HOOK, LINE AND THINKER

The Newsletter of the Fishermen and Scientists Research Society

Issue: 2004 - 3 **Summer 2004**

FREEZING POINT OF SEA WATER

By Carl MacDonald, FSRS Research Biologist

Over the last five years fishermen have been deploying temperature recorders in one of their science lobster traps during the lobster season for the Fishermen and Scientists Research Society's lobster recruitment study. In LFA's 33 and 34 the lobster season extends through the winter months; it commences at the end of November and finishes the end of May. From the middle of January to the middle of February it is not uncommon to see the inshore bottom water temperatures remain under zero degrees Celsius. The question is, "How cold can seawater become before it freezes?" The freezing point of seawater depends upon its salinity. Salinity is the amount of salt that is in seawater. Ocean seawater has a salinity of about 35 parts per thousand. Sea water with a salinity of 35 parts per thousand will freeze at about -2 degrees Celsius. Fresh water with a salinity of 0 parts per thousand will freeze at 0 degrees Celsius. A skim of ice on the surface of seawater is a mixture of freshwater and sea water. So, water with a reduced salinity of say 17 parts per thousand will freeze at about -1 degrees Celsius. The relationship is linear, as salinity increases the temperature to freeze the water has to be lower.

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A REVISIT WITH HURRICANE JUAN

By Shannon Scott-Tibbetts, FSRS Research Assistant

I don't know about you, but I am fascinated by the weather and weather phenomenon like hurricanes. As this is prime hurricane season and the end of September is not very far away, I just wanted to write a little on the major storm we all experienced in Nova Scotia last fall - Hurricane Juan. The effects it had on our surrounding communities like Sambro, Halifax, Eastern Passage, and even Charlottetown, PEI was an eye-opener for me. Certainly not something I want to experience again for many years.

When the FSRS technicians were out this spring with lobster fishermen on the Eastern Shore, they noticed that a lot of the lobsters were very battered. The hurricane would have thrown our coastal ecosystem out of whack and the lobsters would have taken a few tumbles in the turbulence. The majority of them had cracked or broken carapaces that were healing, and would likely be repaired in their next molt.

Here is a brief explanation of tropical storm/hurricane formation. For a storm to develop in the tropics, the water temperature should be warmer than 27°C and the atmosphere calm. Evaporation forces large amounts of moisture into the air, creating a low pressure system. Once this water vapour condenses, it releases heat that powers circular winds. Rainfall in the developing storm releases more heat, activating a convection process that pulls more moisture-rich air up through the centre of the system. The storm grows via this feedback system. The strongest winds are found immediately outside the centre, or "eye" of the hurricane, at ground level. These storms also generate storm surges, which can be devastating to coastal communities. Storm surges are massive waves beneath the centre of the storm. In the eye of the hurricane, air is dragged upward faster than it can rush in at the bottom. This lowers the atmospheric pressure under the eye. As a result, the eye tries to pull at the ocean itself, creating a bulge of water as much as 6 meters high that moves together with the storm. The United States National Ocean and Atmospheric Administration (NOAA) states that a storm surge is "unquestionably the most dangerous part of a hurricane"; the surge can "act like a giant bulldozer sweeping everything in its path".

Hurricane Juan

Visual Satellite image of Juan 600 km south of Halifax Sept 28, 2003
Courtesy of http://www.atl.ec.gc.ca/weather/hurricane/juan/satellite_e.html

Hurricane Juan made landfall on Sept 29, 2003 at 12:10am ADT, between Shad Bay and Prospect as a marginal category 2 hurricane. It will be recorded as the most damaging storm in modern history for Halifax, NS. Widespread tree blow-downs, power outages and damaged homes were some of the effects of this storm. The last time that the city of Halifax was hit by the eastern eyewall (highest winds in a hurricane), was on Aug 22, 1893 when a category 3 storm made landfall in St Margaret's Bay. That storm ("the second Great August Gale") claimed 25 lives and sank the vessels Dorcas and Etta Stewart.

