PART XX.

THE OYSTER, SCALLOP, CLAM, MUSSEL, AND ABALONE INDUSTRIES.

By ERNEST INGERSOLL.

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PART XX.

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By Ernest Ingersoll.

1.—THE OYSTER INDUSTRY.

1. INTRODUCTION, DEFINING AMERICAN OYSTERS.

It is now settled that along the Atlantic coast of the United States there is only one species of oyster, under the name *Ostrea virginica* of Gmelin.

Great dissimilarity can often be seen when one compares two specimens of different ages, or grown at localities widely separated, or in waters of unequal depth and temperature, upon unlike bottoms, or under some other contrasted set of circumstances. Out of this diversity, inevitable to our great extent of north and south coast line, the early naturalists were deceived into naming several species, such as "*borealis*," "*canadensis*," &c., which they supposed to be distinct from one another; but a more extended knowledge has shown that all these grade into one another indistinguishably. "All the various forms," says Prof. A. E. Verrill, of the U. S. Fish Commission, "upon which the several nominal species, united above, have been based by Lamarck and others, often occur together in the same beds in Long Island Sound, and may easily be connected together by all sorts of intermediate forms. Even the same specimen will often have the form of *borealis* in one stage of its growth, and then will suddenly change to the *virginiana* style; and, perhaps, still later, will return to the form of *borealis*. Or these differences may be assumed in reverse order."

This eastern oyster is to be met with, almost without a break, from the northern shores of the Gulf of Mexico northward to Massachusetts Bay. Beyond this it occurs only in a few almost extinct beds on the coast of Maine and Nova Scotia, but reappears again in abundance in the southern part of the Gulf of Saint Lawrence and around Prince Edward Island.

On the Pacific coast, as might be expected, the oysters are different from those of the Atlantic. From California northward occurs the *Ostrea lurida*, commonly known as the "Shoalwater Bay oyster"; while southward, even as far as Ecuador, there flourishes the little *Ostrea conchophila*, reaching its best development in tropical waters.

The full natural history of the species on the Pacific coast is not known. But in respect to the eastern species it has been fully worked out by Mr. W. K. Brooks and Mr. John A. Ryder within the past few years. All the details of the development of the egg and the growth of the young may be found in the writings of these gentlemen since 1880 in the reports of the U. S. Fish Commission, the Maryland State Fish Commission, and the biological publications of the Johns Hopkins University. The general results can only be sketched here in a single paragraph.

It appears that among American oysters there is no distinction of sex, each individual producing one year either spawn (eggs) or the fertilizing milt (spermatozoa), under influences hidden

to us, and the next year the same or perhaps the opposite. By early summer (or later in more northerly latitudes and cooler water), the eggs have ripened in the ovaries of such as are taking the rôle of females for the time being, and gush out into the water in a milky cloud. At the same time spermatozoa are emitted by the males. Both eggs and milt float near the surface of the water and their future depends on an almost immediate and wholly accidental meeting, so that only a very small percentage of the eggs are fertilized before their vitality is lost. Development proceeds rapidly, and in a few hours embryos are hatched and swim about by means of circlets of filaments, called *cilia*, surrounding them. Undergoing speedy growth and change of form, only a few hours pass before they begin to sink to the bottom.

During all this time both eggs and embryos are exposed to a great variety of perils. Sudden changes of temperature and storms are liable to destroy them at a stroke, and they form the food of a long list of marine animals. The moiety which survives to be hatched, and then to sink toward a hoped-for resting place, must face a new danger, for their subsequent life depends upon their avoiding on the one hand an oozy bottom, where they would be smothered, and, on the other, the insecurity of shifting sands. It is necessary that the soft and still microscopic embryos find some solid surface, uncoated with slime, where their filaments may take firm hold and make a firm attachment.

By the time this has been safely accomplished by the "lucky few" out of the crowd of swimming embryos, their companions have exhausted their day of life, or met with some fatal mischance. Every moment witnesses a thinning of the ranks, and shows the necessity of the great supplies of eggs put forth by the mother. Even where the embryo has secured a foothold upon some submerged pebble, or stranded log, or the surface of an old reef, he is still exposed to the danger of being eaten by crabs and fishes and various other depredators. His danger constantly decreases, however. The fewer—perhaps now only a score or so—individuals there are left out of the million or two eggs emitted by the one parent, the more carefully nature guards and cares for them. A few months later the surviving oysterlings have been clothed in an armor stout enough to resist all but a small number of enemies, no more in proportion than it falls to the lot of all animals to encounter in the "struggle for existence."* Various circumstances combine to make the settlement and growth of oysters concentrate at certain favorable points. These congregations of oysters, crowding one another side by side, each generation capped and overborne by the settlement of ensuing ones, form great stony masses in shallow inshore waters, called "grounds," "bars," "reefs," or "rocks." Each of these names is appropriate, since the colonies are often widespread, may oppose barriers to navigation, and are likely to become solid masses of rock through excessive growth and the crushing, solidifying, and cementing action of the sea, which grinds down their protuberances and fills their hollows with stony freight.

2. GEOGRAPHICAL DISTRIBUTION OF AMERICAN OYSTERS.

Having seen that, after his brief embryo stage of freedom, the oyster becomes a fixed and motionless creature, growing in reef-like masses or "beds" along the sea margin, let us now sketch the condition of these oyster-beds on the eastern coast of the Union as they appeared when first discovered by Europeans. This will lead to some notice of the use made of them by the native races of the continent, and form a basis for an inquiry as to the effect which the civilization of the country has upon their quantity and distribution. Let us begin at the north.

GULF OF SAINT LAWRENCE.—The Gulf of Saint Lawrence occupies a huge bight, Gaspé and Anticosti Island on the north and east and Cape Breton on the west. Down in the bottom of the

*A complete popular account, with illustrations, of this early life of the oyster may be found in the present writer's book "Country Cousins," published by Harper & Brothers, New York.

bight lies Prince Edward Island, between which and the mainland flow the shallow currents of Northumberland Strait.

The shores of this region are, for the most part, low bluffs of reddish soil and sloping meadows. Many rivers come down out of the interior, and at the mouth of each there is a shallow estuary or inlet, usually protected from the swell of the outer sea. This condition of things seems highly favorable for oyster growth, since nearly all of these inlets contain colonies of these mollusks, both on the mainland and engirdling Prince Edward Island, except at its western end. On Cape Breton oysters were plentiful throughout the Bras d'Or, and their remains exist at several points on the ocean coast of Nova Scotia.

Probably many of these beds had ceased to be productive long before Europeans arrived, and the region now seems to be slowly becoming less adapted to oyster growth.

THE GULF OF MAINE.—Having passed the peninsula of Nova Scotia we enter what has been called the Gulf of Maine, that great inward bend of coast between Cape Sable and Cape Cod. Between these limits oysters were so rare that so well informed a naturalist as A. A. Gould, in his "Invertebrates of Massachusetts," expressed himself in doubt as to whether they ever had been indigenous north of Cape Cod.

The evidence that this is a mistake, and that formerly oysters grew naturally in the Gulf of Maine, is found partly in the allusions of the early chroniclers, but more strongly in the remains of beds now extinct, and in the relics of Indian oyster-fishing.

When the earliest explorers landed upon the shores of North America, they found that the Indians ate all the various shell-fish we now make use of. They understood the superior value of the clam and oyster, and everywhere along the New England coast were accustomed to assemble at favorable points and have feasts of mollusks and maize, with much merry-making. That fine old institution of Rhode Island and Connecticut, the clam-bake, almost the only thing that was allowed to warm the cockles of a Puritan's heart, and still the jolliest festival in summer experience alongshore, perpetuates this practice of the aborigines.

The red men along the Gulf of Maine were not so blessed as those of more southerly latitudes in respect to a supply of this food, but utilized their privileges as well as they could, and found it worth while to eat some things their more fortunate kinsman rejected. At the mouth of the Damariscotta there exists the greatest of monuments to the antiquity of the oyster in these waters, and a remarkable evidence of how important a food resource it formed to the primitive inhabitants. I refer to that enormous heap of shells, estimated to contain no less than eight millions of cubic feet, which was heaped up by the Indians as the refuse from their long feeding upon oysters at this spot.

But Damariscotta is only one of many places on the Gulf of Maine where these shell-heaps, or extinct deposits under water, show that the oyster once flourished. They are to be found at suitable points all along the coast. More than this, there is abundant evidence that at the time of the coming of Europeans to that coast, beds of living oysters were flourishing (or had very recently become extinct) about the inlets into the Bay of Fundy; at Mount Desert Island, in George's, Damariscotta, and Sheepscot Rivers; throughout the upper and sheltered parts of Casco Bay; probably off Scarborough Headlands, N. H.; in Portsmouth Harbor and the Great Bay of Durham River, Brainford County, N. H.; in Newbury (Parker and Rowley Rivers), Ipswich, Boston (both Charles and Mystic Rivers), Weymouth, Barnstable and Wellfleet, Mass. So far as I can find out, however, there were no other localities of oyster growth north of Cape Cod; and in most of these it was exterminated at a very early day.

One point calls for more particular mention. The limited sea-coast of New Hampshire pro-

duced oysters at Scarborough Headlands, in the Cocheco River, and in Great Bay, an inclosed area of shallow tide-water a few miles up from the mouth of the Piscataqua River, and from the harbor of Portsmouth. At the two former localities no oysters have ever been known alive, but in Great Bay they are not yet quite eradicated.

This interior basin is perhaps 10 miles long and 5 to 7 wide. Large portions of the shores are left as dry flats at every low tide, yet there are channels deep enough to allow large vessels to go up to Newmarket and Exeter when the water is favorable. This spot was renowned among the Indians for the oysters living there, and considerable shell-heaps attest the constant use made of the bivalves. The beds occupy the channels at a dozen or more points, where the water over them is hardly more than 10 feet deep, and fresh. The tide-way, as a rule, is strong, and the bottom tough, clayey mud. The oysters are very large, have the appearance of extreme age, and are heavy, rough, sponge-eaten, and generally dead. In taste this oyster is flat and rather insipid, which is attributed to the too great freshness of the water.

That remains such as I have described prove that the mollusks of whose shells they are made up once lived in the adjacent bay, I think no one could possibly deny. The chief mollusk is the oyster. Now it happens, as I hinted before, that it had been forgotten, and even denied, that this precious bivalve was indigenous north of Cape Cod. Of this, however, there seems to have been plenty of evidence besides these heaps of shells.

As long ago as 1606, when Champlain and Poitrincourt visited Massachusetts Bay, they noted the abundance of "good oysters" as one of the attractions of their landing place, which commentators have decided was probably Barnstable. From this earliest mention down I find that all the descriptions and records of the Massachusetts colonists count the native oysters as an important part of their natural riches, and some interesting incidents are put down in this connection.

CAPE COD TO DELAWARE BAY.—The outer side of Cape Cod, a smooth, surf-hammered beach of sand, is unsuitable to oyster growth, but the first rocky islets at the southern end or "shoulder" of the cape are tenanted by these mollusks, however, and can be traced from the Sandwich all along the eastern shore of Buzzards Bay, at Red Brook, Pocasset, Monument, and far up Wareham River. In colonial days the present townships of Rochester, Mattapoiset, Marion, and Wareham, which are ranged around the head of the bay, were known as Rochester, and tradition says that the place was named after the city of Rochester in England (famous for shellfish) because of the abundance of oysters, quahaugs, clams, scallops, &c., along the shores.

The lower end of the bay, in the neighborhood of New Bedford, is not so well adapted, and consequently poorly stocked. In Newtown Pond, on Martha's Vineyard, oysters were native, but thin and insipid because of the freshness of the water. In the Westport River, just west of New Bedford, a large natural bed formerly existed. Beyond this there is a gap in oyster-growth until the mouth of the Taunton River is reached.

For 12 miles from its mouth this river produces natural oysters, which also grow around the point separating it from Cole's River, where are a few beds. With the exception of the secluded lagoon called Kickamuit, between Warren and Bristol, no more natural beds are to be found *until* we get around to Warren and Barrington Rivers, which are filled with them as far as the tide goes freshly. Crossing the head of Narragansett Bay, living beds occur at Gaspé Point, in Cowesset Bay and at Wickford on the western shore. Extinct colonies once existed near Newport and elsewhere at that lower end of the bay, while at the upper end tradition points out many places long since depopulated. Thus the whole upper half of Providence River was full of them originally, even to the city of Providence and that pretty "cove," now inclosed by a park, near the railway station.

Everywhere on these shores the grass-grown shell heaps show how important to the red men were these mollusks as food in times of scarcity, or as a variation from their inland diet.

Great Salt, or Powaget Pond, in Charlestown, and the Pawtucket River at Westerly, are additional localities for Rhode Island, but neither is of importance. On Block Island an abundance of small oysters formerly dwelt in the pond that occupies so much of the interior of the island, but they were rarely found in a fit condition for food, though made serviceable by transplanting. Their shells were so delicate that it was easy to pinch your thumb and finger through them, and they often contained so much air and fresh water that they would float when thrown overboard in planting, and drift away.

From the eastern part of Connecticut westward and southward along the coast, the thing noteworthy is not where oysters grew naturally in primitive times, but where they did not. Every spot of shore or river-mouth, as far as tide-waters and suitable grounds extended, besides many shallow "reefs" in the open water of Long Island Sound, were crowded with these mollusks, unless unfavorable condition prevented. The most noticeable barren areas were the eastern half of the north shore of Long Island, the storm-swept outer beaches of Montauk and the south shore of Long Island (though these beaches sheltered extensive areas of oyster-beds between them and the mainland), and the open coast of New Jersey, from Sandy Hook almost to Cape May. Here, however, great bays, like that at Barnegat, and several rivers, such as those which reach the sea through Atlantic County and Cape May County, furnish the quiet shallow waters that make an oyster tenantry possible, and in these an extensive growth has always flourished.

In New York Bay—to go back a little—oysters once grew naturally all along the Brooklyn shore, and in the East River; all around Manhattan Island; up the Hudson as far as Sing Sing; on the Jersey shore from that point to Keyport, N. J., and in Keyport, Raritan, Newark, and Hackensack Rivers; all around Staten Island, and on many reefs and wide areas of bottom between Robyn's Reef and Jersey City. Explorers and colonists were saved any trouble in finding this out for themselves, since the red men were in the habit of gathering clams and oysters at all practicable seasons, and depended upon them largely for their food.

Delaware Bay was equally well filled with a native oyster population, not only all along the marshes and inlets of its shores, even above Philadelphia, but over wide areas of its bottom far from shore, and in water of many fathoms depth.

CHESAPEAKE BAY AND SOUTHWARD.—As for the Chesapeake, everybody knows oysters are scattered over every part of its vast area and extend as far up all the rivers as salt water penetrates. To the southward, along the coasts of Virginia and the Carolinas, the inside of the outer "banks" or long line of beaches that protect the inner submerged area of nearly fresh water from the demolishing force of the ocean, is lined with oyster growth to a greater or less degree along its whole extent, but this natural growth is not always available for commerce.

South of New Berne and Beaufort there is no regular production until New River is reached, about half way between Beaufort and Wilmington, where the oysters are of a large size, fairly regular shape, and for the most part single.

South Carolina, having a less broken coast, offers fewer opportunities, but wherever a sheltered nook affords a good chance "reefs" will be found. In the Savannah River itself none grow above the immediate mouth, on account of the great volume of fresh water. Off Potato Point, however, and in the shape of two elongated banks in mid-stream, fine oyster beds are to be found, while everywhere in the thousand channels which intersect the marshy islands that border the coast, making a perfect net-work of salt water tide-ways, the "raccoon" or "bunch" oysters thrive in endless profusion. This abundance becomes more and more noticeable as you approach Fernandina,

Fla. Every stake or bit of sunken log in the marshes, or fallen tree whose branches trail in the water, become at once loaded with "coons." Frequently large specimens are obtainable, and such are very good, but they are rarely eaten.

On the point of land terminating Old Fernandina are remains of an extensive Indian shell heap; and in the bottom of the harbor opposite the marshy shore, between the old and new towns, was formerly an exceedingly large bar of raccoon oysters. Latterly these have died, and now they are being washed up and are forming a long, firm shell beach. At the bar or mouth of Saint John's River good oysters are obtained, though of a very salty taste. They are eaten locally, and sent now and then to Jacksonville by the fishermen. Jacksonville, however, is supplied chiefly by Cedar Keys and Apalachicola, the latter, in my opinion, sending the best oysters sold in that city. Saint Augustine gets her supply from the immediate vicinity, and many parts of the great system of estuaries which extends from the upper end of Indian River down to Bay Biscayne yield edible mollusks of large size and flavor.

The whole of the lower end of the peninsula on both sides is bordered by tangled, ever-increasing, and commercially worthless reefs of small and densly clustered oysters. Among these certain "rocks" have become known which yield a more edible kind, furnishing local markets from Key West to Cedar Keys. At Cedar Keys the sources of supply are Cragin's bars, exposed at low tide, 5 miles south of the village, and a still better locality to the northward. The Cedar Keys oysters are usually of large size, have a different taste from anything I have experienced elsewhere, and one which will commend itself to those who like a saltish oyster.

Apalachicola is favored by the proximity of beds of good oysters, scattered among the hundreds of the "coon-reefs" that barricade the shore swamps and impede navigation at the mouths of the rivers, and at Saint Andrew's Bay, where the water is unfreshened by any large influx, oysters lie in beds distributed all over the upper parts of East, North, and West Bays, and are most abundant in the deep and open water. Choctawhatchie Bay, next westward, contains very few oysters, but the large shell heaps there show that formerly they were taken in vast numbers. Now, the few that are got are found scattered over grassy shoals. At Pensacola the banks lie in Escambia Bay, and are scattering and very poorly stocked—not so well as formerly. The absence of shell heaps on the adjacent shores show that the Indians did not resort to this for a supply of molluscan food to any extent. The coast of Alabama, Mississippi, and the adjacent part of Louisiana, is bordered by our mollusks, the gathering of which supports a large number of men. The same is true of the western coast of Louisiana, where it may be said that the barricades to the encroachments of the sea erected by the oysters are all that preserve that amphibious region from submergence.

3. HISTORY OF THE DECLINE OF NATURAL RESOURCES.

Men went for food, at first, directly to nature, as the lower animals yet do. Afterward they learned to store food materials against future scarcity, and at last attempted to control and increase the supply. By so doing a great improvement was often effected in its quality, its nutritive power was increased, and thus far more than a mere augmentation of quantity was gained.

This is the history not only of agriculture, but of several edible products of the water. Mankind had eaten mollusks a very long time before anything like their cultivation was thought of in the Old World, while the practice is many centuries more recent in the New.

The red men procured their shell-fish by wading out and picking them up at low tide, or by diving. This was mainly the work of the women and children. The shells were opened, ordinarily, by being thrown upon beds of coal, or by being cracked. At Wellfleet, Mass., I dug from a shell

heap a rough stone tool which exhibited signs of long use both as a hammer and as a wedge or knife with which to pry open the valves. Any of their stone knives or smaller hatchets would have been eminently suitable, but an implement in the possession of Dr. R. C. Chapman, of Damariscotta, Me., appears to have been made expressly for this service, and would accomplish the matter as deftly as our modern knives. Stone tools, supposed to have been designed for this use, are mentioned by C. C. Jones and others, among the antiquities of the southern sea-board.

Civilized man, however, ever chary of using his naked fingers, centuries ago devised the ingenious oyster-tongs, modifications of the general pattern of which are shown in accompanying illustrations. In Virginia a truer tongs (since it is single-pointed) is used under the very proper name of "nippers," an illustration of which is also appended.

In addition to these instruments, oysters are taken in some localities by a large, stout, very long-handled rake, with teeth a foot long, sometimes only gently curved; in other patterns so much bowed as to describe more than a half-circle in their curve. The concavity of the bending is, of course, inward—that is, toward the person using the instrument. Dredges also are used in gathering oysters, with various kinds of hauling tackle and windlasses.

Let us begin again at the northern limit of the oyster's range, and see how it has withstood the attacks of civilized man.

GULF OF SAINT LAWRENCE.—The oysters of the Saint Lawrence were among those first utilized by white men in America. Charlevoix mentions the practice of tonging through a hole in the ice, and describes the familar instrument. Oysters once flourished all around Prince Edward Island and skirting the mainland from Cape Breton to the Bay of Chaleur. Part of these beds became extinct in prehistoric ages—so long ago that in many cases they are overlaid by several feet of silt. Many other beds have ceased to produce within historical times, apparently for no other reason than that the natural process of growth has built up the deposit until it has come too near the surface. In a large number of places, once well stocked, production of any importance ceased through the inordinate and vicious methods of oystering, with other injurious practices to help it on. There is room for an entertaining discussion upon the influences affecting the decline of these northern fisheries.

CAUSES OF THE EXTINCTION OF OYSTERS NORTH OF CAPE COD.—Turning to the Gulf of Maine, an interesting inquiry arises in accounting for the extinction of the oyster-life which, as I have shown above, once flourished extensively north of Cape Cod. What killed it?

Beginning with those beds whose extinction seems to have been prehistoric, several theories are at the service of the reader. One is, that the elevation, which the geologists tell us has been proceeding steadily for many centuries, brought about conditions fatal to this sedentary mollusk in certain localities. Another theory charges it to climatic changes, by which the temperature of these waters has been seriously and rapidly lowered. It is the opinion of some students of the physics of the ocean* that the Gulf Stream is gradually bending to a more southerly and easterly course, wedged farther and farther from the North American coast by the inner Arctic current. If this is so the increase of the chilled water pouring into the Gulf of Maine would account for the fatal effects under examination, since the oyster and its co-extinct associates require comparatively warm waters, and, under the influence of the Gulf Stream, flourish at much higher latitudes on the coast of Europe than here.

Except perhaps at Damariscotta, where the space was so limited, I do not think the Indians can be held responsible for the extermination of any of these oysters.

*See a pamphlet by C. A. M. Taber, "How the great Prevailing Winds and Ocean Currents are Produced." Boston, 1882.

One of the first acts of white settlers on the forested coast of Maine, where every stream affords good water-power, was the erection of saw-mills. These mills began at once to pour great quantities of sawdust into each stream, which was carried out into the bay or river below, where it soon sank. At the same time woodmen were clearing the forests and draining the swamps, and farmers were breaking the turf. Each of these operations tends to the carrying away by rain of a far greater amount of silt than under natural conditions. The oysters thus found their clear, salt home freshened by an unusual influx of rain-water, the currents always roily, and themselves gradually smothering in a sediment of sawdust and earth. This, with steady depletion, would put an end to any of the isolated beds like those at Thomaston and Damariscotta, to both of which, tradition asserts, sloops used once to go and get loads of the bivalves for sale in neighboring colonies.

In the Sheepscot River they had a little better chance, and have disappeared only within the last twenty years.* Tradition has it that no more than a century ago vessels used to go to Great Bay, New Hampshire, heretofore alluded to, to be loaded with oysters, the surplus of the home demand. The lagoon became depleted, however, so long ago that the people of the vicinity generally forgot that these mollusks had ever existed there. Hence it was looked upon as a "discovery" when, in 1874, the Coast Survey announced that oyster beds still flourished in Great Bay. At first little was done to make this knowledge available. The following year, however, witnessed great activity. For several months a dozen boats, with two or three men in each, were raking every day, the average take being about five bushels to the man. They used not only tongs and rakes, but in winter they would cut long holes in the ice, and dredge the beds by horse power, stripping them completely. It was seen that this rash and wholesale destruction would speedily exterminate the mollusks, and protective laws were passed by the State, one of which forbade fishing through the ice. This was the most needed, for, as in New Brunswick, the ice-rakers were accustomed to pile upon the ice the débris of dead shells, &c., to all of which young mollusks were attached, and were thus destroyed by freezing instead of being returned to their nursery. But these beneficent restrictions came too late, and the business of oystering is now of no consequence.

History shows that the oysters naturally growing along the upper coast of Massachusetts were all valuable to the early settlers, who quickly exhausted them, not only through use as food, but by digging up the shells to be burned into lime, and by pouring sawdust and sediment into the waters that surrounded them.

So valuable a property were the oyster beds about Boston deemed by the Pilgrims, yet so ruthless were the drafts upon them, that before the end of the seventeenth century the colonies (especially Plymouth) passed restrictive laws, taxed every barrel exported, and prohibited outsiders from fishing.

Natural beds in Massachusetts Bay persisted longest, however, at Wellfleet, near the extreme end of Cape Cod. There originally they were widespread, and, with other shell-fish, a blessed food-resource in the early struggles of the Pilgrim colonists against starvation. It appears that they continued to be fished until about 1775, when a sudden mortality occurred which ended the matter.

* Speculation has been indulged as to whether this little colony of oysters is a natural one or not. There seems to be good evidence to show that it was planted designedly by the Indians, before the advent of white men, with mollusks brought from the Damariscotta beds. The position and condition of the colony; the fact that the banks of this river were thickly populated by Indians, who might be supposed to know enough to save themselves the trouble of going 4 miles every time they wanted oysters, by transplanting them to their own stream; the fact that no more distant stream has them, although no good reason can be discovered for their absence, and the fact that no shell-heaps of any account exist to attest ancient use of the bed, all seem to confirm this supposition.

Until their termination the Wellfleet beds supplied natural oysters sufficient for the trade of Boston, Portsmouth, Portland, and the other shore towns.

BUZZARD'S BAY.—How extensive was the native growth about Buzzard's Bay has been noted. As early as 1775 Wareham forbade any oysters or oyster-shells being taken out of the town. This checked excessive fishing, but gradually it became a dead letter, and the beds of the whole neighborhood so suffered in amount of yield, as well as in the quality of the oysters, that further and severer laws were enacted. Now the Wareham district gives little else except "seed," that is, young oysters intended to be transferred to other localities where they may pursue their growth under more favorable conditions, a subject to be entered into on subsequent pages. On the eastern side of Buzzard's Bay, in Monument River, at Pocassot, and one or two other points, excellent native oysters, growing under protection of good laws, are still obtained of marketable size and of remarkably fine quality.

The earliest voyagers were pleased to find shell-fish abundant, and the English settlers, three or four centuries later, record their thankfulness on similar grounds. From time immemorial, then, oysters have been natives of this district, and legal measures were early adopted looking toward their preservation. These have been successful, and until within the last thirty years "Somersets" (as these oysters were called, after the principal settlement) grew to a large size and held a high place in the New England markets. Latterly, however, they have lost greatly, and assumed a green stain, which has so prejudiced the people against them that the whole trade of the river is devoted to the production and sale of seed.

NARRAGANSETT BAY.—When the people of "The Colony of Rhode Island and the Providence Plantations" felt sure of future stability, they applied to King Charles II for a charter, which was granted in the year 1683. This charter was a wonderful document for those days, because of the well-nigh perfect liberty it embraced, and its hospitality to every conscientious belief. Among the privileges, the right of free fishing in every shape was jealously preserved for public benefit. In 1734–'35, for instance, the first session of the assembly at East Greenwich was distinguished by an act for the preservation of oysters, which the thoughtless inhabitants were burning in large quantities for lime; and, in October, 1766, an "act for the preservation of oysters" was passed, forbidding them to be taken by "drags," or otherwise than by tongs, under a penalty of £10. In the constitution no clause was so scrupulously worded against evasion as that declaring that the rights of fishing should remain precisely as decreed in the old charter. Despite this early vigilance and the elaborate laws which have long been in force for regulating oystering, Narragansett Bay has almost ceased to yield marketable oysters of natural growth, and is steadily declining in the amount of young growth available for transplantation. At only a few places does a breed of oysters, or a "set," as it is termed, occur with any regularity, or of any consequence—a dearth only to be ascribed, I believe, to the antecedent disappearance, through persistent raking, of all old native oysters.

There remains one river, nevertheless, where, under protection, the oysters are able to reproduce regularly every year. This is the Seekonk, which flows down past Pawtucket and Providence, with East Providence on its left, and numerous bridges and small shipping to worry its swift tides. The Seekonk has always been a favorite home of our bivalve, and year by year the river contributes its quota to the tongers, through a space from the Wicksbury pier to nearly 5 miles above. This is due largely to the fact that the oysters of the Seekonk, like those of the Taunton River, are vividly green,* and hence are not subjected to an exterminating drain for marketing. No better reason can be assigned than in the former case, and, like the others, this seed, when trans-

* The Bulletin of the U. S. Fish Commission, Vol. III, 1883, and the annual reports for 1882 and 1883, contain detailed information upon this peculiarity and its causes.

planted for a few months, entirely loses its verdant tint. Seekonk oysters, therefore, never go to market, though their color, due to the same harmless coloring matter as that which tints the leaves of trees, and which is absorbed from the food, has little effect upon the taste, and none upon the wholesomeness of the mollusk.

LONG ISLAND SOUND.—Passing to Long Island Sound, the decline of the native fisheries for direct marketing is quite as marked as in Rhode Island. In the early days the cup-shaped, rather small, flinty-shelled oysters of the Pequonock River, and the plentiful rock oysters of the Thames were highly esteemed in local markets. In Norwich, especially, a large business was carried on with "natives" until quite recently, but this has almost wholly ceased. Breeds at Saybrook, Clinton, and Guilford, once highly productive, are no longer so—in the last-named case manifestly through over-raking, in defiance of law. Native oysters of large size, but with a tendency to grow in bunches, were always to be had scattered among the Thimble Islands, but at Branford, where primitively the river was one great oyster bed, the supply is now wholly exhausted. The whole shore of Connecticut, east of New Haven, does not now yield more than 1,000 or 1,500 bushels of uncultivated oysters fit for market.

The western half of the State, however, has always been more productive, and in coming to New Haven Harbor with the Quinnipiac and its other tributaries, we find the first of several large fields of natural production, the history of which shows the influence of civilization in a very marked manner. For many years the upper part of New Haven Harbor has been the scene of oyster operations. Shell-heaps along the banks of the Quinnipiac show how the aborigines sought in its waters, season after season, the best of bivalves, and the earliest settlers followed their example. Natural beds of oysters were scattered over the bottom of the whole river for 3 miles, and at intervals along the eastern shore of the harbor. The result was that the raking of oysters in this river, and along the eastern shore of the harbor at its mouth, which was a free privilege, was early adopted as a business by many persons who lived near the banks, and a considerable retail peddling trade was thus kept up throughout the neighborhood, in addition to the home-supply. Wagon-loads of opened oysters in kegs traveled in winter to the interior towns, even as far as Albany, and thence westward by canal.

In colonial times not only, but up to the last quarter-century, and therefore long subsequent to the beginning of oyster culture there, wild, uncultivated stock formed an important part of the marketable oysters at New Haven; and the persistence of these "natural beds" here and elsewhere to the southward (as well as in Buzzard's and Narragansett Bays), have formed a fruitful source of embarrassment between the cultivators and the outside public, and the occasion of endless legal tinkering in trying to compromise between new interests and alleged rights and privileges derived from antique laws, a long usage, or, strongest of all, originating in ignorant conservatism.

It was admitted very long ago that some rest was required by even so bountiful grounds as lay under the Quinnipiac, and a law prohibiting fishing in midsummer has been generally regarded for a century or more, yet gradually the oysters became more rare and coveted. The same history is substantially true of all the harbors on the north shore of Long Island Sound.

THE EAST RIVER.—At Norwalk the sound narrows rapidly into the East River, and thence all the way to New York oysters once grew in the greatest profusion on both shores, and in many places in the channel, wherever it was possible for a bed to maintain itself. Most of those localities in shallow water known and raked by the early colonists have long been abandoned or destroyed; but new places were continually originating or being discovered, so that until the beginning of the present century the supply gathered full-grown from their native waters was quite equal to the demand. The principal points for market-catching were Norwalk, Stamford,

Port Chester, and City Island, on the north shore, while the region about Great Neck was the center of the south-shore interest. On Long Island, however, oysters grew in great abundance in every bay and inlet as far east as Port Jefferson, beyond which the bold coast of shifting sand is unsuitable, until the long-ago exterminated colonies inside of Orient Point, at the eastern end, were reached. From Port Jefferson westward a good many native oysters are still taken to market, and once in a while a deposit is found which has lain undisturbed long enough to bring to salable maturity a considerable quantity; yet no one makes much account of these, and the natural beds are devoted almost wholly to seed-producing. Harlem River and Gowanus Bay were *both noted* in primitive times for the excellence of their oysters.*

SOUTH SIDE OF LONG ISLAND, NEW YORK.—A similar fate has overtaken the once highly-productive grounds in the Great South Bay, on the southern shore of Long Island. Originally oysters in this sound were confined almost wholly between Smith's Point and Fire Island—practically to the waters east of Blue Point, known as Brookhaven Bay. This was the home of the famous celebrity, the Blue Point oyster, which was among the earliest to come to New York markets. The present oyster of this brand is small and round, but the old "Blue Points," cherished by the Dutch burghers and peak-hatted sons of the Hamptons, who toasted the king long before our Revolution was thought of, was of the large, crooked, heavy-shelled, elongated kind with which one becomes familiar all along the coast in examining relics of the natural beds. Now and then, a few years ago, one of these aboriginal oysters, of which two dozen made a sufficient armful, was dragged up and excited the curiosity of every one; but the time has gone by when any more of these monsters may be expected. As early as 1679, according to Watson's Annals, this bay had become the scene of an extensive industry. In 1853 the New York Herald reported that the value of all the Blue Point oysters, by which name the Great South Bay oysters generally were meant, did not exceed yearly $200,000. "They are sold for an average of ten shillings ($1.25) a hundred from the beds; but, as they are scarce and have a good reputation, they sell at a considerable advance upon this price when brought to market. At one period, when they might be regarded as in their prime, they attained a remarkable size; but now their proportions, as well as their numbers, have been greatly reduced." The people did not take alarm soon enough. When, a few years later, they did become frightened at the threatened extirpation of their resources, their efforts were all but too late to save the beds from total annihilation. As it is, only transplanted oysters are now sent to market from that district. Between Fire Island and New York Bay no natural beds of any consequence ever grew, so far as we know, but large interests in planting have arisen. Inside New York Bay, however, the oysters formed a very important item in enumerating the advantages of the new country.

How greatly this molluscan abundance was valued by the first colonists is plainly shown in the early descriptions of the country. In 1621 "very large oifters" were too common at "Nieuw Amsterdam" to find a market, everybody being able to supply themselves without charge. "Oysters are very plenty in many places," asserted the traveler Von der Donk in 1641. "Some of these are like the Colchester oysters, and are fit to be eaten raw; others are very large, wherein pearls are frequently found, but as they are of a brownish color they are not valuable. The price for oysters is usually from 8 to 10 stivers per hundred." The inference is, that every man could easily gather for himself all he wanted. That a few years of this sort of thing greatly enhanced their value, however, is shown by the fact that in 1658 the Dutch council, in making an ordin-

*A list and description of the natural beds, at present recognized by law in the waters of the State of Connecticut, is given in the third annual report (1884) of the shell-fish commissioners of that State. The areas, eight in number, aggregate nearly 5,500 acres, and none of any note lie east of Milford.

ance against the cutting of sods in and about the town, found it necessary also to enact a law forbidding "all persons from continuing to dig or dredge any oyster-shells on the East River or on the North River, between this city and the fresh water." This "fresh water" was the pond which is now occupied by the leather district of the city, of which Spruce street is the center.

The digging of shells was for the purpose of making into lime, and also for the purpose of paving the streets (Pearl street received its name from such paving), and in the course of dredging for them great quantities of young living oysters were wasted.

Up to the beginning of the eighteenth century everybody took advantage of this public storehouse of food without "heed for the morrow." But the fame of Carteret's "great plenty and easy to take" had spread abroad, and so many aliens sailed into the placid bay to rake upon the "vast banks," that at last the colonists became alarmed for the continuance of their precious supply. Thus it arose that as early as 1715 was passed the first colonial law in relation to oysters, calculated to protect the beds and save their speedy extermination. New Jersey co-operated, and in 1730 and again in 1737 the two colonies made stronger and stronger enactments to the same end, which had an immediate and favorable effect.

Prof. S. S. Lockwood estimates that, including the waters inside of Staten Island, not less than 350 square miles of rich oyster banks were open to the people dwelling about New York Bay at the time of its first settlement. This resource was deemed inexhaustible, and perhaps might have proved so, or at least have longer delayed its decadence, had not incessant removal of oysters been supplemented by the covering up of the beds or the killing of their occupants by impurities in the water, which more and more increased as population grew and civilization advanced upon the neighboring shores. No doubt the clearing away of the forests and the drainage of so many towns and factories have produced an increase of sediment and pollution in the Hudson River, quite sufficient to put an end to most of its more exposed oyster beds, even had they never been touched; and certainly this is true of the harbor itself.

NEW JERSEY COAST AND DELAWARE BAY.—Moving down the coast of New Jersey a similar decadence of the natural resources we are studying is to be seen. In Barnegat Bay the oyster-growing region is at the northern end, and is about 10 miles long by 2 wide, where the bottom is gravelly. These are called the Cedar Creek grounds, and once yielded the famous Log Creek brand. It is one of the great sources for seeding planting-grounds southward, but is steadily declining through heedless treatment. For many years few salable oysters have gone from this district direct to market, because none are permitted to reach adult size.

All of the sedgy inlets at the mouth of the Mullica River, behind Brigantine, and behind the other beaches southward, contain more or less native oysters, and are the scene of cultivation in a small way by the farmers who live near the shore. Great Egg Harbor, River, and Bay, with their tributaries, have long been proverbial for the plenty of their oysters and clams. The oysters formerly grew in great ridges of astounding fecundity. Incessant tonging by a great number of men through many years has served to spread these reefs, and the oysters are now more thinly dispersed over a wide extent of bottom. This makes their getting slower and more laborious; but the conditions are so favorable that probably there is quite as great a supply of young oysters now in these waters as formerly. A like story could be told of Dennis and Cape May, as far around into Delaware Bay as Maurice Cove.

The oysters of Delaware Bay were prized by the first settlers, and there are frequent allusions to this resource in the early narratives. The Jersey (eastern) shore is bordered by extensive marshes, through which innumerable small creeks find their way from the interior, and which contain many open places called "ponds." Throughout these creeks and ponds, in the tide-ways

and along the edges of the sedge-plats and islands, oysters have always grown in great profusion. In addition to this the bottom of the bay and of the Delaware River, from Cape May beach clear up to and a little above Cohansey Point, at the southern end of Salem County, a distance of not less than 50 miles, is everywhere spotted with oyster beds. The same is true of the opposite (western) shore, which will be considered on another page. These oyster beds are not confined to the shallow waters near shore, or to the sedge-plats, but are apparently scattered over the whole bottom of the bay. Even the ship-channel, 90 fathoms deep, contains them, as experimental dredging shows. On the western, or Delaware shore, the natural beds of oysters—"rock oysters" is the local term—are confined practically to the shore between the mouth of Mahon River and Bombay Hook. Though formerly far more productive, probably, than now, it is from an area of little, if any, greater width that Philadelphia, and the States of Pennsylvania and Delaware generally, have always obtained their oysters. Only portions of this bottom, which extend over about 16 miles, are now productive when dredged, however, and the area is not increasing. Though at all the little ports, and especially at Maurice Cove, a certain number of persons find indolent employment in cruising about the marshes or tonging certain shallows after natural oysters of marketable size, this supply is small, and probably does not exceed 10,000 bushels for all of Delaware Bay, where a great business in cultivation of oysters has grown up.

CHESAPEAKE BAY.—It is not until the Chesapeake Bay has been reached, therefore, that the enquirer can learn that the original wealth of oyster growth is still available for consumption and export. Everywhere northward it has utterly disappeared, or else has been depleted to that extent that its existence is preserved, only by legal protection, and its utility has been degraded to the furnishing of "seed," which must undergo development on the planter's submarine fields before it is fit for sale.

The condition of the oyster beds and the conduct of the fisheries on both shores of the Chesapeake is very fully discussed on subsequent pages, and need not be descanted upon here. It appears, however, that despite the almost immeasurable extent of the original "rocks," the favorable conditions of climate and situation, and the influences which have tended to spread the area of oyster growth, there has been a steady decline in the fisheries, taken as a whole, ever since the civilization of the country began; and that those who understand the matter best see that the practical destruction of the Chesapeake oyster fisheries is only a short distance off, unless less wasteful methods speedily take the place of existing customs. Already the principal use made of Chesapeake oysters is as small seed, a matter not of preference or superior profit, but due to the difficulty of getting oysters in marketable conditions and the growing demands of northern planters for half-grown stock.

NORTH CAROLINA AND SOUTHWARD.—In regard to the coasts of the Southern States I need add little more in this place than was suggested on preceding pages. From North Carolina to Savannah the local trade, conducted largely by wagoners, who cart loads of oysters into the interior, is supplied by men in skiffs, who tong full sized oysters from the natural "rocks,"—a lazy occupation lazily followed. In Georgia, especially in the neighborhood of Savannah, much planting is carried on, and the native growth is therefore gathered more for seed than for market, sloops being employed as well as canoes and skiffs. Fernandina gets all the home oysters it uses from beds over towards Saint Mary's, 10 or 15 miles distant, whence they are brought in small boats by the negroes. On the west coast of Florida each settlement has its local bed, and no transplanting is necessary; but complaint is made at Cedar Keys, whence a large amount is sent inland, that the best beds are becoming exhausted. The people attribute this to cold weather, but it is doubtless the effect of excessive persecution within a too limited area.

There is little complaint, as yet, of depletion of oyster rocks in the Gulf of Mexico, save in certain localities of limited extent, closely adjacent to Mobile or New Orleans, whence favorite brands have been drawn in large quantities.

THE PACIFIC COAST.—On the Pacific coast, however, great scarcity of local oysters has come about, and that region would long ago have been left without this food resource had not successful planting remedied the defect. The principal source of former supply for California and Oregon was Shoalwater Bay, on the coast of Washington Territory, whence fifteen years ago not less than 200,000 bushels of fair oysters, gathered from the natural banks, were brought to San Francisco alone, besides a large quantity supplying Oregon and the Puget Sound towns. Now this has almost wholly ceased, and not one-tenth of the former catch is possible. To what this sudden failure is due I cannot say. In the Gulf of California there is as yet an excessive abundance of the small *Ostrea conchophila*, but this is considered scarcely edible, nor have any operations for its improvement by transplanting been entered into on an extensive scale.

4. NORTHERN "BEDDING" OF CHESAPEAKE OYSTERS.

ORIGIN AND OBJECT OF THE INDUSTRY.—I have now shown that before civilized man began to encroach upon the boundaries of nature in North America oysters grew abundantly along both coasts of the United States and Mexico. It also appears that during the three centuries of occupation of the continent by civilization the natural growth of oysters has completely disappeared in many districts, while it has everywhere been so reduced that almost no oysters are now furnished to the markets, except after some intermediate process intended for their improvement; furthermore, that the natural oyster beds remaining are profitable almost entirely as nurseries of seed to be transplanted, and that even these nurseries are saved from ruin only by legal protection. It will be my next task, therefore, to examine the various methods practiced in the United States by which oysters, naturally poor, are made marketable, or are cultivated upon artificial beds. These methods are of three kinds:

(1) Full-grown oysters are transferred from their beds to another place and left to retain their life, or, if possible, to improve in vigor, size, and quality for a time, not to exceed one season of warm weather.

(2) Oysters which have attained a few months' growth, but are not yet ready for market, are transplanted to new beds and placed under more favorable conditions for prosecuting their growth to a marketable age.

(3) Oysters may be bred from eggs, arrangements for producing and saving which, together with the preservation of the embryos, form a part of the oysterman's plan and process.

I propose now to describe these processes as they appear in America, taking up at the beginning the first named and simplest operation, the transplanting to new beds, for improvement only, of oysters nearly, or quite, in marketable condition.

This began in the economical custom of using leisure hours to bring in supplies from outer beds and deposit them near shore, where they would remain in good condition and be easily accessible. Oysters thus moved, broken apart from hampering clusters, and given more room, gained greatly in size and quality after lying on the new ground a few months, and on Cape Cod it began to be adopted as a regular preparation for market quite a century ago.

This operation was called "planting," but it is a misuse of the word, and the other popular phrases, "laying down" or "bedding," express the fact more truthfully. It is not oyster-*culture* at all as the word is to be used later, but only a device of trade to get fresh oysters and increase

their size and flavor, which adds proportionate profit in selling. It is neither intended nor desired that they shall produce eggs and start a new colony.

The same plan is still pursued in many places where natural beds flourish and a market is handy, especially on the southern coasts in New Jersey and Delaware.

When the native resources began to be insufficient at Wellfleet schooners were sent, as early in the season as cold weather would permit, to buy oysters of more favored localities. These went first to Buzzard's and Narragansett Bays, but speedily extended their purchasing trips as far as Connecticut, Long Island, and finally to Great Egg Harbor, New Jersey, their charterers annually extending their beds in Wellfleet Harbor, until a large business had developed.

When a vessel arrived home from one of these trips she anchored in the district channel and unloaded her oysters into dories—the well-known skiffs of the New England fishermen—putting 50 bushels into each one. At high tide these proceeded to the grounds, already divided by rows of stakes into rectangles a few rods square, and deposited a load of 50 bushels in each "square." In order that the oysters might be distributed as evenly as possible over the bottom, the dory was rowed to the center of a square, and anchored at both ends. The dorymen then threw out the oysters with shovels into all parts of the square, intending at low tide to go over them again with rakes for respreading. The ground chosen was the hard surface of the flats in the western portion of the bay, where the oysters would be left dry about two hours at each low tide. They had very little fresh water near them, and the growth was variable. In a favorable season 100 bushels put down in April would fill 300 bushel-measures when taken up in October, but the percentage of loss was probably never less than one-quarter, and now and then amounted to the whole bed. Drifting sand, sudden frosts when the beds were exposed, disease, and active enemies were the causes that operated against complete success; yet enough success was had to make a very important item in the prosperity of that neighborhood whose subsistence was chiefly derived from the summer fisheries, because it added fall and spring work for both sailors and shore people.

Increasing prices of oysters in Connecticut and elsewhere, owing to the adoption there of similar methods, caused the New England people, early in the present century, to try sending their vessels on the long voyage to Chesapeake Bay after small stock, to be "bedded," as they had long been accustomed to do in winter for the direct supply of northern markets.

This experiment met with success. The strangers grew with great rapidity and found ready buyers, so that on Cape Cod the business of bedding southern oysters soon attained great dimensions, entirely superseding the use of more northern seed stock. At its height, between 1850 and 1860, from 100,000 to 150,000 bushels were laid down in the harbor annually, which, if a fair proportion survived, would yield 300,000 or 400,000 bushels when taken up in the fall. The breaking out of the war of the rebellion, however, so interfered with the getting of oysters in the Chesapeake and so increased the expense that the business began to decline. After the war had closed it revived, but now could not compete with other localities under new phases of the trade. Thus Wellfleet ceased several years ago to bed more oysters than sufficed to meet the local demand.

Meanwhile many other ports along the coast had acted upon the same idea, and the "Virginia trade," as it came generally to be termed, became, and has continued, a recognized and important part of the oyster industry.

At present the principal points are the upper end of Narragansett Bay, R. I., New Haven, Conn., Staten Island, N. Y., and the western shore of Delaware Bay.

