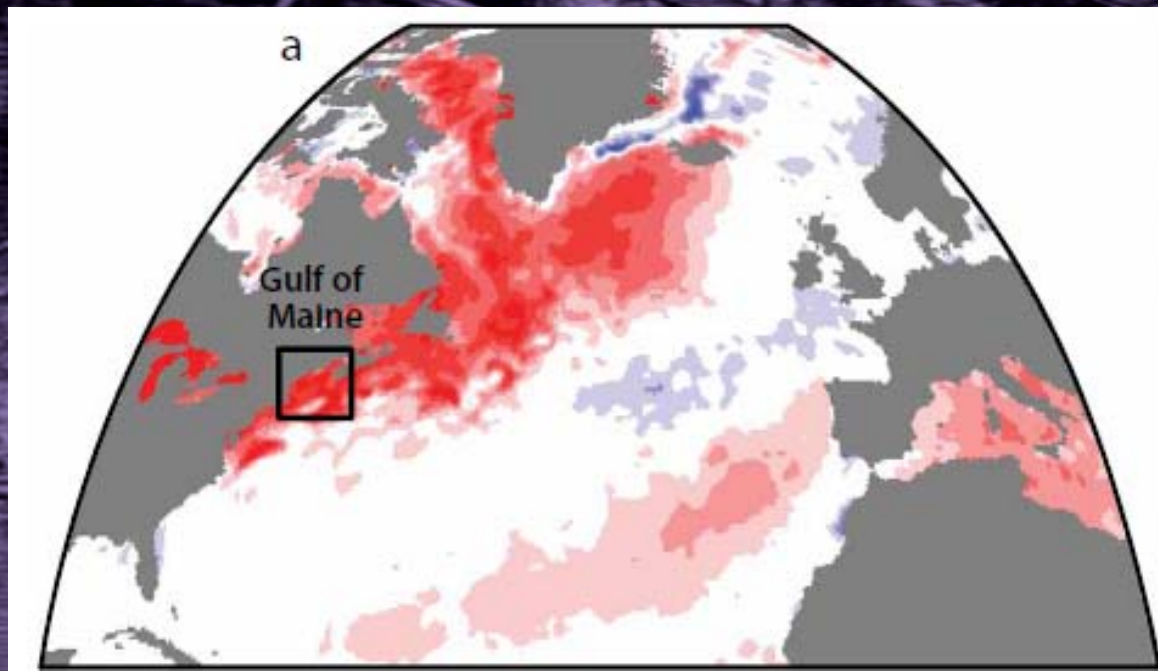


The 2012 ocean heat wave and other recent climate impacts to New England lobsters:

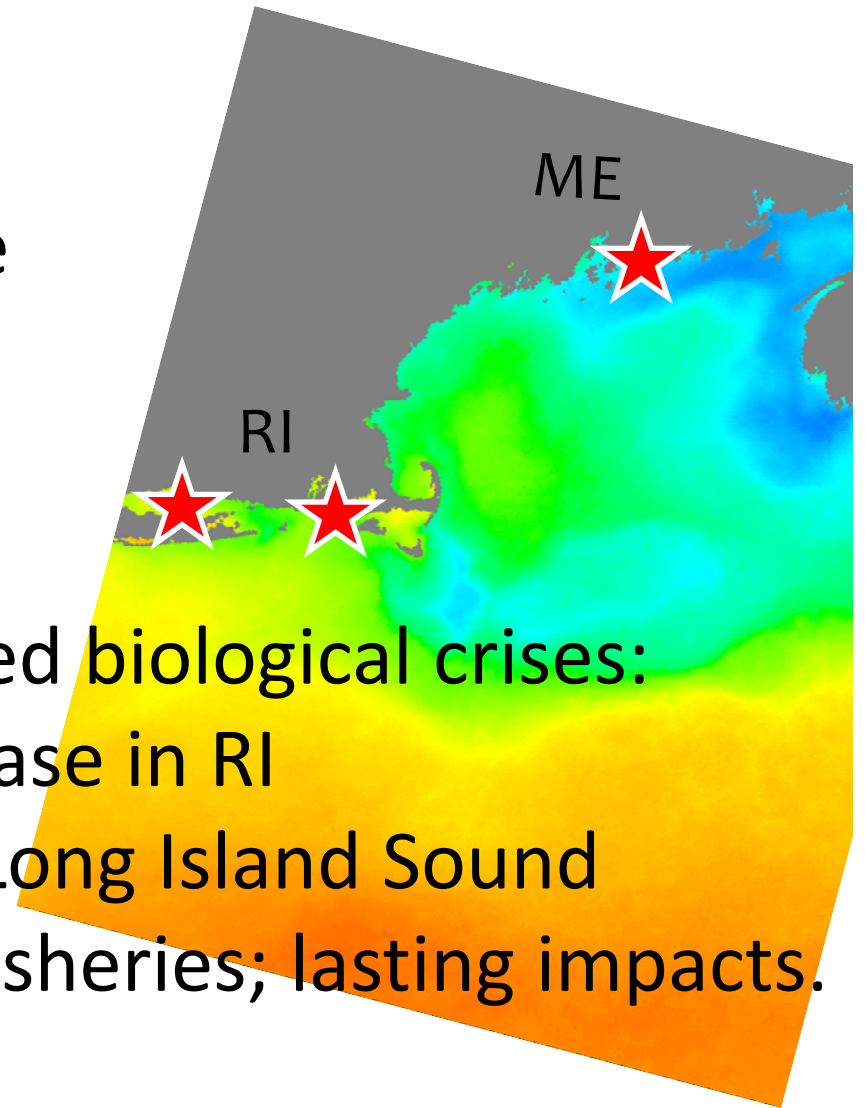
A contrast of economic and biological crises



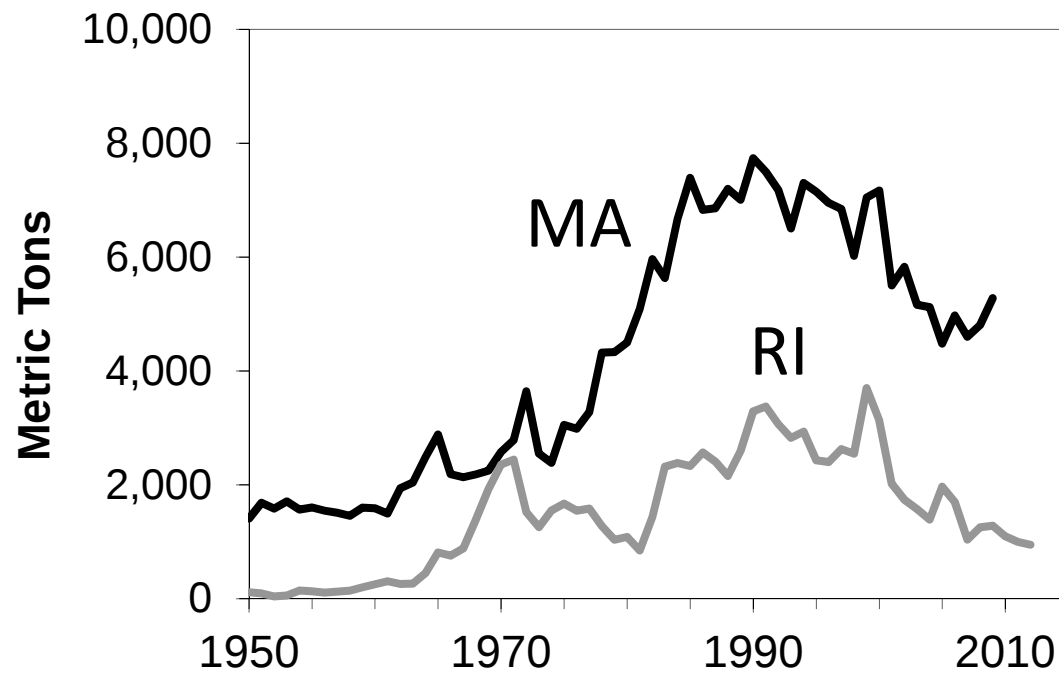
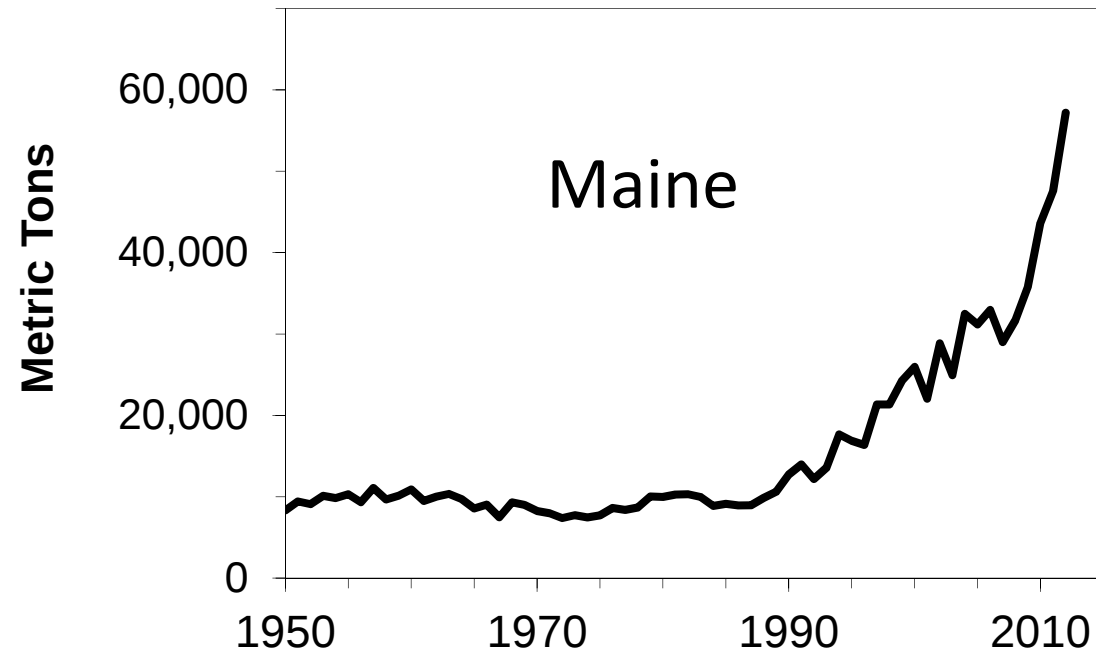
Richard Wahle
University of Maine

