JOINT
FISHERMEN AND SCIENTISTS RESEARCH SOCIETY - GULF OF MAINE LOBSTER FOUNDATION LOBSTER SCIENCE WORKSHOP

February 24, 2005
Howard Johnson Hotel and Convention Centre
Truro, NS

Sponsored by:
Fishermen and Scientists Research Society
Gulf of Maine Lobster Foundation

This report contains excerpts from the complete workshop document.
To obtain a copy of the complete workshop document contact
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1.0 Introduction

The Fishermen and Scientists Research Society (FSRS) and Gulf of Maine Lobster Foundation (GOMLF) held a joint Lobster Science Workshop on February 24, 2005 at the Howard Johnson Hotel and Convention Centre in Truro, NS. The workshop built on the success of the Joint Fishermen and Scientists Research Society - Maine Lobstermen's Association Collaborative Lobster Recruitment Research Workshop held in February 2003. At the 2003 workshop it was agreed to continue this cross-border exchange by holding an annual event. In 2004 a lobster workshop was held as part of the Maine Fishermen's Forum. The current workshop sought to continue this process.

The objectives of the workshop were to:

- Hold a collaborative science workshop which builds on the success of the Joint Fishermen and Scientists Research Society - Maine Lobstermen's Association Collaborative Lobster Recruitment Research Workshop held in February 2003;
- Educate fishermen about the biology of lobster, with a focus on molt stages;
- Review the results of the Lobster Recruitment Index Project;
- Review how the data have been used to date and explore other ways the data can be used to assist in stock assessment and the conservation of the resource;
- Continue to build the collaborative relationship between Canada and the US, and amongst the various stakeholders, in particular fishermen and scientists; and
- Promote the continued participation of fishermen in fisheries science and ensure their continued participation in the Lobster Recruitment (Ventless Trap) Study.

The workshop began with a presentation on the lobster life cycle, focusing on molt stages. The presentation provided information on the different molt stages and how to determine which stage a lobster is at when sampled. Molt stages is a topic that has come to the fore-front in recent years because of such issues as soft shell lobster.

The workshop continued with an update on what has been accomplished since the 2003 workshop and what is left to do. Significant progress has been made. A standardized core project, which includes a standard trap and new measuring gauge, has been adopted by both the FSRS and GOMLF. The GOMLF has converted its data to Access. A lobster data management working group has been established. Plans for expanding the project are still underway.

The next session dealt with results of the project. This led into presentations on how the data has been used, what are other potential uses for the data, and what are the issues that need to be considered when using the data. These presentations gave participants a good foundation for their breakout group discussions on how the data can be used and what other data are needed.

The breakout groups were given a series of questions to respond to:

1) Commercial Trap Sampling Project
   a) Should there be commercial trap sampling in all LFAs?
   b) Is there a willingness in all the LFAs to do the project?
   c) What problems could there be if the project is expanded into additional LFAs and how can the problems be addressed?
2) Use of Data
   a) How would you like the data to be used?
   b) Are there potential uses of the data that are of concern? If so, why and how can the concerns be addressed?
3) How would you like the data to be presented?
4) What other data needs to be collected? (e.g.: information on invasive species, presence of groundfish, water quality, etc.)
5) Other issues relevant to the continuation of the Lobster Recruitment Index/Ventless Trap project.

The responses to these questions provide guidance as to how the Lobster Recruitment Project should proceed and what changes or additions to the project are needed.

1.1 Agenda

Agenda

9:00 - 9:15 Welcome and Introduction - Patty King and Erin Pelletier

9:15 - 10:15 Lobster Life Cycle - Molting Stages - Doug Pezzack

10:15 - 10:30 Coffee Break

10:30 - 10:45 2003 Lobster Recruitment Workshop Action Plan Update – report on the implementation of the action plan from the 2003 workshop – what has been accomplished and what is left to do - Patty King and Erin Pelletier

10:45 - 11:45 Lobster Recruitment Project Results
Gulf of Maine Lobster Foundation - Erin Pelletier
FSRS - Carl MacDonald

11:45 - 1:00 Lunch (provided)

1:00 - 2:00 How Has Recruitment Data Been Used
LFA 27 - 33 Stock Assessment - Ross Claytor
Indicators for Spawners - John Tremblay

2:00 - 3:00 Other Uses of Recruitment Data and Data Use Issues
Trends versus Abundance - Carl Wilson
Comparing Recruitment Trap Sampling Data to At-Sea Sampling Data - Alison Sirois
LFA 33 Commercial Trap Sampling Project and Trap Effectiveness Study - Carl MacDonald

3:00 - 3:15 Coffee Break

3:15 - 4:00 Breakout Group Discussions on how the data can be used and what other data is needed.

4:00 - 4:30 Reports from Breakout Groups

4:30 - 5:00 Future Direction of the Lobster Recruitment Index Project

5:00 - 5:15 Wrap Up and Closing Remarks

2.0 Presentations

2.1 Lobster Life Cycle - Molting Stages

By Doug Pezzack, Invertebrate Fisheries Division, DFO

2.1.1 Presentation Summary

Written by Jennifer LeBlanc

Female lobsters carry eggs on their abdomen for 9-12 months, after a year of carrying them internally. Once hatched, the larvae go through 3 stages in which they are planktonic, living near the surface of the ocean for 3-10 weeks. It is not until the post-larval stage that they finally look like a lobster, though. There is a lot of mortality during the larval stages and during the post-larval stage as they settle on the bottom and search for shelter. Next is the benthic stage. The tiny juvenile lobsters remain in their shelter, feeding and growing. They do not move around a great deal, so they are not often seen or caught in traps. Because they stay hidden, survival rate is believed to be high. Once they've grown to roughly 25-40 mm carapace length (approximately 1-1½ inches), they are more actively moving about the ocean bottom and entering traps. Then, at approximately 9 to 12 months, they reach maturity. In the Bay of Fundy, the lobsters spend about 2 years in the fishery before they reach maturity.

Lobsters have an exoskeleton – their skeleton (the shell) is on the outside of the body and the muscles are on the inside (which is the opposite of humans). This shell is a living tissue, not just an outer protective armor, and is a complex structure of many layers. These layers are made of proteins, lipids (fats), calcium, and chitins. There are pores, or canals, running from the innermost layers to the outer layers, which allow continuous repair and movement of particles and nutrients through all layers of the shell. There are tiny hairs all over the shell, which are especially concentrated around the mouth and the walking legs. These are used as sensory organs, and are shed with the old shell and must be replaced. Having an exoskeleton makes lobsters (and other invertebrates) less vulnerable to predation, but in order to grow, the shell must be shed. Molting is a lengthy, energy-consuming process, and when the lobster first sheds its shell, it is very vulnerable to predators. Not only the soft shell makes movement more difficult.

