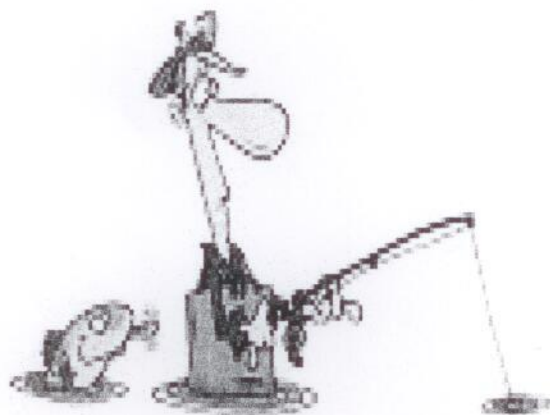


## Fishing Industry on P.E.I





The fishing and aquaculture industry is of major importance to the Prince Edward Island economy, which is not surprising since the province's location is so near to the rich fishing grounds of the Gulf of St. Lawrence. The landed value of the catch, which is made up of a number of species, was over \$170 million in 2006. The province's small population of 140,000 is unable to absorb this production and therefore much of it is marketed within Canada or exported to international markets.

Processing the catch increases the value significantly. The total economic return to the province from the fisheries and aquaculture industry, including employment in processing and related service industries, increases the value to the economy to approximately \$350 million.

PEI fishers have access to the fishing grounds of the Gulf of St. Lawrence and the Northumberland Strait as well as a number of bays and rivers within the province. However, they have only limited access to the offshore fishing resources and the fishery has thus largely developed into an inshore fishery with fishing activities centred within a day or two of sailing from home port.

## AQUACULTURE

PEI has developed a significant aquaculture industry primarily involving the culture of mussels, oysters and salmonids. In the mussel sector, more than 125 growers who lease approximately 275 sites and more than 10,500 acres are involved in this increasingly important industry with rope cultured PEI mussels now being recognized as a gourmet item. The mussel industry has grown from 100,000 pounds in 1980 to 38 million pounds in 2006 and represents 13 per cent of the total landed value of all species on the Island. PEI mussels are sold in markets in Canada, the United States, Europe and Japan. Oysters remain a major contributor to the economy with an aquaculture sector, and a public fishery with 750 active licenses. In the leasehold fishery there are more than 750 sites with leased acreage in excess of 6,500 acres. More than 1,000 fishers and aquaculturists are involved in this fishery. Finfish aquaculture is also a significant sector

with approximately six fresh-water-based farms involved in hatchery and grow-out operations.

## VESSELS

The PEI fishing fleet is made up of approximately 1,425 vessels, most being of the smaller type, between nine and 15 metres (30 to 50 feet). These inshore boats are multipurpose in design, and constructed to suit the highly diversified fishery of PEI.

The vessel design has evolved through the centuries to meet the diversified nature of the fishery and accommodate advancements made to fishing equipment and techniques. Most of the vessels, both of wooden and fibreglass construction, are shallow draft with the majority powered by diesel engines. There is a broad working deck used for setting and hauling gear, and storing the catch.

Vessels operating out of harbours along the Northumberland Strait differ in construction and design from those operating in the Gulf of St. Lawrence. The Northumberland Strait vessels are so named because they are designed for the choppy strait waters, while others are designed to operate in the rolling swell common in the Gulf of St. Lawrence. The majority of vessels are constructed in PEI boat shops.

A fleet of midshore, decked vessels engage in the snow crab fishery.

The mussel industry has developed many styles of aluminum and fibreglass vessels. These are outfitted with hydraulic lifting cranes to service mussel longlines.

The shellfish and estuarial fishery use approximately 1,000 dories, a four- to five-metre wooden or fibreglass boat, powered by an outboard motor.

## HARBOURS

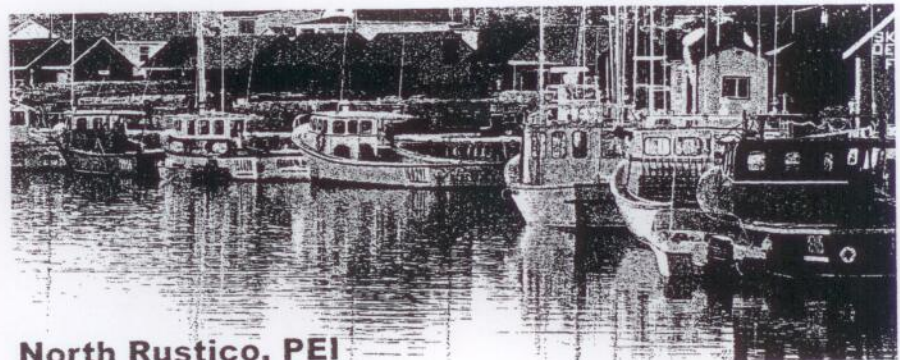
There are some 50 harbours scattered along the PEI coastline, situated mainly in the numerous inlets which shelter the vessels from the sea.

There are approximately 20 major harbours on PEI, which, along with offering shelter, provide services for the fishing fleet. These harbours have modern vessel-berthing areas, bait and equipment facilities, slips to launch and haul up vessels, repair shops, fishing equipment supply stores, fish-landing equipment, and modern plants to process the catch and have ice and cold storage facilities.