Key points

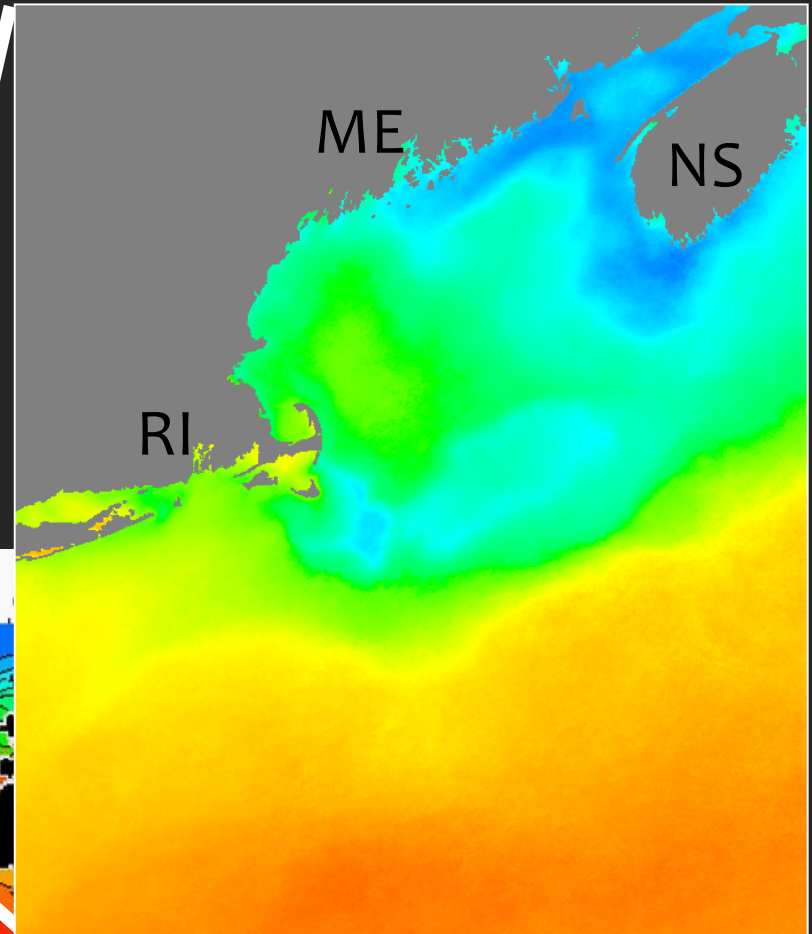
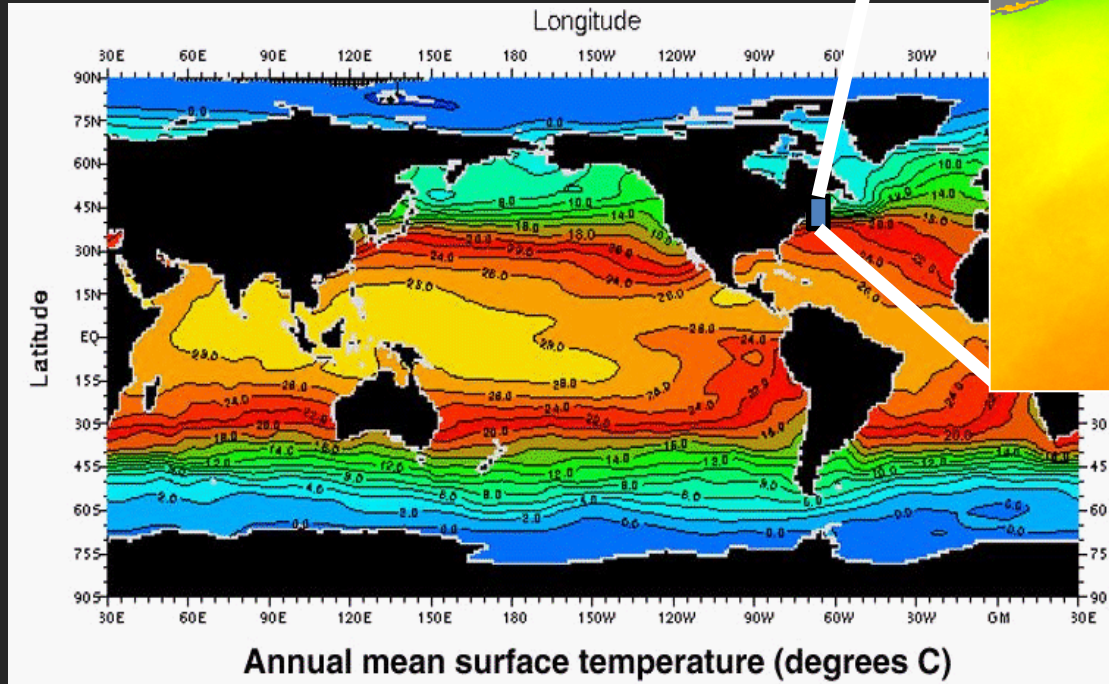
- The 2012 ocean heat wave an economic crisis in ME, not a biological crisis.
- Two previous climate related biological crises:
 - 1997 Onset of shell disease in RI
 - 1999 mass mortality in Long Island Sound led to collapsed lobster fisheries; lasting impacts.
- Nonetheless, all 3 climate related; all 3 had economic fallout.



Lobster Landings



Contrasting Thermal Geography



2012 Ocean Heat Wave

Drives Climate Change

Home to Maine

Fishermen

Gulf of Maine Trends:

