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COMMERCIAL CLAMS OF THE PACIFIC COAST OF THE UNITED STATES

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There are about 500 different kinds of bivalve mollusks living on our Pacific Coast. Of these 35 species are edible clams and only several are commercially important. Others either do not reach a sufficiently large size to be used as food or are found in very limited numbers to maintain the fishery.

RAZOR CLAM

Although the range of distribution of the razor clam, Siliqua patula, is from Pismo, California to the Bering Sea, it occurs in commercial quantities only from the Columbia River to the western extremity of the Alaska peninsula. The most productive beds are those extending from the Columbia River to Copalis along the coast of Washington; the Queen Charlotte Islands in British Columbia; and in Alaska in the waters of Orca Inlet, the Copper River delta near Cordova, Cook Inlet, and the mainland side of Shelikof Straits. In 1943 the U. S. fishery for the razor clam yielded 1,742,753 pounds of clam meats valued at \$144,774. Razor clams account for approximately 65 percent of the total clam take on the Pacific Coast.

Razor clams live in the intertidal zone where they lie buried in the sand with their necks, or siphons, protruding above the surface. During the low water stages, when the clams are exposed, their siphons are covered with a thin layer of sand which makes detection of the clams difficult. The clams can move through the sand very rapidly averaging several feet per minute. Their unusual ability to move so fast is due to their foot, which is a very effective burrowing organ. In digging, the foot of the clam is projected half the length of the shell and pushed into the sand. Below the surface the tip of the foot expands forming a strong anchor. Then the foot muscles contract pulling the clam downwards. The clam can repeat this movement in rapid succession. It has been observed that clams laid on the top of the sand have buried themselves completely in less than seven seconds. When the tides are very low and the water drains out the clams cannot move at their normal speed.

Spawning of razor clams begins soon after the water temperature reaches 55.0 or 58.0 F. On the Washington beaches the clams begin spawning during the second half of May and in early June. In Alaskan waters the beginning of spawning is from 2 to 3 weeks later. Spawning continues for several weeks. The discharged eggs are fertilized in the water and soon develop into small swimming animals known as clam larvae. The larva undergoes gradual development and finally acquires the shape of a clam, loses its swimming ability and sets on sandy beaches, which become its steady habitat. In the years of heavy setting as many as 1450 young clams were found per each square foot of the beach surface. However, heavy mortality among young clams is very common. Therefore, a successful setting does not necessarily mean that the clam population of the beds will be markedly increased.

The clams grow at different rates in different localities. On the southern beds, such as Copalis Beach, there is a very rapid initial growth rate which, however, after several years also declines very rapidly. Therefore, the southern clams show a smaller final size and a shorter life span than those of the northern beds. The young Washington clams reach the size of approximately 2 centimeters by the end of the first winter, while the Alaskan clams from the Cordova district reach the size of only 1/2 centimeter. The size of 4-1/2 inches is reached in 3-1/2 years in Washington and approximately 6-1/2 years in Cordova. This difference in the rate of growth is due to the shorter growing season of Alaska, which is roughly 1/2 as long as in Washington. The maximum age for the Washington razor clam is about 12 years while those from Alaska may reach the age of 17 or 18 years. In the younger specimens size is a fair indication of age. The two-year-old and the four-year-old clams from the same bed are greatly different in length, but the difference between 9-year-olds and 18-year-olds may amount to very little.

The clams are dug at low tide by commercial diggers and in many places by a large number of tourists. The diggers walk slowly along the beach, hitting the sand with the handle of a long narrow-bladed shovel. The vibration causes the clams to start downward and the sudden withdrawal of the body and siphon leaves a characteristic hole on the surface of the sand. At this point the clam should be rapidly spaded out or it will be beyond reach.

Most of the commercial catch of razor clams is canned. A small part is marketed fresh, as shucked meats. The meats have also been frozen in packages. Considerable quantities of clams are now used by commercial fishermen for bait.

No artificial propagation or culture of the clams appeared to be feasible. However, protective measures, such as closed seasons, closed areas, bag limits and especially size limits may help to maintain the fishery.

