



**NOAA
FISHERIES**

Science update

Surveys // IRA & CRF

Science-to-Management

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NOAA Fisheries

MAFAC
Washington, DC
14 November 2023

Outline

- Survey/fleet updates/next steps
- CRF/IRA opportunities/next steps
 - Advanced Tech/Survey Mitigation/CEFI
 - National Survey Program
- Climate and Fisheries
 - Recap from San Diego (May) meeting
 - AK snow crab
- Science-to-Management
 - Tools (e.g., Dismap, CVA, Scenarios)
 - EBFM, Governance
 - Looking forward



Fleet/Survey Updates

- In FY23, NOAA Fisheries completed ~74% (**864/1169**) of our DAS (Days at Sea) on our FSVs. (Note: the 1169 DAS includes a mid-year re-programming.) Challenges included:
 - Workforce
 - Repairs/maintenance
- For FY24, the NOAA Fleet Allocation Plan (FAP) is in revision pending final budgets. The President's Budget aimed for ~1270 DAS for Fisheries surveys.
 - Presently, we are **working on a revised FY24 FAP for ~800 DAS (a reduction of ~450 DAS)**.
 - Of FY24's 800 DAS, ~236 DAS have been completed in Q1 and ~563 DAS remain for Q2-Q4 (1/1/24-9/30/24). Note: to reach 800 DAS we need close to 100% execution in Q2-Q4.
 - A survey prioritization is underway to inform the completion of the revised FY24 FAP.

Fleet/Survey Updates



Looking ahead on NOAA Ships:

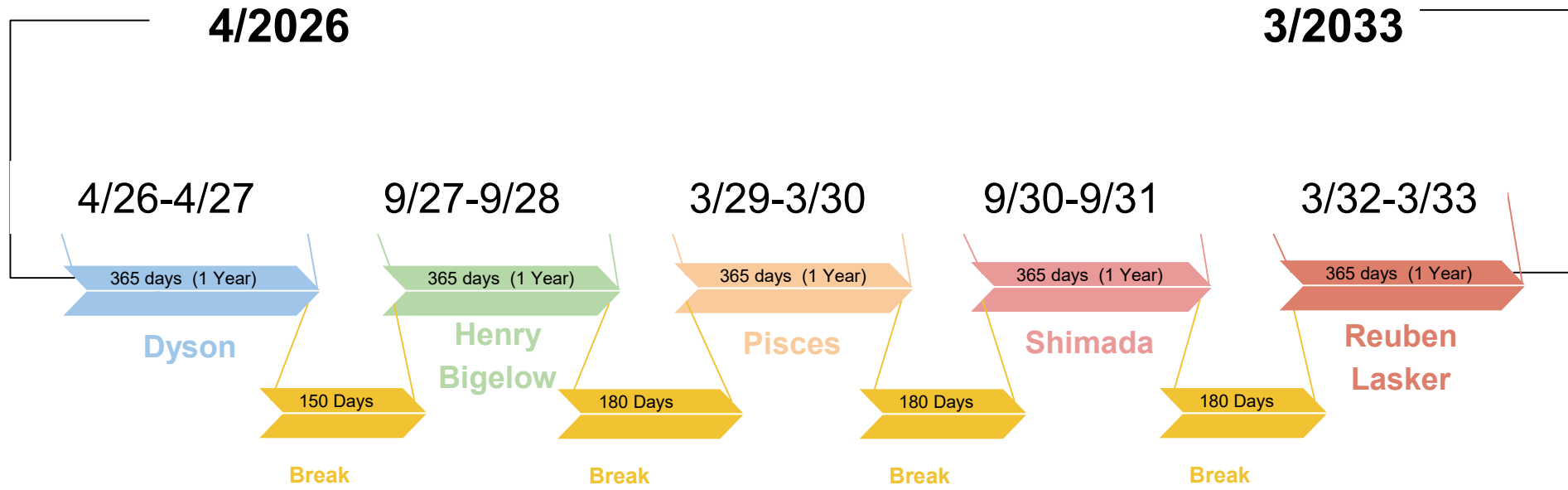
- The *Rainier* experienced a fire on 5 Sept 2023 (all crew safe) and likely unavailable for FY24 (final assessment pending) (<https://www.oma.noaa.gov/mo/news-media/article/noaa-ship-rainier-incident-update>)
- Contracts for two **Class B** (Charting) vessels have been awarded - completion ~2027 (<https://www.noaa.gov/news-release/contract-for-2-noaa-research-ships-awarded-to-thoma-sea-marine-constructors-llc>)
- Analysis of Alternatives (AoA) for **Class C** (Fisheries and Coastal Science) ships underway (availability >2030)
- Midlife Repair Periods (**MRPs**)

Midlife Repair Periods (MRPs)

Context: The FSVs were designed for a 20 year service life. Launched between 2003 and 2012 they are now approaching the end of design service life, and to extend their service life, NOAA is planning on conducting Midlife Repair Periods (MRPs):

- are a thorough, **bow-to-stern, evaluation of the material condition of each vessel and repair** or replacement of any damaged, deteriorated, or other less than optimal parts and systems,
- facilitate **upgrades intended to standardize the fleet**, reduce carbon emissions, and increase overall reliability of the vessels, and
- total approximately **\$85 million for each vessel and take 12-14 months** to complete (2024-2033). (To date, only the *Dyson's* MRP is funded.)

FSV MRP Schedule (as of 10/23)



Dyson, Shimada & Lasker: 2024-2033 scenarios

2024 | 2025

Current hake/CPS
surveys & pilot
integrated



Courtesy Su Kim; NWFSC

2026

Integrated surveys



Drydock: 4/2026 – 4/2027



2027 | 2028 | 2029

Integrated surveys
& more



2030 | 2031

Integrated surveys



Drydock: 9/2030 – 9/2031



2032 | 2033

Integrated surveys

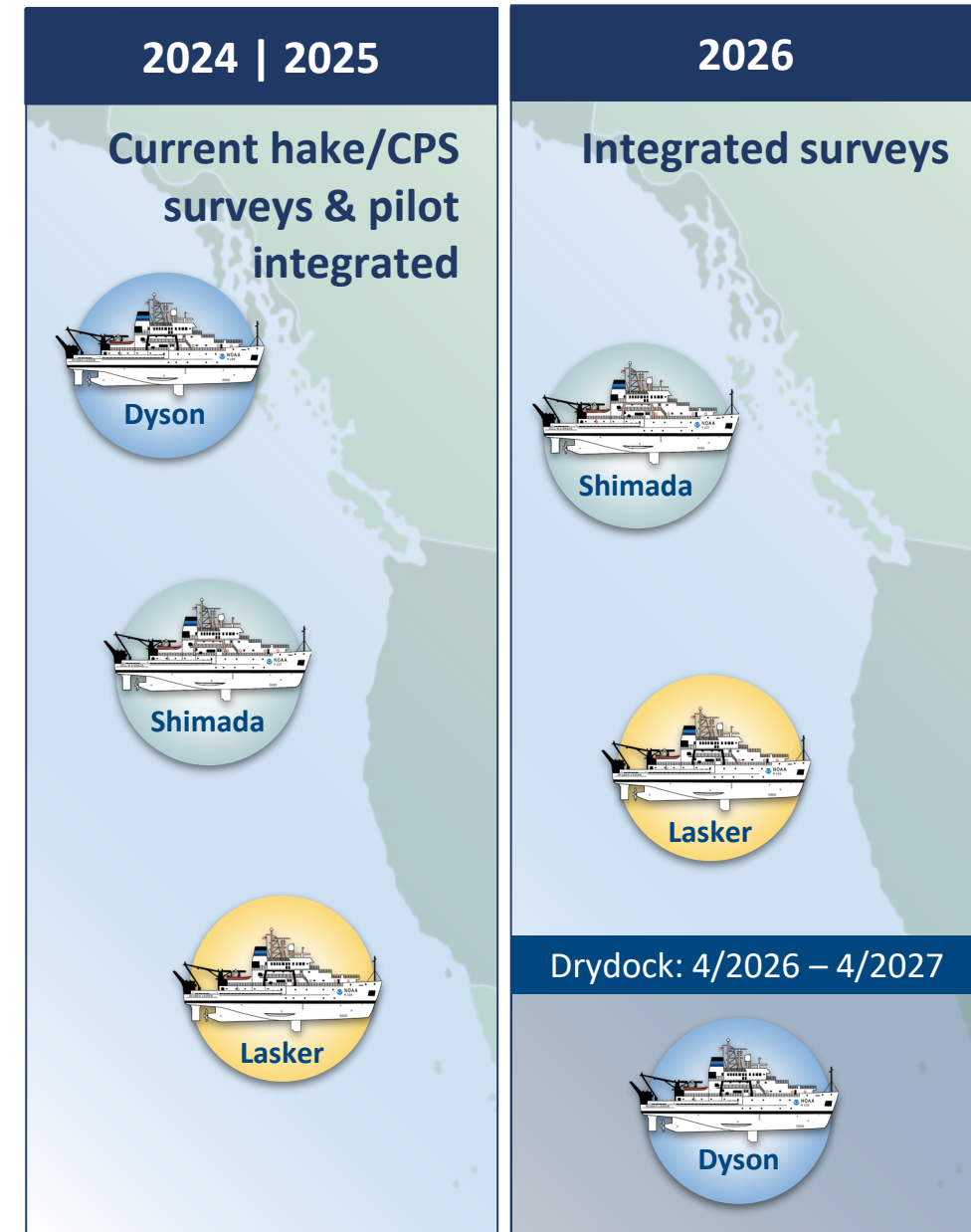


Drydock: 3/2032 – 3/2033

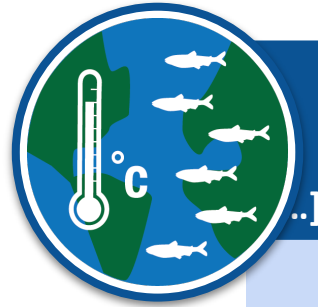


MRP Strategy and Roadmap

- **Ships**
 - Ensure essential surveys NOAA surveys continue
 - How should UNOLS, charter, and industry vessels be factored into mitigation strategies?
 - How will the *Sette*, *Oregon-II* and *Gunter's* expected EOSLs affect the MRPs?
 - How to plan for other possible delays
- **Costs/Budgets**
- **Personnel**
- **Implementation of New Technologies**
- **Communications**



Inflation Reduction Act (IRA) Opportunity



Climate-Ready Fisheries (CRF)

[additionally NARW, Red Snapper, Pacific Salmon, Habitat, Arctic, ..]

- **Climate-Ready Fisheries:** \$349M to support an ambitious new initiative to strengthen the agency's science and survey enterprise.
- This investment will help build a dynamically managed fisheries system that will
 - **Incorporate climate and ecosystem environmental data to**
 - **provide real-time advice and long-range projections to inform and**
 - **support management decisions for affected sectors and communities.**

Data Acquisition

\$105M

Data Modernization & Management

\$40M

Climate Ecosystem & Fisheries Initiative (CEFI)

\$40M

Data Acquisition & Management (\$145M): advanced tech, modern data systems, and infrastructure to modernize stock assessments to account for climate change. Partnerships w/ fishing industry, academia, and state agencies.

