

United States Commission of Fish and Fisheries,
Marshall McDonald, Commissioner.

MAP SHOWING
THE EXTENT AND LOCATION
OF

BEDS OF THE GIANT SCALLOP

OPERATED ON THE COAST OF MAINE

DURING THE YEAR

1889

Accompanying a Report on The Scallop Fishery of Maine

By

Hugh M. Smith

Note. The black areas indicate the beds.

16.—THE GIANT SCALLOP FISHERY OF MAINE.

BY HUGH M. SMITH.

(With Plates CXII-CXVI.)

A.—INTRODUCTION.

The fishery for scallops on the coast of Maine is an industry of such comparatively recent inception that the general fishery interests, except those directly concerned, are, as a rule, misinformed of its extent and character, or wholly ignorant of its existence. Although the industry gives employment to several hundred persons; has considerable capital devoted to it; yields large quantities of a highly esteemed and valuable food product; and is capable of great improvement and development, it appears to have received little attention, and the first investigation of its nature and extent was undertaken by the U. S. Fish Commission in 1889.

As an illustration of the paucity of information on the subject, the writer would quote a well-known authority on mollusks. Speaking of the scallop which is the object of the fishery in Maine, Winslow says:

The species is not abundant nor of commercial importance. It is available for food, however, and is occasionally used as such.*

This may be said to represent all that has been published on the giant scallop viewed from a commercial standpoint. At the time at which Winslow wrote, the foregoing statement was no doubt substantially correct. But conditions have changed; and it is the province of this paper to show that in many localities the species is very abundant and of great and growing economic value; and the fishery is thought to be of sufficient magnitude and importance to warrant the detailed discussion which follows.

The writer is indebted to the following-named persons for valuable data based on original observations on scallops and the scallop fishery adjacent to their homes: Messrs. L. F. Gott, of Tremont; F. W. Lunt, of West Tremont; W. W. A. Heath, of Seal Cove; S. D. Gray, of Cape Rosier; J. M. Vogell, of Castine; and John E. Kelly, of North Boothbay. Acknowledgment of the courtesies extended by these gentlemen is hereby tendered.

* London Fisheries Exhibition, 1883. Catalogue of the Economic Mollusca, by Lieut. Francis Winslow, U. S. Navy, Washington, 1883.

B.—NATURAL HISTORY OF THE GIANT SCALLOP.

1.—THE COMMON AND SCIENTIFIC NAMES.

The large pecten of which this paper treats is known among fishermen and others by several names. In localities in which it is the only representative of the genus it is called simply "scallop." In other sections, where the small scallop (*Pecten irradians*) is also found, the designations "giant scallop" and "great scallop" are given with reference to its size, and "smooth scallop" to distinguish it from the conspicuously crenated shell of the common species; the latter name also suffices to differentiate it from the strongly-ribbed valves of *P. islandicus*, a comparatively large deep-water form occurring in abundance off the same coasts adjacent to which the smooth species is found. The name giant scallop is herein adopted as being expressive and appropriate. Capt. J. W. Collins states that at places on Penobscot Bay the fishermen call the species the "hen clam."

The species, or a very closely related form, was first described by Say as a fossil from the Miocene of Virginia and called *Pecten clintonius*. Under various other names* recent specimens were described by Lamarck, Mighels, Linsley, Stimpson, and others.

It is now held by some writers that the fossil and living forms are identical, and the name advanced by Say in 1824 has consequently been adopted by them. The following remarks on this subject are by Professor Verrill:

A comparison of specimens of this Miocene species, from Surrey, Virginia, with the more strongly ribbed, deep-water form hitherto recorded by me as *Pecten tenuicostatus*, var. *aratus*, shows that they are in all respects essentially identical. In the fossil specimens the ribs are much stronger and more regular than in ordinary specimens of *P. tenuicostatus*, but not more so than in many deep-water specimens taken in 65 to 125 fathoms, off Martha's Vineyard; while among the numerous specimens dredged by us, all gradations [occur] between the strongly ribbed form and those forms common in shallow water, in which the ribs are much more slender, indistinct, or almost obsolete. The forms of the main shell and of the auricles are the same, however, in all these varieties. The fossils, like all the recent specimens, show the peculiar fine, oblique striae or vermiculations between the ribs, both on the body of the shells and on the auricles. In the fossil specimens the ribs, especially those towards the ends of the shell and on the auricles, are crossed by the raised lines of growth in such a way as to form small, rather close, distinctly arched, raised scales; this character, which is not usually seen in the smoother, shallow-water form is found in many of the deep-water specimens quite as prominently or even more so than in the fossils.

There being no doubt, therefore, of the identity of the fossil and the recent shells, the name *Clintonius* should be adopted for this species, on account of its priority, while the name *tenuicostatus* may well be retained to designate the ordinary smoothish, mostly shallow-water variety, found on the New England coast. This name was originally given by Dr. Mighels to very young specimens of this smoothish variety, under the impression that they were a distinct species, but he afterwards recognized the fact that they were only the young of the common species, at that time generally known as the *Pecten magellanicus* Lam.†

* The principal synonymy of the scallop is as follows:

Pecten clintonius Say, Jour. Acad. Nat. Sci. Phil., iv, 1824, p. 124, pl. 9, fig. 2.

Pecten tenuicostatus Mighels, Proc. Bost. Soc. Nat. Hist., i, p. 49, 1841 (young). This is the preferred name in most recent works.

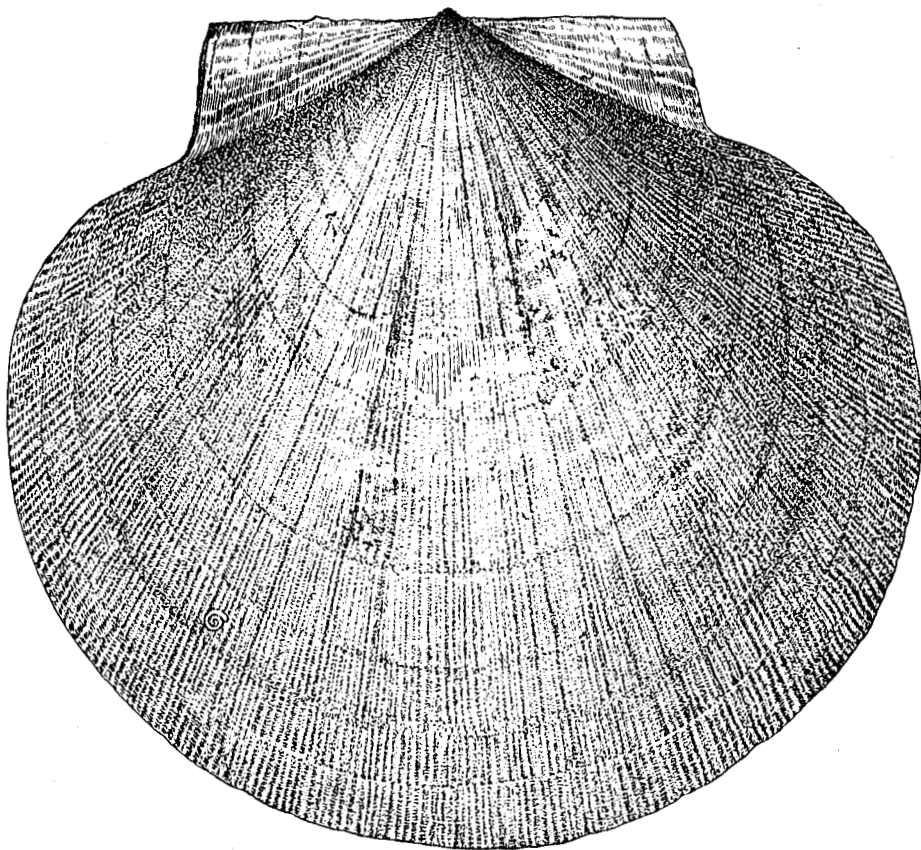
Pecten fuscus Linsley, Amer. Jour. Sci., XLVIII, p. 278, 1845.

Pecten magellanicus Lamarck, Anim. Sans. Vert., ed. II, vol. VII, p. 134.

Pecten brunneus Stimpson, Shells of New England, 1851.

Pecten principoides, Emmonds, Report N. C. Geol. Survey, 1858, p. 280, fig. 198.

† Trans. Conn. Acad., vol. VI. Catalogue of Mollusca of New England Coast, part I, pp. 260-261.



GIANT SCALLOP (*Pecten magellanicus*).
Two-thirds natural size.

Prof. William H. Dall, the honorary curator of the department of mollusks in the U. S. National Museum, in his "Catalogue of the Shell-bearing Marine Mollusks and Brachiopods of the Southeastern Coast of the United States,"* gives preference to the designation of Lamarek, and, under date of October 22, 1890, in reply to an inquiry, writes:

The name *Pecten magellanicus* is by far the oldest, and, in the uncertainty as to the standing of several fossils which have been referred to the species in question, is the one I have adopted.

2.—GEOGRAPHICAL RANGE.

Professor Verrill, in his "Report upon the Invertebrate Animals of Vineyard Sound,"† gives the range of the giant scallop as extending from Labrador to New Jersey. He states that it is rare or local south of Cape Cod. Later explorations have disclosed the fact that the species occurs as far south as Cape Hatteras, and is abundant in many places off the southern coast of New England.

