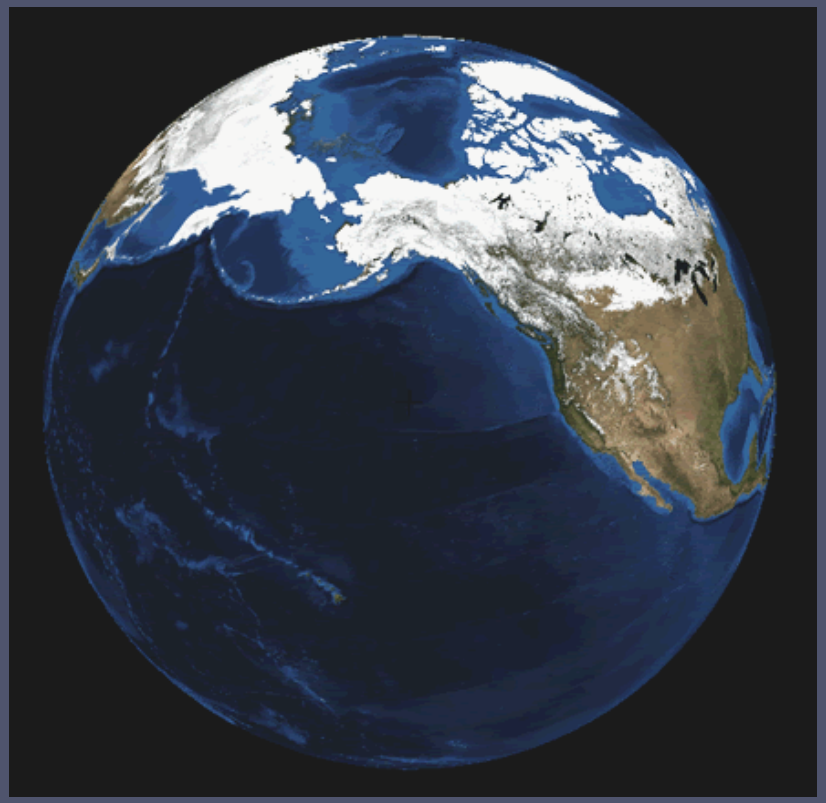
NOAA National Ocean Service
Identifying Research Priorities Workshop