## FISHERMEN

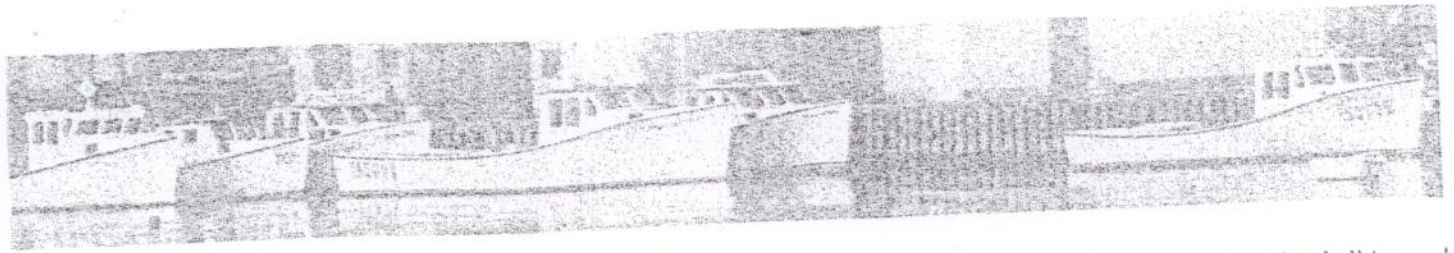
There are more than 4,500 fishers and crew engaged in commercial fishing activities on PEI. Few can engage in the commercial fishery for the full 12-month period because ice surrounds the province for a period of between four and five months annually. In most years, the fishing grounds and harbours are ice covered between December and April.

Most fishers are busy at tasks related to their fishing activities during the winter months. There are nets and traps to be repaired and replaced, and vessels and engines to be repaired. These tasks are very important to fishing operations. Should equipment and vessels not be in top condition when the fishing season opens, lost fishing days and lost income will result.



North Rustico, PEI





Aspects of the aquaculture industry, however, are year round. In fact, the busiest harvest season for mussels is the ice-cover period from December to April. PEI finfish hatcheries are busy in late fall spawning broodstock. The eggs are incubated and hatched over the winter months.

## PROCESSORS

Approximately 60 registered processing facilities on PEI process the species landed in the province. There are processing facilities and/or buying stations located at most harbours. There are two types of processing facilities - the larger facilities are provincially licensed and federally registered which means they can export products off PEI, whereas the smaller provincially licensed plants can only sell within PEI.

Usually the fisher's catch is sold to a single processing firm where daily supplies of bait, fuel and materials to repair gear are purchased. Some belong to co-operatives which purchase the fish, as well as provide supplies and a variety of other services to their membership.

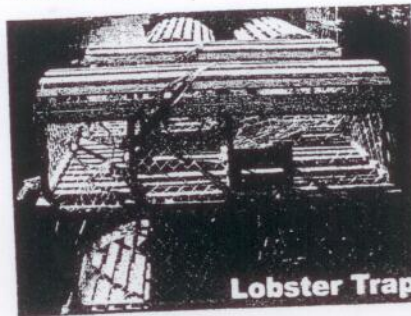
The products produced by processors on PEI include lobster, oysters, scallops, flounder, cod, snow crab, rock crab, toad crab, hake, eels, herring, mackerel, smelts, tuna, quahaugs, clams (both soft-shell and surf), silversides, mussels, trout, salmon, char, whelks (escargot) and marine plants. Most of these species are also processed for export in one or more of the following forms: fresh chilled, frozen, salted, smoked, canned, marinated and other products.

## LOBSTER

The lobster fishery is the major source of income for PEI fishers. Approximately 1,300 of the inshore vessels, operating out of the province, engage in the lobster fishery. It represents a higher percentage of the per capita income than in any other province with a commercial fishery. PEI fishers catch approximately 20 per cent of the annual Canadian landings of lobsters. Lobsters account for some two-thirds to three-quarters of the annual PEI fishing income with a catch of approximately

20 million pounds each year. Conservation practices including seasons, minimum carapace size, escape mechanisms for the undersize lobsters and trap limits have contributed to the stable and successful development of this fishery.

The Island lobster fishery is divided into three areas.



**Lobster Trap**

There is a spring season in areas 24 and 26A (April 30 to June 30) and a fall season in area 25 (August 10 to October 10). Area 24 includes the north side of the province from North Cape to East Point. Area 26A includes the south side of Kings and Queens County from East Point to Victoria. Area 25 includes the west side of Prince County from Victoria to North Cape.

The lobster catch is divided into two categories, depending on lobster size. The standard legal measure of lobster size, or carapace length, is the measured distance from the rear of the eye socket to the end of the body shell (excluding the tail). Minimum size requirements vary from time to time and from area to area.

Lobsters not of minimum legal size must be released into the sea. It is also illegal to retain "berried" lobsters - females with eggs on the undershell. These berried lobsters which are in the final stages of reproduction, are protected by law and must be returned to the water to protect the future of the industry.

The smaller legal-sized lobsters or "canners" historically were so named because the majority of these lobsters were canned.

Most of the canner lobsters are first cooked in the shell. The meat is then removed and processed as thermal canned lobster or as frozen in tins or plastic containers.

Lobster is also frozen in the shell in a brine solution and this product is commonly known as "popsicle pack." In recent years a market for lobster tails has been developed with the tail being frozen in the shell and the remainder of the meat removed and canned.

The larger size or "market" lobsters were so named because many New England states, historically the main importers of live lobster, prohibited their importation unless they met a minimum size requirement. After being caught, these market lobsters are "banded" (rubber bands placed over the lobster's claw) to prevent them from injuring each other.



