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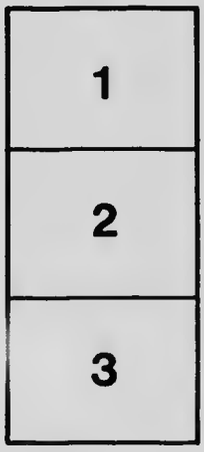

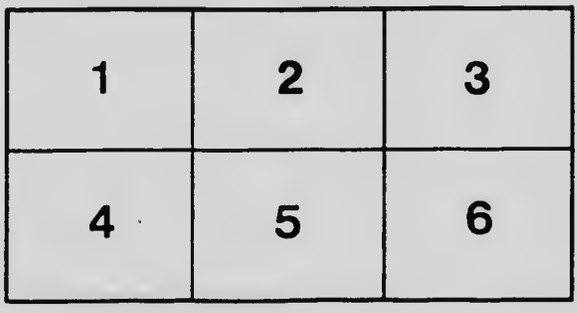

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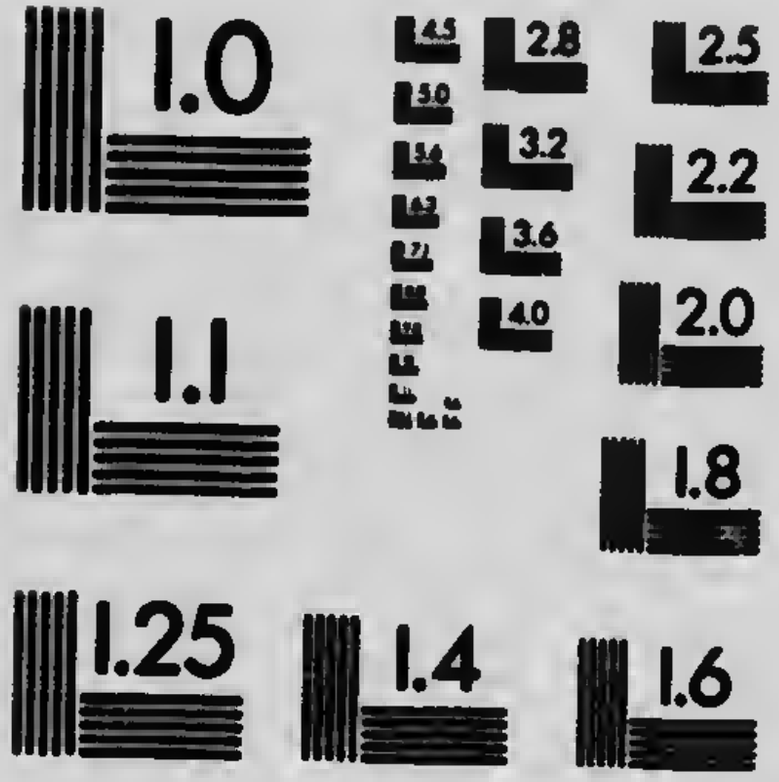

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Some Hints on Oyster Culture

BY

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SOME HINTS

ON

OYSTER CULTURE

BY

ERNEST KEMP.

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PREFACE.

The waters of the Maritime Provinces of Canada are admirably adapted for the cultivation of oysters. Natural beds exist from the Bay de Chaleur along to New Brunswick, and the Nova Scotian coasts, rivers and bays, as far as the entrance to the Strait of Canso, including the waters of Cape Breton, and practically all the waters of Prince Edward Island, giving the oyster culturist ample opportunities to select suitable areas on which to carry on operations.

Frequent enquiries have been made for information necessary to the successful cultivation of oysters. Such information has not hitherto been readily accessible to persons interested in the oyster industry of the Canadian provinces, owing doubtless to the fact that it is only within recent years that the private cultivation of oysters has been seriously attempted or considered in Canada.

It seems therefore timely that the results of wide observation and practical experience should be available to those interested in oyster culture, in order that they may have a general idea of the work required for successfully maintaining and increasing the oyster supply, and in extending the oyster areas, so as to enable the markets to be supplied with a superior quality of oysters.

With this end in view, I shall endeavour in the following pages to make clear to the beginner, or those who are already engaged in the practical cultivation of oysters, an outline of the general requirements.

ERNEST KEMP,
Oyster Expert.

CHARLOTTETOWN, P.E.I., July, 1916.

SOME HINTS ON OYSTER CULTURE

In which the following subjects are referred to:

Some Hints on Oyster Culture.

CANADIAN OYSTER INDUSTRY.

The waters of the Maritime Provinces are well adapted for the cultivation of oysters, as will be seen by the enormous quantities that have been taken in the past, from the natural beds which extend from Caraquet, in New Brunswick down along the shores of Nova Scotia to the Gut of Canso including the inland waters of Cape Breton, and the shores, rivers and bays of Prince Edward Island. The output would have been very much more, had the cultivation of oysters been in existence in the palmy days of oyster fishing.

These natural beds are becoming more depleted each year, through inumerable causes, the chief one being overfishing, which is induced by the high prices that prevail for this delicious bivalve. The waters of the lower provinces abound with oyster food. It is high time that persons should take up this branch of industry which has proved so profitable, and has been so successfully carried on by our southern neighbours. I shall, therefore, endeavour to give a few hints that will assist those who may take up oyster culture.

Theoretically, oyster culture seems so simple, that the wonder is that there are so many failures at it. When we come to put theory into practice, we begin to find out how many local circumstances there are, apparently trifling in themselves, which really exert a powerful influence on the outcome; and it only by many years of watchful observation that any one can acquire sufficient experience to be able to understand and cope with the numerous difficulties which will beset the path of an oyster grower.

Several things have to be taken into consideration to ensure success, and I shall enumerate them, and give an explanation in connection with each.

The Soil.

Oysters cannot thrive where the ground is composed of moving sand, or where soft mud is deposited, and as the size and number of suitable areas are limited, only a very small percentage of the young oysters can find a resting place. The remainder perish. By putting down suitable cultch immense quantities of the wandering spat (or fry) may settle on it, and thus be saved. Unoccupied ground may be prepared for the reception of oysters by spreading sand, gravel and shells over muddy bottoms, or beds may be made in locations where the bottoms are already suitable, by putting down oyster and cultch just before the time of breeding, thus giving the spat a chance to fix themselves before the currents and enemies have had time to destroy them.

Oysters will find a resting place on various kinds of soil. They are to be found on rocky and stony bottoms, attaching themselves to twigs and branches of trees that may be lying in the water, or on any hard, clean substance. The oyster is also found on shelly and muddy bottoms. It will live and thrive in mud as long as it is not too soft to allow it to become entirely buried, and has free access to running water. Such oysters are generally long and irregular in shape, with a soft chalky shell, while an oyster taken from a firm bottom will not, as a rule, be as large, and the shell will be harder and more regular in shape, especially when found singly. Oysters that grow in clusters are chiefly found

on areas where there is a lack of proper cultch, and naturally attach themselves to each other. If these areas were dredged upon, it would loosen the sediment, which would be carried away by the tide; it would cleanse the shells, remove the weeds and extend the area, which would be much cleaner than it is at present. Fishing oysters with a rake, or tongs, contracts rather than extends the beds.

The only obstacle in the way preventing the development of such an industry among us, is the existence of the sentiment, that since the oyster grounds belong to the whole people, they are not a proper field for private labour and industry. An oyster is a subject to improvement by cultivation as a garden root, and the cultivation of oysters is therefore a perfectly proper and legitimate employment for capital and labour, and the common right to the beds must in time give way to private enterprise, just as surely as the common right to the upland has given way before the progress of civilization. Such a change as this cannot be brought about rapidly without causing imaginary hardships or ill-feeling, and it is therefore best that it should come slowly, but the common right to all our people to the use of the oyster beds is a very different thing from the right of a portion of our people to exterminate the beds, and since it is plain that the interest of the whole people demands a change in our oyster industry, everything feasible and reasonable should be done to render possible the growth of our oyster farming industry.

Ice and Frost.

Great care must be exercised in this country to select areas on which the ice will not rest on the bottom, or on which it is likely to be dragged over by rafting. One may choose an area with a smooth surface lying in about four or six feet at low water, or up to twelve or fifteen feet will not hurt. The water should be sufficiently deep not to allow the ice to rest on the beds, but where they are covered by ice and a current of water running between the bottom and the ice, the oysters are protected from the weather and are considered safe. The shallower the water the faster the growth and easier the labour, but probably they would be safer from theft in deeper water.

It is just as injurious to fish oysters through the ice as it is during the hot weather and spawning season. Where this practice has been carried on, heaps of refuse, consisting of dead shells and mud are found bleached by exposure. The loss of oysters in this way must have been enormous. Where the ice does not actually rest on the beds, it has the practical effect of protecting the oysters from change in the temperature. This has proved to be the case in Ostend, Belgium, when the oyster pares happened to freeze over. Originally they were always breaking the ice, thinking it might hurt the oysters to be frozen over, but they suffered great mortality. Since they let the ice remain, they have found scarcely any mortality amongst them.

Frost sometimes congeals the shells together, and the oyster dies from starvation. Shells have been opened and the oysters enveloped in ice. In this state, though dead, they are perfectly good if eaten at once, but when thawed the dead oysters quickly become putrid. In winter, after a thaw, snow water comes down the rivers, increasing the volume of fresh water to such an extent as to cause great mortality to the oysters.

Although one might think that under the water the weather would make no difference to the ground, such is not really the case. It is only when the weather is mild that the soil below the surface of the water becomes loose and soft, and in these places oysters and brood are often taken, but when the weather becomes cold the ground hardens up, and oyster brood cannot be taken at all in the very same place where it was caught previously, or just after the cold weather. This also shows that it is injurious to work too much upon the beds during the winter months.

It has been noticed that during the last few years oysters have been taken in very fair quantities from the river flats and areas that dry at low water, but these areas are not always to be depended upon in their yield, as they are in such exposed positions and subject to the frost. It makes a great difference when the frost sets in on areas such as these, whether the frost comes with any force during spring tides when these areas dry at low water. It is nearly always fatal to the oyster if it does. If on the other hand the ice makes during neap tides and remains, it acts as a covering and protection to the oysters, and, when the ice actually rests upon the flats the soil is sufficiently soft to allow the oysters to be pushed into the mud until the ice rests on the whole area, in such cases the oysters will live, but where they are exposed to the frost, by low tides and heavy winds, they become frozen, which means certain death, especially to the half-grown ones. This was particularly noticed on the flats at Davies Point, Orwell river, P.E.I., covering an area of about seven acres. In 1896 over 1,000 barrels were picked up. That winter, the ice made during low spring tides which appeared to kill nearly everything off, as there was not one-fifth taken from there the following year. Pownal Bay was found to be in the same condition. This has been noticed and watched by practical men.

Tides and Currents.

An oyster requires a clear, clean current of water of sufficient strength to carry off all excrement of the oyster, and other foul matter that may have previously been deposited on the area, either by the preceding tide or lodged there accidentally. Saw-dust, mill rubbish, and heavy soil drainage are very injurious to any oyster bed, and sites where such are apt to obtain should be avoided if possible.

Fresh water in moderation does not harm ,and when mixed with sea water, the oysters appear to fatten and grow more quickly where they are subject to the effects of numerous fresh-water deposits, but with fresh water alone, the flesh of the oyster increases in size, it becomes fat and flabby, and eventually the oyster gapes and dies, with the appearance of bursting open.

Where fresh and salt water are mixed by the tidal currents in rivers, bays, etc., the conditions are excellent for the growth of diatoms, which breed and abound so plentifully on the muddy bottoms. These are carried by the tides over the oyster beds.

I shall now give a short description of oyster food.

Oyster Food.

