Northern Shrimp Management in a warming Gulf of Maine

Jessica Carloni
Northern Shrimp Range

- 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 ~2 1/2 years old
- Transition into females at ~3 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
• Important source of income for New England fishermen
• Estimated value in 2012 $5.1 million
• Estimated value in 2013 $1.2 million *preliminary
- There are NO shrimp!!!!
  – All surveys that capture northern shrimp show a downward trend in 2012
Why is this happening??

1. Predators?

J. Jensen

animalspot.net

thevashionline.com

Foodista.com
2. Population shift?
3. Pollution?
## 4. Overfishing?

<table>
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<tr>
<th>Year</th>
<th>Details</th>
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| **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

*Need to conserve spawners to compensate for increasingly unfavorable environment
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

March
Boothbay Harbor Daily SST

$y = 0.0267x + 0.8793$

$R^2 = 0.3395$
Egg Hatching

- Hatching is occurring earlier and lasting longer in recent years

Richards 2012
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
Questions?