Lobsters spend the majority of their lives either recovering from or preparing to molt. We don't see most of this process, though, because it is internal. The entire molting process can be broken down into the following steps:

1. Intermolt – This stage normally occurs during winter for lobsters which are molting every year. The lobster has recovered from its previous molt and has not started to prepare for the next molt. In larger mature lobsters thish stage may last 1-2 years.
2. The lobster lays down a new epicutical (an inner layer of the shell).
3. Lays down 2nd layer (while doing this, the lobster recycles layers of old shell).
4. Molt.

5. New shell hardens.
6. Process starts all over again.

The molt itself is a relatively quick, but complicated, process. Before molting, the lobster finds a protective shelter because it will be very vulnerable; therefore, there is little chance of ever witnessing a lobster molt because typically a lobster will not be wandering around just before a molt. The actual molt process is as follows:

1. The lobster softens its outer shell.
2. The lobster absorbs a large amount of water into its meat and uses the pressure to break out of shell. This lowers the concentration of blood proteins in the blood. At this point, the lobster still has some flexibility (in hours) as to when it will molt.
3. Once the shell splits between the tail and body, the lobster rolls onto its side and pulls its body out of the shell. At this point, it is committed to molt.
4. Next is a very tricky part – the lobster must pull its large claws through the small knuckles. The lobster uses lubricating fluids and decreases the blood flow to the claws in order to decrease their size. This helps the lobster pull the claws through, but sometimes a lobster will lose a claw during this process.
5. Once the claws are out, the lobster pulls its tail out of the old shell and the molt is complete.
6. Immediately following the molt, the lobster is dark, soft and wrinkly. It looks and feels rubbery. (This new, larger shell is wrinkled in order to fit it underneath the old shell.) The lobster cannot move around, eat, or protect itself.
7. The lobster then starts pumping its body full of water in order to create as much potential volume as possible. The amount of growth after molt depends on the amount of new shell laid down and the amount of water pumped in before the new shell hardens. The lobster can grow up to 50% in size (volume and weight).

After molting it is important for the lobster to harden up as soon as possible. In order to obtain the calcium and minerals to harden the new shell, the lobster eats its old shell, and is able to do this because the jaws and teeth do not shed and so remain hard. After five hours the lobster can start to move and is able to do this. There are also balls of calcium carbonate called gastroliths behind the lining of the stomach, and when the lobster molts, shedding even its stomach and hindgut linings, these gastroliths drop into the new stomach and are absorbed immediately. This also helps the lobster to harden the shell. (Historically, these gastroliths were collected and used for stomach upsets.) After that, it takes roughly two months for the shell to completely harden. Temperature, however, plays a big part in determining how fast the lobster hardens; if the water is colder, it will take longer to harden.

So, how often do lobsters molt? This depends on their size and maturity. Generally, during their first year, lobsters molt between 10-12 times. Once they reach about 50-60mm carapace length they molt about twice a year. Once they are larger than 60mm, they will only molt once a year. When a lobster reaches maturity it switches to a two year cycle and this is related to spawning. A female produces eggs every two years. Mating can only occur just after the female molts, and then she carries the sperm for a year and produces eggs the next

summer. She then carries the eggs for another year. Males mate in their second year of molt. For the males, there is less of a chance to mate during the molt since competition between the males for the females is intense, so the males are more likely to mate once they have hard shell. When the lobsters get larger they will only molt once every two years, and when they've reached approximately 130-150 mm carapace length they only molt every three years.

The amount of growth at molt varies according to size and sex. The amount of growth in males is a little greater every time they molt and on average they grow 15%. Males with a carapace length of 80-90 mm will grow roughly 12-13 mm during a molt. When they are around 100 mm, they grow about 15 mm, and at 150 mm they grow roughly 20 mm during a molt. The amount of growth in females, however, levels off or declines with age. On average, they grow 12 mm with each molt. This is because once they have matured, more energy is instead invested into producing eggs. The size of the molt may also be influenced by the individual's molt history, nutrition, and water temperature.

Molting usually occurs in late summer/early fall, although this will vary depending on the depth of the water and water temperatures in the area. Besides these influences, and the size and sex influences as just mentioned, the timing of the molt may also be influenced by the timing of the previous molt, daylight (time of year), nutrition, and interaction with other lobsters. In lab experiments, when a number of females were kept together with one male, they would stagger their molt so that they would all be able to spawn. It is also possible that a lobster needs a certain number of degree days (so many days of a certain temperature) in order to molt.

Some indicators used to determine molt stage and timing include shell hardness and condition, pleopod examination, and measuring blood protein levels. Durometers are used in Australia and by Clearwater to measure shell hardness. Pleopods are examined under a microscope because they are thin enough to see the new shell forming under the old one. This is the best method for determining molt stage. The blood protein levels, which are currently used by some people in the industry to determine lobster quality, are now being used to get an idea of molt stage. A drop of blood is placed on a refractometer, which provides a scale value of the blood protein levels present. The blood protein levels can suggest molt stage because prior to the molt, blood protein levels are elevated. This is because the lobster is decreasing its fluid volume in order to pull its body out of the old shell. After molt, the lobster fills its body with fluid in order to expand the new shell as much as possible, and so the blood protein levels are low.

Up until now, very little has been known about the molt because the Canadian fisheries are designed in order to avoid the molt. Last summer, though, a new study was initiated in LFAs 33 and 34. The project, which will continue through this year, uses blood proteins levels, pleopods and shell hardness and condition, in order to better understand the molt cycle in these areas. In the 2003-2004 fishing season, these areas have noticed more soft lobsters than in the past, and this study may allow us to better understand what is happening and why.

The lobster's carapace is divided into three areas in order to determine shell hardness. "A" is located right at the front of the carapace, roughly in between the lobster's eyes. This area is the first place on the carapace to harden and so if it happens to be soft (which it seldom is), the lobster probably molted recently. "B" is the area behind that, and is next to harden. The sides of the carapace are "C" and are the last to harden after the molt.

When using the pleopods to determine molt stage, there are basically 6 categories a lobster may fall under.

Stage 0: Intermolt. No new developing shell is observed.
Stage 1.5: A thin line under the shell is visible. This is the new shell forming. The lobster will molt in approximately 3 months (at 10 degrees C).
Stage 2.5: That line is thicker, and the gap between the new and old shell is wider.
Stage 3 : There is a definite line present. The lobster is now committed to molt and will do so within the next month.
Stage 4: Setae (the sensory hairs) forming on the new shell are visible. The lobster will molt in roughly 20 days (at 10 degrees).
Stage 5: The setae are very obvious. The lobster is within a week of molt.

