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NEW ZEALAND.

OYSTER-CULTURE AND OYSTER-FARMING.

(BY H. M. BREWER, F.L.S.)

Laid on the Table by the Hon. Mr. Seddon, with Leave of the House.

In commencing this paper I may say that it does not pretend to be an entirely original composition, but is compiled from the best-known authorities on the subject, supplemented by the writer's own observations and experiments, and with the hope that it may lead to the extension and increase of an industry which has been wonderfully successful in other countries.

In the course of conversation I have found that even those intimately connected with the fishing industry know very little about the earlier stage of oyster-life, and little or nothing as to the means of artificial propagation and protection. I shall therefore commence with a description of the life of an oyster from its incubation.

Oysters do not leave their ova, like many other marine creatures, but incubate them in the folds of their mantle and among the laminæ of their lungs. There the ova remain surrounded by mucous matter, which is necessary to their development, and within which they pass through the embryo state. The mass of ova, or "spat," as it is familiarly called, undergoes various changes in its colour, meanwhile losing its fluidity. This state, it is said, indicates the near termination of the development, and the sending-forth of the embryo to an independent existence; for by this time the young oyster can live without the protection of the maternal organs. An eminent French pisciculturist says that the animated matter escaping from the adults in breeding-ponds is like a thick mist. Being dispersed by the winds, the "spat" is so scattered by the waves that only an imperceptible portion remains near the parent stock; all the rest is dissipated over the sea-space. And if these myriads of animalculæ, tossed by the waves, do not meet with solid bodies to which they can attach themselves, their destruction is certain, for if they do not fall victims to the larger animals which prey upon them, they are unfortunate in not fixing upon a proper place for their development. Thus we see that the spawn of the oyster is well matured before it leaves the protection of the parental shell; and by the aid of a powerful microscope the young animal can be seen with its shell perfect, and with its holding-on apparatus, which is a kind of swimming-pad, ready to clutch the first "coign of vantage" that the current may carry it against. The saving of the spawn cannot be effected unless it falls on proper ground—*i.e.*, ground with a shelly bottom is best for the infant animal. If it falls amongst mud or sand it is sure to perish. That the young oyster must obtain a holding-place is the first and primary condition of its existence. On being exuded from the parental shell the spawn at once rises to the surface, where its vitality is easily affected, and it is often killed in certain places by snow-water or ice. A genial warmth and sunshine is considered highly favourable to its proper development during the few days it floats about on the surface. Except in artificial breeding-places it is thought that not more than one oyster out of each million arrives at maturity. In the matter of climatic influence, therefore, New Zealand, and more especially the North Island, is eminently suitable to a favourable result.

As is well known, there is a period every year during which the oyster is not fished; and the reason why our English oyster-beds have not been ruined or exhausted by overfishing arises, among other causes, from there being a definite close time assigned to the breeding of the mollusc. They begin to sicken there about the end of April, so that it is well that their grand rest commences in May. The shedding of the spawn continues during the whole of the hot months. Although during that period there may be found supplies of healthy oysters, yet, as a general rule, it is better that there should be a total cessation of the trade during the summer months, because, were the beds disturbed by a search for the healthy oysters, the spawn would be scattered and destroyed. Bertram, in his "Harvest of the Sea," says, "It is quite certain that a strict close season for oysters is necessary and advantageous, for we seldom find this mollusc, as we do the herrings and other fish, full of eggs, so that most of the operations connected with its reproduction go on in the months during which there is no dredging. As I have indicated, immense quantities of the spawn of oysters are annually devoured by other molluscs, and by fish and crustaceans of various sizes. On occasion of visiting the beds I have seen the dredge covered with this spawn; and no pen could number the thousands and millions of oysters thus prevented from ripening into life."

The secret of there being only a holding-on place required for the spat of the oyster to insure an immensely-increased supply having been penetrated by the French people (and no doubt they are in some degree indebted to our own oyster-beds on the Colne and at Whitstable for their idea), the plan of systematic oyster-culture was easy enough, as will be immediately shown. A few initiatory experiments, in fact, speedily settled that oysters could be grown in any quantity.