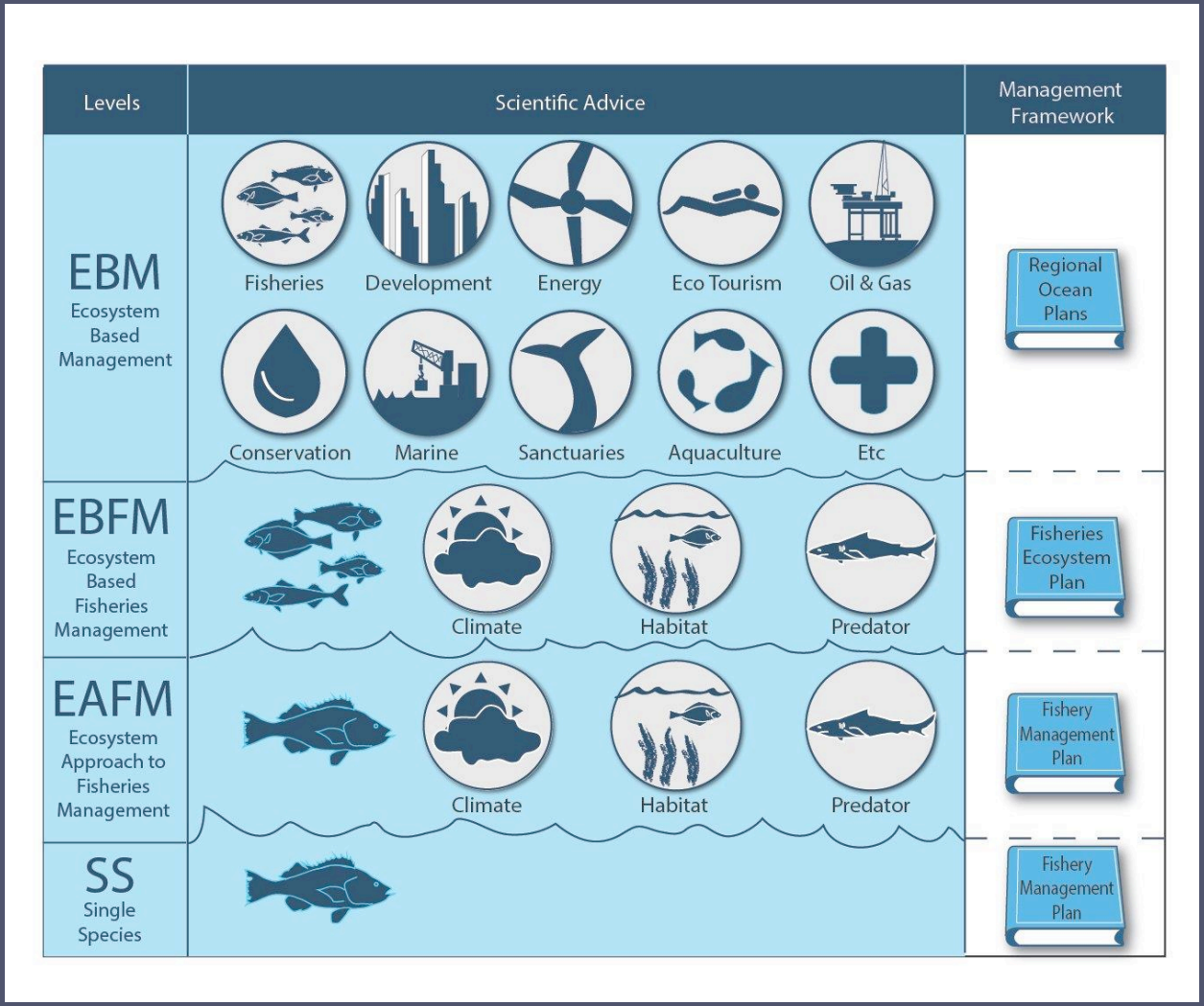
Fishery Manager Needs for Threshold/Tipping Points Products



