

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

February 19, 2009
Best Western Glengarry Hotel, Truro, NS



This report contains excerpts from the complete workshop document. To obtain a copy of the complete workshop document contact the FSRS at 902-876-1160 or by e-mail at info@fsrs.ns.ca or access it on the web at www.fsrs.ns.ca.

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Disclaimer

The discussions following the presentations and the plenary discussions are presented as recorded and interpreted in the rappatours notes. The remarks were not confirmed with or edited by the participants. While every effort was made to ensure accuracy, it is possible that errors or misinterpretations may have occurred. Some of the discussion questions and answers may have been edited for clarification.

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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 19, 2009 at the Best Western Glengarry Hotel in Truro, Nova Scotia. More than 120 people attended the event which brought together industry leaders from throughout Atlantic Canada and the Gulf of Maine, including fishermen, scientists, the academic community, and other industry stakeholders.

The *FSRS-GOMLF Lobster Science Workshop* focused on two main topics. The morning session focused on *Lobster Post-Larval Collector Research Collaboration* and included updates on the various lobster collector research projects currently underway throughout Atlantic Canada and New England. Expanding the scope of the lobster collector research projects was also explored, and a presentation was given on how the lobster collectors could be used as a tool for bio-diversity research. In the plenary session participants discussed formalizing what has to this point been a loose collaboration between the various lobster collector projects, as well as other lobster settlement projects. As part of the discussion on moving forward, the following questions were considered: are any changes/refinements needed to the current standard protocols; data collection, use and management; objectives of the collaboration; who would be the collaborators - collector sampling, suction sampling and biodiversity sampling; and how to integrate collector data with suction sampling and biodiversity data. There was a commitment to move forward with the collaboration, and the importance of such opportunities as this workshop to bring everyone together was stressed. It was recommended that the collaboration of lobster collector projects should meet annually to review results and continue the information exchange and the expansion of the research, both geographically and in terms of the scope of the research.

The second session focused on *Using Science to Better Understand the Environmental and Economic Impacts of the Lobster Fishery*, and included presentations on using life cycle assessment to understand global environmental impacts of lobster fishing in the Gulf of Maine, studies on the impacts of trap density on catch, and bait to catch ratio in the Nova Scotia lobster fishery. The workshop concluded with a short discussion on other research that is being done and potential future research. The following report summarizes the presentations and discussions, as well as the results of the plenary session.

1.1 Agenda

- 9:00 - 10:00 Registration
- 10:00 - 10:15 Welcome/Introductions and Opening Remarks
- 10:15 – 10:45 Overview of Lobster Post-Larval Collector Research Collaboration – Rick Wahle
- 10:45 – 12:45 Regional Summaries and Other Project Overviews
- Beaver Harbour, NB - Rémy Rochette
 - Lobster Bay, Port La Tour, Sambro and Cape Breton, NS – John Tremblay
 - Canso, NS - Katherine Newell
 - Southern Gulf of St. Lawrence DFO Gulf Region - Michel Comeau
 - Gaspé (Grande-Rivière) Quebec – Patty King
 - Bonne Bay and Bonevista Bay, NL - Victoria Burdette-Coutts
 - Monitoring Biological Diversity on Nearshore Lobster Habitat in Nova Scotia - A Fall 2008 Update – Angelica Silva
- 12:45 – 1:45 Lunch
- 1:45 – 2:45 Plenary – Moving Forward: Discussion on Formalizing the Lobster Post-Larval Collector Research Collaboration and Integration With Other Research.
- Are any changes/refinements needed to the current standard protocols?
 - Data Collection, Use and Management
 - Objectives of the Collaboration
 - Who would be the collaborators?
 - ◆ Collector Sampling
 - ◆ Suction Sampling
 - ◆ Biodiversity Sampling
 - How to integrate collector data with suction sampling and biodiversity data
- 2:45 – 3:30 Using Life Cycle Assessment to Understand Global Environmental Impacts of Lobster Fishing in the Gulf of Maine - Catherine Boyd
- 3:30 – 3:45 Coffee Break
- 3:45 – 4:05 Trapped in Maine: Studies on the Impacts of Trap Density on Catch - Carl Wilson
- 4:05 - 4:25 What is the Bait to Catch Ratio in the Nova Scotia Lobster Fishery? - TBA
- 4:25 – 4:55 Plenary - Discussion on What Other Science Needs to be Done, Future Direction
- 4:55 – 5:00 Wrap Up/Closing Remarks
- 5:00 - 6:00 Reception
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2.0 Presentations

2.1 Lobster Passive Postlarval Collector Research Collaboration

By Rick Wahle, Senior Research Scientist, Bigelow Laboratory of Ocean Sciences

2.1.1 Summary

Written by Shannon Scott-Tibbetts, Acting Research Biologist, FSRS and Rick Wahle, Senior Research Scientist, Bigelow Laboratory of Ocean Sciences

Rick Wahle, a senior research scientist from the Bigelow Laboratory for Ocean Sciences, gave an overview of the studies being done on Young-of-Year (YoY) lobster recruitment; in particular, the Lobster Postlarval Collector project. Why would we choose to use postlarval collectors? There has been good success in other parts of the world with using collectors as a tool in forecasting lobster harvests. The western rock lobster (*Panulirus cygnus*) of Western Australia is one example.

For two decades the method of choice to evaluate the abundance of YoY lobsters has been by diver-based suction sampling in shallow (5-10 m) cobble-boulder habitat, the preferred nursery for young lobsters. As of 2008, monitoring by suction sampling was being conducted at some 78 fixed sites within 15 regions in New England and Atlantic Canada. While suction sampling has provided valuable information on time trends and spatial patterns of YoY recruitment, the method has always been limited to the safe and practical limits of SCUBA diving. Passive postlarval collectors, therefore, open a window on YoY recruitment in areas of the sea bed inaccessible to divers.

The collectors were developed in collaboration with New England fishermen with support from one of National Oceanic and Atmospheric Administration's (NOAA) cooperative research programs called the Northeast Consortium (NEC). The idea was to make the collectors easy to deploy with a standard trap hauler and to test their performance. Preliminary trials demonstrated that the densities of YoY lobsters found in collectors compare favourably with those found in the natural cobble habitat with suction sampling. They also found no significant loss of young lobsters during the haul-back process. The size range of newly settled YoY lobsters at the end of the settlement season was around 7-10 mm, but they also found larger lobsters that crawled into the collectors from the surrounding seabed. Fish, crabs and other invertebrates also recruited the collectors.