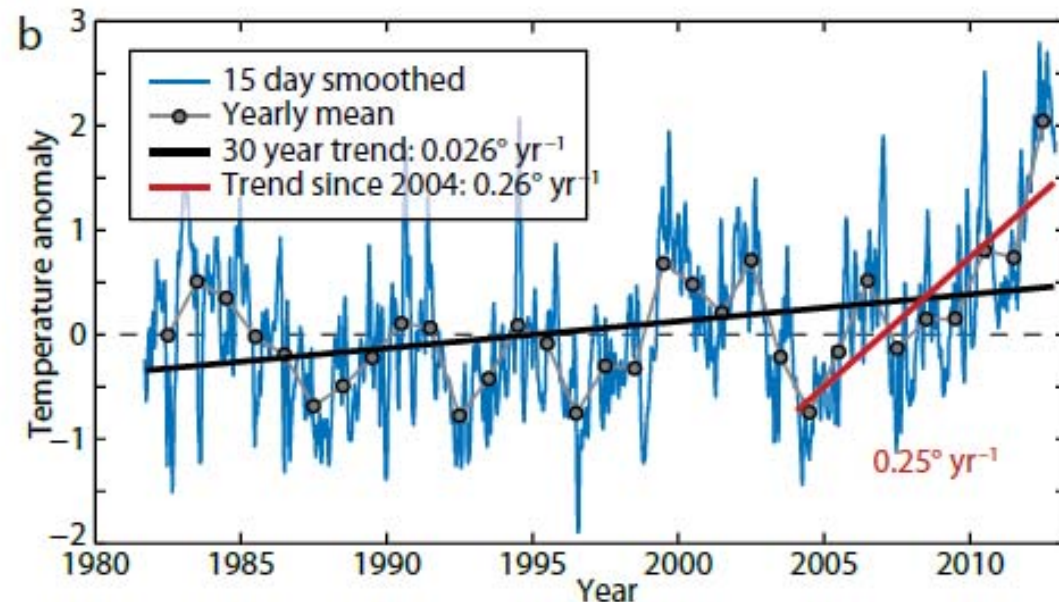
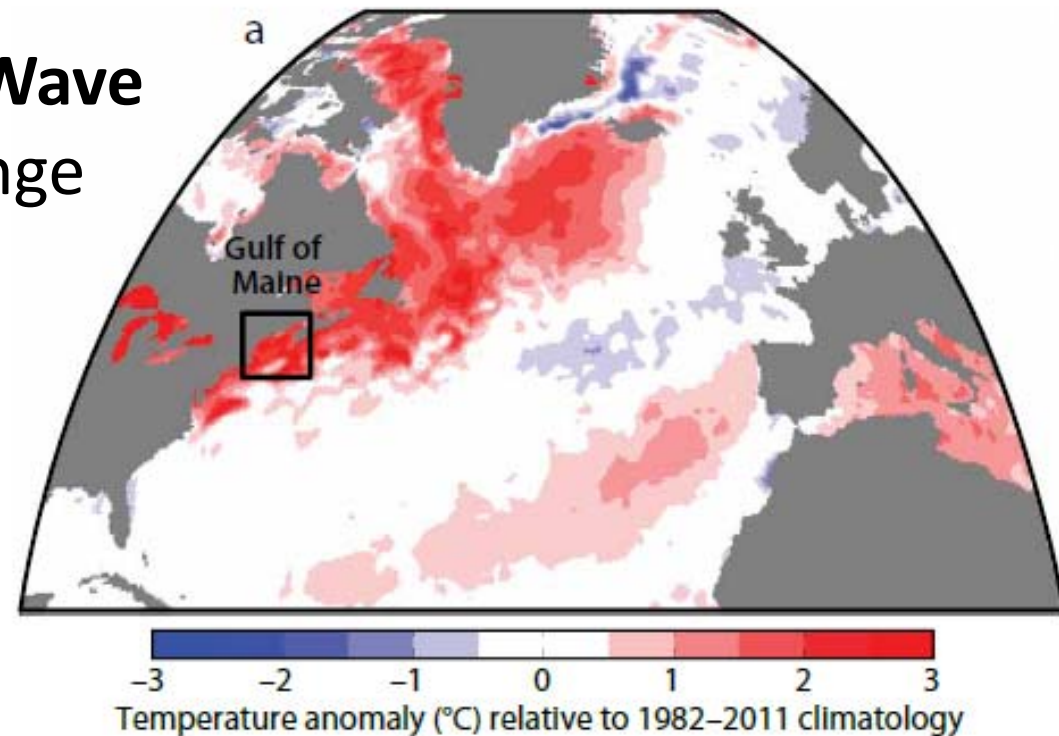
Since 1982:

~1°C every 40 years

Since 2004:

~1°C every 4 years

From: Mills et al. 2013



2012 Heat wave cascading effects

Warm temps

- boost lobster growth
 - early seasonal recruitment
 - glut in catch(not abundance!)
 - price plummets