**Rubber bands placed over the lobster's claw**

They are then placed in salt water pounds (tanks) for storage and transported in refrigerated trucks, or by air, to market. The main markets are in the United States and Canada. Air shipment of live lobsters to European and Japanese markets is also carried out.

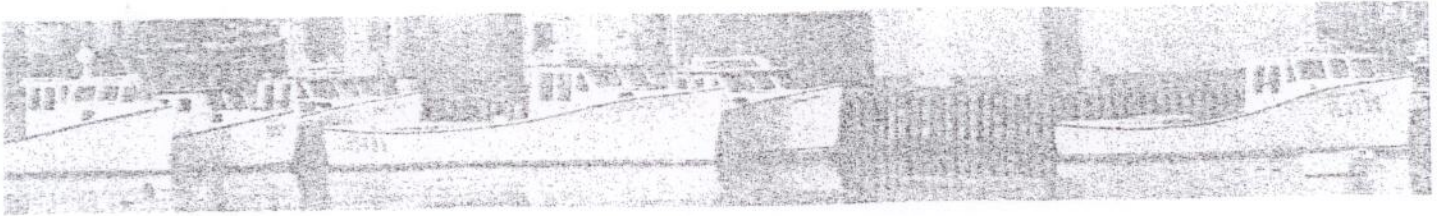
Each PEI fisher is permitted to fish this species for a two-month period. Many of those involved engage in other fisheries in addition to the lobster fishery to complete their yearly income. This is dependent on the other licence(s) that the fisher possesses. The other types of species available will vary from year to year and from area to area.

## SEA PLANTS

Irish moss, *Chondrus crispus*, together with the associated seaplant *Furcellaria*, have provided Island fishers with a valuable harvest. PEI is the Canadian leader in seaplant production with the major species being Irish moss.

On PEI, the industry is centred on the western shore of Prince County, where the largest production of Irish moss is harvested and major buyers have drying and packaging plants.





There are two methods of harvest – by drag rakes or by gathering storm-tossed moss along the shoreline. The harvest is taken by drag rakes towed behind lobster boats, converted for this purpose. Up to six rakes are towed by each boat. Large quantities of Irish moss, sometimes mixed with *Furcellaria*, are washed ashore during gale force winds. Both fishing and non-fishing families can gather this storm-tossed moss, either picking it up from the shore or scooping it from the tidal wash with handrakes or with baskets towed by horses. A number of harvesters dry the wet moss in the sun, usually as a family activity, prior to selling to the buyers.

## GROUND FISH

Groundfish include such bottom feeding species as cod, hake, flounder and other related flatfish species. Because of the closures of the cod fishery and gulf redfish, groundfish landings have declined from 41 million pounds in 1992 to approximately one million pounds in 2006. The catch is mainly marketed as fresh whole and frozen fillets for the United States market. As well, flatfish are used for bait.

The only groundfish fishery currently occurring on the Island is a flatfish fishery and DFO's sentinel fishery. There is a fixed gear (tangle-net) fishery for blackbacks (winter flounder) in the spring and another tangle-net fishery in the east off Fishermen's Bank after the fall herring fishery closes. As well, some mobile gear vessels fish for blackbacks and American plaice in eastern PEI in the fall. The tangle-net fishery is carried out by stringing three to four nets together. The string is set near the bottom, where it is held horizontally in the water. Longlining (or line trawling) is another method of fishing cod and hake and is used in the sentinel fishery. A longline is simply a long fishing line which is set near the bottom with baited hooks attached at intervals.

## SCALLOPS

Scallop fishing is an important supplementary fishery on PEI. Scallops occur mainly along the southern and western side of the Island on grounds shared

by Nova Scotia and New Brunswick fishers. There are two major scallop fishing areas (SFAs): one in the western Northumberland Strait – SFA 22, and the other in the eastern Northumberland Strait – SFA 24. This area has had some buffer zones in place since 1997 to protect lobster and its habitat. As well, a fishery is also carried out on the north shore of PEI in SFA 23. This area has a buffer zone in place as well. Scallops are harvested in the spring in Area 22, late summer and late fall in Area 23 and in late fall in Area 24. The only portion of the scallop that is utilized to any extent is the adductor muscle, which opens and closes the shell.

Scallop fishing is conducted from converted lobster boats, usually dragging four to six "Digby style" scallop drags. The chain sweep method is also used.

## CRAB

Snow crab, rock crab and toad (spider) crab are harvested on PEI in various sized traps. The snow crab fishery, which was carried out in the 1960s, was re-established for PEI fishermen in the mid 1980s. In the snow crab fishery there are 28 permanent licence holders with quotas that vary from year to year based on stock status. A quota is available to First Nations fishers and there is also permanent sharing of snow crab in the Gulf of St. Lawrence with a limited quota. Landings and values have been significant, adding a vital component to PEI's fishing economy. Snow crab is primarily fished off the north



shore of PEI and the majority of the product is shipped to Japan and the United States as frozen clusters consisting of the legs and shoulders. Rock crab has evolved from a bycatch fishery to a fishery with more than 90 licence holders with seasons and quotas. Landings have shown increases in the

last few years and rock crab products are marketed frozen, primarily to the United States and Canadian marketplace.

The toad (spider) crab fishery is a permit fishery with 15 permits issued with the majority of the fishery taking place off northeastern PEI with no set quota. There is a limited quantity in Northumberland Strait as it appears this species prefers deeper water.

