

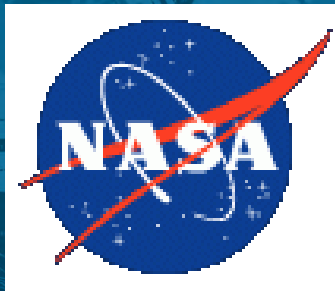
Understanding stakeholder decisions to guide forecasting efforts

Katherine Mills, Andrew Pershing, Richard Wahle

4th International Symposium

Effects of Climate Change on the World's Oceans

June 7, 2018



Gulf of Maine
Research Institute

Science. Education. Community.





Outline

- Forecasting in climate change context
- Stakeholder decisions and time frames
- Forecast products
- Reflections on experiences, best practices, lessons learned

Forecasting in a climate change context

- Rapid change at multiple time scales
- Moving beyond historical experience



New England Lobster Fishery

- Valued at over \$669 M in 2016
- Most valuable species fished in U.S. since 2014
- Accounts for 88% of New Hampshire's landed value and 80% of Maine's



New England Lobster Fishery



Photo: Michelle Brown, GMRI



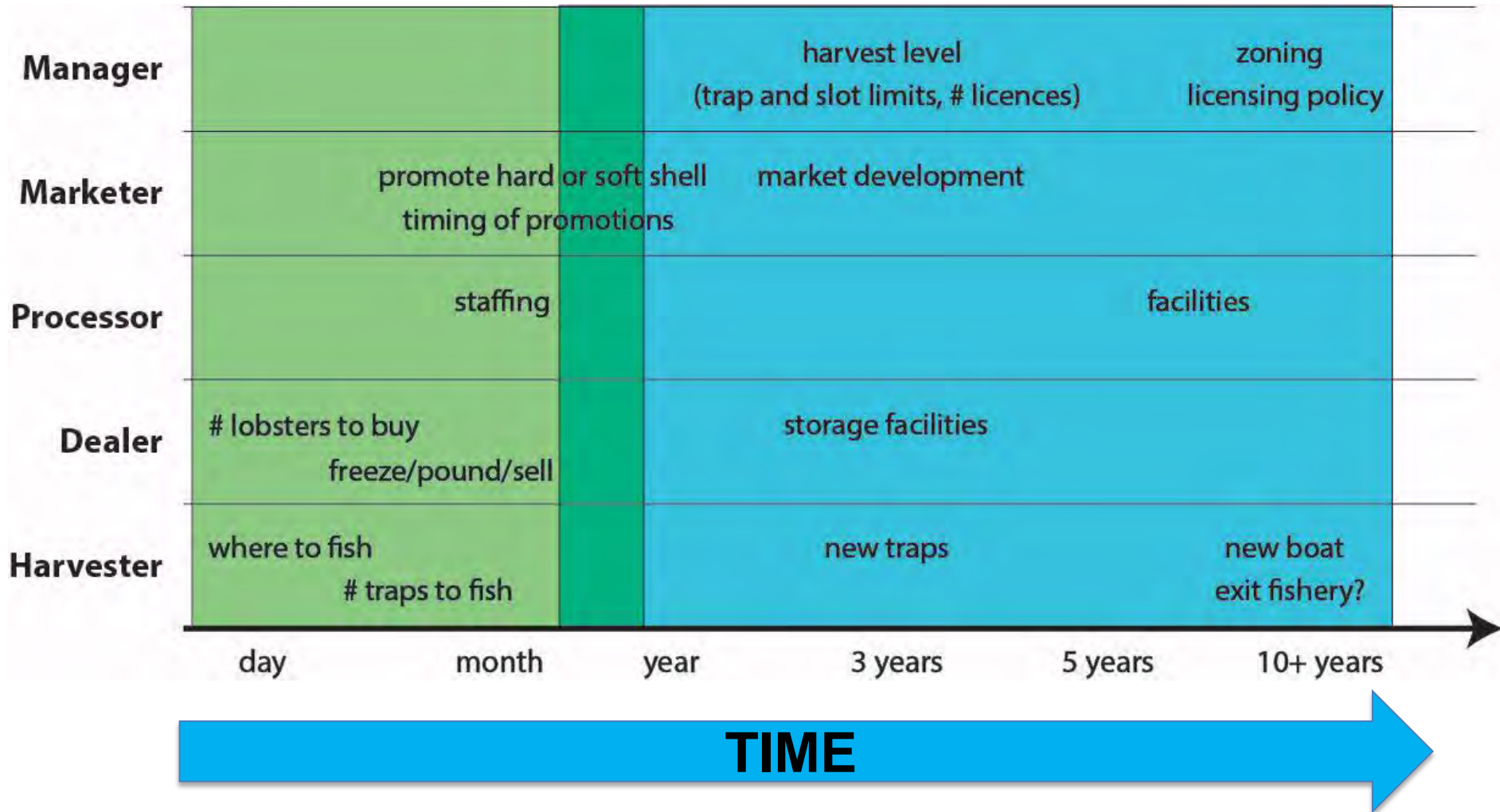
Photo: Curt Brown, Ready Seafood



Photo: Maine Lobstermen's Association



Stakeholder decisions



Forecast time scales

months

years

decades



SEASONAL

When do we expect the lobster fishery to shift into its high landings summer mode?

MULTI-YEAR

What will landings be 5-10 years in the future?

MULTI-DECADE

How abundant will lobster be in the coming decades?

Forecast time scales

months

years

decades



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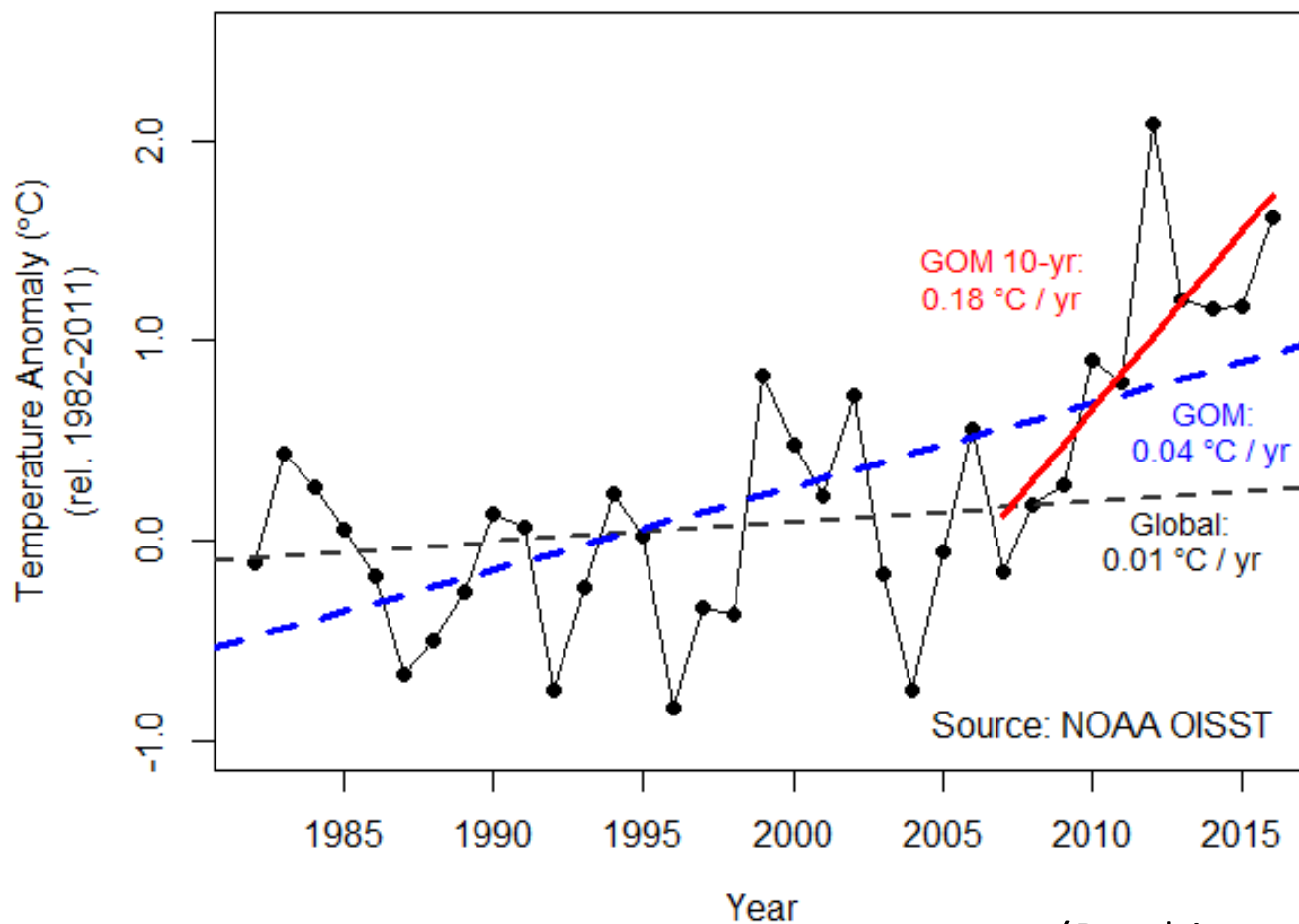
Risk
management



