

**THE UTILIZATION OF LOCALITIES IN NORFOLK AND SUFFOLK
SUITABLE FOR THE CULTIVATION OF MUSSELS AND OTHER
SHELL-FISH.**

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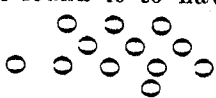
It may be fairly assumed that there is not a square yard of our coasts which has not been visited by the spawn or spat of the mussel (*Mytilus edulis*); and it would therefore appear that, in those places where mussels have not been found, nature protests, as it were, against them; some important conditions necessary for their development must be wanting in the water, soil, or temperature.

Mussel spat, which is free for a short time after extrusion from the parent, will not, as a rule, attach itself in any quantities on a barren sand, but will attach itself in large quantities on sands which contain cockles, although those sands may appear at first sight to be sterile. As the young mussels which have set on the cockle beds grow and become thicker, the cockles are choked and die; but this is a very insecure resting-place, as from the nature of the soil they are liable to be scattered and destroyed by the sea, unless the bed is well sheltered.

The most favorable locality for the permanent welfare of the embryo mussel is from five to fifteen feet above low-water spring tides, on a beach or shore consisting of sand well covered with clean sea-worn stones, varying from the size of a walnut to that of a cricket-ball and larger; this makes a hard, unshifting bed, not easily disturbed by the action of the sea, unless in very exposed localities.

I do not think it possible to demonstrate by maps where mussels can be best cultivated unless a general survey of the coasts of these islands is made, and such favorable localities delineated thereon.

Mussels may be found attached to various objects. Large quantities are found hanging to the piles of bridges, where the water is not too fresh. They are found in large quantities on buoys and vessels moored at sea, such as light-vessels; but, although they are found in such places, it does not follow that they can be best cultivated there.

In British waters, spatting usually takes place in the early spring, and does not appear to be at all dependent on warm weather. On December 7, 1877, I examined some of the undeveloped embryo taken from a spatting mussel, with a microscope, and found it to have a reddish appearance, and of the following shape,  and about the five-hundredth part of an inch in diameter. It would not polarize, so I conclude the shell was not formed. On December 12, 1879, I found large quantities of mussels to contain similar embryos, the weather at the time

being very severe. On December 3, 1880, I found the same. The winters of 1879-'80 and 1880-'81 were exceptionally cold, so that it appears they are not dependent on "heat and tranquillity" for their proper development.

On May 25, 1879, after a very severe winter of about nine weeks' continuous frost, I found on one of the beds under my charge several acres of brood mussels, about the tenth of an inch in length. In the spring of the year 1879 and the spring of 1880 overwhelming quantities of brood were found on the scalps on the east coast of England, which might be measured by hundreds and thousands of acres.

Where mussels are found in thick and dense masses, they will be three years before they are what is called "sizable," that is, two inches in length; but instances are found near low-water mark where a few have become isolated, and have grown much more rapidly.

I do not think that mussels will spat, or rather that the spat will mature, in partially salt water. The only places where I have ever seen any young brood is where the water has the same degree of saltness as the outside sea, which, on the east coast of England, has a density of about 1026½, distilled water being 1000. Although it appears that salt water is necessary at their birth, brackish water is better adapted for fattening and growing, provided they are covered with the tide at high water. I find by experience that the most suitable degree of saltness of the water for fattening purposes is where the density of the water is about 1014. This likewise applies to the fattening of oysters.

To save the bulk of the spat when free is the great object of mussel culture, therefore it is imperative to have the ground of the natural sea bed as free from sand, weeds, and mud as possible, so that the young may have some clean hard substance to which it can attach itself. Ascidians and sponges are very destructive to the young mussel, as they cover the culch, which would otherwise be favorable for their attachment.

Mussels have a great many natural enemies, amongst which may be mentioned the star-fish or five-finger, the dog-whelk (*Purpura lapillus*), the sea-urchin or echinus, sea birds, Danish crows, and sometimes rats; but star-fish deal the most wholesale destruction. I have known ten acres of a thickly covered scalp to be almost denuded in a fortnight. Last summer I had carted from beds under my control between two and three hundred tons of this fish. The star-fish will always attack small mussels in preference to those of larger growth. It first grasps the mussel with its five fingers, and when the mussel opens slightly to breathe and feed, it inserts its stomach, or part of it, into the body of the mussel, when, I believe, digestion commences, and the mussel dies and opens its shell, and the star-fish withdraws its stomach with the meat of the mussel. This operation I have seen performed, in all its stages, thousands of times, upon oysters, mussels, and cockles.

The dog-whelk bores a hole in the shell of the mussel about the size of a small pin-head, and destroys it.

The sea-urchin also bores a hole in the shell of the mussel, but much larger than the dog-whelk, the hole being about the size of a sixpence. This very rarely occurs. I have only seen three instances, and that on large mussels near low-water mark.