Because of the promising results of the initial trials, Wahle and collaborators were awarded a second larger NEC grant to apply the collectors to one of the burning questions in lobster biology: How deep do lobster postlarvae settle? The answer to this question could have important implications for regional differences in lobster production. The objective of this two-

year project was to deploy collectors over a range of depths (5-80 m) in regions of contrasting oceanography to see how the degree of thermal stratification of the water column influences vertical settlement patterns. Three-hundred collectors were divided among three regions: eastern Maine at the mouth of the Bay of Fundy, where the water column is well mixed and temperatures are uniform from surface to bottom; mid-coast Maine where the water column stratifies during the summer, and Rhode Island where it also stratifies, but is considerably warmer over the same depth range. Results of the two years consistently showed that the depth wise pattern of YoY recruitment mirrors the thermal structure of the water column. Where the water column is stratified during the summer, settlers tend to concentrate in the warmer shallow zones, but where temperatures are the same at all depths, settlement is more uniform. Results also indicate that larger lobsters followed the same depth trends as the smaller lobsters.

The back-to-back NEC projects that supported collector development and research in the US became a catalyst for a much wider collaboration among US and Canadian lobster researchers and fishermen from Rhode Island to Newfoundland. The project inspired interest in Norway and Sweden as well. With the FSRS's help in getting the word out, all collaborators adopted the same collector design and sampling protocol. In 2007, with new collaborators in Massachusetts, New Brunswick, Nova Scotia, and Newfoundland some 700 collectors were deployed. And in 2008 with the addition of more sites in the southern Gulf of St. Lawrence and PEI, all told 1128 collectors were deployed over 21 regions. Where collector sites overlapped with suction sampling sites, a strong correlation was found between YoY densities measured by the two methods. Selectivity analysis also suggests that collectors catch slightly more settlers than the suction sampling. To date, no European lobster (*Homarus gammarus*) settlement has been detected with collectors by our Scandinavian colleagues, though.

Wahle also compared the pros and cons of using the collectors versus the suction sampling. The advantage of collectors is that they can go in locations where divers cannot; they are fishermen friendly, and they work well for some species of fish too. Disadvantages of collectors are that they are more expensive and labour-intensive than suction sampling. There is the materials cost, and then the fact that a deployment trip is needed in the spring. In contrast, suction sampling involves only a single trip at the end of the settlement season and involves much less heavy equipment. Suction sampling has therefore become the monitoring tool of choice in the US, and the protocols are very well established, and is funded for the long term by the participating states. NEC funding for the collector research will end in 2009, although collectors may still be used to address focused research questions. The project has made the record books in three ways: the depth comparison has reported the deepest record of settlement at 80 m in Maine; the extended collaboration has made possible the northernmost record for settlers in Bonne Bay, NL; and all together, this has been the largest scale synoptic view of lobster settlement ever conducted.

In the coming years the separate groups will have to decide whether they wish to continue with collectors, suction sampling or both. For those who wish to continue, it will be important to formalize settlement monitoring collaboration. These groups will need to discuss their fishery and biodiversity-related objectives, and how to integrate collector and suction sampling data.

2.1.2 Discussion

Written by Shannon Scott-Tibbetts, Acting Research Biologist, FSRS

Q: Rock Lobster (*Panulirus cygnus*) decline in Australia, did the collectors predict this?

A: Yes, the settlement index has proven to accurately predict changes in landings. There is a 3 year lag between settlers and when they show up in the fishery. This survey has been going on for 40 years.

Comment: Collectors have been used in New England sites in 2005, and then again starting in 2007. Collectors should be set prior to the beginning of the settlement season - in mid-May in Rhode Island, and in mid-July in the Gulf of Maine.

Q: Marine plants growing on collectors, does this have an effect on the lobster catch? Wouldn't it be better to leave them out all year to have a more natural feel to them?

A: Need to haul the traps to do maintenance. Also, can't have traps out all year in some locations due to fishing seasons and logistics of hauling. So, can't keep some out and haul others because that would add confounding effects, and the results would not be comparable.

Q: Reasoning behind the locations of collectors?

A: Hard bottom substrate, standardized depth (to be comparable to suction sampling).

2.2 Regional Summary - Lobster Settlement/Collector Project, Beaver Harbour, NB

By Rémy Rochette, Associate Professor, Biology Department, University of New Brunswick (Saint John)

2.2.1 Summary

Written by Katie McGrath, Fisheries Technician, FSRS

Rémy Rochette of the University of New Brunswick Saint John gave a presentation on *The Lobster Settlement/Collector Project* conducted in 2007 and 2008 in Beaver Harbour, New Brunswick. Beaver Harbour is located in southwestern New Brunswick along the Bay of Fundy. For this project, collectors were deployed to catch young-of-year lobsters to try to find where they are settling, and how the density of settlers in collectors compares to their density on natural substrates outside of the collectors. In 2007, 32 collectors were deployed and in 2008 that number rose to 50.

For the 2007 project year, 32 collectors were deployed on fine-sediment bottoms from July 25th to October 18th. Fourteen of these collectors were placed in “shallow” water (~10 m LAT). These collectors were placed in two lines with 7 collectors per line. Eighteen collectors were placed in “mid-depth” (~12-30 m LAT) locations in four lines of 4 or 5 collectors per line. From this season, some problems were identified such as the weight of the cages, obtaining the assistance of fishermen, the amount of traffic in Beaver Harbour, cage contamination due to dragging during recovery and the cost of deployment and retrieval.

Due to technical difficulties, only slides from the 2007 project year was presented, however, a summary of the 2008 project results was given. In 2008, the 50 traps deployed were separated into two groups of 25. Local fishermen helped with the deployment and retrieval of the collectors.

Summary of 2008 Results:

Site: Beaver Harbour

Deployment: 11 July 2008

Retrieval: 24 October 2008

Total number of collectors: 50 (1 lost)

Layout: 2 groups of 25 collectors; a few meters between adjacent collectors in a group, and approximately 75 meters between groups

Substrate type: Bedrock with rocks and cobbles, as well as sediment with cobbles

Summary statistics (mean # per square meter \pm SE)

Preliminary data from sorting in the field:

24 collectors "NORTH site" (centre: 45°03.551 N, -66° 44.069 W)

YOY: 0.30 ± 0.14

All lobsters: 1.86 ± 0.42

25 collectors "SOUTH site" (centre: 45°03.511 N, -66° 44.077 W)

YOY: 0.57 ± 0.17

All lobsters: 1.14 ± 0.25

All 49 collectors pooled

YOY: 0.44 ± 0.11

All lobsters: 1.49 ± 0.25

Results indicate that there were fewer settlers in 2008 than there were in 2007, but both years the lobster young were about the same size.

Funds have been acquired to continue the project for another 3 years through a NSERC Strategic Project Grant, which will allow for the purchase of 300 new collectors.

2.2.2 Discussion

Written by Katie McGrath, Fisheries Technician, FSRS

Q: Did you compare weather in 2007 and 2008 with the amount of settlers?

A: No we didn't but in the future with more years of collection we could be able to.

Q: Do you take into consideration the prevailing tides when you are placing the collector traps?

A: No we didn't. We had to go with where there was already data collected by suction sampling over the previous 20 years.

