

Sea Cucumbers in Maine — Fishery and Biology

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INTRODUCTION

A new delicacy from the Gulf of Maine is tickling the taste buds of Asian consumers. Sea cucumbers, sometimes called "pickles", belong to a group of animals that include the starfish, sand dollars and sea urchins, and there is very little in their appearance that would



suggest seafood. The meat, however, which includes the body wall and longitudinal muscles, is highly prized in the markets of the far east and this has made the sea cucumber the latest in developing fisheries along the Maine coast. Worldwide, sea cucumbers have been harvested for many years, particularly in the tropical western Pacific and Indian Oceans. World landings amounted to almost 200 million pounds in 1989, about 5 million pounds of which came from the west coast of North America.

The rapid development of the sea cucumber fishery in Maine has raised a question similar to the one raised about the sea urchin fishery. How should we be harvesting this resource to ensure a continuous supply in the future? The answer will be difficult to come by. Just as the sea cucumber has been ignored as a commercial product in the past, it has been ignored as a subject of study by fishery scientists. Our knowledge of the biology of sea cucumbers and how their populations will respond to fishing is rudimentary at best.

For the time being, however, the sea cucumber offers a new economic opportunity for Maine's fishing industry.

THE FISHERY

The sea cucumber fishery and processing industry in Maine is a very recent development and it is believed to be the first time our local species has been used as a commercial product. It began in 1988 as a small operation in the eastern Maine community of Steuben for a period of five or six months. Although brief, this operation is said to have generated employment for 150 people. Later, in 1991, an experimental project was conducted by Dr. Alfred Bushway of the University of Maine and Pete Collin of Coastwide Research in Stonington who measured various parts of the sea cucumber for protein content.

Landings and Value

The fishery began in earnest in 1994 with the sudden availability of foreign markets. It is still small relative to other more established fisheries, but it is developing rapidly. About 3 million

pounds were landed during 1994, with a landed value of around \$150,000. Presently 9 or 10 boats are involved in the fishery, all from eastern Maine.

Sea cucumbers are landed whole in fish totes and the fishermen are paid by the tote rather than by weight. A fish tote holds between 130 and 150 pounds of cucumbers, but due to the composition of the animal much of the weight is sea water. Generally, the final product will be only about 10% of the original body weight if all usable parts are marketed. The price during 1994 ranged from six to eight dollars per tote, or about five to six cents per pound.

Sea cucumbers are presently harvested over rocky bottoms in nearshore waters of eastern Maine. Large, dense beds of animals are reported to be in the area and obviously reflect a virgin population. Most of the harvesting is done in eastern Maine because at the present time that is where the processors are located. Harvestable sea cucumber populations, however, are also reported to be found in other nearshore locations along the coast.

The scallop drag is the gear used to harvest cucumbers, although diving would also be a potential harvesting method. The boats and gear used are the same type employed in the scallop fishery; the boats vary in size between forty and ninety feet. A typical days catch ranges between 70 and 200 totes per day.

Although sea cucumbers "on the hoof" are a very low priced resource, the processing can be labor intensive and therefore there is considerable opportunity for employment in this fishery and value added to the final product.

Products and the Market

In Maine, sea cucumbers are handled in two ways. They may be loaded onto refrigerated trucks at the dock and shipped to Seattle where they are processed, or they are processed in Maine and the product shipped to the far east. In 1994 there were three companies in eastern Maine that processed sea cucumbers. Collectively they employed about 140 people. Given the market potential, the processing capacity will probably expand in the future.

In Maine, a common method of processing is to scrape off and wash the muscles and then vacuum pack and flash freeze the product for shipment to markets. Another type involves cutting the animal open and removing the viscera, while leaving the muscles attached. The cucumber is then dried in this form and shipped. This product can be re-hydrated and used as fresh.

Processors that use only the muscles removed from the bodies are faced with large amounts of waste, as the muscles only account for three to five per cent of body weight. Disposal of this waste is difficult and can be expensive. The skins are a major portion of this waste. A recently found alternative use of the skin is as a protein supplement in animal feeds, as well as a specialized fertilizer.

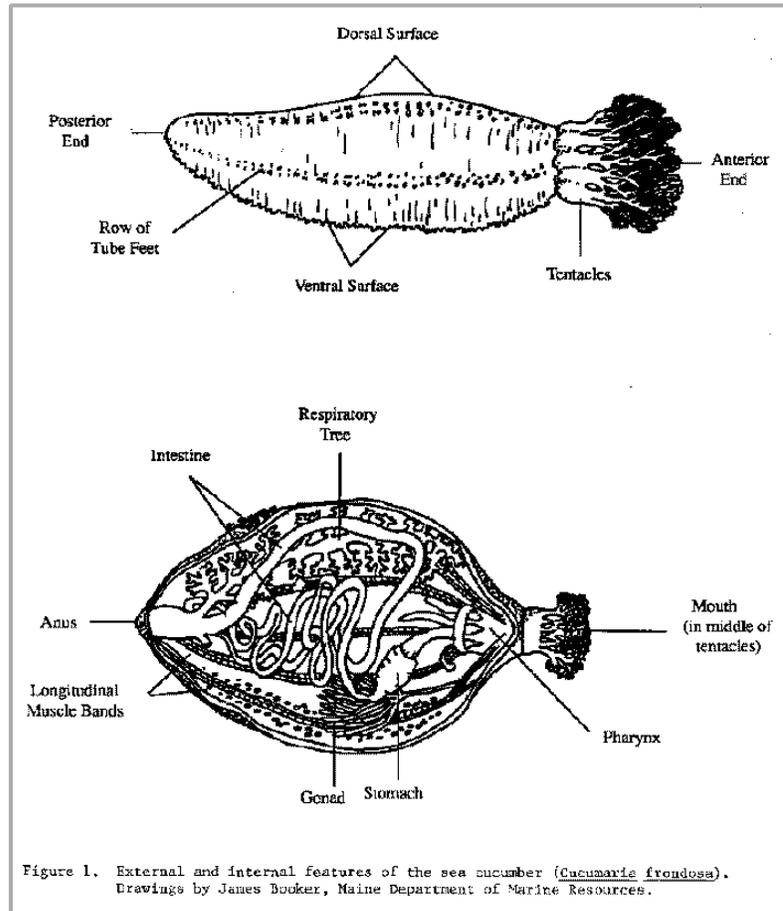
The market for Maine cucumbers is in China and to a lesser extent in other countries of the far east. Most of the world's production of cucumbers is imported by Hong Kong and Singapore and in turn exported to China. The most important product on the world market is the dried body wall

