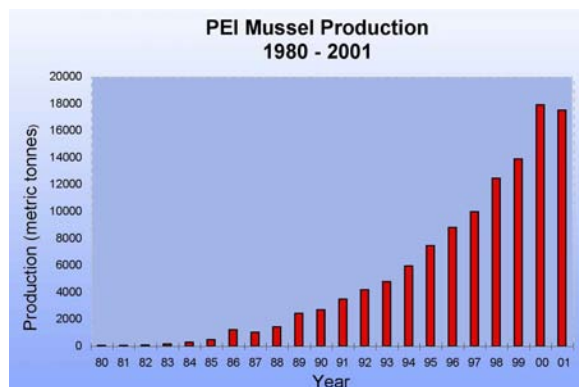


Mussel Culture in Prince Edward Island

Background

Since the mid 1980s, the Prince Edward Island cultured-mussel industry has become a significant contributor to the Island's fishing economy.

Between 1980 and 2001, PEI mussel landings increased from 40 to almost 18,000 metric tonnes. In 2001, the landed value of cultured mussels was about \$23 million and approximately 1,500 Islanders earned their living in the industry.



Using the longline system in protected estuaries, mussel farmers are able to produce a high-quality mussel which is renowned for its superior flavour.

The quality of Island mussels is assured by the industry's advanced technology and the shellfish monitoring programs conducted jointly by the provincial and federal governments.

Growing conditions

Production comes from farms along the east side of the Island where the estuaries tend to be drowned river valleys and from farms along the north shore where the estuaries are barrier beach lagoons.

Water temperatures range from -2°C in January to $22 - 24^{\circ}\text{C}$ or higher in July and August. The salinity usually ranges between 23 parts per thousand and 29 parts per thousand.

The Culture System

The suspended longline system is the culture method utilized throughout the province. There are minor differences between farms, mostly to do with the length of the longlines, the type of anchorage and flotation and the length of the socks.



Mussel boat raising socks on a backline

The size of a mussel farm is measured in lines, a line being 100-200 m of 12 mm polypropylene rope (backline) held near the surface by buoys and anchored at each end by 350 kg cement anchors, or helical screw anchors.

The backline is connected to the anchors by means of scope lines, which are generally three times the water depth in length.

An anchor line runs to a surface marker buoy; this line can then be used to straighten the backline should any slack occur. The most popular flotation device is the styrofoam buoy. Pressurized plastic floats are gaining in popularity although they are considered expensive. A wide variety of anchors were used since the industry was established 25 years ago. The initial sites used sea anchors, scrap metal pieces, train wheels, railroad rails and concrete blocks. Presently, a half barrel of cured concrete sunk into the soft bottom is the most

popular anchor; however, many growers are changing over to screw anchors where firm bottom conditions exist.

Mussel Biology

Mussels are either male or female. Spawning begins in mid-May depending primarily on water temperature. Most, but not all, females have orange-coloured ovaries, whereas the male testes are cream-coloured. During spawning a female can release between three and 20 million eggs.

Numerous spat settlements are common throughout the summer and early fall months, suggesting the occurrence of multiple spawning events. Fertilization is external and the young embryos quickly differentiate into free-swimming larvae.

Once the larvae reach a shell-length between 0.25 mm and 0.30 mm (250-300 microns), at about 24 days old, byssal threads are secreted for attachment to solid substrates, such as rope collectors, maturing mussels, rocks, buoys and wharves. At this stage, the young mussels are mobile and they use their foot to move about.

Seed Collection

Seed is usually collected in the upper reaches of inlets or rivers where shallow water depths limit grow-out operations.

Seed collectors are made primarily from two metre lengths of used 12-18 mm polypropylene rope. Collectors are attached to the backline 30-50 mm apart and weighted to keep them suspended vertically in the water column.

The mussel larvae settle on these collectors and grow rapidly, reaching sizes of 10 to 25 mm by fall. Care must be taken to provide adequate flotation of longlines to avoid mortality of seed by predators or fall-off during storm events.

Mussel growers prefer using graded, larger seed to ensure more uniform growth of the mussels at maturity. Some growers also use wild seed harvested from natural beds on the river bottom.

Collection of seed from these beds during spring and fall is conducted under licenses issued by the Department of Fisheries and Oceans.

Socking the Crop

Harvesting of the seed occurs between early October and late November.



Mussel seed grading equipment

The seed is manually stripped from each collector and transported to shore where specialized grading equipment cleans and sorts seed mussels into three or four sizes depending on the type of equipment used, and preference of use by individual growers.

“Sleeving” or “socking” is the operation by which seed mussels are loaded into the mesh sleeves or socks. A sock is a long mesh tube, often strengthened with a strand of polypropylene twine. Individual socks are about 40 mm in diameter and average 2.5-3.0 metres in length depending on local water depths.

Various types of socking materials with a wide range of mesh sizes accommodate graded/sized mussel seed. Of the three generalized types of mussel socks, (Italian, Spanish and Irish) the Italian is by far the most popular.