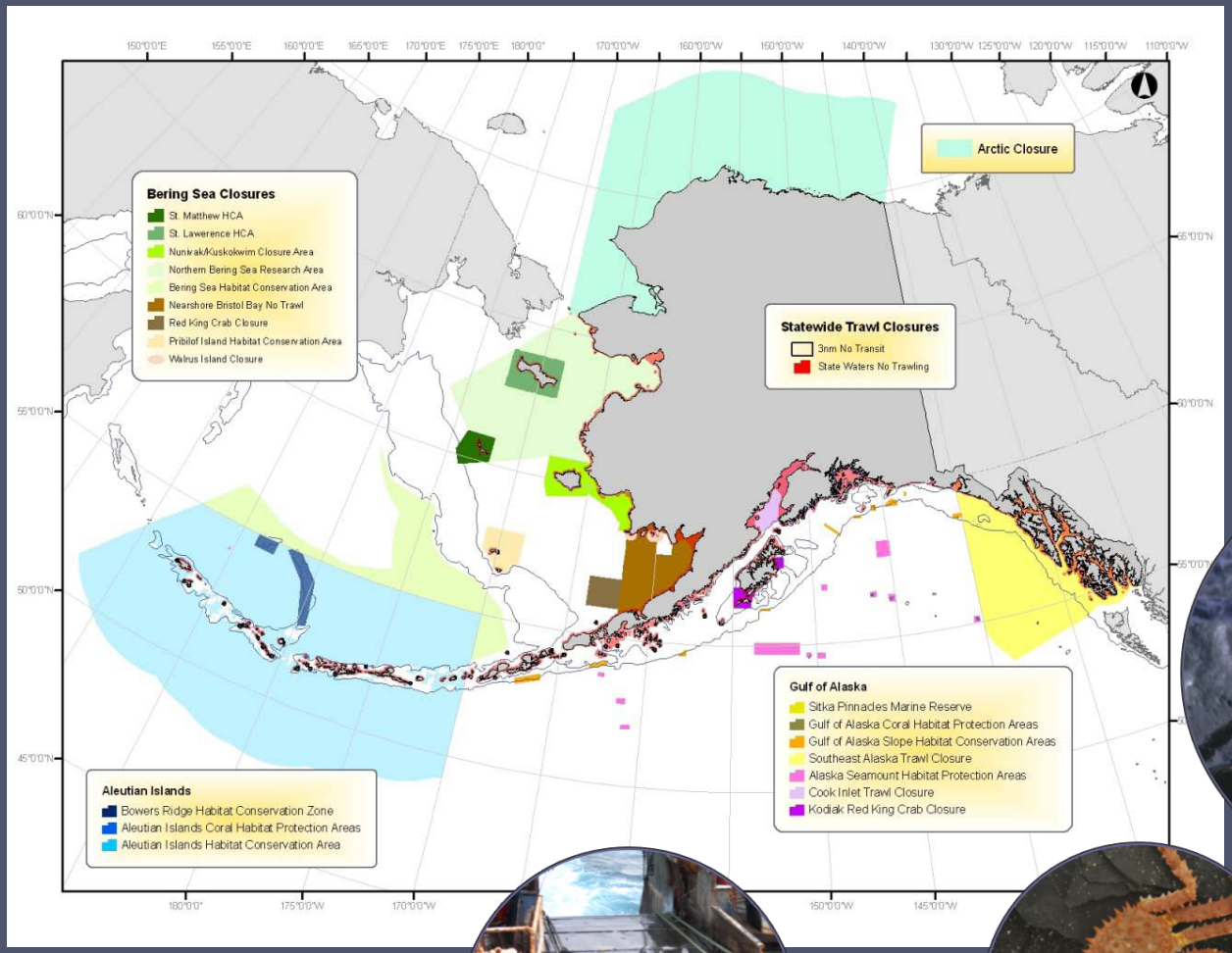
Stephani Zador and Ellen Yasumiishi
Alaska Fisheries Science Center NMFS, NOAA
November 10, 2016

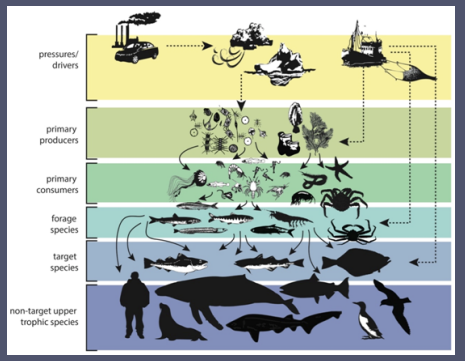
NOAA has mandates to practice Ecosystem-Based (Fishery) Management in federally-managed fisheries

Levels of EBM



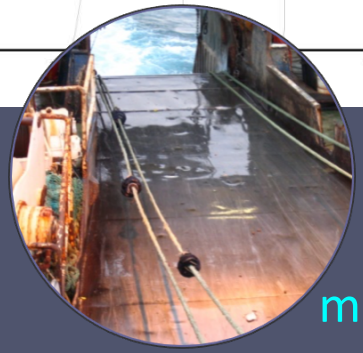
There are a variety of ways we do this in Alaska





Ecosystem models

Fishery Closures



Gear modification

The annual groundfish fishery management process in Alaska

Aug, Sept

NOAA Stock assessments

NOAA Ecosystem considerations

Sept, Nov
Regional Plan Teams

Dec

Scientific and Statistical Committee

Advisory Panel

Council

Fishery quotas set

2.5.a Develop and monitor Ecosystem-Level Reference Points (Guiding Principle 5a)

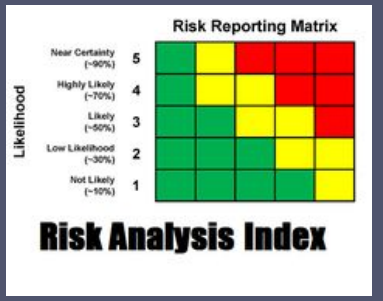
Ecosystem-level reference points (ELRPs) and thresholds can inform the use of statutorily required reference points.
-- EBFM Road Map, August 2016

