



Warmer temperatures, molt timing and lobster seasons in the Canadian Maritimes

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Outline

- Climate change & lobster populations
- Lobster landings & economic climate
- Molting process, frequency and seasonality
- Lobster seasons in the Maritimes & molt timing
- 2012 and the Nova Scotia lobster fishery
- Summary & recommendations



Climate change and lobster populations

- Climate change has potential for many effects on lobster populations and fisheries
- Physiology, ecology, disease
 - Distribution and abundance
- Near-term effects:
 - Changes in seasonality of biological events such as growth – Molting
 - Possible increased catchability
- First, landings & the economic climate

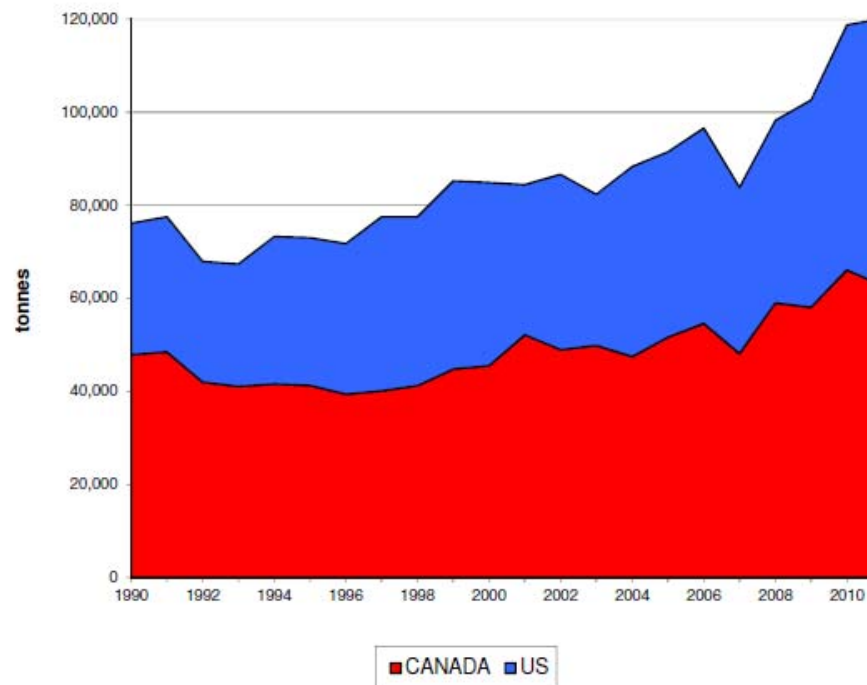


Economic climate

- Lobster landings in both Canada and the US near all-time highs - effects on price....

North American Landings of American Lobster, 1990 to 2011p

- 2011 was a record for the total North American supply of American Lobster at just over **120,100 tonnes**
- Record landings in the **US (57,360 tonnes)** and 2nd all time high in **Canada (62,743 tonnes)**
- 1.1% increase over 2010

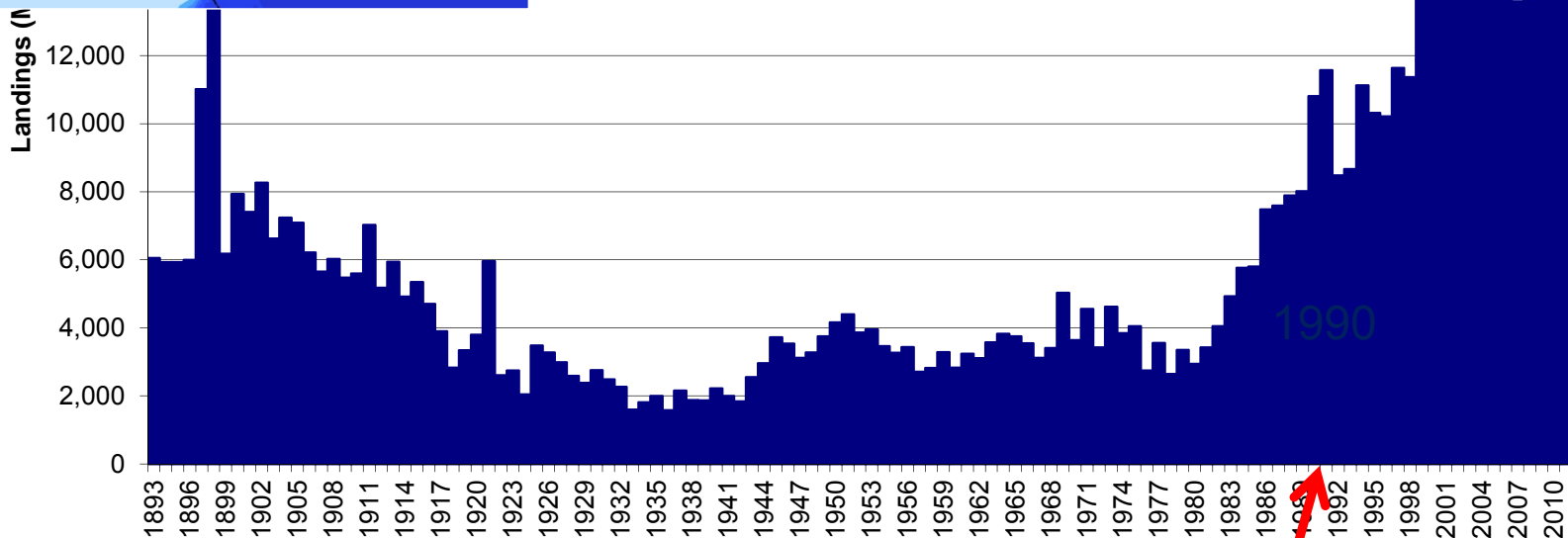


Landings have increased > 20 years



LFA 34 Annual Landings 1893-2011

Lobster Landings (LFA 34): 1893-2011



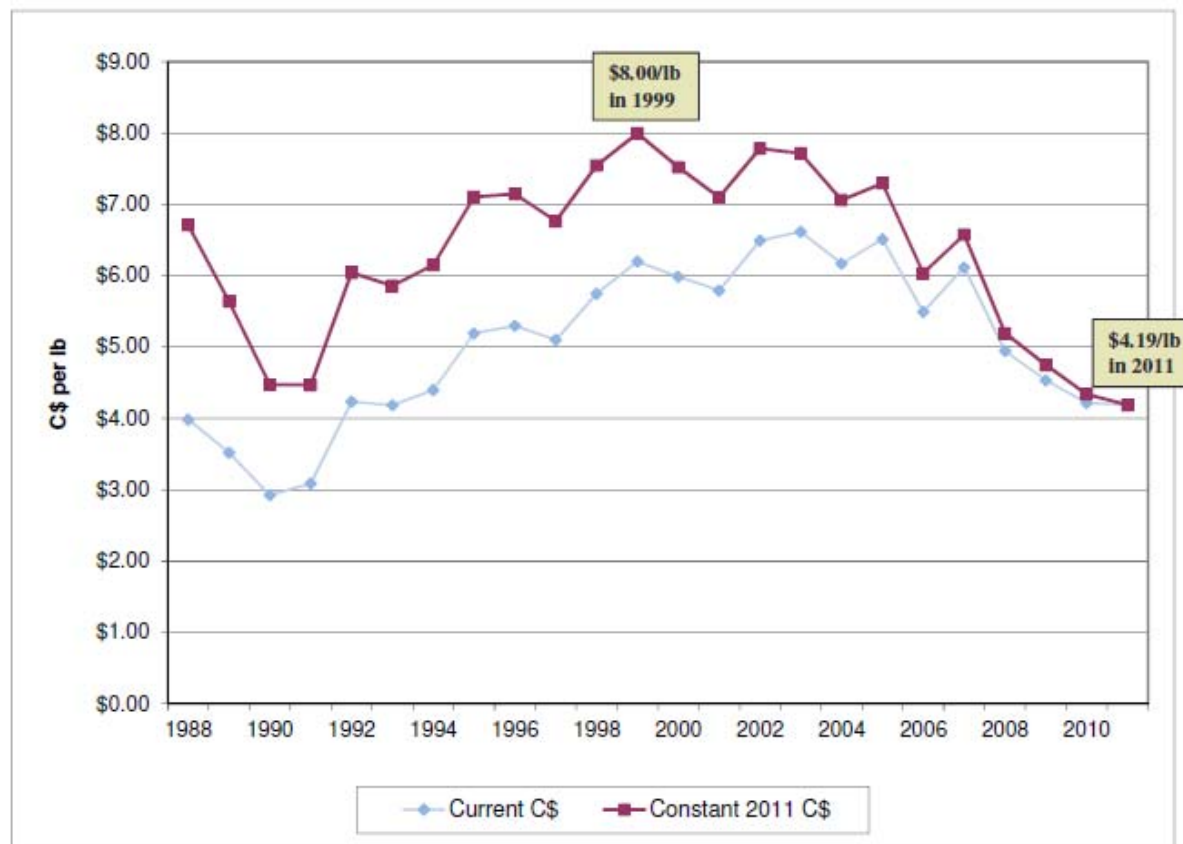
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Economic climate

