

XXII.—REPORT ON THE CONDITION OF OYSTER-CULTURE IN FRANCE IN 1881.*

BY DR. P. BROCCHI.

ANALYSIS.

| | Page. |
|--|-------|
| Preliminary remarks | 1 |
| Origin of oyster-culture in France..... | 2 |
| Branches of oyster-culture; production and raising | 2 |
| Centers of production | 3 |
| Arcachon Bay | 3 |
| Effect of the introduction of Portuguese oysters..... | 5 |
| Morbihan | 7 |
| Raising and fattening centers | 10 |
| Marennes | 10 |
| Courseulles; advantage of fresh water in fattening oysters | 11 |
| Oyster-culture on the Mediterranean coast..... | 12 |
| Condition of oyster-culture, and dangers threatening it..... | 13 |
| Government action required | 15 |
| Advice to oyster-culturists..... | 15 |
| Closing acknowledgments | 15 |

By a decision, dated the 30th June last, the minister of agriculture and commerce, in accordance with a request made some time past by the oyster-cultivators of the Breton district, and with the desire formally expressed by the senatorial commission upon re-stocking the waters, has instituted a course of oyster culture and marine pisciculture in the laboratory founded by Coste at Concareneau (Finistère).

This course, intrusted to M. Brocchi, teacher of zoology at the National Agricultural Institution, was inaugurated on the 5th of September, and has been continued during one month.

Independently of oral instruction, M. Brocchi is charged with the duty of making researches in connection with the important questions to be dealt with in the course. He has just addressed to the minister his first report upon the observations made by him, and upon the actual condition of oyster-culture, which is subjoined.

* Translation by T. H. FARRER of a report made to the minister of marine in France, by M. Brocchi, relative to oyster-culture on the shores of the Channel and of the ocean, and published in the *Journal Officiel de la République Française*, of the 8th of November, 1881 (in continuation of Parliamentary Paper No. 220, of session 1877.)

PARIS, *October 30, 1881.*

MONSIEUR LE MINISTRE: The preparation for the course of oyster-culture, which you have been so good as to intrust to me, has led me to visit the principal centers of oyster-culture in France.

I feel it my duty to render you an account of what I have had an opportunity of observing during my trip, and to lay before you the actual state of oyster-culture in our country. This industry, which is so new and so essentially French, has made rapid strides.

It is not for me now to give the history of oyster-culture; but suffice to say, its origin is of recent date. In fact, it was not until after the publications and the experiments of M. Coste (1856-1858) that the attention of the inhabitants of our coasts was attracted to the possibility of rearing oysters artificially. These experiments, to which the state devoted considerable sums, produced great effect. M. Coste, with an enthusiasm perhaps somewhat exaggerated, but productive of definite and happy results, announced that a new source of wealth was opened up to France.

The experiments, conducted simultaneously in the ocean and the Mediterranean, proved for the most part failures. On the other hand, and this has been too much overlooked, the experiments in the basin of Arcachon were crowned with success. Since then the stimulus has been given, and the industry of oyster-culture has not failed to make rapid progress.

Oyster-culture comprises two very distinct branches; one being production, and the other rearing and fattening.

Production aims at the collection of the embryo oysters, and in this way saves a vast number, which but for the intervention of man would be lost. It is well known that at the moment of its birth the young oyster is provided with locomotive powers, enabling it to swim in the midst of the sea.

After drifting for some time, the young oyster fixes itself on some extraneous body, loses forever its locomotive organs, and becomes the mollusk so well known. But these embryo oysters cannot fix themselves indifferently upon any bodies coming within range.

These bodies must be sufficiently smooth and clean. It happens, therefore, that in the natural course of things, a great quantity of these minute beings, the spat, not finding any objects to which to become attached, falls to the bottom of the sea and perishes. Indeed, that portion which has become attached under favorable circumstances is for a long period exposed to many dangers.

With the view of obviating these inconveniences, the oyster-culturists lay down in the vicinity of natural beds different bodies, designated by the name of collectors, which are intended to collect and preserve the spat. When the spat has become sufficiently developed it is detached, taken off, and given over to the rearer.

