HOOK, LINE AND THINKER

The Newsletter of the Fishermen and Scientists Research Society

Issue: 2006 - 2 **Spring 2006**

FSRS TEAM EXPANDS

The FSRS is growing! A number of new employees have been hired this summer to help us with our expanding number of projects. We would like to take this opportunity to introduce you to our newest employees and remind you of the long-term members of the team. FSRS Research Biologist Carl MacDonald, Senior Fisheries Technician Jeff Graves and Research Assistant Shannon Scott-Tibbetts have all been with the FSRS for over seven years now and are always available to answer any questions or concerns. Their proven dedication and hard work over the years has not gone unnoticed. We continue to have our tried and true Fisheries Technicians serving various areas of the province: Curtis Young in Cape Breton, Rebecca Goreham in Yarmouth, and Jennifer LeBlanc who has moved from the Yarmouth area to the Halifax region. Nell den Heyer joined the FSRS team in October 2005 as Project Officer for the Inshore Ecosystem Project and has been hard at work in the field lately. Back for another summer for dogfish sampling are Ben Robinson and Stacey Fraser. Our keen summer student Dustin Ellsworth has returned for a second year as Assistant Data Analyst; he will be doing data entry for the lobster recruitment project and helping with the v-notching project on the Eastern Shore. Along with these seasoned employees we have hired two new Fisheries Technicians, Alain d'Entremont and Kate Gardiner for the Yarmouth area. Kate will be focusing on the Lobster Molt and Quality Project while Alain will be a jack-of-all trades, doing groundfish condition, dogfish and lobster sampling and generally participating in any projects in his area. Dawn Robia has joined us as a Lobster Technician for the summer and will be working out of Lunenburg doing lobster protein sampling as well as helping with the v-notching project on the Eastern Shore. Aaron Retzlaff will be working with the Lobster Molt and Quality Project data in his 16 week term position as an Assistant Data Analyst for the project. Also assisting with lobster research for the summer is Elspeth Hennigar. Past FSRS Fisheries Technician Megan Veinot has moved on to a contract position with DFO, however, she continues to help out the FSRS on a part-time basis whenever possible. At the helm of the FSRS, keeping it and its projects on course, are as always the PMD Services management team of Patty King and Christine MacKenzie. Thanks to the entire FSRS team for all their hard work and dedication. Check pages 2 and 3 of this issue to learn more about some of the newest members of the team.

• Inside this Issue •

Working With the Lobster Quality Data

My name is Aaron Retzlaff and I have recently been hired to analyze lobster quality data. I am interested in determining what causes sporadic variation in Southwestern Nova Scotia lobsters' quality by analyzing data which have been collected since June 2004. Understanding what causes variation in lobster protein levels and moult timing will help us to better understand this natural resource.

I have a B.Sc. Biology (Hons) which I received from Memorial University in 2004, during which I studied Snow Crab feeding ecology. I am currently finishing my M.Sc. thesis at Saint Mary's University, where I am doing research on fungal pathogens of insects. During my undergraduate and graduate degrees I discovered an affinity for data analysis and consequently have tried to bolster my knowledge of statistics at every opportunity. I hold statistics in esteem because it is the language that describes science and the world around us. Without it, we are like novelists without a grasp of grammar.

On my own time I am an avid fisherman and also enjoy SCUBA diving. I have my Advanced SCUBA, NITROX, and Safety Diver certification and so I'm always looking for dive partners.

I hope to be able to meet all of the other FSRS members so if you have questions regarding the analysis, or just want to visit, feel free to drop by my office, FL-136 in the Fish Lab at BIO, or email me anytime.

Protein Sampling Ahoy!

Hi, my name is Dawn Robia and I will be working with the FSRS for the summer. My tasks during the summer will be v-notching on the Eastern Shore and taking blood protein samples in Lunenburg. My summer so far has been busy and I have experienced and learned a great amount. I have met a lot of great people and look forward to meeting many more.

Local Boy Joins FSRS Team

My name is Alain d'Entremont and I am from the area which has gained notoriety recently mostly for these new windmills that seem to have shown up since I have been away from home, Lower West Pubnico. I recently graduated from Dalhousie University with a Bachelor of Science with my studies focused mainly in Computer Science and Psychology. Don't think about that too much, the link not only isn't obvious, it doesn't exist. I started in Computer Science but quickly realized my place was not behind a computer for 8 hours a day. Psychology always interested me and since I had already spent a few years collecting credits, I decided I should complete some type of degree. Although Computer Science and Psychology are not the first subjects you would think of for a FSRS Fisheries Technician, the key lies in the fact I grew up surrounded by the fishing industry. I worked at Inshore Fisheries Limited and occasionally out on boats since I was 13 years old. Although the hours were sometimes long, I enjoyed that much more than sitting behind a computer. I have worked in plants, on the wharf and on boats; I felt the next logical step was learning about the science aspect of the fishery. My goal as an FSRS Fisheries Technician is to not only have the opportunity to gain knowledge but hopefully be able to also then turnaround and share it, unless it's confidential of course. I look forward to working and meeting many different people with different ideas and agendas and hopefully absorb a bit from everyone. Oh, and I've also learned that some skates can be rather hard to differentiate and that although I once referred to them as Barnyard Skates, there are no skates hanging out in the fields with cows, pigs and chickens… unless you are talking about the feed I guess.

From Wheat Fields to Squid

Greetings from the prairies! My name is Kate Gardiner and I am one of the new Fisheries Technicians for the FSRS. Originally, I come from the small northern Manitoba town of Flin Flon but spent most of my younger years in the beautiful city of Winnipeg. Following high school, I decided that I wasn't

yet ready to face the real world and continued on to the University of Manitoba where, some years later, I received a Bachelor of Science Ecology specializing in Aquatic Ecology and Fisheries Management (and yes, there is a fishery in Manitoba!).

