



**Climate, Ecosystems,  
& Fisheries Initiative**

# **NOAA Climate Ecosystems and Fisheries Initiative (CEFI)**

**ECCWO5, April 2023**

# Ocean & coastal decision makers are facing major challenges

Extreme Events



Longer term change

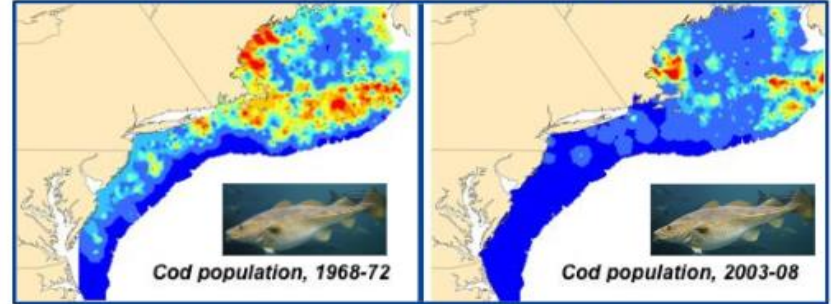


# Climate change is transforming oceans ecosystems

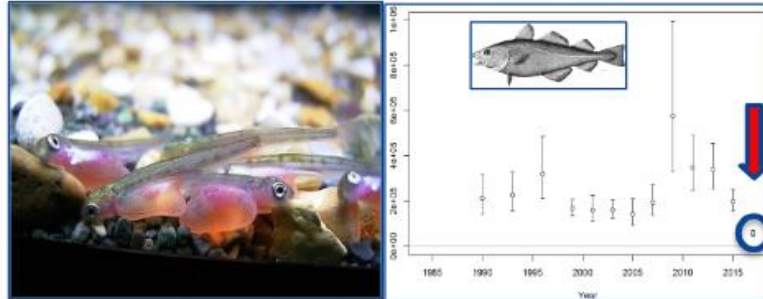
## Changing Habitats



## Shifting Distributions



## Changing Abundance



## Changing Ocean Uses



# There is much at risk

- **Vital living marine resources**
  - Fish stocks
  - Protected species
  - Habitats
- **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**
- **Environmental justice and equity**



# Urgent need for climate informed advice



## Fisheries:

- When and how will the distribution and abundance of stocks change?
- When and how will it affect fisheries and economies?
- What are the best management strategies for changing seas?

## Aquaculture:

- What are best strategies for aquaculture siting & operations?
- How reduce risks from extreme events (e.g., heat waves, harmful algal blooms, pathogens)?

## Protected Species & Areas:

- What are the best protection and recovery plans for changing seas?
- What are the best strategies for existing & new protected areas?

## Coastal Communities:

- What should resource-dependent communities prepare for?
- What are the best adaptation strategies?

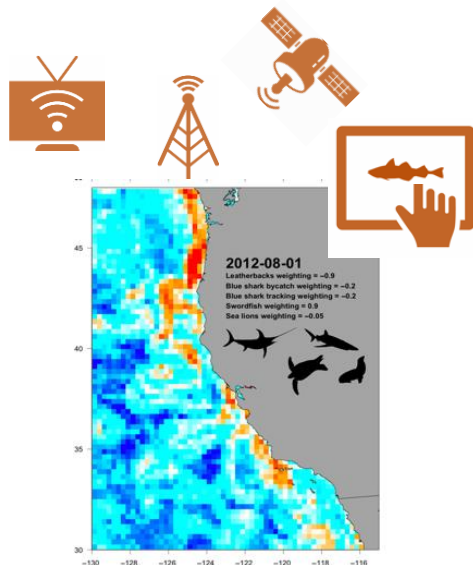
# Need climate informed advice across time scales

