

22.—NOTES ON THE OYSTER FISHERY OF CONNECTICUT.

BY J. W. COLLINS.

(With Plates CLIX-CLXVI.)

I. INTRODUCTORY NOTE.

The following notes on the oyster fishery of Connecticut are based chiefly on the results of an inquiry made, under the direction of the writer, by Mr. Charles H. Stevenson, statistical agent of the U. S. Fish Commission.

The inquiry related particularly to the statistics, methods, and relations of the fishery during 1887, 1888, and 1889; but many additional data were secured, so that it has been practicable to place on record a tolerably full account of the leading events in the fishery since 1880, up to which date the subject was covered by Ingersoll's monograph of the oyster industry of the United States, prepared for the Tenth Census under the direction of the U. S. Commissioner of Fish and Fisheries.

In preparing these notes the object has been simply to call attention to the important commercial features of the industry; the scientific problems connected with this fishery will be considered by those who have studied them. The U. S. Fish Commission steamer *Fish Hawk* has been actively engaged for several summers in making a careful study of certain matters that affect the oyster fishery of Long Island Sound and adjacent regions.

The tabulated statements appended present in a concise manner the general commercial features of the fishery and contain also some special data not commonly shown in this manner, such as the summation of losses by starfish, etc.

No fishery on the Atlantic coast of the United States has attained greater success in recent years than the Connecticut oyster industry. Its history during the past decade has demonstrated the possibility (by well-directed effort, operating under wise laws) of the cultivation of areas of sea-bottom hitherto considered useless for commercial purposes. The success attained where the natural conditions are not specially favorable has attracted widespread attention, particularly in regions interested in the oyster fishery.

In many localities, especially in the Chesapeake Bay region, the general belief has been that the natural wealth of the oyster beds is inexhaustible. Trained from childhood to look upon the oyster grounds as their patrimony, and feeling that there should be no more restrictions upon catching oysters than upon taking any of the

free-swimming migratory species of fish that come with the seasons, it is, perhaps, not remarkable that the fishermen of the Chesapeake have bitterly, and to this time successfully, opposed all attempts at legislation intended to convey proprietary rights in the grounds. The following will illustrate the reliance upon nature :

The value of the oyster business alone to southeast Virginia is nearly \$2,500,000 per annum. It is a crop constantly harvested except in the months of May to August inclusive, and is as constantly replenished by the bountiful hand of nature. No city in the Union is more highly favored in this respect than is this city of Norfolk. It is a crop that requires no sowing or planting, no cultivating—nothing but harvesting. Nature does everything except harvesting the crop.—From "Our Twin Cities of the 19th century (Norfolk and Portsmouth)," Norfolk, 1887-88, p. 91.

Fishing has gone on with little restriction and the depletion of oyster grounds has been so marked of late as to cause the gravest apprehension in both Maryland and Virginia. Thus, while a valuable oyster industry has been built up and maintained in Connecticut under comparatively adverse natural conditions, the most important oyster region of the world is rapidly losing its prestige, and, unless new methods or regulations are adopted, there is reason for apprehending the most unfavorable results in the near future. There can be no question that the example set by Connecticut has been a most useful and important one, and all communities interested in the oyster fishery will doubtless profit by it.

In view of the results of shellfish legislation in Connecticut and the many inquiries about the subject, abstracts of some laws and the full text of the recent and most important ones will be appended.

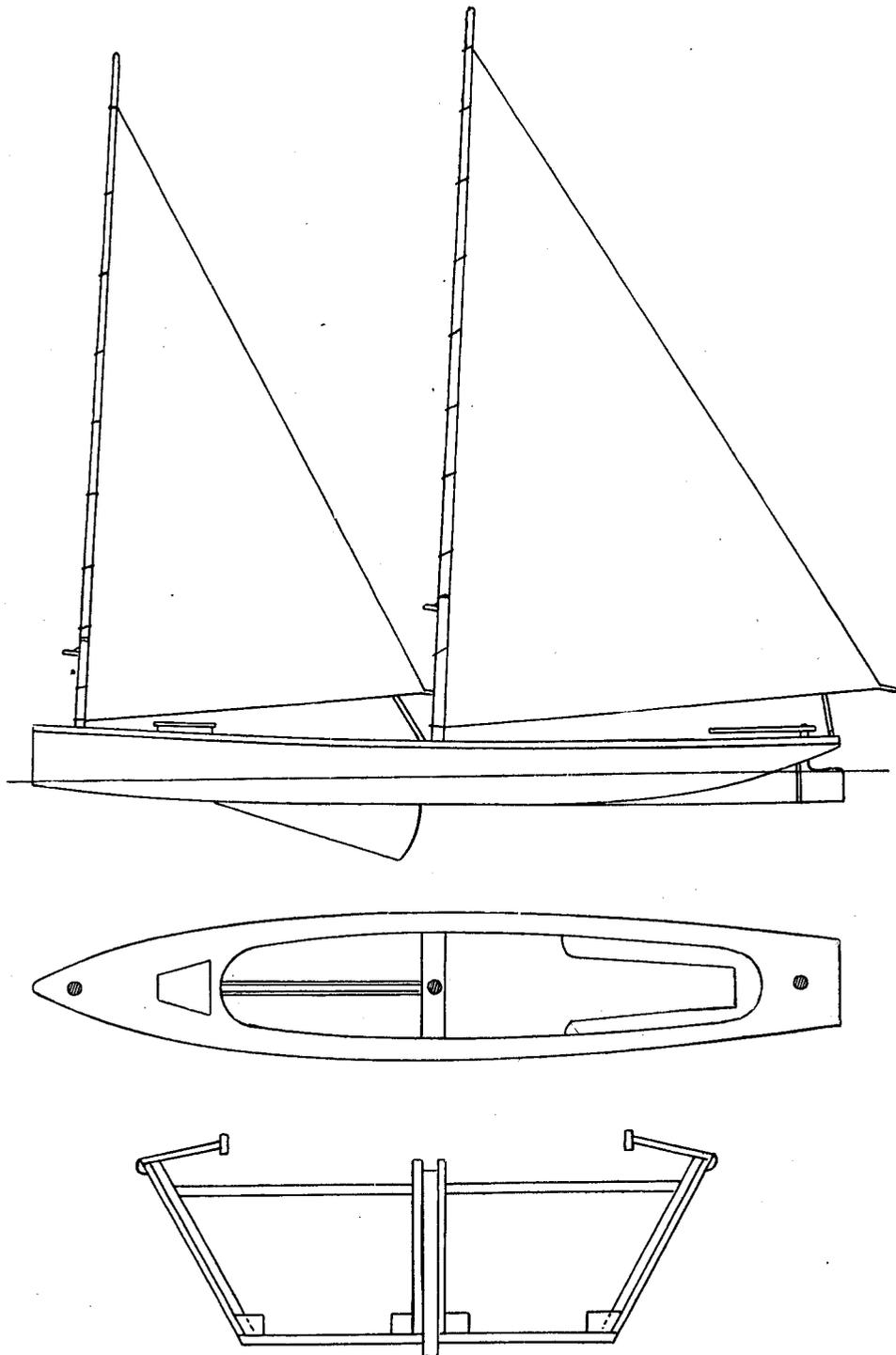
II.—PERSONNEL, WAGES, ETC.

1. *Number and nationality of persons employed.*—The total number of persons employed in the Connecticut oyster industry in 1889 as fishermen and shore operatives was 1,208, which did not differ materially from that of the two previous years. Of these 593 were employed on vessels and boats in cultivating the beds and harvesting the crop. Under ordinary conditions these would be classed as fishermen, but here they engage in sea-farming as well as fishing, and have been designated accordingly.

The shore operatives—those engaged in preparing and shipping the products—numbered 651, of whom 344 were women. The latter are employed mostly at New Haven as "openers;" about one-third of them are of foreign birth, principally natives of Ireland. The men are mostly American-born and natives of New England. The fishermen (or sea-planters) are noted for thrift, enterprise, and aggressive energy, important characteristics in developing the industry in which they are engaged.

In detail, 525 of those employed in cultivating and fishing are citizens of the United States, 24 are Swedes, 11 Germans, 21 Irish, 5 Portuguese, 1 Russian; the nationality of 6 could not be ascertained. Of the shore operatives 521 are Americans, 14 Swedes, 10 Germans, and 106 Irish.

2. *Wages.*—At New Haven the men employed on vessels receive from \$10 to \$15 per week and board themselves, but at Bridgeport and west of that place laborers are paid about \$30 per month with board. The captains and engineers on the steamers receive much higher pay, frequently \$80 per month with board. The board is reckoned at about \$12 per man per month. The average annual wages of those engaged in oyster fishing and cultivation exceeds \$300. In 1889 wages to the amount of



SAILING SHARPIE.

[From Report on the Ship-building Industry of the United States, Vol. VIII, Tenth Census.]

\$213,995 were paid to 693 employés. Reference may be made here to the fact that the earnings of these men are increased considerably by the sale of oysters taken on the natural beds. Stevenson estimates their average annual earnings at about \$385. This average is low because some of the men do not engage exclusively in the oyster industry, but devote a portion of their time to fishing, farming, or some other occupation. It is claimed that a man without capital can easily earn \$500 per year if he is efficient and works all the time. This is much more than could be earned fifteen years ago and much in excess of wages generally received by oystermen elsewhere; for instance, on the Chesapeake. Some fishermen are small proprietors and derive an additional income from their grounds as well as by working on public beds.

Operatives on shore other than "openers" receive from \$10 to \$12 per week, without board. At New Haven openers are paid 3 and 3½ cents per quart of meats. In 1889 the 461 openers at that city were paid \$70,106, an average for the season of about \$175. About three-fourths of the oyster-openers are women, many of whom work somewhat irregularly a part of the year.

The following statements of prominent oystermen regarding the wages of shore operatives will be of interest. Messrs. S. & D. Chipman say:

Oyster-shuckers earn from \$5 to \$7 a week. A few earn as high as \$12 a week.—Report of Connecticut Bureau of Labor Statistics, p. 130.

The openers at City Point receive 17½ cents for a 5-quart pail of opened oysters. The measure is beer, and includes the liquor. The cost of opening a gallon of solid oysters, wine measure, is 20 cents at the above rate to the openers, about 3 cents a gallon being allowed for help and expenses incidental to washing and packing. Oyster-openers average about \$2 a day working 8 or 9 hours, but the amount of work varies from day to day. Indeed, the number of quarts opened depends much on the ability of the opener, varying from 40 to 120.—*Ib.*, p. 133.

The 86 men employed at New Haven market houses as "helpers" earn a yearly average of \$275 for the season, November to May, and for work at odd times between seasons.

III.—VESSELS AND BOATS.

3. *Influence of improved vessels.*—Next to the enactment of favorable laws, nothing, perhaps, has exercised so much influence on the development of oyster farming in Connecticut as the recent improvement in the vessels engaged in this industry.

4. *Historical.*—In early times small rowboats were practically the only craft employed in oystering in this region. These were chiefly, if not wholly, dugout canoes, of which examples are still to be found along the Connecticut shores, though now seldom used. As late as 1880 Ingersoll found fifteen or twenty dugout canoes at New Haven and vicinity employed in taking seed and marketable oysters. The canoes were generally large, and would carry about 40 bushels of oysters. Stevenson says a few of them "may still be seen upon the banks of the Quinepiac, prized more as mementoes of the past than for their present usefulness." In many places the dugouts were superseded by a flat-bottomed, square-ended, scow-like skiff, worth about \$10; but at New Haven and vicinity the sharpie came into general favor some years ago, and was more extensively used in oystering than any other type of boat.

5. *The sharpie.*—The fishermen of Connecticut are credited with originating this craft, which, during the era when boats were chiefly used in the oyster industry, was admirably adapted to the business. Having a sharp bow and a broad, flat bottom,

the sharpie is capable of carrying a large cargo on a very light draft, an important feature in an oyster boat, since it is thus able to pass safely over the scarcely submerged oyster beds. The sharpie is also a swift-sailing vessel under ordinary conditions. At New Haven it is still extensively used. The largest size is chiefly employed in oyster fishing and carries from about 150 to 200 bushels of oysters.

Boats more than 20 feet in length are generally fitted for sailing. They are built longer in proportion than the smaller sharpie, fitted with a centerboard, and, if more than 25 feet long, carry two large leg-of-mutton sails, the foot of each being held straight by a sprit in the clew; the other end of the sprit being fitted into a loop on the mast. Occasionally one of the largest may have booms on its sails. The masts are long and tapering, and usually very small in diameter in proportion to their length. In a stiff breeze they bend like the bamboo yard of an East Indian boat. As a rule the foremast is about six times the beam in length; the mainmast is generally, though not always, shorter, say about five and a half times the beam in length; the spars are seldom supported by shrouds, but a single small wire shroud may sometimes be put on each side of the masts of the very largest boats. The general belief is that the stiffening of the mast by stays and shrouds is detrimental to the sailing qualities of a sharpie.

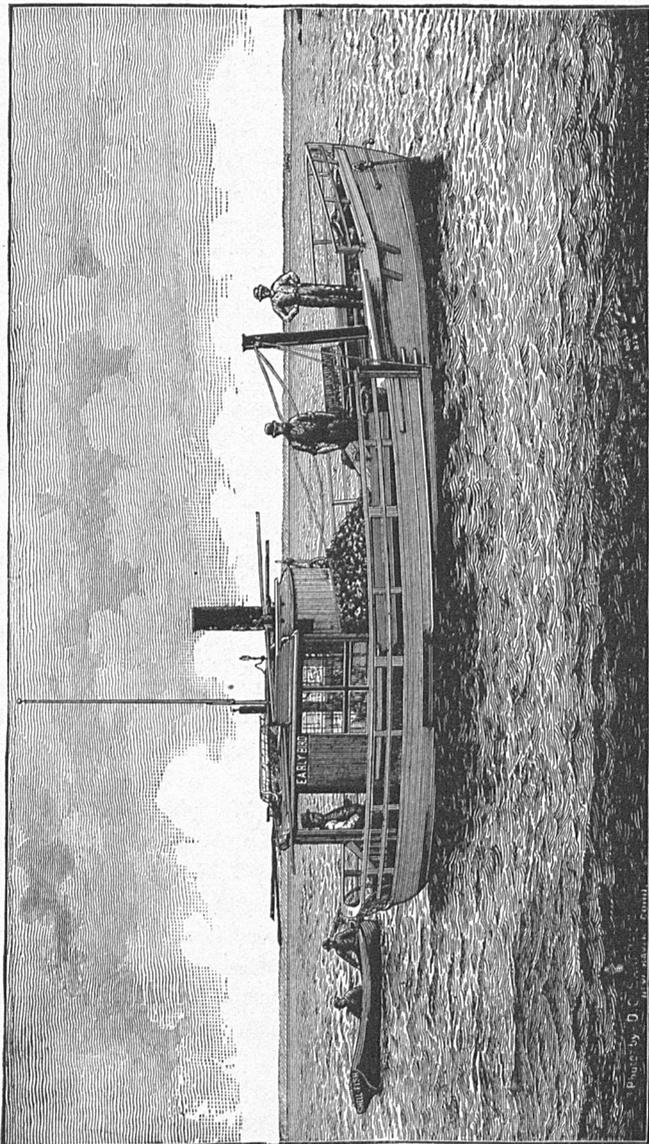
The larger sharpies are usually decked over for a short space at bow and stern, and have washboards running along the sides. The centerboard is a little forward of amidships. There is a good deal of camber to the bottom, particularly in the after section, where there is a deep skag. The lower part of the bow rises nearly to the surface of the water; the rudder is hung outside and is usually very wide. The accompanying illustrations show the form and rig of the typical oyster sharpie. In constructing a boat of this kind, oak and chestnut are used for frames, skag, and gunwales; the planking is pine. Ordinarily, there are two full strakes of planking on a side, and an additional strake at the ends to give the sheer. The planks on the bottom are always put on athwartships. The cost ranges from \$200 to \$400 for the largest class of sharpies, though those employed in the oyster fishery rarely exceed \$200 in value, since many have been in use for a period of years. The following are the dimensions of one of the large oyster sharpies (see plate CLIX): Length, over all, 35 feet; extreme beam, 6 feet; width of floor amidships, 4 feet; depth, 2 feet; height of foremast, 35 feet 6 inches; mainmast, 33 feet 4 inches. Some of the sharpies are wider in proportion than the one figured, the dimensions of which are given above. It is not uncommon for a sharpie 36 feet long to be 8 feet wide and have a capacity for 200 bushels. The Fair Haven boats of 32 to 34 feet carry from 100 to 125 bushels.

6. *Sloop boats*.—In recent years a few full-bodied sloops, about 30 to 40 feet long, have been built in Massachusetts for this trade. These are very burdensome craft, and are also reputed to be fairly good sailers.

7. *Scows*.—A few scows are employed; these are the typical flat-bottomed, square-ended variety.

8. *Sailing vessels*.—Prior to the adoption of steam vessels for dredging, small sloops and schooners were used, and even now many sailing vessels are employed in the Connecticut oyster fishery, in one capacity or another, though the general tendency is toward the substitution of steam power for sail.

Boats and sailing vessels are most numerous employed in the western part of the State, as will be seen by reference to the statistics appended. From 1887 to 1889



THE FIRST OYSTER STEAMER, EARLY BIRD.
[From the Fifth Annual Report of the Connecticut Bureau of Labor Statistics.]

inclusive there was little variation in the number of boats engaged in the oyster industry. Thus, there were 551 boats in 1887, 550 in 1888, and 549 in 1889.* But while the number has decreased slightly there has been a steady improvement in quality and value. The value of boats and outfits amounted to \$61,245 in 1887, \$61,310 in 1888, and \$61,574 in 1889.

The sailing vessels have declined slightly in both number and tonnage in the same period, as follows: 67 vessels of 752.70 tons in 1887, 63 vessels of 692.29 tons in 1888, 59 vessels of 631.01 tons in 1889. It will thus be seen that the average is only about 11 tons. Their value, including outfit, was \$52,405 in 1887, \$45,190 in 1888, and \$40,930 in 1889.

