



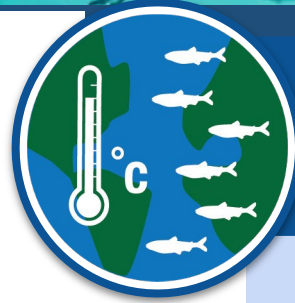
**Climate, Ecosystems,
& Fisheries Initiative**

Climate Ready Fisheries - update

Cisco Werner
NMFS Director of Scientific Programs



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

(Data Acquisition)

- **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** (Summer 2024) and NAPA products (annual, 2024 and beyond)

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



EDA/Advanced Technologies

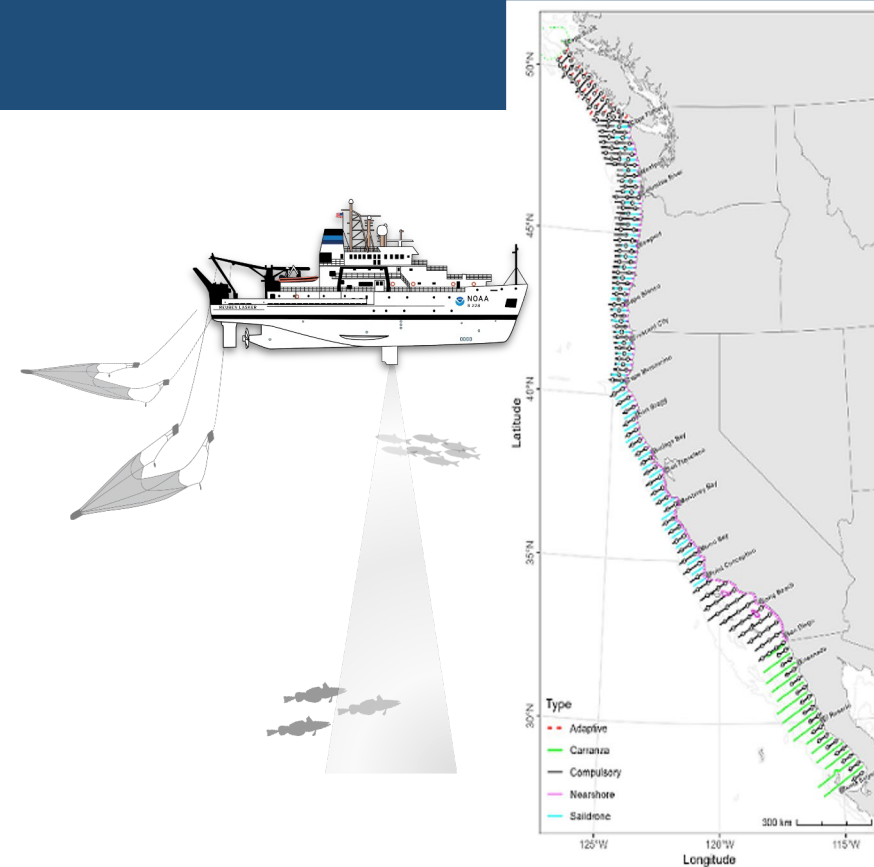
Modernize and transform NMFS' advanced technology through targeted Strategic Initiatives that increase the number and types of observations we can make, and move us toward the greater synoptic (simultaneous) sampling:

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

Survey Mitigation

\$48.6M of IRA funds for Data Gap Mitigation

- Improving survey efficiency
 - Example: Developing an integrated Hake-Coastal Pelagic Survey
- Mitigating lost days-at-sea
 - Example: Chartered vessels for Pacific marine mammal surveys



\$1M newly allocated for a survey contingency fund

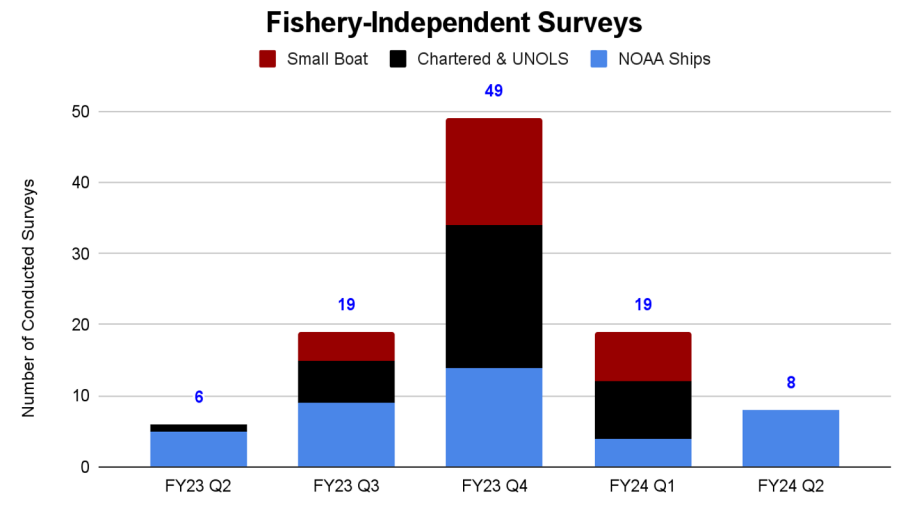
- National fund established to address within year unexpected challenges
- Focus on charters, advanced tech, cooperative research.



NOAA Fisheries Independent Survey Update



Survey Status (Total)	Number of Surveys - Quarter 1 and 2 FY 2024 (Oct 2023 to March 2024)			
	NOAA Ship	Chartered & UNOLS	Small boat	Highlight Surveys
Planned (24)	11	8	5	
Conducted (26)	11	8	7	Q1: HICEAS, EcoMon (Fall), West Coast Groundfish, Rockfish Hook & Line, Gulf of Maine Bottom Longline Q2: Pollock Acoustic Trawl, EcoMon (Winter), Main Hawaiian Island) Insular Bottomfish Survey, CalCOFI
Postponed/Cancelled* (1)	1	0	0	



Survey Highlight: HICEAS

Hawaiian Islands Cetacean and Ecosystem Assessment Survey (HICEAS)

- Important large-scale, multispecies survey: whales, dolphins, seabirds
- Supports protected species and management of the Papahānaumokuākea Marine National Monument
- Cross-center: PIFSC and SWFSC
- Multi-platform: NOAA Ships (*Sette* and *Lasker*), photo and acoustic monitoring, and satellite tagging

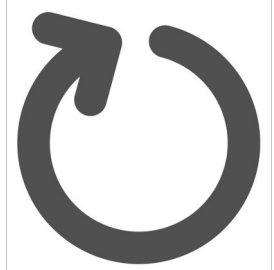


CEFI Outline

- **The grand challenge**
*Fulfilling our mandates in a changing climate
(climate-informed decision making)*
- **What is CEFI?**
- **Where are we and next steps?**