Juan had maximum sustained wind speeds of 85 knots (158 km/h) and the estimated diameter of the hurricane eye was 35 km (from Hubbards to west end Halifax). Storm surge values ranged from 1 m (Mahone Bay), 1.5 m (Halifax Harbour), to more than 1.5 m (Cow Bay). The largest significant waves recorded at the coast were 9 m at Halifax Harbour with maximum waves of 19.9 meters. The areas of greatest impact to property and trees extended along the Atlantic coast from Shad Bay to Clam Harbour, as seen by aerial surveys.

Track of Hurricane Juan
Courtesy of http://www.ns.ec.gc.ca/weather/hurricane/juan/track_e.html

Why was Juan so powerful? According to research at the Canadian Hurricane Centre, there were unusual warm ocean surface temperatures during the end of September. Hurricanes need 26°C temperatures to intensify. The water temperatures between the Gulf Stream and Nova Scotia on Sept 28th were about 18°C. The normal temperature for this date is around 15°C. The warmer water slowed down the rate at which the hurricane would normally weaken in this region. Hurricane Juan did not

Continued on page seven.

TEMPERATURE CONDITIONS IN LOBSTER FISHING AREAS 27-33 ON THE SCOTIAN SHELF: 1999-2003

By Brian Petrie and Roger Pettipas, Dept. of Fisheries and Oceans, Bedford Institute of Oceanography

Temperatures recorded by instruments deployed by the Fishermen and Scientists Research Society (FSRS) in the nearshore zone of the Scotian Shelf from northern Cape Breton to Cape Sable in southwest Nova Scotia are valuable in assessing environmental conditions in lobster fishing areas 27-33. The annual cycles of temperature in these areas can be quite different, by as much as 8^{o}C, as indicated by the average long-term temperatures in the upper 10 m of each region (Fig. 1). Moreover, the annual cycles also vary substantially with depth within any one of the areas. The data shown in Fig. 1 are from the coastal data archive held at BIO and are available to the public through the internet[1]. LFA28, the Bras d'Or Lakes, has the least amount of data, equivalent to 1 instrument running for 2.4 years. This area features the highest temperatures in the upper 10 m. The greatest amount of data, equivalent to a single instrument running for 27 years, is from LFA33 in southwestern Nova Scotia, where the coolest summer temperatures are seen. Most of these data are from the Cape Sable area where long-term temperature monitoring has been conducted by DFO since 1978.

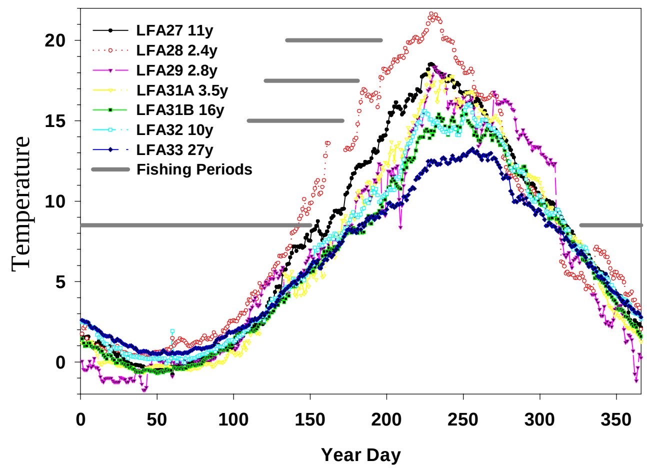

Fig. 1. Long-term annual mean temperatures from 0-10 m for lobster fishing areas 27-33. Fishing seasons are indicated by the grey horizontal bar.

The FSRS data are generally from a lobster fishing season. The number of temperature gauges deployed during these periods is amazing, e.g., in the spring of 2001, 105 recorders were set throughout the region. From 1998 to 2003, about 700 records were collected. These temperature series have shown considerable contrasts between years. This is illustrated in the 1999 and 2003 records from the coastal area of LFA27 between St. Ann's Bay and Scaterie Island.