9. *Work done by boats and sail craft.*—The skiffs, canoes, and sharpies are utilized chiefly for tonging and light dredging; the sailing vessels in spreading shells, etc., over the grounds and in dredging. The latter are mostly sloops, and operate two dredges each; they can not work in calm weather, but since they have exclusive rights on the public beds (where the use of steam is prohibited) they are in favor with small operators and will doubtless form a part of the oyster fleet of this State for some years to come.

10. *Introduction of steamers for oyster dredging.*—Screw steamers have recently been introduced and very successfully employed in the Connecticut oyster fishery. Steam is used for working the dredging apparatus as well as for propelling the vessel, and has effected a great saving of time and labor.

Capt. Peter Decker and his brother, of Norwalk, Connecticut, are credited with having first employed steam to work oyster dredges. They put a boiler and engine into the sloop *Early Bird* to turn the drums on which the dredge lines were hauled, the sails being still depended on to propel the vessel. Afterwards they made an additional improvement by attaching a small screw to their sloop, thus obtaining auxiliary steam power to assist in propelling the vessel when the wind was light. The result of these innovations demonstrated so fully the feasibility of using steam in the oyster trade that ultimately they put a larger boiler and more powerful engine into their vessel, and depended on steam altogether, the mast, bowsprit, and sails being removed (see Pl. CLX). Thus in a short time the sailing sloop was gradually converted into a dredging steamer, and the vessel's effectiveness much improved. By the new arrangement she could haul two dredges at once, taking up from 150 to 200 bushels of oysters per day.

The success of these experiments led others to adopt the same method. A correspondent writing to the *Sea World*, of August 4, 1879, says:

After the experiments of Messrs. Decker Brothers, Mr. W. F. Lockwood, of Norwalk—not an oyster man but an enthusiastic believer in steam dredging—built the steamer *Enterprise* expressly for the business. Her length is 47 feet; beam, 14 feet; and she draws 4 feet of water. She handles two dredges, and hauls from 150 to 200 bushels daily. She cost about \$3,000.

Replying to a letter of inquiry concerning the introduction of steamers in the oyster business, Capt. Peter Decker writes, under date of December 10, 1881:

I put steam-power in my sloop for the purpose of towing and hauling my oyster dredges, in March, 1874, and found her capacity for catching oysters augmented about ten times without increasing her working expenses. In 1876, a boat for the same purpose was built at City Island, New York, and in 1877 another at Norwalk, Connecticut, making three, all told, and now I can count twelve in active

* Of the small boats employed in 1889 Stevenson reports 98 sharpies, of which number 82, valued at \$12,955, are owned at New Haven.

operation and several in the process of construction. I have 56 acres of hard-bottom oyster ground which I was unable to use, owing to its being infested with starfish, and I could not keep them off until I put steam in my boat; then I cleared them all away, and in doing so, I cleaned the bottom to such an extent that it received the young oyster spat, and now the ground is covered with oysters and free from starfish. When I commenced to rig my sloop into a steamer, the rest of the oystermen laughed at me and said I was a fool; but after they found that I could catch more oysters than they could, they went to the legislature and had a law passed to prohibit steam dredging on natural oyster beds. But instead of destroying, I claim that the use of the steamers will create natural beds, which, I think, I have fully demonstrated by cultivating the 56 acres of ground mentioned above.

The *Early Bird* was 31.4 feet long, 13 feet beam, and 3.4 feet deep; she measured only 7.08 tons. After serving 17 years in the oyster industry she was accidentally burned in January, 1889.

11. *Increase in the steam oyster fleet.*—Immediately succeeding the introduction of steam in the oyster fisheries of Long Island Sound a considerable number of oyster steamers were built, and in 1880 there were six in the State of Connecticut, the largest measuring 29.71 tons net; in 1883 there were 31. The following table shows the increase since 1883:

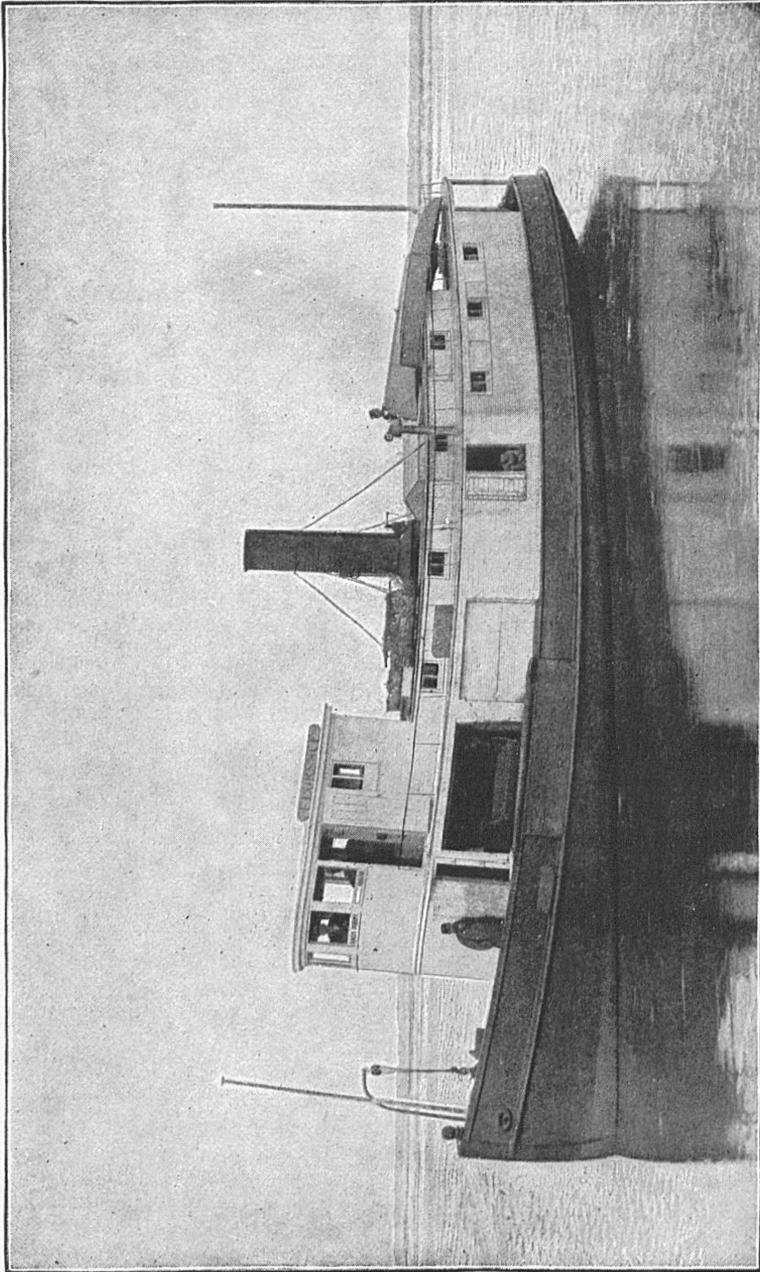
Year.	*No. of vessels.	Cargo capacity.	Aggregate tonnage.
		<i>Bushels.</i>	
1883.....	31	27, 225	715. 11
1884.....	40	36, 720	1, 004. 80
1885.....	48	47, 725	1, 306. 18
1886.....	53	53, 325	1, 498. 23
1887.....	57	61, 685	1, 689. 13
1888.....	58	63, 770	1, 759. 26
1889.....	57	62, 225	1, 744. 08

*Including three vessels under 5 tons each year.

12. *Size of steamers.*—These vessels were then, as now, small screw boats, resembling the steam tugs used for towing vessels. The steamers recently built, however, differ greatly from those in use in 1880. The largest was then less than 30 tons—the average about 15 tons. Now the average exceeds 30 tons, while the maximum size is 147.85 tons gross, or 73.93 tons net; several others are nearly as large. The dimensions, etc., of the largest steamer are: Length, 83 feet; beam, 20 feet; depth, 6 feet; cost, \$16,000; carrying capacity, 2,500 bushels of oysters; fishing capacity, 1,800 bushels of oysters per day from grounds 35 feet under water; crew, 8 men for ordinary work; cost of fuel, water, and oil, about \$100 per month.*

The average size of steamers built during the 5 years ending in 1889 is about 48 tons; length, 65 feet; beam, 18 feet; depth, 5.6 feet; capacity, 1,700 bushels; cost, \$10,000; crew, 4 to 6 men.

*As illustrating the difference in capacity for work between sailing and steam vessels, it is conceded that the steamer above mentioned can dredge as many oysters in one day as can be taken by a medium-sized sailing vessel, with a crew of 3 men, in 70 days, working in the same depth of water, 35 feet. Considering the great difference in the working power of steam and sailing craft, it is not remarkable that the "natural-growthers" raised serious objection to the employment of the former on the public beds as soon as their capacity was demonstrated. The legislature compromised in 1879 by permitting steamers to dredge 2 days in each week throughout the year; but in 1880 dredging on public beds with steam was prohibited.



OYSTER STEAMER, FLORENCE.
[From the Fifth Annual Report of the Connecticut Bureau of Labor Statistics.]

13. *Details of form, etc.*—The steamers are wide and shallow. They have a sharp bow, moderately concave at load line; a straight, nearly vertical stem above water; rather low, flat floor; medium length of run, and round stern. They are generally built with a strong sheer, and provided with a large deck house for the accommodation of the engine room, pilot house, and also for the storage of oysters. Most of the steamers are housed in for almost their entire length, but those sailing from Norwalk and Five-Mile River have the deck open forward of the boiler, so that the wheelman can note the operations on deck and direct the vessel's course in accordance therewith; whereas, when the forward deck is covered, the steering must be directed by those on deck. The pilot regulates the speed, when dredging, by a small wheel lever, placed within easy reach, and properly geared for this purpose. There is considerable diversity in details of finish, etc. Some are more cheaply and roughly finished than others—"built strictly for business" and provided only with necessary fittings. Some are more elaborately equipped, having fine and handsomely furnished cabins, steam-heated pilot houses, and other accessories for comfort and convenience.

The steamer *William A. Lockwood*, one of the largest and finest of the fleet of 1880, is thus described by Captain Rowe, owner and master:

She has a length of 63 feet; a beam of 16 feet; depth of hold of 5 feet; draws 5½ feet of water aft and 2½ feet forward. The machinery is placed well aft and the oyster room amidships; the pilot house is on the hurricane deck. She has a double hoisting engine for hauling in the oysters, and also a very large engine for propelling the boat. Iron blocks and chains are used to haul the dredges. On either side of the boat are two doors provided with a roller, over which the dredge chains run smoothly. The propelling engine is 11 by 11 inches and the hoister 5 by 7 inches.

The following account of the same steamer gives more details of the arrangement and apparatus:

The most efficient and convenient oyster steamer in the country, and perhaps in the world, is that owned by H. C. Rowe, of Fair Haven, Connecticut. She is housed over to protect men and oysters from exposure to storm, sun, and cold, and can work in the coldest weather. She works four large dredges and when running full blast employs 10 men, and takes up 500 bushels a day in 35 feet of water. She is a new boat, having been run about a year. Her boiler is larger and her engine more powerful than usual in a boat of her size, and she can therefore be used for towing, and can force her way through heavy ice in the winter, so that her owner is sure of a supply of oysters for his customers when other dealers may be unable with sailing vessels to get them. Especially is this greatly valuable in connection with the European trade, her owner keeping informed by cable of the state of the market, and taking up and shipping large quantities when the market is high in Liverpool and London. Besides her regular propelling engine she has a double engine for hauling dredges, which hauls all four dredges full of oysters at once and lands them on deck, two on each side. She cost \$6,500. To an oysterman like Mr. Rowe, who cultivates miles of ground and takes up 7,000 bushels in a month, such a boat is of immense convenience.—*Sea World*, August 4, 1879.

The foregoing is equally applicable to the oyster steamers of to-day, which are similar in form, equipment, etc., and differ chiefly in size.

Steamers have been extensively used only by the oyster-planters of Connecticut and New York; nevertheless, the success which has attended them may ultimately lead to their introduction in the Chesapeake Bay and elsewhere.

The number of steamers employed in 1889, of 5 tons and upwards, was 54, with an aggregate tonnage of 1,732.08.* These were valued at \$287,100, and were equipped

* In addition to these there were three small steamers, each less than 5 tons, which have been included with boats in the tabulated statements.

with apparatus of capture worth \$33,640, the combined value of vessels and outfit being \$320,740. This, added to the value of sailing vessels above 5 tons and boats less than that, gives a total investment of \$423,244 in the oyster fleet of Connecticut in the last year of which we have statistical returns.

IV.—HISTORICAL NOTES.

Much has been written concerning the early history of the Connecticut oyster industry; but, in order that its present condition may be better understood, a brief outline is given here of the most important changes that have served to place the industry under existing laws and regulations.

Prior to 1784 no restrictions were placed upon the oyster fishery, it being as free for the enjoyment of all as any of the open-sea fisheries of the present day. This soon led to the depletion of the beds, and it was ultimately evident to the State legislature that some restriction was necessary; but since each section desired legislation different from its neighbor, it was at first deemed best to empower each coast town to regulate the fishery to suit its needs. The result was the following enactment which we find among the "Acts and laws of the State of Connecticut in America for 1784:"

Be it enacted, &c., That any town in the State shall have the authority in town meeting to make rules and ordinances for regulating the fisheries of clams and oysters within their respective limits, or the waters and flats to them adjoining and belonging, and for the preservation of the same, and to impose such penalties as shall be thought proper by such towns for the breach of such rules and ordinances.

Under this law, many of the 24 towns along the coast enacted regulations which served chiefly to restrict the fishery in order to prevent the destruction of the industry. These regulations differed in many particulars, but the "2-bushel law," "close-time law," and a regulation requiring an oysterman to be a resident of the town he fished from, were common to most of the local enactments.

This policy continued in force nearly a century, being qualified from time to time by State regulations, the most important of which was enacted in 1845. This permitted a citizen of the State, under certain restrictions and regulations, to plant in domestic waters such oysters as were brought from other States. In the following year this privilege was extended to cover oysters brought from any place within the limits of the State of Connecticut. This action was caused by the increasing importance of the trade in Southern oysters and the frequent desirability of bedding for a time such as did not find a ready market as well as those taken from the public beds of the State. This did not affect operations on the natural beds, which continued to be depleted. As a result, the oysters obtained on them decreased in size until they became too small to be placed upon the market as taken from the beds: and it was necessary that they should be planted for a year or more that they might reach a marketable size. On this account, in 1855, the State legislature enacted what is known as the "2-acre law," granting each town the right to designate through a committee 2 acres or less of ground in its respective territory on which there was no natural growth of shellfish to any citizen for his use in the cultivation of oysters or other mollusks. This was followed from time to time by additional laws providing for the taxation, protection, sale, etc., of these private grounds. Two acres of oyster beds were then considered sufficient to satisfy the most ambitious. The designated ground may be

used for the cultivation of any kind of useful shellfish, yet oysters alone have so far received special attention. These privileges were not obtained without bitter opposition on the part of the "natural-growthers," as those persons are called who obtain oysters from the natural oyster grounds.

From this planting of small oysters it was learned a "set"* could be obtained on shells or on oysters placed on grounds other than natural beds. This knowledge led to an extension of deep-water planting, and was the source of the present prosperity of the oyster fishery of Connecticut.

Planting was at first confined entirely to shallow water, and it was not until about 10 years later (1865 and subsequently) that men were bold enough to put out oysters in as much as 20 feet of water. This was first done off Noroton Point, in the town of Norwalk. Steam-power was soon after (1874) introduced for dredging oysters both on public and private beds, and by means of this agency the depth was gradually increased on private grounds at Norwalk to 30 feet and more, and this was soon followed by deep-water planting in the vicinity of New Haven, and later in other parts of the State.

But experience soon showed that, to engage in the cultivation of oysters in deep water, much additional and costly apparatus was required, and it was not profitable to farm so small an area as 2 acres. Consequently, the "2-acre" law was evaded, and many additional acres were obtained by some oystermen, who induced their neighbors and friends to aid them by each making application for 2 acres, at the same time signing a quitclaim in favor of the person for whom the action was really taken. Large areas were obtained in this manner by some individuals; indeed, there is on record a deed or quitclaim transferring to one man the ground rights of 224 men. Much of the ground, however, was held solely by "squatter" rights.

The manner in which the ground was at that time designated was so loose and unmethodical as to cause much litigation. There were numerous conflicting claims among the owners of private grounds and between them and the "natural-growthers." These difficulties led to important legislation. In 1881 the State legislature recognized the necessity of placing the designation of the oyster grounds under systematic and authoritative control; therefore it enacted a law establishing the State Shellfish Commission, and invested it with the right of granting perpetual franchises "in such undesignated grounds within said area as are not and for ten years have not been natural clam or oyster beds."

The "said area" alluded to was "bounded westerly and southerly by the State of New York, easterly by the State of Rhode Island, and northerly by a line following the coast of the State at high water, which shall cross all its bays, rivers, creeks, and inlets at such places nearest Long Island Sound as are within and between points on the opposite shores from one of which objects and what is done on the opposite shore can be discerned with the naked eye, or could be discerned but for intervening

* There is no word in the Northern States for infant oysters, except the terms "set," "spat," "spawn," etc., all of which belong originally to the eggs or spawn of the oyster, and not to the young, but are frequently and confusedly applied as well to the half-grown mollusks. In the South the name "blister" (referring to its smooth, puffed-up appearance) is given to the infant oysters, and serves to distinguish them from "seed," "culleus," and "oysters," which represent the successively larger sizes and stages of growth.—The Oyster Industry of the United States, by Ernest Ingersoll, p. 95.

islands."* The oyster grounds not embraced within the area designated by this act were within the jurisdiction of the municipal authorities, and under the same law and regulations as before; a large part, however, had previously been assigned for private use.

By this enactment the oyster areas were divided into two classes; that under the Shellfish Commission, known as the "State grounds;" and the "town grounds," which were unaffected by the new law. But the area of the latter is so small (6,874 acres, or one-tenth of the total amount) that this discussion will be substantially limited to a consideration of the State grounds.

In the language of the Shellfish Commissioners:

By its liberal provisions all old titles are confirmed and future titles are to be made certain by approved legal forms; while all who wish to embark in the business of oyster culture can secure grounds at the merely nominal price of \$1.10 per acre; grounds, too, that will not fail to yield to well-directed effort and insure an abundant pecuniary return.

