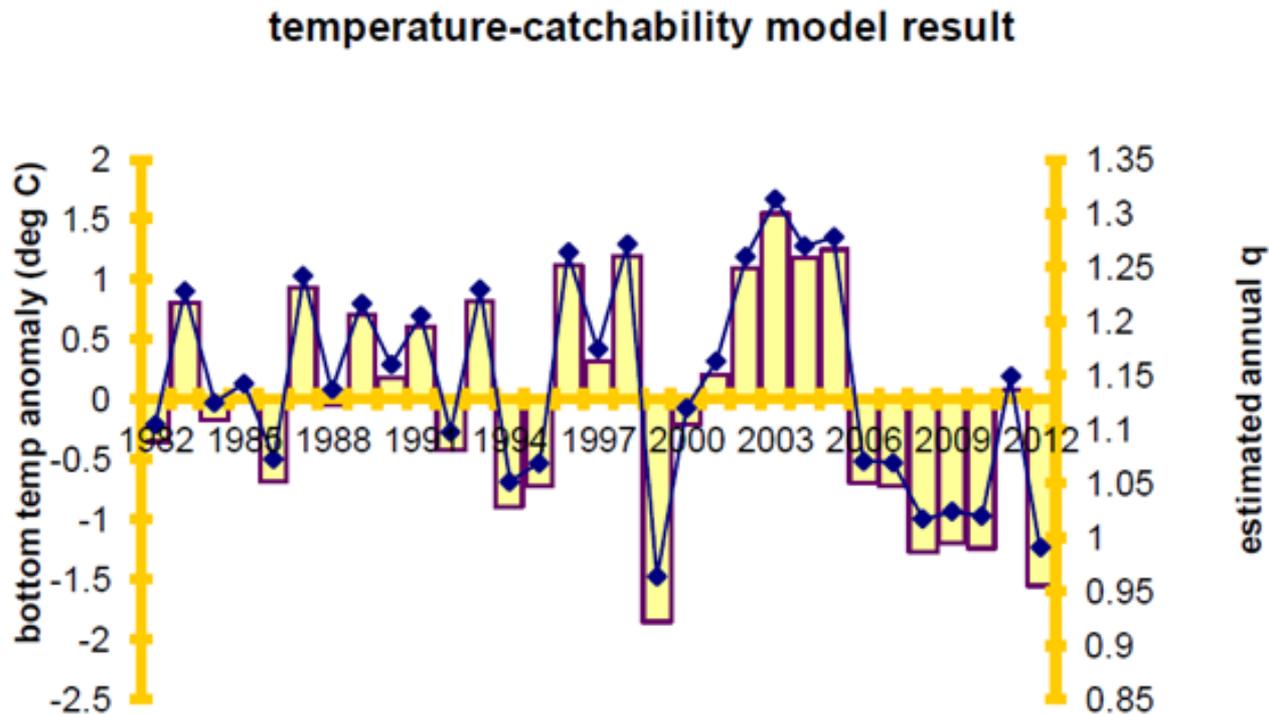
2008-2012 Trend

- ↻ Increase by 1 s.d. over time window
- ↺ decrease by 1 s.d. over time window
- ↔ change <1 s.d. over window

Stock assessments that  
incorporate environmental  
effects

# Explicit environmental effects

Yellowfin sole survey catchability (largest flatfish fishery in US)



