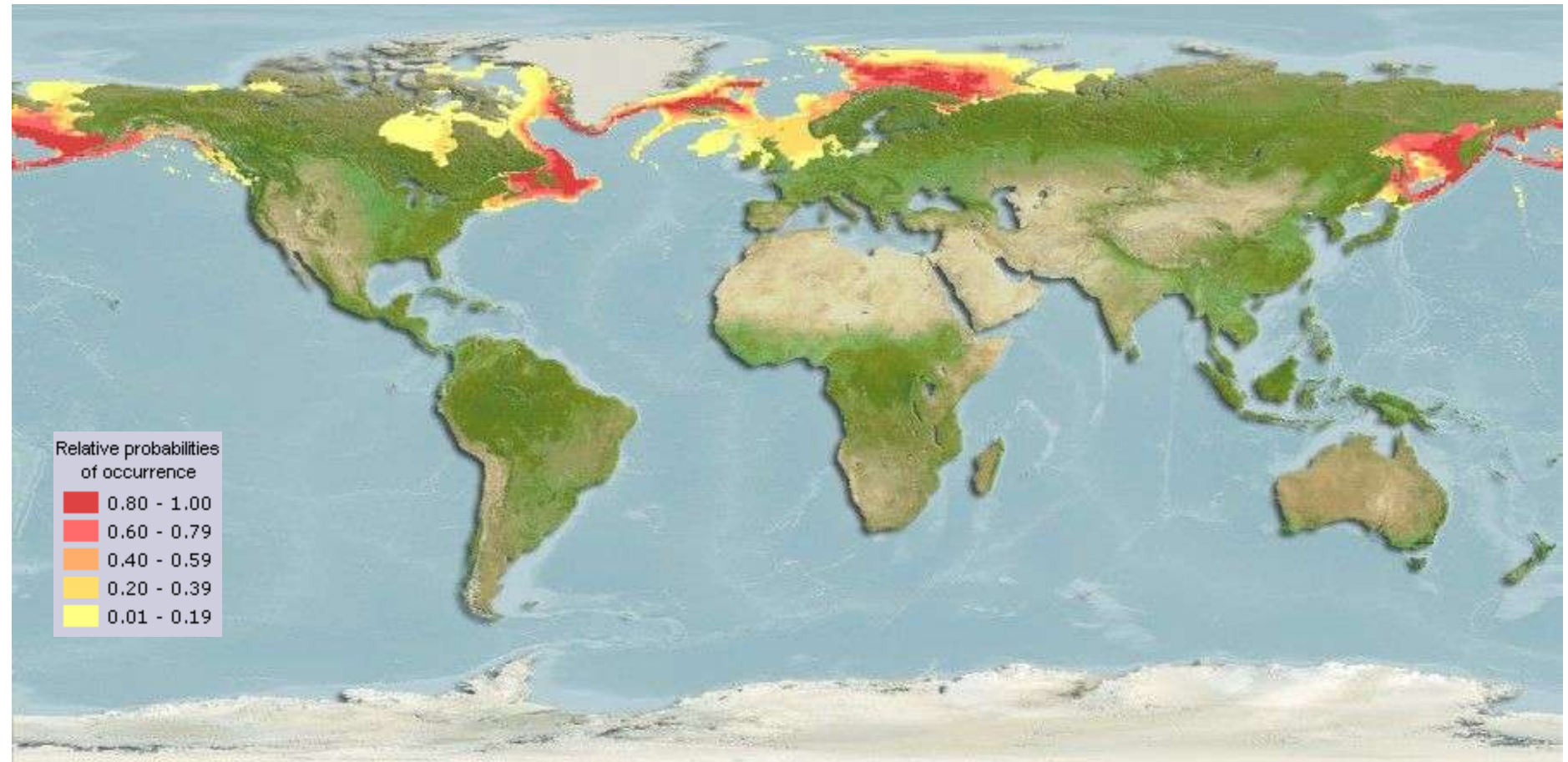


Northern Shrimp Management in a warming Gulf of Maine



Jessica Carloni

Northern Shrimp Range



www.aquamaps.org

- **Gulf of Maine is southern most extent of range**
- **More vulnerable to changes in environment**

GOM Northern Shrimp Biology



- Live about 5 years - longer in Canada
- Prefer soft bottoms, depths 90-180m, cold basins
- Females migrate inshore to hatch eggs in winter, then return offshore. Larvae/juveniles stay inshore ~ 1 year, then migrate offshore
- Females can carry 800 – 3,400 eggs
- Fishery targets age 4 and 5 females
- Fishery reflects weak and strong year classes

Protandric Hermaphrodites

- Larvae born as immature males
Sexually mature at $\sim 2 \frac{1}{2}$ years old
- Transition into females at $\sim 3 \frac{1}{2}$ years old
- Live about 5 years