THE METHODS EMPLOYED.—The methods in all these places are substantially alike. Fish-

ing or coasting vessels are chartered to go and get the oysters, which the captain buys from the tongers in Maryland or Virginia, who surround his vessel the moment he anchors, and rapidly pass up their measurefuls, receiving cash in payment. As soon as loaded he sails away homeward. The round voyage takes from twenty-five to thirty days between the Chesapeake and Providence, and a proportionately shorter time to nearer ports. The vessels sailing to Rhode Island, and many of those to Connecticut shores, belong to the Cape Cod mackerel fleet. Those serving Staten Island are chiefly owned in New York. Those which bring oysters (via the canal) into the Delaware are mainly a smaller, ruder class called "wood-droggers."

Vessels sailing to northern ports carry from 2,500 to 5,000 bushels at a cargo; but the Delaware boats not more than a quarter or third as much, the larger part of which is carried on deck, a practice not permissible in the case of the others, since upon their outside trips they must often encounter heavy gales and severe cold. Steamers have never been used in this traffic.

When the vessel has arrived at her destination her crew is re-enforced by as many additional men as can conveniently work upon her decks. Where feasible, she simply cruises back and forth across the designated ground and the oysters are shoveled on board by means of six-tined, shovel-shaped forks. In other cases her cargo is expeditiously unladen into flat-boats, from which it is thrown broadcast upon the beds, while the schooner is hastening back on a second voyage. As a rule one vessel is chartered by several planters, each of whom pays in advance his part of her expenses and purchasing fund, and receives a proportionate share of the cargo. The captain should be a man of experience in order not to be outrivaled by his competitors in a variety of ways when buying his cargo. Many captains are themselves planters, or at least special partners in the enterprise and are therefore excellent judges of oyster "seed."

EXTENT OF THE BUSINESS.—In the Narragansett Bay about half a million bushels of these oysters are bedded and fattened annually, and it has therefore been the most profitable branch of the oyster business. What part of the Chesapeake Bay furnishes the best oyster for these waters is a question that has received much attention, and upon which diverse opinions are held, but the general verdict seems to be in favor of those from James River, Virginia. These show the largest growth at the end of the season, developing a hard, flinty shell and white meats; on the contrary, at New Haven, James River oysters cannot be used at all. But many cargoes are planted, the precise southern home of which is unknown, sometimes, I am sorry to say, because they are procured in violation of law. A still older headquarters for this trade is Fair Haven, a suburb of New Haven, Conn. This was among the first places in New England to import oysters from New Jersey, and then from Virginia, to be transplanted for additional growth. Twenty-five years ago, a large fleet of Connecticut vessels was employed in this traffic every winter, and some stirring traditions remain of perilous voyages during that icy season. They were better oysters that came in those days, also, than now. A quarter or so of the whole season's importation from the Chesapeake was regularly bedded down in April and May, to supply the summer and fall demand. The favorite bedding-ground then, as now, was "The Beach," a sand-spit running off into the harbor for more than a mile from the Orange (western) shore. This is bare to a great extent at low tide, but covered everywhere at high tide, and is the best possible place for its purpose. The ground on this beach rents from 2 to 5 cents a bushel, according to location. Those men occupying the beach each year—about twenty-five in number—form themselves into a mutually protective association, and provide watchmen who never leave the ground. This Virginia trade began at Fair Haven fifty or sixty years ago and soon became very profitable. Branch houses were established in the larger inland cities, and the great Baltimore packing business (as will be detailed on a subsequent page) was an offshoot of Fair Haven operations. Little competition was

exerted by other ports on Long Island Sound, at none of which has this branch of trade ever flourished extensively. Many or all of the old dealers, or their heirs, continue to bring and bed down southern oysters, which they offer for shipment in the autumn and winter. In 1880 the year's importation amounted to about 450,000 bushels. Those from the Rappahannock were the favorites for winter use, and were imported almost exclusively; for planting purposes, however, Rappahannock oysters were undesirable, and those from Fishing Bay, Saint Mary's, and Crisfield preferred. The great success, however, which has followed the cultivation of native oysters, at New Haven (and elsewhere in Connecticut), particularly on the deep-water farms, has caused a continual diminution of the receipts of "Virginias" there, not only for bedding but for immediate sale in winter. Several men who regularly used them in 1880 had completely ceased to do so by the season of 1883–'84, and during the coming season (1884–'85) probably not more than half the amount named above, or say 250,000 bushels, are likely to be brought to New Haven. Though the prices fluctuate, the general tendency is toward an increase of the cost of this stock.

In the lower part of New York Bay immense plantations of southern oysters (there called "soft," or "fresh," in contradistinction to the "hard" and "salt" stock native to the locality) have been carried on since 1825. The central place is Prince's Bay, Staten Island, and about 300 bushels are bedded there annually.

The methods of work, beginning in March, are not different from those pursued elsewhere and need not be redescribed. Rappahannock and York River stock seems to have been preferred always in this district, and a large number of sloops and schooners run each spring to and from those rivers. The crews of these vessels are not only native Jerseymen or Staten Islanders, but often Chesapeake men, who come up for a brief season's work and then return to their homes.

"They are required," says an account written in 1853, "in the transplanting of a bed, to heave the oysters overboard, to clean the bed about once a year, and perform various other work of a like description. The cleaning of the beds takes place generally every fall, and is accomplished by means of 'scrapers,' singular looking instruments, somewhat resembling scythes, with this exception, that at one side of the blade a large bag, constructed of iron ring-work, like many purses we have seen, is attached. Into this all the scourings of the bed, cleaned off with the front of the blade, fall, and the whole is hauled up at regular intervals and deposited in the boat, to be afterward thrown into the current. In this manner the whole floor of the bed is scraped quite clean, after which it is considered fit for the reception of the oysters." I doubt if this could be observed now. A similar effect is produced by the process of taking up the oysters in the fall, which begins with the first cool days of September. This is done by tonging from small boats, near which a sloop anchors upon the bed, in which the men are quickly carried out and home again, and easily transport their load. Thus the larger part of the harvest is gathered, until the oysters become scarce upon the ground. Then a dredge is thrown over from the sloop, which cruises back and forth across the ground until it is wholly cleaned up. Tonging over the side of a skiff is hard enough work, and requires sturdy, broad-chested men; but dredging is a still more terrible strain upon the muscles, when it comes to dragging the heavy iron frame and bag up from the rough bottom, and lifting it and its load over the rail onto the deck of the vessel. Many of the newer and larger sloops are now provided with a windlass, specially adapted to dredging (see illustration), which relieves the crews to a great extent of the old hand-over-hand back-breaking labor. Drag-rakes are also used very frequently on these grounds, having very long, limber handles. In Connecticut steamers are being used to a greater and greater extent in taking up the harvest, and this dredging, by whatever method, scrapes and cleans the bottom of filth, dead shells, and débris very advantageously.

After the harvest is finished not a few oysters will yet remain on the beds. The grounds of many of the owners are then given up to the laborers who have worked them on hire. Under a new impulse these men go over the grounds again with tongs and dredge. In some cases they work on shares, paying to the owner of the beds one-half or one-third of the results, which makes a really handsome thing for the gleaners, whose work in this way lasts from two to three weeks, making three or four days a week, each man often clearing as his portion from four to five dollars a day.

In Delaware Bay the scene of bedding southern oysters is altogether on the western, or Delaware shore, where 700,000 or 800,000 bushels are laid down every spring, to be taken up for marketing in Philadelphia each fall.

5. THE TRANSPLANTING OF "NATIVE SEED."

REVIEW OF THE INDUSTRY.—The cultivation of oysters transplanted when young (termed "seed") from the natural reefs where they were spawned to inshore, proprietary grounds, or "beds," and yielding a salable crop after several years' growth, under watchful attention, has long been followed in the United States, and is now to be considered. The practice began everywhere as soon as the natural supply of marketable oysters diminished, and at some points has constituted a very large industry. The inquiry is hence an extensive one, but it is restricted to a comparatively narrow compass.

In the Gulf of Maine the few attempts made have not been encouraging, on account of cost of seed, unfavorable climate, and living enemies.*

For similar reasons there are no important planting interests in the remote South. In the Gulf of Mexico almost nothing of the sort is called for, except at Mobile, where 3,000 or 4,000 bushels are annually transplanted; these are obtained from salt water between Mobile Bay and Biloxi, Mississippi, and are deposited in front of each oysterman's land, toward the head of the bay. A permanent colony of oysters usually follows such a deposit, so that little new stock need be added, until the crowding and the concourse of enemies have destroyed its good qualities, when a new foundation is selected. Though these "plants" exceed in quality and price the best wild oysters sent to Mobile market, the industry is subject to many uncertainties, and produces only 15,000 or 20,000 bushels yearly.

Florida shows no oyster culture worth mention, but at Savannah an old planting interest flourishes, situated mainly at Vernonburg and at Thunderbolt, but now spreading elsewhere through the salt marshes under a protection of a liberal State law. The seed used is gathered in the neighborhood, by crews of men in bateaus, who at low tide pick it by hand from the "coon bars," or sometimes by tonging in deep water, where oysters lie on the bottom singly or nearly so. Not more than two years' growth is allowed the beds, and all the methods are crude, yet the product, though ill-looking, has a fine taste.

Save a small amount in North Carolina, no oyster planting is to be met with northward of Savannah until Chesapeake Bay is reached. From Norfolk, Va., to Baltimore, Md.; in the Delaware Bay; on the seaward side of New Jersey; in New York Bay; Great South Bay; Long Island Sound; Rhode Island and southern Massachusetts, however, planting is followed in the most systematic manner, and the product is worth several millions of dollars annually.

* Yet it was talked about in colonial days, and perhaps tried even in prehistoric times; for, as I have ventured elsewhere to suggest, the oyster-beds in the Sheepscot and George Rivers may have been planted there by the Indians, who carried over from Damariscotta, by paths yet traceable, a quantity of full-grown oysters, and placed them in those streams, in order to keep them alive conveniently near home. If this supposition is correct, it is probably the earliest instance of oyster-culture in North America.

THE CHESAPEAKE REGION.—Planting in Chesapeake Bay is confined almost wholly to the Virginia shore. Previous to the late war the oystermen of Virginia were composed of negro slaves, working for their masters, and of a rough class of whites; but at the close of the war the demand for oysters was very great, and many persons who had been reduced to poverty were glad to avail themselves of this chance to make a support. When the trade revived the beds were well stocked with large finely flavored oysters. Men from nearly all occupations, representing all classes of society, eagerly entered the business, and soon there were hundreds of oystermen where formerly there had been but a dozen or so. Many of the most extensive farmers in the tidewater counties found that the condition of labor had so greatly changed that to make a living it was necessary for them to devote all spare time to the oyster trade. This is still done to a considerable extent by those whose farms border on salt water; but the great bulk of the trade is in the hands of a rougher class, and in certain parts of the State it is almost monopolized by negroes. A very noticeable fact is the almost total absence of foreigners, or of men from other States.

The law of Virginia forbids dredging upon the natural beds or "rocks," and general sentiment discourages, to the extent of practical prohibition, the use of the dredge upon private ground. The planted beds are staked off with poles, sometimes fifty to a hundred yards apart. The dredgers sailing over one bed can scarcely, even if so disposed, keep from crossing the line which separates adjoining beds, while a door is opened to dishonesty. The gathering of seed oysters is therefore done by tonging. Where the business is carried on in a small way, the planters and their assistants go in skiffs and canoes to the banks and load as fast as possible. Larger planters, or those who have a greater distance to travel between the seed beds and the planting-grounds, as is the case especially with the planters of Chincoteague, Lynn Haven Bay, and the Hampton Roads, send sloops and small schooners to be loaded partly or wholly by buying of the local tongmen.

Oyster-tonging involves great exposure, hard labor, and some risk, and the men engaged in it are mostly adult males in the vigor of health. The injury to health from exposure is so great that few ever reach old age. The death rate among oystermen, as compared with other trades, is very great. Nor does oyster-tonging give returns in proportion to labor expended. The element of chance is a large one. A clear, smooth water, with its opportunities for "coveing," permits the fisherman to gather in one day what he may not realize by a week's exertion in stormy and tempestuous weather. The influence of these uncertainties upon the habits and thrift of the men is plainly marked, particularly in dislike of steady industry. Few of them ever pretend to work on Saturday, Sunday, or Monday, and, as a rule, they are poverty-stricken to the last degree. The Tenth Census enumerated nearly 12,000 tongmen in Virginia, besides 2,000 more engaged on larger vessels. The average earnings of these were placed at about $200 annually. Between four and five thousand skiffs and canoes were in use, and about thirteen hundred sailing vessels, the most of which were connected with planting operations.

The most productive region for procuring seed is the James River, which is almost paved with a native oyster growth from its mouth nearly to Jamestown. Certain richer tracts, often measuring some hundreds of acres, and denominated shoals, form centers of tonging-work; and on these, in the fall, and again in the spring, will gather a crowd of canoes and a fleet of the sail-boats sent by distant planters to buy the products of the canoeman's daily labor. In midwinter, when the heavy planters are busy marketing their crops, the tongmen are idle, or are attending to their own little cove-beds, and culling out a few bushels a day for sale. Here comes in the art of "coving," a word which arose from the fact that in old times the finest oysters were found in the little sheltered bays or coves that indent the shores. These were single and, having grown under favorable circumstances were of large size and good quality. On days when the water is clear and smooth

enough to permit them to be seen at from 4 to 7 feet of depth, the oysterman goes in search of these extra-fine specimens into bays, creeks and old planting-grounds, and picks them up, one by one, with a pair of single-tined tongs, appropriately called "nippers."

The scene upon one of the James River shoals at the height of the seed-tonging season is an enlivening one. There will be perhaps a hundred small boats on 500 acres, each containing two or three men. Most of these boats are dug-out canoes, pointed at both ends, and so narrow that should a novice step into one it would most probably be overturned; yet the oystermen work in them all day long in smooth weather, and sometimes in pretty stormy weather, and apparently keep them properly balanced without any effort. To propel them through the water they use a long paddle, wielded at the stern, which also serves as a steerer by a skillful turning of the blade. The tongs employed are of three sizes, 24, 32, and 36 inches in breadth of "head," the size used depending upon the abundance of the seed.

Under the excitement of the competition the oystermen wield their heavy tools with great energy, and rarely bring them up empty. As soon as a load has been obtained, they go and deliver it, if they are working for hire, or proceed to sell it to some sloop, at whose mast-head a basket has been hoisted to show that it had come to buy. Some of the seed is sorted over, and only the living oysters in good shape are reserved; but the greater part is accepted by the planters just as it is brought from the bottom, and includes all the dead shells, trash, and injurious vermin that may happen to come out with it. This "run of the rock" may be had for 5 or 10 cents a bushel, while picked seed costs from 10 to 40 cents.

As soon as a boat is loaded all haste is made to get to the planting-grounds, where the cargo is at once tumbled overboard on the private bed. The expense of carrying and planting is from 8 to 10 cents a bushel—an item little if any larger for first-class culled seed than for the mass of trash, only a portion of which represents living and healthy oysters.

The southernmost, and one of the most famous localities for oyster-planting in Virginia, is at Lynnhaven, just inside of Cape Henry. Lynnhaven River, as described to me by Col. Marshall McDonald, of the U. S. Fish Commission, is simply a branching arm of Chesapeake Bay. It is fed by very little surface-drainage, the rain waters of the back country finding their way into it by percolation through the porous subsoils that form the banks. When the tide is out the fresh water flows out on all sides by infiltration, and dilutes the salt water in the coves and all along the shores. When the tide is at the flood the saltness is in a measure restored. It is to these incursions of fresh water twice in twenty-four hours that the extreme fatness and flavor of these oysters are probably to be attributed.

Oysters for planting are obtained from Back Bay and Linkhorn Bay, tributaries of Lynnhaven River, and from spawning-coves in the river itself; those from James River and other localities have not done well. The seed-oysters are carefully separated and planted evenly and thinly over the bottom, by a careful sowing, broadcast, with a shovel. Any bottom will suit, provided it is not sandy, so as to shift with the action of the tide and bury the oysters, and is not too soft to bear their weight. They remain in the beds six years or more, and are then sent to the market, where they bring the highest price on the list, and are consumed almost wholly, in the shell, by hotels and saloons as "fancy" stock. It is said that 200,000 bushels are now laid down at Lynnhaven, yielding 25,000 bushels for sale annually. All the coves of the river and a greater part of its bed are occupied by plants, and it is feared that the capacity of the river has been overtaxed.

The next most important planting-grounds probably are at Chincoteague, on the ocean side of the peninsula, between Chesapeake Bay and the Atlantic. Oyster cultivation was begun here twenty years ago, and proved extremely profitable. The whole bay is now staked off in small

plats, which are always salable should the owner desire to retire from the business of planting. Seed is derived mainly from the James River, and allowed to lie from eighteen months to two, or sometimes even three years. The latter occurs when, as sometimes happens, a bad, or several successively bad seasons for growth and flavor afflict the locality. Thus previous to 1879 the trade there had seriously declined, but the winter of 1879 and 1880 proved so prosperous that Chincoteague again became prominent, and contributed largely to the European exportations. Chincoteague's dealings are almost exclusively by railway with New York and Philadelphia, and in favorable years the production exceeds 300,000 bushels, much above the average in quality, so that most of the population of a large shore region depend upon it altogether.

A large proportion, also, of the people of Elizabeth City County are oystermen, and extensive areas of its coast are planted, chiefly in Mill Creek, back of Fortress Monroe; on Hampton Flats, between Newport News and Hampton Creek; in the Hampton Creek, on the edge of the channel, and in Willoughby Bay, back of the Ripraps, and up James River. On all of these grounds together perhaps 100,000 bushels of planted oysters are now growing; but, though limited spots appear to have been filled beyond their capacity, thousands of acres of excellent planting ground remain unvailable through the prejudicial effect of the State laws. This feature calls forth remarks by Colonel McDonald, which explain the situation: "The Hampton Flats," he writes, "furnish a notable example of a condition of things that is beginning to prevail extensively in Virginia waters. Formerly they were covered with a natural growth of oysters that had great reputation and commanded a high price in the markets. They lay right at the doors of Hampton, and gave profitable employment to her fishermen; now these flats are exhausted, and though possessing a productive capacity of nearly half a million bushels annually under judicious planting, the law of the State, prohibiting planting upon 'oyster rock,' keeps them barren, when an annual income of not less than $125,000 is possible. There are not now, nor is it likely there ever will be again, any natural, wild oysters growing there. Yet 2,500 acres of fine planting-ground, at the very doors of the oystermen, are compelled to lie idle through shortsighted prejudice."

Back River, dividing Elizabeth City County from York, and Poquosin River, a few miles to the northeast, in York County, both contain wide oyster-beds, seed for which is derived mainly from the upper shoals in James River. The natural oyster-rocks of York River, a broad arm of the Chesapeake, 30 miles or more in length, are now insignificant, compared to former days, and most of the oystermen who formerly worked on this river every season now go to the Rappahannock and the James. Relatively the oyster-planting interests are of greater importance, yet are insignificant now compared to what they were ten years ago. At that time the high price of oysters caused overplanting, which led to the impoverishment of the planting-grounds, while the sudden fall in prices ruined most of those who were engaged in the business. The larger part of the seed at present is brought from the Potomac, and costs 15 or 20 cents "laid down." About 350,000 bushels are raised annually for the northern market by fifteen or twenty planters, who receive an average of 35 cents a bushel.

In the Rappahannock it is an indubitable fact that the natural beds are rapidly being destroyed, oysters are becoming scarcer, prices are increasing from 20 to 25 per cent. each year for "plants," and much discouragment is felt. The planting-grounds extend along the flats on both sides in a narrow strip from Ware's wharf or Russell's Rock, which is about 8 miles above the light-house, to the mouth of the river. The seed comes chiefly from the natural beds in the Rappahannock and Potomac Rivers, with a few from elsewhere. The planters are estimated at about a thousand, most of whom do a very small business; and about 400,000 bushels are taken from the beds annually, to be sold to northern captains, as detailed on previous pages.

This concludes the account of oyster-culture in the Chesapeake so far as at present developed. It will be seen that its processes are crude, its growth hindered by many adverse circumstances, and its extent limited. No doubt it will grow amazingly in all respects during the next decade; but before it does many laws must be modified, and much opposition arising from ignorant prejudice must be swept away.

PLANTING ON WESTERN SHORE OF DELAWARE BAY.—Crossing from Chesapeake to Delaware Bay, we meet with a more systematic oyster-culture, and find that the product sells for more than twice as much money, bushel for bushel, although it still must come into competition at home with oysters of natural growth, and enjoys only a small advantage in its own market in the matter of nearness over the Maryland and Virginia fields.

The two sides of the bay, being in different States, under different laws, and affected by different circumstances, present too great diversity to be treated as one.

On the western shore of the bay, in the State of Delaware, are laid down every spring a vast number of half-grown oysters from Virginia, as has been explained; but in addition to this there is an almost equal business in the raising of oysters from local seed.

The planting-grounds lie chiefly opposite the central part of the State, the villages of Little Creek Landing and Mahon's Ditch, close to Dover, being the homes of most of the oystermen. The beds are chiefly so near shore as to be in less than 10 feet depth of water, though some are as deep as 15 feet at low tide. Various sorts of bottom occur, but stiff mud is preferred. In the course of a dozen years' planting on such a spot, the mud, by accumulation of shells and refuse, is converted into a solid surface. It thus is made suitable for the deposit of spawn and the growth of young oysters, which, proceeding continuously, replaces the formerly barren bottom with a genuine natural bed, or "oyster-rock." The title to the plot is not disputed, however, as it would be in some districts, because of this change, and the ground becomes extremely valuable, since it forms a natural nursery. This title is derived from the laws of the State, which allow any one to appropriate for planting purposes not to exceed 15 acres of bottom within certain limits (and excepting all areas where oysters have previously grown naturally), upon the payment of certain fees annually, in addition to which the boats employed by the planter must be licensed, the charge being made at a higher rate than for a license simply to gather wild oysters from the public banks. In return the State gives to the property of the planter beneath as well as above the waves, not only the protection of rigid and plain-spoken laws, but of an efficient police.

As all taking of oysters in public waters is prohibited in summer, the oysterman's year of labor begins on the 1st of September. It is in the fall that he procures nearly all the native seed that he proposes to plant, and his time is very fully occupied at that season. Though continual dredging is pursued on the home-beds, where natural oysters grow, by no means sufficient seed is gathered there to supply the demand. The inshore creek beds of the State furnish about 40,000 bushels of seed which would count 800 to the bushel. The off-shore beds, in the deeper waters, but within State limits, yield about 170,000 bushels. In addition to this there are planted about 160,000 bushels of seed that grew on the New Jersey side, the procuring of which is an evasion of the New Jersey law which prohibits taking any seed from her beds to be planted outside of the State. This evasion and its methods are perfectly well understood by everybody concerned, and if there is a way to put a stop to it (the extreme desirability of which does not appear) no one exerts himself to do so—at least, no one on the Delaware side. The seed is roughly culled.

It is the custom here to allow native oysters to lie two winters before sending to market. There are occasional exceptions, but to dispose of a native bed at the end of a single year's growth

is generally condemned, and with wisdom. Under this arrangement, however, a large part of the plantation must lie idle every alternate year, and in view of this many of the Delaware men complain with much reason that the limit of 15 acres is too small.

The harvesting of the marketable crop begins in September. It is calculated (and generally realized) that as much by measure shall be taken up each year as has been put down—at present about 300,000 bushels. By count, however, there will not be more than half as many, showing that half of the young perish. The profit, then, is almost wholly on the growth; but as, after from eighteen months to two years' waiting, the stock which cost put down, say, 25 cents, sells, bushel for bushel, at from 75 cents to $1.25, the return is a very fair one.

In the process of taking up a bed of oysters here each dredgeful is culled immediately on board, and all the "trash," that is, undersized oysters, shells and refuse, is saved, and at the end of the dredging is taken to the "idle-ground," where a field of seed is growing, and emptied upon it. Much of this trash is alive and will mature. When, six months (or perhaps not until eighteen months) later, this idle-ground is overhauled and culled out for market, it will be found to have been considerably reinforced by the "trash." A second most excellent effect of this system is that it thoroughly cleans the ground from which the season's salable crop is gathered.

The capital which carries on the oystering in the Delaware waters is almost wholly derived from Philadelphia, and most of the men employed belong there.

PLANTING ON EASTERN SHORE OF DELAWARE BAY.—The New Jersey shore of the bay is bordered by extensive marshes, containing innumerable creeks, and many open places called "ponds." Throughout these creeks and ponds, in tide-ways and alongthe edges of the sedge-plats and islands, oysters have always grown in great profusion. In addition to this the bay and the Delaware River, from Cape May beach clear up to and a little above Cohansey Point, at the southern end of Salem County, a distance of not less than 50 miles, are everywhere furnished with oyster-beds, not confined to the shallow waters near shore, or to the sedge-plats, but apparently scattered over the whole bottom of the bay. Even the ship-channel, 90 fathoms deep, contains them.

The center of the present great planting industries on the New Jersey shore is at Maurice Cove. So important had the oyster fisheries in this region become thirty years ago, that they were the subject of much special legislation, which appears in the revised statutes of 1856, and has been little changed. By these laws the planting areas are defined, and county commissioners were authorized to survey and map the bottom of the river and cove, and rent to the highest bidder subdivisions for planting purposes, no one man to own more than 10 acres, and no company more than 30 acres; nor could possession be retained more than five years, at the end of which the land is again put up to be bid upon at a new rent-rate. The commissioners were also enjoined to carry out the general laws relating to shell-fish. Supplements to these laws made stricter provisions against trespass and night fishing, put license-fees upon all boats according to tonnage, and set on foot a peculiar institution in Maurice Cove, called the Oystermen's Association. This association consists of all persons "growing oysters in Maurice River Cove." Once a year it decides by a two-thirds vote what tax (not more than $1 a ton) shall be laid upon all boats of over 5 tons in the association, in addition to the State tax, and it elects an officer empowered to collect this tax and to see that the laws of the locality are not violated.

The main object of the association is protection to property and honest industry, and the chief outlay of the funds derived is the maintenance of a watch-boat and police crew, which shall guard the beds in the cove against thieves and arrest all boats that do not show, by a number in the middle of the mainsail, that they have a license. Many of these home-delinquents would rather

take the chances of arrest than pay the cost of membership in the association. In all about three hundred boats are licensed by as many planters, and some 6,000 acres of ground are cultivated, all in the vicinity of Maurice Cove.

The seed used in this planting is procured almost entirely in Delaware Bay. From the inclosed river and ponds, and also from the outside waters of the bay southward of Egg Island, great numbers of large-sized and sweet oysters have always been taken and sent to market or peddled through the neighborhood. When planting-beds were so greatly increased in Maurice River Cove, the shore people found that the diligent search for young oysters through the marshes, and the persistent dredging during three-fourths of the year, were sensibly diminishing the supply of marketable oysters attainable by the small open boats. Of these there are fifty or more owned along the shore. They are too small to come under the association's tax; do not belong to planters, but are owned by men who live near the shore, and gain a large part of their livelihood by tonging and hand-dredging. These people, owing to misfortune or improvidence, are too poor to plant, but can do well if they are allowed to catch all the year round in the southern part of the bay, where all the oysters taken are of marketable size. For the protection of this class, involving perhaps a thousand families, the legislature of 1880 prohibited all catching of oysters for planting in the southern part of bay.

Though large quantities of seed are furnished the planters from the creeks and marshes by men who pick it up, using small boats, yet the main supply necessarily comes from dredging by the large boats, properly fitted with improved windlasses and deep-water apparatus, on the isolated areas in the upper part of the bay. Six or eight fathoms of line is the ordinary amount used, but successful dredging has been done in all parts of the southern half of Delaware Bay, even where the water is more than 500 feet deep. This deep dredging is unprofitable and not practiced; but that oysters exist there has been shown by experiment, as I was positively assured by Daniel T. Dowell, esq., of Mauricetown, who gave me many interesting notes upon this region. Most of the boats are of good model and build, some exceeding 40 tons burden. They employ, as crews, during ten months of the year, no less than fifteen hundred men, all citizens of New Jersey, and nearly $500,000 must be spent annually by the owners of Maurice Cove beds in the operation of their fleet, while nearly 2,500,000 bushels of seed oysters are taken from the natural rocks and spread upon inshore grounds each year, to be left, as a rule, two years. As near as can be ascertained, 1,600,000 bushels, worth $1,600,000, are at present sent to market in assorted cargoes. A large amount of Philadelphia capital is invested in this region, and I do not know a more generally prosperous oystering community than Maurice Cove seems to be.

THE OCEAN COAST OF NEW JERSEY.—On the outer, or ocean coast of New Jersey lies a long series of sedgy lagoons and inlets, protected by outer beaches, extending with little interruption from Cape May to Barnegat, and again in the rear of Sandy Hook. In almost every one of these local oysters have been transplanted to private beds for additional growth, and at some points a large success has been attained. In Cape May and Atlantic Counties nearly every farmer is also an oyster-planter, getting his seed in the immediate vicinity. The center of this district is in the neighborhood of Atlantic City, where the muddy bottom of Lake's Bay and other noted inlets largely supply the Philadelphia markets.

Many of these planters go in their own sloops after the seed to The Gravelling, a shoal several miles square lying in the mouth of the Mullica River, at the head of Great Bay, N. J. There seems little diminution of the supply of young oysters in this piece of water, which is given by law a summer-rest, and not a few marketable oysters are tonged up every season. Hither, also, resort a host of planters from towns northward, and at the opening of the season, on October 1,

lively work is done. During all day of September 30, and during the night, schooners, sloops, cat-boats, sail-scows, trim yachts, and shapeless, ragged tubs, have gathered there, chosen a spot out of what was left of the space, and anchored. Once the anchor down, no movement elsewhere can be made. Each sail-craft tows behind it one or two small scows, termed "garveys," and has upon its deck one or more small skiffs, or perhaps those ingenious ducking-boats peculiar to this region, called "dinkies." So massive is each year's growth that the first day's work is likely to yield 100 to 150 bushels of seed to the man on the most favorable ground, but by the end of a week most of the tongmen have found it no longer worth their while to work. The owners of the extensive planting interests in Barnegat Bay do not come here, but supply themselves mainly from the Cedar Creek beds, nearer home.

A crop approximating 250,000 bushels is harvested every year from the planting of this home seed along the ocean-shore of New Jersey, but the arrangement and meager care of the beds call for no special remark. The growth is, in general, rather slow, and the product not yet, on the average, of so high a quality or cash value as that of either the Delaware or Raritan shores of the same State.

THE RARITAN DISTRICT.—Passing northward to the Raritan district, we shall find beds of transplanted native oysters maturing upon the shallows all the way from Sandy Hook to Perth Amboy and half engirdling Staten Island; and that there, as elsewhere, this branch of the business is gradually superseding the growing of southern "plants."

But this planting of native seed-oysters in New York Bay is an old industry. In 1853, for example, it was stated there were at least one thousand men employed in cultivating "York Bays" for the purpose of shipping them. "The hardness of their shell and the peculiar saltness of the meat render them better adapted for shipping than any others, and they are, therefore, used almost wholly for the western trade. The boats employed in transporting them from the North River and Newark Bay to the artificial beds are open, and are each generally manned by three or four men. * * * These men work in sloops and skiffs owned by themselves. The owners of each boat are also proprietors of one or more beds planted by themselves. There are about two hundred boats, altogether, each of which is valued at an average of $800."

It is added that one-third of all the seed planted at that time came out of the North River, from beds "which extend at intervals from Piermont to Sing Sing," where the growth was said to be exceedingly quick and abundant. Now the chief source is Newark Bay and Raritan River, though the North and East Rivers and Long Island Sound are drawn upon. A considerable quantity of seed is also brought from as far away as Fair Haven and Blue Point. In most cases the planters themselves gather what they use, by going after it in their own sloops, taking a small boat and a man to help. Not a little is procured at home, especially in the vicinity of Keyport. This grows on soft mud and in sedgy places, and hence is long, slender, crooked, and ill-shaped. Planted in from 10 to 15 feet depth of water, purer, salter, and upon a better bottom than before, it rounds out into good shape, and grows with considerable rapidity in good seasons. The best bottom is a thin layer of mud overlying sand, and the best time for planting is in March, April, and May.

By the end of May all work upon the beds ceases, beyond taking up an occasional boat-load to supply the weak summer demand. The condition of the beds is watched closely, however, by the anxious owners, since it is the midsummer months that determine whether the oysters will report themselves "good" in the fall, or the reverse; which means a profitable business, or the opposite. If the season is hot, equable, and reasonably calm, all is expected to go well. Heavy

storms and great freshets in July and August, on the other hand, produce thin and poor oysters, which will not bring a good price.

Early in the spring, however, before the planting of new seed begins, the oystermen of this district hire help to carry on another feature of their business, the "shifting." As soon as the weather gets fairly settled the "natives," intended to be sent to market the following fall, are taken up from the place where they lie, culled over, and cleaned, if needful, and relaid more thinly on a new bed. Usually this is a movement from a soft to a harder bottom, and sometimes to a region of fresher water. At Perth Amboy, however, oysters shifted are placed farther down the bay. It operates advantageously in two ways: by repressing the tendency to spawn, which is undesirable, and by giving them the benefit of a change of water and food. Moreover, on the sand they will tend to grow round and shapely beyond their ability to do so when crowded in the mud, while the fresher water will make them fatter. The actual result, nevertheless, is sometimes disappointing, particularly if there be no current over the new bed to bring a steady supply of fresh water.

The man who has only a few hundred bushels will do this "shifting," as it is termed, himself; but for the large planters it is usually done by a contractor, either for a lump sum or for an amount of pay based upon an estimate of the quantity, or at the rate of 10 to 15 cents per bushel, according to the density of the oyster-beds, and hence the time to be consumed. In either case the cost is about the same. One gentleman told me he paid $1,300 to have 11,000 bushels shifted under the first named arrangement. While this is going on the southern cargoes are being laid upon the beds, and at Keyport a score or more of negroes from Norfolk annually appear as laborers, returning, at the end of the work, to their homes.

The growth of oysters transplanted to these New York Bay waters is reasonably rapid, though not as fast as occurs in the Great South Bay of Long Island. The usual expectation is to leave the beds undisturbed for three years, then shift in the spring and market in the fall. As planting of seed occurs both spring and fall, the crop of every year is thus the first of a series of six. All "naturals," that is, local oysters, planted will outgrow other seed, doubling in size in a single season. The oysters from the sound, however, have been used largely for European trade for the last two or three years, and have acquired a high reputation. These do not require to lie three years, since they are wanted of small size.

Most of the planters here, as on Long Island and in the East River, are themselves merchants of shell-fish in New York, or in partnership with merchants.

THE SOUTH SHORE OF LONG ISLAND.—On the south shore of Long Island oyster planting is carried on very extensively, and is subdivided into a great number of small holdings. At the western end of Long Island Sound is a series of interlacing channels, through a great marshy lagoon, protected outwardly by Longbeach from the Atlantic, and separated from Hempstead Bay, east, by large islands. This confusing net-work of shallow, tidal creeks, ramifying in all directions through an immense expanse of sedge, lies on the eastern side of the township of Rockaway. West of the town spread the more open waters of Jamaica Bay. In both these waters oysters are grown in great quantities, and as every village, beach, inlet, and channel in the whole region has the name Rockaway attached to it in some shape, it is not surprising that these oysters should take the universal name, too, in the New York markets, whither they all tend. Under closely protective local laws, nearly every family in the town is engaged in oystering. Rockaway men get their seed from Brookhaven and Newark Bay, but prefer East River seed to any other, and use the largest quantity of it. It is brought to them in sloops. Rockaway itself owns few large sail-boats; its channels are too shallow and devious to admit of easy navigation, but every man has a skiff, and all the planters flat planting-boats. Virginia oysters have been tried, but now

none are planted. The growth of Rockaway oysters is extremely rapid. The mud in the bottom of these marshy channels, which is only sufficiently compact to hold the oysters from being smothered, seems to be full of nourishment, and the oysters are always large and fat.

The same story applies with more or less truth all along the shore to Babylon, where a promising industry, for which there is room for great development, has been begun in the neighborhood of Oak Island. The growth of oysters transplanted to Oak Island waters is extremely rapid. They have been known frequently to double their size in a single season, and are often sent to market at the age of fifteen months; that is, the second fall after their birth. This rapidity of growth is attributed to the freshness of the water, but undoubtedly is due to the excess of confervoid and other food in the water. I know no place where it is more abundant, and it is quite possible that the fishermen are right when they attribute the circumstance that oyster-spawn never catches west of Nicoll's Point, except around the mussel-beds in the inlet, to the great prevalence of slime in the water; for this "slime" is the vegetable and hydroid growth that furnishes so much nourishment to the adult oysters, and everywhere covers the bottom with a slippery growth and deposition. The chief drawback to success is the devastation sometimes wrought by moving ice.

This brings us to the Great South Bay, an inclosed space of quiet water behind Fire Island and other beaches, some 30 miles long. It is only at its eastern (Brookhaven) end, however, that oysters grow naturally in any amount, or that oyster-culture has been carried on apart from the Oak Island beds. Very complicated regulations exist as to the legal right of the planters in their grounds, and I must refer the reader to my census monograph* for the particulars. How vast were the natural beds of oysters in the eastern part of Great South Bay has already been noted, and also the way it was exhausted by incessant drafts, not only for plantations on the neighboring shores, but by men who came in sloops from Rhode Island and Massachusetts, Rockaway and New Jersey. Planting interests thus became a necessity a quarter of a century ago, and though the home beds are not yet quite exhausted, they have so decreased, in spite of protective legislation, that the planters there are obliged to bring as much as 100,000 bushels of supplementary seed every year from Newark, North River, or the Connecticut shore. I have discussed this matter, and expressed my opinion as to the decline of the seed-producing power of this district, at great length in my report to the census above referred to. In a word, the oysters are taken up faster than they can multiply—the banks are over-raked.

The center of the planting interest of the Great South Bay is at Patchogue, and there are about 1,000 acres of bottom under cultivation in front of the town. This area includes all the coast from Patchogue to Bayshore, thus taking in the settlements and railway stations, Bayport, Youngport, Blue Point, Sayville, and Oakdale. A part of these lie in the town of Islip and the rest in Brookhaven, and thus come under slightly different regulations, but otherwise they form together a homogeneous district, and the oysters they raise go to market under the general brand-name of "Blue Points." The artificial beds upon which these oysters grow are all near shore, and in water rarely more than 2 fathoms deep, and often less. The bottom varies, but, as a rule, consists of mud overlying sand. The preference is in favor of water 6 to 10 feet in depth, which is deep enough to escape ordinary gales, and is not too expensive to work. The oysters fatten better there than in shoaler water, one planter said. The seed consists of the native growth, eked out by cargoes from New York Bay, the East River, and elsewhere. The experiment of planting Virginia oysters as seed has proved a failure; they develop a shell closely resembling the native, but the moment the oyster is opened the difference and inferiority of the meat is apparent, both to the eye and the taste. Southern oysters will survive the winter in this bay, grow, and emit

* The Oyster Industry, by Ernest Ingersoll: Department of the Interior: Tenth Census, Washington, 1881.

spawn; but planters consider that they tend to reduce the quality and price of the native stock, and hence have almost ceased to bring any.

No less than five hundred sail-boats are to be seen every spring and fall between Moriches and Blue Point gathering seed, carrying it away, and buying it for outside planters. To every one of these five hundred sail-boats, mainly well-built sloops and cat-boats, three men may be counted, so that fifteen hundred men are probably employed in this industry alone at these times. How much seed is procured each season it is impossible to state, but I should judge it to be not less than 100,000 bushels, or twice that amount for the annual yield. The poorer seed caught is sold to a great extent in the rough—stones, shells, dead stuff, and all—just as it comes, since on much of it there are oysters clinging too small to be detached. Much, however, is culled, boys going in the boat and picking the tongfuls over as fast as they are poured out upon a board placed across the middle of the skiff from gunwale to gunwale; for this service from 40 to 60 cents is paid. The buyers are planters at Bellport, Patchogue, Blue Point, Sayville and the towns farther west, and occasionally a man fram Rhode Island or Connecticut, who wants this seed to work up into a particular grade on his home beds.

Home seed is preferred to any from a distance, but it is conceded that oysters taken from the eastern to the western end of the bay grow more rapidly than those not changed. The ordinary amount of small seed put on an acre is 500 bushels, chiefly laid down in the spring. In the fall the owner goes over them and thins them out, finding a great many which are large enough for market, though no bigger than a silver dollar. The rest remain down longer, and meanwhile constant additions of seed are made alongside.

As you go westward to the extremity of the "Blue Point" district, in the neighborhood of Bayshore, you find a feeling of discouragement. The oysters there do not grow as fast or become as finely flavored as those to the eastward, and all the seed must be bought or poached stealthily from Brookhaven. Large quantities of ground there are not taken up, although with the help of capital it might be made productive.

The crops gathered from the beds of the Blue Point district amount in the aggregate to something over 200,000 bushels annually, while the western part of the shore, from Babylon to Coney Island, sends about twice as much to market.

THE EAST RIVER AND LONG ISLAND SOUND.—Going around into the East River, or eastern end of Long Island Sound, we find the mouths of all the rivers and the shallows of nearly every one of the many coves that indent the rocky coasts on both sides occupied by private beds of oysters, each held under local regulations. On the Long Island side the principal points are Great Neck, Port Washington, Oyster Bay, Huntington Bay, and Port Jefferson, with many minor points between; and the annual aggregate yield of the whole north shore of Long Island is between 350,000 and 400,000 bushels, but the average price is less than $1 a bushel.

On the Connecticut shore, also, every sheltered indentation has its planted oyster-beds, especially at City Island, Greenwich, Rowayton, and South Norwalk.

I do not know that the methods differ from those already described, except that no "shifting" is praticed, and in most cases less attention and care is given to the cultivation of the beds than at Staten Island and Patchogue.

The obtaining of the seed is worthy some mention, however. The smaller planters in the eastern part can get nearly enough close at home for their purpose, and are to be seen in great numbers tonging and raking all along between Great Neck and Hell Gate. The best ground is directly in the steamboat channel, where the cinders falling from the innumerable steamers that pass daily furnish a capital "cultch" for the oyster-spat to attach itself to. This ground is gradu-

ally extending itself into a productive tract half way to Norwalk, and the scraping of the bottom with the big, deep-cutting, dredge-like clam-rake undoubtedly contributes to the growth of young oysters as well as young clams there, by preparing the ground to retain the spawn, which is at that very season floating about.

Planters who require large supplies, and nearly all those who live east of Great Neck and City Island, either buy their seed from others or go after it themselves to the public oyster-grounds up the sound, where a large fleet of oyster vessels may be seen during the proper season, gathered from New York, New Jersey, Rhode Island, and the Great South Bay, as well as from the town, along both shores of the sound.

From City Island (the oldest artificial beds in East River) eastward oyster-beds are planted with this seed, annually, at every favorable spot as far as Port Chester and East Chester. The business is of small account, however, though many persons are engaged in it in feeble fashion. The coves about the harbor of Greenwich, Conn., are occupied by planters, who raise perhaps 35,000 bushels annually. Stamford has seen better days than the present in the oyster business, and the same is true of Darien, just beyond.

At Rowayton, or Five Mile River, the next shore-town, however, very important planting interests are owned, and excellent oysters are raised for the New York and European markets. The little creek-mouth is filled with oyster-sloops, and the shores are lined with the warehouses of the planters, who are prosperous and enterprising, harvesting probably 75,000 bushels annually. Like all other parts of the East River, the oysters are sold here wholly in the shell, and almost always by the barrel or bushel, the selling "by count" belonging to the region farther west and to the Long Island shore. Just eastward of Rowayton lies the city and harbor of South Norwalk, one of the most important oyster-producing localities in Long Island Sound, as well as one of the "oldest." The bay at the mouth of the Norwalk River is filled with islands, which protect the shallow waters from the fury of the gales, and their sheltered coves began to be utilized for oyster planting about 1850. Now the business has grown to such proportion that more than one hundred families get their whole support from it, and the annual yield approaches 100,000 bushels, produced by about fifty planters, who occupy 2,500 acres of ground, the right to which they would not sell for less than $8,000 or $10,000. From $50,000 to $75,000 a year are reinvested in the beds at Norwalk, counting the time of the planters as so much money. Few can afford to hire help, except occasionally, for a few days at a time. Wages, in that case, are from $1 to $2 per day. Many of the planters here, and at Rowayton, are also concerned in operations on the opposite shore of Long Island.

At Westport (to move another step eastward) the first efforts at planting were made in the mill-pond east of the village, a pond of salt water about 40 acres in extent. The bottom of this pond is a soft mass of mud; not barren, clayey mud, but a flocculent mass of decayed vegetation, &c., apparently inhabited through and through by the microscopic life, both vegetable and animal, which the oyster feeds upon. Although the young oysters placed there sank out of sight in this mud, they were not smothered on account of its looseness, but, on the contrary, throve to an extraordinary degree, as also did their neighbors, the clams and eels, becoming of great size and extremely fat. Fifteen years ago oysters from this pond sold for $3 a bushel; and for one lot $16.50 is said to have been obtained. Before long, however, a rough class of loungers began to frequent the pond, and the oysters were stolen so fast that planting there has almost wholly ceased, and prices have greatly declined.

Similarly the planting-beds at the mouth of the Saugatuck, where a quarter of a century ago Westport men used to lay down a large part of the 50,000 bushels of small oysters annually

gathered in their populous river-channels, are now almost abandoned, owing to exhaustion of the natural growth in the river.

At Bridgeport something over 100 acres are rented from the town for oyster-culture, and a considerable business is growing up under favorable circumstances. The same may be said of the Milford shore, but probably the total yield from native plants at Westport, Bridgeport, and Milford together will not exceed 15,000 bushels a year, worth $15,000.

I have already spoken so fully of the harbor of New Haven, the next locality, and the seed gathering at its upper end, on previous pages, and shall have so much to say of it hereafter, that it would be a waste of space to go into details here. None or few of the New Haven men plant exclusively native seed oysters, while all use more or less of this kind in connection with their raising of Chesapeake stock and their deep-water spawn catching. All available land on both sides of the harbor is occupied, and it amounts to many hundreds of acres. The seed is gathered in the sound, and large quantities are resold to Rhode Island and other planters. While it is impossible to discriminate between the yield from transplanted small seed and that produced by the deep-water beds (see subsequent pages), I suppose that 75,000 bushels are annually raised in the former way. The methods of transplantation do not differ essentially from those pursued elsewhere, except that rather more care is exercised than in the East River.

Oyster seed is transplanted to inshore beds at Branford, Stony Creek, Guilford, Clinton, Saybrook, and New London, but the business is small in each locality, and the total yield of marketable oysters from this source does not exceed 40,000 bushels.

NARRAGANSETT BAY.—Our next point of inquiry is Narragansett Bay, Rhode Island. Here, as already stated, little remains of the natural wealth of oysters upon which the early planters, half a century ago, could draw to what seemed an unlimited extent. Now the seed used must be imported almost entirely from other States. The planting-grounds of Narragansett Bay and its tributaries lie in the Kickamuit, Warren, Barrington, and Palmer Rivers, on the eastern shore. These are clear streams, with strong tideways refreshing inner basins, shallow and quiet. Rumstick Point separating Warren River from the bay, is a favorite planting point. Beyond this, along the eastern shore of Providence River, come next the planting areas at Nayat Point (Allen's ledge) and Drownville, an important and busy place.