## MACKEREL

Mackerel fishing occurs along most of the Island's coastline but primarily on the north side. Three types of mackerel fishing are important on PEI: gill netting, jigging and to a lesser extent purse seining.

Jigging is important on the north side of PEI. In this fishery, up to six men work from a single boat using lines with five or six hooks attached. In recent years fishers use two pipes, separated slightly to allow hooks to travel through but not the fish. This greatly increases the harvesting ability in handlining. Gill net fishing is also common throughout the province and accounts for increasingly larger landings of this valuable midwater species.

A small percentage of this fish is canned and sold on the international market and a small amount is split and salted or filleted and frozen. At certain times of the year much of the catch is retained and sold for fresh bait primarily in the autumn lobster fishery in PEI and frozen bait in the winter lobster fishery in Nova Scotia. The larger fall mackerel are graded, frozen and packed as a food grade product which is shipped to Japan, Europe and the United States.

## BLUEFIN TUNA

In PEI, bluefin tuna are captured by both commercial and sports fishery methods. The commercial fishery uses the "tended line" method of fishing which involves the use of a baited hook on lines attached to the fishing vessel. The sports fishery involves fishing by using the "rod and reel" method.

Tuna licence holders charter their boats





## Bluefin Tuna



local buyers. It is then shipped to the Japanese market.

Typically, tuna caught off PEI weigh between 800 and 1,200 pounds (360 to 545 kilograms); however, higher weights have been recorded. Island tuna vessels also fish in several areas off the coast of Nova Scotia where the highly migratory bluefin can be found in large schools.

## HERRING

Herring are caught in varying amounts throughout PEI. They are fished by the use of gill nets which may be either secured to the bottom of the sea with the use of weights or left to drift.

The herring fishery has both a spring and fall season. The spring fishery occurs primarily in western PEI and can comprise up to 33 per cent of PEI's total herring landings. Spring herring is used mainly for bait in the lobster fishery, although some herring is also exported for processing into "bloaters" (smoked herring) and fresh to the United States.

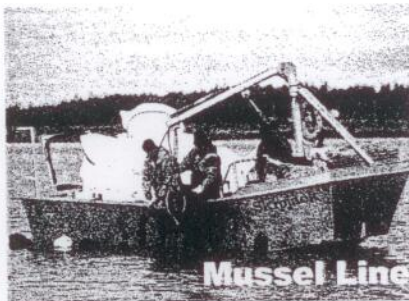
The fall herring fishery, harvested for the roe, occurs off southeastern PEI in the Fishermen's Bank area and also in the North Cape area of the western part of the province. Japan has provided the main market for fall herring products (roe). The remainder of the herring is sold for smoking.

## AQUACULTURE SPECIES

### MUSSELS

PEI rope-cultured mussels marketed under several trades including "Island Blue" are the primary aquaculture spe-

cies. Mussels are cultured in the cool, sheltered waters surrounding Prince Edward Island. They have become one of North America's most popular seafoods. PEI cultured mussels, second in value to lobsters, are grown in mesh socks that are suspended from buoyed rope longlines in the water. The longline is strung tight and anchored securely.



Mussel Line

Socks are filled with seed mussels and suspended from the longline. Harvesting occurs year-round including through the ice during the winter. Because cultured mussels are grown suspended in the water column, they taste sweeter and are more tender than "wild" mussels. They are also plumper, free of grit, have a higher meat yield and a much cleaner appearance.

## OYSTERS

PEI is very famous for "Malpeque" oysters. Although many people associate the Prince Edward Island oyster fishery with cultivation on leased grounds, the majority of the Island's Malpeques come from public fishing grounds. Oyster harvesters operating from small dories lift the oysters from the seabed with toothed tongs. Governments, in cooperation with shellfish fishermen's organizations, carry out an enhancement program to increase natural production. This program has been successful in increasing production substantially during the past 15 years.

There are two seasons in the public fishery - a spring fishery from May 1 to July 15 where oysters are harvested from marginally contaminated areas and relayed to dealers' leases for cleansing, and a fall fishery September 15 to November 30 where oysters are harvested for direct shipment by dealers to the market.

The primary producing grounds are in the western and central areas of Prince Edward Island. A large percentage of Prince Edward Island oysters are sold to off-Island markets where they are served fresh on the half-shell in the retail and food service sectors. In addition to the trade name Malpeque, many oyster shippers have developed their own specific brands.

Numerous leaseholders are active developing their leased grounds as well. Techniques employed include seed collection, nursery culture and grow out. Some leaseholders use floating bags to enhance the growth and survival of small seed. The production of cultured oysters has increased in recent years.

## FINFISH

The finfish species cultured on PEI include Atlantic salmon and rainbow trout. All finfish culture in PEI occurs in land-based tanks or in pond cages. The major component of the finfish culture industry is the export of high-quality, disease-free hatchery products such as eggs, fry and smolts. PEI has a modest but consistent meat fish production. Rainbow trout are cultured by Island growers for markets in the eastern United States and Canada. The popular market size is one to two pounds.

## NEW AQUACULTURE SPECIES

PEI has evaluated a number of potential species for aquaculture. Over the past 10 years government and industry have tested production technologies for sea scallops, quahaugs, soft shell clams, bay scallops, bar clams, artic char and striped bass. While sustainable commercial ventures have not resulted to date, a tremendous understanding of the production factors for these species was gained.