Rearing consists in placing the spat in the best conditions possible, so

that it may grow rapidly, and, so far as can be, be sheltered from the attacks of its natural enemies. Then comes the fattening, that is, the investing the oyster with those physical conditions which render it a luxury for the table.

I must now examine in succession the most important centers of production and rearing.

The two districts in France in which production is attended to on a large scale are: 1. Arcachon; 2. Le Morbihan.

BASIN OF ARCACHON.

In 1863, the industry of oyster-culture did not exist in this basin. At this epoch, in fact, one of our most distinguished pisciculturists, M. Chabot Karlen, published a report upon this part of France. From this interesting work it will be seen that the production of oysters was absolutely neglected in the basin. It is right to add that at that time M. Chabot foresaw the possibility of rearing oysters "in the wide water on the Crassats."

Oysters, however, existed in a natural state in this basin. Here, nevertheless, as everywhere, ignorance and want of foresight had produced bad results. The natural beds were silted up with mud, and the oysters were rapidly disappearing.

Under these circumstances it was that M. Coste resolved upon the establishment of some model *parcs* in this district. Three spots were selected on the surface of the basin, and here the success was complete. Thus one of the new *parcs*, that of Lahillon, 4 hectares in extent, furnished in 1866 more than 5,000,000 of oysters. Now when the operations were commenced in 1863 on this spot, there was nothing but mud. After cleaning the ground, 400,000 oysters were laid down in 1865, and, as I have just observed, the return the following year exceeded 5,000,000.

Such examples were well calculated to make impressions upon the coast population; in consequence, applications for concessions began at once to multiply, and, as I shall presently show, continued to increase.

Some years later the state, perceiving that its example had failed, conceded its model *parcs* to the central society of shipwrecked mariners; but a certain extent of oyster beds was reserved, and serves to supply with spat the surrounding concessions.

The beds so reserved occupy an area of 200 hectares; no fishing is permitted except at intervals of about three years, nor unless a commission representing the fishermen and the cultivators has expressed itself favorable to the fishing.

The marine administration takes great interest in this reserve. Every year 240 *mètres cubes* of small shells are thrown on the surface of these *parcs*, and form in this way natural collections. At the time of the last fishing (1879) this reserve had furnished 25,000,000 of oysters, representing a value of about 250,000 francs. In the month of April, 1881, when

I had the opportunity of visiting these beds, they were covered with fine oysters, and appeared to me to be in excellent condition.

The collectors used at Arcachon consist almost exclusively of tiles previously limed and disposed in hives.

About 10,000,000 of tiles are laid down every year; the most favorable moment for the operation appears to be from the 12th to the 15th of June. The hives remain in position until the month of October; some cultivators, however, allow the collectors to remain all the winter in the basin. This practice is attended with danger, as the spat may be destroyed by the frosts. Anyhow the young oysters are placed either in the *claires* or in the boxes. The *claires* of Arcachon have been too often described to make it necessary for me to do so now.

I shall, however, call to recollection that their depth varies according as they may be intended to receive the spat when detached, or the tiles to which the young oysters are still adhering. As a fact, a certain number of cultivators allow for some time the spat to develop itself on the tiles themselves.

The use of boxes is general at Arcachon. Still, as these engines are somewhat expensive, some cultivators have for economical reasons given up their use. On the other hand, some establishments possess a considerable number. In April last, for instance, 4,000 of these might be seen in one *parc* alone.

The present occasion does not seem fitting for entering into the details of the working arrangements. I desire solely to bring under your notice the proof of the importance of oyster-culture in this part of France.

The following figures, for which I am indebted to the extreme courtesy of M. Lhopital, commissary of marine, are in this point of view specially interesting:

Résumé of oyster operations in the basin of Arcachon.