CEFI (\$40M): Development of ocean ecosystem predictions in preparing for climate-driven problems; predictions extend to coastal communities and economies; and how these predictions will increase communities' resilience.

Survey Vision for the Future

- **Sustain** core strength while we build the **additional capacity** needed to face the growing challenges of climate change.
Action: \$14M/yr in appropriated survey funds and IRA/EDA^(*) mitigation funds.
- **Modernize** - Evaluate and implement **new technology platforms** for collecting data and enhancing workforce proficiency.
Action: IRA EDA/AT^(*) Strategic Initiatives.
- **Strengthen** survey **planning, prioritization, and management** of survey resources to optimize return on investment.
Action: Creation of new National Survey Program (Fall 2023) and NAPA products (annual, November 2023 and beyond)

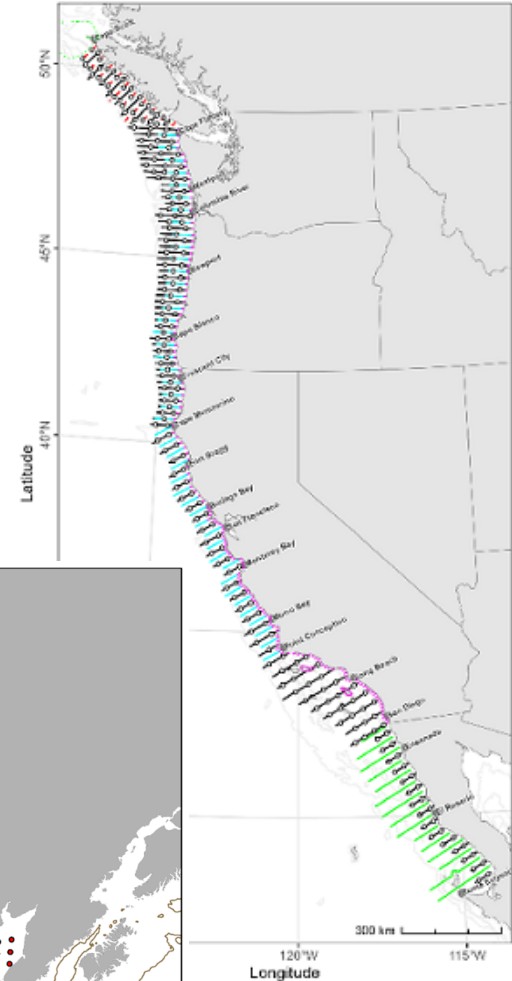
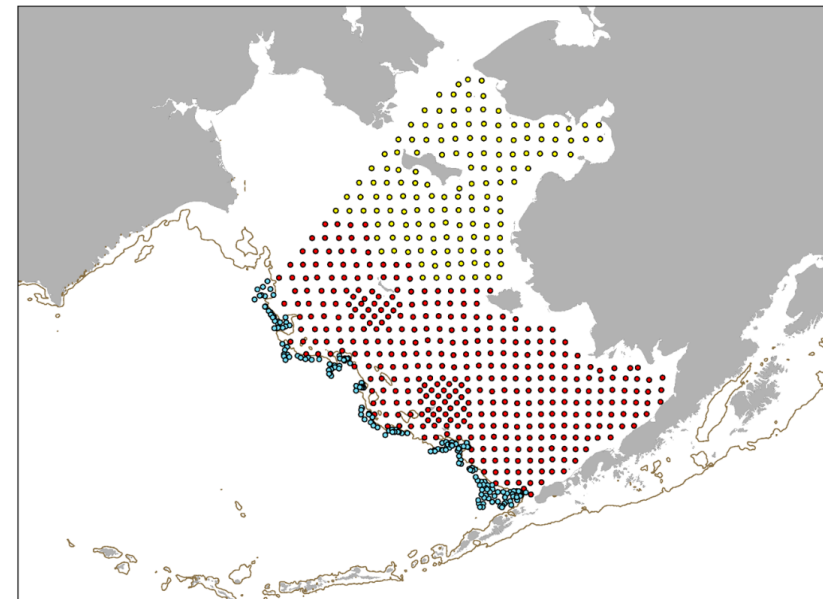
^(*)EDA: Essential Data Acquisition; AT: Advanced Technologies



Essential Data Acquisition (EDA)

Mitigate the recent loss of at-sea survey capability and increase the efficiency of traditional platform data acquisition

- Integrated West Coast Pelagics Survey
- Pacific protected species charters (AK/PI/SW)
- Research vessel purchase (SE/NE)
- Alaska fisheries charters
- National Survey Program
- Other priorities in conjunction w/
annual survey budget



EDA/Advanced Technologies

Modernize and transform NMFS' advanced technology and social science capabilities through **targeted Strategic Initiatives** that increase the number and types of observations we can make, and move us toward the greater synoptic (simultaneous) sampling:

- Uncrewed systems (UxS)
- 'Omics (including eDNA)
- Optical systems
- Active acoustics systems
- Passive acoustic systems
- Remote sensing

NMFS Survey Program [Fisheries-Independent (F-I) Data Acquisition]

- **Drivers:**
 - NAPA, Senior Leadership, Congress...
 - Strategic planning happens nationally
 - Requirements and challenges are increasing
 - Make best use of resources to provide BSIA in accordance with priorities
- **Updates/Status (implement in time to support FY25 planning):**
 - Encompasses the entirety of activities/resources/staff under F-I Data Acquisition
 - **Goal:** Collect priority data in the most efficient/effective ways, and make data readily available
 - **Scope:** Coordinate, Evaluate, Prioritize, Plan, Resource, Execute, Report, Advocate, Innovate



Data Modernization

Transform Fisheries Dependent Data (FDD) into a modern, agile data system in partnership with Coastal States and Fisheries Commissions.

FY23 Program Profile

- Identify requirements for enterprise-capable cloud solutions
- Enhance efficiency in application development and imagery review
- Facilitate adoption of Open Science and Open Data norms
- Support the refinement of an operating model for data modernization

Outyears (FY24-26)

- Establish an enterprise-capable cloud architecture and develop a plan for modernizing NMFS data systems
- Adopt an Open Science and Open Data model
- Development of operating models and to support data modernization efforts beyond FY26



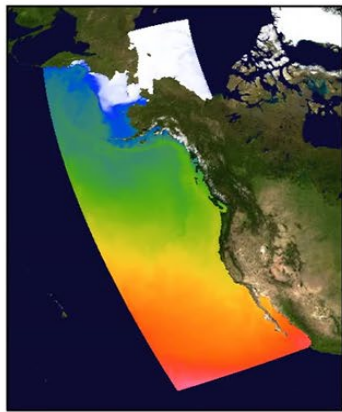
CEFI – next steps

FY24/25:

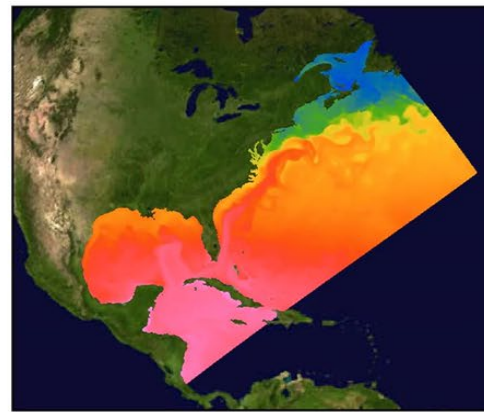
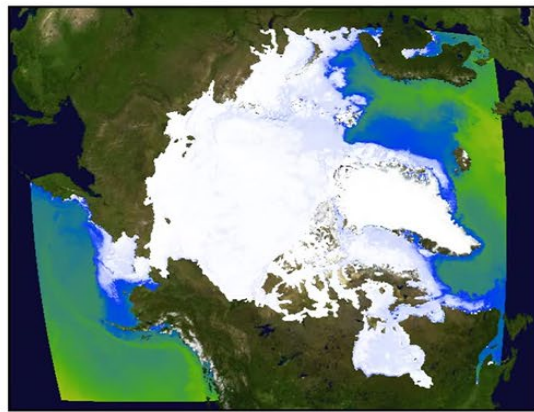
- Robust ocean projections in six regions
- Ocean modeling output accessible from Information Hub
- Decision Support Teams operational in six regions

FY25/26:

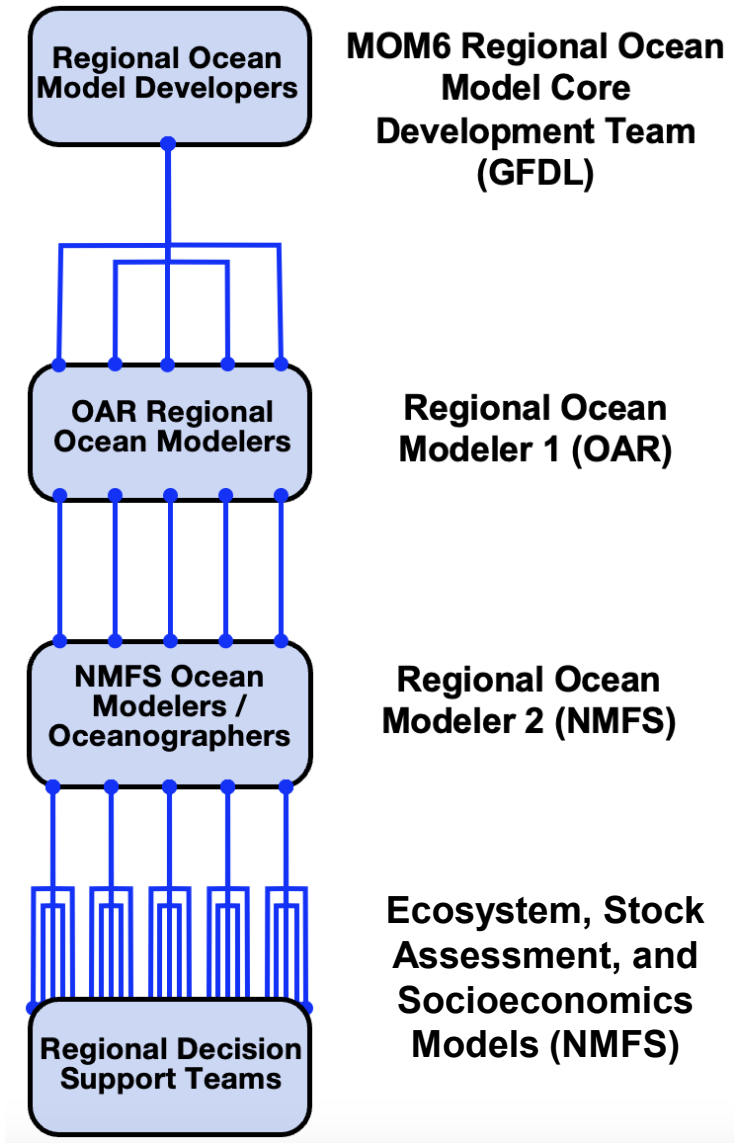
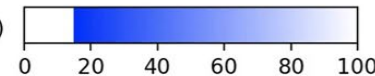
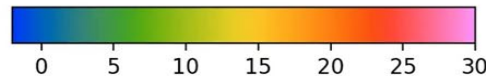
- Climate-related information and advice available in six regions



