Seasonal forecasts for the timing of lobster landings

Andrew Pershing, Katherine E. Mills, Christina M. Hernandez
Gulf of Maine Research Institute

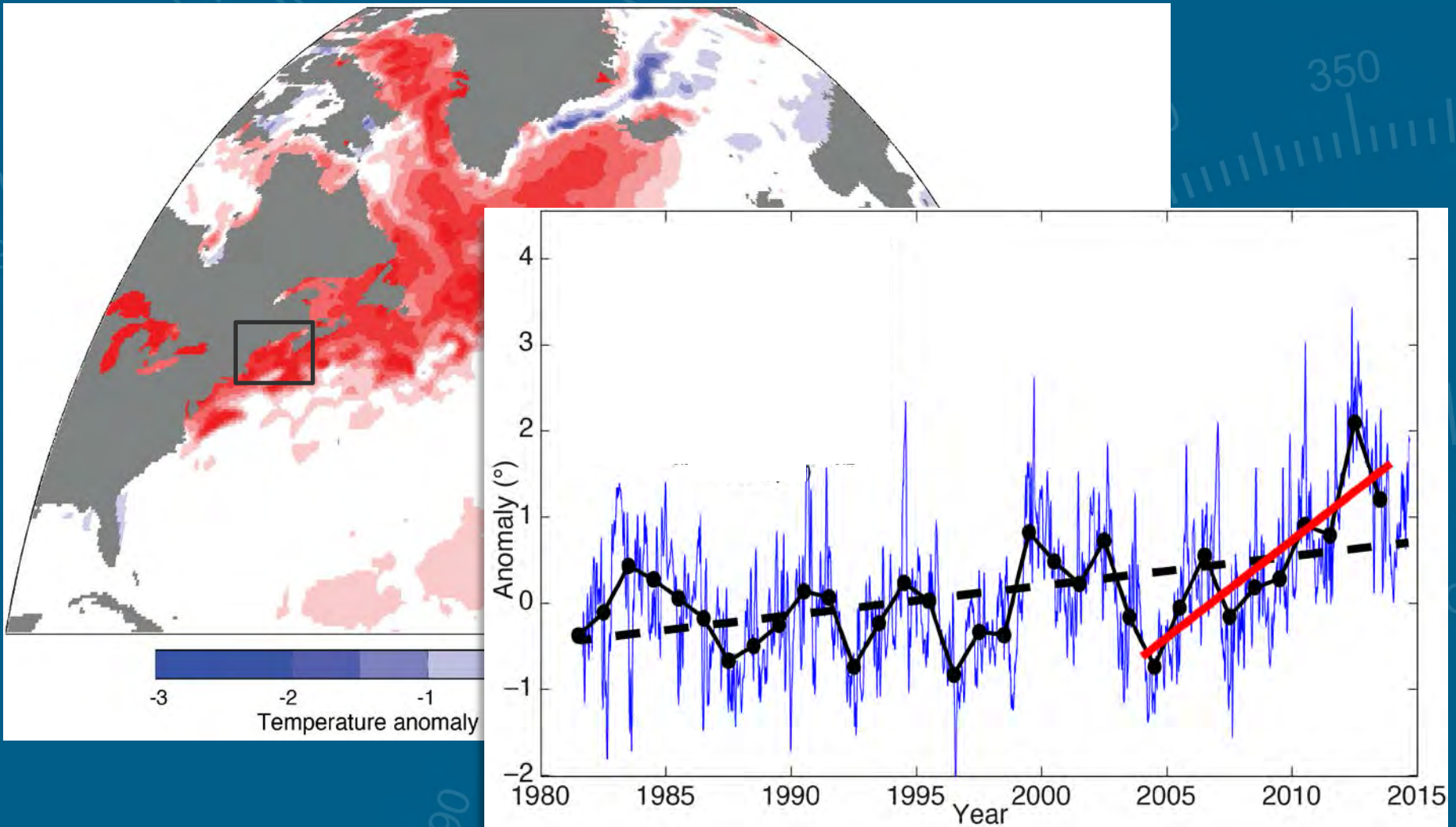Nicholas R. Record
Bigelow Laboratory for Ocean Sciences

Gulf of Maine Research Institute
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GULF OF MAINE COFFEE

Outline

- 2012: when good lobsters go bad
- Is the phenology of landings tied to temperature?
- Can we predict landings phenology?
- Forecasts