| Year. | Number of parcs. | | Number of oysters exported. | Value. | Average price per thousand. |
|-------|------------------|-----------|-----------------------------|---------------------|-----------------------------|
| | Conceded. | Existing. | | | |
| 1865 | 207 | 207 | 10,584,550 | Frances. 338,705.00 | Frances 40 |
| 1866 | 4 | 301 | 7,852,000 | 282,070.00 | 40 |
| 1867 | 30 | 340 | 4,921,210 | 191,175.00 | 16 |
| 1868 | 84 | 434 | 8,690,875 | 319,188.35 | 37 |
| 1869 | 80 | 484 | 10,145,687 | 419,784.00 | 45 |
| 1870 | 21 | 485 | 6,541,140 | 352,666.12 | 58 |
| 1871 | 276 | 761 | 4,807,500 | 263,332.50 | 55 |
| 1872 | 371 | 1,132 | 10,708,740 | 537,515.00 | 41 |
| 1873 | 106 | 1,208 | 25,711,750 | 1,159,397.00 | 45 |
| 1874 | 1,175 | 2,413 | 42,542,650 | 1,745,950.00 | 25 |
| 1875 | 620 | 3,009 | 112,715,233 | 2,817,650.00 | 20 |
| 1876 | 306 | 3,345 | 106,885,450 | 3,841,309.00 | 22 |
| 1877 | 301 | 3,640 | 202,392,225 | 4,450,288.00 | 25 |
| 1878 | 285 | 3,931 | 176,500,225 | 4,428,500.03 | 25 |
| 1879 | 184 | 4,115 | 160,107,275 | 3,944,241.88 | 25 |
| 1880 | 144 | 4,259 | 195,477,357 | 4,254,465.04 | 25 |

On examination of these figures it will be seen :

1. That the number of the *parcs*, which in 1865 was only 297, amounted in 1880 to 4,259.

2. That during that period the number of oysters exported rose from 10,584,000 to 195,477,375, representing a value of 4,254,465 francs.

3. That from 1870 to 1880 the number of oysters exported has exceeded one milliard, and it must be remarked that the oysters cannot be sold until they have obtained a minimum diameter of five centimeters.

It will be seen that the average price per thousand has greatly diminished of late years. This is due to the great quantity of Portuguese oysters introduced now into the basin of Arcachon. And here I must not pass over in silence the sensation which has been caused in the ostricultural world in consequence of the introduction into our waters of Portuguese mollusca.

Some distinguished oyster-culturists have, in fact, advanced the opinion that the Portuguese oyster might cross with the *Ostrea edulis*, and by altering its purity diminish the value of our indigenous oyster. They even announced that they had observed unequivocal traces of this hybridization upon oysters coming from Arcachon.

Among the cultivators at Arcachon this announcement caused an emotion all the more lively as one of the inspectors of fisheries in England had induced his countrymen to purchase no more oysters coming from Arcachon.

The mollusk known under the name of the Portuguese oyster does not belong to the same genus as our indigenous oyster. While the latter is included in the mollusca belonging to the genus *Ostrea*, the former takes its place among those constituting the genus *Gryphæa*, the species *Gryphæa angulata* Lamarek. In other words, the Portuguese oyster is not an oyster in a zoological point of view.

To afford some base for the allegation of hybridization between the two mollusca, it would be necessary, in the first place, to prove that zoologists have been mistaken in creating these two genera, and that Lamarek was in error in separating the *Gryphæa* from the oysters properly so called. In fact, in the present state of science, it is impossible to admit the crossing of two species belonging to different genera. All that we know, on the contrary, is opposed to the possibility of such a hybridization.

I repeat, then, until it has been proved that the genus *Gryphæa* should be omitted from our classifications, the cross between the mollusk of the Tagus and our edible oyster cannot be admitted.

Even allowing the identity of genus of the two mollusks, the characters mentioned by the partisans of hybridization do not appear to me to possess much scientific value.

These characters consist merely in the color of the shell, and no one can be ignorant of the extent to which the colors may vary of animals

belonging unquestionably to the same species. Finally, to be silent on no point, I will add that, from the experiments of MM. de Montaugé and Bouchon-Brandely (experiments which do not seem to me to have been conducted with sufficient scientific precision), it would appear that the spermatozoa of the Portuguese oyster cannot fecundate the ova of the *Ostrea edulis*. I can affirm that, during my stay at Arcachon, I never observed any fact which would make me believe in a change in the oyster produced in that district.

To sum up, I do not believe in a cross between the two mollusks; but I must add that the introduction into our waters of the Portuguese oyster does not strike me as unattended with danger. It is known that, when two species are compelled to live side by side in a limited space, there springs up between them what a celebrated naturalist has called the struggle for existence. This struggle must, sooner or later, end in the discomfiture and disappearance of the weaker species. Under these conditions if the *gryphæa* and the ordinary oyster are brought together, the latter must necessarily succumb.

