Alaska Regional Action Plan 2.0 for Eastern Bering Sea Climate Science

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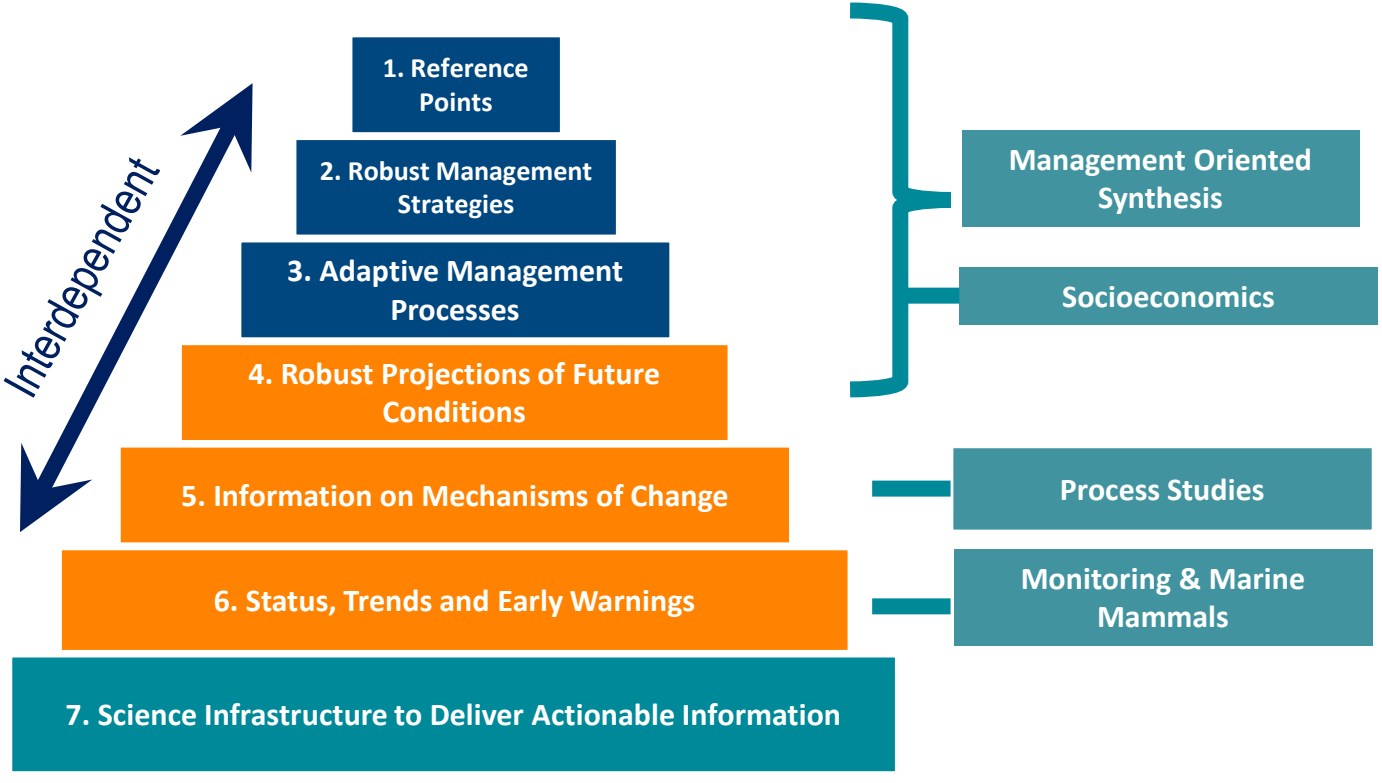
Subject matter sub-lead

- Management Oriented Synthesis (Shotwell)
- Socioeconomics (Haynie)
- Process Studies (Siddon)
- Marine Mammals (Gelatt)
- Monitoring (Barnett)

NOAA Fisheries Climate Science Strategy

https://www.fisheries.noaa.gov/national/climate/noaa-fisheries-climate-science-strategy



Writing Team Project Selection Process

- Sub-leads discuss within subject matter experts
- Sub-leads report back to writing team and develop text for appendix
- Key Action Synthesis based on three broader themes:
  - Invest in Technology
  - Infrastructure
  - Pathways to management including communication
- Full group discussion and review of draft