Strong pillars of wood were driven into the mud and sand; arms were added; the whole was interlaced with branches of trees; and boughs were hung over the beds on ropes and chains, whilst others were sunk in the water and kept down by a weight. A few boatloads of oysters being laid down, the "spat" had no distance to travel in search of a home, but found a resting-place at the moment of being exuded, and "grew and grew" till with fullness of time it became a marketable commodity.

But the history of this modern phase of oyster-farming, as practised on the foreshores of France, is so interesting as to demand a rather detailed notice, for it is one of the most noteworthy circumstances connected with the revived art of fish-culture that it has resulted in placing upon the shores of France an almost countless number of fish-farms for the cultivation of the oyster alone. It is no exaggeration to say that about thirty years ago there was scarcely an oyster of native growth in France. The beds had become so exhausted from overdredging as to be unproductive, and totally unable to recover themselves, so far as their power of reproduction was concerned. As an illustration of the overdredging that had prevailed, it may be stated that oyster-farms which previously employed fourteen hundred men and two hundred boats, and yielded an annual revenue of 400,000f., had become so reduced as to require only a hundred men and twenty boats. Places where there had at one time been as many as fifteen large oyster-banks, and great prosperity among the fisher class, had become almost oysterless, and the people were consequently in despair at the loss of this favourite adjunct to their banquets, and had to resort to other countries for such small supplies as they could obtain. It was under these circumstances that M. Coste instituted that plan of oyster-culture which has been so much noticed of late in the scientific journals, and which appears to have been influenced by the mussel-farms in the Bay of Aiguillon and the oyster-*parcs* of Lake Fusaro—so far, at least, as the principle of cultivation is concerned. At the instigation of the French Government he made a voyage of exploration round the coasts of France and Italy, in order to inquire into the cultivation of the sea-fisheries, and to see how these marine fisheries could be artificially aided, as the fresh-water fisheries had been aided through the rediscovery by Joseph Rémy of the long-forgotten art of pisciculture. Lake Fusaro, one of the places he visited, is devoted to the highly profitable art of oyster-farming, yielding (as has often been published) from this source an annual revenue of £1,200. The mode of oyster-breeding was to erect artificial pyramids of stones in the water, surrounded by stakes of wood in order to intercept the spawn, the oysters being laid down on the stones (see sketch). Fagots of branches were also used to collect the spawn, which, as I have already stated, requires within forty-eight hours of its emission to secure a holding-on place, or be lost for ever. I enclose a rough sketch giving a general view of Lake Fusaro, showing here and there the stakes surrounding the artificial banks, the single and double ranges of stakes on which the fagots are suspended, and at one extremity the labyrinths, in the face of which is a canal, of from $2\frac{1}{2}$ to 3 mètres broad and $1\frac{1}{2}$ mètres deep, joining the lake to the sea. A smaller lake communicates with the canal. The pavilion in the lake is the ordinary residence of the person in charge of the fishery.

