Fisheries and Oceans
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# Underwater World

## The Soft-shell Clam



Canada

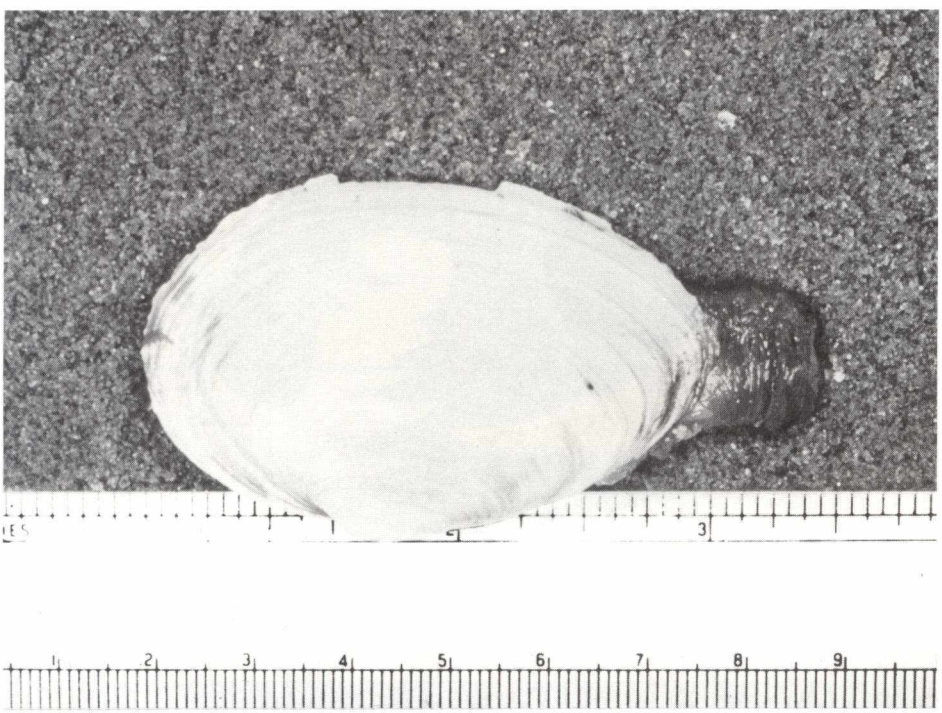
# The Soft-shell Clam

The soft-shell clam, *Mya arenaria*, has been an important resource for a very long time. Early records and archaeological evidence indicate that Indian populations indigenous to the Maritimes highly prized the soft-shell clam for food and jewelry. The presence and extent of shell heaps, called middens, some of which exceed two feet in depth and over several hectares, testify to the early importance of soft-shell clams to these people.

Later records show that early settlers also depended on the then abundant clam stocks to subsidize their nutrition in periods of privation. Clams were, however, never a mainstay in their diet. Since those very early times, soft-shell clams have been used as bait, fertilizer, ornaments, dishes and in some instances a form of currency. One of the first commercial uses of clams was not for food but for bait. In the mid-1800s, clams were harvested and preserved in brine to supply Grand Banks' fishermen with salt bait for the cod, mackerel and halibut fisheries. Over the years a more general and domestic usage and marketing of soft-shell clams took place. Landings increased and reached a peak of 10,525 metric tons (t) in 1950. Now production levels are considerably lower due to decreases in the size of commercial stocks resulting from over-exploitation and natural predation. Many previously open areas have been closed because of fecal coliform contamination from human or animal sources. Nevertheless with increasing public interest, combined with better preserving and marketing methods, the demand for clams remains strong. Now clams are sold for the fresh market and the canned meats for the fried clam, chowder and soup markets.

Although the term soft-shell clam is most commonly used for the species *Mya arenaria*, this same species is also known as: clam, soft clam, squirt clam, steamer and gaper (Fig. 1). The soft-shell clam of the Maritimes belongs to that group in the animal kingdom known as the phylum Mollusca. The Mollusca include all of the bivalves (two shelled) as well as the gastropods (snails) and, probably surprisingly to the non-biologist, the cephalopods (squids, cuttle-fish and octopii).

*Fig. 1 The soft-shell clam* Mya arenaria.



## Description

In general, the shell of *Mya* has a chalky white appearance. This coloration may appear somewhat gray or yellow in younger individuals due to an external covering called the periostracum. This covering tends to erode as the clam ages, resulting in the general white appearance. In some areas *Mya* will appear dark — almost black in colour. This somewhat unusual appearance reflects the high organic content of the muds in which the clam is living. The outer surface of the shell is covered with somewhat eliptical markings, some more pronounced than others.