Reaching back into the country north of Drownville, and protected from the outer bay by Bullock's Point, is Bullock's cove, a shallow estuary, by many regarded as the very best place to plant oysters in the whole State. The only reason I have heard assigned is, that the bottom has many springs in it, supplying constant fresh water. Above, ground is planted as far as Field's Point on the western side. Southward, from Field's Point to Starvegoat Island, runs a reef nearly dry at low tide. This reef was among the earliest tracts taken up by the veteran oysterman, Robert Pettis. When, about 1861, the star-fishes were depopulating the beds all over the bay, he alone was so situated that he could get at them at low tide and destroy them, and his good luck was the occasion of great profit to him. Formerly natural oysters grew abundantly all over this part of the river, but the main deposit was just south of Starvegoat Island, in the center of the tract of 160 acres now known to oystermen as Great Bed. This, in old times, was the great scene of oyster-raking, and it is more than thirty years since these beds were wholly exhausted. Every square rod of this area is now utilized, and large planting tracts also exist at Patuxent, Gaspé Point, Canimicut Point, and, to a slight extent, in the harbors of Wickford and Westerly. There is a constant tendency to enlarge this area, which, in 1880, comprised about a thousand acres, by extension toward deeper water; but it must not be forgotten by the reader that a larger part of

this ground is devoted to the growing of Chesapeake oysters than to the raising of the "native," or northern seed, to which we are now attending.

The seed used, as I have hinted, comes almost wholly from outside waters. Besides small quantities from the Kickamuit and Warren Rivers, the Seekonk, at the head of Providence Harbor, is the only remaining home locality of any account where small oysters may be gathered. The history of this river I have given elsewhere.

The remainder of the seed-oysters planted in Narragansett Bay come from the Connecticut shore, East River, Fire Island, and the Great South Bay, Somerset (planted chiefly by those owning privileges in Taunton River), and from various parts of Buzzard's Bay. I often asked which was best, but could never get evidence of much superiority in any one kind. The success of a planting does not depend on the kind of seed put down so much as it does upon a thousand circumstances of weather, water, and bottom. The seed which would do excellently in one cove would behave badly in the next, and *vice versa*, individual preferences being founded upon these varying and unexplained experiences. The seed from the south shore of Long Island used to be cheapest of all, and good; but a Boston demand ran up the price beyond the pockets of Rhode Island planters. In general, it may be said that any seed transplanted to Narragansett Bay develops into a better oyster than it would have come to be if left in its native waters.

Similarly, it is hard to tell what has been the outcome of a particular planting—that is, how much profit is made—because it is inextricably mixed with various other work. Native seed put down and ready to grow has cost on an average about 60 cents a bushel. To estimate profits on it is out of the question until the oysters are all sold, nor even then. If all does well, treble value is calculated upon in three years' growth.

It is not even decided whether it pays best to grow "natives" or fatten "Chesapeakes." The first year you plant a piece of ground the oysters do the best; the next year poorer; the third year they fail. Consequently, the oystermen try not to plant the same area continually, but shift their oysters around to allow the old ground to be revived by free contact with the sea.

BUZZARD'S BAY.—The oyster-planting operations in Buzzard's Bay, supplied almost wholly by local seed, with small additions, principally from Somerset, are widely distributed but not of great importance. There was formerly a very large oyster business in the Wareham River, but this has been unprofitable of late. The Monument River and the shores near its mouth are probably the points of greatest importance at present. More or less planting is carried on also on the Cape Cod shore at the entrance to Buzzard's Bay, while experiments at Wellfleet are having a profitable outcome.

METHODS OF GATHERING SEED OYSTERS IN LONG ISLAND SOUND.

SEED GATHERING IN LONG ISLAND SOUND.—Before dismissing this subject it will be proper to give some brief account of the seed-gathering in Long Island Sound, which is the source of nearly all supplies east of New York City. Midsummer is the season devoted to this work. In gathering seed near shore, and somewhat otherwise, tongs and occasionally rakes (those with long curved teeth) are used; but in deep water, where all work of consequence is done, the oysters, young, old, and refuse together, are brought from the bottom by dredges of various weights. In the case of all the smaller sail-boats, the dredges having been thrown overboard and filled, are hauled up by hand—a back-breaking operation. The oysters themselves are very heavy, and frequently half the amount caught is composed of shells, dead oysters, winkles, and other trash, which must be culled out, thus compelling the oystermen to twice or thrice the work which they would be put to if there were nothing but oysters on the ground. The work of catching the oysters by any of these methods is, therefore, very tiresome and heavy, and various improvements

have been made, from time to time, in the way of labor-saving, from a simple crank and windlass to patented complicated power-windlasses, similar to those commonly used in the Chesapeake boats. (See illustration.) When a proper breeze is blowing, dredging can be accomplished from a sail-boat, with one of these windlasses, with much quickness and ease. In a calm, or in a gale, however, the work must cease, as a rule.

Under these circumstances, and as the business increased, it is not surprising that the aid of steam should have been enlisted; nor, perhaps, is the controversy which has ensued to be wondered at, since the introduction of novel or superior power into some well-traveled walk of industry has ever met with indignant opposition.

The first utilization of steam in this business, so far as I can learn, was at South Norwalk, about 1870. This was followed by others, until, in 1880, seven dredging steamers were operating in Connecticut waters. In their report for 1884 the shell-fish commissioners of the State enumerated no less than thirty-one, having an aggregate carrying capacity of 27,225 bushels, while several new and larger ones are building.

The growth of this fleet has been regarded with enmity by the great body of shoremen, who looked askance at the rapidity and comprehensiveness of the work performed, and early began to attempt to form public opinion and secure legislation tending to repress this dangerous competition. The first result of this was restricting steam-dredging on public seed ground in the sound to two days of each week. Not satisfied with this, however, laws were sought which, if they did not prohibit the use of steam altogether, should at least restrict it to the designated planting-ground of the owner. The controversy which ensued then was long and bitter. At the time that my special monograph on the oyster was written for the Census Bureau the discussion was at its height, and I gave at length the arguments for and against, together with comments, to which the reader is referred if he desires to go deeper into the question. A strong prejudice still exists, so far as the employment of steamers on public ground is concerned.

OYSTER PLANTING AT SAN FRANCISCO.

One of the most interesting phases of the transplantation of oysters is that by which San Francisco Bay has been stocked from the Atlantic.

The first experimental shipments were made about 1870, on the Alameda side of the bay, with young oysters received by rail from New York. Though the growth was rapid, and the flavor unimpaired, so that success seemed assured, it was not until 1875 that any San Franciscan dealers felt justified in ordering large quantities, but in that year large shipments began, which have been continued with regularity and slowly increasing amount every since, until now something like $600,000 worth (adding freight to first cost) are annually transported across the breadth of the American continent—an almost unexampled movement of living food. The shipping season is from the middle of October until the middle of November, and again from March 15 to the middle of May. The oysters sent to California are all procured from beds in the neighborhood of New York, and are of two classes: first, those of marketable size and designed for immediate use; and, second, those intended to be planted.

For the first purpose stock is selected from York Bay, Blue Point, Staten Island Sound, Rockaway, Norwalk, and occasionally from Virginia, and from Egg Harbor and Maurice Cove, New Jersey; but the whole amount of this class constitutes less than one-fifth of the total shipment. These oysters are either placed on sale at once in the California markets, or are "bedded down" for a few days, to await a favorable sale.

The class of oysters sent as "seed" is entirely different, and is derived chiefly from Newark

Bay and the North River, stock from there standing the journey better than the East River oysters, which otherwise seem preferable. Besides these, seed is sent from Raritan River, New Jersey, and Prince's Bay, Staten Island. This seed is so small that a barrel holds from 3,000 to 5,000; this number, of course, includes even the "blisters," or oysters so young that you cannot easily detect the double character of the shell, which looks like your finger-nail. Although the average time of passage is only eighteen days by the fast-freight lines, it is expected that about one-fourth of each barrelful will prove dead or too weak to survive transplanting at the end of the journey. The "blisters" will be found to have died far more frequently than the larger oysters, none of which, however, are older than a few months and larger than a silver quarter. The cars in which they are carried are double-walled, so as to preserve an equality of temperature so far as possible, and 22,000 pounds is the limit of the cargo allowed by the company. The freight charges at present are about $10 a barrel. This makes it unprofitable to import any seed except that which is very small, and which by growth can add very greatly to their size and consequent value.

The planting beds are situated in various parts of San Francisco Bay, and nearly all go dry at low water. Some of the localities mentioned are: Millbræ, Saucelito, Alameda Creek, Tomales Bay, Belmont, Oakland Creek, and San Leandro. Sheep Island, I believe, is no longer planted. The State owns the bottom and sells it by auction to the highest bidder, the purchaser being given a patent title in perpetuity. The State's nominal price was $1.25 an acre, but most of the suitable ground was taken up long ago, and must now be bought at second-hand. Portions of it have been sold thus for $100 an acre. The growth is extremely rapid, fully three times as rapid as ordinarily takes place in eastern waters, and this growth tends toward the fattening of the flesh rather than to greater weight of shell, a result highly desirable; but the mollusk is not considered so hardy here as at the East. The seed remains on the beds from two to four years before selling.

All attempts to make these eastern oysters fructify and propagate, however, have failed, so far as any commercial benefit is concerned, the oysters dying, seemingly from over-growth, as soon as they have arrived at an age when they might be expected to spawn. This is the local explanation.

It is, however, a fact that a few young eastern oysters are now and then found. The excessive fatness is no doubt due to the thick nutritiously muddy water of the bay, but I should say that this had only a secondary effect on the spawning, which was repressed first by the shock of the long railway journey, and secondly by the unnatural coldness of the water to which they are transplanted. It is a parallel fact to the failure to spawn in the case of southern oysters carried to northern waters on the Atlantic coast. The summer temperature of the water at San Francisco is much lower than that of the water around New York, although the mean winter temperature may be higher.

6. CULTURE OF OYSTERS FROM THE SPAWN.

ORIGIN OF OYSTER-CULTURE.—As the natural wealth of marketable oysters upon the ancient beds began to be exhausted, and the various methods of transplanting to new ground, and of raising oysters from transferred young, began to be practiced, men became more and more studious of the habits of this profitable mollusk, and observant of the conditions which facilitated its health and increase.

Attention was turned most zealously to its spawning and the habits of the young, and thus the main outlines of what is now scientifically known in respect to its reproduction were long ago ascertained by the fishermen. Thus it had been a matter of common observation for many years, before practical advantage was taken of the fact, that any object tossed into the water in summer

became covered at once with infant oysters. Sedges along the edge of the marshes, and buoys, stakes and wharf-piles were similarly clothed. If the circumstances were favorable this deposit survived the winter, and the next spring the youngsters* were large enough to be taken and transplanted. The imagination of the oystermen (at that date not so far astray in many localities as it would be now) filled the waters of the whole offing with drifting eggs and embryos of oysters and clams, and fully half a century ago men began to discuss the possibility of saving some of this wasting spawn. The immediate and logical suggestion, of course, was to place in the shallow water, in places where naturally there was nothing upon which they could "set," objects to which the embryos might attach themselves. A few months later, after they had attained the size suitable for "seed," they could be transplanted at slight expense.

The next question was, What would best serve the purpose? Evidently nothing could be better than the shells which, year by year, accumulated on the shore from the season's opening-trade. They were the customary resting-places of spawn, and at the same time were cheapest. The City Island oysterman, therefore, began to save his shells from the lime-kiln and the road-master, and to spread them on the bottom of the bay, hoping to save some of the oyster-spawn with which his imagination densely crowded the sea-water. This happened, I am told, more than fifty years ago, and a short time afterward, under protection of new laws recognizing property in such investments, planters went into it on an extensive scale along the sound and on the south shore of Long Island. It was soon discovered, however, that uniform success was not to be hoped, and the steady, magnificent crops reaped by the earliest planters were rarely emulated. Many planters, therefore, decried the whole scheme, and returned to their simple transplanting of natural-bed seed; but others, with more consistency, set at work to improve their chances, by making more and more favorable the opportunities for an oyster's egg successfully to attach itself during its brief natatory life, to the stool prepared for it, and afterward to live to an age when it was strong enough to hold its own against the weather. This involved a closer study of the general natural history of the oyster.

The first thing found out was that the floating spawn would not attach itself to, or "set" (in the vernacular of the shore) upon, anything which had not a clean surface; smoothness did not hinder—glass bottles were frequently coated outside and in with young shells—but the surface of the object must not be slimy. It was discovered, too, that the half-sedimentary, half-vegetable deposit of the water, coating any submerged object with a slippery film, was acquired with marvelous speed. Thus shells laid down a very few days before the spawning time of the oysters became so slimy as to catch little or no spawn, no matter how much of it was floating in the water above them. This taught the oystermen that they must not spread their shells until the midst of the spawning season; one step was gained when they ceased spreading in May and waited until July. Now from the 5th to the 15th of that month is considered the proper time, and no shell planting is attempted before or after. This knowledge of the speed with which the shells became slimy was turned to account in another way. It was evident that the swifter the current the less would there be a chance of rapid fouling. Planters, therefore, chose their ground in the swiftest tideways they could find.

By and by another point was gained, resulting from many failures to get the plenteous "set" anticipated. The supposition among the earliest experimenters was that the water every-

* There is no word in the Northern States for infant oysters, except the terms "set," "spat," "spawn," &c., all of which belonged originally to the eggs or spawn of the oyster, yet are confusedly applied as well to half-grown mollusks. In the South the name "blister" (referring to its smooth, puffed-up appearance) is given to the infant oyster, and serves to distinguish it from "seed," "cullens," and "oysters," which represent the successively larger sizes and stages of growth. This expressive name is worthy of general adoption.

where upon the coast was filled, more or less, with drifting oyster-spat during the spawning season, whether there were any beds of oysters in the immediate neighborhood or not; in other words, that there was hardly any limit to the time and distance the spat would drift with the tides, winds, and currents. As a consequence of the opinion, it was believed that one place was as good as another to spread shells for spawn so long as there was a swift current or tideway there. But this view was fallacious, and many acres of shells never exhibited a single oyster, simply because there was no spat or sources of spat in their vicinity.

Having learned this, planters began to see that they must place with or near their beds of shells living mother-oysters, called "spawners," which should supply the desired spat. This is done in two ways, either by laying a narrow bed of old oysters across the tideway in the center of the shelled tract, so that the spawn, as it is emitted, may be carried up and down over the breadth of shells waiting to accommodate it, or by sprinkling spawners all about the ground, at the rate of say 10 bushels to the acre. Under these arrangements the circumstances must be rare and exceptional when a full set will not be secured upon all shells within 20 rods or so of the spawners. Of course fortunate positions may be found where spawn is produced from wild oysters in abundance, or from contiguous planted beds, in which the distribution of special spawners is unnecessary; yet even then it may be said to be a wise precaution. The experience of old planters in Brookhaven Bay, Long Island, has been steadily confirmatory of this.

PREPARATION OF GROUND.—It was not long before a scarcity of suitable ground was felt at the principal centers of production for the carrying on of this new oyster culture. Planters then began to turn their attention toward preparing muddy bottoms by forming over them an artificial crust as a basis for the "stools" or "cultch."* In Rhode Island the planters prepare unsuitable ground by paving it. This is done early in the spring, 10,000 bushels of shells, say, being thrown on, at an expense of from $250 to $300. Then, in June, when the shells have settled well into the mud and formed a strong surface, more clean shells are scattered with a quantity of large living oysters just ready to spawn—100 bushels of "mothers" to 3,000 or 4,000 bushels of shells. Great success in several instances has followed this plan, particularly in Greenwich Bay and Apponaug Cove. One planter told me that he put down, in 1877, about $125 worth of stools and mother-oysters at the latter place, and calculated that he obtained, in a few weeks, $10,000 worth of seed; but a little later it all died—why, he is unable to guess. Another gentleman, at the same place, in 1879, put down 1,600 bushels of shells and 60 bushels of spawning or mother oysters. In the immediate vicinity of these he got a good set; but on a closely adjacent bed, where there were no "mothers," not a young oyster was to be seen. He had had the same experience in the Kickamuit. On the other hand, the simple tumbling over of shells in the hope of catching drifting spawn has proved almost universally a failure here.

DEEP-WATER OYSTER CULTURE AT NEW HAVEN.—This new system of deep-water oyster culture has been carried out more systematically at New Haven, Conn., however, than at any other point on our coast.

By 1870 the business of catching and cultivating native, home-bred oysters at New Haven had grown into a definite and profitable organization. It was not long before all the available inshore bottom was occupied, and the lower river and harbor looked like a submerged forest, so thickly were planted the boundary stakes of the various beds. Encroachments naturally followed

*This word, often shortened into "cutch," is an importation from Europe, and has undergone changes. In the glossary of my monograph I defined it as "material placed in the water to catch the spawn of the oyster." That is the way in which it is used in New England; but in Europe it is the *spawn* itself, and not the stool to which it fastens, that is called "cultch." The latter is evidently etymologically correct, and our American signification is an erroneous and perverted use.

into deeper water, and this proceeded, until finally some adventurous spirits went below the light-house and invaded Long Island Sound.

Incessantly swept by the steady and rapid outflow of the Quinnipiac and Housatonic (whose currents flow eastward), the hard sandy bottom of that part of Long Island Sound is kept clean throughout a considerable area, beyond which is soft, thick mud. There are reefs and rocks scattered about, to be sure, and now and then patches of mud; but over large areas extends only a smooth, unencumbered bottom of sand or gravel, peculiarly adapted to ostreaculture.

This unlooked-for expansion of the business caused considerable excitement. It was seen, in the first place, that existing statutes would not fit all exigencies, and alterations and amendments rapidly followed one another, in which the conflicting interests of the heavy deep-water cultivators and the small inshore owners were sought to be harmonized. Although recognized by law and acknowledged by clear heads since the earliest times, the rights of proprietorship under the water, and the notion of property in the growth and improvement ensuing upon ground granted and worked for ostreaculture, have hardly yet permeated the public mind and become generally accepted facts. Cultivators of all grades found many and many instances in which their staked-out ground was reappropriated, or the oysters upon which they had spent a great deal of time and money were taken, upon some flimsy pretext, by their neighbors even, who angrily resented any imputation of stealing.

One plea under which a vast amount of this sort of stealing and interference with proprietary rights granted by the State was perpetrated or sanctioned by the majority of the watermen was that the locality in question was "natural ground." At the same time any definition or restriction of such ground was impracticable and was resisted by these complainants. The only resource for the man who had invested money in oyster culture, and wanted the opportunity to develop his investment, was to declare that no "natural oyster ground" existed in New Haven Harbor, and that designations past and to come were valid, even though the areas so designated might once have been natural oyster beds. This checkmated the men who "jumped claims," yet refused to be considered thieves; but it caused a tremendous howl against the movers.

Under these rapid and far-reaching developments the New Haven oyster business soon expanded beyond the limits of shallow water, until now the hopes of all cultivators of any consequence are centered upon the deep-water ground, to which the inshore tracts are held as subsidiary, being largely used only as nurseries wherein to grow seed for the outside beds.

The process by which a man secures a large quantity of land outside has been described. It is thought hardly worth trying unless at least 20 acres are obtained, and many of the oyster farmers have more than 100. These large tracts, however, are not always in one piece, though the effort is to get as much together as possible. He obtains the position of the ground, as near as he can, by ranges on the neighboring shores, as described in his leases, and places buoys to mark his boundaries. Then he places other buoys within, so as to divide his property up into squares an acre or so in size. In this way he knows where he is as he proceeds in his labors. Having done this, he is ready to begin his active preparations to found an oyster colony.

The bottom of the sound opposite New Haven, as I have said, is smooth, hard sand, with occasional little patches of mud, but with few rocks. The depth varies from 25 to 40 feet. This area is almost totally void of life, and no oysters whatever were ever found there until "dumps" were made outside the light-house by the dredging boats which had been cleaning out the channel and deposited many living oysters along with the other dredgings in the offing. These dumps very soon became, in this way, oyster beds, supplying a considerable quantity of seed, which was public

property, to be had for the dredging, and furnishing their share of bones of contention in the incessant controversies.

The preparation for an oyster farm here is different from that in Rhode Island. Except within the harbor no great spaces of mud require coating over, and no spot where there is not a swift current is considered worth the trouble. Coarse beach sand is used for pavement, when needed, 200 tons to the acre, which can be spread at the rate of five sharpie-loads a day, at no great expense. The sand forms a crust upon the mud firm enough to keep the oyster from sinking, and it need not be renewed more than once in five years. In some cases, also, the ground, though hard, may be infested with vermin, coated with viscous slime, or for some other reason be in in bad condition. It is then thoroughly cleaned by dredging.

These preliminaries accomplished, the planter is ready to found his new colony. His first act, late in the spring, is to scatter a quantity of full-sized, healthy, native-born oysters, which he calls "spawners." From 30 to 50 bushels to the acre is considered a fair allowance. The bed is then left untouched until the second week of July, at which date the spawners are ready to pour out their ripened eggs. The planter now employs all his sloops, and hires extra men and vessels to distribute broadcast, over the whole tract he proposes to improve that year, the many tons of shells that he has been saving all winter. These shells are clean, and fall right alongside of the mother oysters previously deposited. The chances that they will secure the lodgment of spawn are good.

Sometimes the same plan is pursued with seed that has grown naturally, but too sparingly, upon a piece of uncultivated bottom; or young oysters are scattered there as spawners, and the owner waits until the next season before he "shells" the tract.

The expense of this whole proceeding is not very great, while there is a chance of almost fabulous profits. I was given an account of the cost in three cases. In one, the founding of a "farm" of 50 acres cost $1,650; in another, 60 acres cost $2,255.30; and in a third, 25 acres were fully prepared for $1,240. I think it would not be unfair to average the cost of securing, surveying, and preparing the deep-water beds at about $40 an acre, or about $4,000 for 100 acres. To this must be added about $2 an acre for ground surveys, buoys, anchors, &c.

It was long ago understood that when artificial beds for the capture of spawn were proposed to be prepared, the substance of the stools did not so greatly matter as their position and condition at the time of spawning. Just what makes the best lodgment for oyster spawn intended to be used as seed has been greatly discussed. Oyster shells are very good, certainly, and as they are cheap and almost always at hand in even troublesome quantities, they form the most available cultch, and are most generally used in America, where they are regularly saved for the purpose, and command a market price above the reach of the lime burner, who formerly consumed almost the whole accumulation at the opening-houses. Nevertheless, a more fragile shell, such as a scallop, mussel, or jingle (*Anomia*), is certainly better, because the growth of the attached oysters wrenches the shell to pieces, breaking up the cluster and permitting the singleness and full development to each oyster that is so desirable; or, if the old shell does not break of itself, the culling of the bunch it supports is far more easy than when the foundation is as thick and heavy as an oyster's or clam's shell. To aid this same end tiles have been used as collectors of oyster spat, covered with a certain composition which easily peels off, but is firm enough to hold the young. The anchoring of an old seine at the bottom, the suspending of scallop, cockle, or other thin shells in the water by stringing them from stake to stake a little way under the surface, or the copying of the French *fascines*, would be other means to the same end, advisable especially where it is intended to move the young to new beds. Small gravel has been tried on parts of the Connecticut

coast with great success, the advantage being that not often more than one or two oysters would be attached, and therefore the evil of bunchiness is avoided. "On the Poquonock River, near Groton, white birch bushes are stuck in the river mud about spawning time, in 14 or 15 feet of water at low tide. To these the spat adheres in great quantities. They are left undisturbed eighteen months, by which time the set becomes good sized seed. * * * The average yield is about 5 bushels to the bush. The grounds are so soft and muddy that no other method is feasible. About 50 acres [1881] are under this kind of cultivation, and the area is rapidly extending. The bushes are grappled out of the mud by derricks."

One of my correspondents in Long Island suggests inclosing small beds of oysters, just before spawning, by a high board fence, "with plenty of shells or scraps inside to catch the spawn, which thus could not float away." This idea is substantially followed in France, where stakes of wood are driven into the bottom in a circle around a pyramid of oysters placed on stones in the center; and on the Ile de Ré dikes are built of open stone work, so as to divide the bottom into beds, each of which is owned by a private proprietor; other stone partitions or walls are run across, and upon these stones the spawn fastens. Experiments have been made by Mr. John A. Ryder, of the U. S. Fish Commission toward artificial propagation of oysters in Chesapeake waters after a similar process, and have met with success*; but as yet no practical trial of it has been made on a commercial basis, of which any report has been made public.

The mere manner of spreading the shells is also found to be important. The proper method is to take them from the large scow or sloop which has brought them ashore, in small boat-loads. Having anchored the skiff, the shells are then flirted broadcast in all directions by the shovelful. The next boat-load is anchored a little farther on, and the process repeated. Thus a thin and evenly distributed layer is spread over the whole ground. Just how many bushels a man will place on an acre depends upon both his means and his judgment. If he is shelling entirely new ground he will spread more than he would upon an area already improved, but I suppose 250 bushels to the acre might be considered an average quantity.

By testing early in the fall the planter can tell whether his stools have caught any or much of the desired spawn. The young oysters will appear as minute flakes, easily detected by the experienced eye, attached to all parts of the old shell. If he has got no set whatever he considers his investment a total loss, since by the next season the bed of shells will have become so dirty that the spawn will not take hold if it comes that way. Supposing, on the contrary, that young oysters are found attached in millions, as often happens, crowding upon each old shell over the whole 20 acres; this is a good promise, but the planter's anxieties have just begun. The infant mollusk, when first it takes hold upon the stool, the merest speck upon the surface of the white shell, is exceedingly tender. The chances in its favor in the race against its numberless adversaries are extremely few. The longer it lives the better are its chances, but the tender age lasts all through the autumn and until it has attained the size of a quarter-dollar piece; after that it will withstand ordinary discouragements. It often happens, therefore, that the "splendid set" proves a delusion, and Christmas sees the boasted bed a barren waste. "I reckon I had what 'ud a' made more 'n 10 bushels on that ground last fall, and now there's nary an oyster left worth speakin' on." That is a tune you hear sung over and over.

The vicissitudes through which the young colony must pass are many and trying. On the coast of Connecticut and Rhode Island the autumn gales are often exceedingly destructive, not only killing small oysters but obliterating boundaries and sweeping away old beds. Some parts

* Further experiments have since been very successfully made by the U. S. Fish Commission at the Wood's Holl Station and elsewhere, accounts of which are given in the Bulletins and Reports since 1883.

of New Haven Harbor are peculiarly liable to disasters of this kind, while in other parts the drifting of mud and sand causes large losses. It is believed by many that the beds in the sound, in water more than 25 feet deep, are safe from disturbance from gales; but others decline to put their faith in any depth thus far planted. Frequently oysters cast up by storms, if attended to immediately, can be saved and replanted with profit. Now and then great tracts of promising young oysters will die from no apparent cause. The true explanation probably is that they have starved to death, some evil current turning aside their food. Lastly, there is the constant warfare made upon oysters, young and old, by the active enemies that swim in the waters above them or creep on the bottom beneath.

Granting escape from catastrophes, there must of necessity occur, under the most favorable circumstances, a great waste in the process of growth of young oysters left undisturbed on the artificial beds. Leaving out all other adversities, this will arise from over-crowding. More "blisters" attach themselves upon a single egg than can come to maturity. One or a few will obtain an accession of growth over the rest, and crowd the others down, or overlap them fatally. Even if a large number of young oysters, attached to a single stool, do grow up together equally, their close elbowing of one another will probably result in a close, crabbed bunch of long, slim, unshapely samples, of no value save to be shucked. Notwithstanding this fact is well known, it is the general custom to leave the beds untouched (unless a portion of the bed is raked at the end of a year, to be sold as miscellaneous "seed" to eastern planters) until it has attained the age of three, four, or five years. Then it is worked, at first, probably, with tongs and rakes, getting up the thickest of the crop. This done, dredges are put on, and everything that remains—oysters, shells, and trash—is removed and the ground left clean, ready for a second shelling, or to be planted with seed, perhaps right away, perhaps after the area has lain uncovered to the rejuvenating influences of the sea for a year.

The more advanced and energetic of the planters, however, pursue the following plan: When the bed is two years old, by which time all the young oysters are of sufficient age and hardiness to bear the removal, coarse-netted dredges are put on, and all the bunches of oysters are taken up, knocked to pieces, and either sold as "seed," or redistributed over a new portion of bottom, thus widening the planted area, and at the same time leaving more room for those single oysters to grow which have slipped through the net and so escaped the dredge. The next year after, all the plantation, new and old, is gone over and suitable stock culled out for trade, three-year-old East River oysters being in demand for the European market. This further thins out the beds, so that the fourth year the main crop of fine, well-shaped, well-fed oysters will be taken. During the succeeding summer, or perhaps after a year, the ground will be thoroughly well cleaned up, and prepared for a new shelling.*

* In my report for 1880 I made the following remark as to the extent of the deep-water oyster farming at New Haven: "Out of the 7,000 or 8,000 acres 'designated' in New Haven Harbor and its offing, only from 3,000 to 3,500 are in actual use as yet. The largest possession is Mr. H. C. Rowe's; he operates upon about 1,200 acres. Several other planters have from 200 to 600, while many have 100 acres under cultivation." This has been enormously increased during the four years since elapsed. In the third report (1884) of the shell-fish commissioners of that State a statistical paragraph is given, which I quote, though it applies to the whole State: "The total area of cultivated ground in Connecticut in 1882, under State jurisdiction, was 9,007 acres, according to the tax-list of that year. The area then cultivated under town jurisdiction is not known, but an average of the various estimates would make it at least 2,000 acres. This would make the whole area of Connecticut in 1882 equal to that of Rhode Island in 1884 [elsewhere given as about 11,000 acres, yielding annually 1,000,000 bushels, worth $1,500,000]. During the last two years, however, our area has been largely extended, and there are probably not far from 20,000 acres under cultivation to-day. There were five hundred and sixteen owners in 1882 against two hundred and ninety in 1883, and the number increased annually. Of these owners only five have 5 acres and under apiece, twenty-two have between 5 acres and 20 acres apiece, and the remaining two hundred and sixty-three have 20 acres or more apiece."

OBSTACLES AND FATALITIES.—The obstacles to oyster planting are many, the difficulties often recurring, and the fatalities to which the planted beds are subject are incessant and diverse. The uncertainty and narrowness of laws, the prejudice and dishonesty of his fellow-men, the growing scarcity and increased cost of seed, are preliminary difficulties which have been hinted at. If the attempt is made to catch a "set" of spawn on artificial stools, many an accident may prevent a successful issue. The chill of a storm, a rough gale, or a wayward current may destroy or deviate the embryos that otherwise would have made a fortune for the planter.

But if this crisis is safely passed, and the shells laid down at the proper day are loaded with young, many an evil occurrence may blight the whole. If in shallow water they may be caught up by a deep-moving storm and cast in windrows on the beach; may be smothered in sifted mud, or buried under heaps of moving sand; or the whole colony may die from some indiscernible cause, perhaps lack of food.

Surviving these risks, the young oysters, whether sowed as "seed" or raised from a "set," are exposed to the ravages of a host of enemies—fishes, crabs, star-fishes, mollusks, and worms, not to speak of human thieves and mischief-makers. It is not worth while here to go into this list, or discuss methods of prevention. Full information on the point may be found in my monograph, and still further information, with illustrations of many pests, in a book published by Harper & Brothers, New York, named "Country Cousins: Short Studies into the Natural History of the United States." The catalogue might appal the stoutest heart did he not see the other side and know that, despite all these drawbacks, from unwise legislators down to star-fishes, oysters can be and are raised with success all along our coast.

7. THE MARKETING OF OYSTERS "IN THE SHELL."

I have already alluded to the removal of oysters from the beds, to be sold. This process is nowhere marked by any specially noteworthy features beyond those already mentioned. The season of "catching up" begins early in September and lasts until May. Merely getting the oysters, however, does not make them marketable. In the first place they must be "culled," that is, picked over, separated from one another when they are united in clusters, freed from trash and small ones, and cleansed of mud. They may or may not be further assorted by the planter into the various grades recognized by wholesale merchants.

FRESHENING THE OYSTER.—As they come from their beds in the salt water these oysters are likely to have a flavor not quite their best. Nearly everywhere, therefore, they are placed for a few hours in fresher water. At Providence and some other points this is done by immersing the sloop-load on great rafts called "floats," anchored in the river near the owner's wharf. The Fair Haven men value highly their inshore lots in the Quinnipiac, because of their utility in this respect. Amboy and Staten Island find conveniences near Rahway, N. J. At Keyport, a small creek running through the town (see illustration) is daily crowded with freshening floats, the "skiffs" peculiar to the locality, and other implements of an oysterman's occupation. It is a scene of extraordinary activity, which may be witnessed here in autumn every day, as the oysters are being culled and prepared for sale. The planters of southern New Jersey have contrived an ingenious labor-saving method of "giving their oysters a drink," as they say, by building what are termed "platforms" or "board-banks." In some cases these are nothing better than a mere plank floor, set in the bank in such a way that a boat-load of muddy oysters may be floated alongside at high tide, and the oysters shoveled overboard upon it. The receding tide leaves this bare, and at the same time opens sluice-gates, which allow a stream of fresh water from the land to cover the oysters, under the genial influence of which they rid themselves of the distasteful brine contained

within their shells, and also puff out their forms to an appearance of fatness very pleasing to the epicure.

Frequently, however, an elaboration of the platform is constructed, which is worthy of special note. The bank is dug into and piles are driven, until a floor can be laid at a proper level below high-water mark. Over this a tight shed is built, sometimes 75 feet long by 25 feet wide, and of considerable height. On one side of this shed a canal is dug, into which a boat may run, and its cargo is easily shoveled through large openings in the side of the shed onto the floor within. On the opposite side of the shed, both within and without, run floors or stages above the reach of high water, where the oysters can be piled after freshening, packed in barrels and loaded on boats or drays for shipment. When the tide goes down it leaves the oysters upon the platform within the shed nearly bare, a depth of 8 or 10 inches of water being retained by a footboard at the seaward end of the shed. An arrangement of sluices now admits the fresh water, and the freshening begins. Over the space devoted to the platform or vat, at a sufficient height to let a man stand underneath to shovel up the oysters for packing, in which work he uses a dung-fork, is a broad shelf or garret, where barrels, baskets, boat-gear, and other small property can be safely stowed, since the whole shed, platform, oysters, and all, can be locked up. I have given an illustration of one of these houses at Smith's Landing.

The object of this "drinking" is to allow the oyster to become cleansed and freshened in taste. Finding themselves again in the water after their temporary absence, the oysters all open and "spit out" impurities clinging to the edges of the mantle and gills, and they do this at once, so that usually a single tide is a long enough time to leave them in the fresh water. Moreover, imbibing the fresh water causes them to change in color somewhat, making the flesh a purer white; and it bloats them into an appearance of extreme fatness, which is very appetizing. Most persons believe this to be a true increase of substance and weight, but it is no more than a puffing up.

The main crop has been gathered by the time Christmas is near, but many scattered oysters yet remain, that have escaped both tongs and dredges. In some districts the grounds are then given up to the laborers who have been employed during the summer and fall, and under a new impulse these men go over the grounds again with tongs and dredge. They work on shares usually, returning to the owner of the beds one-half of the results, which makes a really handsome thing for the gleaners, whose work, in this way, lasts from two to three weeks, making three or four days a week, each man often clearing as his portion from $4 to $5 a day. At any rate, such generally is the practice, with its results, at Keyport, N. J., "where for many years the principle of the good old biblical rule of not forgetting the gleaners is almost religiously observed in the last gathering of this harvest of the sea."

METHODS OF SELLING.—The disposal of their crops by the producers is according to various methods, depending largely upon the utility the oysters are to serve. If as seed, the buyers come after them in sloops, and are loaded from the boats of the oystermen. If to go into the city markets, buyers may come after them, or the owners may take them to the city.

In New Orleans some peculiar customs have grown up. To the Old and New Basins (chiefly the former), in the rear of the city, reached by canals from Lake Pontchartrain, come the boats from the eastward, bringing "lake" and "reef" oysters, generally of inferior quality, and intended to be sold to the canning establishments, or to be opened for cooking purposes. The price of the oysters—frequently measured out in quarter-barrel boxes similar to those in use in Mobile—depends upon the state of the market as governed by the supplies received from the west, and often goes down to 50 or 60 cents a barrel, at which price there is no profit, and the oystermen stop running until a rise occurs. At the levee opposite, or just below the famous old French

market, is the other and greatest oyster landing-place, mustering about two hundred and five lateen-rigged boats, with six hundred and fifteen men or more in the foreign-looking crews, making a most picturesque scene. The estimate of annual receipts there in 1880 gave 50,000 barrels, or 125,000 bushels, sold at $2 to $3.50 per barrel. All of these come from westward of the delta, and being large and fine are, as a rule, bought by the saloons and restaurants, and served to their customers on the shell. A peculiar feature of the business on the levee consists of an organization of wharfmen, who form a species of close corporation to do the work of carrying the oysters from the boats to the wagon of the purchaser, who pays them 15 cents a barrel for the service. The boatman having sold his cargo, he then has no further concern, his boat being taken in charge by the carrier, who might be called a 'longshoreman, and who delivers all the oysters, then sweeps the vessel and puts her in proper condition for the crew. While there is no society of these carriers, strictly speaking, they manage to make their business a close corporation, since no one is allowed to discharge a cargo of any kind from the luggers—oysters, oranges, or fruit—except one of the members of the body. There is a man who is called the foreman, who receives all the money for the carriers and who divides the proceeds equally among the different carriers, but just how this is regulated, as well as many other of the details of this quasi-organization, is kept as mysteriously secret as possible. The body is an old one, and now consists of about fifty men in all, mostly Sicilians and low-grade Italians, and the annual receipts for the carriers amount to about $35,000, levied on the oysters, oranges, melons, and various fruits. The system is beginning to be felt as an unwarranted incubus on the trade, and doubtless it will soon be broken up.

GULF OF MEXICO TO NORTH CAROLINA.—Though there is a planting interest at Mobile, Ala., most of the oysters on sale are of native growth and tonged in a part of the bay called the "gully." These are termed "reefers," and are slightly inferior to those artificially grown; some however, growing separately, and distinguished as "sharpers," from the fact that the ends of their shells are unusually sharp, are of very large size, averaging 8 or 10 inches long, and of superior flavor. "Sharpers" are always in demand, though there is some objection to them on account of their being so hard to open. "Reefers" and "sharpers" are caught by men who follow no other pursuit, and who are a quite distinct class from the oyster-boatmen. They have small, flat-bottomed skiffs, of the roughest description, in which they go "a-tonging," two men occupying a boat and taking turns at tonging and culling. As fast as the stock is culled it is placed in shallow oblong boxes, holding one-fourth of a barrel each, and in these measures is sold to the boatmen or carriers at the rate (during the winter of 1880–'81) of 10 cents a "box," or 40 cents a barrel. The carriers having obtained a load for their sail-boats, proceed at once to the city and deliver them to the dealer by whom they are employed to buy or with whom they have contracts. The measure in this transaction is the same box as before, but the price has nearly doubled.

"If the tide is very low," writes Mr. Silas Stearns, of the neighborhood of Appalachicola, "as is the case during 'northers,' the boat is run aground on an oyster-reef, a gangway plank is placed over the side, and the oysters are picked up by hand and carried aboard in tubs. Oystering in this manner is said to be harder and slower than tonging them." I saw the same thing in lower Florida. Great quantities of these oysters are often spoiled by delay in shipping to the interior, so that the wages of this labor are small. At present the year's trade will not amount to more than $5,000 or $6,000, but it is growing.

Nothing need be said in respect to marketing methods at other Southern ports, except that in Florida and parts of Georgia wagoners make a business of carting loads of oysters back into the country from the coast, following regular routes on certain days. This custom reappears in North Carolina, but is going slowly out of vogue.

CHESAPEAKE BAY AND ITS TRIBUTARIES.—In respect to Chesapeake Bay and its rivers much has been said already pertaining to this subject, since a very large proportion of the oysters annually gathered there is sold to Northern captains, or to the Eastern Shore and Lynnhaven planters, who go to the tonging grounds in their schooners for the sake of buying seed as soon as it is caught. Nevertheless there is an immense number of bushels of oysters taken in the shell each season to Norfolk, Crisfield, Washington, and Baltimore for immediate consumption, either in the markets, or in packing-houses and canneries as described further on.

Very strict protective laws have been enacted by both Maryland and Virginia, but the ignorance and temper of the oystermen is such that the enforcement of these laws is almost impossible. In 1868 Maryland commissioned an oyster police force, and furnished a steamer and several fast sailing sloops and schooners, each of which carried cannon and small arms. The police-boats were required to be constantly cruising in search of violators of the oyster laws, who, when caught, were taken before a magistrate for trial. Battles with illegal dredgers, who also go well armed, used to be very common, but are becoming less so, as the effect of the police-boats is good, notwithstanding the fact that the laws have never been in satisfactory shape for the operations of the force, and uncertainty, confusion, and positive hinderance in the carrying out of their obvious intentions have often arisen. The dredging licenses, fines, &c., collected exceed the cost of the force by about $25,000 a year; but the State would find it necessary to maintain this institution should it fail to pay for itself. "Disband the force, and in a few weeks the bay would be a battle ground for tongers and dredgers."

The chapter in my census monograph upon this region was written by Mr. R. H. Edmonds, a most competent observer, and I present herewith an abridgment of his remarks. After lamenting that the beds of all Chesapeake Bay are fast being destroyed, he adds: "Dredging in Maryland is simply a general scramble, carried on in seven hundred boats, manned by fifty-six hundred daring and unscrupulous men, who regard neither the laws of God nor man. Some of the captains and a few of the men may be honest and upright, but it is an unfortunate fact that such form a very small minority. * * * It is now rarely the case that a dredger can be found who will admit that he believes there is any wrong in disregarding the oyster laws, and such a thing as being disgraced among his fellow-workmen by imprisonment for violating the laws is totally unknown. In the above facts will be found sufficient reasons why it has been impossible for the oyster police, since its first organization, to enforce the laws. Seven hundred well-manned, fast-sailing boats, scattered over such a large space as the Chesapeake Bay, are rather difficult to watch, and especially at night."

Mr. Edmonds continues in his hard, but, I believe, entirely just, judgment upon his fellow-citizens, as follows:

"All blame for violating laws does not, however, attach to the boat-owners, as some of them are prominent gentlemen of the most upright character. It is the misfortune of such men that their captains have often been trained by less honest employers, and having once acquired a love of ill-gotten gain it is difficult to keep them from continuing in the same course. As he usually has a share in the profits, it is of course to his interest to make his trips as quickly as possible; and while the boat-owner may be opposed to breaking any laws his captain may think and act otherwise.

"The unscrupulousness of the captain is well assisted by the character of his men. These men, taken as a class, form perhaps one of the most depraved bodies of workmen to be found in the country. They are gathered from jails, penitentiaries, work-houses, and the lowest and vilest dens of the city. They are principally whites, many of whom are foreigners (almost every Euro-

pean country being represented), unable to speak more than a few words of English. When a crew, which usually consists of about eight men, is wanted, the vessel-owner or captain applies to a shipping agent, who then gathers these men wherever they may be found, drunk or sober. As one large boat-owner expressed it to me: 'We don't care where he gets them, whether they are drunk or sober, clothed or naked, just so they can be made to work at turning a windlass.' The shipping agent having placed the crew aboard is then paid $2 for each man furnished. With such a crew as this, who neither know nor care for laws, the captain is of course able to work wherever he desires to. As may be supposed, the life led by these men on board of the vessels is of the roughest kind. When sleeping, surrounded by vermin of all kinds; when working, poorly clad and with every garment stiff with ice, while the wind dashes the fast-freezing spray over them, hour after hour winding away at the windlass, pulling a heavy dredge, or else stooping, with backs nearly broken, culling oysters. Returning from a trip, the men take their little pay and soon spend it in debauchery, amid the lowest groggeries and dens of infamy to be found in certain portions of Baltimore. It is a gratifying fact, though, that even amid such surroundings as these there are some few who are respectable and honorable men. This is more especially the case on the boats owned in the lower counties of Maryland. The crews of these are often gathered from the surrounding neighborhoods, and even as a class are not as degraded as those on Baltimore vessels.

"There are two ways in which these men are paid, the one most generally adopted, at present, being to pay them a stated amount per month, although payment is usually made at the end of each trip, the amount, of course, being proportioned to the length of the trip. The other plan is to allow the crew a share in the profits. When this is done, the vessel at the end of each trip first pays the 'grub bill,' wharfage, and commission merchant's charges; then, of the balance, one-third goes to the owner of the vessel, and a small bonus, usually about $20, to the captain; after which captain and crew all share alike, except the cook, who receives something less than the others. When the first plan is adopted, the men receive their board and from $10 to $12, and occasionally as high as $15, a month. Those working on shares will, during the season, average about the same as those who are paid a certain amount. A fair average of the amount made by each man would be $11 a month, making $77 for a season of seven months. Computing on this average, it will be seen that during an oyster season the four thousand nine hundred dredgers receive about $377,300, and the seven hundred captains, whose wages will average $50 a month, about $245,000, making a total of $622,300. It would also be proper to add to this amount the cost of boarding these men, since that in fact forms a part of their wages. This costs the vessels about $7.50 a month for each man, equal to $420 a season for each boat, or $294,000 for the entire fleet. This, added to $622,300, gives a total of $916,300 paid to the dredgers of Maryland during every oyster season. The law requires all boats engaged in dredging to obtain from the State comptroller a yearly license, costing $3 for each registered ton.*

"Dredging boats range in size from 5 to 75 tons, and in value from $500 or $600 to $8,000, some few owned in the lower part of the State being valued as high as $10,000. The boats owned in Baltimore are, generally, in every way inferior to those hailing from the counties. The present value of these boats, basing the estimate upon information obtained from all parts of the State, would be an average of not less than $1,500, and is believed by many to be much higher. At this rate, however, the 700 boats in the trade would be worth, to-day, $1,050,000. In addition to this, the winders, dredges, roller and chains, and dredge lines on each boat may be valued at $100, although costing considerably more. Adding this to the value of the boats, we have $1,120,000

* Not more than a half or two-thirds pay for this license, hence the necessity of the police.

as the amount of capital invested in the dredging-boats. The total tonnage of the dredging-boats being 16,366, and the estimated value of the same being $1,050,000, the average value will be $64.15 per ton. As some tonnage has lately changed hands in Baltimore at $67, the above estimate can scarcely be too great, when the high class of many of the boats is considered. The amount annually expended for repairing these vessels is about $105,000.