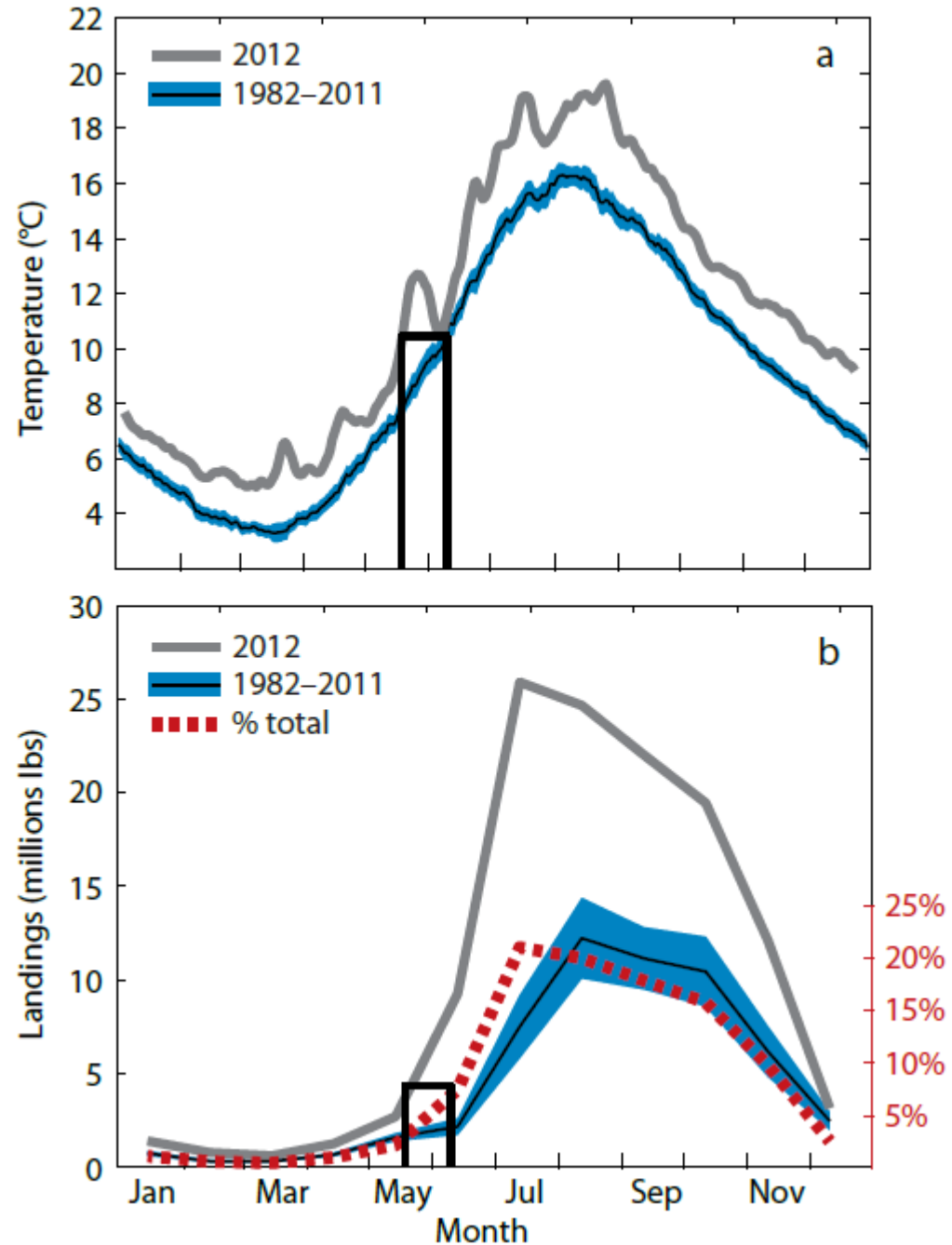


2012 Ocean Heat Wave

- Seasonal Climatology

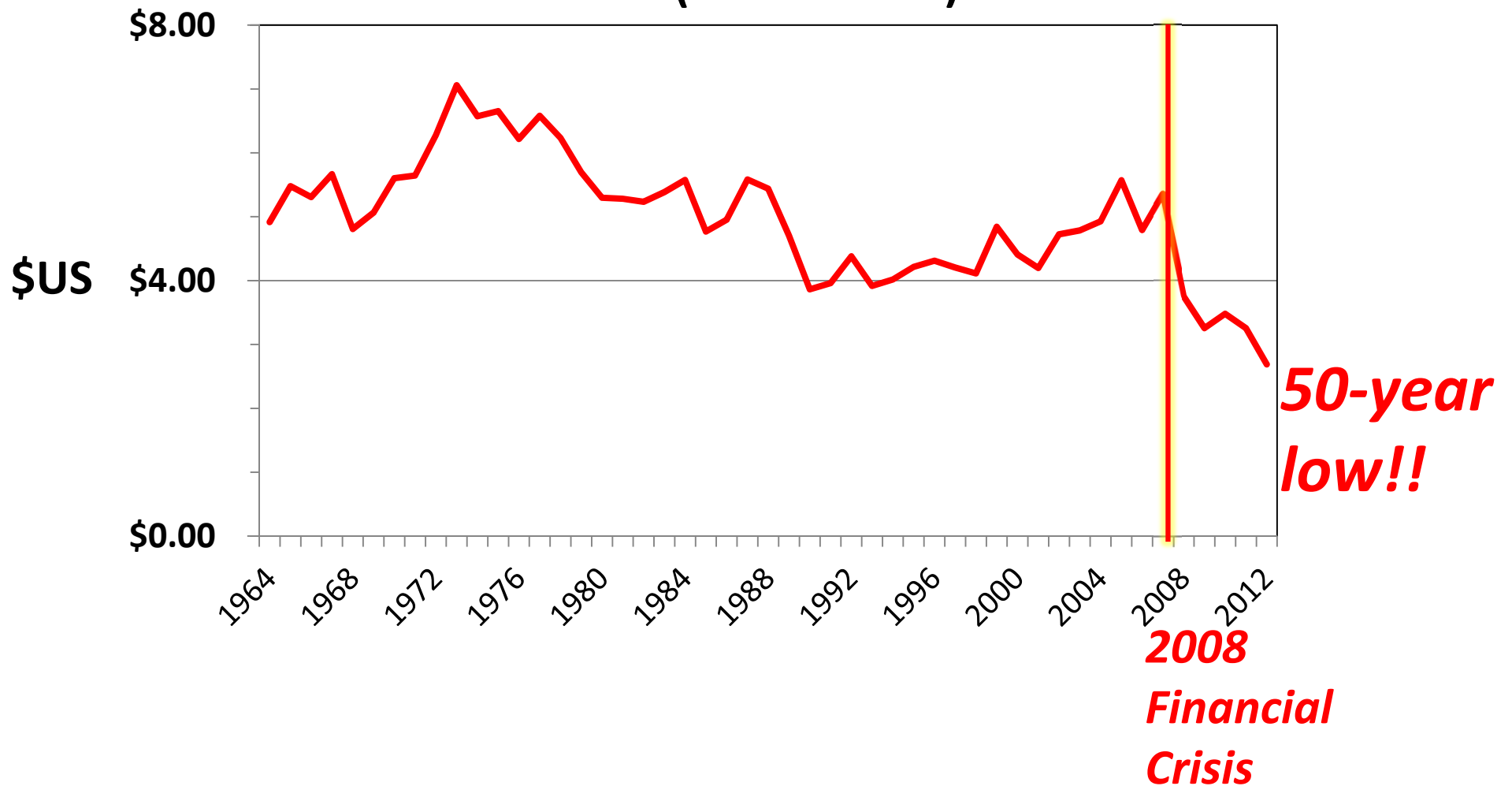
- Lobster Landings

Mills et al. 2013

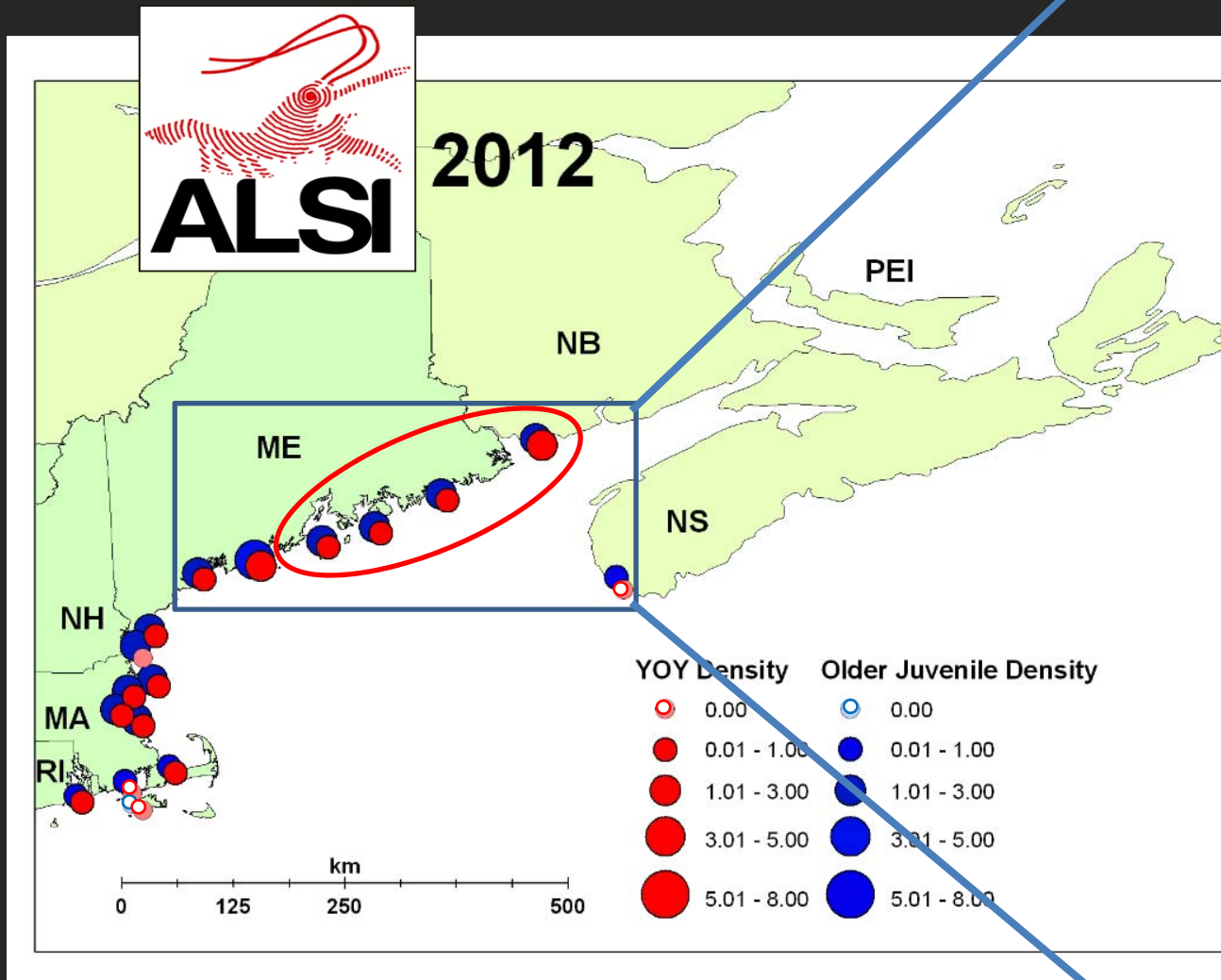


Rising Catch, Dropping Value

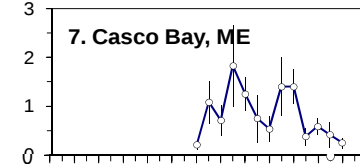
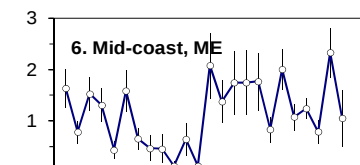
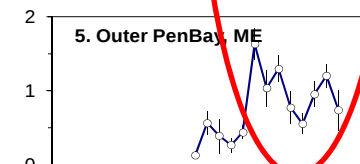
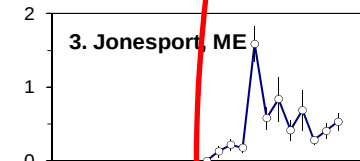
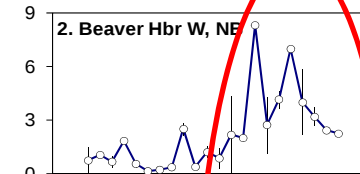
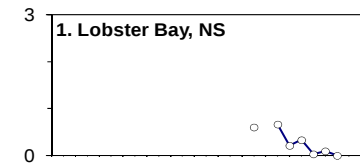
Lobster price/lb adjusted for inflation
(2012 dollars)