- Prices lowest in many years

Inshore Lobster Average Price, Inflation-adjusted, 1988-2011



Economic climate

- Low prices in Canada due to
 - High supply
 - Recession
 - \$CAN close to par with \$US
- In addition industry faces increased prices for fuel, bait
- Anything that affects lobster price important to industry...



Economic climate

So what is concern about molt timing?

- Recently molted lobsters have lower value. Climate change will affect seasonality of molting
- A bit about the molt process....



Molting – A significant event



Start of moult



Ten minutes later



Fifteen minutes later



Moult completed one minute later



Increase in weight by 40-50%



Molting affects lobster behavior, post-capture mortality and value

- After molt and some shell hardening..
 - increased foraging activity
 - more likely to enter and be retained by traps
- Lower value in Canada
 - Recently molted lobsters have lower meat yield
 - Weaker and less able to withstand post-capture holding and transport



Molt frequency and seasonality

- Molting of commercial sizes typically occurs in June-Sept

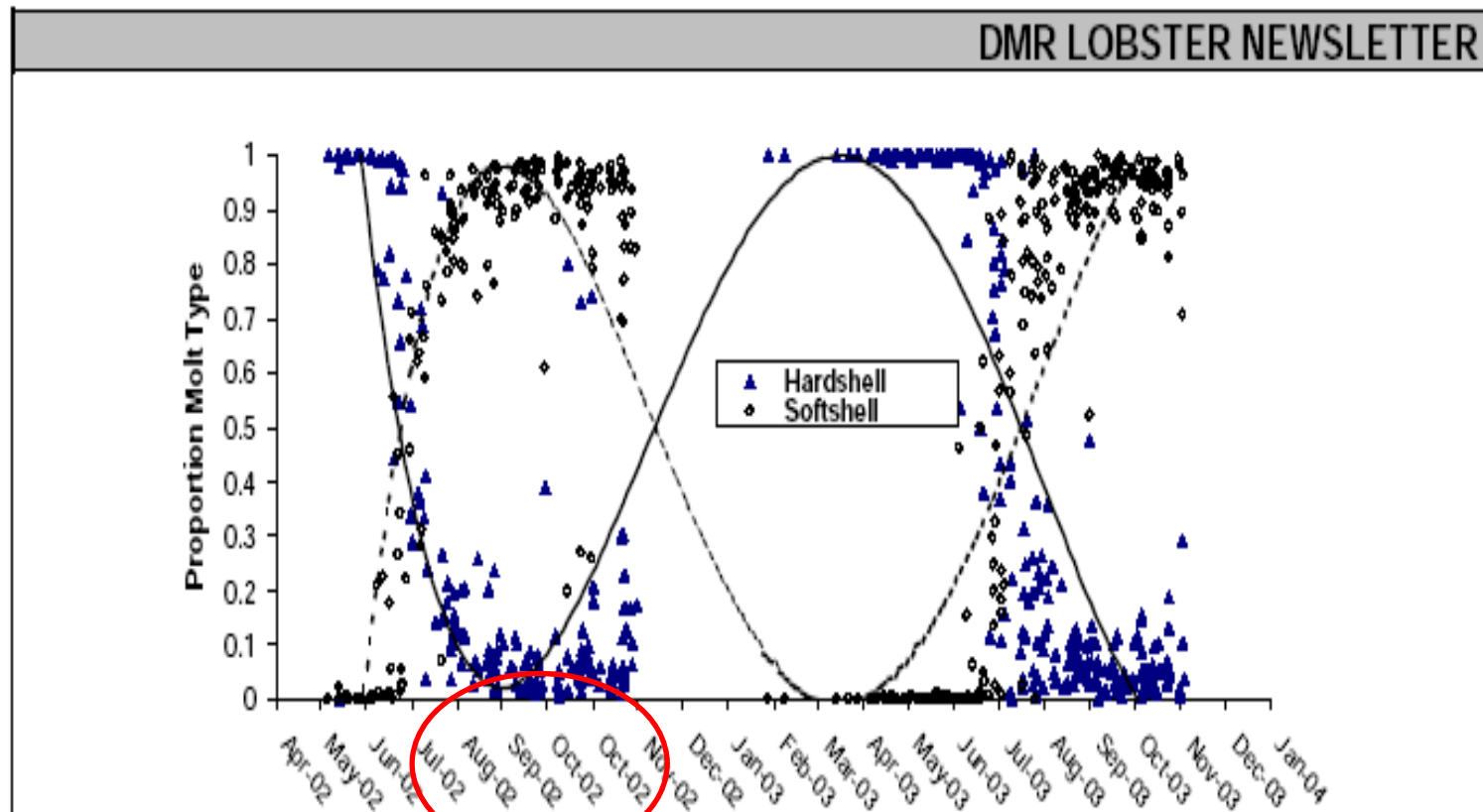


Figure 2. The proportion of hard shell (solid line) and soft shell (broken line) as recorded during sea sampling trips for 2002 and 2003. The annual molt was delayed nearly four weeks in 2003 as compared to 2002.



Molt frequency and seasonality

Factors affecting molt timing

- Lobster size, sex
- Reproductive status
- Nutrition, health
- Interactions with other lobsters
- Temperature