In discussing the question of oyster food in its many aspects, its general character should first be examined. The oyster, it is well known is quite an epicure in its feeding, living almost entirely upon the minute, lowly organized plants that float or swim in its neighbourhood. With its shell slightly opened, and with the dark-coloured sensory margins of its mantle protruding, it draws into its shell a narrowing food-bearing water current. When it once draws in the current, it carefully screens out the minute food particles, and passes out a stream of filtered water. It avoids if possible injecting sand or mud. Oyster food, it will be found, consists mainly of diatoms, a particular kind of minute, lowly organized plants that have the remarkable power of moving about freely in the water. Unlike any other plant, they are inclosed in a pair of saucer-like glassy shells, fitted one to the other like the lid to a pill box. The glassy cases of the minute plants appear in no way to inconvenience the oysters digestion. The mucilaginous sheathing that encases probably many diatoms, is first dissolved, and the digestive juices find their way through the intricate

glassy valves, speedily attacking and reducing the jelly-like contents, together with the enclosed golden-brown pigment pellets. The emptied diatoms appear to settle gradually, and are soon brushed by countless cilia from the stomach to the intestines.

Oatmeal as a Supposed Artificial Food.

As this will probably fall into the hands of others than those who actually cultivate oysters, but who are fond of them, and are in the habit of keeping a small supply on hand, it is advisable to point out that some persons, through lack of knowledge of its natural history have an idea that oatmeal, flour, or other mealy stuffs diluted in water with salt, are beneficial to the oyster, and think that it will fatten it. This notion is absurd in the extreme, as it will only hasten its death. Meal of any description, when wet will naturally swell and eventually turn sour, and so it is when given to the oyster, that the mealy water will enter the shell, filling the fish with this offensive matter, choking the oyster in much the same way as sand will. The consequence is, the oyster puffs up, turns a deathly white in colour, loses its flavour, becomes very insipid, and if left long in this state, will die, while persons are under the impression the oyster is thriving. Let any person, if he choose to keep oysters after they are caught, try the following plan:—Place the oysters in a barrel or other receptacle, putting each oyster in separately with the deep shell downwards; pack as tightly as possible and cover over with a wet cloth or sacking, to keep the air and draught from them. The oysters will feed and fatten in their liquor, and I am confident they will be found in a much better condition, flavour and palatableness, and will keep much longer, than if placed in oatmeal and water. Oatmeal scattered over the oyseters may have a tendency to keep them moist, as it would absorb any dampness. And the oyster shells should never be allowed to become dry; but dryness may be obviated by covering them over with a wet sack or cloth without the ill effects of using oatmeal.

Temperature of the Water.

While working on the beds I have paid strict attention to the temperature of the water, and I see no reason why there should not be a fall of spat each year, if the grounds are in a suitable condition. The temperature gradually rises during the summer months until it reaches 70 degrees and over. The nit gradually falls, giving ample time for the spat to become attached to any object, and start growing before the winter sets in. The water in the bays and rivers are admirably adapted for the cultivation of oysters in that respect.

Oyster Fishing Methods.

Various ideas have been formed with regard to the easiest and most advantageous mode of obtaining oysters, and the implements used are many, a description of which will be given below.

Dredges are about the only implement used in Europe. They are also used to a great extent in the United States, but are very little used in the Dominion, although a very necessary machine where areas require cleaning, and on cultivated areas thay are most economic in the saving of time and lobour. They are made of various shapes and sizes for the different localities where they are worked. Some are made to be used by hand. Others are hove up by a hand winch; while in other cases steam and gasolene power is used to hoist them to the surface. On shallow bottoms the former are mostly used.

Tongs are used in many parts of the United States, and chiefly in Prince Edward Island. They are formed of two rakes joined together with a bolt, so arranged that both handles will work easily at about one-third the length of the handle from the rake. They vary in size and length of handles according to the depth of water in which they are used, the average length of handle being 14 or 16 feet. The width of the rake is about 30 inches, in which curved iron teeth, about three inches long and one and a half inches apart are fixed; when working with the tongs the boat is moored over an oyster bed and moved about from time to time, as required. The tongs are then used on the bottom, and collect oysters, shells, and weeds, which may lay in their way while being drawn together. On raising the tongs to the surface, the contents are culled out, the oysters being saved, while the shells are returned to the water settling on the bottom as the tide carries them. A man equipped with a small row-boat and pair of tongs is able to go where he pleases, and often finds good fishing on very small oyster beds; while dredges require a heavier boat, which they must propel over the grounds with either sails, steam or gasolene power, and need a larger area of ground to work on.

The single-handed rake is used where the bottoms are softer, and also from an open boat, moored. This also varies in size. The rake is about 30 inches wide, with curved teeth from 8 to 10 inches in length and arranged about one and a half inches apart, with a handle from 15 to 25 feet long. It will collect the oysters and shells from the outer edges of the bed, breaking through the crusts of the beds, making them very uneven and doing more damage to a piece of ground than the good they reap by their catch. By this method of fishing the beds are continually becoming more contracted. An oyster bed requires to be as even as possible, and where depressions are made on oyster beds the sediment soon settles, making mud holes, where eventually eelgrass will grow and the beds soon become covered over with it.

I have seen Indians use the flat eel-spears bent round at right angles, making a hook of it, with which they will fish among the rocks and ledges. They are expert in obtaining oysters by that method.

In Cape Breton an instrument called a dip-net is used. It consists of a circular or oblong band of iron about 8 inches in diameter, and when oblong will be 12 inches by 8. At the back or bottom of this is attached a small net, made of either wire or twine and fixed to a pole from 10 to 15 feet long for a handle. When an oyster is seen on the bottom by the man in the boat it is scooped into the dip-net. The water is clear, as a rule, the bottom being easily visible at a depth of 6 to 9 feet. At times when there is wind and it is difficult to see the bottom, some of the fishermen will sprinkle oil on the rough water around their boat, enabling them to see the bottom more clearly. But the most crude method of all was a split stick, which was formerly used in Cape Breton. The person using it would be looking over the boat's side as it drifted along, and on seeing an oyster, this pole, which was split at the lower end into four parts and slightly opened, was thrust over the oyster, and when a firm hold was found to have been obtained the stick was raised and the oyster extracted. It was a slow method, but these men obtained a very good sample of oysters and no very small ones were caught. Indeed each locality seems to have its own peculiar method of fishing oysters.

Oyster Dredges.

An explanation of the dredge and its uses in oyster culture will now be given.

In preparing grounds for cultivation, the main object is to have a clean area to begin with. The most efficient, effective, and economical method in this case is the use of the dredge, which is a triangular shaped instrument,

consisting of a bit or rake nearly three feet long, made of flat iron about three-eighths of an inch thick and two inches in width and set at an angle so that it comes in contact with the ground, behind which a small net is fitted and made to hold from one to two bushels. This will receive and collect all the bit of the dredge has turned over. The sides of the bit are joined to two pieces of iron about three feet six inches long and welded together at the upper end, to which a ring is fitted. A rope is attached to this ring, and in this way it is towed and brought to the surface when required. It is also strengthened by a piece of iron running from the ring down the centre two-thirds the length of the sides and connected by a cross-piece of iron holding the two outside limbs in their place, which strengthens the frame considerably. To this is also secured the upper side of the net. The bag or net is so constructed that the lower or underneath side is generally made of iron or galvanized wire rings and made into a netting, because there is more wear on the lower side, as it is dragged over the bottom, and most of the weight of the contents lay on that side. The upper side is an ordinary piece of common netting made with strong twine. This being much lighter, it fills out, forming an open-mouthed bag by the action of the water running through the meshes while the dredge is being towed over the grounds. The lower end of the bag is kept square by means of a stout stick attched to both the lower corners. This keeps the net from fouling, and also acts as a handle when emptying the contents of the dredge on deck. The dredge is generally towed behind a small steamboat or from the weather side of a sailing boat, the boat being allowed to fall to leeward and forge ahead slowly, the length of the rope being regulated from the deck by the depth of water the bed is lying in, speed of the boat, and the conditions of the weather. After a little practice it can be easily ascertained whether the dredge is full or empty, or is catching anything, by the feeling of the dredge-rope. If everything is satisfactory a strong vibration is felt on the rope as the dredge is being dragged over the bottom, and the weight is found to increase. Sometimes the boat is going too fast, or the line may be too short, and the dredge does not even touch the bottom. This is called swimming the dredge and can only be adjusted and regulated by practice, both as regards the speed of the vessel or the length of rope.

Where dredges are worked by hand it is not desirable to have them made too heavy. It would be a greater advantage to work two lighter ones than one heavy one, and that fault would often prejudice many persons against their use. The iron frame-work of a dredge weighing about 20 pounds is a very fair weight for a hand dredge. The lighter the line the better it will fish as their is not so much resistance against the water. The result is that the dredge will be towed lightly over the beds, collecting all surface shells, stones, weed, oysters, brood or any other substance or matter that lies in its way. If oysters have been planted, or are laying on the area, they are caught much faster than by the ordinary methods now in use in this country. Large quantities may be caught in the course of a day from a well stocked bed, by the use of the dredge. A large item in saving labour would be noticed in the course of a season, it being far more economical and satisfactory to use a dredge than any other implement or method. It also disturbs the sediment or silt which is naturally carried away by the currents, and the result is the grounds are cleaned while the oysters are being caught for market. It keeps the areas level, and if the shells are old and decayed, they may be removed to the outside edges of the bed. The dredges are sometimes towed to the extreme length or breadth of the cultivated area or even beyond it, the shells and refuse often being thrown overboard outside the edges of the bed, and if this is continued it can easily be seen that the beds must soon become more extensive, and the result is that by the use of dredges the beds are increasing in size, while the methods now in use are of no value whatever in cleaning or keeping an area in order, and tend to contract rather

than extend the beds, as is the desire of any one wishing to make an improvement and success in his undertaking.

Oysters and other kinds of shellfish can be taken by this method in any depth of water. Oysters are thus caught from the beds at Whitstable, England, where they lie in six or seven feet at low water, there being a rise and fall of tide averaging about twelve feet. They are also caught in the North Sea off the Dutch coast in from twenty to thirty fathoms of water, and other places where the depth varies from one to thirty fathoms. The shape and weight of the dredge varies with the locality and nature of the bottom where the fishermen intend working. A dredge is made much heavier and wider for deep water than for shallow water, and dredges vary in weight from twenty to eighty pounds and upwards.

All persons who have used oyster dredges in this country speak very favourably of them. I am certain that when the dredge is fairly introduced and its merits thoroughly tested, it will supersede both the rake and tongs on private areas, and open up a new feature in the private cultivation of oysters.

Dredges are also used in England to obtain the whelk, which is used as an article of food, and also a valuable bait by cod-fishermen. It is likewise used to catch mussels and starfish, utilized by the farmers as a fertilizer, and quite a number of men find employment in loading their boats with them for the different markets.

Oyster Areas.

I will now deal with the ground which is most suitable for culture. Dead oyster beds which have a sufficient depth of water over them to avoid the ice resting upon them, are the best to select. These areas give the culturist a firm bottom, and probably only require a little raking over to put them in a condition to commence laying down oysters.

Areas selected for the cultivation of oysters should have a level, smooth and firm bottom, consisting of clay, shells, firm sand (not shifting) gravel or mud not more than two of three inches thick with a hard bottom underneath. Soft mud is undesirable for several reasons. First, if it is sufficiently soft for the oyster to sink into it and become buried. This is fatal to the oyster, as it must open its shells to breathe and allow a flow of water through its gills to receive nourishment. Then the bottom requires so much material to be spread over it to make it firm, and if this has to be done, sand spread evenly over the area will often form a crust firm enough to lay a coating of shells upon the crust before depositing oyster seed.