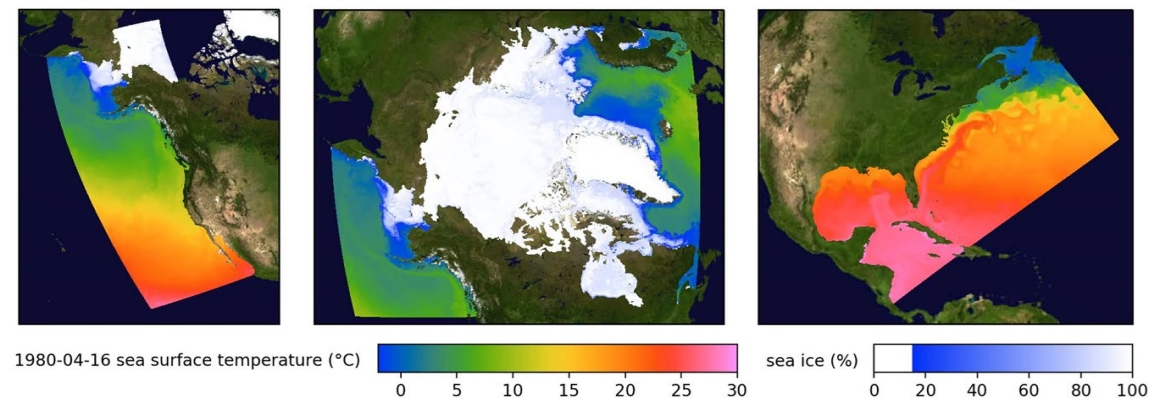
1980-04-16 sea surface temperature (°C)



sea ice (%)



CEFI: provide a national capacity for sustained provision of regional ocean and climate information across LMR management time scales

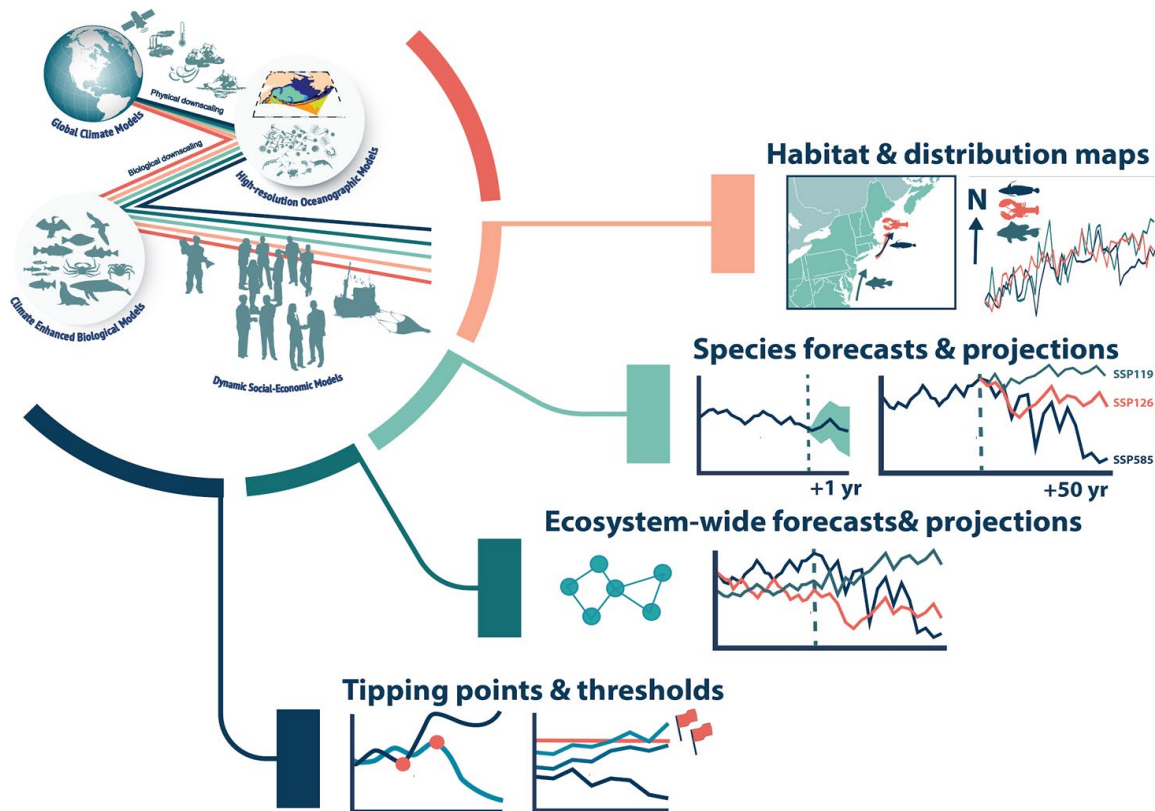


Ocean Predictions

Decision Support Teams

Advice Pathways

Applications



- Population Modelers
- Stock Assessors
- Risk Assessors
- Ecosystem Assessors
- EFH Assessors
- Impact Assessors
- Strategy Evaluators

- Scenario Planning
- Risk Assessments
- Rapid Responses
- Consultations
- Management Strategies
- Rebuilding & Recovery Plans

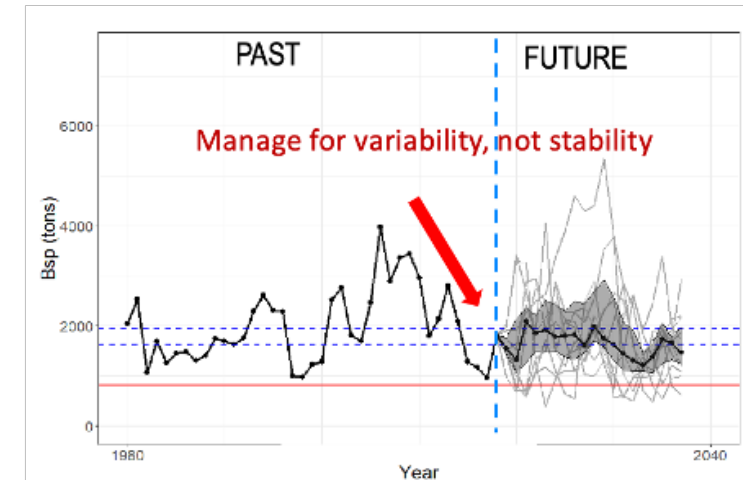
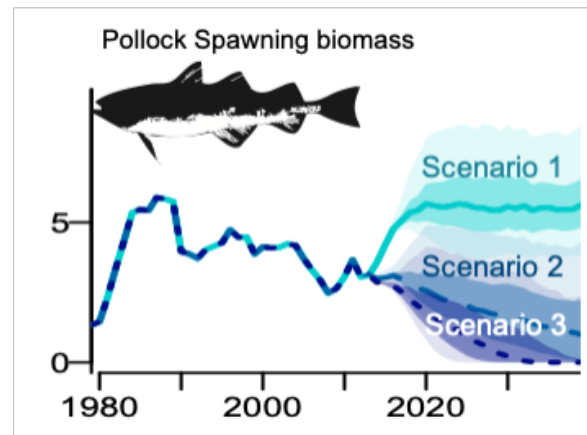
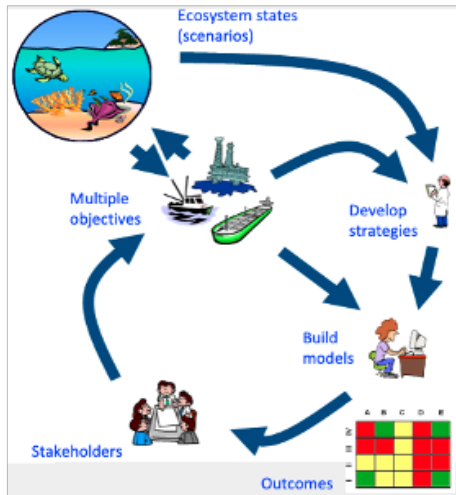
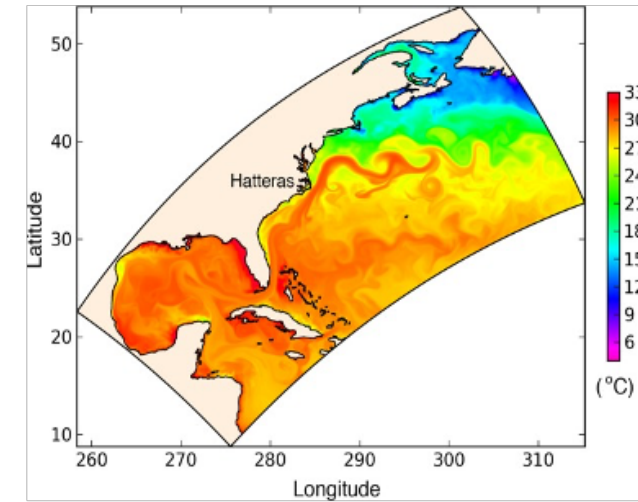
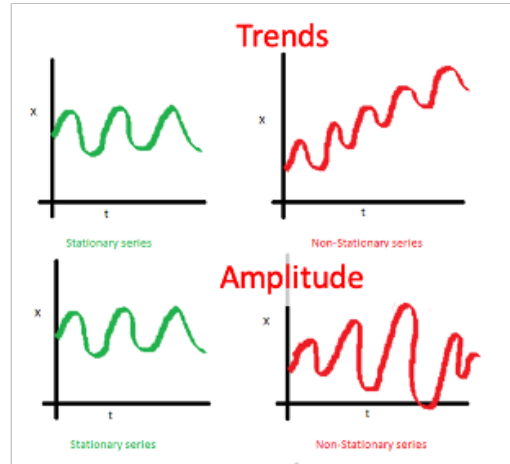


Science to Management

Considerations and Next Steps

Recap of last meeting: science updates

- Non-stationarity
- Need to know
- Need to evolve our advice
- Climate Ecosystem and Fisheries Initiative (CEFI)



Recap of last meeting...