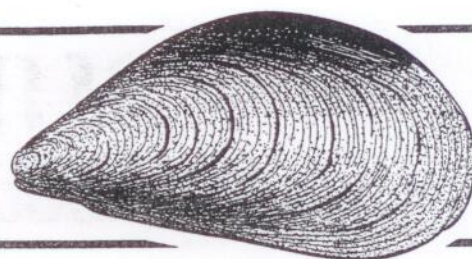
*Fishing and Aquaculture of PEI May/2007*

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# Aqua Info

## AQUACULTURE NOTES

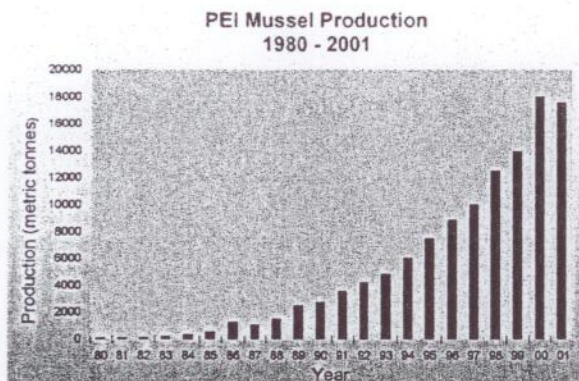


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## Mussel Culture in Prince Edward Island

### 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.

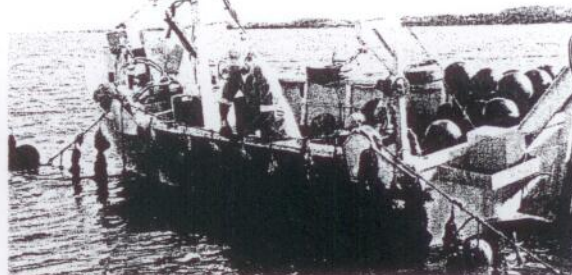
### Growing conditions

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  $-2^{\circ}\text{C}$  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





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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.

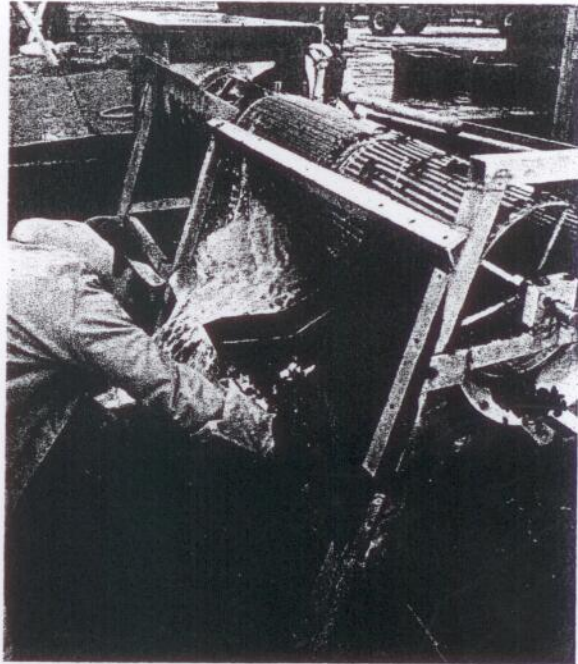
The mussel larvae settle on these collectors and grow rapidly, reaching sizes of 10 to 25 mm by fall. Care must be taken to provide adequate flotation of longlines to avoid mortality of seed by predators or fall-off during storm events.

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.

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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

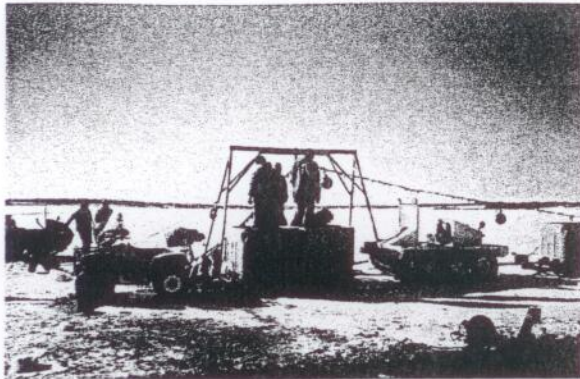
After 18 to 24 months, the mussels reach a marketable size of 55 to 60 mm. Each line will then contain nearly two tonnes of mussels.

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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#### For further information contact:

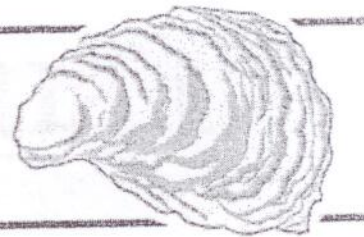
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# Aqua Info

## AQUACULTURE NOTES



AIN 18.2005

## Oyster Production in Prince Edward Island

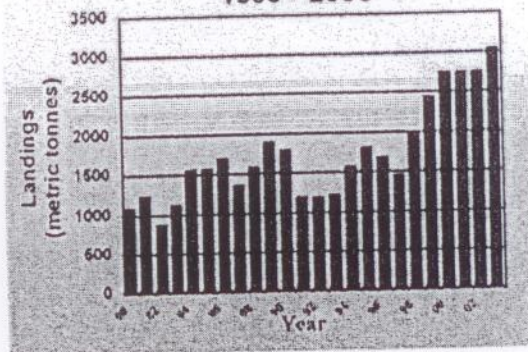
### Background

The oyster which is native to the North American Atlantic coast is commonly known as the Atlantic oyster, American oyster or Eastern oyster (*Crassostrea virginica*). In Prince Edward Island, this species has become synonymous with Malpeque Bay, well known for its production of the world famous Malpeque oyster. PEI is near the most northerly tip of the oyster's range. PEI's warm, shallow, food rich bays and estuaries provide excellent growing conditions for oysters. Oysters of the same species can have very different qualities due to local variation and the influence of the environment in which they grow. This is why the Malpeque oyster can be acknowledged for its superior flavour.