Major changes in ocean conditions

**Extreme
Events**



**Longer term
change**

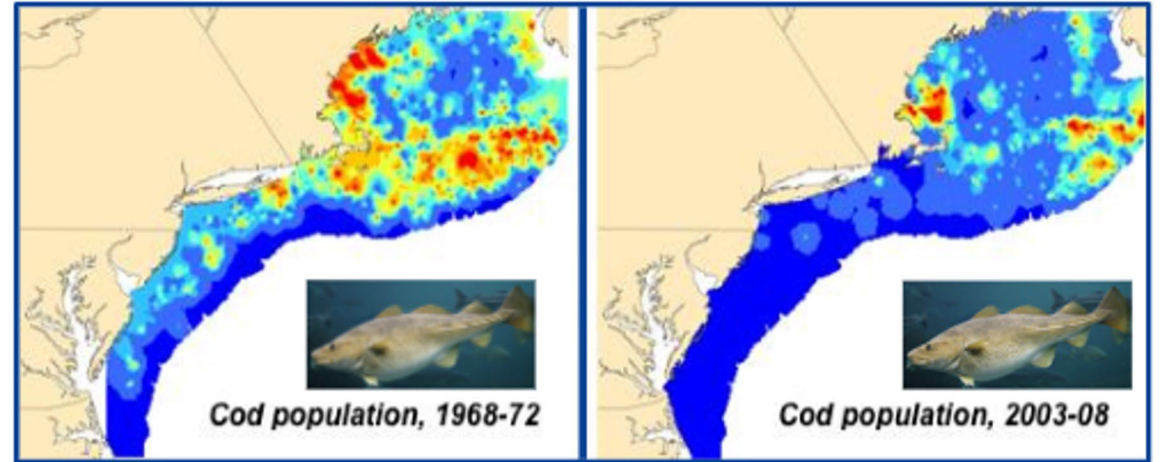


The impacts are real...

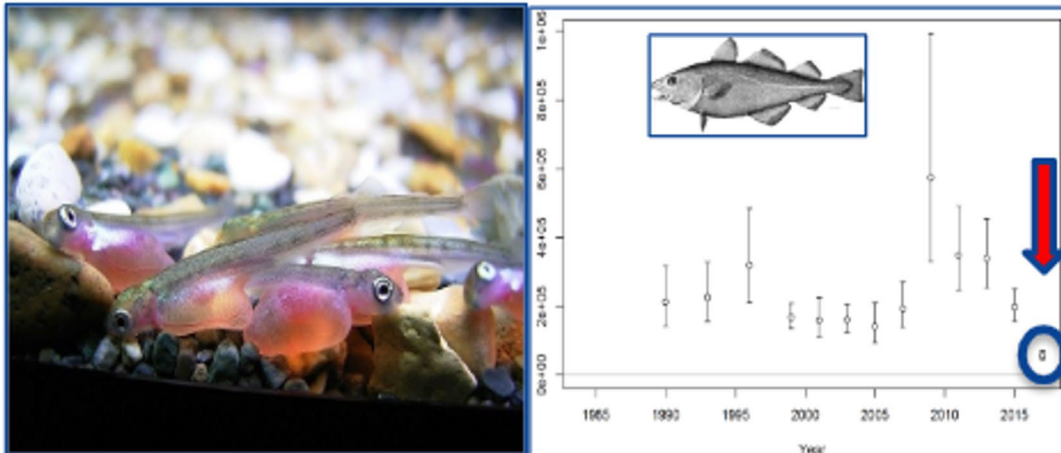
Changing Habitats



Shifting Distributions



Changing Abundance



Changing Ocean Uses



And they affect...

- **Vital living marine resources**
 - Fish stocks
 - Protected species
 - Habitat
- **Blue Economy**
 - Fisheries (\$370 billion, 1.8 million jobs/yr)
 - Aquaculture
 - Shipping, energy, tourism and other sectors
 - 1000's of businesses
 - 1000's of coastal communities
- **Cultural heritage**
- **Equity and environmental justice**

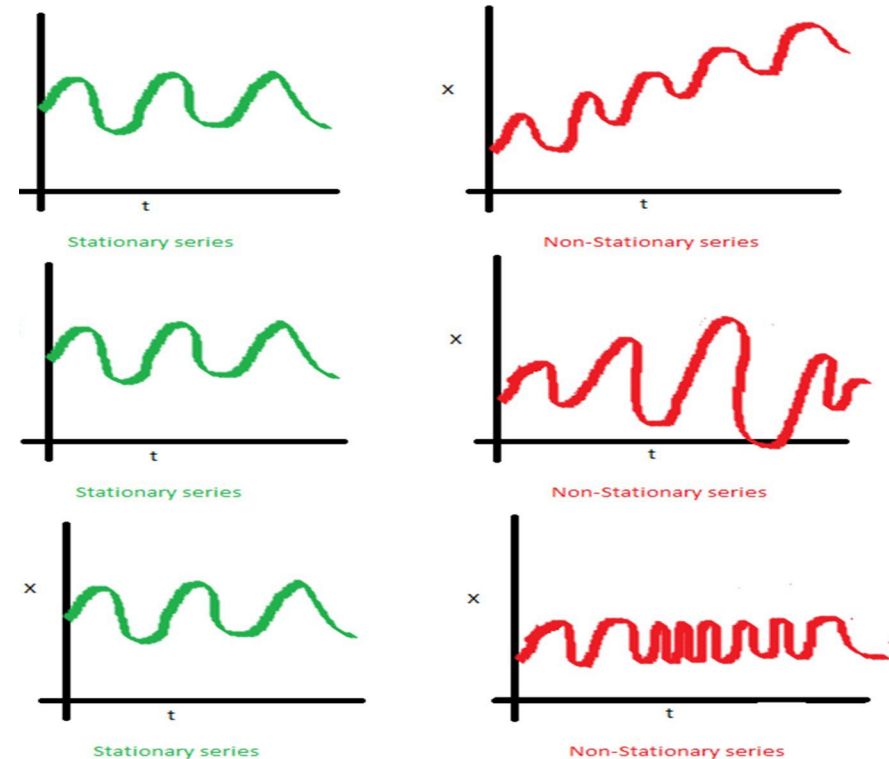


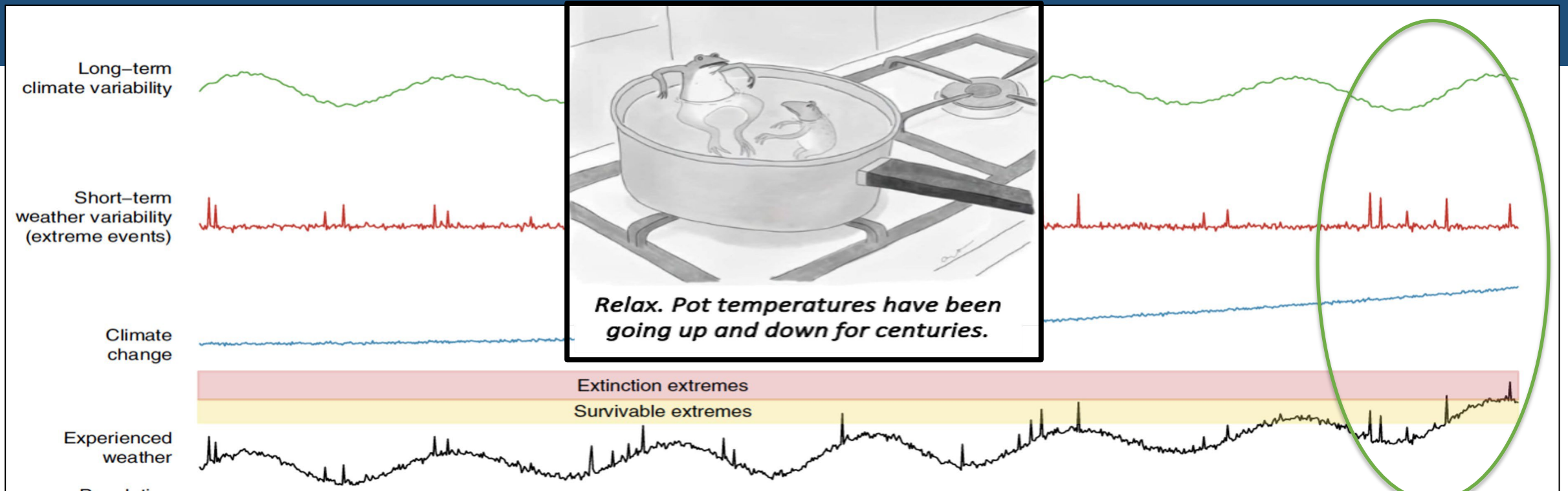
From *stationarity* to *non-stationarity*

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”**.