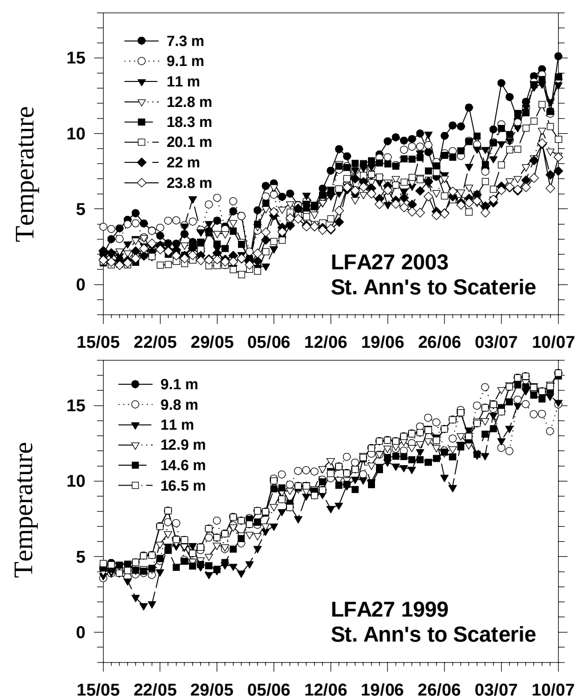

Fig.2. Temperature series from LFA27 at several depths from 1999 and 2003.

(Fig. 2). The plots show temperature variations at 6 depths (9.1 to 16.5 m) in 1999 and 8 depths (7.3 to 23.8 m) in 2003. These records were collected during the local lobster fishing season from mid-May to mid-July. Both plots have the same time and temperature scales. Clearly the waters were warmer in 1999, increasing almost continuously from between 4^{o}C and 5^{o}C at the start of the season to between 15^{o}C and 17^{o}C at the end. On the other hand in mid-May 2003, temperatures were from about 1^{o}C to 4^{o}C, colder than they were in 1999; by mid-July 2003, temperatures covered a wide range from 7.5^{o}C