Other enactments followed, until at present the title to and confidence in the tenure of oyster franchises are as well assured as the titles to the lands above water; and so favorable to the promotion of the oyster industry has been this and the subsequent legislation that, in the trip of investigation from one end of the State to the other made by Mr. Stevenson, nothing in the line of legal patronage or protection was found wanting.

During the first month in which the commission was organized applications were received for 31,263.5 acres, or about one-tenth of the total area under its control; but of the amount thus applied for only about one-third was designated, due to conflicting applications and failure on the part of applicants to comply with the necessary requirements.

The establishment of the commission resulted in securing satisfactory relations between the officials and those engaged in the oyster industry. The result has been exceedingly gratifying, and it is a matter of State pride that, starting with conditions less favorable than in some other localities, an important business enterprise has been built up, and the fact has been clearly and forcibly demonstrated that the prosperity of a great commonwealth may be materially advanced by the proper utilization of areas of sea-bottom within its jurisdiction.

The organization of the Shellfish Commission, and the assurance that a proper legal title could be secured for grounds, induced the oyster-planters to enter into the business with energy and determination. The growth of the industry was marvelous. Large areas of ground were purchased. Larger steamers and improved apparatus of capture were rapidly constructed and put to work to cultivate what was previously a barren and unprofitable waste of sea-covered territory.

While the greater part of the ground was taken by those who intended to improve and utilize it, some was secured by persons who invested merely for speculative purposes, or who aided by furnishing capital to prosecute the business. Indeed, considering the small cost of the ground and the promise of quick and profitable returns, it is not strange that capital was attracted to this industry.

* Extract from law of 1881; see laws appended.

V.—THE OYSTER GROUNDS.

14. *Location and extent.*—The oyster grounds of Connecticut were formerly situated almost wholly in the shallow waters of the bays, coves, and estuaries along the coast, but about 1865, when the practicability of deep-water planting became apparent, areas farther from shore were utilized. This extension of cultivated bottom toward the middle of the sound has continued until now some of the beds are 8 miles from the mainland, reaching fully to the State line which divides Long Island Sound almost equally between Connecticut and New York.

This division gives to Connecticut about 370,000 acres, or nearly 580 square miles of Long Island Sound and adjacent bays. Of this area, some 35,000 acres lie within the bays and estuaries bounded and included by the "commissioners' shore line," and consequently subject to the jurisdiction of some one of the twenty-four towns within whose borders they lie; hence, they are known as "town grounds." The remaining 335,000 acres are "State grounds," under the control of the Shellfish Commission. About 15,000 acres of this region are covered with ledges and islands, so that some 320,000 acres are under water. Of the above, 5,819 acres are "natural oyster beds," thus leaving over 314,000 acres, of which the title to 70,132.9 is vested in individuals, and the remainder is still available for designation by the Shellfish Commission to whomsoever may desire to purchase any of it.

Of the 35,000 acres of "town grounds," 6,874 acres are owned by individuals, 13,482 acres are public beds, and the remainder, of but little value, lies at waste, and may be designated to individuals by the towns. The area held by individuals or firms varies from 2 to about 7,000 acres; the average is 186.5.

The number of proprietors of "State grounds," in each year since 1881, is as follows:

1882	216	1886	434
1883	290	1887	431
1884	385	1888	401
1885	423	1889	376

Stevenson says that, of the 376 proprietors of "State grounds," 16 own 28,443 acres, valued at \$678,000, and cultivate 15,716 acres, upon which it was estimated there were 1,645,000 bushels of oysters.

In 1889 49 persons or firms had 10 acres or less; 40 held between 10 and 25 acres; 118 between 25 and 100, and the rest had upwards of 100 acres. The number of owners of "town grounds" in 1889, who had no "State grounds," was probably about 100 (none of whom own large areas), thus making an aggregate of some 476 proprietors of oyster grounds in the State. Some of these are not cultivators, but hold the property for speculative purposes.

The following table shows concisely and clearly the distribution of all the private grounds in the State:

Locality.	Under State jurisdiction.			Under town jurisdiction.			Grand total.
	Cultivated.	Uncultivated.	Total.	Cultivated.	Uncultivated.	Total.	
	<i>Acres.</i>	<i>Acres.</i>		<i>Acres.</i>	<i>Acres.</i>		
Greenwich.....	2,052.1	2,385.5	4,437.6	480	205	685	5,122.6
Stamford.....	694	882.6	1,576.6	125	65	190	1,766.6
Noroton.....	719.4	516.7	1,236.1	45	60	105	1,341.1
Norwalk.....	2,742	2,374.3	5,116.3	940	202	1,142	6,258.3
Westport.....	2,918.4	5,186.7	8,105.1	20	.....	20	8,125.1
Fairfield.....	991.8	1,747.2	2,739	.....	45	45	2,784
Bridgeport.....	1,055	3,144.6	4,199.6	59	4	63	4,262.6
Stratford.....	3,918.8	3,204.6	7,123.4	20	83	103	7,226.4
Milford.....	2,274.7	8,818.5	11,093.2	.....	.....	.....	11,093.2
New Haven*.....	6,949.8	7,014.2	13,964	1,812	454.7	2,266.7	16,233.7
Branford.....	200	1,098.6	1,298.6	120	730	850	2,148.6
Guilford.....	500	4,318.4	4,818.4	.....	810	810	5,648.4
Madison.....	580	3,632.5	4,212.5	18	282	300	4,512.5
Clinton.....	.....	168	168	35	.....	35	203
Saybrook.....	.....	25	25	.....	.....	.....	25
Thames River.....	.....	.....	.....	70	.....	70	70
Groton.....	.....	.....	.....	170	.....	170	170
Stonington.....	.....	19.5	19.5	20	.....	20	39.5
Total.....	25,596	44,536.9	70,132.9	3,934	2,940.7	6,874.7	77,007.6

* Including Orange and East Haven.

15. *Depth of water.*—The greatest depth of water in Long Island Sound is a few miles north of Great Gull Island, where it is 312 feet; the greatest in Connecticut limits is 190 feet, off the town of Norwalk. The depth of water over planted ground varies from 3 to 85 feet, the latter off the town of Norwalk; the average depth for planted grounds is from 30 to 35 feet.

16. *Designation of oyster grounds.*—Of the 70,132.9 acres of "designated State ground," 33,987.9* acres were granted prior to June 1, 1881, when the Shellfish Commission was established. The following table shows the area of State ground owned by individuals each year since June 1, 1881, and the acreage on which there were oysters in each of the years since records have been kept:

Period.	With oysters.	Without oysters.	Total.
	<i>Acres.</i>	<i>Acres.</i>	<i>Acres.</i>
1881*.....	.....	.....	33,987.90
1881†.....	.....	.....	51,444.10
1882†.....	9,007.00	48,818.60	57,825.60
1883†.....	†11,500.00	61,036.80	72,536.80
1884†.....	14,066.00	64,976.48	79,042.48
1885†.....	16,201.70	63,454.00	79,655.70
1886†.....	20,714.20	63,823.60	84,537.80
1887†.....	17,800.00	60,649.30	78,449.30
1888†.....	17,400.00	57,067.56	74,467.56
1889†.....	15,400.00	54,732.90	70,132.90

* June 1.

† December 1.

‡ Estimated.

It will be observed that the area held by individuals steadily increased until 1886, since which time it has constantly decreased. This is due to the following reasons: When the commission was established in 1881, and even before, the value of the oyster grounds was beginning to be appreciated, and as soon as it was made evident

* These figures, as well as many of the following relative to oyster grounds, were taken from the records in the office of the State Shellfish Commission; hence they are as correct as can be obtained.

that their titles would be secure cultivators obtained as much as practicable of what was thought to be "good ground;" but, because of a limited knowledge of the needs of the oyster and of the character of the bottom, many acres of unsuitable ground were secured. Much of this was resold to the State in consideration of \$1 per acre, under the provision made in one section of the act establishing a Shellfish Commission, providing for the return to the State, under certain restrictions, of all ground found, after a fair trial, to be unadapted to the cultivation of oysters.

The decrease in area designated annually is due to several causes: The grounds held by the State have unavoidably become more and more distant from the fishing centers and markets; the condition of the distant ground is generally less desirable than the designated areas; the chance of obtaining a "set" is uncertain, and the danger from the starfish is great; it has therefore generally been deemed unwise to attempt the improvement of remote areas under such disadvantages. It is believed by some that there are yet many acres of unappropriated bottom equally as good as much which has been taken up.

17. *Value of oyster grounds.*—The present market value of all the private ground in the State is about \$1,237,695, of which \$920,820 is for the cultivated grounds, and \$136,875 for the unimproved portion. This gives an average value for the former of \$31.14 per acre, and for the latter of \$6.46 per acre.

The value of cultivated grounds varies from \$5 to \$2,500 per acre, the latter being the price for a few acres in New Haven Harbor, where southern oysters are bedded in spring to be taken up in the fall. The price paid for this was \$1,300 per acre. The best grounds lie off New Haven, Norwalk, Stratford, and Bridgeport; those in the eastern part of the State are less valuable.

But values are constantly changing, since localities that are very productive one year may be almost worthless the next, on account of being covered with sand, mud, etc. The best ground has a clean, rocky, or shell bottom, in a moderate current of deep and brackish water, and in the neighborhood of other beds of spawning oysters. A muddy bottom causes the oysters to grow fast, but they are liable to suffocation, and besides have not so delicate a flavor as those raised on rocky ground. Much of the muddy ground has been recently reclaimed by spreading upon it large quantities of sand and gravel, but this is a somewhat costly method. Sometimes a bed may be slightly lower than the adjacent grounds, thus causing it to receive many oysters from adjoining areas, increasing the value of the one at the expense of the others.

While there may be considerable fluctuation in the value of bottom devoted to oyster culture, it will be observed that the average is much above that of land used for strictly agricultural purposes, while the annual product of the 15,400 acres on which there are oysters amounts to about \$1,500,000, and this on an area which, 15 or 20 years ago, was for the most part unproductive.

18. *Taxes.*—The State derives a small revenue by a 1 per cent. tax on about a 50 per cent. valuation on the grounds under the jurisdiction of the Shellfish Commission, while some of the towns collect a uniform tax of 25 cents per acre from the areas within their jurisdiction. The State grounds thus cost the holders at first \$1.10 per acre, plus expense of buoying, etc., and an annual tax averaging about 8 $\frac{3}{4}$ cents per acre. The minimum tax collected from a single individual in 1888 was 25 cents; the maximum tax on a private holding was \$666.33; the total tax amounted to \$6,761.83.

19. *Public beds.*—The following statement occurs in a decision made by an able judge in the State of Maryland :

Land can not be said to be a natural oyster bar or bed merely because oysters are scattered here and there upon it, and because, if planted, they will readily live and thrive there; but wherever the natural growth is so thick and abundant that the public resort to it for a livelihood, it is a natural bar or bed.

Perhaps no better definition, legal or otherwise, of what constitutes a natural oyster bed has been given; yet the history of the public grounds of Connecticut illustrates the fact that this definition is scarcely complete, because it takes no cognizance of the variation in productiveness of oyster beds in short periods of time. A bed may produce abundantly one season, and so little the following year that only few persons will resort to it. An excellent example of this is the famous Bridgeport bed, from which were taken 115,000 bushels of oysters in 1887, while in 1889 only a very small portion of it was fished on, and the yield was not more than 3,500 bushels. This has been almost equaled by the beds of New Haven Harbor (not including Quinepiac River), which produced in 1888 about 65,000 bushels of oyster seed, and in 1887 and 1889 only about 5,000 bushels in each year. It will thus be seen that the foregoing definition is scarcely correct, for what is a natural bed one year may not be such the next year; and in order that no cause for grievance may lie with the "natural-growthers," no ground in Connecticut can be designated that has at any time for 10 years previous been a natural bed in the sense of the above-mentioned decision.

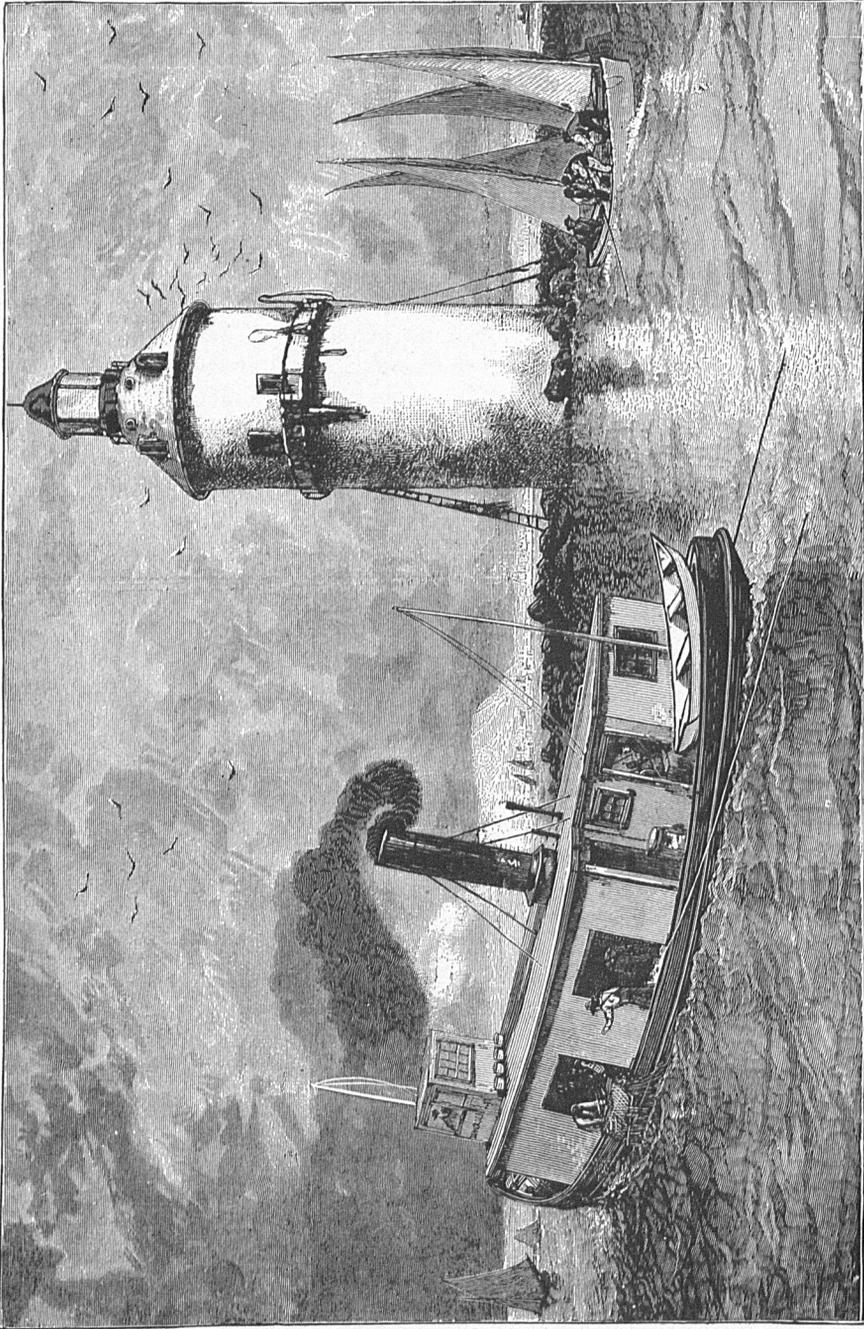
20. *Area and products of natural beds.*—The following statement shows the area of natural beds in each town under the town and State jurisdiction, and also the quantity and value of the product for the years 1887, 1888, and 1889 :

Locality.	Town.		Total.	Yield 1887.		Yield 1888.		Yield 1889.	
	Acres.	Acres.		Bushels.	Dollars.	Bushels.	Dollars.	Bushels.	Dollars.
Greenwich.....	1,600	875	2,475	6,200	2,170	6,000	2,350	1,200	360
Stamford.....	350	.....	350	2,400	800	2,000	700	1,500	500
Noroton.....	275	150	425	2,000	800	1,900	800	1,100	520
Norwalk.....	1,650	160	1,810	28,000	8,400	21,500	6,260	12,500	5,750
Westport.....	1,400	90	1,490	3,000	800	3,000	800	2,500	800
Fairfield.....	800	1,150	1,950	4,000	1,200	4,000	1,200	3,500	1,200
Bridgeport.....	1,240	334	1,574	115,000	19,800	31,000	12,610	3,500	1,700
Stratford.....	1,442	3,050	4,492	19,000	3,800	8,000	2,500	4,500	2,200
Milford.....	1,000	.....	1,000	6,000	2,150	10,000	3,400	8,000	2,400
New Haven.....	2,900	.....	2,900	35,000	12,500	81,000	18,000	24,000	9,875
Branford.....	125	.....	125	850	285	900	270	1,100	330
Madison*.....	200	.....	200	12,500	4,500	7,000	2,850	5,500	2,580
Clinton.....	250	.....	250	3,500	1,800	3,500	1,800	3,500	1,800
Westbrook.....	50	.....	50	1,800	1,300	1,300	1,000	1,000	650
Saybrook.....	150	.....	150	750	950	1,500	1,900	200	275
Niantic.....	5	.....	5	.....	.....	.....	.....	40	80
Thames River.....	20	.....	20	2,000	1,000	1,850	925	120	60
Groton.....	25	.....	25	800	2,000	460	1,150	90	225
Total.....	13,482	5,809	19,911	242,800	64,255	184,910	58,515	73,850	31,305

* Including East River, a part of which is in the limits of Guilford township.

21. *Restrictions about fishing on public beds, etc.*—No one is permitted to use steam in any manner for taking oysters from the public beds, and no dredge or other contrivance weighing over 30 pounds may be employed.

Ten years ago more persons were at work on the natural beds than on private holdings; but, although the attention paid to private grounds has diminished the number of persons depending on natural areas, the natural beds have become so de-



OYSTER-DREDGING STEAMER AND SHARPIES AT WORK IN LONG ISLAND SOUND.

pleted that at present no one depends wholly on them. The value of oysters from natural beds amounted in 1889 to only \$31,305, while the yield of the cultivated beds brought \$1,040,372, or more than 33 times as much. Of the 73,850 bushels obtained from public beds in 1889, about 5,000 bushels were marketed for food; the remainder were used for seed by the cultivators of this and other States.