Rapid response



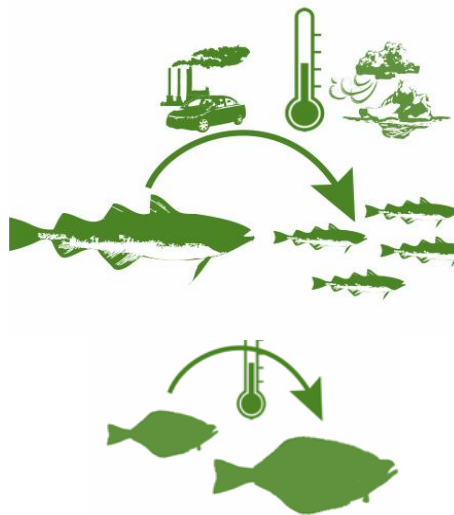
Long-term planning

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



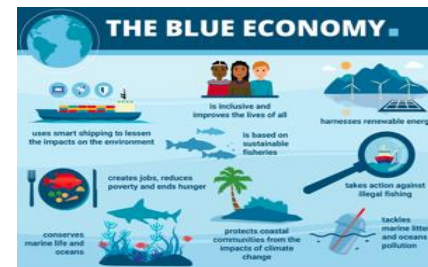
Hazen et al. 2019  
<https://advances.sciencemag.org/content/4/5/eaar3001>

## Climate-enhanced stock assessments to prevent overfishing



Hollowed et al. 2020 (ACLIM)

## Climate-smart strategies for multi-level adaptation



[www.blueeconomyconference.go.ke](http://www.blueeconomyconference.go.ke)

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

KHolsman graphics

# Problem: No system to support climate informed decision making

## Today

1. **No regular delivery** of ocean forecasts and projections.
2. **No operational system** to produce ecosystem scenarios, risk assessments & management advice.
3. **Low ability** to use climate-informed advice to reduce risks and increase resilience.
4. **Little planning** for extreme events and longer term changes.



## With CEFI

1. **Regular delivery** of robust ocean forecasts and projections.
2. **Operational delivery** of robust ecosystem scenarios, risk assessments & best options.
3. **High ability** to use climate-informed advice to reduce risks and increase resilience.
4. **Improved planning** for extreme events and longer term changes.

# Overview: What is CEFI?

**A cross-NOAA effort to provide climate-informed advice** for marine resource management and community adaptation.

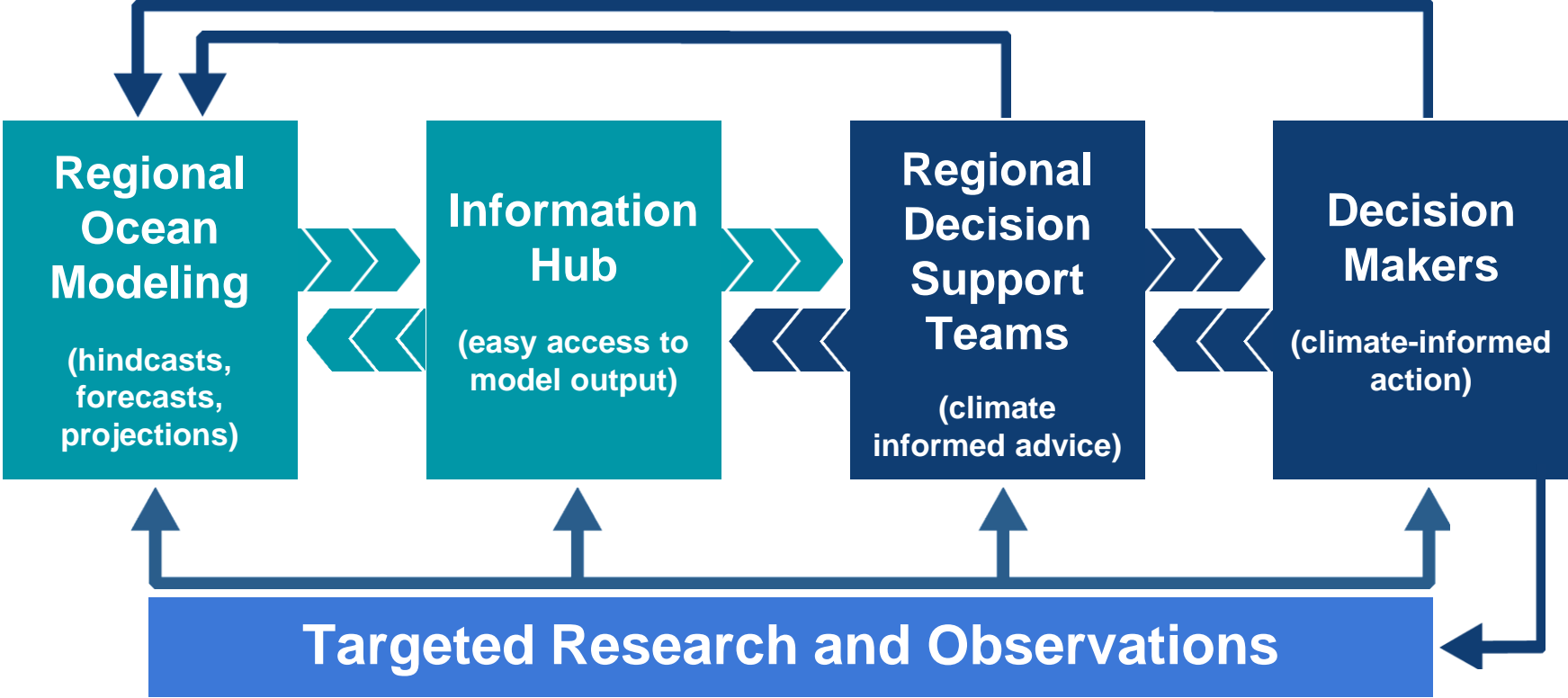
**Builds on existing NOAA investments** in research, modeling, and decision-making.