Having all this education behind me, I decided to try to venture into the working force. I started as a Wetland Interpreter at the Oak Hammock Marsh Interpretive Centre (a joint venture of Manitoba Conservation and Ducks Unlimited Canada, as well as the Canadian head office of Ducks Unlimited). My job was to teach visitors and school groups about the importance and complexities of wetlands. I also had the opportunity to go to schools throughout Saskatchewan, western Ontario and all of Manitoba (you name the town, I've probably taught there!).

Realizing that teaching kids requires a huge amount of energy, I decided that I should try my hand at research. I was offered a job at the Atlantic Reference Centre (part of the Huntsman Marine Science Centre - HMSC) in St. Andrews, New Brunswick as a DFO Intern. My job was to sort through and identify thousands of marine invertebrates, mainly squid! Most people would have found that boring but I loved all the weird shapes and adaptations of the deep sea creatures. I also became pretty good at it and can now identify most squid at sight. I continued on at the Huntsman Marine Science Centre as the Teaching Assistant for two summers, again teaching kids about conservation and ecology but this time it was marine related and I got to go on a boat! I also spent the winter developing some of the programs offered at the HMSC as well as a life-sized inflatable Northern Right Whale named Ebb. For those curious, she's made out of greenhouse plastic and tape and can inflate within 5 minutes by putting a normal house fan behind the flukes. Ebb is now taken to schools around New Brunswick as part of the Fundy Giants program I developed.

Again realizing that I lacked the energy to teach kids, I decided to return to university to attempt a Marine Biology degree. Having never gone to Newfoundland before, and needing a good excuse to go, I chose the Memorial University of Newfoundland to continue my studies. There, I completed an Honours degree with my thesis focusing on the environmental cues affecting larval rainbow smelt migration and retention in estuaries. For my thesis, I got to go smelt fishing for a whole summer and became well acquainted with one of Newfoundland's primary residents, the moose! Before moving to Newfoundland, I had never seen a moose before (and not for a lack of trying), but after that summer, I never want to see another! Besides having several moose a night run in front of my car and having my car charged by a protective mother moose, I also had the unfortunate luck of running into them several times while walking the rivers.

If it wasn't moose, it was bogs. Shortly after reading an article on bog people (very interesting), I ended up walking through a bog to set a net. It was all fine until, on my way back, I ended up to my waist in peat! That same day, I discovered the joys of blackflies and still have the scars to remind me that deet is my friend.

Now that I have finished my second Bachelor of Science degree, I again felt the need to enter the real world and I look forward to working as a technician for the FSRS on the Lobster Molt and Quality study. This will be my first intro to the world of lobster fishing and I'm sure it will be an adventure, as long as I don't see any more moose!

PATTY'S PICKS –WEBSITES OF INTEREST

http://coastal-studies.org/research/whoowns.html— The University of Hull, 'Who owns the sea' conference proceedings.

SAMPLING NEWLY-SETTLED LOBSTERS IN SOUTHWEST NOVA SCOTIA

By John Tremblay, DFO Science and Rick Wahle, Bigelow Laboratory for Ocean Sciences

The early bottom-dwelling stages of lobsters are typically found in areas where the bottom cover provides shelter, such as coarse sediment in the size range of tennis balls to basket balls. Having survived the precarious planktonic larval stages, these newly-settled lobsters need to avoid predators such as fish and crabs. When they make the transition to the bottom from August to October as stage IV post-larvae, they are typically 4-6 mm in carapace length (CL). Before their first winter the newly-settled lobsters may molt several times and reach a size of 13 mm CL or so.

The abundance of newly-settled lobsters may allow for the prediction of the relative abundance of lobsters that are available to the fishery in 5-7 years. Such a predictor is the basis for the New England Settlement Index which consists of annual sampling at different locations from Rhode Island to Beaver Harbour in the outer Bay of Fundy. A description of the New England Settlement Index is provided in Issue 2005-02 of Hook Line and Thinker.

To better understand recruitment variation in the Gulf of Maine as whole, samples from the productive lobster grounds of southwest Nova Scotia would be very useful. In the long-term, a recruitment predictor for southwest Nova Scotia is also possible. To assess the feasibility of establishing sampling sites in southwest Nova Scotia, scientists Rick Wahle (Bigelow Laboratory for Ocean Sciences in Maine) and Robert Russell (Dept. of Marine Resources, State of Maine) travelled to southwest Nova Scotia in October 2005. There they met John Tremblay, Cheryl Frail, Steve Nolan and Alan Reeves (DFO Science Branch) to conduct a pilot study in the inner portion of Lobster Bay. Peter Spinney, a Lower Argyle fisherman provided his lobster boat to carry people and equipment, and a DFO runabout was used to tend SCUBA divers.

Sampling newly settled lobsters in quadrats (measured rectangles that can be laid on the ocean bottom) involves at least two divers. One diver handles a “suction sampler”, while the other diver places the

Fig. 1. Sorting a sample for newly-settled lobsters.

quadrat and moves cobbles and boulders near the mouth of the suction sampler. The suction sampler consists of a 4 inch diameter PVC pipe about 6' in length that is connected to an extra SCUBA tank. When held vertically near the bottom, the air from the tank rises through the pipe creating suction at the lower opening. A sample collection bag is attached to the top of the sampler. The sampling operation begins by placing a quadrat (0.5 m by 1.0 m) in a suitable habitat. The mouth of the suction sampler is then moved inside the quadrat while cobbles and moderate sized boulders are lifted and then returned to their original locations. The sample from each quadrat is collected in a bag attached to the end of the sampler. Each "site" consists of 12 quadrats, for a total of 6 m^2 sampled per site. With 4 divers we typically completed one site in about 30 minutes.

Once back on the surface, each sample bag is emptied onto a screen for sorting (Fig. 1).

Samples typically consist of gravel, shell hash, worms, and small crustaceans including the odd lobster or crab. Most lobsters captured were less than 25 mm (1 inch) CL (Fig. 2).