The majority of growers undertake socking operations from early October to mid or late November depending on the year. It is during this time of year that employment in the mussel industry peaks. Spring socking is not prominent as warming water temperatures adversely affects mussel migration sometimes leading to unacceptable performance of the seed.



Typical sock/sleeving apparatus

In October the socks are filled at a density of 120 to 240 seed mussels per foot of sock. The seed mussels migrate through the mesh and become attached to the outside of the sock by byssal threads with their syphons pointed outward.

Freeze-over of mussel-producing bays and rivers in winter has resulted in development of adaptive technology to safeguard losses of gear to ice, particularly in spring. Longlines left at the surface would be destroyed by ice. Ice thickness is normally between 30 and 90 cm so the complete array of longlines must be submerged before freeze-over.

Concrete blocks (35 kg) are tied to the backline at 10-15 m intervals in November and the flotation buoys are adjusted accordingly. The concrete blocks pull the longline at least 1.5 m beneath the water surface yet allow the socks to float clear of the bottom. This prevents the mussels from suffocating in the mud and from attack by large starfish or crabs. Extreme care is required for this process as the margin of error is small due to the shallowness of the water. Even one buoy frozen in the ice can result in damaged lines.

In the spring some growers refloat their longlines to the surface by removing some of the weights, and at the same time the socks are examined and predators and/or fouling can be removed.

One method of removing fouling organisms, such as the second set of mussel spat (seed), is to temporarily (seven to 10 days) lower the lines to the bottom so the mussel socks are just touching. Rock crabs and/or starfish will then climb onto the mussel socks and remove the smaller, thinner shelled second set of mussel spat.

Some growers leave their lines sunk until they are ready for harvest to avoid heavy spatfall on the growing crop. Others will remove some of the cement blocks, letting the lines float nearer the surface to take advantage of the warm, often more productive water. Some growers prefer to leave the mussels sunk for the entire grow-out period.

Harvesting

After 18 to 24 months, the mussels reach a marketable size of 55 to 60 mm. Each line will then contain nearly two tonnes of mussels.

In the winter months, specialized techniques are required to harvest through ice-covered bays. Some growers locate lines using ice poles. Workers in insulated survival suits use chain saws equipped with a special ice cutting blade to cut a 1x2 m hole through the ice.

A diver ties a line from the winch over an A-frame to the longline and then releases the longline from its moorings. The line is hauled up through the ice by a portable, mechanical or hydraulic, winch positioned approximately 10 m from the hole.

As the lines emerge, the socks of mature mussels are cut from the backline, stacked in insulated plastic boxes and protected from wind-chill. Although mussels may be harvested throughout the year, meat quality, market demand and prices are also important factors in the decision to harvest.



Harvesting mussels through ice in winter

Harvesting in open water is generally carried out in a boat equipped with a boom and a hydraulic winch.

The backline is partly lifted out of the water and the socks are severed from the backline and hauled into the boat. To minimize losses due to fall-off of mussels during harvesting, the boat may be equipped with an aluminum chute to guide the longline and socks aboard. Other growers may have to double sock a larger sock over the mussels to prevent fall-off. This operation can be conducted from a boat using the “bucket method” or underwater using divers.

Processing

The mussels are transported to the processing plant where they are mechanically declumped, washed and graded. The byssus (beard) are removed by a special de-byssing machine. Finally, the mussels are inspected and any broken or substandard shells are removed before they are packed for shipment to domestic or foreign markets. Presently, there are eight provincially licensed and federally registered mussel processing plants.

Research and Development

Research and development priorities have been developed by the industry in collaboration with federal and provincial government departments, and universities. For example, studies to examine the productive capacity of mussel-producing estuaries will help industry determine the maximum yield of mussels yet ensure long-term sustainability of the mussel sector and other fishery resources.

Research is required into management techniques that will optimize sustainable production of high-quality mussels. The positive benefits of mussels to reduce nutrient loading, phytoplankton blooms and potential for increasing biodiversity in the water column and in the benthos should be investigated.

Ongoing research to reduce the damage caused by sea duck and bay duck predation on seed during fall respects a high-priority level. The development of effective deterrent techniques and innovative protective socking and bay specific deterrent management plans will ensure that interactions between sea ducks and mussel farming operations will be minimal.

Introduction of invasive species, such as the clubbed tunicate, create a significant threat to the cultured mussel industry. More information on the clubbed tunicate life cycle, their impact on seed collection and grow-out mussel performance, as well as possible control methods needs to be determined. Collaborative research on issues such as these will strengthen the industry’s ability to sustain itself in the Island’s resource-driven economy.

Conclusion

The production of cultured mussels is an acknowledged high-growth industry. While still a relatively young sector, the mussel industry has created numerous jobs and has assisted to diversify the fishery.

The mussel industry has also resulted in tremendous spin-offs in the supplies and services sectors. Prince Edward Island has developed a reputation for high quality mussels on the hard work of producers, processors and both levels of government. These efforts will ensure Prince Edward Island mussels maintain a strong share in the marketplace.

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