BUTTER CLAM

The butter clam, Saxidomus nuttallii, also known as the "Washington clam," "big clam" and "money shell" (because the California Indians used the shells for money) ranges from San Diego to Humboldt Bay. It lives in the mud flats of many bays and inlets burrowing from 8 to 10 inches below the surface of the mud. Occasionally it reaches the size of 9 inches. Because of their size and firm white meat, butter clams are considered among the finest of the bay clams. On hard bottoms or in gravel they are dug with a shovel during the low tidal stages, but on soft sand usually a clam hook is used.

Clam diggers do not distinguish between this clam and the very similar but small S. giganteus, the range of which extends north from Humboldt Bay and which is quite common on the beaches of Puget Sound, British Columbia and Alaska. In British Columbia it is the most abundant species of clams and is used most extensively for canning. In 1942-43, 2,893,222 pounds of these clams were taken there. In 1944 the butter clam fishery of the United States yielded 476,444 pounds of meat valued at \$9,647.

No extensive studies of the habits of butter clams have been made so far but, in general, it is known that their life history resembles that of other related species.

SOFT-SHELL CLAM

The soft-shell clam, Mya arenaria, also known as "long clam," "mud clam" and "eastern clam," is not a native species but was accidentally introduced from the Atlantic Coast, about 1870, with shipments of eastern oysters to California and Washington waters. Later it was planted in several other places and soon spread along the coast. Because of the favorable conditions found for its existence, it rapidly multiplied and became one of the most important of the commercial clams of the Pacific Coast. In 1943 the soft-shell clam fishery produced 14,900 pounds of meat worth \$2,794.

The biology and life habits of the soft-shell clam are well known from studies made on this species on the Atlantic Coast. A brief description of these is given in Fishery Leaflet No. 13 devoted to the life history and cultivation of this clam. Here it is sufficient to say that the soft-shell clam can be easily cultivated in many bays and harbors of the Pacific Coast, and that its farming may be a very profitable business. In some places, as in San Francisco Bay, it may be necessary to fence the beds to protect the clams from skates or the sting rays which destroy these mollusks in large quantities.

PISMO CLAM

The pismo clam, Tivela stultorum, is found in the States of California and Oregon. Recently a Mexican fishery for this clam has developed in lower California. The clams are found on sandy beaches exposed to the heavy pounding of the surf. During stormy weather the clams dig down to a considerable depth to avoid being washed out, but normally they burrow in the sand at depths about equal to the length of their shells, which in large specimens reaches 7 inches. They usually orient themselves in the direction of the wave action with the hinge toward the ocean. Although they are not as active diggers as the razor clams, they can, nevertheless, move rather rapidly.

A number of years ago these clams were so plentiful that they were turned out of the sand at low tide with teams and plows and used to feed hogs. Now, however, because of the intensive fishery the clam population has been considerably reduced and in 1943 only 11,400 pounds valued at \$3,490 were gotten by commercial diggers. Campers and tourists also take a large number of these clams.

The clams spawn in late summer. A single large female may produce as many as 75 million eggs, which are about 1/360 of an inch in diameter. The growth of the pismo clam shows a definite seasonal rhythm which is quite rapid in the summer and very slow in the winter. In general, it is a very slow-growing form requiring from 4 to 7 years to reach its present legal size of 5 inches. The clam may continue to grow until it is at least 15 years old.

Among the natural enemies of the young and adult clams are various marine snails, starfish, birds and rays. Certain physical causes, such as frosts and storms, may sometimes cause the destruction of many small clams. However, the present decline of the fishery could be largely ascribed to overfishing and to some extent to pollution.

LITTLE-NECK CLAM

Little-neck clams (Paphia staminea) are found from Alaska to Mexico on sandy beaches and on gravel bars near the entrances of bays and inlets where they burrow to a depth of 3 to 8 inches. They usually do not occur in deep soft mud. The average marketable size is about 2 inches but a size of nearly 3 inches may be reached. These clams are also known as "rock cockles."

In some localities, as in Puget Sound and British Columbia, these clams form beds, sometimes of considerable extent. Because of their comparatively small size and their ability to keep their shells tight together for a long time the little-neck clams are most suitable to be sold in fresh condition. In 1942 approximately 146,000 pounds of these clams are harvested in Washington and over 200,000 pounds in the waters of British Columbia.