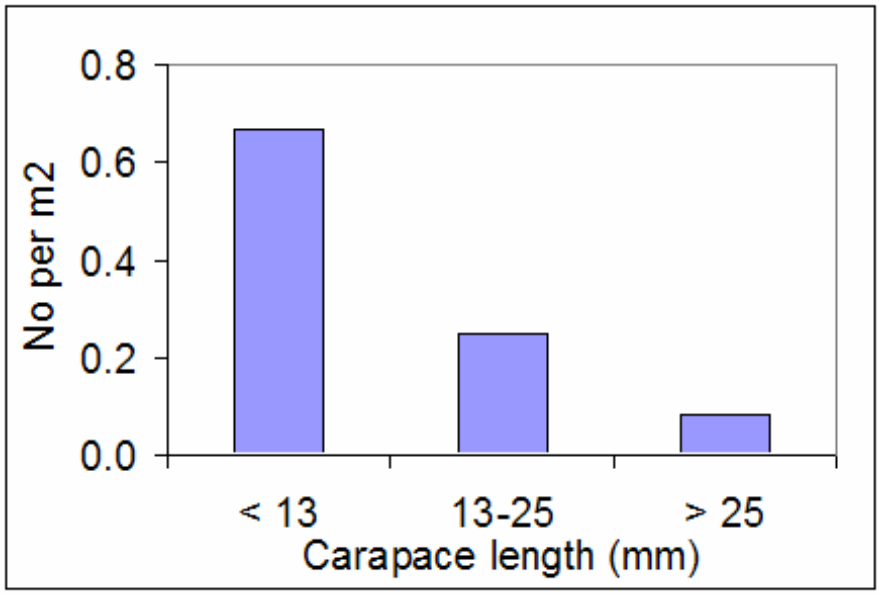

Fig. 2. Density (Number per m^2) of juvenile lobsters collected during suction sampling at 6 sites in Lobster Bay, Oct. 2005.

Over the course of a day and a half, six sites were completed within inner Lobster Bay. Only one site had no juvenile lobsters. The smallest size class had a density of 0.7 lobsters per m^2, similar to what has been found in mid-coast Maine in recent years. Quadrats from other potential sites in Lobster Bay may have resulted in higher densities.

Fig. 3. Some newly-settled and older juvenile lobsters collected by suction-sampling at six sites in inner Lobster Bay.

This small study demonstrated that juvenile lobsters could be sampled effectively with the methods developed in other areas of the Gulf of Maine and the Bay of Fundy. To establish a sampling site in southwest Nova Scotia would require further evaluation of potential sites and some assurance that monitoring of the sites could be funded for at least five years. Previous annual updates of the New England Settlement Index are available at the Bigelow Laboratory for Ocean Sciences website: http://www.bigelow.org/srs/lobsterset.html.

WHY ICELAND HAS A COD FISHERY AND NEWFOUNDLAND DOES NOT

By Chris Corkett, Dalhousie University

Disclaimer: *The views expressed in this article are not necessarily those of the Fishermen and Scientists Research Society or its members and are solely those of the writer.*

Background

Chris Corkett is a Senior Instructor with the Biology Department at Dalhousie University in Halifax, Nova Scotia. He has a B.Sc. in Zoology and a Ph.D. in Marine Biology. In this article, he uses the Principles of Transference and Barrenness in an analytic explanation for why Newfoundland lost its cod fishery

Introduction

As everyone knows Newfoundland's Northern cod fishery has been under a fishing moratorium since 1992 with the stocks still showing no real sign of recovery some 13 years later. However Newfoundland is not alone in being short of cod. Britain, for example, has long been unable to satisfy demand for its traditional fish & chips and now has an annual demand for cod of 170,000 t well above the British fishing fleet's quota for North Sea cod which, in 2002 was just under 34,000 t.[1] By contrast, Iceland and Norway both have cod fisheries that are in excellent condition with 'fishing quotas of both countries fluctuating only slightly from year to year around an average of 190,000 t.'[1] Cod is Iceland's biggest fish export and this Island country supplies much of the British demand for cod, a lucrative market it meets with value added chilled and frozen cod fillets.

Assessing Iceland's success and Newfoundland's failure: an analytic or science of science approach

So what lessons can we learn from Iceland? Perhaps if we study the history of their fisheries we can find some factual difference from those of Atlantic Canada that will explain Iceland's success. This is not the approach I take in this article; here, I do not look for factual answers but look for analytic answers; analytic answers are applicable universally and are sought for the management of commercial fisheries by applying the *Principle of Transference* – what is true in logic is true in scientific method. So when a scientific method analyses science-based activity, the method becomes a *science of science*.

Who are the management decision makers?

Just as laws are made by a collection of people in a parliament (or in some societies by a single Monarch); so regulatory fisheries policy is made by a collection of people (the decision makers) in a fisheries commission (or in some cases by a single Minister of the Crown). Scientific advice based on scientific fact is one of the important inputs the decision makers seek in order to help them make the decisions needed to manage a fishery.

How are decisions based on scientific fact?

From a logical point of view there are two ways a decision can be based on facts or data; two ways that can be put in the form of two simplified general schemata:

(a) facts → model → positive prediction → decision
(b) decision ← negative advice ← facts

Under scientific schema (a) it is very clear how the decision makers get their advice; scientists collect data that is used to form a model that is used to provide advice. Clearly, if the data is uncertain the scientific advice will be uncertain; sometimes summarized as: 'Garbage in; Garbage out'. This is the

type of scientific modeling used by the Federal Department of Fisheries (DFO) and the type of advice it produces will be called *positive political advice*; it is the type of scientific advice given the decision makers responsible for managing the Newfoundland cod stocks. This advice is referred to as being 'political' since it is not neutral in policy terms. It describes a decision, a political or policy decision to be taken as, for example: 'The total allowable catch (TAC) should be 20 million pounds'. Less clear is how the decision makers obtain their scientific advice under schema (b).