(Barb Muhling and Elliott Hazen)

Shifting habitats and associated ecosystems will impact:

- Survey planning
- Stock structure
- Transboundary management
- Bycatch
- Changing prey interactions
- Changing social vulnerability
- Emerging fisheries

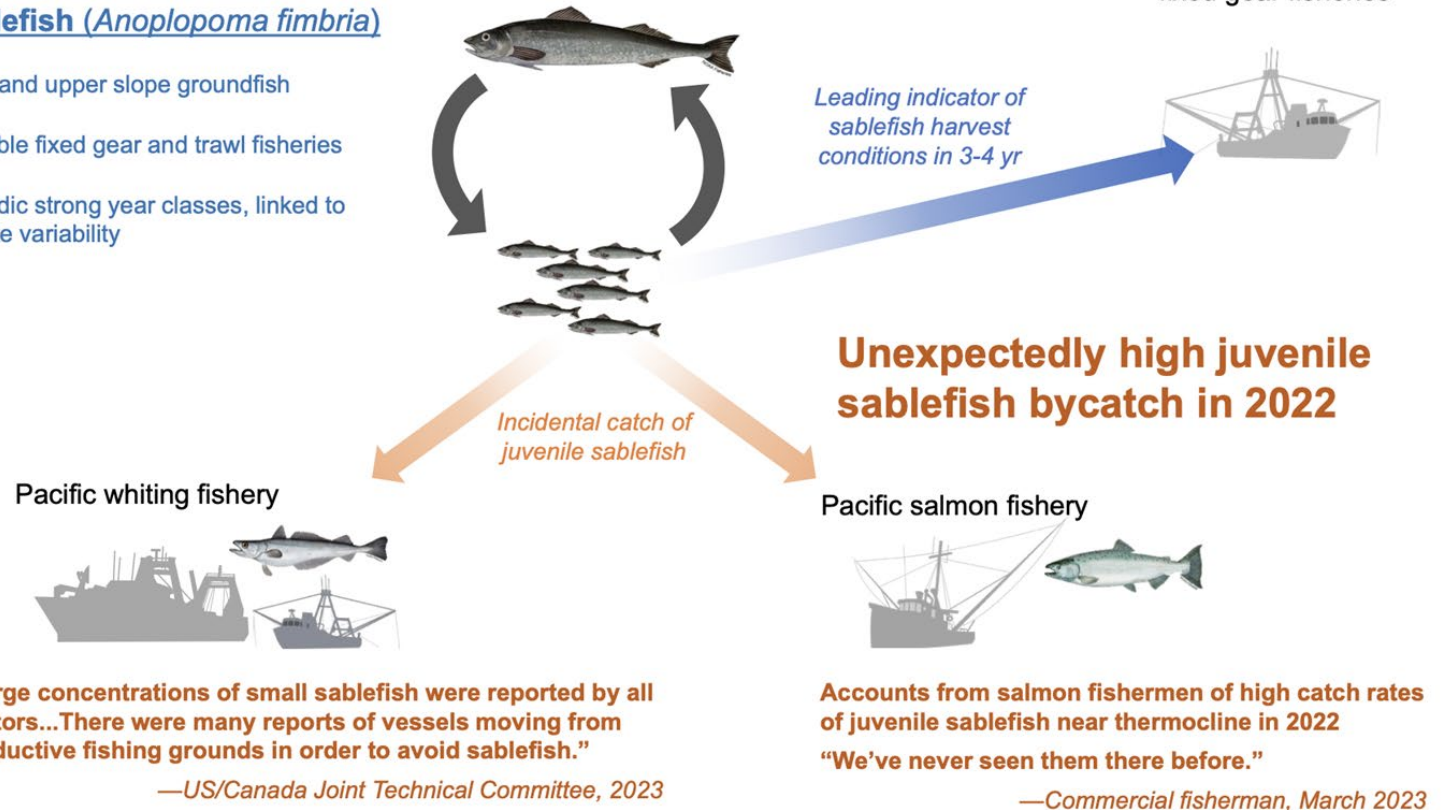
Case study: climate-driven impacts on bycatch

Sablefish (*Anoplopoma fimbria*)

Shelf and upper slope groundfish

Valuable fixed gear and trawl fisheries

Episodic strong year classes, linked to climate variability



Recap message from the Councils...



- Councils need to start preparing now for increasingly complex management decisions due to climate change
- Investment is needed in the development of new data collection and analysis tools that are responsive to changing conditions
- SSCs and Councils need to be prepared to transition toward a more sophisticated toolbox
- Stakeholder engagement will be critical for adaptive management to be successful



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<https://www.npfmc.org/SCS7/2/>



NOAA FISHERIES

Billions of crabs went missing around Alaska. Scientists now know what happened to them

By Rachel Ramirez, CNN
Updated 3:04 AM EDT, Fri October 20, 2023



Joshua A. Bickel/AP

<https://www.cnn.com/2023/10/19/us/alaska-crabs-ocean-heat-climate/index.html#:~:text=MoLts%20and%20shells%20from%20snow.Scienc%20Center%20in%20Kodiak%2C%20Alaska.&text=Billions%20of%20snow%20crabs%20have,them%20to%20starve%20to%20death.>

Snow crab are widely distributed on the eastern Bering Sea shelf, and **densities of crab were an order of magnitude lower in 2021 compared with 2018.**

MARINE HEATWAVES

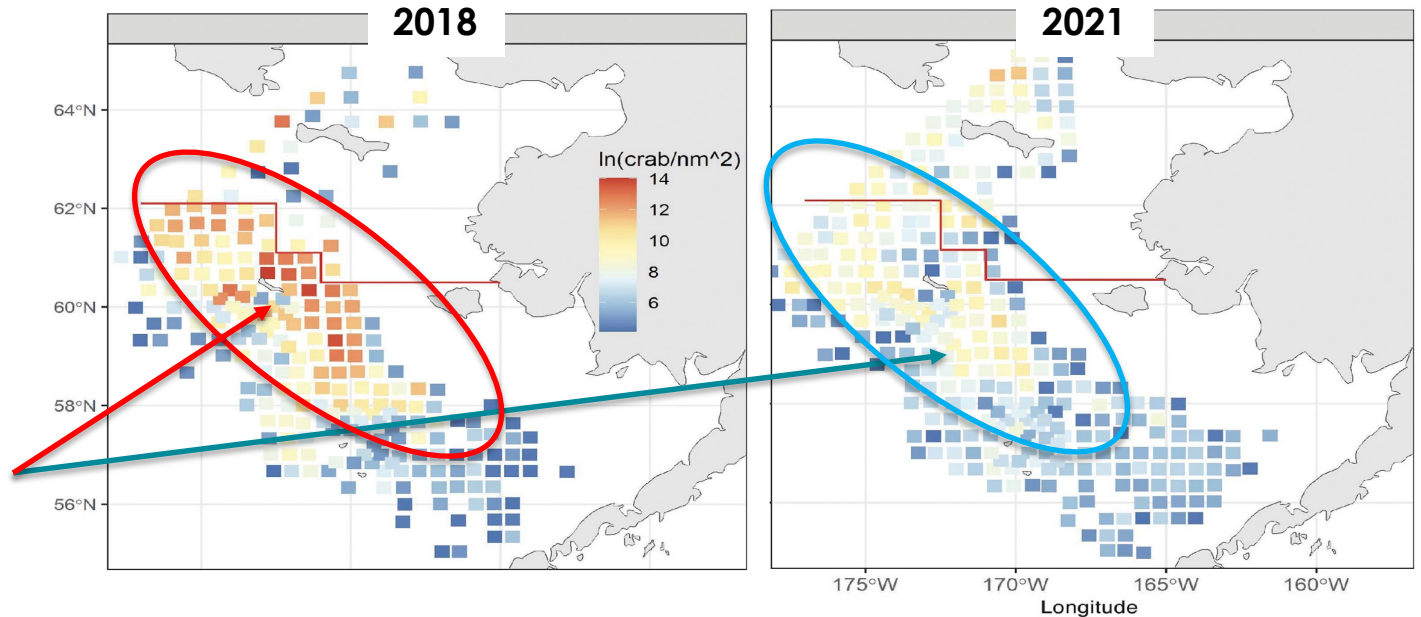
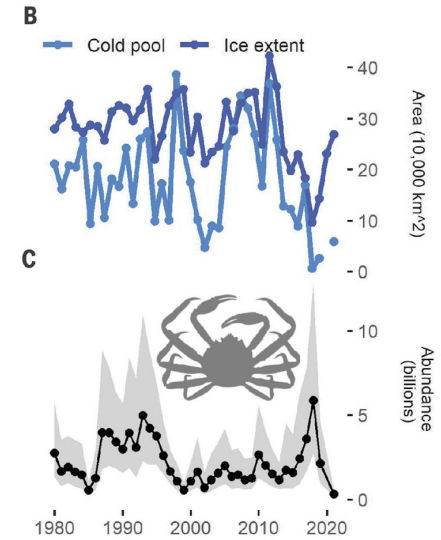
The collapse of eastern Bering Sea snow crab

Cody S. Szuwalski^{1*}, Kerim Aydin¹, Erin J. Fedewa², Brian Garber-Yonts¹, Michael A. Litzow²

The snow crab is an iconic species in the Bering Sea that supports an economically important fishery and undergoes extensive monitoring and management. Since 2018, more than 10 billion snow crab have disappeared from the eastern Bering Sea, and the population collapsed to historical lows in 2021. We link this collapse to a marine heatwave in the eastern Bering Sea during 2018 and 2019. Calculated caloric requirements, reduced spatial distribution, and observed body conditions suggest that starvation played a role in the collapse. The mortality event appears to be one of the largest reported losses of motile marine macrofauna to marine heatwaves globally.

Szuwalski *et al.*, *Science* **382**, 306–310 (2023) 20 October 2023

<https://www.science.org/doi/epdf/10.1126/science.adf6035>



Each square indicates a survey tow with snow crab present, and the red line separates the northern Bering Sea survey and eastern Bering Sea survey extent. lat, latitude; lon, longitude.

What/how did this happen?

The unprecedented caloric demands, coupled with a small area from which to forage relative to historical grounds, suggest that **starvation likely played a role in the disappearance of more than 10 billion snow crab**, similar to the marine heatwave–related collapse of Pacific cod in the Gulf of Alaska in 2016.

Could we have foreseen the collapse?

The model for mature mortality performed similarly, forecasting an increase in mortality over the projection period, but it **was not able to reach the estimated mortalities until the most recent data were included in the model**. This suggests that the **circumstances underpinning the recent collapse were unprecedented** in the Bering Sea in recent history.

Szuwalski *et al.*, *Science* **382**, 306–310 (2023) 20 October 2023

Science/management implications

- Our **current management tools** base management targets and **projected sustainable yields^(*)** on the historical dynamics of a population.
 - However, **projections based on historical dynamics are unreliable** when the future environmental conditions of a region will not resemble the past.
 - Our experience in the management of a collapsing snow crab population suggests that considering environmental influence in estimates of biomass used to set catch limits can be important, but **how to consider environmental change in management targets is an unresolved question.**

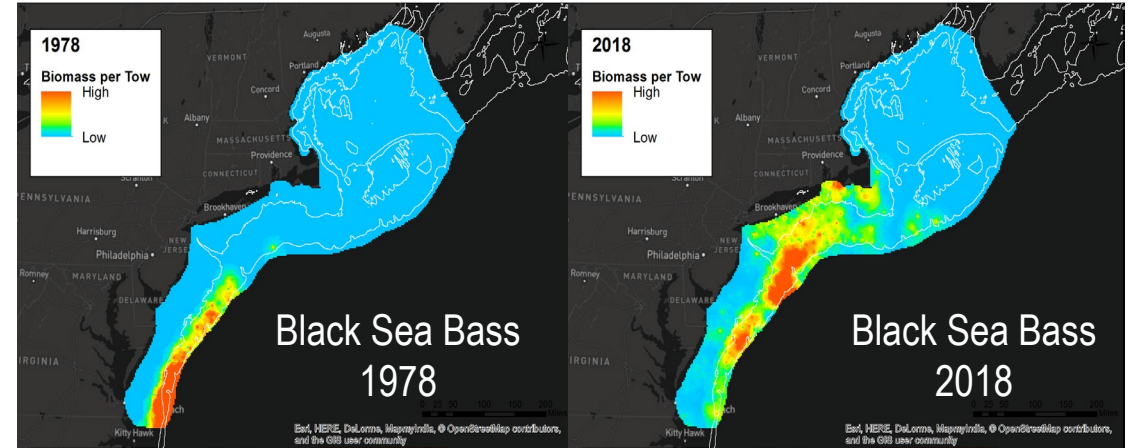
^(*)MSY (Max Sustainable Yield) is the largest long-term average catch or yield that can be taken from a stock or stock complex **under prevailing ecological, environmental conditions** and fishery technological characteristics ...