Planning
and policy

Gulf of Maine setting

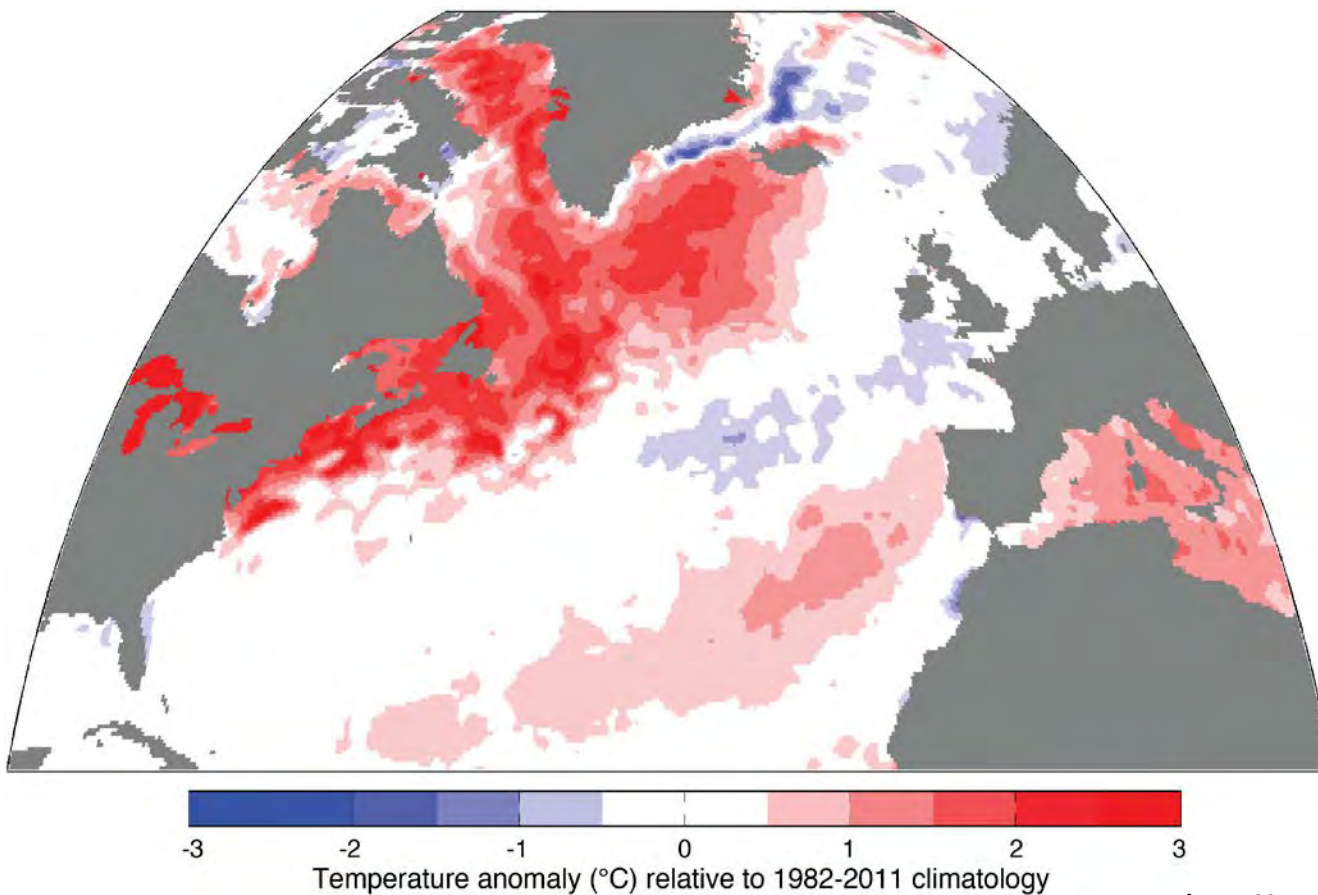
Gulf of Maine Sea Surface Temperature



(Pershing et al. 2015)

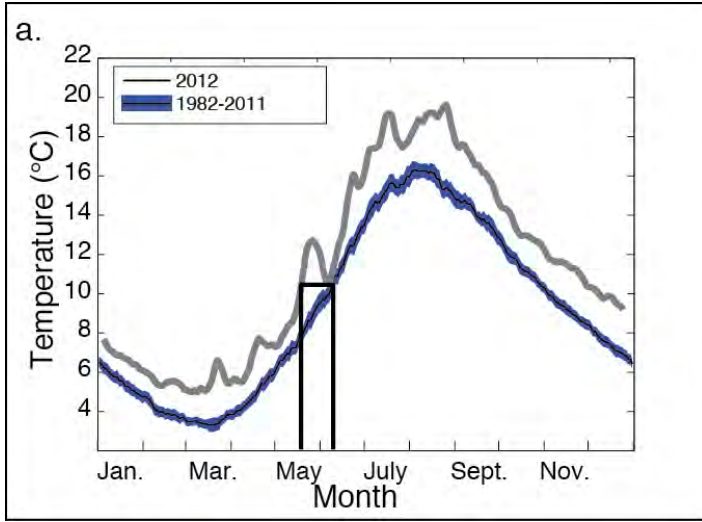
Gulf of Maine setting

2012 Northwest Atlantic heat wave



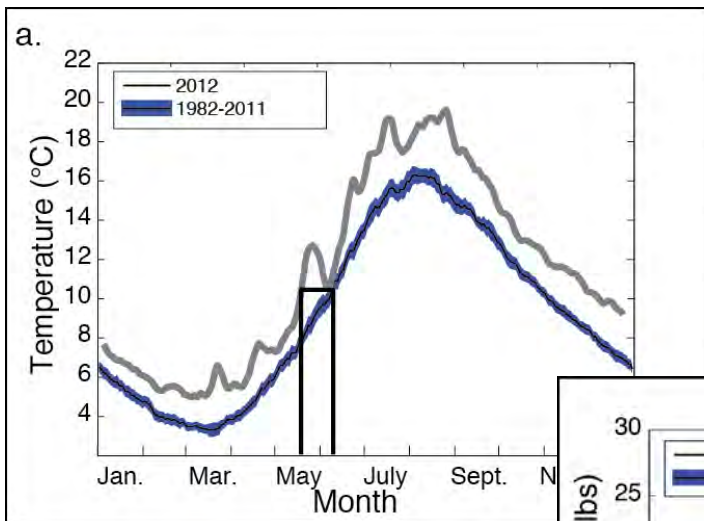
(Mills et al. 2013)

Seasonal forecast

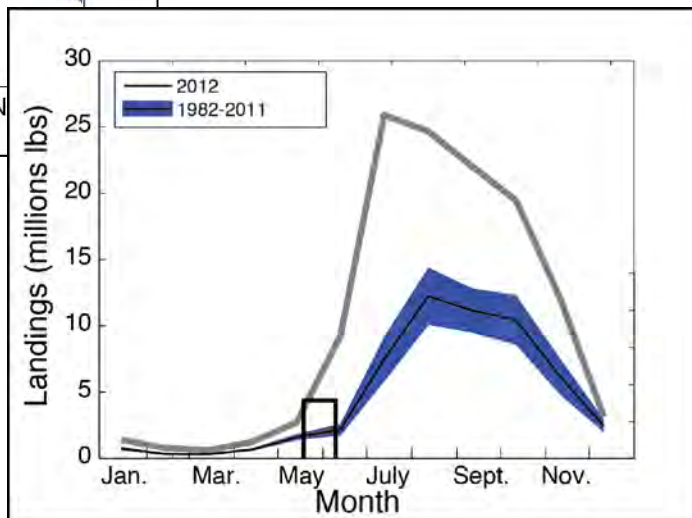


(Mills et al. 2013)

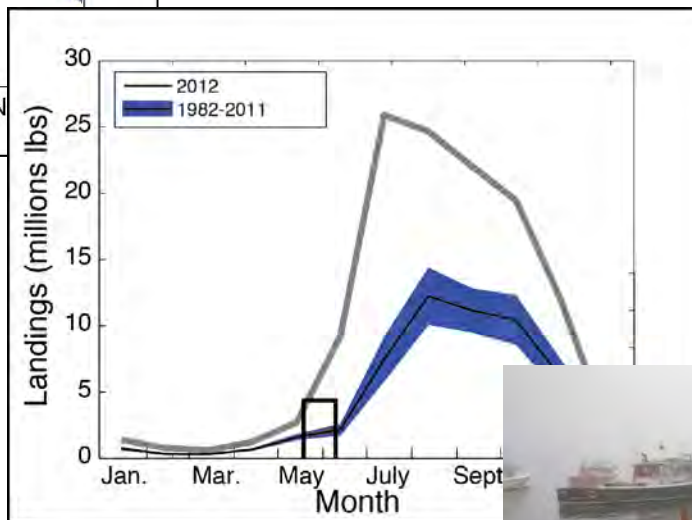
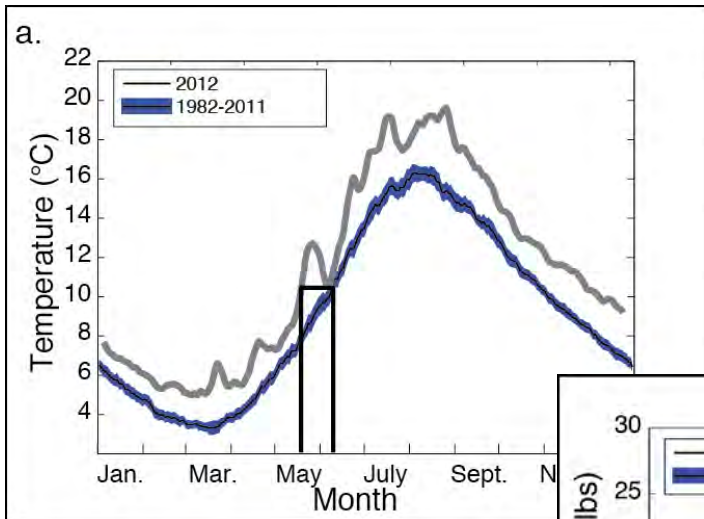
Seasonal forecast



(Mills et al. 2013)



Seasonal forecast



(Mills et al. 2013)



Seasonal forecast

- Motivation

- Conversations with industry leaders and managers:

Could we have known?