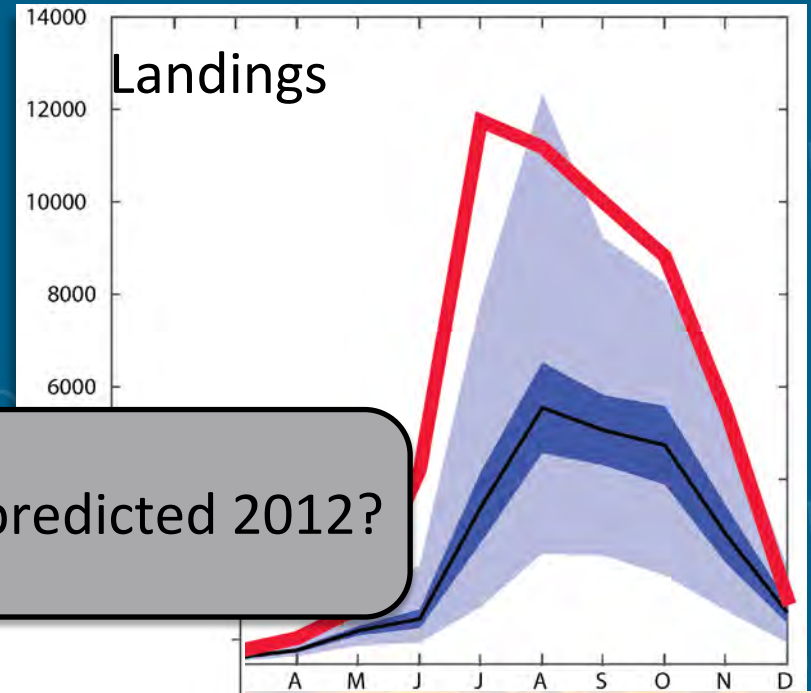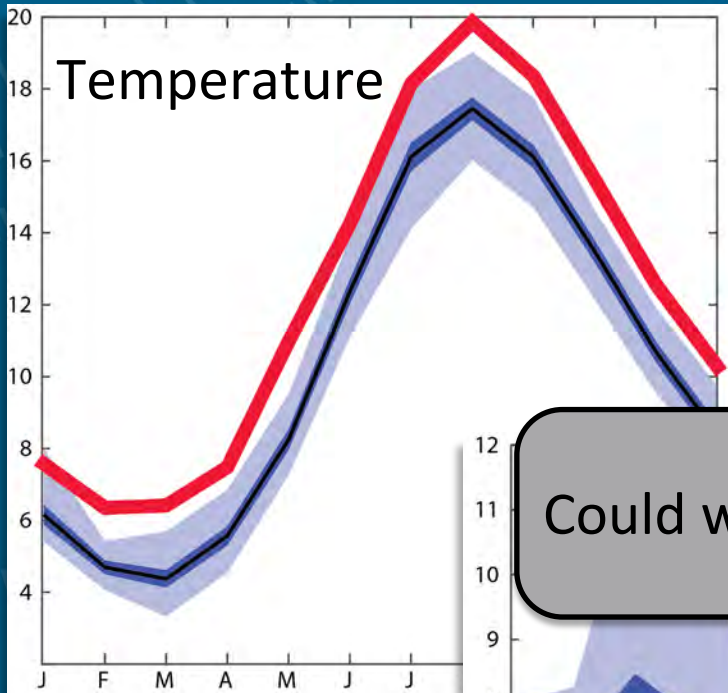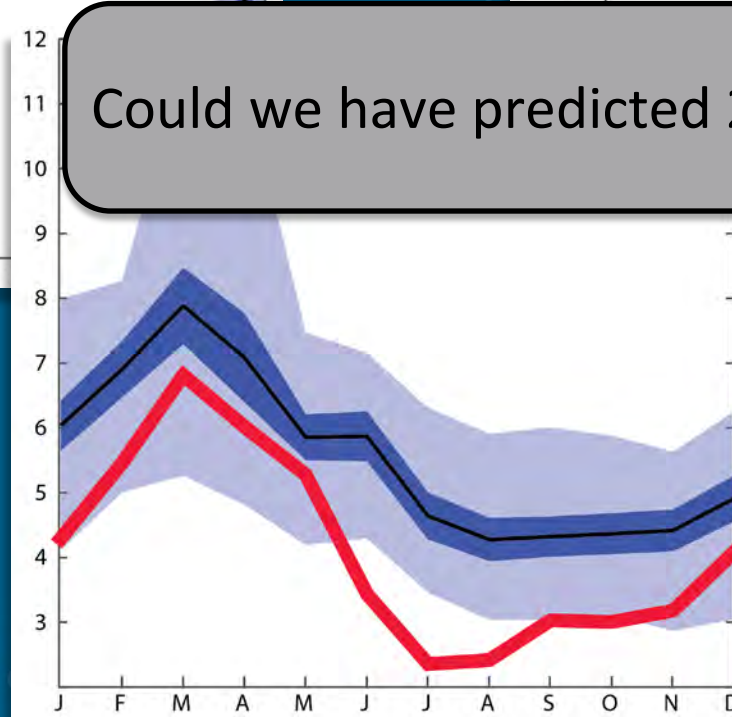# 2012 Ocean Heatwave