Rocky bottom should be avoided as it would cause so much wear and tear to the gear.

Often flat areas are to be found with eelgrass growing all over the bottom. This can be removed by hauling rakes over it and tearing it out by the roots and then spreading gravel and shell over the area before planting the oysters. Areas should be avoided where they are exposed to shifting sand-bars as they will often destroy oyster beds by covering them up entirely, and all the work and expense laid out on such areas will be entirely lost.

Inland bays, mouths of rivers, and rivers are the best sites to choose, as they are generally protected by land, against heavy gales of wind and sea, which would often destroy beds if exposed to heavy ground sweels.

Persons in the oyster business, and having a piece of suitable ground on which oysters can be temporarily laid, find it invaluable for keeping their stock until they find a firm market. These persons can afford to be more particular in their culling as they can return all immature oysters to their beds. These can lay and develop into larger oysters, giving a profit, if only in the growth

alone, where oysters are sold by the measure. It is especially so with those who buy from the ordinary fishermen, when so many small ones are to be found when culling for market.

On obtaining possession of an area for the purpose of putting it into a state of cultivation, the beds may be stocked by picking small oysters on the ebb-dries and shallows, which if they are not removed are inevitably lost, as they would perish with the winter's frosts.

It must also be borne in mind that the taking up of private areas in the lower provinces for the cultivation of oysters is of recent date, and that no areas are leased where oysters exist, so that persons who take up areas are not thoroughly acquainted with oyster culture in all its branches, and it is only fair to give these pioneers in oyster culture a start that will encourage them to keep it up.

The oyster industry in Eastern Canada has been purely taking advantage of a natural resource, and it has had many things to hinder its success. In the past a great many more small oysters have been destroyed above the high-water mark and at the doors of packers warehouses than have ever been relaid by persons having licensed areas. Then again, mud-digging has destroyed many oysters, as well as brood and valuable soil which can never be reclaimed. Fishing in close season and through the ice has had also its ill effects; but I am in hopes that with proper regulations and leased areas, combined efforts of fishery officers the oyster industry may yet be able to hold its own. It is far preferable for a few barrels of oysters to be transplanted on an area where no oysters exist, and see that they are being watched and cared for, than to see heaps of bleached shells piled up on the shore, being the cullings and young oysters left to decay.

In allowing persons to take up areas on depleted beds or other grounds they may choose, and stocking them with young and full-grown oysters, it must not be forgotten that these persons having no control whatever over the spat; and may be the means of restocking many natural beds which are in the vicinity of the leased ones, and I therefore consider it of very great importance to grant licensed areas when not interfering with the public fishery, and I strongly advise the encouragement of private culture, which will eventually be the only means of keeping up and maintaining the supply, which at the present time does not equal the demand.

After selecting and securing a suitable area the next step is to commence operations on this marine farm. The first thing is to ascertain the nature of the bottom, if it is clean, or dirty, hard or soft, even or uneven. If dirty it should be dredged over and cleaned. The weeds, if any, should be removed and the bottom made as even as possible. Should the area consist of an old depleted bed, the turning over of the old shells will greatly benefit it.

Areas of any size may be undertaken now there are such facilities in motor power. If the area is small or large, a boat can be obtained of any power required for the work. Motor boats and steam power make easier the work, which was originally carried on by sails and oars.

After an area has been prepared the next step is to stock it. In planting oysters no hard and fast rules are given. If oysters are found to thrive in certain waters, it is well to continue cultivating them on the same area, but it has often been observed that the removal of oysters from one ground to another has the general effect of improving both their flavour and their size. The spring of the year, before the hot weather sets in, is the best time for planting. By placing the oysters in shallow water during the spring and summer months, they will grow much faster than if placed in deeper water, as the sun causes the water to become much warmer, the oyster being very sensitive to the action of light and heat which promotes a rapid growth. Oysters planted in the autumn are not so likely to thrive, as owing to the change of soil and falling temperature, the oyster is not properly acclimatized before winter sets in, which very often

proves disastrous. Oysters grow but little during the winter months, with the exception of getting thicker. Consequently fall planting is full of risk, and will likely result in loss or in little or no gain, although there are exceptions in every case. Young oysters taken in the spring have survived the winter, and the change of water and warmer temperature, will give them every chance to live and grow.

In obtaining the necessary quantity of oysters for planting purposes, extra care should be taken to secure them in a fresh condition, and if time will admit of it, they should be very carefully overhauled, and if they are found to be in clusters they should be separated as much as possible, either from other oysters, shells, stones, or anything else they may have adhered to. This separation gives the oysters a better chance to grow into natural shape, as oysters grow better singly than when in clusters. In securing the stock the size of the oyster should be considered. for which I give the following reasons:—Small or young oysters planted on a bed are preferable as their growth alone will result in large proportionate returns and profits. A young oyster is not so likely to die when transplanted to another bed, as when older, nor is it any advantage to transplant a full grown oyster unless for immediate use. One great advantage in the trade of this country, is the rapid growth of the oysters, as they are bought and sold by measure.

Great care should be taken of the spat, as the older it is, the hardier it becomes, and if the young are saved a good harvest may be reaped in the future. The living and the dead shells of the adult oysters furnish the best surface for the attachment of the young, and for this reason the localities where areas are already established are those where the young have the most favourable surroundings and the best show for life. The beds thus tend to remain permanent and of substantially the same size and shape. It is well known that shell-fish of all kinds thrive best where the supply of lime is the greatest. The dead oyster-shell is soon corroded and in a few years almost entirely dissolved by the sea-water, and I think this fact is another reason why the young oysters thrive best on a natural bed. It is also known that the temperature on a live bed of oysters in winter is higher than on the barren bottom, and where there is traffic over the ice, oyster beds are always avoided, as the ice is much thinner, and is the first place to open up in the spring. In some cases it is unsafe to cross oyster beds at all, as the ice is so thin.

As a rule, oyster brood picked from an ebb-dry ground or above low-water mark, are much hardier than those taken from deeper water, and by removing them into deep water they would be secure from the heavy frosts which prevail around our shores. The quality of these oysters is, as a rule, very good.

Cultch is the name given to the débris of shells, stones, etc., which are found at the bottom of the sea, on or near oyster beds. It has been the practice from time immemorial to supplement the natural supply by throwing down deposits of this sort on oyster grounds. Oyster and cockle shells make the best material for this purpose. In default of this, stones and pebbles may be used, the great point being that the cultch, whatever it is composed of, should be clean, and for this purpose the shorter the time it is laid down before the spat falls the better.

Shells may be collected from oyster saloons and deposited near the shore. Exposing them to the weather, the sun, the rain, frost and snow will have the desired effect upon them. They will be thoroughly cleansed of all organic or other matter, and when laid on the oyster beds, are excellent spat collectors. They also serve to make a firm foundation in extending an area if required by the planter. Also they may be obtained from oyster beds, taken in the dredge when fishing for oysters and laid on shore in heaps until required for use, or when enlarging an area, may be deposited there each day as they are caught, according to the discretion of those who have charge of the work.

The quantity of shells to be planted per acre will depend entirely upon the character of the bottom in question, being of course greater where the bottom is at all soft. In any case enough shells should be used to completely cover the bottom with a layer of at least one shell deep. If evenly distributed 2,000 bushels of shells will give a layer of one shell in thickness over one acre, and the amounts necessary to prepare any bottom may be reckoned on this basis.

When single oyster shells are used for planting, it will be found that they will fall with the concave side of the shell uppermost, so that the edges of the shell on the underside will remain clean for the longest time and the largest number of spat will become attached to this part of the shell, although all may be of equal cleanliness. Since the oyster fry seem to prefer the underside of the shells as a place of attachment, it follows that by putting down a sufficient quantity of shells to make a layer two or more shells in thickness, there will be a much greater surface exposed on the under side of the shells and the chances of a good set of spat are thereby increased.

Other material may be used, such as coarse gravel, small pebbles, tin cans, tin cuttings, old boots, iron, etc. Birch brush is also laid down. In fact any object with a clean rough surface, and the smaller the article the better it is, as the oysters are not so likely to grow in clusters, which distort the shape of the oyster, and they have to be separated as soon as possible.

Oyster Planting.

After the ground has been cleaned of all weeds, and other débris removed, and the area shelled, the next thing is to stock it with oysters suitable to the locality. Great care should be taken to plant them in water of a depth of from four to six feet at low water in sheltered places in order to protect them from frost and ice and where the areas are exposed to the weather deeper water is advisable in order to avoid the ground swell breaking upon the beds.

The depth of the water is an item to be considered. Oysters planted in shallow water will grow much faster than those planted in deep water as there is a difference in the temperature and light, and an oyster grows much faster in warm water than in cold.

The choice of oysters to be planted rests with the owner. Some will prefer to plant the small seed and wait until it matures, while others will lay a half grown oyster which will be ready for market much sooner, while others will divide their areas into sections, planting different sizes on each lot. To get the best results the seed should be uniform in size, so that the sample, whatever size it is, will mature at practically the same time. This will save a lot of labour in the handling of them, when catching them for market. It will be found that the smaller the oyster seed at the time it is planted, the greater will be the returns on the capital invested.

Another item is the number of oysters to be planted on each acre, and that is a matter which requires a little consideration before determining how to act. The oysters should not be deposited too thickly over the beds, and the amount that appears to give the best results is from 500 to 800 bushels to the acre. This of course is a matter of judgment of the owner. If the beds are sown too thick they get crowded when growing and do not get the nourishment they would if they were spread more thinly over the beds.

If seed oysters are single and thinly spread over the beds they do not require the attention that a bed would which is thickly covered with oysters. Seed oysters of all sizes may be obtained from reliable firms of oyster growers in the United States. When planting these oysters, the greatest care should be exercised to distribute them as evenly as possible all over the bed. This

can be done by the men in charge of the boat as he sails over the beds, using his judgment in covering the whole area, the crew spreading them with a shovel in the same manner as a farmer spreads manure over his fields.

Then when spatting time arrives (between July and August) the shells on hand should be scattered over the whole area under his control, in the hope of catching spat on his own beds.

Oysters will spat in shallow water sooner than they will in deeper water, owing to the difference of temperature at different depths.

They will breed long before they are full grown, very probably in the first year of their age; certainly the second. Their productiveness appears to reach its maximum at six or seven years, and afterwards to decline.

The state of the weather has a serious influence on the spawn, and on the adult oyster's power of spawning. A cold, wet and windy season is very unfavourable, and a decidedly cold day will kill the spat, so that it will be seen that while in the embryonic state, young oysters are very delicate and susceptible to cold. If the temperature of the sea suddenly drops many degrees, they all close their shells and fall to the bottom dead, just as a frosty night will "nip up" and cause to fall off from the branches the delicate blossoms of fruit trees. If, on the contrary, the weather continues of a warm and equable temperature day and night, and if it be at the same time calm, the young oysters will have a chance of taking up their positions on the various substances they love best, viz., stones, gravel, empty shells, living oysters and other clean, hard substance.

Holding an oyster area does not compel a person to ship his oysters to market as soon as the season opens, to be sold for whatever price they will bring, but rather the reverse. The oysters may be kept until an order for them is received. In filling orders good uniform sized oysters should be used, whether they be large or medium size. Oysters should always be graded, so that the customers may know they can depend upon getting what they order. This will soon create business. If the weather gets warm at the latter part of September, it is the shipper's business to use his judgment in sending oysters to market. That is one great advantage to a person holding a license for an area of oyster ground. He can meet the demands of the market without overstocking it, by sending the best quality and size, leaving his small ones to develop into full-grown oysters. Let me also add that it is imperative that whatever close time is required by law, shall be honourably and conscientiously observed; as there is nothing to be gained by supplying a few oysters to the public during the summer months. If the oysters are caught for market during these months, the grounds would be disturbed, the supply of breeding oysters lessened, and it would be impossible to calculate the amount of death and injury caused to spat, young brood and immature oysters, by securing a small quantity, in order to satisfy the palate of a few fastidious persons who are entirely ignorant of what they are eating. The close season should be well observed, not only as far as the oyster is concerned, regarding its breeding qualities; but at that period it is really not in a fit condition to be eaten, and fatal cases have been reported through eating oysters during the hot weather.