The Portuguese mollusk is unquestionably more robust, more enduring, and, I should say, more prolific. The facility with which it propagates its species is really very remarkable.

It is known how the Portuguese oyster took possession of a portion of our coasts: a few hundreds of them having been accidentally brought to the embouchure of the Gironde soon formed considerable beds. Even this year I have been able to see collectors placed on the shores of the Isle of Oléron, covered almost exclusively with Portuguese spat.

I think, therefore, that in the generality of cases the culture of the *graphæa*, if carried on in the vicinity of *parcs* of ordinary oysters, may lead to serious evils. And yet I saw nothing at Arcachon leading me to think that the Portuguese oyster would supplant the ordinary oyster.

Here is, in addition, the very disinterested testimony of M. Lhopital, commissary of marine, to whom I had imparted my fears on seeing the daily increase in the introduction of the Portuguese oyster into the basin of Arcachon. He wrote to me recently as follows:

“Previous to the question of hybridization that of the entire occupation of the collectors, by the Portuguese oysters, had produced commotion among the maritime population of Arcachon. Some *parqueurs* had even demanded that the introduction of these oysters into our waters should be absolutely prohibited, and in the beginning of 1878 the minister directed an inquiry into the matter.

“It was ascertained that the danger apprehended was not serious. It is more than twenty years since enormous quantities of Portuguese oysters were introduced into the basin of Arcachon, which came either directly from the mouth of the Tagus or from the Bay of Corogne, or from England, or the embouchure of the Gironde. Well, with perhaps the exception of one or two years, it has been remarked that the repro-

duction of Portuguese oysters has been but trifling. The collectors detached this year may be said practically to have had none on them; and I have had much trouble in finding a few specimens on the reserved beds."

M. Lhopital attributes this failure in the reproduction of the Portuguese oyster in the basin of Arcachon to the purity of the waters and the absence of mud.

I am very much disposed to accept the explanation given by the commissary of marine. It is, in fact, to be remarked, that, wherever the Portuguese oyster is seen to propagate rapidly, there the presence of mud will be found in a state of suspension in the water. Still, it seems to me that the oyster-cultivators of Arcachon should take some precautions, and watch attentively what is going on in their *parcs*. A change in the currents would quite suffice to load the waters with mud and cover the collectors with the spat of the Portuguese oysters. I am not of opinion, however, that the state should interfere in this question otherwise than by giving advice.

Such, then, at the present time is the condition of the oyster industry in the basin of Arcachon, a condition which is certainly remarkable and worthy of fixed attention.

MORBIHAN.

Another important center for the production of oysters exists on our Breton coasts. It is known under the name of the Oyster Basin of Auray.

The cultivation of oysters in this region is of recent date. It is now fifteen or sixteen years since the first collectors were placed in the rivers of Morbihan. The center of the operations is to be found in the rivers or creeks which run into or open out in the Bay of Quiberon. The oyster-breeding establishments, in going from west to east, occupy successively the Creek of Po, the Trinity River, the Creek of St. Philibert, and the Auray River.

Natural beds of oysters exist in most of these rivers. The most important are those in the Auray River, which are about 22 kilometers in length, and those of the Trinity and Saint Philibert Rivers, which extend for about 15 kilometers.

Unfortunately these beds are in bad condition. This year they have been carefully explored by dredging, and the results obtained have been far from satisfactory.

Subjoined is a table showing the results of oyster fishing in the district of Auray from 1876 to 1881:

AURAY RIVER AND DEPENDENCIES.

| Years. | Number of beds. | Number of men. | Number of women. | Duration of dredging. | Quantity of oysters dredged. | Average price per thousand. | Total produce of sale. |
|------------|-----------------|----------------|------------------|-----------------------|------------------------------|-----------------------------|------------------------|
| 1876 | 594 | 1,782 | | h. m. | 19,974,000 | 21.65 | 432,341 |
| 1877 | 623 | 1,664 | 332 | 13 0 | 13,343,000 | 10.75 | 263,652 |
| 1878 | 694 | 1,852 | 448 | 15 45 | 27,145,000 | 15.75 | 427,841 |
| 1879 | 782 | 2,183 | 447 | 8 45 | 11,173,000 | 16.70 | 186,670 |
| 1880 | 809 | 2,379 | 491 | 9 30 | 8,283,000 | 20.40 | 175,263 |
| 1881 | 882 | 2,518 | 445 | 15 0 | 11,061,000 | 13.70 | 157,645 |