**An end-to-end decision support system** addressing four requirements:

1. **Reliable delivery** of robust ocean forecasts and projections
2. **Operational production** of climate-informed ecosystem projections, risk assessments and adaptation strategies
3. **Increased decision maker capacity** to use climate advice
4. **Targeted research & observations** for validation & innovation



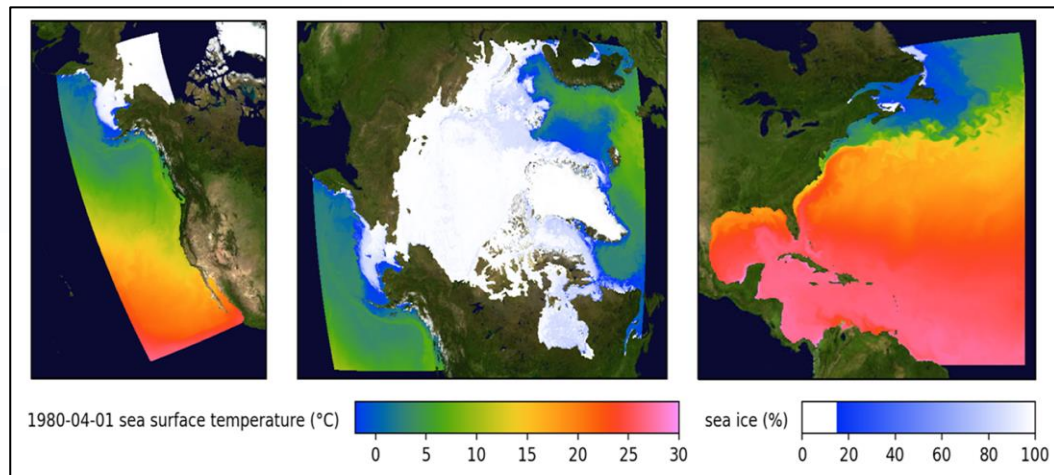
# CEFI Decision Support System



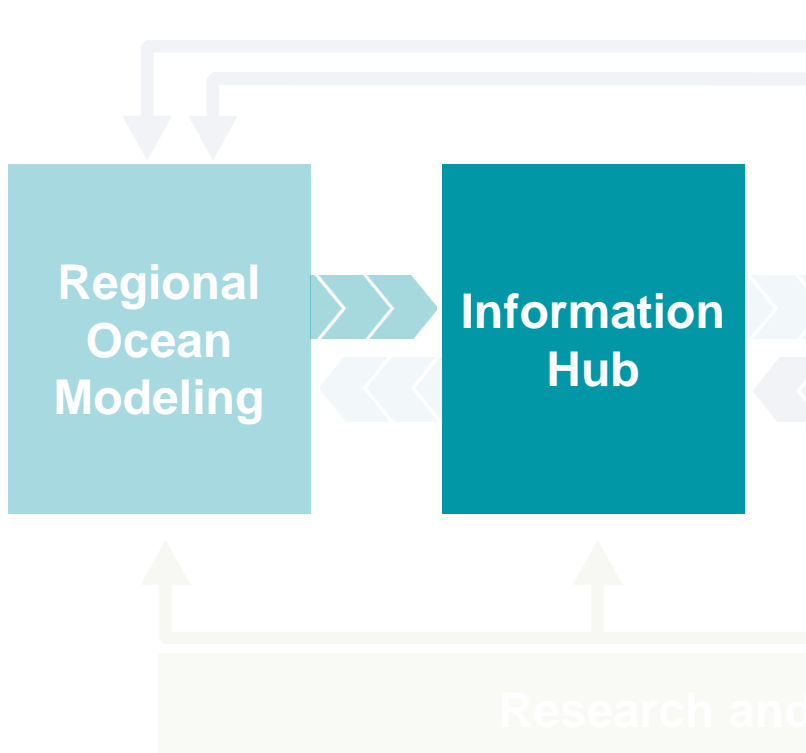
# CEFI Decision Support System

Regional  
Ocean  
Modeling

Produce regional ocean hindcasts, forecasts, predictions and projections



# CEFI Decision Support System

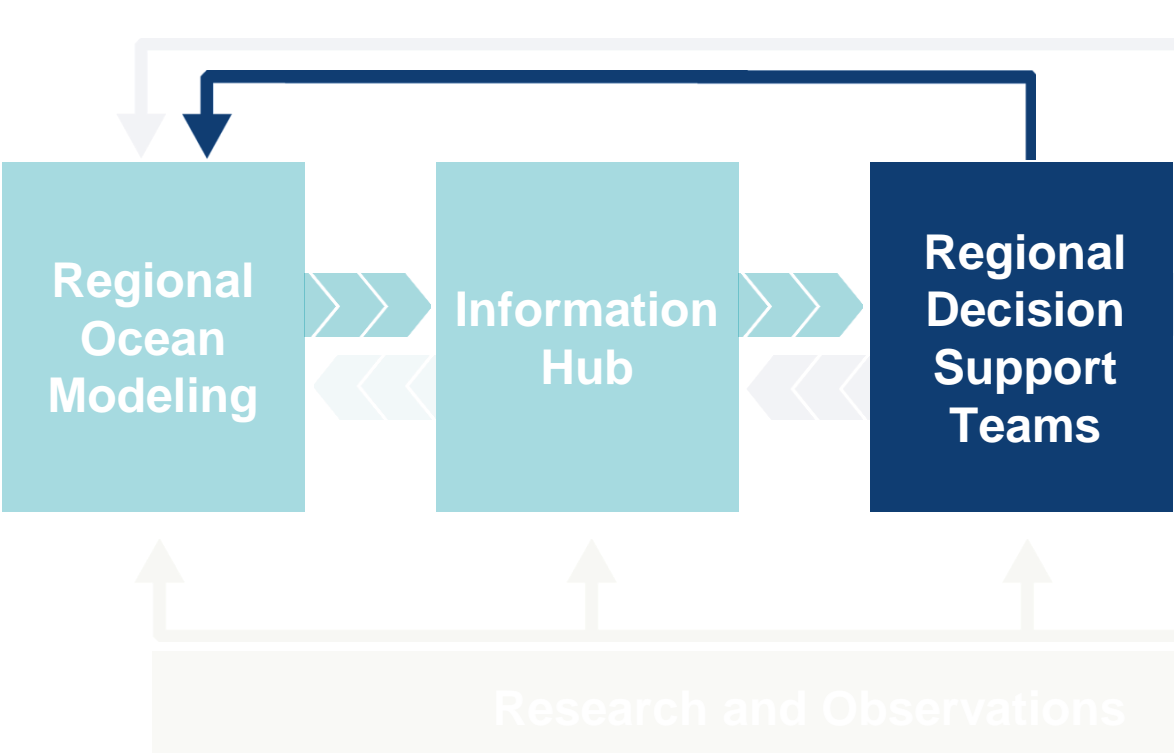


Serve model output in standardized format

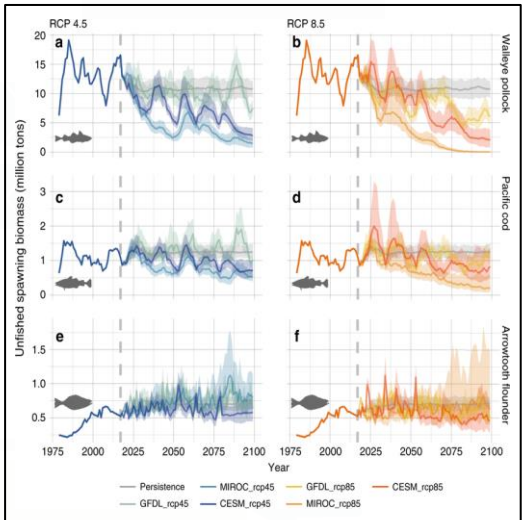
The screenshot shows the 'Gridded Climate Data' website from the Physical Sciences Laboratory. It features a map of the United States and a table of datasets.

Dataset	Description	Options