Growing Challenges for Effective Resource Management

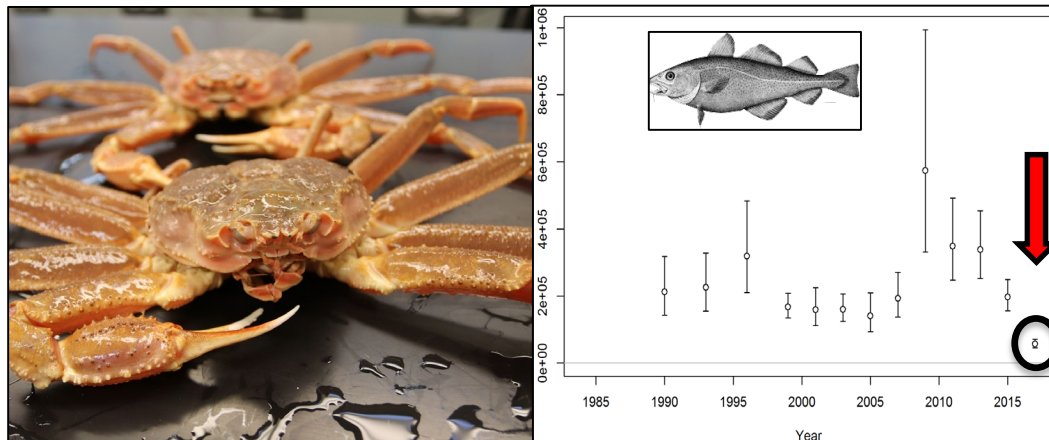
Changing Habitats



Shifting Distributions



Changing Abundance

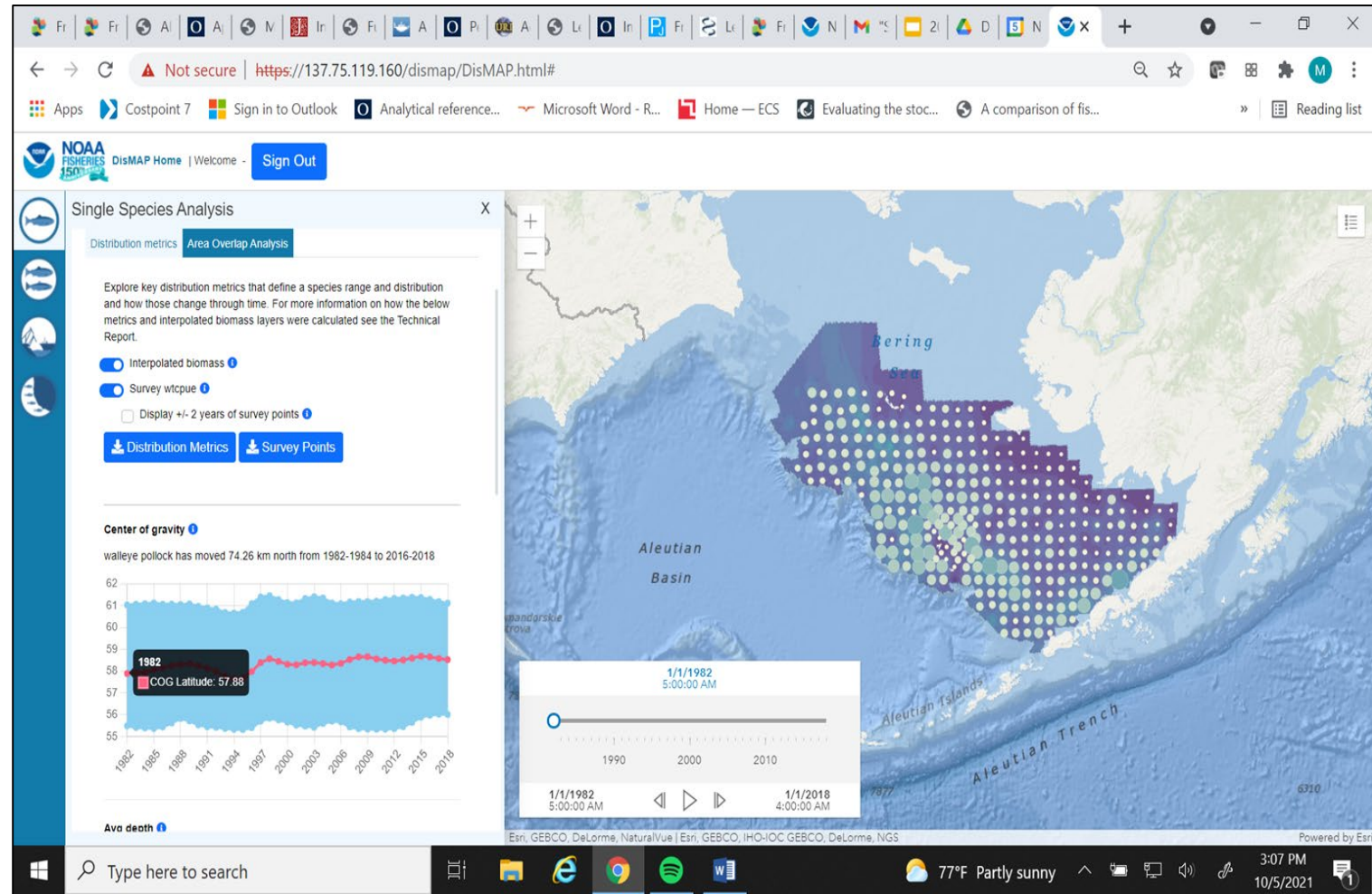


Changing Interactions



Understanding Shifting Distributions – DisMAP portal

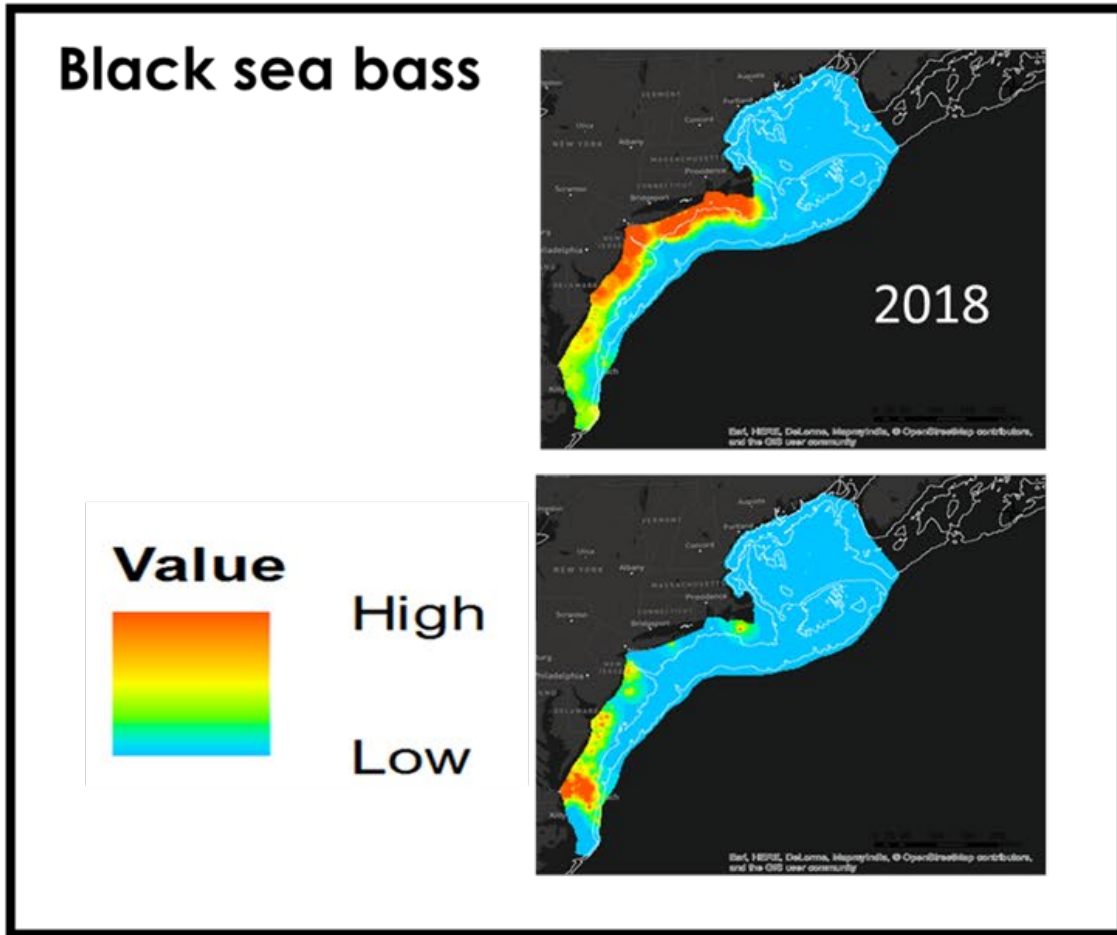
- Distributions and analysis tools for 400+ species of marine fish and invertebrates
- User-friendly tool to help in climate-ready decision making.



