



**NOAA
FISHERIES**

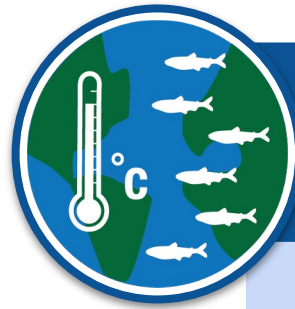
Science Updates

- Climate Ready Fisheries (CRF)
- Midlife Repair Periods (MRPs)
- Climate, Ecosystems & Fisheries Initiative (CEFI)

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**NPFMC
Kodiak, AK
7 June 2024**

Inflation Reduction Act (IRA) Opportunity



Climate-Ready Fisheries (CRF)

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

- **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: 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 & Data Acquisition Program

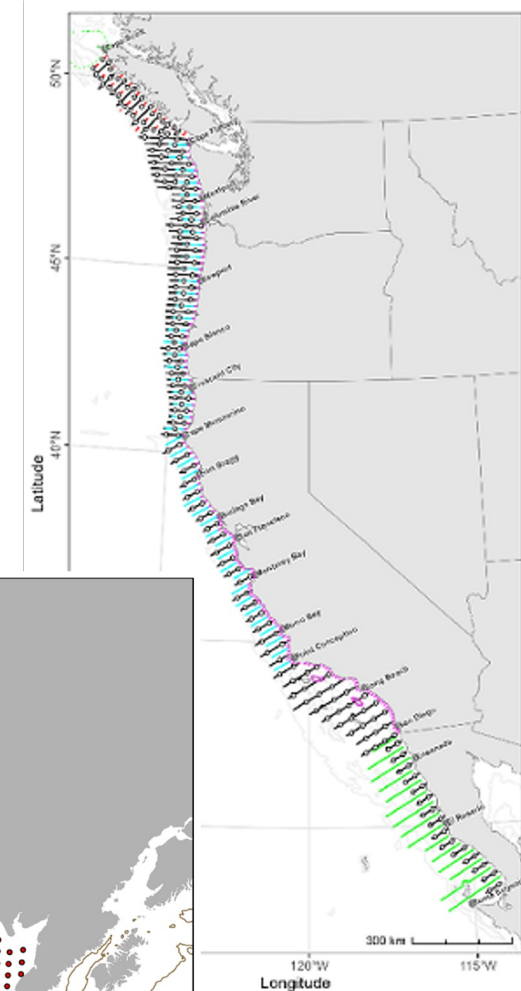
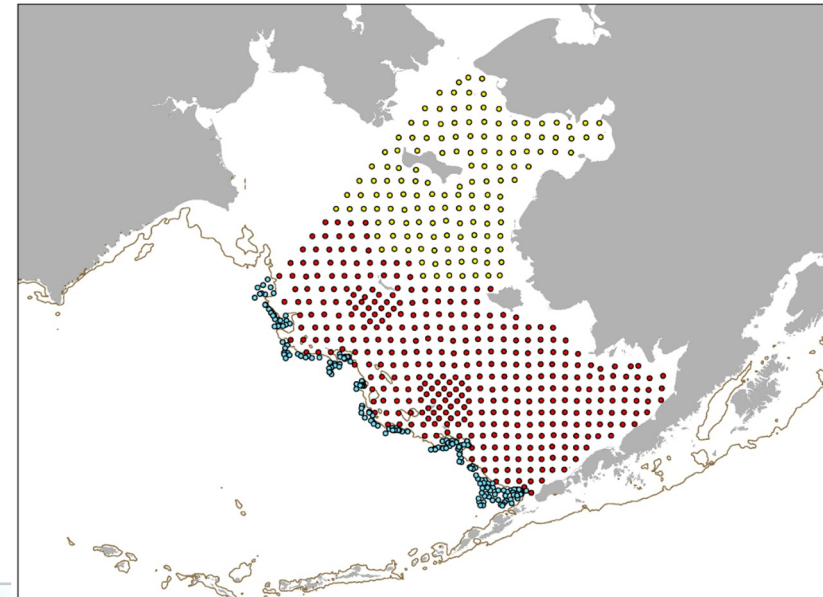
^(*)EDA: Essential Data Acquisition; AT: Advanced Technologies



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 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 (NaSDAP)

National Survey and Data Acquisition Program

- **Drivers**
 - NAPA, 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 to begin FY25 planning)**
 - Encompasses the entirety of activities/resources/staff under Fisheries- Independent 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
 - **Roles:** Science Board (oversight); OST (management and coordination); NaSDAP Steering Group; and links w/Fleet Council and other partners

