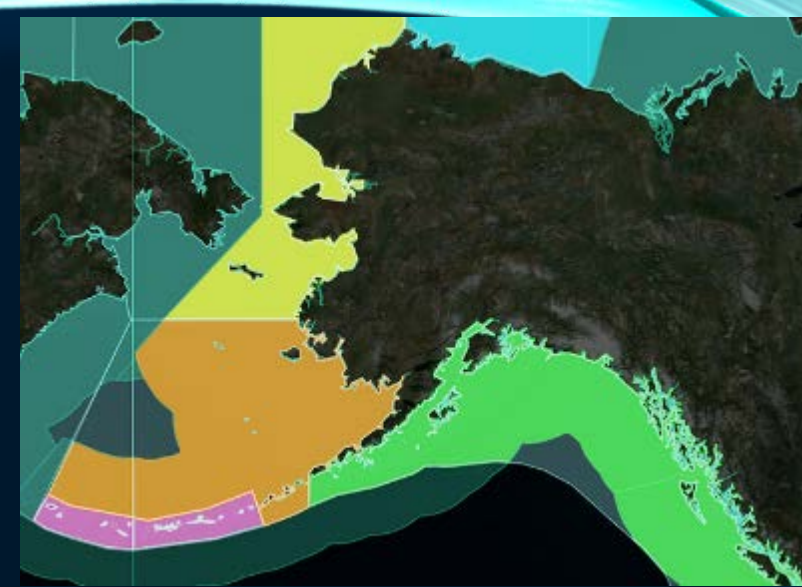


# What science is needed for fisheries management to be resilient to unprecedented and rapid change in the Bering Sea?



Robert Foy