Air and Marine Temperature Anomalies: HADCRUT4	Jones (CRU) Combined Air/Marine Temperature Anomalies	🔍 📄 📄
CMAP Precipitation	Monthly and pentad global gridded precipitation means. It includes a standard and enhanced version (with NCEP Reanalysis) from 1979 to near the present.	🔍 📄 📄
COBE Sea Surface Temperature	Monthly 1° x 1° SST dataset from 1891 to present from the JMA. Datasets uses 3D Var to fill gaps.	🔍 📄 📄
COBE SST 2 and Sea Ice	Monthly 1° x 1° SST dataset from 1950 from the Japanese Meteorological Center (JMA).	🔍 📄 📄
CPC Global Unified Gauge-Based Analysis of Daily Precipitation	CPC 0.5x0.5 Global Daily Unified Gauge-Based Analysis of Precipitation.	🔍 📄 📄
CPC Global Unified Temperature	CPC 0.5x0.5 Global Daily Gridded Temperature	🔍 📄 📄
CPC Soil Moisture V2	Monthly Gridded CPC Soil Moisture from a model from 1948 to present.	🔍 📄 📄
CPC Unified Gauge-Based Analysis of Daily Precipitation over CONUS	CPC Unified Gauge-Based Analysis of Daily Precipitation over CONUS at PSD: Gridded Monthly Values. Monthly Values after 2008 are from the real time files (RT).	🔍 📄 📄
CPC Unified Gauge-Based Analysis of Daily Precipitation over CONUS RT at PSD	CPC Unified Gauge-Based Analysis of Daily Precipitation over CONUS at PSD: Gridded Monthly Values. Monthly Values after 2008 are from the real time files (RT).	🔍 📄 📄
CRU Air Temperature and Combined Air Temperature/Marine Anomalies V4	Global gridded (5°x5°) monthly anomalies of observed air temperature and combined observed air and marine temperature (HADCRUT4) from the mid 1800s to near present.	🔍 📄 📄
GHCN version 3 Land Temperature and Version 2 Land Precipitation Dataset	GHCN V3 contains gridded precipitation anomalies calculated from the GHCN version 2 monthly precipitation data set. 1264 homogenously adjusted precipitation stations were combined with a data set containing 20,990 raw precipitation stations throughout the globe.	🔍 📄 📄
GHCN CAMS Gridded 2m Temperature (L4v5)	GHCN CAMS is a high-resolution (0.5x0.5) analyzed global land surface temperatures from 1948 to near present.	🔍 📄 📄