22. *Effect of the State policy.*—It will be observed from the foregoing that, had Connecticut pursued the present policy of Maryland and Virginia, her oyster fishery in 1889 would have supported about 60 men. Under the present system over 1,200 persons, exclusive of capitalists, are directly dependent on the oyster industry, while many more are supported by constructing steamers and dredges, making tubs, baskets, etc., expressing oysters, and by the many other industries more or less dependent upon the prosperity of the oyster fishery.

VI.—METHODS OF CULTIVATION, TRADE, FISHING, ETC.

23. *Obtaining ground.*—Whoever desires to cultivate oysters in Connecticut must first obtain possession of a section of suitable ground. He may either buy this from some one in the business or secure it from the State Shellfish Commission at \$1.10 per acre. By the former method he will either be likely to obtain poor ground or to pay many times as much as an equal area purchased from the commission would cost. Shrewd operators bear in mind that although the choicest grounds are in the hands of individuals, yet there are many acres of worthless private holdings, while the State still has much worth cultivating.

The best course is to serve an apprenticeship until one becomes sufficiently acquainted with the business to wisely select his own ground. Next best to this would be to employ an experienced and reliable cultivator to secure it. The ground should be as much together as possible for general convenience and to keep it free from starfish.

24. *Preparing the ground for a "set."*—After the ground has been obtained and the proper boundaries located, it is best to go over it with a steamer and dredge from it all extraneous substances generally classified as "rubbish." Those most extensively engaged in the business have steamers, some firms own several, while a few parties have no apparatus, their work being done for a certain sum by those who own steamers or sailboats. One or two dredging steamers belonging in the State are kept for daily hire; their owners have no oyster grounds and seek employment from those who have. These steamers, with the crews, may be hired for from \$20 to \$30 per day.*

If the ground is somewhat muddy some cultivators place gravel upon it at the rate of 100 to 200 tons to the acre. This system has produced excellent results.

The first plants of oysters may be made upon a new bed in three ways:

(1) Young "seed" oysters taken from the natural beds may be distributed over the ground, together with gravel, "jingles," or other shells taken therewith.

(2) If the area is distant from the spawning grounds it is often best to scatter adult oysters upon it, some time prior to July, the beginning of the spawning season, in order to secure a "set." In such cases, about 25 to 50 bushels of oysters are spread over each acre. Oysters are not usually purchased for this purpose. If a cultivator

* In the report of the Connecticut Bureau of Labor statistics for 1889 (p. 114) the statement is made that "nine steamers oyster in the sound, but are owned in New York."

has any beds remote from those containing spawners, and for this reason it is necessary to plant with adults, he generally has other grounds from which the requisite supplies can be obtained.

(3) If a new bed is near cultivated areas amply supplied with spawners it is only necessary to prepare the ground for a "set." Indeed the system of planting adults is less extensively practiced than it was a few years ago. In 1887 the amount of spawners transplanted in the State was 73,800 bushels, of which one firm handled over one-half; in 1888, 69,525 bushels were utilized in this manner, and in 1889 only 64,200 bushels.

In all cases, whether spawners are planted or not, the careful cultivator will, during July, spread about 300 bushels of shells as evenly as practicable over each acre of his ground. Sometimes they are distributed much more abundantly, but this quantity is sufficient if the shells are spread evenly and the bottom is not too muddy.

July is a busy month for those engaged in oyster cultivation. Some firms employ as many as 50 or 60 men, besides numerous schooners, scows, or other craft to distribute shells and prepare the beds to receive the spat. To obtain a good "set" means prosperity, while the lack of it causes scarcity and renders the business less profitable.

Some idea of the extent to which shells are employed in preparing oyster grounds in Connecticut may be obtained from the fact that at New Haven alone 1,298,580 bushels were planted in 1887, 1,269,300 bushels in 1888, and 1,148,125 bushels in 1889. A single firm has made annual deposits of 425,000 bushels.

East of Norwalk the cultivators use oyster shells obtained chiefly from the opening houses in New Haven and vicinity. The shells cost about 5 cents per bushel, and to distribute them costs from 2 to 3 cents per bushel. A large quantity is also obtained from the Housatonic River. At Norwalk and further west, several varieties of shells are used in addition to oyster shells. These are chiefly "jingles" (*Anomia ephippium*), "quarter-decks" (*Crepidula fornicata*), and "scallop" (*Pecten irradians*), obtained mostly from Peconic Bay, at the eastern end of Long Island, where about 325,000 bushels of mixed shells are annually taken and carried to the oyster regions of Connecticut and New York. The use of "jingles" and "quarter-decks" for this purpose originated in 1880, when Capt. James Monsell, of Greenport, Long Island, began the business, which he controls at the present time.

25. *Comparative merits of gravel, various kinds of shells, etc.*—It is probable that gravel is as desirable a material for the "clutch"* as anything yet used in Long Island Sound. Its comparative value is not dependent entirely upon its cheapness. It is considered by many preferable to oyster shells, because only one or two young oysters would "set" upon each pebble, and there is not the crowding that often occurs when large shells are used, since it is easy to distribute the spat attached to gravel whenever proper to do so. Oysters not crowded are more uniform in shape and better generally than those piled upon each other in clusters. For this reason the small "quarter-decks" and fragile "jingles" are considered much better than oyster shells. Some planters hold that they have a special value, because they are easily broken by the action of the water and thus do not encumber the ground after serving their purpose as "spat-gatherers." This is one reason why the shells from the Housatonic River are so much desired. It seems somewhat remarkable that oyster shells are not

* This term, imported from Europe, has been changed from "cutch" or "cultch," to clutch. It is applied to stones, pieces of brick, gravel, shells, etc., to which young oysters can attach themselves.

broken into comparatively small pieces before they are distributed on the grounds, to prevent the crowding of large numbers of spat on the same shell, as is now the rule. The shells could be broken at small cost, and the greater area of ground a certain quantity would cover would seem to warrant a slight additional expense.

26. *The Poquonock method.*—In the preceding discussions mention has been made of nearly all the methods resorted to in Connecticut to catch oyster spat, excepting the “brush” or “Poquonock” method. The latter was discovered by accident, about 1868, on the Poquonock River, a small stream in the town of Groton. A farmer, after trimming his orchard and throwing the branches of the trees into the river, was much surprised, in the succeeding autumn, to find the brush covered with oysters. This suggested the employment of the method to others, who used any cheap brush that was convenient. The material was usually placed in the water during May or June, and the spat secured in this manner was commonly taken off and marketed the following winter, or at least before the second winter. The chief reason for this was that the brush was generally put down in comparatively shallow water, about $2\frac{1}{2}$ fathoms at low tide, and if the young oysters were allowed to remain on it for 2 years they would fall off by their own weight. They were also exposed to the danger of being “winterkilled” during cold weather, because of being so near the surface. They were generally large enough to market in 18 months or so, say about the beginning of the second winter.

The Poquonock method has been moderately successful, and perhaps is the best for the locality where it is employed. There are several reasons why it has not proved entirely successful; among which may be mentioned the collection of large quantities of eelgrass about the flats at the mouth of the stream, causing stagnation of the water and producing such conditions that the board of health of the town has caused the bushes to be pulled up and destroyed. However, while the bushes could be kept down, the young oysters have invariably grown rapidly, probably because the bottom of the river is very muddy.

As an illustration of this method we are informed, by one who has had large experience in the business, that on one occasion the spat obtained on a single bush produced 12 bushels of oysters. This, however, is seldom equaled. The Connecticut Bureau of Labor Statistics state that “one bush bore 25 bushels, but the average yield is about 5” (p. 112). This statement is thought to be rather large by those familiar with the subject. The consensus of statement is that this manner of collecting a “set” of oysters is less profitable than generally represented, but that greater success would result if the system could be tried in a locality where the water is less sluggish and where there would be no official interference.

27. *Suggestions.*—Mr. Stevenson suggests another method for collecting oyster spat, which seems worthy of trial, but has not yet been experimented with in Connecticut, so far as he knows: Strands of old rope, old netting or other flexible material could be suspended in the water on a horizontal line, similar to the ground line of a trawl, at the season when oysters are spawning. This might be a good arrangement and probably the material could be improved by coating it with rubber or some other material to which the young oysters would readily and easily attach themselves. One advantage would be that the young oysters could readily be transported wherever it was desirable to convey them; they could be easily separated and planted, while the collectors could be used in succeeding years.

28. *Contingencies of the business, etc.*—The greatest care and good judgment in preparing oyster grounds may fail to secure the chief object aimed at: the obtainment of a good "set." If the shells spread over the beds are permitted to lie on the ground they become covered with silt or slime, which renders them unsuitable for obtaining a "set" the following year. Nevertheless, some oystermen permit the shells to remain on the bottom and simply stir them up with a dredge the next summer, a short time before the spawning period of the oyster. The best method is to dredge the shells during "slack time" when the steamers are not needed for other purposes. The shells are landed and left on shore until the proper time to again spread them on the grounds. This method is comparatively new and is increasing in favor; in 1887 only 39,000 bushels were thus taken up in the whole State; in 1888 the number increased to 157,000 bushels; and the quantity in 1889 was 334,500 bushels. It is only just to say that a considerable percentage of this increase was due to the decrease in the quantity of spat secured. The value of the shells covers the cost of taking them up, so that there is no actual financial loss in the transaction, while there is an important advantage in having a "clean bed" for the spawning season.

29. *Care required.*—Constant care and vigilance are required to insure complete success in oyster planting, even when conditions are fairly favorable. In the first place the young oysters are exposed to the danger of being "winterkilled," even if a good "set" is obtained. If this peril is escaped, there is always danger of destruction by starfish, drills, or other enemies.

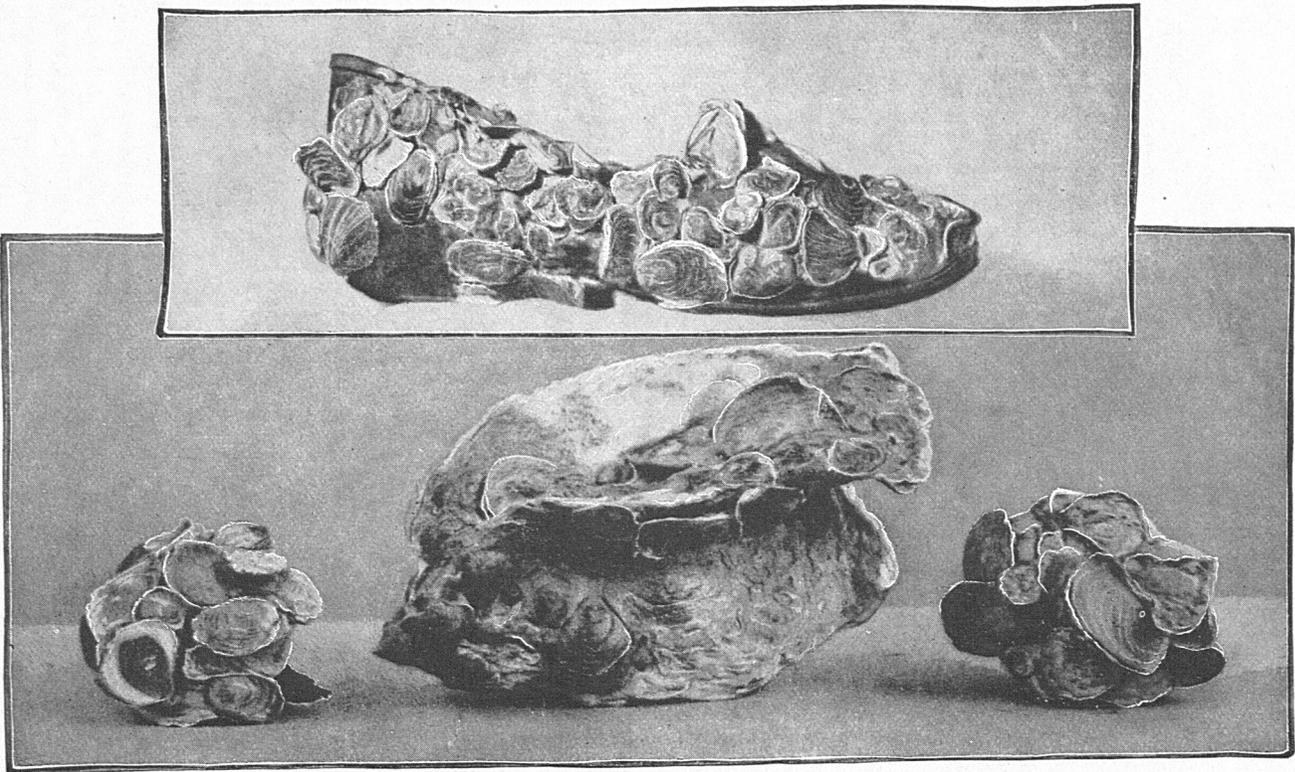
Many of the largest cultivators remove the young oysters into deeper water in the spring, where the conditions are better for growth, the crop less liable to injury or destruction by storms, and less exposed to other harmful agencies. When two years old the oysters are large enough for "seed," and quantities are usually sold every year to planters of Rhode Island, Long Island, and to some in Connecticut who have not all they need.

30. *Classification of oyster-planters.*—Those engaged in the cultivation of oysters in Connecticut may be roughly classified under three general heads. Most of them give greatest attention to one branch of the industry, engaging in the others to a less extent; while many do not divide their interests, considering it most profitable to limit their operations to one specialty. The classes may be designated as follows: Growers of oysters for opening; cultivators of stock for exportation to Europe; and seed-producers.

Those embraced in the first class are mostly located at New Haven. Of 863,890 bushels of oysters obtained by the cultivators of that city in 1889, 632,990 bushels were opened, 26,050 bushels sold in the shell for market purposes, and the remaining 204,850 bushels sold as seed to the planters of Rhode Island and Long Island. Besides the 632,990 bushels of oysters of their own production opened, the New Haven operators purchased 117,900 bushels, of which 80,500 bushels were raised in Connecticut and 37,400 bushels brought from Virginia.

Those who devote themselves chiefly to producing stock for exportation are mostly located west of Stratford, although during some seasons many oysters are taken east of that town for European markets.

Many of the oyster-planters give exclusive attention to raising "seed," which they sell to other cultivators, mostly out of the State. This business is increasing. The seed grounds are distributed all along the coast, the greater number being off



YOUNG OYSTERS (AGE THREE TO SIX MONTHS) SET ON OYSTER SHELLS AND A RUBBER SHOE—TAKEN IN DREDGING FOR OYSTERS.

[From the Fifth Annual Report of the Connecticut Bureau of Labor Statistics.]

New Haven and Norwalk. The quantities and values of seed oysters produced in the State during the past three years were: 299,180 bushels in 1887, worth \$155,000; 302,290 bushels in 1888, valued at \$166,478; 446,249 bushels in 1889, worth \$244,866.

31. *Growth of oysters, trade, etc.*—Local conditions have much to do with the growth or development of the oyster, and in a large measure influence the planters in the choice of the special branch of work in which they engage. The perception of the oystermen has been sharpened by keen competition; their judgment has been ripened by experience, and, with the active and enterprising spirit characteristic of them, they adopt such methods of work and trade as give the most profitable returns.

It has been mentioned that large quantities of seed oysters are sold to parties on Long Island, and it may seem somewhat remarkable that the latter can purchase seed from Connecticut and still successfully compete with the planters of that State. The reason is this: Oysters grow much more rapidly in the waters off the south side of Long Island than off the Connecticut shore. Stevenson says it is claimed that 2-year-old seed planted in the spring at Jamaica Bay (on the south side of Long Island) attain a marketable size by fall of the same year, while it would require at least two years to reach the same size in Connecticut waters. Indeed, there is said to be considerable difference in this respect between the eastern and western part of the State. The oysters near New Haven and eastward mature earlier than farther west. At Norwalk about 1,500 3-year-old oysters fill a barrel of ordinary size; from 1,200 to 1,400 of 4-year-old; 1,000 to 1,200 5-year-old; 800 to 1,000 6-year-old, and 650 to 825 7-year-old. There is considerable variation due to character of bottom, etc., but the above figures represent the average and ordinary differences in oysters of the same season.

The largest dealers, especially at New Haven, permit the oysters to remain on the grounds until of sufficient size to be placed on the market, which is about four years from the time of spawning. The age of marketable oysters varies, however, with the nature of the ground, the weather, and the locality.

After oysters attain a marketable size it is only necessary to dredge them and carry them to the shipping-point, or to the shucking and packing establishments. At New Haven or vicinity they mostly go to the oyster houses, where they are opened and packed in receptacles of various sorts and sizes for distribution over the country. At Bridgeport and Norwalk they may be assorted for sale to the exporters, or for exportation by the planter himself; or perhaps they are taken directly to New York for sale.

The Connecticut oystermen have four grades of oysters to which specific trade names are applied. Those 2 to 3 years old are "cullentines"; "culls" are commonly 3 years old or more; "boxes" range from 4 to 6 years old, and "extras" from 5 years upwards. The first two grades are generally opened and shipped without the shell; they are chiefly used for stews. The higher grades are mostly marketed in the shell, and from these come the choice stock for export to Europe. In 1889 the price of "culls" was about \$3.50 per thousand, while "boxes" sold for \$7 per thousand.

It will be readily understood that there must necessarily be much variation in the manner of handling the products, which it is not practicable to fully describe within the limits of these notes.

32. *Planting southern oysters.*—One important branch of oyster cultivation has not hitherto been described. This is the planting of southern oysters in Connecticut waters. This business is prosecuted only from New Haven Harbor, by the marketmen at Fair Haven, which is that part of New Haven situated on the Quinepiac

River. The oysters are brought in the spring from the Lower Chesapeake and tributaries by sailing vessels, the freightage, etc., being about 10 cents per bushel. The cost, delivered in Connecticut, has been as follows: In 1887, 42 cents per bushel; in 1888, 45 cents, and in 1889 about 47 cents. The cost has been constantly advancing for several years, owing to increased scarcity.