Temperature affects molt timing

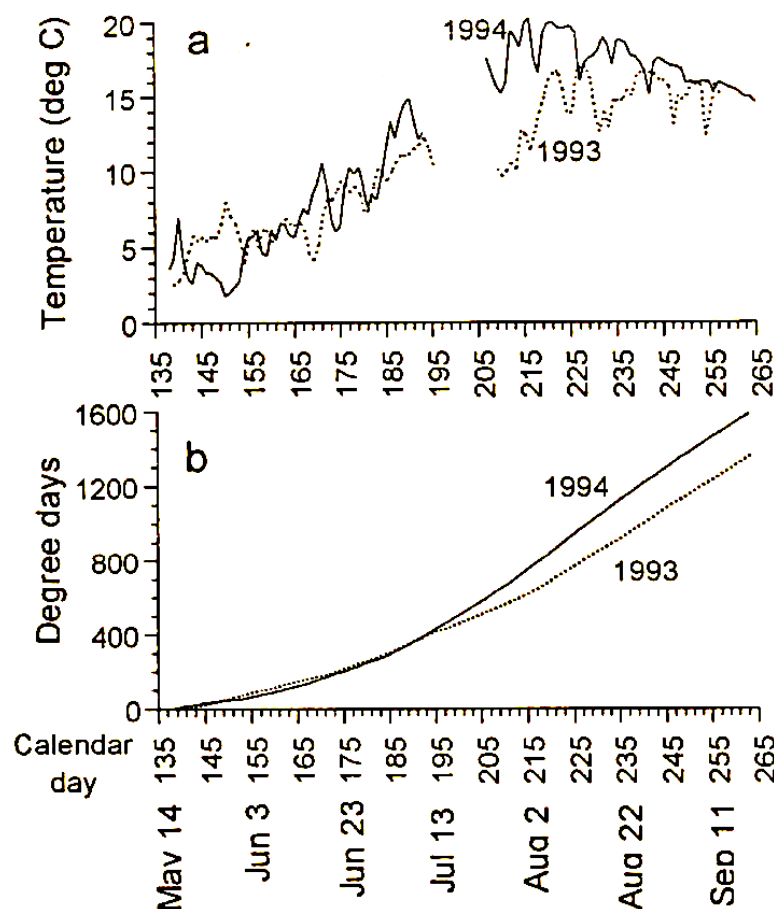


Figure 3. Seasonal temperatures (a) and degree days (b) in St. Anns Bay in 1993 and 1994. Temperatures were measured at 4–8 m off Little River, with the exception of the May to July 1993 record (4–8 m off Englishtown).

Sex / Size (mm CL)	Advanced Pre-Molt	Post-molt
1993 (cold)		
Males < 70	Aug 14	Sep 12
Females < 70	Aug 14	Sep 11
Males 70-93	Aug 20	Sep 9
Females 70-93	Aug 28	Sep 12
1994 (warm)		
Males < 70	Aug 1 (-13 d)	Aug 26 (-17 d)
Females < 70	Jul 26 (-19 d)	Aug 24 (-18 d)
Males 70-93	Jul 22 (-28 d)	Aug 27 (-13 d)
Females 70-93	Aug 9 (-19 d)	Aug 27 (-14 d)