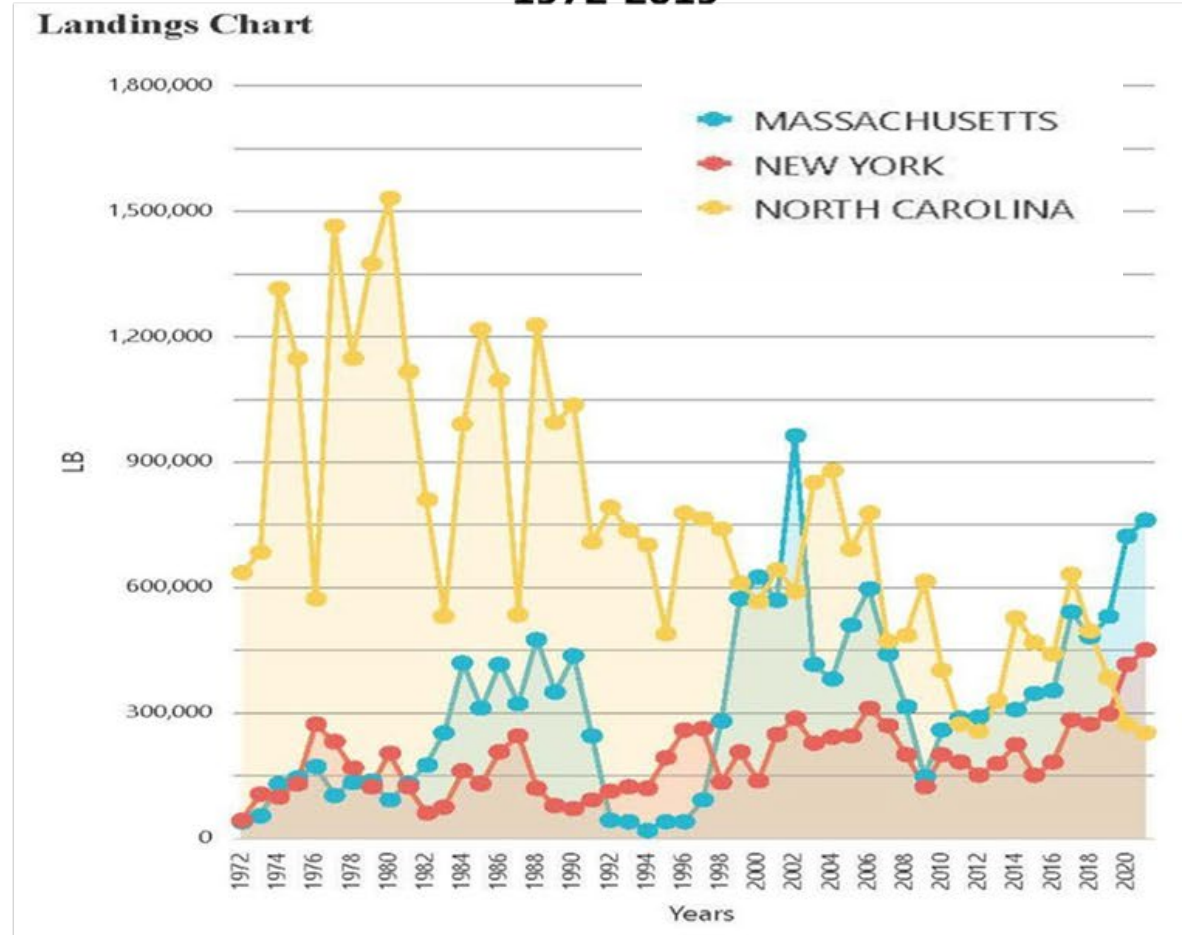
<https://apps-st.fisheries.noaa.gov/dismap/DisMAP.html>

Black Sea Bass Range Distribution

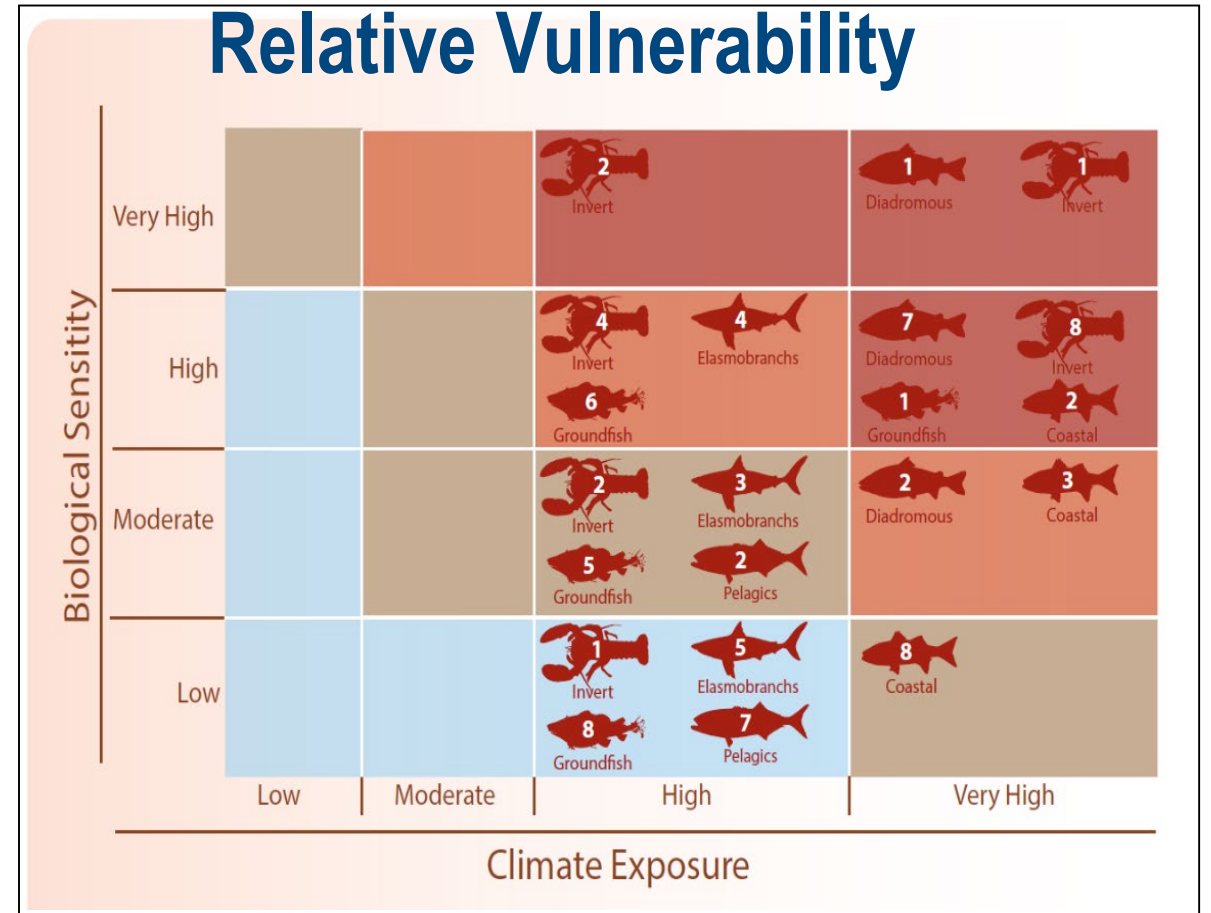
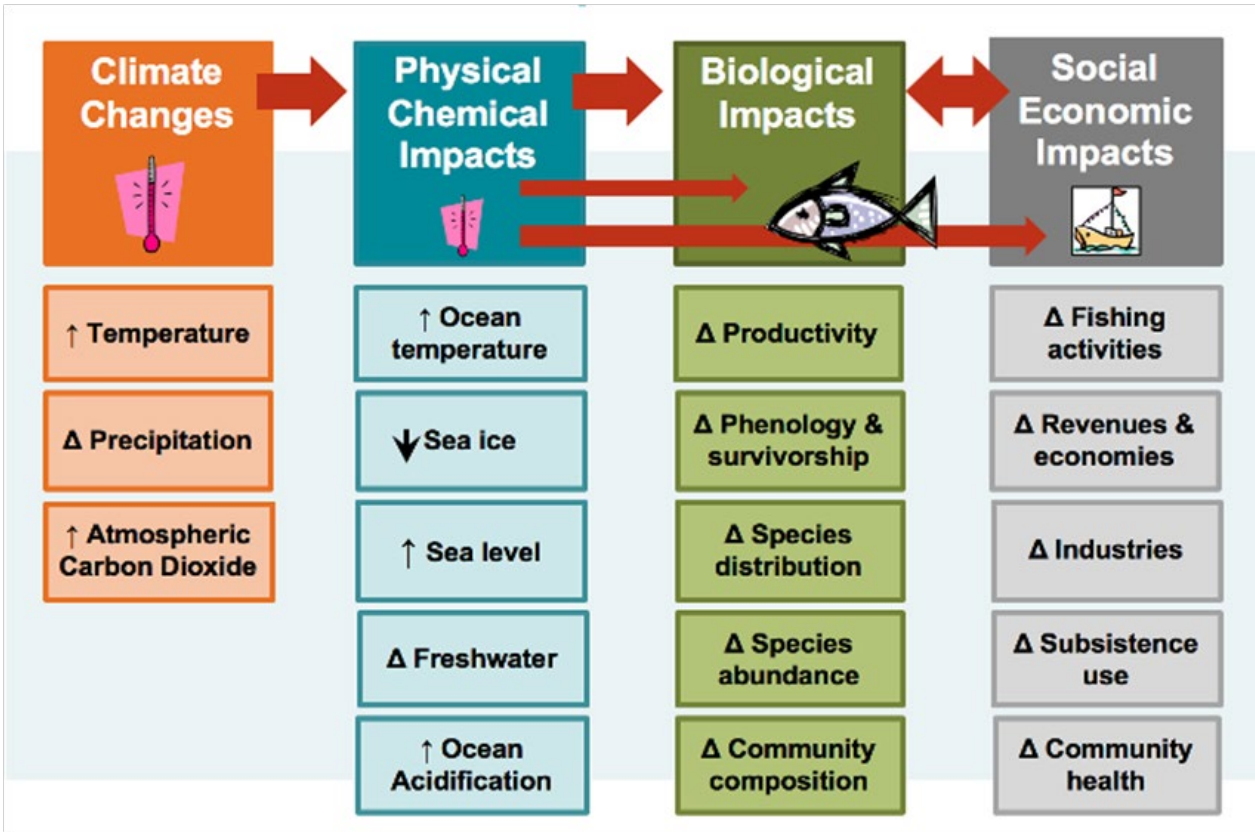
Geographic shifts