NPFMC Science and Statistical Committee Workshop

February 2023

“We must listen to science — and act.”  
[EO 14008 (2021)]

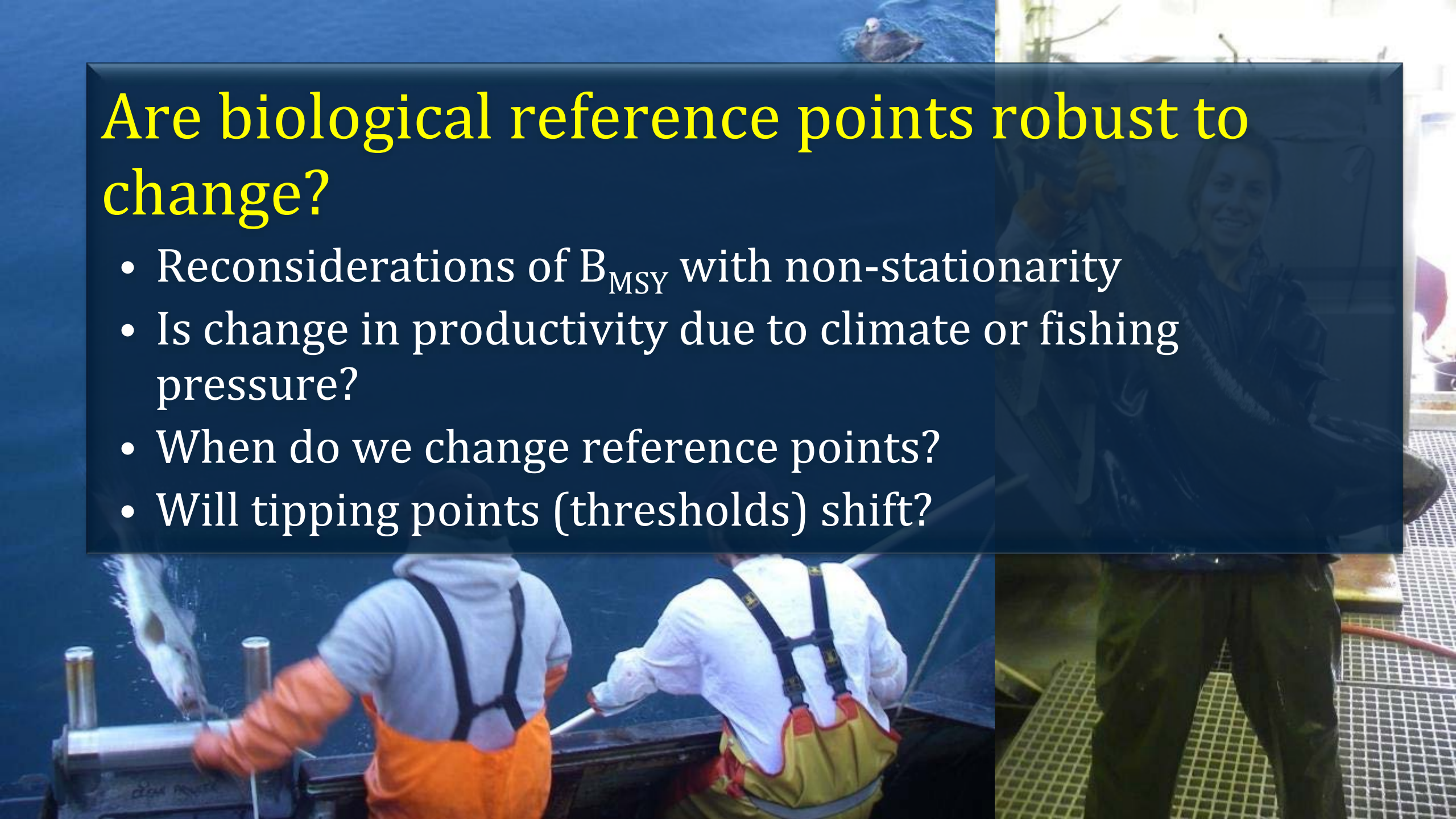
# Have we been here before?