From Tremblay and Eagles, 1997

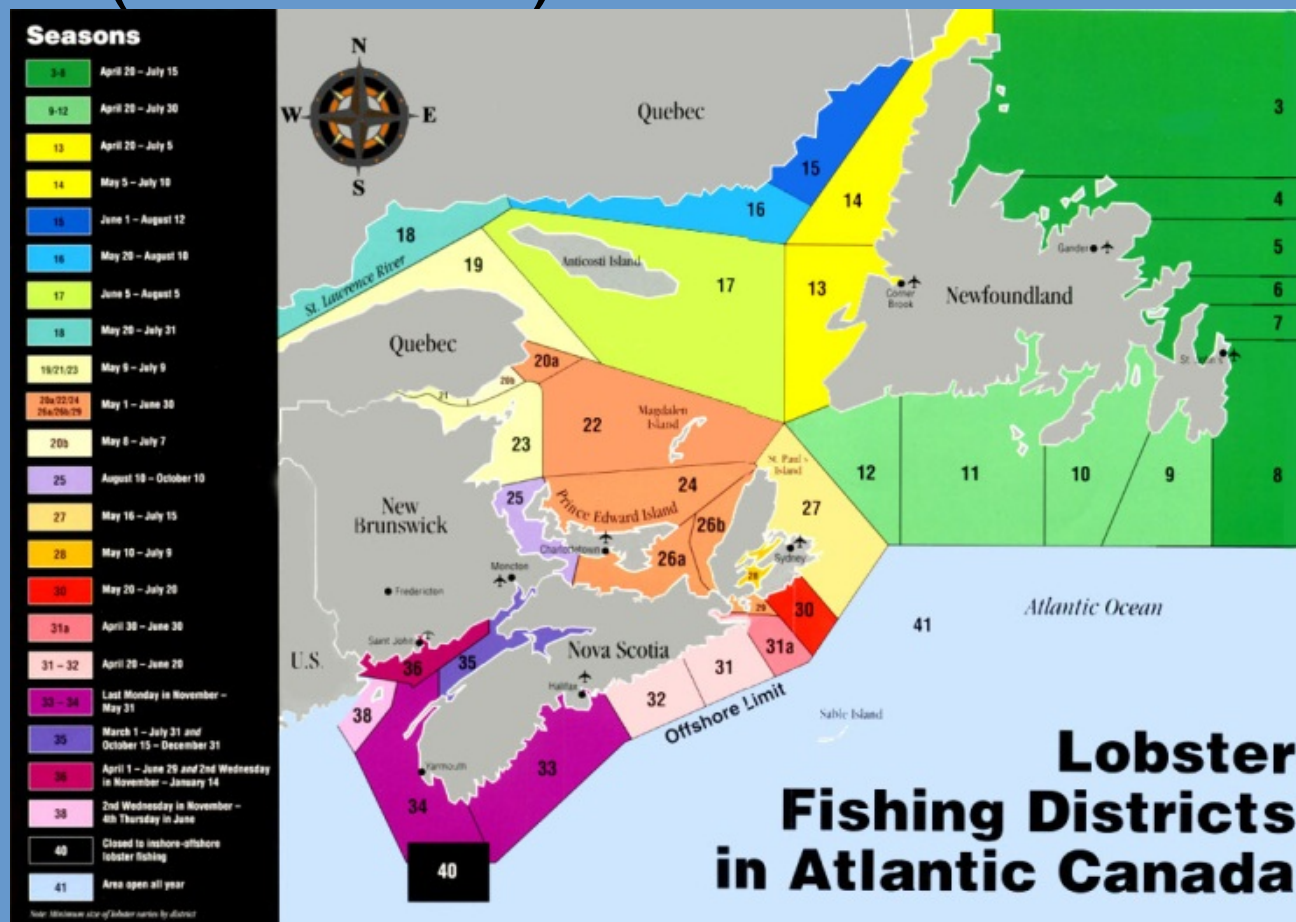


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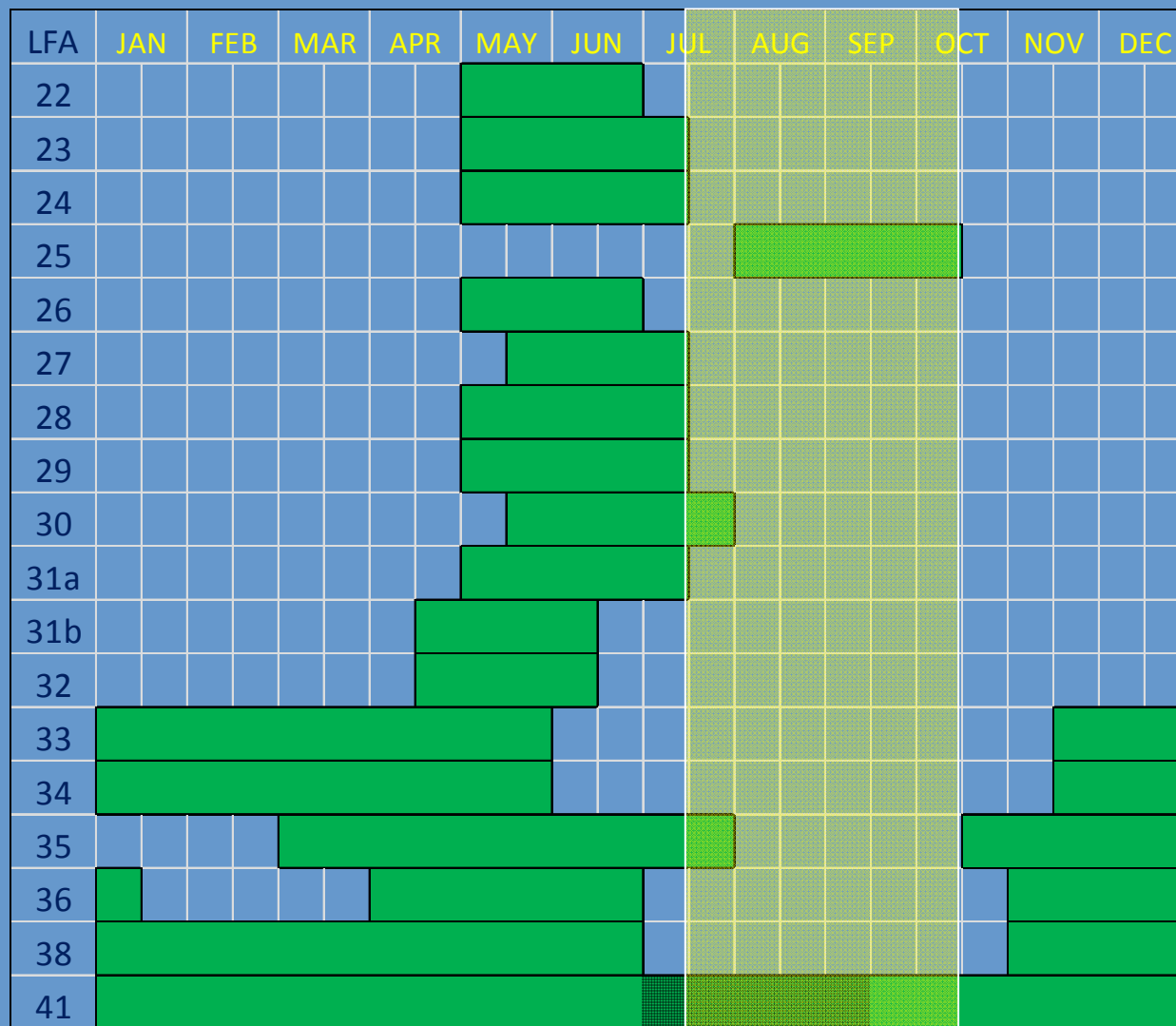
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Lobster seasons in Atlantic Canada

- Timed to reduce incidence of recently molted (“soft-shell”) lobsters



Most fishing seasons in Canada closed mid-July to mid-Oct



Recent issues with seasons and molting

- In last decade, increased proportion of soft-shelled lobsters in December in fall seasons
 - later than normal molt ...
- Increased proportion of soft-shelled lobsters in late spring
 - earlier than normal molt
- Temperature a factor....
- Changes in abundance & fishing practices complicate interpretation



Southwest Nova Scotia

- During the 2003/2004 season, there was a particularly high percentage of soft-shell lobsters
- High mortalities during holding
- Still an issue...



2011 season

Lobsters weak, have soft shells this season, fishermen say

December 8, 2011 - 5:37am BY BRIAN MEDEL YARMOUTH BUREAU

Catches decent at close of first week, but prices too low to break even

YARMOUTH — More than a few lobster landed during the first week of the fall lobster season in southwestern Nova Scotia have soft shells or appear weak and listless, say some in the industry.

And numerous weak lobster are dying in salt water storage tanks on shore, said one lobster buyer who spoke on condition of anonymity.

Lobster fishing is intense right now and the price being paid to fishermen is low, they say.

At \$3.25 per pound, it's hard to survive. Some fishermen say \$5 per pound is the new break-even point.

That coupled with the fact that many lobster are found dead in storage facilities before they can even be shipped is making for an all around tense first week for this lobster season.



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Southwest Nova Scotia – research to document seasonal molt timing

- From 2004 to present, research to better document and understand the annual changes in molt timing
- Collaboration among lobster harvesters, buyers, dealers, processors, and scientists

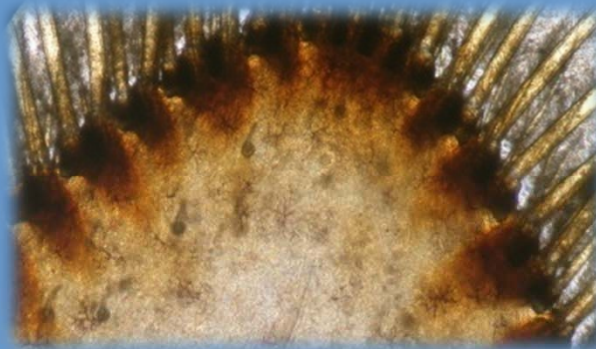


Approaches for assessing molt stage

Hemolymph
Proteins

Pre-molt Staging

Shell Hardness



- Is the sampling program representative of the natural population?
- Is the likelihood to enter a sampling trap consistent across entire population?
- Shelter-specific behaviour around the time of the moult?

Results to date indicate complex seasonality



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2012 and Nova Scotia Lobster Fishery

- Temperature
- Effects on lobster fishery
 - Holding mortality
 - Earlier biological seasons
 - Higher rate of molting
 - Increased catch?
 - Trawl survey index affected ?
- Moves to earlier season dates



Temperature trends 1980-2012

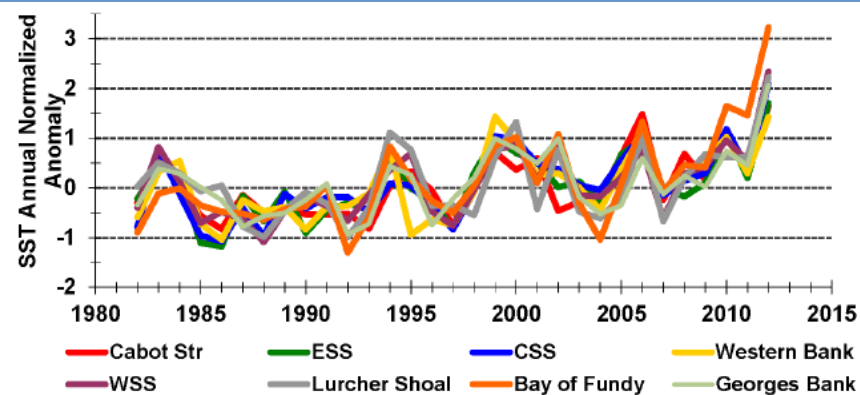
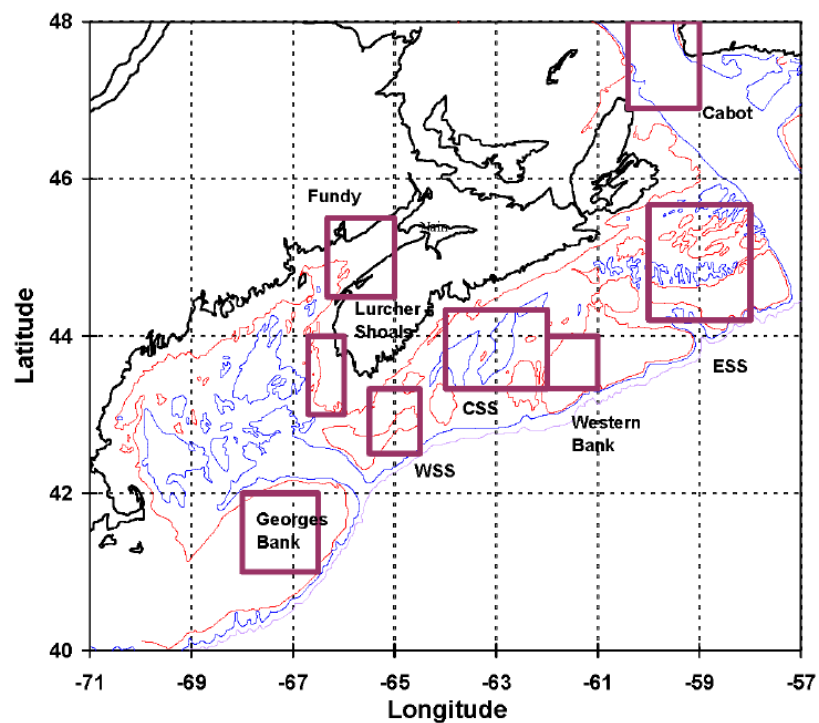


Figure 14. Scotian Shelf-Gulf of Maine areas (Cabot Strait, Eastern Scotian Shelf (EES), Western Bank, Central Scotian Shelf (CSS), Western Scotian Shelf (WSS), Georges Bank, Lurcher Shoals and Bay of Fundy) used for extraction of sea surface temperature (upper panel). The annual sea surface temperature anomalies derived from satellite imagery compared to their long-term monthly means (lower panel).