The oyster is the second most valued shellfish species grown in Prince Edward Island after the blue mussel (*Mytilus edulis*). PEI is the leading oyster producer in Eastern Canada, accounting for more than 80 per cent of the total landings. In recent years, annual production figures have topped three thousand metric tonnes with a landed value \$7.4 million. Although oyster landings and values fluctuate from year to year, PEI's oyster landings have increased 115 per cent in volume and 245 per cent in value in the last decade. PEI has a well-established market in Canada, selling the bulk of its production in Quebec and Ontario. In the past seven years, however, increasingly more oysters are being exported, principally to the United States. Less than five percent of PEI's total export goes to the overseas market. Most of the sales are *Choice* grade, served primarily in the half-shell and eaten raw at up-scale restaurants and oyster bars. Lower grade *Standards* are popular in Quebec. *Commercials* make up a small proportion of overall landings and they are often used in chowders or stews. There is also a small market for raw shucked

oysters packed fresh in plastic tubs for use in chowders or stews for both the restaurant trade and domestic use.

PEI Oyster Landings  
1980 - 2003



### A Lesson in History

The history of the Malpeque Oyster actually begins with its use by the Island's aboriginals as a food source. The fact that oysters have been found in Malpeque Bay for thousands of years is described in a speech in 1915 by Hon. A.E. Arsenault: "That oysters have existed in Malpeque and St. Peter's bays, and which in places are over 35 feet deep". In the late 1700s and early 1800s, Acadians who first settled the shore of Malpeque Bay had no market for oysters. Since the oysters were so plentiful, large quantities were spread over the land as fertilizer. The shells were also burned for the lime they produced, until 1832 when the province enacted a statute banning the practice. In 1868, another conservation measure banned the fishing of oysters from June 1 to September 1 during the spawning season. Before PEI joined Confederation in 1873, the Dominion of Canada granted licences or leases for the exclusive right of fishing oyster beds. The opening of the



Agriculture, Fisheries and Aquaculture



Intercolonial Railway in 1876 opened new markets for Malpeque oysters in Montreal and other parts of Canada. This meant an increase in production which put added pressure on the natural stocks. Production reached its highest level in the 1880s and 1890s.

By the turn of the century, Bedeque Bay stocks were decimated and as a result Malpeque Bay oysters were exposed to increased pressure. As many as 500 boats were engaged in the oyster fishery in Malpeque Bay at that time. Soon the oyster stocks declined to an extent that oysters were brought in from New England to bolster the industry. Little was it known that these oysters were the likely source of what had become known as Malpeque Disease.

Malpeque Disease devastated the industry with a mortality rate over 90 per cent. By the 1920s, oysters which appeared resistant to the disease were used to re-seed once productive oyster beds.

The development of an oyster research facility at Ellerslie on Bideford River led to a rebirth of the oyster industry. Culture methods were developed which forged the framework of PEI's present day success in Canadian oyster production.

### General Description

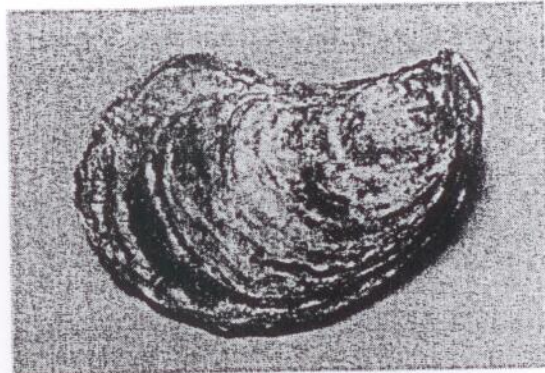
The oyster is a bivalve mollusc consisting of a soft body enclosed between two calcareous shells or valves, joined together by a tough ligament along a narrow hinge line.

The shell varies in colour but is mainly a mixture of grey, brown, white or green shades. The two valves are asymmetrical, the lower one is cupped to accommodate the body while the upper valve is flat and acts as a lid. A large adductor muscle attached to both shells controls the opening and closing of the shells.

Oysters require oxygen much like a fish - using gills and mantle. The gills play a major role in feeding by maintaining a steady water flow and filtering the water to collect food particles (plankton).

Selected food items are passed into a pouch-shaped channel surrounded by a digestive gland. Waste passes through a long, coiled intestine to be discharged by the exhalant current.

Oysters can feed on plankton almost continuously when conditions are favourable. The warmer the water, the more active the feeding up to about 26°C. A 10 cm (4 inch) long oyster can pump or filter 9-13 L (2-3 gallons) of water an hour. Feeding ceases when water temperatures drop below 4°C.



Choice grade oyster from East River, PEI

### Reproduction and Early Development

Oysters have separate sexes, but individuals can change sex during their life span. Spawning is triggered when water temperatures rise above 20°C (68°F) usually after mid-July.

Fertilization is external and within 24 hours the larva begins to form a shell, and develops a feeding and swimming organ. After feeding and drifting about in tidal currents for up to three weeks, the *veliger* larvae reaches about 300 microns and the probing foot seeks a site for attachment.