TRINITY RIVER.

| | | | | | | | |
|------------|-----|-----|-------|-------|-----------|-------|--------|
| 1876 | 133 | 429 | | 10 30 | 2,042,000 | 17.00 | 31,722 |
| 1877 | 115 | 273 | | 11 40 | 2,558,000 | 22.20 | 50,232 |
| 1878 | 154 | 400 | 108 | 7 40 | 2,206,000 | 22.50 | 49,591 |
| 1879 | 135 | 418 | 101 | 6 20 | 1,058,000 | 22.00 | 23,330 |
| 1880 | 88 | 198 | 79 | 4 15 | 257,000 | 84.00 | 8,737 |
| 1881 | 83 | 167 | 112 | 4 50 | 601,000 | 24.00 | 14,670 |

If these figures are referred to one scale, *i. e.*, to the number of oysters obtained by one dredger in an hour, the following are the results:—

AURAY RIVER.

| | Oysters. |
|---|----------|
| 1877. One dredger in one hour produces..... | 411 |
| 1878. One dredger in one hour produces..... | 747 |
| 1879. One dredger in one hour produces..... | 485 |
| 1880. One dredger in one hour produces..... | 315 |
| 1881. One dredger in one hour produces..... | 262 |

TRINITY RIVER.

| | Oysters. |
|--|----------|
| 1876. One dredger in one hour produces | 453 |
| 1877. One dredger in one hour produces..... | 453 |
| 1878. One dredger in one hour produces..... | 712 |
| 1879. One dredger in one hour produces..... | 566 |
| 1880. One dredger in one hour produces..... | 322 |
| 1881. One dredger in one hour produces..... | 444 |

From the above it will be clearly seen that the beds are becoming less productive; it is true that in the Trinity River the average revived in 1881, but when it is considered how low the totals have been (in 1881 the total number of oysters dredged was only 601,000), the averages are not very accurate. One portion of a bed, in fact, after remaining undredged for several years, may yield a great quantity of oysters, and thus raise the average considerably.

In spite of these unfavorable conditions the production by the rivers of Auray is not unimportant, as the following figures will show :

| Years. | Marketable oysters exported. | Spat. |
|----------------|------------------------------|-------------|
| 1876-'77 | 7,260,000 | 46,050,000 |
| 1877-'78 | 8,094,000 | 46,004,000 |
| 1878-'79 | 7,084,000 | 40,526,000 |
| 1879-'80 | 10,599,000 | 37,618,000 |
| 1880-'81 | 33,325,000 | 155,418,000 |

Some observations are now necessary. In the first place it is to be remarked that these figures are necessarily below the actual fact. In obtaining them regard must be had to the alleged practice of certain oyster-cultivators of concealing the actual amounts through fear of their patents being raised. The number of oysters exported either from Brittany or from other centers of oyster-culture is considerably higher than that stated by those interested.

It must also be remarked that the spat is furnished not merely by the natural beds, but, also by important reserves, which are owned by numerous oyster-cultivators. This explains how, in spite of the precarious state of the natural beds, the yield of young oysters continues to be abundant.

The figures which I have the honor to submit to you will further show the sensible increase in oyster production in the basin of Auray. In 1876-'77, the number of oysters exported was only 7,260,000. In 1880-'81 it had reached 33,325,000.

The oyster-cultivators of this district have to contend against a natural obstacle—the mud which abounds in the rivers and creeks of Morbihan. Thanks to an ingenious disposition of collecting tiles, this obstacle has been surmounted. The collectors if disposed in hives would become rapidly covered with mud; this method has consequently been discarded in favor of that which is called the *bouquet* or *champignon*.

The tiles are pierced with one hole at each extremity, and are joined some 12 or 14 together by means of wire. They are then attached firmly to the head of a stake, 1 m. to 1 m. 50 in length, which can be easily fixed in the ground.