Continuing Projects	Objective	Sub Group
Stock Assessment Enterprise	1, 2, 6, 7	
Multispecies technical interaction model	2	
Management strategy evaluations (MSEs)	2	
Alaska Integrated Ecosystem Assessments and Ecosystem Status Reports	6	
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Fisheries Monitoring and Assessment	6, 7	
Fish and Crab Surveys	6, 7	
Age and Growth Monitoring	6, 7	
Marine Mammal Assessments	6, 7	
Seabird Bycatch and Encounters	6, 7	
Standard Shipboard Oceanographic Collections for Ecosystem Monitoring	6	
Standard Ichthyoplankton and Juvenile Fish Monitoring	6	
Oceanographic Moorings	6	
Derived products from ecosystem monitoring	5, 6	
Groundfish Stock Structure and Salmon Stock Identification	6	
Recruitment Processes Alliance (RPA)	5	
Ocean Acidification Research	5	
HABs Research	4	
Satellite tagging of northern fur seals	5, 6	
Support for rapid response indicators of ecosystem status	6	
Identify bio-geochemical thresholds and mechanisms driving ecosystem reorganization	5	
Northern fur seal research	2, 5, 6	
Assess economic and social impacts of climate change	3	
Modeling fisher behavior in response to changing climate, markets and management	3	
Identify human community dependence on LMRs and effects of climate change	3	
Regional Economic Impacts of Climate Change	3	
Arctic Council, AMAP, impacts on coastal communities	3	
Integrated economic impact assessments of Ocean Acidification	3, 5	
Community and economic surveys	3	

Post 2016 Projects	Objective	Sub Group
Inshore and coastal assessments	6	
eDNA (northward shifts)	7	
Shifting Spatial Distributions	6	
Biogeochemical process monitoring	4	
Ecosystem and Socioeconomic Profiles (ESPs)	5	
Risk Tables	1, 5, 6	
Species Distribution Models for Identifying Essential Fish Habitat	5	
Transition from ROMS to MOM6	4	
Bering Seasons program-phase 2	4	
The Alaska Climate Integrated Modeling Project Phase 2	1–4	
Northern fur seal foraging model in ACLIM Phase 2	3. 5	
Fisheries Integrated Modeling System	1, 2	
Council Bering SEa FEP Local Knowledge Traditional Knowledge and Subsistence Taskforce	2, 3, 6	
Climate Change and Crab Working Group	1, 5	
International coordination (NMFS/ DFO and PICES	2, 4, 5	
The PICES/ICES Working Group on Impacts of Warming on Growth Rates and Fisheries Yields	1, 5	
Sustainability of Marine Ecosystems through global knowledge networks	4, 5	
Modeling the management and fishery response to changing fishing abundance with the ACLIM ATTACH Model	3	
Developing socioeconomic scenarios to evaluate possible future management and harvest scenarios	3	
Identifying fishing effort by modeling Vessel Monitoring System (VMS) and Automatic Information System (AIS) data	5	
Annual Community Engagement and Participation Overview (ACEPO)	5	
Communication foundation for co-producing science with Bering Sea communities	3	

Gap Projects	Objective	Sub Group
Discretionary Funds for Rapid/ Emergency	6, 7	
Supplemental Support for Southeastern Bering Sea Ecosystem Assessment and Monitoring Surveys	6, 7	
Supplemental Support for Northern Bering Sea Ecosystem Assessment and Monitoring Surveys	6, 7	
Forage Fish Population Dynamics	7	
Expand Marine Mammal Assessments	3, 6, 7	
Fully support NOAA oceanographic moorings	6, 7	
Expanded bio-physical data collections on NOAA moorings	6, 7	
Expanded bio-physical data collections on NOAA uncrewed surface vehicles	5–7	
Laboratory infrastructure - environmental tolerances, food habits and bioenergetics	5–7	
Information trade-offs with current and alternative sample size and data collection methods	6, 7	
Strengthen partnerships with Russian Federation to share data on transbound-ary stocks	6, 7	
Communication, Cooperation and Infrastructure to Increase Efficiency and Comfortability of Monitoring data	7	
Euphausiid population dynamics	5–7	
Nearshore ecosystems and juvenile fish population dynamics	5	
Climate Fisheries Initiative funding for Fisheries and Climate Decision Support Systems	1–5	
AFSC Climate Research and Activity Facilitator	7	
Improve communication of risks of climate change to fishing dependent communities	3	
Bridging knowledge to inform Bering Sea Management (BKIBS)	3	
Invest in training, education, and infrastructure though implementation of CFI FACSS	1-7	
Arctic marine assessment program for Protected Species (ArMAPPS)	6, 7	
Modernize Alaska marine mammal assessment surveys	5, 6	
Expand research to understand how climate change will impact fishery-dependent human communities and evaluate socioeconomic scope for adaptation	3	
Adapting to Life Without Ice: Food security, subsistence, and nutrition in the Bering Strait	3	
Non-market values of the Bering Sea ecosystem	3	
Ecosystem service valuation (SPURF)	3	

OBJECTIVES

1. Climate-Informed Reference Points
2. Robust Management Strategies
3. Adaptive Management Processes
4. Project Future Conditions
5. Understand Mechanisms of Change
6. Track Change and Provide Early Warnings
7. Build and Maintain Adequate Science Infrastructure