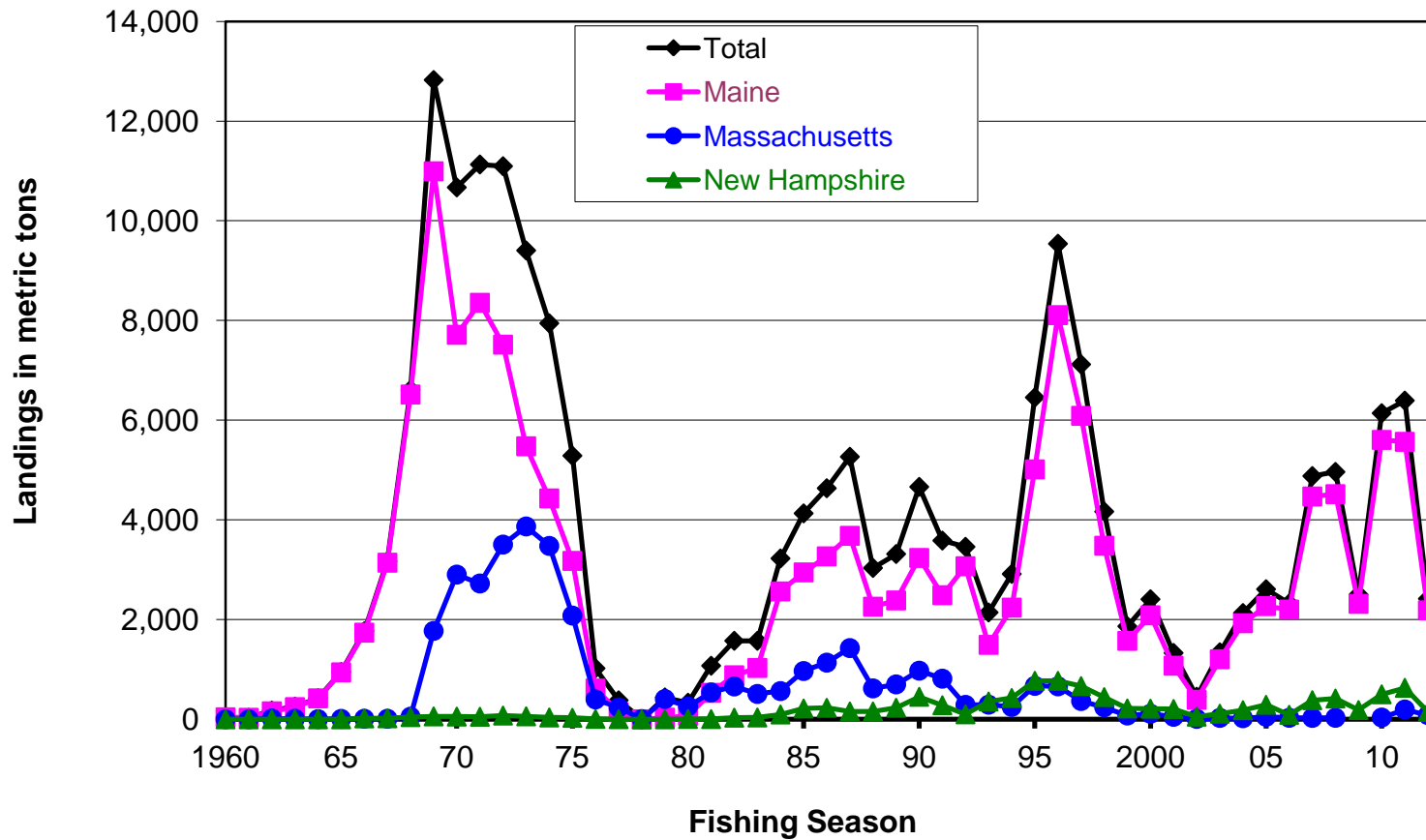
J. Angsten

ASMFC Managed Species

- Fisheries Management Plan
- Technical Committee (TC)
 - Conduct Annual Stock Assessment
- Advisory Panel (AP)
- Northern Shrimp Section
 - Assign TAC each season (Dec-April) based on TC's recommendation and input from the AP