- 1977-78 regime shift
- Stock assessments increase  $M$  to address changes in abundance indices
- Average recruitment,  $B_{MSY}$  proxy years, average catch



# Are biological reference points robust to change?

- Reconsiderations of  $B_{MSY}$  with non-stationarity
- Is change in productivity due to climate or fishing pressure?
- When do we change reference points?
- Will tipping points (thresholds) shift?

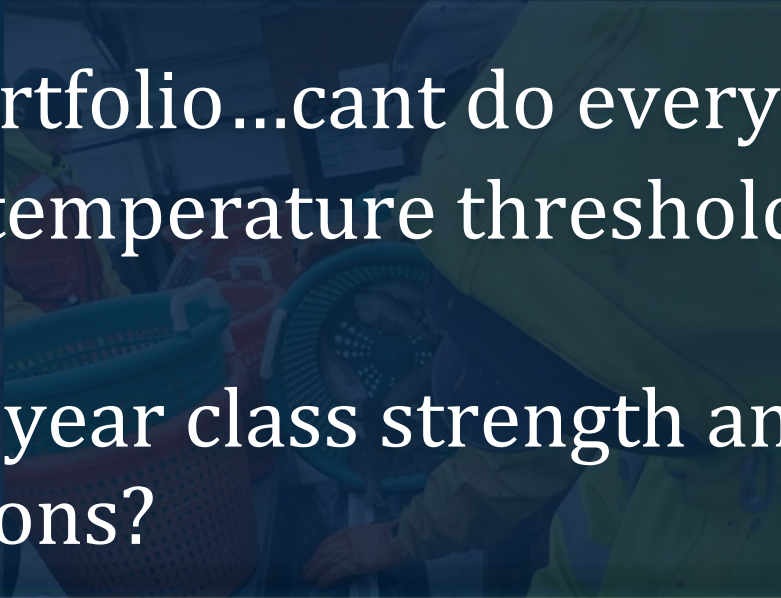
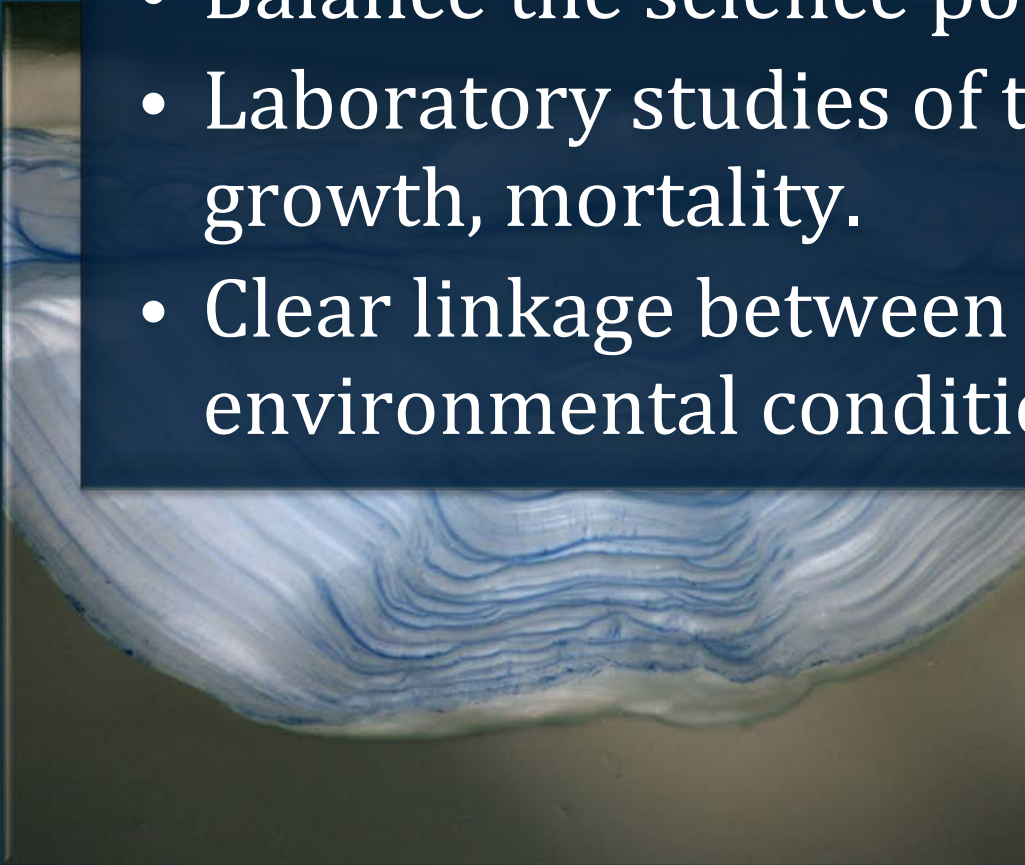


# What data are needed to monitor expansion?

- Ecosystem dynamics that explain slow decline versus abrupt stock change.
- Understanding the magnitude of the change.
- Connectivity among ecosystems (shelf, NBS, NW-BS, Chukchi)
- Innovative observational tools
- Expand tagging and tracking

# How do we more effectively identify bottlenecks?

- Balance the science portfolio...cant do everything
- Laboratory studies of temperature thresholds: impacts on growth, mortality.
- Clear linkage between year class strength and environmental conditions?