This system, the first idea of which is due to M. Leroux, has the double advantage of preventing the accumulation of mud on the collectors, and of rendering the fixing of these engines easier and more rapid. The time which appears to be the most favorable for laying down the tiles is in Brittany from the 1st to the 20th of July. This date is one month later than that in which, in the basin of Arcachon, this operation is conducted. The difference is easily explained by the difference in temperature at these two points on our sea-coast.

The use of boxes is not so frequent in Brittany as at Arcachon. For this there are several reasons, the most important of which is the follow-

ing: While the oyster-cultivators at Arcachon are unable to export their oysters until they have attained the size of five centimetres, the Bretons are at liberty to sell, generally, the oyster while in the condition of spat, and are not bound to occupy themselves with the rearing. The question of price is an important one, especially as oyster culture is still in its infancy in this district.

A certain number of oyster-cultivators in Brittany substitute, to some extent, for the use of boxes, the use of what is termed *l'huile à tessons*. This expression may be thus explained: the young oysters are left for a certain time on the tiles, and then, instead of detaching them, the collector itself is cut into fragments. Each oyster adheres to one of these fragments. This system, which was invented by one of our most distinguished oyster-cultivators, Dr. Greppy, possessed the advantage of placing the oyster in a better position for resisting the attacks of its natural enemies; the crab, for instance.

Other cultivators allow the oyster to remain fixed to the collector for two years. They place the tiles, when covered with spat, in the emerging basin or merely in the *claires*. The loss attending the operation of detachment is considerable; but some oysters are checked in their growth owing to their pressing too closely one against the other.

I have no occasion now to enter into further details, but will proceed to consider the centers for rearing and fattening. The most important centers for fattening will be found at Marennes and la Tremblade.

Marennes has been noted for many years for the production of green oysters; but for some time past this locality has supplied commerce with large quantities of oysters which have been imported from all parts of France and laid down for the purpose of rearing and fattening.

The following figures, for which I am indebted to the kindness of M. Senné-Desjardins, show the importance of this trade at Marennes.

YEAR 1880-'81.

The number of oysters imported into Marennes, was 190,000,000, of which 130,000,000 were introduced into *viviers* and *dépôts*, and 60,000,000 were introduced into *claires*.

Of the 130,000,000, there were 40,000,000 Portuguese, and 90,000,000 French oysters.

YEAR 1880-'81.

Oysters exported from Marennes, 151,000,000. Of this number 54,000,000 Portuguese, and 47,000,000 French, went from the *viviers* and *dépôts*; 50,000,000 were produced from *claires*. Marennes has sent out this year 151,000,000 oysters, representing a value of 5,900,000 francs. I should point out that, for the reasons already stated, these figures should be raised rather than lowered.

Marennes, then, it will be seen, in addition to the oysters reared in the *claires*, carries on an important trade in oysters. Of the 190,000,000 imported in 1880-'81, 60,000,000 only went into the *claires*.

It is also impossible not to perceive how the trade in Portuguese oysters has developed. Of the 151,000,000 of oysters sold this year 54,000,000 were Portuguese.

I must now pause for an instant to dwell on the care bestowed by the cultivators of this district on their *claires*. Not that I desire now to bring forward facts already well known, but because I conceive that the administration of the *claires* of Marenes might be imitated with advantage in other centers of oyster cultivation.

The *claires* are placed on both banks of the Seudre; they are not, as at Arcachon, submerged at each tide, but only at spring tide. Some are even a long way from the banks of the river. They are so worked that some are in a state of preparation whilst others are in use.

The preparation of the ground generally goes on in March. It includes two operations: *gralage* and *la mise en humeur*.

Gralage has for its object the purification of the soil by evaporation; it lasts from six weeks to two months. The *claires* are cut; that is, the water is no longer kept in them, and they are not visited by the sea except at high tides. They dry in the sun. When the *claire* is *gralée*, or, in other words, covered with a well-drained bed, 15 days are spent in bringing it into condition. A small quantity of water is allowed to enter, and the retention is resumed.

The dry crust dissolves in the water, produces a kind of effervescence, and the final result is a uniform deposit on the *claire* of a creamy precipitate, which is called *humeur*. The oysters may now be laid down, and they begin to turn green at the end of a fortnight.