From: Hebert, D., Pettipas, R., Brickman, D., and Dever M. 2013. Meteorological, Sea Ice and Physical Oceanographic Conditions on the Scotian Shelf and in the Gulf of Maine during 2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/058. v + 46 p.



Temperature anomalies

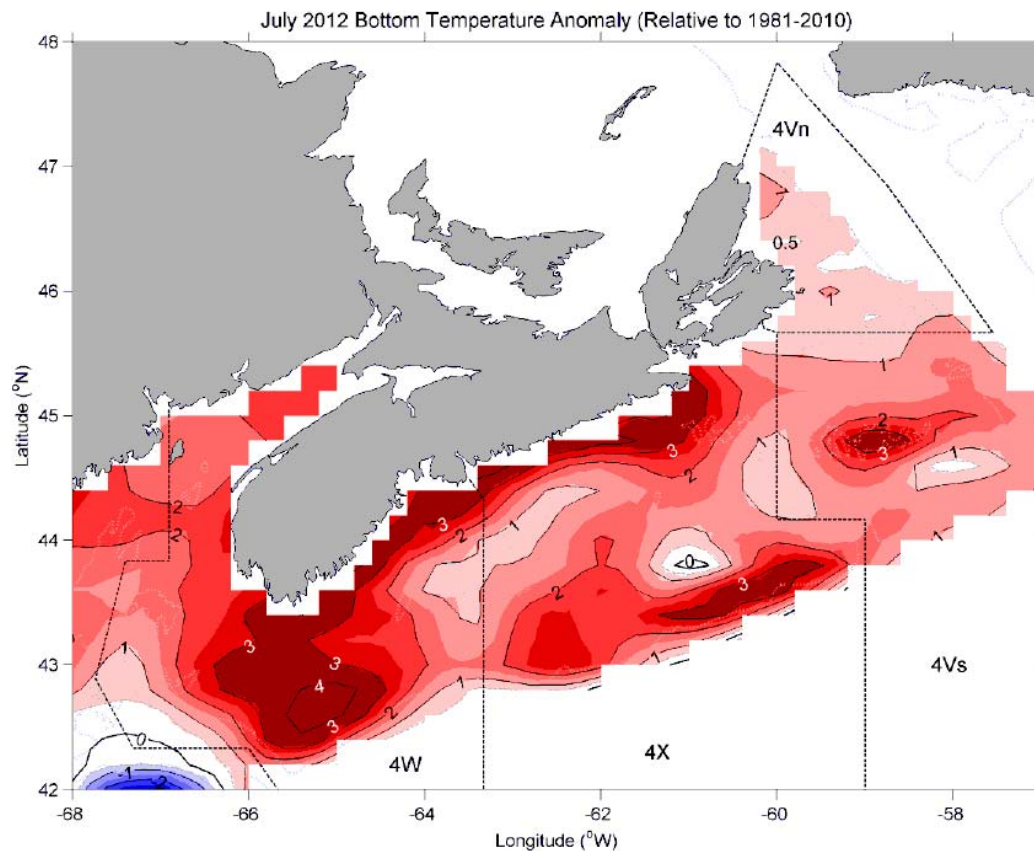


Figure 21. July bottom temperature (upper panel) and anomaly (lower panel; relative to 1981-2010) maps for 2012.

From: Hebert, D., Pettipas, R., Brickman, D., and Dever M. 2013. Meteorological, Sea Ice and Physical Oceanographic Conditions on the Scotian Shelf and in the Gulf of Maine during 2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2013/058. v + 46 p.



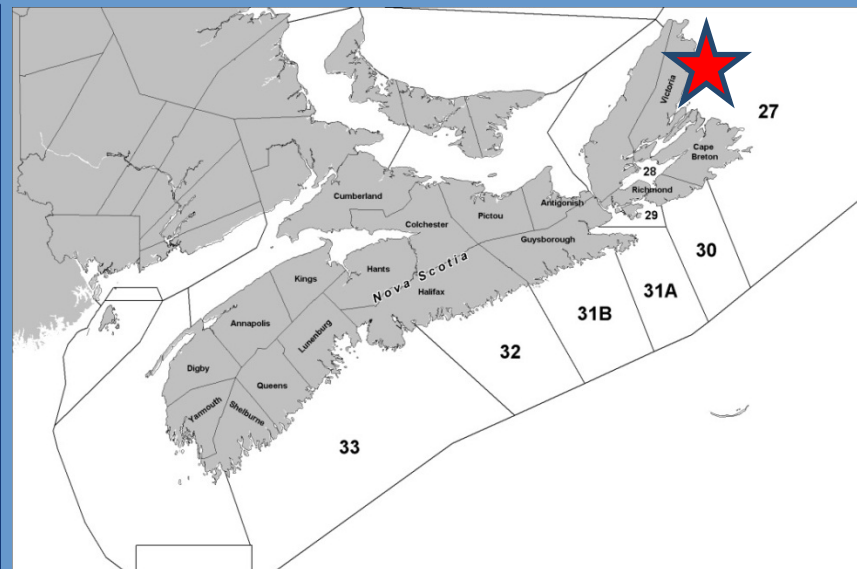
In 2012 holding mortality increased

MAINSTREET CAPE BRETON | Oct 18, 2012 | 2:30

Lobster Deaths - Osborne Burke

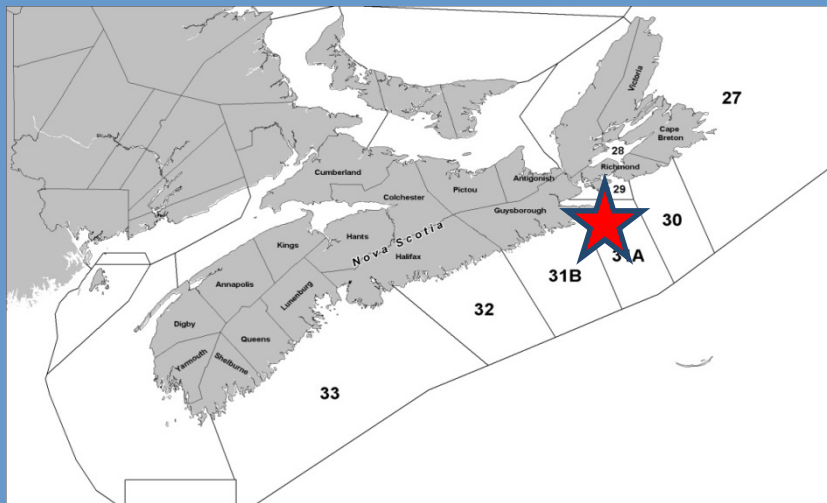
Many of us enjoyed this summer's warmer ocean waters but that increase in temperature was deadly for hundreds of thousands of lobsters. They were being kept in boxes in the waters along the Cape Breton coast. Lobster buyers were holding onto them while they tried to find someone to buy them at a fair price.