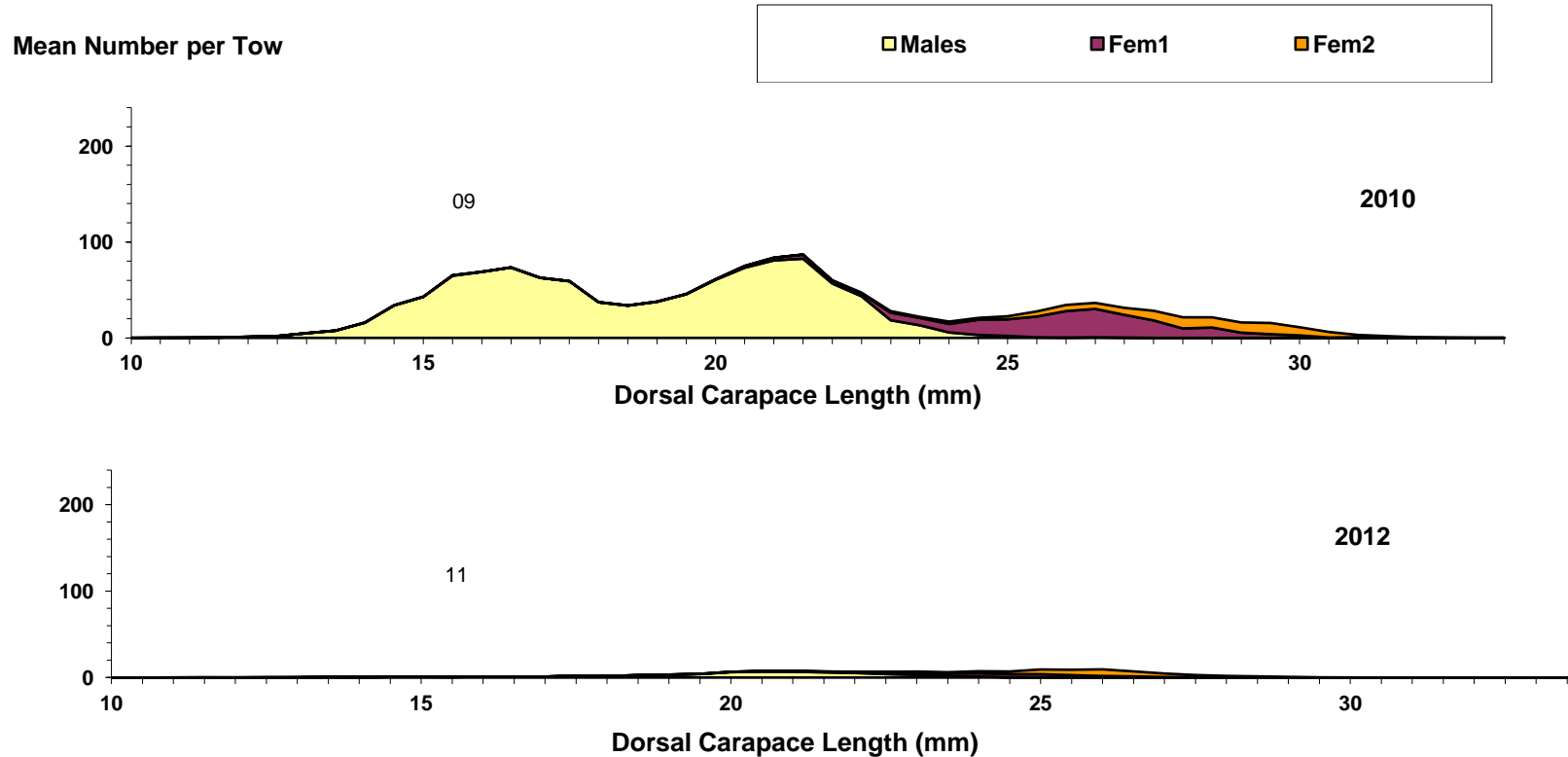


GOM Landings



- Important source of income for New England fishermen
- Estimated value in 2012 \$5.1 million
- Estimated value in 2013 \$1.2 million *preliminary

Huge Problem



- There are NO shrimp!!!!
 - All surveys that capture northern shrimp show a downward trend in 2012

Why is this happening??

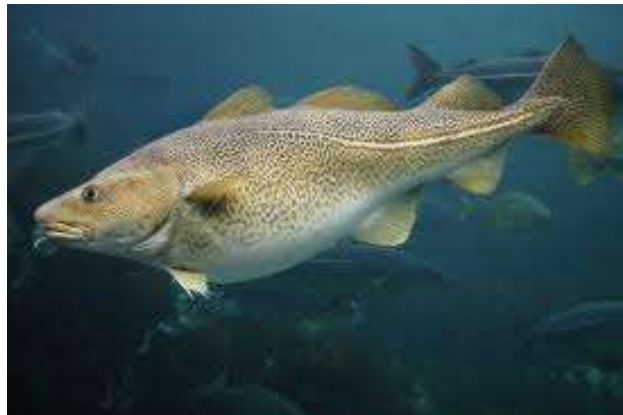
1. Predators?