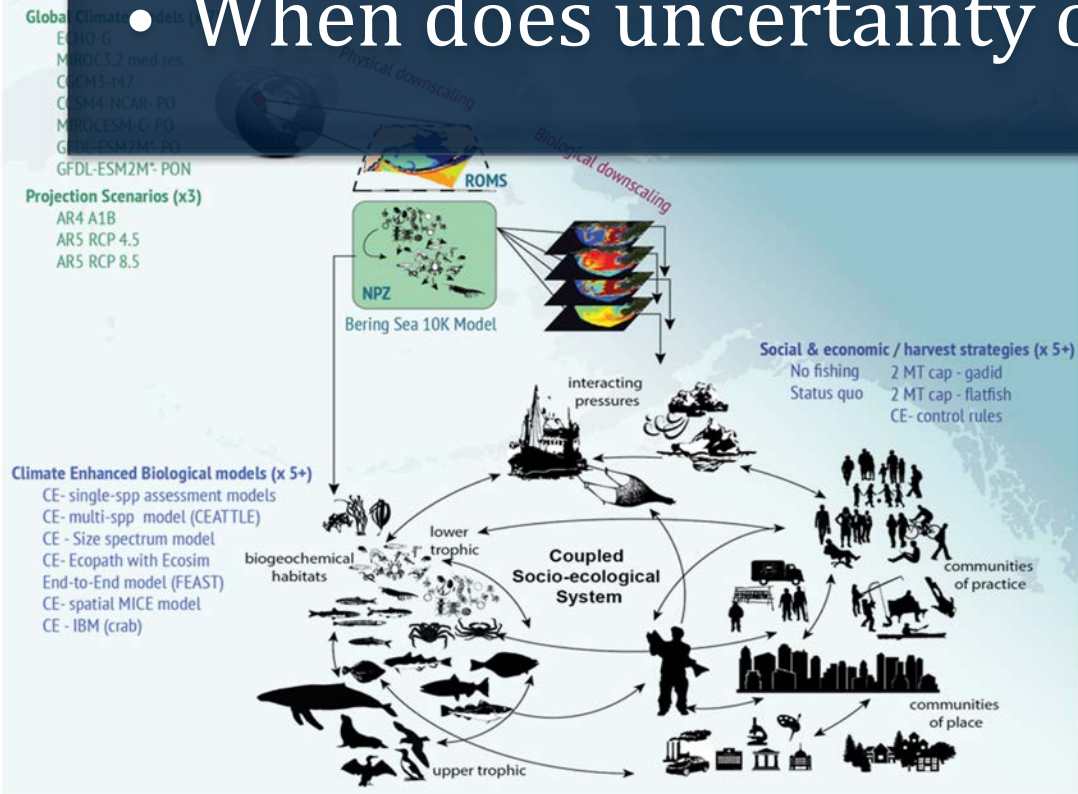


# Can we plan for extreme events?

- 2019 cold pool contraction
- Scenario planning
- How fast will the NBS-Chukchi region shift from benthic to pelagic energy flow?
- Can we reasonably monitor the Chukchi ecosystem and address EBS FMP species dependence on the NBS ecosystem?
- Catchability=selectivity + availability

# Can we really improve on predictions in a meaningful way to inform management?

- 2-5 year forecasts vs long term prediction
- When does uncertainty outweigh usefulness of forecasts?



# How to take precautionary approach without unnecessarily reducing harvest?

- Acceptable levels of uncertainty, risk
- Science informed adaptability in real time
- Can we provide data to inform flexibility
- Balance of management informed indicators and mechanisms
- How do we provide bookends for management and expect decisions?



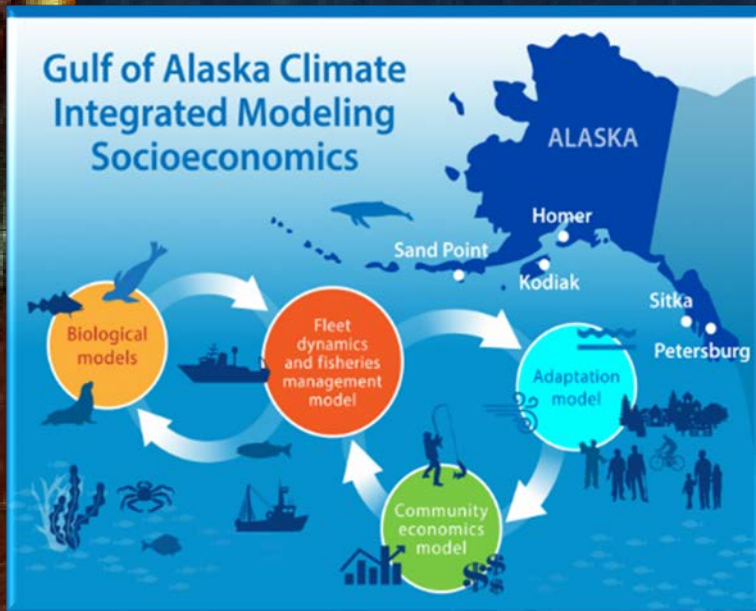
# More effective harvest to optimize economics?

- Boom and bust not sustainable...the tale of crab
- Can science inform harvest alternatives to promote more stability? (Tanner crab example)
- Information to inform MSE?