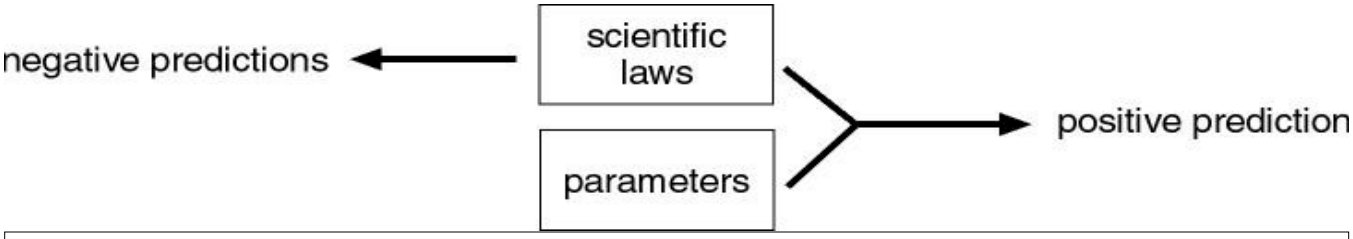

Fig. 1 An analytic illustration of how the laws of physics (i) predict the weather with *positive* predictions, predictions derived from the dual premises of scientific laws and their parameters and (ii) guide an engineering with *negative* predictions, predictions deduced from the scientific laws themselves (after the philosopher Karl Popper).

How is advice derived from a science?
Since we are making use of logical analysis we do not answer the question 'What is scientific advice?' with the obvious: 'Scientific advice is advice given by scientists' but rather re-phrase the question to read: 'How is advice derived from a science?' and turn to the laws of physics (and physical engineering) as a paradigm on which to base our answer.

Logic involves a study of the transfer of truth (or the retransmission of falsity) between the premise and conclusion of a formal argument. Under the Principle of Transference, a prediction, such as the prediction of tomorrow's weather ('positive prediction' in Fig. 1), becomes a conclusion derived from dual premises where one of the premises represents the scientific law ('scientific laws' in Fig. 1.) and the other the parameters in the law ('parameters' in Fig. 1). We will call this type of prediction a *positive apolitical prediction*, apolitical because it does not describe a decision that is to be taken.

It is not generally realized however that, from the logical point of view, by far the most common type of scientific prediction is not positive at all but *negative*. The physical engineer is guided by negative scientific predictions ('negative predictions' in Fig. 1); predictions that set limits on what can be achieved. These negative scientific predictions, unlike the positive predictions which are dual premised, are deduced directly from the scientific law itself.

We are now in a position to understand decision making schemata (b) above; here the management decisions of a *social engineering* are guided by negative predictions, generalized predictions that tell the fisheries manager what can not be accomplished and should not therefore be attempted ('negative predictions' in Fig. 1). We will refer to this kind of advice as *negative apolitical advice* - 'apolitical' since, like the prediction of weather, it is not descriptive of a policy decision.

So far so good, but we have a problem. If scientific advice is given as advice that describes what *not* to do; how do the decision makers know what actually to do?!

How do the decision makers decide what to do?
Again we look to our paradigm of the physical sciences for answers as to how decisions are made but this time we look, not to the laws of physics, but to physical engineering. The engineer makes decisions

all the time and this is done by *trial and error*; that is, a decision is taken (trial) and factual feedback is obtained by 'seeing what happens' (error elimination). We can represent this engineering decision making by the schema:

(c) decision ← error elimination ← facts

Schemata (b) and (c) have clear similarities and can be summarized by the *analytic problem solving schemata* provided by the philosopher of science, Karl Popper [2], as:

$$P_1 \rightarrow TD \rightarrow EE \rightarrow P_2 \rightarrow TD \rightarrow EE \ldots \text{etc.} \qquad (1)$$

where P_1 = the initial problems including the goal to be pursued (How do we obtain a sustainable fishery? How do we obtain further employment for our fish processors?); TD = tentative decision, a tentative policy that reflects the chosen goal; EE = error elimination, objective feedback by which the effectiveness of the policy is assessed and P_2 = the new problems and consequences that arises as the result of the decision taken.

So what are the social laws that guide the fishery decision makers?

So far we have been talking about scientific laws and have used the laws of physics as our paradigm. It is pretty obvious to everyone we have nothing like the laws of physics to guide our fishery decision making – so what is it that forms the scientific laws for the fisheries? The answer is surprising and, at first glance, not very convincing; it is the models of fisheries economics that form the 'scientific laws' that guide our trial and error managing; again, we turn to logical analysis to make our case.

Iceland and its tradition of fisheries economics

Models of theoretical economics are built around 'agents' that act entirely rationally. In fisheries economics this modeled rationality involves a totally unregulated fishery, referred to as an *open-access* fishery that allows for the prejudicial nature of derby fishing to be assessed logically. Just as the laws of physics set limits on what can be accomplished by the engineer, the logical models of fisheries economics give *negative advice* that explains what can not be accomplished by a decision taking; as:

'You *cannot* obtain a sustainable fishery (goal) while at the same time providing unlimited jobs for fishermen (social objective)'

'You *cannot* obtain unlimited jobs for fishermen (goal) without using tax payer's money'

'You *cannot* obtain a sustainable fishery (goal) without controlling the prejudicial behavior of fishing derbies'

'You *cannot* control fishing derbies (goal) without assigning property rights in the form of Individual Transferable Quotas (ITQs)'

The point I am making here is *not* that these examples are necessarily true or even particularly good (they may or may not be well corroborated by the facts). The important point is these examples show how, from the logical point of view, scientific advice takes the analytic form of a *politically neutral* conditional argument, as:

'*If* you choose to accept goal or objective A *then* you *cannot* at the same time achieve goal or objective B'

'*If* you wish to achieve goal A *then* you have to control consequence B' or: 'You *cannot* achieve goal A without also controlling concomitant effect B'

A fisheries economic tradition involves *negative apolitical advice*. Options and goals, together with their potential problems, are presented to the decision makers but the decisions, *and the responsibility that goes with these decisions*, remain entirely in the hands of the decision takers. This is quite different from the positive advice given to fishery management by DFO science; positive advice that is not politically neutral since it describes the actual policy decision that should be taken, as, for example: 'The TAC should be 20 million pounds' .