Lobster Settlement Index



- Settlement down in 2012

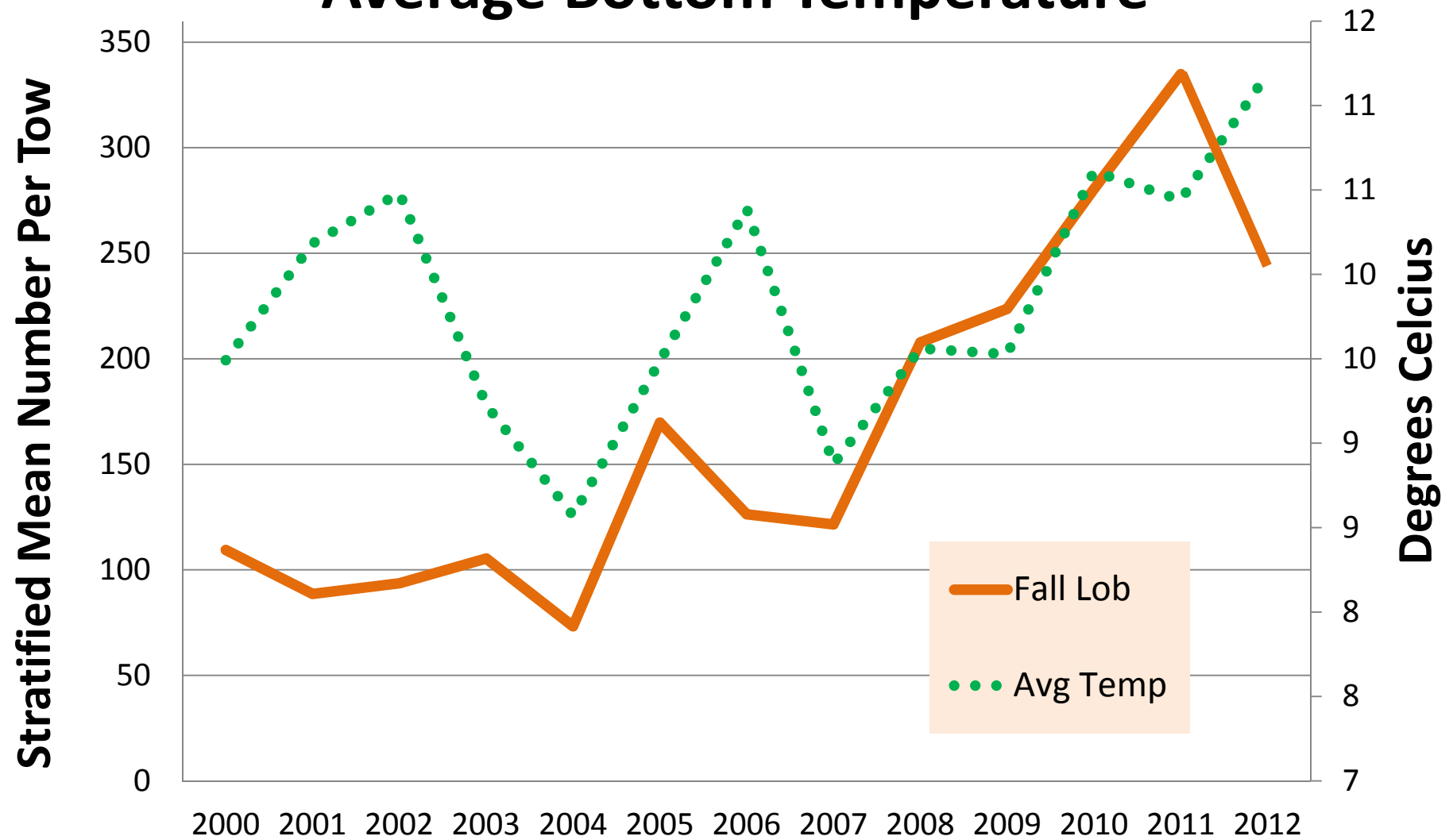


$N\ m^{-2}$

1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014

ME/NH Fall Trawl Survey

Lobster Abundance & Average Bottom Temperature

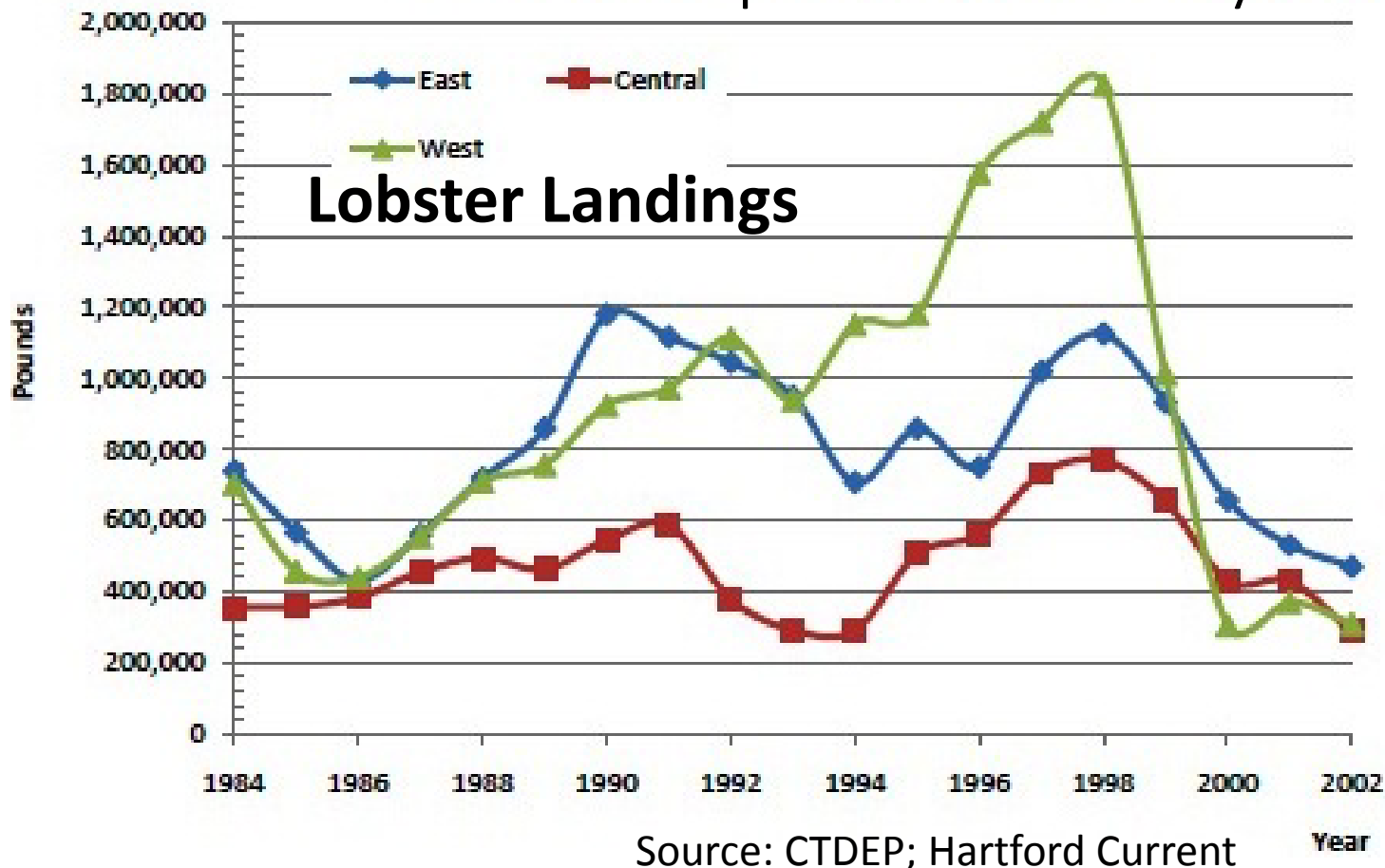


Source: K. Stepanek, ME DMR

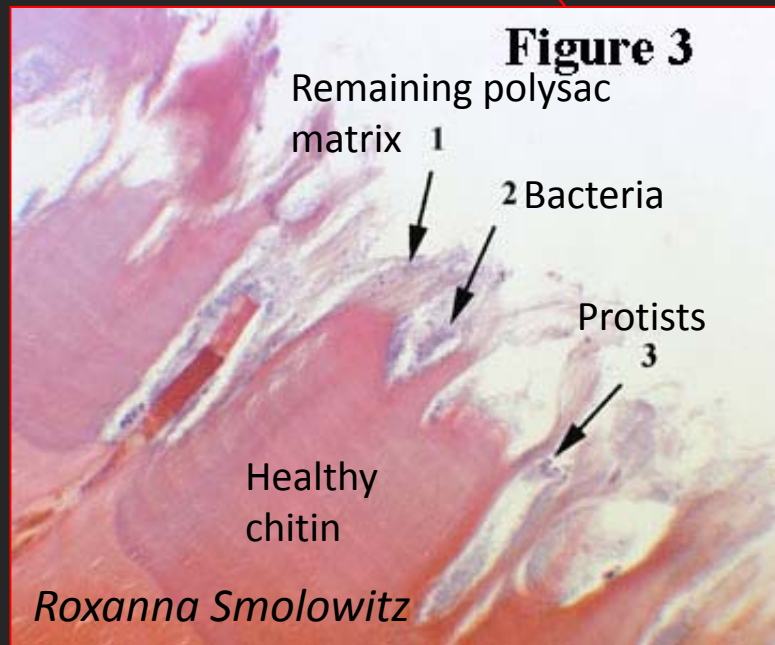
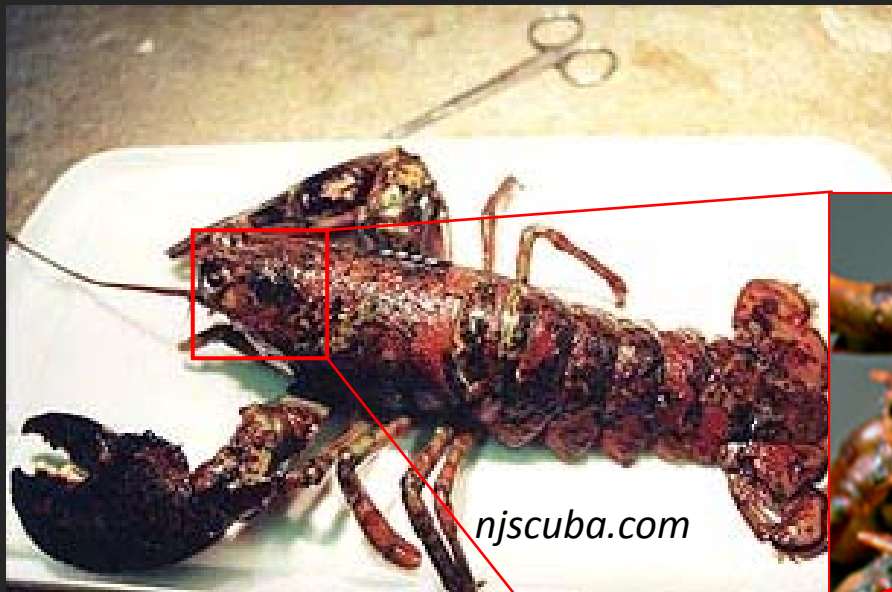
Long Island Sound Lobster Die-Off 1999

