

Green Sea Urchin (*Stronglyocentrotus droebachiensis*)

Description, Distribution and Biology

Sea urchin is a member of a large group of marine invertebrates in the phylum Echinodermata family including starfish, sea cucumber, sea lily, and brittle star. It has a spherical body, five equal body segments and is covered with long movable spines located on its hard, calcareous shell (test), (Fig.1). The spines are used for locomotion, as a passive defence against predators and for trapping floating food particles. Tube feet are located between the spines and are used for movement, capturing food and for attaching to substrates. A stinging jaw (or small pinchers), called the pedicellariae, is also used for protection and to clutch food items. The mouth of the sea urchin is located on the underside of the organism and consists of a 5-pointed jaw called "Aristotle's Lantern".



Figure 1. Sea Urchin. Source: Department of Fisheries and Oceans, Ottawa, Canada

The green sea urchin is the most widely dispersed of all Echinoderms, having a circumpolar distribution. Its range extends into the Arctic regions of both the Pacific and Atlantic Oceans. On the east coast of North America, the green sea urchin is commonly found from Baffin Island, south to Cape Cod and in deeper waters to New Jersey. Green sea urchin is abundant in subtidal areas with salinity greater than 15 ppt, just below the algal fringe between 5 and 10 m but has been found in depths up to 60 m. Although found on a variety of bottom types, it prefers exposed rocky substrates.

Sea urchin typically has separate sexes and fertilization takes place externally. Spawning occurs in the spring and early summer when water and food conditions are favourable. Females will release several million eggs into the water column, which will unite with sperm released from the males. After hatching, the free-swimming larvae enter a multistage planktonic existence, which lasts several months, before they settle to the bottom and undergo metamorphosis into the initial post-larval stage (juvenile) within hours. Sexual maturity is reached at 4 to 10 years, with a diameter of 1.8 to 2.5 cm.

The green sea urchin predominantly grazes on seaweeds, mainly kelp, but will consume a wide variety of organisms including other algae, mussels, sand dollar, barnacle, whelk, periwinkle, sponge, dead or dying fish and in extreme circumstances other sea urchin. The main predators of adult sea urchin include sea otter, lobster, crab, sea star, wolf eel, ocean pout, Atlantic wolffish and other predaceous fishes. Sea urchin larvae feed primarily on phytoplankton. After settling to the bottom, juveniles feed on a variety of organic material, living or dead. The main predators during the

Harvesting and Management

larval stage include zooplankton, surface feeding fish and bird species.

Several countries throughout the world including Canada and the United States harvest sea urchin. Traditionally, Japan was the largest harvester and producer, but in recent years demand has increased and now much of the roe is imported. On the Pacific coast of North America, red, purple and green sea urchins are commercially harvested while on the east coast only green sea urchins are economically important. A green sea urchin fishery began in Maine, USA in 1933, and remained the only urchin fishery on the east coast until the early 1990s. In 1989, New Hampshire began a green sea urchin fishery and in 1991, a commercial fishery was established in Massachusetts. Regions in eastern Canada also initiated an urchin fishery. Attempts have been made to commercialize this resource in Newfoundland since 1969, but the industry is still considered a new and emerging fishery. A number of experimental projects have been initiated to evaluate the potential of a sea urchin fishery in coastal areas of Newfoundland, however there is still limited knowledge regarding urchin location, stock distribution, and breeding season.

Sea urchin is harvested by a variety of methods including diving, dip nets, baited whelk pots, modified whelk pots or ring traps, pumps, or dragging. Diving for urchins is the most successful and commonly used method. Experimental fisheries conducted in Newfoundland in 1994, proved whelk pots and dip nets were inadequate for harvesting urchins in coastal waters. Dragging proved to be cost effective but was non-selective in regards to size and disrupted bottom substrates. Therefore, diving is the only method currently permitted in Newfoundland waters.

The green sea urchin fishery in Newfoundland typically begins in October, when sea urchin roe is considered mature and suitable for harvesting and continues until May, when urchins begin to spawn. The fishery is concentrated in Trinity, Bonavista and Notre Dame Bays. Urchin is typically harvested when they reach 5 cm in diameter, have a roe yield of 10%, and roe colour is yellow to orange. The Newfoundland urchin fishery landings have increased from 62 metric tonnes (mt) in 1993, to 928 mt in 1998, and decreased slightly to 837 mt in 2001. The landed value of sea urchins in Newfoundland has steadily increased from \$62,000 in 1993, to \$1,391,000 in 2001 (Fig. 2). In recent years the price has fluctuated \$0.40/lb and \$ 1.00/lb, depending on quality and market

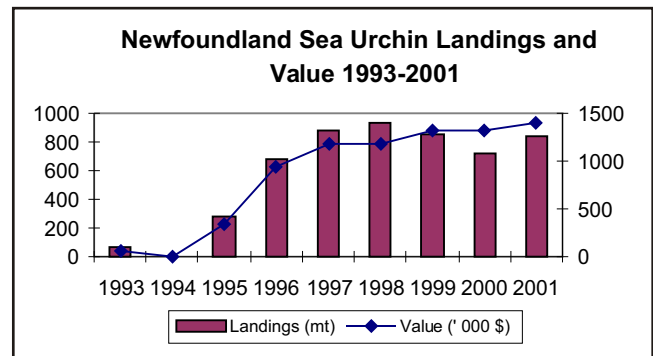


Figure 2. Newfoundland Sea Urchin Landings and Value 1993-2001.
Source: DFO Statistics, Canada

demand.

The Department of Fisheries and Oceans issue green sea urchin licenses in Newfoundland. License holders are permitted to harvest up to 100 mt and carry a maximum of 4 divers per vessel. The

Processing and Markets

minimum retention size for urchins is 4.8 cm test diameter.

Registered processing facilities require sea urchin to be landed live. Once the urchins arrive at the plant they are held in a chill storage ($\sim 10^{\circ}\text{C}$) until processed. Sea urchin can be prepared for live shipment to markets or processed to extract the roe. Urchin roe (“uni” or “nama uni” in Japan) is primarily sold fresh but can be frozen (“reito uni”), salted (“shio uni”), baked (“yaki uni”), or steamed (“mushi uni”). Processing sea urchin roe is extremely labour intensive. The test or shell is cracked manually using pliers and the gonads of both sexes is gently extracted, washed, and packaged. The largest importer of sea urchin roe is Japan, followed by Hong Kong, Korea, Spain, Italy, Afghanistan, Albania, Algeria, and American Samoa. Canada was the third largest importer of urchin roe from the United States between 1997 and 2002. There are a number of factors affecting the price of sea urchin roe, including the colour, shape, size, taste and firmness of the sac. Newfoundland urchin roe was well received on the Japanese market according to colour and taste. The size was

Constraints and Future Development

smaller and the texture was soft but both acceptable and comparable to the Japanese product.

Future development of this resource in Newfoundland will require further investigation into resource identification in coastal areas of Newfoundland and Labrador. Work should be conducted on developing urchin culture. The culture of sea urchin will allow for a consistent supply of raw material for markets and protect natural populations from over harvesting. In addition, new labour efficient mechanical processing techniques have to be developed and more research is required in product development.

ADDITIONAL READINGS:

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