# Preparing for an Uncertain Fishing Future:

## Bringing communities together with climate and marine scientists to understand predictive capabilities and information needs

A workshop in the Island Institute's *Climate of Change* series, December 18, 2014

**Organized by the Island Institute and co-hosted with Maine Coast Fishermen's Association, Maine Lobstermen's Association, and Cape Cod Commercial Fishermen's Alliance. Facilitated by Laura Taylor Singer, SAMBAS Consulting LLC**

## Overview of the Workshop

Maine's fishermen make investments in their communities and businesses every season. Because fishermen are keen observers of the natural world, they regularly make business decisions based on shifting environmental conditions. However, the Gulf of Maine is changing at a rapid rate and in ways never before seen by today's fishermen. Seasonal forecasting and longer-term projections can suggest time frames over which changes may occur. While we know that these projections will not be able to 'predict' the future, through an understanding of likely future conditions in the Gulf of Maine they can provide insights relevant to the business decisions that people are making today.

The "Predictive Capabilities Workshop" brought together a diverse group of climate and marine scientists, fishermen, and other marine stakeholders to provide practical links between current climate projection work and the real world issues facing Maine's fishermen and coastal communities. Participants learned about climate models and other forecasting methods and also heard perspectives about the issues facing fishermen as they adapt to future changes in the Gulf of Maine (GOM).

## The Future Gulf of Maine

Workshop participants made predictions about how the natural and socioeconomic environments in the GOM might change in the next 15–20 years. Warming waters are expected with an increase in seasonal temperature ranges and vertical stratification. More frequent and larger storm events will likely cause coastal erosion and damage to infrastructure along the waterfront. New species will be migrating into the GOM from the Southeast Atlantic and Mid-Atlantic, creating changes in predator/prey interactions and new fishing opportunities. Lobster stocks in Southern Maine are anticipated to continue dropping, although many predicted lobster would still be the predominant fishery in Maine for the foreseeable future. Invasive species (e.g. green crabs) and water-borne disease (e.g. lobster shell disease) are apt to increase. And changes in marine mammal populations (e.g. right whales and seals) are also likely as the GOM ecosystem changes.

> **We are going to see surprises. The only certainty is that it is going to be different!**
> Bob Steneck, UMaine

Changes in management institutions are also anticipated. In the future, societal impacts may be a more important part of the management considerations and ecosystem-based fisheries management (EBFM) may well be better incorporated into the management structure. Several workshop participants predicted that it will be necessary to restructure the fisheries management councils to accommodate changes in the GOM and two or more councils may merge. New trans-boundary agreements with Canada will allow for better integration of fisheries. Social attitudes toward management may shift as well, though conflict and resistance to policy are still expected.

Future changes in GOM species will most likely result in the migration of permits and potential changes in access to the resource. The vessels in the fleet may become larger to accommodate more severe storms and offshore fishing and there will likely be increased consolidation resulting in fewer commercial fishermen. Other activities such as offshore wind and tidal energy, aquaculture, shipping, and cruise traffic are predicted to be more prevalent, and user conflicts will need to be managed.

Rising sea levels and an increase in coastal storms will affect everyone along the New England coast. It is most likely that future activities to protect coastal infrastructure and re-nourish beaches will increase. Communities will also need to make choices about investing resources in supporting working waterfronts or other structures along the vulnerable coastline.

### Changes in the Gulf of Maine

- In the last decade, the rate of warming in GOM and NW Atlantic has been 0.23°C/yr (~0.5°F/yr), which is greater than 99.9% of the world's ocean.
- The Gulf Stream is being pushed further to the Northwest, allowing more, warmer saltier water to enter through Northeast channel.
- High resolution climate models for the GOM project sea surface temperature increases of 2.5 to 3.5°C and bottom temperature increases of 3 to 6°C by 2080.
- Salinity is changing - increasing in the south and decreasing in the north.
- Precipitation is going to increase with more rain than snow with consequences for the water cycle.
- Sea level is going to continue to rise depending upon ice melt.