The plan of the Fusaro oyster-breeders struck M. Coste as being eminently practical, and suitable for imitation on the coast of France. He had one of the stakes pulled up, and was gratified to find it covered with oysters of all sizes and ages. The Lake Fusaro system of cultivation was therefore, at the instigation of Professor Coste, strongly recommended by the French Government to the French people as being the most suitable to follow, and experiments were at once entered upon with a view to prove whether it would be as practicable to cultivate oysters as easily among the agitated waves of the open sea as in the quiet waters of Fusaro. In order to settle this point it was determined to renew the old oyster-beds in the Bay of St. Brieuc; and, notwithstanding the fact that the water there is exceedingly deep, and the winds very violent, immediate and almost miraculous success was the result. The fascines laid down soon became covered with seed, and branches were exhibited at Paris and other places containing thousands of young oysters. The experiments in oyster-culture tried at St. Brieuc were commenced on part of a space of 3,000 acres that was deemed suitable for the reception of "spat." A quantity of breeding-oysters was laid down either on the old beds, or on newly-constructed longitudinal banks. These were sown thick on a bottom composed chiefly of immense quantities of old shells—the "middens" of Calcale, in fact—so that there was more than ordinary good chance for the spat finding at once a good holding-on place. And here I may say that, when coming down the coast and strolling about Waikanae and its vicinity, it has often struck me what admirable material there was there for oyster-culture, as almost everywhere on the sea-coast you find hillocks of old shells. I trust they may some day be utilised for the purpose for which they seem so specially intended. To continue, however, the remarks about St. Brieuc: Over some of the new banks fascines made of boughs tightly tied together (our own manuka would be admirable for this purpose) were sunk, and chained, so as to intercept such portions of the spawn as were likely to be carried away by the force of the tide. In less than six months the success of the operations was assured, for at the proper season a great fall of spawn had occurred, and the bottom shells were covered with the spat, while the fascines were so thickly coated with young oysters that an estimate of 20,000 for each fascine was not thought an exaggeration.

Oyster-parks.

Twelve months before the date of the experiments above described at St. Brieuc the artificial culture of oysters had successfully commenced on another part of the coast—namely, the Île de Ré, near La Rochelle, in the Bay of Biscay, which may now be designated as the capital of French oysterdom. It is curious to note the very rapid growth of the industry of oyster-culture on the Île de Ré. It was begun so recently as 1868, and there are now upwards of 4,000 *parcs* and *claires* upon its shores, and the people may be seen as busy in their fish-parks as the market-gardeners of Kent are in their strawberry-beds.

I am now going to show how an ordinary working-man can, and often does, take the initiative in introducing a national industry, and show by a practical example what can be done.

Oyster-farming on the Île was inaugurated by one Beuf, a stonemason. This shrewd fellow, who was a keen observer of nature, and had seen the oyster-spat grow to maturity, began think-

ing of oyster-culture simultaneously with Professor Coste, and wondering if it could be carried out on those portions of the public foreshore that were left dry by the ebbs of the tide. He determined to try the experiment on a small scale, so as to obtain a practical solution of his "idea," and with this view he enclosed a small portion of the foreshore of the island by building a rough dyke about 18in. in height. In this park he laid down a few bushels of growing oysters, placing amongst them a quantity of large stones, which he gathered out of the surrounding mud. This initiatory experiment was so successful that in the course of the year he was able to sell a considerable number of oysters from his stock. The result was, of course, very encouraging to the enterprising mason, and the money was in a sense found money, for the oysters went on growing while he was at work at his own proper trade as a mason. Elated by the profit of his experiment, he proceeded to enlarge the proportions of his park, and in the second year was able to dispose of forty pounds' worth more without impoverishing in the least degree his breeding-stock.

After Beuf had demonstrated the practicability of oyster-farming, the extension of the system over the foreshore of the island between Point de Risedoux and Point de Lorme was rapid and effective—so much so that two hundred beds were conceded by the Government previous to 1868, while an additional five hundred beds were speedily laid down. So rapid, indeed, has been the progress of oyster-culture at the Île de Ré that what was formerly a series of enormous and unproductive mud-banks, occupying a stretch of shore about four leagues in length, is now so transformed, and the whole place so changed, that it seems the work of a miracle.

Mr. Ashworth, so well known as a salmon-breeder in Ireland, says that oyster-farming on the shores of the French coast is one of the greatest industrial facts of the present age, and thinks that it will in the end be more profitable than salmon-breeding. It is calculated that, in spite of the bad spatting of the last three years, there is a stock of oysters in the beds on the Île de Ré, accumulated in only six years, of the value of £100,000. No charge is made for the oyster-parks by Government, but each plot is marked and defined on a map, and the produce is considered to be the private property of the person who establishes it. They vary in size, 20 or 30 yards square. The stones or tiles are placed in rows about 5ft. apart, with the ends open so as to admit of the wash of the tide in and out. To construct an oyster-bed 30 yards square costs about £12, and it has been calculated that the return from some of the beds has been as high as 1,000 per cent. If the limits of this paper would permit I could give many more particulars about this industry, such as the proper mode of constructing oyster-parks on a large scale; but I think I have said enough to prove that it could easily be commenced and profitably carried on in New Zealand.