Changing Port Landings 1972-2019



Understanding Vulnerability – Climate Vulnerability Analyses

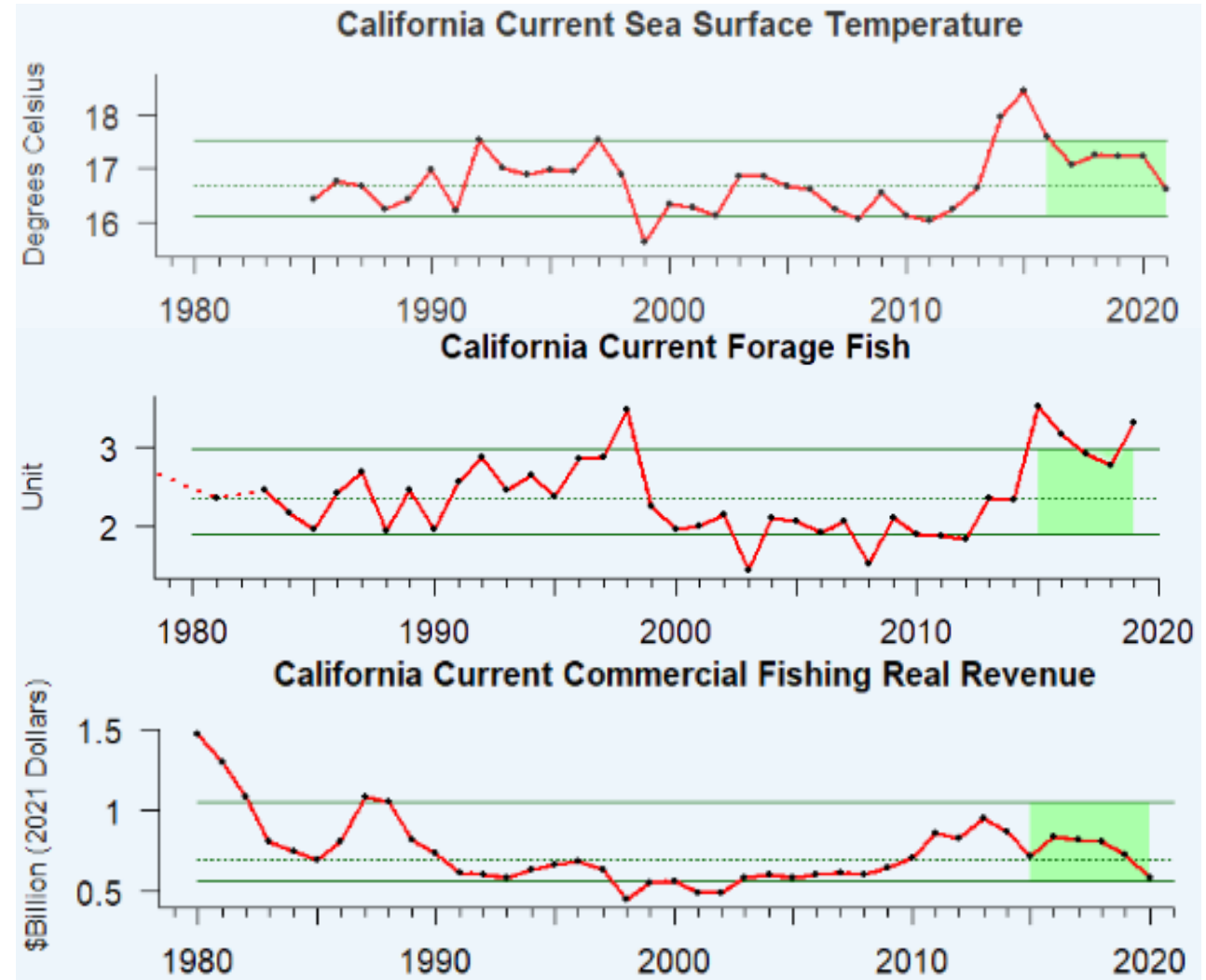


Online Tool - <https://www.fisheries.noaa.gov/data-tools/climate-vulnerability-assessment-tool>

Understanding what is changing = Ecosystem Status Reports

Provide trends in a variety of indicators

- physical (e.g., temperature)
- chemical (e.g., oxygen)
- biological (e.g., forage, predators)
- Socio-economic (e.g., landings, market diversity)



<https://www.integratedecosystemassessment.noaa.gov/Ecosystem-Status-Reports>

<https://ecowatch.noaa.gov/>

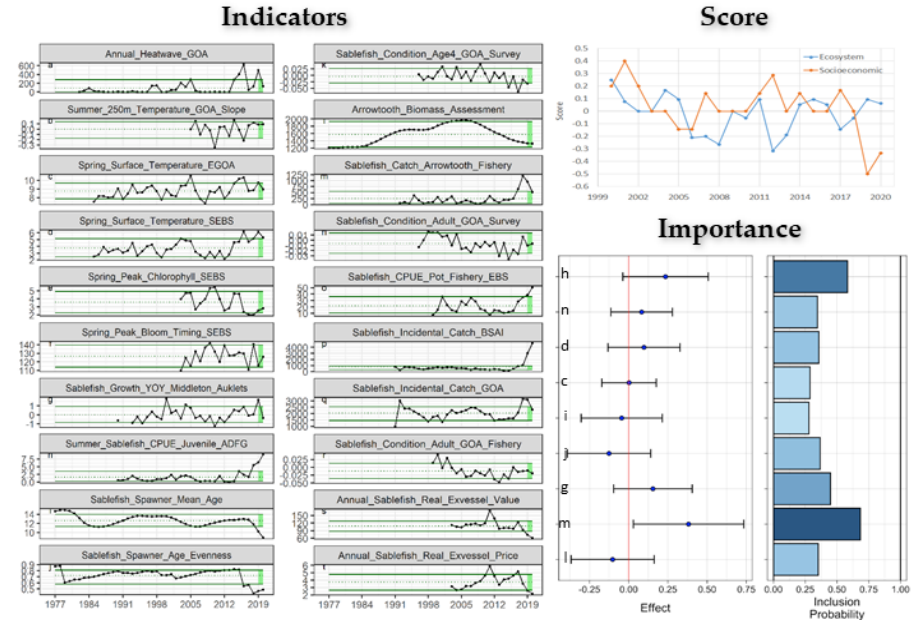
Understanding Stock Specific Influences - Ecosystem and Socioeconomic Profiles

- Provides indicators relevant for specific stock – for use in future stock assessments or management.
- Being used in Alaska & NE
- Working to expand nationally



Sablefish (*Anoplopoma fimbria*)

- Data rich stock, high recruitment variability, rapid early life growth, shifting distribution, high value



- Presence of 2016 and 2019 year class in ADF&G survey, age 4 fish generally in poor condition, higher spatial overlap with arrowtooth in fishery, physical + but < from 2019, lower stable, upper slight >
- Incidental catch < in GOA, > in BSAI indicates expanding habitat, ex-vessel value and price/pound on recent decline, community analysis in progress

Research Model Performance (hypothetical)

Model	ABC	OFL	Cross Validation	Retrospective	Recruitment Comparison	SSB Comparison
SAFE	26,250	30,000	28% +/- 6%	+0.19	0.5	0.5
Eco	23,625	27,000	46% +/- 12%	+0.07	0.65	0.3

ESP: <https://www.afsc.noaa.gov/REFM/Docs/YEAR1/GOAsablefish.pdf>, Contact: Kalei.Shotwell@noaa.gov

Identifying Appropriate Catch Levels

- Environmentally linked stock assessments.
- Risk tables.



Model Term	Factors	Example Species
Catchability	Temperature-dependent	Yellowfin Sole (BSAI) 
Natural Mortality	Harmful Algal Bloom (Red Tide)	Gag 

Table. Risk table summary.

Assessment Related Considerations	Population Dynamics Considerations	Environmental and Ecosystem Considerations	Fishery Performance Considerations
Level 3: Major concern	Level 3: Major concern	Level 2: Substantially increased concern	Level 3: Major concern

Benefits of Scenario Planning

NMFS is working to increase our capacity to do Scenario Planning

- Involves strong stakeholder participation which helps with buy-in
- Facilitates identification of innovative ideas
- Helps create alignment towards a common vision
- Leads to more robust decisions and plans
- Successfully used for fisheries and protected resources

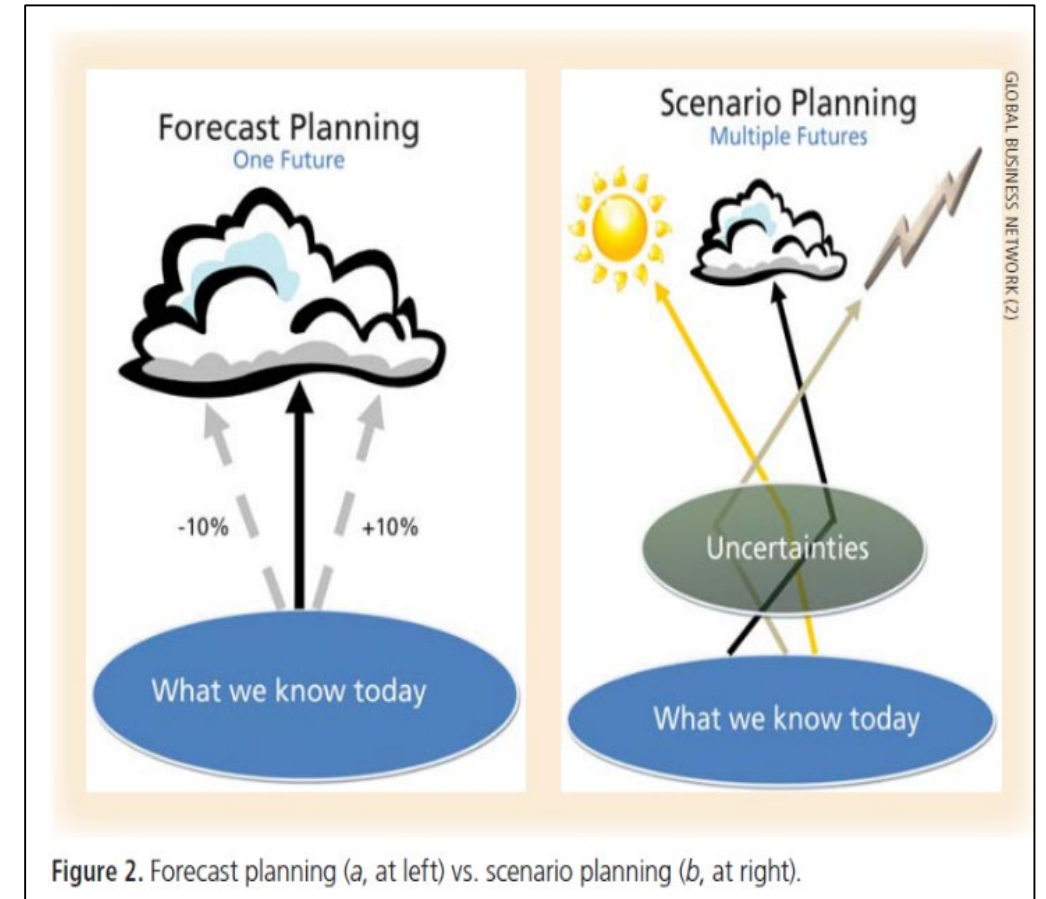


Figure 2. Forecast planning (a, at left) vs. scenario planning (b, at right).