Locally it has been found in the waters of Labrador, Nova Scotia, Bay of Fundy, Passamaquoddy Bay, Frenchman's Bay, Penobscot Bay, Bagaduce River, Sheepscot River, Casco Bay, Massachusetts Bay, George's Bank, Block Island, Connecticut, New York, New Jersey, Virginia, and North Carolina. The mollusk is thought to be most abundant in the Gulf of Maine, off the coasts of Maine and Massachusetts, where several thousand specimens have been brought up from deep water at a single haul of the beam-trawl on the U. S. Fish Commission exploring steamers *Albatross* and *Fish Hawk*.

3.—BATHYMETRICAL RANGE.

The depth at which the scallop has been ascertained to occur varies with the locality, but generally speaking may be said to range from 1 to 150 fathoms for living specimens; dead shells have been dredged at a depth of 400 fathoms. Verrill cites the depth in different sections as follows: Labrador, 2 to 15 fathoms; Frenchman's Bay, 3 to 10 fathoms; Passamaquoddy Bay and Bay of Fundy, 1 to 109 fathoms; Massachusetts and Casco Bays, 4 to 80 fathoms; George's Bank, 45 fathoms. Detailed figures showing the depth of the numerous beds of scallops on the coast of Maine that have been operated by the fishermen are given further on under the head of "Fishing Grounds."

4.—DESCRIPTION OF THE SCALLOP.

Dr. R. E. C. Stearns, of the Smithsonian Institution, is to be credited with the following graphic account of the anatomy of the scallop; although it applies more strictly to the species with crenated valves, the description is no doubt almost equally appropriate to the one under consideration:

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 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

* Bull. 37 U. S. Nat. Mus., 1889.

† Report U. S. Commissioner of Fish and Fisheries, 1871-'72, pp. 295-747.

also adorned with a row of conspicuous round black eyes 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 scallop has been described as "orbicular, rather higher than long, thin and translucent when young, thick, strong, and opaque when mature, equilateral, inequivalve, the lower valve being nearly flat and not attaining the edge of the upper valve by an eighth of an inch or more; upper valve moderately convex, valves widely gaping near the hinge, surface everywhere sculptured with radiating punctured lines or grooves about half as wide as the spaces between them, somewhat zigzag in their course. These lines are crossed by closely arranged lines of growth, which on the convex valve are scalloped or vaulted over the radiating lines; flattened valve white, convex valve dingy, reddish-brown, or flesh-colored. Hinge margin narrow, straight, ears equal, the notch in the lower valve rounded and shallow. Interior white, smooth, glossy, with minute radiating lines not corresponding to the exterior grooves." †

5.—SIZE, GROWTH AND DEATH, HABITS, ETC.

The scallop shares with other deep-water mollusca the obscurity concerning their life history which is thrown around them by the great difficulties in the way of a comprehensive research. The commercial fisherman, as a rule, is not a close observer of inconspicuous vital phenomena, and he can not be expected to depart beyond a certain point from the realms of practical business to delve in the domain of natural science. In the case of the particular species under consideration, the writer found that what would in almost any other sphere have been an exhaustive inquiry was almost barren of results. Until the establishment of large marine aquaria, in which the lives of fish, crustaceans, mollusks, and other orders can be studied with but little or no departure from the natural conditions, it would appear that a complete knowledge of the habits and of the most practical methods of propagation, cultivation, and protection of many of our important water animals will always be lacking.

Viewed from the standpoint of size alone, the giant scallop is probably the largest edible mollusk on the Atlantic coast of the United States. The average diameter of the specimens taken for market on the coast of Maine is about 5½ inches, although much larger individuals are not uncommon, and those the size of a nickel coin are sometimes brought up. The largest examples recorded from Mount Desert, Castine, and Little Deer Isle have been 9 inches in diameter. The edible muscular portion of a scallop of this size is about 3 inches in diameter and weighs 9 or 10 ounces. The average size of the "meat," however, is a little more than 1 inch in diameter.

The general impression among fishermen is that the scallop is a rapid grower, reaching maturity in a few years. In this respect the giant scallop agrees with the prob-

* Overland Monthly, April, 1873.

† Gould, Invertebrates of Massachusetts, 1870, pp. 196, 197.

able rate of growth in *P. irradians*, which has been more thoroughly studied than any other species in this country. The basis for the belief that the scallop attains the proximate limit of size in a few seasons is that frequently, in the spring, when the fishermen visit a ground on which they have worked the previous fall, the scallops are found to be so small that it hardly pays to take them, while in the succeeding autumn and winter they are as large as in the previous year.

Mr. Heath states that the fishermen of Mount Desert Island find the scallops that are 4 or 5 inches in diameter to be the cleanest, brightest, and liveliest. Those of 8 inches look old, their shells are dingy, rough, and brittle, and are apt to be more or less honeycombed by the chambers of the boring-sponge.

The duration of the life of a scallop after reaching maturity is thought to be quite brief. Some fishermen think that it dies within one year, and it seems probable that the life term is normally not more than 5 or 6 years.

Mr. Benedict, as the result of observations off the Massachusetts coast, thinks that exceptionally at least the scallop attains great age. Mr. Vogell, of Castine, has also seen specimens that were so large, thick, and tough that he estimated their age at not less than 15 years.

Unlike many mollusks, the scallop has the interesting and useful accomplishment of free locomotion in the water. By means of the powerful adductor muscle the animal is able to rapidly close its valves and to forcibly throw out the water between them. The resistance thus arising tends to swiftly propel the mollusk in the opposite direction by a series of short jerks. Few fishermen are aware of this phenomenon and few persons have ever witnessed it, owing to the depth at which the swimming operations usually occur. The sight of a school of scallops moving in unison through the water is said to be a very striking one. The small shallow-water species (*P. irradians*) is frequently seen swimming, or "dancing," as the sliding motion is termed; but only here and there on the Maine coast are fishermen found who have actually observed the habit in the giant scallop.

This faculty of the scallop is probably exercised when in search of new feeding-grounds or of water of a more congenial temperature. It is a matter of personal experience with the fishermen of certain localities to find that the scallop beds shift from time to time, although these wholesale migrations are not nearly so extensive as might be supposed and in some localities are unknown, although not for that reason alone necessarily absent. Inquiry in the vicinity of Mount Desert Island failed to elicit the knowledge of any perceptible change in the position of the beds in that vicinity, which have been operated from the same positions since the establishment of the fishery. Mr. Vogell, speaking of the beds in the vicinity of Castine, says they do sometimes shift, and that there will at times be good fishing on a ground which a week before was destitute of scallops. He assigns the search for food as the cause of the movements. Mr. Gray, of Cape Rosier, has observed that in the summer, after the water becomes warm, the scallops are apt to leave the sites frequented during the cooler months and seek deeper water or retire to grounds with a different character of bottom. The general opinion among fishermen in that section is that upon the return of cold weather, about October 1, they "pod up" on hard, pebbly shoals, with a strong current, for the purpose, it is supposed, of undergoing the reproductive process. Information received in the fall of 1890 stated that no scallops were being found on some grounds that were profitably worked in the spring of the same year, while new

beds were discovered in spots on which no scallops were previously known. In the same locality beds have apparently shifted in a single day; but such striking migrations are thought to be undertaken only by small bodies of scallops.

6.—PARASITES OF THE SCALLOP.

(a) *Crabs*.—Like the oyster, the scallop is the host of a species of crab (*Pinnotheres maculatum*) peculiar to it and to the common mussel (*Mytilus edulis*). This parasite is lodged in the gill cavity of the mollusks and appears to exert no injurious effect on their life or growth. Mr. Rathbun writes regarding it:

It attains a larger size than the oyster-crab, and, as in the case of the latter, the females alone are parasitic, the males having only been found swimming at the surface of the sea. We have never heard of this species being eaten, probably because neither the mussel nor the smooth scallop has ever been much used as a food in this country. In the summer of 1880, while dredging off Newport, Rhode Island, the United States Fish Commission steamer *Fish Hawk* came upon extensive beds of the smooth scallop, from a bushel of which nearly a pint of these crabs were obtained. Again, in 1881, the same species was encountered in great abundance by the same party in Vineyard Sound, in *Mytilus edulis*. As an experiment, they were cooked along with the mussels and found to be very palatable, although their shell is, perhaps, somewhat harder than that of *Pinnotheres ostreum*.*

Mr. F. W. Lunt, of West Tremont, Maine, informs the writer that four or five crabs are sometimes found lodged in a single scallop, and that even as many as ten have occasionally been observed. That the crab is not a constant inhabitant is well known, and some fishermen have never seen it. Mr. L. F. Gott, of Tremont, in preparing several hundred bushels of scallops for market, did not find a single crab.

So far as can be learned, the crabs are never eaten on the Maine coast.

(b) *Boring-sponges*.—The shells of many scallops, but more especially those of larger size, are more or less eaten by a boring-sponge (*Oliona sulphurea*), which attacks the shell and honeycombs it in all directions. The upper valve appears to be more frequently affected. Ordinarily the sponge does not pierce the hard, glistening, inner lining of the shell, but confines its ravages to the softer outside layers. When the nacre is perforated, however, the irritation produced causes the scallop to throw over the opening a secretion of lime salts which quickly repairs the injury, and no harm results to the animal. The inner surfaces of some specimens are covered with small papillary elevations that are supposed to have been produced in this way.

The fishermen, as a rule, do not think the sponge is responsible for the borings seen in the shells, but attribute them to a small worm that finds a shelter in the sponge. This worm is by some fishermen thought to be a real enemy of the scallop, and it is said that specimens of the mollusk are often found that have been bored through and killed by it.