Where does DFO science go so wrong?

The scientists at the Federal Department of Fisheries (DFO) frequently complain that the politicians do not listen to their advice, and indeed there is some truth to this; but, from a logical point of view, it is not at all surprising DFO advice is not listened to since this advice itself is not politically neutral; quite simply, there is no reason why DFO's advice describing the decision to be taken (such as: 'The TAC should be 20 million pounds') should not be changed for political policy reasons! Why should the decision makers not strive to reduce unemployment (goal) by favoring a TAC of, say, 30 million pounds instead of 20 million pounds? Or strive to raise the standard of decision making by apply the precautionary principle (standard) and setting a TAC of, say, 10 million pounds or should it be 5 million pounds?

Unlike the 'decision first' of scheme (b) above, DFO advice follows schema (a); here, decisions come after the facts since they are seen as being derivable from facts. The reason this approach is so damaging is that it puts the emphasis in entirely the wrong direction; instead of understanding that all decisions *have to be taken* we are now led to believe decisions can be *reduced to facts* - better decisions require better facts – find the 'better facts' and we have the 'better decisions'. Whereas it is a matter of elementary logic that decisions together with goals (such as sustainability) and standards (such as the precautionary principle) cannot be produced from, or be reduced to, facts.

Concluding comments

Individual Transferable Quotas (ITQs) were introduced into Iceland in 1984 and Iceland has had over 20 years to overcome some of the many difficulties associated with this way of maximizing economic benefit. It is very easy to find objections to the ITQ system; detractors point out, for example, you end up with the smaller fishing boats being bought out; the larger boat owners and processors end up owning much of the available quota. Quite so, but if your goal is to maintain high employment for fishermen and processors then you should never even consider introducing a management system involving quota ownership. However, if your goal is to establish and maintain a sustainable fishery you will then appreciate the wisdom of involving market forces in both reducing and controlling overcapacity. The supporters of the ITQ system point out that under this system of economic benefit vessel owners have an incentive to buy one another out, a form of fleet downsizing that, contrary to the usual practice, reduces fishing overcapacity without involving government money[3].

Unlike Iceland, Newfoundland has never had a real chance to even begin to control its overcapacity; DFO scientific advice; advice on which the Newfoundland fishery decisions have been based has been fundamentally flawed in three basic ways:

1. Newfoundland's management decisions have been guided by models that model fish populations (and more recently describe ecosystems); while we need to understand fish populations and ecosystems, these are not the models needed to guide political and management decisions; social science models, models that allow us to understand the prejudicial behavior of derby fishing, are needed for guiding management decisions.
2. Newfoundland's management decisions have been guided by positive *political* predictions; while positive predictions (such as a prediction of the weather) exist, these are not the predictions based on facts that are needed to guide decisions; negative *apolitical* predictions, conditional predictions that outline what cannot be achieved are needed for guiding policy

decisions.

3. It has been generally assumed that the goals and standards of Newfoundland's fisheries may be reduced to facts or data. Fishery goals (such as sustainability) and fishery standards (such as the precautionary principle) form normative laws (not scientific laws); like decisions, normative laws or norms reflect the values of the proponents and cannot be produced from, or be reduced to, facts or data.

These three fundamental errors in methodology have meant that the management of Newfoundland's fisheries has been, and continues to be, guided by a science of science or scientific method that is both illogical and irrational; but does this matter? Just as a *science* is contained by its own laws, a *science of science* or scientific method is contained by the laws of logic; just as we can expect empirical consequences if we break the laws of a science there are methodological consequences if we break the laws of a logic, consequences that can be summed up under the *Principle of Barrenness*, as: 'Irrational scientific methods can bear no fruit'. Quite simply, the long established irrationality of a DFO science has never given Newfoundland the same chance as Iceland; the chance to take control of its overcapacity and so achieve a sustainable cod fishery.

References

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NEW TO THE FSRS LIBRARY

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AVC Lobster Science Centre

3rd Annual Lobster Science Workshop

The Delta Prince Edward
Charlottetown
Prince Edward Island
July 26 & 27, 2006

"Marine Ecosystem Health - Crustaceans & Their Environment"

We are pleased and excited to let you know that the AVC Lobster Science Centre will be hosting the 3rd Annual Lobster Science Workshop at the Delta Prince Edward Hotel in Charlottetown, on July 26 and 27, 2006! The theme for the upcoming workshop is ***Marine Ecosystem Health - Crustaceans & their Environment***. This will ensure great and positive interactions among fishermen, processors, exporters, biologists, research scientists and others.

The tentative agenda for the **3rd Annual Lobster Science Workshop** includes a Meet and Greet Reception on Wednesday evening, sessions on the Lobster Health Research at the AVC Lobster Science Centre on Thursday morning and on Ecosystem-based Crustacean Research on Thursday afternoon; followed by an open forum on applied research in Marine Ecosystem Health. This open-floored discussion will allow everyone to contribute to the workshop and help identify important issues. Finally, the event will conclude with a Banquet on Thursday evening. We look forward to seeing you all at this event!

For more information, please visit our website at www.lobsterscience.ca/workshop/

NOVA SCOTIA'S SEABIRDS – PART I – THE NORTHERN GANNET

By Jennifer LeBlanc, FSRS Fisheries Technician

Many people don't think of birds when they think of marine animals, but over 250 species of seabirds worldwide get their food from the ocean (and occasionally become food for larger predators such as whales and sharks) and are therefore an important part of the ocean's food web.

Seabirds typically migrate huge distances each year. Arctic terns have the longest migration of any bird, flying from the Arctic to the Antarctic. Many marine birds travel constantly, following food and good weather. Most seabirds feed on small fish and plankton. They feed in a variety of ways: swooping down to scoop up food at the surface while flying (such as storm petrels and terns), feeding while sitting on the water (such as kittiwakes and phalaropes), or diving after prey. Northern Gannets are perhaps our most famous diver; they dive head first to depths of 15m, sometimes reaching speeds of 10km/h!

