

30.—DEEP-WATER OYSTER CULTURE.

BY HENRY C. ROWE.

It is conceded, I think, that the oyster-growers of Connecticut have taken the lead in the artificial propagation and cultivation of oysters in deep water; by deep water I mean a depth of from 30 to 75 feet. It is but twenty years since the commencement of this industry, but during the past few years there have appeared no new features of special importance. Consequently I can offer no novel information on the subject, and will attempt simply to give a brief outline of what has been done.

The amount of capital now invested in oyster-culture in Connecticut is about \$4,000,000; the annual product about \$1,500,000; the number of men employed about 1,100, and of vessels 453. You will remember that these figures represent only the direct results of the industry, and that there are many kinds of manufacturing and other business which are dependent upon and are maintained to a greater or less degree by it.

Twenty years ago this deep-water oyster-cultivation did not exist. The official records show that in 1874 I applied for and received the first grant of oyster-ground outside of the harbors, rivers, bays, and reefs in Long Island Sound, extending into a depth of over 35 feet of water. The proposed enterprise of propagation and cultivating oysters in deep water was then ridiculed as visionary, and many reasons were given why it must necessarily prove a failure. The authors of these prophecies, however, were neglectful of the admonition of Mark Twain when he said, "If you don't know, don't prophesy." I am glad to say that the enterprise thus inaugurated has proved a success, although many obstacles and difficulties were encountered and overcome, especially in the early years of its development.

Oyster-ground is now owned by 336 owners, to the extent of 68,686.8 acres, which is practically all the ground suitable for oyster cultivation in the deep waters of Connecticut. The product of the cultivated grounds is estimated in bushels at 2,500,000 per year.

You will bear in mind that none of these oysters are the product of the natural beds, but are propagated and grown upon our private farms, in much the same way that the farmers of the great West cultivate their grain.

The first step toward our oyster-cultivation was, of course, to secure a lawful title to the grounds necessary for its prosecution. This was difficult to obtain, owing to the prejudice against any private ownership of oyster-grounds; also because the boundaries of jurisdictions in the waters between towns and States and the United States were not defined.

As to the question of State boundaries, commissions were appointed by New York and Connecticut—that from Connecticut being led by Hon. Luzon B. Morris, the present governor of the State. The lines having been agreed upon by these State commissions, the agreement was ratified by the general assembly of each State, and afterwards by the Congress of the United States.

Many other questions arose in connection with this industry which required legislative action, and several questions of importance were settled in the Supreme Court.

Let us suppose that we have acquired a good title to a thousand acres of ground suitable for the cultivation of oysters and over which the water is not too salt or too fresh, too shallow or too deep. The first step is to buoy it out so that its boundaries may be distinctly marked, and that we may avoid planting the grounds of others. In the grant or designation its area and position is designated by distances from certain fixed points, such as light-houses, steeples, prominent rocks, etc. The buoys marking the limits of the ground are usually located in the first place by means of the sextant, angles for which have been previously taken from the map on which the grounds are marked. After the buoys have been once set by sextant, if carried away by storms or ice, they are usually replaced by cross ranges, using any prominent objects upon the shore or adjacent islands, such as steeples, prominent houses and rocks, light-houses and beacons. It is usual to take several different ranges, so that if the objects are destroyed in any of them, the others can be successfully used.

After the ground is buoyed we would place 30,000 bushels of adult oysters on it to furnish the eggs and milt to stock this thousand acres with oysters. A single female oyster produces several millions of eggs yearly, which, during the warmest weather, are expelled into the water, where they float hither and thither in the tides and currents. Doubtless but a small proportion are ever fertilized. Vast quantities fail to come in contact with the fertilizing element which also floats and swims in the water. Millions are devoured by animalculæ, and still more are destroyed by sudden falls of temperature in the surface of the water, caused by cold rains, at this critical period of the existence of the oyster.

The embryology of the oyster is an interesting study. In 1882, Lieut. Francis Winslow, U. S. N., well known for his able and exhaustive studies of the oyster under the direction of the U. S. Government, was with me for several weeks, during which time many millions of oysters per day were propagated under artificial conditions, and the impregnation, segmentation, and other interesting changes which they experience, were observed under the microscope. Many millions of oysters which had developed nearly to the stage of attaching, were deposited in Long Island Sound.

Sometimes infusoria would generate in the jars of water in which the oysters were kept, and would kill the oysters by millions.

The little oysters float about for several days, many of them on or near the surface of the water; after this roving existence, during which they are subject to many changes, the survivors reach what is called the "attaching stage," when they are ready to adhere to some hard, clean substance and commence a more settled existence.