thevashionline.com



J. Jensen

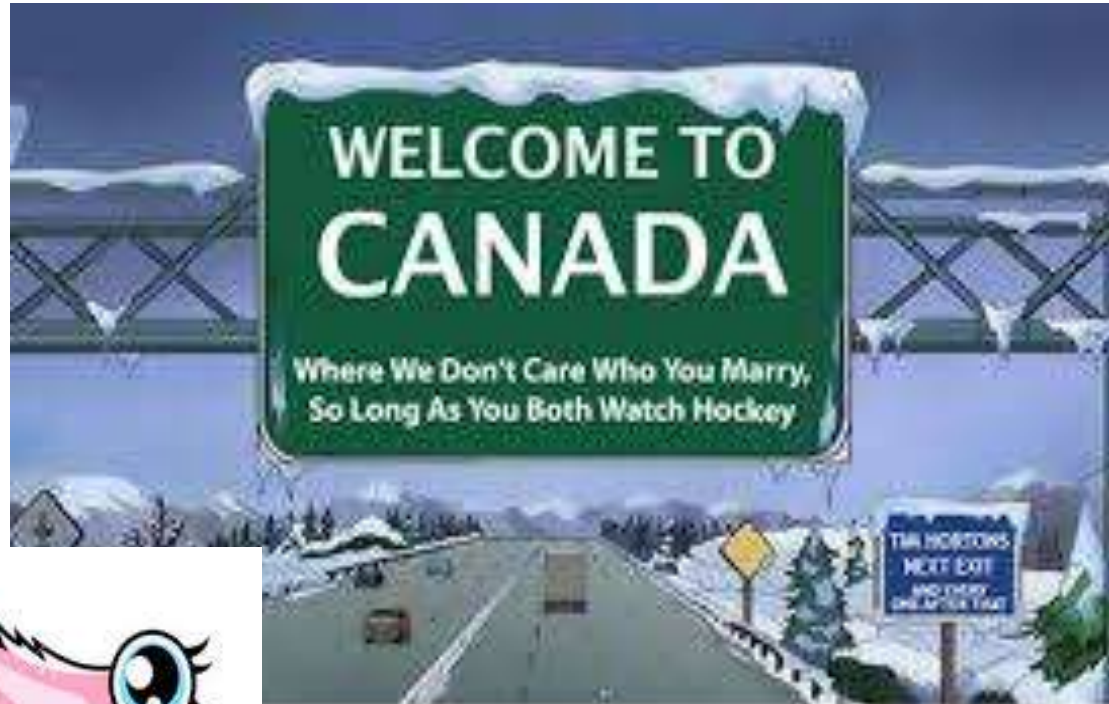


animalspot.net



Foodista.com

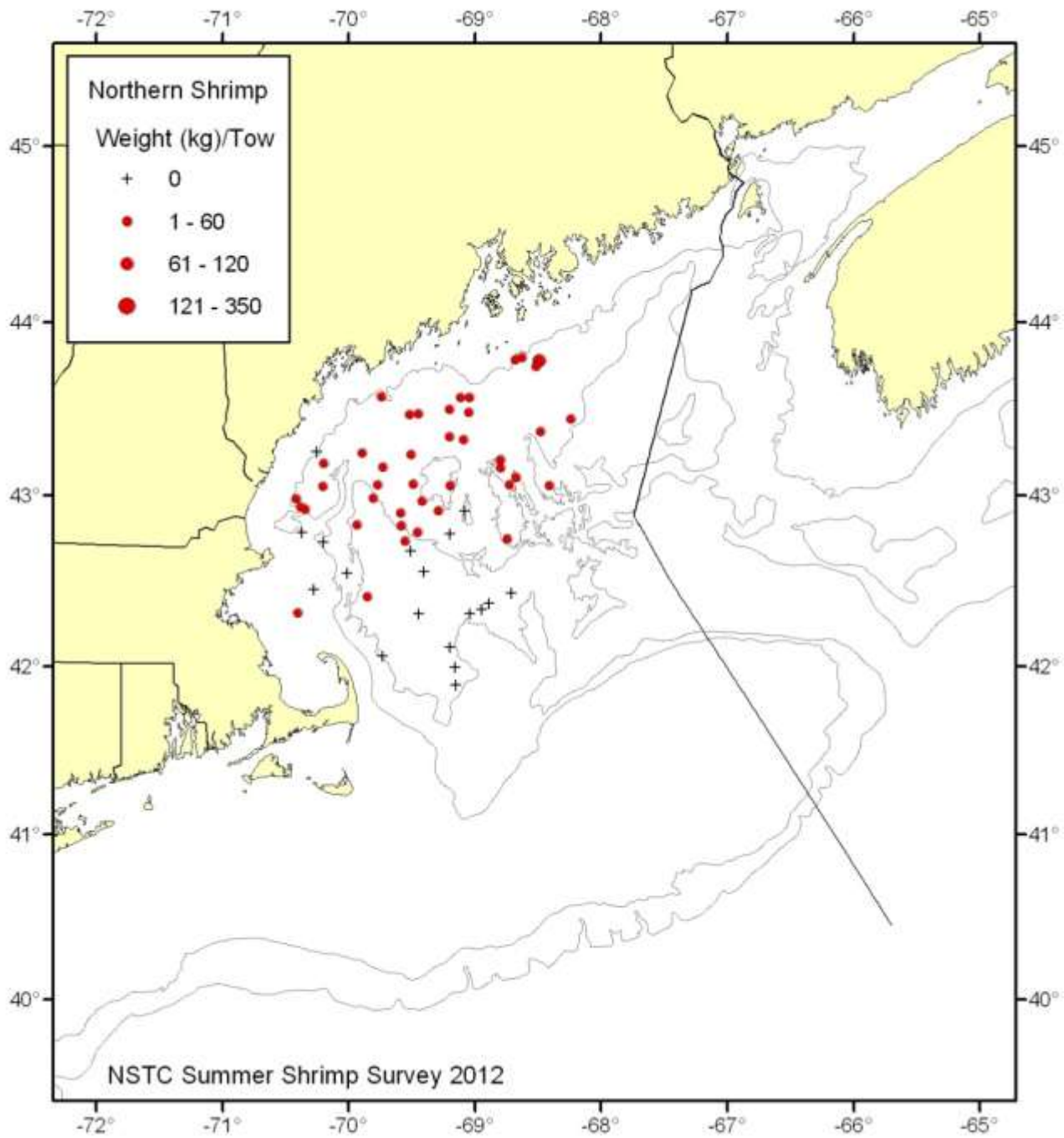
2. Population shift?