"Scraping, which is simply dredging on a smaller scale, both as to the size of the boat and the dredge, is conducted only in shallow water; and, while dredge licenses are issued by the State, scraping licenses are obtained from the counties, and hold good only in the local waters of the county in which issued. Dorchester, Talbot, and Somerset are the only counties in which scraping licenses are issued. In the first two the charge is regulated by the tonnage of the vessel (being $2 per ton), while in the last there is a uniform charge of $10 on each boat, regardless of size. The crews of these vessels average about four men each, the majority of whom are able to return home after each day's work, as the boat does not go out of the county waters, except to make an occasional run to a neighboring market. * * * I feel safe in placing the number of scraping boats at five hundred and fifty, carrying twenty-two hundred men. An additional three hundred and thirty boats are working without license. The pay of these men will average about $18 a month each, for the seven and a half months employed, amounting to $135 for the season, and making a total of $297,000 received by the twenty-two hundred men, including the captains, whose pay is of course larger than that of the men. The average value of scraping-boats, including their outfit, is $800, which gives a total of $440,000 invested in scraping About $27,500 is annually expended in repairing these boats.

"Socially and morally the scrapers are somewhat superior to the dredgers. Tonging, although employing less capital and fewer men than dredging, is probably of greater value to the State than the latter, because the men engaged in it are of a better class, are better remunerated for their labor, and are less prone to evade the laws than the dredgers. While this much may be said in the tongmen's favor, it is yet an unpleasant truth that they, like all others engaged in the oyster trade, either as catchers or shuckers, are, as a class, indolent and improvident. The majority of them live near the water, often owning a small house and an acre or so of land (the value of which depends upon the proximity of good oyster and fishing grounds), and a canoe or an interest in one, used in winter for oystering and in summer for fishing. Having secured a house, their ambition seems to be satisfied, and but little time or money is spent in beautifying or improving it. It is too often the case that tongers, especially many of the negroes, who comprise about one-third of the total number, will work only one or two days at a time, and then remain idle until necessity forces them again to earn a few dollars.

"By others, however, tonging is pursued as steadily and systematically as the wind and waves will allow, and when this is done I think it may safely be said that the remuneration is equally as fair as in other trades. Those who pursue tonging in this way form the most intelligent class of oystermen in the State. In some cases farmers and others, holding prominent social positions, may be found oystering during several of the winter months, when their legitimate business does not require close attention. Tonging necessitates very great exposure to the cold, but is, however, hardly as severe in this respect as dredging, and, moreover, the tongers suffer less, from the fact that they are generally better clad than the dredgers, and seldom work either during very cold or very windy weather, on account of the smallness of their boats. From this cause I find that even the industrious ones will lose, on an average, at least two days out of every week, and when the time wasted by the idle ones is taken into account it will be found that one hundred and twenty days out of an oyster season of eight months is about the average length of time for each tonger.

In this actual loss of at least one-half of their time may be seen the cause which prevents the tongers, as a class, from making any improvement in their financial condition, and upon their financial condition depends their social position. * * *

"Tonging, although generally confined to shallow water, is in some of the tributaries of the bay carried on in water varying in depth from 18 to 20 feet.

"Engaged in tonging there are 5,148 men, using 1,825 canoes or other small boats. To obtain even an approximate average of the amount of money made by each tonger is almost impossible, but I think it will be very near correct to estimate it at $225 a season, at which rate the total amount made by the tongers would be $1,158,300. There being 1,825 boats and 5,148 men, the average number of men carried by each boat is a little less than 3. Many of the larger boats are held in joint ownership by two or three parties. * * * The size of the tonging-canoe ranges from 15 or 16 feet to 30 feet or more, the larger ones being called 'bugeyes.' Owing to this diversity in size it is very difficult to estimate the value of these boats, but a fair average is about $100, which would cover the entire outfit, making $182,500 the amount invested in tonging-boats.

"Closely connected with tonging, and each mutually dependent upon the other, is another branch of the trade, conducted by vessels generally known as runners, of which there are owned in this State two hundred, carrying about eight hundred men. The oysters caught by tongers are either sold to these vessels, and by them carried to some market in the State, or they are bought by boats owned in other States and carried to northern cities. The runner will anchor near some tonging-ground, and an empty basket or a small flag will be hoisted to the mast-head as a signal that she is ready to receive oysters. In one or two days she will be loaded, and is at once off for a market. On some occasions half a dozen or more runners may be seen in the same locality, surrounded by forty or fifty canoes. As soon as a tonger has caught as many as his small boat will carry he sells out to the runner and returns to work. The men employed on runners will average about $18 a month, including their board, which, with the pay of the captains (which is about $50 a month), will amount to $166,400 for a season of eight months, that being the length of time that these vessels are engaged in carrying oysters. Reckoning the average value of the runners at $1,500, will give a total of $300,000 in this branch of the trade. About $30,000 is annually spent in repairing the two hundred runners.

"Summarizing the foregoing statistics as to the number of vessels, their value, &c., it is seen that there are [in 1880]:

Boats.	Number.	Crews.	Annual wages.
Dredging	700	5,600	$916,800
Scraping	550	2,200	297,000
Canoes	1,825	5,148	1,158,300
Runners	200	800	166,400
Total	3,275	13,748	2,538,000

"The totals of this table furnish an average of $184.60 for each man. It is utterly impossible to obtain the number of people supported by this $2,538,000. Perhaps not one-half of the dredgers support any family; but with tongers and scrapers it is different. Five is usually reckoned as the average number of a family, but as very many of these men are single it would be too high in the present case. It can scarcely, however, be too much to reckon that for every oysterman there is an average of four individuals dependent upon him. This would give 54,992 as the number of people supported by the catching of oysters in this State. In addition to this there are hundreds dependent indirectly, as shopkeepers and in other ways, upon the oystermen.

"Invested in oyster-boats, the summary is: 700 dredgers, at $1,500, $1,050,000; outfit of same, $70,000; 550 scrapers, at $800, $440,000; 200 runners, at $1,500, $300,000; 1,825 canoes, at $100, $182,500; total 3,275—$2,042,500."

In respect to oystering in Virginia waters (the preceding paragraphs, quoted from Mr. Edmonds, all refer primarily to Maryland), I have given all needful details in the chapter on The Virginia Trade. My summary for the yield of Virginia in 1880 was as follows:

Packed in the State, 1,622,130 bushels; shipped out of the State in shell, 3,315,190 bushels; used for local consumption in the cities of the State, 275,000 bushels; used for local consumption in the small towns and counties of the State, 1,625,000 bushels; total, 6,837,320 bushels.

The average value of these oysters from first hands would be about 27 cents a bushel, or a sum total of $1,846,076.40.

Nearly the whole catch of Maryland and Virginia oysters, not sold as seed, is devoted to the "packing," either raw or cooked, which will be considered below on pages 559–562. Probably the total amount sent to market in shell for immediate consumption in the several towns along both shores will not exceed half a million bushels annually, and this forms an important item of daily food, the year round, with all "tide-water" people. Baltimore is the greatest market. "In Baltimore," says Mr. Edmonds, "the city trade is monopolized by a number of commission houses, which handle all the oysters taken for local use, with the exception of the receipts by steamers. From the books of these firms it was ascertained that the sales of oysters from September 1, 1879, to May 1, 1880, for consumption in the city and suburbs, amounted to 793,680 bushels. Add to this 25,000 bushels received by steamers, and the total retail trade is found to be 818,680 bushels. The average price paid for shucking raw oysters is 15 cents a gallon; these, being all of fine quality, will open a gallon to a bushel, and hence the amount paid for opening 818,680 bushels would be $122,802. Estimating the average amount made by the shuckers at $6 a week, or $192 for the season, it is seen that there are six hundred and forty men steadily employed for nearly eight months of the year in opening oysters for local consumption in Baltimore. There is, in addition to these, a large number of men who sell oysters around the streets; others who rent a cellar room and sell from there; some engage in driving oyster-carts, and a few are employed only during the oyster season in restaurants as extra help. As near as can be ascertained, the number of these may be placed at five hundred, with wages and earnings amounting to $96,000. Of these eleven hundred and forty men about eight hundred are negroes."

In addition to its own stock, Baltimore and also Washington annually use a large quantity of "fancy" oysters from northern cities.

OYSTER TRADE OF PHILADELPHIA.—Passing to Philadelphia, we find that city an oyster market for a region entirely different in its conditions from the Chesapeake region, which extends from Barnegat around to and including the whole of Delaware Bay. The transportation to the city from New York and the Atlantic coast of New Jersey, and to some extent from the Delaware Bay shore of the same State, is by rail, and amounted, in 1880, to nearly 300,000 bushels, while 200,000 bushels more came from Baltimore and Chesapeake points by rail and steamer. By sail-vessels from the eastern shore of Delaware Bay came about 1,500,000 bushels yearly, while the western shore of the bay produces nearly another million. Lastly, in winter, about 250,000 bushels are taken by sailing-vessels through the canal from the Chesapeake to Philadelphia, for immediate use. A summation of the supplies from all these sources gives, as the total quantity annually handled in Philadelphia, 2,680,000 bushels, or more than 800,000,000 oysters, worth, in round numbers, not less than $2,500,000 at wholesale.

But, of course, only a portion of these oysters are consumed within the limits of the city of

Philadelphia. A large part is distributed widely throughout a region which includes the Delaware Valley, the State of Pennsylvania, and to some extent the West, competing in the shell-trade with New York and Baltimore. Philadelphia has no packing establishments, and ships very few opened oysters.

The total wholesale trade of Philadelphia is now divided, so far as can be ascertained, among about fifty firms. Most of these dealers are also planters, furnishing the capital with which their partners plant upon ground outside of Pennsylvania. A large part of all the floating and shore-property credited to the shores of Delaware Bay, and estimated in a preceding chapter, is really owned, therefore, in Philadelphia; perhaps a million dollars is invested in the oyster business in the city itself apart from this outside capital and liabilities.

Dealings in oysters in Philadelphia are chiefly carried on at the foot of Spruce street, at the foot of Vine street, and at the Brown street wharves. In each case the locality is determined by the presence of a large provision-market, and the business in general fishing centers near it. At Brown street there is an association of the owners of boats selling there for mutual protection on questions of wharfage and the like. Most of the business is done at Spruce street, where the Jersey boats chiefly go, and where some of the heaviest dealers have their offices. Estimates as accurate as possible give from three hundred to three hundred and fifty families supported by the wholesale business in the city, and between three and four thousand persons who make their living out of the retail trade.

THE NEW YORK MARKET.—The common market for all oysters grown in New Jersey north of Barnegat, in New York Bay, on Staten and Long Islands, and in Connecticut as far east as Norwalk, is the city of New York, and the receipts, not only, but the greater part of the deliveries at this center are of oysters in the shell. In my monograph I gave many interesting reminiscences of the early days of the oyster trade in this region, which I have not the space to repeat.

Most of the New York oyster firms are of long standing, and the same names appear which are conspicuous in the oyster annals of City Island and Staten Island, for these two localities have supplied the most of them. Van Name, Houseman, Silsbee, Wright, Burbank, Boyle, Frazer, Woglom, Decker, and others are examples. Many of the gentlemen now conducting the business under these names only succeeded their fathers and grandfathers, who established the trade they enjoy. The growth of the opportunities of business, however, has been very rapid, and has brought in many new men. From being (as it was a century ago in New York) the common food of the poor man, so plenteous and vulgar that no feast ever saw its name upon the *menu*, the oyster become only a luxury for the well-to-do, and the prime feature of holiday banquets. Recovering from the scarcity which had brought this change about, by means of the artificial cultivation of immense quantities, oysters a second time have become abundant as an article of food, enjoyed alike by rich and poor. Those who live in the interior or abroad can hardly appreciate how extensive is the demand and supply in the coast cities. "Oysters pickled, stewed, baked, roasted, fried, and scalloped; oysters made into soups, patties, and puddings; oysters with condiments and without condiments; oysters for breakfast, dinner, and supper; oysters without stint or limit, fresh as the pure air, and almost as abundant, are daily offered to the palates of the Manhattanese, and appreciated with all the gratitude which such a bounty of nature ought to inspire."

Formerly the regular markets, especially Catherine market, were the trading places in shellfish as well as other edibles; but for the last twenty years the wholesale oyster business in New York has been confined almost exclusively to two localities, the trades of which are to a certain extent distinct. One of these centers is at the foot of Broome street, East River, and the other at the foot of West Tenth street, North River, nearly opposite. The method of business at each is

substantially the same, the difference consisting in the character of the oysters handled, none from the East River and few from the south shore going to the West Tenth street market, which is mainly in the hands of Staten Island planter-merchants. In addition to this, a few firms are engaged at wholesale in Fulton market, and three firms near Washington market import oysters, opened, from the South.

All of the dealers on the East and North Rivers occupy floating places of business, known as "scows," "oyster-boats," or "barges," being flat-bottomed boats, made with unusual strength and of the most durable materials, and which closely resemble the conventional "Noah's ark" of the toy-shops and Sunday-school picture-books, except that they have flat roofs. One of fair size would measure 75 feet in length and 24 feet in width.

The deep hold, well floored, serves as a cellar, cool in summer and warm in winter; oysters will never freeze there when the hatches are closed. Over the whole craft, flush with the outside, is built a house, two stories in height. The floor of the first story is the deck of the scow. This is the general business apartment, and gives room for storage, the opening of oysters, and transaction of business. Above is a loft where are stored barrels, baskets, and machinery. In the rear, usually—sometimes in the front end—is fitted up an office. The daily capacity of such a barge is about 700 bushels.

These scows are securely moored, side by side, to the wharf, or rather to the water-wall of the city, and are reached by broad swinging platforms, which allow them to rise and fall with the tide. At the rear end, therefore, they can always be closely approached by the sloops and boats which bring to their owners their stock. Such a barge is worth from $1,500 to $4,000, and, with an annual overhauling and calking, will last as long as a man is likely to need it. There are thirty of these barges, representing at present a value of $75,000. To these barges at the foot of Broome street come the oysters from East River and Long Island beds; also somewhat from Staten Island and Virginia, but to a small extent compared with the west-side business in these two classes.

Three sorts of trade are carried on, as follows: (1) Some dealers are also planters and sell their own oysters; (2) Dealers buy from planters and sell; (3) Dealers sell on commission.

The planting of oysters by the New York dealers is almost wholly by partnership methods, and New York furnishes a large part of the capital which operates beds from Keyport, N. J., to Norwalk, Conn. It is very rare, however, that this planting is done in the capitalist's name. The arrangement between the New Yorker and his rural partner is usually this: The former furnishes the needed money, the latter does all the labor, and the cost of taking up and the profits are equally divided. The reason why the capitalist's name does not appear, which would redound to his credit as an extensive operator, is, that the beds are usually in Connecticut or in New Jersey, while he is a citizen of New York, and in both those States the law forbids a non-inhabitant to plant oysters. The same law holds even in respect to towns, so that a man must live immediately at his beds if he intends to work them himself. But, of course, no legislation can forbid partnership or borrowing money, or hiring out one's services, even if the other party concerned be not a citizen of the State or township.

A large proportion of the oysters handled by these New York firms, however, are bought from planters who own beds on the Connecticut or Long Island shore, in Staten Island Sound, or elsewhere. The owner may load up his sloop and bring his crop to the city to dispose of to him who will pay best; or the dealer may send out his own sloops to the producing-grounds, and, with his business card painted all over the mainsail, cruise about until he has bought a cargo at a satisfactory price. The more usual method, however, is to have it understood beforehand that certain

dealers will take all the oysters certain planters can raise. Often money is advanced upon this understanding, or other help given, so that there is a closer business relation than ordinary between the buyers and the planters—an intimacy (and confusion in the matter of statistics) to which the extensive partnership system lends itself.

The third method—*i. e.*, sales on commission—explains itself. It is not extensively followed, since the planters do not have faith in it, and the dealers do not care to encourage it.

Some dealers are shippers wholly, finding their customers all over New York, Lower Canada, and the Lake States; others restrict their whole custom to the city and suburbs. The former require less men and dispose of larger packages at each order; the latter require many trucks and delivery carts, though most of their customers themselves come after their supplies. I believe the shipping trade is generally thought more desirable. The scene at the barges on both rivers, during the busy months of autumn and winter, is a very lively one. The sloops, very trim craft, bringing oysters to be sold, will sometimes lie a dozen deep opposite the barges, with plank walks across their decks from the outer ones to the shore. The captain and crew attend to the getting up of the cargo out of the hold and putting it into baskets, sorting it at the same time. East River and Staten Island oysters are sold by the hundred or the thousand, as a rule, and must all be counted. An expert man will count them accurately as fast as they can be carried ashore. Long Island stock is generally sold by the "basket," this measure holding somewhat less than a bushel; but some dealers compel the sloops to measure by baskets furnished them, which hold a full bushel, or a trifle over. Even then care is taken not to shake the contents down. Virginia oysters may be measured by the basket, but are paid for by the cargo or fraction of a cargo, except where, as in the case of Staten Island planters, southern oysters, having laid a few months in Prince's Bay or the sound, are brought to the city to be sold.

The carrying of oysters from the vessels into the barges affords employment to a distinct class of men, known as "carriers." There are from twenty-five to forty of these on each river. They do not work on salary, but get 10 cents a thousand for the oysters carried, reckoning seven small and four large baskets to the thousand. This seems very small wages, but they average from $25 to $30 a week during half the year, paid by the owners of the oysters sold. The opening of oysters by the trade in New York is not systematically carried on, and scarcely any is done until after the holidays. I doubt if more than one hundred or one hundred and fifty men are ever employed at once in the whole city in opening for the wholesale trade. All the openers are men, chiefly those who in summer get their living as deck-hands on steamboats and by other marine occupations. The pay is 10 cents a thousand, at which rate about $3 a day is regularly made when work is plentiful.

As to how many persons are concerned in the retail oyster business of the city only a mere guess is possible, since a very large proportion of them are temporarily engaged, or have their business so inextricably mixed with the liquor trade, or the business of selling fish and general provisions, that it is out of the question to define it separately with any exactness. Twenty-five years ago, when the "oyster riots" attracted attention to the matter, the number of persons supported by the restaurant trade in oysters was estimated at five thousand. Whether it is not double that at this time it is impossible to say; but I consider it safe to say that five thousand families, at least, find their chief or exclusive support in selling or preparing the mollusks for immediate consumption in the metropolis and its closely adjacent cities.

The wages vary immensely, depending on employer, sex, age, and capacity of the employed, amount of working time, kind of work, &c. Women receive from $3 to $6 per week; boys and men from $4 to $20. A correct average is almost impossible, and a total approximate summation

of the wages paid out in the course of a year in the retail trade is impossible. In the cooking of oysters the southern kinds are used, because these are cheapest, a special price being charged for a "stew" of northern oysters. For fried oysters, on the other hand, which require to be of larger size to make a show, the "box" size is used, and these are generally "Sound" or "East River" oysters. Oysters sold to be eaten raw may be anything and everything of respectable size; but the old brand names, "Saddle-Rock," "Shrewsbury," "Sound," "Blue Point," "Keyport," &c., the popularity of which was won long ago, are still attached. I suppose, for example, that twenty times as many "Shrewsbury" oysters are sold every season in New York as are raised each year in that river. The largest oyster saloons were formerly in Fulton market, and have a world-wide reputation. Now they are rivaled by up-town establishments.

OYSTER EXPORT TRADE.—One very important feature of the wholesale oyster trade in New York is the export of oysters in the shell to Europe. A barrel or two had often been carried across by steamers previous to an experiment by Mr. George H. Shaffer, of Fulton market, in 1870. The small consignment sent out by him reached England in good condition, sold well, and was followed by others, so that a regular trade was established. Mr. Shaffer, however, enjoyed a monopoly of it (and the large profits which at first accrued) only a short time, for his competitors were wide awake, and also began shipping to Europe, so that almost at a bound the exportation of oysters reached its full strength as a profitable business; that is, about as many were sent as there are now—all the foreign markets will bear.

The kind of oyster required for export is such as has not found favor in this country, where the "Saddle-Rock" and "Shrewsbury" are lauded above all others. The native European bivalve is small, rarely exceeding the size of a silver dollar, and is more popular than the American oyster. The oysters sent abroad, therefore, are all single (since they are to be eaten on the half-shell, and not cooked), small, and round; they are selected from the "culls" or smallest of the three classes into which our oysters are usually assorted, and have received the trade appellation of "London stock."

Because the oysters, native and cultivated, which are grown at the eastern end of the Great South Bay, on the south shore of Long Island, best fulfilled the conditions, they were the first to be exported to England, and have most largely, perhaps, entered into the trade. They are known both at home and abroad as "Blue Points," and acquired a reputation in England superior to all others up to the season of 1879, when there was a falling off in their quality and a consequent loss of esteem.

Besides the "Blue Points," great quantities of oysters from the East River (particularly Rowayton, Norwalk, and Bridgeport), have been shipped, chiefly through J. & J. Ellsworth; a less number from Rockaway and Fire Island, and large quantities from Staten Island waters, under the brand of "Sounds." These last became the favorites abroad during the past season, the "East Rivers" coming second, and the unfortunate "Blue Points" third; and, inasmuch as they cost less than either of the other brands, money was made upon them liberally, while no one who forwarded "Blue Points" received much if any profit, and many shippers lost money.

The London stock, having been picked out by the planter, is purchased by the shipper on the ground, where he sends his boats to buy daily, or keeps a permanent agent and packer. He culls it a second time, discarding about one-fourth, so that it is estimated that 4 bushels of oysters are caught for every barrel exported, since the barrels (second-hand flour barrels) hold scantily 3 bushels. The useless residue is not wasted, but thrown back upon the packer's own bed to grow further. The number of oysters in a barrel varies from 1,200 to 2,000; the more there are the better the English retail buyer likes it, since he sells them by count.

Packed so as to prevent injurious jarring, and stowed in the extreme forward part of the vessel, where they keep cool, the mollusks cross the Atlantic in excellent shape. No time is lost in getting the oysters, when packed, into the steamer, and many are taken in sloops directly from the producing points to the steamer's wharf, and thus escape the bother and expense of a second or third handling in New York.

Some American firms have regular agents abroad who care for and dispose of the oysters sent to them. In other cases they are consigned by the shippers to commission merchants on the other side. Liverpool has been the great receiving point for Great Britain, because it was the nearest port. It was found that the extra time required, and the port charges on cargoes sent direct to London by steamer, more than overbalanced the slight saving effected in freight over those forwarded by rail from Liverpool. The amount of oysters sent each week, though not large, has sometimes been more than could be disposed of before the next shipment arrived. To provide against loss in this contingency, the largest dealers own spaces of sea-bottom, where the surplusage is thrown overboard to keep in good condition and drawn upon as required. Some thousands of barrels are sent annually, which are intended to lie and grow there from one to three years. American oysters laid down thus in foreign waters have never been known to spawn, so far as I could learn, but the conditions have never been favorable; and no experiment, that I am aware of, has been tried to ascertain whether seed oysters from the United States, properly planted, would not grow into good health, emit spawn, and establish their race upon the European coasts. I see no reason why such an experiment should not prove entirely successful.

The prices received for American oysters sent abroad have been very various, ranging during 1880 from 5 to 40 shillings a barrel. Leaving out the various deductions necessary, it is considered fair to estimate $5 to be the average cash return to this country for each barrel. At this rate the stated total of 63,300 barrels (about 175,000 bushels) would net the United States no less than $316,500 in gold, an amount which would by no other means be brought into our pockets, and which enriches the country by so much, since the value exchanged for it does not, in any degree, impoverish the country, but is a product of labor which would not otherwise be employed, and the disposal of a product not otherwise to be used.

In my monograph I gave precise statistics of exports of oysters from 1864 to 1880. This showed a steady gain. In 1864 the export amounted to only about $85,000; ten years later it was near $250,000, and 1880, over $460,000. Of these almost exactly one-quarter was sent to Canada, leaving about $360,000 worth to be sent to Europe, and, in trifling quantity, to Mexico and the East Indies. Nine-tenths of the whole transatlantic traffic is from New York to Liverpool. In 1880 the total number of barrels exported was 63,300, containing about 190,000 bushels, or, counting 1,200 oysters (a low estimate) to the barrel, no less than 76,000,000 by count. The general opinion at New York is that European demand will increase steadily, while there will not be an overplus of stock here, since the East River beds are slowly failing and are more and more required for a seed supply. The shippers are, therefore, hopeful of profitable prices in future.

EASTERN NEW ENGLAND.—Passing now to the marketing of oysters in eastern New England, the first point to be mentioned is New Haven, as having anything more than a merely local trade; but here the business is almost wholly that of shipping opened raw oysters, the details of which appear on the next page.* The same is true of New London, Providence, New Bedford,

* "*Four grades are recognised by the Connecticut oystermen: 'Cullentines,' two years and three months old; 'Culls,' three years old; 'Boxes,' four to six years old; 'Extras,' five years old and upwards. The first and second are used principally for stews, and are sent to market, without the shell, in cans and kegs. The third and fourth are sent out generally in the shell in bags, boxes, and barrels. Natives are in the greatest demand and bring the best prices. The supply rarely equals the demand. When the stock of natives is exhausted resort is had to the choice Virginia plants that have been a year or more in Connecticut waters.*" (Rep't Conn. Shell-fish Com'rs, 1881, p. 65.)

and the seaports north of Boston. Everywhere except in New Hampshire and Maine the wholesale dealers are also the planters, and do not sell many oysters beyond what they have raised themselves. At certain points, as for example, Monument River, Mass., the oysters are so fine and large, and the locality comparatively so small, that they are marketed almost wholly in the shell and go to supply the "bench" trade of Boston, *i. e.*, to be sold in restaurants and hotels for eating "on the half-shell." Fishing through the ice with tongs is habitual all winter in that district, yet the oystermen do not complain of it as especially cold or unpleasant work. In order to keep the oysters from freezing, they dip in water the bag which they intend to put them in, and hold it upright until it freezes stiff. It thus stands conveniently open like a barrel, and no wind can blow through its sides to the detriment of the contents.

In winter large quantities of oysters from the Chesapeake are imported by the vessel load, as I have explained, for immediate consumption; these are used for opening and cooking, the higher grade, fresher "native" oysters from New England waters being reserved for the "shell" trade. Formerly enormous quantities of southern oysters were bedded at Boston, but now the encroachments of the building and filling in along the water-front overrun the old limits of the bedding grounds, and even the ancient natural beds. Where the Boston and Maine's car-house now stands a leading dealer not many years ago laid down 42,000 bushels in a single season. It was known as White Island at that time. The South Boston flats are being graded up into streets, and the Charles, Mystic, and Malden Rivers, Bird Island, and other places were long ago abandoned because the wharves or the sewerage of the city has destroyed their usefulness to the oysterman. Instead of bedding in his own harbor, therefore, the Boston dealer now rents ground in Buzzard's or Narragansett Bays, and lays down there the Virginia oysters he proposes to use for his summer and autumn trade, or else he has abandoned the practice altogether.

8. THE MARKETING OF OYSTERS "OPENED."

The opening of oysters and shipment of their flesh in water-tight receptacles to customers at a distance is a practice which began at Fair Haven (New Haven), Conn., half a century ago. In the early days the opening was done by the townspeople at their homes, and dealers packed in little wooden kegs, or in square tin cans for shipment to distant points under the protection of ice.

Nowadays this work is done wholly in the dealer's factory on the wharf where his schooners or steamers unload. As soon as the oysters are opened they are placed in a flat pan with a perforated bottom, called a skimmer, where they are drained of their accompanying liquor. From time to time a quantity are dipped out and put into a large colander, placed over a tall cask. Here a stream of water is turned upon them, and they are stirred about until washed clean, after which they are put into wooden tubs for shipment, or tin cans for local traffic. The tubs are all labeled with the name of the owner, and are returned by the customer. Their covers fit with exactness, and lock with rivet and seal in such a way that they cannot be opened on the road without certain discovery. The "shuckers" are mainly girls, who make fair wages.

The expressage of oysters from Fair Haven to the interior of New England is so large that the afternoon trains have one car, and sometimes two, devoted exclusively to the carriage of these goods. Large shipments were formerly made in wagons to Albany and thence to the large towns in central New York. Now these oysters go by rail much farther westward, even to Chicago, Cincinnati, and San Francisco.

At Providence, also, oysters are opened in enormous quantities every winter, the dealers here, as at New Haven, disposing in this way of nearly the whole of their crop and of all the winter receipts by vessel from the Chesapeake. New Haven's trade extends through western New Eng-

land and New York, but Providence supplies Boston, eastern New England, and Canada. All the openers there are men, and call themselves "cutters," using the knife in a different way from either the New Haven or New York methods.

Nearly half a century ago one or two New Haven men of energy conceived the idea of taking their warehouses to the oysters, instead of bringing the mollusks so far to the sales-room. They therefore opened branch houses in Baltimore. Others followed, and the names of Maltby, Mallory, Hemingway, Rowe, and their confrères, long familiar in Connecticut, became equally well known along the Chesapeake. All the great Baltimore firms of old standing originated in Fair Haven, just as Wellfleet, an obscure village on Cape Cod, supplied Portland, Boston, and Providence with its oystermen. The result was the same in both cases; the home interests retrograded when metropolitan advantages began to be used in competition, and at Fair Haven considerable and rapid changes in methods, as well as the results of trade, have come about.

None of these pioneers of the great Baltimore packing concerns was more enterprising than C. S. Maltby. As his business increased he established a line of wagons from Baltimore to Pittsburgh, and was thus enabled to supply the West with fresh oysters long before the Baltimore and Ohio Railroad had stretched out its track to that then distant region.

A few years later Mr. A. Field, also a native of Connecticut, began to sell oysters which he first steamed and then hermetically sealed in tin cans. This preparation was received with favor, and the new trade grew very rapidly. Records furnished by C. S. Maltby inform us that in 1865 1,875,000 bushels of oysters were packed raw in Baltimore, and 1,360,000 bushels were preserved. In 1869 he numbers in Maryland 55 packers, who, at 500 to 2,500 cans per day, put up 12,000,000 to 15,000,000 cans in a season of seven months, using 5,000,000 bushels. Sixty "raw" houses that year employed 3,000 hands, while the packers gave employment to 7,500 persons. Large quantities of canned oysters were annually sent, at that time, by steamship to Havana. In 1872 the same notes record as opening oysters, 2,000 men; making cans, 300 men; box makers, 50 men; clerks and laborers, 300. All these were in the "raw" trade of Baltimore. The profits to be had, and the stress of competition caused fraudulent methods to be introduced by dishonest firms, and the business at Baltimore was threatened with ruin. A combination of reputable firms was formed, under the name of the Union Oyster Company, to protect themselves, but this succeeded only partially, and the "steamed" trade is now in a low condition. "The raw-oyster business," as Mr. Edmonds observes in his account heretofore referred to, "has always been more profitable and less subject to the vicissitudes of trade, although there are many losses from spoilt oysters when the weather happens to turn suddenly warm. Raw oysters, after being opened, are packed in small air-tight cans holding about a quart, and these are arranged in rows in a long wooden box, with a block of ice between each row, or they are emptied into a keg, half-barrel, or barrel made for this purpose. When the latter plan is pursued, the keg or barrel is filled to about five-sixths of its capacity, and then a large piece of ice is thrown in, after which the top is fastened on as closely as possible, and it is at once shipped to the West, usually by special oyster trains or by express. Packed in this way, with moderately cold weather, the oysters will keep very well for a week or ten days. During the most active part of the "raw" season there are daily oyster trains of from thirty to forty cars from Baltimore to the West, where nearly all the Baltimore oysters are consumed. From the shores of the Chesapeake Bay as far as Detroit there is scarcely a city or town (connected with any of the great trunk lines) which is not supplied with Maryland raw oysters. Farther west, and to a considerable extent in European countries, the demand is supplied by steamed oysters. The oysters used in the raw trade are of a finer quality, and consequently command better prices than steamed."

The statistics of oyster-packing in Baltimore in 1880 are given by Mr. Edmonds as follows:

"During the season extending from September 1, 1879, to May 15, 1880, the number of vessels loaded with oysters arriving at Baltimore was 9,543 (or a daily average of 37 for the 257 days), bringing 7,252,972 bushels, which would make the average cargo 760 bushels. In addition to the amount brought by sail-vessels, there were 25,000 bushels received by steamers and consigned directly to hotels and restaurants, making a total of 7,277,972 bushels, of which there were packed raw 3,769,353 bushels, hermetically sealed 2,689,939 bushels, and used for city consumption 818,680 bushels. Engaged in oyster packing in Baltimore there are forty-five firms, with a capital of $2,338,300, occupying, in their business, houses and grounds with an estimated value of $1,360,966. During the summer these firms are generally engaged in fruit packing, and their capital and buildings are thus in active use during the entire year. These firms employ 4,167 males and 2,460 females—total, 6,627; and during the season of 1879–'80 paid to them in wages $602,427. The total number of bushels of oysters packed was 6,459,292, which required 25,546,780 tin cans and 929,614 wooden cases. The value of the oysters packed, including shucking, cans, &c., was $3,547,349. For the tin cans $794,919 was paid, and for the wooden cases $102,622.

"Of the 6,179 males [in Baltimore and other packing-houses in Maryland], nearly all of whom are employed in the 'raw' trade, about three-fourths are negroes, the majority of them being comparatively steady workmen, while the whites are more generally disposed to be idle and intemperate. The few whites in the business are generally of a very low class of society. Within the past year a few females have essayed to shuck raw oysters, but their number is still very small, and will probably so continue, owing to the nature of the work. The 2,460 females are all employed in the steam oyster-houses of Baltimore. They are mostly white girls of from sixteen to twenty-five years of age, the proportion of older ones as well as of colored being small. These girls are almost without exception of foreign birth or parentage, the largest proportion being of Bohemian origin, with Irish probably coming next. Few American girls, however poor, will consent to engage in this occupation, as in it both sexes must mingle indiscriminately, without regard to color, class, or condition. Owing to the thorough steaming the oysters are very easily opened, and the amount of physical labor required is comparatively light; but during the busy season the work begins about daybreak and lasts until dark, and is of course exceedingly fatiguing. An industrious hand can make from 75 cents to $1 a day, but from the great irregularity in their work they are probably not engaged over one-half of the time.

"Considering the class of the people employed in the packing-houses, I do not think it safe to estimate more than an average of two individuals dependent upon the wages of each shucker, at which rate there are in Maryland 17,278 people dependent upon oyster-shucking."

In addition to Baltimore, packing is carried on in Maryland at several other points. Mr. Edmonds reports these as follows for 1880: Crisfield, 16 firms, 678 employés, packing 427,270 bushels, worth $165,800; Cambridge, 8 firms, 385 employés, 205,410 bushels, worth $76,658; Annapolis, 8 firms, 315 employés, 156,703 bushels, worth $69,555; Oxford, 7 firms, 156 employés, 108,960 bushels, worth $39,986; Saint Michaels, 4 firms, 91 employés, 37,788 bushels, worth $14,053; Somerset County, 10 firms, 387 employés, 224,817 bushels, worth $86,945; Seaford, Del., also has a packing trade supplied by Maryland oysters. Mr. Edmonds says: "There are at Seaford seven oyster-packing firms, having an aggregate capital of $14,600, and occupying buildings estimated to be worth $28,500. From September 1, 1879, to May 1, 1880, 184,500 bushels of oysters were packed raw, giving employment to 170 males and 45 females, the wages of both for the season amounting to $14,230. The estimated value of the oysters, after being shucked and packed, was $71,350. When shucked oysters are shipped in bulk, the package (barrel or half-barrel) is re-

turned after being emptied, and then refilled. On this account only 1,400 packages, costing $1,000, were bought by Seaford packers during the season of 1879–'80. About 400 persons are dependent upon the oyster trade of Seaford. The local consumption, added to the packing, gives a total of 200,000 bushels handled at Seaford."

The packing trade of Virginia is of much later origin than that of Maryland. About 1859, Mr. Edmonds states, an oyster-packing establishment was instituted in Norfolk; but it was not until 1865 that the trade became extensive, and during the last few years it has developed rapidly, much to the benefit of the town, where now employment is afforded to a large number of new people. The trade in Norfolk (which is in the hands of Boston and New York capitalists) is almost exclusively in raw oysters, and in 1879–'80 its sales reached 1,370,855 bushels, more than all Maryland together, outside of Baltimore, and ten times as much as the rest of Virginia.

A great difference exists between Norfolk and Baltimore, also, in other respects. While Baltimore supplies the inland demand, and has branch houses in Chicago, Norfolk sends her stock northward and along the sea-board through agents in New York and Boston. No less than 250,000 gallons were thus received in Boston alone between September, 1879, and April, 1880. The effect has been very marked upon the trade in these northern cities; whether for good or ill there are two opposite opinions, the general verdict being that this feature works against the best interests of the trade. In their favor, it is said, in general, that these oysters can be sold cheaper than any other, and hence are accessible to the poorer class of people; that they are as good as the cargo oysters, and that in the increased number sold is compensation for the diminished percentage of profit. In opposition it is asserted that their quality is poor; that they are unhealthy; that the losses attending them are greater than with cargoes, and that they unduly cheapen all superior grades of stock. Two grades are brought to Boston from Norfolk, but ten times as many of the "common" as of the "selected." They are often dirty, and are washed again and again until the aroma and delectable flavor is all gone from their lacerated and rinsed remains; hence they are only fit to be cooked in a method calculated to disguise their insipidity by the time Vermont, Maine, or Canada gets them for dinner.

Providence takes a large amount of the Norfolk-opened stock, but New Haven has little reason to do so. In New York dealing in these raw oysters forms the whole business of two or three firms, who disposed in 1880 of about 600,000 gallons, selling chiefly in the city, but also shipping by express to interior points. More or less of the raw oysters from Baltimore and other points in Maryland and Virginia are also mingled with those from Norfolk in this channel of trade, and the trade is increasing. It gives better satisfaction in general in New York than in Boston, both because the stock itself seems generally of better quality, and because the shorter distance and superior accommodations in transit bring the oysters here in better condition. The reshipments are very widely scattered through the country, especially northward. Occasionally, however, orders come from the distant west. Opened oysters have even been sent to Great Britain, and gave good satisfaction there. Long transportation, without harm, has been made possible by various improved and patented contrivances for refrigeration in the shape of barrels, cans, and smaller packages.

At some places on the remote southern coast a packing business has sprung up. Attempts at New Berne, N. C., have proved failures only on account of the utter unreliability of the laborers employed, who could not be persuaded to work with steadiness, no matter how large the pay. In treating a perishable article and meeting a delicate market, such as the oyster packer handles, this obstacle, of course, was fatal to the enterprise. Savannah opens enough for the local demand and a narrow range of shipments in Georgia and South Carolina, Charleston offering little compe-

tition. At Mobile the business is more extensive, and the shipments reach far inland. Mobile is the headquarters of factories for canning the wild "reef" oysters gathered off the coast of Mississippi and eastern Louisiana. These factories employ a hundred or more hands in opening and packing. Their main business is in cooked and canned oysters, which are steamed and sealed in substantially the same way as at Baltimore. One specialty, however, is the putting up of canned fried oysters, after a patented method. Statistics of this are not at hand. The pickling of oysters, formerly practiced largely at Mobile, has gone out of vogue, as it has in northern cities, where it used to be important.

With respect to New Orleans I wrote as follows in 1880:

"The shipment of oysters inland from New Orleans has hitherto been of very small account, and principally of fresh oysters. Now, however, at least two canning establishments have been started in the city, which make a large item in their general preserving business of cooked and hermetically sealed *oysters, prepared substantially as in Baltimore. Several brands have been* put upon the market with good satisfaction, selling at $2.50 per dozen two-pound cans for first quality, and $1.80 for second, and at $1.10 for one-pound cans. About $100,000 worth of these canned oysters are said to have been put up during 1880, nearly all of which were taken by the trade of the city and immediate neighborhood. The capital invested is, perhaps, $75,000, but is applied to shrimp, lobster, and fruit canning as well as oysters. In these establishments only about thirty male adults are employed, the openers being girls, about one hundred in number, all white and chiefly German and American in nationality, who are paid from 4 to 6 cents for each kettleful, a "kettle" holding two quarts. Work is irregular, because of the difficulty of getting *oysters in sufficient quantity and when needed* (owing *mainly* to the indisposition of the oystermen to work in bad weather), and the total earnings of the openers and employés during the "oyster-run" in the factories, will probably not exceed $20,000. These factories have not been long enough in progress to furnish more exact information than is here given. Their capacity is far in advance of their present product, and they anticipate a highly successful future, confident that they can secure the trade of the lower Mississippi Valley, to the exclusion of oysters canned in northern cities."

9. UTILIZATION OF OYSTER SHELLS.

The utilization of oyster shells is extensive and in various directions. They serve as "metal" for roads and foot-paths; as "filling" for wharves, low lands, fortifications, and railway embankments; as stools for new oyster beds; as ballast for vessels; as material for lime, and as manure for exhausted fields, or a component in mixed fertilizers, besides some minor uses, such as food for poultry, &c.

One is astonished, upon first going to an oyster locality, to see the huge piles of shells, and discover *what spacious areas have* been raised above tide level or otherwise filled in with these animal structures. If there are 23,000,000 bushels opened annually in the United States, an equal measure of shells accumulates, amounting to no less than 243,390,000 cubic feet, which would spread 3 feet deep over a space more than 450,000 yards square. Next to their utilization in filling hollows, the largest portion of the emptied shells are converted into lime. Time was when no other lime was used by the early colonists, and the practice has persisted, several of the New England shore towns supporting mills and kilns grinding nothing but oyster shells. "By the addition of the proper materials, clay and magnesia," it is recorded, "Mr. Kingsley, a lime-burner of Boston, some years ago prepared an excellent hydraulic cement, which is used not only for laying drains, cisterns, &c., but its whiteness renders it suitable for the manufacture of fountains, vases, and ornamental articles, which are to be placed in exposed situations."

The use of the shells as a fertilizer is also an ancient practice. In the Canadian provinces the remains of extinct oyster beds are dredged by huge machines made for the purpose, and spread upon the lands under the name of mussel-mud. Along Pamlico Sound, North Carolina, when the weather becomes warm and there is no other employment for their boats, the fishermen rake up boat-loads of rough "coon oysters" and carry them to the farmers up the rivers to be sold and used as manure, for which from 3 to 5 cents a bushel is paid. In Florida and the Gulf States the best farms and gardens are those located upon the shell mounds, where the finest trees grow; and in the Northern States these old heaps have long been resorted to by farmers as a store house of top-dressing for their fields. The immense banks at Damariscotta, Me., are constantly utilized for this purpose. The shells are first burned, and the remains of various rude kilns exist, one of which greatly excited the antiquarians who first exhumed it, who were sure they had hit upon an aboriginal, prehistoric home, until they found half a brick in the bottom. In fact almost the whole of the lime now made from oyster-shells at the factories is converted into a fertilizer, in composition with other manures, or unmixed.

These and other minor utilizations are disappearing, however, along the northern coast, through the increased value of the shells to spread on the bottom for the founding of new colonies, as has been explained; and before long, no doubt, nearly all the shells accumulated will be saved by planters for this purpose, as a better economy than to sell them.

10. STATISTICAL SUMMARY.

Statistical tables, in 1880, showing, by States, the persons employed, capital invested, and value of products in the oyster industry.

States.	Grand total.			Persons employed.		Apparatus and capital.		
	Number of persons employed.	Bushels of oysters produced.	Value of oysters as sold.	Fishermen.	Shoremen.	*Total* capital invested in oyster industry.	Number of vessels.	Value of vessels.
Maine	15	.....	*$37,500	5	10	$4,210	1	$3,000
New Hampshire	9	1,000	6,050	6	3	2,400	.....	.....
Massachusetts	896	35,000	405,550	409	487	303,175	56	227,000
Rhode Island	650	163,200	356,925	300	350	110,000	.....	.....
Connecticut	1,006	336,450	672,875	672	334	361,200	100	69,000
New York	2,724	1,043,300	1,577,050	1,958	766	1,013,060	426	397,000
New Jersey	2,917	1,975,000	2,080,625	2,605	312	1,057,000	575	530,000
Pennsylvania	.....	.....	*187,500	.....	.....	.....	.....	.....
Delaware	1,065	300,000	687,725	820	†245	145,500	65	50,000
Maryland	23,402	10,600,000	4,730,476	13,748	‡9,654	6,634,850	1,450	1,750,000
Virginia	16,315	6,837,320	2,218,276	14,236	§2,079	1,351,100	1,317	460,950
North Carolina	1,020	170,000	60,000	1,000	20	68,500	90	22,500
South Carolina	185	50,000	20,000	175	10	12,250	10	2,500
Georgia	350	70,000	35,000	300	50	18,500	.....	.....
Florida	166	78,500	35,950	140	26	22,000	.....	.....
Alabama	300	104,500	44,950	250	50	16,000	20	6,000
Mississippi	60	25,000	10,000	50	10	3,000	.....	.....
Louisiana	1,400	225,000	200,000	1,300	100	86,750	45	10,750
Texas	240	95,000	47,200	200	40	17,750	.....	.....
Washington Territory	85	15,000	45,000	75	10	6,550	.....	.....
Total	52,805	22,195,370	13,438,852	38,249	14,566	10,583,295	4,155	3,528,700

Statistical tables, in 1880, showing, by States, the persons employed, capital invested, &c.—Continued.

States.	Apparatus and capital.				Products.			
	Number of boats.	Value of boats.	Value of gear and outfit.	Value of shore property.	Bushels of oysters produced.	Value of same to producer.	Enhancement of value of oysters in process of preparation for market. ‖	
							Number of bushels.	Amount of enhancement.
Maine	3	$60	$150	$1,000	.....	.....	75,000	$37,500
New Hampshire	5	300	100	2,000	1,000	$800	7,000	5,250
Massachusetts	117	9,485	10,600	56,000	36,000	41,800	514,000	363,750
Rhode Island	100	14,500	5,500	90,000	163,200	225,500	274,300	131,425
Connecticut	563	33,185	19,385	239,650	336,450	388,625	515,000	286,250
New York	1,714	121,700	42,460	451,900	1,043,300	1,043,300	1,065,000	533,750
New Jersey	1,400	110,500	91,500	325,000	1,975,000	1,970,000	237,500	110,625
Pennsylvania	.....	.....	.....	.....	.....	.....	††250,000	167,500
Delaware	300	12,000	10,000	¶73,500	300,000	425,000	‡‡834,500	§§362,725
Maryland	1,825	130,520	101,480	**3,992,350	10,600,000	2,650,000	7,653,492	2,080,476
Virginia	4,481	224,050	329,250	‖‖336,850	6,837,320	1,948,636	1,822,130	269,740
North Carolina	800	16,000	15,000	15,000	170,000	60,000	.....	.....
South Carolina	100	2,500	2,250	5,000	60,000	20,000	.....	.....
Georgia	100	10,000	3,500	5,000	70,000	35,000	.....	.....
Florida	110	8,000	2,000	12,000	78,600	15,950	.....	.....
Alabama	42	4,000	3,000	3,000	104,500	44,950	.....	.....
Mississippi	40	1,000	500	1,500	25,000	10,000	.....	.....
Louisiana	120	3,000	13,000	10,000	295,000	260,000	.....	.....
Texas	70	6,750	2,000	9,000	95,000	47,300	.....	.....
Washington Territory	40	800	750	5,000	15,000	10,000	.....	.....
Total	11,930	708,350	712,515	5,633,750	22,195,370	9,034,861	13,047,922	4,368,991

2.—THE SCALLOP FISHERY.