Could this have been predicted?

Seasonal forecast

- Motivation

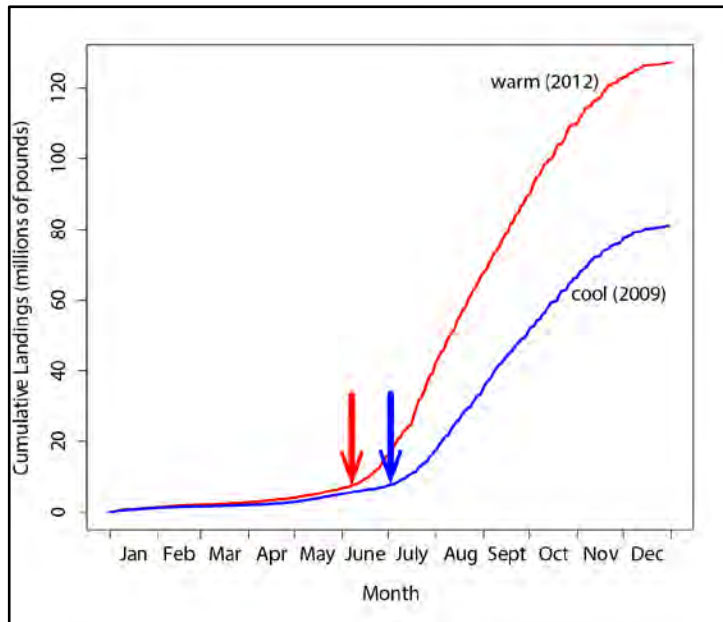
- Conversations with industry leaders and managers:

Could we have known?

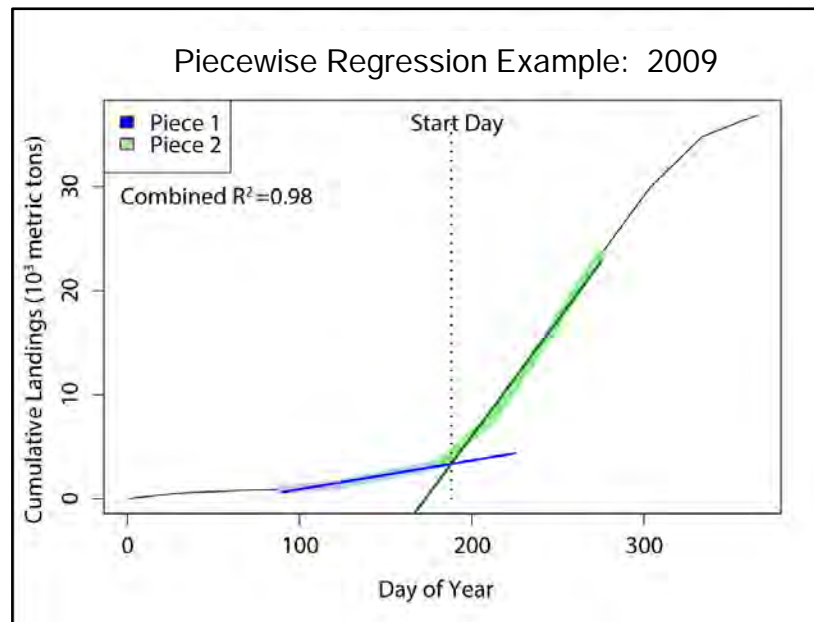
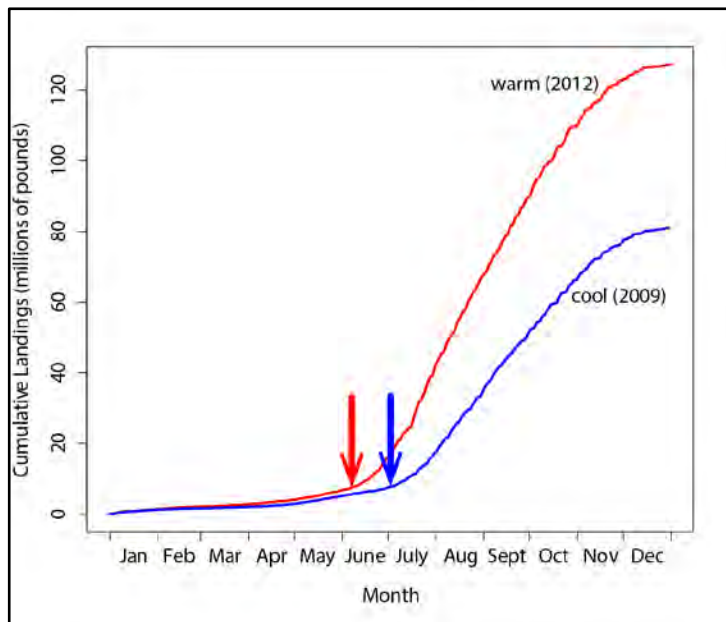
Could this have been predicted?

- Information to supply chain

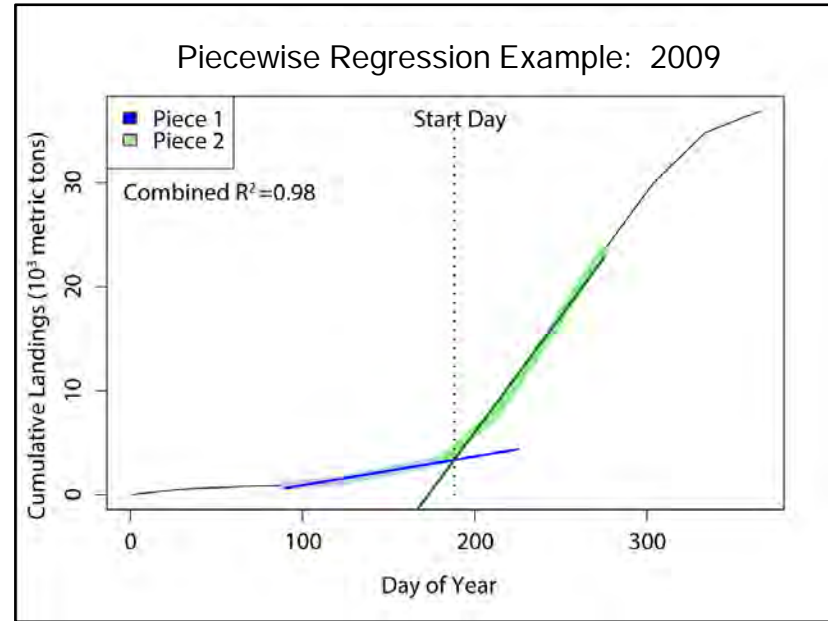
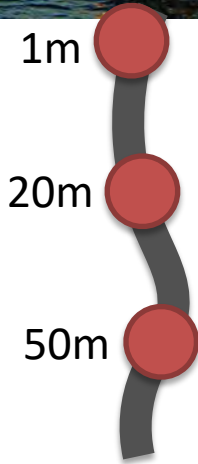
Seasonal forecast