As to the working of oyster beds, an eminent authority has said it is utterly useless to enclose a piece of ground and simply plant it. It is also useless to throw a lot of oysters down among every state of filth. One must keep constantly dredging, not only the bed itself, but the public beds outside, so as to keep the bottom fit for the reception and growth of the young oysters, and free of its multitudinous and natural enemies. An oyster ground is naturally dirty in the summer. Seaweed grows rapidly in hot weather. Weeds collect mud and consequently, as the summer advance, the grounds become dirtier and dirtier. Time may also be devoted when cleaning an area, or catching the

stock for market, to separate any small oysters that may have attached themselves to full grown oysters or shells that have been brought to the surface in the dredge with other cultch, and in this way a person is always improving his own grounds, which he will soon find out to his advantage.

Experiments have been made by the Department with depleted beds at Shediac, N.B. The areas there have been cleaned and restocked with young oysters, which have grown very fast. They are full of life, and on several of the oysters and shells there are traces of spat, from the smallest size up to the full-grown bivalve; the ground being clean and of healthy appearance. On one portion of the bed oysters were planted from Curtain Island, P.E.I. These oysters have grown very much more than those which were obtained from Buctouche or Cocagne, although the latter are in splendid condition.

The wealth within the reach of our people and their descendants, from the oyster grounds in our waters is almost beyond belief, and it is not too much to affirm that that their money value is more than equal to the same amount of dry land.

Whenever the natural conditions will admit of it, the yielding capacity of an oyster-bed may be increased by improving and enlarging the ground for the reception of the young oysters. The natural banks should be improved by removing the mud and seaweed with dredges, also by scattering the shells of oysters and other molluscs over the bottom. When circumstances will permit, all vermin which are taken in the dredge, and which kill oysters or consume their food, should be destroyed. In England this collection is generally used as a fertilizer upon the fishermen's vegetable gardens Thus it is a benefit in two ways, by removing it from the oyster beds, and placing it as manure upon garden soil.

The Enemies of the Oyster.

There are some who would imagine that the cultivation of oysters is a matter that requires little attention, and when the area is once planted there is nothing further to trouble about until the oysters have grown large enough and are ready for market, but I must call attention to the facts of the case, when it will be seen that it is not all sunshine with the oyster cuiturist. The following are some of the enemies:—Starfish or fivefingers, dog-whelks or borers, seaweed, sea-worms, sand, mussels, sawdust, etc. The destructive powers and effects of these enemies may be considered with advantage.

Fivefingers or Starfish.

The following is quoted from Philpot:—"No person would have thought, on placing an oyster and a fivefinger side by side, that the starfish was a relentless foe to the oyster. Those who can remember their first fruitless endeavours to open an oyster may naturally wonder how the starfish can achieve such a feat. As I have repeatedly seen it proceeds as follows:—Clasping the oyster in its rays, it brings its mouth opposite the hinges. From the mouth it pours a secretion which paralyses the hinge-muscle, and causes the shell to open. It cannot, like the dog-whelk, extract its prey and put it into its stomach, so it reverses the process, and puts its stomach into, or rather over, the oyster, protruding the stomach from its mouth, surrounding the oyster with its coats, digesting it, and then withdrawing the stomach into its body. The wildest fancy of Oriental legends never equalled in grotesque imagination this perfectly true history of the oyster and the starfish.

But although the starfish can, in this extraordinary manner, manage to devour an oyster as big as himself, it must evidently be somewhat troublesome

to him, for he prefers to attack oyster-beds covered with spat, brood, or half-ware;—that is, oysters from one to three years of age, whose shells are not hard, and whose flesh is more delicate and pleasing to the enchinodermal stomach."

Starfish will also feed on mussels, which themselves destroy oysters by smothering them, and on whelk tingles, dead crabs, barnacles, etc., so that, after all, they may do some good, as a certain amount of vermin in a game preserve is anything but injurious to the welfare of the whole population; the vermin keep up the balance of nature by destroying and eating the sick and weakly animals, which might otherwise die a lingering death.

Sea Urchins.

The next on the list of the oyster's enemies is the Echini, "sea eggs" or sea urchins, whose well known empty cases are so common on every shore. The body of the sea urchin consists essentially of an exterior shell or solid corona, covered with spines, and invested in a delicate membrane, furnished with vibratile cilia. This corona is formed or an assemblage of contiguous polygonal plates, adhering together by their edges. The plates are so arranged that the shell is divided into vertical zones. These zones are of two kinds, one being very much larger than the other. The plates of the larger zones are covered with sharp spines, which are movable, and serve at once for protection and locomotion. The plates of the smaller zones are pierced with pores, from which issue filaments, by which the animal breathes and walks

It can travel either on its back or stomach. Whatever their posture they have always a certain number of feet which carry them, and suckers with which they attach themselves. In certain circumstances the animal walks by turning upon itself in a wheeling motion.

Nothing is more curious than to see a sea-urchin walk upon smooth sand. One of the most singular organs of this interesting animal is its mouth. It is the most curious. Placed underneath the body, it occupies the centre of a soft space invested with a thick resisting membrane; it opens and shuts incessantly, showing five sharp teeth projecting from the surface, the edges meeting at a point supported and protected by a very complicated framework, which has received the name of Aristotle's lantern. To this formidable mouth is attached an oesophagus, or gullet, and an intestine which extends along the interior walls of the corona, describing the circumference of its principal contour.

That sea-urchins are regarded as vermin in the oyster pares has been proved by the following evidence:—In the month of May of a certain year a sudden inroad of these sea-urchins was discovered in the Paglesham fishery (Essex), and by the month of August of that year they had eaten an enormous quantity of oyster spat, the size of a split pea. Frank Buckland noticed several of these creatures on the oyster beds in Kilkerran Bay, near Ballynohinch, Galway, and naively remarks, " that they are not there for nothing."

Dog-Whelks.

The dog-whelk or " whelk-tingle " (Purpura lapillus) is extremely injurious to oysters, and destroys them in vast numbers. Frank Buckland speaks of them as follows:—"These dog-whelks seem to find in a short space of time where the oysters may be found in numbers, for my friend Mr. Browning tells me that not very long ago some fishermen found a bed of oysters out in the mid-channel deep sea. These oysters were, at the time they were found, not large enough to be dredged up and taken away to lay down on private beds, so the dredgers determined to leave them till they grew to the proper size.

They had not, however, calculated upon the whelk-tingle, for these rascals, soon after the departure of the fishermen, found out the bed as well as the fishermen, and were there before them, killing every one of the oysters, leaving only the clocks, or empty shells; and when the dredgemen came next year to take up the oysters, they found nothing but whelk-tingles and fivefingers, but no oysters." The whelk-tingle gets at the meat of the oyster by boring the shell with his sharp tongue, which causes the mollusc to open its valves. Rewards are offered by the oyster proprietors in England for these whelk-tingles, one shilling a bucket being paid for them.

Lieutenant Winslow reports:—"Another enemy to the oyster, particularly when young, is the Astytis, discovered in Chesapeake Bay, near Crisfield, Md. Also the rough whelk (Urosalpinx cinereus) is known to do great injury to the oyster in Long Island Sound, and the destruction of the young allued to in his previous reports as due to drills may be effected by this animal. That large numbers are destroyed by the whelks cannot be doubted; but as it is possible that the Astyris may also assist in this destruction, a more extended investigation of this question, than I was enabled to make, is desirable."

Seaweed.

Seaweed of every description should be removed from all oyster beds, as it increases the work of dredging, covers up the oysters and grounds, and at the season of spatting it covers the cultch, so that the spat that settles there is lost. Weeds also collect mud, which would smother the spat even if it found a resting place, and generally makes foul and dirty ground. The oyster areas cannot be too clean for the reception of spat, and the cultivation of oysters.

Eelgrass which is found in large quantities all over the water bottoms in the lower provinces grows to a great length, and during the summer season it accumulates a large quantity of sediment as the tide filters through it.

Then when it is ripe it sometimes is washed ashore by gales of wind, or as is often the case it falls where it grows and rots, forming a coating over the whole area; and this goes on continually year after year, and has a tendency to fill up our shallow bays and inlets.

Sea-Worms.

Sea-worms, some of which are of great beauty, are also enemies to the oysters. They bore through the shell at all points. Frequently the oyster will resist the invasion of the enemy by depositing some pearly matter between its tender body and the mouth of the invader, and thus compel him to beat a retreat. But others are not so fortunate; for in the holes drilled by the sea-worms a preparation is often made for the assaults of a parasitic sponge, which insinuates itself and eats further than its predecessor into the oyster, causing the softer parts of the shell to rot away, and spreading through the whole substance of the oyster like a dry rot in wood, until vitality is destroyed and its loosened shell becomes detached and empty.

Sand.

Amongst the inanimate enemies of oysters, Frank Buckland makes special mention of sand and frost. He says that "of all inanimate objects which are inimical to the oyster, there is none more fatal than sand. If we consider the highly sensitive and delicate structure of the oyster, it will be easily seen how very obnoxious sand would be to its welfare. 'The worst of sand is that it is very liable to shift about in the sea, and great sand-storms not unfrequently occur, just as they do in the deserts of Arabia, destroying suddenly whole caravans of

camels and men. When I was at the Isle of Re, Dr. Kemmerer gave a famous instanee of a large number of oysters being destroyed by sand. This event happened at a plaee called Morique in Franee. There was a large number of tiles laid down at this spot, and there were, besides, a large number of oysters naturally adherent to the roeks. Just oustide, however, there was a moving sandbank. The oysters spat had taken well, both on the tiles and on the stones, but during a storm the waves brought a quantity of sand, ruined the whole bed, and killed every oyster.

Although sand in large quantities is very dangerous to oysters, yet a eertain quantity is by no means prejudieial to their welfare. The admixture should amount to what my friends at the Isle of Re eall "sable vaseux" or mud sand, whieh is good for oysters, but it requires an experieneed eye to know it when they see it."

Sand destroys oysters either by smothering them en masse or by getting between the shell near the hinge, where the oyster eannot get rid of it.

Frost, iee and snow are also destruetive to oysters, but Buekland is of opinion that in all ordinary frosts, where the oysters are eovered with three or four feet of water, they are safe.

By reading the above it will be seen that it is dangerous to plaee oysters on area where the sand is eontinually shifting, for when the oyster opens to feed, the sand is drawn in between the valves of the shells, and it is unable to throw it out on aeeount of its weight, and eonsequently it dies. Any person thinking of eultivating oysters should first aseertain whether the area in question is suitable, and the question ean be settled just as easily by experimenting with a few as with a large quantity, and in the event of failure, would save a large expense.

Mussels.

I must not omit to mention mussels as being one of the oyster's enemies. In some plaees they are more so than others. They are the worst plague of the pares at Oleron, Franee. They multiply there in sueh numbers that if the eoneessions are not visited, and the mussels removed eaeh time the tide allows it, they soon eover the ground in very thiek masses.