### Some Potential Impacts on Fisheries

- Exposure to changes in temperature and ocean acidification are the most important factors.
- Temperature events impact cod biomass and whether females are effective in producing new cod.
- Based on NOAA's temperature forecast, very warm spring water temperatures are predicted in the GOM in 2015 resulting in another early lobster shed as seen in 2012.
- Exposure of marine life and commercial fished species to climate change in the Northeast US is high to very high.
- Sensitivity is higher for diadromous and shellfish; lower for groundfish and pelagics.
- Approaching the 2050 time period, atmospheric carbon makes aquaculture at the mouth of rivers in New England using present methods a risky proposition.

## Preparing for Change

Despite the increasingly unpredictable nature of the ocean, a panel discussion among fishermen at the workshop indicated a degree of short and long term business planning. For lobstermen, gear is the shortest-term investment. At roughly $100 each (fully rigged), traps are replaced on a five to six year rolling basis. Electronics such as radar and "bottom gear" may be used for seven to ten years until they need replacement at roughly $5,000 each. The engine will hopefully last at least 10 years before it needs to be replaced and can cost anywhere from $30,000 up. An investment in a new boat could cost $250,000 or more and last 20-30 years or "'til I'm done fishing." Although some fishermen do create an annual business plan, many fishermen assume they will do the same thing as previous years and only plan on a weekly or daily basis based on markets.

> **Your business can't go out any further than the resource will allow you to plan.**
> Steve Train, lobsterman

Maine's lobstermen are becoming increasingly aware that the GOM is changing and that those changes can have a profound impact on their bottom line. In 2012, the GOM experienced the largest, most intense warming event in the last 30 years. The warm spring waters impacted the timing of lobster shedding and caused more lobsters to be caught in the spring than typical years. The landing of five million pounds of lobsters early in the season reportedly caused a 50 million dollar decline in revenue, as processors weren't ready to buy US lobsters and prices dropped. The 2012 warming event caused many lobstermen to begin to consider how the environment may be changing and if markets and managers are ready.

In order to be prepared, lobster processors and dealers will need to better plan for dramatic shifts in supply in the future. The management institutions in place lag behind the state of the resource and don't have the tools to react quickly to changes. Managers will need to consider how regulatory changes could impact swings in the supply and consider new ways to be more flexible to react more quickly to changing conditions. As different species migrate into the GOM, criteria to establish when to declare that a regime shift has occurred will need to be developed. In addition, new regulations will be required to provide access to emerging fisheries opportunities. New markets will also need to be created. Consumers of seafood will also demand further advancement of traceability of seafood products and assurances that new species are being managed sustainably.

### Addressing Uncertainty in Fisheries Science and Management

*A report produced by Eric Schwaab at the National Aquarium to advance best practices for addressing the impact of science and management uncertainty on fisheries management systems*

Report available: aqua.org/care/fisheries

Key Themes

1. Identifying and Communicating Sources and Treatments of Uncertainty
2. Best Practices for Reducing Uncertainty
3. Special Case: Managing Fisheries in the Context of Environmental Change
4. Risk-Based Management Decisions: Prioritizing Responses to Uncertainty

## Models & Data

Workshop participants exchanged ideas about the kind of modeling that may be useful. Although predictive models may be available, in order for them to be useful, the broader industry and fisheries managers must have confidence in the models. For example, it has taken 10-15 years for the lobster industry to buy-in to the lobster settlement index. Settlement researchers are just beginning to look at forecasting. Instead of just asking "how can fishermen *use* the models" it is important to also ask "how can fishermen *inform* the models" and creating ways for fishermen to continue to be involved in data collection. A general discussion of the risk vs. the uncertainty of the model predictions would also be constructive. Spatial and temporal scales are important to clarify as well.

Workshop participants were generally optimistic that progress will be made in data collection by increasing fishery monitoring and collecting better quality fishery-dependent data. It is likely that this will result in the availability of more accurate predictions and the development of new tools. A new generation of fishermen will also have more exposure and experience with fisheries science. It is expected that data collection techniques will be more cost effective in the future and an increase in fishermen's observations will better ground truth predictions.