Mills et al. (2013)Fisheries management in a changing climate: lessons from the 2012 ocean heat wave. O

2012 Ocean Heatwave
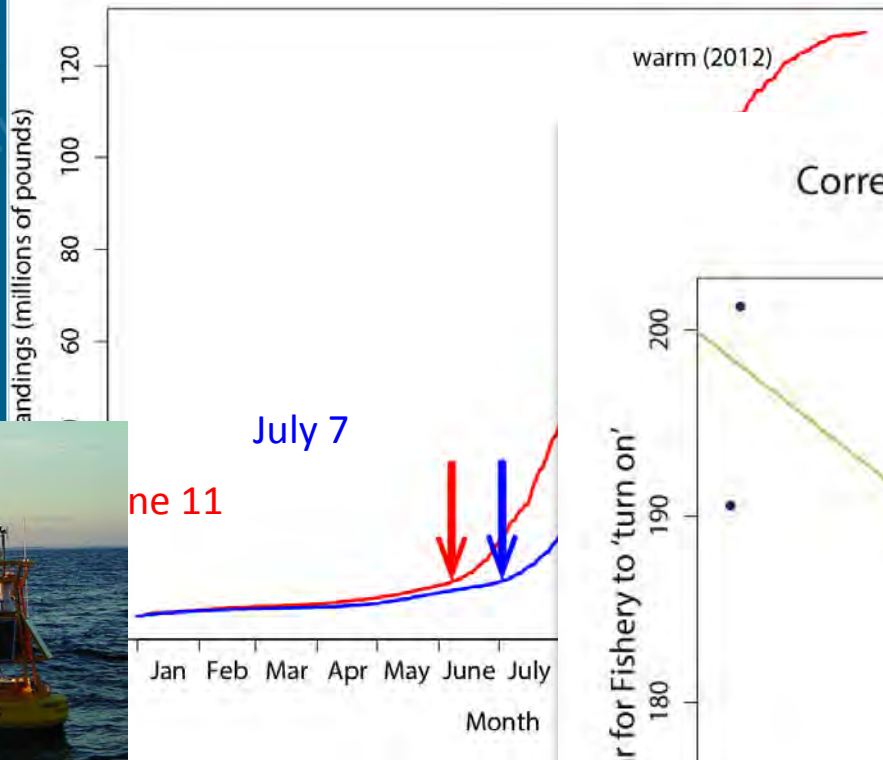

Temperature

Landings

Could we have predicted 2012?