After being taken to Connecticut they are bedded on grounds in New Haven Harbor, chiefly on the western side, on a long sandy bar, known locally as "The Beach." For this purpose an acre may have placed upon it as much as 2,000 bushels. The ground used is mainly the property of the owners of the oysters, but frequently it is hired for the season for bedding southern oysters, at a rental varying from 2 to 12 cents per bushel, according to location, the average being nearer the former than the latter price. The planters combine for mutual protection, employing watchmen, etc., to look after the beds.

These oysters are not taken up until winter, when they have increased greatly in size and attained much of the fine flavor characteristic of Connecticut oysters, for which they may be sold, or they are disposed of under their own name, according to the nature of the demand.

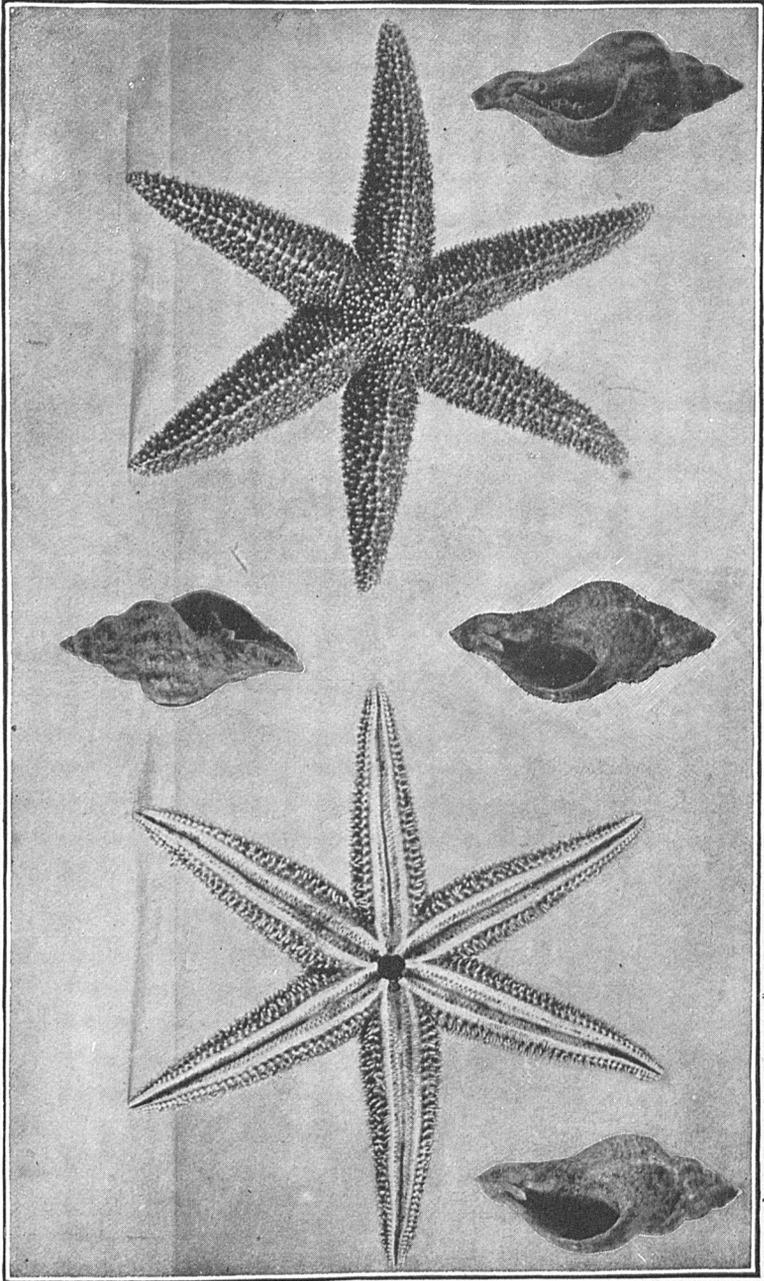
The following table shows the number of bushels planted during the past three years, their cost, the quantity taken up, and price received after opening:

Year.	Bushels planted.	Cost.	Bushels taken up.	Amount received.
1887.....	87,440	\$36,101	110,900	\$83,950
1888.....	95,325	41,585	124,100	83,450
1889.....	115,062	53,716	142,700	111,225

It will be observed that the oysters increased nearly one-third in bulk during the time they were bedded. The ratio of increase has slightly diminished recently, on account of the great destructiveness of the drills in New Haven Harbor.

Many oysters are still brought from the Chesapeake to be opened immediately upon their arrival. This trade began about 1835; it reached its maximum between 1855 and 1860, when probably between 500,000 and 750,000 bushels were annually transported. When native oysters began to be easily raised the use of southern oysters decreased; but, owing to the recent slight check in the productiveness of the Connecticut beds, it has increased somewhat during the past three years. In 1887 the number of southern oysters purchased to be opened at once was 32,500 bushels, costing \$17,900; in 1888 it was 37,300 bushels, costing \$19,194; and in 1889 it was 37,400 bushels, costing \$21,682.

33. *Export trade.*—The exportation of American oysters to Europe depends chiefly on the product of the Connecticut grounds. As a rule, few oysters are taken from east of Milford for this purpose, though occasionally many are sent to Europe from New Haven. The stock intended for foreign markets consists of oysters carefully culled, after which they are packed for shipment in flour barrels holding about 3 bushels each. They are pressed down as tightly as possible into the barrels so that they will not rattle about, and also to prevent them from opening their shells; as long as the shells remain closed the liquid is retained, thus keeping the oysters alive much longer than would otherwise be practicable.



1. DRILLS (ONE AND ONE-QUARTER SIZE). 2 AND 3. VIEW OF UPPER SIDE AND UNDER SIDE OF STARFISH; SIX ARMS.
[From the Fifth Annual Report of the Connecticut Bureau of Labor Statistics.]

The quantity of oysters annually shipped to Europe from Connecticut amounts to about three-fourths of the entire transatlantic export from America of this mollusk. The shipping season extends from November to May. The business is conducted on steamships plying between New York City and European ports. About nineteen-twentieths of them go directly to Liverpool. The following statement shows the total exportation of oysters from New York to European ports from 1878-79 to 1888-89:

Season.	Barrels.	Season.	Barrels.
1878-79.....	50,063	1884-85.....	98,802
1879-80.....	67,116	1885-86.....	98,997
1880-81.....	70,768	1886-87.....	100,906
1881-82.....	65,012	1887-88.....	99,123
1882-83.....	64,437	1888-89.....	103,109
1883-84.....	71,021		

There is a small trade with Canada. The oysters sent there are opened and shipped in tubs. Consignments leaving New Haven one day generally reach Montreal the next day.

34. *California trade.*—Comparatively few Connecticut oysters are shipped to California; oysters intended for that market are sent mostly from Newark Bay and localities farther south.

35. *Disposition of shells.*—A small business is carried on in New Haven in burning lime from oyster shells. About 80,000 bushels of shells are annually used for this purpose, of which 20,000 bushels are burned by the New Haven Gas Company. The average price is said to be \$66 a carload of 600 bushels.* Thus the total value of this secondary product was \$8,800.

36. *Methods of fishing.*—The two methods of fishing in vogue in Connecticut are tonging and dredging; it is not deemed necessary to speak of these processes in detail, as many elaborate descriptions have been published.

It may be mentioned that tonging is one of the oldest methods employed in America. Tonging from open boats is still prosecuted in Connecticut, particularly on the public beds, where the use of apparatus is restricted by law.

Dredging is the most common and important method; it is carried on very extensively on private grounds, and is the only system adapted to the cultivation of deep-water areas. Much improvement in this method has resulted from the introduction of screw steamers, which can tow four dredges and operate them by steam-power, whereas the sailing vessels can manage only two at most, and these must be slowly and laboriously operated by hand.

On a sailing dredger the dredge is usually hove up by a small hand-driven winch, upon which the tow rope is wound. The oysters are dumped on deck for culling, or in exceptionally cold weather they are thrown into the hold to prevent freezing.

On a steamer the process is quite different. When dredging, a section of the side of the deck house is removed, so that the oysters may be thrown on the main deck. As fast as the dredges are lifted they are swung in over the rail, their contents quickly emptied, and they are lowered again to the bottom for another load. This goes on continuously until the day's fishing is over. It naturally follows that much material is dredged that has to be culled out from the more valuable part of the catch; perhaps

* Report of Bureau of Labor Statistics, p. 134.

a portion is thrown over on the ground, for its improvement, but injurious material, such as starfish, drills, or other "rubbish," is carefully taken away and deposited where it can do no harm.

To wash the oysters, which is often done on the ground, the dredge is brought near the surface and before being taken on board it is raised and lowered several times, thus washing out the mud, sand, etc. Years ago there was much difficulty in doing this, since a positive clutch was used on the drum upon which is wound the dredge chain, and the latter could not easily be released; now this trouble is obviated by the use of a friction clutch.

There appears to be considerable variation in the capacity of dredges. Capt. Peter Decker says the dredges he uses on his new steamer "weigh 100 pounds, and a full bag will bring in 5 bushels."* Another authority states that the capacity of the average steamer's dredges is 10 to 12 bushels. There are few dredges that will dump 30 bushels.†

Oysters raised by the Poquonock method are lifted, bushes and all, by derricks.‡

VII.—UNFAVORABLE CONDITIONS, ENEMIES, ETC.

37. *Injury by unfavorable weather.*—Among the agencies tending to check the prosperity of the oyster industry in Long Island Sound, adverse weather during the spawning season may undoubtedly be given precedence. Warm, sunny weather is necessary to the life and healthy growth of the oyster spat; and to obtain a "set" is essential to financial success. Sometimes, even after an excellent "set" has been obtained, the young oysters are "winterkilled"—destroyed by the low temperature of the water in exceptionally cold weather. In many cases, when not killed, they are left in such a weakened condition in the spring that they are easily destroyed by enemies. To prevent this the oysters are often moved, before the weather becomes too cold, and planted in deep water, where they will not be affected by sudden changes of temperature.

In autumn and winter heavy gales frequently blow through the Sound with great force, particularly from the eastward. At such times the sea is heavy, and sweeps over the shallow oyster beds with destructive force. It is common, after a heavy easterly gale, to find the beaches strewn with windrows of oysters; frequently the oysters are smothered on the grounds by an accumulation of sand and mud. When oysters are washed out upon the shores the only remedy is to take them up and replant them. If this can be done in time they will be saved. Oysters planted in deep water are not liable to disasters of this kind, since beds at a depth of 35 feet or thereabouts are not usually affected by storms.

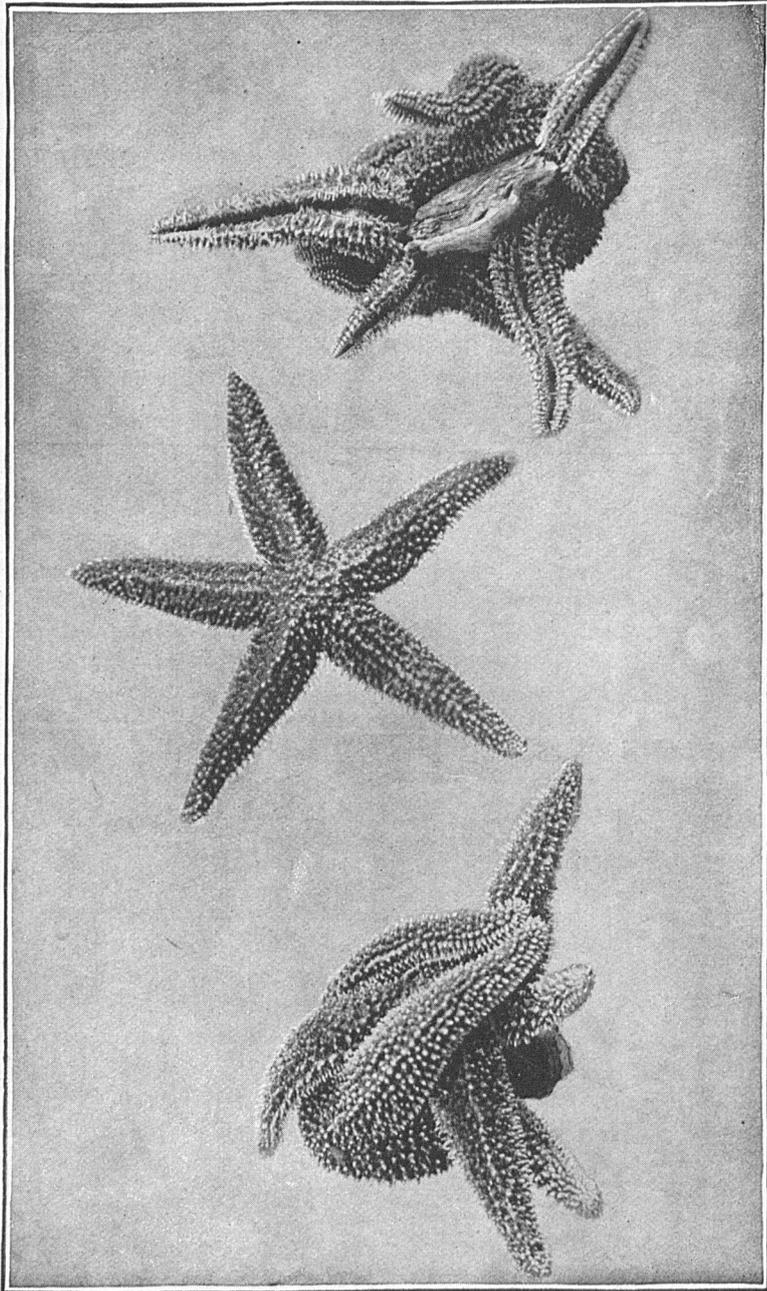
A study of the oyster question leads to the conclusion that there is a remarkable coincidence between years of moderately warm, clear weather, and subsequent seasons of exceptional abundance of oysters.

38. *Injury by mud.*—Although the development of the oyster is advanced by its vicinity to muddy bottom, injury through the influence of mud is one of the dangers to which it is liable. If, for instance, the infant oyster encounters the slightest film

* Report of Connecticut Bureau of Labor Statistics, p. 126.

† *Ib.*, p. 127.

‡ *Ib.*, p. 112.



1 AND 2. TWO STARFISH DESTROYING AN OYSTER; TWO VIEWS. 3. STARFISH; FIVE ARMS.
[From the Fifth Annual Report of the Connecticut Bureau of Labor Statistics.]

of mud, its gills are filled and suffocation ensues. This happens even if the water is only slightly muddy. For this reason muddy grounds are not suitable for the bedding of small oysters or for the collection of spat. Large oysters are not so liable to injury, as they are generally able to get their "bills" or "nibs" above the mud in which they are imbedded. Indeed, oysters grow much more rapidly in the vicinity of muddy grounds if they are large enough to escape injury from their surroundings. Excellent results have been obtained with ground of this character by distributing gravel over it in the proportion of about 200 tons per acre, or enough to prevent the oysters from sinking into the mud.

39. *Stagnant water*.—Injury to oysters by stagnant water is comparatively rare. The only place where Mr. Stevenson found this had occurred was on the Poquonock River, in the town of Groton. There the current is checked by eelgrass, and during hot weather it sometimes becomes peculiarly offensive and causes the death of the oysters within the limits of the stagnant water.

40. *Freshets*.—The danger arising from freshets is the opposite of that incurred from stagnant water. In some cases, oyster beds located at or near the mouths of such streams as the Thames and Connecticut Rivers are damaged by an excess of fresh water and heavy currents during the spring freshets. Not only does the water at such times destroy the oyster directly, but it is claimed that it develops a vegetable growth resembling a fungus which covers some of the beds and smothers the bivalve. This result can not be prevented, except by removing the oysters as soon as possible after the beginning of the freshet, a process attended with great difficulty and sometimes impracticable.

41. *Destruction by starfish*.—Next to bad weather and the consequent dangers which beset the young oyster, the most destructive agency in Connecticut waters is the starfish (*Asterias forbesii*), known in different sections by the various names of "sea-stars," "five-fingers," "crossfish," "sun-stars," and "stars." It is believed this pest destroys more oysters than all other agencies combined, except bad weather.

The starfish does not occur in fresh water, nor is it found in brackish water in numbers sufficient to be harmful; therefore, the so-called inshore grounds, particularly in the estuaries of rivers, do not suffer seriously from its attacks. Indeed, it was not until about 1882, when the grounds in the deep waters of the Sound had been stocked with oysters, that its enormous abundance and destructive power were fully understood. Large areas had been prepared for oyster beds, but many of the cultivators had so much ground that they could not attend to it properly, and, through neglect, it became a favorite breeding-place for starfish. No contrivance had been made suitable to cope with this destructive animal. One oyster-planter estimated the damage on one of his beds at \$90,000 in six months, though in the same time he expended \$9,000 in catching "stars."

There is a wide variation in the damage sustained from starfish by different firms and in different seasons. One firm having a product of \$100,000 annually, estimated its loss in 1889 at only a few hundred dollars. The previous year, however, its beds were suddenly infested with myriads of "stars," and it was estimated that \$15,000 worth of oysters had been destroyed before the actual condition was known. Another firm, with a yield of about \$175,000 in two years, 1888-89, lost only about \$2,500 worth from attacks of starfish. The diminished loss is due to the fact that these firms keep their steamers almost constantly patrolling the oyster beds.

It is claimed that some planters suffer severe losses because they own beds near grounds covered with starfish. Although they may make strenuous efforts to keep their beds clean, their work is rendered almost useless by starfish from neighboring grounds. This is one reason why oyster-farmers consider it a disadvantage for the State to reserve natural beds for public use, since no one has sufficient interest in them to spend time and money in keeping them free from starfish and other pests.

Notwithstanding the annual expenditure of many thousands of dollars to keep the beds free from starfish, the estimated damage done by them in Connecticut waters amounted to \$463,600 in 1887, to \$631,500* in 1888, and to \$412,250 in 1889.

During 1889 many steamers were kept at work a greater part of the time in the effort to clean the oyster beds from "stars." One firm took from its beds in a single year 7,000 bushels, or 2,500,000 starfish in round numbers. In some cases 75 bushels were taken in a single day. The total quantity of starfish taken from Connecticut beds in 1888 amounted to about 42,000 bushels, or nearly 15,000,000 individuals.

The starfish is destructive to oysters of all sizes. The fishermen and planters hold varying beliefs respecting the method of attack, which will not be discussed here. The reader is referred to scientific treatises on the subject published elsewhere.† In a subsequent paragraph reference is made to the means employed to clean the beds.