Our transatlantic cousins, ever ready and to the front when a profit is to be made, carry on the trade to a great extent. The great market there is the City of Baltimore, where it is not uncommon for one or two firms to "can" a million bushels in one year. Immense numbers of these canned oysters are despatched all over the States, to the prairies of the far West, to the cities of New Mexico, to the military forts of the Great American Desert, to the restaurants of Honolulu, and to the miners searching for gold in the Rocky Mountains; whilst fresh oysters packed in ice have been sent to great distances. In the oyster-fisheries of Maryland alone as many as six hundred vessels of about 23 tons each are engaged, in addition to two thousand boats or canoes. These employ about seven thousand men, and if we add those engaged in the carrying trade it would give the number of persons employed in the oyster trade of the State of Maryland as at least ten thousand, all obtaining remunerative employment.

In concluding this article on oyster-culture it may not be out of place to say a few words on acclimatisation at the antipodes. It seems strange that in the generally complete furnishing of the earth so much was left undone in New Zealand. In the earlier days there were no edible fish of any size in the streams of the colony if we except the bright little upokororo (*Prototroctes oxyrhynchus*) and the wretched kokopu (*Galaxias fasciatus*). It depends upon acclimatisation societies and private individuals to remedy this defect. How successfully this has been done is shown by the number of tourists who annually come from Australia and other places to our southern streams for the sole purpose of trout-fishing. The North Island has been a little later in its development, but the splendid streams in the Wairarapa, Hawke's Bay, Wanganui, and Taranaki districts are now being plentifully stocked with the best breeds of fish obtainable. I have no hesitation in saying that in a few years these districts will be an angler's paradise, and second to none in the world. The efforts of such men as Mr. W. H. Beetham, of the Wairarapa; Mr. Alexander J. Rutherfurd, of Wellington; Mr. S. C. Farr, of Christchurch; the late Mr. Arthur, of Dunedin; and others, are not, perhaps, at the present time appreciated at their true value, but they will be in years to come. An enterprise which will not only largely increase our food-supply, but will also make the colony attractive to the moneyed classes of other countries, must prove an inestimable benefit.

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ILLUSTRATIONS.

1, Lake Fusaro. 2, Oyster Pyramids. 3, Oyster Fascines.