The truth of the matter seems to be that the chambers and channels seen in the scallop-shell are made by the boring-sponge, which may sometimes cause the death of the animal by irritation or otherwise. After reaching a certain age the sponge generally dies, and the unoccupied recesses are then appropriated by a worm which is harmless so far as any power to bore through the shell is concerned. Mr. Richard Rathbun, to whom I am indebted for the foregoing suggestion, informs me that there is no worm affecting the shellfish in our waters that is capable of puncturing a shell,

*The Fisheries and Fishery Industries of the United States. Section 1, text, page 766.

although there are numbers of species that frequent the recesses and holes made by boring-sponges, etc.

(c) *Fish*.—A small fish of the genus *Liparis* (the "sea snails," so called) is sometimes found in the scallop, where it goes for protection. It is supposed that in escaping from an enemy it darts between the open valves of a scallop, and these, closing, imprison the fish. It appears to exert no injurious effects on the mollusk, and, no doubt, is glad to escape as soon as the captor opens its valves.

(d) *Annelids*.—A number of species of worms are parasitic on the shell of the scallop. The worm tubes of some of them are large and strong, and, with the sponges, often bind the scallops together in a dense mass, as mentioned hereafter.

A small annelid of the genus *Spirorbis* occurs abundantly on specimens of the scallop collected by the writer in Maine; the species is shown on the accompanying figure of the scallop shell.

C.—THE FISHERY.

7.—ORIGIN, DEVELOPMENT, AND PRESENT CONDITION

In the numerous accounts of the scallop fishery contained in "The Fisheries and Fishery Industries of the United States," there is no reference to this industry in Maine, and it may, therefore, be assumed that in 1879 and 1880, the years embraced by that work and prior thereto, the species was unknown as an economic product.* Inquiry has failed to disclose the whereabouts of the giant scallop fishery referred to by Ingersoll (see foot-note), which was discontinued on account of the depletion of the beds brought about by excessive dredging; but it is well known that in certain localities this species of scallop has been used for local consumption for many years.

The existence of large beds of the giant scallop on the coast of Maine, accompanied by an appreciation of their commercial value, became known to fishermen at a number of isolated places about the same time. From numerous inquiries among the fishermen along different portions of the coast, it would appear that in no locality is the fishery more than five or six years old, while in most of the centers it has been carried on less than three years, as will appear from the following history of its origin in the various sections:

Beginning at the east, the towns in the waters adjacent to which the scallop fishery is or has been prosecuted, are Tremont, Mount Desert, Deer Isle, Sedgwick, Brooksville, Castine, Wiscasset, Edgecomb, Newcastle, Westport, Boothbay, and Georgetown.

On the western side of Mount Desert Island, in the town of the same name, the fishery for scallops originated in 1884. It was inaugurated by vessels coming from the

* In his monograph on the scallop fishery, in volume 2 of section v of the above report, Mr. Ingersoll says (p. 570):

"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 excessive raking and dredging for them."

It is suggested that Mr. Ingersoll was probably referring to *P. magellanicus* and not *P. islandicus*, which is a species inhabiting very deep water and never the object of a fishery, or but sparingly used for food, so far as known. This view is borne out by the fact that in a subsequent paper on "The Scallop and its Fishery," published by Mr. Ingersoll in the *American Naturalist* (1886), substantially the same thought is expressed, *P. tenuicostatus* being substituted for *P. islandicus*.

westward and, at first, using an oyster dredge, and later the more effective form of apparatus which has since been generally adopted by the fishermen of this and other localities. The first trials were made in the deep water in the vicinity of Bartlett's Island, Pretty Marsh, and Mount Desert. It would appear that prior to the advent of these vessels the fishermen of Mount Desert were unaware of the existence of scallop beds in their vicinity, or at least of scallops in sufficient numbers to warrant their shipment to distant markets, although, according to Mr. W. W. A. Heath, the efficient and accommodating customs officer at South West Harbor, the line fishermen in the vicinity of Mount Desert Island had for years frequently brought up scallops that had by chance become attached to their hooks. In the winter of 1885-'86 the native fishermen became interested, and as many as twenty men from Bartlett's Island and Pretty Marsh were regularly engaged in taking scallops for the New York market. From that date the fishery declined somewhat, owing, it is said, to the exhaustion of certain of the beds incident to overfishing. In 1887 but four men gave attention to it, and in 1888 and 1889 only seven.

In Tremont the fishery sprung into existence about the same time as in Mount Desert, probably as a result of the same impetus. It is now followed from The Center, West Tremont, or Goose Cove, and Bass Harbor, the fishermen frequenting grounds near Bartlett's Island and other localities south of that place. The number of men engaged in the fishery in the town has decreased during the past few years, there being thirty-one in 1887, twenty-three in 1888, and eighteen in 1889.

The winter of 1886-'87 witnessed the beginning of a scallop fishery at Little Deer Isle which was destined to become the most important fishery of the kind in the State. In 1886 a vessel from Portland visited the grounds off the southern shore of the island, and during that year took considerable quantities of scallops. The native fishermen quickly appreciated the commercial value of their beds, and in 1887 no less than twenty-six persons were regularly engaged in the fishery. More than 5,000 bushels were the result of the first year's operations. Since then the industry has more than doubled in importance, and in 1889 the yield was more than one-fourth that of all other localities combined, although the output of the numerous towns on the Sheepscot River, considered collectively, was considerably larger than that of Little Deer Isle.

The existence of giant scallops in the vicinity of Castine has long been known. Men are still alive who remember to have taken scallops as many as forty or sixty years ago. The town has had a more or less regular local supply for about forty years. Twenty-six years ago, as the writer is informed by Mr. Vogell, a man attempted to make a business of peddling scallops among the people living in places remote from the fishery; but the fine edible qualities of the mollusk were not appreciated by them, and the venture was abandoned. About 1876, the Castine Packing Company undertook to put scallops on the market in a canned condition, as is now so commonly done with clams in many localities on the coast of Maine. It is said that the company was unable to properly preserve the thick, solid meats, and the effort was abortive. Six years ago, however, the attempt was renewed and was in a measure successful. It was found that by previously frying the meats they could be canned without difficulty, but the method was considered too costly and was not put to much practical use; and the fishery, which would otherwise have been maintained by home demand, was diverted to supply distant markets.

The business of taking scallops for shipment to western cities began in the fall of 1884. In the early history of the industry the shipment of 50 gallons of meats in one day was considered very large. Since then the fishery has grown uninterruptedly and reached large proportions, and at times during the past five years as many as 1,000 gallons have been in one day shipped from Castine by the fishermen of that town and Cape Rosier, while the yearly output in favorable years is over 5,000 gallons. Twenty-four men were engaged in this fishery in 1889, a larger number than had previously been employed in the town in any one year.

The fishermen of Cape Rosier frequent waters similar or adjacent to those of Little Deer Isle, and became interested in the fishery about the same time. From thirty-one to thirty-six persons have followed the business each year, the number in 1889 being larger than in any previous season.

Two fishermen from Sedgwick plied their operations in 1888 and 1889 on the same grounds visited by the Little Deer Isle fishermen, but did not engage in the fishery prior thereto.

The history of the scallop fishery in the Sheepscot River dates from 1887. It is stated that the existence of beds was accidentally ascertained by scallops becoming entangled in lobster traps. The discovery was immediately put to practical use. A fisherman of the town of Westport made a dredge adapted to bringing up scallops, and operated it with gratifying results in the river opposite that place. Within a short time other boats were fitted out from the various towns on the river, and the fishery was established on quite a large scale. Two years' steady work on the extensive beds has failed to deplete them, and it seems probable that, with proper forethought on the part of the fishermen, the grounds will not be exhausted for many years, although the conditions for the perpetuation of a profitable fishery are not so favorable as would be afforded by deeper and less circumscribed beds.

The principal fishing is now done by fishermen of Boothbay, Westport, Southport, Edgecomb, and Georgetown. The business has also engaged irregularly and to a very small extent a few fishermen from Newcastle and Wiscasset. In 1889 sixty-four persons followed the fishery, of whom more than a third were from Boothbay. The number of fishermen has increased each year since the inauguration of the fishery; and the quantity of scallops taken in 1889 was larger than the output of any other locality.

There can be no doubt that large undiscovered beds of scallops exist, especially in the deeper waters, on various portions of the Maine coast, that will from time to time be discovered and become available when the present sources of supply are exhausted. The indefatigable "down East" fisherman will not be long in finding new grounds and applying improved methods of capture when the occasion requires, and the perpetuation of this profitable and unique fishery will be secured.

The following ingenious explanation of the presence of scallops on the coast of Maine is from the Bucksport (Maine) Clipper of December 3, 1885:

The scallop found in such large quantities now along the coast of Maine is not an indigenous bivalve. It was brought here by the early French settlers and planted (in the sea) near their abodes. Its original home may have been the Gulf of St. Lawrence, near the Labrador coast, and Straits of Belle Isle, and perhaps some came from the coast of France. It ought and is to be found the most plentiful near the sites of the old French settlements, such as Castine, Mount Desert, etc., which corroborates the above assertion. * * *

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Bull. U. S. F. C. 89—21

in the community that the French were responsible for the planting of scallops, which, prior to this feat in artificial propagation, were not, according to this account, found on the Maine coast. That this is a fallacy can readily be shown by citing the existence of this species in a fossil state from Labrador to Virginia, and of large areas covered with the scallop along the whole Atlantic coast as far south as Cape Hatteras, there being no evidence to show that they were originally brought from the Gulf of St. Lawrence, the Straits of Belle Isle, or any other place. It is quite plausible no doubt that the early French colonists on the Maine coast took up scallops from the deeper waters and for convenience planted them nearer their settlements, but it seems altogether out of the question that they should have transported live scallops from Labrador and even from France to Maine, and so formed the vast beds that now exist off the coast of the United States.