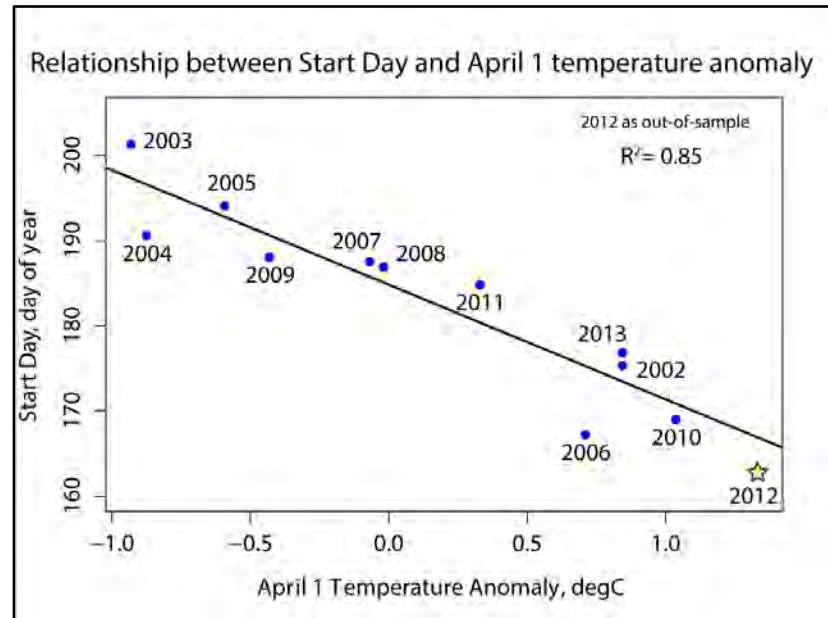
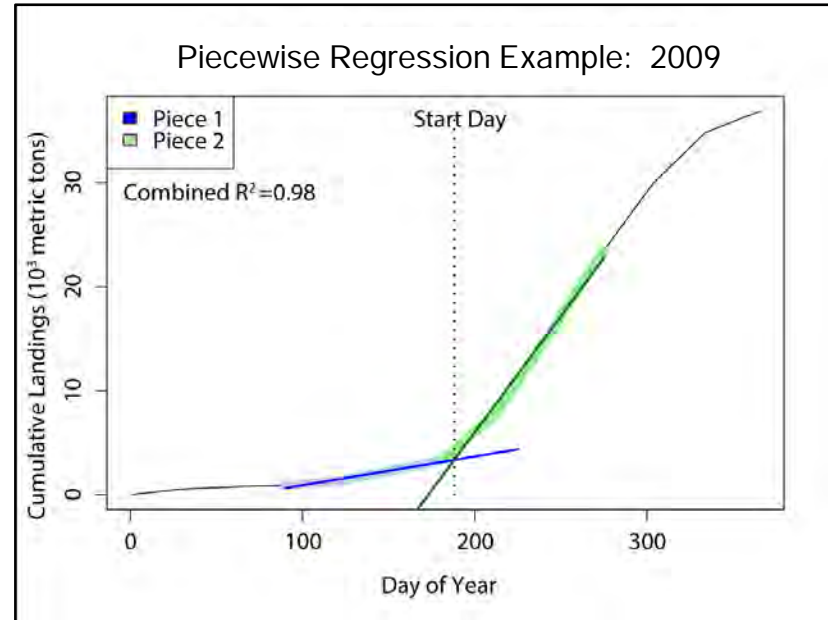
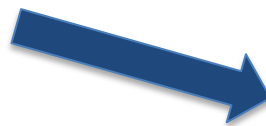
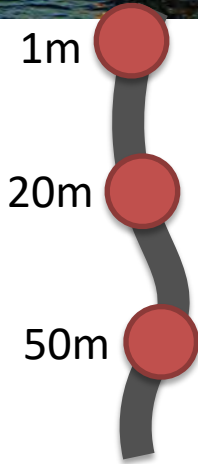
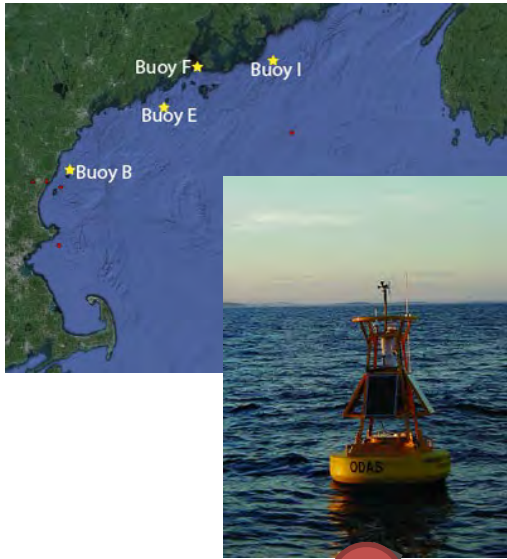
Seasonal forecast



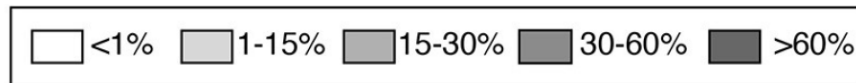
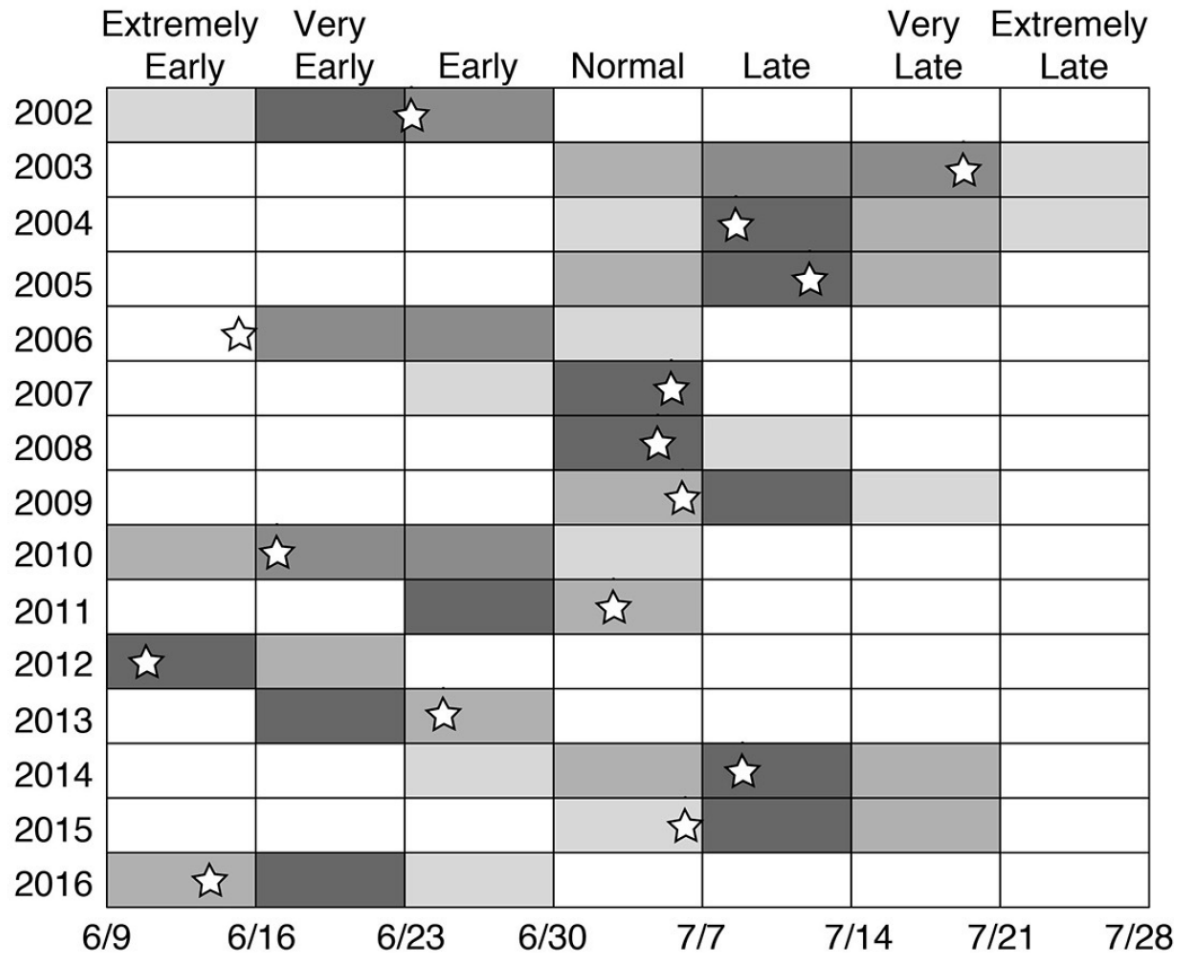
Seasonal forecast