This operation must be conducted every year. The oysters are laid down at the bottom of the *claire*, and placed at a proper distance from each other by hand. About 5,000 are placed in an area of 33 acres.

Down to the present time the industry of Marenes has been confined to rearing and fattening. It is to be hoped that before long production will be introduced into this locality. The commissary of marine of this quarter is indeed actually engaged on this question.

Having resided for a long time at Auray, M. Senné-Desjardins is conversant with every question pertaining to oyster-cultivation. His intelligence and the devotion he displays in all his duties allow of the hope that this new enterprise will be a success. On many other points of our sea-shore the rearing of oysters engages attention.

I do not consider it desirable to pass in review all the localities where the industry is exercised, but I will speak a few words respecting one of these centers which, I think, possesses special interest.

I wish to speak of the *parcs* established some time since at Coursulles. They are situated in the vicinity of the Seulle, a small river which runs into the sea at this point of our Norman coast.

The canals which communicate with the sea and the oyster basins are so disposed that when the sea rises it cannot, during neap tide, get beyond the sluice gates; consequently, during that period the sea water

is not renewed. During the spring tide, the salt water can enter the canals, but only after having mixed with the fresh water of the Seulle. Pure sea water never enters the *parcs*.

It has been long ago remarked that the oysters placed in the basins of Courseulles fatten rapidly and acquire a particularly delicate taste.

I have thought it important to bring forward these facts, because, from all I have learned and from all I have seen, it appears to me that the blending of fresh and salt water is a condition which, if not indispensable, is, at all events, one of the most advantageous for the fattening of the oyster. In the same way the currents influence, in an unquestionably beneficial way, the growth of the oyster.

French oysters transported to the mouth of the Thames, where the water is nearly fresh, soon acquire the qualities which recommend them to the gourmet. Many of the oysters sold as Ostend oysters have no other origin.

It has further been remarked that oysters taken in the bay of Chesapeake are much fatter than those dredged on other parts of the American coast. It is very probable that this favorable feature is due to the numerous streams of fresh water which run into the bay.

I believe, then, that the fattening of the oyster ought to be recommended on all parts of our coast where natural conditions render possible a blending of fresh with salt water.

At Lorient several establishments, where this desideratum has been realized, are on the high road to prosperity. These examples might easily be multiplied.

For some time past the rearing and fattening of oysters has engaged attention in the basin of Auray.

The cultivators here have to contend with a difficulty arising out of the want of consistency in the soil. But their industry has surmounted this unfavorable condition by macadamizing the mud. For this purpose, they place on the surface of the soil sand and stones, which eventually form a sufficient resting bed.

I believe that the cultivators of Brittany will eventually raise oysters by these means. But I fear that fattening in this district is not followed by good results. In fact, except in a few favored spots, the want of fresh water will be a serious obstacle to perfect success.

I need not, I think, dwell more upon this portion of my report. But I desire to draw your attention to this fact, that, while oyster cultivation is relatively a success on our ocean-bound coasts, it is, so to say, not represented upon our Mediterranean shores.

All the attempts made formerly by M. Coste have been without result. I consider it useless to recur to these unfortunate experiences, but there is some degree of interest in the inquiry whether oyster-cultivation ought to be definitely abandoned in this part of France.

At present several species of oysters live in the Mediterranean. These are as follows:

1. *Ostrea edulis* and its varieties.—This oyster appears to experience difficulty in existing in the Mediterranean, except in that portion of the sea which washes our coasts. It never forms beds. Some solitary specimens may be found on the muddy bottom, at a depth of from 30 to 60 meters, outside the embouchure of the Rhone.

2. *Ostrea cyrnusii*.—This oyster bears a great resemblance to the *Edulis*. It is distinguishable more particularly by the greater length of the hinges. It is found in the brackish water on the east side of Corsica.

3. *Ostrea cochlear*.—I only cite this species as a matter of form. It is a very small and rare oyster, living at a great depth (100 to 140 meters). In a comestible point of view it has no interest.

4. *Ostrea stantina*.—This is a small species, tolerably abundant at Toulon, but more rare on the rest of our coast. It seems to prefer impure waters.