A “Perfect Storm” of extremes

- Hot summer, Low DO
- Wind-induced mixing (Hurricane Floyd)
- Historic Rainfall – low-salinity shock
- 75-95% collapse of lobster fishery

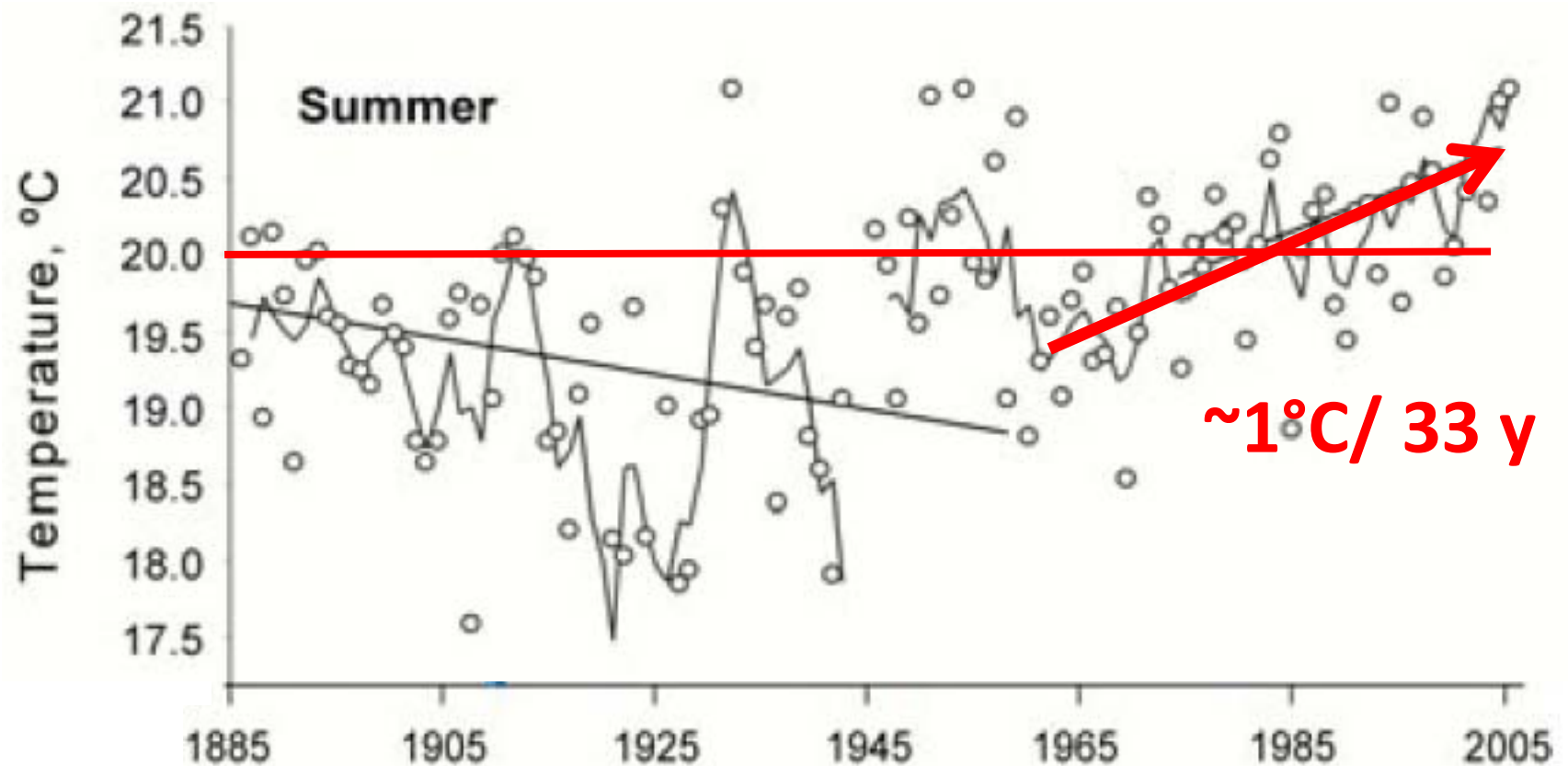


Shell Disease



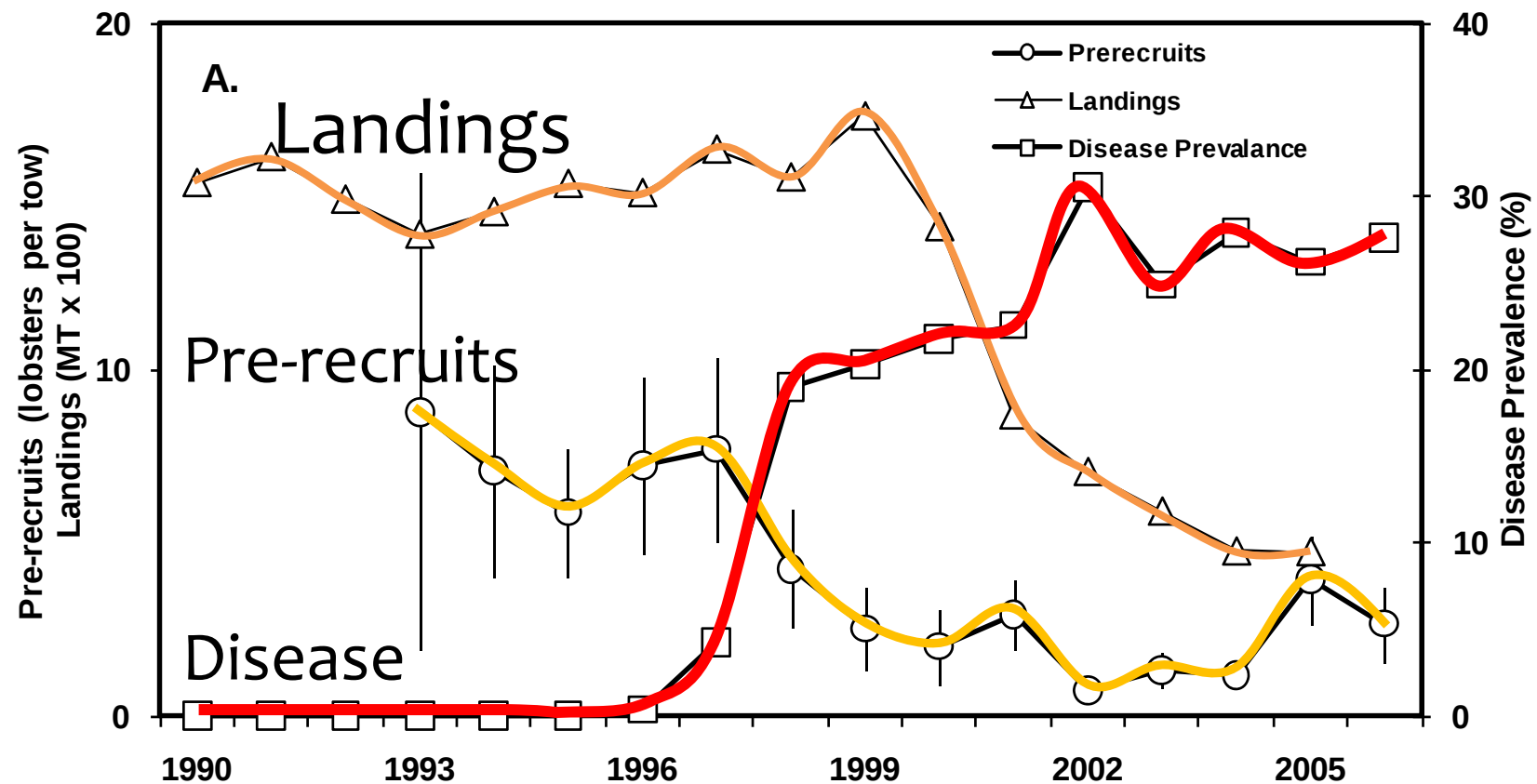
**in Southern
New England**

Climate change in Narragansett Bay



Source: Nixon et al. (2004)