Seasonal forecast

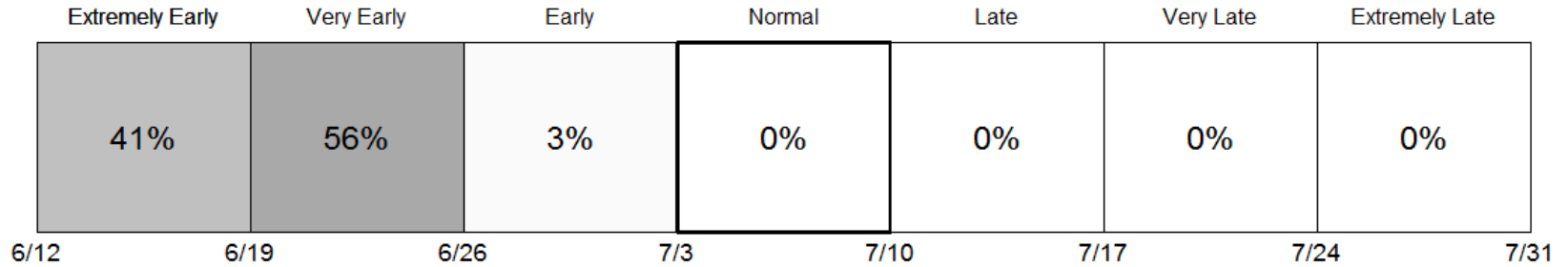


Out-of-sample skill for April 1 forecast

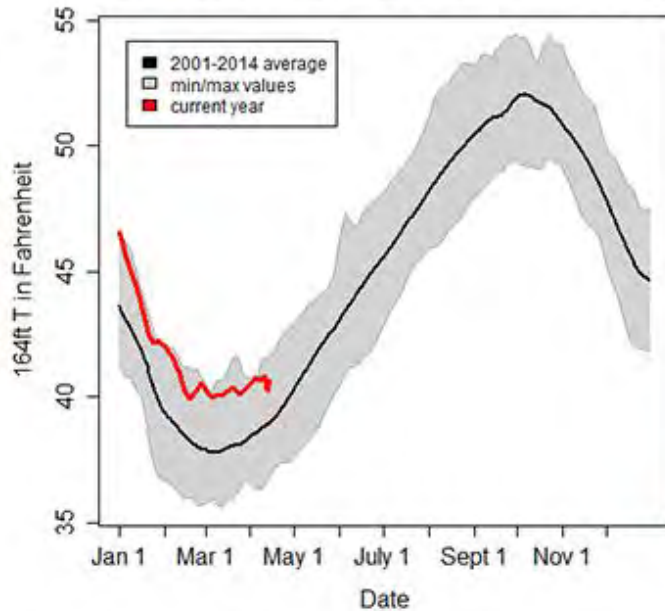


(Mills et al. 2017)

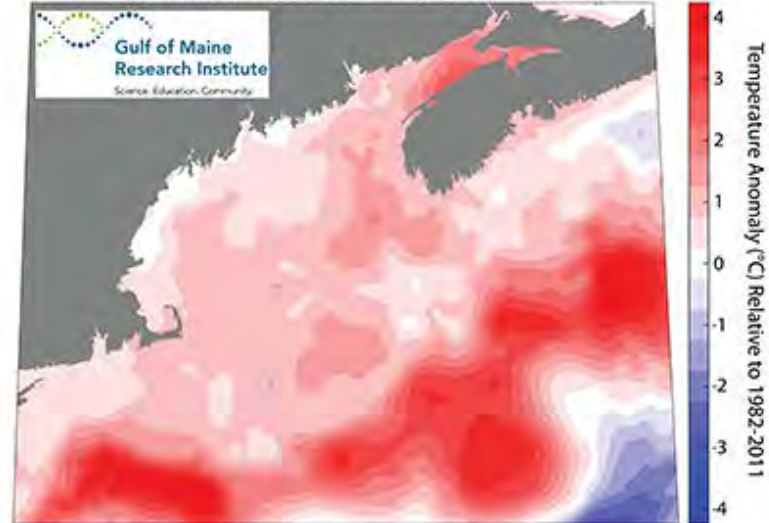
April 13 Forecast



Gulf of Maine: water temperature (164ft depth)



Sea Surface Temperature Anomalies for April 6-13, 2016



Seasonal forecast

	Extremely Early	Very Early	Early	Normal	Late	Very Late	Extremely Late	
March 2	55%	41%	4%	0%	0%	0%	0%	
March 9	47%	50%	3%	0%	0%	0%	0%	
March 16	53%	46%	1%	0%	0%	0%	0%	
March 23	68%	31%	1%	0%	0%	0%	0%	
March 30	36%	62%	2%	0%	0%	0%	0%	
April 6	51%	48%	1%	0%	0%	0%	0%	
April 13	41%	56%	3%	0%	0%	0%	0%	
	6/12	6/19	6/26	7/3	7/10	7/17	7/24	7/31

Informal industry input

Scale disconnect

- Statewide forecast vs. local experience
- Limited relevance to lobstermen

Confusion over weekly updates

- Attempt to convey uncertainty

Lobstermen already know on-water conditions

Our own concerns

Inability to update data

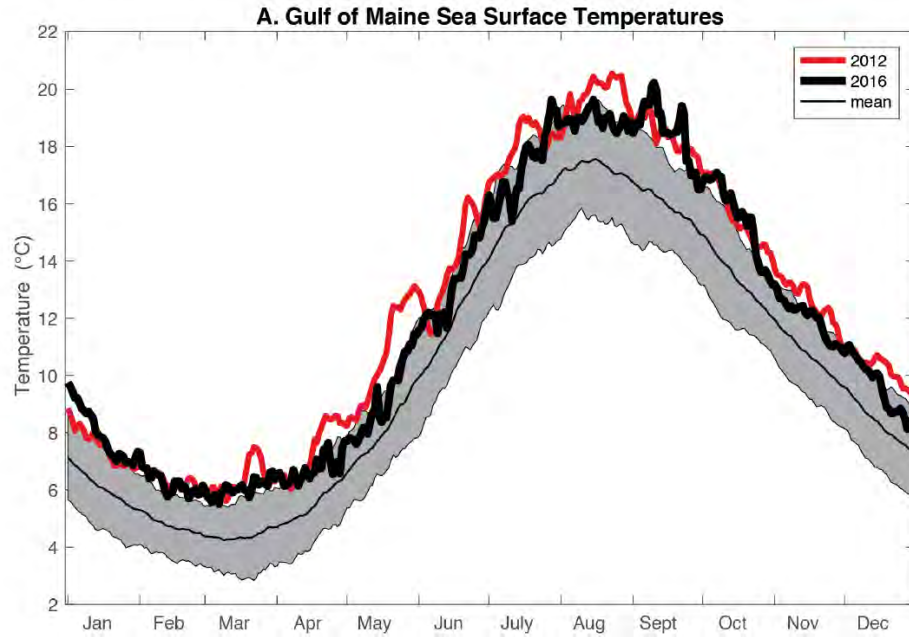
- Unable to see how actual landings compared to forecast for nearly a year

Lack of experience among users

Lobstermen more engaged than other stakeholders

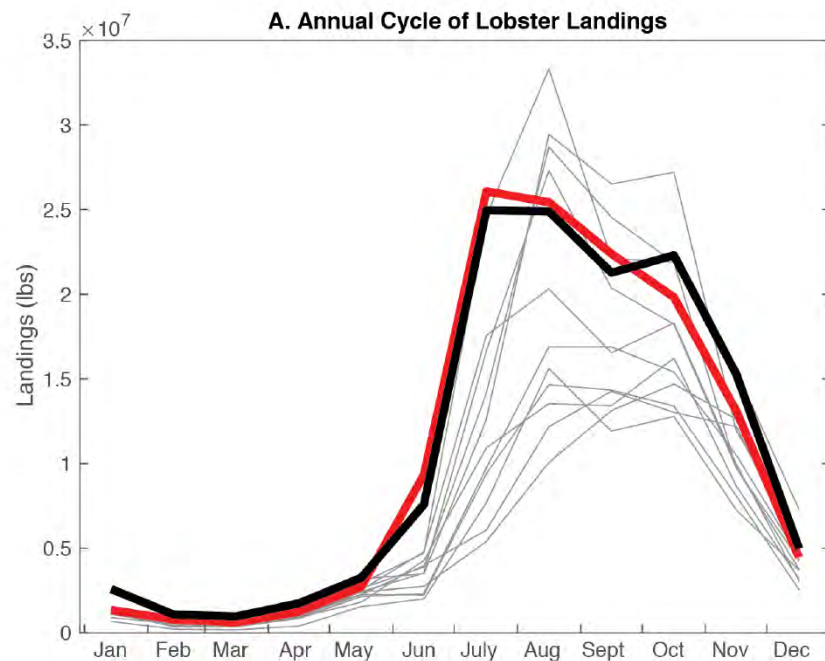
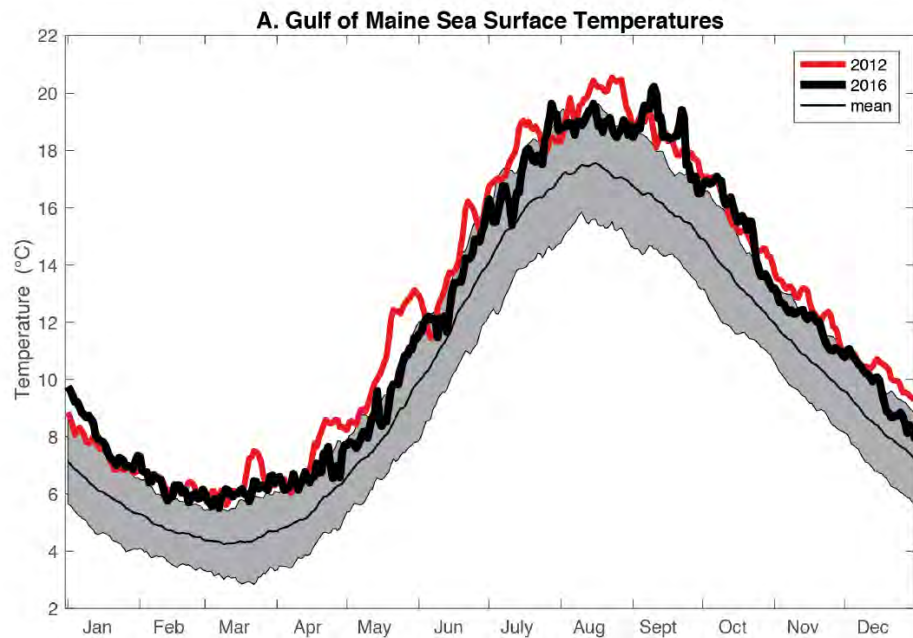
- Limited use by or input from dealers