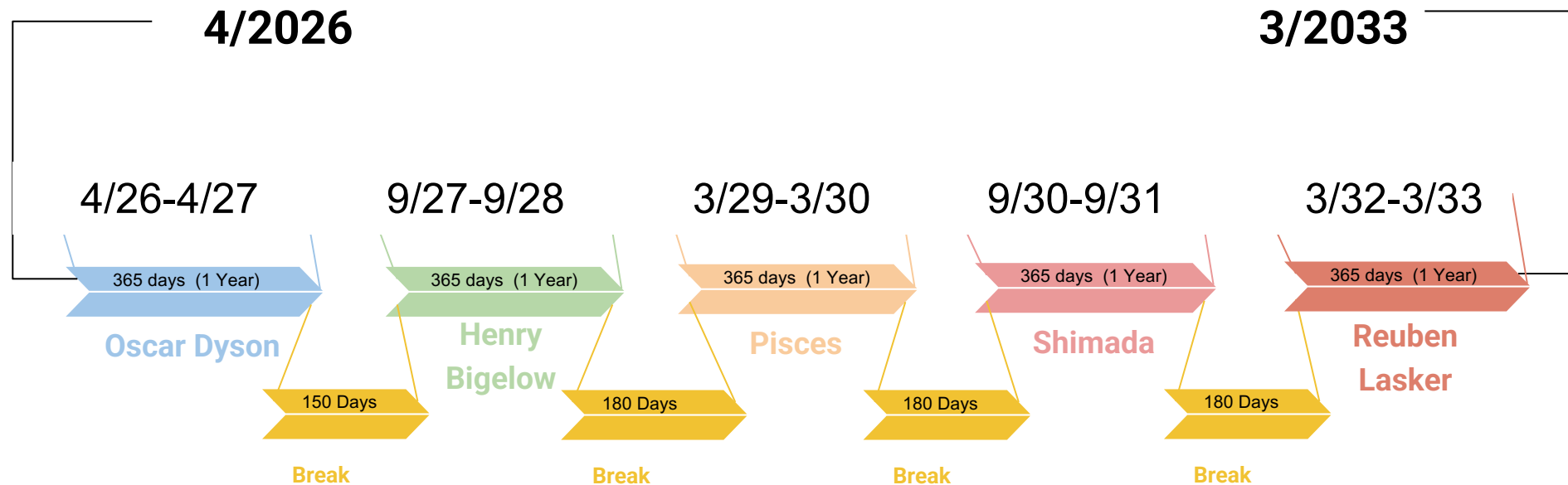
Midlife Repair Periods (MRPs)

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, the *Dyson's* MRP is funded.)

FSV MRPs

(Anticipated Schedule)