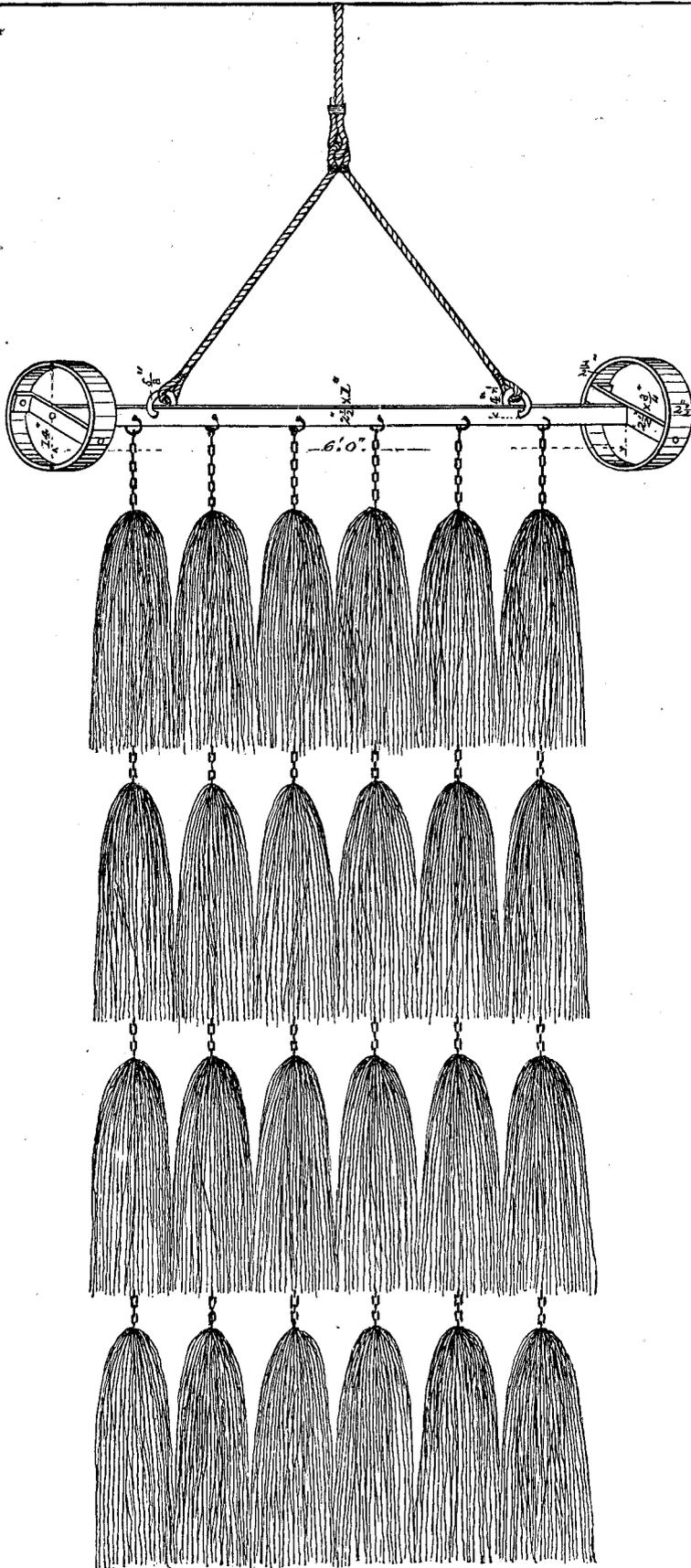
42. *Drills*.—The drill and "winkles" are very troublesome to the oyster-planter. There are three species of these—the drill (*Urosalpinx cinerea*) and two kinds of periwinkle (*Sycotypus canaliculatus* and *Fulgur carica*)—all known by the common name of "borers," a term derived from the manner in which they are supposed to effect an entrance into the shell of an oyster. The drill is particularly destructive to small oysters, but the periwinkles are larger and consequently able to prey upon full-grown stock. What may be termed the tongue of the drill is provided with several rows of teeth-like appendages with which it rasps an entrance into the shell, and then the defenseless oyster is eaten piece-meal. The drill usually bores through the side of an oyster. In some localities these "borers" are more harmful than starfish, since they are always on the ground and always destructive, while the "star" is migratory and leaves the beds a portion of the year. These pests are most prominent in New Haven Harbor and at Princess Bay, New York. They apparently increase in numbers and destructive power each year. At New Haven the estimated damage done by them in the past three years was \$15,000 in 1887, \$20,000 in 1888, and \$25,000 in 1889.

It is fortunate that this destruction is not widespread, for it is more difficult to rid the oyster beds of drills than to clean off the starfish. The latter are taken up with the oysters, even without special dredging, and to this extent at least the grounds may be frequently cleaned; but the drill is so small that few are ever taken in an ordinary dredge. The best remedy is to clean the infested locality thoroughly by dredging it several times, using a small-meshed net on the dredge; both oysters and "borers" are taken; the former are replanted and the latter destroyed.

43. *Other harmful agencies*.—There are various other minor enemies or agencies injurious to the oyster, but these are mostly of small consequence.

* The exceptional damage caused in 1888 is probably because they fed upon the large set of young oysters secured in 1887, which could be more easily destroyed than adults.

† See Ingersoll's Monograph, p. 228. Also Bulletin U. S. Fish Com., vol. v., 1885, p. 77. Also "A history of British starfishes," by Edward Forbes, p. 87.



TANGLES RIGGED FOR USE.

[From Report of the U. S. Fish Commission for 1883.]

It is estimated that 25 or 30 adult oysters produce eggs enough each season to equal the annual product of Connecticut waters, if all reached maturity. This exceptional fertility is nature's provision against the almost equal mortality in that critical period when the eggs or young are floating and when countless millions are destroyed by many agencies. It is believed that crabs and several species of fish consume large quantities of young when in the spat stage. All this affects the prosperity of the planter, but he feels most severely the loss of oysters after they reach a marketable size as "seed," "plants," etc. Much of this loss is unpreventable; but if some plan could be successfully adopted to protect the spat for at least a few weeks in its earlier stages, much might be gained. Some method like that suggested by Prof. John A. Ryder, embryologist of the U. S. Fish Commission (see Bull. U. S. Fish Com., vol. III, 1883, p. 281-294), might be found advantageous to oyster-planters. There are many ponds along the Connecticut coast suitable for experimenting with this method, and many others could readily be constructed at small expense.

In an appended table the estimated losses by starfish and other injurious agencies are given.

44. *Suggestions for removing starfish from oyster grounds.*—Much labor and inventive skill have been employed to accomplish this object, but with only partial success so far. The first plan was to dredge both oysters and starfish together, replant the former and destroy the latter. This method was too laborious, and much effort was put forth to discover some way of taking starfish without disturbing the oysters. Among the devices produced was a dredge, consisting, in general, of a pair of runners, to which was attached a net bag raised by framework a few inches above the runners. A valuable improvement to this consists of a line fastened between and connecting the two runners, and to it is attached numerous drags. These drags cause the starfish to rise from the oysters, so that the former are caught in the bag and secured without disturbing the mollusks.

In the investigations of the U. S. Fish Commission the ordinary tangles (made of hemp rope) have been found very effective in bringing up starfish and similar animals from the bottom of the sea, even in much greater depths than occur over the oyster beds in Long Island Sound. Several forms of tangles have been used. One consists of a triangular bar, shaped something like a harrow, with numerous bunches of rope yarn, like deck swabs, fastened to it. This would probably not be suitable for work on an oyster bed, because the iron frame would injure the oysters. Another form (see illustration, plate CLXVI) used by the Fish Commission would doubtless be very serviceable; this consists simply of an iron bar, with a fixed wheel at each end, and several series of tangles attached to the bar, at proper distances. Two or perhaps more of these could be used from a steamer at the same time, and it is believed they would be very effective in cleaning the ground. I would, however, suggest that revolving instead of fixed wheels be used. This style of apparatus has been thus described in a "Report on the construction and outfit of the U. S. Fish Commission steamer *Albatross*," published in the Report of the U. S. Fish Commission for 1883, p. 91:

This form of tangle bar * * * consists of an iron bar supported at each end by a fixed wheel or iron hoop. Six chains about 12 feet in length are attached to the bar at intervals of 1 foot. To these chains are secured deck swabs, or bundles of rope yarns, at intervals of about 18 inches. It is very useful on rocky bottoms, where it will capture specimens when no other device could be made available.

DIMENSIONS.

Wheels : Diameter, 1 foot 2 inches; width, 2½ inches; thickness of iron, one-half inch; width of crossbars, 2¼ inches; thickness of crossbars, three-fourths of an inch.

Chain bar : Length, 6 feet; width, 2½ inches; thickness, 1 inch; rings for drag rope, diameter, 4 inches; rings for drag rope, diameter of iron, five-eighths of an inch.

Tangle chains : Diameter of iron, three-eighths of an inch; length, 12 feet.

Tangles, hemp, length, 3 feet.

VIII.—FINANCIAL RESULTS.

45. *In general.*—The oyster industry of Connecticut has probably been the most successful fishery on the Atlantic coast of the United States during the past decade. Its development and prosperity have been remarkable, as will be apparent from a comparison of past and present statistics. In 1880 the total investments in vessels, boats, equipment, and shore property amounted to \$361,200. The product was 336,450 bushels of oysters, worth \$386,625 to the producer. In 1889 the total investments were classified as follows:

Vessels, boats, and equipments	\$423,544
Buildings, docks, etc	311,970
Accessory shore property and cash capital	278,200
Oyster grounds	1,237,695
Oysters on beds	1,424,855

*3,676,264

The census of 1880 took no account of the value of oyster beds or the available crop upon them. Omitting these items for 1889, it will be seen that the investments in vessels, boats, shore property, etc., reached a total of \$1,013,714, an increase over 1880 of nearly 300 per cent. The yield of the fishery in 1889 amounted to 1,485,861 bushels of oysters, with a value of \$1,055,807, an increase over the census year nearly equal to the difference in investments.

Notwithstanding this general prosperity there have been instances where individuals were unfortunate because they entered into the business without sufficient knowledge of it to insure success. But with few exceptions the oyster-planters have been very successful. Many who started in the business with almost nothing have gained thousands of dollars by their energy and enterprise.

46. *Investments, etc.*—The greater part of the money now invested in the fishery has been made by the persons engaged exclusively in it. Fifteen years ago it is said there were few persons engaged in this fishery who were possessed of \$10,000. Now one would scarcely be classed as a successful cultivator the value of whose oyster property alone does not reach \$20,000. One company has over \$400,000 invested, including the estimated value of oysters on the beds; another nearly \$300,000, and several about \$200,000 each. There are fifteen firms each of which has oyster property amounting to more than \$50,000. Of those having less than \$50,000 invested eighteen have over \$20,000, and seventeen more than \$10,000 but less than \$20,000. These amounts are exclusive of cash capital, of which large sums are frequently employed.

* The above tabulation simply gives the present valuation of the oyster properties—the amounts for which they could be sold at ordinary market prices—and does not necessarily represent the money put into the industry.

47. *Profit and loss.*—In 1881, when the Shellfish Commission was authorized and the present system inaugurated, and in the years immediately succeeding, nearly everyone engaged in oyster-raising was successful. At that time grounds could be obtained at a comparatively low price; the high values of to-day were not thought of; satisfactory “sets” were secured quite regularly, and starfish had not then caused such havoc on the oyster beds as in recent seasons. Large profits accrued from small investments. The claim has been made that one investment of \$200 realized a profit in 3 years of 8,500 per cent., but this is believed to be slightly exaggerated. During the past few years, however, there has been a multiplication of unfavorable influences. Many complain of losing money, and there appear to be more exceptions to the general prosperity than usual. Still, the industry as a whole has been very prosperous.

The receipts in 1889 (including the public beds) were \$1,055,807, and the expenditures \$632,283, leaving a profit of \$423,524, which is more than 11 per cent. annual return on the investment, including the oyster grounds and the oysters on them. Some of the more fortunate have made much more than this average; others have fallen below it. In one case a firm reported receipts in 1889 amounting to about \$75,000; their expenses were about \$25,000; the previous year its receipts were over \$100,000, expenses \$30,000; in 1887 receipts about \$50,000, expenses \$28,000.

In another case the following results were obtained from a bed having an area a trifle less than 100 acres: In 1887 30,000 bushels of oysters were taken from it, after which 33,000 bushels of oyster shells were strewn over it, at a cost, including labor, shells, etc., of \$2,500. A set was secured that summer and the spat lived successfully through the succeeding winter. In 1888 nothing was done to the bed except to search it for starfish, the expenditure for this amounting to about \$500. In 1889 \$1,200 was expended in hunting starfish and in taking up 4,200 bushels of oysters, which sold for \$3,190. In December, 1889, there were 70,000 bushels of oysters on the bed (accepting the most conservative estimate) which it was expected would be taken up the next year; these had a value on the bed of \$52,000. Thus the total expenditure for 3 years—1887 to 1889, inclusive—including the annual tax of \$40, amounted to \$4,320, while the money received from sales (\$3,190) added to the value of the crop on the bed made a total of \$55,190. This leaves a net profit of \$50,870. The bed on which these results were obtained is considered only fair, worth about \$70 per acre. The success was due, first, to the procurement of a good set, and, second, to vigilance in protecting the crop from injury by starfish. Stevenson thinks it represents very fairly what may be expected of grounds off the Connecticut shore if a good set is obtained and the ravages of starfish prevented.

To illustrate the losses met with by some, it is stated that one cultivator put \$25,000 into the business; in 1889 he had received only \$2,000 from his investment and offered to sell his entire oyster property for \$7,500.

IX.—STATISTICAL STATEMENTS.

The tabular statements on the following pages cover other phases of the industry and convey a complete idea of the extent and condition of the business in each coast town during the years 1887, 1888, and 1889.

48. Table of persons employed.

Towns.	Fishermen and others engaged in cultivating and harvesting the oysters.										Shoremen and others engaged in preparing the oysters for market.									
	Number.			Nationality in 1889.							1887.		1888.		1889.		Nationality in 1889.			
	1887.	1888.	1889.	United States.	Swede.	German.	Irish.	Portuguese.	Russian.	Others.	Male.	Female.	Male.	Female.	Male.	Female.	United States.	Swede.	German.	Irish.
Greenwich	43	49	49	49																
Stamford	21	20	20	20																
Noroton	24	3	22	19	1	2														
Norwalk	143	127	143	129	5	3	3	2	1	24		32		85		33	1	1		
Westport and Fairfield	10	10	10	10																
Bridgeport	48	49	51	42	2	1	4	2		20		44		18		11	2	2	3	
Stratford	28	28	23	13	5	1	3	1		42		36		30		25	3	2		
Milford	16	18	22	22						14		31		20		20				
New Haven	209	204	211	179	11	4	11			6	209	347	203	344	203	345	432	8	5	103
Branford	12	14	12	12																
Guilford	3	3	3	3																
Madison	8	9	8	8																
Clinton	8	8	8	8																
Quiambog and Mumford's Cove	7	7	7	7																
New London	4	4	4	4																
Total	584	573	593	525	24	11	21	5	1	6	309	347	340	344	306	345	521	14	10	106

49. Table showing capital invested and annual expenditures.

Towns.	Steam vessels.								
	Number.			Net tonnage.			Value, including outfit.		
	1887.	1888.	1889.	1887.	1888.	1889.	1887.	1888.	1889.
Greenwich	1	1	1	34.75	34.75	34.75	\$7,250	\$7,050	\$6,850
Stamford	1	1	1	8.34	8.34	8.34	2,000	1,900	1,800
Noroton	2	2		55.50	55.50		10,400	9,800	
Norwalk	13	14	14	322.89	346.50	346.50	76,450	86,100	80,750
Westport and Fairfield	1	1	1	7.73	7.73	7.73	2,000	2,100	2,000
Bridgeport	7	6	6	264.14	253.89	284.92	38,700	33,500	37,800
Stratford	4	4	4	179.44	179.44	179.44	23,790	22,800	21,300
Milford	2	2	3	76.02	75.98	85.31	17,350	16,950	20,500
New Haven	22	23	23	713.70	770.51	770.47	147,350	152,600	147,250
New London	1	1	*1	14.62	14.62	14.62	2,500	2,400	2,400
Total	54	55	54	1,677.13	1,747.26	1,732.08	327,790	335,200	320,740

Towns.	Sail vessels.									Boats.					
	Number.			Net tonnage.			Value, including outfit.			Number.			Value, including outfit.		
	1887.	1888.	1889.	1887.	1888.	1889.	1887.	1888.	1889.	1887.	1888.	1889.	1887.	1888.	1889.
Greenwich	16	19	20	144.50	179.24	188.90	\$9,515	\$9,820	\$11,185	80	80	81	\$5,675	\$5,775	\$5,780
Stamford	7	6	6	59.91	46.53	46.53	4,430	3,745	3,600	28	28	26	2,700	2,700	2,604
Noroton	5	4	3	40.45	35.10	22.11	3,195	2,500	1,530	35	35	35	3,100	3,100	3,120
Norwalk	14	12	12	156.56	130.85	130.79	10,570	8,560	8,335	210	210	208	18,800	18,800	18,820
Westport and Fairfield	1	1	1	15.70	15.70	15.70	800	750	660	4	3	3	275	230	230
Bridgeport	7	7	5	80.74	80.74	49.29	6,505	6,225	3,920	20	20	21	3,220	3,220	3,280
Stratford										12	12	12	2,930	2,930	2,930
Milford	1	1	1	11.76	11.76	11.76	550	500	500	4	4	5	1,840	1,840	1,920
New Haven	14	12	11	225.91	181.39	165.93	15,590	12,490	11,200	110	110	111	17,700	17,700	17,855
Branford										11	11	10	490	490	450
Guilford	2	1		17.17	10.98		1,250	600		15	15	15	1,315	1,325	1,325
Madison										10	10	10	2,700	2,700	2,700
Clinton										5	5	5	250	250	250
Quiambog and Mumford's Cove										7	7	7	250	250	250
Total	67	63	59	752.70	692.29	631.01	52,405	45,190	40,930	551	550	549	61,245	61,310	61,574

* This vessel is employed exclusively in taking oysters in Rhode Island waters.