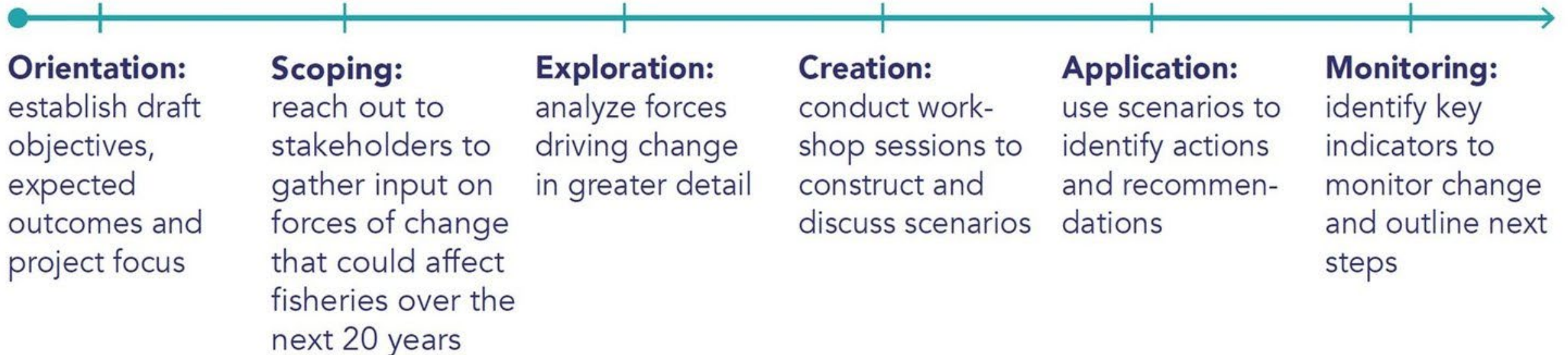
East Coast Climate Change Scenario Planning



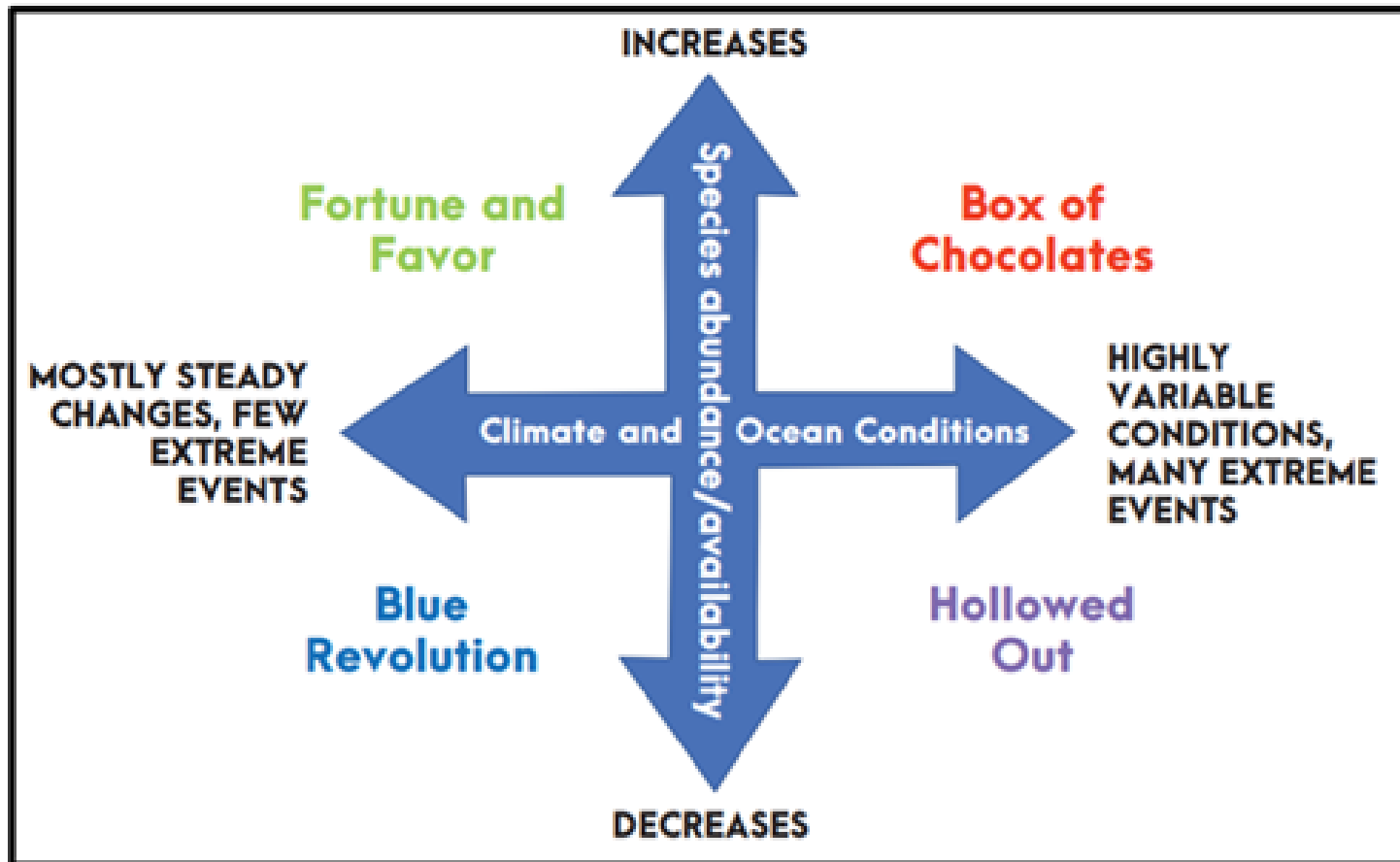
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Pacific Coast Climate Change Scenario Planning



North Pacific Coast Climate Change Scenario Planning

Objective 1



COLLATE

Coordinate the review of existing and emergent climate information on impacts, adaptation, and residual risk.

Objective 2



SYNTHESIZE

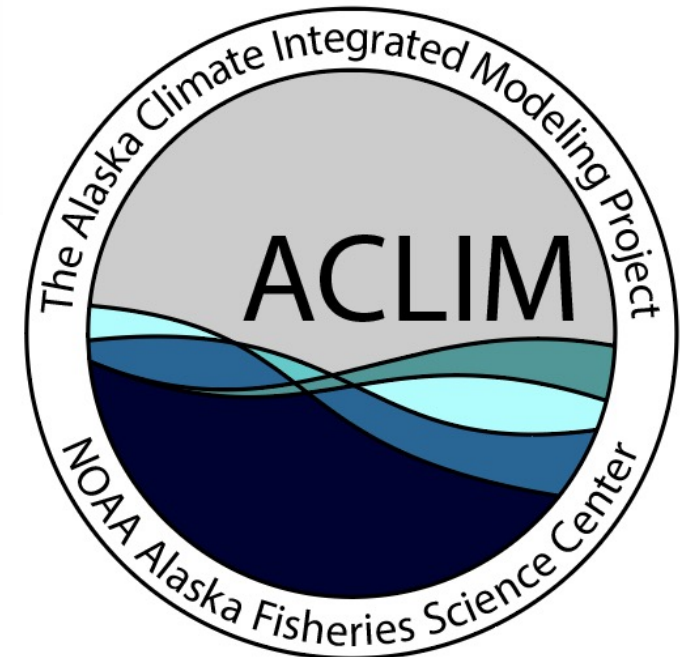
Assess key climate change impacts, adaptation actions, and residual risk.

Objective 3



COMMUNICATE

Summarize and communicate potential risks and adaptation actions.

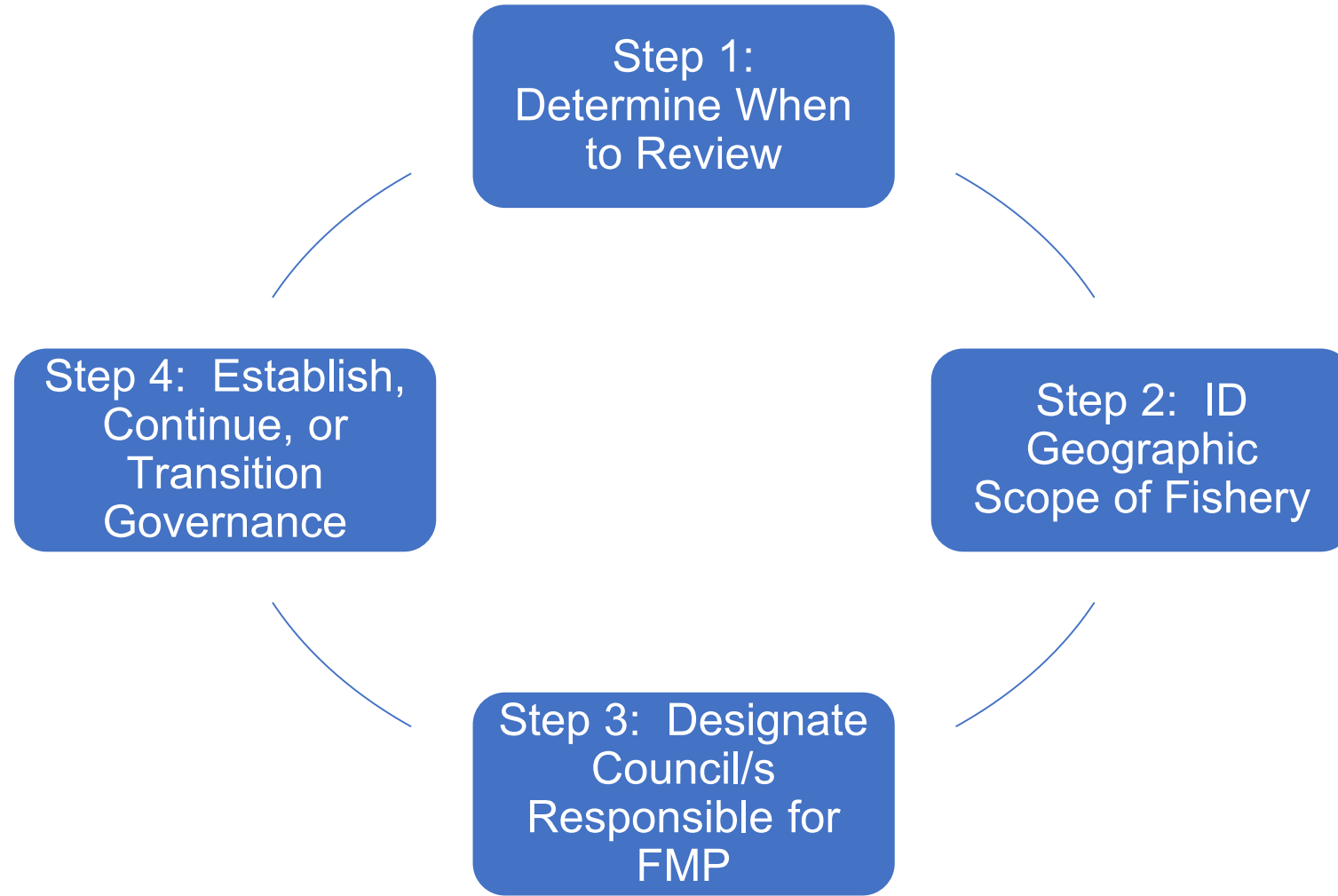


Ecosystem Based Fisheries Management Policy and Road Map Revisions

- Changing environmental conditions are part of EBFM
- The updates will incorporate climate challenges, successes, and identify priorities
- Expect to finalize revised documents in 2024



Governance Policy = Key Components



Governance Policy - Timeline and Next Steps

May 2022: Discussed Project Plan with CCC; Adjusted timeline

Oct. 2022: Discussed Outline for Policy with CCC, Requested input on components and criteria

Feb. 2023: East Coast Scenario Planning Workshop

March/April 2023: Drafted Proposed Policy

May 2023: Reviewed Draft Proposed Policy with CCC

Oct. 2023: Discuss CCC and Council Feedback

Nov. 17, 2023: Due Date for all comments, including NOAA offices

No later than Summer 2024: Finalize and Rollout Policy

NMFS Forward Looking Work—



Climate-ready Fisheries funding from IRA

Climate, Ecosystems and Fisheries Initiative

Revisions to the EBFM Policy and Road Map

Draft Governance Policy

Take Home Messages

- *NMFS is using various tools to address climate challenges and needs*
- *NMFS is doing forward looking work to set us up for coming challenges*



Questions?