8.—APPARATUS AND METHODS OF CAPTURE.

The form of apparatus now in general use in taking scallops resembles in some respects a small oyster dredge, and is called a dredge or scoop by the fishermen. It differs from the oyster dredge in certain features, however, which an inspection of the accompanying figure will readily suggest. The size of the dredge varies somewhat with the locality, but the figure and the following description may be regarded as applying to a dredge of average dimensions.

The essential parts of a scallop dredge are the handle or "pull-bail," the iron frame forming the mouth of the dredge, and the pocket into which the mollusks are received.

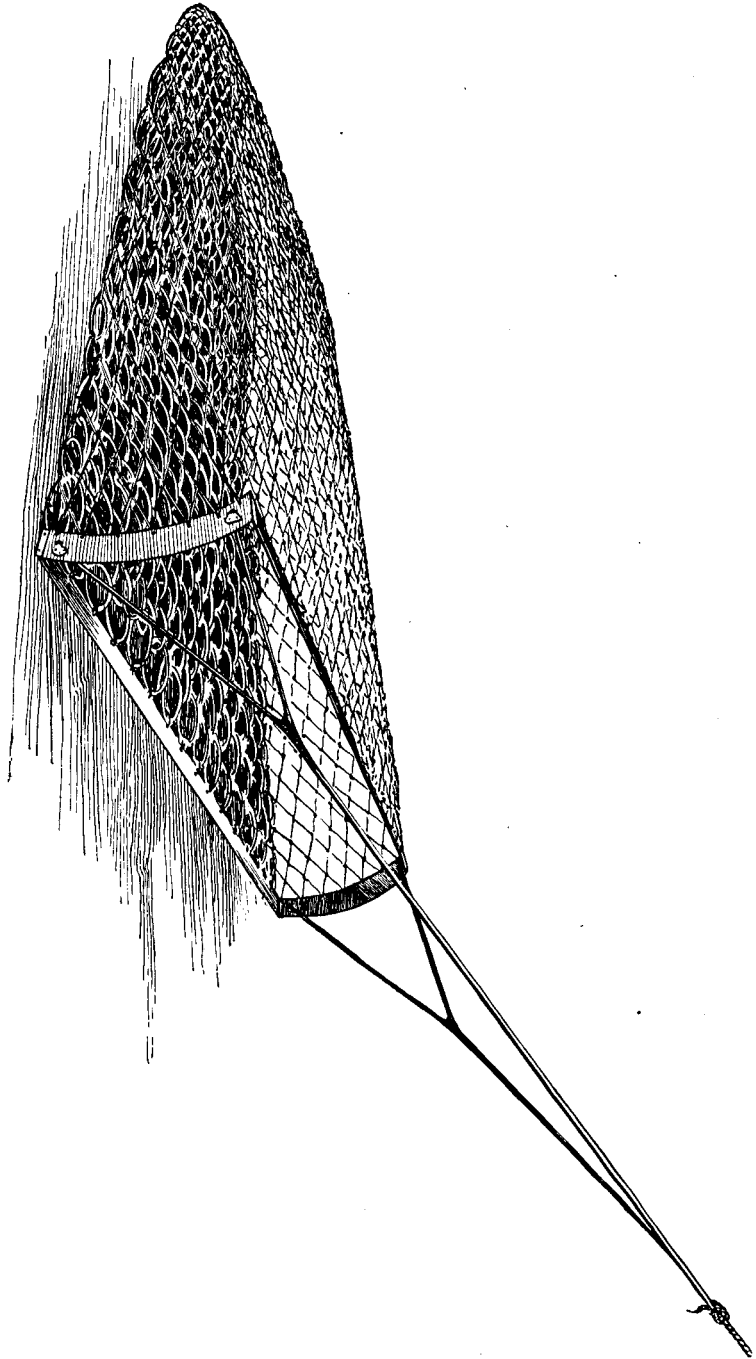
The handle or "pull-bail" consists of two iron bars, which come together at the top and form an eye in which the rope or warp is fastened. The eye is 4 or 5 feet from the mouth of the dredge. Towards the mouth the bars divide and go to the four corners of the rectangular iron frame to which the bagging is attached, and are riveted firmly, so that no motion is permitted. The division of the bars is for strength.

The framework forming the mouth of the dredge is composed of flat iron bars $1\frac{1}{2}$ inches wide and one-fourth of an inch thick. The bars are fastened together as shown in the figure, and form an aperture 3 feet 3 inches by 9 inches. The bagging is fastened to the frame by means of holes made in its inner edge.

The lower side of the pocket consists of iron rings of sufficient size to permit the smaller unmarketable scallops to slip through. Usually the rings are $2\frac{1}{2}$ to 4 inches in diameter. The top and sides of the pocket are made of marline and cod lines. This arrangement of iron and twine is necessary in order to prevent the dredge from rapidly wearing out. The inferior portion is subjected to rough usage in being dragged over the rough bottoms on which the scallops are found, and a bagging other than that described would be unfit for the purpose. That part of the pocket made of netting serves simply to confine the scallops, and is not required to be of metal, which, in addition to being more expensive, would also add greatly to the weight of the dredge and the consequent difficulty of operating it. The pocket is 4 feet in depth and in width corresponds with that of the framework. It has a capacity for about two hundred scallops.

The warp or rope by which the dredge is manipulated varies in length with the depth of water in which it is used. Owing to the oblique position which it occupies

SCALLOP DREDGE.



when in the water, it is necessarily much longer than would be required to reach simply to the bottom in a perpendicular direction. The usual length of rope is 50 to 150 fathoms.

The value of such a dredge as has been described is about \$5, exclusive of the warp. One dredge is the usual complement of a boat carrying two men.

A dredge employed by the fishermen of Castine and vicinity, described by Mr. Vogell, is similar in construction to the specimen figured, but is of considerably smaller size, the framework being 23 inches wide and 9 inches high, the arms of the "pull bail" 20 inches long, and the pocket 24 inches deep.

In fishing for scallops, the warp is tied to a thwart of the boat and the dredge is lowered to the bottom near the edge of the bed. Then both men "lay to" and row over the ground, towing the dredge. If the wind be propitious the sail is raised, and the towing may be exclusively done by the wind, but usually the sail is supplemented by the oars. If the bed be small the men may tow the dredge from one side to the other before drawing it up. When operating on larger beds the dredge is hauled up every 200 or 300 feet, the frequency varying with the abundance of the scallops. When vessels are employed the fishing is carried on from small boats, as elsewhere stated. Sometimes, however, in certain localities, the fishing is done by running out the dredge with a boat and hauling it in from the side of the vessel, which is kept at anchor. The advantage arising from the use of vessels is referred to in the next section.

On the Sheepscot River, where the fishing maneuvers are carried on from large, decked, sloop-rigged boats, provided with a crew of one or two men and fitted out with one dredge, the scallops are taken by sailing back and forth over the beds while towing the scrape. The boats are too large to permit the use of oars, which, moreover, are not required by the nature of the grounds.

9. VESSELS AND BOATS EMPLOYED.

As already stated, the first attempts to take scallops in the vicinity of Mount Desert Island were by men operating in vessels, but the use of the latter never became popular on the island, and they have never been regularly employed. Only a few trials with vessels have been made since the establishment of the fishery. In the vicinity of Castine and Cape Rosier vessels appear to have been in greater favor than elsewhere, and several have been employed annually. The following statement shows the vessels which, from time to time, during the past 3 years have been devoted during a portion of the season to scallop fishing:

Name of vessel.	Net tonnage.	Fishing grounds.	No. of boats carried.
Allena L. Gray.....	15.02	Penobscot Bay and tributaries.....	2
Commerce.....	46.20	Penobscot Bay and tributaries.....	7
Cygnet.....	13.17	Off Mount Desert Island.....	2
Major.....	6.62	Penobscot Bay and tributaries.....	2
Ripple.....	24.29	Off Mount Desert Island.....	2

The schooner *Allena L. Gray* was built in 1889 and first used in the scallop business from Cape Rosier in the season of 1889-90. As an example of the amount of

work that can be done with vessels, it may be stated that, during the period indicated, this schooner took 1,400 bushels of scallops.

It should be remembered that even when vessels are used the actual fishing is done from small boats carried for the purpose, the vessel simply serving as a lodging place for the crew and to freight the catch to the shipping point. The usual complement of a vessel engaged in this fishery is one boat to every two men of the crew, the boats ordinarily being dories, pea-pods, and other common types.

It may be of interest in this place to point out what appear to be some of the advantages and disadvantages of vessels and boats in this fishery. When the industry is carried on primarily from boats the men are forced to make short trips, are interrupted in their operations by rough weather, and are obliged to return to shore to shuck and otherwise prepare the catch for shipment. On the other hand, with a vessel anchored on the grounds, the facilities for taking care of the catch are as good as those on shore, there is less time lost in landing the products, time can be economized by "weathering" moderate storms and resuming operations as soon as fishing becomes possible, ice can be carried with which to preserve the catch until a full fare is secured, better opportunity is afforded for getting the scallops to the shipping place, and in various other ways it would appear that the vessel or decked boat is, on the whole, more serviceable and efficacious. The advantage is not so great, however, when the fishing grounds are inshore or adjacent to the point of shipment.

No special types of boats are employed in the shore fishery. There are few scallop fishermen that do not at some period during the year engage in other branches of the fisheries, and the same boat is employed for both purposes. The scallop boats, therefore, are the ordinary forms found in the region, varying with the localities in which the fishery is prosecuted. Consequently we find that in the Mount Desert and Little Deer Isle sections, pea-pods are the prevailing class, while farther west dories are in most common use. In the vicinity of Castine and Cape Rosier the employment of small, decked, sloop-rigged boats has recently been increasing, the number at the latter place having advanced from 1 in 1887 to 6 in 1889. On the Sheepscot River the favorite form of craft is also a sloop-rigged boat. The pea-pods and dories have an average value of \$15, and the decked boats range in price from \$100 to \$200, those in the Sheepscot River being, as a class, the most expensive.