2.3 Regional Summary - Settlement Collectors Along Coastal Nova Scotia in 2008 - Lobster Bay, Port La Tour, Sambro and Cape Breton, NS

By John Tremblay, Research Scientist, Fisheries and Oceans Canada

2.3.1 Summary

Written by Tricia Pearo, Fisheries Technician, FSRS

The Fall 2008 Issue of *Hook, Line and Thinker* (Issue 2008-4) featured an article on the Lobster Settlement Collector Project in 2008 by John Tremblay. The data from this project was presented at the Lobster Science Workshop in Truro on February 19, 2009. The following summarizes the presentation.

In the summer of 2008, a total of 288 collectors were deployed at certain locations along the coast of Nova Scotia in waters ranging in depth from 4 to 36 meters. 138 collectors were deployed in Lobster Bay (Lower Argyle) and 50 each in Port LaTour, Pennant Point and Big Bras d'Or, Cape Breton. At least one temperature gauge was attached to a collector per site. Collectors were retrieved in October until mid-November. A pullmaster winch, an overhead winch and an A frame were used in the deployment and retrieval of the collectors. Most importantly, this project could not be accomplished without the time and dedication from the volunteer fishermen.

Data was taken from each collector. This consisted of the size and sex of all lobsters and crabs, fish size, and a count of other taxa. The lobster data has been entered into a database, while the taxa data has not yet been entered.

Suction sampling was done in October, 2008 (Lobster Bay only) and fewer settlers were found compared to 2007. However, the suction sampling was done after a storm, so diving conditions were not the best.

The water temperatures varied for each location. In Lobster Bay, the temperatures were all above 12 degrees Celsius except for a period between late August and mid-September. For Port LaTour, the temperatures were lower. In early August, temperatures were below 12 degrees Celsius, where not much settlement would be expected. Temperatures around Pennant Point were more variable and lower. The bottom temperature dropped to 6 -7 degrees Celsius around September 9th to 19th. In Big Bras d'Or, Cape Breton, temperatures did not seem to be an issue since they were well above 16 degrees Celsius for the most part.

Retrieval of the collectors worked well overall. Out of the 288 collectors deployed at the 4 sites only 6 were left on the bottom. There were some difficulties in grappling in Port LaTour on the western site that was more exposed to the wind. The swells here may have caused the collector ground lines to move around. There were also challenges with retrieval in Big Bras d'Or.

Settlers were only found in Lobster Bay and Port La Tour and settlement in Lobster Bay was markedly lower compared to 2007. In Port La Tour settlement was observed on only the eastern side of the harbour in a more protected area. The low settlement on the western side of Port LaTour Harbour was likely related to low temperatures and possibly rougher sea state.

Whether the low settlement in Lobster Bay in 2008 was more typical than 2007, will require additional years of data. The Lobster Settlement Collector Project will continue in Lobster Bay and Port LaTour in 2009 and, if funding permits, Pennant Point and the Big Bras d'Or area will be sampled another year. The project may be expanded to other sites in the future given funding and interest from industry. Additional sites on the Eastern Shore and off southwest Nova Scotia should be considered. If this does happen, two teams would be needed for retrieval, as there is much time and effort to this project.

2.4 Regional Summary - GCIFA Artificial Collector Project - Canso, NS

By Katherine Newell, GCIFA

2.4.1 Summary

Written by Lindsay Butland, Fisheries Technician, FSRS

The Guysborough County Inshore Fishermen's Association (GCIFA) initiated an Artificial Collector Project in 2007, deploying 20 specially designed collectors from Canso, NS. In 2008, the total number of collectors deployed was increased to 50 and a further 10 collectors are to be deployed in 2009. In 2007, the collectors were deployed at two predetermined sites and in 2008 an additional site was added.

In 2008, sixteen collectors were set at Site 1, located between Port Felix and Flying Point Shoal in 6 fathoms of water in an area of rocky bottom. Ten collectors were deployed in 3-4 fathoms on a sandy/seaweed bottom at Site 2, located between Whitehead and Raspberry. Twenty-four collectors were positioned on a cobble bottom in 3-6 fathoms at Site 3, located at Whitehead. This was an increase of 30 collectors from 2007 and a further 10 collectors are to be set next year, increasing the total to 60. Temperature gauges were set at each location; temperatures ranged from 5°C - 20°C consistently. In 2009, Sites 1 and 2 will be removed and 30 collectors for both LFA 31A and LFA 31B will be deployed by local fishermen.

In 2007 there was one male lobster (9.8mm) and 39 other marine species. In 2008 they found sea urchins, one female lobster (10mm), various shrimp types (some were berried), fish, crab and starfish. Data was sent to the Bedford Institute of Oceanography to be sorted and analyzed. This process is still ongoing.

2.5 Regional Summary - Collectors to Evaluate Lobster Settlement and the Biodiversity of Species Settling in the Coastal Habitat - Southern Gulf of St. Lawrence

By Michel Comeau, Fisheries and Oceans Canada, Gulf Region

2.5.1 Summary

Written by Katie McGrath, Fisheries Technician, FSRS

In the Southern Gulf of St. Lawrence, collectors were deployed by Fisheries and Oceans Canada, Gulf Region, in partnership with the Gulf Nova Scotia Bonifide Fishermen's Association (GNSBFA), Maritime Fishermen's Union, PEI Fishermen's Association and PEI provincial government, to evaluate lobster settlement and the biodiversity of species settling in the coastal habitat. The objectives of the project were to evaluate the level of yearly lobster postlarval settlement, quantify the abundance of all species collected, and assess physiological conditions of the lobsters collected, such as contaminant exposure, antioxidant, stress oxidant and genomics.

All of the 230 collectors that were deployed were filled at a local rock quarry using a standardized size of 4 - 6 inch rocks. Gravel was also added to some of the collectors (5 per location). The collectors were placed in 8 different locations: 30 collectors in Caraquet, Neguac, Shediac, Covehead, Bedeque, and Arisiag; 25 in Havre Boucher and Maisonnette. They were placed at a depth range of 5.5 - 7.5 meters in a 5 x 6 grid. For most of the locations, five collectors were tied together with a buoy at each end. The deployment was video taped by divers to verify their positioning; the divers untied all the ropes. In Havre Boucher/Auld's Cove, the collectors were deployed individually with a single rope and buoy that remained attached.

Mud crabs were found in Shediac and Bedeque. A lot of mussels were found in Caraquet and Neguac. Young-of-year lobsters were found only in Neguac, Covehead and Arisaig. The researchers found it odd not to find young-of-year lobsters in the Maisonnette and Caraquet areas since they are areas with a very good juvenile population, and a high number of walk-in (1- and 2-yr old) lobsters were observed in the collectors.

Funding has been requested in order to continue the project in 2009. The plan is to have collectors all around Prince Edward Island and to continue the collaboration with the GNSBFA from Nova Scotia.