themetapicture.com



istockphoto.com



3. Pollution?



4. Overfishing?

2010

- 180 day season
- Dec 1 – May 29
- 4,900 mt TAC

Section closed early on
5/5/10 with 6,256 mt
(1,356 mt over TAC)
2,989,437 lbs

2011

- 136 day season
- Dec 1 – April 15
- 4,000 mt TAC

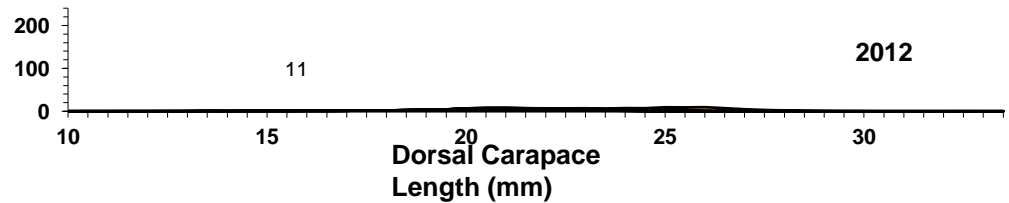
Section closed early on
2/28/11 with 5,944 mt
(1,944 mt over TAC)
4,285,742 lbs

2012

- Trawl: Jan 2 – M,W,F
- Trap: Feb 1 – 1,000/lb
daily limit
- 2,211 mt TAC
- End when landings
reached 95% of TAC

Section closed on
2/17/12 with 2,418 mt
(207 mt over TAC)
456,000 lbs

4. Overfishing con't



2013

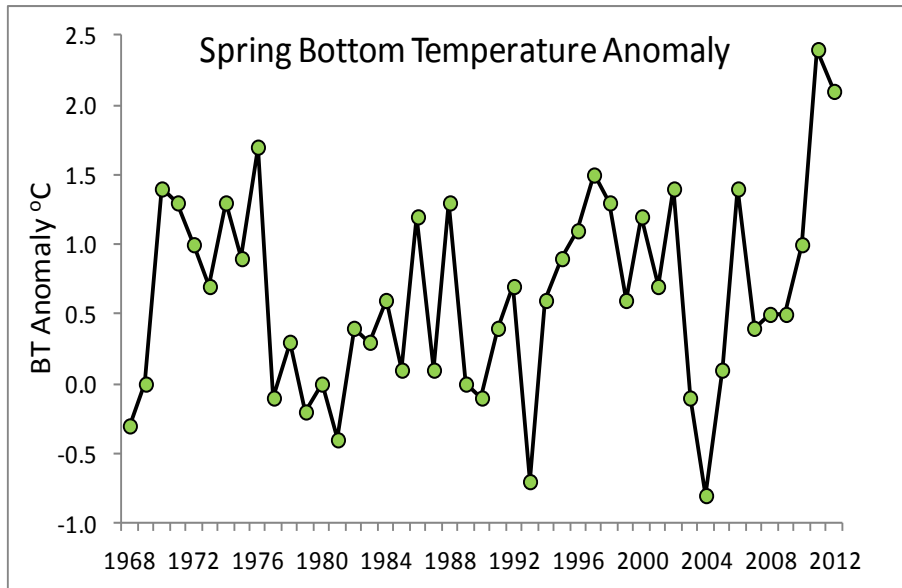
- TC recommended a moratorium
- AP pleaded for a season- they depend on the income
- Section set 625 mt TAC (75% reduction from 2012)
- Fishermen were NOT catching shrimp?!?!?
 - Section increased the # of landing days
 - Later in season allowed 7 days a week with no trip limits. Set an end date of 4/12/13
- To date 302.5 mt have been landed