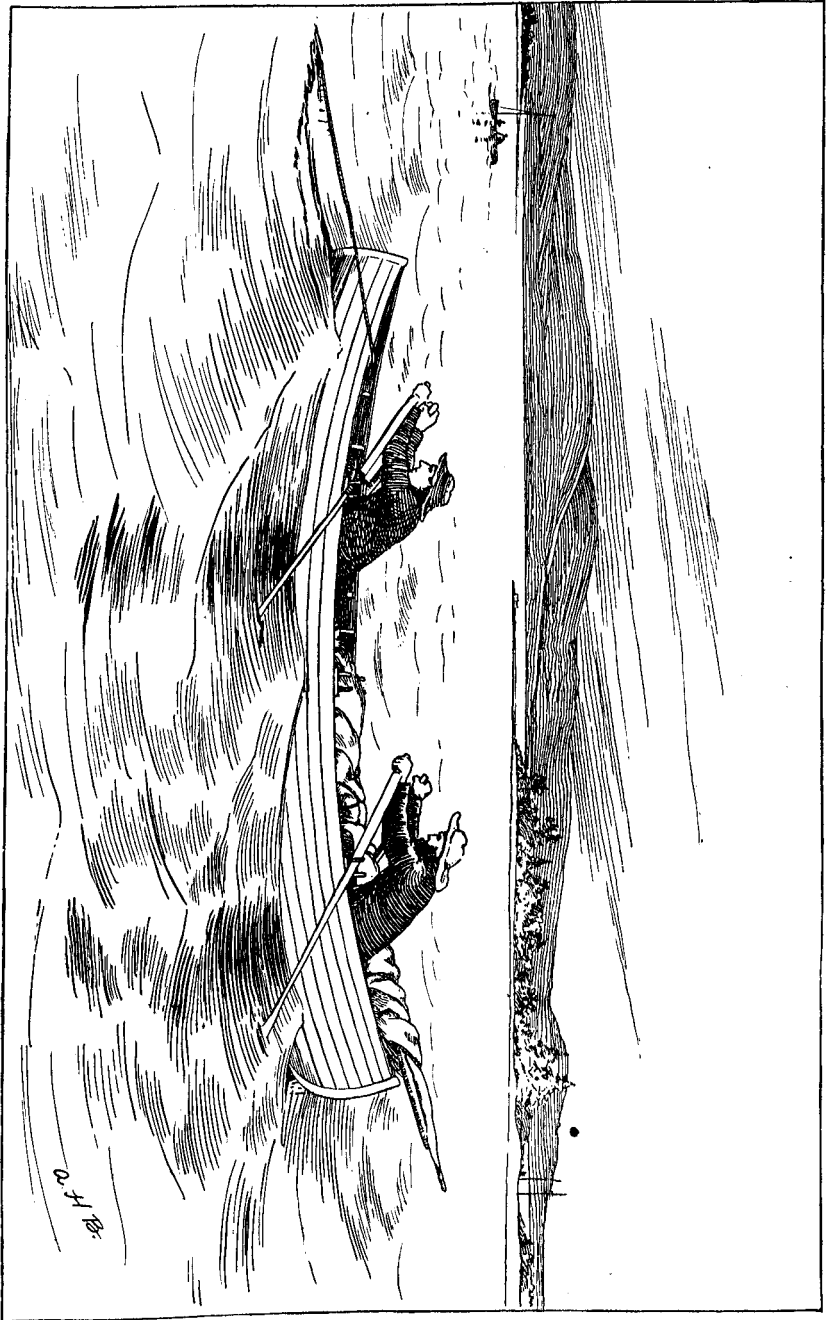
Generally speaking, the larger a boat the less serviceable it is in this fishery, other things being equal. This is especially true where rowing is the method of propulsion and sailing is not followed at all or is only supplemental to it. When sailing is chiefly followed, the objections to a craft of large size are not so potent, up to a certain limit. It is said that there are considerable difficulties in the way of properly operating a boat over 25 feet in length, and the fishermen in most localities prefer a much smaller one. In the eastern portion of the scallop territory, that is, between Castine and Mount Desert Island, the fishermen consider the most useful kind of a boat to be about 16 feet in length.

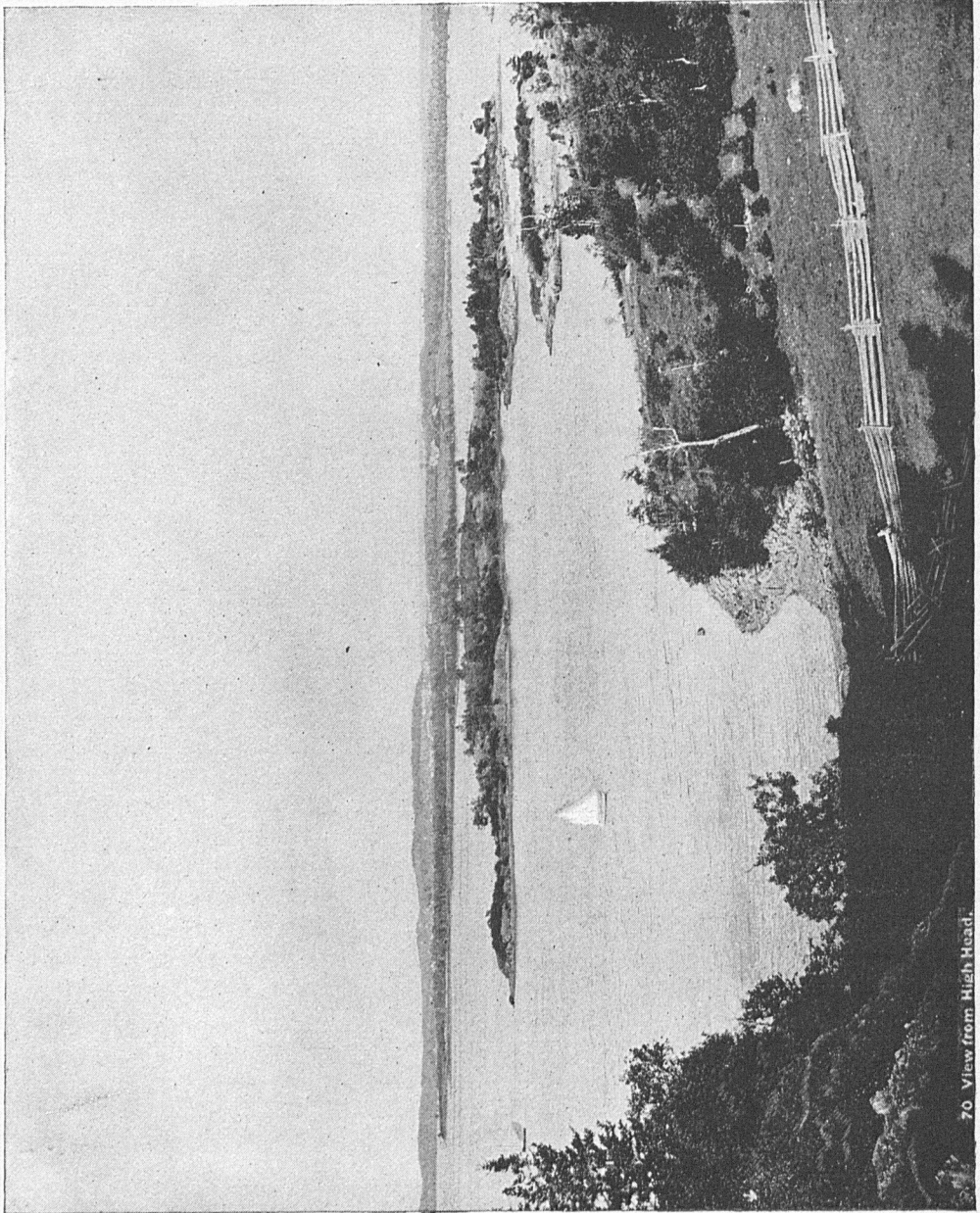
In 1888, it is reported that a man in the vicinity of Castine employed a small steamer in the scallop fishery, but unsuccessfully, and the attempt was abandoned.

10. THE FISHING GROUNDS.

(a) *Location of the beds.*—All the scallop beds, the existence of which was known and on which the fishermen operated in 1889, are shown on the accompanying map.

TOWING A SCALLOP DREDGE OFF MT. DESERT.





70 View from High Head.

SCALLOP GROUNDS AT MOUTH OF BAGADUCE RIVER, MAINE.

The position of the beds, as given on the chart, is based on information and descriptions furnished by fishermen and other responsible parties in the different sections. In the absence of any surveys or other definite means of locating the grounds, their position, as well as their size and shape, must be understood as being only approximately correct, although, for the purposes of this paper, it is sufficiently accurate.

The position of the beds may be briefly summarized as follows:

Off Mount Desert Island.—Nine beds have been discovered in this vicinity. Three are adjacent to Bartlett's Island, one being near the northern end, at the entrance to the narrows; another off the southeastern end, opposite Pretty Marsh Harbor; and the third off the southern extremity. The fourth bed runs parallel with Hardwood Island, between it and the shore of Mount Desert Island. Two of the remaining beds are near Moose Island, and the others are located some 3 miles off the coast and 4 miles south of Moose Island, in the neighborhood of Ship Island. The four beds first named are the largest, and those last mentioned the smallest, those at Moose Island being intermediate in size as well as in position. It is somewhat interesting to observe that all of these beds, extending over a tract 10-miles in length, run north and south in an almost direct line.