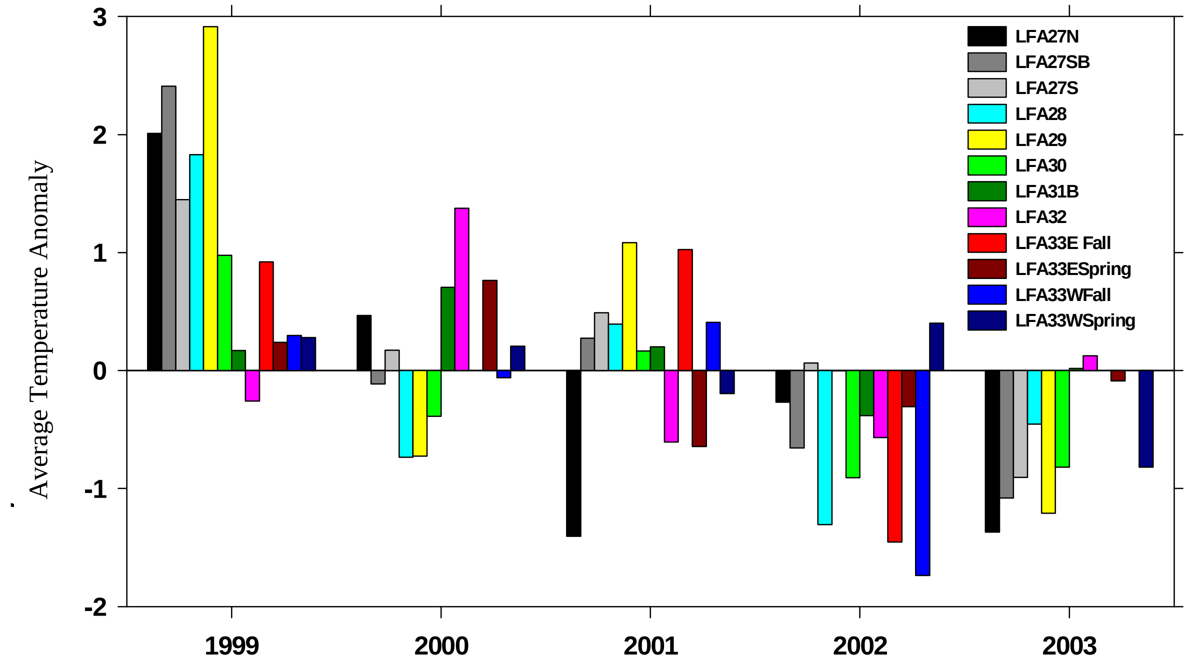

Fig. 3. Temperature anomalies for fishing areas LFA27-33 for 1999-2003. The results for LFA28 and LFA30 are for sea surface temperature derived from satellite data.

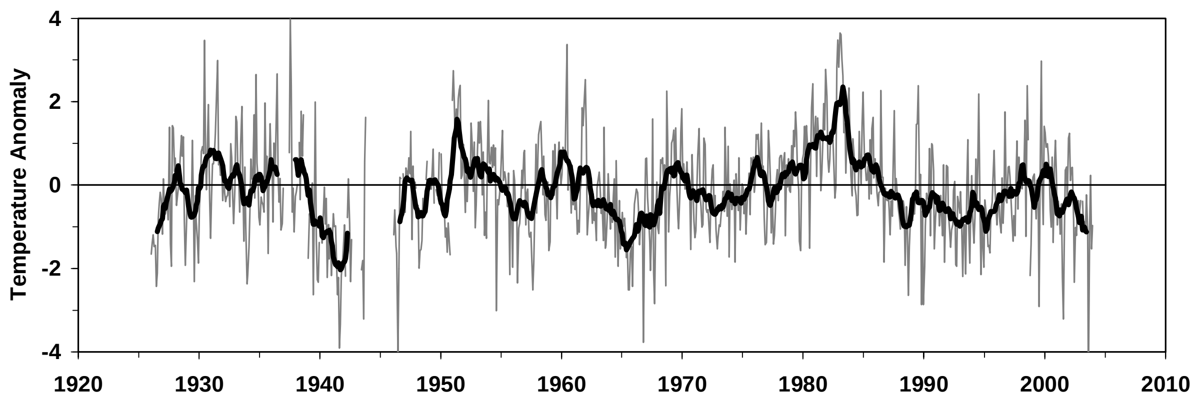

Fig. 4. Monthly (grey line) and annual (heavy black line) sea surface temperature anomalies at Halifax, 1926-2003. The anomalies are calculated from the mean temperatures for the 1971-2000 period.

to 15°C. While the temperature range at any specific time in 1999 between 9.1 and 16.5 m, the shallowest and deepest records, was only about 3°C throughout the season, the range between the 7.3 and 12.8 m records in 2003 reached 8°C.

Petrie and Pettipas (2004) have presented a detailed analysis of the FSRS data collected from 1999-2003 for LFA27-33 and developed a technique to estimate the temperature anomalies among records for this period. Anomalies can be positive, indicating warmer than average temperatures, or negative, indicating cooler than average values. We show only one of their results here: the anomalies of the mean temperature over a fishing season. They also discuss the rate of change of temperature and the amount of temperature variability. Figure 3 indicates that temperatures during the fishing seasons were mostly above normal in 1999 by as much as approximately 3°C (LFA29). Since then, waters have been cooling so that in 2002 and 2003 temperatures were about 1°C below normal. The greatest cooling occurred in the areas around Cape Breton where on average temperatures decreased by 3.1°C from 1999 to 2003. Note that LFA27 has been split into 3 parts, from Cape North to St. Ann's Bay (27N), from St.

Ann's to Scaterie (27SB) and from Scaterie to the western boundary of LFA27 (27S). Similarly LFA33 was split into 2 parts, 33E from Halifax to Lunenburg and 33W from Lunenburg to Cape Sable.

Have changes of this magnitude been seen in the past anywhere in the region? The longest, nearly continuous time series is sea surface temperature at Halifax (Fig. 4). From this record, we see that there has been cooling from the late 1990s to 2003, as was shown by the FSRS data. There have also been notable cool periods in the past, such as in the early 1940s, the mid-1960s and from the late 1980s to the mid-1990s. Above normal temperatures are particularly evident in the early to mid-1980s.