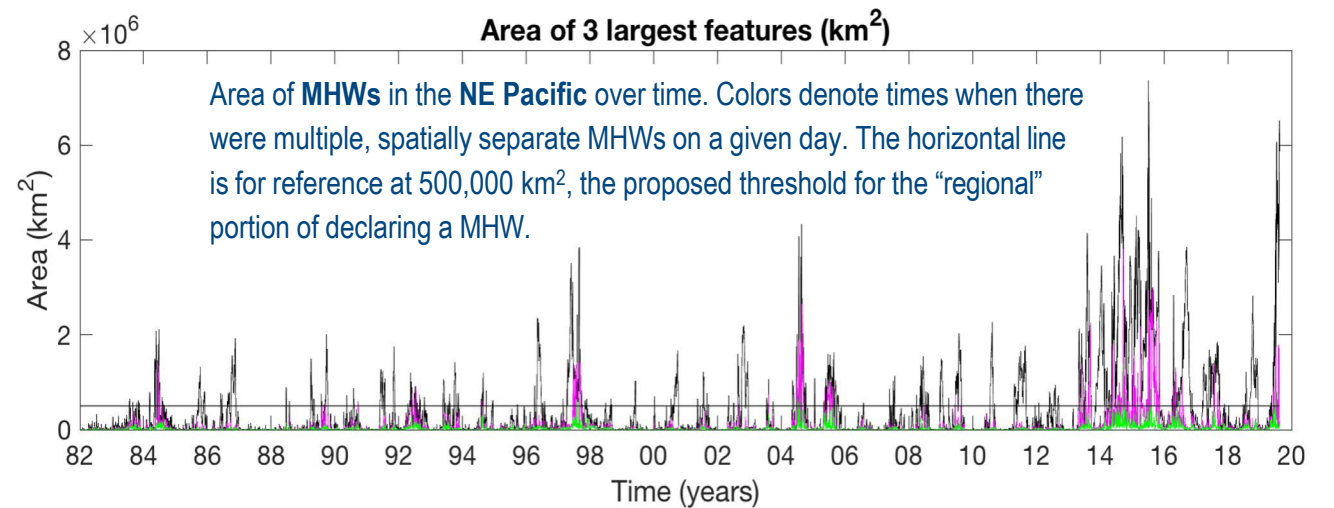
- **Stationarity** – fluctuations within an unchanging envelope of variability.
- **Non-stationarity** – (mean, variance, etc.) change w/ time





Harris et al. (2018), *Nature Clim. Ch.*

**Interacting (evolving) conditions:
long-term, short-term, secular
(climate), extreme events**



(A. Leising and S. Bograd)

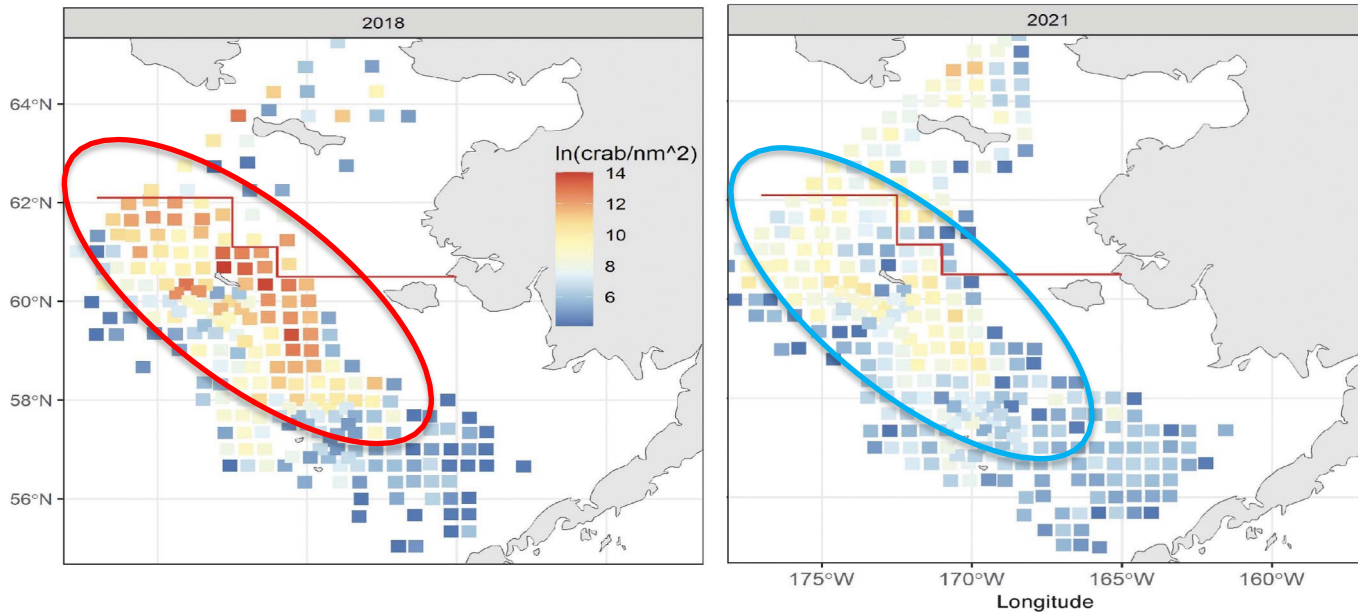
The collapse of eastern Bering Sea snow crab

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?**

Urgent need for climate informed advice



Fisheries:

- What are the current impacts to stocks, fisheries and communities?
- What are the expected impacts / risks?
- What are the best strategies for resilience and adaptation?

Aquaculture:

- Strategies for siting & operations?

Protected Places and Resources:

- Strategies for protecting at-risk species and important places?

Resource Dependent Communities:

- What prepare for and how adapt?

CEFI is built on the work of many.....

CEFI builds on many efforts (e.g., GLOBEC, FATE, IEA, EBFM) and a steady march forward:

- April 2016 - ACLIM project begins (Alaska Climate Integrated Modeling Project).
- April 2019 - OAR & NMFS launch development of CEFI ((in this very room!)).
- March 2020 - CEFI White Paper completed.
- April 2020 - Endorsed as a “Priority Initiative” by NOAA Earth Systems Integration Board.
- April 2021 - CEFI “Implementation Approach” completed.
- Sept 2021 - NOAA Science Advisory Board strongly supports CEFI implementation.
- Oct 2022 - Formed implementation structure (Exec & Steering Comms, 5 Teams).
- May 2023 - Launched implementation with Inflation Reduction Act funding.
- May 2024 - Implementation underway (e.g., staffing, user engagement, workplans)

Over 30 years since GLOBEC
(or 60 years since CalCOFI)

Input and engagement has been critical to shaping the CEFI System

Multiple sources of input and engagement including.....