Temperature and Landings
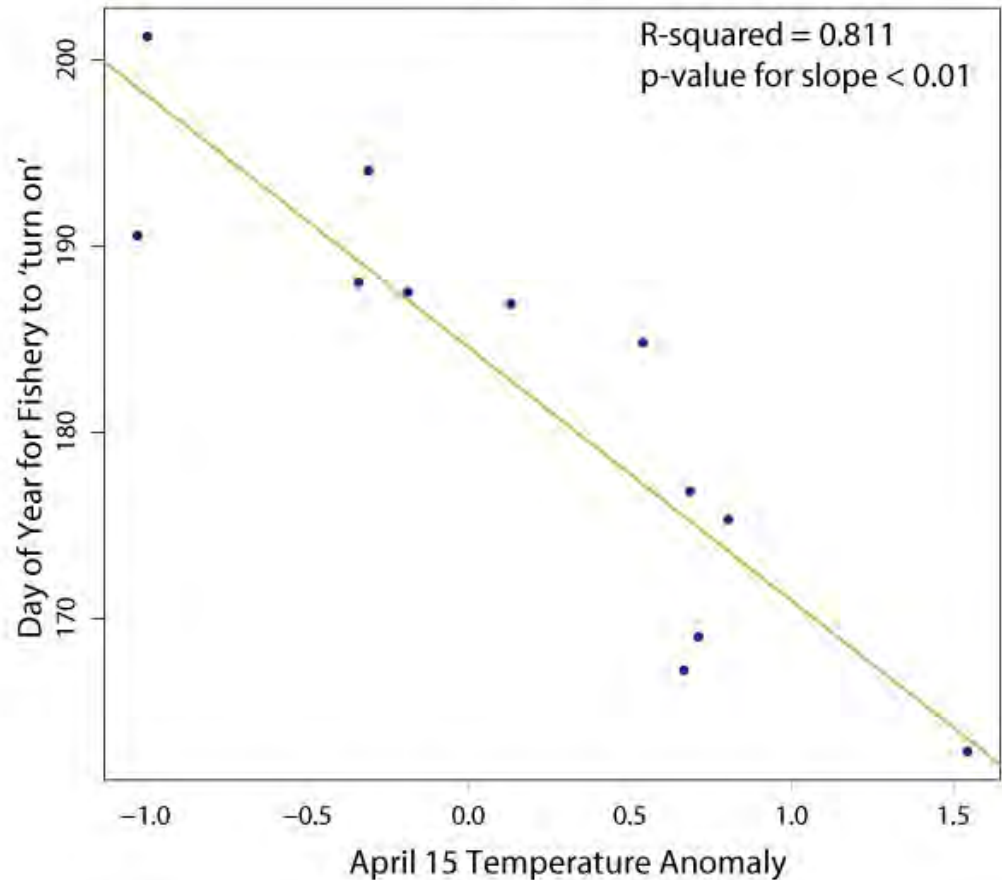
Predictability

Average 50m Temperature Linear Regression R-squared

Red: p-value less than 0.05

April 15

Predictability

1m

20m

50m

March

Predictability

1m

20m

50m

March

Predictability

1m

20m

50m
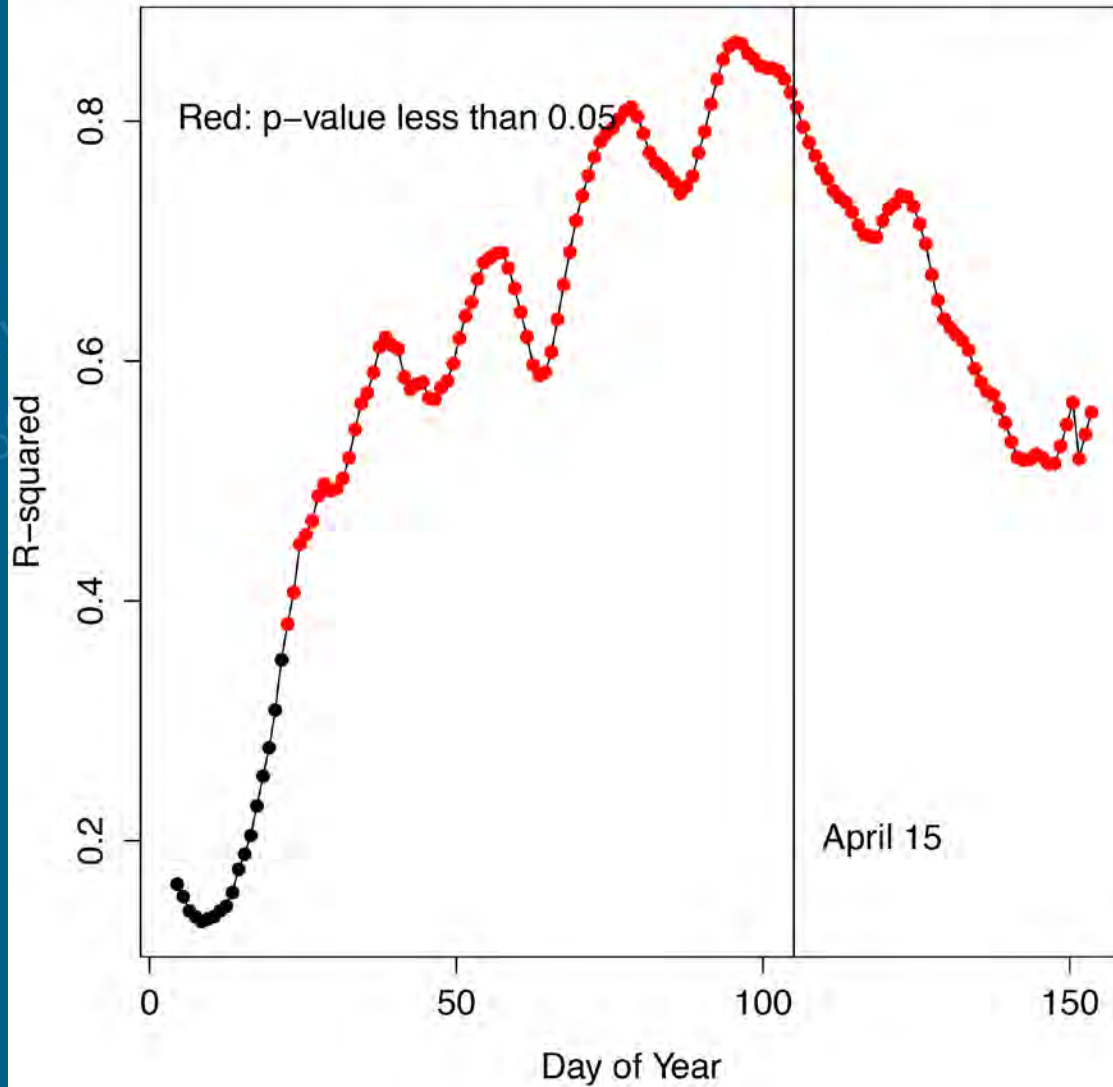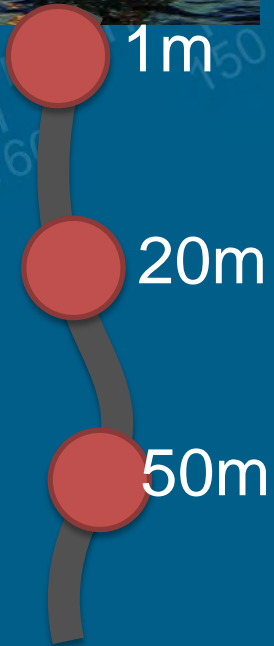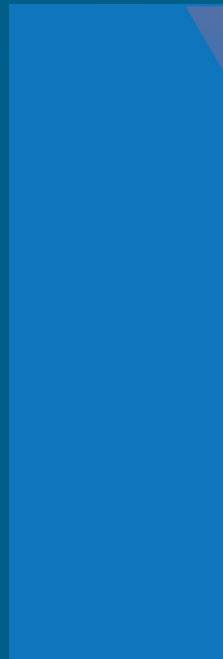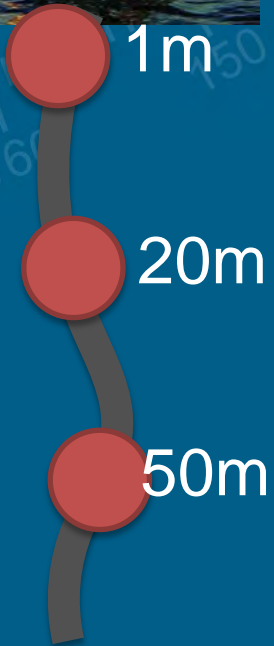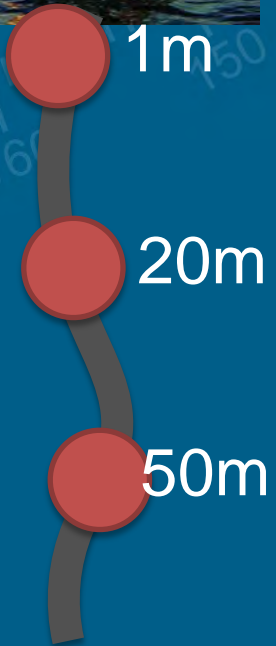
March   April