The Northern Gannet
www.birdlife.org

SO, since I already introduced you to the Northern Gannet, let's look at this beautiful bird a little closer. Unfortunately, gannets do not breed in Nova Scotia in huge numbers anymore, so the best chance to see this booby is during migration in early spring and fall.

The Northern Gannet is well adapted to diving for its prey. Besides its beautifully streamlined body, the bird's skull is especially strong and the face and chest have air sacs under the skin which inflate to handle the impact of hitting the water. Also, they have no nostrils, and their eyes are both positioned forward, allowing the birds to focus forward and judge distances. When a flying gannet spots a fish below, it dives almost vertically, with partially folded wings. Underwater, its large webbed feet allow it to swim strongly to capture prey such as capelin, herring, mackerel, sand lance and squid. These birds are easy to identify. They are our largest seabird with wingspans reaching nearly 2 meters. An adult gannet's body is bright white, and the wings are white with black tips. The head is tinged yellowish-orange during breeding season, with a large grey bill and blue eyes. The legs and feet are grey too. In flight, the gannet alternates between stiff wing beats and glides.

The forward-looking blue eyes of a gannet
www.wildshots.co.uk

IN NEED OF SOME FISHING KNOWLEDGE!

By Melanie Hurlburt , Oceans Policy Officer, Oceans and Coastal Management Division, DFO

Hi, my name is Melanie Hurlburt and I am a former FSRS technician for the Yarmouth/Digby area, now working with the Oceans and Coastal Management Division of Fisheries and Oceans Canada. I am currently working on a project to identify biologically significant areas in the offshore portion (beyond 12 nm) of the Scotian Shelf. This project is related to the work that is being done by the FSRS and DFO on the inshore, but has a specific focus on the offshore. Similar to the inshore ecosystem research project that was highlighted in the last newsletter, we will be asking fishermen to help us identify significant areas through a Local Ecological Knowledge Survey (LEK). I will be contacting fishermen, selected from the DFO database shortly and asking them to identify local experts. I will then meet with the identified experts to obtain their knowledge. I look forward to having the opportunity to talk with you and learn more about our oceans and ecosystems from you. If you have any questions on this project please contact me at 902-426-1446. Thanks!

NEW ENGLAND LOBSTER SETTLEMENT INDEX: *UPDATE 2005*
CLIMATE CONTROLS?

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The New England lobster settlement index survey has several new developments to report on the coverage and utility of the time series. Currently supported by three US states and Canada's Department of Fisheries & Oceans (DFO), one of the central goals is to better understand the causes and consequences of variable larval supply to regional differences and time trends in the adult population. This update briefly summarizes the 2005 settlement patterns and features a new development in the program.

· ***Expanding Horizons:*** In 2005, John Tremblay, of DFO Canada, led pilot sampling at six new sites in Lobster Bay, southwest Nova Scotia, broadening the geographic scope of the survey (Fig. 1). He reported densities of young-of-year lobsters comparable to counts on the other side of the Gulf in Maine during the same year (Fig. 2).

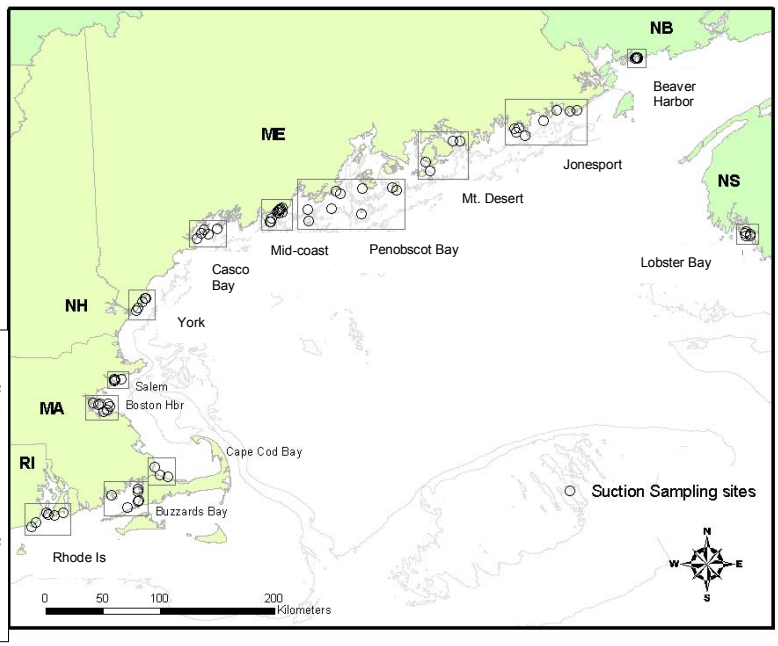

Fig. 1. Sampling sites of the New England lobster settlement index. Initiated at a few sites in Maine and Rhode Island in 1989-90, the survey now spans some 65 sites from RI to New Brunswick. Six new sites in Lobster Bay, Nova Scotia were sampled in 2005. Boxes surround sites used for regional averages shown in Fig. 2. Surveys are conducted by divers using suction samplers in shallow rocky nurseries.

· ***Eastern Pulse:*** Most regions in 2005 saw the continuation of the stretch of strong settlement since 2001. The remarkable feature of this year's survey was the pulse of high settlement in eastern Maine and New Brunswick (Fig. 2). Eastern Maine, which historically has received a relatively poor supply of settlers, saw higher densities that are more comparable to western Maine. Most remarkable were the astronomically high numbers in Beaver Harbor, NB, a location that has historically had high numbers. This pulse of settlement in eastern Maine may bode well for recruitment to the fishery in the future. In last year's update, for example, we reported how the settlement index was proving to be of predictive value for trends in the abundance of lobsters about to enter Rhode Island's fishery. But the question remains: what drives variability in settlement in the first place?