1. *We need to identify ecosystem and climate-informed reference points and thresholds*
2. *They need to be linked to management objectives*

Recommended research priorities

Need:

- Actionable, quantifiable, climate-informed ecosystem thresholds
- Tools to convey information (e.g., online real-time stop light matrix)



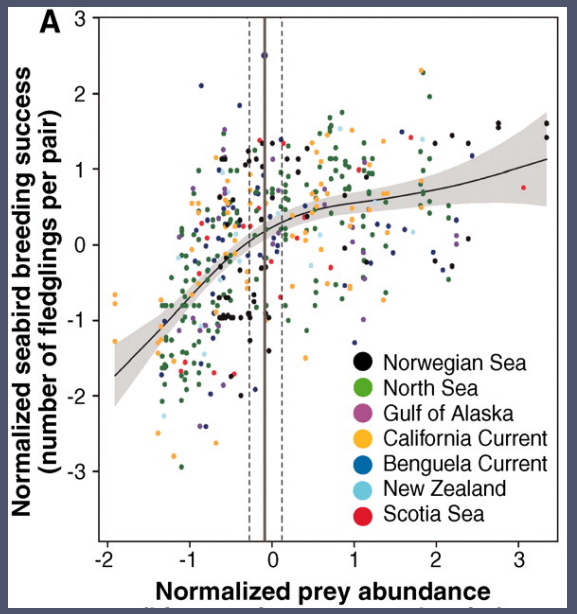
Requires: Retrospective studies, cumulative qualitative indicators, ecosystem model development, projections, trade-off analyses.

Specific Research Needs

1. Retrospective statistical analyses to identify climate-driven tipping points, ecosystem thresholds, and leading indicators of regime shifts in Alaskan marine ecosystems
2. How will potential changes in ecosystem structure and function (e.g., benthic v. pelagic pathways) affect species and ecosystem resilience to changes in climate?
3. What are leading indicators of regime shifts in Alaskan marine ecosystems?
4. At what ecosystem thresholds do we expect decreased resiliency to climate impacts?
5. Understand the impacts of climate changes of species in the north and south ends of their distribution.
6. Conduct analyses of the impact of changes in sea temperature on species condition, composition, distribution, and abundance **across large marine ecosystems**.

Example research questions

1. How much pollock do we need to have to sustain fur seals, seabirds, and fisheries? (e.g., Cury et al 1/3 for the birds)
2. The EBS has changed from interannual variation in sea ice extent to multi-year stanzas. What is the tipping point at which this changes ecosystem structure and function?



3. At what point do we adjust reference points in stock assessments to reflect climate-induced change?
4. How do single variable versus multivariate variables affect delineation of important thresholds, with respect to synergistic or antagonistic effects of multiple variables (e.g., fishing, climate, shipping, temperature)

Observed climate related changes in nearshore fish ecosystems: at risk habitats

North: Bering Sea reduced sea ice alters the marine ecosystem

- Shifts in species composition and distribution. More juvenile salmon, Norton Sound herring, smaller copepods, lower over wintering survival of juvenile pelagic fishes.
- Reduced fish condition (juvenile sockeye salmon, juvenile Chinook salmon, immature chum salmon, and adult sockeye salmon salmon, juvenile pollock)
- Later returns of adult sockeye salmon in Bristol Bay (Need a model to predict return timing).

South: Gulf of Alaska warming

- Shifts in species composition (more pomfret, large squid, albacore). Are they predators or competitors of native species?
- Reduced fish condition (pink salmon) but not impacting over wintering survival yet, how warm is too warm for condition to impact survival?
- Lower than expected salmon returns, poor over winter survival (Winter ecosystem survey?)

Leverage existing efforts

1. Eastern Bering Sea 9 month forecast: cold pool size
2. Ecosystem indicator predictions: e.g., pollock year class strength
3. ACLIM - Alaska Climate Change Integrated Modeling Project
4. Threshold identification and development: other regions and broad scale comparisons