Operational Forecasts
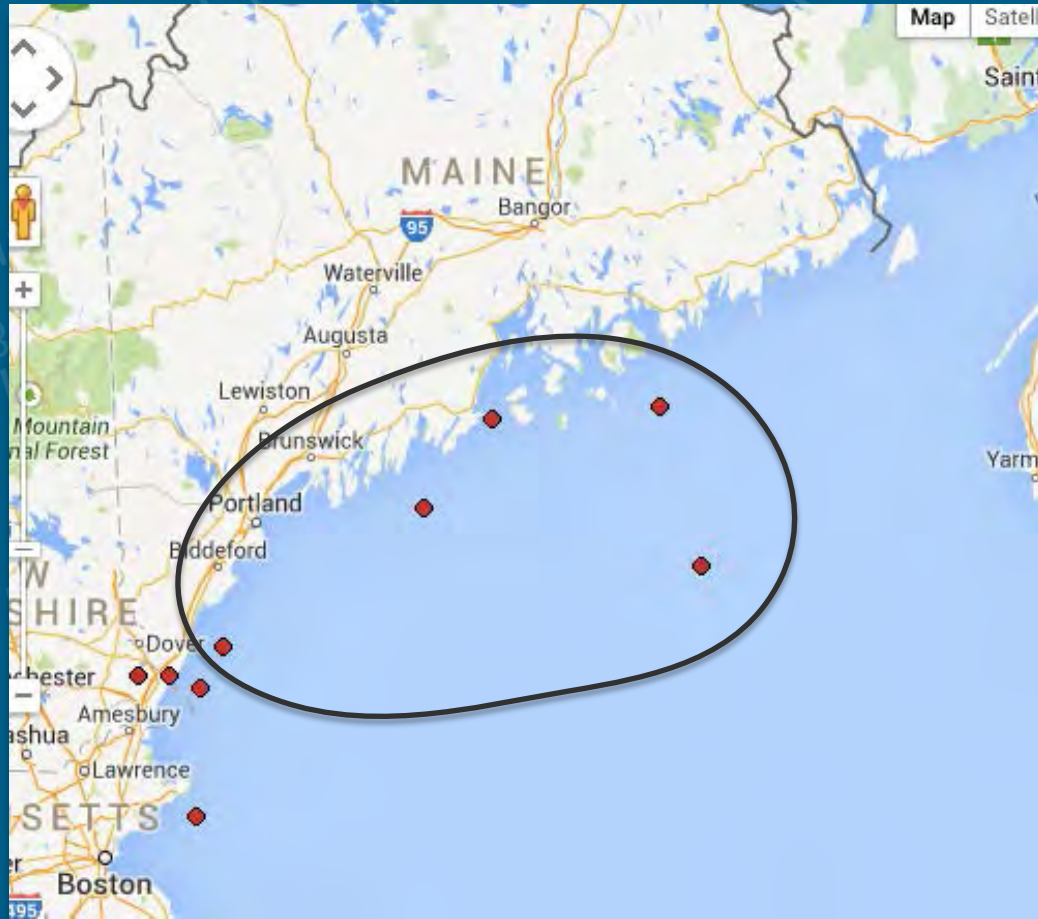
- linear models for 5 buoys + average
- randomly draw model coefficients and apply
- http://neracoos.org/ yields probability of start date in a time window