HEART COCKLE

The heart cockle, Cardium corbis, is found on tidal flats in inlets and bays and also on sand and gravel beaches from the Bering Sea to Mexico being most common in British Columbia and Puget Sound. The cockles live on the surface of the flats, or just beneath it in semi-liquid sand. They are active diggers and can dig in quickly with their large foot, but their short siphons do not allow them to burrow to any great depth.

The cockle is hermaphroditic, i. e., it produces male and female cells which are usually shed simultaneously. Sometimes, however, the eggs are discharged first, while the male cells are discharged later in the season. Spawning usually begins in the spring and continues for some time. As in the case of the razor clam, the rate of growth of the southern cockle is more rapid than the rate of those of colder water. However, it is believed that the cockle seldom reaches an age older than 7 years.

Cockles are tasty but, unfortunately, they cannot be found in large enough quantities to be an important commercial species.

CAPER OR HORSE-CLAM

The gaper or horse-clam (Schizothaerus nuttallii) is a large clam which grows to 8 inches in length and 4 pounds in weight. Its range of distribution is from Alaska to San Diego. It lives in the mud bottoms of most of the bays and inlets from 1 to 3 feet below the surface. With exception of the geoduck, this is the largest clam of our Pacific Coast. This clam is also known under the names of "summer clam," "rubber-neck clam," "big-neck clam," "otter-shell clam" and "great Washington clam."

The shells of the gaper are thin and are incapable of closing tightly over its large body. The siphon or, as it is commonly called, "neck" is large and long, protected by a tough brown skin and by two horny valves at the tip, a device not found in any other of the common clams. The body proper is quite small in comparison with the siphon. The meat is white and has a very fine flavor. The muscular siphons are also utilized in chowder after being pounded or ground into small pieces. In olden days the Indians dried the siphons for winter use. In 1942, 2,600 pounds of horse-clams valued at \$578 were taken from the waters of California and over 8,000 pounds from British Columbia.

GEODUCK

The geoduck, Panope generosa, lives deep in the unshifting sand and mud bottoms of sheltered bays from Alaska to Mexico. It is usually found on the mean low water line or somewhat below. It is the largest of our clams; individuals more than 8 inches long and weighing more than 10 pounds are not uncommon.

The geoduck lives in a semi-permanent burrow that is often 3 or 4 feet below the surface, sending its long siphon upward. Any disturbance in his neighborhood causes the geoduck partially to retract his siphon. Further disturbance causes further retraction of the siphon but because the shells of the geoduck are not large enough their siphons cannot be completely withdrawn into the shell.

Because of the condition in which the geoduck lives it is comparatively safe from all of its enemies except man and has no need for much activity. Contrary to popular belief it is an extremely poor digger. No commercial fishery is conducted for the geoducks and they are protected in many areas by a low bag limit.

SANITARY CONTROL

Clams, like all other shellfish that can be eaten raw, are subjected to rigid sanitary regulations and inspection exercised by the Federal and State health authorities. The laws prohibit the removal of clams from waters which do not meet definite standards of purity. Clams gathered from certified areas and opened at shucking houses are examined and must comply with bacteriological and chemical standards set forth by the health authorities. Employees of the shucking houses must undergo frequent medical examinations. Persons found suffering from contagious diseases are not permitted to handle fresh clams. The shucking houses and their equipment also are inspected periodically by municipal and state sanitary authorities.

Although the mollusks described in this leaflet are good to eat, it must be remembered that at certain seasons of the year they should be used for food with great caution. In the summer the water along the clam beaches may contain a large number of minute organisms which give it a reddish color. The clams that feed on these organisms may become poisonous to people who eat them. This illness, known as "mussel poisoning," although it may originate from eating mollusks other than mussels, has been recorded from scattered points of the Pacific Coast. In some states every season the Board of Health or fishery authorities announce the time when it is safe to eat clams.

Regulation of the Clam Fisheries

The clam fisheries in every state are regulated by special organizations, usually the State Fishery Commissions or Boards. These organizations introduce and enforce the laws directed to protect the fisheries. They may require digging clammers and sometimes tourists to acquire a license for digging clams. They may also establish closed seasons,

bag limits and size limits for each species. Persons interested in digging clams for pleasure or profit should inquire at their State Fishery Boards concerning the existing laws in regard to the species which they intend to take.

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