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

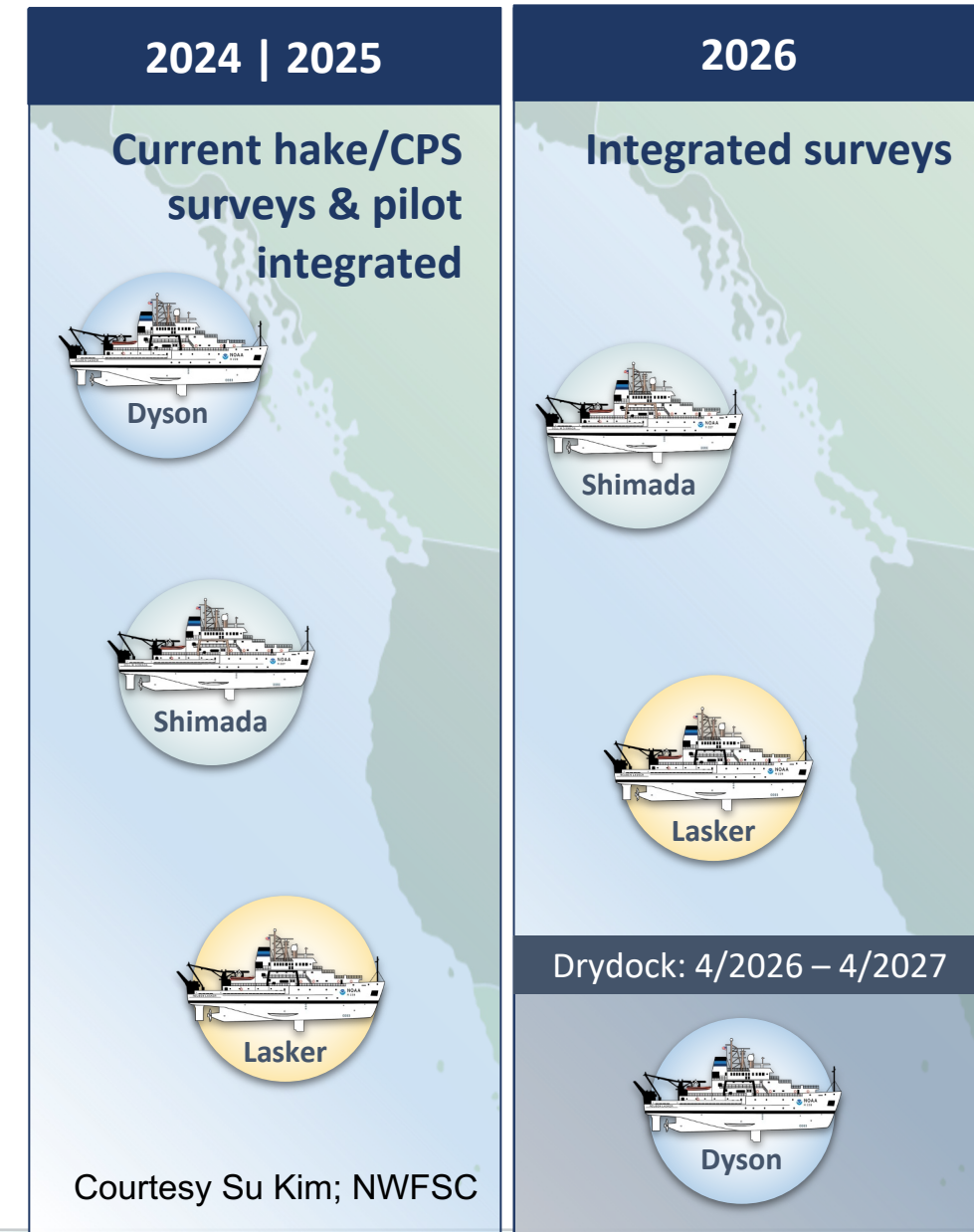


Drydock: 3/2032 – 3/2033



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**





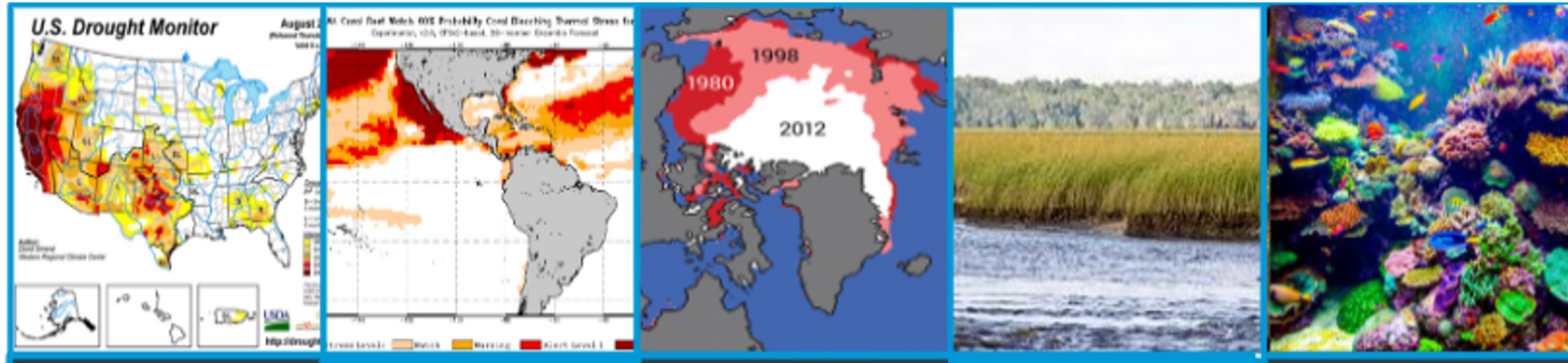
Climate, Ecosystems, & Fisheries Initiative

Climate Ready Fisheries – update

CEFI Summit, May 7-9, 2024 (SWFSC, La Jolla, CA)



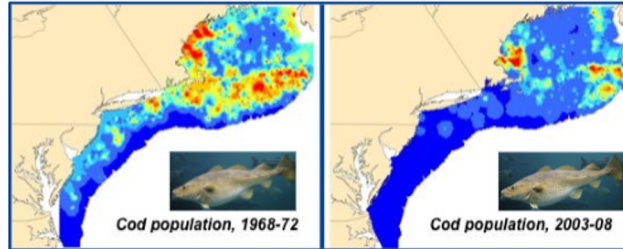
Changing ocean conditions...



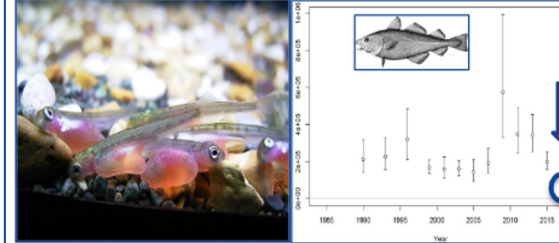
Changing Habitats



Shifting Distributions



Changing Abundance



Changing Ocean Uses



Vital living marine resources

- Fish stocks
- Protected species
- Habitat

Blue Economy

- Fisheries (\$370Bn, 1.8M jobs/yr)
- Aquaculture
- Shipping, energy, tourism, other sectors