5. Global warming?

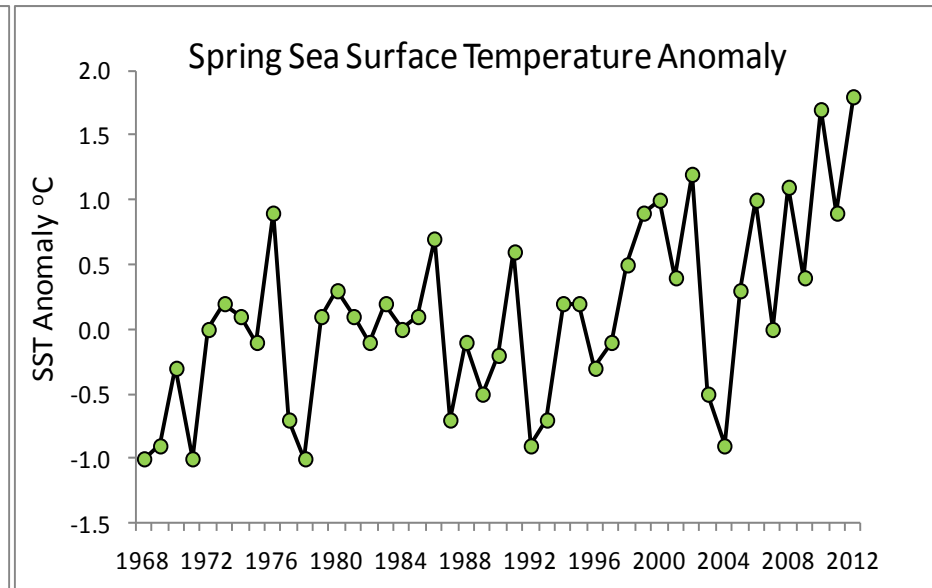


Temperature Data

- **2011 and 2012 spring bottom temps were warmest on record**



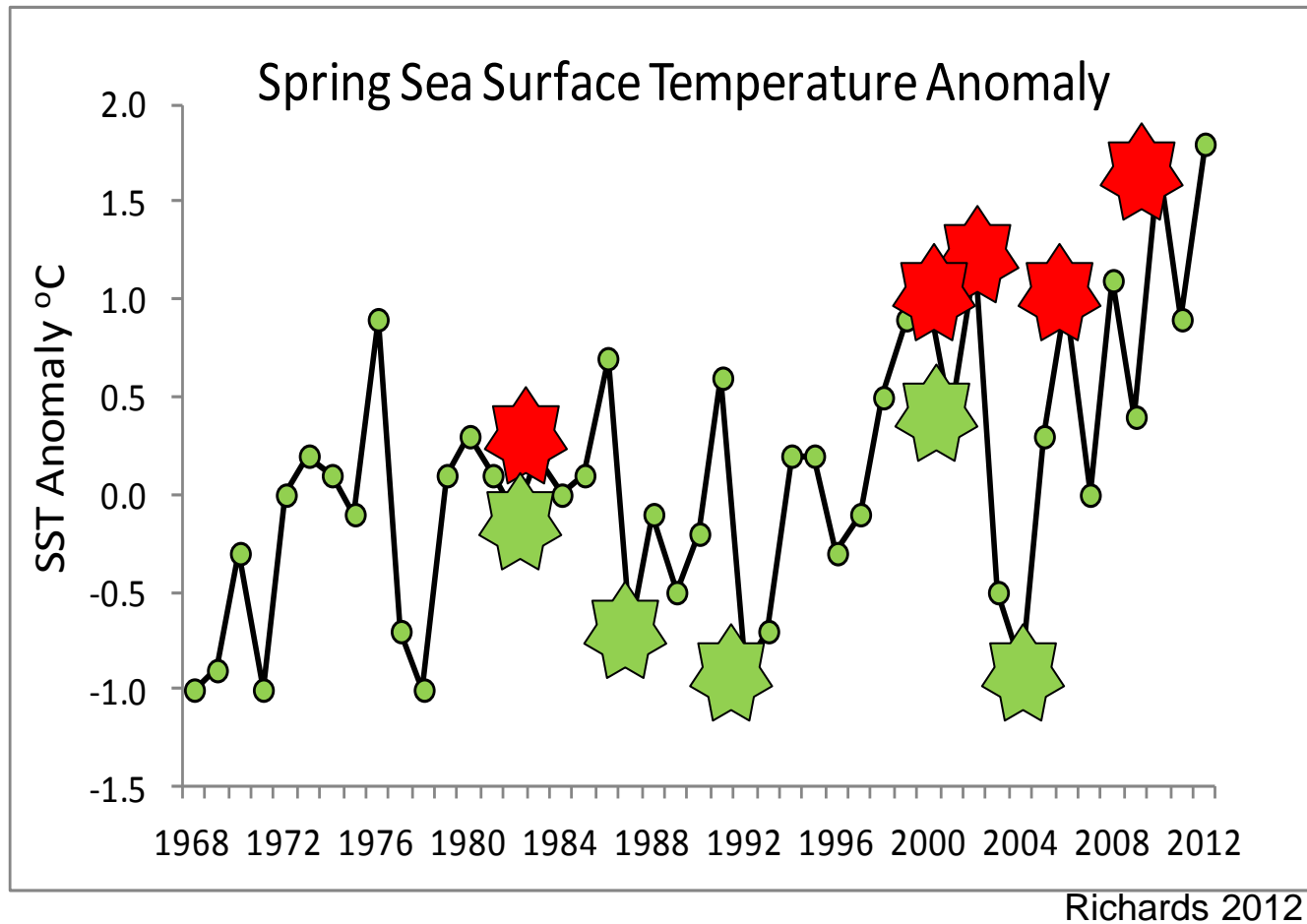
Richards 2012



Richards 2012

***Need to conserve spawners to compensate for