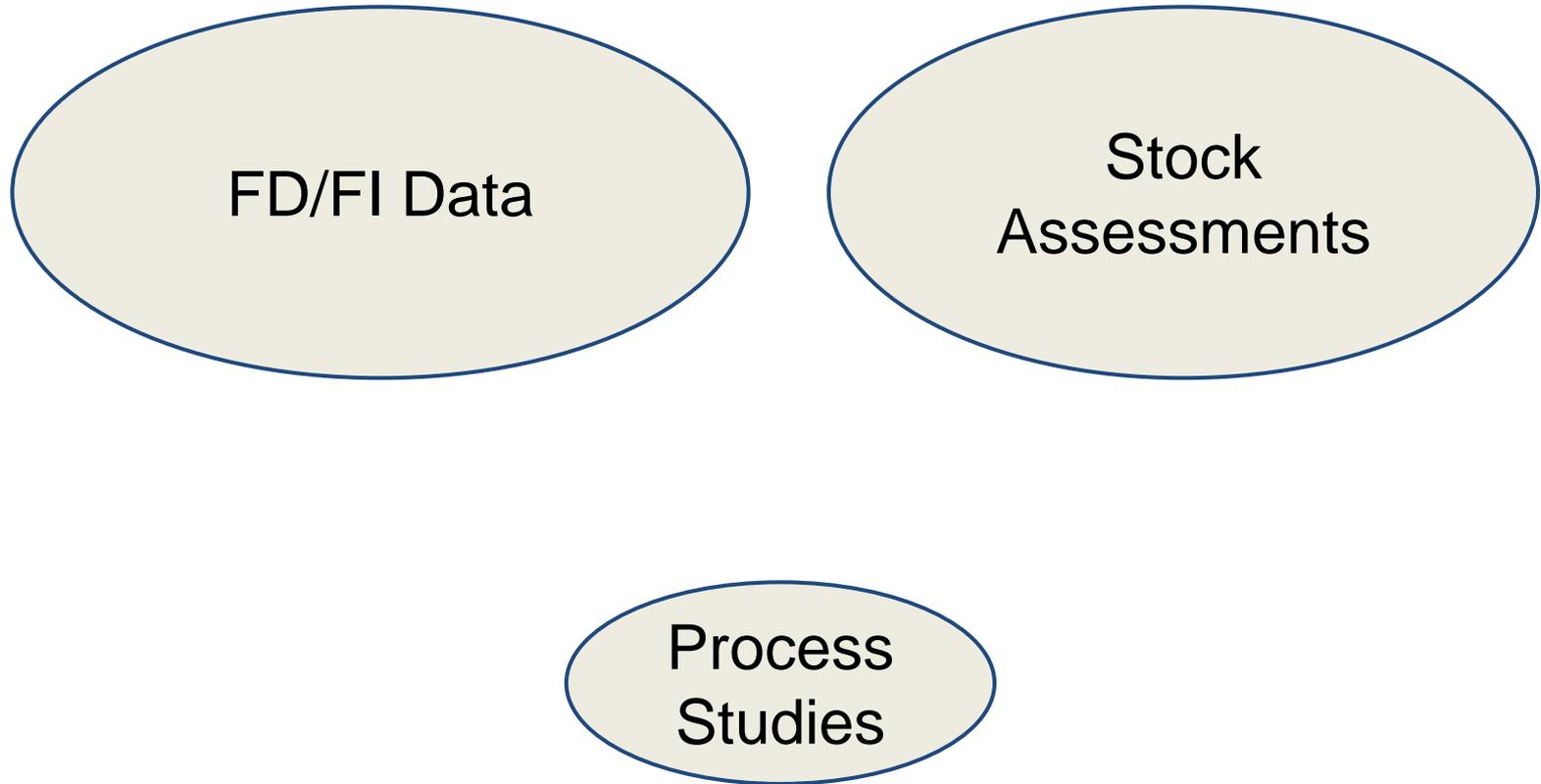
# Explicit environmental effects

- Flathead sole, survey catchability
- Northern rock sole, survey catchability (testing)
- Octopus consumption model (food habits)
- Test for regime shifts in recruitment time series (e.g., yellowfin sole)

# Current Fisheries and the Environment (FATE) projects

- Influence of climate, predation, and bycatch rates on **biological reference points** estimated from multispecies and single species stock assessment models
- Population connectivity via larval drift of Pribilof Islands **blue king crab** in the Eastern Bering Sea
- Spatial and temporal variability of **walleye pollock fecundity** estimates for the Gulf of Alaska and Eastern Bering Sea
- Refining a marine ecosystem index for Alaska: developing **reference points** for ecosystem based management and integrated ecosystem assessments
- **Ecosystem Considerations** chapter, indicator-based ecosystem assessments

# Balance of process studies and stock assessments



# Data collections used in process studies

- Moorings
- Ichthyoplankton surveys
- Bottom trawl surveys
- Acoustic surveys
- Surface trawl/acoustic surveys (aka BASIS)
- Nearshore surveys
- Many of these surveys also conduct measurements of physical and biological (e.g., zooplankton) oceanography

# Future Work and Integration

- Integrated Ecosystem Research Programs
- Recruitment Processes Alliance
- Spatially-explicit ecosystem models (FEAST)
- Management Strategy Evaluations (MSE)
- IPCC-scenario driven projections (e.g., Mueter et al 2011; Ianelli et al. 2011)
- Bioeconomic modeling of crab fisheries and ocean acidification

# Strengths, Challenges, and Solutions

- Strengths
  - Existing cross-Division collaborations (and PMEL)
  - Successful programs (Bering Sea Project)
- Challenges
  - Prioritizing research questions
  - Choosing long-term process time series
  - Balancing Arctic and fisheries-related studies
- Solutions
  - Plan and Collaborate
  - Leadership buy-in
  - Focus shifts annually between GOA and EBS