These are the annual growth marks or rings which can be used to aid in aging clams. In general, the shell reaches a maximum size of about 10 cm in length but some have been reported to exceed 15 cm. At the posterior end there are two siphons (Fig. 2). This region has great extendability and is sometimes referred to as the "neck" of the clam. At the opposite end to the

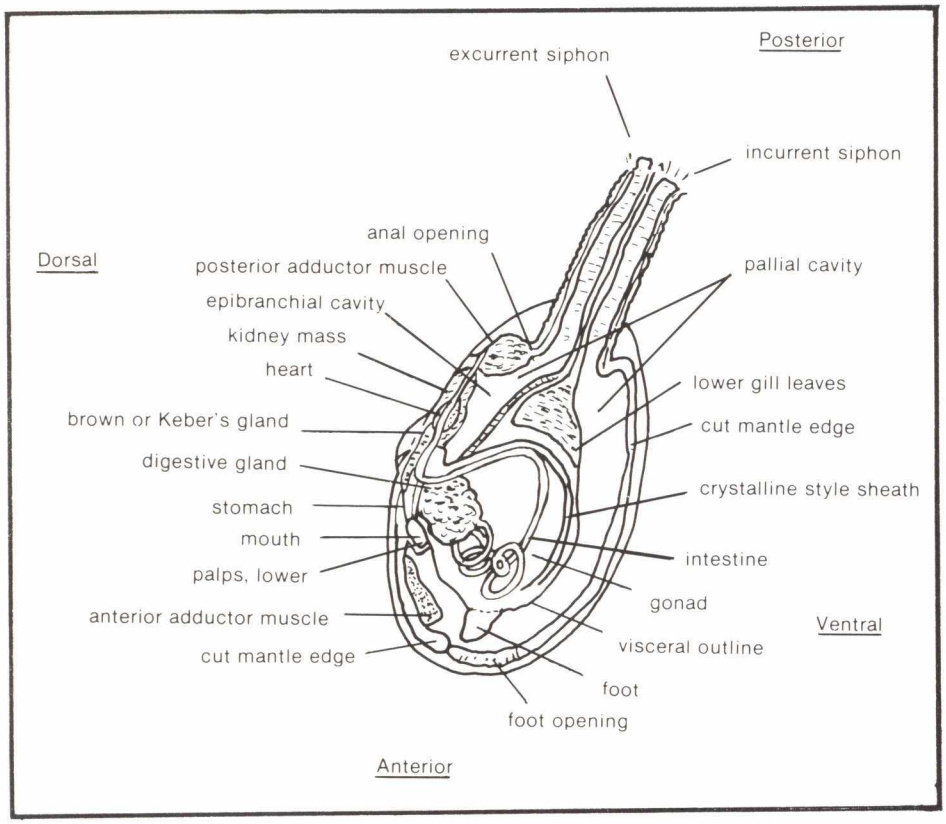



*Fig. 2 Internal anatomy of the soft-shell clam.*

siphons is the clam's foot. The foot is a muscular tongue-shaped organ capable of great expansion and contraction which enables the clam to burrow quickly into the sediment.

**Distribution**

The earliest fossil records of *Mya*, the genus to which the soft-shell clam belongs, date back to the Miocene Period, approximately 25 million years ago. Today, *Mya arenaria* is widely distributed in both North American and European coastal waters. On the east coast of North America the soft-shell clam ranges from the Labrador region to Cape Hatteras. It is abundant from Chesapeake Bay northward but becomes scarce south of North Carolina, U.S.A. In European waters it has been recorded from Norway to the Bay of Biscay, France. Surprisingly, throughout shellfish-loving Europe, it is not a sought-after species. *Mya arenaria* was not a species of the Pacific coast of North America until, around 1879, young *Mya arenaria* were accidentally introduced into San Francisco Bay, California, along with shipments of seed oysters transplanted from the Atlantic coast. Since that time they have spread south to the Monterey region of California and northward to Alaskan waters. This clam is also found along the western Pacific coast of Asia from the Kamchatka Peninsula, U.S.S.R., to the northern regions of the Japanese islands. They are found in suitable substrates throughout the marine intertidal of the Maritimes.

**Habitat**

*Mya* are found in bays and estuaries, intertidally and subtidally, to depths of about 9 m. They require a salinity of 5 parts per thousand to survive but do best at salinities in the range of 25 to 35 parts per thousand and at temperatures from 6° to 14°C. Normal sea water has a salinity of 34 parts per thousand. Clams live buried in bottom sediments; often in fine sands mixed with clay or with black muds of high organic content. They also occur in more gravelly soil and even in stony or rocky places, but in these latter areas they are generally rare and not in sufficient quantities to be of economic value. Being buried to depths of up to 10 cm, the soft-shell clam must use its siphon to pump water from the sea bottom above it in order to respire and feed. The siphon may be up to three times as long as the shell.