increasingly unfavorable environment**

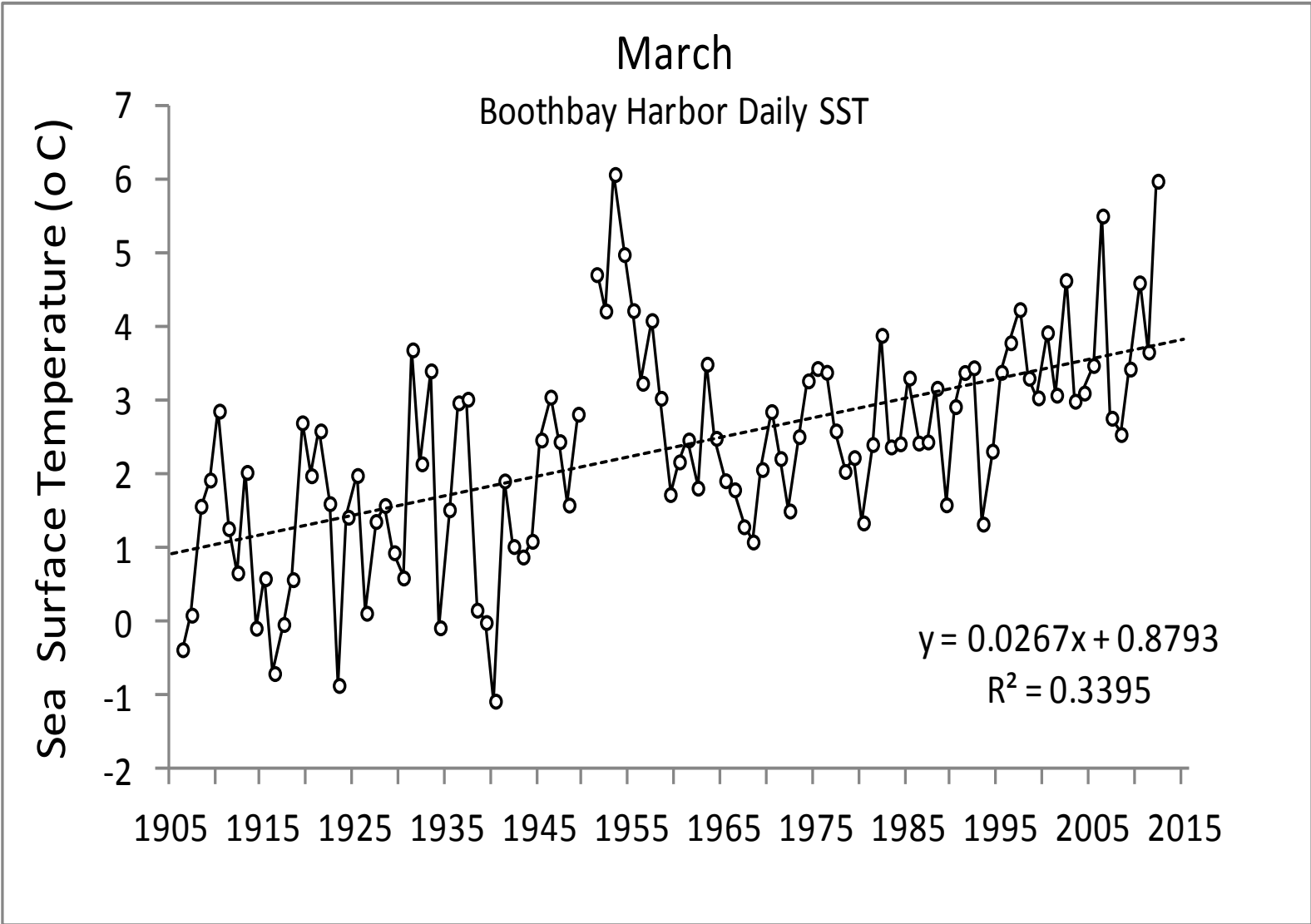
Temperature Data



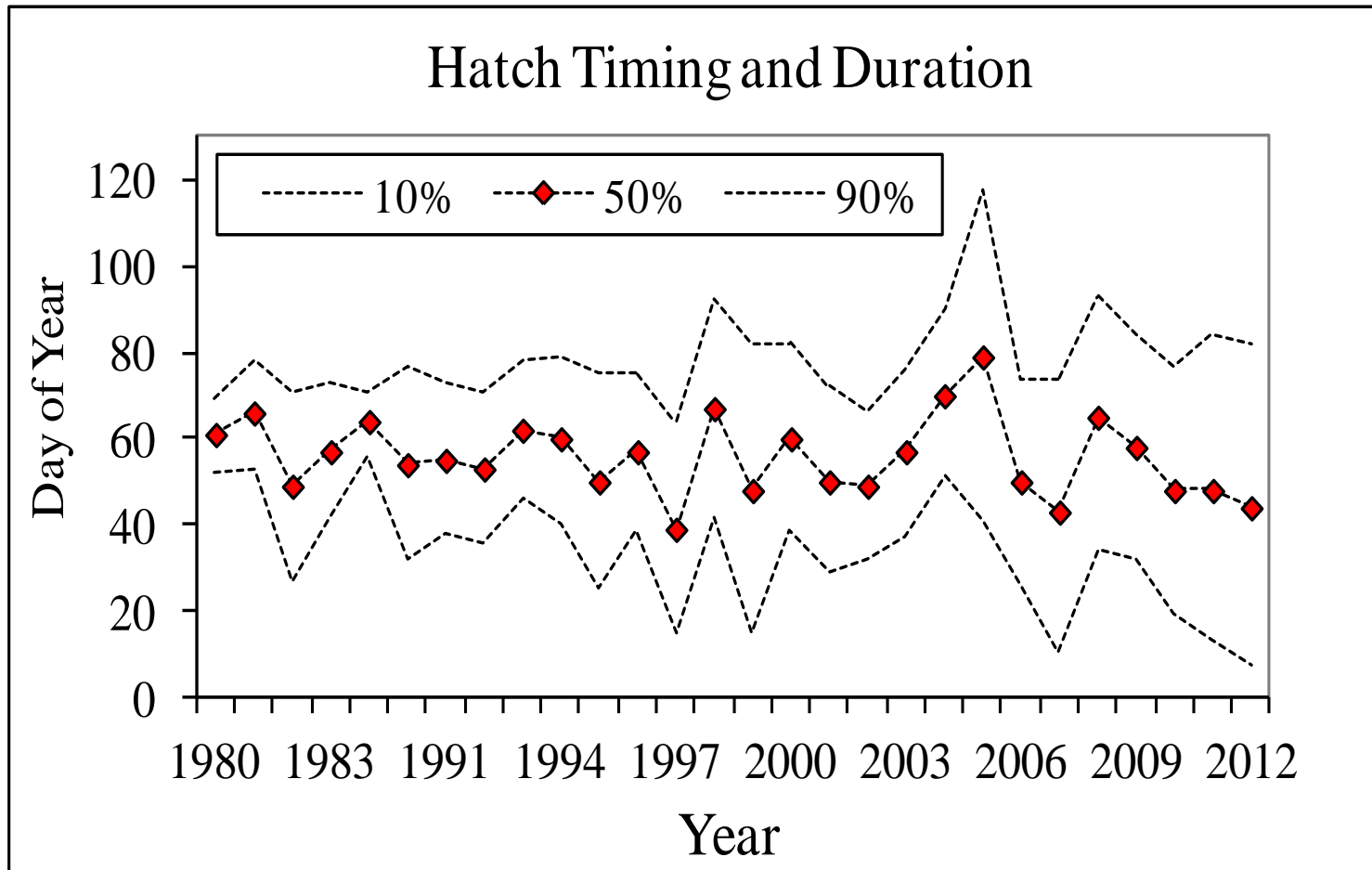
High temps coincide with poor recruitment years (**1983, 2000, 2002, 2006, 2010 are weakest year classes in time series**)