PRIMARY AFSC SUB GROUP

- Monitoring
- Socio-economics
- Process Research
- Marine Mammals
- Management - Oriented Synthesis

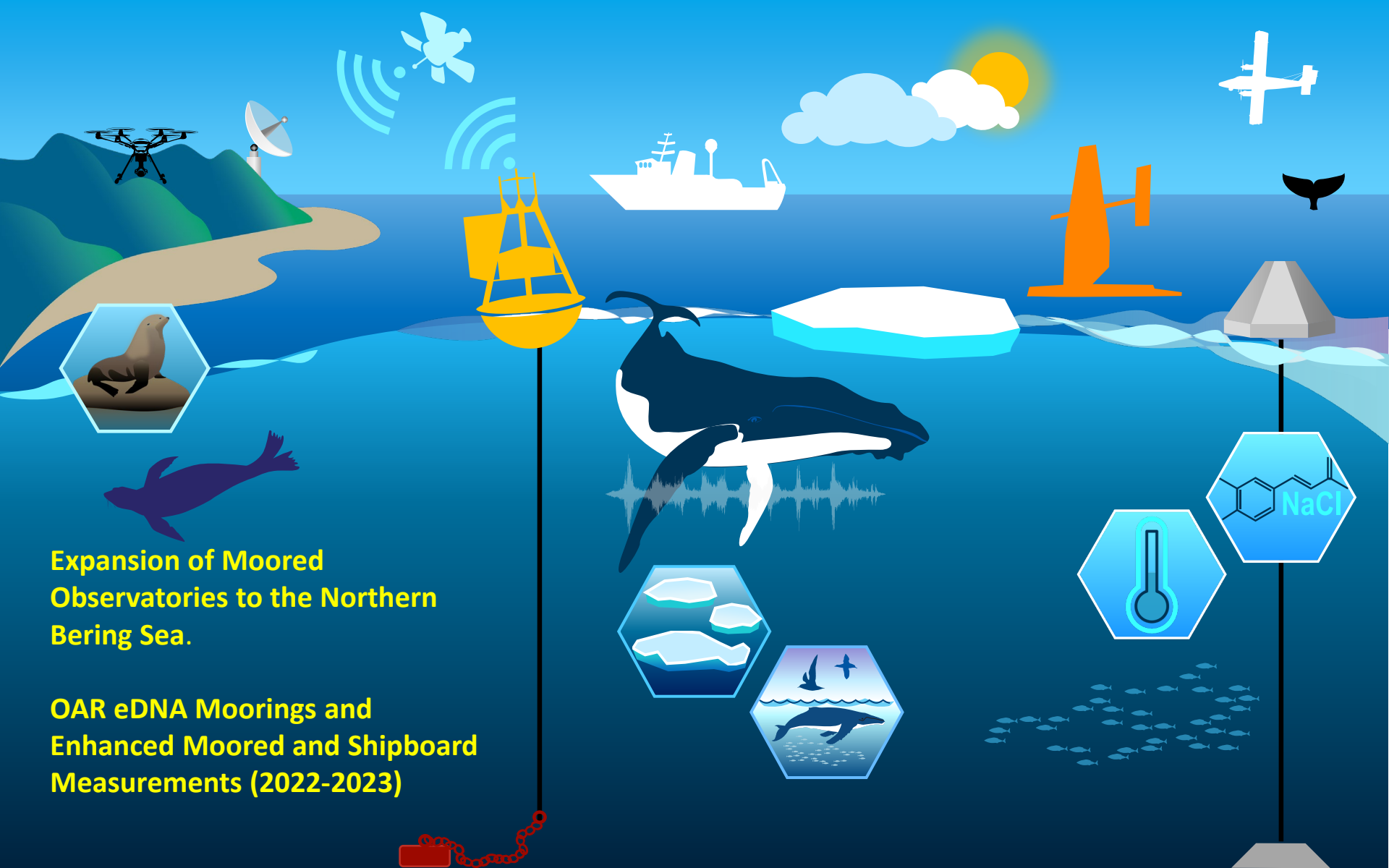
	Continuing	Post-2016	Gap
Monitoring	10	2	12
Process Studies	6	2	2
Management Oriented Synthesis	4	14	5
Marine Mammals	1		2
Socioeconomics	7	5	4
Total	**28**	**23**	**25**

Emerging Opportunities

- **NOAA's Climate Fisheries Initiative (CFI):** In response to clear evidence for the profound role of climate on fish and fisheries in the United States, NOAA launched the Climate Fisheries Initiative (CFI). The CFI enlists all NOAA line offices to provide Fisheries and Climate decision Support Systems (FACSS) in at least five US Large Marine Ecosystems (LMEs). The CFI provides the critical infrastructure to establish a permanent climate change research element to the science portfolio of NOAA.
- **FY22 NOAA Fisheries Survey Infrastructure:** In recognition of the growing need for ongoing and expanded ecosystem linked sampling and analysis, NMFS requested a budget increase in 2022 for fisheries survey infrastructure. This increase in infrastructure funding will ensure regions like the EBS continue to be monitored and assessed into the future.