These FSRS data add considerably to the existing coastal temperature database available through the DFO Maritimes Ocean Sciences Division Website[1]. It would be useful to derive a long-term climatology for each of the LFAs based on the combination of this dataset with other archived observations. An earlier version of this by Petrie and Jordan (1993) should be updated. However, since the depths and positions of most of the FSRS instruments change during the lobster fishing seasons (which generally occur when the temperature varies significantly with depth), it will be a challenge to modify the existing coastal temperature database to accommodate these records. The current database cannot handle time series whose positions change during the mooring period. It is also highly desirable to collect temperature records for the whole year, not just limited to lobster fishing seasons. DFO has started a modest program to acquire year-round data at a number of sites in the LFA 27-34 region.

[1]http://www.mar.dfo-mpo.gc.ca/science/ocean/home.html

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ARTIFICIAL REEFS FOR LOBSTERS


By Carl MacDonald, FSRS Research Biologist

The idea of making an artificial reef in the marine environment is not a new idea. Man has been creating artificial reefs unintentionally for centuries, better known as ship wrecks. Adding a hard substrate allows a variety of marine plants and organisms to populate the structure.

In the 1960's and 1970's people took on a direct role in creating marine reefs. Many of the first reefs were constructed as a means of waste disposal, leaving a bad reputation of artificial reefs among some biologists. One of the first reef materials used were old car tires. One of the largest tire reefs created was off of Fort Lauderdale Florida, USA. In the early 1970's an estimated 2 million tires were scattered over 35 acres of the ocean floor in an attempt to create an artificial reef (South Florida Sun-Sentinel 2003). Results were that few marine creatures made their homes among the radials. Some sponges and corals latched onto the tires but most marine creatures had a difficult time creating a home on the unstable rubber surfaces. Even worse the tires moved during a Hurricane and became a source of pollution (South Florida Sun-Sentinel 2003). It turned out that Fort Lauderdale's tire reef was an environmental disaster.

It is suggested that tires should not be used for artificial reefs. It is recommended using only materials of natural geological origin and the construction should withstand a minimum of 100 years (Grove, R.S. et. al., 1991). Re-enforced concrete meets the standard and is now one of the most common materials used in artificial reefs.

Continued on page eight.

A Revisit with Hurricane Juan *(continued from page three.)*

weaken at all when it headed across the cooler shelf waters south of Nova Scotia. The hurricane accelerated and its wind speed increased. The storm core itself was weakening but its forward momentum counteracted that effect. The hurricane wasn't affected by the Shelf's relatively cooler waters because it was moving so quickly and therefore there was less time for the storm to weaken.

The influences of ocean surface water temperature on the intensity of hurricanes in Atlantic Canada are being investigated by Environment Canada and the Canadian Hurricane Centre. If a small difference in temperature (between 15°C and 18°C) makes a significant difference on storm strength, then long term trends in ocean temperatures need to be explored.

On April 30, 2004, Environment Canada succeeded in its bid to get the World Meteorological Organization to retire the name "Juan" from its rotating list. Environment Canada requested the name be retired in consideration of the devastating impacts of the hurricane on the people of NS and PEI.

This year we have already seen a major storm (Charley), a category 4 Hurricane, hit the US and Hurricane Bonnie brought heavy rain and winds to NB, I think we will all be watching the weather bulletins a little more closely in the aftermath of our own Hurricane Juan.

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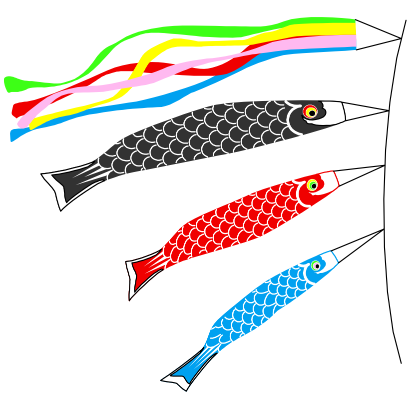
THE FSRS WELCOMES NEW MEMBERS



The Fishermen and Scientists Research Society would like to welcome the following members, whose applications were approved at the June 30th Executive Committee meeting. We trust that this expansion of the FSRS's membership will prove to be beneficial to all involved.