So why is it important to understand the molt timing and cycle in Nova Scotia?

1. The fishery in Nova Scotia is recruitment-based, so understanding the molt is critical.
2. Understanding the timing of the molt allows us to avoid fishing during the time when soft-shelled and low-meat lobsters are most prevalent.
3. It can help to determine the costs and benefits of conservation measures.
4. Important to understand how environmental change may effect the lobsters and the fishery.

2.1.2 Discussion

Written by Jennifer LeBlanc

Q. Since lobsters are less active in lower temperatures, if the lobster molts later in the season, will there be a delay in recovery and hardening?

A. If the lobster molts later in the season, and the waters are colder, then it will probably take longer to harden. Different areas may see different trends.

Q. Did Hurricane Juan affect the molting process? Since the water temperature seemed the increase at that time? Would it speed things up?

A. Warmer temperatures would speed up the molting process. It also may have shocked the lobsters or disrupted the molting process, but those lobsters that were committed to molt would not have been able to reverse the process and would have molted anyway.

Comment: It is important to understand age to help in managing the fishery.

Comment: Ageing lobsters is quite variable, there is a good deal of variability of ages found by different people. There needs to be more work on ageing, but it could be useful in the fishery.

Q. Why do we find lobsters of the same size, some with barnacles and old shells and some have clean shell (indicating they molted more recently)?
A. There is a lot of variability in molting. There is no cut off point when lobster switches to 3-4 year cycle, so one animal may be in a 2 year cycle and another of the same size may be in a 1 or 3 year cycle.

Q. Since a lobster's shell is so complex, does V-notching cause them pain?
A. There have been studies recently in Norway on invertebrates and they determined that invertebrates do not feel pain. They will react, but they do not feel pain as humans do, since their brains are not as advanced as humans.

Q. How long does it take for a lobster's shell to harden after molt?
A. The lobster's shell takes roughly 2 months to completely harden.

Q. How long after that is it until meat yield is back to normal?
A. During these 2 months of shell hardening, the meat is replacing the water content, and so normally will be back to normal after these 2 months.

Q. Can the blood protein levels indicate the meat quality?
A. No. In order to understand or predict meat quality, one needs to have a good history of the area temperatures, molt cycle, and other factors. It is important to realize that there is a lot of variation from area to area. The Lobster Science Centre has a machine that measures meat yield.

Q. How long after molting do lobsters start to look for food and eat?
A. Immediately after molting the lobster eats its shell and gets nutrients from it. After molting, a lobster is very hungry and will eat as soon as it can, so the catchability is always very high after the molt. Once the lobster starts to harden it will actively seek food and eat, although the exact amount of time it takes to reach this point is uncertain.

Q. How does the temperature affect molt?
A. Lobsters are cold-blooded and are therefore affected by temperature. If the temperature is colder before the molt, the molt will be delayed. If the temperature is colder soon after the molt, the hardening will be delayed. In places where the temperatures are warmer, such as the Southern Gulf, the molt is quite precise. Around here, where the waters are colder, the molt cycles vary. Below 5 degrees, the molt cycle is halted (unless the lobster has already committed to molt).

Q. If a molt is skipped, will the size of the next molt be affected?
A. So little is understood right now about lobsters and their molting that we can't be sure of the affects of a skipped molt.

2.2 2003 Lobster Recruitment Workshop Action Plan Update

By Patty King, Fishermen & Scientists Research Society and Erin Pelletier, Gulf of Maine Lobster Foundation

2.2.1 Presentation Summary

Written by Amanda Facey

An update was presented on the Gulf of Maine Lobster Foundation (GOMLF) and the Fishermen and Scientists Research Society's (FSRS) collaboration on the Lobster Recruitment Project. The GOMLF and the FSRS now have the same trap design, which is the FSRS's original design. The measuring gauge was also changed in the fall of 2003 to include more sizes. Sizes greater than 100 mm and less than 51 mm were added. Data sheets were standardized for core data; there is flexibility to collect more data that may be important to individual organizations. The Data Management Working Group looked at the databases to see how they could be more compatible. The GOMLF was entering their data into Excel, but it was decided that the FSRS Access database was a better format. The GOMLF re-entered their data into Access and will continue to use this program for data entry. Prior to working with the FSRS, the GOMLF had 3-4 years of data on lobster recruitment already collected. They also have Environmental Monitors on Lobster Traps (eMOLT) data.

2.2.2 Discussion

Written by Amanda Facey

Q. The US and Canada have different fishing seasons. Has there been any thought to collecting out of season data to get a complete time series?

A. There is some out of season data from LFA 38 as well as LFA 31A and the Lunenburg area (LFA 33).

Q. How can data be collected during the summer (out of season) months?

A. There have been problems getting a funding commitment and a commitment from fishermen. There has been some effort in LFA 29, but there is not enough commitment. The Native fishery provides some summer research under the auspices of soft shell research. Some data is also provided by Barry Levy's Lobstermen Tours, and LFA 31 is collecting some data outside of the FSRS.

Comment: There should be an effort to try to get a standard method of data collection so all of the data can be used together.

Q. Is the data available to anyone?

A. If you abide by the data sharing policy of the FSRS and are approved by the FSRS Scientific Program Committee, the data can be used by other organizations.

Comment: There is some concern about the use of the FSRS recruitment data in the DFO stock assessments.

Comment: Ross Claytor stressed that the data is used more to look at trends than to measure abundances.

2.3 Lobster Recruitment Project Results

By Erin Pelletier, Gulf of Maine Lobster Foundation

2.3.1 Presentation Summary

Written by Jennifer LeBlanc

The Gulf of Maine Lobster Foundation (GOMLF) is a non-profit organization involved in long-term lobster research and the lobster industry in the Maine, Massachusetts, and New Hampshire. In 2002, the GOMLF took over a ventless trap survey project, which was previously run by Department of Marine Resources (DMR) and the New England Aquarium. Although the project was quite similar to the FSRS' recruitment study, this was before they had even heard of the FSRS. After the connection was made between the two organizations, the projects were standardized. By 2004, the data recorded in the logbooks, the measuring gauges, and traps were all standardized, allowing the information collected by both the FSRS and the GOMLF to be shared and compared.

Currently there are 28 participants in Maine involved in the ventless trap survey, with at least two fishermen in each zone. In 2004, these fishermen measured approximately 9,000 lobsters; up from approximately 1,000 in 2003. This project allowed the standardized ventless traps (the same as those used by the FSRS) to be compared to the ventless traps that were already being used by the GOMLF. They found that the catches from the two trap types were quite similar, and so it has been possible to use the information gathered by the GOMLF before the standardization as well. The GOMLF will continue to use their three trap plan (a ventless trap, the standardized FSRS ventless trap, and a control trap), but will add elements from the FSRS program, such as data sharing with the fishermen.