Cultural heritage

Equity and environmental justice

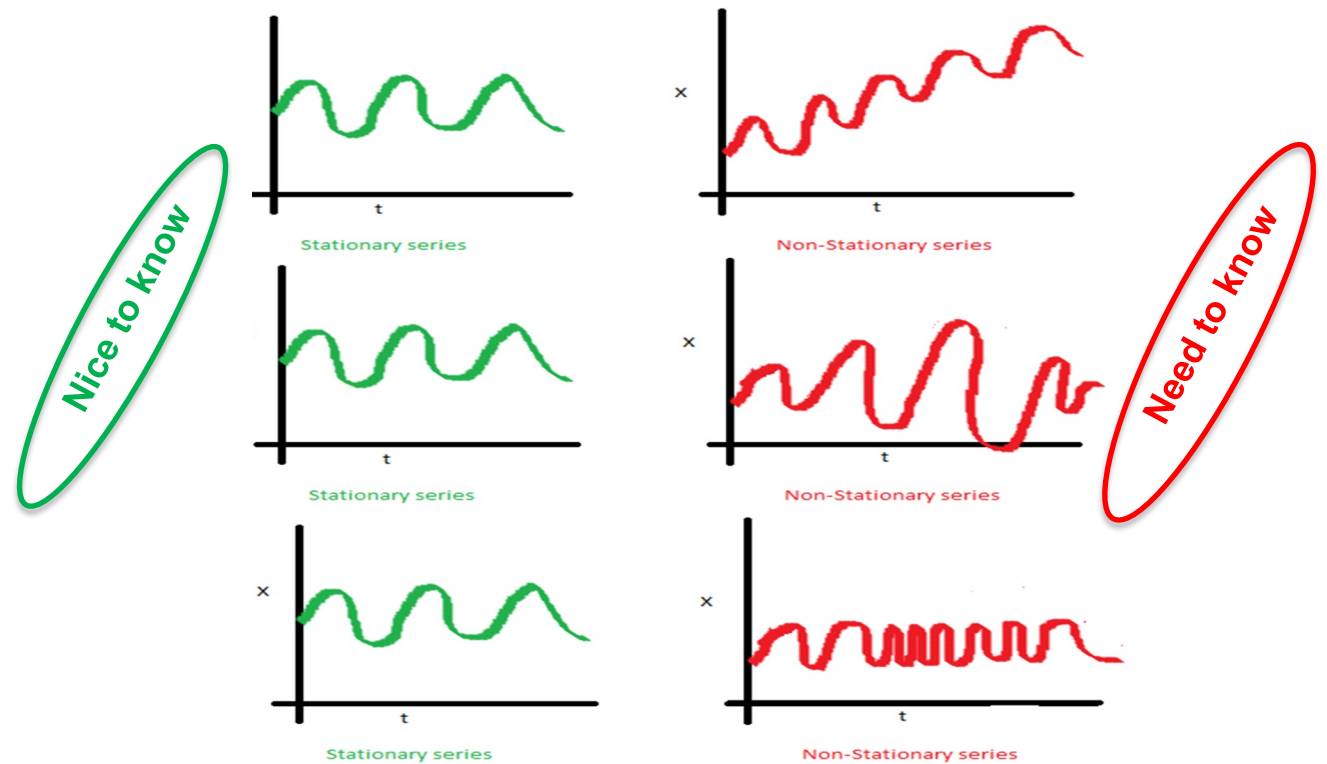


From *stationarity* to *non-stationarity*

Present Assessment Models for LMR Management

- In general, **no long-term trends**, no regime shifts, etc.
- Inclusion of **random year-to-year fluctuations** with perhaps some autocorrelation.
- Reference points and rebuilding targets represent **“prevailing environmental conditions”**.

- **Stationarity** – fluctuations within an unchanging envelope of variability.
- **Non-stationarity** – (mean, variance, etc.) change w/ time



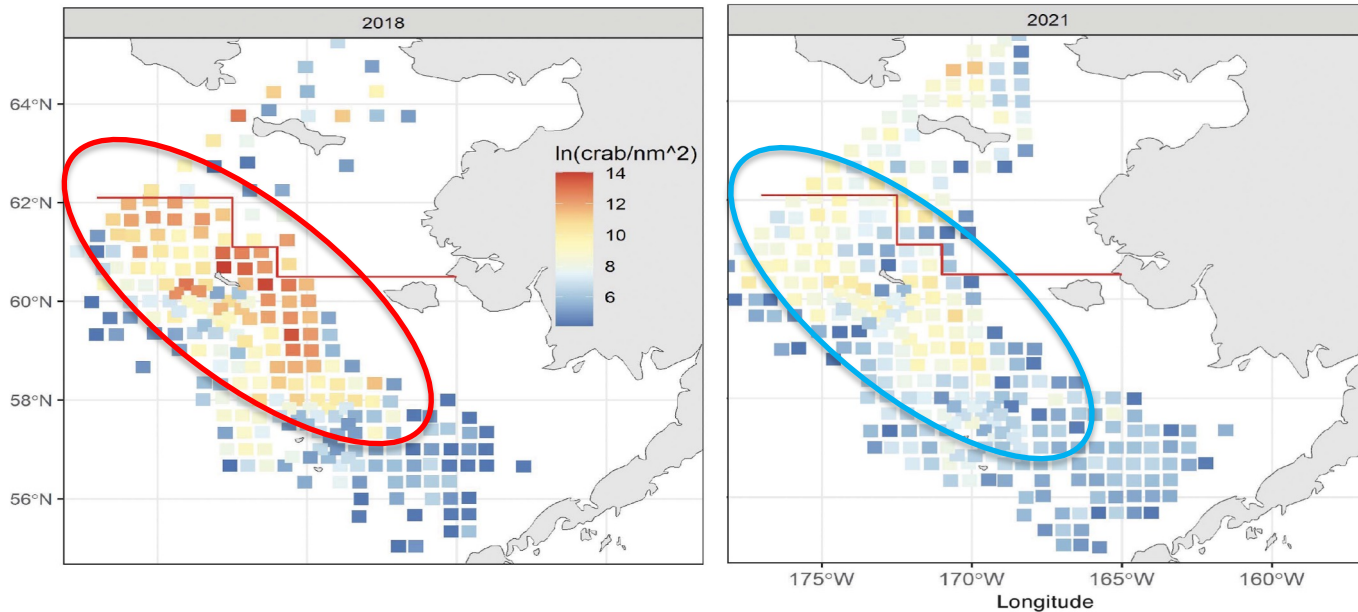
The collapse of eastern Bering Sea snow crab

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



2018

2021



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.**

- The **circumstances underpinning the recent collapse were unprecedented** in the Bering Sea in recent history.
- **Models were not able to reach the estimated mortalities until the most recent data were included.**
- **Could have foreseen the collapse?**

What is CEFI?