**Food and Feeding**

Soft-shell clams feed on microscopic plant and animal matter which is suspended in the water column just above the bottom. Through the beating of small hairlike cilia, a current is created which draws water through the incurrent siphon (Fig. 2). Up to 54 L of water may be filtered per day by each clam. The microscopic food, such as filamentous algae, diatoms, algal fragments and naked flagellates floating in the water, are then trapped within the body and passed to the mouth, again with the aid of cilia. After digestion, fecal material is released at the anus and is flushed out of the body through the exhalent siphon.

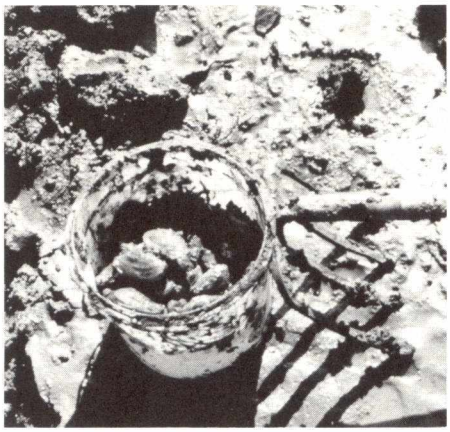


*Fig. 3 The clam hack or hoe used by fishermen.*

*Fig. 4 Fishermen using clam hack.*

*Fig. 5 Commercial digging on a clam flat.*

**Reproduction**

Soft-shell clams are dioecious, meaning that the sexes are separate. They mature at a shell length of about 2.5 cm which may be reached at an age of about two to three years.

As water temperature warms with the onset of summer, the gonads begin to grow rapidly and occupy much of the visceral cavity (the space enclosed by the shell). The gonads of both sexes are generally cream to yellow. By June the maturation of sperm and eggs is usually complete and spawning may occur with the proper stimulus. Generally, spawning peaks around mid-July, and, like many other intertidal invertebrates, is linked to the monthly tidal cycle and to water temperature. Fertilization is external; egg and sperm being released through the excurrent siphon, into the water column where they unite. The resulting fertilized egg develops into a larvae which remains in the plankton for a period of about two weeks. During this period the larvae feed on microplanktonic organisms in the water. At the end of this planktonic period, larvae undergo a metamorphosis into juvenile clams and settle to the bottom where they temporarily attach themselves to the sediment by byssal threads.

Soon they release their byssal attachment and begin to crawl about the bottom with the use of their highly extensible foot. When animals reach the size of about 6 mm they establish a permanent burrow. As the animal grows it burrows deeper, again through use of the highly extensible and mobile foot.

**Growth Rates**

There are many biological, physical and chemical factors which affect growth. In general, however, the soft-shell clam grows fastest in the late spring and early summer, then growth slows in the fall and may halt entirely in winter. The most rapid growth takes place over the first few years and declines markedly after four or five years. In the Maritimes, small clams grow about 3.0 cm in one year and larger animals grow about 0.9 cm.

**Enemies**

Soft-shell clams have many predators. Diving ducks, whistling swans, cormorants, gulls and even crows constitute some of the major bird predators. Fish such as rays, flounders, cod and sculpins will eat whole clams or sometimes just nip off their siphons. Their invertebrate predators include starfish, clam drilling snails and green crabs. In the early 1950s the green crab was a major predator of soft-shell clams in the Maritimes. Man is also a severe predator both in direct harvest and indirectly by killing many individuals as a result of the procedures used in commercial harvesting.

**Contamination**

Over the years, as a result of coastal development, a large number of estuaries and intertidal flats have become contaminated with fecal coliforms and other potentially harmful organisms. Because molluscan shellfish tend to concentrate these contaminants, many large and previously productive clam beds have had to be closed to fishing. However, clams can rid themselves of the contaminants if they are held in suitable conditions with clean seawater for a brief period of time; usually about 48 hours. This process is generally referred to as depuration. Depuration then, is the controlled purification of bacterially contaminated shellfish. It has been widely recognized as a means of increasing production through the utilization of marginally contaminated shellfish. Self-cleansing is an alternative method to depuration. In self-cleansing, shellfish are held in floating trays or placed on the sea bottom in areas having acceptably clean water. The principle difference from depuration is that the process is uncontrolled and hence somewhat less reliable. Neither depuration nor self-cleansing have been used in the Maritimes since the early 1950s, although successful depuration trials were carried out in the Annapolis Basin Area of Nova Scotia in the mid-1970s. There has recently been renewed interest in methods of cleansing shellfish and increasing the resource available for harvest.