Sea birds, Danish crows, and rats break the shell and devour the mussel.

I consider the best and only way that existing natural mussel beds can be properly cultivated and protected is to make them the actual property of some one. If they are allowed to be fished indiscriminately they will quickly become exhausted, as has been the case with hundreds of natural scalps on the coast.

Fifty years ago mussels were very prolific on the east coast of England, and almost every small harbor had its natural scalp outside, which fed the "lays" or fattening grounds inside, to the great profit of the owners of such lays. About that period some ill-starred individual discovered they were valuable for manure, when commenced a raid on the scalps, which is the origin of their present downfall. I can remember, as a boy, seeing hundreds and thousands of tons brought to land and sold to the farmers for manure, at three-halfpence a bushel.

An act was passed by Parliament in 1868, called "The sea fisheries act, 1868," which enables the board of trade to grant provisional orders to corporations and private individuals to regulate oyster and mussel fisheries; but the result, so far, has been very unsatisfactory. The reports of Mr. H. Cholmondeley Pennell and Mr. W. E. Hall, two of the inspectors of fisheries, on the oyster and mussel fisheries, at eighteen different stations, show the beds to be worked in a very unsatisfactory manner.

Mr. Hall reports in 1877 that the Boston corporation undertook to regulate the fishing in Boston deeps in the year 1870, so as to maintain the supply. The oyster beds, he states, remain in the state of denudation which characterized them in 1869. The supply of mussels, however, seems to be rapidly diminishing, from the persistent poaching of the fishermen and from want of power of the corporation under their "order" to close a sufficient portion of the ground every year. A similar "order" was granted to the corporation of King's Lynn in 1872. Mr. Hall reports on this "order" that the corporation system of management in regard to mussels is dangerous to the permanent welfare of the fishery, whilst as regards oysters the order is not carried into effect.

Under clause 4 of the order, the corporation is compelled to keep open for fishing two-thirds of the area of the oyster and mussel beds, thus leaving a large porportion of the whole in a great measure at the mercy of the fishermen; and Mr. Hall justly points out the danger to which the mussel beds of the wash are necessarily exposed from this provision.

When a mussel bed is opened by either of the above-mentioned corporations, a day is fixed and duly advertised, and at twelve o'clock at night scores of boats commence taking the mussels, some by tons and

some only by a few bushels. The next day the markets are glutted with small mussels, and in some instances I have known them to be unsaleable. Even at the best they only make very small prices, whereas if they had been gradually sent to the various markets good prices would have been made. These provisional orders are simply a farce, as far as regards providing the long-line fishermen with mussels.

I am the lessee of about eleven miles of sea beach on the Norfolk coast, belonging to Hamon Le Strange, esq., whose title to the proprietary right descends from a grant made in the eleventh century by William II to William d'Albini, his butler.

The fishing on this beach consists of mussels, cockles, clams, 'winkles, and a few oysters.

When I hired the fishing, six years ago, there was not one ton of mussels on the whole eleven miles. I appointed watchers, enforced a close time, cleaned the ground, and endeavored to keep off poachers, but with very indifferent success. Mr. Le Strange, in 1879, applied to the board of trade for the grant of an order for the establishment and maintenance of a several oyster and mussel fishery, under the powers of "The sea fisheries act, 1868," so as to provide a better protection for the fishery. The board of trade sent an inspector down to hold an inquiry as to the proposed order, but from that day to this the order has not been granted.

If such an order could be obtained it would greatly benefit the long-line fishermen off the coasts of Northumberland and the south of Scotland, as I have special railway rates to all the ports on these coasts, and can afford, when I have any mussels, to deliver them at a reasonable price for bait. The importance of mussels for bait to these deep-sea line boats is incalculable.

Mr. P. Wilson, Her Majesty's fishery officer at Eyemouth, in Scotland, reports that in one week the boats from Burnmouth, Coldingham, and Eyemouth used for baiting their long lines 61 tons of mussels. They landed, with this quantity of mussels, 25,620 stone of haddocks, besides a considerable quantity of cod and whiting, and got for the fish 1s. 8d. per stone, equal to about £2,500. Observe, in one week alone 61 tons of mussels were used at these three fishing stations for bait, the cost of which was about £160, the produce in fish from which was 25,620 stone, worth £2,500. Mr. Wilson also reports that when the fishermen are unable to obtain mussels, they have had to bait their lines in many instances with bullock's liver, and be content with half a catch of fish.