49. Table showing capital invested and annual expenditures—Continued.

Towns.	Total capital invested in vessels and boats.			Value of wharves and build-ings.	Value of grounds.	Value of oysters on grounds.	Cash capital.	Total capital invested.	Aggregate expense in cultivating the beds and preparing the oysters for market.		
	1887.	1888.	1889.						1887.	1888.	1889.
Greenwich	\$22,440	\$22,045	\$23,815	\$500	\$65,500	\$60,000	\$3,500	\$153,315	\$11,550	\$13,370	\$12,275
Stamford	9,150	8,845	8,064	2,900	24,210	25,000	4,000	64,174	5,595	5,485	5,290
Noroton	16,695	15,400	4,650	2,500	16,000	18,000	4,000	45,150	9,850	8,850	4,835
Norwalk	105,820	113,460	107,905	52,600	237,120	385,000	40,000	822,625	62,010	62,200	63,360
Westport and Fairfield	3,075	3,080	2,890	250	6,500	8,400	2,100	20,140	1,585	2,375	1,640
Bridgeport	48,425	42,045	45,000	27,200	65,390	72,000	22,000	231,500	22,790	29,365	28,025
Stratford	26,720	25,730	24,230	11,500	159,800	79,000	15,000	289,530	37,395	30,790	27,310
Milford	19,740	19,290	23,010	6,000	26,000	150,000	13,000	218,010	14,250	27,900	21,585
New Haven	180,640	182,790	176,305	204,250	613,540	600,155	172,100	1,775,350	271,864	228,419	264,406
Branford	1,740	1,090	450	3,500	8,800	7,500	2,000	22,250	3,385	4,515	3,985
Guilford	1,315	1,325	1,325	500	3,000	2,500	.....	6,825	375	595	305
Madison	2,700	2,700	2,700	.....	3,500	1,200	.....	7,000	455	475	415
Clinton	250	250	250	200	1,850	5,000	500	7,800	1,465	1,475	1,345
Westbrook .....	.....	.....	.....	.....	125	.....	.....	125	.....	.....	.....
Thames River .....	.....	.....	.....	.....	2,500	.....	.....	2,500	.....	.....	.....
Poquonock .....	.....	.....	.....	.....	800	.....	.....	800	.....	.....	.....
Quiamhog and Mumford's Cove	250	250	250	70	3,000	2,100	.....	5,420	1,375	1,905	1,665
New London	2,500	2,400	2,400	.....	.....	.....	.....	2,400	.....	.....	.....
Stonington .....	.....	.....	.....	.....	60	.....	.....	60	.....	.....	.....
Total.....	441,440	441,700	423,241	311,970	1,237,695	1,424,835	278,200	3,675,964	443,944	417,489	436,451

50. Quantities and values of material used and of seed planted in preparing oyster grounds.

Material used at the towns named.	Bushels.			Value.		
	1887.	1888.	1889.	1887.	1888.	1889.
<i>Shells.</i>						
Greenwich	48,000	46,000	18,000	\$3,600	\$3,280	\$1,220
Stamford	11,000	10,000	8,000	800	700	520
Noroton	15,000	25,000	3,000	780	1,300	140
Norwalk	268,240	372,330	283,000	19,970	28,305	19,825
Westport and Fairfield	8,500	18,000	20,000	425	900	1,000
Bridgeport	65,500	81,200	135,000	3,275	4,100	6,730
Stratford	140,000	270,000	118,000	5,930	7,918	4,300
Milford	*170,000	*180,000	*180,000	3,700	4,200	4,200
New Haven	1,298,580	1,269,300	1,148,125	64,124	66,484	56,675
Branford	6,000	8,000	1,200	420	560	77
Total.....	2,080,820	2,279,830	1,914,325	103,024	117,747	94,687
<i>Northern seed.</i>						
Greenwich	11,000	4,800	1,500	3,800	2,000	600
Stamford	4,900	5,000	1,800	1,700	2,000	750
Noroton	2,000	2,000	1,000	800	1,000	500
Norwalk	39,140	41,000	23,300	10,170	17,160	8,100
Westport and Fairfield	1,300	3,700	2,500	500	1,400	950
Bridgeport	8,500	5,800	10,500	2,835	1,800	5,400
Milford .....	.....	5,000	2,000	.....	1,500	600
New Haven	24,260	52,550	55,400	8,211	15,880	19,395
Branford	13,000	12,000	4,900	9,000	8,250	3,520
Guilford	900	900	200	540	550	130
Madison	2,550	1,240	850	800	380	200
Clinton	2,500	2,600	2,800	900	980	1,100
Quiamhog and Mumford's Cove	1,700	4,200	3,250	1,110	2,665	1,957
Total.....	111,750	140,790	110,000	40,366	55,625	43,262
<i>Southern seed.</i>						
New Haven	87,440	95,325	115,062	36,101	41,585	53,716

*Including gravel planted.

51. *Estimated value of oysters destroyed by enemies and other agencies.*

Towns.	Value of oysters destroyed by starfish.			Value of oysters destroyed by other agencies, as drills, mud, ice, frost, etc.			Total value of oysters destroyed.		
	1887.	1888.	1889.	1887.	1888.	1889.	1887.	1888.	1889.
Greenwich.....	\$1,500	\$2,000	\$1,500	\$800	\$800	\$500	\$2,300	\$2,800	\$2,000
Stamford.....	4,000	4,000	5,000	1,000	1,000	1,000	5,000	5,000	6,000
Noroton.....	1,000	1,000	1,000	400	400	350	1,400	1,400	1,350
Norwalk.....	90,000	85,000	71,000	5,000	5,000	5,000	95,000	90,000	76,000
Bridgeport.....	125,000	129,000	47,250	3,500	4,000	3,500	128,500	133,000	50,750
Stratford.....	32,000	26,000	25,000	400	500	500	32,400	26,500	25,500
Milford.....	1,500	1,500	1,000				1,500	1,500	1,000
New Haven.....	208,600	383,000	259,000	28,100	35,050	41,600	236,700	418,050	300,600
Brantford.....			1,500						1,500
Total.....	463,600	631,500	412,250	39,200	46,750	52,450	502,800	678,250	464,700

52.—*Table showing the quantities and values of oysters and shells taken from private and public grounds.*

Oysters and shells taken from private and public grounds at the towns named.	Bushels.			Value.			
	1887.	1888.	1889.	1887.	1888.	1889.	
I. Private grounds:							
Seed oysters:							
Greenwich.....		9,000	9,100	5,500	\$6,750	\$6,750	\$3,850
Stamford.....		4,500	4,100	4,000	1,900	1,900	1,910
Noroton.....		7,000	8,000	8,000	4,100	4,500	4,600
Norwalk.....		145,080	140,780	132,899	76,330	81,978	78,621
Westport and Fairfield.....				3,500		1,925	
Bridgeport.....			2,000	2,000		1,300	
Stratford.....		10,500	750	1,500	6,275	285	820
Milford.....		35,000	38,000	84,000	19,250	24,700	54,600
New Haven.....		88,100	99,500	204,850	40,395	45,265	97,240
Total.....		299,180	302,290	446,249	155,000	166,478	244,866
Southern plants:							
New Haven.....		110,900	124,100	142,700	83,950	93,450	111,225
Native oysters to open:							
Norwalk.....		3,000	3,000	3,000	3,000	3,000	3,000
Bridgeport.....		2,000	2,000	2,000	2,200	2,200	2,200
Stratford.....		74,000	33,500	10,500	61,500	31,500	9,500
Milford.....			30,000			26,000	
New Haven.....		503,600	495,140	490,290	376,710	362,750	342,680
Total.....		582,600	593,640	505,790	443,410	425,450	357,380
Native oysters in shell:							
Greenwich.....		20,000	20,500	17,000	16,000	16,400	13,600
Stamford.....		12,000	10,000	10,150	12,000	10,000	10,150
Noroton.....		13,000	10,000	10,000	13,000	10,000	10,000
Norwalk.....		102,340	119,117	127,442	86,339	114,560	127,746
Westport and Fairfield.....		800	1,200	2,800	1,100	2,000	3,500
Bridgeport.....		29,777	43,379	48,080	32,260	43,960	48,165
Stratford.....		30,587	22,034	37,740	25,859	18,421	34,980
Milford.....		32,000	51,000	28,800	52,000	41,000	20,370
New Haven.....		77,536	36,707	26,050	44,100	27,970	22,200
Brantford.....		11,000	11,500	6,500	13,400	14,000	8,100
Guilford.....		1,400	500	600	1,500	670	720
Madison.....		1,250	980	1,100	1,450	1,050	1,200
Clinton.....		4,000	3,700	4,100	6,000	5,900	6,500
Quitabog and Mumford's Cove.....		1,700	4,250	1,910	4,100	9,880	3,800
Total.....		337,190	334,927	317,272	289,168	315,811	311,031
Shells:							
Stamford.....			5,000	4,000		250	200
Norwalk.....		6,000	20,000	30,000	320	1,200	1,500
Bridgeport.....		10,000	42,000	28,000	500	2,100	1,400
Stratford.....				90,000			3,850
New Haven.....		23,000	90,000	182,500	1,050	4,450	8,920
Total.....		39,000	157,000	334,500	1,870	8,000	15,870

52.—Table showing the quantities and values of oysters and shells, etc.—Continued.

Oysters and shells taken from private and public grounds at the towns named.	Bushels.			Value.		
	1887.	1888.	1889.	1887.	1888.	1889.
II. Public grounds:						
Greenwich.....	6,200	6,000	1,200	\$2,170	\$2,350	\$360
Stamford.....	2,400	2,000	1,500	800	700	500
Noroton.....	2,000	1,900	1,100	800	800	520
Norwalk.....	28,000	21,500	12,500	8,400	6,260	5,760
Westport and Fairfield.....	7,000	7,000	6,000	2,000	2,000	2,000
Bridgeport.....	115,000	81,000	3,500	19,800	12,610	1,700
Stratford.....	19,000	8,000	4,500	3,800	2,500	2,200
Milford.....	6,000	10,000	8,000	2,150	3,400	2,400
New Haven.....	35,000	81,000	24,000	12,500	18,000	9,875
Branford.....	850	900	1,100	285	270	330
Madison.....	12,500	7,000	5,500	4,500	2,850	2,580
Clinton.....	3,500	3,530	3,500	1,800	1,800	1,800
Westbrook.....	1,800	1,300	1,000	1,800	1,000	650
Saybrook.....	750	1,500	200	950	1,900	275
Niantic.....			40			80
Thames River.....	2,000	1,850	120	1,000	925	60
Poquonock.....	800	460	90	2,000	1,150	225
Total	242,800	184,910	78,850	64,255	58,515	31,305
III. Total from public and private grounds (not including shells):						
Greenwich.....	35,200	35,600	23,700	24,920	25,500	17,810
Stamford.....	18,900	16,100	15,650	14,700	12,600	12,560
Noroton.....	22,000	19,900	19,100	17,900	15,800	15,120
Norwalk.....	278,420	284,397	275,841	174,069	205,798	215,117
Westport and Fairfield.....	7,600	8,200	12,800	8,100	4,000	7,425
Bridgeport.....	146,777	78,379	55,580	54,280	59,870	53,365
Stratford.....	134,087	64,284	54,240	97,434	52,706	47,500
Milford.....	73,000	120,000	115,800	53,400	95,100	77,370
New Haven.....	815,188	836,507	887,890	557,715	547,435	583,220
Branford.....	11,850	12,400	7,600	13,685	14,270	8,430
Guilford.....	1,400	500	600	1,500	670	720
Madison.....	13,750	7,850	6,600	5,950	3,900	3,780
Clinton.....	7,500	7,200	7,600	7,800	7,700	8,300
Westbrook.....	1,800	1,300	1,000	1,300	1,000	650
Saybrook.....	750	1,500	200	950	1,900	275
Niantic.....			40			80
Thames River.....	2,000	1,850	120	1,000	925	60
Poquonock.....	800	460	90	2,000	1,150	225
Quiambog and Mumford's Cove.....	1,700	4,250	1,910	4,100	9,850	3,800
Total	1,572,670	1,509,867	1,485,861	1,035,783	1,050,704	1,055,807

NOTE.—The total figures include the quantity and value of oyster-shells resulting from the stock opened before being sold; but the shells taken up from the beds as such do not enter into the totals.

X.—OYSTER LEGISLATION OF CONNECTICUT.

The following digest of Connecticut laws enacted prior to 1881 for the control of the shellfish fisheries of the State is from "The Oyster Industry," by Ernest Ingersoll, pages 67 to 70. The legislation of 1881 is the most important enacted by the State, and for this reason it is given in full, as supplementary to the digest.

[Laws of State of Connecticut, Chapter IV, Part I, Article I.]

SECTION 1. Describes the particular territory within which the selectmen of East Haven may "designate" or grant ground for the planting and cultivation of oysters; describes within what other waters the oyster committee of the same town may designate; and gives to the selectmen of Orange all the powers of an oyster committee.

SEC. 2. Provides that any town except East Haven and Orange may appoint a committee of not more than five electors, which shall designate to applicants suitable places in the navigable waters of the town for planting or cultivating oysters, clams, or mussels.

SEC. 3. Any person desiring to plant or cultivate oysters, clams, or mussels may apply in writing for a suitable place, and such committee or selectmen may make such designation, not exceeding 2 acres in extent, after the applicant has proved that the ground has not previously been set off for this

purpose; that the ground is within town limits; and that fees due to the town for this designation have been deposited. Town clerks may grant the required certificates, and town treasurers receipt for payments of fees. Violations of this act by members of town committees are punishable. Having received his designation, the applicant must mark the boundaries of his ground by buoys or stakes, set at suitable distances and labeled with the name or initials of the owner; and until then he shall not be permitted to catch oysters upon the ground. Designations may be made to several in common.

SEC. 4. Every person who shall plant or cultivate oysters, clams, or mussels in any such place shall own them, and also all other oysters, clams, or mussels in such place, and have the exclusive right of taking up and disposing of them and of using such place for the purpose of planting or cultivating oysters, clams, or mussels therein, which shall be transferable by written assignment, but nothing herein contained shall affect the rights of any owner of lands in which there may be salt-water creeks or inlets, or which may be opposite or contiguous to such navigable waters; nor the existing by-laws of any city, town, or borough; nor authorize any committee or selectmen to designate, or any person to mark, stake out, or inclose any natural oyster bed (except in New Haven harbor and its tributaries, and for a distance not exceeding 2 miles from the mouth of said harbor), or infringe the free navigation of said waters, or interfere with the drawing of seines in any place established and customarily used for seine fishing.

SEC. 5. Any person procuring oyster ground "for the purpose of assigning rights which he may acquire for profit or speculation," shall be fined \$50.

SEC. 6. Amended and replaced by subsequent legislation, adds to the powers of the New Haven committee the power to designate ground for oyster planting and cultivation in the waters of Long Island Sound, which lies between East Haven and a line parallel to its boundary and 500 yards to the westward; and the selectmen of Orange may designate between this tract and a line due south from Savin Rock, even though such ground "may have been natural oyster beds." And the committee's previous designations in this territory are hereby confirmed.

SEC. 7. Enjoins that all designations of oyster ground, when made, shall be exactly recorded in the office of the town clerk, together with all descriptions and assignments; "and all attested copies of such applications, designations, and assignments, with a certificate that they have been recorded, shall be conclusive evidence of the fact of such record, and prima facie evidence of the validity of such application, designation, and assignment."

SEC. 8. Any owner who has lost the evidences of title to oyster ground, after having filed them with the town clerk, may apply to the town committee, and if he satisfies them of his claim, he may receive from them a new title; but there are heavy penalties for fraud under this provision. In case of boundaries being lost, or when the committee authorized to stake out oyster grounds have described the boundaries incorrectly, the superior court, as a court of equity, may, upon petition, order such uncertain boundaries to be reestablished, according to prescribed methods, except in cases where a map of the ground has been filed with the town clerk, in which case uncertain bounds are to be established by a surveyor appointed by a judge of the superior court.

SEC. 9. When there are more than thirty designations in any one town the selectmen shall procure a map of the district.

SEC. 10. An owner desiring to dam or lock an inlet or salt-water creek for the purpose of cultivating oysters therein, the selectmen shall visit the spot and report upon the propriety of the request at a meeting of the town; if the meeting approves, the owner may build a dam, etc., as indicated by the selectmen, and maintain it during the pleasure of the general assembly.

SEC. 11. When any natural oyster bed is set apart, contrary to law, the superior court in the same county has power to revoke the designation, if it deems it best; but must give the owner time to remove any oysters and improvements on the property.

SECS. 12 and 13. Conferred privileges upon Guilford which that town declined to ratify.

SEC. 14. No person, except the authorized committee or selectmen, shall stake out or inclose any oyster grounds in navigable waters, unless such persons shall own this ground under the provisions of this chapter; penalty, fine not to exceed \$50.

SEC. 15. Any member of a committee who shall designate ground for oyster cultivation upon natural oyster beds, or in any other place where it is prohibited by law, shall forfeit from \$25 to \$200, excepting in Orange, New Haven, and East Haven.

SEC. 16. Any other person than the owner, who shall unlawfully remove any shells or shellfish from a place designated for oyster planting, shall be fined not exceeding \$300, or imprisoned not more than one year; but if the offense be committed at night, heavier penalties are decreed.

SEC. 17. Forbids taking any oysters or oyster shells from the Thames River between March 1 and November 1.

SEC. 18. Every person who shall willfully injure any inclosure legally designated for oyster planting, remove any buoys or stakes, injure any oysters, remove any shells from such inclosure, or willfully deposit mud there, shall be subject to heavy penalties, after trial before a justice of the peace, with right of appeal to the superior court.

SEC. 19. Provides penalties for injury to dams or locks of any oyster pond.

SEC. 20. Prohibits taking "shells or shellfish" between sunset and sunrise, from any navigable waters of the State (except clams in Branford harbor from April to October), under fine of \$50 to \$100, or imprisonment, or both.

SEC. 21. Prohibits the taking of shellfish, or the use of spears for taking fish, within any area designated for oyster planting, within 2 miles of the shores of Branford or East Haven; penalty, fine of from \$7 to \$100, or imprisonment.