The fishermen keep the traps in a fixed location and are required to check these traps at least twice every month. This year, temperature recorders were added to the traps. The fishermen are also given a trap description card with the logbook. They enter such information as location and depth onto this card. This way they only have to fill it out once so there is no repetition, and it simplifies the logbook.

Future plans include stabilizing funding and increasing the outreach of the Foundation. The GOMLF also plans to increase the amount of participants, meetings, and data sharing. They also plan to get the individual results out to all of the fishermen involved (as the FSRS does successfully). There will also be an effort to continue data sharing with the FSRS and DMR, and also to promote the use of this data in stock assessments.

2.3.2 Discussion

Written by Jennifer LeBlanc

Comment: Laurence Cook felt there was a different between the standard ventless and ventless.

Q. Can the FSRS have a trap description card instead of filling out the location/date every day?

A. The method currently used by the FSRS is preferred because in case the traps have to be moved (ie. bad weather coming), the new data will be recorded.

2.4 Lobster Recruitment Project Results

By Carl MacDonald, Fishermen and Scientists Research Society

2.4.1 Presentation Summary

Written by Amanda Facey

The Lobster Recruitment Project started in 1999 and is a very useful program. It gives an indication of the lobsters that will moult into legal size. Temperature recorders are also provided with the traps and temperatures have now been recorded from Cape Breton to Digby. There has been a large increase in the number of fishermen participating in the project since 2003-2004, LFA 33 is doing a commercial trap study in addition to the recruitment trap study.

Results from the project indicate an increase in recruitment in LFA 29. In 2002 there were few small lobsters, but there has been a significant increase in their numbers over the last few years. LFA 29 landings have also increased since 2002.

2.4.2 Discussion

Written by Amanda Facey

Comment: The LFA 29 surplus happened all at once and it didn't just come from what was there.

Q. Where did they come from? Did some migrate from another area or was there a higher survival rate among the lobsters that were already there?
A. We don't know. It may have been an increased survival rate of the eggs.

Q. What about LFA 31 and 32? Will they see the same trend?
A. LFA 31B did increase, but LFA 32 didn't.

Comment: There should be an effort to increase participation in the study to get a more complete picture.

Q. Could the increased recruitment in LFA 29 be mortality related?
A. Again, it is felt that the increase in numbers was due to egg survival.

Q. Could there be an offshore exploratory fishery?

Q. Are you going to do the same with the FSRS logbook as the GOMLF did with theirs to avoid repetitiveness?
A. We want to keep the location on each page because that sometimes does change.

Comment: The Gulf of Maine (GoM) has a $250 million fishing industry, but only $100,000 goes into science.

Comment: Approximately 1% of lobster eggs survive, if 2% of the eggs survive the fishery would double. Something as simple as wind change could affect a population. LFA 29 has a narrow habitat; these lobsters probably wouldn't survive offshore.

2.5 How Has Recruitment Data Been Used—LFA 27-33 Stock Assessment

By Ross Claytor, Invertebrate Fisheries Division, DFO

2.5.1 Presentation Summary

Written by Shannon Scott-Tibbetts

What do we need to know?

How does the lobster population responds to fishing, ecosystem changes, and management actions? There are some indicators used to track these issues:

- abundance trends (legal sizes, recruits, spawners),
- distribution,
- exploitation rate, and
- environment (temperature).

FSRS recruitment data provides all of these indicators:

- abundance trends by area and size,
- distribution by size,
- exploitation rate by area and size, and
- environment (temperature).

Greater than 50% of the data in recent assessments was FSRS Recruitment data.

To make better use of the abundance indicators:

- to capture migration (add more recruitment traps, do not move them),
- increasing participation reduces uncertainty in the data, and
- can more accurately show abundance.

To better use the distribution Indicators:

- benefit to stationary traps for looking at distribution trends

Some examples of distribution of lobsters using the FSRS data
(Fall 2002-2003, Spring 2003):

- Size 3 to Size 7 measure: larger amounts of lobsters found in LFA 27 (northern Cape Breton), and LFA34 (Yarmouth/Digby area).
- Size 6 lobsters showing up in LFA 33 and along Eastern Shore.
- Size 8 lobsters seem to be found along the whole coastline.

From data collected in the FSRS traps, there appears to be an increase in the distribution of berried females along the sampling area. In Fall 2002, the occurrence of berried females is greater in the Sambro area and along the Eastern Shore than in Fall 1999. But there were also more participants in Fall 2002 to measure the lobsters.

Advantages to increasing the number of participants:
- gives a better idea of where the berried females are and therefore the egg production in certain areas,
- fills in areas where we have little data, and
- will complete information by adding traps and not moving the existing ones.

Temperature data collected:
- Look at how spring temperatures might influence different divisions.
- It can help separate ecosystem, abundance and fishing effects.

Looking at the FSRS collected data:
- LFA 33 was quite variable in the spring and pretty steady and predictable in the fall

Exploitation rate can also be examined. This measures the changes in the ratio of legal to sub legal catches in the season. The number of sublegals should remain constant during fishing while the number of legals will change.

Looking at temperatures versus catch data:
- Looking at how temperature increases affect catch variability.

Look at data per LFA to see what trends have occurred.

What do we need?
Stationary traps and increased geographic coverage, in places where catch rates are low, more participation is needed.

Future analysis:
- In the short term, developing catchability-temperature relationships using recruits, abundance indicators corrected for temperature, investigate temperature effects on exploitation.

2.5.2 Discussion

Written by Shannon Scott-Tibbetts

Comments: Recruitment traps don't trap large berried lobsters so can't be used as a tool to measure those lobsters.

2.6 How Has Recruitment Data Been Used - Indicators for Spawners

By John Tremblay, Invertebrate Fisheries Division, DFO

2.6.1 Presentation Summary

Written by Carl MacDonald

Lobster biologist John Tremblay from the Bedford Institute of Oceanography provided a presentation on spawner catch rates in traps as an indicator. He compared the spawning indicator based on FSRS trap data with those based on at-sea samples performed in Little River.

An indicator is a number that represents a trend in a time series. Fisheries indicators can usually be grouped by abundance, production, fishing mortality, and environment. Examples of each fisheries indicator would be: catch rate, juvenile recruitment, exploitation, and bottom temperatures.

Within LFA 27 there was an increase in minimum legal size from 70 mm to 76 mm. From that change in regulations one would expect a shift in the size distribution, an increase in the percentage of markets in the catch and more females would be able to spawn. You would see more berried females now because over 50% of the females reach sexual maturity below the current minimum legal size. As well, more lobsters escape the fishery and get a chance to spawn with the larger minimum legal size.