- 2019 to present - Cross-NOAA input and leadership from the beginning.
- 2021 - Input and support from the NOAA Science Advisory Board.
- 2022 - Public input on "... how to make fisheries, protected resources, and aquaculture more resilient to climate change".
- 2022 - Input from the 7th Scientific Coordination Subcommittee on "Adapting Fishery Management to Changing Ecosystems"
- 2022-24 - Input from resource managers and science partners:
 - NMFS Programs (fisheries, protected resources, habitat, aquaculture)
 - NOS National Marine Sanctuaries

Internal and external input and advice: SAB, MAFAC, Councils, Public Comment...

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.

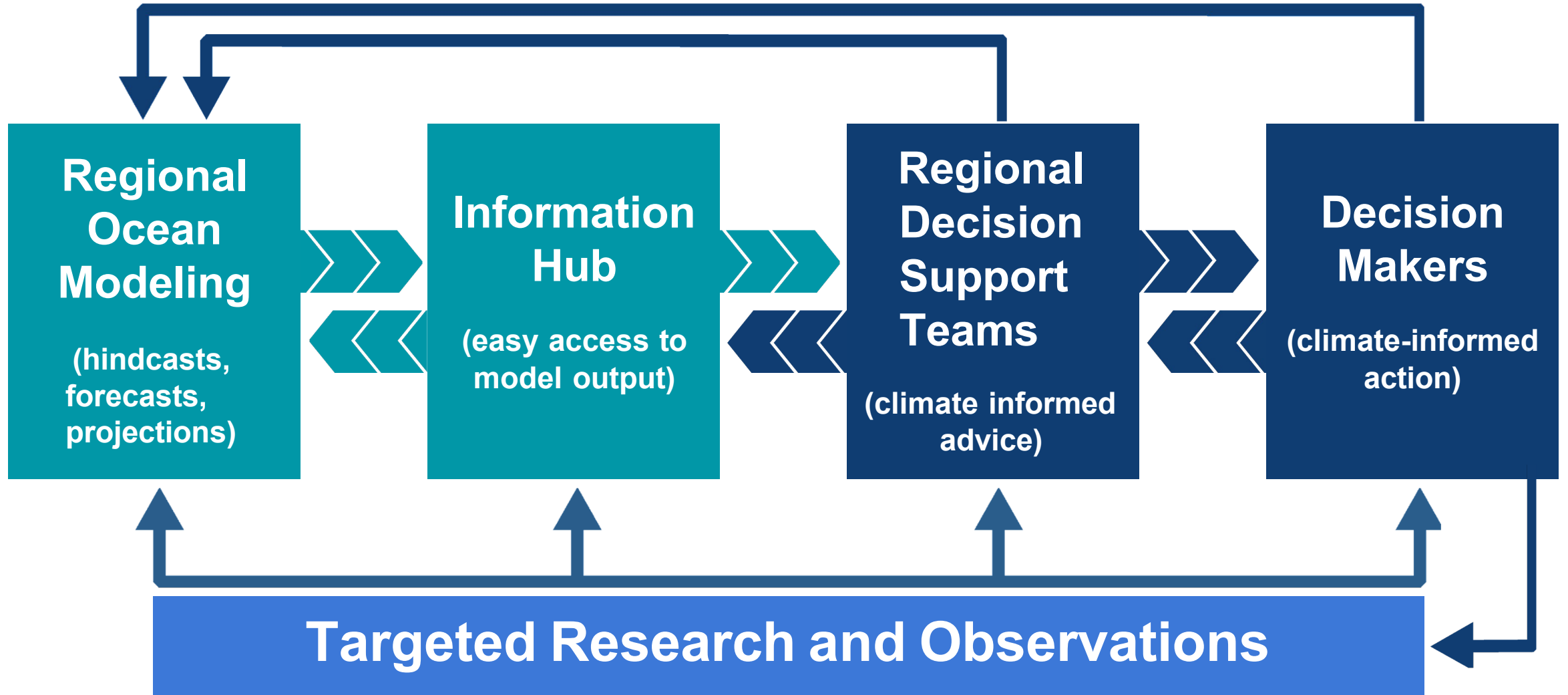
CEFI Summit, May 7-9, 2024 (SWFSC, La Jolla, CA)



The CEFI Summit brought together NOAA **builders and users of the CEFI Decision Support System** to ensure effective build-out of the System with IRA funding over the next three years. It included **over 140 participants from four NOAA Line Offices** (NMFS, OAR, NOS, NESDIS) and all U.S. ocean and coastal regions, and the Great Lakes. The Summit:

- (1) affirmed the CEFI purpose, goals, and structure;
- (2) provided input on products, workflows and timelines for CEFI System Components;
- (3) strengthened collaborations; and,
- (4) identified key next steps, including continued engagement with target audiences/users.