Larvae will set on many clean surfaces such as shell, stone, metal, brick, glass and plastic. Once it finds a suitable substrate, the foot secretes a cement-like adhesive. Material put out for oysters to attach to is called *culch*, the process of becoming cemented to the culch is termed *setting*, and once the larvae have set, the young oyster becomes known as *spat*. The young oyster now becomes immobile for the rest of its life, feeding only on what food the water brings, unable to escape overcrowding, or flee from predators.

### Growth

Growth is optimal from May to November at temperatures between 10-23°C with a recess in July for spawning.

Oysters continue to grow throughout their life span, but growth slows with age. Some oysters have attained a length of 38 cm (15 inches) and can weigh in excess of 1.35 kg (three pounds). The rate of growth varies by estuary. In PEI for example, growth is fastest in Bedeque Bay at up to 37 mm/year, it is moderate in East River, and it is slowest in branches of Malpeque Bay at 10 mm/year.

The shape and outer appearance of an oyster's shell reflect the conditions under which it has grown. Crowding produces shell distortions. On muddy bottoms and on over-crowded beds the



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shells grow long and narrow. On hard, sandy bottoms where there is no over-crowding, the shells grow round, and are deeply cupped, producing oysters of first-rate quality. In general, it takes an oyster between five to seven years to reach the minimum market-length of 76 mm (three inches), however with applied culture techniques four years is possible.

#### **Mortality**

Oysters have a number of predators which can devastate oyster beds and reduce production. A high proportion of the oyster larvae are consumed by other organisms feeding on the plankton community, including adult oysters.

The change from a free-swimming larval stage to a sessile life exposes juvenile oysters to new enemies. The most common predators of oysters are starfish, rock crabs, lobsters, mud crabs, oyster drills and moon snails. Adverse environmental conditions including prolonged exposure to freezing temperatures at low tide, heavy silt or marine plant growth (which can smother oysters), can result in heavy oyster mortality in some years. In addition to life forms that prey on oysters, there are those which compete with them for available food and space. Blue mussels, for example can be a major competitor in some areas. Three recent invaders to PEI waters, the oyster thief (1997), and clubbed tunicate (1998), threaten oyster production by fouling shells or gear, and green crab (1998) prey on oyster spat.

#### **Disease**

A large variety of diseases may affect the oyster, but the best known is the Malpeque Disease, which first appeared in Malpeque Bay in the early 1900s. This serious infection devastated oyster stocks in PEI and eventually spread to New Brunswick and Nova Scotia. The agent causing the disease is still present and virulent for weaker oysters although no outbreaks have been documented since the early 1960s. The cause of the disease is still being studied.

The PEI Fisheries and Aquaculture Division in cooperation with DFO monitors the health of oyster stocks in the province. A number of other disease organisms such as SSO (Seaside Organism) and MSX (Multinucleated Sphere Organism) both caused by a microscopic parasite have made an appearance in the Atlantic region in recent years. While SSO has been found at background levels in PEI, MSX has not been found outside its recent occurrence in Nova Scotia's, Cape Breton Island.

Oyster shells can be invaded by pests like the boring sponge (*Cliona spp.*) or bristle worm (*Polydora spp.*) making them unmarketable.

#### **Water Quality**

The Canadian Shellfish Sanitation Program (CSSP) which is jointly administered by DFO, the Canadian Food Inspection Agency (CFIA) and Environment Canada has the primary objective to protect the public from the consumption of contaminated shellfish by ensuring they are harvested from waters of acceptable sanitary and bacteriological quality. The classifications presently used to describe water quality conditions are approved, conditionally approved and closed areas.

#### **Oyster Fishing and Culture**

In PEI, the federal Department of Fisheries and Oceans (DFO) manages and regulates oyster harvesting.

A rather complicated set of regulations governs the oyster fishing seasons. Seasons differ for public and leased ground. For the public fishery, the spring season is May 1 to July 15 and the fall fishery is September 15 to November 30. The majority of oyster fishers hold both spring and fall licences.

There are also oyster spat collection licences issued for approved and closed areas as well as a few communal oyster licences that are issued to First Nations.

In 2002, DFO issued 1,841 commercial oyster licences, 189 spat collection licences and 88 aboriginal commercial licences. During the spring public fishery, commercial fishers can harvest oysters in contaminated public beds or closed areas. The oysters of at least 76 mm are sold to registered buyers who then relay them to approved beds on private leases in clean areas, or to a depuration facility for cleansing.

In PEI, the areas with the greatest concentration of oyster leases are Foxley River and Conway Narrows on the north shore; and Egmont Bay, East River and Orwell Bay on the south shore. The majority of oyster leases are bottom leases (84 per cent), the remaining 16 per cent being water column or off-bottom leases. In PEI, the 777 leases are held by 616 leaseholders (individuals or companies) of which approximately 350 are also registered commercial fishers. Overall, the oyster industry employs more than 1,000 Islanders.

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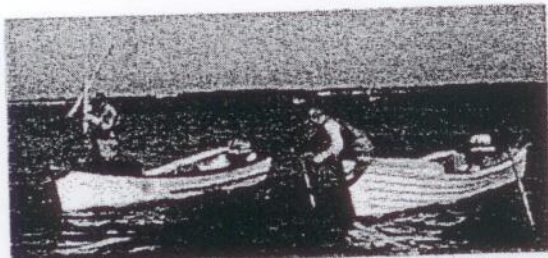
## Enhancement

The Fisheries and Aquaculture Division, the PEI Shellfish Association and leaseholders use a number of techniques to enhance oyster production. The division has conducted a shell-bed cultivation project on public oyster beds in the West and North rivers for the past 20 years. Specially designed cultivators towed behind a boat expose clean shell for oyster spat to settle on. Eighty to 100 acres of oyster ground is improved annually using this technique.