The question arises how does spawner catch rates in FSRS science traps compare with at-sea sampling catch rates? From plotting the data it was evident that FSRS traps were just as efficient as commercial traps in catching small berried lobsters in Cape Breton, LFA 27. However, the FSRS data did not show as strong a seasonal trend. FSRS traps did not always catch more berried lobsters at the end of the season. This could be due to a small number of FSRS trap hauls per day compounded by only examining a narrow size range (71mm-75mm) of the berried animals.

As an indicator of spawner abundance both sea sampling and the FSRS science traps showed an increasing trend in the catch rates of berried lobsters over the years of increasing the minimum legal size (MLS). The FSRS science traps trend was upward but not as strong as the trend from the at-sea sampling. Overall, the spawner abundance indicator trend from the FSRS traps is comparable to the indicator based on the at-sea samples. A longer time-series and more participants in the FSRS study will increase the value of this indicator.

2.6.2 Discussion

Written by Carl MacDonald

Comment: In northern Cape Breton they have been changing trap type over the last five years while in Little River there has been little change in the traps over the years. This could have some impact on your results.

Comment: A comment was made about using the standard FSRS recruitment traps to gather data.

Q. How would you account for the changes in effort around these traps?
A. John Tremblay stressed that they aren't using the data from one area (Little River) to draw conclusions about results for a completely different area. Each area has to be looked at separately.

Q. There is increasing water temperatures around the end of the regular lobster season in LFA 29. We end up handling a lot of berried females. Could the season start sooner to protect the females who are going to be releasing eggs that year?
A. John heard about this comment at an earlier meeting. It is true that handling a lot of females with eggs ready to hatch may cause some egg mortality. To avoid this problem seasons would have to be shifted earlier by up to three weeks. Such a change would need considerable discussion and consensus.

2.7 Other Uses of Recruitment Data and Data Use Issues - Trends versus Abundance

By Carl Wilson, Maine Department of Marine Resources

2.7.1 Presentation Summary

Written by Jennifer LeBlanc

The goals of this project were to understand the patterns of distribution and abundance of juvenile lobsters, and to compare the catch from fishermen's traps to fishery-independent abundance estimates using standard traps, ventless traps, trawl surveys, and diver surveys.

The initial surveys were conducted in Maine between 1989-1997. Diver surveys were conducted during the day and in shallow water (10m). They purposely avoided deep areas such as estuaries and embayments. These surveys were substrate specific; that is, they were only conducted on particular substrates: "Boulder", Ledge, and Sediment. Routinely, sampled areas were approximately 40km^2, with samples no less than 20km^2. The abundance of lobsters in two size classes, early benthic (20-39mm) and adolescent (40-90mm) carapace length, were examined.

The recruitment trap data collected has shown no correlation between recruits in their first year and adults a few years later. Instead, what has been typically observed is that populations of all sizes increase or decrease at the same time and in the same places.

Catch per commercial trap information (size, sex, and shell and reproductive condition) was also collected and compared to the catch from diver samples. What these studies found was that diver surveys can predict catch rate of sub-legal lobsters, but cannot predict the catch rate of legal lobsters. There is, however, a correlation between the diver survey catches and the catch rate X the number of traps. This is because as the number of traps in an area increases catch rate declines; in some areas, there are more than 1000 traps per square kilometer. Diver surveys are useful, though, because they can resolve spatial and temporal differences between other survey methods.

By comparing the catches from standard and ventless traps to what was actually on the bottom (determined by the diver surveys), it was also determined that standard commercial traps may better predict the sub-legal densities better than ventless traps. The better correlation between commercial traps and diver surveys, though, is probably because there are many more commercial trap samples than ventless samples.

Trawl surveys are the standard fishery-independent survey method used for assessments in the US. Trawl surveys are conducted during the day, and only soft bottom (featureless) areas are trawled. Areas with high trap densities are avoided because of gear conflict. In a 50 minute tow approximately 3000 lobsters are caught. It was found that the catches from ventless trap surveys and trawl surveys are highly correlated. Basically, Carl Wilson felt that all of these sampling methods have benefits, and limits, and none should be ruled out at this time.

2.7.2 Discussion

Written by Jennifer LeBlanc

Comment: He was concerned about using the trawl survey as a way to measure abundance of lobsters. Many agreed, that it is harmful to the habitat and other marine creatures in the area, and is, therefore, not a preferred method of sampling. It was commented since there was a positive correlation between the trawl survey and the trap survey in regards to what was caught, there was no point in doing trawl surveys.

Q. Have you done sea samples along side of trawl surveys to compare the differences in catch?

A. Yes, sea samples were conducted along side of the trawl surveys and there were big differences in the results. The number of sub-legals versus legals was greatly different between the ventless traps and trawls.

Sub-legals:legals – 15:1 – ventless
Sub-legals:legals – 3:1 – trawls

The differences between the two methods are largely the result of the trawl being hauled during the day when lobsters are normally not moving around much, whereas the traps are set and lobsters crawl in at night. Also, there are spatial differences – the trawl survey was not surveying the exact location of the traps. Carl Wilson agreed there is a direct impact to the bottom; crabs, clams, and other organisms are killed.

Q. A participant had seen a video of lobsters going in and out of traps and wondered how many lobsters are recaptures and how does that change the catch data?

A. The FSRS started to record recapture data when the recruitment data was first started but didn't find a significant number of recaptured lobsters; about 2-3% were recaught. A similar study was conducted in Maine, and they found only 10% were recaught.

2.8 Other Uses of Recruitment Data and Data Use Issues - Comparing Recruitment Data to At-Sea Sampling

By Alison Sirois, presented by Carl Wilson

2.8.1 Presentation Summary

Written by Amanda Facey

One use of sea sample and recruitment trap data is to help with stock assessments, and the data is also being used to look at maturity in berried females. Sea sample data and recruitment trap data have different goals. Sea samples are quota based and are not true random samples because they are done wherever the fishermen are fishing. Later in the year the fishery also moves offshore. Fishermen are asked to keep recruitment traps in the same place throughout the season. Another difference between the two methods of data collection is the cost. Sea sampling is much more expensive than using recruitment traps.

2.8.2 Discussion

Written by Amanda Facey

Q. How do lobsters sustain themselves in Maine? Is the lobster fishery feeding itself through the availability of bait as a food source? Have any diet studies been done on lobsters to see what the differences are between the diets of the lobsters in and out of the fishing season?

A. There was work done on lobster diet in the US.

Q. How are trawl surveys impacting the environment and lobsters?

A. They are definitely controversial. As a result of the trawl 30-40% of soft lobsters caught are damaged. About 15 000 lobsters are measured annually in the trawl. Even if every single one was killed, it would not hurt the fishery very much. If they weren't killed by the trawl, fishermen would catch them anyway.