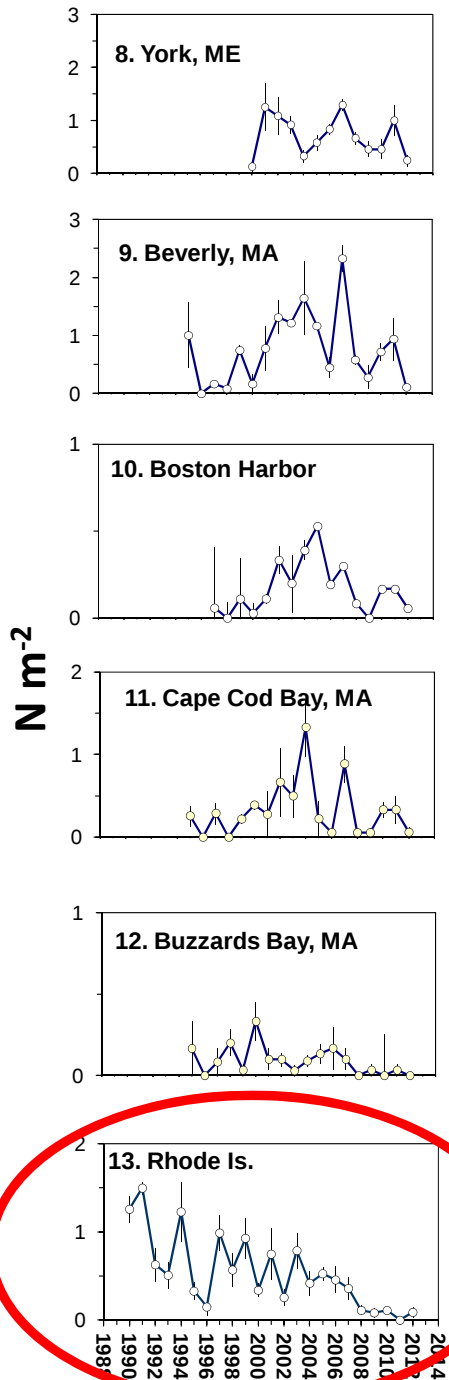
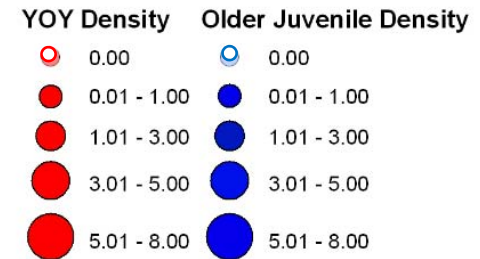
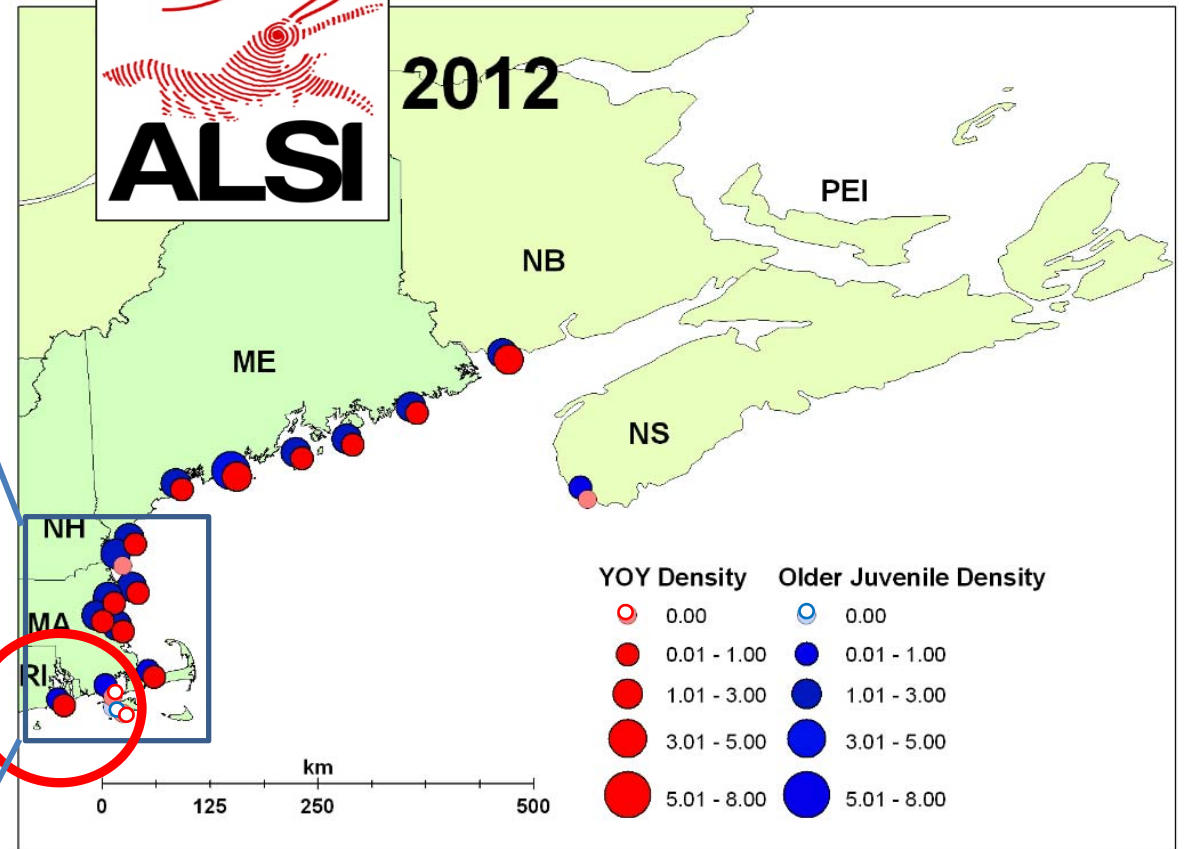
Rhode Island's time line: landings, pre-recruits and shell disease