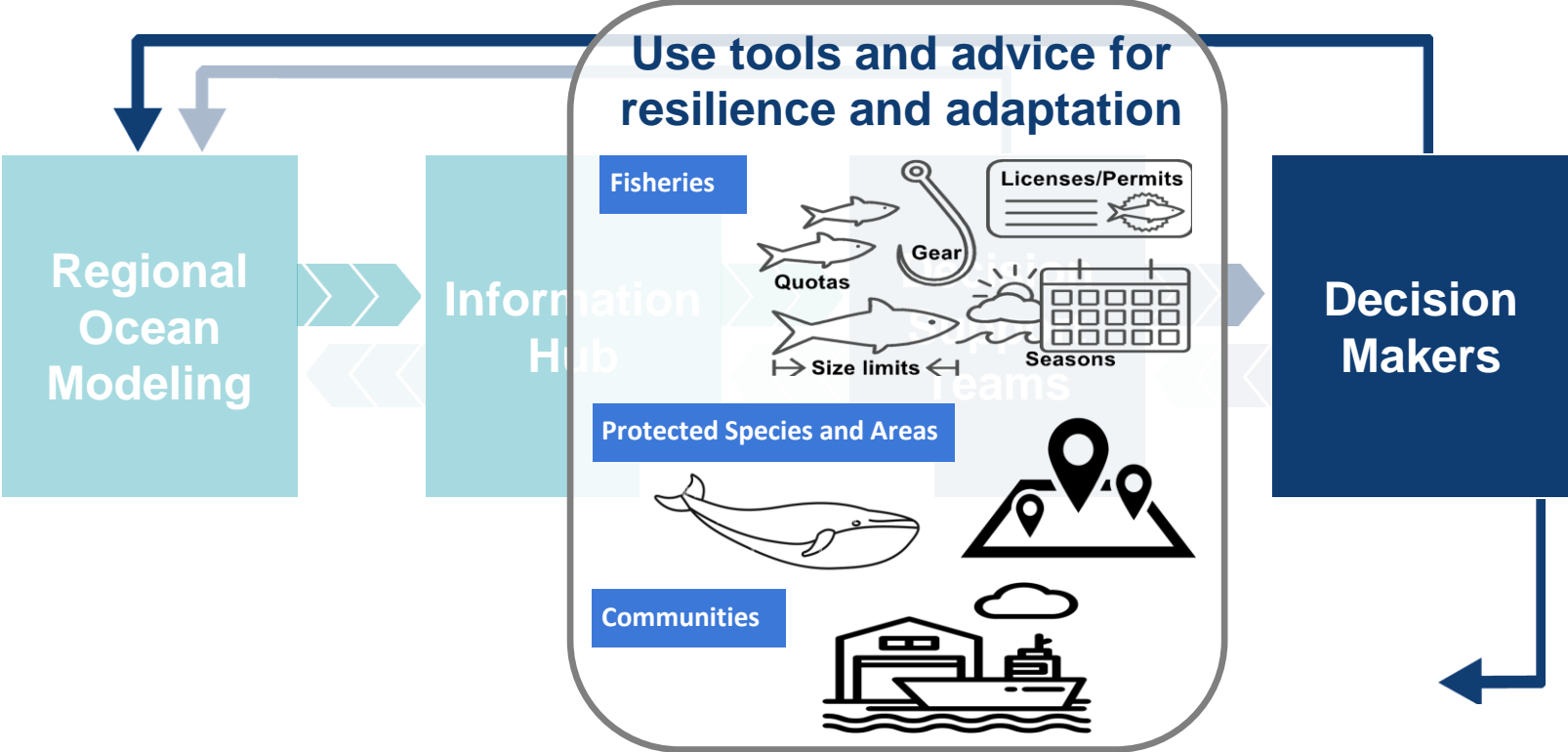
# CEFI Decision Support System