Q. What is the impact of these trawl surveys on the ocean bottom?

A. There is a direct impact. Crabs, clams, etc. are crushed. Scallop, urchin and shrimp dragging along Maine have much more of an impact.

2.9 Other Uses of Recruitment Data and Data Use Issues - LFA 33 Commercial Trap Sampling Project and Trap Effectiveness Study

By Carl MacDonald, Fishermen and Scientists Research Society

2.9.1 Presentation Summary

Written by Shannon Scott-Tibbetts

The LFA 33 Commercial Trap Study began as a pilot project in Fall 2003. Recruitment Study participants were asked to collect data from three of their commercial traps. There was more participation in Fall 2003-Spring 2004 and the project continued into Fall 2004-Spring 2005. In Fall 2004, the three commercial traps fished for the FSRS study were allowed to be additional traps to the fisherman's legal limit and once this occurred there was more interest in the project. There are currently 55 fishermen helping out with the additional science. Some fishermen only collect data from their science commercial traps while others collect data from both the recruitment science traps as well as their own commercial science traps.

The commercial traps are particular to each fisherman and they are tagged with either a yellow disc provided by the FSRS, or by the fisherman's own method. They also must have a science tag attached to specify they are part of the Commercial Trap Project. Participants fill out an information sheet on their commercial traps that are being used in the science study. They include: information on the measurements of the trap, the kind of trap, the entrance rings specifications and escape vents.

What are the benefits of collecting this data?

- Develop an index for berried females
- Compare the exploitation rates from commercial traps and recruitment traps
- Tag recapture monitoring
- Gather industry knowledge and input
- Greater geographic coverage of trap data collected during the season

Some results from the Commercial trap study:
LFA 33 Fall 2002 – the commercial traps caught less sub legal lobsters and more legal lobsters than the recruitment traps. Data from Spring 2003, Fall 2003 and Spring 2004 all showed the similar trend of legal and sub-legal catches in the commercial and recruitment traps.

Lobster Recruitment Trap Effectiveness Study
This study was done for two years by two different fishermen. One fisherman was in LFA 34 (Fall 2002-Spring 2003), and the other one was in LFA 33 (Fall 2003-Spring 2004). Fishermen measured lobsters from two commercial traps, two recruitment traps, two commercial traps with escapes closed. The area fished and the type and size of the traps were different for the two years. This study was initiated to determine if the FSRS recruitment traps do catch smaller lobsters as well as determining the size of lobster a closed vent com-

Some results from the Trap-Effectiveness Study:
LFA 34 (Fall 2002-Spring 2003) - Looking at the catch of sub-legals/10 trap hauls, it was shown that the recruitment traps do catch more than the regular commercial traps and that the modified commercial traps catch also retain more sub-legals than the commercial traps. The number of legal lobsters caught in the recruitment traps was more than the commercial traps and the modified commercial traps.

LFA 33 (Fall 2003-Spring 2004) - the number of sub-legal lobsters caught in the recruitment traps and the modified commercial traps were greater than those caught in the commercial traps. The number of legal lobsters caught in the commercial and modified commercial traps was greater in this case than the recruitment traps.

Lessons Learned:

- Trap design and location both play a large factor in lobster catchability.
- Traps with the same design have the same catch rate when fished in the same location.
- Traps with the same design have different catch rates when fished in different locations

It is very important that the Recruitment traps be standardized and fished in the same location every year. This allows for the comparisons to be made over the years and to look for trends in recruitment over time.

2.9.2 Discussion

Written by Shannon Scott-Tibbetts

Q. Will the Commercial Trap Study be expanded into other LFA's?
A. If there is interest in the other LFAs, it would be beneficial to have them involved. This question will be discussed in the breakout group session.

Q. In regard to the Trap-Effectiveness Study - is it not good, then, that there are other traps nearby?
A. The study showed that the two end traps in the trawl did not catch more lobsters or less lobsters than the traps inside the trawl. It was the trap type that determined the catchability.

3.0 Breakout Groups - How the Data Can Be Used and What Other Data is Needed

Breakout groups were given a series of questions to respond to:

1) Commercial Trap Sampling Project
   a) Should there be commercial trap sampling in all LFAs?
   b) Is there a willingness in all the LFAs to do the project?
   c) What problems could there be if the project is expanded into additional LFAs and how can the problems be addressed?
2) Use of Data
   a) How would you like the data to be used?
   b) Are there potential uses of the data that are of concern? If so, why and how can the concerns be addressed?
3) How would you like the data to be presented?
4) What other data needs to be collected? (e.g.: information on invasive species, presence of groundfish, water quality, etc.)
5) Other issues relevant to the continuation of the Lobster Recruitment Index/Ventless Trap project.

The results of the group discussions are highlighted in this section. Each group presented the results of their group's discussions in a plenary session; a summary of the main points from these presentations and the conclusions are included in the next section.

Breakout Group Questions

1. Commercial Trap Sampling Project

a. Should there be commercial trap sampling in all LFAs?

Group 1:
- Yes

Group 2:
- Yes

Group 3:
- Yes. Bay of Fundy.

Group 4:
- Yes

Group 5:
- Yes

b. Is there a willingness in all the LFAs to do the project?

Group 1:

- LFA 33 is a great model.
- Outreach is needed. You have to send letters to individual fishermen giving everyone an opportunity to participate.

Group 2:

- Some, but not all.

Group 3:

- In the absence of the sea sampling program there is a need for commercial trap sampling in all LFAs.
- Would depend on how it was done. Do by more people to get big picture.

Group 4:

- Yes, (once explained to fishermen) although we (group 4) were only from a few LFAs and zones.

Group 5:

- Yes, depends on LFA committees.

c. What problems could there be if the project is expanded into additional LFAs and how can the problems be addressed?

Group 1:

- Who would collect and analyze data?
- Funding? Staff?
- Jealousy if guys don't get to participate. Must send letter to all so everyone gets a fair chance.
- Need to address out-of-season sampling.
- If data can't go anywhere, it will be frustrating, compliance will fall off.
- Recruitment study – stagger traps and same site.
- Forms easy for fishermen to understand and enter information, so science can analyze.
- Bottleneck is data entry.

Group 2:

- Fishermen do study initially with own traps, if they do well at it, then next year they get 3 extra tags (commercial traps recording the data, no vents blocked off).
- Extra effort problem.
- Address funding.
- Limit to 55 participants.

Group 3:

- More traps in Grand Manan will be a problem. Spread across district would be better.
- What about having more fishermen?
- 30-40% participating would be great.
- Too small a snapshot makes them nervous.