2012 / 2016 contrast

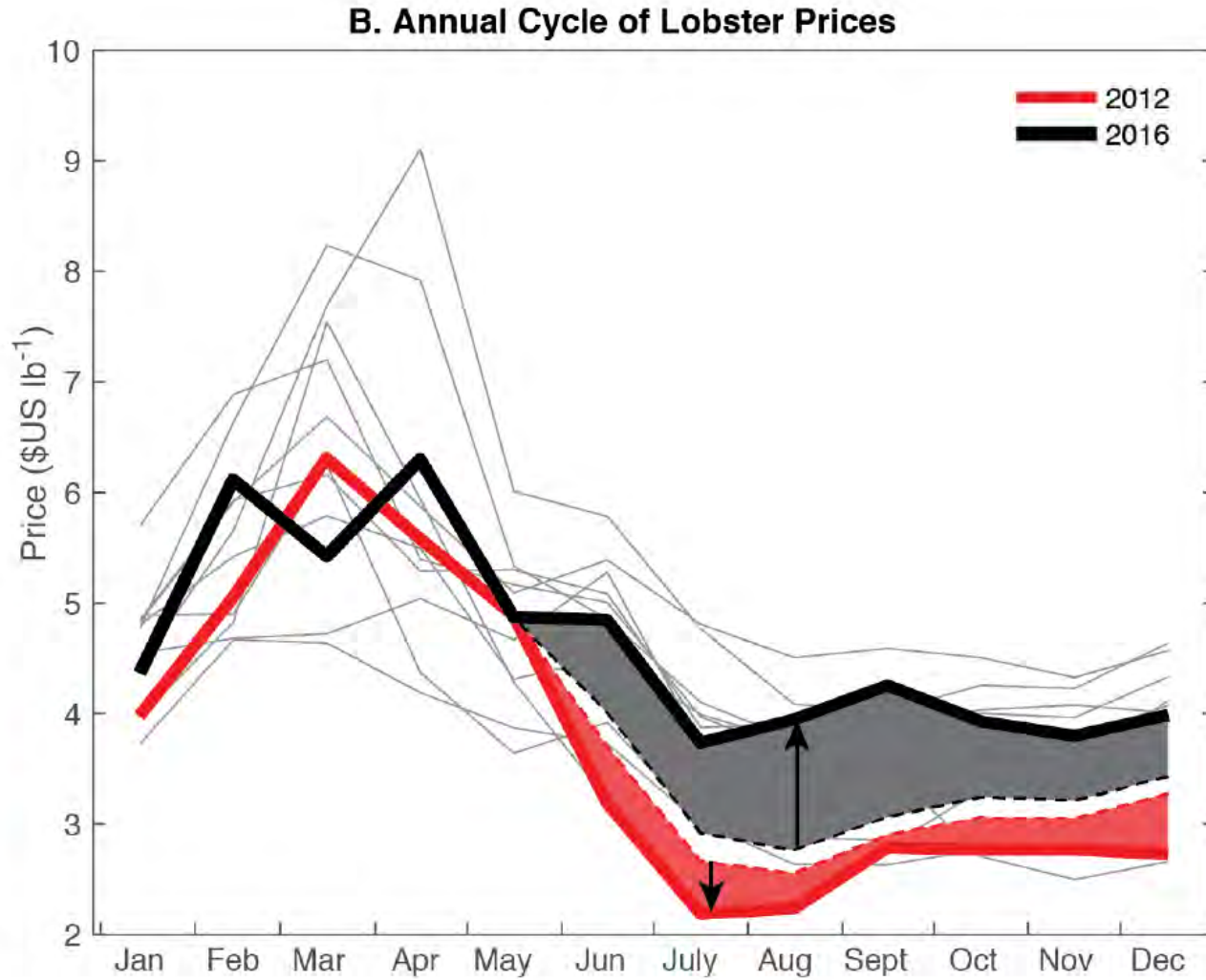


(Pershing et al. *in review*)

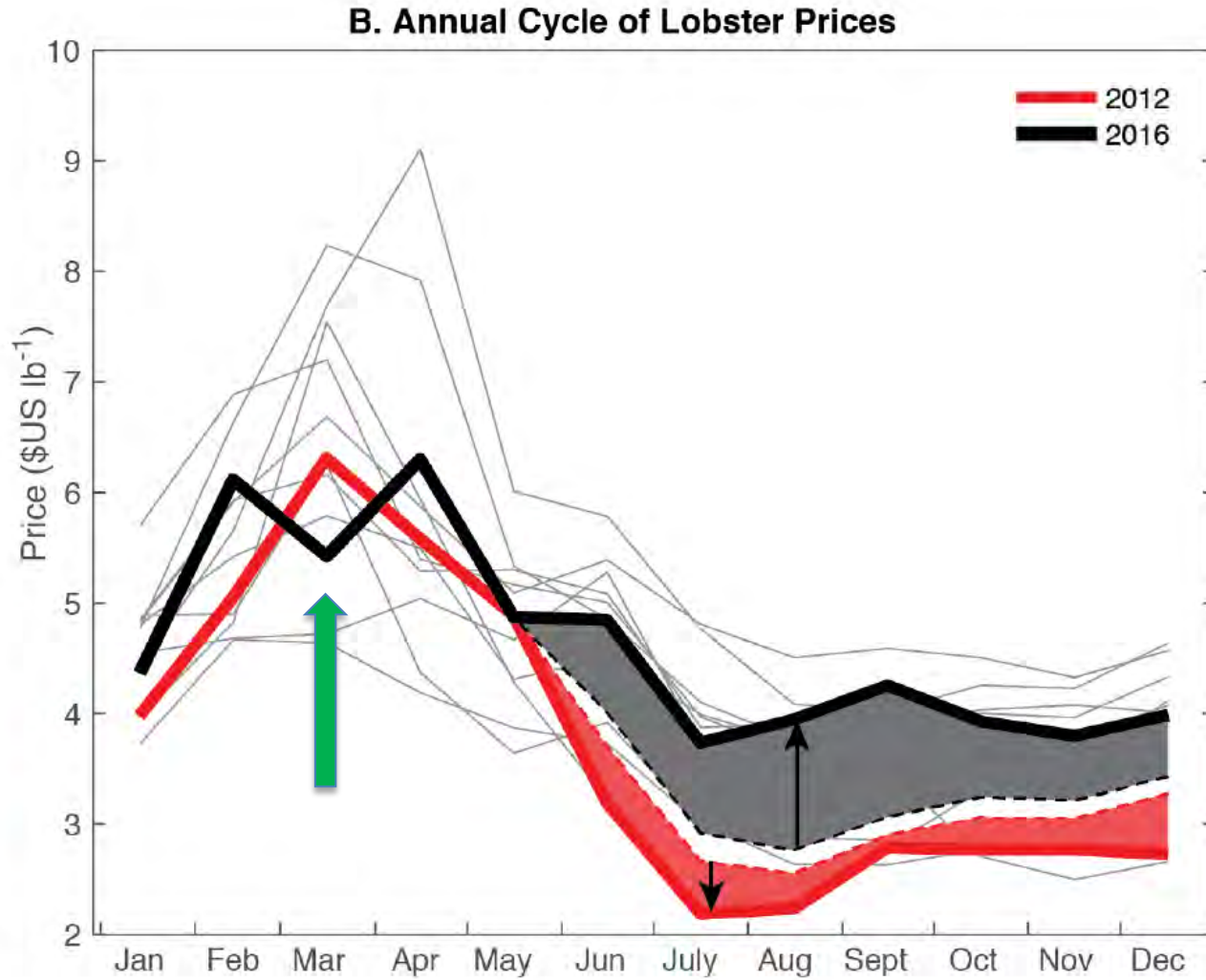
Seasonal forecast



(Pershing et al. *in review*)



(Pershing et al. *in review*)



(Pershing et al. *in review*)

Second annual lobster forecast predicts early season start

(Undercurrent News)

Maine Lobsters' Early Shed Could Impact Price

(NECN)