I also remember an instanee where mussels had shed spat on two oyster areas in Holland. One owner endeavoured to remove the mussels, letting the oysters remain, but the mussels grew faster than they eould be eleared off. The eonsequenee was that mud had aeeumulated to sueh an extent that the oysters were literally smothered, and what did live were thin and starved, and were a dead loss to the owner. The other area was eleared of its oysters with all possible speed, and the only loss ineurred was the labour in removing the stoek to more suitable beds. On another oeeasion, a spat of mussels settled on the Whitstable Oyster Company's grounds. As soon as it was diseovered, instruetions were given to the men to remove all they possibly eould, but, in the meantime a vessel load of starfish were deposited over the grounds to destroy them, as starfish will always take to what is most delieate and easy to get at. The mussels being very young at this time, were, with the aid of fivefingers and man, soon got rid of. The starfish were then in turn disposed of, by being eaught in the dredge, or they would soon have attaeked the young oysters, when they found that mussels were getting searce.

Mussels inerease and grow very fast, attaching themselves to any firm substanee by means of horny threads (byssus) whieh they hold themselves in any one loeality. Mud eolleets among them, and mud banks are often built by myriads of these shellfish attaehing themselves together. They thrive on muddy bottoms and beeome very numerous. They live on the same food as oysters, and when found in the same loeality, the result is, that the oysters are starved out.

The men of Arcachon, France, say that there is not enough lime in the water for both the oysters and the mussels, and the latter being the stronger, they get all the lime, and the former suffer correspondingly. This is one way of expressing the general fact that somehow in the complex struggle for existence the mussels get on best.

Sawdust.

Sawdust when thrown into rivers or bays from saw-mills has always proved fatal to oyster beds. The lumber is generally sawn in a wet or green state, the saw-dust is heavy, and when thrown into the water it is carried away by the tide and gradually sinks to the bottom where it soon begins to decompose, and when this substance is moved it throws off a most offensive odour. Have known where oyster beds have been completely covered over by a thick layer of sawdust, with the result that all life on that bed and its vicinity soon became exterminated. The culturist should therefore guard himself as much as possible against all the above mentioned enemies of the oyster.

Questions about Oysters.

I have often been asked the question. Which side should an oyster lie on? It is immaterial, as when once the oyster finds its resting place, there it must remain until it is caught, dies, or is removed by the action of the sea or tide. In this connection I quote from "Philpots Oysters and all about them:"—

"A controversy hinged upon whether an oyster, while on the bed, lay on the flat or convex side. Mr. Frank Buckland who originated this dispute, maintained that the right, proper and natural position of the oyster, when at the bottom of the sea, is with the flat shell downwards; but the natural position of the oyster is of no practical importance whatever; and I know from practical observation of the beds at Newhaven and Cockenzie, that oysters lie both ways. Indeed with a dozen or two of dredges tearing over the beds it is impossible but that they must lie quite higgledy-piggledy, so to speak."

In the parcs at St. Joseph's in France, which are most exposed to the inclemency of the weather, the oysters are turned, and laid on their flat sides. This ingenious arrangements renders the animal less accessible to the action of the cold, and gives the shell a firmer position, thus preventing it from being too easily lifted by the surf, and from being thrown to a distance by the violence of the sea.

There have been several other disputes about points in the natural history of the oyster, one in particular as to whether the oyster is provided with organs of vision. Various opinions have been enunciated as to whether an oyster has eyes. One author asserts that it has as many as twenty-four, which is again denied, and the assertion made that so-called eyes projecting from the border of the mantle have no optical power whatever; but, be that as it may, the oyster has a power of knowing the light from the dark. Fishermen say that if the water is clear where these creatures are lying on their beds, they may be seen to close their shells whenever the shadow of a boat passes over them.

The following article is taken from a supplement to the Charlottetown Guardian of July 1915:—

"The oyster fishery has, during the past few years, been attracting special attention.

This luscious bivalve abounded in almost all the bays and rivers of the Province, and for many years afforded profitable employment to hundreds of fishermen. No efforts were made to conserve the industry and the constant reaping without sowing had the inevitable result. Total extinction threatened

the much prized oyster. The rate of decline in the annual oyster harvest will be seen in the fact that the total catch in 1882, which amounted to 57,042 barrels, valued at $3 per barrel, had in 1912 fallen to 8,835 barrels valued at $7.50 per barrel.

Successive provincial administrations had grappled with the subject with a view to preventing the extinction of this valuable shellfish.

Jurisdiction over the inshore waters of the Island had, according to an interpretation of the British North America Act, been somewhat vaguely divided between the Federal and Provincial Governments and a satisfactory solution of the conservation problem seemed impossible. It was not until 1911 that definite steps were taken when an agreement was concluded between the present Dominion and Provincial Governments by which the latter was entrusted with the sole administration of the oyster areas.

Under this agreement steps were at once taken to convert the depleted and barren areas into oyster farms. Richmond Bay, by far the wealthiest oyster section in the Province, was surveyed and laid off into measured areas. Of the 30,000 acres in the bay 14,000 were reserved for public fishing and the remainder offered to lessees at a rental of one to five dollars a year per acre. Five thousand acres were taken up by companies during the first year and the work of development was commenced in earnest. Bottoms were cleaned up, young oysters planted and already there are many indications that the original wealth of this magnificent Bay will not only be restored but that there will be greater production than ever. Other areas in different parts of the Province have been and are being surveyed, and oyster culture promises shortly to form one of the most lucrative industries in the Province".

The following are the total quantity of oysters caught in the lower provinces, from 1876 to 1914-15, compiled from Annual reports of the Department of Fisheries.

	Barrels.
New Brunswick	595,123
Prince Edward Island	897,466
Nova Scotia	77,332
Total	1,569,921

There is no sufficient reason why the demand for oysters throughout the Dominion should not be supplied by our own people. The inland markets are easily accessible, and the domestic consumption would, no doubt, be increased if the article were produced and supplied with our own resources, at a lessened cost. The area of oyster grounds on the Canadian coast is very extensive, and is situated in localities admirably adapted for the growth and nutrition of oysters.

The larger the area under cultivation, the brighter the prospect for the natural beds, as the spat floating from a planted area, may be carried on to the public beds which is often the case, or vice versa.

In order to convey to the mind of the culturist certain things to be carried out and others to be avoided, so as to crown his efforts with success, I do not think it will be out of place to make a few remarks relating to the above work, as it is carried on in other countries; each country carrying out their own ideas in different ways according to the climate and locality.

One can then form a general opinion as to the most economic and successful mode of procedure in his own individual case.

Oyster Culture in the United States, Atlantic Coast.

On nearly the whole length of the Atlantic coastline of the United States from Massachusetts round to Texas in the Gulf of Mexico, oysters are to be found.

In this country oyster culture is an industry of great importance.. There is such a vast area of water suitable to the natural conditions of the oyster, and the demand being so great that the grounds are divided into two parts, one being the public, or natural beds of the State, and the other consists of areas or grounds brought into a state of cultivation by owners and lessees, who devote their time and spend large sums of money in order to bring these grounds into a high state of cultivation. After that is done, the first expense being the heaviest, the grounds are kept clean, and oysters are obtained for market at the same time. Oysters are so cheap and plentiful that they are eaten by all classes. They are also exported in large quantities to the European markets and also to the Pacific coasts for planting purposes.

Oysters have been planted here for the past hundred years or more, and each year finds larger areas of ground under cultivation than the previous one, and there is still plenty of room for expansion, as these shell-fish can be distributed with despatch over the whole continent, by means of railways and steamboats. The oyster trade in this country is now the largest in the world. Some of the methods of cultivating these beds are:—

Oyster Planting.

Oyster planting is the placing of small or "seed" oysters upon bottoms which are favourable to their growth. Planting also adds very greatly to the value of oysters, as they grow more rapidly, and are of better quality when thus scattered, than they are upon the natural beds. Ingersoll quotes the statement that $13 worth of small "seed" oysters yielded, after they had been planted for two years, oysters which were sold for $114, besides about thirty bushels, which were used as food by the planter's family. Oyster planting can be carried on, only on private grounds, and it cannot flourish in a community which does not respect the right of the private owner to the oysters which he has planted.

The industry does not always require a large capital as it can be carried on with profit on a very small scale, although the oysters need constant and intelligent attention. In all places where it has been employed, it has greatly added to the prosperity of the communities which have engaged in it, and has greatly increased the population of the shores along which it has been encouraged and protected.

By way of example I shall describe how the work is done in the State of Connecticut, the system being practically the same as is followed in the other oyster States.

The Oyster Fishery of Connecticut.

The mehods employed in this State are of the greatest interest, for Connecticut has been able, by the adoption of a wise plan, to build up a great oyster industry in a very short time, and to place the business upon a sound and substantial foundation. The natural beds of this State are limited. Upon the most liberal estimate, they do not exceed 5,000 acres, all told, which furnish a few marketable oysters, and are chiefly valuable as a supply of seed oysters for planting. Three years of efficient protection, under wise laws, has effected such a change in this State, which was so recently compelled to purchase oysters, that, we are informed by good authority, it has furnished seed in considerable quantities to New York, Rhode Island and New Jersey, besides sending an

immense supply to European planters. One firm shipped 60 car-loads of seed oysters to San Francisco. The 60 car-loads, or more than 15,000,000 young oysters, had been secured by persons employed in planting on the Pacific coast.

A method which is capable of producing such a result as this in three years' time is worth more careful examination. In each area there are natural beds, which are open to the public, and private grounds which are leased to individuals or companies by law for the cultivation of oysters.

The Public Beds of Connecticut.

The natural beds are open to all residents of the State at all times except at night; but no one is allowed to use a steamboat upon them, or to use a dredge which weighs more than thirty pounds. The use of steam vessels for dredging upon the public beds has only recently been prohibited. Steam vessels are used upon the private beds, and the proposition to close the public to them was warmly attacked, but was finally adopted.

In gathering seed near the shore, tongs and occasionally rakes (those with long curved teeth) are used, but the marketable oysters are nearly all brought from the bottom by dredges of various weights and slight differences in pattern. In the case of all the smaller sail-boats, the dredges having been thrown overboard and filled, are hauled up by hand. The oysters themselves are very heavy, and frequently half the amount caught is composed of shells, dead oysters, winkles, and other refuse, which must be culled out, thus compelling the oystermen to do twice or thrice the work which they would be put to if there were nothing but oysters on the ground. The work of catching the oysters by any of these methods is, therefore, very tiresome and heavy, and various improvements have been made from time to time in the way of labour-saving, from a simple crank and windlass to patented complicated power windlasses. When a proper breeze is blowing, dredging can be accomplished from a sail-boat, and the dredge is raised with one of these windl... g can be carried on with much quickness and ease. In a calm or in ... however, the work must cease as a rule. Under these circumstances, and as the business increased, it is not surprising that the aid of steam should have been enlisted; nor perhaps is the controversy which has ensued to be wondered at, since the introduction of novel or superior power into some well-travelled walks of industry has ever met with indignant opposition.

The first to use steam in this business, so far as I can learn, was Captain Peter Decker and brother, of South Norwalk. After the Messrs. Deckers' experiment, Mr. W. H. Lockwood, of Norwalk, not an oysterman, but an enthusiastic believer in steam dredging, built the steamer "Enterprise" expressly for the business. Her length is 47 feet, beam 14 feet, and draught 4 feet. She handled two dredges, and has a capacity of about 200 bushels. These were followed by several other steamers, and now gasoline boats take an active part in the industry.

The Private Oyster Grounds of Connecticut.

Th... lands which are thus appropriated are taxed like real estate. And they ma... be attached or executed upon like real estate. The oyster committee of each town has power to decide upon the sum which is to be paid for the grounds and the term of years for which they are to be leased. No person can gather a...y oysters upon private beds unless they are properly staked or buoyed out, and marked at each corner with the owner's name. The removal of oysters from private grounds, without the authority from the owner, is punished by a fine of from $300 to $500, or by imprisonment for one year; and the injury

or destruction of the stake or buoys, or the grounds, or the oysters upon them, is punished by a fine of from $50 to $700, or by imprisonment from one month to six months; and any boats which are used in violation of the law are confiscated and sold at auction, the seizing officer receiving one half the proceeds and the town the other half.