Emerging Opportunities

- **Expansion of Moored Observatories to the Northern Bering Sea**. PMEL (EcoFOCI) has maintained four long-term biophysical moorings in the Bering Sea: M2 (26 years); M4 (23 years); M5 (17 years); and M8 (17 years). These moorings will continue to be maintained. In addition, a fifth site (M14) has been established north east of St. Lawrence Island. M2 and M8 have been upgraded to include cutting edge technology (Technology Box).
- **OAR eDNA Moorings and Shipboard Measurements (2022-2023**). PMEL has submitted a funding request to OAR to continue eDNA research at the lab. The overarching goal for this proposal is to quantify changes in the Arctic (Bering and Chukchi seas) ecosystems using both moored and shipboard measurements of eDNA.

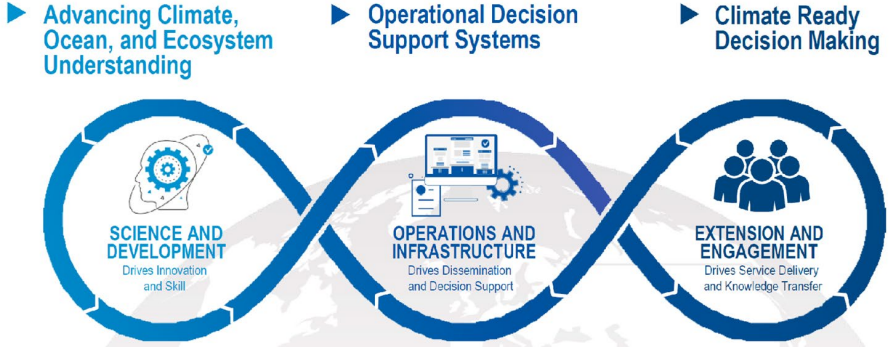


Expansion of Moored Observatories to the Northern Bering Sea.

OAR eDNA Moorings and Enhanced Moored and Shipboard Measurements (2022-2023)

NOAA's Climate and Fisheries Initiative

- **Challenge:** Climate change is impacting the nation's valuable marine and Great Lakes ecosystems, fisheries, and the communities that depend on them. These impacts are creating urgent questions that demand climate-informed answers.
- **Response:** NOAA's Climate Fisheries Initiative is a cross-NOAA effort which, when combined with existing programs, will enable the sustained operational ocean prediction and decision support system needed to reduce negative impacts and increase resilience of ecosystems and coastal communities



CFI Draft Implementation Approach
CFI Webpage

Scenarios

- **Scenario 1**, the agency will continue to rely on temporary funding for multiple projects, particularly those that advance NOAA Fisheries' ability to build fishery and climate decision support systems into the future. Lack of sampling in the slope region and irregular sampling in the NBS will reduce the agency's ability to track impacts of climate change on LMRs. Likewise, reduced process studies and intermittent sampling of ichthyoplankton and age-0 pollock populations retard the pace at which mechanistic understanding advances.
- **Scenario 2**, the four FY 2022 initiatives would address key infrastructure (staffing and ship-time) needed to sustainably expand surveys into the Northern Bering Sea and deliver fishery and climate decision support to fishery-dependent communities and managers. The influx of base funding will allow AFSC to grow survey teams to accommodate this new and challenging monitoring need.

Key Gaps in Infrastructure (RAP Levels 5-7)

- Ecosystem data collection –
  - (bloom timing, seasonality, species comp)
  - Microzooplankton community and shifts in species composition and grazing rates
- Expansion of summer acoustic surveys to inner domain
  - Euphausiids
  - Forage fish (juvenile Pollock)
- HABs
- Mechanisms underlying spatial shifts (NBS survey)
- Ocean biogeochemical sampling in NBS (benthic pelagic coupling)
- Climate-mediated demographic vulnerability
- Predator-prey
- Survey frequency for pinnipeds
- Baseline information for cetaceans (ArMAPPS)

Key Gaps in Pathways for Fisheries and Climate Decision Support (RAP Levels 1-4)

- CFI implementation across NOAA new hires
- Communication
- Understanding human community adaptations
- Non-market conservation of BS ecosystem

Key Input from CPT

- Missing projects in Appendix?
- Missing gaps?
- Are key actions complete?