.....



- Warm temperatures implicated but likely due to associated oxygen depletion
- Proposed solutions – earlier season, increased chilling capacity in holding facilities

Shifts in biological season noted in 2012



- Guysborough County Fisherman's Association undertakes various biological surveys

- Noted biological events occurring earlier for several years; 2012 extreme
 - Lobster molting & egg hatching; jellyfish, bait fish, tuna...



Seasons opened a few days earlier in 2013 in response to 2012

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Jennifer Cook, retail supervisor at Clearwater Seafoods in Bedford, NS holds some premium hard shelled lobster over the lobster tank on display in the middle of the store, Oct. 19, 2012.

For The Globe and Mail

SYDNEY, N.S.

Delayed start to lobster season off Cape Breton pleases fishermen

Published Thursday, Apr. 04, 2013 08:49AM EDT

Last updated Thursday, Apr. 04, 2013 08:50AM EDT

Fishermen in a large Cape Breton lobster fishing area say delaying the start of the season by a week should improve the chances of good weather and better catches.

Chris MacDonald, a member of a lobster advisory group for an area from Cape North to Gabarus, says May 11 was the preferred opening date for fishermen in his area of False Bay and Port Morien.

He says fishermen in the area opted for that date when they were asked for their choice.

He says the weather will likely be calmer to give the lobsters a little more time to move and trap.

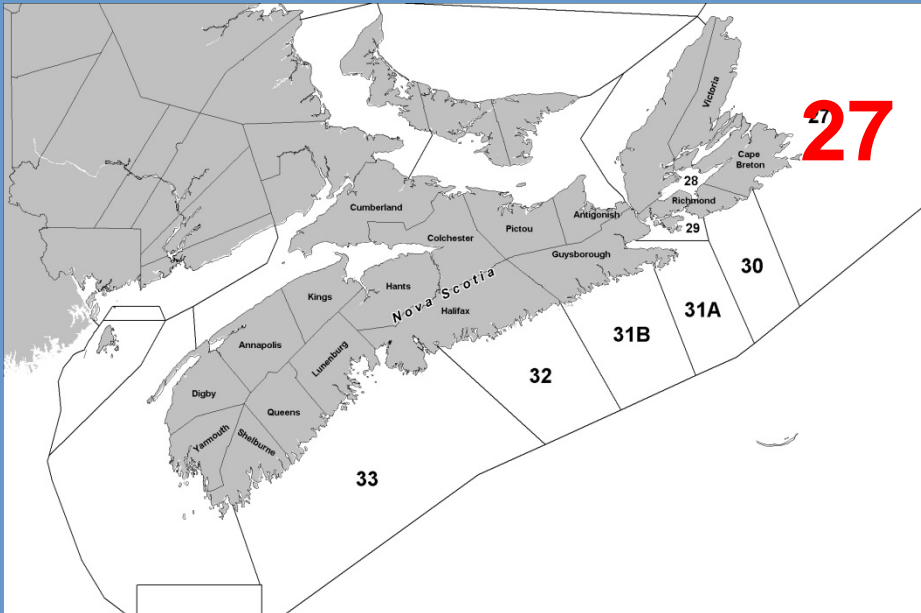
- LFA 27 – 4 days earlier
- LFA 31A – 7 days earlier



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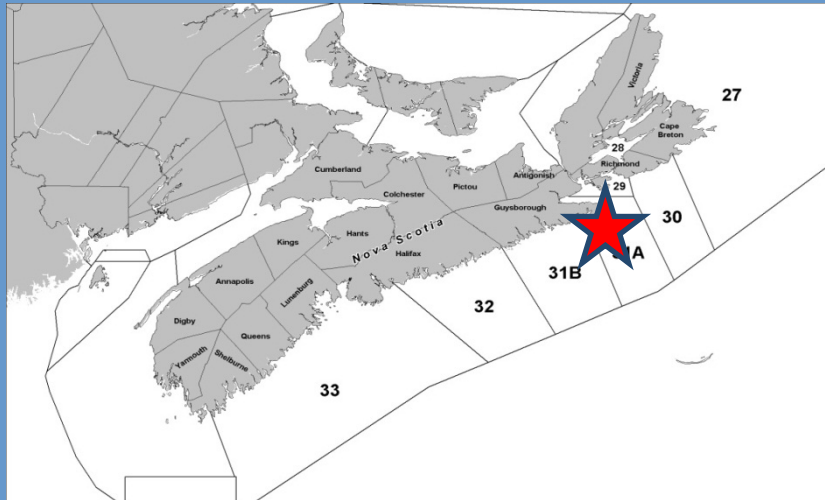
Effect of earlier 2013 opening in LFA 27



- Irrelevant---fishermen went on strike for higher prices until May 16th
- Catches were high, likely due to good conditions for fishing



Effect of earlier 2013 opening in LFA31a



- Not viewed as a success...
- Water temperatures lower than normal; wind conditions unfavorable
- Catches were low during the first week

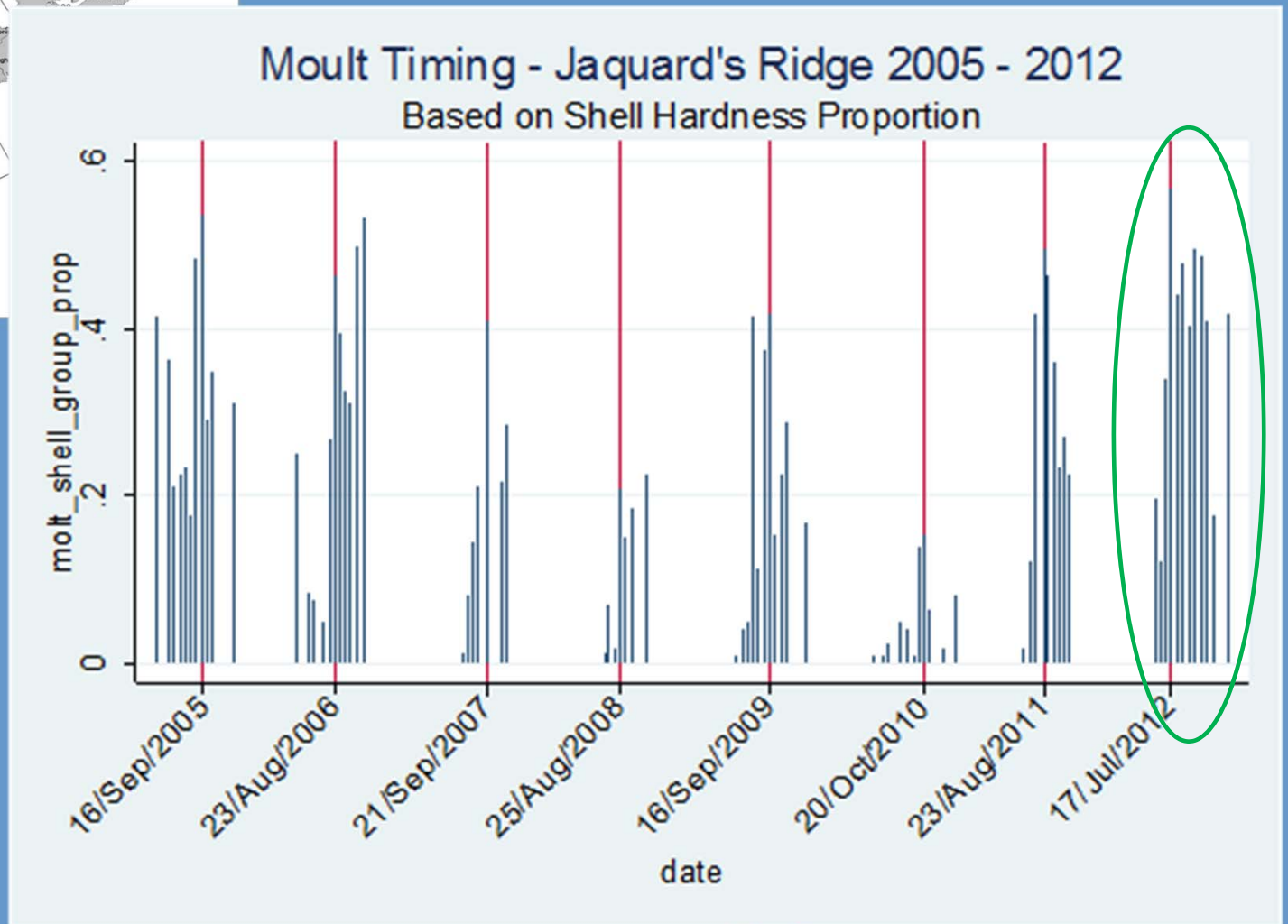
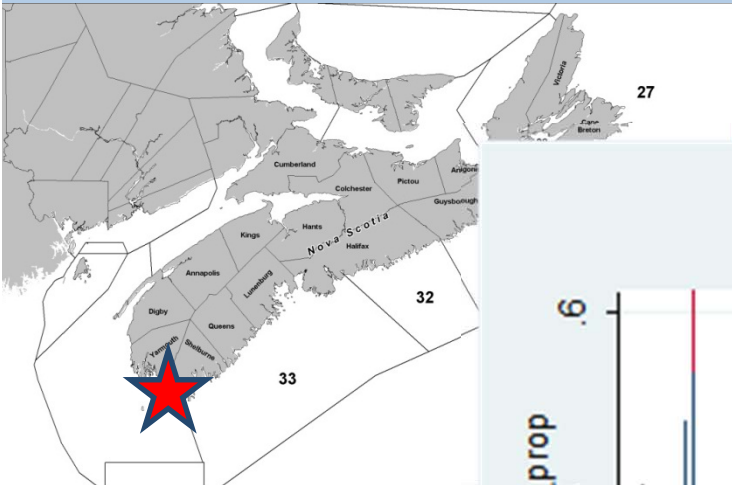