Group 4:

- The collection and analyzing of data (speed, efficiency).
- Consistency among LFAs (for example, equal # of fishermen or by landings).
- Quality control.
- Instruction of fishermen (to ensure all are sampling correctly and the same).

Group 5:

- Problem with increase in effort in certain areas once more traps are in the water.
- More data collected, could be a problem with data entry and timely. return of results to each fishermen.

2. Use if Data

a. How would you like the data to be used?

Group 1:

- Goes back to the harvesters/guys collecting data.
- Analyzed by scientists BUT reviewed by harvesters before it goes anywhere.
- Multiple years combined.
- Need to build trust between fishermen and scientists.
- FSRS model status quo – executive and directors look at data and review requests – vote on whether to release. This method works really well to build TRUST with harvesters collecting data.
- Like the way data is being used now: requests, presentations at meetings, constant communication – data and uses will evolve over time.

Group 2:

- Stock assessment.
- All data.

Group 3:

- Properly, carefully.
- Used in assessments.
- Predict index with confidence.

Group 4:

- Stock assessments.
- Effects of industrial development (ie. Pipelines, dredging, etc).
- Compensation.

Group 5:

- Independent science is good.
- Data collection is good since it gives additional monitoring resource.

b. Are there potential uses of the data that are of concern? If so, why and how can the concerns be addressed?

Group 1:

- Never give out individual results.
- Misused – misinterpreted in a way that wasn't intended.

Group 2:

- Biomass concern.
- Biomass exploitation concerns.
- Trust of individual scientists.

Group 3:

- This data is a piece of the puzzle.
- Study the trend of pre-recruit population, not for exploitation.

Group 4:

- Could be misused (quotas, etc.).
- It may not be representative of what is out there.

Group 5:

- Concern with DFO using data for stock and biomass assessments – there has to be caution with using recruitment data and the use of indicators.
- Should not be used on its own.

3. How would you like the data to be presented?

Group 1:

- Existing formats (charts/graphs) are good.
- Discussion helps to clarify.
- Create an environment that fishermen feel safe to ask questions.
- Take the time to explain in a way that everyone can understand.

Group 2:

- Keep it as it is – Carl's doing a good job.
- Annual real time economic impact assessment should be done, and/or monitoring.

Group 3:

- Fishermen to present the data.
- Online data.
- Current FSRS graphs are good.
- Inches, lbs, instead of shell in metric.

Group 4:

- Presented in an easy-to-understand format (ie. graphs) - "Like Carl does it!".

Group 5:

- Happy with the way data is presented at the different meetings.
- Format works.

4. What other data needs to be collected? (e.g. Information on invasive species, presence of groundfish, water quality, etc.)

Group 1:

- Monitor changes in gear – describe gear in logbooks (% of gear by material made, rings, length, etc).
- Help monitor changes in effort.
- Concern – how to quantify this information into results.
- Information needs vary from district to district, ie. Are lobsters in an area produced in an area?
- Currents (local and broad scale).
- Migration (local and broad scale).
- Water quality – pollutants, land-based influences. Get baseline water quality and monitor changes.
- Ballast water from large ships.
- Indicate invasive species.
- Emergency response for spills.

Group 2:

- Information on lobster quality, lobster blood protein, sea state (water temperature, wind, etc.), data on diet of lobsters, invasive species (what fishermen are seeing … green crab), monitoring for shell disease.
- Food availability – part of problem in some areas.

Group 3:

- Presence of other gear/buoys.
- Off-season catches – use charter boat operators.
- Wind data, sea conditions.
- Amount of bait used when set.

Group 4:

- Sea state.
- Predators in trap.
- Suggest other things to fishermen to record in "comments" section such as invasive species or growth on traps.

Group 5:

- More studies on migration.
- Changes wind direction/speed to sea state for recruitment trap data.

5. Other issues relevant to the continuation of the Lobster Recruitment Index/Ventless Trap project?

Group 1:

- Stabilize funding.
- Staffing.
- Allow LFAs to collect dues with portion dedicated to funding .
- Increase participation in other LFAs, especially 35-38.
- More money from processors.
- Fund and expand!

Group 2:

- Funding stability.

Group 3:

- Recapture rates – bands on the knuckles.

Group 4:

- Funding.
- Data management.
- Whether the traps are our own or extras (Commercial Trap Sampling Project).
- Having the project approved by each LFA advisory board (Commercial Trap Sampling Project).

Group 5:

- Funding. – Has to be industry supported.
- Participation – Increase in other areas and in current LFAs.
- Quality of data collected – Have to be sure and confident in the data.

4.0 Breakout Groups Summary and Conclusions

The previous section of this report provides details on the breakout group discussions. Following the breakout group session, each group presented their responses to the questions they had been assigned. This was followed by a plenary session where the conclusions and recommendations from the breakout group presentations were summarized. This summary provides guidance as to how the Lobster Recruitment Project should proceed and what changes or additions to the project are needed.

Commercial Trap Sampling

There was general agreement that there should be commercial trap sampling in all areas. It was noted, however, that whether or not all areas would participate would depend on the structure of the project and how the data is used. It was proposed that the project structure being used in LFA 33 should be used as the model for introducing the project in other areas. Whether the traps are in addition to the legal limit could vary by area. The project would need to be approved by the LFA Advisory Committee. Maine expressed an interest in using electronic logbooks with sampling protocols.

The main concern with expanding commercial trap sampling was how to deal with the increased amount of data entry and analysis. It would be important to maintain the current quick turnaround time on getting results back to individuals. This problem would need to be addressed before the project expands.

Use of Lobster Recruitment (Ventless Trap) Data

There was agreement that how the FSRS is using the data is a good model. It allows for industry peer review of the results. Results are presented in an easy to understand format and in a timely manner.

Potential uses of the data identified by the breakout groups included: stock assessments, indicator of abundance, economic impacts on fishermen, and effects of industrial development on the fishery. It was stressed that for stock assessments multiple data sources are needed; ie: the recruitment data cannot be the only data used in the assessment, it is only one piece of the puzzle. Stock assessments must be clearly understood by industry; this requires education and communication. It was noted that stock assessments must pass scientific scrutiny.

Although indicator of abundance was identified as a potential use of the data, it was done so with caution. Concern was expressed about using the data to estimate exploitation rates and whether the data is reflective of the abundance of what is out there since the traps target only part of the population. Those using the data need to be clear about the objective of the data. Data would need to be reviewed on a case by case basis. Industry needs to be involved in the review to ensure their concerns are addressed.

Ensuring confidentiality of an individual's information continues to be important. Data needs to be grouped when presented. There was a general concern about the possibility of data being used against fishermen, ie: that it could be misused or misinterpreted, which could lead to misuse of the results by management. The FSRS data sharing policies help to address these concerns. Continuing to build trust between the fishermen and the scientists using the data is another important part of the process.