2.5.2 Discussion

Written by Katie McGrath, Fisheries Technician, FSRS

Q: Did you find green crabs in any of your collectors?

A: No, only mud crabs in the Shediac and Bedeque areas and rock crabs in all locations.

Q: Can you describe where the gravel is in the collector?

A: Three small scoops of gravel are added to cover the bottom of the collector.

Q: Should the gravel be standardized or be left as a comparable tool?

A: Can be used as a comparable tool with proper knowledge. In the future we could look at the relationship with different amounts of sediment.

2.6 Regional Summary - Use of Lobster Collectors to Study the Growth of Seeded Stage IV Postlarvae in Gaspé (Grande-Rivière), Quebec

By Louise Gendron, Biologist, Maurice Lamontagne Institute, Fisheries and Oceans Canada, presented by Patty King, General Manager, Fishermen and Scientists Research Society

2.6.1 Summary

Written by Eric Branton, Fisheries Technician, FSRS

The Use of Lobster Collectors to Study the Growth of Seeded Stage IV Postlarvae in Gaspé (Grande Rivière), Quebec project was conducted in 2008 from June until October. There were 24 collectors deployed off the coast of the Gaspé Peninsula near the town of Grande Rivière. The collectors were divided into two groups of 12. The difference between the two was the diet that the postlarvae lobsters were being fed while in a lobster hatchery. Each collector contained 15 seeded stage IV lobsters; the collectors were set at a standard depth of 5 meters. Each of the collectors was covered with a mesh lining in order to keep the lobsters within the collectors. There were also 5 collectors placed without the mesh lining to see if the lobsters would stay within the collectors. All of the collectors were placed out on June 12, 2008 and retrieved on October 8-9, 2008. There were also two collectors kept in a laboratory enclosure during the same period of time, seeded with 37% of the postlarvae lobsters.

When the collectors were retrieved there were many unforeseen problems. The netting used to cover the collectors had been eaten by sea urchins and some of the lobsters had left. Furthermore, at least 13 of the collectors had been displaced, 6 overturned, and one was lost completely.

They collected all of the stage IV lobsters within the collectors but there was no way to tell the difference between the wild and seeded lobsters. There is a plan to compare the lobsters from the collectors to the ones kept in the lab and to tissue samples from the females that were used to provide the seeded lobsters. This would be done in order to figure out if the lobsters found in the collectors were wild or seeded.

The area sampled with the lobster collectors was an area of known settlement. A survey was done in June 2008. They sampled 33 stations that were 5 meters squared and spread out 15 km off the coast, and found lobsters in 30 of the stations, with a total of 185 lobsters. Out of the 185 lobsters collected, 40% were from the 2007 cohort and 30% from the 2006 cohort.

2.7 Regional Summary - Bonne Bay, St John Bay and Bonevista Bay, NL

By Victoria Burdett-Coutts, MSc Candidate, Memorial University

2.7.1 Summary

Written by Miriam Morgan, Assistant Data Analyst, FSRS and Victoria Burdett-Coutts, MSc Candidate, Memorial University

In 2007 and 2008, Memorial University of Newfoundland (MUN) graduate student Victoria Burdett-Coutts evaluated the abundance and distribution of the early life stages of the American lobster in coastal Newfoundland (Bonne Bay, St John Bay, Bonevista Bay). This research consisted of neuston tows to sample the planktonic stages and a variety of methodologies to sample the Young-of-Year (YoY) settlers. In 2008 three different methodologies were utilized to obtain this objective; diver based suction sampling and visual surveys, and the deployment of collector trays. The collectors were of general design, covered in petmesh; each was filled with rocks that had been collected from surrounding beaches. Collectors were deployed by fishermen, with 5 sites in Bonne Bay, 2 sites in St. John Bay, and 5 sites in Bonevista Bay. Each site had between 8 to 10 collectors and all trays were deployed in 5 – 10 m below Mean Low Water (MLW). Suction sampling was carried out by using well established protocol with 3 sites in Bonne Bay and 5 sites in Eastport. SCUBA visual surveys occurred at 9 sites in Bonne Bay.

In 2008 three YoY settlers were found in Bonne Bay, one at the mouth of the Bay and two inside the Bay. No settlers were found in St John Bay or Eastport. Neuston sampling in Bonne Bay from 2008 revealed significant numbers of all larval stages, with the highest numbers at the mouth of the Bay. Previous years of planktonic sampling have only revealed high numbers of stage I lobsters.

Overall it was found that early life stages of American lobster are in low abundances in Newfoundland, which is not surprising given the northern limit of this species. The potential benefits of research on the fringe of a species range may provide clues to impacts from environmental effects such as climate change. Additionally, the American lobster fishery is very important to the fishers of the province and a better understanding of its recruitment dynamics is important. Therefore there is validity in studying the northern limit of lobster.

2.7.2 Discussion

Written by Miriam Morgan, Assistant Data Analyst, FSRS

Q: How is suction sampling done?

A: Two diver process where one diver operates the suction sampler while the second diver removes rocks.

Q: Were water temperatures observed in the study?

A: Two trays per site had temperature loggers; each tray had one logger at the surface and one on the bottom. Temperature loggers were located at each site, one for bottom temperature and one for surface temperature.

Q: Are smaller berried females due to warmer weather?

A: This has not been studied in Newfoundland, although some fishers believe that there are increasingly higher numbers of berried females and that they are berried at a smaller size.

2.8 Monitoring Biological Diversity on Nearshore Lobster Habitat in Nova Scotia

By Angelica Silva, Research Scientist, Fisheries and Oceans Canada

2.8.1 Summary

Written by Shannon Scott-Tibbetts, Acting Research Biologist, FSRS

Angelica Silva, a research scientist from the Department of Fisheries and Oceans, gave a presentation outlining using the postlarval collectors as a biodiversity tool. There is a scarcity of information about biological factors that might influence habitat selection by new lobster settlers in Nova Scotia. There is limited sampling of natural habitat by diving to establish associated biological diversity. Postlarval collectors provide a consistent sampling unit that provides a summary at the end of a three month period.

Lobsters have a complex life cycle: berried females release eggs after 9 months, larvae remain in planktonic stage for 3-10 weeks and may be settlers for 6 months - 1 year. Lobsters reach sexual maturity within 6-12 years depending on geographic location. Since the window for lobster settlement is July-October, the collectors were deployed during July and retrieved in October/November.

Objectives for the first and second year of study were to define standard protocols and methods to collect information on biological diversity data for Nova Scotia, identify organisms to the lowest taxa possible, establish baseline information for long term monitoring, recognize the importance of broad collaboration and support from various groups and organizations, and evaluate preliminary results to assess the value of collectors as a tool to monitor biological diversity.

With help from others, DFO personnel and FSRS technicians retrieved the collectors and examined the contents. Every species in the collectors was recorded on a data sheet. Everything was washed into a net and samples were collected from 39 collectors and taken back to BIO for further examination.