CEFI Decision Support System

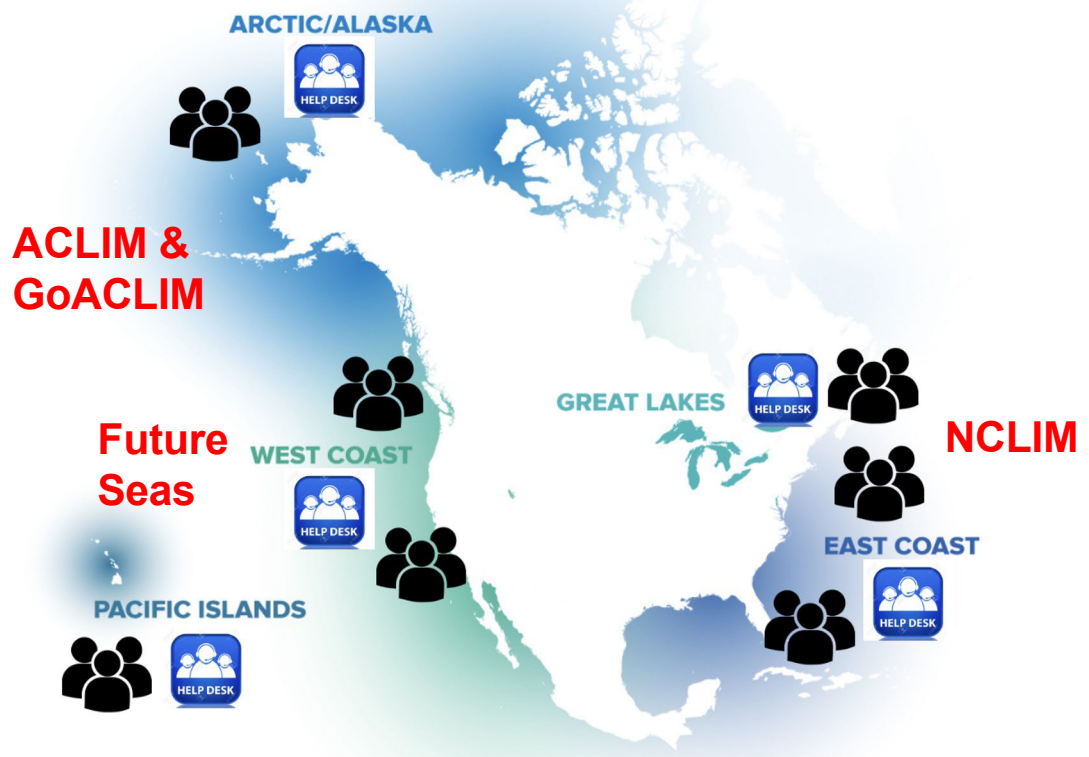


CEFI Regional Teams

Regional Ocean Modeling Teams



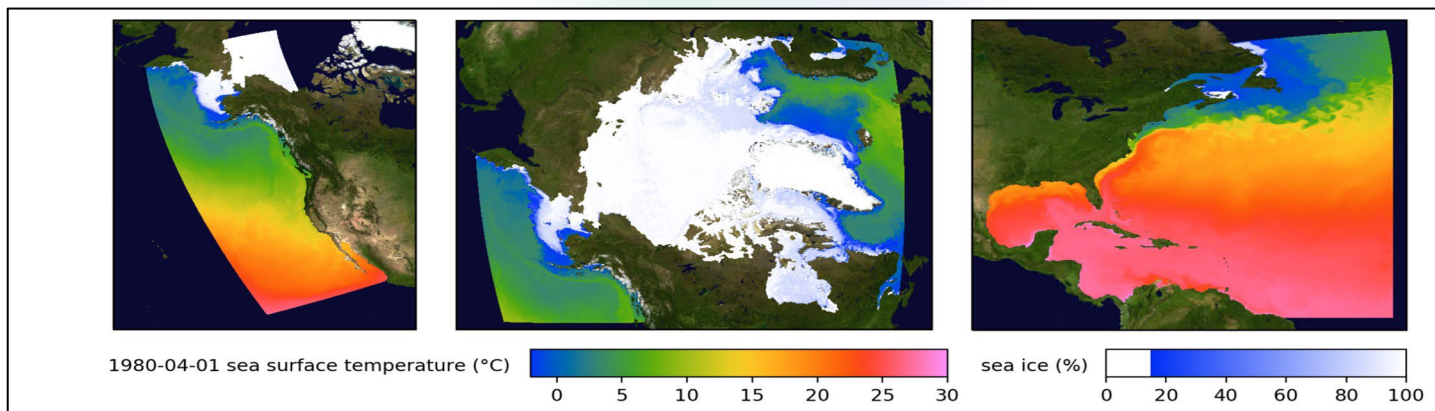
Customize MOM6 regional ocean outlooks for Decision Support Teams & other users



Regional Decision Support Teams



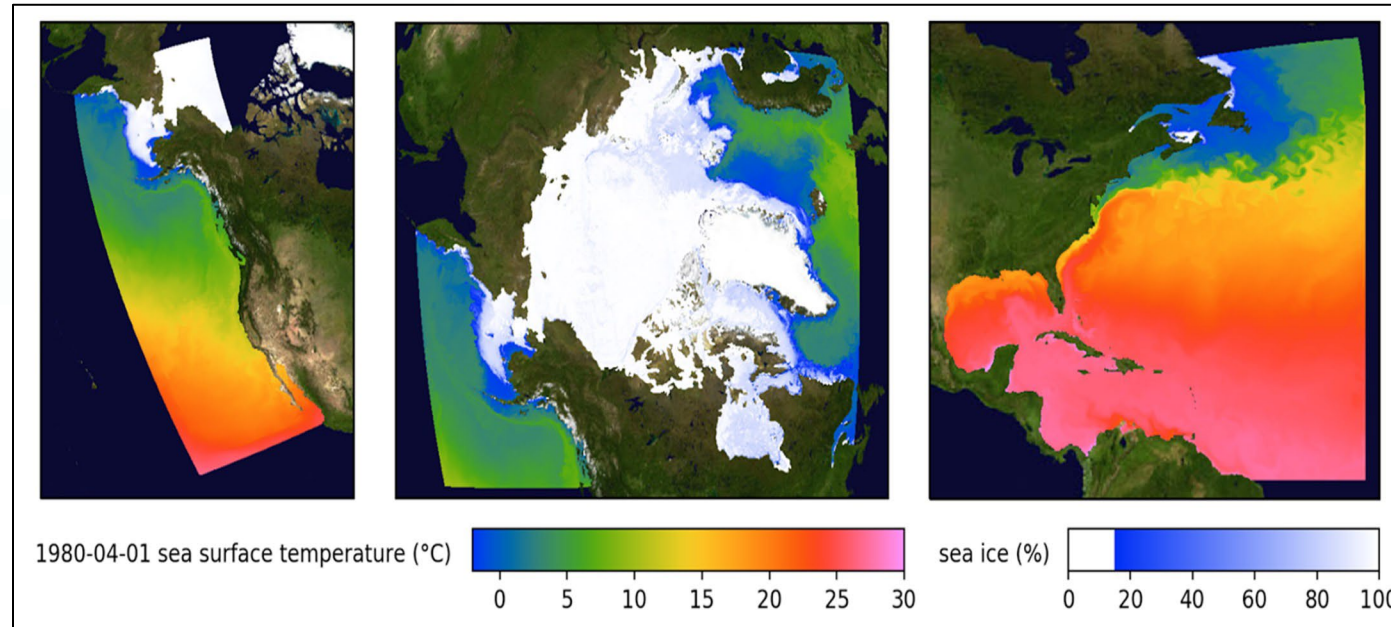
Produce socio-ecological outlooks, information & advice for decision makers