1. THE NATURAL HISTORY OF THE SCALLOP.

The name of the mollusk under consideration is also written escallop (from the French *escallope*, and the Dutch *schelp*, a shell, allied to *scale* according to Skeat) and scollop. Of other common names there are many in various languages, as will appear. The scallops are bivalves, with gills fringed like a comb, or pectinated, a characteristic of the class to which they belong. But in this family the indented, often almost toothed, edges of the shell itself carry out the resemblance to a comb so well, in addition to the internal structure, that they have retained for themselves the name *Pectinidæ*, referring to the whole family, and *Pecten* for the principal and typical genus. They are also called, in Italy, "*cape saute*;" in Holland, "*mantels*;" in Languedoc, "*coquilles large*;" in Brittany and Normandy, "*kofiches*." In England one hears such names as "fan-shells," "frills," or "queens" in South Devon, according to Montagu; and on the Dorset coast the fishermen call them "squinns." In the north of France one kind bears the name of "*vanneau*," or "*olivette*," and another species (*P. maximus*) is an article of food. Of the latter,

* This quantity represents simply the enhancement, the first cost being included in the Maryland and Virginia statistics.
† Of these, 215 are employed in the canneries at Seaford.
‡ Of these, 8,864 are employed at the various canneries.
§ Of these, 1,576 are employed in the canneries.
‖ This includes, planting, bedding, fattening, and transportation to distant markets in oyster vessels.
¶ Of this, $28,500 is invested in the cannery interests at Seaford.
** Of this amount, $2,492,350 represents the cash capital invested in the cannery industry.
†† Brought in winter by vessels registered in other States, the men engaged and the value of the vessels being accounted for elsewhere.
‡‡ Of these, 784,500 bushels were packed at Seaford, and 650,000 bushels were planted in Delaware Bay.
§§ Of this, $22,225 represents the enhancement on those canned.
‖‖ Of this, $119,250 represents the cash capital in the cannery interests, and $167,500 the value of buildings and fixtures for canning.

Jeffrey, a British conchologist, says: "If the oyster is the king of mollusks, this has a just claim to the rank and title of prince." In the fish markets of the north of France it is called "*grand-palerine*," or "*palourde*." In the south of England it shares with another species the name of "frill," and in the north that of "clam." Barbet speaks of it as the "ducal-mantle pecten," and says it served the Romans and Greeks as food, and when dressed with pepper and cummin seed, became a medicine. It is this species which is believed to have been designated as the *Kleis* of Xenocrates and Galen. This species (*P. maximus*), Jeffrey says, was formerly "plentiful in Lulworth Bay, on the Dorset coast; but now they are rarely found alive. I was told that the breed had been exterminated there by an epicurean officer of the coast guard. The late Major Martin would permit any conchologist to dredge as much as he pleased in the bays of the Connemara coast, provided he only took useless shells, * * * but all the big clams (*P. maximus*) were reserved for the table at Ballynahinch castle." The high reputation of this species causes it to be much sought after, and it "is a constant visitant of the London markets. Scalloped with bread-crumbs in its own shell, or fried with a little butter and pepper, it forms a very delicious morsel." The deeper shell was formerly employed in scalloping oysters, whence the name of this form of cooking them.

The scallop shell appears very frequently in literature. It is often used in heraldry to indicate that the bearer has made long voyages by sea. It has been the badge of several orders of knighthood, and still figures in many coats of arms. This half-chivalrous, half-saintly significance in heraldry was usually in memory of the Crusades, and marked those who had been attached to those mediæval expeditions, or had been on a holy pilgrimage, either to the shrine of St. James the Great of Compostella, in Spain (whence its name "St. James shell"), or to the Holy Land. Both amounted to the same thing, since the knights and monks of the Crusades in the ninth and tenth centuries adopted St. James as their saint of saints, and, converting the fisherman of Gennesaret into a Spanish warrior, assigned him the scallop shell for his "cognizance."*

Sir Walter Scott, in his poem "Marmion," refers to this badge, or emblem, as follows:

Here is a holy Palmer come,
From Salem first and last from Rome;
One that hath kissed the blessed tomb,
And visited each holy shrine,
In Araby and Palestine.

* * * * * * *

In Sinai's wilderness he saw
The Mount where Israel heard the law,
'Mid thunder-dint and flashing leven,
And shadows, mists, and darkness, given.
He shows St. James's cockle-shell—
Of fair Montserrat, too, can tell.

[STANZA XXIII.

The summoned Palmer came in place.
His sable cowl o'erhung his face;
In his black mantle was he clad,
With Peter's keys, in cloth of red,
On his broad shoulders wrought;
The scallop shell his cap did deck.

[STANZA XXVII.

And in "The Pilgrimage," written by Sir Walter Raleigh, he says:

Give me my scallop-shell of quiet,
My staff of faith to walk upon;
My scrip of joy, immortal diet;
My bottle of salvation.

* Moule's "Heraldry of Fish."

Several species were worn as pilgrim emblems in this way, but chiefly *Pecten jacobæ* and *Pecten maximus*. This is not the only place these lovely shells have in history and song and art; for, in the days when Ossian sang, the flat valves were the plates, the hollow ones the drinking cups, of Fingal and his heroes. "Distinguished artists," says the conchologist Say, "have judged them worthy of representation on their canvas, and the voluptuous form of Venus* is seen supported on the waves by the valve of a *Pecten* * * * A beautiful species which inhabits a portion of the Pacific is deified by the natives of some of the islands of that ocean."

Ceremonial employment and significance have been found for the scallop among various savage nations, and a few such instances relating to our American Indians were mentioned by Dr. R. E. C. Stearns in a paper in the *Overland Monthly* (April, 1873), as follows:

"The scallops are, and have been, esteemed for food and other purposes by the aboriginal tribes as well as by their civilized successors. In the shell heaps of Florida, among the *Kjækkenmœddings*, or kitchen refuse, we find great numbers of these shells, especially in a heap at Cedar Keys; and the shells of some of the west American species, found in Puget Sound, are now used by the Indians in that neighborhood, for in the ethnological department of the Smithsonian Institution at Washington (specimens 4773–4–5) are rattles made of valves of the *Pecten hastatus*, which were used by the Makah Indians in the vicinity of Neeah Bay in their dances; and another specimen is a rattle made from the convex valves of a larger species (*Pecten caurinus*) and formerly used as a medicine-rattle. These rattles are made by piercing a hole through the valves and stringing them upon a willow or similar twig."

Mr. Stearns in the same essay has furnished a most charming account of the anatomy of the scallop, which I cannot do better than to quote:

"The animal of the fan-shells is exceedingly beautiful. The mantle, or thin outer edge, which is the part nearest the rim or edge of the valves, conforms to the internal fluted structure of the latter, and presents the appearance of a delicately pointed ruffle or frill. This mantle is a thin and almost transparent membrane, adorned with a delicate fringe of slender, thread-like processes or filaments, and furnished with glands which secrete a coloring matter of the same tint as the shell; the valves increase in size, in harmony with the growth of the soft parts, by the deposition, around and upon the edges of membranous matter, from the fringed edge of the mantle which secretes it. This cover is also adorned with a row of conspicuous round black eyes (*ocelli*) around its base.† The lungs or gills are between the two folds of the mantle, composed of fibers pointing outward, of delicate form, and free at their outer edges, so as to float loosely in the water. The mouth is placed between the two inmost gills, where they unite. It is a simple orifice, destitute of teeth, but with four membranous lips on each side of the aperture.

"The mechanism by which respiration and nutrition are secured is elaborate and exceedingly interesting. The filaments of the gill-fringe, when examined under a powerful microscope, are seen to be covered with numberless minute, hair-like processes, endowed with the power of rapid motion. These are called *cilia*, and, when the animal is alive and *in situ*, with the valves gaping, may be seen in constant vibration in the water, generating, by their mutual action, a system of currents by which the surface of the gills is laved, diverting toward the mouth animalcules and other small nutritious particles.

"The shell of the scallops consists almost exclusively, says Dr. W. B. Carpenter, of membranous

*"Scallops or Venus-eocle" is one among John Josselyn, gent's, "list of rarities."

†A portion of this mantle can usually be seen, showing a finely fringed curtain of scarlet or orange, the mantle itself being of a delicate fawn color, the whole set off with a number of bright, glistening eyes, of an elegant emerald green, encircled with a band of turquoise blue. The finest jewels of our fairest belles can be no brighter than the natural ornaments of this common mollusk.

laminæ, coarsely or finely corrugated. It is composed of two very distinct layers, differing in color—and also in texture and destructibility—but having essentially the same structure. Traces of cellularity are sometimes discoverable on the external surface, and one species (*P. nobilis*) has a distinct prismatic cellular layer externally. As the idea of the Corinthian *capital* is believed to have been suggested to Callimachus, the Grecian architect, by a plant of the Acanthus growing around a basket, it is quite possible that the fluting of the Corinthian *column* may have been suggested by the internal grooving of the pecten shells."

The present writer is compelled to acknowledge his ignorance concerning much of the infancy as well as the habits in later life of this mollusk that he would like to know. In relation to our common commercial species, the *Pecten irradians*, it "occurs among the eel-grass on muddy shores in great abundance in many localities, especially in sheltered places;" but Professor Verrill, whose words I have just repeated, adds that it is "also frequently found living on sandy shores and flats or in the pools."

The spawn (or eggs) is thrown out into the water much in the manner of oysters, clams, and other bivalves, and such of it as escapes destruction by fishes or the hundred of accidents that threaten the life of those delicate objects, catches on stones, seaweeds, and other firm supports, from the sheltered tide-pools down to a considerable depth. This is early in the summer. By the middle of July, in Narragansett Bay, this "seed" is about as large as the head of a lead-pencil, and it does not drop from its support for two weeks or more. The growth is very rapid while the warm weather lasts, so that they attain about half their full size when winter stops, or nearly stops, their further growth. In November the young scallops, spawned the previous June, will be found in great numbers all along the shore, from an inch to an inch and a half in diameter, and moving about very actively.

Where eel-grass grows in quantities, however, as in Oyster Bay, on the northern shore of Long Island, the young keep among it, clinging to the stalks, until by their weight they bend the grass down or break it, when they drift out the bay with the grass when it floats away in the fall. In the spring of 1880 the grass came into the bay, bringing young scallops; thus the abundance that year was accounted for, though there had not been a crop before in that bay since 1874. I have not heard what effect the subsequent severe winter (of 1880–'81) had upon these scallops. When older and free from the need of protection in the eel-grass, they go moving about the bay "until they find the right bottom to live upon," as an experienced Long Islander writes, "when, in sailor phrase, they come to anchor and stay there, unless driven away by heavy storms, as often happens. Under such an accident thousands of bushels are often driven up on the shores of the bay and die there by freezing."

Referring to this point, Capt. S. Pidgeon, of Sag Harbor, says that, if possible, when driven before a storm, they will work to windward, and he has seen them swimming in schools 10 feet deep. North Carolinians report that the movements are all within small limits, and that in those southern "sounds" the scallops prefer the grassy beds in shoal water, but are occasionally found on the sand. Though they increase in size very little during the winter, they are said to begin a second period of growth in spring, and to come to maturity in a single year, so that they frequently produce spawn in the June following their birth, and are in condition for the market the subsequent autumn—that is, when from fifteen to eighteen months old. The rapidity with which they enlarge their size, and particularly their fatness, or the ratio of flesh to shell, estimated by measure, is shown when they come to be prepared for market. At New Bedford, I am informed, a bushel of scallops will yield only 2 quarts of "meats" at the beginning of the season, in Octo-

ber; in November a bushel will yield 6 pints, while a month later a gallon of meat is "cut out" of a single bushel of shells. Exactly similar reports of difference between the first and last of the season were given me at Greenwich. The fishermen call this increase "growing," and it seems to be the fact.

Fishermen believe that scallops never spawn more than once, and die before they reach an age of three years. Mr. Wm. Wilson, an experienced fisherman and dealer in Rhode Island, told Mr. Ludwig Kumlien, of the Fisheries Census staff, that specimens two years old were seldom taken alive, and were "of no account as food." Another fisherman stated that he had captured "only two two-year-olds in the whole season." At Northport, Long Island, I was assured that scallops were tolerably plentiful in that harbor once in five years. The second year following the season of plenty would produce a few, the third year a scattering one or two, the fourth year absolutely nothing. Then would come a sudden accession from some unknown source. Much the same story comes from Port Jefferson, L. I.

If this theory of scallop reproduction be true, it presents a case where the generations follow one another so rapidly that there are never two ranks, or generations, in condition to reproduce their kind at once, except in rare individual instances, since all or nearly all of the old ones die before the young ones have grown old enough to spawn. If such a state of affairs exist, of course any sudden catastrophe, such as a great and cold storm during the winter, or the covering of the water where they lie for a long period under a sheet of ice, happening to kill all the tender young (and old ones, too, often) in a particular district, will exterminate the breed there, since, even if the older and tougher ones survive this shock they will not live long enough, or at any rate will be unable to spawn again, and so start a new generation. It is easy to see, too, how an excessive onslaught of dredging in a particular district might utterly destroy the fishing there until some fortunate, perhaps long-delayed, accident should recolonize the district with a new set of scallops descended from wholly outside stock. This was appreciated when the Cape Cod man remarked, in lamenting the ruin which was being perpetrated by the too greedy pursuit of scallops in the waters south of Barnstable, "scallops live but three years and can be exterminated in one winter by carelessness."

In order to understand how such wholesale ruin is prevented or, rather, how, when it does occur in any locality, the district is restocked, and also such reports of practical observers as that from Northport, we must remind ourselves not only of what I have already said of the drifting of the young, but that the scallop, unlike many of the mollusca, is not fixed to one spot, nor is it even compelled, like others of its class, to glide along the bottom with slow and regular movement; "but locomotion in this genus is rapid, and by a succession of springs or leaps," so that it is often spoken of as the "dancing." The method of the scallop's activity is as follows: When it is alarmed, or wishes to change its location, or regain the water after being left upon the beach by the recession of the tide, it opens and energetically closes its valves, thus expelling the water from the gill-cavity, the reaction shooting the creature backward. The quick shutting of the shells makes a loud snap, which can be heard at a considerable distance. Thus the scallop is able to rise swiftly to the surface of the water by a succession of zigzag, arrow-like dartings upward, and then to slide down again in a wavering inclined line until it reaches the bottom at a distance of several yards from where it started. Repetitions of this comical maneuver in progression, with long rests between, carry it over long distances; and that scallops sometimes do make considerable journeys in large companies is well proved.

"One can scarcely see a lovelier sight than that of a large number of these pretty creatures, with shells of every hue from purple white to black, enlivened with shades of pink, yellow, fawn,

and other tints, darting about in the clear water, up, down, here, there, everywhere. In their flight-like movements, vertical, horizontal, east, west, north, and south, they are more suggestive of a flock of winged animals than of bivalves of which to make a meal."

Lack of a knowledge of this vagabondish trait in the scallop once cost a French merchant dear. Having purchased several thousands of scallops in England, he laid them down in his *parc* at Port-en-Bassin, but found them all gone next tide, for when the water came in they all shot off sternforemost, like *picuvres*. "Why, I was shrimping down in the bay there once," said a South of England dredgerman, when he heard of this story "and I seen something a shootin' along a front o' me what I'd never sin afore; 'n giv chace to 'n; and he to shoot again, and sich like, on and on—why, for thirty fathoms 'n more, till at last, when he'd a got deeper'n I cared fur to foller 'n, I seen it were a scallop. Aye, they shoots, jist like that, I can tell 'ee; but oysters," said he, "disn't."

It is asserted that they will now and then leap to a small distance above the water. Referring to this jumping power, Mr. Say relates the following: "Mr. Lesson has immersed a basket of Pectens in the water of the sea, within about 6 inches of its rim. The individuals, he says, which formed the superior layer, constrained in their movements by those that were beneath, after many fruitless efforts, succeeded in leaping from their prison. * * * In this way all the contents of the basket disappeared within fifteen minutes. Smellie repeats from Pliny that 'when the sea is calm troops or little fleets of scallops are often observed swimming on the surface. They raise one valve of their shell above the surface, which becomes a kind of sail, while the other remains under the water and answers the purpose of an anchor by steadying the animal and preventing its being overset. When an enemy approaches they instantly shut their shells, plunge to the bottom, and the whole fleet disappears.' We have not heard that this remarkable flotilla has been observed since the time of Pliny."

The young scallops are much more active and swift in all these movements than the adults. Not all scallops possess the activity of our common Atlantic coast species and of some foreign ones. Many of them have a sort of beard (*byssus*), at least when young, by which they attach themselves to rocks, seaweeds, and other marine bodies, as do the mussels, which are also bearded; having anchored thus, they are fixed forever. In general, the youngsters are more active than the older ones.

In the case of our common *Pecten irradians*, I have already given a sketch of the doings of the young. In the autumn there seems to be a migration towards the shallow water of the shore by the older scallops, and then the fishing begins. The grounds where scallops are now dredged are open tracts of sandy bottom, or else places where a thin layer of mud overlies the sand. Reefs of rocks and very soft bottom are both avoided by this mollusk. The same holds good in New York Bay, on the New Jersey coast, and in every locality where these mollusks abound. Information is scanty as to the depth to which they might be found, but it is no doubt considerable. The great bulk of those taken now, however, are dredged in less than a dozen feet of water.

The scallopers will tell you everywhere that the more they are raked the more abundant they become. I heard this from many dredgers myself, and the reports of others contain the same assertion. Raking, they say, scatters the young, and keeps them from crowding one another; in short, it lets them grow. Yet in each locality they will tell you that the yield there now does not compare in quantity with ten, fifteen, or twenty years ago. The splendid large *Pecten islandicus*, which formerly abounded on the coast of Maine and in the Bay of Fundy, is now so nearly extinct that it has become a prize to the conchologist. This came about entirely through an excessive raking and dredging for them. Long Island Sound has now been depopulated of its scal-

lops and the same is true of New York Harbor, the Sandy Hook region, and much of the New Jersey coast. At Greenwich, Conn., I was told that where ten or fifteen years ago one could fill a dredge in a few rods, and a boat would take 50 to 100 bushels a day, now only about 10 bushels a day was the average catch. From one-half to three-fourths of the dredgeful will prove trash. At Hyannis, Mass., they said four years ago that the scallops were disappearing and attributed it to the fact that in culling, the fishermen would not throw back the little ones. Many similar statements for other localities might be given. The irregularity of the present supply is also pointed out. "Some seasons the mollusks are much larger and finer than others. Thus this year they have been small. Last year they were twice the size." That is a report from Peconic, L. I. In 1879 an immense area of young growth was discovered about Crawford's Island, in Narragansett Bay; yet all died off in an incomprehensible manner before fall. Speaking of this subject to Mr. Kumlien, Mr. Wilson remarked: "When they first began catching scallops about twenty years ago in Cowesett Bay there were a hundred bushels to one. I can give no theory for their increase and decrease. One year there may be hardly any at all, and the next year a great plenty. I think the severity of the winter temperature has much to do with it. The year 1879 was a poor season, but this season (1880) young scallops are more plenty than ever before known."

2. APPARATUS AND METHODS OF CAPTURE.

The method of catching scallops everywhere pursued at present is by dredging. This would seem to be the only practicable way, and has been proved so, but early accounts of the fishing show that scoop-nets, usually on the end of long poles, were formerly used. This was speedily condemned, however, because it could be employed only where "scallops are a foot thick and miles in length," as one fisherman expressed it.

Following this came the invention of the small, triangular dredge, intended to be hauled astern of either a row-boat or sailing craft. I have never heard of any steam dredging for scallops. The ordinary scallop dredge holds from one to two bushels, but varies somewhat in form at different points along the coast. That in use in Buzzard's Bay, according to Mr. W. A. Wilcox, consists of an oval iron frame 3½ feet long. In front (or underneath) it is wire-netted but behind (above) is made of twine. Small sail-boats (dories) with a crew of two men fish with from one to twelve of these dredges over at once, sailing with just enough "sheet" to allow a slow headway. As soon as a dredge is felt to be full they "luff up" and haul it in, then empty and go on. If the wind is unfavorable one man will row while the other attends to the dredge.

In Narragansett Bay sail-boats, generally cat-rigged, are used, and the dredges are of special construction, in two shapes. Mr. Ludwig Kumlien reports:

"The dredge for a soft bottom differs from the other in having the 'blade' adjusted to swing in the 'eyes' of the arms in order to prevent its sinking into the mud. This is called the 'kettle-bail' style of dredge. The blade will fly up instead of digging into the bottom when undue pressure is exerted upon it.

"For a rocky bottom a dredge is used which has the blade immovably fastened to the arms; otherwise it does not differ from the 'kettle-bail' and it is known as a 'scraper.'

"In calm weather a small iron-framed dip-net, on a long pole, is employed in shoal water.

"The dredges are simply dragged by the boats until they are full. The large boats haul six to eight at a time; the smaller ones three, four, or five."

The number of dredges thrown out at once depends on the strength of the wind. The boat

sails itself with two reefs in, and is steered by the dredges. When they are full, as can be told by feeling the cables, the boatman "starts up his sheets all round," and hauls in his catch.

A good account in the New York Herald, describing modern operations in Peconic Bay, Long Island, shows that neither tools nor methods differ there from those just detailed.

3. DISPOSITION OF THE CATCH.

Not all of the scallop's flesh, as everybody knows, is fit for food, nor is it edible at all seasons. That portion of the mollusk employed is the firm, yellowish-white mass of that great muscle called the adductor, by which the animal pulls his shells together and is able to keep them shut. Few of the fishermen or dealers, not to speak of consumers, recognize this, however, and call the portion "eye" or "heart" under a vague impression that it is a vital organ of some sort, since when it is injured the scallop opens his shells, an act which, with the uninformed, is tantamount to its death.

"They are good boiled and pickled," says the judicious De Voe, with calmness, "but much better fried; many, however, do not like their peculiar sweetness, which is somewhat like the flavor of a rich soft clam's, but much more cloying and satisfactory." More enthusiasm warms the heart in this: "Broiled and stuffed with forcemeat, and served in his own shells, he not only forms an ornament to the table, but a pleasing variety amongst the fish." But the real, passionate admiration of a *bon vivant* is only breathed in the following, the *credo* of a disciple of Epicurus and a Herald reporter:

"Of—

> All fish from sea or shore,
> Freshet or purling brook, for which was drained
> Pontus and Lucrene Bay and Afric coast,

the crisp, tawny, not overfried scollop is the most delectable. The unctuous morsels cannot be manducated with dispassionate pretenses. A healthy person cannot swallow them with an affectation of not knowing what he is eating, for they possess an indefinable lusciousness not possessed by any fish or fruit, yet approximating to a combination of them all."

To come down to our prose again, I may remind the reader that the opening, as a rule, is done at home. There is little time or opportunity for opening on the boats, and not even as much culling is done there as there ought to be. Moreover, to throw over the offal and refuse (which a Greenwich man called "gauch") onto the ground would be considered bad policy and likely to drive the living scallops away, or interfere with their proper breeding. All the opening is done on shore, therefore, and a large number of persons are given employment outside of the dredgers. No statistics of any such employment are available for Rhode Island or Massachusetts, but an interesting and faithful picture is presented of this industry at New Suffolk (or Cutchogue), Long Island, by a recent writer in the New York Herald, as follows:

"As soon as a load is obtained away go the scallopers for the harbor. The beach at New Suffolk *is lined with their houses, no less than eleven of which are to be seen* within a quarter of a mile's walk along the sands. The largest of these buildings is 30 feet long by 20 wide. A broad shelf runs along each side, projecting a couple of feet from the walls, and reaching to the *waist of a man. Holes are cut in this shelf at regular intervals along its length.* Barrels are placed under these holes for the refuse. The scallops are piled up at the back of the shelf spoken of. The openers stand opposite the openings. Dexterity is here seen in the aptitude acquired by long practice. The openers are generally women, of all ages. Apart from the damp floors and dripping surroundings the work is not hard. Some of the young girls work after being married; come regularly in the season to gain a penny or two for those little extras coveted by all. We saw in one house two young wives, with cradles behind them containing less than year-old babies,

opening scollops with their hands, singing merrily some baby song to quiet the young ones, and by an indescribable motion of the left foot rocking the cradles with a gentle motion all-sufficient to keep the nurseling quiet. In another corner was a mother nursing her three-weeks-old babe at an interval in the work.

"A slow opener, at the present rates paid for labor—12½ cents for a gallon of eyes—will earn from 80 cents to $1 a day; a rapid one, one-half more. The fastest we observed was a lad of fourteen, named Patsy McGuire, who opened at the rate of thirty a minute by the watch. It takes 2 bushels of bivalves to make a gallon of eyes. In the work a leather palm is used to protect the hands.

"The motions of the expert opener are but three after the scallop is in hand. The bivalve is taken in the left hand, palm up, with the hinges of the scallop toward the opener's body. The knife—a simple piece of steel, ground sharp and with one end stuck in a small wooden handle—is inserted in the opening of the shell farthest from the breast. A turn is given, cutting apart the shells. The upper eye is severed through by this movement. A flirt at the same moment throws off the upper shell. The second motion cuts the lower fastenings of the eye to the under shell and takes the soft and useless rim off. The last motion throws the shell in one barrel and the soft and slimy rim in another, while the eye is thrown into a basin of yellow stoneware holding a gallon. They are then taken from the basin, thrown into a large colander, thoroughly washed, placed in clean boxes and shipped to New York and Brooklyn. The prices this year [1879] have been high, the shipper realizing $1.50 a gallon. The highest price ever given was $2.50, the lowest 50 cents, which does not pay the cost of the catch."

It is said that each of the eleven shops mentioned employs one boat and two men to catch for them, and from five to fifteen (averaging ten) persons in opening. The total of this is one hundred and thirty-three, the number of persons hired in New Suffolk, Long Island, alone, during the oyster season, besides many independent boatmen and dredgers.* The Herald's review, heretofore quoted, places the whole number of those employed at New Suffolk, scallop head-quarters, as about one hundred and fifty of all ages, from men and women of sixty all the way down to boys and girls of ten and twelve. The carefully ascertained census of Mr. Fred. Mather, made in this same locality and shown in the appended table, nearly coincides with this.

At Greenwich, R. I., the scallops are "shipped loose in small wooden boxes, without ice," according to Kumlien, "as ice spoils their flavor and swells them up. They are obliged to ice those sent to New York in the early part of the season, nevertheless, but the flavor is much impaired by the meat coming in contact with the sweet water."

There is and ought to be little or no waste in the scallop fishery. The oyster-planters of Providence and Taunton Rivers justly regard scallop shells as the best possible cultch for their seed-beds and pay a higher price for them than for oyster shells. The same disposal is made of the shells accumulating at New Suffolk, "piles of which to the height of 8 or 10 feet and covering a quarter of an acre were alongside the opening-houses." They are used to deposit on the oyster beds of Long Island Sound, and no less than *50,000* bushels, for which *$1,250*, at *2½ cents a* bushel, was paid, were sold at New Suffolk alone in 1880. One single firm in Fair Haven, Conn., has ordered 25,000 bushels to be saved for them from the scallop-opening in 1881.

The use of a somewhat similar shell, the cockle (*Cardium*), in France in the cultivation of oysters is described by Major Hayes in his report to the English Government on the Oyster Fisheries of France, in 1877. "In examining the channels [at Arcachon]" says Major Hayes, "my

* Thanks are due to Mr. O. B. Goldsmith, of Cutchogue, for information from that region.

attention was directed to a form of collector which I had not seen previously. It consisted of cockle shells strung closely together upon a wire, a hole being made in the shell near the hinge; the wire is run through, and when strung they are placed at the proper time in situations favorable for catching spat. They are kept about 3 inches above the mud by means of pegs placed at intervals, to which the wire is attached, and they appeared to me to succeed admirably."

The Long Islanders are famous for the extent to which they utilize dead fish (menhaden or *mossbunkers*) and other marine organisms as manure. It is not strange, therefore, to find that they economize the offal of the scallop-opening, which is mixed in the compost heap with the seaweed of the beach and makes a grand manure for the enriching of the growing corn, the fertilizer being placed in the hill instead of being sown broadcast on the land. I presume the same utilization of the refuse is practiced in Rhode Island, though I did not learn the facts there so specifically.

"This multitude of scallops," says a recent writer, "attracts to the waters of Peconic Bay thousands of water fowl. Black ducks, geese, loons, and the common non-edible ducks, such as coots, old squaws, and whistlers, are in immense numbers, while the gulls fairly whiten the sand bars when the receding tide leaves the sands bare. Robin's Island has at its north and south ends two sand bars, which are bare at low water for half a mile. On these bars, therefore, are left scallops, razor-fish, five-fingers, and all the minute crustacea that make up marine life. Where food is abundant there will be found something to feed upon it. Hence the crowds of birds on these points at low water reminds one of the fabulous anecdotes regarding bird life related in the stories of a Jules Verné."

But these birds are not the only enemies of scallops. They form the favorite food of many fishes, especially the cod, and its congeners. The small boring mollusks attack them more commonly even than the oyster, whenever they can catch a scallop quiet long enough to get a fair hold upon him; and for the same reason, namely, because their shells are more fragile than the oyster's, many species of star-fish, including some small and weak ones and some living only in deep water, are accustomed to seize upon and devour them. The scallop is very quick-sighted (if not exactly in eye-sight, at least by some other means of apprehension) and active in avoiding his enemies, so that it is able to escape many times when a more sluggish mollusk, no better armored than he, would perish. The compensation for his thin, easily crushed, or quickly bored shells, then, is his sharpness of wit and swiftness of locomotion, and so he is able to hold his own in the fight for existence, which is ever going on among the denizens of the deep, as well as those of the upper world.

4. EXTENT OF THE SCALLOP FISHERY.

A statistical view of the annual production of scallops, so far as I have been able to come at it, remains to be given.

SCALLOP FISHING AT CAPE COD AND BUZZARD'S BAY.—As the common scallop (*Pecten irradians*) is found only in a "rare and local" way north of Cape Cod, we must look to the southward of that great dividing point for any commercial fishery of them. The most northerly locality at which such a fishery exists, as far as I am informed, is at Hyannis, Mass., and during the winter of 1877 many persons of all ages and conditions were employed in it there. One firm fitted up a large house expressly for the business, and employed a large number of openers. Skiffs, cat-rigged yawl-boats, dories, and punts, two hundred in number, and of every size, shape, form, and color were used; most of them were flat-bottomed, shaped like a flat-iron, and therefore very "tender" when afloat. Each boat carried two dredges, locally termed "drags." In that year according

to Mr. F. W. True, each of the two hundred boats averaged about 120 bushels, or 100 gallons, during the season, which would give a total of 24,000 bushels, or 20,000 gallons, for the fleet. The scallops were sent to New York and also to Boston, and an average price of $5 per half barrel was received. In 1876 the price was $7 and in 1878 only $3.50.

Further inquiries show that this spurt at Hyannis had no precedent and has completely died away, so that at present there is no catch there, or at least no shipments.

In the Acushnet River, and all along the western shore of Buzzard's Bay, these little mollusks abound, and their catching has come to be of considerable importance to that locality. Mr. W. A. Wilcox, who sends me notes on the subject, says that it is only eighteen years ago that a fisherman of Fairhaven (opposite New Bedford) was unable to sell 5 gallons that he had caught. But the taste has been acquired, and a local market has grown up to important proportions, so that in 1880 fourteen men and ten small boats (dories) were dredging for scallops in Buzzard's Bay from the middle of October to the middle of January. Mr. Wilcox says: "These small boats will take from 10 to 75 bushels a day." The men are not able or not willing to work every day, however, since the tautog and other fishing calls for their attention, and there is danger of overstocking the market. It therefore happens that the total catch reported for both New Bedford and Fairhaven men will not exceed 6,400 gallons, valued at $3,840, 60 cents being a fair average price in this and the Boston market. The value of the investment devoted to this business at Fairhaven is about $120.

SCALLOP FISHING IN RHODE ISLAND.—The next scalloping-ground is in Mount Hope Bay and Cole's River, Massachusetts, on the eastern side of Narragansett Bay, for information in regard to which I am indebted to Mr. Ludwig Kumlien. The best grounds in this neighborhood lie between Gardiner's Neck and Warren's Neck and for a short distance up Cole's River. The number of men employed there was reported at about twenty-five, seventeen of whom were "cutters," or those who open the shells as fast as they are dredged and extract the edible portion. This force was divided among eight boats. The season here begins September 1 and lasts until the weather becomes too cold and stormy for work. The product for the year 1879 was estimated by Mr. Kumlien's informants at 8,000 bushels, equal to 6,000 gallons, which sold at 60 cents, and so realized $3,600, or $150 apiece, on the average, for those engaged. Two-thirds of this catch was sent to New York, the remainder going to Boston, Fall River, Mass., and small neighboring towns. Complaint was made that much of the catch in 1878 had to be thrown away, since there was no market for it. The investment at Cole's River in this business Mr. Kumlien sums up at $1,040, giving $640 as value of sail-boats and $400 as value of dredges and other implements. I think this is too high, however, and prefer to make the sum $800.

This brings me to perhaps the most important scallop fishery at present on the whole coast—that of Greenwich Bay, Rhode Island. There is said to have been some catching near Pawtuxet, in Providence River, but, if true, the fishery has not yielded anything of late to amount to much. The only beds of value, therefore, are to be found in Greenwich or Cowchusett Bay, an indentation of the western shore of Narragansett Bay. There the scallop beds, according to a map furnished by Mr. Ludwig Kumlien, are as follows:

I. About Chippanogset Island, at the western extremity of Greenwich Bay, extending about one-third of a mile from the island-shore. These are considered among the best of all the grounds.

II. On the north shore, the beds begin near the mouth of Apponang River and extend eastward, reaching out into the bay from a quarter to half a mile for a distance of about 2 miles, then extending southward in a curve as far as the channel, and opposite Spring Rocks, on Warwick

Neck (where the beds seem to stop). The fishing ground lies in the channel to 35 feet in depth. This ground is known as the North Shore or Apponaug grounds.

III. On the south and east shores of the bay are found the most extensive and profitable beds. These begin about one-fourth of a mile north of Pottowomut Rocks in about 13 feet of water, extend eastward to the channel, and then curve gently southward, going outside of Hunt's Ledge; in fact, they may be said to take in almost the entire flats west and southwest of the main channel. These beds also extend southward as far as Quanset Point, a distance of about 5 miles, but not south of Pojack Point. The grounds are of little value in comparison to the Greenwich Bay beds proper.

The Chippanogset grounds are considered to be the best, as they seldom give out. When this occurs the remainder are sure to be of no account.

It appears that Greenwich Bay has not always been the home of scallop and scallop fishing. In the East Greenwich Palladium of November, 1867, some quotable statements appeared.

"Only a few years ago Cowesett Bay * * * contained but few scallops or oysters. Clams and quahaugs were from time immemorial abundant along its shores. * * * Some six years ago it was found by a few fishermen that large quantities of scallops had planted themselves upon the sand-bars and grassy flats in the bay, and that they were approaching a size suitable for table. The next year they were taken in small quantities. Subsequently the scallop fishery was carried on extensively, employing, perhaps, fifty boats and nearly one hundred men from September to May. Hundreds of bushels were caught daily, cut out, and sent to order from all points of the compass to market. Many thousand gallons were disposed of last year * * * at prices that well paid the fishermen."

Later it was said: "The scallops have had to retreat from the bay to a great extent. * * * A new bed of 50 acres lying between Warwick Neck, the Middle ground, and the Spindle, in the shape of a triangle, has just been discovered, where the scallops are large and plenty, and where every pleasant day a score of boats may be seen."

My information is, that in the winter of 1879–'80 there were ninety boats in the fleet. But Mr. Kumlien, relying upon the estimates of Mr. William Wilson, a large dealer, gives the number of boats as eighty, and intimates that additional boats from Massachusetts and elsewhere often dredge in the bay. These boats are nearly all cat-rigged, there being only two or three sloops and several small sharpies. At an average valuation of $150, they would sum up $12,000 as a total.

To man these Greenwich boats and "cut out" the meats employs about one hundred hands, twenty-five or thirty of whom are women and girls. This is in 1880; in 1879 less were employed in catching, but nearly double the number in opening for market. The previous year (1878) was an unusually good one in this business, and Mr. Wilson alone employed about twenty hands.

There are several methods of conducting this fishery here. The man who owns the boat may catch for himself or on shares with his companion. Shippers often furnish boats, dredges, &c., and pay various prices, at a certain rate per bushel, from 10 cents upward, according to the abundance or scarcity of the stock. The opening is rarely done in the boats, since the throwing overboard of the offal and waste matter (here known as "gauch") is considered injurious to the beds, and the practice gives an opportunity for fraud under the State law, as is charged against some Providence craft. Moreover, there is sale for the shells to neighboring oyster planters, to be used as "stools" for oyster spat to catch upon.

A law of the State of Rhode Island alluded to, specifies in respect to Greenwich Bay that

not more than 15 bushels of scallops shall be taken by one boat in one day, and only between the 15th of September and the 15th of May. In respect to this law Mr. Kumlien says: "We are informed that certain of the scallopers were instrumental in getting this law passed, in the hopes of raising the price; when they found it did not serve that purpose, they were the first to break it. We are informed the law is of no account at all. Quantities are stolen long before the time allowed, and the majority of the boats take all they can get, as they can fish only when there is a wind." Though I heard dissatisfaction expressed with the law, I was assured, when I was there, that the law was well kept by all the Greenwich scallopers at least, and, indeed, by everybody. Each man's jealousy of his neighbor's getting an advantage over him, a feeling which seems far more strongly developed among the followers of the sea than among any class of landsmen I know of, prompted an incessant watch upon one another's movements, the sharpness of which was increased by the knowledge that to the informant went half the fine levied upon conviction. No one seemed to have any better protective measure to propose, at any rate.

Restricted by this law and the circumstances, the catch of Greenwich Bay during the six active weeks in the autumn of 1879 was closely estimated at 24,000 bushels. Mr. Wilson considers this equal to 24,000 gallons, but I think they would hardly measure so much, and would prefer to say 20,000 gallons. At 60 cents per gallon (which the fishermen consider too low to be profitable or encouraging even) the value of the catch would be $12,000. The bulk of the scallops caught here go to New York, but Providence, Newport, and Connecticut towns receive small but regular supplies. They bear a high reputation in all markets.

To the value of the boats must be added five hundred dredges, at $4 apiece, making $2,000 and about $500 for other accouterments. The total floating capital invested in the scallop fishery here is, then, $14,500.

At Wickford, R. I., there live a few scallopers, and three boats are owned; but these have been included in the statistics of Greenwich Bay, where they do all their fishing.

LONG ISLAND SOUND.—Though formerly there were an abundance of scallops on the Connecticut coast, as is recorded by the early writers, no catching of them there now is profitable. This is true of all Long Island Sound, apparently, though occasional catches are made at long intervals. At Oyster Bay, Mr. Fred. Mather was told that every few years they had a crop of scallops, and that in 1880 there were large numbers of young, as large as a quarter-dollar, to be seen. The fishermen told him that there were always a few. Hempstead Bay formerly possessed them, but they have now wholly disappeared from its area. Five years ago (1875) these shell-fish were plentiful in Port Jefferson Harbor, being taken by the boat-load. After an almost entire absence, about 250 gallons were caught and opened in 1880. The irregularity of Northport Harbor has already been mentioned. The last occasion when they appeared in force was in 1878, during which year the crop was said to be 10,000 bushels, which would perhaps "open" 7,500 gallons, worth $4,000. I am inclined to think this a large estimate, however. A few years ago, it is said, scallops were common enough off Bridgeport, Conn., but have now wholly disappeared, the few that are caught anywhere in that neighborhood there finding a prompt local sale.

THE SCALLOP INDUSTRY AT EAST END OF LONG ISLAND.—In Peconic and the other bays at the eastern end of Long Island, inclosed by Montauk and Orient Points and Gardiner's Island, is the very important scallop ground and fishery to which I have already alluded as having its headquarters at New Suffolk, or Cutchogue, as it is known to the Post-Office Department and railway people. Here this industry takes the place of an oyster-culture or clam-digging, and ranks high as a means of support to the people along the shore. In October of 1879 the account of this fishery, already quoted, was printed in the New York Herald, which I am glad to copy and con-

dense, since it has been approved as trustworthy by Mr. O. B. Goldsmith and other experienced persons living at New Suffolk:

"New Suffolk, Long Island, situated on the north shore, and midway of the length of Great *Peconic Bay, whose waters reach from Greenport, on Long Island Sound, to Riverhead, a distance* of 40 miles, is the great fishing-ground. * * * The favorite grounds lie in a line drawn from northwest to southeast across the bay from New Suffolk toward Southampton, on the eastern shore. Here the scallops are always found."

The history of their discovery and the origin of the business has been detailed in a letter to the Census Bureau by Capt. Ira B. Tuthill, jr., of New Suffolk. He says New Suffolk is the chief, and has the largest number of individuals engaged in the trade. "Fourteen vessels, in size from the cat-rigged sail-boat of a couple of tons register to the schooner-rigged vessel of twenty, hail from New Suffolk. The crews run from a man and a boy on the smaller to a half dozen able-bodied men on the larger boats. The work is of the hardest and the coldest sort. No one that has not the constitution of a horse could stand it. No weather is severe enough to keep these hardy, tough men from making a catch whenever a 'bed' is found. The wages are not high—are really low when the exposure incident to the trade is remembered—but the work comes in at a time of year when there is little demand for labor, and hence the men for the work are easily procured. As was the case years ago in the whale fishery, boats are built or purchased for the special purpose. The owner or owners receive such a proportion for interest money, the captain of the boat gets a 'lay' in the profits instead of wages, while the men will average $1.50 a day for their earnings. * * * The largest vessels of the fleet engaged in the scallop trade are as named below:

Names of vessels.	Names of captains.	Port.
Emma Wilson	Frank Acker	New Suffolk.
Mary Boyes	T. Billard	Do.
Maggie	Bryan Hudson	Do.
Flora	Steve Heffern	Do.
Mary	Thomas Edwards	Do.
Cloud	Stacy Webb	Do.
Gypsy	C. Halsey	Do.
Nightingale	Patrick Gowen	Do.
Eva	Benjamin Webb	Do.
Annie Bell	William King	Do.
Blackbird	George Goldsmith	Do.
Three *Brothers*	*Foster Fanning*	*Do.*
Skitterer	Warren Wells	Mattituck.
Horace Greeley	W. Reeves	Do.
Little Maid	A. Overton	Do.
Walter Girard	G. Cronse	Do.
Mary Ann	H. Howell	Do.

The origin of this business in that locality is recent.

The fishing season lasts from October to April, but the catch varies from year to year. In 1877 it seems to have been remarkably high, 80,000 bushels, yielding 40,000 gallons (it is estimated), having gone to New York from this locality. The price, however, ran down as low as 50 cents per gallon, barely paying expenses. In 1878 only 20,000 gallons were produced, or half the previous season's yield, and in 1879 it was lighter yet. In 1857, the sloop Tradesman (40 or 50 tons), of Norwalk, Conn. (the captain of which was afterwards light-house keeper at Norwalk Islands), came over to Long Island in search of scallops. After trying in several parts of Gardiner's Bay without success, they started up the Peconic, and, being oystermen, they had some idea as to

the sort of bottom suitable to the animals they were looking for. After several unsuccessful trials they "hove their dredges off the northeastern point of Robin's Island, opposite New Suffolk, and when they hauled them in found them solid-full of scallops." Anchoring there at night, they renewed work the next morning, and soon had taken up 750 bushels, with which they departed.

A few days later a second large sloop appeared, and after a day's dredging carried away about 1,000 bushels. Scallops had been taken out of the bay and eaten by the people on its shores ever since the first settlement of the region, but only in small quantities, caught by a hand-net or picked up at low tide. What use was to be found for whole ship-loads, therefore, excited much questioning among the bay-men. This resulted in the discovery, by the next summer, that there was a considerable demand for scallops in Norwalk, Bridgeport, New Haven, and other Connecticut towns. C. W. Fanning, George I. and O. H. Tuthill of New Suffolk, therefore began to compete with the sloops, which still came from across the sound. Late in the season one of the citizens tried the experiment of shipping to New York, sending 7 gallons in a common nail-keg. The commission merchant in Fulton market to whom they were consigned replied that nobody knew what they were, but that if Mr. Tuthill would send a few in the shell they might be made to go. Accordingly a box of scallops in their jackets were shipped to New York, and in a week $3 was returned as the proceeds of their sale. This was the beginning of a scallop business which now amounts to $15,000 or $20,000 a year. New Suffolk remains the natural center and headquarters, because the facilities to open the scallops are better there than elsewhere, and the village is nearest the most productive grounds, which are on the northern side of Peconic Bay.

The catch in 1879, it is reported, was only about 20,000 bushels, or 12,000 gallons; consequently prices were high, the skippers often selling on the shore for as high as $1.25 or $1.50 per gallon. It is probable, however, that an average of 75 cents would be fully as high as the truth would permit, which would make $9,000 the value of the whole catch.

For the season of 1880, which has been far better, owing, no doubt, in a large degree to the openness of the previous winter, the record of the catch has been very carefully worked out by Mr. Fred. Mather, and I give his figures without change, embodying them in a table which comprehends the scallop-fishing interest of all Peconic Bay:

Statistics of scallop industry of Peconic Bay, Long Island, in 1880.

Places.	Bushels.	Gallons.	Pounds.	Value.	Men.	Women and children.	Estimated investment.
Greenport	2,222	1,111	10,000	$666 60	10	54	
Southhold	6,888	4,444	40,000	2,666 40	2	13	
Peconic	4,000	2,000	18,000	1,200 00	20	50	
Jamesport	1,666	833	8,500	699 60	16	61	
Mattituck	4,000	2,000	18,000	1,200 00	5	17	
New Suffolk	18,000	9,000	81,000	5,400 00	90	110	$20,000
Franklinville	1,776	888	8,000	532 80	4	10	
Sag Harbor	11,110	5,555	50,000	3,333 00	30	100	
Springs	10,000	5,000	45,000	3,000 00	10	40	
East Hampton	888	444	4,000	266 40	2	6	
Bridgehampton	1,776	888	8,000	532 80	4	10	
Totals	54,326	32,153	290,500	19,491 60	193	471	

Amount earned by men, $15,682.64; amount earned by women and children, $3,859.36. Sale of 50,000 bushels of shells, at 2½ cents, $1,250.

Concerning the facts represented by the figures given above, some remarks will be advisable. Of the 90 men credited to New Suffolk, 70 are fishermen and 20 are openers. Out of the 200 persons engaged in this industry, 8 are Scotch, 12 Irish, 4 German, and 176 Americans. Of the 90 men, 50 are married, and in all 340 persons are dependent, giving an average of about $57

apiece income all round for each season. The fleet averages 100 bushels (in shell) a day, or 18,000 for the past season, each of which will produce half a gallon of meats on the average, or 9,000 gallons in all. The price for opening was formerly 25 cents a gallon; but it came down in 1879 to 15 cents and in 1880 to 12 cents, but if prices are good it is expected to go back to 15 cents. The total earned by the openers at New Suffolk (almost wholly women and children) last season, was $1,080; divided among 110, this gives each one hardly $10, but of course the distribution was far from equal. The average earnings of the 70 fishermen amounted to $97.40. These figures closely represent the average of the whole $19,491 received by the shore people for the scallops sold.