NERAC **OS**

I **OS** INTEGRATED OCEAN OBSERVING SYSTEM

Hindcasts

2009

Early Season

Late Season

First Forecast

Last Forecast

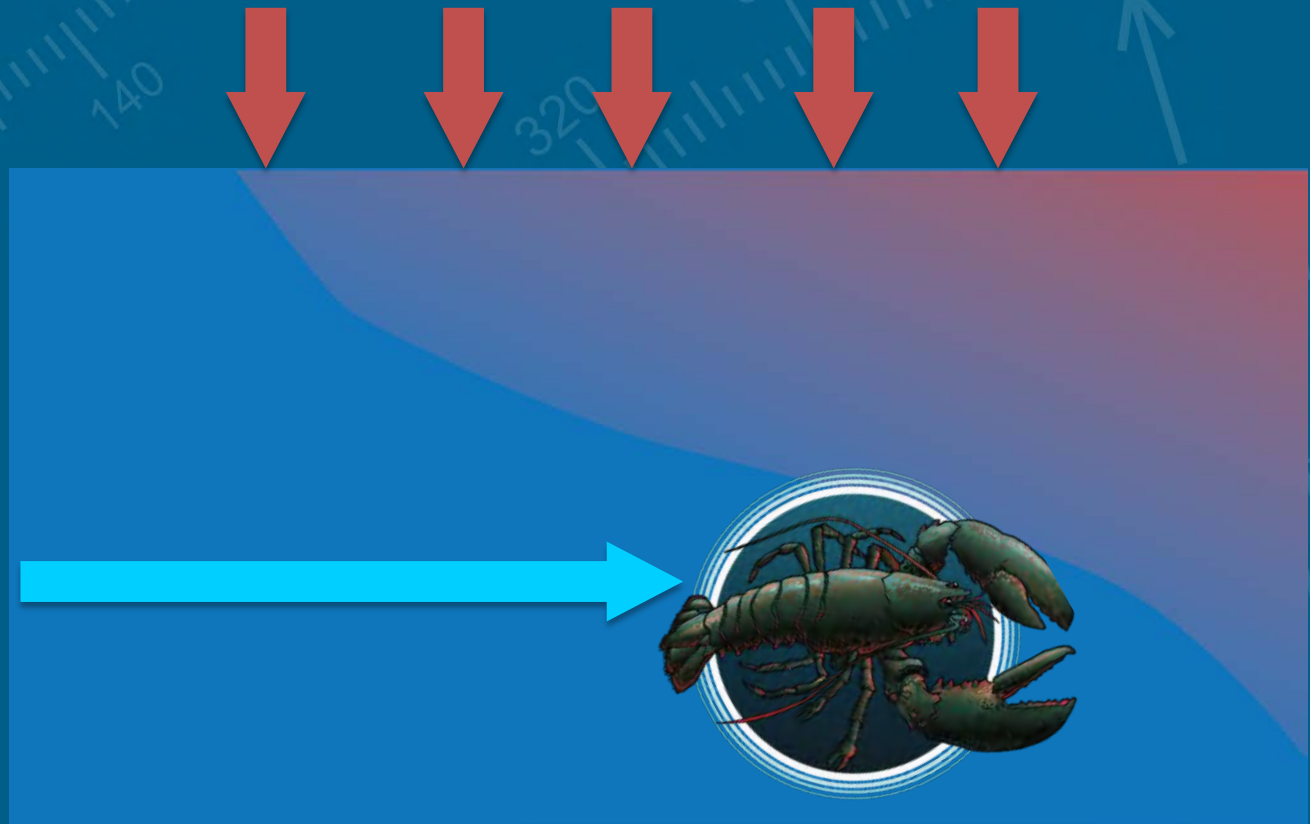|	Extremely Early	Very Early	Early	Normal	Late	Very Late	Extremely Late
March 1	0%	0%	0.97%	93.?%	5.67%	0.07%	0%
March 15	0%	0%	1.69%	83.?%	14.62%	0%	0%
April 1	0%	0%	2.45%	42.?%	54.87%	0.45%	0%
April 15	0%	0%	1.77%	76.4%	21.56%	0.18%	0%
May 1	0%	0%	13.35%	82.?%	4.4%	0%	0%
May 15	0%	0%	19.05%	77.?%	3.35%	0%	0%