Low temps coincide with better recruitment years (**1982, 1987, 1992, 2001, 2004 are strongest year classes in time series**)

Surface Temperatures



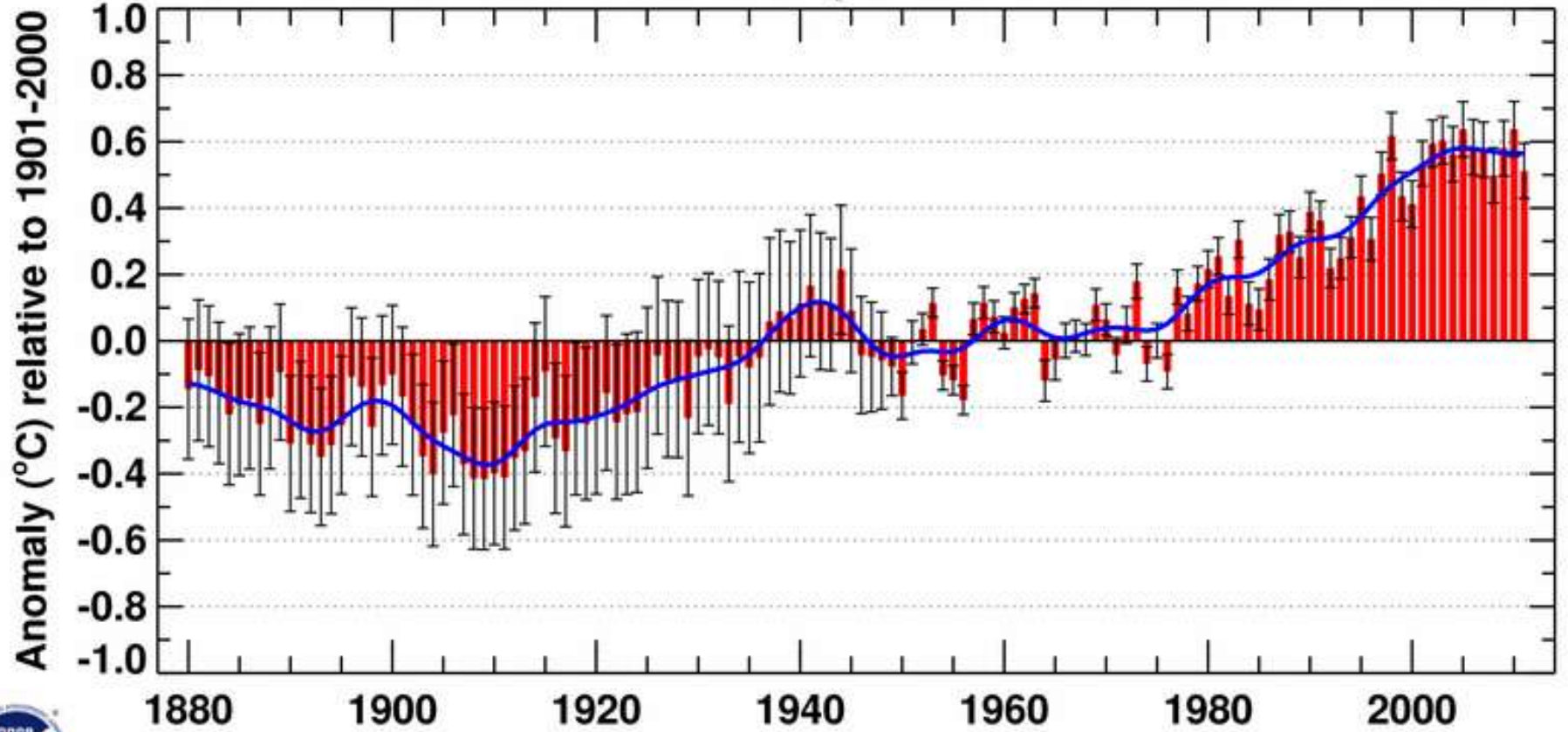
Egg Hatching



Richards 2012

- Hatching is occurring earlier and lasting longer in recent years

Jan-Dec Global Mean Temperature over Land & Ocean



NCDC/NESDIS/NOAA

In Summary

- Northern shrimp are at the southern most part of their range
- Changes in temperature has been shown to affect hatch date and impact the recruitment strength



A. D'eon

Questions?



T. Gosselin