The "rims" or refuse, which was formerly sold at $1 per barrel to the fertilizer factories, is now usually retained by each proprietor for his own land. Some of the scallop-boats are used in the clam trade during the "off season."

NEW JERSEY AND SOUTHWARD.—Scallops are taken to a very small extent at different points on the coast of New Jersey and southward, but nowhere enter into trade, so far as I can learn, except at Morehead City, N. C., there being a large bed of them in Bogue Sound, just opposite that town. Fishermen there have long taken them for local use and have shipped a few to the nearer northern markets from time to time. In the winter of 1876–'77 the business reached its height and several thousand gallons were sent north, a few going as far as Philadelphia and New York. Since this date few have been shipped and the supply is consumed locally.

The height of the season is from December to February 15, though they are abundant during the entire year. In winter fifteen or twenty men and boys often engage in this fishery, while five or six continue the business during the summer months. An average catch is from 4 to 6 bushels at a tide, the fishermen wading for them on the grassy shoals, that are nearly dry at low water. Ten thousand bushels would probably be a high estimate of the total yearly crop, opening, say, 7,500 gallons. Formerly 60 cents a gallon was the price, but in 1880 they brought only 40 cents. The supply is regulated wholly by the demand, and if a market could be found for them at good prices a considerable quantity could be obtained.

SCALLOPS IN CALIFORNIA.—The scallop occurs on the southern coast of California, in a species resembling *Pecten irradians*. Prof. D. S. Jordan writes me that it is very abundant about Wilmington in the lagoons, where it is caught by any one inclined to go for it, and sells in Wilmington at 25 to 50 cents a bucket. It is liked by the people, but there is no regular market or trade. It is now several years since Dr. R. E. C. Stearns expressed his surprise that the San Diego scallop had not been introduced into the San Francisco markets, and prophesied that it soon would be.

STATISTICS OF SCALLOP FISHERIES OF THE ATLANTIC STATES.

Statistics furnished from New York and Brooklyn give an idea of the consumption, and are repeated below. It is said that in the New York markets Rhode Island scallops bring better prices than Long Island ones. "New York dealers tell me," says Mather, "that the former are larger, and that it is the custom of the Long Island men to wash their scallops too much in fresh water, which causes them to swell and look good and to measure more, but that they shrink up small when cooked. Three gallons of open scallops placed in fresh water overnight will swell to 4 gallons by morning. Salt water does not swell them."

Mr. Lamphier reports that in 1880 there were used in Fulton market alone 29,499 gallons, and in Brooklyn and other suburbs 25,501 gallons more, making 55,000 gallons in all.

This shows that New York City absorbs four-fifths of all the scallops caught on our coast, which, so far as this investigation goes, aggregate as follows:

	Gallons of meats.
Buzzard's Bay	6,400
Cole's River	6,000
Rhode Island	20,000
Long Island	32,163
New Jersey and southward	7,500
Total	72,063

Value, at 40 cents per gallon, $28,825.20.

3. THE CLAM FISHERIES.

1. THE PRINCIPAL SPECIES OF AMERICAN CLAMS USED FOR FOOD.

The "clams" of commerce in the United States are of various species, differing widely in all features except the single quality of being edible bivalves. This permits the including of nearly all the double-shelled mollusks. The list, enumerating those most commonly used, is as follows:

ATLANTIC COAST.

Mya arenaria. Soft clam.
Venus mercenaria. Quahaug or hard clam.
Mactra solidissima. Surf or sea clam.
Cyprina islandica. False quahaug.
Callista gigantea. Painted clam.
Gnathodon cuneatus. Cuneata clam.

PACIFIC COAST.

Pachyderma crassatelloides. Hen clam.
Saxidomus aratus. Round clam.
Chione succincta. Little neck clam.
Mactra falcata. Western surf clam.
Schizothærus nuttalli. Gapers.
Macoma nasuta. Tellens.
Semele decisa. Flat clam.

It is my purpose to treat of these separately, since the circumstances of their distribution, gathering, and sale favor it, and I will begin with that most important, probably, to the Atlantic coast, the clam, *par excellence.*

(a) FISHERY FOR SOFT CLAMS.

2. NATURAL HISTORY OF MYA ARENARIA.

The common names of *Mya arenaria* are numerous. North of Cape Cod it is simply the "clam," distinguished, if at all, by the name "soft clam." In Long Island Sound and at New York it is most spoken of as the "long clam" and "squirt clam." English books and people call it the "sand-gaper," the "old maid," &c.

A moist and muddy clam is not altogether an attractive object. Yet there is much about it

that is interesting. Take up one of those *Mya* clams, for instance, and look at it. The two oblong, slight, bluish-white shells hold within an unintelligible yellowish mass, while projecting from one end is a blackish, wrinkled lump that, upon being irritated, quickly withdraws, throwing out at the same time a stream of water, while the shells shut tightly together. But put this forbidding looking creature in a shallow pan of fresh sea-water 12 or 15 inches in length. Although this, its natural element, is no doubt instantly grateful to it, the animal must be left quietly for a few hours before it recovers confidence. Then the blackened tube—of which a glimpse was afforded before—gradually protrudes from between the margins of the two halves or valves of the shell, and slowly extends itself until a length of several inches is displayed. Now it is easy to see that this organ has two openings at the end, beautifully fringed with appendages like little feelers, and mottled with the richest brown. It really, then, consists of two tubes, one on top of the other, leading to the body of the clam, and if you observe the openings closely, you will see a current of water flowing into one of them, and another current pouring as steadily out of the other. These currents are produced by the tremulous motion of innumerable minute hairs (*cilia*) that line the interior of the animal. The extensile and contractile double tube is termed the "siphon," and the currents "siphonal currents."

The anatomy of the clam, like that of nearly all bivalved mollusks, is very simple. Forcing them open, we find that the two halves of the shell are held together by a pair of strong muscles, but if the animal would keep his doors quite closed he must exert a continued effort, since immediately beneath the hinge, occupying a little cup-shaped projection like a bracket, is an elastic substance which acts to throw the valves a little apart when the muscles are relaxed, just as a piece of india-rubber squeezed into the hinge of a door would tend to open it as soon as the pressure was removed. Having taken off one valve, we find lining it—and the other as well—a thin membrane, called the mantle. The scalloped border which follows the edges of the shells is thickened and united, except a small slit through which the "foot" projects at the end opposite the siphon. The foot is a tough and muscular organ serving as an excavator. Within the mantle are the curtain-like gills, between which lie the muscles that operate the foot and siphon, the abdomen and the viscera, which form the principal edible parts. The mouth is just under the forward transverse muscle, and opens almost directly into the stomach. The intestine, after several turns, goes back directly through the heart to its orifice near the mouth. The ordinary length of the shell is about 3 inches, but it is not uncommon to find it much larger, while the siphon may be projected fully a foot.

In this country the *Mya* clams are found from South Carolina to the Arctic Ocean, where the seals, walrus, polar bear, and Arctic fox feed upon them whenever they have a chance. They are scarce south of Cape Hatteras, and most abundant on the New England coast. They occur on the northern coasts of Europe as far south as England and France, on the northeastern coast of Asia, in Japan, and in Alaska. It is therefore essentially a northern species, and had the same general distribution as far back as the pliocene and miocene ages of geology.

Soft clams are everywhere denizens of the beach between tide-marks. The soil that suits them best is sand, with a large admixture of gravel or mud, but all sorts of places are occupied where the water is sufficiently brackish and where it is possible for them to burrow. The specimens that live on the outer sandy beaches have a much whiter, thinner, and more regular shell than those found in estuaries; they are often really delicate in texture, and covered, even when full grown, with a thin, yellowish epidermis, making a striking difference between them and the homely, rough, mud-colored specimens usually seen in the markets. Now, as in 1616, when Capt. John Smith wrote "You shal scarce find any Baye, Shallow Shore or Cove of sand, wyere

you may not take many Clampes," these mollusks are very numerous. More than a hundred, of different sizes, are said to be sometimes dug from a single square foot of ground in Boston Harbor.

On such beaches as I have mentioned, the young clam, as soon as old enough, turns his head down, and pushing out his foot, which he can fold into various shapes, "now a dibble or spade, a trepan or pointed graving tool, a hook, a sharp wedge," he digs his way straight down, 6 or 8 inches into the sand, leaving stretched behind him his siphonal tubes, to keep up his communication with the surface. When the water over him is deep, the siphons are thrust well out; when shallow, as in some tide pool, only the fringe of short tentacles is visible above the closely impacted mud, and when, as happens most of the time, in the case of those clams whose home is near high-tide mark, there is no water over him at all, his tubes are withdrawn wholly into the sand.

Confined in his burrow deep in the earth, the clam cannot roam in search of food. It is, therefore, to bring sustenance to it that the tubes are pushed up into the sea and the cilia set in motion. A current of water is sucked in, bearing microscopic particles, as aliment for the stomach, and bringing oxygen to revivify the blood brought into contact with it in the gills. Its burden unloaded, the available residue of the water flows out through the discharging siphon, carrying with it all excrementitious matter, and a continuous current is thus kept up. It is never "long between drinks" with this bivalve, which may, perhaps, account for the origin of the adage "happy as a clam."

The spawning season, according to the fishermen, occurs in June and July. The eggs, issuing from the ovaries of the female, find their way into the cavities of the outer gills, where they are fructified. There they develop until the eggs are furnished with triangular, vellum-like shells just large enough to be seen, which are discharged by thousands into the water and left to take care of themselves. How long it is before they reach a sufficient size to settle down in life and construct a burrow for themselves is unknown—probably not a great while. It is doubtful indeed whether one in a hundred ever fulfills that domestic ambition before being swallowed by some one of the numberless aquatic birds, fishes, and crabs, that are on the lookout for just such tidbits. Nevertheless the little clams do their "level best," anchoring themselves by a slender thread to the bottom, and holding on against the currents with all their might.

Beds of soft clams are sometimes of vast extent, and are usually found in sheltered parts of the coast, where the action of the waves is not sufficiently strong seriously to disturb the beach. The inside of the long sandy neck connecting Nahant with Lynn, for example, is filled with them, while on the outside, where the surf pounds, not one is to be found. They are sought at low tide, betraying their hiding places by squirting water up when the sand is shaken or pressed. That is the spot to drive in your spade. Since the days of the Mayflower, hogs have had sagacity enough to discover the situation of the buried bivalves at low water, and to root them out and devour them, for no less than 250 years ago old Thomas Morton recorded that this diet "makes the swine prove exceedingly," and Wood, in his "New England Prospect" (1634), remarks:

"These fishes be in great plenty in most parts of the country, which is a great commodity for the feeding of swine both in winter and summer, for, being once used to those places, they will repair to them as duly every ebb as if they were driven to them by keepers."

Long Island farmers and their swine are of the same opinion and practice still.

Such clams as have been unlucky enough to be washed out and cast high up by some rude breaker, and yet escape the pigs, are quickly seized upon by gulls, cormorants, crows, and other large birds that frequent the shore. During the winter months when ice is often piled high upon the northern beaches, the clams bury themselves more deeply than ordinary, and get along

as well as they can. They seem able to endure great cold without harm. Professor Agassiz found within their shells icicles, which did not incommode them in the least.

The utilization of the soft clam as human food and as bait forms an important element of the marine wealth and industries of the United States, and has been carefully kept in view during the progress of the present investigations.

3. SOFT-CLAM FISHERY OF MAINE.

Though occurring in the Gulf of Saint Lawrence, clams are little eaten there. In the Bay of Fundy, however, they are constantly dug in sufficient quantity for household use, and the shell-heaps left by the Indians consist almost wholly of these shells. The absence of extensive mud flats bordering the sea along this precipitous and rock-bound coast, however, makes it unsuitable for the growth of clams to any great extent until the bay at Jonesport, Me., is reached, where between that town and Rogue Island are very important diggings. From there all along the shore to West Goldsborough these mollusks are got in variable quantities. At West Gouldsborough, however, they exist in great abundance. The next important point is Mount Desert, or rather Bartlett's Island, close by, which yields more than Mount Desert; beyond which few are found as far as Eggemoggin Reach, where between Deer Island and the mainland enormous quantities of clams are got for local consumption and for sale. Northward of this point, Isleborough, in the mouth of the the Penobscot River, is a very productive ground, but between the Penobscot and Casco Bay there are only small diggings, nor any deserving special mention between Portland and Portsmouth.

The point of special interest on this coast, as a clam locality, is Deer Island, not only because of its extreme productiveness, but also because it is the only place in the United States where women make a practice of digging clams.

For statistics of the coast of Maine I am indebted to Mr. R. E. Earll, of the U. S. Fish Commission, who furnishes them as follows:

Locality, 1879.	Product.	Value.
	Bushels.	
Eastport custom-house district	1,500	$525
Machias custom-house district	20,100	6,916
Frenchman's Bay custom-house district	15,159	5,144
Castine custom-house district	52,520	15,142
Belfast custom-house district	7,265	1,980
Waldoborough custom-house district	14,798	3,756
Bath and Wiscasset	16,628	4,851
Portland	62,352	15,618
South of Portland	122,067	36,124
Coast of Maine	316,383	90,056

As I have intimated, the greater part, perhaps nine-tenths, of these clams are prepared for bait, an account of which is deferred until a later paragraph. Those used as food are eaten at home by the persons catching, who are the farmers and villagers living near the shore, or who come down, picnic fashion, from the interior, as did the Indians of yore, to enjoy a feast of clams and sea-side recreation, or they are disposed of in the markets of the coast towns. I think few are sent to Boston from farther away than Scarborough, in Maine. According to the History of Scarborough, by the way, "It was not until within a few years [previous to 1852] that any of our citizens made it a part of their yearly business to procure clam-bait for the fishermen on the Banks. The clam-flats have now become a source of considerable profit to many of the townsmen. During the winter and spring of the present year (1852) they have procured nearly 2,000 barrels of this bait."

It follows, from the nature of the case, that along this northern coast, where foreigners are few, and nearly everybody, however estimable or well to do, works with his hands and is largely concerned in fishing and other marine industries, those who "go clamming" suffer no less of social respect on account of their humble employment, nor do they deserve to by reason of any more "shiftless" and loose behavior than characterizes the majority of their fellow citizens. I point this out here, because as I advance down the coast into different conditions of society the reader will find a great change in the *morale* of the clam-digging fraternity.

4. SOFT-CLAM FISHERY OF MASSACHUSETTS.

GENERAL REVIEW.—Leaving Maine, all the coast of Massachusetts Bay is found to be a highly productive region for soft clams, and an immense trade is supported, centering in Boston.

The abundance of clams was a matter of great solace and profit to the Puritan colonists, as quaintly expressed chronicles bear witness. For example, it is recorded in the early annals of Plymouth that a good man, in a time of scarcity of food, asked his pastor to dine on clams, and returned thanks that they were permitted "to suck of the treasure hid in the mud." That was surely being jolly under creditable circumstances. In his "New England Canaan," 1632, Thomas Morton mentions among the riches of the New World certain fishes and mollusks, among which our *Mya* is prominent.*

The digging of clams is the winter occupation, whenever weather will permit, of all the people who live along the shore and get their living from the sea wherever suitable flats are accessible, and the business is quite as high in repute and remunerative as the fishing. It has changed but little in its general features since described in "Peter Gott, the Cape Ann fisherman," as practiced twenty-five years ago on the Ipswich Banks:

"When the tide is out, on pleasant winter days, one will often see gangs of ten, twenty, or fifty men and boys busily employed in turning up the mud on the flats, and picking up the clams into buckets. The implement which they use is a stout fork, with three flat prongs, each about an inch wide and 10 or 12 inches long. The men go out on the flats in wherries, when the tide is retiring, and push an oar into the mud and make fast the boat to it, and as soon as the water has left the boat commence operations. When a bucket is filled it is emptied into the boat. They continue their work until the tide comes in again sufficiently to float the boat, when they pull to the wharf.

"On many places on the shores of these flats there are groups of small huts, 10 or 12 feet square, with stone chimneys running up on the outside, furnished within with a small stove and two or three stools for seats. The clams are deposited in these huts, and in those parts of the day when the tide is in, so that the men cannot work out on the flats, and in stormy weather they are employed in shocking them, as it is called. that is, in opening the shell and taking out the clam, which is done with a small, stout knife. As the clams are taken from the shell they are dropped into a bucket; when the bucket is filled they are emptied into a barrel. Around these huts it is not uncommon to see heaps of clam shells larger than the huts themselves, the accumulations of a winter's labor. The clam diggers sell the produce of their labor to traders, who send their

*Morton says: Mustles there are infinite store. I have often gon to Wassaguscus, where were excellent Mustles to eate (for variety) the fish is so fat and large.

Clames is a shell-fish, which I have seene sold in Westminster for 12 pe. the skore. These our swine feede upon; and of them there is no want, every shore is full, it makes the swine proove exceedingly, they will not faile at low water to be with them. The Salvages are much taken with the delight of this fishe; and are not cloyed (notwithstanding the plenty) for our swine we finde it a good commodity.

Razer fishes there are.

Fresles there are, Cockles and Scallopes and divers other sorts of Shell-fishe, very good foode.

teams around to the huts weekly or daily, according to the weather, and carry them to their storehouses, and repack and salt them and head them up in barrels, when they are ready for the market."

The price paid in Massachusetts is considerably higher than the average price in Maine, because of the nearness to a good market, and may be placed at 39 cents.

The great majority of the clams dug here, as northward, are made into bait, rather than sent to market. There are a few boats, of small size (dories chiefly), which regularly come to Boston during the colder half of the year with from forty to two hundred baskets of clams, which they offer for sale at retail down on the wharves, lounging against the railing and smoking or whittling, with a sample-basket at their feet, while waiting for a customer. Three or four oyster firms there also deal in clams and other shell-fish. Estimating the combined sales of these merchants, afloat and ashore, I conclude that the whole consumption of Boston and its shipping custom amounts to about 60,000 bushels yearly, worth to the wholesaler about $50,000. Exports of clams to the amount of $11,846 were made in 1879.

NEWBURYPORT TO GLOUCESTER.—Beginning at Newburyport, Mass., the following statistics of supply and incidents of the local fishery are available, for much of which I owe thanks to Mr. W. A. Wilcox, United States Fish Commission, of Gloucester. At Newburyport clam digging is followed when little else can be done by those who follow fishing. At these seasons of scarcity the banks at the mouth of the Merrimac are resorted to by nearly four hundred men (half as many can sometimes be seen at once), who dig up good wages, the amount dependent only upon their industry, for the supply seems inexhaustible, and increasing rather than diminishing. In 1860 the crop was valued at from $10,000 to $15,000 annually. In 1880 Mr. Wilcox reports thirty boats, worth $750, and sixty men constantly and professionally engaged in clamming. Their product was 28,800 bushels, worth $11,520.

The next center of clam digging is at Ipswich, where long ago its importance was recognized by the settlers, and was legislated upon in a precautionary way.

In 1763 the Ipswich authorities forbade the digging of more clams than were needed for the use of the people of the town and for fishing vessels, allowing one barrel for each of a crew to the banks and in proportion for boats in the bay. In 1771 it was enacted that "owners of vessels are to pay 6*d.* a barrel. The poor may dig and sell clams out of town for 2*s.* a barrel." In 1789 the town voted to let the clam-flats and sand-banks at the rate of 1*s.* a barrel for clams. At that time 1,000 barrels of clams were annually dug and sold in Boston and elsewhere for bait, counting five hundred to six hundred a barrel of shelled clams.

"At present," says Mr. Wilcox, "the clam digging or flats extend from Rowley southward 10 miles, to Essex, with a width of half a mile. At Essex and elsewhere the clam beds have been plowed, but the experiment was found unprofitable. The State law permits any fisherman to dig 2 bushels for bait. The town law places the clam-flats in the hands of the selectmen, who give a license to work on them only to citizens. All others working there are liable to arrest, a fine of $1 a bushel for all clams dug, and confiscation of all tools. This law is strictly enforced. For the last ten years no close season has been observed, and during this time the clams have steadily decreased in abundance. To arrest this decadence a close season was proclaimed in 1880, no clams being dug from May 15 to October 15 of each year, except for fishing-bait, as before mentioned. Attempts at cultivation have failed hitherto.

"During 1879, from March to June, seventy-five men were engaged in the business, and fifty men from November until March. During 1879, 500 barrels were put up as bait, a very small amount compared with the thousands of barrels recorded a few years ago. On the other hand, a

large demand has recently sprung up from Boston and other towns for clams as food. From June to September of 1880, 40 barrels a week were shipped in shell from Ipswich to Salem, and between December and March 60 barrels a week to Boston and elsewhere. From December 1 to April 1 280 gallons a week were shipped open to be eaten, chiefly to Boston."

The present prices realized by the diggers are as follows, for various uses:

To be eaten:	
For clams in shell, per barrel	$1 00
For clams shelled, per gallon	25
As bait:	
Sshelled, fresh, per barrel	4 00
Shelled, salted, per barrel	3 00
Shelled, per water-bucket	50

Mr. Wilcox estimates the clam outfit of the locality to be worth $1,650, comprised in thirty-five dories, fifteen small boats, and sundry implements. The product of the digging in 1880 he gives as follows:

750 barrels shelled	$3,000
480 barrels in shell	480
4,480 gallons	1,120
Total	4,600

This, he says, equals 11,500 bushels, which would give an average price per bushel of 40 cents, and average annual receipts for each of the one hundred and twenty-five diggers of about $37.

From the clam flats in Essex and Annisquam Rivers about 20,000 to 25,000 bushels are annually gathered. Some of these are salted for bait in the fisheries from Gloucester, but the greater part is shipped to Boston either in the shell or "shucked."

BOSTON AND VICINITY.—In Boston Harbor clams are much depleted, owing to the fact that they are remorselessly dug the year through, chiefly by a class of ignorant foreigners who go down the harbor for the purpose. July and August are the most productive months, there being a large demand for the "clam-bakes," which picnic parties from the cities indulge in on the various beaches. All the clams got in Boston Harbor are very small because they are allowed little chance to grow; in March and April they are hardly worth eating. It is difficult to judge of the amount caught in Boston Harbor annually, but I think 40,000 bushels is not far out of the way.

South of Boston, Plymouth and Duxbury beaches form the first important stations. The whole shore there, a citizen of Plymouth said to me, was "saturated" with them. The young clams would sometimes whiten a flat "as though it had snowed." He had known them gathered by simply digging a regular trench and picking up the mollusks thrown out. The digging is mainly done in the winter, when a large class of men are employed every day. They sell them, opened, at 10 cents a "bucket" or pailful for small ones. Large ones are now scarce, not being given time to grow, and are kept in the shell for the Plymouth and Boston markets. But great quantities of clams not bigger than a dollar are hawked through the interior by peddlers.

At the time of my visit they were very scarce, and the tide allowed digging only very early in the morning or late at night; and the total catch of 1880, according to Mr. Wilcox, was only 5,000 bushels at Plymouth and 5,000 at Duxbury, worth about 50 cents per bushel, or $5,000.

CLAM FISHERIES AT CAPE COD.—At Harwich, says Mr. F. W. True, there are fifteen men who rake in winter at Pleasant Bay. They average 75 bushels each, or 1,125 bushels in all, worth nearly $400.

This brings us to Chatham, one of the most important places on the coast for soft clams. My statistics concerning it are based on the reports gathered by Mr. True.

The clam fishery at Chatham as a business dates back about fifteen years. It began in small proportions and has grown rapidly, especially since the decline of the fishing business in general. Many men do not now realize enough from their summer fishing to support their families upon during the winter; they must dig clams or starve. There are also many old men whose time of offshore fishing has gone by, and who must content themselves with inshore fishing in summer and clam raking in winter. From these two classes the force of clam fishermen in most part comes. With them, however, are many youths who still live under the paternal roof, but whose fathers are unable to support them. Altogether about one hundred and fifty men dig for clams every winter in Chatham Harbor, beginning in November and raking every fair day until April. The tools used are short-handled, three-pronged iron rakes. The law of the State applying to these flats is as follows:

"No fisherman or any other person shall take from the towns of Chatham and Nantucket any shell-fish, for bait or other use, except clams and a shell-fish commonly known by the name of horse-feet; and no quantity exceeding seven bushels of clams, including the shells, or one hundred of said horse-feet shall be taken in one week for each vessel or craft, nor in any case without a permit being first obtained from the selectmen of the town."*

Following is Mr. F. W. True's report, made in 1880, on the present condition of the fishery:

"About five years ago Mr. Taylor's father took about 150 barrels to Provincetown, where they were looked upon with favor. Since that time and until last year the business rapidly increased. The clams are sold by the fishermen to three or four firms in the grocery business in Chatham, who advance them credit, hold the clams over until spring, and then sell them at good prices. This is to the advantage of the fishermen, and makes a little trade for the shops. Usually about 700 barrels of salt clams are sold each year at $4 per barrel. This is equal to about 4,800 bushels. Each man would get about 5 barrels as an average, but some who are very persistent and successful take 25 barrels. In the winter of 1877–'78 the sea-clam fishery at Dennis Port was a partial failure, and in that year 1,000 barrels of Chathams were sold. Last winter (1878–'79) clams were scarce at Chatham and not much over 400 barrels were taken. These were all salted and sold for bait at much higher rates than previously. It happened last year that cod were very abundant in Provincetown Harbor, and as a consequence bait was in demand. Chatham is but a short distance from Provincetown by rail. As fresh bait is always preferred to salt bait, a large amount of clams were sent from Chatham out of the shell but not salted. Probably about 300 barrels were shipped for immediate use.

"In addition to this catch by citizens, for the past three years a Boston dealer has sent down a team to cart clams from Chatham to the depot at Harwich, and hired men at 25 cents per bushel to dig them. It is supposed that he took in the neighborhood of 2,000 barrels of clams in the shell each year.

"The citizens of Chatham feel very much offended at having their fisheries disturbed by an outsider and appealed to the General Court for protection."

Examination of this report seems to disclose that one hundred and fifty men sell 8,400 bushels for themselves and about 24,000 bushels for the Boston firm, whose intruding enterprise and competition naturally disgust them. This makes 32,400 bushels. Supposing they eat at home 2,600 bushels, an estimate of the total yield at that locality per year would be 35,000 bushels. They are worth not more than 35 cents a bushel, however, which would make the cash value of the crop $12,250.

Beyond this point anything on the bay side of Cape Cod in the way of soft clams is of small

*Rev. Stat., c. 55, § 16; Stat. 1850, c. 6, § 2.

importance, except at Orleans, where some few men who have been in mackerel vessels in summer stay at home and dig clams in Town Cove, getting perhaps 250 bushels, all of which are salted and sold at Provincetown at $4 a barrel.

SOUTH OF CAPE COD.—When Cape Cod is passed the digging of soft clams, in Massachusetts, is unimportant, as they are more scarce than in Massachusetts Bay, and have a rival in the quahaug. Clamming is carried on in Buzzard's Bay, but not to a much greater extent than supplies the home demand. This coast, and that of the islands off it, are too rocky to make good clamming ground in many places. The shipments by rail to Boston—whither nearly all go—amount to only about 100 barrels a year, and I suppose 10,000 bushels, worth $5,000, would adequately represent the whole catch for both bait and food.

STATISTICS FOR MASSACHUSETTS.—The total yield of soft clams in Massachusetts, in 1880, was as follows:

Customs district.	Bushels.	Value.
Newburyport	39,126	$17,948
Gloucester	26,359	11,994
Boston	34,940	17,470
Plymouth	10,000	5,000
Barnstable	32,773	15,420
Nantucket	2,253	872
Edgartown	4,000	1,570
New Bedford	5,800	2,900
Fall River	3,375	3,121
Total	158,626	76,195

Of the above quantity, 31,832 bushels, worth $12,305, were used as bait in the fisheries.

5. SOFT-CLAM FISHERY OF NARRAGANSETT BAY AND CONNECTICUT.

In Narragansett Bay the gathering of soft clams becomes the business of a great many poor men and boys in winter, who search for them along a stretch of about 18 miles, from Sabine's Point to Cold River, on the eastern side, and from Field's Point to Greenwich Bay, on the western. Clam grounds are found at Wickford, R. I., also, and altogether it is calculated that about 35,000 bushels are dug. These go chiefly to New York, and are worth from 75 cents to $1 per bushel, so that the total value of the crop is about $30,000.

Roger Williams's "Key" (p. 224) makes mention of this mollusk under the name "sickishuog,"* a Narragansett word. The paragraph is as follows:

"*Sickishuog.*—This is a sweet kind of shell fish, which all Indians generally, over the country, winter and summer, delight in; and at low water the women dig for them. This fish, and the natural liquor of it, they boil, and it makes their broth and their nassaump (which is a kind of thickened broth) and their bread seasonable and savory instead of salt."

Proceeding westward to the Connecticut coast, the soft or "long" clams are found more scattered, and used mainly in winter, when the quahaug is out of season. I find noted a product at Clinton, Conn., of 4,500 bushels; at Fair Haven, 2,500 bushels, and at Norwalk, Conn., 7,000 bushels. Those taken at Guilford are of very excellent quality and became famous formerly on account of their size. A dozen years ago, according to Verrill, the Guilford clams were assorted into regular sizes, and bought from the fishermen on the spot by the hundred. "Those of large size bring about $3 per hundred; these are retailed in the market at New Haven for 60 cents per

* William Wood, in his "New England's Prospect" (1634) says the Massachusetts coast tribes spelled the word "suckia smacke."

dozen. Smaller sizes bring 48 cents and 36 cents per dozen. During unusually low tides in winter clams of extraordinary size are obtained at Guilford, below the zone ordinarily uncovered by the tide; these often weigh a pound or more, and sell for about $1.25 per dozen; occasionally the weight is as much as a pound and a half, and the shells become 6 or 8 inches in length." In 1880 I visited Guilford, but heard that no clams were now dug there of large size, and that all were sold by the bushel at a price not greater than elsewhere. Verrill gives the prices of clams in Connecticut, about 1870, as follows: "The ordinary long clams of small and moderate sizes bring 95 cents, $1.25, and $2 per bushel at wholesale; these retail in our markets at 50 cents to 75 cents per peck, the smallest sizes being cheapest, while the reverse is the case with the round clams." The total product of Connecticut, home-consumption and export, will no doubt amount to 75,000 bushels (and probably much more) every year.

At Bridgeport, of late, serious attempts at clam-planting have been made by Hawley, Lewis, and other oyster growers, in spite of immense opposition from the shore people of the suburbs, who, as usual, bitterly and blindly opposed any cultivation of marine products. Privilege to ground was first secured under the general State law, and afterwards, in one case at least, bought outright in order to leave no doubt as to right. This beginning required a long time, during which, as one man expressed it to me, he "fit the subject from Tophet to wayback!"

At first small clams, which were bought at 50 cents a bushel for the purpose, were regularly planted in the sand between tide-lines by punching a hole and pushing the young mollusk down into it. This was found too slow and laborious work, however, and the method of plowing the seed in was undertaken. After many trials of all sorts of plows and cultivators, surface and subsoil, and proving them unadapted to the turning of the dense, wet, heavy mixture of sand and mud, Mr. Wheeler Hawley succeeded in inventing a light plow, having a thin, narrow, steel mold-board, which did the work satisfactorily. It was three years after the first considerable planting of seed when I was there, and the whole beach, for half an acre in extent, was as full of the holes indicating clam-burrows as a vast colander. When you dug down you found the mollusks shoulder to shoulder and piled on top of one another. This was manifestly too many, yet they seemed to be doing well, except that the growth was slow. The owner was engaged in thinning them out, and increasing the area of his ground by transplanting. This gentleman says that the clam in Long Island Sound spawns in June, grows only a little during the winter months, and increases in size so slowly that the planter must wait four or five years for his first crop. This attained, however, he will find his whole space "saturated" with young clams derived from his transplanted stock, and can draw almost endlessly upon his "bank" as each selling season comes round. I know no branch of mollusk culture likely to prove more remunerative than this so long as it is not overdone.

6. SOFT-CLAM FISHERY OF LONG ISLAND.

Crossing to Long Island, the careful inquiries of Mr. Fred. Mather provide full data to show the product of the southern shore of Long Island Sound. Mr. Mather reports the yield of 1880 to be as follows:

Locality.	Bushels.	Value, at 50 cents.
Whitestone	100	$50
Little Neck	200	100
Port Washington	400	200
Glen Cove	600	300
Oyster Bay	50,000	25,000
Cold Spring Harbor	18,000	9,000
Bayville	75,000	37,500
Huntington	35,000	17,500
Centreport	75,000	37,500
Saint James	900	450
Stony Brook	30,000	15,000
Setauket	5,000	2,500
Port Jefferson	3,400	1,700
Total	293,600	146,850

The great irregularity observable between localities in close proximity is perhaps not wholly explainable. You will hear that in this place or that (as, for example, Cow Bay) they were abundant formerly, but have now died out, while elsewhere (as at Riverhead) they are reported reappearing. The conditions of the bottom are to be considered, of course; the number of enemies present, and, lastly, the amount of searching which is made for them. At Port Washington, for instance, more soft clams might perhaps be found if the people were not too busy with oysters and quahaugs to look for them. All of those sold from this northern coast go to New York, and chiefly by boat, in the spring and autumn. There is also a considerable trade in carting into the interior of the island and to Brooklyn by peddlers.

In Gardiner's and Peconic Bays, at the eastern end of Long Island, clamming is not much of a pursuit. They believe at Greenport that the soft clams are not good until snow comes and its melting fattens them. Napeague beach is a favorite clamming ground, and another is on Shelter Island. Many are dug as bait for summer fishing and pleasure parties. The rest are cooked at home for cool-weather chowders. Mr. Mather reports from 50 to 500 bushels from each shore village around the bay, except Three Mile Harbor, which digs 8,000 bushels, and Sag Harbor 3,000. The total product is given at 13,575 bushels, worth about $7,000. On the south side no clams or quahaugs of consequence are found except near the western end of Great South Bay, and thence to Coney Island, but they are reported to be gradually moving eastward. Formerly the flats opposite Babylon were good clamming ground, but the closing of Oak Island inlet, about thirty years ago, so excluded the salt water as to ruin the supply. In South Oyster Bay a product of about 2,000 bushels annually is realized, while Hempstead and Rockaway Bays and westward are credited by Mr. Fred. Mather with 75,000 bushels. Many years ago this was also an important business around Rockaway, and a large number of poor families were and are supported wholly out of it. As you drive along the shore road through this region you constantly come upon miserable roadside shanties, houses of the clammers, and in front will be some old boxes and barrels, with great dirty heaps of shells. Perhaps the father and big boys of the family will have just returned from digging, and the whole family, rough and mud-covered men, worn-out and bedraggled mother, slatternly girls, and besmeared youngsters, will be clustered about the booty, opening them and dropping dirt and clams together into the old pails and buckets out of which they are to

be sent to market. I do not know, and it is hardly worth while to inquire, how many souls manage to exist in this way, except to show that in providing so easy and ignoble employment laziness is encouraged and a large class of citizens enabled to live in shiftless penury, which can only breed idleness and crime in the neighborhood. It is doubtful, therefore, whether the plenitude of soft clams in this region is not more of a curse than a blessing to Long Island.

7. SOFT-CLAM FISHERIES OF NEW JERSEY AND SOUTHWARD.

In New York Harbor clams used to be gathered in great abundance along the Communipaw Flats and at the mouth of Newark Bay, but that ground is now unproductive, having been exhausted or ruined by various causes incident to its proximity to the metropolis. Along the northern line of the New Jersey shore, however, from Raritan River to Sandy Hook, the soft clams are still dug, during all the cooler months of the year. The westerly winds of winter sometimes produce extra low tides, and less accessible and richer spaces of bottom are exposed than the ordinary ebb discloses. At these times it is an interesting sight to witness the wide-reaching mud flats, abandoned for a little while by the sea, speckled with hundreds of men and boys, wading and stooping and digging for dear life; not exactly "making hay while the sun shines," but "clamming while the tide's out." But the class who are thus seen making a spasmodic effort at work are socially very inferior and incorrigibly lazy. Of course there are exceptions, but that, unfortunately, is their general character. "What a life of toil and drudgery this is," exclaims Professor Lockwood, who knew it well at Keyport, and gave me many memoranda. "What a low status in the social scale it enforces, and low, few, and primitive are the daily wants it supplies. I could point out cases in which this sort of living has gone down from father to son, as a sort of fated pariah inheritance. An old fellow named Bailey used to bring a basket of long clams on his back, without stopping, 4 miles. Opened they made 18 quarts, which he would sell at 12½ cents a quart, or $2.25. Now his son, almost a hump-back, brings soft clams regularly in winter to Keyport from Port Monmouth, 5 miles distant, 'toting' a bushel on his bent back without once resting. Old Bailey, or any of his fraternity, would work in the morning until he had dug perhaps three-quarters of a bushel, opening perhaps 7 quarts if he should take them to the town, for which he might receive 25 cents per quart. Often he would be aided in this digging by his two boys. On arriving at home the wife and all her children would open the clams, after which the husband would peddle them until he had sold enough to buy the loaf of bread and other simple material for the family's evening meal. It was living literally from hand to mouth; literally sufficient for the day was its morning toil and its evening recompense. No animal could possibly live more strictly in its own feral way than does such a family of clammers. Their only luxuries are vile tobacco and vilest whisky; the only variation in their degrading work, the peddling of oysters picked from the refuse heaps of the planters."

From Sandy Hook southward to Barnegat Inlet, Mr. R. E. Earll reports 20,489,000 soft clams taken annually, at the present time. This is equal to about 70,000 bushels. As the value is given at $29,500, the average price becomes a trifle over 40 cents per bushel. In fact, however, they are chiefly sold by count.

Below Barnegat this sort of mollusk grows scarce, and only about 2,000 bushels are reported for all the rest of the State. Probably an estimate of 100,000 bushels would cover New Jersey and southward.

In a New York newspaper of thirty years ago I find a short description of "shucking" as

practiced on the New Jersey coast at that time, when more of these clams seem to have been furnished there than nowadays:

"The clams are thoroughly washed before they are given over to the knives of the 'shellers,' or 'openers,' as they are sometimes called. As many as two dozen shellers are at work at one time, among whom are children, old persons, and, in fact, all who can handle a knife. These are seated round a large tub into which the unshelled clams are thrown promiscuously, while the shells are deposited in a heap by themselves. The rapidity with which they are opened would astonish a stranger to the business. They are not opened with the point of the knife, nor is the front of the shell broken as is the case with oysters; but the clam itself is adjusted to the edge of the knife and forced open by striking it upon the edge of the tub, or some other hard substance. Before they are taken to market large quantities of them are attached to strings and sold in this way off carts."

In Maryland and Virginia the soft clam, though abundant enough on suitable shores, is eaten by the negroes almost alone and does not enter into trade at all. It is called "butterfish" and "mannoze" or "nanninose," the last being corruptions of an Indian word.

8. THE SOFT CLAM ON THE PACIFIC COAST.

This mollusk has been transplanted to Californian waters during the past few years; by accident apparently, being taken with the oyster seed which is annually sent in large quantities from the Eastern States. It appears to have thriven very well, and to have multiplied so as to stock San Francisco Bay with a good supply, succeeding in this respect where the oysters fail. I do not possess accurate information on this matter, however, and would not speak positively.

9. THE USES OF SOFT CLAMS.

The ordinary method of cooking clams is by making them into a soup, or by the mixture of various other ingredients forming a thick sort of broth known as chowder, which is a favorite dish in the more northern States. Frying clams is also practiced in various ways, and Mr. Carley and other dealers in New York and Boston pickle them to a considerable extent. These pickles are used principally by ships, but in 1854 a large supply was sent to California. They are also salted like mackerel, but to a small extent. They are to be bought in the markets raw all the year round; and in New York they are always sold in "strings" of a dozen connected by a cotton cord. In the spring, particularly, the region about Fulton market is crowded with clam vendors, chiefly from Long Island and Staten Island, who come in wagons and retail their clams, both in shell and by the string, with much chaffering and clamor. Both these and the quahaugs are also sold from baskets, wheelbarrows, and crazy wagons, by the peripatetic vendors, whose prolonged howl—"Cla-a-a-ams! fresh cla-a-a-ms!!"—is so well known in the suburban parts of the city. In Newark I used to hear a song drawled out by these street merchants of mollusks which would do well as the opening measures of a dirge. The larger part of those taken each year, however, are used as bait, and something remains to be said in regard to the preparation of this. Our fishermen very long ago learned that most carnivorous fishes, and those of the cod family in particular, have a special fondness for the various species of *Mya*, the codfish of Newfoundland Banks relying very largely for nourishment upon a species allied to our edible *Mya arenaria*. The soft clam came at once into approved use, therefore, in shore fishing of almost all varieties, and with other bait-mollusks, was carried farther and farther to sea as the fishing voyages lengthened. The clams used inshore then, as now, were fresh; and when, following their retreating prey, the

fishermen went far to sea after cod and mackerel, the smacks south of Cape Cod enveloped live clams in netting bags, and kept them in the wells with which many of the vessels are provided. If the voyage is to be a short one, clams may also be preserved alive for a considerable period by being put in a cool place, and stores of ice are now taken on some vessels from New York for this purpose.

The vessels of Cape Cod, Gloucester, and Maine, which form the largest part of the fleet on the Banks of Newfoundland in the cod and mackerel fisheries, have no wells, and therefore are obliged to carry their bait removed from the shell, salted and packed in barrels. With the edible *Mya arenaria* are often mixed in the bait-barrel an inferior species, the "sea-clam" or "skimmer" and also the quahaug, both of which are to be considered hereafter. The principal depots for the digging, manufacture, or sale of bait to the "bankers" have been already mentioned, but every town on the New England coast north of Cape Cod, where clams occur at all, is a point of bait supply. The salting is of two kinds, "full salting" and "slack salting" or "corning." In the former, 1 bushel of salt is placed in each barrel of opened clams; in the latter case, from half a peck to half a bushel of salt is allowed to every barrel. It is reckoned that 12 bushels of clams in the shell make a barrel of salt bait, the present price of which is about $4.

In the old style of mackerel fishing, however, clams were chopped up (often with a mixture of menhaden) and sprinkled overboard as "toll-bait" to attract the mackerel to the surface. A vessel going to the Gulf of Saint Lawrence on a mackerel voyage of three months, in the old days, would carry from 5 to 10 barrels of salted clams, besides 30 to 35 barrels of menhaden; but it was generally thought that the clams were much better than the menhaden. Now mackerel are caught in seines, and there is now little use for toll-bait.

In the cod-fishery trawls are not baited with clams, and their use is therefore restricted to the hand-line or dory-fishing. In this fishery about one hundred vessels go every year on trips of from three to four months' duration to the Grand and Western Banks. The crews of these vessels will average twelve men, each one of whom will, as a rule, use 2 barrels of salted clams before the end of the season. This makes an average of 24 barrels for one hundred vessels, or an annual consumption, north of Cape Cod, of 2,400 barrels, representing 28,800 bushels (in the shell), annually consumed as salt bait on the Banks of Newfoundland alone.

10. STATISTICAL RECAPITULATION OF FISHERY FOR SOFT CLAMS.

A summary of the statistics of the foregoing pages produces the following table:

Statistics of production of Mya arenaria in 1880.

District.	Number of bushels.	Value.
Maine	318,383	$90,036
New Hampshire*	17,960	8,980
Massachusetts	158,628	76,195
Rhode Island	53,960	43,564
Connecticut	75,000	38,000
New York	340,775	256,581
New Jersey and southward	100,000	45,000
Total†	1,064,704	562,376

* The clam fisheries of this State have not been noted on the preceding pages. The information gathered by the census agents give the statistics as herein.—A. H. CLARK.

† Number of clams by count, at two hundred per bushel, 212,940,800.

(*b*)—FISHERY FOR QUAHAUGS.

11. NATURAL HISTORY OF VENUS MERCENARIA.

Next to the *Mya arenaria* in commercial importance stands the quahaug.

Its scientific name is *Venus mercenaria*, derived from the use of its shell as material for coining their money by many Indian coast-tribes, and its Indian names have been preserved and studied with care by Mr. J. H. Trumbull, of Hartford, Conn., who kindly writes to me as follows concerning them:

"For the spelling and derivation of the common name, quahaug, in the last edition of Webster, I am, I believe, responsible. The pronunciation there given is that of Eastern Connecticut and Rhode Island—kwaw'hŏg. I have occasionally heard the name reduced to a monosyllable—quaw'g; and, farther east, it is often made pooquaw.*

"In a note to my edition of Roger Williams's Indian Key (Narragansett Club Publication, Vol. I, p. 140) I gave two or three other dialectic forms of the Indian name. As you may not have the volume within reach, I copy the note: 'Pequot, *p'quaughkaug*. Pres. Stiles, MS.—Abanaki, *pekwe*, pl. *pekwahak*, 'huitres' Râle. The signification appears to be either 'thick shell' or 'tightly closed shell.' The Delaware equivalent is—as Zeisberger wrote it—*pooque-u*, a mussel. I have now no doubt that the second meaning given above, 'tightly closed,' is the true one, distinguishing the *V. mercenaria* from the more common *Mya*, or gaping clam. Strachey's Virginia Vocabulary (about 1612) gives *cawaik* for 'oysters,' which is, I have no doubt, another form of the same name, *p'cawaik*.' The vocabularies mentioned are the only ones I now remember in which the name is found."

The shape of the quahaug is well defined in the accompanying figure (see plate), and is familiar to all eastern people. Like all of the genus *Venus*, the shells are chalky, roundish, somewhat globose, ornamented with concentric ribs, the "heel" or beaks pointing far forward, with a deeply-curved indentation in front, which the fishermen on the south shore of Long Island call "the point of a clam." The color varies from brownish-white to smoke-tint, sometimes painted with waving lines and zigzags of red and brown, there being so much difference between varieties from different localities and depths that many have been described as distinct species. The posterior end of the shell (*i. e.*, farthest from the beaks) terminates in a blunt point. The surface is covered with concentric grooves and ridges, the ridges being crowded and rising into thin sharp plates most conspicuous at the ends; the central portion is nearly smooth. There are also minute lines radiating from the beaks to the margin, where they form a lattice-work with the concentric lines; this is an important character helping to distinguish this shell from the *Cyprina islandica* and other allied species. Within, the color of the shells is white, with sometimes a dirty yellow tinge in aged specimens. The impressions marking the attachments of the large adductor muscles, and usually called the "eyes" by the clam-diggers, are deep and united by a well-marked line defining the edge of the mantle. These impressions and the interior margin are a beautiful dark violet color. The general length and breadth are about 3 by 2½ inches.

The quahaug is very abundant along the coast from Cape Cod to Florida; north of Cape Cod it is comparatively rare and local. It does not occur on the coast of Maine or in the Bay of Fundy, except in a few special localities, in small, sheltered bays, where the water is shallow and warm, as at Quahog Bay, near Portland; but in the southern parts of the Gulf of Saint Lawrence, as about Prince Edward's Island and the opposite coast of Nova Scotia, where the water is shallow

* The writer of an account of Martha's Vineyard, about 1807, makes the common name *poquaw*.—E. I.

and much warmer than on the coast of Maine, this species again occurs in some abundance, associated with the oyster and many other southern species that are also absent from the northern coasts of New England, and constitute here a genuine southern colony, surrounded on all sides, both north and south, by the boreal fauna.