SEC. 22. Prohibits the use of dredges in New Haven Harbor west of a line from Farm River to Scotch Cap, and north of a line from Scotch Cap to Southwest Ledge, and then westerly to Hines's place in Orange; prohibits taking shellfish in Morris Creek, except on or adjacent to one's own land; and prohibits dredging *by steam* anywhere away from upon one's own ground, more than 2 days in the week, under heavy penalties, which may be imposed by a justice of the peace, subject to an appeal to the superior court. Dredging on one's own ground is allowed, however, in East Haven waters to the owners of ground southerly of a line drawn from The Chimneys, through Quix's Ledge and Adam's Fall, until it intersects a line drawn from the old light-house to Savin Rock.

SEC. 23. All sheriffs and constables shall, and any other persons may, seize any boat or vessel illegally used in dredging, with its tackle, apparel, and furniture, wherever found, within 1 year thereafter; and, if condemned, the boat, etc., shall be sold after the prescribed form.

SEC. 24. When there shall be found in any waters of this State on board any boat or vessel, illegally used under the provisions of this chapter, any dredge or shells and shellfish, it shall be prima facie evidence that said boat or vessel was used contrary to the provisions of said chapter.

SEC. 25. No person shall gather shells or shellfish in any waters of this State for himself or his employer unless he and his employer are at that time, and have been for 6 months previous, actual inhabitants of the State.

SEC. 26. Refers to lobsters.

LAWS SINCE 1875.

Since the revision of the statutes in 1875, the following additional laws have been enacted:

MARCH 16, 1878.—When oysters have been planted on any ground legally designated, and doubt arises as to the jurisdiction of neighboring towns over it, prosecutions against the owner may be made in either of the three towns nearest.

MARCH 27, 1878.—No committee or selectmen of any town shall designate, and no person shall mark, stake out, or inclose for the cultivation of oysters, clams, or mussels, any natural clam bed.

MARCH 27, 1878.—No person shall take or carry away from Branford or Farm Rivers any oyster shells or seed oysters, for the purpose of planting them on private beds; or more than 2 bushels of oysters in a single day; or shall use tongs for taking oysters there between May 1 and October 1; under penalty of forfeiting \$14 before a justice of the peace in Branford or East Haven, with a right of appeal to the superior court.

NAVIGATION LAWS.

There are two clauses in the State's navigation laws (chapter VIII) which concern oysters, as follows:

SEC. 19. Every person who shall deposit any substance, except oyster shells, in the harbors of New Haven, Bridgeport, and Stamford, shall be fined from \$50 to \$500, or imprisonment, or both.

SEC. 20. Gives the city court or a justice of the peace jurisdiction in such cases.

REMEDYING WEAK TITLES.

By a series of amendments and resolutions the legislature has "healed" many weak titles to oyster ground, by enacting that designations of ground for planting and cultivating oysters, clams, or mussels shall be valid and confirmed, including:

I. All granted informally under the provisions of chapter 3, section VIII, although the owners may have lost their evidences of title after having filed the same with the town clerk (July 17, 1875).

II. All in which the applicant may be a married woman or a minor (March 16, 1878).

III. All in which the application was made for the purpose of transferring the privileges; and all such transfers are confirmed (March 27, 1878).

IV. All designations for "planting," where "cultivation" is not mentioned.

V. All designations of ground described as containing not over 2 acres to each applicant, exclusive of muddy or rocky bottom, although the total quantity of ground embraced in the designation may be more than 2 acres to each applicant (March 27, 1878).

VI. All designations previous to March, 1879, by the town of East Haven, between its westerly boundary and a line drawn due south from the center of the mouth of East Haven River.

ESTABLISHMENT OF A STATE COMMISSION FOR LOCATING OYSTER GROUNDS.

Finally, some months subsequent to the compilation of the previous legal information, the legislature of 1881 passed an act, given herewith in full, which reconstructs the methods hitherto in vogue and reads as follows:

An Act Establishing a State Commission for the Designation of Oyster Grounds.

Be it enacted by the senate and house of representatives in general assembly convened, The State shall exercise exclusive jurisdiction and control over all shellfisheries which are located in that area of the State which is within that part of Long Island Sound and its tributaries bounded westerly and southerly by the State of New York, easterly by the State of Rhode Island, and northerly by a line, following the coasts of the State at high water, which shall cross all its bays, rivers, creeks, and inlets at such places nearest Long Island Sound as are within and between points on opposite shores, from one of which objects and what is done on the opposite shore can be reasonably discerned with the naked eye, or could be discovered but for intervening islands. And all shellfisheries not within said area shall be and remain within the jurisdiction and control of the towns in which they are located under the same laws and regulations and through the same selectmen and oyster committees as heretofore. If a difference shall arise between any town and the commissioners as hereinafter provided for, as to the boundary line between said town and the area so to be mapped, said town, by its selectmen, may bring its petition to the superior court for the county within which said town is situated, to determine said boundary line, and said court upon reasonable notice to the parties shall hear said petition and appoint a committee to ascertain the facts in such case and report the same to said court, and said court shall thereupon make such order as may be proper in the premises.

SEC. 2. The three fish commissioners of the State now in office, and their successors, shall also be and constitute a board of commissioners of shellfisheries, and be empowered to make or cause to be made a survey and map of all the grounds within the said area in Long Island Sound which have been or may be designated for the planting or cultivation of shellfish; shall ascertain the ownership thereof, and how much of the same is actually in use for said purposes; they shall also cause a survey of all the natural oyster beds in said area, and shall locate and delineate the same on said map, which survey and map when completed shall not cost a sum exceeding \$2,500, and shall report to the next session of the legislature a plan for an equitable taxation of the property in said fisheries, and make an annual report of the state and condition of said fisheries to the legislature, and the said commissioners shall be empowered to appoint and employ a clerk of and for said board, and they shall each give a bond to the State with sufficient surety for the faithful performance of their duties, and for the payment to the State treasurer of all money that may come into their hands under this act in the sum of \$2,000.

SEC. 3. The said commissioners shall also be empowered, in the name and in behalf of the State,

to grant by written instruments, for the purpose of planting and cultivating shellfish, perpetual franchises in such undesignated grounds within said area as are not and for ten years have not been natural clam or oyster beds, whenever application in writing is made to them through their clerk by any person or persons who have resided in the State not less than one year next preceding the date of said application. The said application and the said grant shall be in manner and form as shall be approved by the chief justice of the State, and all such grants may be assigned to any person or persons who are or have been residents of the State for not less than one year next preceding such assignment, by a written assignment, in manner and form approved by said chief justice; and the said commissioners shall keep books of record, and record all such grants and assignments therein, and the same shall also be recorded in the town clerk's office in the town bounded on Long Island Sound within the meridian boundary lines of which said grounds are located.

SEC. 4. When any such application is filed with the clerk of said commissioners, he shall note on the same the date of its reception and shall cause a written notice, stating the name and residence of the applicant, the date of filing the application, the location, area, and description of the ground applied for, to be posted in the office of the town clerk of the town bounded on the said Long Island Sound within the meridian boundary lines of which said grounds are located, where such notice shall remain posted for 20 days. Any person or persons objecting to the granting of the grounds applied for, as aforesaid, may file a written notice with the town clerk, stating the grounds of his or their objections, upon the payment to said town clerk of the sum of 25 cents, and at the end of said 20 days the said town clerk shall forward all such written objections to the clerk of said commission; and in case such objections are so filed and forwarded the said commissioners, or a majority, shall upon 10 days' notice in writing, mailed or personally delivered to all the parties in interest, hear and pass upon such objections at the town in which such grounds are located as aforesaid, and if such objections are not sustained, and the area of ground is not, in the opinion of the commissioners, of unreasonable extent, they may, for the actual costs of surveying and mapping of such grounds, and the further consideration of \$1 per acre, paid to the said commissioners, to be by them paid over to the treasurer of the State, grant a perpetual franchise for the planting and cultivating shellfish in such ground, or in any part of the same, in the manner aforesaid; and where no such objections are made, such grants may be made for the considerations hereinbefore named. At all hearings authorized by this act the said commissioners may, by themselves or their clerks, subpoena witnesses and administer oaths as in courts of law.

SEC. 5. The said commissioners shall, previous to the delivery of any instrument conveying the right to plant or cultivate shellfish on any of said grounds, make or cause to be made a survey of the same, and shall locate and delineate the same, or cause it to be located and delineated upon the map aforesaid, and upon receipt of said instrument of conveyance the grantee shall at once cause the grounds therein conveyed to be plainly marked out by stakes, buoys, ranges, or monuments, which stakes and buoys shall be continued by the said grantee and his legal representatives, and the right to use and occupy said grounds for said purposes shall be and remain in said grantee and his legal representatives: *Provided*, That if the grantee or holder of said grounds does not actually use and occupy the same for the purposes named, in good faith, within 5 years after the time of receiving such grant, the said commissioners shall petition the superior court of the county having jurisdiction over the said grounds to appoint a committee to inquire and report to said court as to the use and occupancy of such grounds in good faith, and said court shall in such case appoint such committee, who, after 12 days' notice to petitioners and respondents, shall hear such petition and report the facts thereon to said court, and if it shall appear that said grounds are not used and occupied in good faith for the purpose of planting or cultivating shellfish the said court may order that said grounds revert to the State, and that all stakes and buoys marking the same be removed, the costs in said petition to be paid at the discretion of the court.

SEC. 6. When, after the occupancy and cultivation of any grounds designated as aforesaid by the grantee or his legal representatives, it shall appear to said commissioners that said grounds are not suited for the planting or cultivation of oysters, said grantee, upon receiving a certificate to that effect from said commissioners, may surrender the same, or any part thereof, not less than 100 acres, to the State, by an instrument of release of all his rights and title thereto, and shall, on delivery of such instrument to the said commissioners, receive their certificate of said release of said grounds, the location and number of acres described therein, which shall be filed with the State treasurer, who shall pay to the holder the sum of \$1 for every acre of ground described in said release where said sum has been paid therefor to the State. And the said release shall be recorded by the said commissioners in their record books, and in the town clerk's office in the town adjacent to and within the meridian

boundary lines of which said grounds are located. For all purposes relating to judicial proceedings in criminal matters the jurisdiction of justices of the peace of the several towns bordering on Long Island Sound shall extend southerly by lines running due south by true meridian from the southern termini of the boundary lines between said towns to the boundary line between the States of Connecticut and New York.

SEC. 7. Said commissioners shall provide, in addition to the general map of said grounds, sectional maps, comprising all grounds located within the meridian boundary lines of the several towns on the shores of the State, which maps shall be lodged in the town clerk's office of the said respective towns, and said commissioners shall also provide and lodge with said town clerks blank applications for such grounds and record books for recording conveyances of the same, and all conveyances of such grounds and assignments, reversion, and releases of the same shall be recorded in the books of said commissioners, and in the town clerks' offices in the towns adjacent to and within the meridian boundary lines of which said grounds are located, in such books as are provided by said commissioners, subject to legal fees for such recording; and the cost of all such maps, blank books, surveys, and all other expenses necessary for carrying out the provisions of this act, shall be audited by the comptroller and paid for by the treasurer of the State; and the said commissioners shall each receive for their services \$5 per day for the time they are actually employed, as provided for in this act; their accounts for such service to be audited by the comptroller and paid by the treasurer of the State.

SEC. 8. All designations and transfers of oyster, clam, or mussel grounds within the waters of Long Island Sound heretofore made (except designations made of natural oyster, clam, or mussel beds) are hereby validated and confirmed.

SEC. 9. All the provisions of the statutes of this State relating to the planting, cultivating, working, and protecting shellfisheries upon grounds heretofore designated under said laws, except as provided for in section 8 of this act and as are inconsistent with this act, are hereby continued and made applicable to such designations as may be made under the provisions of this act.

SEC. 10. When it shall be shown to the satisfaction of the said commissioners that any natural oyster or clam bed has been designated by them to any person or persons, the said commissioners shall petition the superior court of the county having jurisdiction over the said grounds to appoint a committee to inquire and report to the said court the facts as to such grounds, and said court shall in such case appoint such committee, who after 12 days' notice to the petitioners and respondents shall hear such petition, and report the facts thereon to said court; and if it shall appear that any natural oyster or clam bed, or any part thereof, have been so designated, the said court may order that said grounds may revert to the State, after a reasonable time for the claimant of the same to remove any shellfish he may have planted or cultivated thereon in good faith, and said court may further order that all stakes and buoys marking the same be removed, the costs in said petition to be taxed at the discretion of the court.

SEC. 11. Any commissioner who shall knowingly grant to any person or persons a franchise, as hereinbefore provided, in any natural oyster or clam bed, shall be subject to a fine of not less than \$100 nor more than \$500, and if such franchise is granted the grant shall be void, and all moneys paid thereon shall be forfeited to the State; and the said commissioners shall in no case grant to any person or persons a right to plant or cultivate shellfish which shall interfere with any established right of fishing, and if any such grant is made the same shall be void.

SEC. 12. The superior court of New Haven County on the application of the selectmen of the town of Orange, and the superior court of any county on the application of the oyster-ground committee of any town in said county, shall appoint a committee of three disinterested persons of the town within the boundaries of which any natural oyster, clam, or mussel beds exist, to ascertain, locate, and describe by proper boundaries, all the natural oyster, clam, or mussel beds within the boundaries of such town. Said committee so appointed shall first give 3 weeks' notice, by advertising in a newspaper published in or nearest to said town, of the time and place of their first meeting for such purpose; they shall hear parties who appear before them, and may take evidence from such other sources as they may, in their discretion, deem proper, and they shall make written designations by ranges, bounds, and areas of all the natural oyster, clam, and mussel beds within the boundaries of the town they are appointed for, and shall make a report of their doings to the superior court, and such report, when made to and accepted by said court, and recorded in the records thereof, shall be a final and conclusive determination of the extent, boundaries, and location of such natural beds at the date of such report. It shall be the duty of the clerk of the court to transmit to the town clerk of each of said towns a certified copy of said report so accepted and recorded, in relation to the beds of such town, which shall be recorded by said

town clerk in the book kept by him for the record of applications, designations, and conveyance of designated grounds. Such public notice of said application to the superior court, and of the time and place of the return of the same, shall be given by said selectmen or oyster-ground committee as any judge of the superior court may order. It shall be the duty of the selectmen of the town of Orange, and of the oyster committees of other towns, upon a written request so to do, signed by twenty electors of their respective towns, to make such application to the superior court within 30 days after receiving a copy of such written request, and said application shall be privileged, and shall be heard and disposed of at the term of said court to which such application is returned, in preference to other causes. All expenses properly incurred by such selectmen and oyster-ground committees in said applications, and the doings thereunder, and the fees of said committees so appointed by court, shall be taxed by the clerk of said court and paid by the State upon his order. Any designation of ground for the planting or cultivation of shellfish, within the areas so established by such report of said committee, shall be void.

SEC. 13. The selectmen of the town of Orange and the committees of other towns shall, at the expense of their respective towns, procure and cause to be lodged and kept in the office of the town clerk of each town, respectively, accurate maps showing the boundary lines of their said towns in the navigable waters of the State, and all designations of ground for the cultivation of shellfish heretofore made and that shall hereafter be made within such boundaries, and shall number said designations on said maps, and shall cause to be designated on said maps all natural oyster, clam, and mussel beds lying within their several towns, respectively, as the same shall be ascertained by said report of said committees so recorded in said towns, as hereinbefore provided.

SEC. 14. All acts and parts of acts inconsistent herewith are hereby repealed, but this act shall not affect any suit now pending.

Approved, April 14, 1881.

ANALYSIS OF ARTICLE.

	Page.		Page.
<i>Introductory note</i>	461	<i>Methods of cultivation, etc.—Continued.</i>	
<i>Personnel, wages, etc.</i>	462, 463	29. Care required.....	478
1. Number and nationality of persons employed.....	462	30. Classification of oyster-planters.....	478
2. Wages.....	462, 463	31. Growth of oysters, trade, etc.....	479
<i>Vessels and boats</i>	463-468	32. Planting southern oysters.....	470, 480
3. Influence of improved vessels.....	463	33. Export trade.....	480, 481
4. Historical.....	463	34. California trade.....	481
5. The sharpie.....	463, 464	35. Disposition of shells.....	481
6. Sloop boats.....	464	36. Methods of fishing.....	481, 482
7. Scows.....	464	<i>Unfavorable conditions, enemies, etc.</i>	482-486
8. Sailing vessels.....	464, 465	37. Injury by unfavorable weather.....	482
9. Work done by boats and sail craft.....	465	38. Injury by mud.....	482, 483
10. Introduction of steamers for oyster dredging.....	465, 466	39. Stagnant water.....	483
11. Increase in the steam oyster fleet.....	466	40. Freshets.....	483
12. Size of steamers.....	466	41. Destruction by starfish.....	483, 484
13. Details of form, etc.....	467	42. Drills.....	484
<i>Historical notes</i>	468-470	43. Other harmful agencies.....	484, 485
<i>The oyster grounds</i>	471-475	44. Suggestions for removing starfish from oyster grounds.....	485, 486
14. Location and extent.....	471, 472	<i>Financial results</i>	486-487
15. Depth of water.....	472	45. In general.....	486
16. Designations.....	472, 473	46. Investments, etc.....	486
17. Value.....	473	47. Profit and loss.....	487
18. Taxes.....	473	<i>Statistical statements</i>	487-491
19. Public beds.....	474	48. Table of persons employed.....	488
20. Area and products of natural beds.....	474	49. Table showing capital invested and annual expenditures.....	488, 489
21. Restrictions about fishing.....	474, 475	50. Quantities and values of material used and of seed planted in preparing oyster grounds.....	489
22. Effect of the State policy.....	475	51. Estimated value of oysters destroyed by enemies and other agencies.....	490
<i>Methods of cultivation, trade, fishing, etc.</i>	475-482	52. Table showing the quantities and values of oysters and shells taken from private and public grounds.....	490, 491
23. Obtaining ground.....	475	<i>Oyster legislation of Connecticut</i>	491-497
24. Preparing the ground for a "set".....	475, 476		
25. Comparative merits of gravel, various kinds of shells, etc.....	476, 477		
26. The Poquonock method.....	477		
27. Suggestions.....	477		
28. Contingencies of the business, etc.....	478		