CEFI Decision Support System

Produce regional ocean hindcasts, forecasts, predictions and projections

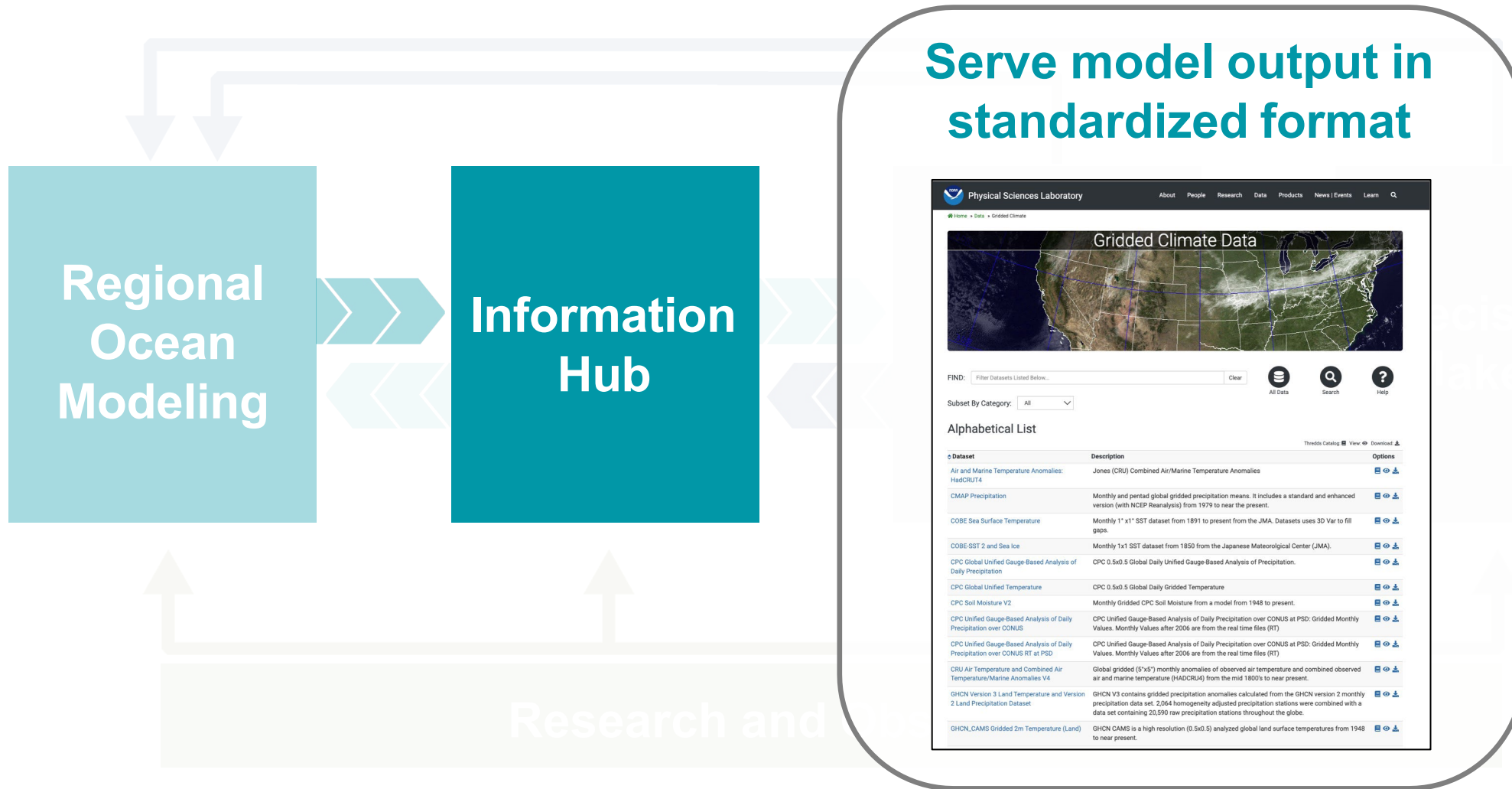
Regional
Ocean
Modeling



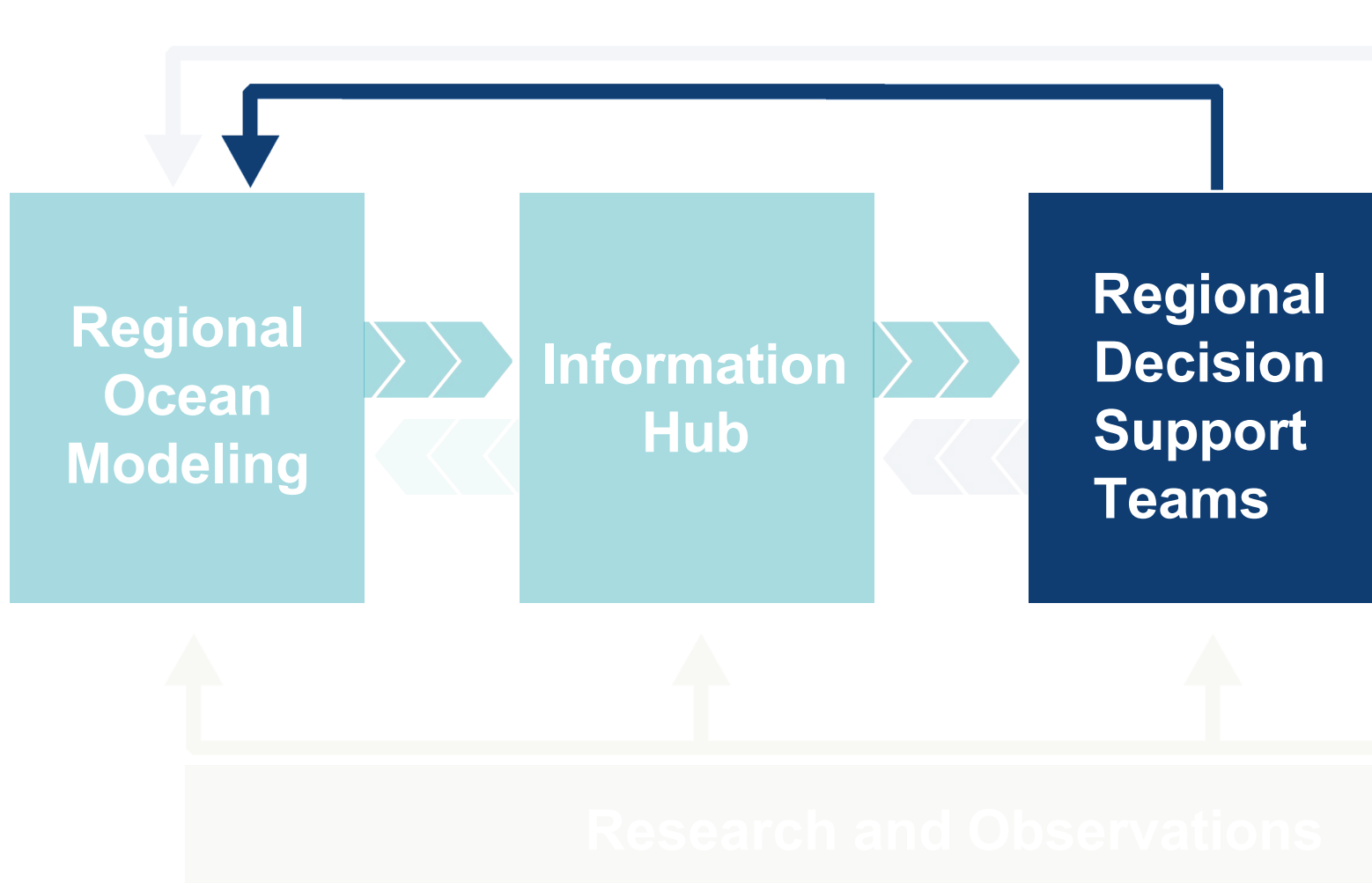
Example: Timeline for Regional Ocean Modeling Products

Year	East Coast	West Coast and Arctic	Great Lakes, Pacific Islands
FY23	Initial hindcast	Initial Configuration	
FY24	Hindcast update, retrospective seasonal predictions	Initial hindcast	Initial configuration
FY25	Hindcast update, retrospective decadal predictions, initial climate change projections	Hindcast update, retrospective seasonal predictions, initial climate change projections	Initial hindcast
FY26	Hindcast update, expanded projections, seasonal outlooks reliably delivered	Hindcast update, expanded projections, retrospective decadal predictions	Hindcast update, retrospective seasonal predictions, initial climate change projections
FY27	All products reliably delivered	Hindcast update, seasonal outlooks reliably delivered	Hindcast update, expanded projections, retrospective decadal predictions
FY28	All products reliably delivered	All products reliably delivered	Hindcast update, seasonal outlooks reliably delivered
FY29	All products reliably delivered	All products reliably delivered	All products reliably delivered