The shells commence to form and the specific gravity of the shells assists in carrying them to the bottom. The greater proportion of the embryo oysters fall upon mud or fine sand and are destroyed. It is for this reason that we furnish hard, clean material to which they may attach themselves. After having planted our adult oysters to serve as parents for the new crop, our next step is to plant upon the same

ground, in the month of July, from 10 to 20 times as many bushels of clean oyster shells or other hard, clean substance, such as broken stones, tiles, etc.

Upon this 1,000 acres we will suppose that we plant 500,000 bushels of shells, and by the end of July, in the climate of Connecticut, we begin to look with our magnifying glasses for the first appearance of the young oysters, which we shall hope have attached to the shells or other "cultch," which we have provided for them.

In some favorable years, the attachment or "set," as it is called, is very plenty, and most of the shells which are planted are well covered with the little oysters. In other years the "set" is very light, or an entire failure. Such was the case in 1889; due, as I believe, to the great amount of rain which fell in July, chilling the surface of the water suddenly and thus destroying the floating embryos.

In case the season is unfavorable and there is not an adequate quantity of the young set upon the shells, it will be necessary to replant the ground another year; but before doing so, it is desirable to catch up most of the shells previously planted and let them remain upon land for several months, for after they have been planted for a month or two, they have very little value for catching the "set," as they become coated with more or less sediment and vegetable growth, and are not available unless cleaned in some way.

After attaching, the oyster grows very rapidly and reaches in the fall about the size of a finger-nail, varying much, however, in the different localities and in different seasons.

When oysters are 1 or 2 years old, if there is an unusually large crop, it is necessary to catch a portion of them and transplant them to other grounds, so that they may have room to grow without crowding. If crowded they do not grow in good shape. Those experienced in the industry sometimes transplant large quantities of oysters from one kind of ground to another, for the purpose of improving their shape and making them fatter when marketed.

But the dangers to the life of the little oysters are by no means over when the attachment occurs, especially while they are still small. Vast quantities are destroyed by starfish, drills, storms, mud, sand worms, etc. The starfish has been the oyster's greatest enemy, but the drill is becoming even more destructive. The little starfish attach temporarily to the shells at about the same time that the young oysters do, and begin immediately to prey upon them. As they become older the starfish move in armies, as the grasshoppers and locusts do on land; an army of them will destroy thousands of bushels of oysters in a few days. I estimated the destruction of a crop of oysters planted by myself in 1882 at \$90,000 in six months, while \$9,000 were spent in the same period in catching the starfish which were doing the mischief.

For catching starfish, contrivances called "tangles" or "mops" are used, which consist of frames of iron attached to chains, which are dragged by the oyster steamers. To these frames of iron are attached about 20 small ropes, to which large bunches of coarse cotton-thread waste are fastened. As these "mops" are drawn over the beds, the starfish become entangled in the meshes of the cotton thread, and after a few minutes dragging are pulled to the surface by steam power; one drift of a few minutes sometimes catching as many as 1,200 or 1,500 starfish on a single "mop."

The common sand worm, *Sabellaria vulgaris*, is occasionally found in sufficient numbers to destroy a whole bed of young seed oysters. This is simply because in

building their sand houses over the little oysters the oysters are smothered and poisoned by the sulphureted hydrogen thus generated.

The drill has been long found in our harbors and rivers, but for the last few years it has become much more plenty in the deep water of the Sound; they destroy vast quantities of oysters by boring a minute hole, about as large as a needle, in the upper valve of the oyster. The invention of some appliance for catching the drills is very desirable. I estimate the damage they cause at over \$1,000,000 annually.

The periwinkle is another persistent enemy, but is more destructive to the older oysters, while the others mentioned work faster among the younger ones.

Occasionally vast quantities of oysters are destroyed by storms; this is caused by the agitation of the water when the wind is in such a direction and of such velocity as to cause a heavy sea. During the past August the damage by a heavy gale to the oyster industry has been estimated by some authorities at \$3,000,000. At that time the wind reached a velocity of 53 miles an hour, and undoubtedly a large amount of damage was occasioned, but in my opinion the above estimate of loss was much too high.

For catching oysters from the farms steamers are now mostly employed. Previous to the deep-water cultivation oysters had been gathered by hand power, with rakes, tongs, and dredges.

In 1878, when I commenced to use the first oyster steamer owned in New Haven, it was said that steam could not be used to advantage in this industry, and its expense would consume more than the profits of the business.

There are now 68 steamers employed, one of which can take up 2,000 bushels of oysters in a day (more than 50 men can catch), in twice or three times the depth of water.

Oyster and fish culture have added much to the food supply of the world. We who grow oysters hope that you who multiply the fish will recognize us as in a common cause. We who devote our efforts to devising new methods of providing food can not have the honor to benefit mankind in the same way as those who minister to their religious, governmental, and educational needs, but so long as famine and want occur, if we help to prevent the suffering of our fellow creatures, we may hope in some humble degree to be classed, like "Abou ben Adhem," with "those who love their fellow men."