Some preliminary results from 2007:

- Lobster Bay - 138 collectors on hard bottom, 71 settlers found (<12 mm), 133 lobsters (<30mm), 147 lobsters (<42 mm), 15 species of crustaceans, 15 species of fish.
- Whitehead - 10 collectors on sandy bottom, 10 on hard bottom, 1 settler (<10 mm), mostly juvenile stages of invertebrates and fish, 33 species of invertebrates, 5 species of fish, 6 species of algae/eelgrass.
- Sambro - 40 collectors, 1 settler found.

Results from 2008:

- 39 biological samples collected from 4 areas in the Argyle region (Lear’s Island, Canoe Island, Abbott’s Harbour, and Jones Island).
- No biological samples were collected from East Pennant or Cape Breton area.
- 50 biological samples were collected from 3 areas in the Whitehead region.

In the Argyle region, all samples were sorted but biomass and some identification is pending. Species of sponges, cnideria, molluscs, worms, crustaceans, nematods, echinoderms and chordates were found. In the Whitehead area, 14 samples have been analyzed to date.

In 2008, collectors showed an increase in the number of species per collector from 2007. This is preliminary work only. Detailed analysis will reveal baseline biological information for long term monitoring. Settlement of lobsters, molluscs, worms, echinoderms and some invasive species vary with locations. A minimum of three years of data is necessary to establish a baseline.

2.8.2 Discussion

Written by Shannon Scott-Tibbetts, Acting Research Biologist, FSRS

Q: Any plans on expanding the sampling?

A: All depends on funding for the next year. We would like to continue with the current areas to get more information.

2.9 Using Life Cycle Assessment to Understand Global Environmental Impacts of Lobster Fishing in the Gulf of Maine

By Catherine Boyd, Dalhousie University

2.9.1 Summary

Written by Eric Branton, Fisheries Technician, FSRS and Catherine Boyd, Dalhousie University

A life cycle assessment (LCA) is a study of the resource inputs and environmental repercussions (such as a Carbon Footprint) of the entire life cycle of a product, through any resource extraction, processing, transport, use and waste treatment phases. When undertaking an LCA of the lobster industry, an assessment must include an evaluation of the construction of lobster boats and traps, fishing for the directed species and any species used as bait, as well as storage and transportation of animals once they are landed at the wharf. All of these industry components must be taken into account because they all require natural resources and have impacts on the environment. This study compared the different impacts associated with lobster fisheries in the state of Maine and in Canada’s Lobster Fishing Area (LFA) 34. These two fisheries were compared because both take place within the Gulf of Maine, and target the same lobster biomass. However, the two fisheries are very different in some respects. For example, the Maine fishery is open all year while LFA 34 is open during the last week of November until the end of May. Maine has a trap limit of 800 while LFA 34 has a trap limit of 375 for part of the season and 400 for the remainder. Although both fisheries are limited entry, there are far fewer licensed fishermen in LFA 34 (967) than in Maine (5764).

To compare differences in operations of each fishery, inputs for both areas were quantified and compared. Table 1 compares operational inputs to the fisheries in relation to a tonne of lobster landed to the dock:

Table 1: Comparison of operational inputs to the lobster fisheries in Maine and LFA 34

Operational input		LFA 34	Maine	Maine : LFA 34
Fuel l/t		1026	991	0.97
Sea days (days/t)		3.7	11.4	3.08
Bait	Amount (t/t)	1.06	2.97	2.80
	Variety	Fresh frozen herring	Salt herring	

Fishing operations in both Maine and LFA 34 used about the same amount of fuel in order catch one tonne of lobster. The Maine fishermen used almost three times more bait and spent approximately three times as many days at sea as the fishermen in LFA 34. The reasons for these efficiency differences in fuel, bait, and days at sea are not fully known. However the different management measures - such as season closures and trap limits – as well as different fishing strategies – such as distances traveled from port to the fishing grounds - could account for operational differences.

Different environmental impacts can be measured once the operational inputs are taken into account. The remainder of the presentation focused on how operational inputs could be translated into a carbon footprint – a measure to indicate the level of greenhouse gases attributable to a product or system. Table 2 gives the amount of greenhouse gases attributed to each stage of the fishing operations measured in kilograms of carbon dioxide equivalents.

Table 2: Greenhouse gases associated with different aspects of lobster fishing in LFA 34 and Maine measured in carbon dioxide equivalents (CO₂ eq)

Kg CO ₂ eq	LFA 34	Maine
Boat/Trap	100	160
Bait	725	1580
Diesel	3342	3230
Total	4168	4913

Differences in the carbon footprints of the two fisheries are largely attributable to the amount of direct and indirect fossil fuel inputs to the system. In the case of boats and traps, it is the energy used to extract the raw materials and construct the boat and gear. With respect to bait it is both the fuel consumed during the collection of the fish as well as any electricity used in processing and storage that contribute greenhouse gases. The direct diesel inputs to the lobster fishing activity have the greatest contribution to the carbon footprint.

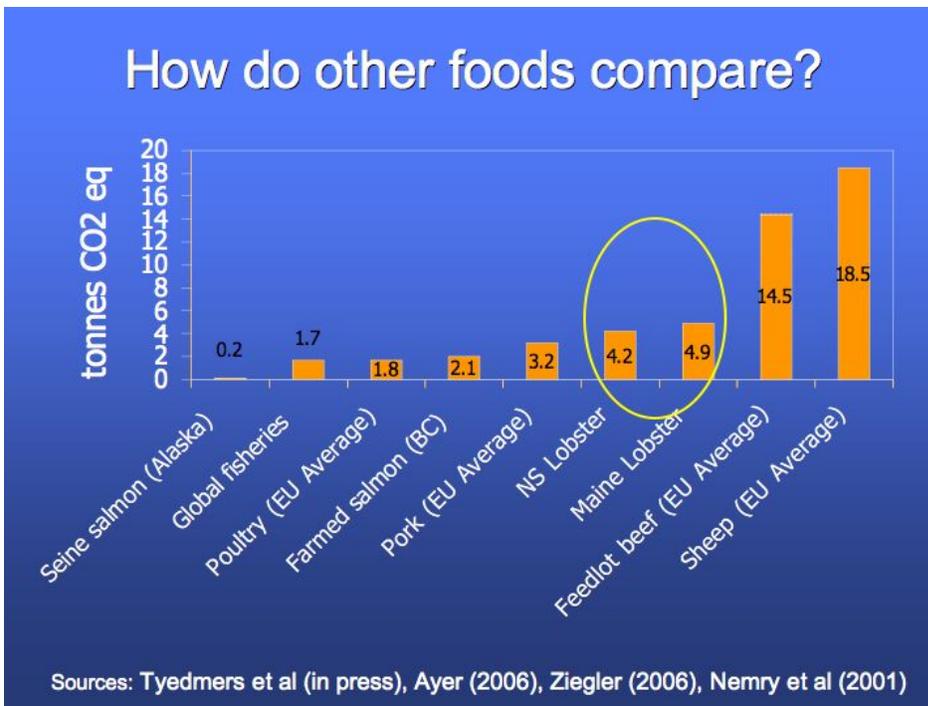


Figure 1: A comparison of the carbon footprints of different food production systems. All products are measured in terms of 1 tonne of unprocessed animals delivered to farm gate or fishing wharf.