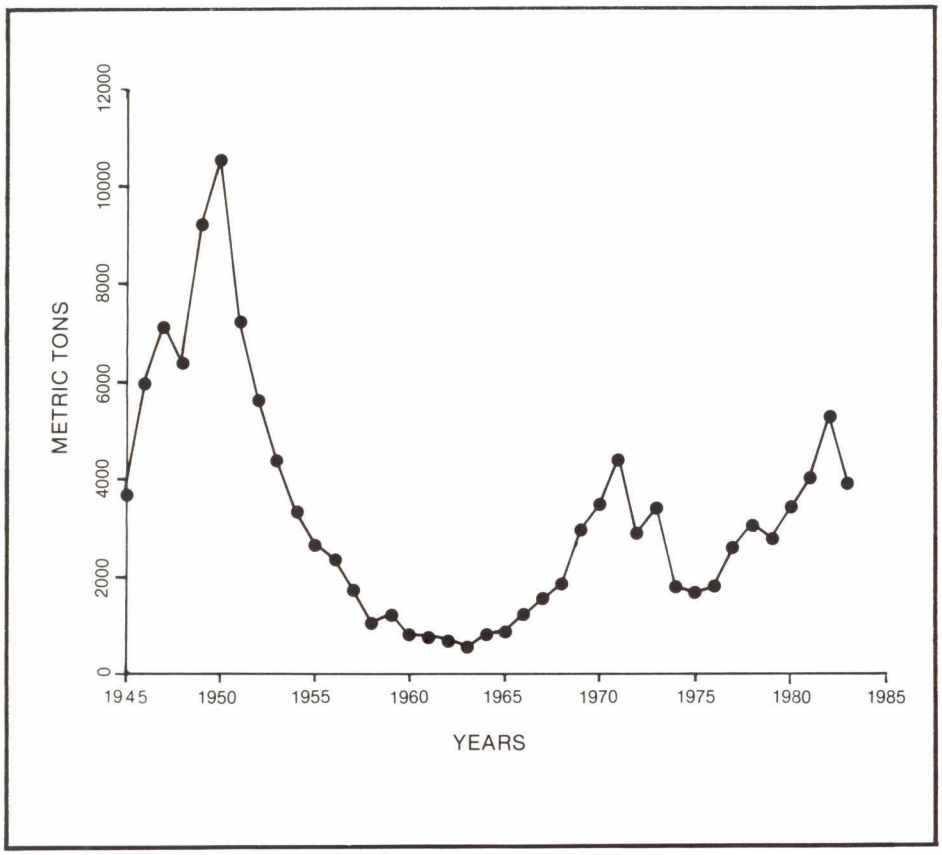



*Fig. 6 Record of soft-shell clam landings in the Maritimes from 1945 to 1983.*

During certain periods of the year, most notably the spring and summer, molluscan shellfish of all varieties may become contaminated with a toxin referred to as Paralytic Shellfish Poison (PSP). Consumption of clams highly contaminated with PSP may be lethal. The shellfish pick up this toxin from a dinoflagellate, a small microscopic plankter of the genus *Gonyaulax*, which they eat. Fortunately, not all clam-producing areas are affected and those that are, are well monitored by the Department of Fisheries and Oceans in order to detect the presence of toxins. When levels of toxins become elevated the clam fishery is closed to both commercial and recreational fishing. In areas where PSP or fecal coliform contamination present a risk, signs are posted on or near clam flats to notify the public. However, prior to harvesting in an unfamiliar area it is best to contact the local fisheries officer to verify whether the clam flat is open or closed.

The period of closure for PSP varies from year to year, but unlike contamination from fecal coliforms, the duration of closures for PSP is generally relatively short.

**History of Commercial Exploitation**

Clam resources in the Maritimes have been commercially exploited since at least the turn of the century. The harvesting methods have changed very little. Fishermen armed with a clam hoe or hack (Fig. 3) and containers follow the receeding tide to dig clams (Fig. 4a, b). The fishermen have about four hours to pick clams before the tide returns. They then sell their catch to a clam buyer who, in turn, sells to a processing plant. At the plant the clams are cleaned and shipped directly to retail markets or they may be shucked, washed and then canned.

Clam landings in the Maritimes reached their peak of 10,525 t in 1950 (Fig. 5). Subsequently there was a dramatic drop reaching a low of 555 t in 1963. This decline in landings appears to have been the combined result of overfishing and natural predation by the green crab. (This natural predator exhibited a dramatic extension of its range and a significant increase in numbers from 1950 to the early 1960s). Catches then rose steadily and reached 4,404 t by 1971. This was followed by another brief decline where catches dropped to 1,683 t in 1975. Since 1975 clam landings have continued to increase steadily to 3,910 t in 1983.

**Regulations**

The minimum size for harvesting soft-shell clams varies throughout the Maritimes ranging from 3.8 to 5.1 cm. Techniques of harvesting are also regulated. At present, regulations stipulate that no person shall fish for clams except with hand tools. However, there are provisions in the regulations which allow for the use of mechanical devices under special circumstances.

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