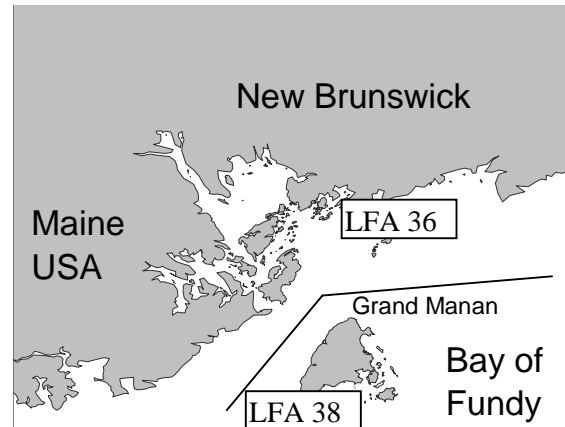


Southwestern New Brunswick Green Sea Urchins



Background

The green sea urchin, *Strongylocentrotus droebachiensis*, is an echinoderm which ranges in the Atlantic Ocean from New Jersey to the Arctic, extending south to Britain. It is also distributed in the Pacific Ocean from Washington to Alaska. The animals are omnivorous in nature although they feed primarily on seaweeds. Sea urchins are most plentiful in shallow waters less than 10 m deep although they may be found down to 1,200 m. Urchins can be found on virtually any type of substrate, but they generally prefer harder surfaces. The animals have separate sexes and spawn in late winter/early spring. The resulting planktonic larvae settle in 8 to 12 weeks. Growth is dependent on food supply and the time required to reach commercial size (50 mm) may take from 3 to 15 years.

There are two fishing zones, based on Lobster Fishing Areas: LFA 38 (Grand Manan) and LFA 36 (encompassing the remaining area on the mainland including coastal islands). The majority of the catch is taken from shallow water coastal areas < 10 m deep.

The sea urchin fishery, in southwestern New Brunswick in the Bay of Fundy, initially developed as an additional source of product for the industry based in the United States. Small landings (1-2 tons) occurred in the 1950's and 1960's just before the Christmas season on Campobello, but the industry did not really develop until 1987. The majority of the harvesting effort in the area has been with the use of drags, although the number of diving-based operations has recently increased. In 1994, the drag fishery switched from using scallop drags to a lighter gear known as the "Green" drag. Landings have steadily risen from 47 tons in 1987 to 1,446 tons in 1995. The value has increased from less than \$100,000 during this period to almost \$3 million.

The fishery is regulated through limited entry, size limits, seasons, time of harvesting, gear restrictions, sorting catch at sea, statistical reporting through a logbook program, protected areas for scientific research, sanctions and dockside monitoring with individual non-transferable quotas (in Grand Manan only to date).

The Fishery

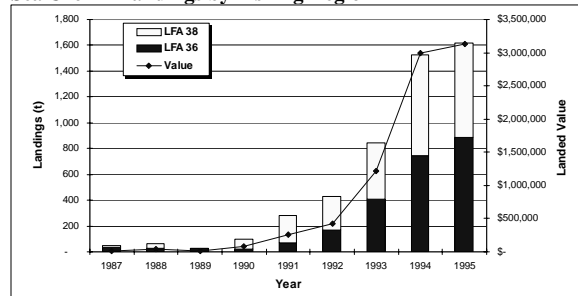
A Conservation Harvesting Plan (CHP) specifically for southwestern New Brunswick was developed in consultation with all the license holders in the fishery. At the present time, there are two versions of the CHP; one for LFA 38 (Grand Manan) and one for LFA 36 (the rest of the Quoddy Region). All participants must have a personal fisher's registration and the license holder must be the operator of the vessel. The common elements of both plans are: a minimum size limit (test diameter) of 51 mm (2.0 in.), sea urchins to be sorted and culled at sea, harvesting between sunrise and sunset, mandatory submission of logbooks, sanctions and the establishment of protected areas for scientific research. For LFA 38 (Grand Manan), the season extends from November 1 to April 15, fishing gear is limited exclusively to either "Green" drags with a maximum width of 1.83 m (6 ft) or diver-based techniques (i.e. suction harvester), and a program for individual non-transferable quotas with dockside monitoring is in place. For LFA 36, the season extends from October 1 to May 15, fishing gear is limited exclusively to "Green" drags with a maximum width of 3.05 m (10 ft) or diver-based techniques (i.e. suction harvester), maximum of four divers in the water and two skiffs may be used within 457 m (1,500 ft) of the mother boat to tend the divers. Dragging operations are subject to scallop regulations in the inshore areas which limits the season to the second Tuesday in January to the end of March. These regulations are reviewed on an annual basis with members of the sea urchin industry.