Concerning the curious instance of a colony isolated in Casco Bay, Maine, Prof. A. E. Verrill draws some quotable inferences in a late Report of the U. S. Fish Commission. From a critical examination of this and similar colonies, Prof. A. E. Verrill concludes:

"First, that in the Post-pliocene and Champlain periods the coast was at a lower level, and the marine climate of Casco Bay colder than at present, probably that of the present Newfoundland or Labrador coast. Second, that at a subsequent period, when the coast had attained nearly or quite its present level, the marine temperature was considerably higher than at present. Third, that the temperature of these waters has gradually declined, but was still somewhat higher at the period when the Indian shell heaps were formed than at present."

A like conclusion is reached by the examination of a somewhat similar colony on the Saint Lawrence. Professor Verrill ascribes the survival of these earliest colonies to the fact that, in the increasing coldness of the water, the peculiar isolation and other favorable conditions of their position protected them against the general fate of their neighbors.

This clam is thus assigned to a very ancient race.

The home of the quahaug everywhere is on sandy and muddy flats, just beyond low-water mark. It also inhabits the estuaries, where it most abounds, especially in shallow but pretty salt water. It is also found on oyster beds, when these do not take the form of rocky reefs, and in this capacity often helps the unconscientious to defy the laws, by alleging, whenever they are caught tonging or raking on forbidden ground, that they are only getting clams and would be glad of all the assistance the discoverer might give in culling out oysters accidentally caught. On these bottoms of sand and mud the clam spends most of its time in crawling about with the shell upright and partly exposed. It can travel pretty fast, and leaves behind it a well plowed furrow. Sometimes it is left bare by low spring tides when making these excursions. In such cases, if it wishes, or at any other time, it can easily and quickly burrow beneath the sand by means of its thin-edged but broad and muscular foot. The lobes of the mantle are separate all around the front and ventral rim of the shell, and their edges are thin, white, and folded into delicate frills. Owing to this broad opening in the mantle, the foot can be protruded from any part of the ventral side, and has an extensive sweep, forward and backward. The foot and mantle edges are white; but the two short siphon-tubes—for, not burrowing far down like the soft clam, it has no need of the long distensible feeding apparatus of that and the razor-fish—are united from their base to near the ends, and are yellowish or brownish orange toward the end, more or less mottled and streaked with dark brown, and sometimes with opaque white. When very aged, so as to deserve the New Jersey term "bull-nose," the whole flesh loses its white color and becomes a dirty, forbidding yellow-brown.

The generation of the quahaug is after the general plan of *Lamellibranchiate* molluska, but I am not aware that any naturalist has made its embryology a special study. The eggs are probably fertilized within the body, and sustained in the folds of the mantle and gills until they have attained rudimentary shells, when they are sent out and lie upon the bottom to become the food of crabs, ground-feeding fishes and various other enemies to their welfare. This happens early in summer, and the young are sometimes observable in enormous numbers. In the summer of 1879 the shallow sand-beach opposite Babylon, Long Island, for 10 miles in length was crowded with young quahaugs from the size of a pin-head to that of a silver 3-cent piece. The succeeding

winter being very mild these all lived through it, which they probably would not have done had the frosts been very severe, for the water was only 2 to 4 feet deep. There were none in the deeper water off shore. The same season a similarly innumerable generation of young quahaugs was deposited at East Point, in Raritan Bay, New Jersey, where they were so thick that you could not pick up a handful of sand which did not contain a hundred or so.

Opinions along shore vary as to their rate of growth. Some men would tell me they increased in size very rapidly, others would say slowly. The situation undoubtedly makes considerable difference, but it is probable that the middling sized quahaugs sent to market are at least five years old, and that they attain great age if undisturbed. The rapidity of its growth has an effect, it is said, on the shape and appearance of the shells. Those that grow fast are wedge-shaped with only a slight convexity, while one that grows slowly becomes more globose or gibbous. The shells of these will be found much heavier and thicker than the others, and their flesh (in old age at least) shows a turbid, orange-brown, nasty tint, and is very tough, in high contrast to the creamy whiteness and tenderness of younger and more thrifty specimens. These heavy and almost worthless old fellows are called "bull-noses." Sometimes they exceed a pound, avoirdupois, in weight.

At the approach of cold weather in September the quahaugs begin to "settle" or sink down from their position on the surface of the bottom to another about 2 inches below. Here they remain until the approach of spring.

12. APPARATUS AND METHODS OF GATHERING QUAHAUGS.

The procuring, consumption, and sale of quahaugs is a constant and persistent industry along the whole extent of our coast south of Cape Cod, wherever the conditions are suitable or people live near the beach; yet, from the nature of their home, and the fact that they must be taken with the help of heavy instruments, it employs a less number of hands, no doubt, than does the annual search for the soft clam. Although there are many oystermen who never seek for quahaugs, and a numerous body of the clamming fraternity who are not interested in oyster-culture, yet it is largely true that the same men are to be found in the ranks of both industries at different seasons of the year. Upon the whole I should regard the army of men who gather the hard clams as a superior class to those who dig the soft clams. This is owing, as I have already said, to the greater difficulties in the way in the present case. Women and children cannot do much at it because of lack of strength; lazy, useless men will not attempt it because it involves too much exertion and steady diligence. Yet I was told that in the Great South Bay of Long Island the clammers were of a very low grade of morality, as a rule, being mostly foreigners who had failed at everything else, and who in this hand-to-mouth employment proved themselves far from valuable citizens. But I think this is an exceptional instance, and I believe that in the great majority of cases the men who gather hard clams are the stout-armed native oystermen and farmers who live adjacent to the water and make this a regular summer occupation. In a letter to me during the year 1875, my kind and venerable friend, Prof. Samuel W. Lockwood, of Freehold, N. J., gives me a picture of this as familiar to him then at Keyport.

"They go after hard-shelled clams from Keyport in squatty, one-sailed vessels, called "cats," dragging clam-rakes, which are thrown out and drawn in by the wind. The ground extends in Raritan Bay from Sandy Hook to South Amboy. A good day's catch would be from 3 to 3½ barrels of 'count' clams—that is, clams of such size that eight hundred will fill a barrel, and at wholesale worth about $3. All below this size are sold by the bushel, at from 60 cents to $1, depending more on demand than size. These are sometimes so small as to count two thousand to

the barrel; and if about 1¼ inches in diameter go by the name of 'tea-clams.' It must be remembered that thrift and its contrary are as often found among these watermen as in other departments of industry. The man who owns his boat and sells his stock by the ten or twenty thousand at wholesale is a sort of aristocrat compared to those who go down to the shore daily, with a basket, get their somewhat precarious catch, take it home on their backs, open the bivalves, and then peddle the result in a can with a quart measure in the other hand, usually winding up their work by 3 p. m."

The methods and instruments of clam gathering are simple and easily described. The quahaugs, left bare at low tide, may sometimes be taken by hand. The Indians, who had no machinery for aiding them, caught them by wading in and feeling for them with their toes, something the early colonists quickly learned to do. Another way was by diving; this was the work of the squaws and the older children, and was, of course, exceedingly laborious.

The tools at present used are oyster tongs, straight rakes, curved drag-rakes, and dredges.

The oyster tongs are rarely used for this purpose since the quahaugs do not ordinarily lie thickly enough; but many are caught along with oysters.

The rake employed at Wellfleet is described by Mr. True as similar in form to an oyster rake, but made of steel instead of iron. "In former days this instrument was of iron, the tips of the teeth only being of steel. An average rake has seventeen teeth and weighs about 12 pounds. The handle or tail is of wood and is about 23 feet long."

The clam rake in use on the south shore of Long Island is much like a garden rake in shape; but the teeth or tines are from 6 to 12 inches in length, and only an inch or so apart, while the head of the rake is from 2 to 3 feet across.

Another form seen in Long Island Sound, New York Bay, &c., has its tines set very closely together and very much curved inward, so that the operator can alternately push and pull with the rake in his swaying boat, and yet cause it to dig down into the sand underneath the clams. On the top of the strong pole-handle, therefore, is a cross-piece to give a firm two-handed hold. The man who uses this rake generally goes alone in his small boat. The drag-rake is an exaggeration of this form, both in the extraordinary curvature of the teeth and in the breadth of the head, which is often 4 feet across. It is generally operated like a dredge, and is rarely used outside of Rhode Island, or even there at present. I fancy it must have been such an instrument as this, which, under the name of "scraper" was in service twenty-five years ago, or more, about New York. I find it described as "furnished with a large number of semi-circular teeth, each of which is as thick as a man's little finger and about 6 inches long. It is thrown over the side of the boat." This account adds, "and when it has sunk into the sand to the required depth, it is drawn along the bottom, and taken up about once every minute, when the clams are extracted from the sand, washed, and thrown into the boat. This is exceedingly laborious work and four or five hours of it in one day is sufficient to use up the stoutest scraper. Tonging clams is even more laborious and straining, but is not so generally pursued." The clam tongs of that day differed from the oyster tongs, we are told, in having a wider head, 3½ feet being the average measurement. Quite opposed to this, we find that the tongs now in use in the Chesapeake Bay differ from oyster tongs chiefly in having a narrower head, which measures only 1 or 1½ feet.

13. IMPORTANCE OF QUAHAUGS FOR FOOD.

The value of the quahaug among the food-mollusks was recognized long before scientific men gave it a Latin name and census-takers studied its commercial relations.

The Indians along our whole sea-coast have always been accustomed to eat some sort or

another of shell-fish. In Alaska it is the mussel; at Puget Sound it is the *Schizothærus*, which they smoke for winter stores; in California, the oyster and other bivalves; in the Gulf of Mexico, the *Gnathodon*, of which the shell-roads around New Orleans and Mobile are made; on the Atlantic shores, the oyster, common and horse mussels, razor-shell, cockle, scallop, and two clams besides the fresh-water unios and anodons. To what an extent these various mollusks furnished sustenance to the wild tribes of the coast and of the Mississippi Valley is shown by the vast banks of cast-away shells that remain to mark the points of aboriginal habitation. The Gulf coast and some parts of the interior of Florida are so full of mounds composed of broken shells of nearly every species, large and small, found in the adjacent sea, and of wide fields strewn with unios not only, but also with the smaller gasteropods, *Ampullaria* and *Paludina*, that the fact is commonly known to the people living there; while the savannas of Georgia, the banks of the Mississippi and its tributaries—particularly along the Ohio—of the Susquehanna and Delaware, and even of the Merrimac and Concord Rivers, in Massachusetts, are dotted with heaps of the mussels existing in those rivers, the animals of which have been consumed by the Indians. The same sort of remains are found on the Pacific slope and in South America.

As for shell-heaps upon ocean coasts, they are world-wide in their distribution, and often prominent in appearance. On certain points of the shores of Denmark and Norway there were disclosed, many years ago, banks of marine shells, sometimes 1,000 feet in length, 200 feet in breadth, and 10 feet in depth. At first these were taken for natural deposits, but it was observed that here only adult specimens of the littoral fauna were present, and closer examination revealed calcined shells, circles of blackened stones indicating fire-places, fragments of the bones of edible animals, and remains of rude utensils and implements. Thus it came finally to be proved that they were the kitchen-refuse of ancient mollusk eaters, and were called "kjoekken moeddings." This discovery prompted research, and similar deposits were soon found in various other parts of the world. Our own coast is lined with them, from the piles which grew up around the doorways of fishers on the low Florida shores, until their huts stood on hillocks above the reach of the highest tides, to the layers of oyster shells exposed on the cliffs of Maine, where "mine oyster" is no longer to be found. Most of our refuse heaps are buried under a foot or more of soil, and have long nourished the roots of a (so-called) primeval forest, but there are others which did not cease to be increased until the Indians were driven back from the coast by white settlers. At these places they spent a portion of each year, probably the winter months, when the climate of the shore is warmer than that of the interior, in feasting, while some perhaps lived there permanently, raising in the cast-away shells unconscious monuments of their sea-shore life. At such times the two clams, but mainly the quahaug, formed the chief comestible.

How greatly the quahaug was prized by the early New England settlers appears from the many allusions to it in their writings, particularly in those of Roger Williams. Not only the meat, but the shell was utilized by them, in the making of various utensils and implements, such as arrow points, scrapers, paint-holders and spoons.*

It was from the purple "eye" and edge of the quahaug that the Indians fashioned their famous wampum, or dark shell beads with which they ornamented their clothing and furniture, adorned their hair and necks, or made their ceremonial peace and war belts and their insignia of authority. Wampum, combined with the white beads, made chiefly from the central column of the conch or periwinkles (*Busycon* and *Fulgur*), also passed as money among the Indians themselves

* "The dainty Indian maize
Was eat with clamp shells out of wooden trays."

not only, but between them and the whites, and, previous to the eighteenth century, in the ordinary trade of both the English and the Dutch merchants. I have elsewhere given a history of this shell money, which appears in a great diversity of forms on both coasts of the United States and played a very important part in aboriginal economy, and shall not dwell upon the matter here, further than to identify the quahaug with it.

As I have already said, this shell was valuable to the Indians as a food resource, and they taught the whites how to use it. Governor Winthrop called it "a dainty food" and wrote home that "the flesh eats like veal; the English make pyes thereof." An interesting reminiscence in this connection occurs in Baron Kalm's "Travels," 1748, as follows (the Baron is speaking of New York):

"A considerable commerce is carried on in this article, with such Indians as live farther up the country. When these people inhabited the coast they were able to catch their own clams, which at that time made a great part of their food; but at present this is the business of the Dutch and English, who live in Long Island and other maritime provinces. As soon as the shells are caught, the fish is taken out of them, drawn upon a wire, and hung up in the open air, in order to dry by the heat of the sun. When this is done, the flesh is put into the proper vessels, and carried to Albany upon the river Hudson; there the Indians buy them, and reckon them one of their best dishes. Besides the Europeans, many of the native Indians come annually down to the sea-shore, in order to catch clams, proceeding with them afterwards in the manner I have just described."

That this practice was long continued, there is plenty of evidence. Coast tribes conquered by the Six Nations were compelled to pay their tribute, or at least a portion of it, in this commodity, which became a luxury in the interior. Professor Lockwood told me of an old Quaker who lived near Point Pleasant, Ocean County, New Jersey, whose grandfather often saw the Indians there drying clams and oysters by the sun on pieces of bark. The Chinese still do this, but Americans have wholly forgotten the custom, so far as I know, with the disappearance of the Indian. I have heard that some years ago a factory was started in New Jersey to preserve clams and also oysters by a process of drying and granulation. It was asserted that soups and chowder could be made to the best advantage from this desiccated material. The product is said to have proved of good quality; but as it did not find general favor, the business was abandoned.

The chief use of clams in early days was in summer and fall. Then it was that the Indians came to the sea-shore for their greatest festival, that of the green corn. On such an occasion a great assembling of sages and warriors with their families was held at the beach, and clams, succulent ears and seaweed were roasted together in astonishing quantity, amid all the delights of a New England mid-summer by the ocean and every savage amusement. So good a custom merited perpetuation, and has, indeed, survived to the present day in the "clam-bake," that patriarchial institution of New England, where the icy Puritan might permit himself to be won a little from his rigor by the seductive mussel, and the prim maidens enjoyed a moment's timid relax from conscientious austerity in the fun of saying "periwinkle." Nor is the custom yet extinct, although it is no longer possible that the clam-bake should be a season of universal holiday as of yore. But now and then some great occasion in Rhode Island or Connecticut is celebrated much after the traditional fashion, and the wise and renowned joined in the festivity, as in the old days when Diedrich Knickerbocker and his friends sailed over to Communipaw to discuss grave questions of Dutch polity as they smoked their pipes beside the sunlit bay until the quahaugs were toasted

brown, and they could eat them slowly, as befits the viand, and listen to Jacob Steendam as, sonorously, he sang his "Praises of New Netherlands,"—

En Kreeft, en Krab, en Mossels: Oesters, die
Een better is als Europa drie
In veelheyt heel on-kenbaar voorhem, wie
't Mocht onderwindon.

Now, the manner of a modern clam-bake is this: A circular hearth is first made in the sand with flat stones, upon which a fire is kept up until they are red hot and the coals fall down into a flat heap. A layer of sea-weed is then placed upon them, and upon the seaweed a layer of clams about 3 inches thick covered by more seaweed; then follows a layer of green corn in the husk, intermixed with potatoes and other vegetables; then a layer of oysters, crabs (in sacks to prevent their escape), and poultry, dressed and seasoned; then more seaweed. This arrangement is continued according to the number of persons to take part in the feast, and when the pile is complete it is covered with canvas overlaid with wet seaweed to prevent the steam from escaping. When after about an hour the whole is cooked each one helps himself without ceremony to morsels from the delicious mass. This joyful marine barbacue has prompted to verse some genial soul whose heart was warmed, and he tells cleverly how others may emulate his epicurean delight and possibly also meet the muse at table. Here is his recipe—I wish I knew his name that I might sound that too:

First catch your clams—along the ebbing edges
Of saline coves you'll find the precious wedges
With backs up, lurking in the sandy bottom;
Pull in your iron rake, and lo! you've got 'em.
Take thirty large ones, put a basin under,
Add water (three quarts) to the native liquor,
Bring to a boil (and, by the way, the quicker
It boils the better, if you do it cutely);
Now add the clams, chopped up and minced minutely,
Allow a longer boil of just three minutes,
And while it bubbles, quickly stir within its
Tumultuous depths, where still the mollusks mutter,
Four tablespoons of flour and four of butter,
A pint of milk, some pepper to your notion;
And clams need salting, although born of ocean.
Remove from fire (if much boiled they will suffer—
You'll find that india-rubber isn't tougher);
After 'tis off add three fresh eggs well beaten,
Stir once more and it's ready to be eaten.
Fruit of the wave! Oh, dainty and delicious!
Food for the gods! Ambrosia for Aspicius!
Worthy to thrill the soul of sea-born Venus
Or titillate the palate of Silenus!

A "clam-bake" expresses the sum of all human happiness to the Rhode Islander, and to gather all his relatives and friends on the sea-shore, bake the roystering clam in dried seaweed, and eat it with other good things, fills his cup of joy. As enthusiasm and emotion always seem odd, and perhaps ludicrous to those who are not under its influence, the New Englanders get much fun poked at them by outsiders. It is related, for example, that a Sunday-school teacher in Rhode Island told the pupils that there were poor children in Illinois who had never experienced the supreme delight of a clam-bake, and the last penny in the juvenile pocket was dropped in the plate in aid of the benighted sufferers.

A better story, however, is the following, which I "sell to you as I bought it," not making myself responsible for the truth of the tale: Prof. Anton Siegafritz was selected a few years ago by the Prussian authorities to examine into the expediency of making plantations of oysters,

like those at Ostend and St. Nazaire. In his preliminary report he advanced the theory that in the case of persons having more bodily than mental exercise, the eating of shell-fish produced emotional insanity. His principal illustration is derived from what he saw in America. With a seriousness that precludes all suspicion of caricature the learned professor says:

"While I was in America I saw the excitements caused by immoderate indulgence in shell-fish violently illustrated. They have there a sort of political assemblage called a clam-bake, where speeches and music and songs are interspersed with profuse feasts upon a species of oyster called the clam. Vast crowds attend these celebrations, and no sooner are they gorged with the insidious comestible, than they become full of excitement and furores; swear themselves away in fealty to the most worthless of demagogues; sing, fight, dance, gouge one another's eyes out and conduct themselves like madmen in a conflagration."

But enough of this joking.

In Northern New Jersey they call small young quahaugs, only an inch or so in breadth, "tea" clams. These are often served at an evening meal, two or three being opened and set in a row on each one's plate with a slice of lemon as an appetizer. One item in trade is pickling, and for this purpose the tender small clams are always reserved. For this sort the dealers generally depend on the mud-catchers, or rakers, who work in shallow water, and often orders are given to Shrewsbury men for this kind. They pass as "Little Necks," however, by the market-men.

14. THE PRINCIPAL MARKETS.

The principal depots for the sale of quahaugs are New York and Philadelphia. All the coast towns south of Providence use them, but Boston sells comparatively few. In the scrap-books preserved by Mr. Thomas DeVoe, of New York, I find a long account of the clam-trade of that metropolis in 1855. The wholesale and retail trade at that time was estimated at $600,000, but this included both hard and soft clams; still the vast majority were quahaugs. There were one hundred sail-vessels carrying clams to Oliver street and to Washington market in summer; in winter they brought oysters. To these must be added twenty others supplying North River towns. Besides the large boats, about two hundred small boats, handled by one or two men, were engaged, and the value of all the crafts, big and little, was given at $50,000. The largest vessels were of about 50 tons burden. They were usually owned by two partners, and manned by two men and a boy. The average tonnage was 30, and the average cargo 100,000 clams. Including all from the diggers to the retailers and hawkers, eight thousand persons were supposed to be dependent on this trade centering at New York, during a large portion, at least, of the year. The principal fisheries at that time were in Atlantic County, New Jersey—New Inlet, Absecom, and Egg Harbor being the best; in the Great South Bay and in Cow and Little Neck Bays, Long Island. A few came from the Chesapeake. Then, as now, there were no exclusive clam dealers, but all the oyster merchants sold them. Fulton and Catherine markets were the main depots, and the colored people are noted as particularly fond of them and were large buyers. The business was thus conducted:

"The wholesale dealers enter into a contract to supply their customers with a certain amount at appointed times. The agreement is signed by both parties, each of whom is liable to a forfeiture of $100 in the event of non-fulfillment. The captain owning the boat sails for the fishing-grounds, where he purchases the clams indiscriminately among the small boatmen, and having loaded his vessel within the time prescribed by the contract, returns to the specified place. Here he finds his customer, with his wagons ready to receive his freight and to transfer it to the hands of the retail dealers, who generally purchase by the thousand. When a delay is caused by unavoid-

able circumstances, such as a difficulty in procuring the required supply or unfavorable weather, the penalty is never enforced."

In addition to this, many clams were brought into New York by wagons from Long Island. This is still the case in respect to both hard and soft kinds. A considerable trade was then in existence in clams salted and pickled for the European steamers and the interior. There was also an inland commerce (still continued) in quahaugs, packed in ice or preserved in the manner of oysters, since immigrants have taken to the prairies the taste for the fry, the fritter, and the chowder, perhaps because they find in their salt flavor the best reminder of the early home by the seaside. I have heard an old clam dealer recommend a dozen raw before breakfast as sure cure for obstinate dyspepsia. The sale of clams in Catherine market in 1855 was $20,000, a falling off it was reported, from the previous demand. During that decade the price of hard clams in New York varied from 37½ cents to $1 a hundred for ordinary, according to size, but those from Shrewsbury and Little Neck often brought much higher prices, the greatest quantity coming from New Jersey.

At present the clam business is an appendage or department of the oyster trade, as of yore, and its statistics were found to be inaccessible through these channels. But careful inquiry along the whole Atlantic coast, in which my own labors were most generously and skillfully supplemented by Mr. R. E. Earll, enables me to present a pretty accurate view of the present consumption.

15. THE QUAHAUG CLAMMING-GROUNDS.

GULF OF SAINT LAWRENCE TO BUZZARD'S BAY.—In the Gulf of Saint Lawrence quahaugs occur, but are never eaten, nor are any mollusks other than oysters.

The early productiveness of Cape Cod is shown by the presence of numerous shell-heaps, particularly in Wellfleet and Barnstable Harbors, filled up by the Indians and consisting almost wholly of the shells of this mollusk. Though in greatly depleted numbers, the quahaug still survives along the inside of the cape, and at Wellfleet has been raked from early times by the settlers. Mr. F. W. True contributes some notes on this place, from which I learn that the quahaug fishery as a business there dates from the beginning of the present century. It grew in extent until 1863, and from that time until 1868 the trade was at its height, since when it has diminished year by year, owing to lack of good market rather than failure of the supply. Between 1863 and 1869 the average catch each year was not less than 2,500 bushels. Of this amount a comparatively small part was consumed at Wellfleet, and the rest were shipped to Boston, Provincetown, Salem, Newport, Manchester, and a few other New England ports. From 1870 to 1876 the quantity of quahaugs taken per year decreased from 2,500 bushels to 1,800 bushels; and this latter amount has remained constant to the present year. Of the total catch in 1878 fully one-half, or 900 bushels, was consumed in Wellfleet. The remaining 900 bushels were shipped to Boston and other neighboring towns. For three years beginning with 1876, 75 bushels of quahaugs have been annually shipped to New York City.

Quahaugs are found in all parts of Wellfleet Bay, except in a small spot near the wharves, called the "Deep Hole," and a similar one on the west side of the bay. Both of these places are covered with a thick soft mud. It is not usual, however, to fish in parts of the bay where the average depth at low water exceeds 8 feet. Most of the raking is done on the western side. In ordinary years quahaug raking is begun the last of March, and continues until the first of October. As a general thing no raking is done during the winter months, although in some years a small amount has been done through holes cut in the ice. The fishermen rake about four tides per week, beginning at half-ebb and raking to half-flood. The boats used are either cat-boats

or yawls rigged with two sails. Each boat carries one man. The rake has been described. The baskets in which the quahaugs are collected and measured are of the ordinary manufacture and hold about a bushel each, and the whole outfit of a quahaug fisherman does not cost over $150, and the total amount of capital invested in apparatus at the present time in Wellfleet does not exceed $800. This amount is about evenly divided between the five men, none of whom are engaged in this fishery more than a part of their time.

Quahaugs are sent to market always in the shell, and packed in second-hand flour or sugar barrels. The wholesale price of quahaugs for many years averaged 60 cents per bushel, but in 1879 it fell to 55 cents. One dollar and seventy-five cents is the average wholesale price per barrel. Quahaugs retail in Wellfleet at 80 cents per bushel. The usual method of transportation is by packet, at a cost of 25 cents per barrel.

The Wellfleet fishermen employ no agent, but receive orders directly from merchants in various places, who know them personally.

At Orleans, some few men who go mackereling in summer stay at home and dig clams in winter, getting perhaps 50 barrels of quahaugs, among others, which are peddled in town. The south side of the cape is hardly more productive commercially, although the mollusks are plenty enough at certain points, as, for instance, at Waquoit; and I fancy that 3,000 barrels, holding, say, 7,500 bushels, and worth $5,000, will cover the whole cash sales of the cape.

Martha's Vineyard used to be bordered by good quahaug ground, but I am not aware that many are caught there now. In an old book I find the following historical allusion to it:

"The poquau (*V. mercenaria*) is found in Old Town Harbor, at Cape Poge, and in Menemsha Pond; great quantities are exported. It is taken up with iron rakes in deep water; and in shallow water it is picked up by the hand. The siki, or common clam, is found on the borders of the lagunes and in several other parts of the island. It attains its full size in two years. Much examination has convinced us that it has not the power of locomotion; but the poquau is able to cover itself with sand, and to move itself forward, though very slowly. Two thousand dollars' worth of clams, at $9 a barrel, have been sold in Edgartown, the present year [*i. e.*, previous to August, 1807]. They also begin to be taken at Menemsha Pond, and we believe in other places, and sold for bait. The razor shell and the muscle are scarce."

NARRAGANSETT BAY.—In Narragansett Bay, Rhode Island, the yield is large, as might be expected of the traditional home of the "wampampeege." Seventy-five men, it is asserted, take an average of 1½ bushels a day the year round. The ground extends on both sides of Providence River below Field's Point and down to the deep water, perhaps farther. They are also caught at Wickford, to the extent of 1,000 bushels. Adding this to the estimate for Providence River gives over 42,000 bushels as the annual yield, nearly all of which goes to Providence and returns the fishermen about $35,000.

COAST OF CONNECTICUT.—I must deplore a lamentable lack of statistics in regard to the coast of Connecticut. At Norwalk three oystermen ship them, together with supplies from Long Island. The quahaugs are caught by seventy-five men, all among the islands in the harbor, and amount to about 7,000 bushels a year, worth $5,000. At Rowayton, close by, twenty-five men take half as many, and a small planting has been begun. I think it would not be much out of the way to say that at least 25,000 bushels were sent to market annually from Connecticut, and another 25,000 bushels eaten at home. The class of men who get them and the soft clams mainly, are a miserable set who help the oystermen in winter and "go clamming" in summer. They are locally known as "proggers." The hard clams are reported on this shore to be found over a wider area than formerly, but in far less quantity.

From City Island, in East River, four boats run twice a week for three or four months. This makes about one hundred and twelve trips, which, with an average cargo of 300 bushels, amounting to 33,600 bushels, having a market value of about $22,000. It is a more solid business here than farther eastward.

NORTH SHORE OF LONG ISLAND.—Crossing over to the Long Island shore, I have Mr. Mather's notes and statistics:

"Flushing Bay" clams are larger than "Little Necks," are solid and fat, and the shells are dark while those of the latter are light, a difference caused by the dark mud of the bay, the "Little Neck's" lying in sand.

At Little Neck a very few soft clams are taken, but the hard clams have a very high reputation, and are in great demand when oysters are out of season. They are most esteemed when about the size of a quarter-dollar, and are usually eaten raw. The bottom of the bay is sandy and the shells light colored.

About thirty men, from Roslyn, occasionally rake for oysters and clams, but do not depend entirely upon it. They only have a skiff and a rake apiece, and not over $75 is invested.

At Glen Cove some clams of both sorts are got along with the oysters.

In Oyster Bay soft clams are more plenty than in the bays west of it, but hard clams are not.

At Port Washington I was told that about five hundred persons regularly raked quahaugs in summer, and the clams were slightly scarcer than formerly. About three hundred of these men rake in or near Cow Bay, while two hundred go down or up the sound for several miles. The catch is from 1 to 3 bushels a day, but an average would be 2 bushels. The season lasts through perhaps one hundred working days. If you say, then, that 400 bushels a day are caught inside Cow Bay and 300 bushels a day outside, with 5,000 bushels caught along with the oysters in winter, you have a total of 75,000 bushels. This, at an average price of 65 cents, would be worth $48,750.

Mr. Fred. Mather's summary for this north shore, in respect to hard clams, is as follows:

Locality.	Bushels.	First value.
Flushing	20,000	$15,000
Whitestone	40,000	30,000
Little Neck	50,000	35,000
Roslyn	10,000	7,500
Glen Cove	2,500	18,000
Oyster Bay	6,000	4,000
Cold Spring	2,000	1,500
Port Washington	75,000	48,750
Bayville	5,000	3,750
Huntington	20,000	15,000
Centreport	25,000	18,000
Saint James	500	400
Stony Brook	20,000	15,000
East Setauket	20,000	15,000
Port Jefferson	5,000	3,500
Mount Sinai	500	300
Total	301,500	220,700

SOUTH SHORE OF LONG ISLAND.—Turning Orient Point and entering the sheltered waters of Gardiner's and Peconic Bays, we find a few quahaugs, reported by Mr. Mather in careful detail as follows:

Locality.	Bushels.	First value.
Riverhead	2,500	$1,500
Jamesport	2,000	1,300
Mattituck	600	400
New Suffolk	10,000	7,500
Southold	400	300
Greenport	1,000	750
East Marion	200	150
Orient	500	350
Three-Mile Harbor	1,000	750
Amagansett	100	75
East Hampton	150	120
Sag Harbor	1,000	750
Bridgehampton	50	35
Water Mill	180	150
Southampton	1,000	750
Total	20,680	14,880

At New Suffolk some of the many scallop boats are used in the off-season in getting hard clams, averaging 4 bushels a day from April to October. They take them early and bed them down for summer.

The south shore of Long Island is also a great source of the supply of clams which go to New York and are used to supply the immense and numerous summer hotels which are open along the whole length of the island during warm weather. It is asserted that in the Great South Bay the clams are gradually moving eastward, the limit of their occupation at present being Ferry's Bed, off Brown's Point. They are taken all the year round, when ice does not prevent, but most actively when oysters are out of season. The oyster boats from 2 to 6 tons in size are used, and five hundred men, with two hundred boys, work more or less at this fishing. A good day's work now is to procure a thousand clams, or about three bushels (for they are of small size), worth about $2. The tongs and rakes are made heavier than those used in oystering, generally having iron heads, and costing $5 or $6.

At Islip a firm of packers puts up these clams for market. The statistics of this firm's business for 1880 are as follows:

Men employed	10
Women employed	12
Boys and girls employed	4
Men catching clams	80
Number of clams used	5,000,000
Number of 2-pound cans "clams"	75,000
Number of 1-pound cans "clams"	40,000
Number of 2-pound cans "clam chowder"	10,000
Number of 1-pound cans "clam chowder"	3,000

At Amityville one man has attempted successfully the cultivation of quahaugs. His method is simply to gather or purchase them when about the size of pennies and spread them upon his oyster beds. He says they grow very fast and return him a good profit.

Statistics of this region are furnished by Mr. Mather's notes as follows:

District.	Bushels.	Value.
Atlantisville	500	$375
South Oyster Bay	7,000	5,250
Hempstead and Rockaway	15,000	11,250
Flatlands, &c	4,500	3,375
Bath, &c	7,000	5,250
Packed	17,000	10,000
Total	51,000	35,500

NEW YORK BAY.—I am at a loss what estimate to make for the yearly catch of quahaugs in New York Bay, including by that term all the water inside of Sandy Hook where these mollusks grow, but I suppose 150,000 bushels, worth about $100,000, would include all taken, except those caught by the considerable number of boats which go from Staten Island and New Jersey towns, Perth Amboy, Keyport, Shrewsbury, &c., down to Sandy Hook. These are included in what follows. My notes give 125,000 bushels to Raritan and Prince's Bays alone. The quahaugs caught otherwise in New York Bay are taken chiefly with the oysters and by the oyster planters, though a large number of people alongshore, of the poorer class, make a summer employment of raking them. This number varies, and is not separate from the population already described and enumerated under the history of the oyster product of this coast. The same may be said of the boats employed. In the winter both men and boats are hired by oystermen, or work their own beds and regard that as their real business. There are few exceptions to this practice here or elsewhere. The clams bring the fishermen about 60 cents a bushel.

NEW JERSEY.—The amount of the quahaug fishery in New Jersey was a subject of careful inquiry when I was along that coast, and was also attended to by Mr. R. E. Earll. His estimate for all the shore from (and including) Sandy Hook to Barnegat light, gives as the yield, in 1880, 18,931,000 by count. This, at 300 to the bushel, would give 63,103 bushels, which is valued by him at $35,625.

From Barnegat Light southward around Cape May to Cohansey Creek makes another district to which he assigns an annual catch of 85,741,000, or about 285,803 bushels, worth, it is stated, $117,667. The northernmost locality of this district is "Clam Bay," which is just inside of Barnegat light-house, and yields 150,000 bushels a year, I was told. Boats come from New York to buy them of the men who rake. Great Bay, at the mouth of Mullica River, is another extensive ground, much resorted to by buyers from Philadelphia as well as New York, and yields 40,000 bushels annually. From Lake's Bay, just in the rear of Atlantic City, the clams are sent chiefly by rail to Philadelphia, about 18,000 bushels going last year. Little Egg Harbor is credited with 25,000, and Seaville, still farther south, with 8,000 bushels in 1880. All these are from my own studies, and the total, 241,000 bushels, agrees pretty closely with Mr. Earll's estimate, which, however, is worthy of higher credence in this case than my own.

CHESAPEAKE REGION.—The Chesapeake region is highly productive, but I must confess to incomplete information in regard to it. The clamming ground extends from New Point, north of Mob Jack Bay, on the western shore, to Old Point, on Hampton Roads, and on the eastern shore from Pokomoke Sound southward. The principal markets are Baltimore, Norfolk, and Yorktown. These clams are got by the oyster tongers, when the summer close-season for the oyster-beds comes on, and the best market prices are received in April and May, because then the whole army have not begun tonging. These clams are sold by the thousand, and the general price ranges from

$1.50 to $2, but $2.25 was paid in 1881. Estimates at hand of the present yield gives to Baltimore (as destination) about 3,500,000 yearly; to Norfolk, 2,000,000 and to other markets (almost wholly Yorktown), 2,000,000. These 7,500,000 quahaugs will measure about 30,000 bushels, and are worth, at $1.75 a thousand, $11,375. I am convinced, however, that these figures are much too small to represent the total year's catch in Chesapeake Bay.

NORTH CAROLINA.—Southward of Norfolk not many quahaugs are obtained at present. Some years ago the Norfolk dealers sent boats down to the sounds of North Carolina, particularly to Okracoke Inlet, to buy clams, but that experiment was found unprofitable, both on account of the length of the voyage, and the fact that no dependence could be placed upon the fishermen getting the clams when they were wanted, notwithstanding the abundance of this mollusk. To the small exportation and the local consumption of the whole coast from Norfolk to Florida at 50,000 bushels a year, three-fourths of which is given to North Carolina, would not be far from the truth in my opinion. This 50,000 bushels will not be worth more than $20,000 however.

16. STATISTICAL RECAPITULATION OF QUAHAUG FISHERY.

Summarizing, we have the total quantity of quahaugs used in the United States annually:

Locality.	Bushels.	By count.	Value.
New England	102,300	30,690,000	$70,000
Long Island*	466,250	121,884,000	303,080
New York Bay	150,000	45,000,000	100,000
New Jersey	348,936	104,671,800	153,292
Chesapeake	30,000	9,000,000	11,375
Southern States	50,000	15,000,000	20,000
Total	1,087,486	326,245,800	657,747

*Including 30,000 bushels from City Island, East River.

(c) FISHERY FOR SEA-CLAMS.

17. DISTRIBUTION, METHODS OF GATHERING, AND USES OF SEA-CLAMS.

In addition to the quahaug and the soft clam, there are several bivalves of minor usefulness as food. Chief of these is the *Mactra solidissima*, which is known under such diverse names as "sea-clam," "surf-clam," "hen-clam," "beach-clam," "dipper," "skimmer," &c. It is distinguished by its great size and smooth surface, some of the shells being more than 6 inches long and 4 or 5 broad; and there is great variation in the form of the shell, some being oval, others more oblong or elliptical, and others nearly triangular; some are very swollen, others quite compressed. Though more active than the quahaug, it frequents much the same localities, being seldom found away from sandy beaches, and there remaining below low-water mark and thence to a depth of 4 or 5 fathoms. Hence it is not so easily obtained as the quahaug. "The siphon-tubes are quite short, and the creature usually does not burrow very deeply, nor does it seem to construct any permanent burrows. But it has a very large muscular compressed foot, with which it can quickly burrow beneath the surface of the sand. Nevertheless large numbers are always thrown on the beaches by violent storms and once there they are very soon devoured by crows, gulls, and other large birds that frequent the shores."

The range of the species includes our whole coast from the Gulf of Mexico to Labrador, but this clam is familiar only to the people of Massachusetts Bay, Cape Cod, the south shore of Long Island, and New Jersey. One of the earliest tracts written upon our natural history, Wood's "New

England Prospect" (1634), says that along Nahant beach the sea, "after storms casts up greate store of great Clammes, which the Indians, taking out of their shels, carry home in baskets;" also of "clammes as big as a halfe-penny loaf, which are greate dainties amongst the natives." It is evident that this is the species referred to. Following their example, the Massachusetts people have always eaten them to some extent, and one Boston merchant told me that a few years ago he was able to sell fifteen barrels a year, but that now there was no call for them. They were worth $3.50 a barrel at the beach and sold for $4 a barrel in Boston. On Cape Cod they are eaten to some extent when washed up on the "backside" of the cape, all of the mollusk being thrown away except the "cheeks;" precisely what this portion represented however, I was unable to learn. This is a traditional custom, as I was assured in conversation with an old Provincetown man: "I hearn old folks say," he explained "yeou mustn't eat none of it, 'cept the cheeks. They pretend to say the rest is poison, or suthin."

I suggested that at Lynn the whole animal was eaten, and said perhaps the people there were tougher. "Well, I dunno," he replied, "most all the folks at Swampscott are Cape Codders." They are occasionally eaten in the lower towns of the cape, too, and on Long Island, where the south shore is frequently strewed with them. Mr. Mather makes a note of this as follows:

"It is very large, and would afford a cheap and wholesome stock for soup, if the American poor did not always want the very best of everything. We know a poor man in Brooklyn who, when out of work, walks down to Coney Island and gets a bag full with which he rides back on the street cars, and, said he, 'I can get clams enough to make good soup for my big family for a week, by taking one day, and 15 cents for car fare.' Here is a text for a political economist. We have often said that there is more good food wasted in the United States than in any other country, but as population increases this will remedy itself. At present our people are too proud to buy anything but the choicest things in market, or even to ride second class; but in a few more generations the fishermen of Long Island Sound won't say with indignation, of a truly fine fish which graces the tables of the best in the land in Europe and some parts of New York, 'No sir; I never was poor enough to eat sturgeon.' We repeat, sea-clams make good soup; we have eaten it and pretend to know the various grades of goodness in salt-water clams and oysters."

They rarely appear in New York markets, and I suppose their general rejection as food is due partly to their inaccessibility, partly to prejudice against them, but chiefly from the fact that they are likely to prove tough, and of a "sweetish" flavor, disliked by many persons in comparison with the abundant oysters, quahaugs, and *Mya* clams.

In New Jersey, they occasionally serve as manure, being now and then thrown up on the outer beaches in vast wind-rows, sometimes 2 or 3 feet deep, and so dense that they may be shoveled up. There are records of many such a visitation, the latest of which, perhaps, was during the winter of 1877–'78, when the farmers along the shore from Atlantic City to Cape May carted away hundreds of wagon-loads of the washed-out flesh of these mollusks and spread it on their fields. They were utilized also as food for hogs and poultry, and as bait. The same was true at Barnegat, and, Mr. Lockwood tells me, has happened frequently near Sandy Hook. This great bivalve is principally serviceable then, as bait, and as such it occupies considerable time and attention everywhere along the coast, briefly and at irregular intervals. On Cape Cod, nevertheless—that great depot for all sorts of marine industries—the fishery for sea-clams takes on a commercial importance. In the course of Mr. True's investigations of the shore-interests of that interesting and amphibious corner of the United States, he learned that at Dennisport, in 1879, there were about two hundred and forty dories procuring sea-clams within a mile and a half of the village, half of which were owned in Dennisport, and the rest in Harwich, Chatham, West

Dennis, South Yarmouth, South Harwich, East Harwich, North Dennis, Brewster, and Nantucket. These dories employed about two hundred and fifty men, half of whom belonged in Dennisport.

The history of this fishery is this: About 1870 Mr. Joshua Pierce discovered the sea-clams in the neighborhood of a wreck, outside the port. That winter Mr. Pierce, accompanied by another man went again to the spot and brought in a large number of the clams. The next year there were eight boats engaged. Thus the business has continued to grow until the winter of 1876–'77, when the zenith seems to have been reached with a product of 3,000 barrels. Since then there has been a decrease, due, it is said (no doubt properly) to overfishing, and not throwing back the very small ones; and no exact report of the present diminished yield is available.

Out of the whole number of men employed, some fifty hire dory and gear, paying an eighth of the amount made. Of the rest, many buy dories and gear, paying a dollar or two on them from week to week until all has been paid. The rakes in use are made of iron, with wooden handles from 20 to 27 feet long; they have seventeen to twenty-five teeth, and cost $5 to $8. Most of the raking is done in water 8 feet deep at ebb tide, but sometimes the men go into very deep water, trying once, and often twice each day. Dealers on shore pay from 25 to 28 cents a bushel for the catch.

The clams are sold almost wholly as bait for the bank fisheries, and therefore must be opened and packed in barrels for shipment to Cape Cod ports, Boston, Swampscott, Rockport, Gloucester, Portsmouth, Newport, New York and New London; for the last two years three-fourths of the whole have been sent to Boston. In 1877–'78, thirty men were employed in opening the clams, but in 1878–'79 only twenty found work, and were paid at the rate of 10 cents a bushel. Barrels are made chiefly by two men, one in Dennisport and the other in West Dennis, and cost from 50 to 75 cents each. In the fall it takes 16 bushels of clams to fill a barrel with "meats," in the spring only about 12 bushels, showing considerable rapidity of growth in the mollusks during the winter. Cartage and transportation add 60 cents, so that in Boston the actual cost of a barrel of sea-clams, calculated as above, will be about $5.75; the price last year was actually $6. The year 1873 saw it at the highest, $9. In addition to this, the shells are sold at 5 cents a wagon-load for road-making.

At West Dennis, also, is a small business employing, according to Mr. True, twenty-five men, and yielding about 400 barrels.

Mr. True estimates the capital invested in this fishery on Cape Cod in the following manner, but apparently refers to the year 1877, in the item "3,000 barrels," since not so many are used now—perhaps not more than 2,000:

240 dories, at $8	$1,920
250 rakes, at $7	1,750
Gear (anchors, &c.), at $3 to a dory	720
34 shanties, at $50	1,700
3,000 barrels, at 60 cents	1,800
Fuel, repairs, &c., at least	110
	$8,000

To the above may be added perhaps $2,000 as representing the capital in use in the "South Village," making $10,000 for the whole.

At this point, for want of a better place, I may insert the following bit of information as to the law of Massachusetts (1867) "concerning clam-bait:"

"CHAP. 347, SEC. 1. When clam-bait is sold by the barrel it shall be construed to mean a fish-barrel of not more than 29 nor less than 28 gallons, and shall contain 26 gallons of clams and not over 3 gallons of pickle. If a disagreement arises between the purchaser and seller respect-

ing its quantity, either party may call on an inspector of fish and have it measured, and if it does not contain the number of gallons of clams aforesaid, the seller shall receive pay for only the number of gallons each barrel contains, and shall pay the expense of measuring and coopering; otherwise the purchaser shall pay the expense."

(*d*) CLAMS OF THE PACIFIC COAST.

18. COMMERCIAL IMPORTANCE OF PACIFIC COAST CLAMS.

The edible mollusks in addition to oysters to be found on the Pacific coast of the United States are many. First in importance among them probably is the *Lutraria maxima*, concerning which a long account is furnished by Mr. J. K. Lord, in his "Naturalist in British Columbia," which I subjoin in full.

"Among the edible shell-fish found on the coast of Vancouver Island and British Columbia, the Great Clam as it is there styled (*Lutraria maxima*), or the otter-shell of conchologists, is by far the most valuable. Clams are one of the staple articles of winter food on which all Indian tribes in a great measure depend who inhabit the northwest coast of America. The clam to the Indians is a sort of molluscous cereal, that they gather and garner during the summer months; and an outline sketch of this giant bivalve's habits and style of living, how captured, and what becomes of it after being made a prisoner, may be interesting; its habits, and the uses to which, if not designed, it is at least appropriated, being generally less known than its minute anatomy. Clams attain an immense size; I have measured shells 8 inches from the hinge to the edge of the valve. We used them as soap-dishes at our headquarters on Vancouver Island.

"The clam has a very wide range, and is thickly distributed along the mainland and Vancouver Island coasts; his favorite haunts are the great sand-banks that run out sometimes over a mile from the shore. The rise and fall of the tide is from 30 to 40 feet, so that at low water immense flats or beaches, consisting of mud and sand, are laid bare.