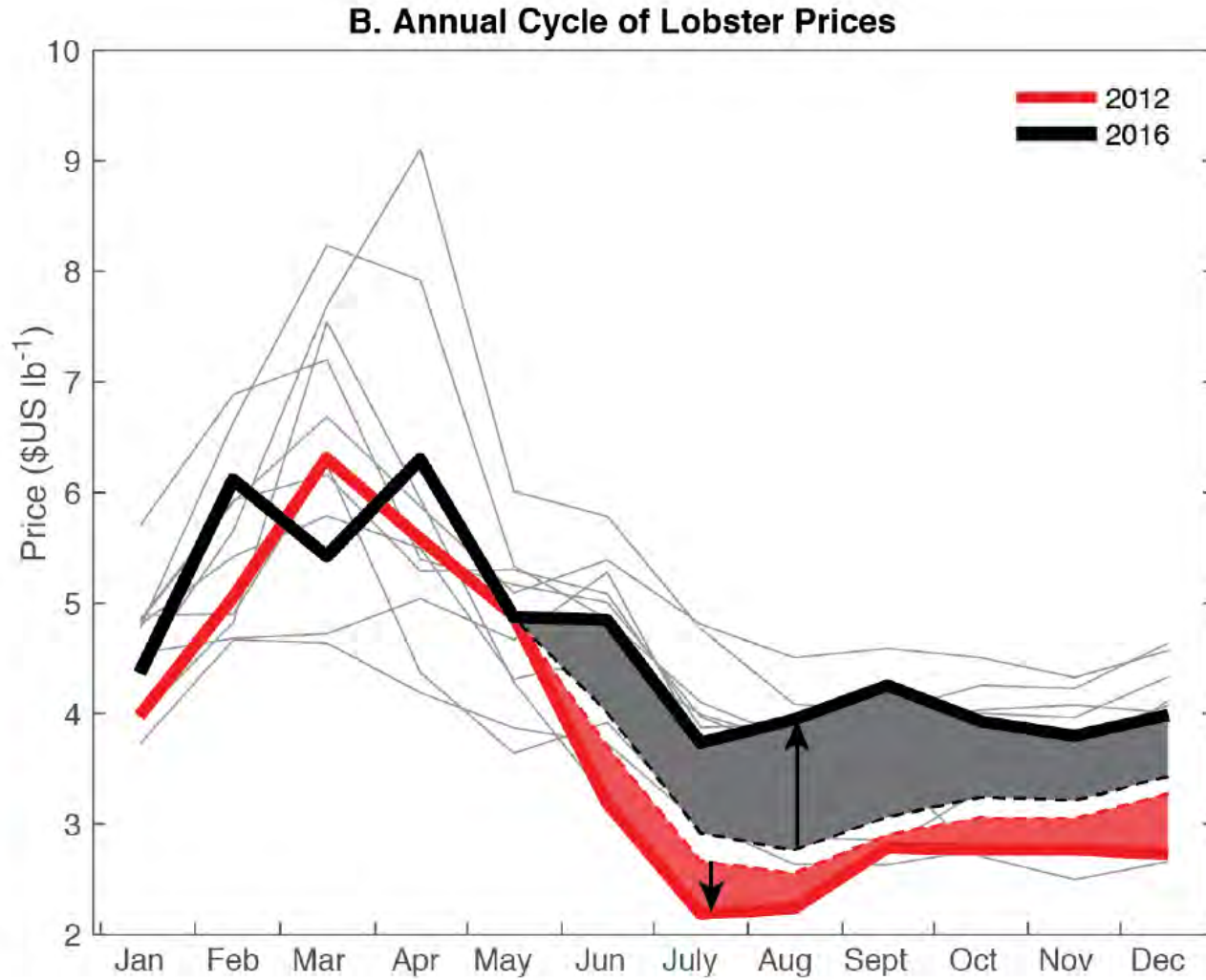
Summer price drop for live lobsters may come early this year

(Associated Press)

Maine lobster industry wary as warm waters suggest repeat of disastrous 2012 season

Scientists see signs of another 'ocean heat wave,' when early shell-shedding led to a supply glut, diving prices and a season of turmoil. Are we better prepared this time?

(Portland Press Herald)



(Pershing et al. *in review*)

Forecasting advisory panel

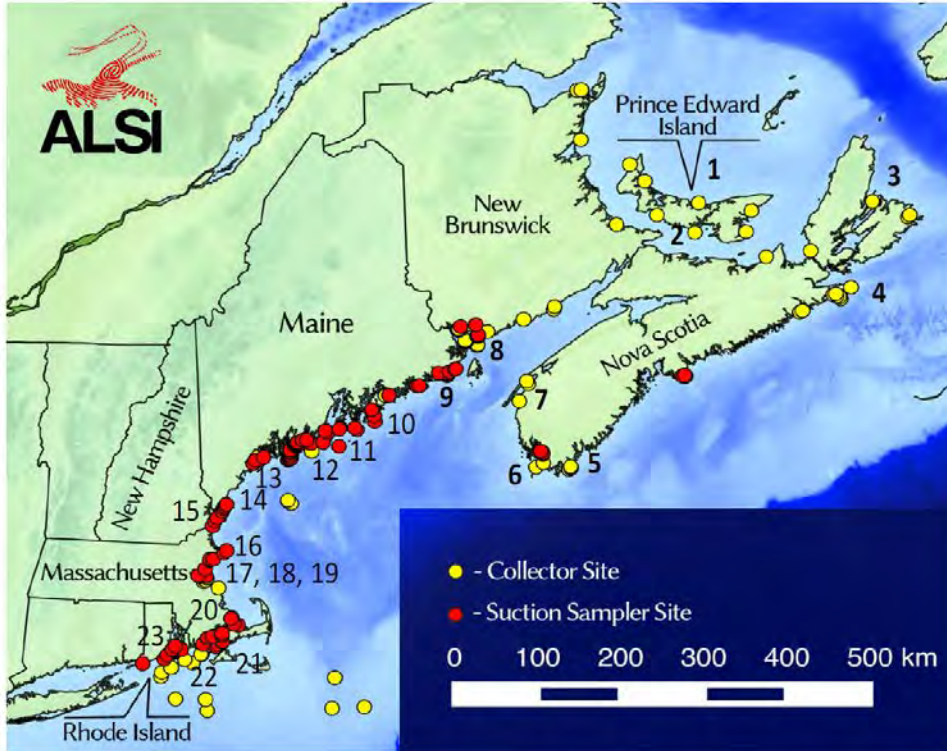
- 8 industry members (mostly harvesters, 2 dealers), 1 agency biologist/manager
- 4 key points of input:
 - Value
 - Improvements
 - Alternatives that would be useful
 - Communication



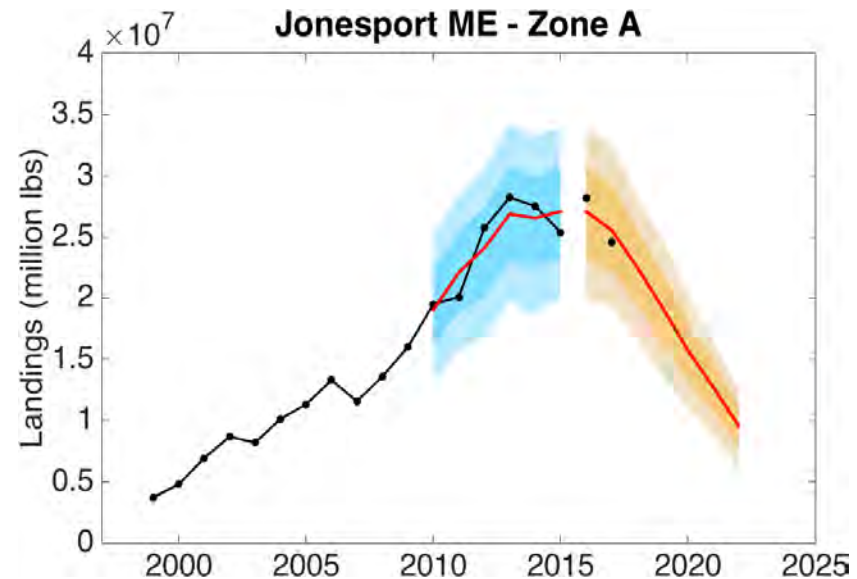
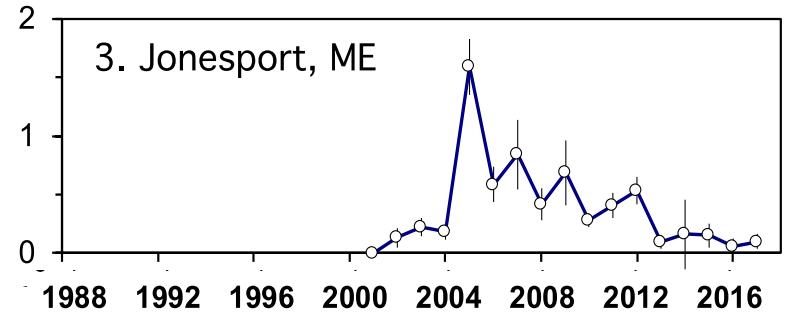
Forecasting advisory panel

- Key pieces of advice:
 - Forecast environmental conditions or species, not fishery or industry
 - Communicate forecast to industry only
 - Forecast to long time scales (years to decades)
 - Near-term has potential to create disruptions
 - Lobstermen observe conditions and have good sense of what is happening at short time scales