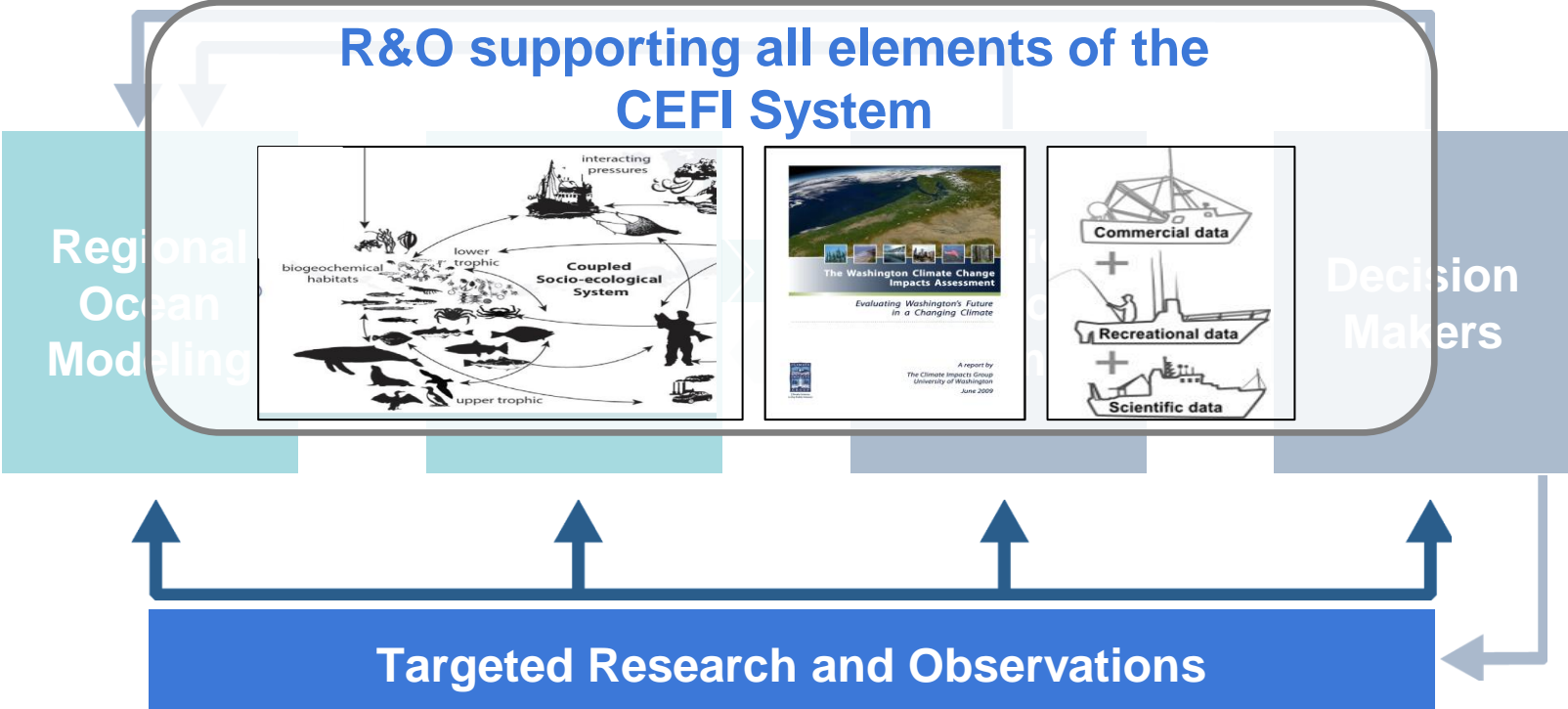
**Produce tools and advice for climate-ready resource management**