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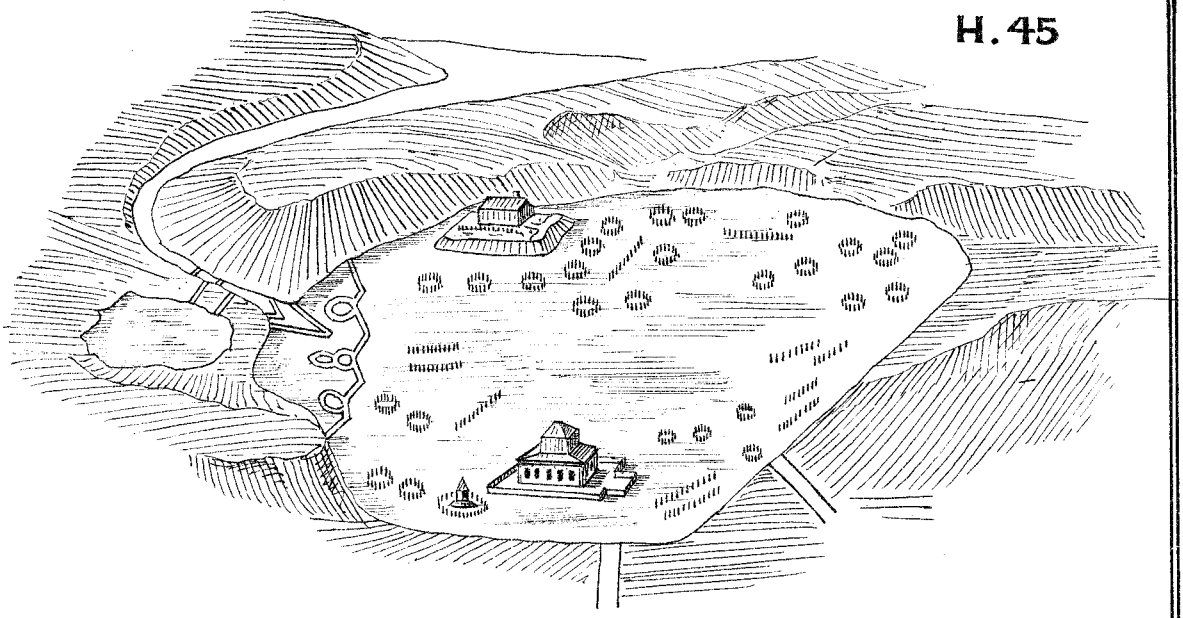
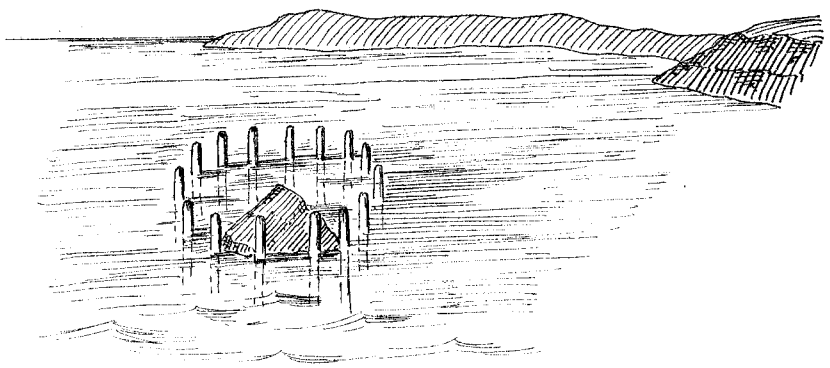
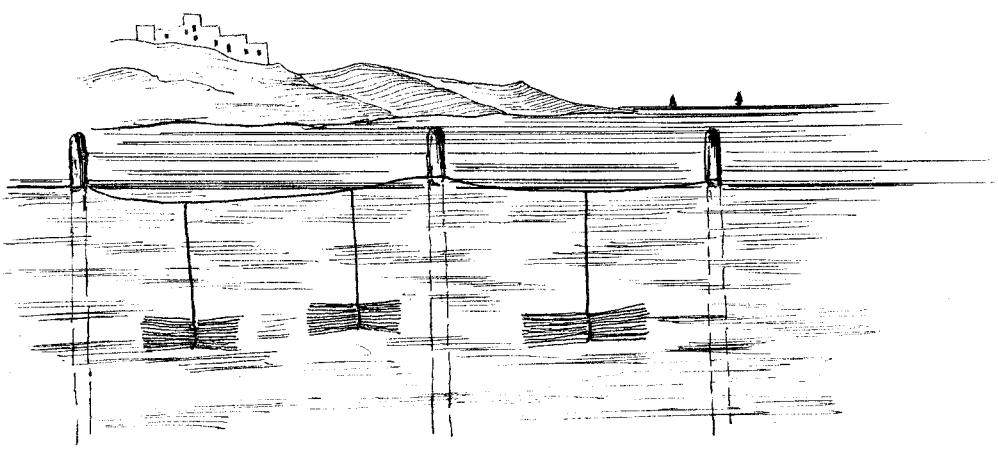


Lake Fusaro (1)



Oyster Pyramid (2)



Oyster Fascines (3)