The greatest trouble I have in protecting my mussel beds is from a class of men who call themselves fishermen, but who are half farm-laborers and half fish-hawkers, and are the scum of the villages bordering on the coast. I have lost from two to three thousand tons of mussels in one year by these men, which would otherwise have gone to Scotland to be used as bait by real fishermen. All of this might have been prevented had the board of trade granted a provisional order for

this fishery when requested. I have read somewhere that the definition of the word "fisherman" is a man skilled in fishing, who proceeds to sea in a vessel, and by means of an engine catches fish. The men who rob me of my mussels do not proceed to sea, and have no skilled knowledge of fishing. They also rob the country of an enormous quantity of fish food, which would otherwise be caught and consumed. Taking Mr. Wilson's figures that sixty-one tons of mussels will catch £2,500 worth of haddocks, cod, and whiting, one thousand tons of mussels would catch about £41,000 worth of fish.

I consider that where natural beds of mussels have once existed and the ground has not altered, there new mussel beds may be established and cultivated; but the government must grant provisional orders to persons desirous and willing to take in hand the cultivation of mussels and oysters, and not allow the officials at the board of trade to prevent the granting of such orders. The orders must enforce heavy penalties on persons illegally taking the mollusks, and provide for the imprisonment of those people who are unable to pay the fines and costs, as the greatest amount of poaching is done by the impecunious inhabitants of the villages adjacent to the shore, and whose forefathers, a hundred years ago, were the wreckers and smugglers of that age; in fact, illegally taking oysters and mussels from a several fishery should be felony.

Mussels are largely cultivated on the Continent. The exports from Antwerp for Paris alone, as recorded in the "*Halles Centrales Statistics*," for the season of 1873, amounted to 7,000,000 francs (£280,000), which are the produce of natural beds and scalps unimproved by man's care.

In the town of St. Valery-sur-Somme, in France, artificial breeding, rearing, and fattening of mussels, upon principles akin to those which obtain in ostreaculture, is carried on, and the success attained is such as to be worthy of a record in the history of attempts made to utilize the unbounded wealth of food lying ready to man's hand along the sea-shore. Lines of wattled stakes, averaging 530 yards in length, are driven in the sand close to the fair-way, just above low-water mark. These *les bouchots de grand flot* extend over 25 acres. They serve for fixing the spat, which is floated up to them by the tidal currents, and constitute a collecting ground for brood, which are afterwards removed into shallow tanks of about 50 acres, dug out high on the strands between the tide marks. They are puddled with clay and fitted with sluice-gates. The salt water in these tanks is slightly admixed with soft river water. They also serve as nurseries for the young mussels, which hang in clusters and gather on wattles. When they attain proper size for transplanting they are removed into the *parc*, where they will grow and develop into marketable mussels. All this is being successfully carried out by M. Lemaire, who obtained from the French Government, in 1873, leave to appropriate a small strip of 40 acres of the foreshore fringing the low sandy estuary of the Somme. The success of this short

experiment was so marked, that after an official visit paid by the minister of marine, Admiral Fourichon, and a number of *savants*, including M. Coste, who had predicted a failure, that the original concession was extended to 620 acres.

There are numerous other places on the continent of Europe where oyster and mussel culture is successfully carried on.

The secret of the whole matter is, that where mussel and oyster culture has proved successful, the person undertaking the same has obtained a concession from the government to work the beds exclusively himself, and has not been hampered by other persons claiming a right to fish on his grounds; in other words, fishings are worked in precisely the same way as farms on the land, where the farmer sows his seed and at the proper season reaps his corn.

In England the laws allow the seed to be sown and protected to a certain extent, and when the mollusks are a certain size, *i. e.*, $2\frac{1}{2}$ inches for oysters and 2 inches for mussels, the whole world is free to come and fish on the beds by taking out a nominal license, which is at the rate of 3s. 6d. per ton on the burden of the smack for one year, or 9d. per ton per month. This applies only to fisheries worked under the "Sea fisheries act, 1868."

To make the oysters and mussels the actual property of some private individual or body corporate, appears at first sight to be rather hard on the so-called fishermen, but it must be borne in mind that any person who undertakes to properly cultivate a portion of the foreshore for the increase of oysters and mussels must be in a position to extend a certain amount of capital, and therefore he would not, very probably, do much manual labor, but confine his energies to the employment of watchers or water bailiffs, to the making of "lays" or "parcs," by digging large reservoirs between tide marks, and the various other expenses contingent upon the enterprise; so that the supply of mollusks would be greatly increased, and the fisherman or laborer employed would have more work than he has under the present exhausted state of things.

I wish this essay to be read in conjunction with my "Essay on the artificial propagation of anadromous fish, other than the salmon, and the restocking the tidal waters of our large rivers artificially with smelts, &c."

Under the "orders" granted to the corporations of Lynn and Boston for the cultivation of oysters and mussels, they have collectively jurisdiction over 229 square miles in the Wash, and I have no hesitation in saying that, if the mussel beds within this area were properly worked, they are capable of supplying the whole of the long-line fisheries of the country with bait.

MARCH, 1881.