Off Little Deer Isle and Cape Rosier.—A large area lying south of Little Deer Isle and Cape Rosier, between these places and North Haven Island, is more or less covered with scallops, which are taken jointly by the fishermen from Little Deer Isle, Cape Rosier, Sedgwick, and occasionally Castine. The area embraced between the peripheral beds is about 45 square miles, and includes numerous islands, among which the largest are Eagle, Bare, Butter, Spruce Head, Little Spruce Head, Beach, Colt Head, Bradbury, Crow, Pickering, Eaton's, Sheep, Western, Pond, and Hog Islands. Between or clustered around these the beds are found. More beds are known to exist in this region than in any other on the Maine coast, although they are mostly of small size. Of the thirty-four separate beds operated in 1889 only three were of large dimensions. Two of these were east of Hog Island, and the other east of Pickering Island. New beds are continually discovered in this region, as the smaller and older beds are exhausted.

Bagaduce River, Lawrence Bay, and off Brooksville.—Prior to 10 years ago the only bed in the vicinity of Castine, the existence of which was known by the fishermen, was some distance up the Bagaduce River. Since the demand for scallops has increased, the fishermen have had to search for other sources of supply, and Mr. Vogell states that new beds of greater or less extent are now found almost every year. In 1889 there were five beds in the Bagaduce River. Two of these, of considerable size, were above Castine, another large bed was nearly opposite that city, and a smaller one was situated a little nearer the mouth of the river; the fifth, a medium-sized bed, was at the junction of the river with Penobscot Bay.

Smith's Cove or Lawrence Bay is an indentation of considerable size in the Bagaduce River, opposite Castine. Near the head of this body of water a small bed existed in 1889.

Immediately north of Holbrook Island a bed was operated in 1889 similar in size to that occurring in the mouth of the Bagaduce River. A very large area directly west of Holbrook Island and nearest to the shores of Islesborough is known to exist, which is thickly covered with scallops. Its limits are somewhat in dispute, owing to the fact that but few fishermen ever essay to work it because of its depth, which is

for the most part over 45 fathoms. This has proved to be too deep for regular profitable fishing. Southwest of this large bed, and still nearer Islesborough, a much smaller bed has been found, which is chiefly visited by Cape Rosier fishermen.

Sheepscot River.—The scallop beds in the Sheepscot are of greater extent than those found elsewhere in the State. They begin a short distance north of Sweet's Island and extend up the river in a more or less unbroken chain to within about 2 miles of Wiscasset. An offshoot also enters Cross River, a tributary of the Sheepscot, to the distance of about a mile. The area covered by the scallops in this river is about 7 miles long, and, in the widest part, opposite Barter's Island, from one-quarter to one-half a mile across, tapering in the upper course of the river to conform with the width of the stream. It is estimated that not less than 2 square miles of bottom are covered by these mollusks in the river in question.

(b) *Depth of the beds.*—The depth of water in which scallops occur no doubt accounts in a great measure for the comparatively few localities in which the mollusks have been found. It is well known that vast beds exist off the Maine coast, but these are inaccessible to the fishermen both on account of their depth and their distance from the shore.

The beds which are worked on the coast of Maine may be said to range from 4 to 40 fathoms in depth. The depth varies with the region and with particular spots in each region. The most important soundings, as gleaned from the fishermen and the charts of the United States Coast Survey, may be briefly stated as follows for the principal beds:

Location of beds.	Approximate range of depth.	
	<i>Fathoms.</i>	
Bartlett's Island, northern end	7½	to 11
Bartlett's Island, eastern side	9	25
Bartlett's Island, southern end	10	35
Hardwood Island	34	40
Moose Island	15	21
Numerous beds between North Haven and Cape Rosier	4	27
Bagaduce River, upper beds	3	8
Bagaduce River, bed at mouth	5	12½
Holbrook Island	9	13
Large bed off Brooksville	20	46
Sheepscot River	6	22
Average	11	24

(c) *Shape and character of the beds.*—Data relative to the shape and thickness of the scallop beds are not so abundant or conclusive as could be desired. In general it may be stated that the areas covered by scallops are usually irregularly oval in outline and the proportional length of long and short diameters appears to depend entirely on the strength and direction of the current, the major axis in all cases being in the line of the current. This is very noticeable in the Bagaduce River and the beds around Bartlett's Island, for instance, where the feature can be directly traced to the action of the water.

The fishermen in some localities think that the scallops are sometimes disposed in a shape approximating a broad-based cone, and when not so placed that they lie one upon the other in several layers, most thickly aggregated towards the center of the bed. The opinion also prevails that some beds at least are raised a foot or more above the level of the surrounding bottom.

However this may be, it is known that the mollusks lie thickly on the bottom, and that ten or twelve successive hauls may often be made over the same spot before the scallops appear to be seriously diminished.

Mr. James E. Benedict, for some years the naturalist on board the U. S. Fish Commission exploring steamer *Albatross*, informs the writer that in many localities off our coast the scallops lie very thickly on the bottom, and are so closely matted together by the sponges and worm-tubes that locomotion is impossible. Under such conditions the working of the beds would probably be promotive of the growth and improvement in the quality of the individual animals and the expansion of the beds, by breaking up the masses of mollusks and giving them an opportunity to exercise their locomotive faculties in search of new feeding grounds.

(d) *Nature of the bottom.*—Scallops can not be said to prefer any particular kind of bottom, and their presence in a given locality is rather to be attributed to favorable conditions of salinity and temperature than to the character of the bottom. In certain places the mollusks may be found on a rocky bottom, for instance, to the exclusion of other kinds, while in an adjoining section they may occur only on soft sticky mud.

Off Mount Desert Island the greatest variety of bottom is found. The beds adjacent to the northern and eastern sides of Bartlett's Island and off Hardwood Island are on soft bottom, as ascertained by the U. S. Coast Survey. The bed at the southern end of Bartlett's Island is on rocky bottom. Sticky mud predominates off Moose Island. Mr. Heath remarks that the scallops in that vicinity occur on bottoms of rock, reddish gravel, hard clay, and dead shells.

Mr. Gray has found that the numerous beds in the Penobscot Bay, between Eagle Island and Dice's Head, occur mostly on the hard, rocky bottoms, some of them so rugged that a dredge can not be used thereon. The large bed near the Islesborough shore appears to be chiefly on clay and mud.

In the Bagaduce River the bottom is mostly rocky. Mr. Vogell states that the scallops do not there occur on soft bottom, but seem to prefer hard, smooth areas, covered with free rocks from the size of pebbles to stones so large that a dredge is sometimes caught behind them and lost.

In the Sheepscot River, black and gray sand and mud appear to be the predominant forms of bottom.

11.—FISHING SEASON.

The fishing season varies in the different localities. It depends chiefly on the proximity of the markets. Generally speaking, where there is a good local demand in the vicinity of the scallop beds, the fishery may continue throughout the year; in other cases, with distant markets, the fishery has to be regulated by the weather and is confined to the colder months, during which shipments may be safely made for long distances.

On Mount Desert Island, the months of July and August see the greatest activity among the scallop fishermen, and the bulk of the catch is made during that time; in November and December a few men also follow the business; during the remainder of the year, however, the output is small and uncertain.

At Little Deer Isle, an isolated center, the principal operations are carried on from the first of December till the termination of cold weather in March or April; in

1889-'90 it extended from December 1 to March 20. A small amount of fishing is also done in the fall.

The season at Castine and Cape Rosier usually begins November 1 and terminates April 1. The winter of 1888-'89 was an open one and therefore unfavorable to the business.

In the Sheepscot River the scallops are taken only during the winter months.

12.—RESULTS OF THE FISHERY IN 1887, 1888, AND 1889.

The aggregate output of the fishery in 1887, 1888, and 1889, respectively, was 35,204 bushels, 29,578 bushels, and 45,368 bushels. The equivalent numbers of gallons were 23,277 in 1887, 19,028 in 1888, and 29,851 in 1889. The total value of the products as sold by the fishermen was \$13,994 in 1887, \$11,278 in 1888, and \$18,647 in 1889. The output of the different localities is shown in detail in the accompanying tables.

In the first year the localities yielding the largest quantities were, in their order, Castine, Sheepscot River, Tremont, Little Deer Isle, Cape Rosier, and Mount Desert. In 1888 and 1889 the order varied somewhat. The Sheepscot River is to be credited with the largest catch, followed by Little Deer Isle, Castine, Cape Rosier, Tremont, Mount Desert, and Sedgwick.

The average stock per man in 1889 was only \$95 and is always necessarily low, owing to the large number of persons who engage in the fishery only irregularly, and also to the short time during which the fishery is prosecuted in most localities. It should also be borne in mind that few, if any, men depend exclusively on scalloping for a livelihood. The following table shows the fluctuations in the average stock per man in the different localities during the past 3 years :

Table showing the average stock of persons engaged in the scallop fishery.

Locality.	1887.	1888.	1889.
Mount Desert.....	\$150	\$125	\$100
Tremont.....	92	63	54
Little Deer Isle.....	65	51	139
Sedgwick.....		33	50
Cape Rosier.....	54	44	106
Castine.....	125	118	119
Sheepscot River.....	71	60	74
Total.....	85	64	95

Men who may be said to have made a business of scalloping during the continuance of the season stocked quite as much as usually results from other fisheries for the same length of time. For instance, at least fifteen men in Castine and Cape Rosier annually take scallops to the value of \$200 each, although the average stock of the fishermen of those places is only about half that sum.