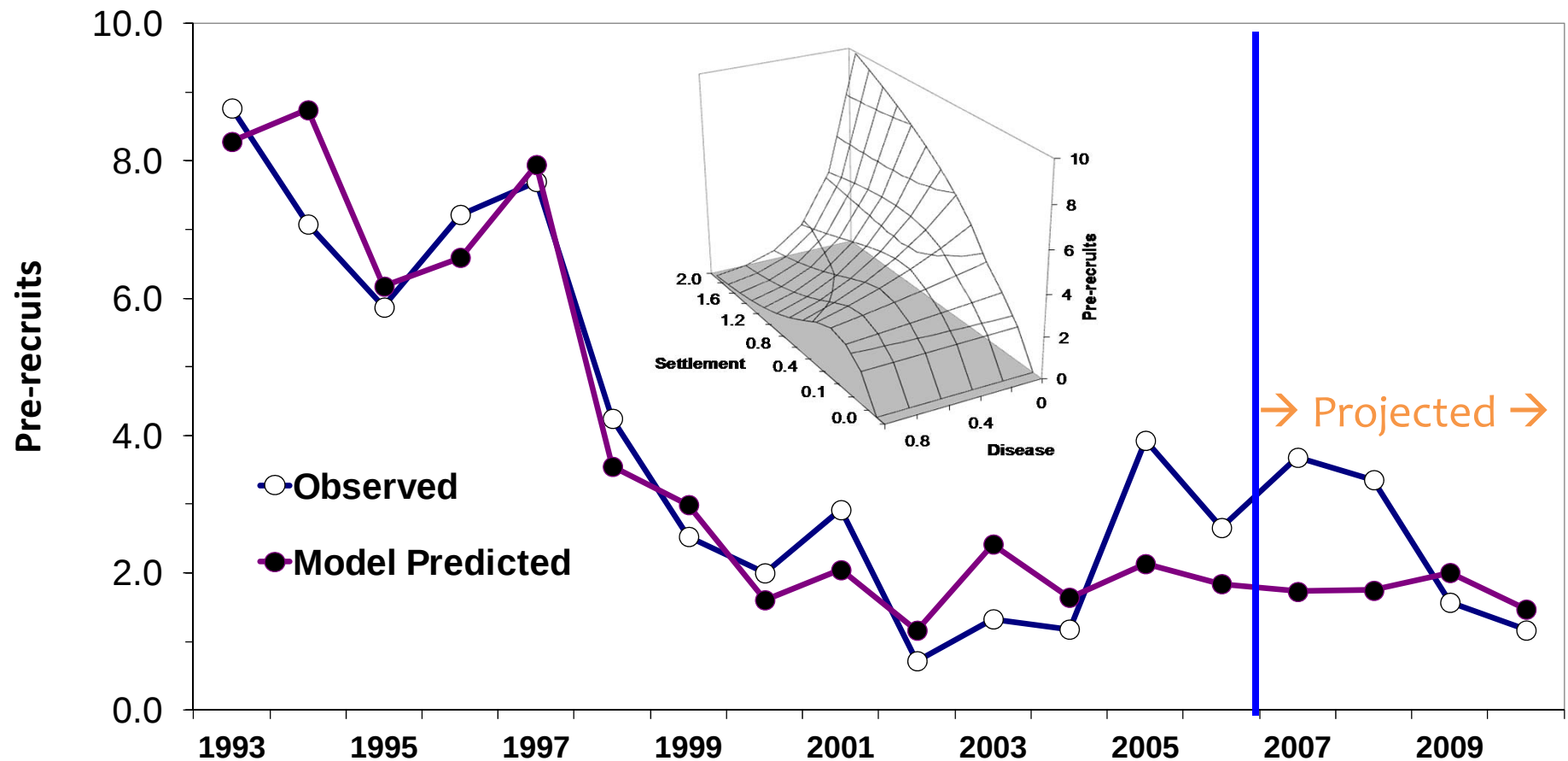
Lobster Settlement Index



2012

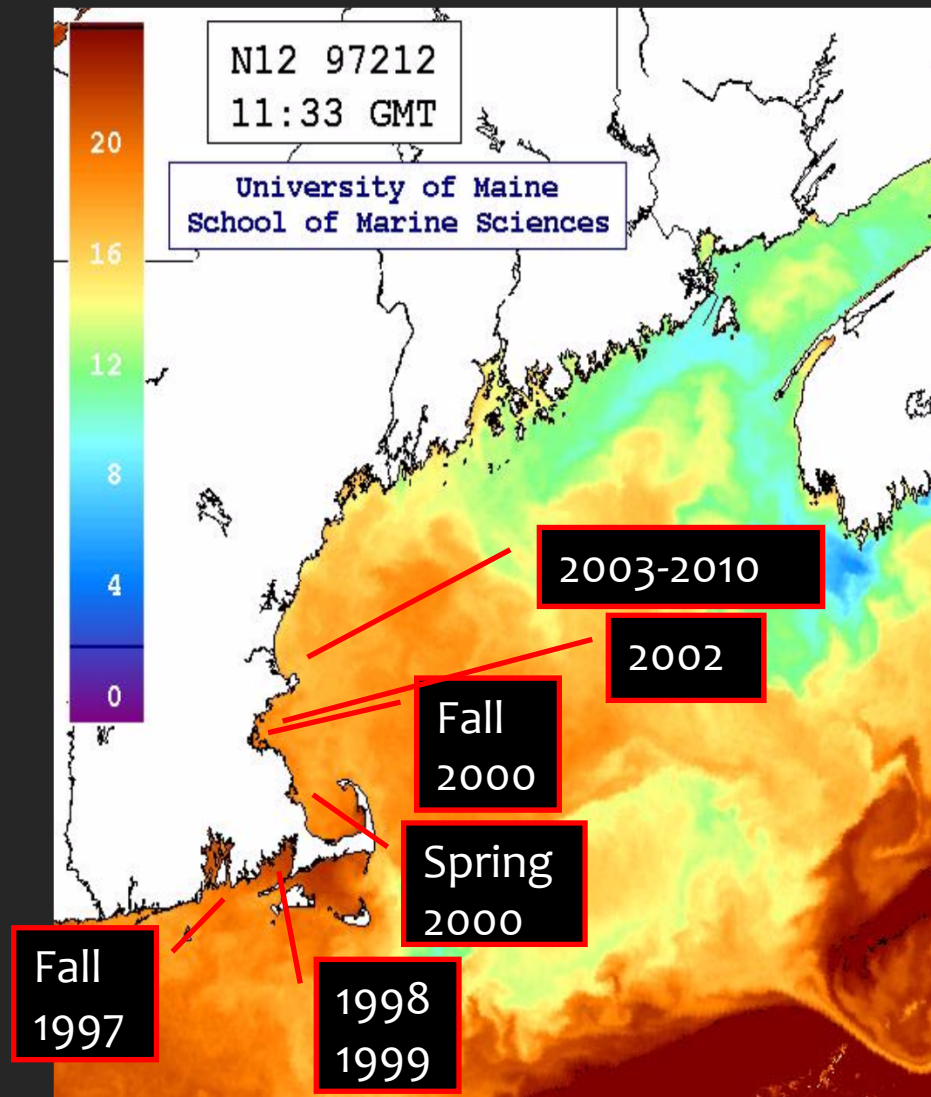


Rhode Island: Joint effects of settlement & disease



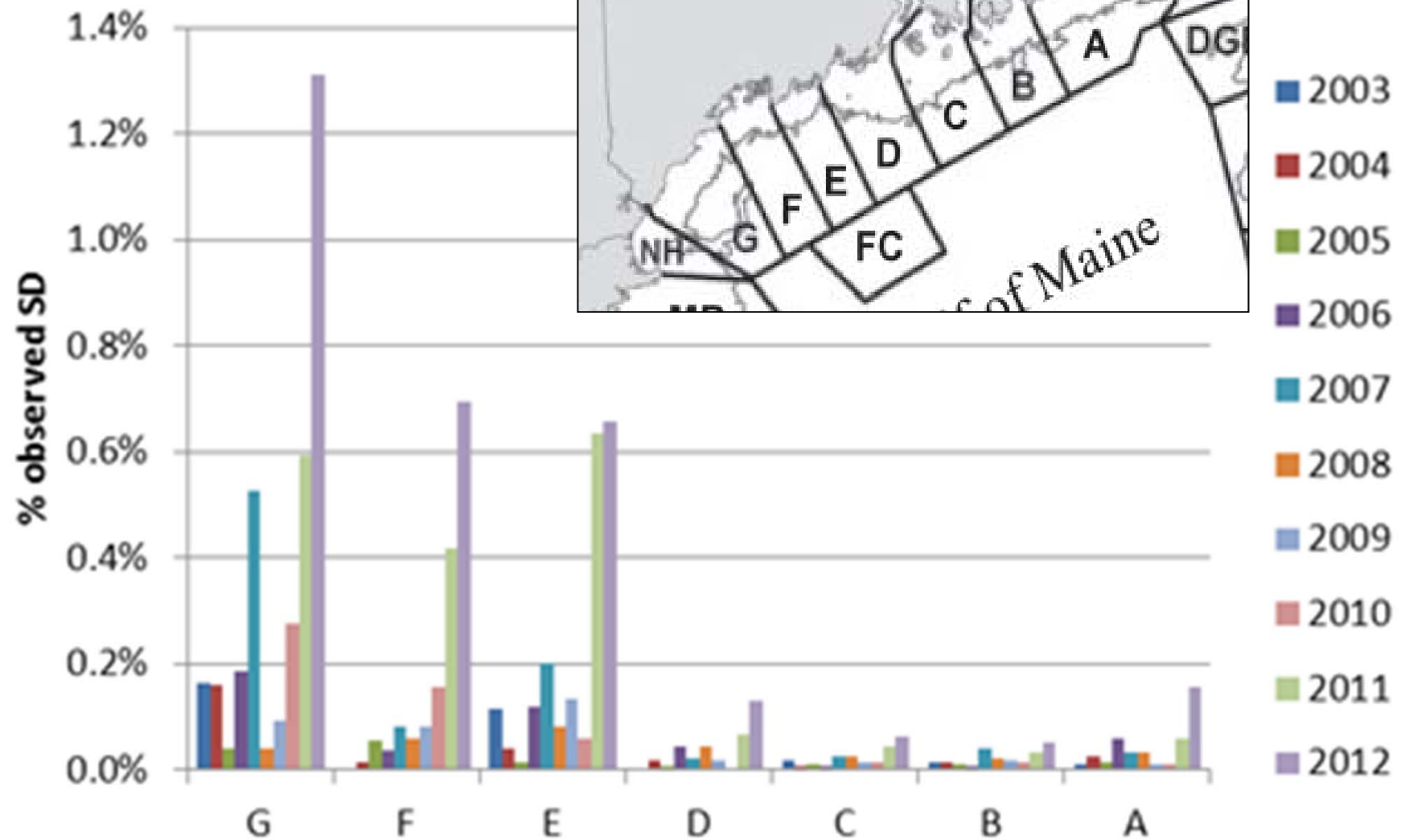
Wahle et al. 2009

Is the Gulf of Maine Next?



Source: R. Glenn,
MA DMF

Shell Disease in Maine 2003- 2012



Source: Maine DMR

Recap & Conclusions

- 1997 RI Shell disease → collapse
- 1999 LIS Perfect Storm → collapse
- 2008 Global financial crisis → price drop
- 2012 Ocean heat wave → price drop
- 3 of the 4 above climate related
- Is lobster fate in our hands?