"There is nothing poetical about the clam, and its habits are anything but clean; groveling in the mud and feeding on the veriest filth it can find appears to constitute the great pleasure of its life; the stomach is a kind of dust-hole, into which anything and everything finds ready admission. Its powers of digestion must be something wonderful; I believe clams could sup on copper tacks, and not suffer from nightmare. Spending the greater part of its time buried about 2 feet deep, the long siphon reaching to the surface discovers its whereabouts, as the ebbing tide leaves the mud, by continually squirting up small jets of water, about 6 or 8 inches high. The sand flats dry, out marches an army of squaws (Indian women), as it is derogatory to the dignity of a man to dig clams. With only a small bit of skin or cedar-mat tied round the waist, the women tramp through the mud, a basket made from cedar root in one hand, and in the other a bent stick about 4 feet long. Thus armed they begin to dig up the mud-homes of the unsuspecting clam; guided by the jets of water, they push down the bent stick, and experience has taught them to make sure of getting it well under the shell; placing a stone behind the stick, against which the squaw fixes her foot firmly, she lifts away; the clam comes from darkness into light ere he knows it, and thence into the Indian's basket. The basket filled, the clam pickers trudge back again to the lodge, and next to open him. He is not a native to be astonished with an oyster-knife; once having shut his mouth, no force saving that of dashing his shell into atoms will induce him to open it. But the wily redskin, if she does not know the old fable of the wind and the sun trying their respective powers on the traveler, at least adopts the same principle on the luckless clam; what knife and lever fail to do, a genial warmth accomplishes. The same plan the sun adopted to make the trav-

eler take off his coat (more persuasive, perhaps, than pleasant) the Indian squaw has recourse to in order to make the clam open his shell.

"Hollowing out a ring in the ground about 8 inches deep, they fill the circle with large pebbles, made red hot in the camp fire near by, and on these heated stones put the bivalve martyr. The heat soon finds its way through the shelly armor, the powerful ropes that hold the doors together slacken, and, as his mansion gradually grows 'too hot to hold him' the door opens a little for a taste of fresh air. Biding her chance, armed with a long, smooth, sharp-pointed stick, sits the squaw—dusky, grim, and dirty—anxiously watching the clam's movements. The stronghold opens, and the clam drinks draught after draught of the cool life-giving air; then down upon him the savage pounces, and astonishes his heated and fevered imagination by thrusting, with all her force, the long sharp stick into the unguarded house: crash it goes through the quivering tissues; his chance is over! Jerking him off the heated stones, pitilessly his house is forced open; ropes, hinges, fastenings crack like packthread, and the mollusk is ruthlessly dragged from his shelly home, naked and lifeless.

"Having got the clam out the next thing is to preserve it for winter. This is effectually accomplished by stringing-up and smoking. A long wooden needle, with an eye at the end, is threaded with a cord made from native hemp, and on this the clams are strung like dried apples, and thoroughly smoked in the interior of the lodge. A more effectual smoking-house could hardly be found; I can imagine nothing in the 'wide, wide world' half as filthy, loathsome, and disgusting as the interior of an Indian house. Every group has some eatable—fish, mollusk, bird, or animal—and what the men and squaws do not consume, is pitched to the dusky little savages, that, naked and dirty, are thick as ants in a hill; from these the residue descends to the dogs, and what they leave some lower form of animal life manages to consume. Nothing eatable that is once brought in is ever by any chance swept or carried out again, and either becomes some other form of life, or, decomposing, assumes its elemental condition.

"An old settler once told me a story, as we were hunting together, and I think I can vouch for the truth of what he related, of having seen a duck trapped by a clam: 'You see, sir, as I was a cruising down the flats about sun-up, the tide jist at the nip, as it is now, I see a whole pile of shoveler ducks snabbling in the mud, and busy as dog-fish in herring-time; so I creeps down, and slap I lets 'em have it: six on 'em turned over, and off went the pack gallows-scared and quacking like mad. Down I runs to pick up the dead uns, when I see an old mallard a playing up all kinds o' antics, jumping, backing, flapping, but fast by the head, as if he had his nose in a steel trap; and when I comes up to him, blest if a large clam hadn't hold of him, hard and fast, by the beak. The old mallard might a'tried his darndest, but may I never bait a martin-trap again if that clam wouldn't a' held him agin any odds 'til the tide run in, and then he'd a' been 'a gone shoveler sure as shooting; so I cracked up the clam with the butt of my old gun, and bagged the mallard."

In addition to this a large number of other edible bivalves exist in the waters of the Pacific, and have added to the food resources of the Indians on that coast, or are yet eaten by white men and Chinese. Some of these are described elsewhere, such as the mollusks and abalone (*Haliotis*), or have been alluded to in the introductory volume, Section I, of this report upon the fisheries. I shall content myself therefore by mentioning that the bay of San Francisco, in particular, and some other portions of the sea-shore of California, are now being peopled with the eastern clams of both species which have been taken thither, mainly or wholly by accident, with eastern transplanted oysters. They thrive in their new quarters, increase and grow rapidly and are figuring largely in local markets. To what extent Prof. Jordan has included native mollusks with these

introduced clams in the following figures I am not informed; but his totals reported from California of edible shell-fish other than oysters, is as follows:

Statistics of clams gathered in California in 1880.

County.	Number.	Value.
San Diego	10,000	$100
Los Angeles	2,500	25
Ventura	500	10
Marin	40,000	400
Total	53,000	535

(e) THE RAZOR-FISH.

19. NATURAL HISTORY AND COMMERCIAL IMPORTANCE.

Another bivalved mollusk to be noticed among our edible shell-fish is the razor-clam (*Ensatella americana*), which is a common inhabitant of sand-flats and sand-bars, where the water is pure, generally living near low-water mark or below, but sometimes found considerably above low-water mark. "This curious mollusk," writes Professor A. E. Verrill, in one of the pleasantest of his many pages concerning New England's invertebrates, "constructs a deep, nearly round, somewhat permanent burrow, which descends nearly perpendicularly into the sand to the depth of 2 or 3 feet. These holes can generally be recognized, by their large size and somewhat elliptical form, when the tide is out. Sometimes they are very abundant in certain spots and not found elsewhere in the neighborhood. They sometimes come to the top of the burrow, when left by the tide, and project an inch or two of the end of the shell above the surface of the sand; at such times, if cautiously approached, many can easily be secured by pulling them out with a sudden jerk, but if the sand be jarred the whole colony will usually take the alarm and instantly disappear. When thus warned it is generally useless to attempt to dig them out, for they quickly descend beyond the reach of the spade. They will often hold themselves so firmly in their holes by means of the expanded end of the long muscular foot, that the body may be drawn entirely out of the shell before they will let go. When not visible at the orifice they can often be secured by cutting off their retreat with a sudden oblique thrust of the spade below them. They are obliged to come up to the upper part of the burrow on account of the shortness of their siphons or breathing-tubes, which can be protruded only about an inch in specimens of the ordinary size, and, as they depend upon one of these to bring them both food and oxygen, and on the other (dorsal) one to carry off the waste water and excretions, it is essential for their happiness that the orifices of these tubes should be at or near the opening of the burrow most of the time. In this respect the common 'long clam' (*Mya arenaria*) and many others that have very long and extensile tubes have a great advantage. But the 'razor-shell' makes up for this disadvantage by its much greater activity. Its foot or locomotive organ is long and very muscular, and projects directly forward from the anterior end of the shell; at the end it is obliquely beveled and pointed, and it is capable of being expanded at the end into a large bulb, or even into a broad disk, when it wishes to hold itself firmly and securely in its burrow. In excavating its burrows it contracts the end of the foot to a point and then thrusts it beneath the surface of the sand; then, by forcing water into the terminal portion, it expands it into a swollen, bulbous form, and thus crowds the sand aside and enlarges the burrow; then, by using the bulb as a hold-fast, the shell can be drawn forward by the contraction of the foot; the latter is then contracted into a pointed form and the same operations are repeated. The burrow thus started soon becomes deep enough so that the shell will

maintain an upright position, when the work becomes much easier and the burrow rapidly increases in depth."

A very amusing account of the efforts of a naturalist to procure one of the English species is to be read in Lankester's "Uses of Animals," a part of which I may be permitted to quote:

"After many vain efforts to secure one of these creatures alive, I mentioned my failures to the late Prof. Edward Forbes. 'Oh,' he said, with a waggish smile, 'there is nothing easier. All you have to do is to put a little salt on their holes and they will come out.' I remembered, you know, the story of putting salt on birds' tails, and although I resolved secretly to try my friend's plan, it was so simple, I had not the courage to tell him that I would. I had, however, no sooner got to the sea-side than I quietly stole to the pantry and pocketed some salt, and then went alone at low tide to the sandy shore. As soon as I espied a hole I looked round, for I almost fancied I heard my friend chuckle over my shoulder; however, nobody was there, and down went a pinch of salt over the hole. What I now beheld almost staggered me. Was it the ghost of some razor-fish whose head I had chopped off in digging that now rose before me to arraign me for my malice, or was it a real live razor-fish, that now raised its long shell at least half out of the sand? I grasped it, fully expecting it would vanish, but I found I had won my prize. It was a real, solid, specimen of the species *Solen maximus* that I had in my hand.

"I soon had a number of others which were all carried home in triumph. Of course there were more than were required for science, and at the suggestion of a Scotch friend the animals not wanted were made into soup. When the soup was brought to table, our Scotch friend vowed it particularly fine, and ate a basin with at least twenty razor-fish in it. One tablespoonful satisfied the ladies, whilst myself and an English friend declared—against our consciences I do verily believe—that we had never eaten anything more excellent. I counted the number of the creatures I was able to swallow; it amounted to exactly three. After a tumbler of whisky and water, taken, of course, medicinally, arrangements were made for a dredge in the morning. The Scotchman was up at five, but I and my English friend could not make our appearance. Nightmare and other symptoms of indigestion had fairly upset us and unfitted us for anything so ticklish as a dredging excursion. Now, I do not wish to say anything against razor-fish as an article of diet, but from what I have told you, they would seem to possess an amount of resistance to the ordinary digestive activity of the stomach that would render it highly desirable to insure before taking them such a digestion as a Highlander from his mountain wilds is known to possess.

"Notwithstanding this *dictum*, it is certain that the ancients, who were not backward in discovering what was fit to eat, were fond of *solens*. 'Athæneus directs them to be boiled or fried, or, what is still better, to roast them on live coals till they gape.' The same author * * * quotes a commendation of Sophron, who not only praises them as great delicacies, but says they are particularly *grateful to widows*."

Knowing that a couple of centuries ago they were commonly eaten in Italy, in France, in England, and especially during Lent in Ireland, the early visitors to America observed at once that they occurred here also, adding another to the long list of marine delicacies which the New World boasted. It is evidently the *Solen* (or modern *Ensatella*) that Josselyn means in the following:

"*An achariston for pin and web.*—Sheath-fish, which are there very plentiful; a delicate fish as good a prawn; covered with a thin shell, like the sheath of a knife, and of the color of a mussel. Which shell, calcin'd and pulveriz'd, is excellent to take off a pin and web, or any kind of filme growing over the eye."

But Americans never took kindly to eating the razors, or even putting them into their *materia medica*. Under the name of "long clam," "knife-handle," and "razor clam," they are occasionally

seen in New York market, but have no sale as food. Their taste is sweetish and not approved. The same is true of the Pacific coast, though there they are said to be of "fine flavor." As bait the razors serve a good but limited purpose, particularly on Cape Cod and along the south shore of Long Island, but there is no regular demand for them. In his "Market Assistant" Mr. Thomas DeVoe, records that during a gale in February, 1839, so many clams of all sorts were sent ashore on the beach "that it is supposed it would require all the horses and wagons in the town of Hempstead for months to carry them away." No doubt the Long Islanders availed themselves of this visitation to get much manuring for their sandy farms.

The razor-shell, like all other bivalves, depends upon the minute infusoria and other organic particles, animal and vegetable, brought in by the current of water that supplies the gills with oxygen. It is preyed upon by several fishes that seem to be able to root it out of the sand, or perhaps seize it when at the surface. In this region its principal enemies are the tautog and skates. The latter appear to eat only the "foot," for in their stomachs there are sometimes many specimens of this organ, but no shells or other parts. I was told by a New Jersey bay-man, too, that the conchs (*Fulgur*) would pull the razors out of their burrows and devour them. The long and pretty shells are devoted to a variety of ornamental uses, where they can be kept whole, for they are too thin and brittle to be cut up as are heavier shells.

(*f*) STATISTICAL RECAPITULATION.

20. STATISTICS OF THE CLAM FISHERIES OF THE UNITED STATES.

The total summary of the business in "clams" of various kinds in the United States, detailed statistics of which have been given on previous pages, foots up as follows:

Kind.	Bushels.	Value.
Soft clams	1,064,704	$562,376
Quahaugs	1,087,486	637,747
Sea clams, &c	30,000	7,500
Californian clams	2,120	535
Total	2,184,310	1,228,158

4.—MUSSEL FISHERY.

1. THE SPECIES, GEOGRAPHICAL DISTRIBUTION, AND HABITS OF MUSSELS.*

Of mussels there are four common species on the Atlantic coast of the United States, besides several species on the Pacific coast. These are the following:

Mytilus edulis Linné. Arctic Ocean to Cape Hatteras and San Francisco.

Modiolaria nigra. Northern, in the deep sea.

Modiola modiolus. Arctic Ocean to New Jersey and Southern California.

Modiola plicatula. Maine to Georgia; Gulf of Saint Lawrence.

The internal structure of mussels, their food and manner of life are not greatly different from that of other bivalved mollusks, and need not be described at length here. Both valves of the shell are alike in shape and size. The hinge or lock uniting them is located in the smallest angle of the triangle formed by the shells, and both of the latter end at this point in short conical elevations.

* Further details of the natural history of mussels, as also information about the *Unionidæ*, or fresh water mussels and other mollusks not considered here, will be found in Section I of this report, Natural History of Aquatic Animals.

At the opposite end there is a small opening in the shell corresponding to the anus of the mussel; and in close proximity runs a short fringed tube connecting with the inner organs of respiration. On both sides of the mouth there are long, narrow, folded tentacles. Under and behind the base of the muscles which control the foot, is situated the byssus-spinning gland. From its cavity a groove extends along the lower side of the foot, and ends at its tip in a transverse cavity containing a small plate, perforated by seven small apertures, used for sucking.

Characteristic of the mussels is the strong, triangular "foot," and the "beard" or byssus, a group of silken threads. The foot is the weaver of the mussel's beard, and the manner of secretion of the threads takes place in a fashion quite analogous to that in which the spider makes its thread. From special glands under and behind the foot comes a viscid, semi fluid material, which, run into the groove in the foot, sets therein as a firm thread. This thread is drawn out of the foot by the retraction of that organ, and another thread is rapidly formed, until the beard grows apace, and the mussel has tied itself to something or has tied something to it. This attachment is made early in life to the surface of the rock, log, or other object forming its abode. The second engraving represents the mussel thus attached. In most cases several tie themselves to each other and to a common object, and thus form large clusters. "Thus a very firm and secure anchorage is effected, and they are generally able to ride out the most violent storms, though, by the giving way of the rocks or shells to which they are attached, many are always stranded on the beaches after severe storms. * * * These shells are not destined to remain forever fixed, however, for they not only swim free when first hatched, but even in after life they can, at will, let go their anchor-threads, or 'byssus,' and creep about by means of their slender 'foot,' until they find another anchorage that suits them better, and they can even climb up the perpendicular sides of rocks or piles by means of the threads of the 'byssus,' which they then stretch out and attach, one after another, in the direction they wish to climb, each one being fastened a little higher up than the last. Thus, little by little, the heavy shell is drawn up, much in the manner employed by some spiders when moving or suspending an unusually large victim." Though written by Professor Verrill concerning the edible mussel, the words just quoted will apply substantially to all species.

"The 'beard' of the mussel as a zoological curiosity is interesting enough, no doubt, but that it could by any stretch of the imagination be regarded as subserving an important function in defending man's structures against the ravages of time and tide is altogether an unlikely supposition. Listen, however, to a recital, as quoted by Mr. Gosse in his manual of the 'Mollusca.' 'At the town of Bideford, in Devonshire, there is a long bridge of twenty-four arches across the Torridge River, near its junction with the Taw. At this bridge the tide flows so rapidly that it cannot be kept in repair by mortar. The corporation, therefore, keep boats in employ to bring mussels to it, and the interstices of the bridge are filled by hand with the semussels. It is supported from being driven away by the tide entirely by the strong threads these mussels fix to the stone work; and by an act or grant, it is a crime liable to transportation for any person to remove these mussels, unless in the presence and by the consent of the corporation trustees.' Such a history is both curious and interesting, and in the absence of any contradiction—Mr. Gosse's 'Manual' bears date 1854—the correctness of the narrative may be assumed, if only from an inductive inference concerning the strength of the *byssus* of the mussels on the beach. The story, besides, presents but another, and, perhaps, novel illustration of the old axiom, *L'union fait la force.* Utilitarianism may again claim us when we find that a near neighbor of the mussel—the Mediterranean pinna—manufactures a silky *byssus* in sufficient quantity to enable the Sicilians to

weave it into gloves and stockings. These latter are rather *articles de luxe*, however, than garments of wear, and are costly withal, the latter fact depending on the nature of their origin and the trouble of manufacture. Pope Benedict XV received in 1754 from certain of his subjects a pair of stockings of Pinna's 'beard,' and the event was regarded as testifying to the worth of the present and to the dexterity of the manufacturers—a dexterity which was certainly equaled in respect of its ingenuity by Dame Nature herself in the production of the raw material."*

The American representatives of the European edible mussel are somewhat different in appearance, as may be seen by comparing specimens of the two varieties. Our shell is more thin, pellucid, and beautiful in its colors and radiating ornamentation.

Its home is among the rocks toward low-water mark and in the larger pools, particularly in shallow bays and estuaries, wherever there is an opportunity for anchorage to some firm object, and at the same time more or less mud. It is also frequently found on sandy flats in large patches fastened together by the threads of byssus. Gosse in his "Tenby" (p. 30) speaks of "myriads of mussels" in a cavern pool at Tenby: "These latter form a remarkable feature of the place; they fringe the walls of the cave and the rocks around up to a certain level; they floor the pools; and they cluster around every stone, being packed so densely that it would not be possible to thrust even the blade of a knife between them without violence. Thus they form great patches, or rather tracts, of intense blackness, from the general hue of the mussel-shells, though on a minute examination we can discover many individuals among the sable host which are beautifully tinted with pellucid olive or golden brown and pointed with radiating bands of purple. They adhere with great force to the rock and to each other by means of the silky threads of byssus, which they spin as their mooring cables, and which are capable of resisting a strong pull."

From such sheltered and favorable conditions it ventures out into deeper and rougher life, for Verrill dredged them off Eastport, Me., in 40 or 50 fathoms, where the tide runs with great force, and it has since been dredged in still deeper water in the same region, showing that it can live and prosper equally well under the most diverse conditions. This was not so new information as it seems to be, however, since in the New York Journal of August 4, 1785, a nautical correspondent informs shipmasters "that in latitude 35° 40′ and longitude of Cape Hatteras, there is a large mussel-bank, intermixed with cockles and pebbles, in 50 fathoms of water, and abounding in sundry fish, as sea bass, sea trout, flounders, skates, cusk, and dogfish; also in winter ballahs. All these fish are extraordinarily large and numerous."

To-day the most productive localities for mussels are the swift tideways of the inlets through Fire Island and the other beaches on the southern shore of Long Island, the channels about Sandy Hook, and the inlets of the beaches between Barnegat and Cape May. There are many beds in the lower part of New York Bay, also, particularly north of Point Comfort, near East Point buoy and near the Highlands; also in the East River.

"The specimens from sheltered localities and sandy bottoms are, however, much more delicate in texture and more brilliant in color than those from more exposed situations. Some of the thinner and more delicate specimens, from quiet and pure waters, are translucent and very beautifully colored with brown, olive, green, yellow, and indigo-blue, alternating in radiating bands of different widths; while others are nearly uniform pale yellow or translucent horn color. Those from the exposed shores are generally thicker, opaque, and plain dull brown, or bluish black, and not unfrequently they are very much distorted."†

This species breeds early in the spring. The eggs hatch into little free-swimming microscopic

* Belgravia. † A. E. Verrill.

objects which rapidly develop into something recognizable, and when only about the size of the head of a pin attach themselves in myriads to weeds and other objects, living or dead, near shore. In this condition they furnish food to a large number of rapacious animals, but grow with such celerity that those which survive attain their full size and armor in two seasons, or, under the most favorable auspices, even in one year.

Associated with the *Mytilus edulis*, and of like habits in general, are two other widely diffused species, the big "horse mussel" (*Modiola modiolus*) and the ribbed mussel (*Modiola plicatula*).

The former of these two is Arctic in its range, and rarely seen south of New Jersey on our coast, or Great Britain and France, in Europe. Fond of the deeper water it is to be looked for, according to Verrill, "at extreme low-water mark in the crevices between the rocks, and usually nearly buried in the gravel and firmly anchored in its place. Sometimes it occurs in the larger pools, well down toward low-water mark, * * * and, although it is almost entirely confined to rocky shores and bottoms, it extends to considerable depths, for we dredged it abundantly in the Bay of Fundy, at various depths, down to 70 fathoms." It is larger and heavier than the common mussel, being 6 inches in length sometimes. Generally lacking anything like the pretty radiating lines which adorn the mytilus, this mussel is covered with chestnut-black glossy coat, rudely haired towards the tip. It will easily be distinguished.

Modiola nigra is a rare form occasionally washed up on our northern shores by storms. It lives in the deep sea.

Modiola plicatula, on the other hand, belongs to high-water mark, clinging to rocks exposed more than half the time in many cases by the receding of the tide. It is very abundant in Long Island and New Jersey, along the muddy borders of the marshes and banks and among the roots of grass. In the brackish tide-streams that indent the coast, and in the drains through the salt marshes, these ribbed mussels are found crowded in among the stones, or embedded in the peat-like soil of the banks near high-water mark. "In this position, with the upper posterior portion slightly exposed, they crowd in such numbers as to form a complete stratum from 6 to 12 inches in thickness. A great portion of the time they are, of course, out of water; but they retain enough to serve the demands of their economy during the recess of the tide, and eject it when any disturbance prompts them to close the shell."

A closely allied species, the *Modiola hamatus*, is occasionally met with, especially on oyster beds, adhering to the shells, where it is sometimes very abundant. It has been introduced with the oysters, from the south, where it is common. It somewhat resembles the preceding species, but it is shorter, broader, with strong radiating ribs, many of which are forked. Its color is yellow or yellowish brown, from which fact it gets the popular name of "yellow mussel." It belongs naturally to the Gulf of Mexico and the southern Atlantic coast from Florida to Delaware, but is so thoroughly introduced into New Jersey that, as Professor Lockwood informs me, it grows abundantly through the sedges along the southern coast of that State, and serves as "stools" for the young wild oysters. In New York Bay these shells exist in considerable quantities, but do not multiply, and unless re-enforced by constant accessions from the Chesapeake Bay, brought by the oystermen, would speedily disappear.

The natural service rendered to the world by the race of mussels, so far as we can see, consists in the resistance their well-knitted colonies oppose to the waves and currents, thus preventing largely the wear and tear of certain portions of coast; in the fact that the highly useful oyster often finds a lodgment for his young on their shells when otherwise they would perish; and in the food which they supply to marine animals of various kinds.

Seals, particularly in babyhood or youth, subsist largely upon molluscs, the most accessible

of which, where they live, is probably the large arctic mussel. "The common star-fishes feed largely upon mussels, as well as oysters, and they also have many other enemies among the invertebrates, chiefly the whelk, drill, and other boring or crushing shell-fish. A small parasitic crab, *Pinnotheres maculatus*, lives in their shells, between their gills, in the same manner as the common *Pinnotheres ostreum* lives in the oyster. The principal enemies of mussels, though, are fishes of various sorts. The scup and other kinds devour their young, and the drum, weakfish, tautog, &c., live largely upon the older ones wherever the beds exist." In some regions, New York Bay particularly, it is difficult to prevent clusters of mussels growing among the planted oysters. This is considered very damaging by the planters, not because the mere presence of the mussels is harmful, but because they attract the drums, skates, and other fishes highly destructive to the valuable oysters. At Stump Shoal, Little Egg Harbor, N. J., however, I was assured that the excess of mussels there would crowd out the oysters by their abundance and more rapid growth, so that planting there was impracticable.

2. COMMERCIAL IMPORTANCE OF MUSSELS.

Besides being almost indispensable as bait for certain fish, mussels are extensively used as an article of food. They are largely cultivated in all European waters, in so-called "parks." In the North Sea these consist of large numbers of trees, from which the smaller branches only have been cut, and which are planted in the bottom of the sea at such a distance from the shore that their upper portion is partially laid bare at low water. After four or five years they are raised, stripped, and replaced by others. In the bay of Keil, Germany, alone, about one thousand of these trees are annually planted and about 1,000 tons of mussels are brought on the market. Bad seasons occur, however, both with respect to quality and quantity, owing to various causes. In the Adriatic the mussels are raised on ropes extended between poles rammed into the ground. The ropes are raised and stripped once in eighteen months. The mussel beds of Great Britain and western continental Europe are worth hundreds of thousands of dollars annually. For information in detail in respect to them the reader may consult the lectures by Dr. Philip Carpenter on Mollusca, printed in the Smithsonian Report for 1860, Simmonds's "Commercial Products of the Sea," Phipson's "Utilization of Minute Life," and so forth.

In America no such cultivation has ever existed, or is likely to be adopted for scores of years to come, since our wealth of the preferable oysters and clams is so great; still this mollusk is not altogether neglected on the American bill of fare. But before I proceed further let me say that to the aborigines of this continent the mussel has always been of very great importance as food; and in conversation recently with Mr. H. W. Elliott, who has acquired a wide reputation by his reports upon the fur-seal fisheries and the general natural history of Alaska, I learned many interesting facts bearing on this point.

Mr. Elliott said that the mussel of Alaska, which is the same as the *Mytilus edulis* of Europe and the eastern United States, is found from Saint Lawrence Island, south of Bering Strait, through Bering Sea, along the southern shores of the Aleutian Islands, and in the waters contiguous to the coast all the way to San Francisco. Mr. Elliott is not sure, but he believes it clings to the small islands known as the Diomedes, and is gathered by the Eskimo (in limited quantities) clear around to Point Barrow. It is in great abundance from the head of Cross Sound to the Straits of Fuca, and is especially luxuriant in growth and numbers throughout the whole of the Sitkan Archipelago and in that extensive chain of lesser and greater islands which break the swell of the North Pacific ere it reaches the coast of British Columbia. It is also abundant, but not of so large size, in the whole of Puget Sound and neighborhood.

Of that whole great region it constitutes the molluscan food-supply, since no oysters grow there, and the "clams" (*Cardium, Mya*, &c.) are nowhere numerous. Every day the women and children of all the Indians near the coast are out picking mussels from the rocks, and they are eaten the year round. The white inhabitants of that wilderness also consume them, and the Russian name for these mollusks is "black shells" (*chornie rakooshka*).

The Alaskan method of cooking is by boiling. Sometimes a whole bunch weighing 10, 20, or even 40 pounds, is thrown into the pot of boiling water. When the shells gape the water is poured off, and the Indians sitting around the fire gleefully pick out the mollusks with their fingers and transfer them swiftly to their mouths by the same primitive instruments.

Similar feasts take place on Vancouver Island and elsewhere among the more southern tribes, but there they are said generally to practice roasting instead of boiling.

As is shown by tradition and the presence of the shells scattered through the shell-heaps of the Atlantic coast, mussels formed an important article of food to the eastern Indians. Prof. Samuel Lockwood told me he once discovered a place on Mohinksun Creek, near Keyport, N. J., where it was evident that the Indians had lived wholly on *Modiolus modiola*, raising a monument of the fact in a great heap of the refuse shells. There is no doubt that everywhere along the coast they gathered and ate them constantly.

The Indians made use of their shells also. It is well known to all that the vanity of the redman is shocked by the presence of the meagre beard which would, if permitted, grow in a scanty way upon his chin. All Indians pull out these hairs with a diligence which disregards all the pain. The apparatus used by the Delawares to accomplish this, according to Heckewelder, "consisted of a pair of mussel shells, sharpened on a gritty stone, which answered very well, being somewhat like pincers."

In respect to the present demand for these mollusks, I find that it is very small, except in New York City. Almost the only other locality where I found them availed of as food was at Savannah, Ga., where the negroes eat them occasionally, but find them tough and often bitter. They are never seen in the Savannah markets.

In the city of New York, however, they have been constantly used as an article of food for many years. The season for mussels is midsummer, though some have asserted that they are only fit to eat during cold weather. That they do not come to market much in winter, however, is largely due to the fact that then the persons who employ idle time in summer in procuring them are busy.

The mussels sold in New York markets come from the East River, from Sandy Hook, and especially from Rockaway and Canarsie, Long Island. There are some evidently from the north shore of Long Island, also, since Mr. Mather gives me a note that one man at Port Jefferson shipped 300 bushels a day on many days, and in May and June of 1880 averaged 900 bushels a day. He got $1.25 a barrel for them in New York. Mussels are exceedingly plenty there, but the demand is limited.

The men who gather mussels for this market are an inferior part of the population, as a rule, since the regular oystermen do not care to take the trouble. The clammers get them to a certain extent. They are detached from the rocky beds, where they lie in masses, by the use of a strong fork.

The mussels are brought to the city every day, and are sold almost entirely at Fulton market, where several wagon loads and several sail-boat loads are disposed of each morning, at from $1 to $1.50 a barrel. A few also are daily received at the Broome street wharves. The amount

coming in varies, but runs from 1,000 to 1,500 bushels daily, so near as I could learn the total season's supply amounting perhaps to 100,000 bushels.

This employs several boats regularly, chiefly, as I have said, those running from Fire Island Inlet and Rockaway. They "float" the mussels—*i. e.*, put them in fresh water and inflate them much as they do oysters—before taking them to market.

Occasionally the mussels are eaten raw, but this is in their poorest shape. Mr. DeVoe, in his Market Assistant, says "they are best boiled and pickled, but, on account of their solid texture, &c., they do not readily digest, and therefore do not agree with many stomachs."

Mr. Elliott remarked to me in the conversation mentioned above, that the Alaskan Indians recognized very well the dangerous intestinal troubles which were likely to follow the eating of *Mytilus*, and escaped them by extracting the byssus whenever it was green; this greenness indicating a poisonous quality due to the convervoid food the mollusk had fed upon. The season of the year, as some have supposed, has nothing to do with these deleterious properties.

The ordinary method of preparation in New York is by pickling. This preparation, which is a troublesome and expensive matter, is done by the oyster-saloon men, who sell them to customers by the quart at 25 cents, or gallon at $1, almost wholly in the city.

Mussels to be pickled are first taken one by one and deprived of their "beard," which is the name given to the byssus, by pulling it out. This is hard work, for the byssus is strongly inserted into the muscular center of the animal. They are next thoroughly washed, and after that boiled for a considerable time. This finished, the animals are removed from the shells, and again thoroughly washed in fresh water. They are then thrown into the pickle, and are soon ready for the table. The pickle is made according to a variety of recipes, each man considering his method the best, the differences depending upon the character and amount of the condiments put in, with the natural "liquor" of the mussel and the vinegar which are the chief ingredients.

From Monterey, Cal., comes word through Prof. D. S. Jordan that 5,000 bushels of mussels are eaten there; this is the only note from the Pacific coast, so far as refers to civilized usage.

A second, but perhaps equally important, utilization of mussels is by making manure out of them. This is extensively done and might be largely increased with undoubted profit. The value of this fertilizer and the State's natural resources in it were long ago recognized by New Jersey. In the geology of Cape May County, published by the State in 1857, occur the following paragraphs on this point: "There are great quantities of mussels in the creeks and thoroughfares of the marshes. They are usually attached to sods and roots in the banks, entirely covering the surface of such objects. They could be very easily and cheaply collected, by detaching them from the sods, by the use of a sharp spade, and by loading them directly into boats. The animal matter and the lime of their thin shells are both valuable for manure, and could be advantageously used.

The value of mussel beds for manure is given in an article from Essex County, Mass., published in the Country Gentleman, vol. 7, p. 155: "Thousands of cords of mussel beds are annually taken from the bed of the streams bordering on the sea, and used on grounds cultivated. I have repeatedly witnessed the value of this fertilizer in the growing of carrots and onions. The very best crops of carrots I saw the last season, more than 34 tons to the acre, had no other fertilizer applied to the land. For the last thirty years I have known it applied to lands on which onions have been grown, with a product varying from 300 to 600 bushels to the acre. It sells, delivered several miles from where it is dug, at $4 or $5 the cord. It is usually gathered in the winter months, taken to the shore in scows or gondolas, and thence to the fields where it is used. Sometimes it is laid in a pile of several cords together, and after it has been exposed to the frosts

of winter distributed from 4 to 8 cords to the acre. At other times it is laid out in heaps of a few bushels only, which remain for a time exposed to the frost."

"Mussels and star-fish (five-fingers)," says a writer in the Agricultural Gazette, "have long been an established manure in the neighborhood of Faversham, Kent. They are procured by dredging. The mussels sell at 16*s.* sterling per wagon, and five-fingers at 21*s.*"

At present in Southern New Jersey mussels are got in great quantities through the summer at the inlets in Little Egg Harbor and south of Beach Haven. The shore farmers gather them for home use, during the slack days of August, and the clammers work at procuring them and bringing them to sell to the farmers at irregular times and places, to as great an extent, no doubt, as on Long Island. The measure is usually a wagon load of 30 bushels, for which $1.25 to $1.50 is charged. No statistics of the amount thus disposed of could be procured. Horseshoe Bay (where Raritan Bay rounds into Sandy Hook) is the favorite scene of mussel gathering in the northern part of the State, but only enough for the fields next to the shore is taken annually.

Along the eastern half of the south shore of Long Island exists a similar industry. They are taken with oyster tongs and rakes in summer, and sold at 3 cents a bushel, 200,000 bushels according to Fred. Mather being turned into manure between Moriches and Babylon in 1880, Elsewhere perhaps 50,000 bushels are so used.

Summarizing all, gives values as follows:

100,000 bushels to New York market, at 20 cents	$20,000
250,000 bushels on Long Island, at 3 cents	7,500
250,000 bushels in New Jersey, at 4 cents	10,000
Total, 600,000	*$37,500*

5.—THE ABALONE FISHERY.

The family of the abalone-shells, ormer-shells, or sea-ears (*Haliotidæ*) is a large one and has considerable commercial importance in various parts of the world. Though well represented on the eastern (European) shore of the Atlantic, yet there are none on the Atlantic coast of North America, nor anywhere in South America, while they abound along our Pacific from Cape Saint Lucas to Kamtchatka and also in Japan and Australasia.

In California these mollusks are all known as "abalone," which is said to be a corruption of Spanish *aulon* or *aulone*. The Indians, again, who used the shining shells very largely as ornaments and also worked them into coin, called it *whilo;* the money itself they knew by the same name, and usually handled it in separate pieces, which served as gorgets, girdles and head-dresses when not passing in trade.

The gleaming, nacreous, highly tinted beauty of the sea-ears has proved attractive not to savage eyes alone. In Europe they are extensively employed for inlaying work, in decorating fancy sign-boards, in ornamenting articles in papier-maché, and in making fancy buttons, studs, buckles, &c. They are sometimes called in trade "aurora shells," and one of the seventy or more described species abounds in the Channel Islands under the name of "ormer," "ormier," or "omar,"* where it is cooked for food after being well beaten to reduce its toughness.

* This word is contracted from *oreille-de-mer* of the French. The Portuguese name is *Lapa burra*. The Italian, *Orecchiale*, and the Sicilian, *Patella reale*. Cherbourg fish-woman, according to Jeffreys, call it *si les (six yeux)* from an idea that the orifices in the shells are real eyelets or peep-holes. The Eolians gave it the pretty name of Venus's ear. It is the mother-of-pearl or Norman shell of old English writers, the last name perhaps corrupted from the same origin as "ormer." These shells are popularly spoken of as sea-ears, and the scientific name is *Haliotis*, from the Greek *halios*, marine, and *otis*, ear. Ear-shell and abalone are the usual American appellations.

"The people of Guernsey and Jersey" says Simmonds, "ornament their houses with the shells of the ormer, disposing them frequently in *quincunx* order, and placing them so that their bright interior may catch the rays of the sun. Some of the large and splendid intertropical species, which, after removing the outer layer, take a polish almost equaling the natural brilliancy of the interior, might be converted into dishes for holding fruit. If mounted with good taste, their indescribable iridescence and prismatic colors would materially add to the richness of an elegant table."

On the Pacific coast of the United States, especially in Southern California, the gathering of *Haliotis* shells, or abalones, affords employment to a large number of persons, and a considerable commerce has sprung up, which is chiefly in the hands of the Chinese.

That this should be so is very natural. At home the Chinese were, and are yet, accustomed to dry the flesh of their own *Haliotis*. Finding in California the same luxury, they at once began to gather the abalones for the sake of the meat, which they dried and salted and sent home to China at a good profit. After a time white men began to gather up the shells thrown away and work them into polished mantle ornaments and articles of jewelry. Thus apprised of their value, the Chinamen also saved all the shells they got, and soon found this half of the catch brought more money than the flesh. For three or four years past the business in these shells has been very extensive; but fears are felt for its future, since the mollusks are being rapidly exterminated along the whole coast.

The species which enter into this western industry are said to be four:

Haliotis cracherodii.

San Francisco to Lower California.

Haliotis splendens.

San Diego and adjacent islands.

Haliotis corrugata.

Santa Barbara to San Diego and Catalina Island.

Haliotis rufescens.

Mendocino County southerly to Saint Nicholas Island.

The first named of these is the ordinary abalone of commerce; the last is northern and rarely seen, but was the one most employed by the Indians for making *ukilo* money and ornamental disks.

Late information and partial statistics of the abalone fishery are furnished by the investigations of Messrs. David S. Jordan and W. N. Lockington of the Census Office, whose figures are for the year 1879. They inform us that the abalone producing region embraces the coast of California from San Francisco to the southern boundary; also the peninsula of Lower California and the opposite shores of Mexico. Those credited to San Diego County and San Francisco in the appended table are largely derived from Mexican waters. Until lately the Mexican Government paid no attention to the depredations of the abalone fishers on their coasts; but now a consulate has been established at San Diego, and a license duty of $60 a year is placed upon every boat from the United States going in search of these shell-fish in their waters.

In respect to San Diego County it appears that "most of the abalones are collected by Chinamen, who have already stripped the coast as far south as Cerros Island. There are eight companies of them now between there and San Diego; four of these companies belong at San Diego, and combine this labor with 'red-fishing.' During the first week of January, 1880, alone, their sales amounted to 10 tons of shells, worth (then) $450, besides the meat they saved, which is worth 5 cents a pound in San Diego City."

In Los Angeles County the white men control two-thirds of the trade, deriving their stock mainly from Santa Catalina, San Clemente, and adjacent islands.

Ventura ships very little, and what comes from her coast is mainly in Santa Barbara boats.

In Santa Barbara County, however, more is done, a schooner called the Surprise being constantly employed in taking Chinese colonies to the various islands, and receiving the shells to pay for the transportation, while the Chinamen retain the flesh for their own profit. Various Californians also work at it irregularly, and there are a few Chinese permanently located along the coast near Point Concepcion and Point Arguello.

The entire sea-front of San Luis Obispo County is bordered by detached rocks, and is therefore very favorable to the growth of Haliotides. San Simeon, Cayucos, and Port Harford are the principal points of shipment, and thence the abalone fishermen, principally Chinese, send their catch to market.

Monterey County contributes a small quota, and there is also a colony of Chinese on Santa Cruz, and another on Santa Rosa Island collecting abalones; but the exact account of what they do was not ascertained; their probable product is included in the following estimate table under the head of San Francisco:

Summary table of the abalone fishery in 1879.

County.	Meats.		Shells.		Total value.
	Pounds.	Value.	Pounds.	Value.	
San Diego	280,000	$14,000	1,400,000	$30,000+	$44,000+
Los Angeles	160,000	8,000	800,000	18,000+	26,000+
Ventura	20,000	1,000	100,000	2,500	3,500
Santa Barbara	100,000	5,000	500,000	12,500	17,500
San Luis Obispo	15,600	780	23,500	575	1,355
Monterey	12,000	600	60,000	1,500	2,100
San Francisco*	190,000	9,500	950,000	23,750	33,250
Total	777,600	38,880	3,833,500	88,825+	127,705+

*Those credited to San Francisco are taken in the neighborhood and the off-shore islands, by Chinese.

Concerning the habits of the Haliotides little need be said. They dwell upon weed-grown rocks not far from the low-water line and feed upon the sea vegetables. Their foot is "very large, rounded at the ends and fringed with thread-like tentaculæ, which, when the animal is protruded from the shell below the surface of the water, are gently swayed with a somewhat vibratory motion." They move very little and with great slowness. The broad muscular foot is adapted less to locomotion than for adhesion, and so strong is the force with which they cling to the rock, withdrawing their protracted lobes and squatting flat down at the least disturbance, that it often is exceedingly difficult to detach them, even with the aid of the trowel or spade to slip under them which is usually carried by the fishermen. Another method is to pour over them a small quantity of warm water, and then give them a sharp push with the foot sideways.

There is a grisly story of a poor Chinamen, who discovered a large abalone left bare by the tide and partly exposing his mantle-lobes. The man had no spade with him, but attempted to tear the mollusk up with his fingers. No sooner did the abalone feel his touch, however, than it shut down, pinching the Chinaman's fingers between its shell and the rock so tightly that he could not pull them away before the tide, rising with cruel speed, had drowned him in this creature's clutch. Whether or not this be an "ower true tale," it illustrates the strength with which the mol-

lusk holds to its site—a power of anchorage necessary when storms beat upon its native rocks with almost resistless force.

The tenacity of life of this mollusk seems equal to its hold upon the rocks. Dr. R. E. C. Stearns, of San Francisco, writes that he has frequently removed the animal from the shell by means of a sharp knife and thrown it into the water, when "it would at once descend and place itself in its normal position upon a rock, to which it would adhere with apparently as much tenacity as before it was deprived of its shelly covering."

The meat of abalone has long formed an article of food in various parts of the world—Senegal, the South Sea Islands, Malaya, China, Japan, and our Pacific coast. It is said to be "exceedingly nutritious, but indigestible." In San Francisco it is rarely eaten except by Chinamen, who are the only ones who gather it. A simple process of salting and drying is all that is necessary for its preservation, after which the larger portion of every season's crop is exported to China. In order to get a ton of meat about 6 tons of living animals must be gathered, but how many individuals this represents cannot be stated. After being cured abalone meat is worth about 5 cents a pound or $100 a ton in San Francisco; and the value of the crop in 1879 was nearly $40,000. The number of men employed is unknown, but amounts to some hundreds. The coast is so stripped of haliotis now, that the Chinamen are compelled to resort to unfrequented islands, transportation to which is afforded them by American capitalists, who take their pay in shells, while the Chinese retain the meats.

The trade in abalone shells, indeed, is of twice as much importance, financially speaking, as that of meats, since it amounts to nearly $90,000 annually. Some Americans also are engaged in this business, and the finishing-off of the shells for market is wholly in their hands.

The shell of haliotis is one of the most brilliantly beautiful in its interior of any known. The lustrous, iridescent curves of the nacre delight every eye, and is due to a peculiar cellular structure of the laminæ which make up the shell. In aged specimens the part to which the muscle is attached is raised above the level of the rest of the interior and presents a roughened or carved surface of irregular shape, often fancifully imitative of some other object. The writer has seen one which thus contained a singularly correct profile of Napoleon I.

Outside the shells are usually rough and unattractive, but support a small forest of minute vegetable and animal forms very interesting to a naturalist. A curious case is mentioned by Dr. Stearns where a haliotis had been attacked by another mollusk, a boring bivalve, known as *Navea*, which had cut its way through the shell. Advised of this enemy, the haliotis had defended itself by adding coating upon coating of nacre, as a bulwark between him and his foe, until, as the *Navea* progressed, a large knob was built in the interior of the abalone's shell.

The shells are usually sent to San Francisco from the lower counties of the State in the rough. In addition to the regular trade, the captains of coasters often make a special trip, or pick up return cargoes, and speculators venture with a single cargo or two now and then. This is the sort of supply which is credited to San Francisco in the above table, in addition to the regular trade owned there.

The price paid for them by the merchants varies greatly, running from $40 up to $90 a ton; an average price last year would be $50 or $60. From San Francisco they are shipped to China, Europe, and the Eastern States. In China they are broken up and used for inlaying in connection with the lacquer-work for which the Chinese are famous. The mosaics of Europe are often adorned in the same way, various arts are served by their glittering fragments, and in Guernsey their scintillating surfaces, dangling from strings on the top of poles, become effective in frightening birds from the grain-fields. Many of the shells sent to Europe are polished with the help of acids

and reshipped to the United States, where they are valued as mantle ornaments, toilet-soap basins card-cases, and receptacles for flowers. The same work is done to some extent in San Francisco. Mr. Lockington reports that many are there manufactured into combs of various descriptions, perticularly ladies high hair-combs of great elegance and costliness, for which there is a large demand.

At San Diego, according to Prof. Jordan's notes, one gentleman sold about $1,500 worth of polished shells during 1879, at from 25 cents to $5 each according to size and beauty. Most of these were sent to the East by mail in "nests" of four to six, at $2 to $5 per nest. Many are also sold to tourists. In polishing, the young of *Haliotis splendens* are treated with diluted hydrochloric acid. Other species and the adult of *splendens* are ground down on stones by hand, until the rough exterior is removed and the lustrous under-layers are revealed. Steam grinding wears them away too fast and holes result, unless the operator is very careful. After grinding, the shells are varnished.

Some persons suppose that the four, six, or eight round holes which are seen along the ridge at one side of the abalone shell are designed by the man who polished it. But this is a mistake. Through those holes, when the animal sits close down upon the rock, he derives the pure water necessary for his breathing. From them also protrude little horns or feelers, by which he is warned of the approach of any danger.

To the Indians of California the haliotis was very valuable. They wore it as an ornament about their necks and in their hair. The tribes of the interior were so attracted by its glitter that they were willing to pay a large price in barter to possess it. A horse was not an infrequent price for a fine shell. The coast tribes also made from them beads and coin of different values and shapes. These were all made from the red-backed abalone, *Haliotis rufescens*. Mr. Stephen Powers, describing this shell money, says:

"The uhllo pieces are of a uniform size on the same string; they do not mix them. The dollar pieces are generally about one and a fourth inches long and an inch wide, the smaller about as long, but narrower. A couple of fragments I picked up in an old Indian camp are worth 25 cents each. The Indians are very ingenious and economical in working up the aulones. Wherever there is a broad flat space they take out a dollar piece; where the curve is sharp, a smaller one. They especially value the outer edge of the whorl or lip, where the color is brilliant, and these they are obliged to cut in 25-cent pieces. You will see that the uhllo is cut into pieces of different sizes, and even pieces of the same size vary in value according to their brilliancy. * * * All the money that I have seen was strung on grocery twine, but they often use sinews of various kinds, also the outer bark of a weed called milkweed about here.

"The uhllo necklace has three or four strings of very small glass beads above the shells, forming a band about one-quarter of an inch wide, which encircle the neck."