How To Present Data

There was overwhelming support for the way the FSRS currently presents the data. There is an interest in seeing more results posted to the website (results only, not raw data). There was also a request for the inclusion of a conversion table in the logbook, which would show the conversion between the imperial and metric measurements, particularly for inches and millimeters and pounds and kilograms.

Other Data Needs

It was recognized that the data needs vary from area to area. There were a number of topics identified for which there appeared to be common interest in collecting data:

- Monitor changes in gear and gear interaction. Determine how commercial gear impacts the recruitment traps. The concern is how to quantify this.
- Baseline water quality. The Gulf of Maine Council on the Marine Environment is involved with indicators research, including indicators of contaminants in the water, and could be an information resource for water quality information.
- Lobster quality.
- Sea state.
- Predators.
- Invasive species.
- Migration (tagging) studies.

Other Issues

Stable funding was identified as the main issue of concern. It was agreed that the project needs to be industry supported. Some LFAs are already exploring ways to collect money from their fishermen that could be given to the FSRS to support the project. Processors were also suggested as another source of funding.

Data management is of concern, particularly in light of the increase in amount of data that would result from the proposed expansion of the recruitment project and commercial trap sampling. Having adequate staff to deal with data entry and analysis is part of this issue and is dependent on having stable funding.

There was interest in expanding into other areas, in particular LFAs 35 – 38. It was recognized that some areas may have particular concerns which would require adapting the project to address those concerns. In the US, the project is expanding into Massachusetts.

Project participants expressed interest in knowing what the recapture rate is in the recruitment traps. Although the FSRS did knuckle band tagging to study this in one LFA and showed low recapture rates, it was suggested that it should be done by at least one person in each LFA/fishing zone.

It was recognized that ensuring the quality of the data collected is very important. We need to be confident in the data. Measures are in place to ensure quality control of the data.

The lifespan of the recruitment traps was questioned. Currently, the onus is on the fishermen to determine when their recruitment traps need to be replaced. It was proposed that staff should inspect the traps periodically to determine if they need to be replaced.

Conclusions

Both the Lobster Recruitment (Ventless Trap) and Commercial Trap Sampling projects are valuable sources of information and need to continue into the long-term and be expanded. To do this, stable long-term funding is needed. All stakeholders should be considered potential sources of funding (e.g.: government, fishermen, processors, etc.).

The uses of the data continue to grow. The data is an important part of the stock assessment process, however, it is only one piece of the puzzle and cannot be used in isolation. Industry needs to be involved in the review of the data and results to ensure any concerns about how the data are being used are addressed. Ensuring timely results are provided back to participants (both of their own data and the grouped data) and presented at industry meetings is important to the success of the project.

The annual cross-border exchange through workshops such this is important and needs to continue. In 2006, the FSRS will send a group to the lobster workshop to be held as part of the Maine Fishermen's Forum.

5.0 Acknowledgements

The workshop would not have been possible without the cooperation of the Fishermen and Scientists Research Society and the Gulf of Maine Lobster Foundation, and the financial support of the NS Department of Agriculture and Fisheries.

We would also like to gratefully acknowledge the following individuals:

The Guest Speakers:	Ross Claytor Patty King Carl MacDonald Erin Pelletier Doug Pezzack John Tremblay Carl Wilson
FSRS Staff:	Amanda Facey Jennifer LeBlanc Carl MacDonald Shannon Scott-Tibbetts

The breakout group chairs, recorders and presenters.

And of course all those who attended the workshop.

Thank You

Appendix A: Participant List

Name	Organization/LFA
Ricky Alley	Islesford, ME
Jerry Amirault	
Nellie Baker-Stevens	Eastern Shore Fishermen's Protection Association
John Barrett	Massachusetts Lobstermen's Association
Mike Boudreau	LFA 34
Hubert Boutilier	LFA 32
Randy Boutilier	LFA 32
John Carver	Massachusetts Lobstermen's Association
Ross Claytor	FSRS Scientific Program Committee Chair
Laurence Cook	LFA 38
Robert Courtney	LFA 27
Jason Day	Vinalhaven, ME
Walter Day	Vinalhaven, ME
Kim Drysdale	Oceans 11 Teacher
Brian Everett	LFA 33
Amanda Facey	Fisheries Technician, Fishermen and Scientists Research Society
David Ferguson	LFA 27
Barbara Fifield	Fishermen's Voice
Cheryl Frail	Crustacean Technician, Invertebrate Fisheries Division, DFO
Andrew Gallant	LFA 36
Patrick Gray	LFA 33
Garnet Heisler	LFA 33
Bobby Ingalls	Bucks Harbor, ME
Mark Jeffrey	LFA 34
Bob Johnston	AVC Lobster Science Centre
Andrew Kehoe	LFA 29
Mary Kenneally	
Patty King	General Manager, Fishermen and Scientists Research Society
Jean Lavalee	Clinical Scientist, AVC Lobster Science Centre
Jen LeBlanc	Fisheries Technician, Fishermen and Scientists Research Society
Barry Levy	LFA 33
John Levy	LFA 33
Carl MacDonald	Research Biologist, Fishermen and Scientists Research Society
Gordon MacDonald	LFA 30
Malcolm MacDonald	LFA 30
Robert MacMillan	Lobster Biologist, PEI Dept. Agriculture, Fisheries & Aquaculture
Rodney Manthorne	LFA 31B
Patrice McCarron	Maine Lobstermen's Association
Bob Miller	Lobster Scientist, Invertebrate Fisheries Division, DFO

Name	Organization/LFA
Mike Myrick	Cushing, ME
Eugene O'Leary	LFA 31A
Bruce Osbourne	NS Dept. of Agriculture and Fisheries
Brad Parady	Kittery Point, ME
Erin Pelletier	Gulf of Maine Lobstermen's Association
Doug Pezzack	Crustacean Biologist, Invertebrate Fisheries Division, DFO
Harold Pottie	LFA 32
Shelley Rector	Oceans 11 Teacher, Middleton High School
Steve Robbins	Stonington, ME
Shannon Scott-Tibbetts	Research Assistant, Fishermen and Scientists Research Society
Dennis Smith	LFA 27
Wilford Smith	LFA 33
Ken Snow	LFA 31A
Ashton Spinney	LFA 34
Wayne Spinney	LFA 34
Ron Stevens	LFA 32
Elliott Thomas	Yarmouth, ME
Tammy Watson	Biologist, Clearwater
Monty Way	Field Technician, FFAW
Zach Whitener	Long Island, ME
Bill Williams	LFA 33
Carl Wilson	Maine Department of Marine Resources