Accessing and Visualizing Satellite Data for Fisheries Managers in the Northeast Shelf Large Marine Ecosystem
Use Case

• In recent years, environmental conditions in the NES LME have changed rapidly impacting marine resources and fisheries.

• 2012 warming event in the Gulf of Maine led to changes in fish distribution and timing impacting the lobster fishery, closures of the northern shrimp fishery and continued decline in cod.
Use Case

**CLIMATE**

**NOAA: In 2012, Waters Off Northeast U.S. Coast Were Warmer Than Usual**

BY JOE ROMM APR 28, 2013 12:24 PM

A new “Ecosystem Advisory” from NOAA’s Northeast Fisheries Science Center (NEFSC) reports that “Ecosystems off the coast of Maine and New Hampshire experienced warming and less extreme winter temperatures than average and during 2012 with below-average temperatures for the Gulf of Maine.”

The Ecosystem Advisory noted that, compared to the 1981-2010 average temperature (11.0°C), the temperature was 2°C below average for the Gulf of Maine and 1°C below average for the mid- and northern parts of the Northeast U.S. Continental Shelf.

The advisory also noted that warming temperatures have increased the risk of disease in fish, and that warming has increased the likelihood of heat stress in fish.

**SCIENCE**

**Cod’s Continuing Decline Shows Need for Better Management**

By ERICA GOODIE OCT 29, 2015

Sea surface temperatures in the Gulf of Maine have been increasing at an average rate of about 14 degrees Celsius per century, leading to an increase in the number of days with temperatures above 15°C. This increase is causing problems for cod, which need cooler temperatures to survive.

... The temperatures are increasing faster than the cod can adapt, leading to a decline in the population.

**REPORT**

**Slow adaptation in the face of rapid warming leads to collapse of the Gulf of Maine cod fishery**

Andrew J. Pershing1,*, Michael A. Alexander2, Christina M. Hernandez2,1, Lisa A. Kerr1, Arnault Le Bris1, Katherine E. Mills1, Janet A. Nye3, Nicholas R. Record4, Hillary A. Scannell4,1, James D. Scott2,5, Graham D. Sherwood1, Andrew C. Thomas5

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Science 29 Oct 2015:
DOI: 10.1126/science.aaa9819
http://www.science.org/ScienceMagask/2015/
Specific recommendations

At a 2013 NOAA-sponsored climate workshop in Providence, RI, participants identified:

‘need to track the pulse of ecosystem conditions via core observations of key indicators to track current changes and provide managers with early warnings of future changes’

– https://joss.ucar.edu/meetings/understanding-climate-impacts-fish-stocks-northeast-shelf-large-marine-ecosystem-key
Recommendations to Actions

• Facilitate access to fisheries and climate data for fisheries stakeholders in the Northeast through the creation of a dynamic data dashboard
  – **Engage stakeholders** in advisory capacity (e.g. fisheries managers, researchers, industry leaders, ENGOs)
  – Make complex climate-relevant data **accessible and easy** to understand
  – Develop **interactive visualizations** to quickly assess conditions in the ocean and evaluate them in the context of past, present and projected change
  – Keep **data fresh** through daily updates
Data: Sea Surface Temperature

- NOAA NCEI daily Optimum Interpolation Sea Surface Temperature (or daily OISST)
  - Anomalies (daily OISST minus a 30-year climatology mean) to represent departures from normal or average conditions

Spatial Averaging

- Aggregation of SST data from grid points contained within specific sub-regions
- Average time series for each grid point within the sub region (Ecological Production Units – EPUs)
- NES LME: Gulf of Maine, Georges Bank, Scotian Shelf and Mid-Atlantic Bight
Reference Levels (climatologies)

To answer the simple question: ‘are we hot or cold?’

• Need reference point or climatology that defines what is normal
• 30 year period (1/1/1982-12/31/11) calculate high/low means, averages and standard deviations for each sub-region for each day of the year
• The values become background climatology that current conditions (monthly/daily) can be overlaid with current data dynamically updated on a daily basis
Marine Ecosystem Outlook Dashboard

The rapid changes experienced in the Northeast Shelf Large Marine Ecosystem (NES LME), as well as the high degree of natural variability in this system, are prompting new discussions about how to incorporate environmental information into fisheries policy and management and into the industry.

The Marine Ecosystem Outlook Dashboard provides access to the latest and most relevant data on climate and ocean conditions for use in preparing for and responding to changes in the ecosystem.

Click the tabs in the menu to dive deeper into dynamic data sets or access climate outlook and analyses in the region.

Updates from the Region

- NMFS Ecosystem Spring Outlook Advisory
- NCDC publishes climatologies for the region
- Gulf of Maine Council quarterly index

Recently Updated Datasets

- Sea surface temperature - OISST
- Anomaly - OISST
- Fisheries spawning stock biomass for cod
- Anomaly maps for region and sub-region
- Climatology data by sub-region
- Lobster landings

Today in the NESLME

Climatology, Sea Surface Temperature anomaly data for November 4, 2015
[click for more data]
Marine Ecosystem Outlook Dashboard
Outlooks and Advisories

**Ecosystem Advisory for the Northeast Shelf Large Marine Ecosystem**
Summary of conditions for the Northeast Shelf Ecosystem. Produced in the spring and the fall, the Ecosystem Advisory provides information on sea surface temperature, phytoplankton and zooplankton blooms, chlorophyll distribution, species trends, long term projections and more.
http://www.nefsc.noaa.gov/ecosys/advisory/current/

**Northwest Atlantic Regional Climatology**
NCEI Regional Climatology Team1 developed a new set of high-resolution quality-controlled long-term annual, seasonal and monthly mean temperature and salinity fields on different depth levels.

**Gulf of Maine Region Climate Impacts and Outlook and Dashboard**
The quarterly Gulf of Maine Region Climate Impacts and Outlook offers a snapshot of recent weather events and anomalies; regional weather impacts on ecosystems and economic sectors; and a forecast for the coming three months.
http://www.gulfofmaine.org/dashboard/

**OceanAdapt**
OceanAdapt is a collaboration between the Pinsky Lab of Rutgers University and the National Marine Fisheries Service (NMFS) to provide information about the impacts of changing climate and other factors on the distribution of marine life to the National Climate Assessment, fisheries communities, policymakers, and to others.
http://oceanadapt.rutgers.edu/regional_data/
Next steps

• Launch the preliminary tool with stakeholder group
  – Feedback/input
• Incorporate more relevant datasets
  – Climate Projections
    • NMME Temperature
  – Fisheries landings
    • Groundfish
    • Lobster
    • Mid-Atlantic fisheries
  – Physical Data
    • Chlorophyll
    • Salinity
    • Precipitation
    • Bottom Temperature
Climatology

OISST SST & Anomaly

Gulf of Maine - Feb 20, 2016

From Mar 19, 2015 To Mar 19, 2016

Sunday, Feb 21, 2016
- SST Anomaly: 1.67
- SST: 6.29
- SST Min Max Range: 3.69 – 6.04
- Mean SST: 4.65

Source: NOAA National Climatic Data Center
Anomaly Trends

OISST Regional Anomalies

Gulf of Maine - Mar 13, 2016

Week from Monday, Mar 14, 2016
- COM: 1.77°C
- SS: 1.75°C
- GB: 1.74°C
- MAB: 2.51°C
- NESHELF: 3.91°C
Anomaly Map
Outlooks and Advisories

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