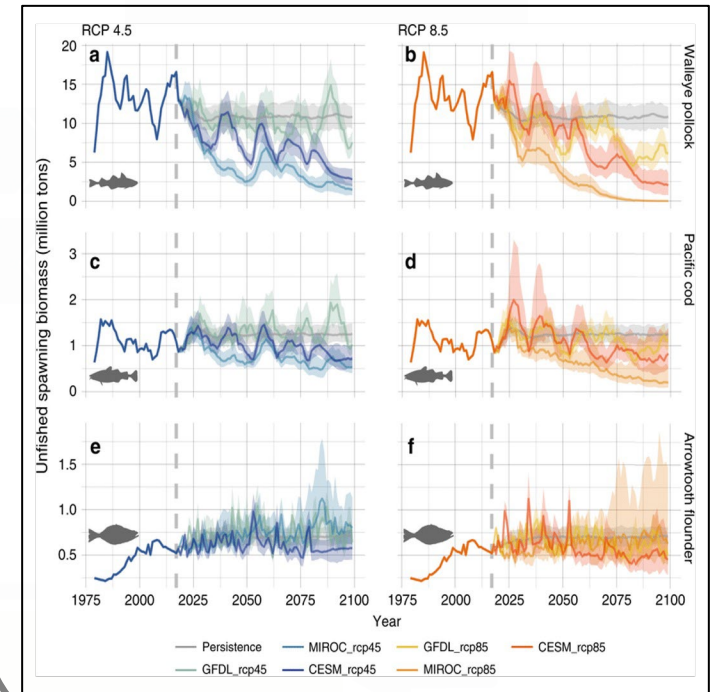
CEFI Decision Support System



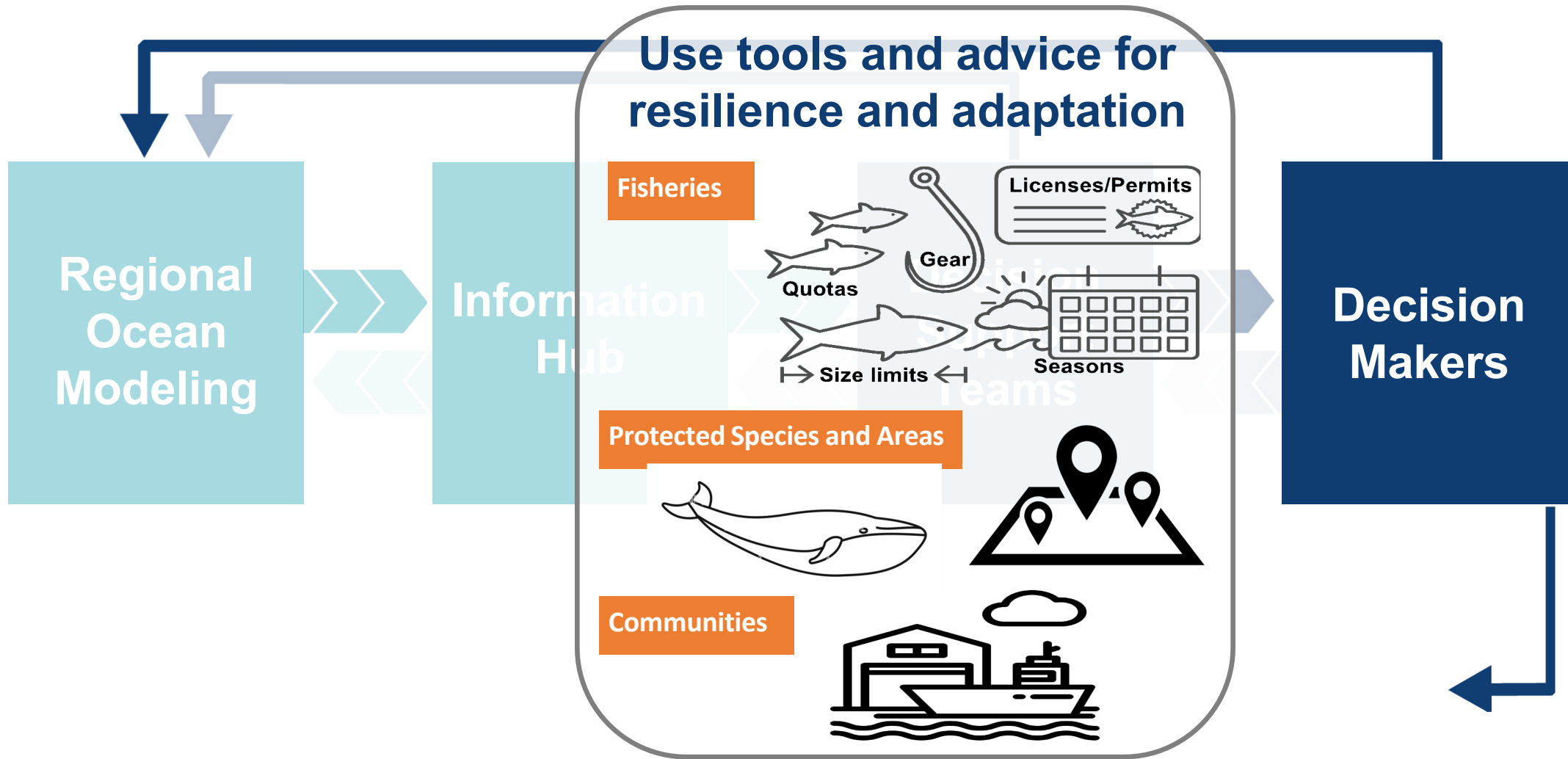
CEFI Decision Support System



Produce tools and advice for climate-ready resource management

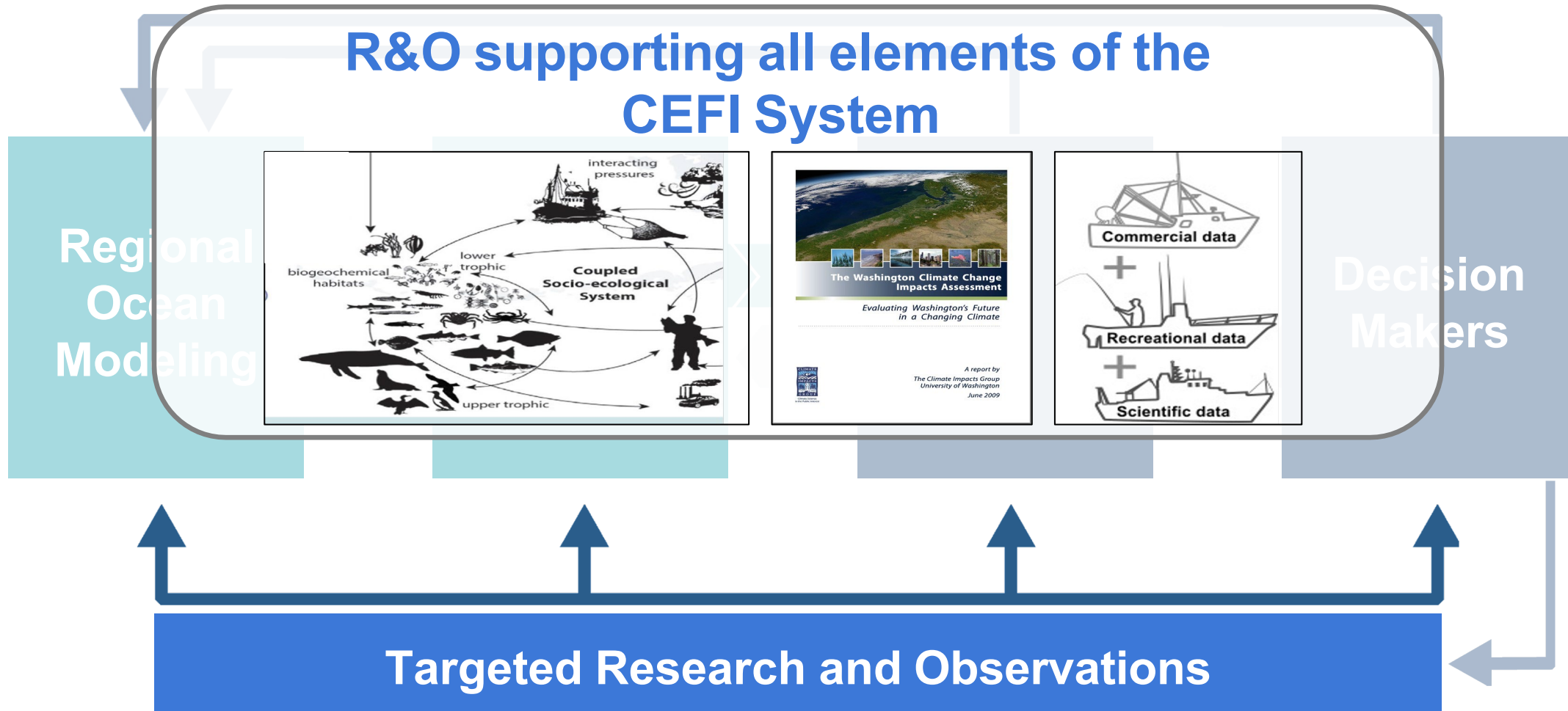


CEFI Decision Support System

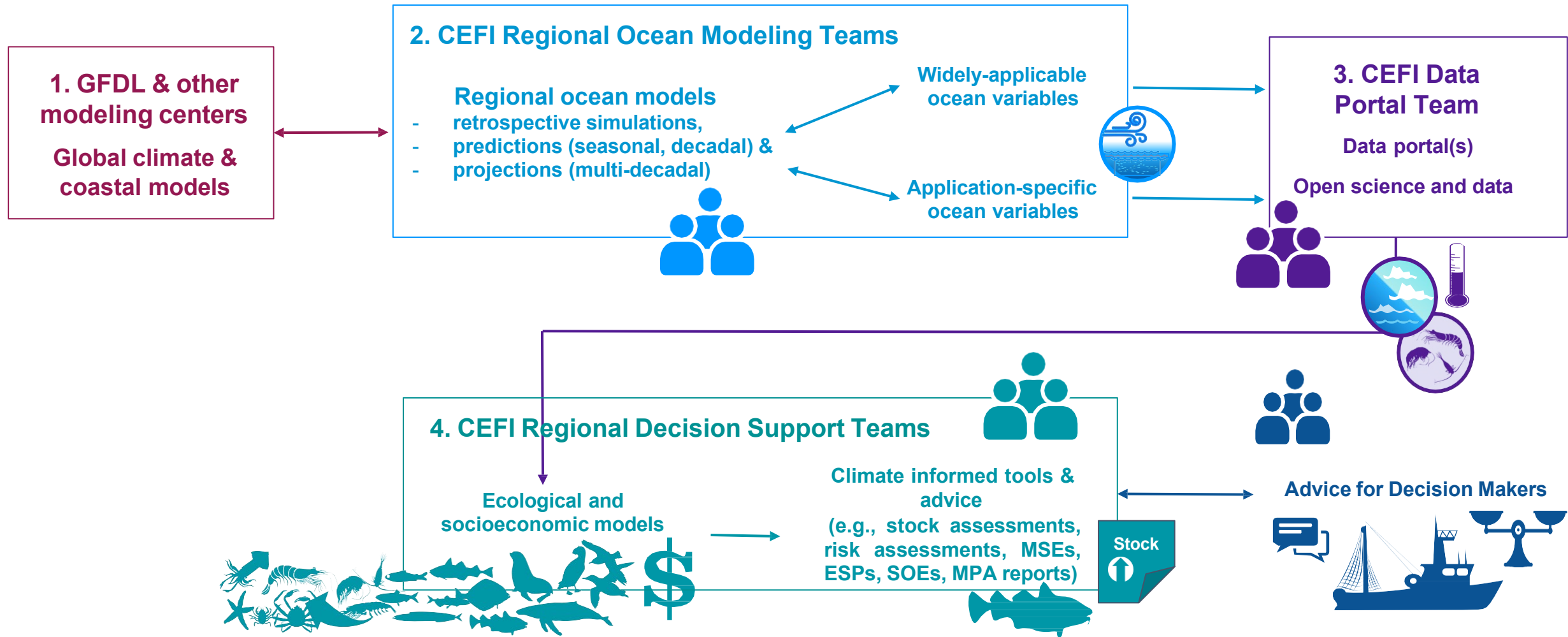


CEFI Decision Support System

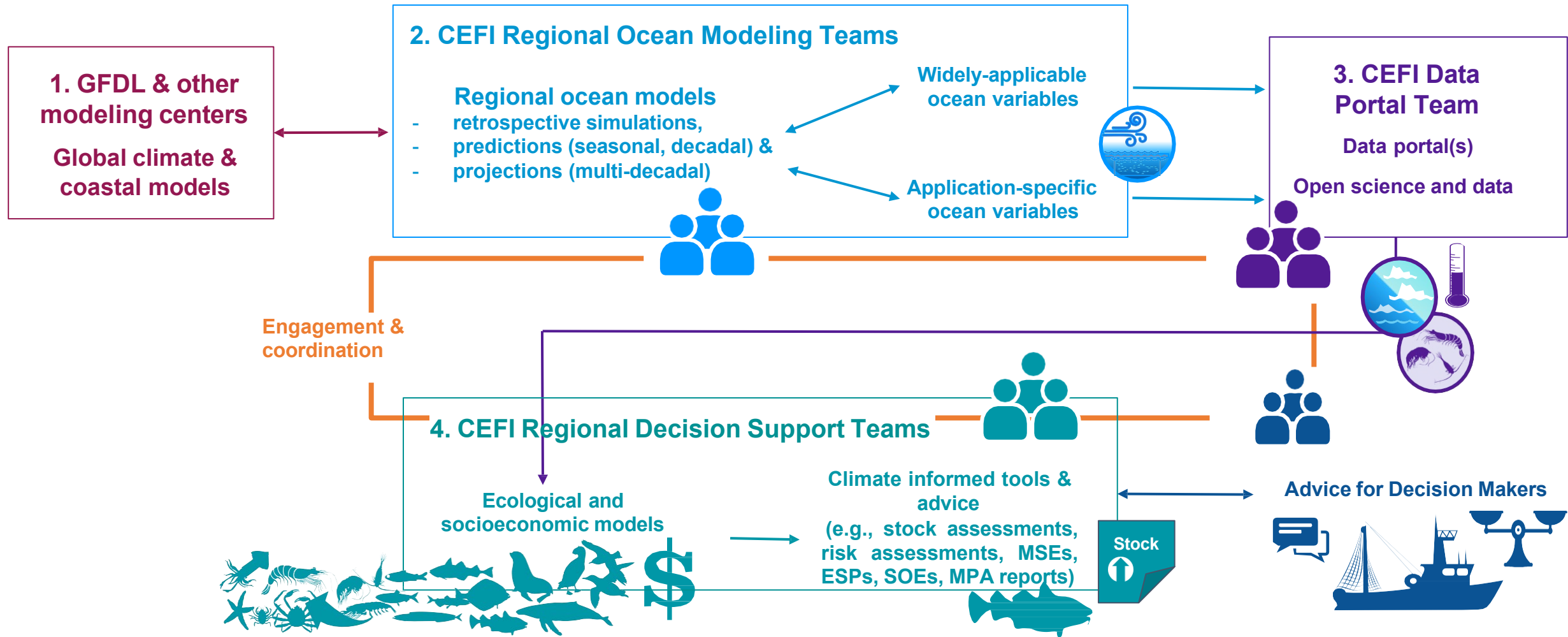
R&O supporting all elements of the CEFI System



Decision Support System Workflow



Decision Support System Workflow



Present Status

Development of the CEFI System is underway:

- **IRA Funding** - \$40M thru 2026 (OAR \$16M, NMFS \$20M, NOS \$4M)
 - MOM6 Regional Ocean Grids (5 regions)
 - Regional Ocean Modeling Teams in 5 regions
 - Initial Decision Support Teams in 7 regions
- **Building on existing investments including**
 - On-going science and management activities.
 - CEFI pilots ([Bering Sea ACLIM](#), [Gulf of Alaska GOACLIM](#), [West Coast Future Seas](#), [Northeast NCLIM](#)).
 - Other IRA investments

Thank you