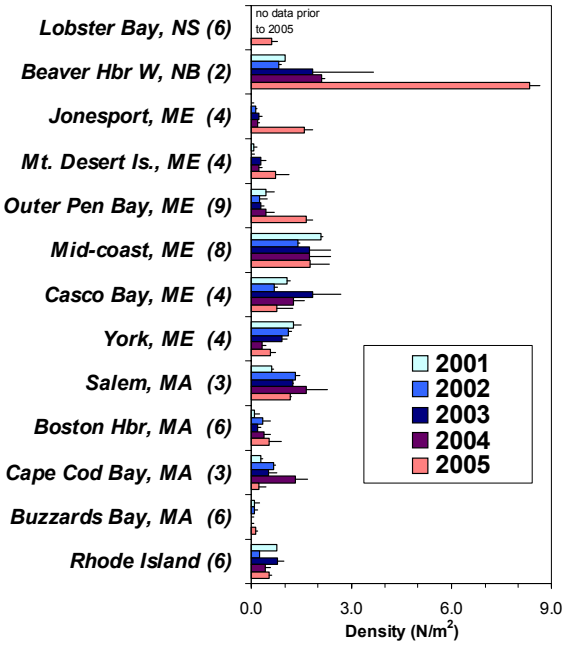

Fig. 2. Regional average lobster settlement throughout New England from 2000 to 2004. Number of sites averaged for a region in parentheses.

· ***Links to Climate:*** We are interested not only in future projections, but in looking back in time to understand the conditions during the larval hatch and development period that might explain the ups and downs in the supply of settlers. While the number of egg-bearing females is not likely to change much from year to year, the environmental conditions that affect the transport and survival of larvae hatching from those females can vary dramatically, and are therefore considered to be an important player in settlement patterns. In our 2003 update we explained how time trends in settlement have proven to be synchronous over large geographic areas; that is, when it is a strong settlement year in mid-coast Maine, for example, it also tends to be a strong year in Beaver Harbor, New Brunswick, and Salem, Massachusetts at opposite ends of the Gulf of Maine. We must conclude that whatever forces drive annual variability in settlement, they are operating at large geographic scales. Larger scale processes likely to be operating synchronously are ocean circulation and weather. This large scale spatial coherence, as it is called by oceanographers, suggests that lobster settlement is coupled to changes in the ocean-atmosphere system around the Gulf of Maine.

In a preliminary analysis led by oceanographer Andrew Pershing, Cornell University, we have discovered that the time series of lobster settlement in mid-coast Maine, our longest time series, mirrors the pattern of an atmospheric measure called the *"mean summer 700 millibar geopotential height anomaly"* (Fig 3). Atmospheric pressure, measured as millibars (mb), is about 1013 mb at sea level, and it decreases with greater altitude. The *700 mb geopotential height* is the altitude at which the atmospheric pressure is 700 mb. That height varies as low and high pressure systems move through a region. The *height anomaly* is the difference between the measured height and the long-term average height at that location. High values of geopotential indicate elevated atmospheric pressure, such as occur when a "Bermuda High" brings hot sunny weather to New England during the summer. Gradients in geopotential height indicate the strength and direction of large-scale winds. In this preliminary analysis, we found no strong east-west or north-south gradients in the geopotential fields associated with lobster settlement, either during low or high settlement years. This suggests that winds may not play as important a role in large scale variability, contrary to our original hypothesis. Instead, high settlement was associated with generally higher pressure (upper half of Fig 3b) and low settlement with lower pressure (lower half of Fig. 3b). At the scale of this analysis, an increase in the regional average geopotential likely indicates a northerly shift in the path of the jet stream, resulting in a warmer atmosphere, warmer sea surface temperatures, and in turn, more rapid lobster larval development. Less time spent in the water column should reduce larval exposure to predators and their chances of being dispersed offshore.

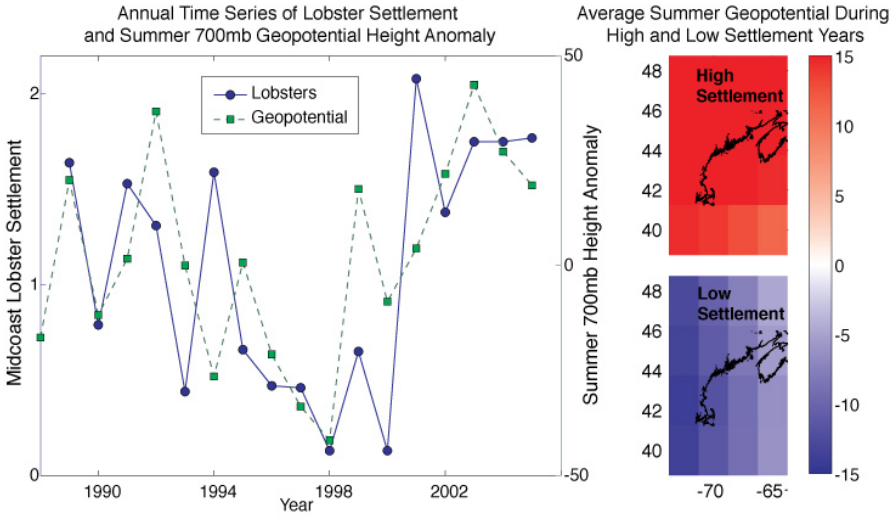

Fig. 3. **Atmospheric correlates of settlement.** (a) Correlated time series of mid-coast Maine settlement (circles) and summer geopotential in the northeast US (squares). (b) Geopotential gradient maps associated with high (top) and low (bottom) settlement years. Absence of strong gradients suggests wind is not as strong a factor as suspected (from Wahle & Pershing in prep.).

This is only the first step in an analysis exploring the atmospheric and oceanographic conditions determining patterns of settlement in time and space. The correlation between settlement and geopotential may provide a way to estimate the impact of global climate change on one aspect of lobster biology.