6/12   6/19   6/26   7/3   7/10   7/17   7/24   7/31

Hindcasts

2012

Early Season

Late Season

First Forecast

Last Forecast

	Extremely Early	Very Early	Early	Normal	Late	Very Late	Extremely Late
March 1	47.74%	51.4%	0.85%	0%	0%	0%	0%
March 15	81.74%	17.92%	0.34%	0%	0%	0%	0%
April 1	73.61%	26.27%	0.13%	0%	0%	0%	0%
April 15	88.34%	11.45%	0.21%	0%	0%	0%	0%
May 1	77.3%	21.57%	1.13%	0%	0%	0%	0%
May 15	19.72%	70.65%	9.63%	0%	0%	0%	0%

12   6/19   6/26   7/3   7/10   7/17   7/24   7/31

Hindcasts

2003

Early Season   Late Season

First Forecast

	Extremely Early	Very Early	Early	Normal	Late	Very Late	Extremely Late
March 1	0%	0%	20%	39.3%	36.97%	3.3%	0%
March 15	0%	0%	0%	20%	52.15%	23.02%	3.93%
April 1	0%	0%	17.86%	9.15%	52.43%	18.41%	2.15%
April 15	0%	0%	0%	19.64%	42.71%	26.27%	11.37%
May 1	0%	0%	0%	33.48%	39.95%	2.7%	1.87%
May 15	0%	0%	0.13%	57.79%	25.45%	14.25%	2.39%

6/12   6/19   6/26   7/3   7/10   7/17   7/24   7/31

Last Forecast

March 4 Forecast

	Extremely Early	Very Early	Early	Normal	Late	Very Late	Extremely Late
	0%	0%	0%	31%	36%	31%	2%
	6/12	6/19	6/26	7/3	7/10	7/17	7/24	7/31
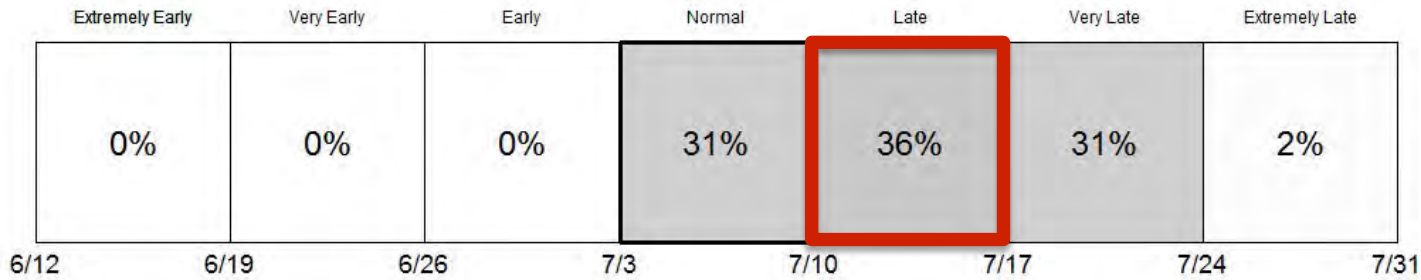
- www.gmri.org/lobster-forecast
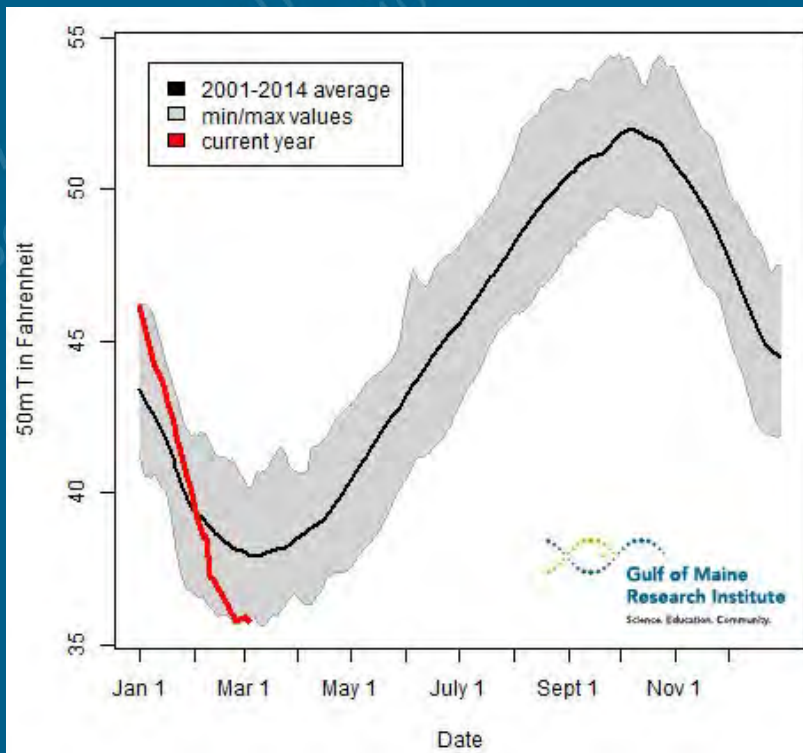
- 3/4—cold water
- predicting late season