Certain towns, however, have a somewhat different law; thus the town of Guildford has, by special Act of legislature, the right to lease its grounds for ten years to the highest bidder at public auction, but it cannot lease more than five acres to one person. The grounds which are thus appropriated to private parties by the towns are not used for framing or propagating oysters, except in a few cases, but simply for planting, and the seed is either taken from the public beds or is purchased from the holders of private grounds in the area under the jurisdiction of the State, or from persons outside the State. The system does not, therefore, materially increase the number of oysters, but it does greatly increase their value; and it is therefore a great source of wealth to the people of the State, and nearly all lands adapted for the purpose are now appropriated.

Deep-Water Oyster Cultivation in Connecticut.

The business of planting oysters in Connecticut, under the provisions which have just been explained, grew so rapidly that all the inshore available bottom near New Haven was soon occupied, and these waters looked like a submerged forest, so thickly were they planted with boundary stakes. At last Mr. H. C. Rowe ventured out into the deeper water of Long Island Sound, and inaugurated a new era in American oyster culture by the establishment of an oyster farm in water forty feet deep.

This new departure has led to the development of a new form of oyster culture, which is not planting, but farming in its true sense, since the "seed" oysters are sced in reality, bringing forth after t! ir kind a thousand fold, and thus building up on private grounds what can be best described as artificial natural beds of oysters. The movement which has led to this result is the most important step which has ever been taken in America towards an enlightened method of managing the oyster industry. It has been met at each stage by the most violent opposition, and its history should be of very great interest to all places which control waters in which oysters flourish. Mr. Rowe soon had many imitators, and as oyster culture in deep water cannot be managed on a small scale, the tracts which were leased were necessarily outside the limit of two acres, which was all that was allowed by a strict interpretation of the law.

The rapid development of the industry was watched with angry excitement and as it was seen that the existing statutes had never contemplated anything of this sort, alterations and amendments rapidly followed one another, now in the interest of the deep-water cultivators, and now in the interest of the small planting tracts nearer the shore.

The fishermen along shore indignantly opposed the capitalists, and on the ground that everything under the water is common property, only removed the oysters from private grounds As there was no survey or delineation of the "natural beds," unlimited stealing from private grounds was perpetrated and looked upon with general favour by the great majority of fishermen on the plea that the grounds in question were "natural beds."

The deep-water cultivators, increasing in numbers and in influence, were able to secure the passage of a law declaring that in a considerable area of the State there are no legally "natural beds," and the possibility of successfully propagating oysters in great numbers in deep water was soon proved, and the business continued to grow, and to increase in importance, in spite of opposition; but so much discontent existed that a resolution was passed by the legislature protecting the deep-water planters.

Deep-water cultivation is thought hardly worth while trying unless at least fifty acres are obtained, and many of the oyster farmers have more than one hundred acres These large tracts, however, are not always in one piece, although the effort is to get as much together as possible The oyster farmer obtains the position of the ground, as near as he can, by ranges on the neighbouring shores, as described in his leases, and places buoys to mark his boundaries. Then he places other buoys within this area so as to divide his property up into squares, an acre or so in size, according to his own ideas. In this way he knows where he is as he proceeds in his labours. Having done this, he is ready to begin his active preparations and to found an oyster colony in the usual way.

Preparations.

When a cultivator begins the preparation of a deep-water farm, his first act is to scatter over it, in the spring (about May), a quantity of full sized, healthy native oysters, which he calls "spawners". The amount of these that he scatters depends on circumstances; from thirty to fifty bushels to the acre is considered a fair allowance here I believe. The rule is, one bushel of spawners to ten bushels of cultch. He now waits until early in July, from the 5th to the 15th is considered the most favourable time, when he thinks his spawners must be ready to emit their spat. He then employs all his sloops, and hires extra vessels and men, to take to the beds the tons of shells he has been saving up all winter, and distribute them broadcast over the whole tract of land he proposes to improve that year. These shells are clean, and fall right alongside of the mother oysters previously deposited.

The chances are fair for catching spawn. Sometimes the sanguine plan is pursued with seed that has grown sparingly upon a piece of ground; young oysters are scattered as spawners, and the owner waits until the next season before he shells his tract. Sometimes the ground must be cleaned before any preparation can be begun upon it, by dredging or otherwise. W thin the harbour for instance, considerable muddy bottom has been utilized by first paving it with coarse beach sand. No spot where there is not a swift current is considered worth this trouble. The proper amount is 200 tons of sand to the acre, which can be spread at very little expense. The sand forms a crust upon the mud fi m enough to keep the oyster from sinking, and it need not be renewed more than once in five years.

Expenses of an Oyster Farm.

In either case, therefore, the planter's expense has not been enormous. I present herewith two statements of the outlay under the operations outlined above, which are as follows:—

No. 1.—Fifty acres:—	
2,000 bushels spawners, at 30 cents	$ 600 00
15,000 bushels shells, at 3 cents	450 00
Planting 15,000 bushels shells at 4 cents	600 00
Total	$ 1 650 00
No. 2.—Sixty acres:—	
2,000 bushels spawners at 56½ cents	$ 1,130 00
17,000 bushels shells at 4 cents	680 00
4,453 bushels Bridgeport seed at 10 cents	445 30
Total	$ 2,255 30

In a third case, Captain G. H. Townsend gave me a statement of the expenses of starting a farm of twenty five ac es off the mouth of East Haven River. This was a more elaborate arrangement, but on the other hand, was accomplished through a variety of favourable conditions, cheaper than would have been possible with the ground o herwise situated.

2,000 bushels small raw oysters at 25 cents.....	$ 500 00
Spreading same and [illegible] at 5 cents.....	100 00
600 bushels dredge[illegible] 40 cents.....	240 00
10,000 bushels she[illegible] down a. 4 cents.....	400 00
Total.....	$ 1,240 00

It would not be unfair to average the cost of securing, surveying, and preparing the deep-water beds at about $40 an acre, or about $4,000 for 100 acres. To this must be added about $2 an acre for ground surveys buoys, anchors, etc. This starts the planter in his undertaking, and if these beds are in an exposed position they are liable to suffer loss by storms, shifting sands, etc. If, on the other hand, they are well protected by nature, there is the watching and attention to be given to these grounds, as the catching of the stock, after it has matured, or the separating of the seed which must cost a further sum, but when once started, there are always oysters which are caught that can be marketed, so that you are killing two birds with one stone, catching the oysters, and cleaning the grounds.

Management of the Oyster Farm.

Having secured a spat of young oysters upon the cultch which has been laid down for them, they are left alone until they attain the age of three, four or five years, according to the thrift and the trade for which they are designated, by the end of which time they have reached a large size and degree of fatness, if the season has been favourable. If, as is largely done by those planters who live at Oyster Point, they are to be sold as seed oysters to the planters at Providence River, or other places, they are taken up when only one or two years old. It is not considered, as a rule, profitable to wait for the maturity of the stock.

With regard to transplanting the oyster and its transportation, all experienced persons are of the opinion that delicacy in handling, and freedom from jars, concussions and shocks of any kind are desirable. Oysters when under hatches, have very frequently been killed by heavy thunder-storms and firing of guns. Any concussion or sudden shock will prove destructive, if they are in a confined space. Oysters taken up during the summer are much more susceptible to injury from this cause than those obtained during the winter.

Oysters are transplanted at any and all seasons, but generally in the spring and autumn.

Extract on the Close Season.

Among the popular remedies for the protection of the oyster beds, the shortening of the season is a favourite measure, and it has many advocates.

This remedy seems, at first sight, to be an effective one, but a little thought shows that it is in reality of no very great value. So long as the present oyster policy is maintained, it will be necessary to have a close season to facilitate the enforcement of other legal measures; but as it is clear to everyone that a good number of fishermen, working upon a bed for a short season, will do just as much

damage as a lesser number working for a longer time, we cannot hope that laws to shorten the season will, in themselves, effect any great improvement in the condition of the beds. Thus overfishing in November is, in this respect, just as bad as overfishing in May.

At any time before the end of May, the disturbance of the beds can do little harm, and the experience of the Connecticut oyster farmers shows that the thorough raking of the beds, just before the spawing season is a positive benefit. The young oysters cannot attach themselves to dirty and slimy shells, and if all the sponges, hydroids and seaweeds could be dragged from our beds in April and May, and if all the old decayed and slimy shells could be plowed under, and covered with cleaner shells from below the surface, by dredging just before the spawing season, the fertility of the beds would be greatly increased, and there is, therefore, nothing in the nature of the oyster to demand the closure of the beds in April and May.

The oyster regulations governing the different States are numerous, as each State has its own Board of Commissioners, who have control of the waters, in their respect ve jurisdictions; and in each case the laws are laid down to suit the industry in each particular district.

The spatting season also is more extended than in our own waters and the f rther south one goes the longer it lasts. In the northern States the spatting season extends from May till September, while in the Gulf of Mexico it will last from April till November. This is caused by the difference in temperature of the water. The oysters growing in the warmer waters of the southern States are not considered to be as good as those grown in the cooler waters of the northern States; the southern oyster is of much quicker growth and more irregular in shape than those taken from the northern beds.

This business having been established for so many years, the planter has gained a lot of valuable information through practical experience. One of their chief aims is to be able to catch as large a quantity of spat on their own grounds as possible, and they find that clean oyster shells are the best spat collectors that can be obtained. All the shells are therefore laid aside to be used for the preparation and extension of their beds. They are spread over the areas just at the right time, when the oyster is ready to emit the spat.

The collection of shells is obtained by the canning of large quantities of oysters annually, and the shucking or opening the oysters at the packing houses; sending only the meat of the oyster to market, enables the saving of a large item in transportation. The shells are piled up to dry. They are exposed to the sun and rain, frost and snow, which have the desired effect on them,the mud being removed and they are thoroughly cleansed of all organic or other matter.

Sometimes the surplus shells are dredged from off the beds, the oysters and young ones are culled out, and the shells are piled up on the shore to dry, and be used again when required.

OYSTER CULTURE IN EUROPE.

The Whitstable Oyster Company, England.

My intimate connection with the Whitstable Oyster Company of which I am still a member, and where I have gained most of my practical knowledge and experience, will enable me to bring to your notice a few facts connected with the inception, development and present standing of the above named corporation.

In 1793, an Act of Parliament was obtained, incorporating the company of Free Fishers and Dredgers of Whitstable, and granting them the Common Seal. Since that year, the company has regularly held, each July, its Water Court,

presided over be a Steward. On that day all its officers are elected for the following year. Only freemen of the company were allowed to attend meetings, or fish on these grounds, a rule rigidly enforced.

The membership of this company was originally obtained by birthright, only the sons of freemen were admitted on the annual Water Court following their twenty-first birthday, but owing to the members becoming so numerous, it was decided to take only the eldest son from each family; finding this course did not improve matters in the company, in 1896 they formed themselves into a joint stock company, valuing each member's share at so much per head; now a person can sell his whole share, or a portion of it, the company working strictly on a commercial basis.

The oyster beds are about one and a half square miles in size, but the company hold freehold land to a great extent.

From two to three hundred men find employment in the oyster fishery nearly the whole year round. The total number of members at the present time belonging to the company is 550, the annual turnover being about £70,000 and the total value of the whole concern is estimated at about £200,000 sterling.

Their grounds are always kept well supplied with stock, consisting of marketable and young oysters, which are either bred on their own grounds or purchased from the adjoining oyster grounds.