# CEFI Decision Support System



# CEFI Decision Support System

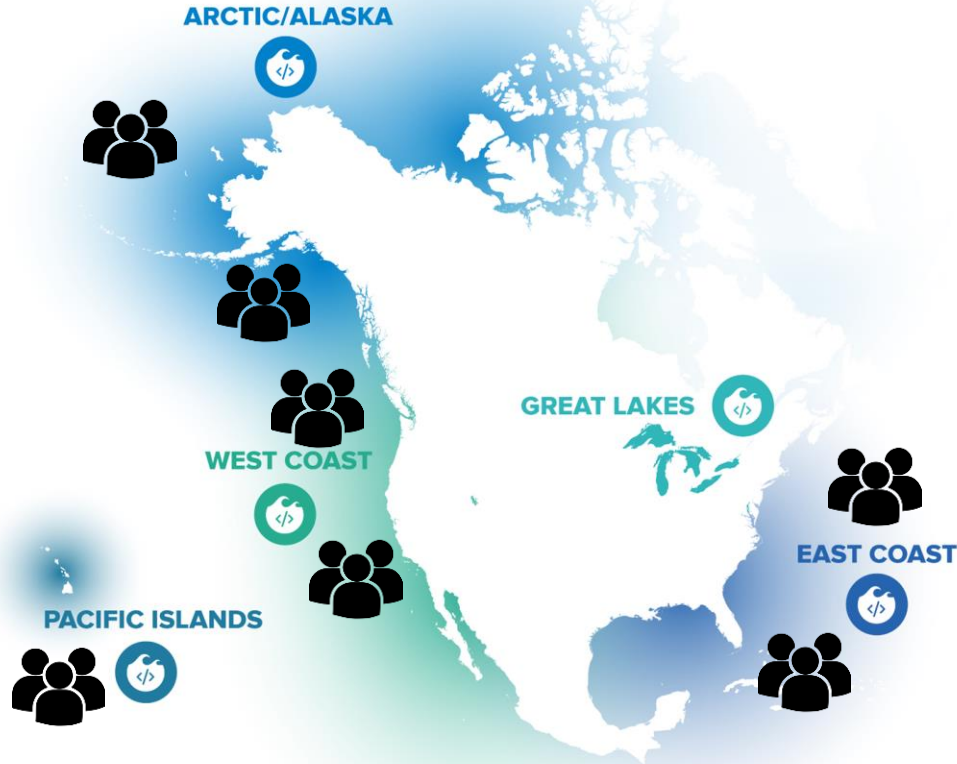


# CEFI Regional Teams

Regional  
Ocean  
Modeling  
Teams



HELP DESK



Regional  
Decision  
Support  
Teams



# Operational CEFI System = Climate Informed Decisions

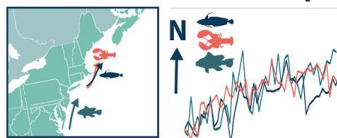
## ESM Regional Ocean Predictions



## Regional Decision Support Team

### Products

#### Habitat & distribution maps



#### Species forecasts & projections



#### Ecosystem-wide forecasts & projections



#### Tipping points & thresholds



## Advice Pathways

Population Modelers

Stock Assessors

Ecosystem Assessors

Socio-Econ Assessors

Risk Assessors

Strategy Assessors

## Regional Applications

### Climate Ready:

- Rapid responses
- Scenario planning
- Risk assessments
- Fisheries management strategies
- Species recovery plans
- Community adaptation plans





# What will CEFI do?

- ***National ocean modeling system*** providing robust regional forecasts and projections of future ocean conditions.
- ***Operational production and delivery of climate informed advice*** for multiple decision makers.
- ***Climate ready resource management*** and community adaptation.
- ***Continuous innovation and validation*** so the CEFI system evolves and improves over time.
- ***Increased resilience and adaptation*** of marine resources, sectors, communities and economies.

# CEFI is foundation for Climate ready action



## Climate Ready Fisheries:

- Rapid responses to extreme events
- Sustainable fisheries management in the face of changing abundance and distributions
- Fishing sectors informed and adapting

## Climate Ready Aquaculture:

- Climate-informed aquaculture siting & operations
- Proactive planning for extreme events (e.g., heat waves, harmful algal blooms, pathogens)?

## Climate Ready Protected Species & Areas:

- Rapid responses to extreme events reduce impacts
- Climate informed species recovery plans
- Climate ready implementation of existing & new protected areas

## Climate Ready Coastal Communities:

- Fishing communities developing and implementing adaptation plans



## Climate, Ecosystems, & Fisheries Initiative

# Thank you

For more information on CEFI please visit:  
<https://www.fisheries.noaa.gov/topic/climate-change>  
Or contact [roger.b.griffis@noaa.gov](mailto:roger.b.griffis@noaa.gov)