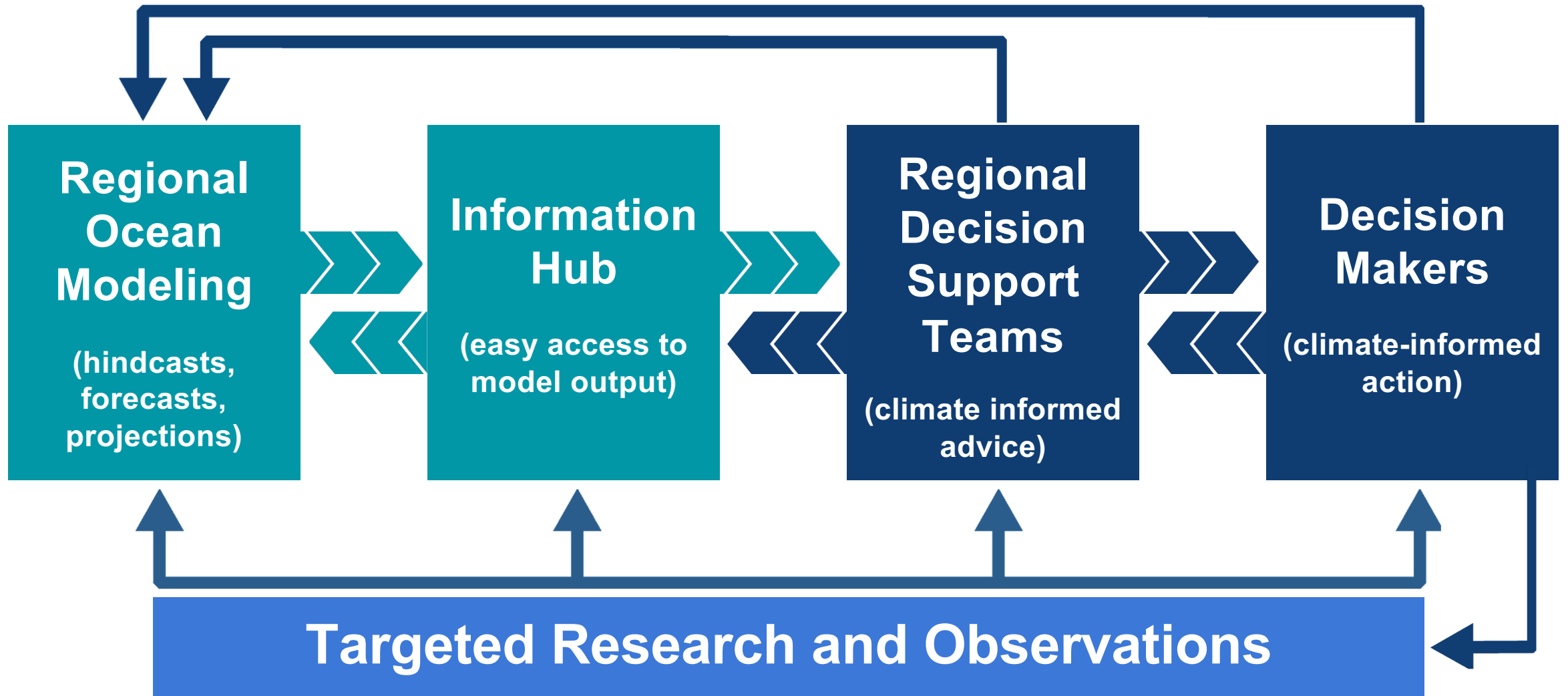
CEFI is a cross-NOAA effort to provide climate-informed advice for marine resource management and community adaptation.

It builds on NOAA investments in research, modeling, and decision-making.

It is an end-to-end decision support system to address four requirements:

1. **Reliable delivery** of robust ocean forecasts and projections.
2. **Operational production** of climate-informed advice (*ecological outlooks, risk assessments, management & adaptation strategies*).
3. **Increased capacity** for climate-informed decision-making.
4. **Research & observations** for validation & innovation.