A great deal of the labourer's time is taken up on the grounds at Whitstable in keeping the area clean and in order. This is done with more than one motive in view. I must here explain that several classes or qualities of oysters are planted on these grounds, and each area is divided, by stakes, beacons and buoys into square patches, keeping each grade of oyster on its own particular bed.

The men are instructed how long to work, the area they are to work upon, and the quantity of marketable oysters they are to bring on shore. They then leave for the grounds which are from three to four miles offshore. The rowboats leave the shore with from four to seven men as a crew for each boat. These boats have from a quarter to three quarters o a mile to row to the sailing (or dredging) boats. They use from three to five dredges (five being the limit), and their time on the ground is occupied in culling out from the contents of the dredge all marketable oysters that are required for the day's catch. The spat, young oysters, or half-ware are not overlooked, but are carefully picked out, and if attached to weed, stones or shells, are removed, if it can be done without injury to the young oyster; these are placed on an area especially reserved for them, the shells are then carefully gone through and if any marine enemies to the oyster are found, such as starfish, dog-whelk, mussels or seaweed, they are placed on one side to be destroyed. The shells are then returned to the water, the dredge is again hauled to the surface and the above performance is repeated.

Sometimes a few boats are to be seen working on an area where the young ones are planted. These crews are generally selected from careful men. They go to examine the state of the ground, pick out all marketable oysters, and see there are no enemies to the young ones. Through the continual working of these grounds, the shells are kept very clean. They lie thick upon the beds, and this is the only method that is used to try and catch the spat, as the area is so exposed to the open sea, and all the fiercest gales that blow, viz., from the north-west round north to about east-south-east, it is very surprising to an interested observer what is annually found on these shells. Not nearly enough are saved to supply the demands of the trade, and young native oysters are bought from the fishermen who dredge on the natural grounds; also from oyster culturists in Essex, who are more successful in saving their spat, owing o the sheltered localities in which their grounds are situated. These grounds at Whitstable are considered the finest on the coast for fattening purposes, and their name comes first among oyster dealers.

If the boats are working time or tide-work, when the day's work is completed a signal is given by the man in charge of the fleet, to discontinue work. All the boats are then headed for their moorings. On reaching them the sails are furled, the oysters are placed in the row-boats and proceeds to the company's store with all possible speed, the master of each boat reporting to the officer in charge the number of oysters caught, also the number of men who worked with him. The oysters are received by a staff of men who place the oysters in hoop nets, which hold about two bushels (16 gallons) each.

Under cover of this store are two large pits with concrete bottom and sides, and connected with the sea by a sluice pipe, which dries at half tide. This pit can be kept full of fresh sea-water or let run dry as desired. The nets of oysters are attached to ropes and suspended in the pits until they are required for market, the time varying from immediate use to about forty-eight hours, when the stock is again replenished. It is in this way that the public are supplied. The oysters, as they are ordered for market, are raised from the pits, reculled, counted, or measured, and washed clean, which is a very important item in the English market, packed up in sealed boxes, or securely sewn up in strong bags. They are then hauled to the railway depot, where the facilities are good for the transit of perishable goods.

I may say that no oysters are ever sent to market on commission. All kinds of oysters have their fixed prices, and there is very little variation during the season.

These beds lie in about 6 feet of water at low tide. There is a rise and fall of about 12 or 13 feet, ordinary spring tides.

The company is governed by officers elected each year, forming two committees, which work jointly and separately. One is called the finance or estate's committee, which attends to the financial affairs, while the other is called the working committee. It is the duty of the latter to see that the ground is properly worked and cared for, to lay off areas and superintend the laying and catching of oysters and other minor duties. A chairman is appointed in charge of the former, while a foreman and deputy foreman is attached to the latter, with treasurer, secretary and other minor officers.

Until about the year 1875 no French brood or oysters were laid on English oyster grounds. But owing to the scarcity of spat falling in English waters about that time, on account of successive cold seasons, thus causing a steady decrease of oysters round the British coast, oysters cultivated in France were brought over and laid down on the English beds. Oyster culture in France has reached large proportions. The climatic conditions are favourable, and the beds of that country are now able to furnish the English markets with whatever supplies are needed. Larger quantities are being imported from France each year, and before I left England the Whitstable company alone laid on their grounds 20,000,000 French oysters to enable them to supply the demands of the trade in the following season, with a good second quality oyster.

These oysters from the south of France are now laid every spring on the Whitstable oyster beds, which are exeellent fattening grounds. It is found by practieal experienee that it pays better to purchase in the spring of each year oysters two-thirds grown than to expend the amount paid for them on artificial culture. The oysters are sometimes conveyed in large quantities by fast steamers direct from the French plantations, and on arrival are immediately laid on the grounds. As many as 5,000,000 oysters have been laid in the space of 4 hours. The dredging boats will run alongside the steamer and will take a deck-load of oysters and then sail over the grounds, distributing them by means of shovels as they sail along.

A large staff of men are usually employed when there is any quantity of oysters to be laid, so that no time is lost, and the oysters are placed on the beds as soon as possible.

In the fall they are caught and marketed. This gives employment to a number of the company, with a profitable margin. As no artificial means are used for the propagation of the oyster, beyond shelling and keeping the grounds clean, large sums of money are required to secure this stock. The price of native brood and half-ware has gradually been on the increase. Here is an illustration:—In 1860 my father's vessel and a few others (called market boats) as they are larger than the ordinary dredging boats, and are engaged in conveying oysters from the different fisheries to market, were engaged in obtaining oysters for planting for the company. One of the cargoes consisted of 112 tubs of oysters (24 gallons to the tub). The price then paid was six shillings per tub, or a total value of £33 12s. On his return from Canada, after an inspection of the oyster beds in the maritime provinces in 1892, or thirty-two years later, one of his vessels had on board a cargo of the same quantity and quality of oysters. The sum paid for them by the company was £1 per tub, or a total value of £1,680.

These areas are perfectly level and even. They are kept so by means of dredges working over them. There is a good foundation of shells which serves as a bed for the oysters. These shells also act as spat collectors.

The company is most particular about the beds, great care being taken not to disturb or destroy the soil. A vessel is not allowed to anchor on the grounds, they being guarded by three watch-boats with crews for night and day work. A rake of any description is not allowed to be used under any circumstances. On one occasion a vessel named the "Resolute" of about 350 tons burden, through an error in the captain's judgment, ran aground on the beds and remained there for eight hours. Although this vessel was owned by members of the above company, yet the matter was compromised by payment of £150, as damages. This shows the value and care that is bestowed on these beds. Other companies are just as particular in their care and preservation of their beds.

The company's "store" before referred to, is a spacious building at the head of the beach, and besides containing the pits, the lower part of the building is divided into packing rooms, store-rooms for boxes, barrels, bags, twine, and other necessary material and implements that are used, offices and committee rooms, and above this flat there is a large hall covering the whole building and capable of accommodating over 600 persons. It is in this hall that all their meetings are held, being either annual, quarterly or special, so that all the work of the company is carried on under one roof. From these offices one has a splendid view of the sea including the oyster beds in the distance.

While this company carries on its business on a large scale, it will be seen that its methods are simple and direct. Great care is taken of the grounds and brood. The storage of oysters in small net bags suspended in the pits is only temporary, as the stock is replenished every day or every other day, as the case may be.

The English and French oysters are not so hardy as the Canadian oyster. This work could be carried on in just the same way in this country, even on a small scale with profitable results.

The price of the shares is continually increasing, which speaks for itself. As previously stated the work is now being carried on under a commercial basis, the labourer being paid for his hire, with a staff of experienced men acting as managers and directors of the concern.

Very little, if an poaching is carried on by the outside fishermen in English waters. At one time some of the ordinary fishermen were strongly opposed to the scheme where companies applied for concessions, but after these companies became established, in many cases it was found to be of great benefit to them, as it opened up a ready market for their catch of oysters whether large or small ones, and often they would find employment by hiring themselves

and their boats to the oyster growers, where their time would be taken up in cleaning and cultivating the grounds, also catching oysters for market when trade was brisk, so that the apparent loss of a small area of ground which was really useless to them, but where they would occasionally try to fish upon, eventually became a source of regular employment to many of them

Should any poachers be caught in the act they are usually severely dealt with at the hands of Justice. To prevent raids being made by poachers on these valuable grounds a staff of watchmen are always on hand both day and night. Dogs are often trained on these boats to bark as soon as a boat or vessel comes within the limits of the grounds, or is sailing by. These means all tend to keep marauders at bay. Creeps or grapnels are also used; they are attached to chains and spread over the area, which would catch a dredge if it were hauled over them. Prevention is often better than cure.

Dr Bashford Dean, in a report on the European methods of oyster culture quotes the following:—

"Oyster culture in England generally varies but little in methods from that of Whitstable; other localities, therefore, need be but little commented upon. At Faversham to the westward, and Herne Bay to the eastward of Whitstable, sediment deposits and invasions of mud, and at the latter place, shiftings of sand also, have been of considerable annoyance. The remedy has been continual dredging of the grounds, together with judicious shelling or macadamizing of the bottom at certain areas. Weeds have been carefully dredged out as a means of keeping the grounds clear and allowing the tides to wash off the depositing sediment. In regions where spat is expected to occur with some regularity, the greatest care is taken by reshelling and cleaning the bottom, to assure the greatest chance of a successful set This character of bottom is often secured in the rivers Blackwater, Crouch and Colne (below Colchester) by a regular process of harrowing the bottom during the beginning of the spring. By this means, the loose sediment accumulating during the winter is broken up and carried off by the tide. For this operation a harrow is prepared, with iron teeth, two or three inches in length, bent slightly at the tips. When in use it is carefully arranged so that the teeth may not break through the crust which was formed by the shelling process of former years; this is prevented by adjusting the length of the harrow rope from the dredging vessel, and the behaviour of the harrow, like that of a dredge, is readily determined by the feeling of the rope."

Essex Oyster Grounds and Areas.

On the northern side of the entrance to the River Thames the county of Essex is situated, with oyster breeding areas in the rivers Blackwater, Mersey, Colne and Crouch. These rivers contain very valuable oyster breeding areas. They are owned by companies and individuals who cultivate their beds with extreme care, and protect them from molestation. The mode of dredging is somewhat similar to those of the Whitstable Company, with the exception that some of these grounds are worked by small steamboats, built expressly for that purpose. Some of the rivers are winding and inland, with a comparatively strong current. There they cannot depend on wind to assist them, and as these beds are worked nearly every day, it is considered more economical to use steam. These boats are built with a very wide beam, and the deck is carried out from the stern of the boat to the outside edge of the paddle-box, giving a very large deck area on a small boat.

The owners of these grounds are very particular about the shelling of their beds, as this is the mode of catching their spat. The shells are exposed to the sun, wind and rain. They are dried in this way. All animal and vegetable

matter dies and becomes separated from them, and on moving these shells they are very clean in appearance, rough to the touch, and are most suitable as spat collectors.

Cockle shells are also used as spat collectors in these rivers. The shells are small and light, not sufficiently large to alter the shape of the oyster in its growth. They are easily detached or broken off from the young oyster. Large quantities of cockles are caught at Southend and boiled on the shore, the fish being extracted from the shells by means of a sieve just in the same way as cinders are separated from ashes. The flesh of the cockle is sent to market already shelled, or in bulk, as we term it, and is considered a delicacy by some. The shells, after being subjected to boiling water, are very clean, and serve the above purpose admirably.

With some companies, the cost of shelling the grounds just previous to the spatting season amounts to quite a considerable sum. The shell of the cockle, being very light, is laid as a finishing touch to their work. They then let them rest during the summer, anticipating a spat of brood as a reward for their labours. Cockle shells are also secured for shelling oyster beds from the shores of the Isle of Sheppy.