## Information Needs

Fishermen discussed the information that would help them prepare for future changes in the GOM. Lobstermen would like to see more accurate predictions of the timing of the lobster molt and improvements to other forecasting models in the northeast. However, models should remain flexible so they can be modified as conditions change. Real time data from industry, such as placing temperature and current data sensors on lobster traps, (like the EMOLT project, Environmental Monitors on Lobster Traps) was a recurring idea from participants. In addition, participants emphasized that science needs to be sophisticated enough to incorporate this real time data so it is used in the models.

Some fishermen would like to see more retrospective analyses done and further exploration of predator/prey interactions. There is also a desire to explore connections between land and sea. Participants advocated for improvements to the quality of fishery-dependent data, including location, and better availability of data that is collected. Many participants mentioned that fishermen should continue working with scientists on collaborative research to provide input for management.

### Questions from Fishermen

- **How soon will we see changes in fisheries?**
- **How and when will OA impact lobsters?**
- **What new species are coming and when are they going to stay? (E.g. will the predicted increase in squid provide a steady enough supply to invest in gear or not?)**
- **What is the plan for licensing with regard to emerging fisheries?**

## Communication & Outreach Methods

Workshop participants discussed the challenges of getting modeling information to fishermen and out to coastal communities. Education and outreach that is digestible for all audiences was recognized as an important goal. Some participants cautioned that care is needed when trying to simplify science too much as you can often lose

the details. The message needs to be tailored to the audience. The use of images and info-graphics to communicate complex information is often highly effective.

### Communications Tools

- **Mobile Apps**
- **Web Portals**
- **Social Media**
- **Fishing Associations**
- **Email List Serve**
- **Direct Communication**

Although there are many ways to distribute information, several participants advocated for direct communication with fishermen about the science with the opportunity for dialogue. Modelers should host events where they can get direct feedback about the models and hear what types of information would be useful for the audience. The discussions would also benefit by having a mix of fishing industry folks, including buyers and processors, as they will also be impacted by climate change.

Some participants believed buy-in from industry for predictive models will increase over time. By better understanding the model structure, the data used and how to interpret the model outputs, people can make their own assessment of the risks. The message is that change is coming. Communication needs to focus on why this is important and what fishermen and coastal communities can do to plan.

## Resources Available to End Users

**Northeast Ocean Data Portal:** http://www.northeastoceandata.org
Maps and data for ocean planning in the northeastern United States.

**Northeastern Regional Association of Coastal and Ocean Observing System:** http://www.neracoos.org
Real-time data based on a regional coastal ocean observing system for the northeast United States and Canadian Maritime provinces, as part of the United States Integrated Ocean Observing System (IOOS)

**Climate Information for the Eastern United States and Atlantic Canada:** www.gulfofmaine.org/dashboard
Recent and real-time data to help track regional change

**Gulf of Maine Climate Network:** http://www.gulfofmaine.org/2/climate-network-homepage/
The Climate Network brings together planners and scientists from around the Gulf of Maine to raise awareness about climate impacts and inspire effective action in local communities.

**NExUS:** NEclimateUS.org
A searchable online database that provides a gateway to climate information for the Eastern US, Atlantic Canada and the maritime region known as the Northwest Atlantic.

## About Our Climate of Change Series

The Island Institute works to sustain Maine's island and remote coastal communities, and to exchange ideas and experiences to further the sustainability of communities here and elsewhere. During the summer of 2013, we initiated our *Climate of Change* workshop series to address how the changing climate and ocean chemistry may impact Gulf of Maine fisheries and the communities that depend upon them. This is a summary of the third workshop in the series.

We also produced a series of short videos, each of which explores specific, climate-related impacts on fishing communities. To view the reports, presentations and other products from our efforts, including detailed presentation notes from this workshop, please go to: www.islandinstitute.org/climateofchange