CEFI Decision Support System

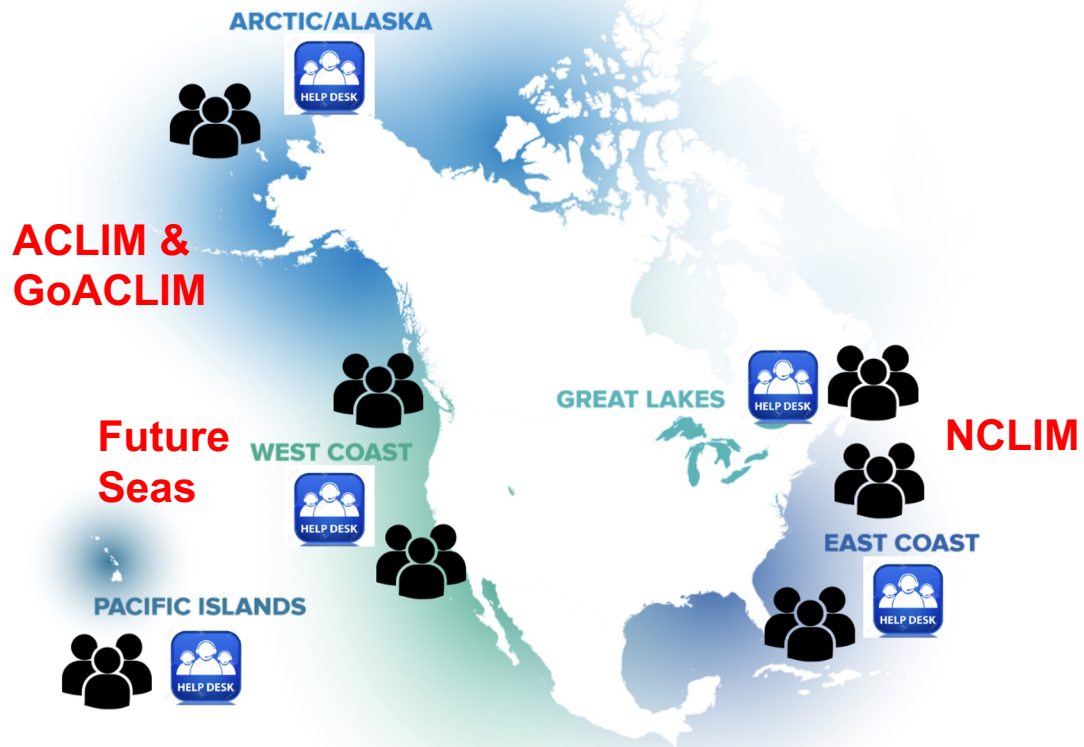


CEFI Regional Teams

Regional Ocean Modeling Teams



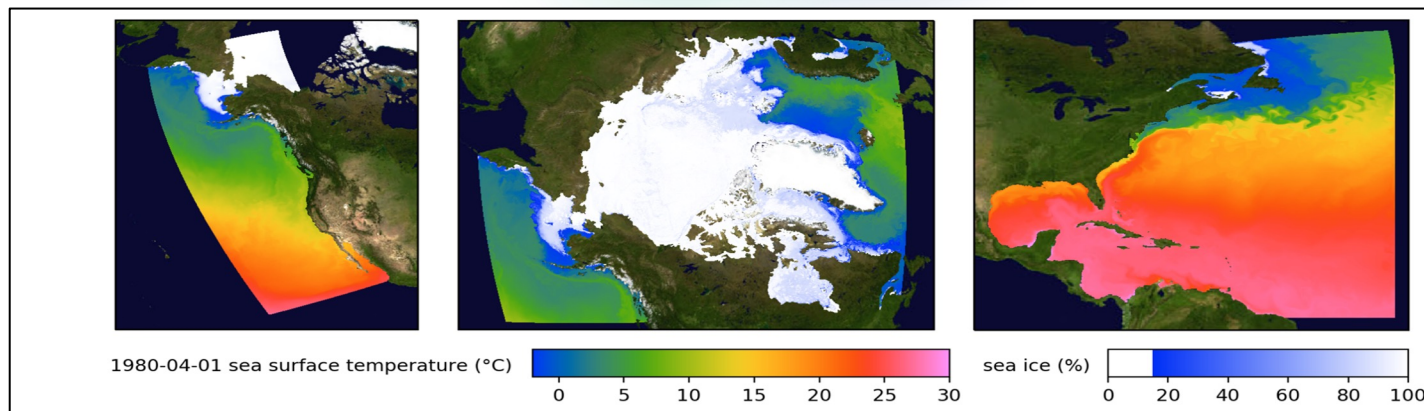
Customize MOM6 regional ocean outlooks for Decision Support Teams & other users



Regional Decision Support Teams



Produce socio-ecological outlooks, information & advice for decision makers



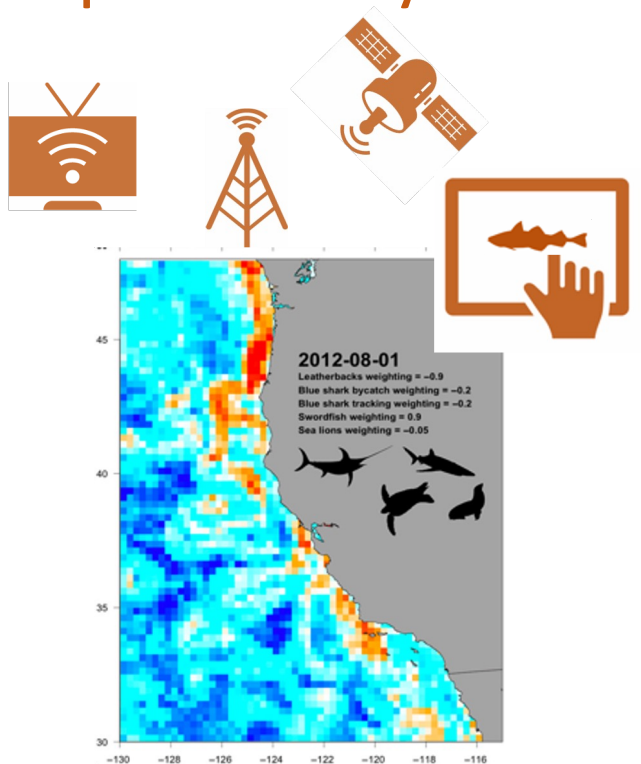
Climate informed advice across time scales