March 18 Forecast

Extremely Early	Very Early	Early	Normal	Late	Very Late	Extremely Late
0%	0%	4%	46%	46%	4%	0%

6/12   6/19   6/26   7/3   7/10   7/17   7/24   7/31
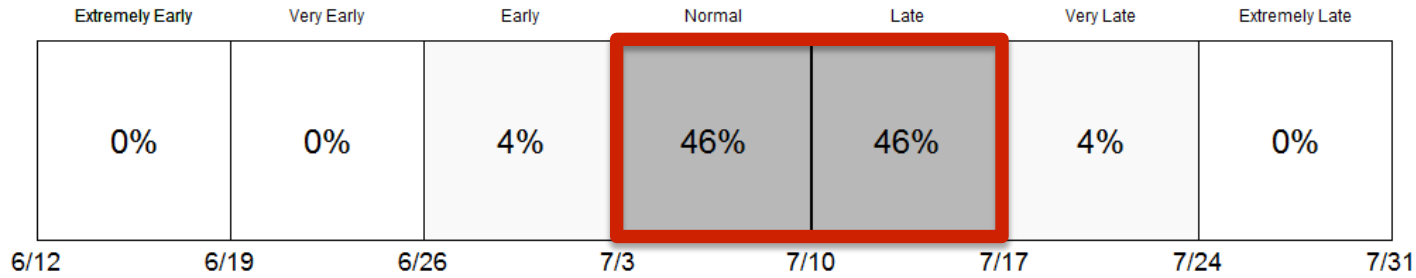
- www.gmri.org/lobster-forecast
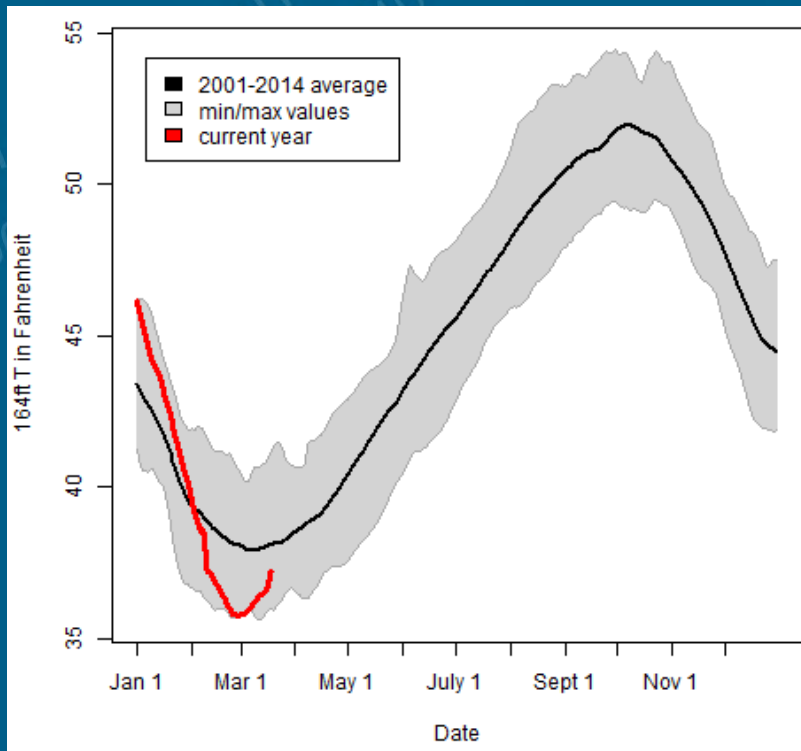
- 3/18—warming
- shift towards normal

Conclusion

- Phenology matters, at least for lobsters and lobstermen

- Simple model can give 2-3 month forecast
  - better at early years than late
  - max skill in late April

- Questions:
  - can we push the forecasts earlier?
  - how can the industry react?