Duncan Allen
David Chambers
Rhonda Cottreau
Vanessa Kavanagh
Bam Deo Pandey
Craig Purchase
Sherrylynn Rowe
Bill Williams
Dollie Campbell
David Chu
Ricky Joudrey
Cory Nickerson
Kara Paul
Alan Reeves
Monty Way
Brian Petrie

Artificial Reefs for Lobsters *(continued from page six.)*

The role of an artificial reef in enhancing lobster stocks is one of providing habitat (Jensen, A.C. et. al., 1998). In some areas where fishermen fish lobsters there is a limited area of prime lobster habitat and in other areas there is damage to natural reefs and lobster habitat.

The first artificial reef for lobster was built in 1965 in the Northumberland Strait, Gulf of St. Lawrence, Canada. The artificial reef was made from quarried sandstone rocks, ranging in size from 5 to 100 cm in diameter and up to 15 cm thick. The reef was about 100m long by about 50 m wide. The reef is 5km from shore in 18 meters of water. The quarry rock reef was placed 400 m away from minor lobster habitat, and 2 – 2.5 km away from major concentrations of lobsters (Scarratt 1968, 1973). Diving scientists monitored the artificial reef for lobsters over the next seven years. The first lobsters to inhabit the artificial reef were larger lobsters looking for new shelters (45 mm to 77 mm). Over the next few years small lobsters also inhabited the reef (10 mm to 80 mm). The dive surveys showed the lobster population on the reef increased from nothing in 1965 to more than 400 lobsters by 1971(Scarratt, 1973). Of the 400 lobsters only 10% were of legal size. After 7 years of study of this artificial lobster reef the result was a biomass of lobster equal to that of nearby natural productive lobster grounds for an equal size area. Scarratt (1973) states that an artificial reef created for lobsters alone is not a sound economic investment. The reef only provides a small number of lobsters to be harvested by fishermen. To construct a superior reef for lobsters it is suggested that the reef material does not need be as thick. The amount of rock material could have been deposited over an area 4 to 5 times as large, supporting 4 to 5 times as many lobsters. With that said, parts of this artificial lobster reef that were laid on sand are settling and being covered by sand (Scarratt, 1973).

It is also suggested that an artificial reef could actually harm or decrease a lobster stock. The creation of artificial reefs may not increase the abundance of lobster but attract lobsters from lower concentrations to a reef making them more vulnerable to fishing mortality and thus have a detrimental effect on the already reduced stock (Bohnsack et. al., 1991). For example, the first lobsters to inhabit the reef are usually larger lobsters looking for new burrows. If fishing pressure is high on the artificial reef, the habitat improvement would probably not enrich stock abundance. Lobsters from lower density areas are attracted to the artificial reef, making them easier to catch, removing more of the spawning stock.

An artificial lobster reef has to be designed with lobster behaviour in mind. Lobsters are found on a variety of bottom types such as cobble, rocky outcrops, reefs mud and sandy bottoms depending where they are in their life cycle (Spanier, E. 1994). Lobsters of varying size require different shelter or habitats. Cobble reefs provide a number of nooks and crannies for juvenile lobsters, as well as the correct food source for the juvenile lobsters. Juvenile lobsters should be considered solitary animals. They avoid predators by staying in burrows the majority of the time. Large lobsters tend to be more transient, they have fewer predators as they increase in size. As a lobster molts and grows larger it needs a larger size burrow, and would move off the reef if a suitable burrow was not available.

The artificial reef must provide a habitat for various size lobsters where they can obtain protection from potential predators and where they can find an ample supply of food in the immediate vicinity. A first step in creating a good artificial reef for lobsters is to assure the correct structural design for post larval lobsters to inhabit (Comeau, M. 1999). In this way, there is an addition to the overall lobster population, not just attracting adult lobster from surrounding habitats to a reef. The idea is to create a habitat area where lobsters would exist in all life stages; just settled larvae, juveniles, adult lobsters, and spawning females. The artificial lobster reef should be designed and constructed with the lobster's life history kept in mind.