13.—SUGGESTIONS FOR THE POSSIBLE ADVANCEMENT OF THE FISHERY.

The probability of making large fares, were it possible to operate to advantage on the deeper beds, suggests the need of a more improved form of dredge. With the present dredge it is not easy to take scallops at a greater depth than 30 fathoms. Probably the most extensive beds lie beyond that depth and have never been disturbed

by man. There seems to be no doubt that a rich harvest awaits the man who first uses a form of apparatus that can be operated in almost any reasonable depth of water, say 100 fathoms.

In the oyster fisheries of the Chesapeake the need of such an apparatus has long been felt to compensate for the depletion of the inshore beds by making available new and productive grounds that can not be reached by the ordinary forms of apparatus. Through the ingenuity of Mr. Charles L. Marsh, of Solomon's Island, Maryland, a simple device has been patented which makes it possible to take oysters in any depth of water. The apparatus is essentially similar to the ordinary tongs so commonly used, but is devoid of handles. The latter made it impossible to take oysters in a greater depth than 30 or 35 feet, and even with that depth the work is not devoid of much fatigue and unsatisfactory results. That a similar form of tongs, made on the same principle, can be advantageously employed in deep water in the scallop fishery there can be no doubt. Its advantage over the common dredge is as great as its superiority over the ordinary oyster tongs. Requiring the services of but one person, it can be operated from the side of a vessel by each member of the crew, and it can also be employed in small open boats carrying one or two men. The disadvantage of having to row and sail back and forth over the grounds is done away with; it is possible to locate the bed before unlocking the tongs, thus making sure of the catch; and although more costly it is more economical in the end, because requiring the services of fewer men and insuring greater results in a given time.

The experience of the U. S. Fish Commission has demonstrated that the beam-trawl is the most effective apparatus for the capture of scallops. By means of it many bushels have been brought up at a single haul off the Massachusetts coast. It seems proper, therefore, to speak of it in this connection as a possible substitute for the smaller dredge on many portions of the coast of Maine.

In using the beam-trawl it would be necessary to work on smooth bottom, since rough, stony ground would tear the net. Fortunately the deep-water beds are believed to be generally on bottom that is suitable for operating the beam-trawl; at least many such areas have been found in the explorations of the Fish Commission.

The beam-trawl is somewhat more expensive than the dredge, but its effectiveness is believed to be vastly greater. Besides, a small trawl, with a 12 to 15 foot beam, can be operated with the same number of men that is needed for towing a dredge. A large sailboat could tow the trawl and, with the assistance of some sort of mechanical device to raise it (like a capstan, or the winch that is used by the drift-net fishermen of Great Britain), it could be easily managed by two men.

Small steam vessels or launches could probably be successfully employed in this fishery if the demand for scallops reaches proportions that call for the employment of additional capital and a material increase in the output. Their use would do much to economize time and to increase the catch while, of course, steam could be utilized to hoist the trawl.

For information concerning the beam-trawl, its manipulation, etc., the reader is referred to the exhaustive paper on the subject by Capt. J. W. Collins.*

*The beam-trawl fishery of Great Britain, with notes on beam-trawling in other countries, etc. Bulletin U. S. Fish Commission, Vol. VII, 1887.

D.—THE USES OF THE GIANT SCALLOP.

14.—THE FOOD VALUE OF THE SCALLOP.

Scallops in general have always been highly esteemed for their edible qualities, and in many localities are regarded as among the choicest products of the water. Although such a comparatively new article, the size of the giant scallop, as well as its flavor, has already secured for it a steady and growing demand, and it seems destined to maintain a prominent place in the estimation of the epicurean and the public. Unfortunately, the usual retail prices are so high that the great mass of the people have never been permitted to partake of this luscious food.

As will be seen in the paragraph giving quotations of the wholesale prices of scallops in the Boston market, the Maine species appears to be regarded somewhat less favorably than the smaller mollusk taken in Rhode Island and the vicinity of Cape Cod.

Mr. James E. Benedict found that specimens secured in deep water off Cape Cod by the *Albatross* were not so delicately flavored as *P. irradians*, although he considered them very fine. He explained that these individuals were bound together on the bottom in great crowded masses by the worm-tubes and boring sponges, so that growth, reproduction, and feeding were interfered with and the animals were unable to avail themselves of the function of swimming, the exercise of which would naturally have tended to improve their quality. The beds found in shoaler water are not so seriously affected by these parasites and shift from time to time, as has been shown. The scallops are therefore of better quality.

Prof. W. O. Atwater, in an elaborate paper in the Report of the United States Commissioner of Fish and Fisheries for 1883, on the chemical constituents of marine food products, gives tables showing the relative food value of fish, shell-fish, crustaceans, etc., as indicated by the percentage of protein, fats, carbo-hydrates, and mineral matters which they contain. The protein compounds or albuminoids have a threefold function in the economy, to quote Professor Atwater: (1) They form the basis of blood, muscle, connective tissue, etc.; (2) they are transformed into fats and carbo-hydrates, and are stored as such in the body; (3) they are consumed for fuel. The fats are (1) stored as fat and (2) consumed for fuel, and the carbo-hydrates (starches, sugars, etc.) are (1) transformed into fat and (2) consumed for fuel. Protein, representing the essential portion of food, performing the functions in part of both fats and carbo-hydrates, in addition to forming the basis of blood, muscle, and other tissues, is to be taken as the standard in comparing the food values of different substances.

Reference to the following table, adapted from Atwater, showing the proportion of watery and solid constituents in all the common edible mollusks and the percentage of protein, fats, carbo-hydrates, and ash in the solids or nutrients, discloses the fact that scallops* surpass all of the other shell-fish in the total percentage of nutrients and in the proportion of protein. It is also somewhat interesting to observe that oysters rank last in the list.

*The analysis is that of the small scallop (*P. irradians*), which can not differ materially from the giant scallop, for which no analyses are available.

Table showing, by weight, the proportion of watery and nutrient constituents of certain mollusks.

[Adapted from Atwater.*]

Constituents.	Scallop.†	Oyster.‡	Long clam.‡	Round clam.‡	Mussel (<i>Mytilus edulis</i>).‡
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Water	80.3	87.3	85.9	86.2	84.2
Nutrients or solids.....	19.7	12.7	14.1	13.8	15.8
Protein	14.7	6.0	8.5	6.6	8.7
Fats	0.2	1.2	1.0	0.4	1.1
Carbo-hydrates.....	3.4	3.5	2.0	4.2	4.1
Minerals	1.4	2.0	2.6	2.6	1.9

* See Report U. S. Commissioner of Fish and Fisheries, 1883, p. 443.

† Edible portion, i. e., adductor muscle.

‡ Shell contents.

15.—ON THE USE OF SCALLOPS FOR BAIT.

The bait question on the New England coast has ever been an important one, and of late years it has attracted the attention and demanded the consideration not only of those directly interested in the prosecution of the commercial fisheries, but also of the lawgivers and diplomats of the land. Whatever, therefore, may be done to call attention to possible new sources of supply, to be utilized in periods of scarcity of the regular bait products, seems worthy of presentation.

This preface brings us to a consideration of the use of scallops as possible substitutes for or coequals with the soft clams (*Mya arenaria*) as bait in the hand-line and trawl fisheries. It may be said at the outset that experiments with scallops have not as yet been sufficiently complete or exhaustive to decide what their real value is or just how high a place they are destined to occupy in the estimation of the fishermen. Even if it be finally ascertained that they are inferior to clams, their possible utility should be remembered; and there will no doubt be times in the history of many fishing localities when a supply of fresh or salt scallop bait will not be wholly worthless.

One of the earliest specimens of giant scallops that reached the hands of the conchologist was obtained from the stomach of a codfish.* Since then, scallops have been repeatedly found in the stomachs of cod and other marine species usually known under the general name of "ground fish." From this circumstance the suggestion no doubt arose of the probable value of the mollusk as a bait; it does not appear, however, that anything more than irregular or spasmodic attempts have been made to employ it, owing possibly to prejudice, but chiefly to a misapprehension of its value.

A strong reason for the use of the scallop for bait lies in the fact that the portion of the animal which can be so utilized is now considered valueless. As is well known, only the muscular portion of the meat is marketable for food, and the "skirts" or "rims" are regarded as a waste product by the fishermen and consequently thrown away. This waste is enormous, amounting in 1889 to not less than 30,000 gallons. When it is considered that this figure represents above 1,500 barrels of salt bait, which could have been secured for but little more than the cost of the barrels and salt, the great actual loss to the fishermen may be appreciated, especially in view of the probable value and efficacy of this kind of bait.

* Under the name of *P. fuscus*, Linsley, in 1845, described this species of scallop from a specimen taken from the stomach of a cod caught at Stonington, Conn. See synonymy, in foot-note, page 314, of this paper.

A number of isolated trials with both fresh and salt scallops have come to the notice of the writer. The consensus of opinion seems to be that in a fresh condition they are quite as attractive as clams. When salted, however, there is a difference of sentiment, the burden of the testimony being that in the bank fisheries they are somewhat inferior to clams, although until more conclusive experiments are made the matter must be regarded as *sub judice*. The information received regarding the use of scallops in the shore fisheries is that they have proved fully as good as clams when given an impartial trial.

Mr. J. M. Vogell, of Castine, states that in 1887 a fisherman in that vicinity took 5 barrels of scallop bait on a trip, but he failed to make a satisfactory fare, and no one in that region has employed the mollusk since that time.

