

#### The CEFI Modeling System:

A National Regional Ocean Modeling and Climate-Scale Prediction System for NOAA's Marine Resource and Ecosystem Mandates (and more)

Presented by Charlie Stock on behalf of many across GFDL, NOAA and beyond

Q3: How can GFDL research and modeling be further utilized to meet NOAA stakeholder needs and enhance research partnerships to ensure GFDL's success?



5-Year Review January 28-30, 2025

# Coastal communities, ecosystems and economies face myriad climate challenges that are generating pressing stakeholder questions



- When is a fishery no longer viable? When should a new fishery be established?
- How should regional quotas and international agreements account for changing stock boundaries?
- Which management strategies can robustly maintain economic and conservation goals in the face of worsening climate extremes?
- Where should I site aquaculture operations to minimize climate risks?

And many more....

GFDL has helped bring climate predictions and projections to marine resource science and management





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#### "Dealing with environmental change rests with a capacity to anticipate"

Clark et al., Science, 2001







### The Climate Ecosystems & Fisheries Initiative (CEFI) is building a national decision-support system to meet these challenges







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### **GFDL is leading development of CEFI modeling system**







### How are we getting this done and is it sustainable?

#### NOAA HPC + climate workflows





#### How are we getting this done and is it sustainable?



- CEFI draws from and contributes to a robust open development code base supported by NOAA and many others
- Biweekly open regional MOM6 development meetings
- CEFI GitHub site:
  - $\circ$  Source code for MOM6 + COBALT
  - Workflows and build scripts (FMS/FRE)
  - Pre/Post-processing tools
  - Diagnostic scripts
  - Testing cases for code changes
  - Containers to accelerate innovation

#### https://github.com/NOAA-GFDL/CEFI-regional-MOM6

5-YEAR REVIEW

JANUARY 28-30, 2025



### How far have we gotten after our first full year?

	NW Atlantic	NE Pacific	Arctic Ocean	Pacific Islands	Great Lakes
ROMT Formed					
Baseline Config					
Hindcast					
Retro. Seasonal					
Retro. Decadal					
Projections					
Seasonal Outlook					
Decadal Outlook					
Full delivery (Phy	vs+BGC)	Physics deliv	vered	Runs under	analysis
ATMOSPHERIC					





## Disseminating data through the CEFI data portal

Data portal effort led by NOAA/PSL, visualizing seasonal forecast data from Ross et al., (2024)

Data Options	Figure options
ariable : Sea surface temperature 🗸	Maximum Value :
nitial year : 2022 V	Minimum Value :
nitial month : March ~	Number of Discrete Values:
tatistics : upper tercile probability ~	Colorbar ? : RdBu_r ~
epth : single layer v	Clear All
locked depth : not applicable ~	
nalyses dashboard : Forecast Spread ~	
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Ensemble predictions provide uncertainties essential for informed decisions

 Probability that sea surface temperatures will be in the upper tercile



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### The regional MOM6/CEFI modeling system at work internationally



Park, Hallberg et al. (in prep)



Configurations also under development in Australia, west Africa/Benguela Current system





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### **Beyond fisheries and ecosystems**

The CEFI modeling system is a climate-scale coastal ocean modeling and prediction system to broadly support NOAA's mission:

- Fisheries and marine ecosystems (Initial driver, this talk)
- Sea level rise on seasonal to multi-decadal time horizons (next talk)
- Marine Carbon Dioxide Removal (mCDR) (ongoing)

Looking forward:

- Observing system evaluation framework for coast-wide observing networks
- Navigation-relevant seasonal sea ice outlooks
- Coastal tourism and recreation applications