Molting in 2012

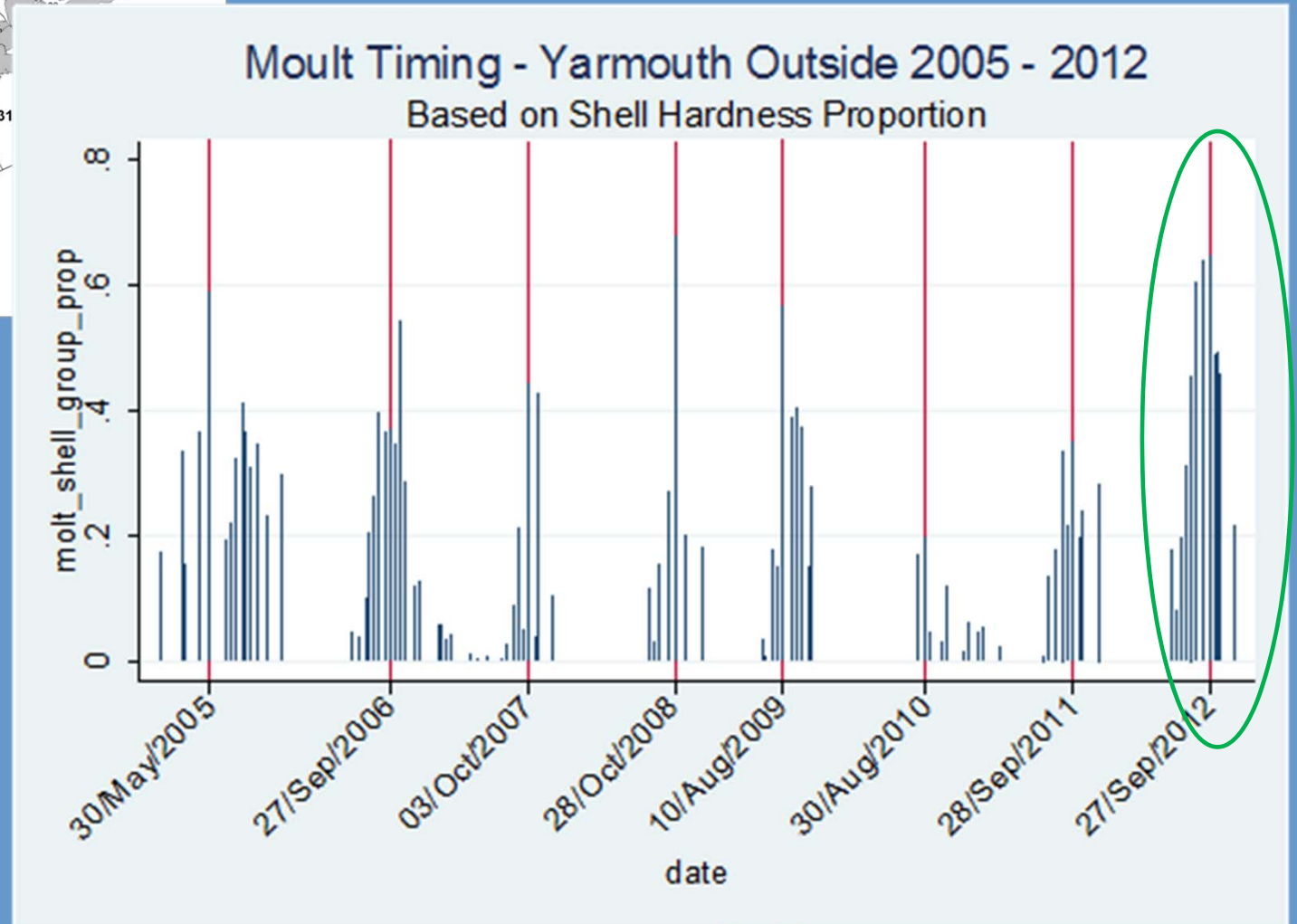
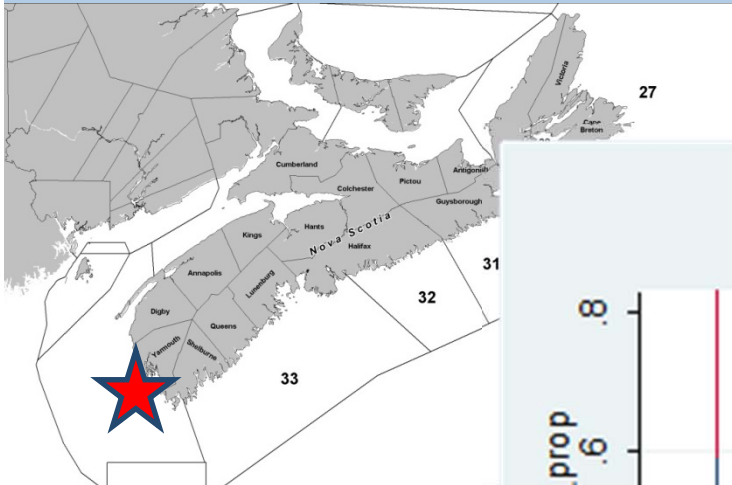
- Lost of anecdotal evidence of earlier molting in eastern areas
- In southwest (Canadian GOM), molting much more protracted
- Molt indicators inconsistent
- Qualitatively - in 2012 higher proportion of soft shell lobster over the season



Greater molting activity Jacquards Ridge



Greater molting activity Yarmouth outside



Did 2012 temperature contribute to increased fishery catch?