Figure 1 contextualizes the carbon footprints of lobster fishing in both LFA 34 and Maine by comparing them to the carbon footprints of other food production systems. As the figure indicates, lobster fishing has a higher carbon footprint than some foods, but less than others. The differences are attributable to the vastly different production systems unique to each food type.

Life cycle assessments attempt to take into account the broader environmental implications of and the opportunities for improvements to a product or process through all stages. In the lobsters fisheries of both LFA 34 and Maine, improvements in efficiency can be achieved by shifting away from fossil fuels in all phases of production.

2.9.2 Discussion

Written by Eric Branton, Fisheries Technician, FSRS and Catherine Boyd, Dalhousie University

Comment: The use of tonne, weight of lobster, does not take into account the economic benefit or the amount of useable meat.

Q: How much of the CO₂ emissions are made by government regulations?

A: This is very hard to measure but it definitely exists. For example, due to government regulations, boats in LFA 34 are length restricted. This has resulted in a trend to increase deck space by building very wide boats that are not very fuel efficient.

Q: What is the meat yield of each type of food in the comparison?

A: The lobsters have a meat yield of 35% while salmon have a yield of 60%.

Q: Why do Maine fishermen have more sea days but lower fuel consumption?

A: Not sure why there is a difference. One theory is that Maine has a longer season and fishermen have more opportunities to go to sea, however trap saturation may limit the ability of each fisherman's catch rates. LFA 34 fishermen may go to less crowded fishing grounds further from shore but need more fuel to get there.

Q: What impact does the LCA have on MSC certification?

A: LCA is not currently part of the MSC certification process. MSC certification assesses the health of the stock, the impacts of the fishery on the benthic environment and non-target species, and the fishing management system.

Q: Was it a tonne of usable meat or just product in total?

A: It was just a tonne of shell-on lobster landed to dock.

Q: Why do sheep and cow production systems have larger carbon footprints than lobsters?

A: There are many reasons depending on the system under analysis. LCAs of sheep and cow production systems must take into account the feed given to the animals (and the associated crop growing inputs) as well as the treatment of manure.

2.10 Trapped in Maine: Studies on the Impacts of Trap Density on Catch

By Carl Wilson, Biologist, Maine Department of Marine Resources

2.10.1 Summary

Written by Katie McGrath, Fisheries Technician, FSRS

The Maine Department of Marine Resources is conducting studies to evaluate the impact of trap density on the amount of lobsters caught using comparisons between the Nova Scotia and the Maine lobster fisheries. At first glance it would appear that lobster fishermen in Maine have better catch rates than their counterparts in Nova Scotia since their catch rate is approximately 30% higher than the fishermen in LFA 34. These numbers are deceiving and it must be noted that the Maine fishermen set their traps year round and have 8 to 9 times more traps in the water at any give time than the fishermen in LFA 34. In LFA 34 the lobster season starts on the last Monday of November and ends May 31, approximately a six month season. This means that lobstermen in Maine use 13 times more traps than are used in LFA 34 to catch the same number of lobster.

There are seven lobster management areas along the coast of Maine identified by the letters A-G. Each area has a trap limit of 800 traps per boat with the exception of Area E. Area E opted to reduce their trap numbers to 600 per boat. In Casco Bay, the most populated bay (known to fishermen as the bay of pigs), there are over 2000 traps per square kilometer. Line tangles in this bay can reach upwards of 40 traps. As in Nova Scotia, 50 % of the annual catch is caught within the first few weeks of the start of the fishing season.

In an effort to better understand the views and concerns of the Maine lobster fishermen, a poll was conducted asking lobster fishermen various questions about their fishery. Of the 6,832 surveys sent to licence holders, 35% responded. Of those respondents 57% were in favour of reducing the number of traps as was done in Area E.

From September through October 2005, cooperative experiments were performed to test the impacts of trap density in the lobster fishing areas off the coast of Maine. As part of the study, each lobster was batch tagged, legal size lobsters were removed from the area and the tags of any recaptured lobsters were recorded. In 2007 an experiment was conducted to further investigate the impact of soak times on a catch. It was discovered that there were some local impacts on catch rates, that migration is greater than depletion, and that overall the lower the trap densities the higher the catch rate. It should be noted that the cumulative impacts remain about the same and the catch is impacted by the amount of soak time given. It was concluded that there could be cost savings potential with reduced trap numbers and the biological impacts would be neutral.

In the spring of 2007, lobster fishermen in the Monhegan Bay area went to the State Legislature and had the statute changed to decrease their season by two months and cut the number of

traps per boat in half. The results from the 2007 to 2008 season showed a 72% increase in catch. For 2009, funding has been applied for to look at the Tennants Harbour area to see if results there would be similar to those in Monhegan Bay.

2.11 What is the Bait to Catch Ratio in the Nova Scotia Lobster Fishery?

By Luke Harnish, former School for Resources and Environmental Studies student, Dalhousie University
Presented by Patty King, General Manager, Fishermen and Scientists Research Society

2.11.1 Summary

Written by Tricia Pearo, Fisheries Technician, FSRS

You may have heard the common bait stereotype that a little bait will catch a lot of fish. Luke Harnish, a former School for Resources and Environmental Studies (SRES) student at Dalhousie University, decided to take the first look ever into the amount of bait usage in the Nova Scotia Lobster Fishery.

Harnish looked into some of the bait types used in the Lobster Fishery: mackerel, herring, redfish, haddock, sculpin and rock crab. He focused on two locations within Lobster Fishing Area (LFA) 33: St. Margaret's Bay and Mahone Bay. The LFA 33 season is open from the last Monday in November to May 31st each year.

Voluntary Bait Review Surveys were handed out to fishermen within Mahone Bay and St. Margaret's Bay to determine how much bait was used for each trap haul, as well as for the season. Bait and trap haul information was also collected from the Fishermen and Scientists Research Society's Lobster Short Term Recruitment Index Project from 2002 to 2005.

Based on interview results, the average amount of bait used in the fall and spring was 11,500 lbs, ranging from 5,000 to 16,000 lbs. The average amount used per trap haul was 1.9 lbs of bait, with a range from 1.25 to 3 lbs. All fishermen interviewed fished the maximum amount of traps. It was noted that when there was a presence of sea fleas in colder waters, the amount of bait usage increased. The Lobster Short Term Recruitment Index Project data showed there were more legal sized lobsters caught in the fall than in the spring from 2002 to 2005.