A second reason to create an artificial reef is to mitigate damages or losses of natural habitats. For example, the creation of a new wharf could destroy some lobster habitat and therefore there is a need to mitigate damages and create new habitat elsewhere. The new habitat is generally created in an area with lower productivity, mainly on mud or sand bottoms. A type of habitat structure that is being considered in mitigation is reef balls. The reef balls are made out of concrete and weigh about 1000 pounds each. A reef ball has flat bottom, are open at the top and are covered with Swiss cheese-like holes. The holes are designed to shelter various size lobsters. In April 2004, scientists from the Bedford Institute of Oceanography placed two reef balls in the Halifax Harbour area to see how well the balls work in Nova Scotia's marine environment (The Chronicle-Herald, 2004).

Artificial reef constructions can be very costly. Tons of concrete and hours of fabrication time are required to make a number of reef balls. Transporting the reef balls requires cranes and a large vessel.

However, fishermen are looking for an economically viable solution to create reefs. What is the low cost effective solution? There is a need to use readily available materials that could be deployed in an effective manner. The artificial lobster reef needs to be designed for all size lobsters (Stottrup, J.G. et. al., 1998). There is also a need to monitor fishing pressure. If there is far too much fishing effort in an area, the creation of an artificial lobster reef will not be the solution (Jensen, A.C. et. al., 1994). In most areas around Atlantic Canada there is a sufficient amount of prime lobster habitat. Just look back to a time when there was no commercial lobster fishery. How many lobsters did the area sustain? Habitat is not always the limiting factor. Ensuring there is a robust spawning stock and allowing the juveniles to recruit into the fishery are the primary points.

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CCGS TELEOST GROUNDFISH SURVEY, JULY 2004

By Amanda Facey, FSRS Fisheries Technician

When the opportunity to participate in the July groundfish survey arose, I was quick to express my interest. After several weeks of getting my hopes up, I learned that the TBA female would be me. I spent the next few weeks preparing myself for the trip.

I had no idea what to expect. The Teleost was substituting for CCGS Alfred Needler, which has been under repairs. Many people say that it is like a cruise ship compared to the Needler. This put me a little more at ease. Many questions and answers later, I felt prepared.

After several changes in our departure time we were to be on board the Teleost at 6:30 PM on July 17. First on the agenda was to go over safety procedures. To my delight I was chosen to demonstrate putting on a survival suit. Fortunately, I did this without much difficulty, and did not make everyone think I was incompetent before we even left port.

Finally, we were on our way out of Halifax Harbour. Unfortunately, I did make one mistake before we left. I did not take any anti-nauseate prior to leaving, and I was paying for it less than three hours into the trip. It was not a great start and I was horrified that I would be spending the rest of the trip hunched over. The sickness was short-lived until Monday night when we experienced rough seas and once again I was feeling green. After that night I had my sea legs and was fine for the rest of the trip.

I was anticipating my first watch and our first catch. It didn't take long to learn the names of different species and how to tell similar ones apart, especially when we were getting hundreds of some in one catch. The best part was seeing a species I have never seen and/or heard of before. My favorite discovery was the spiny lumpsucker, and I have to say the strangest thing I saw was a sea mouse.

The time between watches and catches consisted mainly of reading, watching movies and going outside for some "fresh" air. Even out on the ocean some smells are unavoidable. We only saw land once during the whole trip. We were fortunate to have a clear day to see Cape Smokey as we made our way along the coast of Cape Breton. We also did a lot of eating. The Teleost's homeport is St. John's and all of the crew are Newfoundlanders. We received the traditional Newfoundland hospitality, especially when it came to the food. We were served cod cheeks and tongues and boiled dinners on more than one occasion. Kudos to Dave and Izzy!