# What data needed to support sustainable communities?

- Small communities dependent on industry
- Ecosystem change effects on subsistence communities
- Fisheries effects and species interactions with marine mammals, herring, salmon.



# Northern Bering Sea Climate Resilience Area

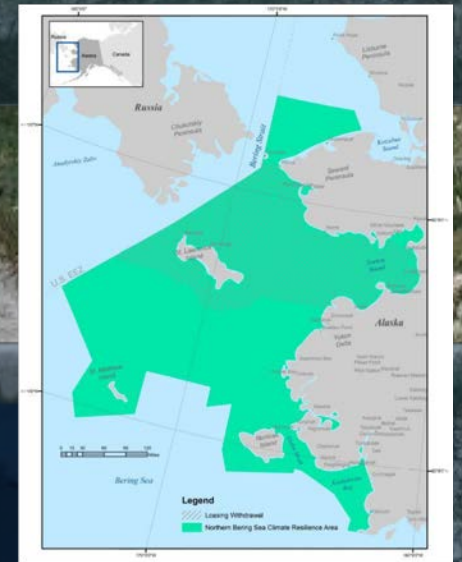
## Tribal Advisory Council & Federal Agency Task Force

- “... with attention given to climate resilience; the rights, needs, and knowledge of Alaska Native tribes; the delicate and unique ecosystem; and the protection of marine mammals and other wildlife.”

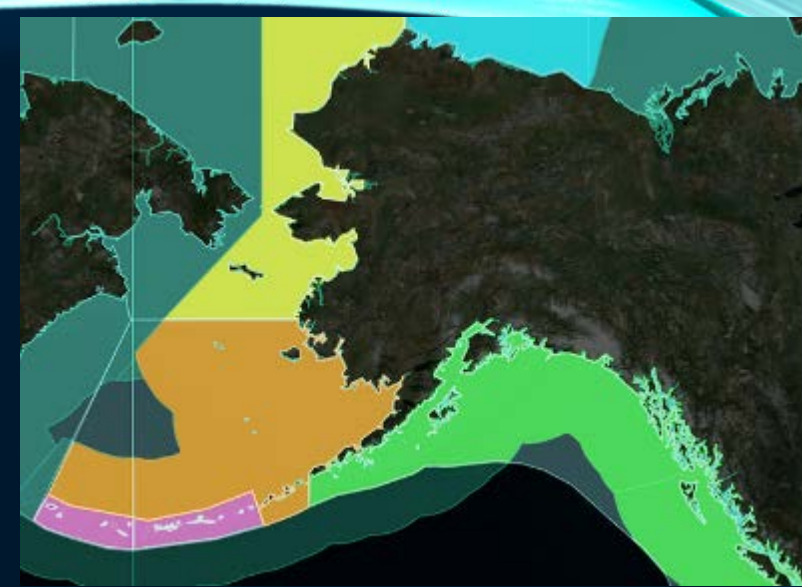
## 2020 Bering Sea Action Team

### Interagency Arctic Research Policy Committee (IARPC)

- How are rapid environmental changes (e.g. loss of sea ice, harmful algal blooms) affecting food security (e.g. commercial, subsistence), marine ecosystems (e.g. marine mammals, sea birds), and regional health/safety risks?



- **What do we know about the current and near-term future environmental and ecological states of the northern Bering Sea and southern Chukchi Sea?**
- **What data do we need to collect and monitor in the northern Bering Sea and southern Chukchi Sea to support ecosystem based fishery management of species in the Bering Sea Fishery Management Plans?**
- **Science to Management: what tools do we have or need to apply these data to management of Bering Sea fisheries?**



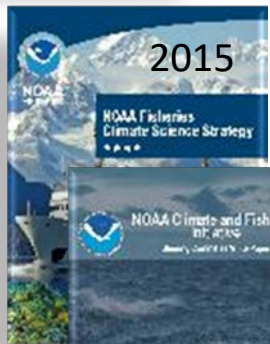
# Alaska - Climate Informed Science for Management



- Ecosystem Based Management Policy



- FEP
- ESR
- ESP



- RAPs
- FEP-CCTF
- ACLIM
- CFI