After reviewing the results, Harnish found that there was a trend in the average bait to catch ratio per month. There was a significant amount of bait used (over 20 lbs) per lobster in the month of March. He also discovered that most of the fish used for bait were migratory.

The Department of Fisheries and Oceans, the Fishermen and Scientists Research Society and the School for Resources and Environmental Studies are interested in these results. Future research may involve examining stomach contents of lobsters for the amount of bait and to calculate the amount of carbon added to the ecosystem via bait.

3.0 Plenary Sessions

3.1 Moving Forward: Discussion on Formalizing the Lobster Post-Larval Collector Research Collaboration and Integration with Other Research

Summarized by: Miriam Morgan, FSRS Fisheries Technician, Laura Ludwig, GOMLF Project Manager and Patty King, FSRS General Manager

This plenary session focused on five questions in relation to formalizing the lobster post-larval collector research collaboration. The results of the discussions are highlighted in this section.

Are any changes/refinements needed to the current standard protocols?

Data Collection, Use and Management

Objectives of the Collaboration

Who would be the collaborators?

Collector Sampling

Suction Sampling

Biodiversity Sampling

How to integrate collector data with suction sampling and biodiversity data.

Are any changes/refinements needed to the current standard protocols?

It was agreed that standardizing the methodology is important and that there is still room for fine-tuning of the methodology. Site selection was one of the main issues discussed; the discussion included the following:

- A lot of emphasis is placed on haphazard sites. We've got very limited effort and infinite sites – need to pick the right spots.
- Would it be useful to do an interview-based survey asking fishermen where they observe very small juvenile lobster? It could be overlaid with ventless trap data to help select sites. It was noted that the FSRS has local ecological knowledge surveys from its Inshore Ecosystem Project upon which they could draw.
- Well-placed effort can help with predictive models.
- John Tremblay commented that concerning the issue of site selection, it is basically a shot in the dark. We did talk to fishermen; we are looking for areas with hard bottoms. In Lobster Bay we may like to extend sampling to a larger area. The primary goal is an indicator of settlers (temporal trends).
- Rémy Rochette commented that the information is good for temporal trends, although if you want spatial, we do not have the proper design. He indicated that they just got funding and have a meeting in the month to come; at that time, they may make spatial inferences on a small spatial scale (3 sites, 20 collectors).
- Carl Wilson commented that temporal trends are good; they are derived from data that we have right now. There is a fair amount of larval sampling done. It was

suggested the LNG companies might like to compare information, we could consider coordinating some of the LNG sampling with the research done on both sides of the border.

- Gareth Harding commented that there are negative sites in Nova Scotia and Newfoundland. It is important to find where the larvae are settling. There is a lot of zero sampling. It is better to put collectors downwind rather than upwind; wind direction needs to be taken into account when selecting sites.
- Suction sampling represents time trends rather than representing abundance. You need a few sites that are well chosen. It is accurately demonstrating things to come more and more often.

The discussion also included the following:

- What about tracking time trends? Following cohorts through time?
- The question was asked whether collectors have ever been put offshore (Georges Bank). It has been considered but is not supported yet in the US.
- Climate change may factor in all this work. It was commented that there could be more support for it from the US government due to the new NOAA director's interest in it. The question was asked if the survey fits into the climate change initiative. Is there potential for a trans-boundary initiative, a trans-boundary assessment of lobster?

Objectives of the Collaboration/Who would be the collaborators?

This portion of the discussion considered how formal should the collaboration be, should the focus be on suction or collector sampling, and who plans to continue the research. The collaboration is still in the early stages and there is interest in maintaining a collaboration. It was noted that different groups have different priorities. The primary focus is on lobster, however, there is also interest in crabs, fish, associated fauna, etc..

It was commented that suction sampling is already developed and proving useful and is the preferred method in some areas, however, each monitoring program has its own set of needs and collector sampling may be the preferred method for other areas. It was commented that both methods of sampling are forecasting tools to help predict the future.

The project leaders for the various areas were asked to comment on the future direction of their individual projects and participation in the collaboration. All were interested in being part of the collaboration. Their comments included the following:

- Rick Wahle indicated that he can play the role of “warehouse” for the monitoring programs. Everyone would do their own data collection and then send it to him. A regional summary sheet would be made up by Charlene Bergeron, and then an annual report of the year's results would be prepared. Others would benefit from the pooled and summarized data. If he had to do more than this, funding would be needed. Rick indicated that for the States suction sampling is best for the most part,

- although collectors go where divers can't go.
- Katherine Newell, from Canso, indicated that the collectors work for them and they plan to stay with them for now. They have done it for two years now. She commented that it is harder to get divers due to it being an isolated area.
 - Victoria Burdett-Coutts indicated that the collectors won't be continuing in Newfoundland as it was part of graduate research that is now done. There may be an opportunity for suction sampling down the road.
 - Michel Comeau indicated that more collectors will be used, that it will continue in the Southern Gulf of St. Lawrence (GSL) for another year. They plan to work in collaboration with the PEIFA (PEI Fishermen's Association) and get fishermen more involved. They are interested in doing more biodiversity work. There are issues with rock crabs in the GSL; the collectors are a good tool to observe rock crab, which are a key species. Peter Lawton tried the suction sampling method but it's too murky and challenging. Suction sampling is not viable as the winds create zero visibility. They will look at transect work the year after. PEI also has a ventless trap survey, which will hopefully be a good link to the collectors. They are working on getting funding for three years.
 - John Tremblay indicated they are looking at three more years of collector work in a few areas and then see where things are at at that point. There is not a large diver resource in his area, which is required for suction sampling, therefore they will continue with using the collectors. He does have a small group of divers to continue the suction sampling in Lobster Bay and hopes to continue it for three years at least.
 - Angelica Silva commented that Lobster Bay is also a good site for biodiversity. She is hoping to continue her biodiversity work in Lobster Bay; she is looking into funding.
 - Rémy Rochette indicated that the Southwest Bay of Fundy has funding for 300 collectors, which is good for two years. They would like to do biodiversity work. There will be 5-6 graduate projects in the next 2-3 years, with one large project working on lobsters; it will also use suction sampling that can be compared with collectors. He was unsure of whether or not they will continue after that; they will look at the data and decide at that point. If the data is promising, he felt they should be able to find funding for the SW Bay of Fundy. The more useful the data is the longer you can keep the projects running. Collaborations with other universities will involve genetic work, among other graduate student projects, during that 3-year endeavor.