After about a week and a half, I was getting a little home sick and looking forward to the stability of land. The senior staff took this opportunity to cause us rookies some further anxiety towards the end of the trip. We were scheduled to arrive in Halifax on Friday, July 30. A rumor started circulating that we would not be getting home until the following Tuesday because we were behind. Thankfully I was let in on the joke and got to watch the others squirm for a day or two.

We started into Halifax Harbour late Friday night to the sights and sounds of the Tall Ships Festival on the waterfront. What a beautiful sight it was. It took us a few hours to get to BIO and dock. After saying our goodbyes we all went our separate ways looking forward to our own beds and probably disappointed that we would have to make our own breakfast in the morning.

I am so grateful for this experience and thank all of the people who helped me and were good company.

YARMOUTH SHARK SCRAMBLE 2004 – THE BIG FISH THAT DIDN'T GET AWAY

By Jennifer LeBlanc, FSRS Fisheries Technician

On August 21 and 22, 2004, I had the pleasure of helping out at Yarmouth's seventh annual Shark Scramble. During such derbies, recreational fishermen compete with rods and reels and are allowed to land any sharks they catch. These events provide excellent opportunities for scientists and members of the community to get up close and personal with Atlantic Canada's sharks.

This year a total of 76 sharks were landed, comprised of 70 blue sharks and 6 shortfin makos. After spending weeks working with spiny dogfish, these animals were quite impressive! I was disappointed, though, that there were no thresher sharks or great whites - a long shot, I know. I did, however, get to work with one massive mako! Saturday evening we watched as a boat pulled up with what appeared to be a fairly large mako on board. It was only when we watched as the crane went on two wheels as it tried to lift her that we realized this was no ordinary shark. Once a couple of forklifts joined in and they got the mako into the air, we stood in awe of the 1082 lb. female hanging before us! According to Dr. Steve Campana, a biologist at the Bedford Institute of Oceanography, this 10 ft 10in" mako is probably over 20 years old and undoubtedly breaks the Canadian recreational record.

Shortfin makos (*Isurus oxyrinchus*) are easily recognized by their counter shaded colouring (dark blue on the back fading to white on the belly), their crescent shaped tail (the bottom tail fin is equally as long as the bottom one), and long teeth that are visible even when the mouth is closed. Makos are one of the fastest sharks, reaching speeds of up to 35km/hr and are known to leap out of the water (breach), particularly when hooked. For more information about maritime sharks, visit http://www.mar.dfo-mpo.gc.ca/science/shark/.

Some interesting data that is collected from the sharks include length, weight, sex, stage of maturity, and stomach contents. Such information can be compared with other years to determine any changes in the shark populations over time. In the stomachs of the sharks we sampled I was amazed to find a number of fish species, including lamprey and lumpfish, feathers, and the remains of at least two different types of marine mammal. I was disappointed, though, to find that the huge mako, which was caught by Jamie Doucette of Wedgeport, had a completely empty stomach.

I am so glad I had the opportunity to take part in the shark scramble. Some may think dissecting sharks is a messy job but hey, not many people have been in the belly of a shark and lived to tell about it!

BEACHCOMBING - What's New in The News

LOBSTER TALK

Fishermen and scientists gathered in Portland, Maine in April to participate in the First Lobster Town Meeting put on by the Lobster Institute of the University of Maine in Orono. Fishermen from both the U.S. and Canada attended the meeting to discuss issues concerning the lobster industry.

The fishermen addressed many of their concerns during the meeting. In particular, they were concerned about water quality. They discussed many sources that could effect water quality including spraying of pesticides for West Nile Virus and chlorinated water from sewage treatment plants.

To find out more about the First Lobster Town Meeting, check out the article in the June 2004 issue of ***The Navigator. "Lobster - Plenty to Talk About". pg 26-30, vol. 7, No. 6.***

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www.fsrs.ns.ca

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UPCOMING EVENTS

Mark Your Calendars!

The Fishermen and Scientists Research Society's 12th Annual Conference will be held February 25th and 26th, 2005.

Watch for more information on the conference in the next newsletter and on our website at www.fsrs.ns.ca.