of the cucumber which is consumed in China as "trepang" or "beche-de-mer". It is used in soups or stir-fries. There is also demand for just the muscle, raw and flash frozen.

BIOLOGY

Sea cucumbers belong to a group of echinoderms called holothurians. They are sluggish, tube-shaped, bottom dwelling animals that are found worldwide. There are several species of holothurians in the Gulf of Maine but the one most commonly found nearshore, *Cucumaria frondosa*, is the subject of this new fishery.

C. frondosa is a cold water animal found along the western Atlantic coast from Greenland to the northern shore of Cape Cod. In the Gulf of Maine it can be one of the most abundant benthic animals found over rocky bottoms and in some local areas may account for 50% of the benthic biomass. It is most common in depths of less than 100 feet of water and it prefers to cling to hard surfaces, but can be found in coarse gravel or shell debris.



C. frondosa does look very much like a cucumber (Figure 1). It has a long, cylindrical body with greenish to brownish, leathery skin and five rows of tube feet which are used for locomotion and attachment. At one end is a mouth with a circle of branching tentacles and at the other an anal opening. The animal lays on its side so the ventral side, which comes in contact with the bottom, has well developed tube feet for attachment, while on the dorsal side the tube feet are less developed. The body is extremely flexible and can be tightened into a knot when stressed or loosened into a long tube when relaxed. The relaxed bodies of larger individuals may reach almost 20 inches.

The internal organs of the cucumber lay within the tube-like body chamber surrounded by the skin and a layer of longitudinal muscle bands. It is the skin and muscle bands that are the edible part of the animal. The internal organs consist of the digestive system for food processing, the gonad for reproduction, the respiratory trees for the removal of oxygen from the water, and a nerve ring that directs the operation of the muscles and tentacles. The cucumber is capable of

eviscerating (casting off) its internal body organs during times of stress which can later be regenerated.

The sea cucumber is a non-selective suspension feeder, taking its food indiscriminately from the surrounding water. The small bits of detritus and microscopic organisms that are floating just above the bottom are trapped by the cucumber's tentacles. There are ten tentacles that are covered with a sticky mucous and are extended in the water until they are filled with food particles. One at a time the tentacles are then placed in the mouth opening where the food material is scraped off. When feeding, the animal always orients itself into the prevailing water current in order to take full advantage of the available food supply.

The sexes are separate, but microscopic examination of the gonad is the only reliable way to distinguish males from females. The gonad is located along one side of the body cavity and begins to produce eggs or sperm in the fall for the next spring's spawning season. Spawning occurs from about late March to mid-April and coincides with the spring plankton bloom. At this time the eggs and sperm are released into the water column where the eggs are fertilized and develop into a brief larval stage, at which time the animals are bright red, planktonic and called a "pentacula". By the end of May the larvae have evolved into juveniles and settled to the bottom.

From here on we know very little about the age and growth of the sea cucumber. After settlement the juveniles appear to hide among the rocks until they are 2"-3" long. Here they are relatively safe from predators and commercial drags. Practically nothing is known about the rate at which they grow or how long they live, except that their life span does appear to exceed seven years. The age at sexual maturity may be 4 to 5 years but that is not more than an educated guess.

THE RESOURCE

Like many previously underutilized resources for which markets emerge suddenly, there has been practically no population information collected on sea cucumbers. The size of the population, the time it takes for year classes to grow to sexual maturity and to commercial size and the rate at which populations are being exploited are pieces of information that are needed to make rational management decisions.

From all reports there are large areas of bottom along the coast where sea cucumbers are abundant and for now the fishery is exploiting virgin stock. The only regulations that apply to this fishery are the requirement to have a commercial harvesters license, a drag no larger than 5'6", and no nighttime dragging. The drag size limit was implemented to avoid conflict between cucumber harvesters and lobstermen.

In contrast to Maine's emerging fishery, Washington State has an established cucumber fishery that is harvested by divers. It began to decline due to overfishing in the late 1980's. At that time several measures were put into place that seem to have stabilized the resource. These measures included a six month fishing season, limited entry, and a rotation of harvest between four areas to give the resource a 3 1/2 year period for reproduction.

Pressure on the sea cucumber resource is likely to increase in the future, given the viability of the market and the likely shift in effort from other Maine fisheries that have been overexploited. The choice will be to harvest as much as the demand will allow, make the money as long as the resource lasts and then move on, or to harvest in a more limited way and have a stable resource available over time.

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