Landings in southwestern New Brunswick have increased by almost two orders of magnitude since 1989 from 29 t to over 1,600 t. Initially the landings seem to display exponential growth, but the rate of increase in landings have slowed in 1994 and 1995. The value of the product has increased during this period from \$16,000 to over \$3 million.

Bay of Fundy Landings (tons), Value (\$'000s)

Year	1989	1990	1991	1992	1993	1994	1995
Wt.	29	95	279	429	846	1,529	1,621
Value	16	86	253	422	1,222	2,999	3,125

Sea Urchin Landings by Fishing Region



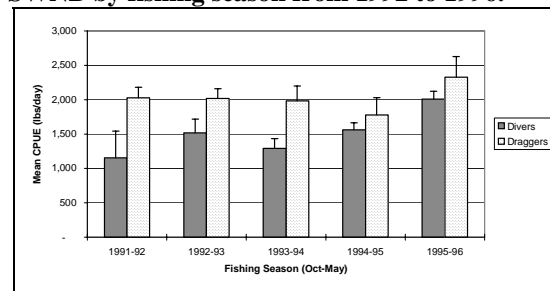
Resource Status

The fishery is primarily monitored with analysis of logbooks submitted by the 31 fishers on a monthly basis. Recent compliance for logbook submission is very high as it is part of their license conditions. These data are used to calculate CPUE indices for individuals, groups and locations. In 1992 and 1993, large scale diver-based surveys were done for much of the commercially fished areas. Subsequent to those surveys, reference transects were surveyed annually to monitor changes in density and size distribution.

The mean CPUE (catch-per-unit-effort) per dive license in LFA 38 based on data from 1992 to 1995 was almost double that of a dive license from LFA 36. The pattern was consistent among years. However, although the differences are real and are probably due to stock characteristics, LFA 38 was represented by only a single dive license whereas LFA 36 had nine. Competition between dive licenses in LFA 36 may explain some of the differences in magnitude of the catch rate. Overall, for divers in southwestern New Brunswick, the mean daily catch rate per diver (1995/96) was approximately 2,000 lbs (890 Kg) per day. The mean catch rate has not changed much since 1992 for either LFA, although there was a suggestion of a slight increase in 1995/96. Diving in LFA ceased in the spring of 1995 as the only diver there converted his license to dragging.

Similar patterns in CPUE for draggers was observed as LFA 38 was again higher than LFA 36 by approximately 35%. The differences in the two areas are consistent over the time period from 1992 to 1995. For LFA 38, there does not appear to be any change over time in catch rates, but there may be a slight decline in LFA 36. Overall, in southwestern New Brunswick, the draggers harvest approximately 2,000 lbs (890 Kg) per day; similar to the divers. The largest difference between the two groups is the number of days they can fish during the season. Divers are limited to calmer periods of weather and locations.