The PEI Shellfish Association also provides further improvements to the public oyster grounds through oyster seed replanting projects, shell mining and spreading, and shallow and deep-water oyster relays. Many leaseholders use similar techniques.

## Harvesting

The principal method of harvesting oysters is the use of rakes or *tongs*. Hand-picking is not permitted. TONGING is the oldest method used to harvest oysters in waters up to about 4.3 metres (14 feet). Tongs have long handles and curved teeth and are operated in a scissor-like fashion by hand from a dory.



Tonging oysters in East River, Prince Edward Island

After harvesting, oysters are culled, cleaned and graded. Clusters are separated and undersized oysters, as well as old shells, are returned to the beds.

Fishers can also collect spat from their own leases or approved spat collection sites or purchased from commercially licenced producers.

A wide variety of spat collectors are used, including Chinese hats, vexar sheets, drainage tiles, veneer rings and mollusc shells. The collectors are coated with cement and put in the water just before spatfall, around three weeks after the water warms above 20°C, generally in mid to late July. The division's Oyster Monitoring Program advises producers on the best time to place collectors in the water to ensure a good set and reduce the incidence of other unwanted organisms (sea squirts, barnacles, mussels) that can also attach to the collectors. Most

aquaculturists will separate the seed from the collectors during fall for grow-out elsewhere.

The seed oysters are then spread directly on the bottom or placed in specially designed protective materials such as vexar bags. In the previous year or two prior to harvest, oysters can be placed directly onto the bottom to improve shell thickness and shape. The off-bottom technique consists of growing oysters in suspension utilizing floating vexar bags or floating bags attached to longlines either singly or in special racks that may contain several bags.

The oysters are grown close to the surface during the summer months, hibernate in suspension under the ice in winter, and placed at or re-suspended to the surface the next spring.

## Processing

According to Canadian fish inspection regulations, oysters must be bought and sold according to specific grades, namely *Fancy*, *Choice*, *Standard*, and *Sub-standard* or *Commercial*.

There are 13 provincially licenced and federally registered processors of oysters in PEI. These processors also hold a plant registration from the federal Canadian Food Inspection Agency (CFIA) which permits the export of seafood products. In addition, a small number of provincially licenced processors provide oysters for the in-province or domestic market.

## Conclusion

Regulations and programs to manage, conserve and enhance the oyster fishery, as well as to protect the industry and public at large, are continuously being improved.

Numerous collaborative aquaculture and bivalve shellfish research projects assist the industry so that PEI oyster production will continue to maintain its fair share in the marketplace.

No other experience rivals that of consuming a Malpeque oyster in the half-shell.

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## Fun Fish Facts

- If you keep a goldfish in the dark room, it will eventually turn white.
- Fish don't have ears. They hear or feel vibrations along the lateral line of their bodies.
- Fish that live more than 800 meters below the ocean surface don't have eyes.
- A jellyfish is 95% water.
- One type of jellyfish has tentacles that can grow up to 100 feet long.
- The squid and the octopus each have 2 gills, 2 kidneys, and 3 hearts.
- Isn't the sea slug clever! It really has no defenses of its own, so it borrows weapons from other creatures. For example, it actually manages to swallow the jellyfish's sting cells, which then find their way to the sea slug's skin. Once there the slug uses them as if they were its own.
- Seals seldom sleep. In fact they have been known to swim continuously for eight months and travel 10,000 kilometers.
- Some sharks have a bad attitude even before they're born. While examining a pregnant sand tiger shark, scientist Stewart Springer was bitten by its embryo.
- During a lifetime a tiger shark will produce, use and then shed some 24,000 teeth.
- A shark can detect one part of blood in 100 million parts of water.
- A shark is the only fish that can blink with both eyes.
- The skin of sharks was once sold and used as sandpaper.
- Starfish haven't got brains.
- When a whale wants to change its line of sight, it must move its whole body because its eyeballs are fixed.
- The largest clam ever recorded weighed nearly 600 pounds.
- Electric eels produce enough energy in one shock to light up every room in your house.

\*<http://www.butlerwebs.com/animals/fish.htm#DID%20YOU%20KNOW?/>



## Fishing Industry on P.E. I Quiz:

1. Production of mussels comes from which end of the island?
  - A, West
  - B, East
  - C, North
  - D, South
  
2. What kind of line method is used throughout the province?
  - A, Suspended longline system
  - B, Suspended shortline system
  - C, Net lines
  - D, Long haul lines
  
3. The operation by which seed mussels are loaded into mesh is called...
  - A, Stuffing the sleeves
  - B, Storing and stocking
  - C, Sleeving and stocking
  - D, Filling up the pants
  
4. Once ready for harvest, each mussel line will have how many tones of mussels?
  - A, 1 tone
  - B, 4 tones
  - C, 9 tones
  - D, 2 tones
  
5. Why is continued research for mussels necessary?
  - A, To find the most effective way to produce large quantities
  - B, To optimize sustainable production of high quality mussels
  - C, To research and learn more about the little known mussel
  - D, To let universities contribute to the booming mussel industry



## Fishing Industry on P.E.I Quiz Answers:

1. B

2. A

3. C

4. D

5. B