Rapid response

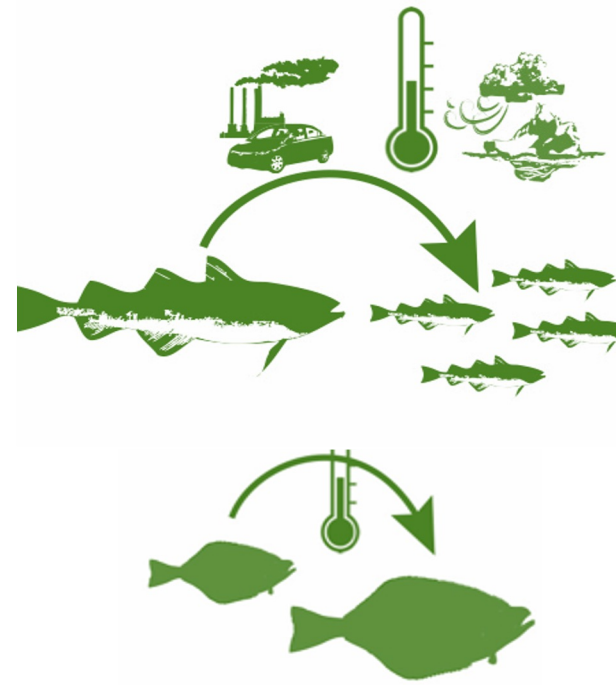


Long-term planning

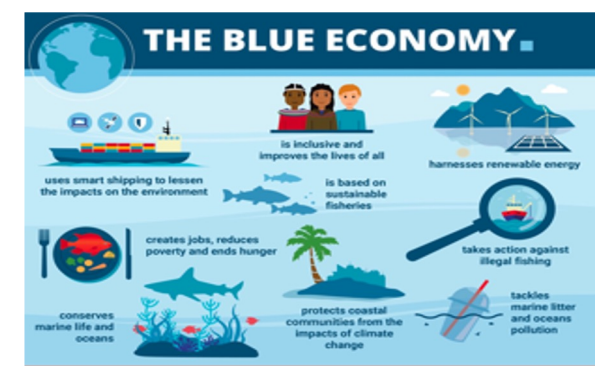
Climate-linked real-time species maps to reduce by-catch



Climate-enhanced stock assessments to prevent overfishing



Climate-smart strategies for multi-level adaptation



www.blueeconomyconference.go.ke

Hazen et al. 2019
https://advances.sciencemag.org/content/4/5/eaar3001

Santos et al. 2020.
https://www.nature.com/articles/s41893-020-0513-x

Hollowed et al. 2020 (ACLIM)



Expand on current tools and pathways

- Climate-enhanced Stock Assessments
 - Ecosystem Status Reports (ESRs)
 - Ecosystem and Socioeconomic Profiles (ESPs)
 - Risk Tables
-
- Risk Assessments
 - Scenario Planning
 - Climate-informed MSEs
 - Distribution Mapping and Analysis Portal (DisMAP)

CEFI will support these tools to inform Annual Harvest Setting Process

CEFI will support operational delivery of these tools to inform management decision making

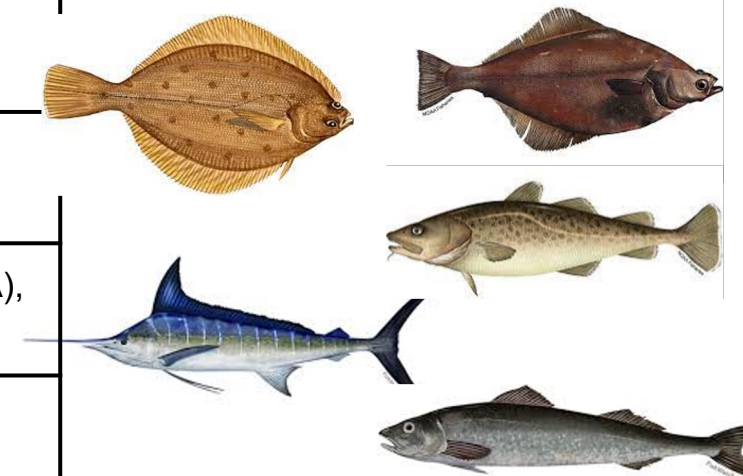


Example products: Climate-informed Stock Assessments

Examples of efforts to incorporate changing ocean ecosystem conditions in stock assessments (*Accepted in Research track assessment, # presented in alt models)

Model Term	Linkage Approach	Environmental Factor(s)	Example Species
Catchability	Covariate in model	Temperature-dependent, survey/spawn timing; Atlantic Multi-decadal Oscillation	Walleye Pollock (GOA)#, Yellowfin Sole (EBS) , Arrowtooth Flounder (BSAI) , Pacific Cod (GOA) ; Swordfish (North Atlantic)
Recruitment	Covariate in model	Sea surface height; Temperature-dependent; Marine heatwave	Sablefish (West Coast) , Petrale Sole#; Black sea bass (Mid-Atlantic)*; Pacific Cod (GOA)#
Growth	Covariate in model	Temperature-dependent	Pacific cod (GOA)#
	Time-blocks	Pacific Decadal Oscillation	Chilipepper Rockfish
Mortality	Time-blocks	Harmful algal blooms; Marine Heatwave	Gag Grouper, Red Grouper; Pacific cod (GOA), Snow crab (EBS)
	Covariate in model	Marine Heatwave	Pacific Cod (GOA)#