Oyster pits have been dug out along these rivers abreast of the oyster grounds, for the purpose of storing oysters for immediate shipment in large quantities, especially to the French and Belgium markets. The oysters are caught daily and deposited in the pits until a vessel arrives for the purpose of taking them across the North Sea. These pits are extensive, and are connected with the river by a sluice, and can be drained dry in one tide if desired, as the bottoms of the pits are above low-water mark. Large quantities of oysters, in fact, nearly all the stock of small oysters, are wintered there, to save them from being exposed to the freshets in the early spring. This process has a detrimental effect on the growth of the oyster, but saves its life. The English native oyster is of slow growth, and when frequently moved from the beds to the pits the effect is to materially stunt its growth. The shell of this oyster is hard and clean, with a clear pearly inside.

At Brightlingsea, in the waters of Colne creek, French, Spanish, North Sea, Portugese and American oysters are laid down for fattening purposes along the ebb-dry. Here extensive flats are left dry at each tide, and these are excellent fattening grounds. During the spring of the year these areas are planted at, or just below low-water mark. The owners watch the oysters and occasionally move them about to prevent them from being silted over; also to pick out any enemies or dead oysters. When ready for market, these oysters are easily obtained. They are disposed of, as a rule, before the frost sets in, as it is very destructive to the oyster when it is lying between wind and water, or they are removed to the beds in the channel of the river.

At the mouth of the River Colne there is a large tract of water named "Pont". This portion has a very firm bottom, something similar to the Kentish flats, and on it public oyster dredging is carried on. The oysters caught from such areas as these are generally sold to companies, who relay them on their own grounds.

No size limit is in force in England, as the young oyster is valuable, and if caught is not destroyed, but is placed on private grounds, the fishermen being paid according to size and quantity.

Oyster Culture in France.

French oyster culture differs entirely in its methods from those of other countries, as the work is chiefly artificial. I do not think such method could be carried on as successfully here as there. This is owing to the long severe

winters which visit our shores. The ice in the spring keeps the wa r chilled, and as the weather is very unsettled until the spring is advanced, it is late before anything can be done.

Artificial cultivation is carried on as follows:—Water areas were leased for a certain period from the State. During the spawning season, brushwood was arranged all around and over these plots. Tiles were also used, which were coated with a solution of sand and lime, forming a rough covering of cement for oyster spat to adhere to. These were then arranged in layers or in piles laid crossways. These tiles are not flat, but long and rounded, so that the spat might adhere to both sides. After the spatting was over, the tiles were carefully inspected, and if the spat had adhered, they were sometimes placed into deeper water until the following spring, and at others stripped late in the fall. The mode was to remove the young oysters by means of a peculiar kind of knife or chisel, removing the cement at the same time. These methods are still followed.

The oysters being very tender, cannot stand much rough usage. After being removed they are placed in wire or gauze trays for a short time. All the cement that can be removed without killing the oysters, is taken away. They are then returned to the trays to protect them from marine enemies, viz.—sand, mud, starfish, dog-whelk, dogfish, etc., until they are sufficiently grown to be large enough to deposit them on the layings to grow into marketable oysters. The trays are slightly raised from the ground so that no slit may settle on them, as dirt of any description at this period would be fatal to the young oyster. These trays are placed in shallow water, where, during the warm weather the growth is rapid.

There is about 15 feet rise and fall of tide in some of these localities. The shores are generally sloping from high to low-water mark, this gives persons a large area, and a long time to work between tides.

The chief factor of success of ostriculture in France is the labour which is devoted to their grounds. It is estimated that over 200,000 people find employment in this industry around the coast of France. It gives a large revenue to the State in the way of fees on leases of grounds.

The areas cultivated have to be studied. Some of them cannot furnish the seed and at the same time produce oysters for consumption. Some producers will engage themselves in securing the seed, and when of a sufficient size,will dispose of it to other growers whose grounds are so situated and adapted that they will fatten or green the oyster, as may be required. Transplanting oysters in this way, where the waters are at all suitable, has a beneficial effect. The oysters will often put on a growth of shell, besides increase the size and flavour of the fish.

The following figures are from the report of Mr. George Michel. He says that in one year the total output was more than fourteen hundred million oysters, which provided labour for about 300,000 persons, and was worth $2,650,000 in money to France. This rich harvest was reaped from about 50 square miles of the sea-bottom, which would otherwise have remained entirely unproductive.

The industry is exceedingly profitable to the country. We are told on other official authority that a crop of oysters valued at eight million dollars was raised in this way upon a farm of 492 acres, while upon another farm of 500 acres, sixteen million oysters were taken in six tides, although there were no oysters to be found there when the farm was established five years before.

A result of this work on the private areas is that the natural beds are kept in good order, well watched and moderately worked, and so become more and more fertile, and the fishery on these beds, which it was feared would disappear for ever, has on the contrary, become more productive.

This industry goes on increasing in volume from year to year.

Oyster Culture in Holland.

Oyster cultivation in Holland is carried on in much the same way as in France, but the oysters are of a superior grade, and of slower growth, owing to the colder climate and longer winter.

Tiles and cultch are used to secure the spat. The foreshores are also used as layings for growing purposes, and when winter sets in the oysters that are not marketed are deposited in a sufficient depth of water to protect them from frost, snow and ice. The areas are leased for a term of years from the Government, and at the expiration of the terms, they are again leased by auction to the highest bidder.

Further north natural beds are found, although they are not very productive. The soil too, is more of a shifting nature, so that artificial culture has never been successful along the German coast.

The following is an extract from Dr. Bashford Dean's "European Methods of Oyster Culture;—"

"Among the European systems of rental of State lands, the careful methods of Holland are worthy of consideration, especially as the matter of rental with us will become of greater importance as demand for cultural property increases. State policy in Holland has not hesitated to give short leases at competitive prices; on the ground that valuable land should not be continued in the hands of one who does not pay for it a just rental, and that the balance established by competition is apt to be the fairest in the end at all interested parties, State, culturists and public at large."

The prices of leases vary according to location and past results, showing how the value of one locality above another for this and other purposes of oyster culture appears to be gradually established by experience and is indeed recognized by those interested in the industry.

The following are a few comparative numbers of the sums for which the same plots were leased in 1870, and the prices realized in 1885:—

Allotment No. 176, 12 acres, was leased in 1870 for £22 10s. a year; in 1885, £508 a year was charged.

Allotment No. 138, 12 acres, was leased in 1870 for £18 10s. a year; in 1885, £762 10s. a year was charged.

Others have gradually come down in the market as, for example, No. 280, 24 acres, brought, in 1877, £45 16s.; in 1879, £1 10s. No. 415, 18 acres, brought, in 1877, £2 1s.; in 1882, 10s.

The fluctuation it will be seen considerable, and only rivalled by that mysterious fluctuation of spat which, in the breeding season, is carried to and fro at each turning tide, all through the basin of the eastern Schelde.

It should also be specially mentioned, that after the beds at Yerseke had been withdrawn fom public fishing, no obligatory close season for oyster fishing was ever prescribed. The lessees could dredge for their oysters at whatever time of the year they liked. That they did not generally do so in summer was, in the first place, for fear of disturbing the growth, the delicate edges of the shell being at this period more particularly liable to break; and secondly, because the oysters are found to be less palatable at this time of the year.

It will be noticed by the above that one of the reasons of success must be attributed to the leaseholders refraining from selling their oysters during the summer months. Although there is no close season, their own judgment is sufficient to regulate the commencement of the season, which does not begin with them until the weather has become comparatively cool.

I have been unable to obtain any later data of the above rentals, but the same system is carried on successfully and sales of oysters are increasing annually. Many persons in Holland who are unable to go into the cultivation of oysters,

for want of capital, have made a success in cultivating the edible mussel, and many mussel farms are being successfully operated at several inlets in the mouth of the Schelde and Brewershaven. The chief markets are England, France and Belgium.

Oyster Culture in Italy.

Artificial means of collecting spat in Italy has been carried on for centuries, although the method is somewhat different from that of other countries. It is not carried on to the same extent as in France, as the oysters are not exported in any quantities, and are chiefly used for local consumption and supplying areas in their southern waters with growing oysters.

As one approaches the city of Tarente on the railroad from Brindisi, a very good idea may be obtained of the extent of oyster culture as the road bends around the shore of Mare Piecolo. As far as one can see the bay is bristling with oyster stakes, whose ends projects several feet above the surface. These are soon observed to pass into distant perspective in regular lines, and to mark off the water surface into squares, as of a checker board. These inclosures, which in France would be called oyster pares, measure about 15 feet square. They are leased at about 50 cents a year, and each culturist secures as many as he can cultivate. They are rented from a joint stock company, which has obtained from the city council the leasehold of the entire bay bottom surveyed out in about twenty sections, for an annual sum of $10,000. The minuteness of the subdivision of this area is the result and also the cause of competition, and the energy of rival culturists adds much to the success of their industry.

The Italian is the very opposite of the French system of oyster culture. French proprietors cultivate the shore lines between the levels of high and low water; while the Italians cultivate oysters in all depths of water and make the number of oysters fattened in a given parc stand in proportion to the volume of water. Having but scanty fall of tide, their system has become vertical oyster culture. To cultivate horizontally the French have hardened their muddy shores. The Italian culturist has devised every means of supporting his oysters in the water between bottom and surface, by using ropes, baskets and nets.

In France a parc of several hundred acres may be devoted to collecting the seed oysters. A second parc may be of value in growing the oysters, and a third may serve to fatten or prepare them for market. A Tarentine parc may represent every branch of the industry. In the area of fifteen square feet a culturist may collect the young oysters, grow, fatten and prepare them for market.

Loose bundles of hazel or gorse boughs, termed fascines, form the most convenient collectors. These, when covered with young oysters, may be broken into twigs and woven into ropes, which, when suspended, utilize the water volume from surface to bottom. Oysters that have become detached and fallen to the bottom, together with grown oysters, are placed for storage and final growth in the suspended baskets.

It is certain that the spawning season in the warm waters of the Mediterranean is an extensive one, stated by the proprietors to extend from April to October. The greatest set, however, occurs about the end of June.

It is clear, however, from fascines that had been put down in January, and which were examined in April, that spawning had taken place during the cold weather, and it may in consequence be inferred that the spawning continues intermittently throughout the year.

The baskets suspended from poles are an essential part of the Italian method of culture. In these, stray oysters collected from the bottom, as well as grown oysters taken from the ropes during the process of overhauling, are given their final growth. These baskets vary considerably in size and shape,

the most usual form being loosely woven and shaped like a cheese box. Another device used in giving the oysters their final growth is a net covered iron ring with a diameter of five feet which, may support four or five hundred oysters; while a single rope 14 feet in length interwoven with twigs is said to rear about 2,000 marketable oysters.

Oysters two years old will attain a diameter of three and a half inches and are sold for ablout 80 cents per 100. The annual yield is about 20,000,000.

It will be seen that this mode of culture is entirely different from either the French or English system. It shows that if holders are pressed for room, oysters can be successfully cultivated between the surface of the water and the bottom. It appears to be the cleanest way, as all sediment is so easily removed by a slight shake of the ropes. The growth also is very rapid, owing no doubt to the sheltered positions, mild weather, and absence of ice.

I have given a brief outline of the practical methods in the United States and some European countries, and have endeavoured to set forth a general idea of the work that may be safely carried on in the Maritime Provinces.

For ages past oysters have existed in our waters, and although they are decreasing, yet, with care and attention to this branch of the industry, there is no doubt that this valuable bivalve may be increased, both in quantity and quality.

Oyster culture has flourished in other countries, and I see no reason why it should not be successfully carried out in this Dominion of ours.