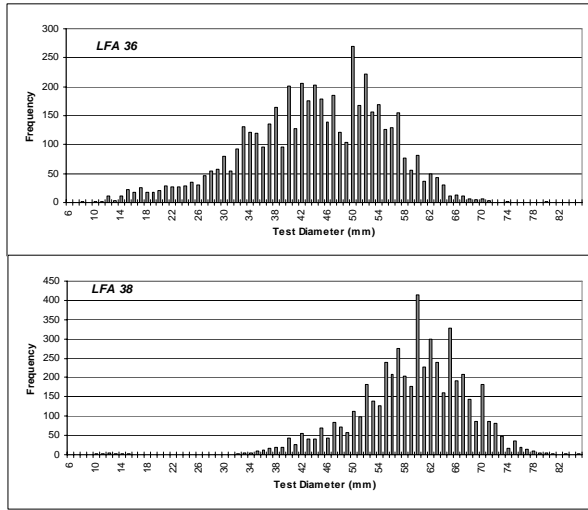
Catch rates for dive and drag licenses (lbs/day) in SWNB by fishing season from 1992 to 1996.



A dive survey which assessed animals larger than 10 mm, indicated there was a gradation from small to large sea urchins in population size distribution from Passamaquoddy Bay to Grand Manan. Growth studies on sea urchins in the southwestern New Brunswick area have revealed that the sea urchins are slower growing and much older than originally expected. The average age for a legal size (50 mm) sea urchin in most locations sampled was 12 to 15 years. This is two to three times older than those found on the east coast of Nova Scotia. This slow growth is thought to be due to competition among animals and over-grazing of the food supplies. Based on standard larval settlement collectors, recruitment of juveniles to the population was found to be approximately 20 to 60 juveniles/m². These values are three order of magnitude lower than those found in similarly populated urchin beds in New Hampshire (40,000 / m²) (Harris, 1994).

The 1992-93 **survey** of Grand Manan, Campobello and Deer Island showed there were significant differences between the two LFA areas with respect to size distribution. The mode for animals in LFA 36 was approximately 45 mm while the mode from LFA 38 was 60 mm. Based on the absence of small urchins in the samples, there was very little recruitment to the population observed in LFA 38.

Sea urchin size distribution from LFA 36 and LFA 38



LFA 36 was broken down into three areas: Campobello Island and Deer Island which were surveyed in 1992-93 and the mainland from Letete to Maces Bay which was surveyed in 1993-94.

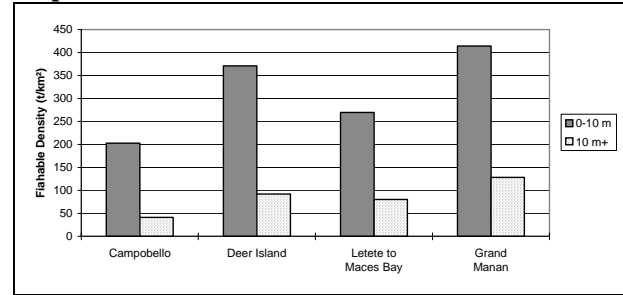
Total biomass and fishable (urchins > 50 mm) biomass (t) of sea urchins by LFA based on dive surveys.

LFA	Area	0-10 m depth		10+ m depth	
		Total	Fishable	Total	Fishable
36	Campobello	4,110	1,736	1,070	197
	Deer Island	12,660	4,265	4,574	991
	Letete - Maces Bay	10,189	5,237	1,897	819
	subtotal	26,959	11,238	7,540	2,007
38	Grand Manan	26,815	23,350	10,433	6,529
36+38	Total	53,774	34,588	17,974	8,536

In LFA 36, the biomass of sea urchins for the three areas surveyed was 34,499.1 tonnes of which a total of 13,245 tonnes was fishable (38%). Most of this was in the shallow areas (<10 m). LFA 38 showed similar patterns in distribution with depth although a higher percentage of animals were in the fishable category.

The fishable densities of sea urchins (tonnes/km²) in the different geographic areas ranged from 200 to over 400 in the shallow waters.