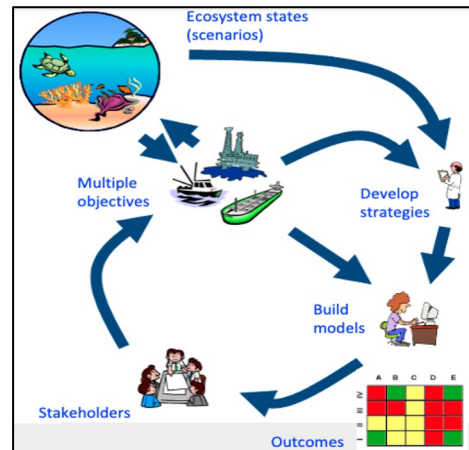
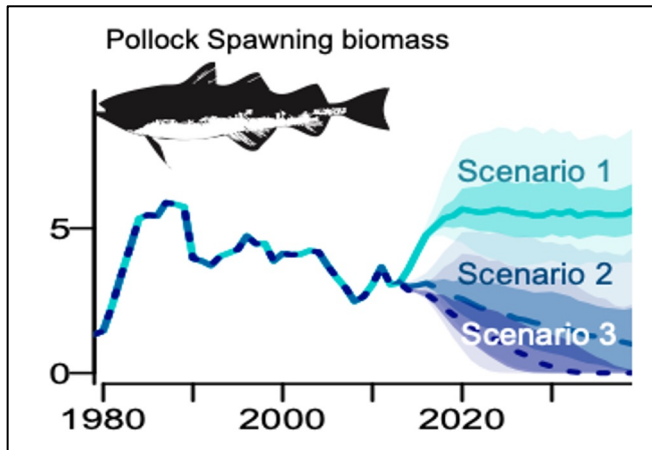
- **Many assessments implicitly account for environmental variability**; assumptions may not apply to changing ocean conditions
- Presently, **5 operational stock assessments include a direct linkage between a climate/ environmental driver**
- **Growing number are testing linkages** via new model runs or Research Track Assessments



CEFI: support for other products

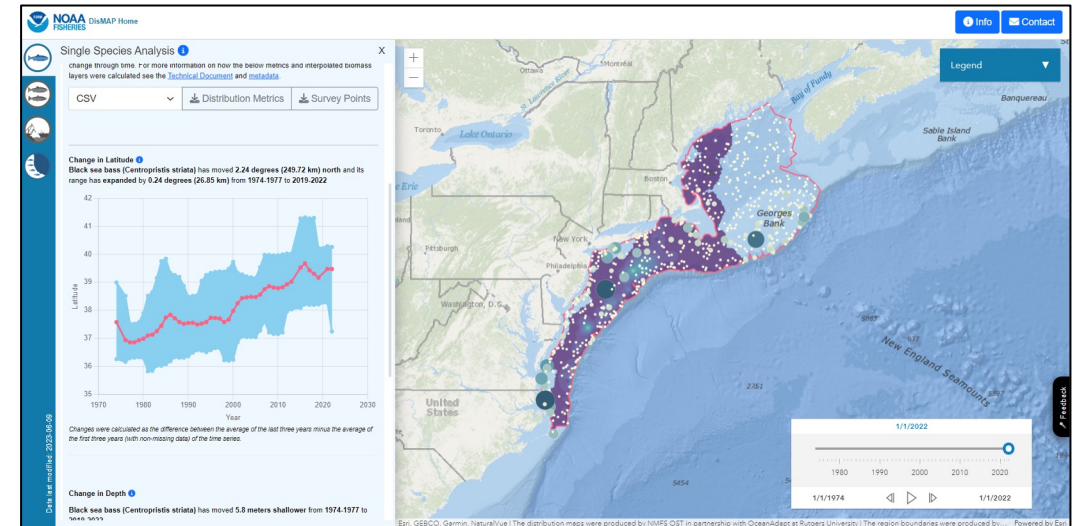
Scenario Planning & Climate-informed Management Strategy Evaluations

- **Scenario planning and MSEs are powerful tools** to assess risks and options for range of likely future conditions.
- **CEFI will directly support increased use of scenario planning & climate-informed MSEs** to assess the performance of different mgmt strategies in changing oceans.
- **Scenario planning already underway:**
 - [East Coast](#) (2021-2023)
 - [PFMC](#) (2019-2022)
 - [NPFMC](#) (June 2024)



Information on shifting distributions

- **DisMAP** is a user-friendly tool for use in climate-ready decision making (<https://apps-st.fisheries.noaa.gov/dismap/>)
- **DisMAP provides information** on past and current distributions and analysis tools for 400+ species of fish and invertebrate species in U.S. marine waters.
- **CEFI will increase development of projections** of future species distributions w/ changing ocean conditions.



In summary.....

CEFI is a cross-NOAA effort to provide climate-informed advice for marine resource management and community adaptation.

NOAA will build-out an initial CEFI Decision Support System in each region over the next three years with IRA funding (\$40M across NMFS, OAR & NOS).

Each region is identifying their CEFI demonstration projects to meet priority needs building on existing efforts in each region.

Q1: What are the key issues & products CEFI should address?

Q2: How to increase engagement and co-production of climate-informed advice over the next three years?

Q3: How to leverage IRA-funded Council and CEFI efforts to advance climate-informed decision making?

Thank you