69 STUDENTS RECEIVE FSRS OCEANS 11 PROGRAM AWARD FOR OUTSTANDING ACHIEVEMENT

69 students from Oceans 11 classes throughout Nova Scotia received the sixth annual Fishermen and Scientists Research Society Award for Outstanding Achievement in the Oceans 11 Program. Twenty-seven of these students received their awards at a ceremony held at the Bedford Institute of Oceanography, on Oceans Day. Each student was presented with their award and given a tour of the facilities by friendly and well trained tour guides. This annual award recognizes students, nominated by their teachers, who have demonstrated outstanding accomplishments in their Oceans 11 class, including level of interest, participation and contribution to the class, along with scholastic achievement. The Oceans 11 Program is a science program for grade 11 students, offering them the opportunity to learn about a wide range of marine science topics, including biology, oceanography, fisheries science and fisheries management.

The Fishermen and Scientists Research Society (FSRS) is a non-profit organization which strives to improve the state and sustainablity of our fisheries resources. The FSRS members, as the name suggests, are predominantly either fishermen, or scientists who study the fisheries resources, and the marine systems on which they depend. Other members include social scientists, educators and interested citizens. The prime requirements are an interest in the goals of the FSRS and a willingness to contribute towards them.

The FSRS works towards its goals in two related ways. First, members conduct science projects. These involve field collection of data, samples and specimens, and laboratory processing and analysis by FSRS technicians, interns and members. The data produced by FSRS projects have been used in stock assessments, marine mapping of fisheries resources and published results have appeared in the primary scientific literature. The second way the FSRS seeks to improve the long-term prospects of our fisheries is through education, or more properly, co-education. Both the fishermen and scientist members have a wealth of knowledge about fisheries resources and the ocean. They certainly do not express it the same way but, more importantly it is not the same knowledge. When these two groups have put their heads together, learned each other's way of describing what they know, and pooled their knowledge, strong new insights have emerged.

The FSRS implemented the Oceans 11 Achievement Award to recognize the efforts of others that work towards the goals they share with the FSRS. The development of the Oceans 11 program in our schools is clearly such an effort, and the achievements of students in the program are worthy of recognition.

The FSRS congratulates the following students who received the award:

Advocate District School:	Rebecca Connors;
Amherst Regional High School:	Alicia Chapman, Sarah Sears;
Avon View High School:	Josh Seaboyer;
Breton Eduction Centre:	Brittany Darroch;
Central Kings Rural High School:	Jordan Sanford, Brianne Williams;
Cobequid Educational Centre:	Ashley Clarke, Page Colpitts, Justin Colson, Rylan Crocker, Jeramy Jennings, Peter Keddy, Naomi McLean,

	Jay Peppard,
	Matt Richards,
	Sarah Robinson;
Cole Harbour District High School:	Jessica Carter,
	Sara Ede,
	Melanie Hackett,
	Amber Hanrahan,
	Marcus Marsman,
	Lisa Wilson;
Dalbae Academy:	Breanna MacEachern;
Drumlin Heights:	Sandi Emily Crowell,
	Zackery Armond d'Entremont;
Ecole Secondaire de Par-en-Bas:	Andrea Atkinson;
Glace Bay High School:	Justin Clements,
	Paul Glancey,
	Susan Macdonald,
	Kelly MacQuarrie,
	Leanne Mauger,
	Brandon O'Donnell,
	Nicole Prince,
	Katelyn Robinson;
Halifax West High School:	Andrew Davies;
Holy Angels High School:	Katherine Furlong,
	Kaitlin Poirier,
	Sara Tobin;
J.L. Ilsley High School:	Jessica Pyke;
Liverpool Regional High School:	Travis Donovan;
Middleton Regional High School:	Kendra Burchill,
	Emily Herrick,
	Jessica Ritcey;
Musquodoboit Rural High School:	Cale Kilyanek;
Prince Andrew High School:	Jessica Anderson,
	Miranda Bostock,
	Catlin Burke,
	Darren Guay,
	Travis Kearney;
Pugwash District High School:	Jeremy Davidson;
Queen Elizabeth High School:	Charlotte Hall-Coates,
	Sine MacAdam,
	Jonathan Reid;
River Hebert District High School:	Kayla Brown;
Riverview Rural High School:	Griffyn Chezenko,
	Kylie DeCoste,
	Jessica MacDonald,
	Lisa MacDonald,
	Katelyn MacIntyre;
Sackville High School:	Ashley Godin;
Sir John A. MacDonald High School:	Michellene Boutilier,
	Tiffany Morash,
	Daniel Stevens,
	Katelyn Stewart,
	Megan Waterman;
South Colchester Academy:	Jessica Geddes;
Strait Area Education Recreation Center:	Margaret Shermerhorn;
Truro Adult High School:	Paul Crowe.

BEACHCOMBING – What's New in The News

Northeast Consortium Cooperative Haddock Tagging

The Northeast Consortium, Cape Cod Commercial Hook Fishermen's Association, Gulf of Maine Research Institute and NOAA Fisheries Northeast Fisheries Science Center are participating in an ongoing mark and recapture haddock tagging project on Georges Bank and the Gulf of Maine. Started in March of 2005, the project is hoping to develop a better understanding of haddock movement across management units and closed areas.

For more information about this program visit:

www.ccchfa.org/tagging

or if you would like to view an interactive mapping website visit:

www.gmamapping.org/haddockmapping.

CLARIFICATION ON SHELLFISH WORKING GROUP REPORT DISCUSSION

In the discussion section of the Shellfish Working Group Report included in the last issue of the *Hook, Line and Thinker* (Issue 2006-1, Page 26), the comment was made that 70-80% of females have lesions. Please note, this percentage does not apply to Maine. In 2004 in Maine only about 40 out of 140,000 lobsters sampled had shell disease; the number was similar in 2005. The higher incidence of shell disease referred to in the newsletter occurs in Southern New England. We apologize for any misunderstanding and any inconvenience caused and trust this satisfactorily clarifies the point.

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UPCOMING EVENTS

Eastern Canadian Fisheries Exposition

Mariners Centre
Yarmouth, Nova Scotia
February 23-25, 2007