Density of sea urchin biomass from the dive surveys in LFA 36 and LFA 38 for shallow and deep water



The 1995 re-surveying of transects done in 1992 in the key sites was very helpful in trying to understand how the fishery may be affecting the local sea urchin stocks. There were many areas where the size distribution of the population changed from the 1992 sampling period as the proportion of larger individuals were reduced in the population. This is not surprising as the commercial fishery would be targeting those larger animals. Deer Island seemed to show this pattern more dramatically than any of the other sampling areas. There was only one site on Grand Manan (G-9) where the percentage of commercial sized sea urchins (over 50 mm) actually increased in the population.

In both the 1992 and 1995 surveys, the average size of sea urchins in the mainland sites was generally much smaller than that found on Grand Manan. The size distributions of the sea urchins were very much site dependent.

There was no clear pattern of changes in the density of sea urchins between sites. In some areas, the densities increased in 1995 from the 1992 survey while in other it either stayed the same or decreased. Patterns of distribution along the 150 m transect line also varied similarly. Some of this variation might be explained by the time of year when the animals were sampled (e.g. if the distribution of the animals differed between the spring and the fall). However, no information is available on seasonal movement patterns of animals in this area.

Overall, it appears as though we can detect some of the changes the fishery is having on the population density and distribution patterns with this technique. The changes in density seem to be area specific with most of the Deer Island locations showing the largest changes.

Recruitment to the population at all sites tested so far, based on standard larval settlement collectors, has been lower than expected (approximately 30

juveniles/m²). In comparison with some of the work done on settlement in New Hampshire, settlement rates on collectors here have been three orders of magnitude lower. These results are similar to those found in the Eastport area of Maine (L. Harris, pers. comm.). How this affects the recruitment rate of animals into the fished population is unknown at the present time.

Uncertainty: It is very difficult to give an accurate picture of the state of the urchin populations as we do not have a good understanding of the new animals entering the fished populations.

Based on observations made by scientific staff, there is an interaction between the fishing operation and the benthic ecosystem. At the lowest level, it is the removal of larger sea urchins from the population which will likely change the successful competition for food items within the smaller size groups. The removal of urchins may also affect the growth of macrophyte algae by lowering the grazing pressure. However, the largest benthic impact at the present time is the effects of the drags on the benthic community. As the fishery generally operates on hard bottom, the action of the chain sweeps on the bottom of the drag act in a shearing fashion and scrape a lot of epibenthic organisms off the rocks as well as the targeted sea urchins. The level of this impact or the long-term effects are unknown. Another interaction between the fished population and the gear is the incidental mortality rate from either divers or draggers. Experiments have demonstrated the sensitivity of the animals to stress from harvesting and handling.

Sea urchin populations in southwestern New Brunswick are generally made up of old and slow growing individuals in comparison to animals from eastern Nova Scotia. In most locations examined so far, a 50 mm animal (minimum legal size) is between 10 and 15 years old. In Nova Scotia, a 50 mm animal is between 4 and 6 years old in most cases (S. Meidel, pers. comm.). The only exception to this slow growth was found in two locations, Lubec Narrows, near Campobello Island and Nantucket Island off Grand Manan where a 50 mm animal may be 4 to 5 years old. Both of these locations have been fished heavily for years. Therefore, it may be possible that the growth rates observed are the result of density dependent growth factors. More work is needed in the future to determine the carrying capacity of a particular type of substrate for sea urchin production.

Outlook

The fishery for sea urchins in southwestern New Brunswick looks to be peaking in its landings based on 1995 figures. This peaking may be partly due to the institution of a TAC in LFA 38 in 1995-96 although the landings from LFA 36 (which does not have a TAC) only increased slightly from the previous year. Long-term projections of production at the present time are not warranted due to the lack of understanding of the production system. Harvesting will affect the densities which will subsequently affect the production rates. What that new production level will be is not known at the present time.

One of the major issues facing the management of the industry is the concept of harvesting poor quality sea urchins, holding them in captivity and fattening them with supplemental food and then selling them at a much higher price. There are many applications in New Brunswick at the present time for this type of venture.

For More Information

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