At Mount Desert Island, pickled scallops have been sparingly used on a number of occasions during recent years in the line fisheries and are reported to have given as good results as clams.

There seems to be no reason why the scallop fishermen, when shucking these bivalves, should not preserve that portion of the animal which is now discarded, following the same method in curing it that is now pursued in the clam bait-fishery. At a comparatively small outlay for salt and barrels, and with practically no loss of time, what is believed to be a really valuable salt bait could be put on the market and the fishermen would be financially benefited to the extent of perhaps \$5,000 or \$7,000 annually.

16.—UTILIZATION OF THE SHELLS.

The beauty of the scallop shells has secured for them a demand that is not as yet very extensive, but appears to be yearly increasing. They are in considerable favor with artists, who paint marine and other views on the smooth interior; and they are also employed in the making of pincushions and other similar ornaments. The chief market at the present time is Bar Harbor, where, in addition to the foregoing uses, the Indians and others fashion them into attractive baskets and other receptacles.

The shells have been more or less frequently used at restaurants and fashionable dinner parties where the search for the unique has suggested the substitution of this article for a plate in serving numerous fancy food-preparations. For this purpose they have been brought as far as Washington. Scallops have also been served in their own shells.

A homely use of the shells is mentioned by Captain Collins, who remembers that in the Penobscot region they were formerly sometimes employed in skimming milk, and they may still be used for that purpose.

The sales of shells at the present time do not amount to more than \$100 annually; but it would doubtless be desirable for the fishermen in all localities to remember the economic value which these products have, and to endeavor to create a more regular demand that would no doubt contribute noticeably to the financial results of the fishery.

E.—PREPARATION OF PRODUCTS, MARKETS, ETC.

17.—HANDLING THE CATCH, SHIPMENTS, ETC.

The scallops which are considered large enough for market range in diameter from 4 to 8 inches, averaging about 5½ inches. Few individuals less than 4 inches are ever utilized, the fishermen in most places, with commendable forethought, either returning them to the water when brought up in the dredge along with the larger specimens or having the rings forming the bag of such size that the small ones pass through unharmed.

From ninety to one hundred and ten scallops are usually required to fill a bushel measure. The largest specimens, perhaps, are secured around Mount Desert Island, while in the Sheepscot River they are relatively smaller.

In many localities a bushel of scallops, when shucked, will yield a gallon of meats. At Castine, Little Deer Isle, and Cape Rosier, however, about 1½ bushels are usually required to shuck out a gallon of meats, and on the Sheepscot River about 2 bushels are considered as equivalent to a gallon. The weight of a gallon of meats is 9 to 9½ pounds.

Practically the entire production of scallops is placed on the market in a shucked condition, the few sales in the shell being either local or to fill special orders.

After returning from the fishing grounds the fishermen repair to some spot on the shore or to an outhouse, and there, assisted in some localities by the women and children of their families, open the scallops, retaining the thick, firm adductor muscle ("eye" or "heart," so called) and throwing away the mantles or "skirts," except in the few instances noted. The meats are placed in buckets, boxes, firkins, etc., holding from 1 to 20 gallons, and, when destined for more distant markets, are in a frozen condition or in cold storage during transportation. Shipments are commonly made by the fishermen themselves and not through the intervention of a local dealer. The scallops, except in rare instances, are sold on commission.

It seems worthy of remark that the practice of soaking the meats, which is so prevalent at certain places on the Massachusetts coast and elsewhere, is not followed, so far as known, in Maine. By immersing the meats of the small scallop (*P. irradians*) in water from ten to sixteen hours, they are greatly increased in bulk, and the result is that what was originally a gallon becomes 1 gallon and 3 quarts. It is evident that this is a profitable procedure. If for any reason, however, the sale of such meats is much delayed after reaching market and the surplus of water is lost by evaporation, the scallops are much inferior in quality to those that have not been so manipulated. It is said that the inception of soaking of Massachusetts scallops may be attributed to the fact that the meat of the Maine species is so much larger that it was almost closing the Boston market against the small but equally palatable *Pecten irradians*.

18.—MARKETS.

Boston is now the principal market for scallops, receiving almost the entire output of certain centers. Smaller quantities are consigned to New York, Philadelphia, and numerous towns in Maine, among which may be mentioned Portland, Bangor, Augusta, and Belfast. When the shipping of scallops from Mount Desert Island first began,

practically the entire catch was sent to New York, but of late, owing to the close proximity of Boston and the creation of a more steady demand, the bulk of the yield has been shipped to that place during the colder months. During the open season at Bar Harbor and other fashionable resorts on the island, nearly all the scallops taken in that region find a ready local sale. The output of Little Deer Isle is mostly sent to New York and Philadelphia. Boothbay and the other towns and settlements on or adjacent to the Sheepscot River receive a large part of the catch of that stream, the shipments to distant places being limited.

19.—PRICES.

Although the prices received for scallops at the beginning of the fisheries have not been maintained, they have not declined so materially as to prevent the profitable prosecution of the fishery at the present time; and it seems probable that with the growing demand for the mollusk the prices are not destined to reach any lower basis than the average for the past three years.

At the inception of the fishery, the scallop meats often sold for \$2.50 or more per gallon. As the supply increased the prices dropped and at times have reached the low figure of 25 cents per gallon. The average value to the fishermen during the years 1887-'89 was between 50 and 75 cents, although not infrequently \$1 and \$1.25 have been obtained.

The prices naturally vary with the supply and the demand and the state of preservation in which the scallops reach market.

Mr. F. F. Dimick, the secretary of the Boston Fish Bureau, states that there has been little if any variation in the average prices of Maine scallops in the Boston fish market in the past two or three years, during which time the wholesale value ranged from 50 cents to \$1.25 per gallon.

Regarding the relative value of the giant scallop and the small species taken in Massachusetts and Rhode Island, Mr. Dimick finds that in Boston the Rhode Island stock is the most highly esteemed, while the scallops from Cape Cod rank next, followed by the Maine species. The ruling prices received by the fishermen for the Rhode Island goods are from 75 cents to \$1 per gallon, and by the wholesale merchants from \$1 to \$1.50. The scallops from Cape Cod bring 50 cents to \$1 at first hands and 75 cents to \$1.25 at wholesale.

F.—STATISTICS OF THE FISHERY.

20.—Table of persons employed.

Locality.	1887.	1888.	1889.
Mount Desert	4	7	7
Tremont	34	23	16
Little Deer Isle	26	42	44
Sedgwick	2	2
Cape Rosier	31	31	36
Castine	36	22	28
Sheepscot River	33	48	64
Total	164	175	197

21.—Table of boats and apparatus.

Locality.	Boats.						Value of apparatus and accessories.			Total investment.		
	Number.			Value.			1887.	1888.	1889.	1887.	1888.	1889.
	1887.	1888.	1889.	1887.	1888.	1889.						
Mount Desert	2	4	4	\$30	\$60	\$60	\$33	\$65	\$65	\$63	\$125	\$125
Tremont	17	12	9	389	272	170	322	226	159	711	498	329
Little Deer Isle	13	21	22	195	315	330	169	273	286	364	588	616
Sedgwick		1	1		25	25		15	15		40	40
Cape Rosier	16	16	24	440	440	1,345	230	230	373	670	670	1,718
Castine	31	24	32	1,085	945	1,395	330	262	345	1,415	1,207	1,740
Sheepscot River	22	31	41	3,208	4,590	6,075	215	310	412	3,423	4,900	6,487
Total	101	109	133	5,347	6,617	9,400	1,299	1,381	1,655	6,646	8,028	11,055

22.—Table of products.

Locality.	1887.			1888.			1889.		
	Number bushels of scallops.	Equivalent number of gallons.	Value to fishermen.	Number bushels of scallops.	Equivalent number of gallons.	Value to fishermen.	Number bushels of scallops.	Equivalent number of gallons.	Value to fishermen.
Mount Desert	800	800	\$600	1,170	1,170	\$875	935	935	\$700
Tremont	7,856	6,106	3,126	2,652	2,372	1,440	1,541	1,241	864
Little Deer Isle	5,070	3,380	1,690	6,415	4,274	2,137	12,074	9,713	6,104
Sedgwick				98	65	65	150	100	100
Cape Rosier	3,593	2,395	1,760	2,842	1,895	1,360	5,860	3,920	2,810
Castine	9,623	6,415	4,490	5,950	3,967	2,588	7,488	4,992	3,344
Sheepscot River	8,262	4,181	2,328	10,450	5,285	2,813	17,300	8,950	4,725
Total	35,204	23,277	13,994	29,578	19,028	11,278	45,368	29,851	18,647

SYNOPSIS OF ARTICLE.

A.—Introduction	Page.	313	C.—The fishery—Continued.	Page.	
B.—Natural history of the giant scallop		314	13. Suggestions for the possible advancement of the fishery		328
1. The common and scientific names		314	D.—The uses of the giant scallop		330
2. Geographical range		315	14. The food value of the scallop		330
3. Bathymetrical range		315	15. On the use of scallops for bait		331
4. Description of the scallop		315	16. Utilization of the shells		332
5. Size, growth and death, habits, etc.		316	E.—Preparation of products, markets, etc.		333
6. Parasites of the scallop		318	17. Handling the catch, shipments, etc.		333
C.—The fishery		319	18. Markets		333
7. Origin, development, and present condition		319	19. Prices		334
8. Apparatus and methods of capture		322	F.—Statistics of the fishery		334
9. Vessels and boats employed		323	20. Table of persons employed		334
10. The fishing grounds		324	21. Table of boats and apparatus		335
11. Fishing season		327	22. Table of products		335
12. Results of the fishery, 1887-1889.		328			