Multi-year forecast

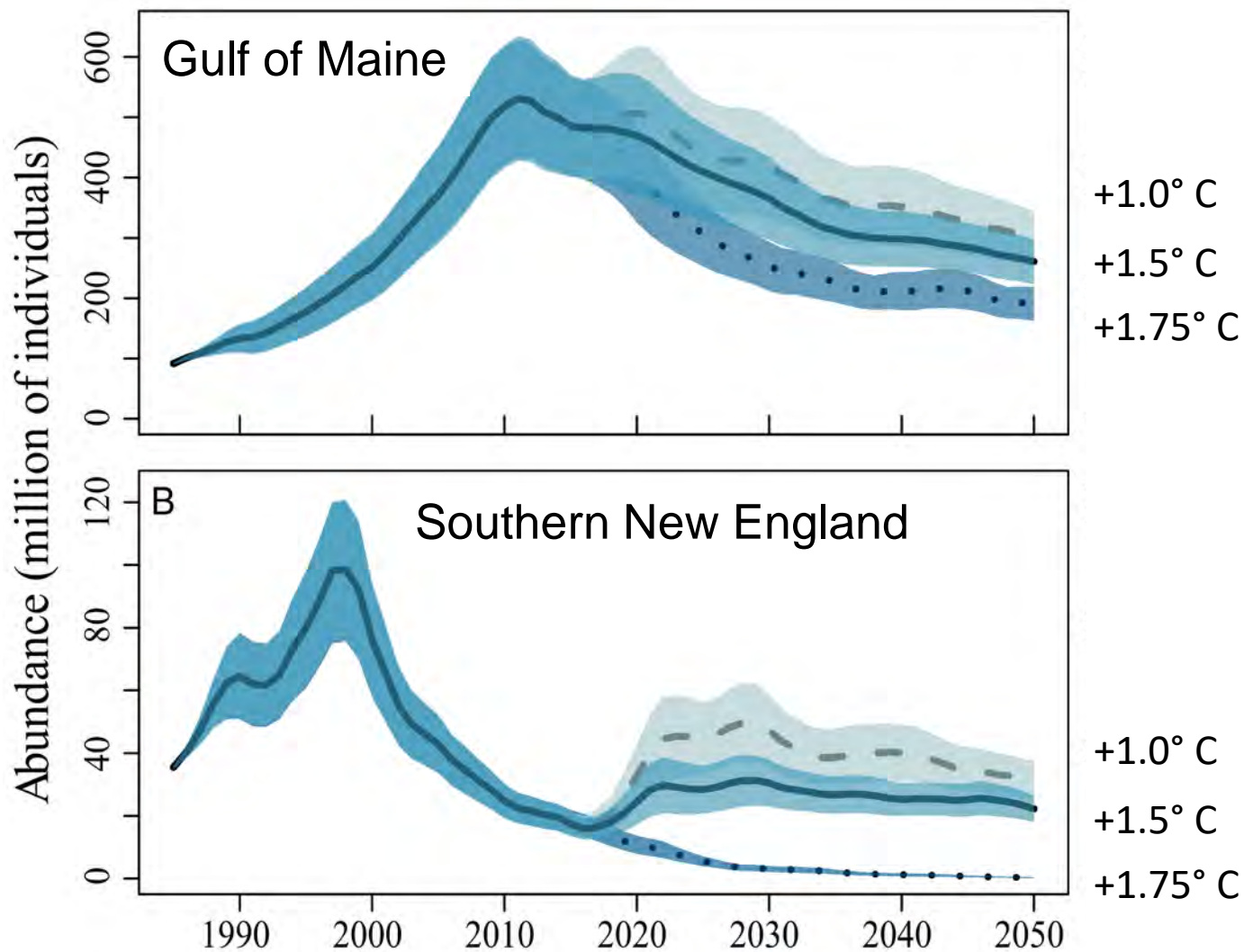


Young of Year (m^{-2})



Oppenheim talk, S2, 18:00

Multi-decadal projection



(Le Bris et al. 2018)



Multi-decadal projection

Maine conservation efforts have helped lobsters as oceans warm

(Bangor Daily News)

Gulf of Maine lobster population past its peak, study says, and a big drop is due

Scientists say warming waters in the Gulf of Maine will lower lobster populations 40 to 62 percent over the next 30 years, but conservation measures the state adopted decades ago will mitigate the impact.

Our View: Time for Maine to look past lobster boom years

A study predicting a long-term decline in lobster landings is a prod to consider what's next.

Letter to the editor: Don't look past the lobster boom; work to protect what we have

(Portland Press Herald)

State disputes study that predicts sharp decline in Gulf of Maine lobsters

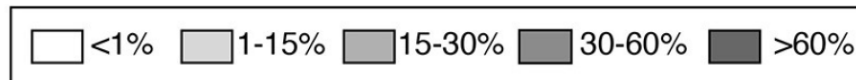
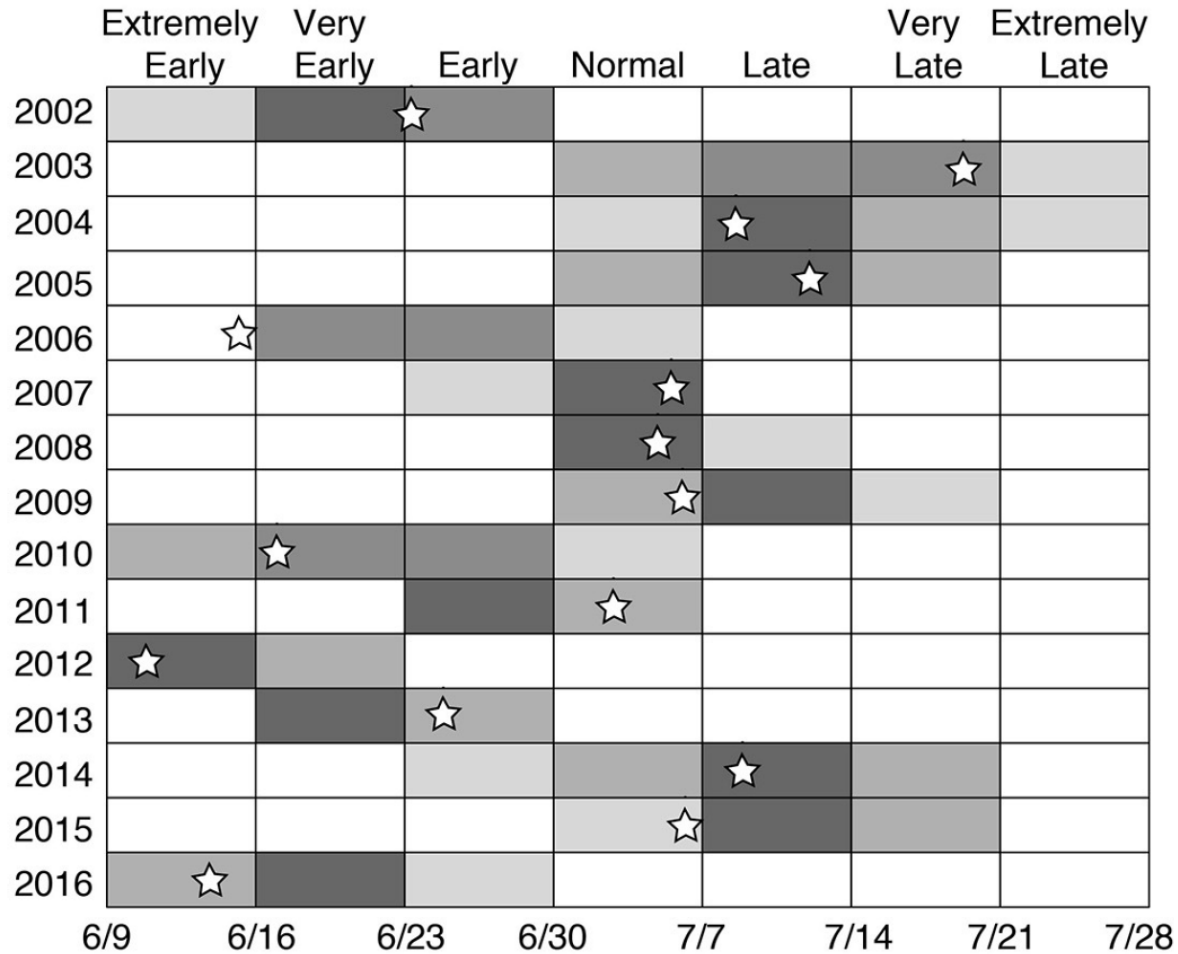
The Department of Marine Resources won't be using researchers' model to make management decisions, saying that forecasting fishery populations 30 years out is extremely difficult.

(Portland Press Herald)

Maine Lobster Dealers Association Director Annie Tselikis said the Gulf of Maine Research Institute, a nonprofit based in Portland, had made inaccurate molt forecasts that had spooked buyers and hurt the industry.

“GMRI has a track record with forecasting in the lobster industry, and it isn’t a good one,” Tselikis said. “If they can’t forecast on a four-month timeline, how are we supposed to put stock in a 30-year report?”

Out-of-sample skill for April 1 forecast



(Mills et al. 2017)

Lessons learned

- Best practices can create unexpected challenges
 - Convey uncertainty
 - Define audience
 - Engage users
- Complicated supply chain adds complications
 - Competing stakeholder interests
 - Different decision points
 - Can influence winners and losers
 - Potential for industry disruption
- Time scales of information influence perceptions
 - Year after forecast issued before we can validate
- Media

Lessons learned

- Trust
 - Long to build, fast to lose
 - Ongoing dialogues not always sufficient
 - Messenger matters
- Challenge: Role of science and scientists
 - Obligation to share knowledge evenly and fairly
 - Desire to offer useful information
 - Potential for creating disruptions to industry

Questions?

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