The discussion also included the following:

- South of the border is more suction sampling, to the north is more collectors.
- Bob Glenn, DMF, just got funding to continue the collectors in southern New England, building on Rick's work.
- There are at least three places where the two sampling methods are happening side-by-side.
- These initial steps will help inform larger work later on; could become a useful

- forecasting tool.
- Carl Wilson commented that for Maine it's more efficient to put four divers in for a month to do all the sampling. He also indicated they don't have time to do biodiversity work, the commitment isn't there; they had to drop fish.
 - Extra collectors could be sent to southern New England or New York; they'd be interested.
 - As we look to move forward, it was felt it would be useful to identify some of the issues that might arise with collaboration, such as publications/co-authorship, having annual meetings, etc.. It was suggested that the FSRs could host an annual meeting and hold it in conjunction with their annual conference as has been done this year and last year. This will need to be discussed with and approved by the FSRs Executive Committee.
 - Carl Wilson and Rick Wahle explained that a workshop is being planned for June 19 - 21, 2009 in Boothbay Harbor, Maine, to celebrate 20 years of collaborative collection effort (one of the longest-running data collection efforts in terms of time series) at the DMR's Burnt Island site.

Data Collection, Use and Management/How to integrate collector data with suction sampling and biodiversity data

The discussion centered around the management of the data and which database to use. The discussion included the following:

- Rick currently plays the role of "warehouse" for the data. An annual regional summary sheet is generated by Charlene Bergeron. It was suggested they could continue in that role; there is a benefit to having it all in one place.
- Michel Comeau explained that he has a major database in place thanks to Denis Gagnon. He suggested they could also be the custodian; they have a server and personnel. They didn't have time for a lot of data to be put into the database; they could hire people to enter data.
- The issue of confidentiality and proprietary data was discussed. The question was asked if it is possible to keep separate databases. Is it possible for each organization to have a copy of the format of the database, for example Michel Comeau's database, to ensure consistent data entry while maintaining separate ownership of their data? Denis Gagnon noted that they are doing something similar in PEI; they are using the same format of database and entering their own data. Excel would be workable with the database. They will design a database for their region. Those from the Maritimes can send their information to them, or they could send the database format to the other organizations.
- The state of Maine already manages the database in Maine. It was suggested that the projects in the US could deposit their data with Rick Wahle and the projects in Canada could send their data to Michel Comeau's group (DFO). A regional summary sheet could be created each year from the combined databases.

- Everyone is collecting different information, therefore the database would need to be tweaked to accommodate the different focuses.
- It was suggested that a web-based data entry portal would be helpful. It could automatically produce graphs and do calculations. It was commented that DFO has been working on it and may get through the bugs soon. They are also working on the confidentiality issue. Michel Comeau suggested they could get their web guy involved; we would just have to identify the path to take.
- The question was asked whether or not the data would become public domain if DFO became the custodian of the data. Michel Comeau indicated that if the data was not collected through DFO using public funding then no the data would not become public domain. Access could be restricted; it would be protected under the privacy act. They are currently going through what they can and can't do, reading the privacy act. Some groups might be more concerned with ownership than others.
- How to move forward was discussed. Should timelines/dates be set? It was agreed that the conversation should continue, should maintain a forum to exchange data.
- Rick Wahle commented that it is good to have advice from those who do this - lobster model. How does all of that operate? Are there any legal issues? We have a vision to share a common data set; although it is not the best forum at this workshop to work out all the details, we need communication in order to move forward.
- It was suggested that the FSRS Data Management Working Group could facilitate meetings and/or the development of data management and sharing protocols.

3.2 Discussion on What Other Science Needs to be Done, Future Direction

The workshop concluded with a general discussion on what other science needs to be done and future direction of lobster research. The following summarizes the points discussed.

- Q: Joanne Butland: Can DFO give us a suggestion of v-notching in knowing just what is to be protected? We need to know where the lobsters are moving. DFO science gives number to protect mature females. Need some sort of tracking to create a number. A fair number of movement studies were done in the late 1990's.
- A: John Tremblay: Had a hard time evaluating v-notching in our areas, v-notching is voluntary.
- A: Carl Wilson: V-notching has been a key factor in the success of the Maine lobster fishery. Without v-notching Maine would be in a world of hurt. Developed a technique as a percentage of egg bearing lobster v-notched.

Comment: PSP (Paralytic Shellfish Poisoning) levels showed up in Maine last summer so a monitoring program was quickly put together at a number of sites. Sampling was conducted for the two weeks before Christmas. Some lobster showed an increase in PSP in tomalley. Health Canada will be reissuing a health advisory this week or next week stating

adults – one tomalley/day, children – none. Most sites were deemed safe, with only a few sites showing an increased level. Health Canada is not going to identify individual sites since migration will not allow for the determination of the exact location the lobsters came from.

Comment: Jean Lavallée: The AVC Lobster Science Centre was involved in organizing the sampling which was then carried out by the provinces. Looking at the data, some sites have a high level of PSP. CFIA wants to increase coverage and continue the project. Most sites are safe and a few are high. Could be linked to the high year for algae in the Bay of Fundy.

Q: Does it have to do with red algae?

A: Yes.

4.0 Conclusion

The *FSRS-GOMLF Lobster Science Workshop* continued and expanded upon the cross-border information sharing and collaboration initiated through past workshops and other initiatives, such as collaborative research projects amongst the FSRS, the GOMLF, Fisheries and Oceans Canada, the Bigelow Laboratory for Ocean Sciences, and various Atlantic Canadian universities. The *Lobster Post-Larval Collector Research Collaboration* is one such initiative and was the primary focus of the workshop. There was a commitment to move forward with the collaboration, and the importance of such opportunities as this workshop to bring everyone together was stressed. It was recommended that the collaboration of lobster collector projects should meet annually to review results and continue the information exchange and the expansion of the research, both geographically and in terms of the scope of the research.

Discussions on how to move forward included looking at if any changes or refinements are need to the current standard protocols, will groups use suction sampling and/or collectors, and data management and sharing. It was agreed that standardizing the methodology is important and that there is still room for fine-tuning of the methodology. It was recognized that different groups have different priorities. The primary focus is on lobster, however, there is also interest in crabs, fish, associated fauna, etc.. Suction sampling is the preferred method in some areas and is already developed and proving useful, however, each monitoring program has it own set of needs and collector sampling is the preferred method for other areas. It was agreed that both methods of sampling are valuable forecasting tools.

It was agreed that we have a vision to share a common data set, however, there are a number of issues that need to be considered, including who should be the custodian of the data, confidentiality, ownership, and how to move forward with developing and implementing a strategy for data management and sharing. It was suggested that Rick Wahle could be the custodian of the data for the projects in the US and that Michel Comeau (DFO) could share his database format with the other projects and perhaps be the custodian of the data for the projects in Canada. It was agreed that a regional summary sheet could be created each year from the combined databases. It was suggested that the FSRS Data Management Working Group could facilitate meetings and/or the development of data management and sharing protocols.

The other focus of the workshop was on *Using Science to Better Understand the Environmental and Economic Impacts of the Lobster Fishery*, and included presentations on using life cycle assessment to understand global environmental impacts of lobster fishing in the Gulf of Maine, studies on the impacts of trap density on catch, and bait to catch ratio in the Nova Scotia lobster fishery. The workshop concluded with a short discussion on other research that is being done and potential future research.

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Thank You