Lobster glut leads to quotas amid low prices

Prices remain low as boats return to the water

[CBC News](#)

Posted: May 21, 2013 10:20 PM AT

Last Updated: May 21, 2013 10:47 PM AT



Some fishermen say they'll have to sell some of their catch directly to the public now that there's quotas. (CBC)

Many P.E.I. lobster fishermen face daily quotas on their catches because the processors say they're being overwhelmed by large catches.

The quotas, which started over the weekend, range between 500 to 1,000 pounds per boat. It's adding to boiling frustrations after low prices sparked protests last week.

"It's tough," said Mike McGeoghegan, president of the P.E.I. Fishermen's Association. He said fishermen can't find extra buyers for the overage. "Right now, you just have to slow down your fishing. Fish less traps."

In Abrams Village, the Acadian Fisheries Co-op has been processing lobster steadily.

"I certainly believe that as soon as the plants are able to handle more volume, they will allow the fishermen to bring in more," said Jeff Malloy, a spokesperson for PEI processors.

"The last number of years, there certainly has been less capacity in the industry, especially here on P.E.I. with plant closures and such."

Craig Avery, president of the Western Gulf Fishermen's Association, said some fishermen will have to sell their catch directly to the public.

"There's been quite a glut, you know, the catches are phenomenal in a lot of places where there haven't been lobsters other years," he said. "We just haven't got the capacity in our plants to be able to process and package everything that's coming in."

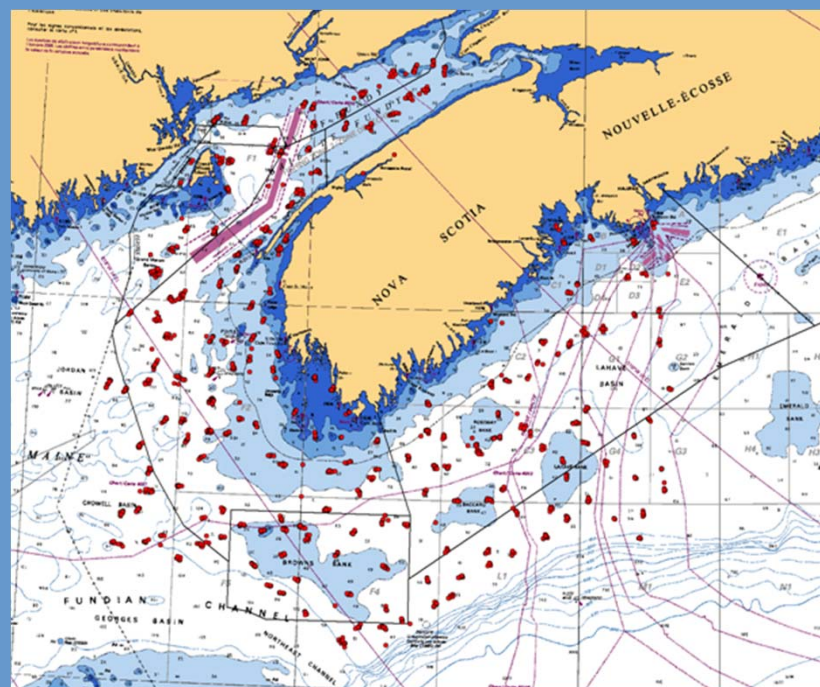
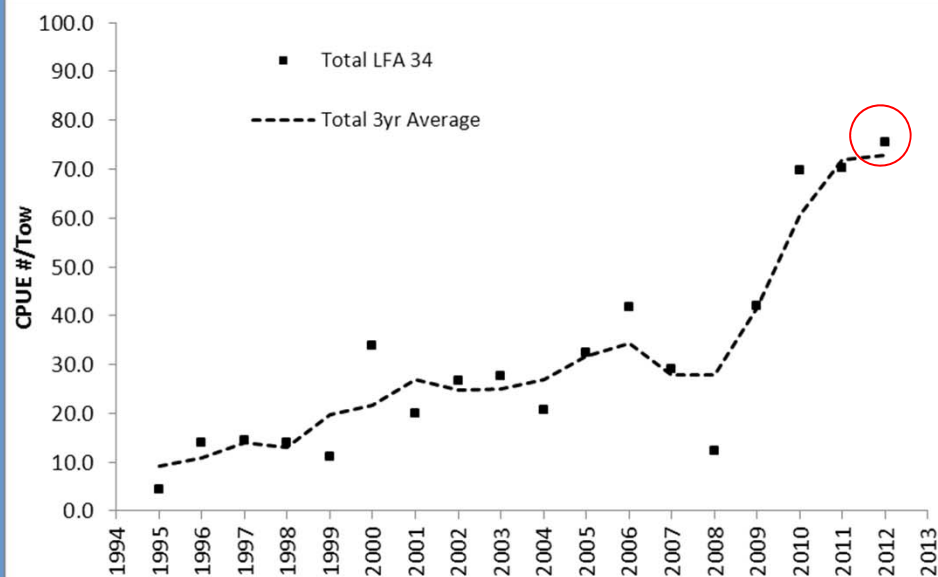
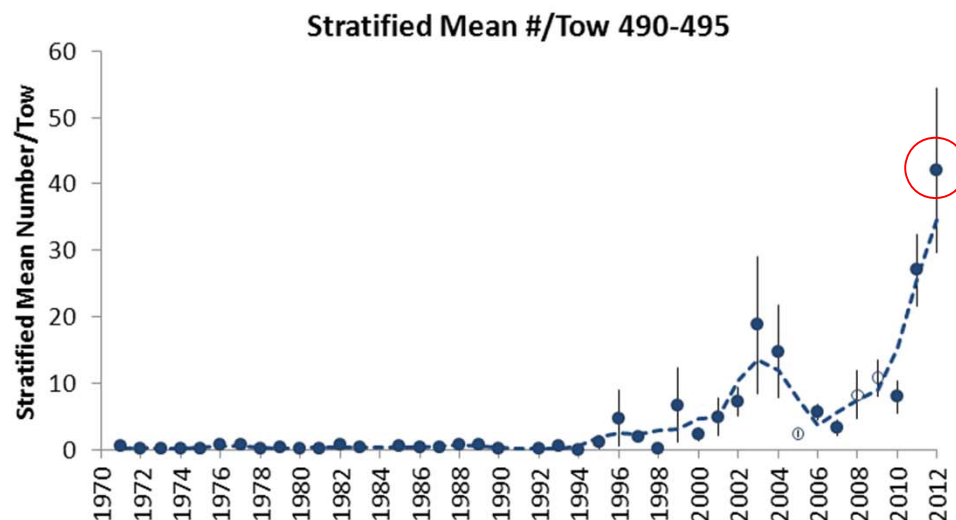
- Temperatures may have been high enough to increase lobster activity and catchability
- In some areas buyers imposed quotas...



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2012 – Survey indices affected?



Summary

- Lobster fishery currently in high abundance/low price environment
- Effect of 2012 temperatures - evidence of higher post-capture lobster mortality, earlier and increased molting activity, possibly higher catches
- Some fishery management adaptations which were not very effective for different reasons



Some Recommendations

Science

- Needs to be effective monitoring for molt timing and duration, and other biological events such as reproduction
- How will these be affected by temperature & other aspects of climate change
- Improved pre-season prediction and potential responses



Recommendations

Management (Federal, Industry, Province)

- Season dates should be flexible – meet conservation but adjust to maximize value
- Decision rules & improved capacity for decision-making by industry
- Consider season date changes as experiment
- Continue to develop markets; consider changes to lobster buying process