Of these species, two only offer any interest in a cultivator's point of view. These are the *Ostrea edulis* and the *Ostrea cyrnusii*.

All the experiments which have been made down to the present time have been with regard to the *Ostrea edulis*. M. Coste used for his operations oysters produced by the coast of Brittany. As already remarked, this species does not propagate itself readily on our Mediterranean coasts. Many zoologists attribute this fact to the water of this sea being too salt. However this may be, I think that new efforts should be made, and that this time the oysters from the coasts of Corsica should be employed, *Ostrea cyrnusii*.

I am inclined to believe that this species would afford good results if introduced into the marine ponds so numerous along our southern coasts, to which I have already had the honor to draw your attention. Such are the chief points to which I was desirous of inviting your attention. To sum up, the state of oyster-cultivation in France is sufficiently satisfactory.

This new industry has not only succeeded in sending a great quantity of these mollusca to the markets of our country, but it likewise exports a considerable number. Thus, last year French cultivators sent to London 28,000,000 of oysters. Belgium receives several millions every year.

Nevertheless, I am convinced that oyster-cultivation might be more fully developed if it were protected from certain dangers by which it is menaced, some of which are really of a grave character. Permit me to lay before you these dangers, as well as the means which, in my opinion, should be employed to combat them.

I have already had occasion to refer to the rapid deterioration of the natural beds. This, without question, is the most grave danger, in any way, of oyster-cultivation. It is, therefore, of moment to trace the causes to which this state of deterioration may be ascribed.

Two main facts may be brought forward. In the first place, it is

necessary to refer to the thefts committed on the beds, which are of incessant occurrence.

These thefts are committed openly. The thieves not only attack the reserved beds, but may be seen to take up their position on *parcs* owned by individuals, breaking the *claires*, and taking away their contents. The employés of the marine, though well-intentioned and of undoubted loyalty, are not in a position to meet the depredations of these undaunted robbers.

As a fact, the means at the disposal of the maritime authority are not, in the generality of instances, adequate for the pursuit and capture of the poachers. This class of pirates being furnished with swift craft, having an admirable knowledge of the grounds upon which they are operating, and always taking advantage of rough weather, cannot, as a rule, be caught.

The coast guard will never be able to act efficaciously until they have steam sloops at their command. This expedient, which has already been recommended by M. Robin, a member of the Senate, seems to me to be the only way of insuring an effectual surveillance.

But this is not all. When, under fortunate circumstance, the thief has been captured, the punishment awaiting him is really ridiculous. One may see a man who, in a few hours, has stolen oysters worth two or three hundred francs condemned to pay a fine of five francs!

Another very important cause of the deterioration of the natural beds is the overdredging. Before reaching a marketable size, the oyster requires a period of time which may be computed at two or three years. Now, on certain parts of our coasts, and especially in the rivers of Auray, dredging is conducted every year. True it is that fishermen are recommended to throw back under-sized oysters, but everyone must see that this is an ineffectual measure. It ought to be made imperative that dredging should not be conducted on the same bed oftener than every second or third year. Such is the practice at Arcachon, and I have had occasion to point out that the results are excellent.

A further cause of the non-development of oyster-cultivation, in Brittany, at all events, is the rent (to my mind too high), which is exacted from the concessionaires of the shore.

While at Arcachon the rent ranges from 30 to 45 francs the hectare, according to the position of the *parcs*, cultivators in Brittany pay no less than 100 francs for an equal area.

Now these shores are fit for no other purpose; they are simply mud banks, without any value whatever. The sum of 100 francs the hectare is more of the nature of regular rent than a concession.

Here, then, is a really high tax pressing heavily upon a new industry which, on every account, deserves protection and encouragement.

Besides the interest which this industry presents in itself, it is not to be forgotten that the oyster-cultivation occupies each year a great num-

ber of persons, women and children, who, but for it, would be without employment.

To sum up, I think it would be desirable to see Government take the following steps:

1. Place at the disposal of the coast guard a certain number of steam sloops, which are the only craft fit for pursuing with success the poachers on our natural beds.
2. Regulate the dredging of these beds so that no bed should be dredged except once in three years.
3. Recommend to the competent authorities increased severity in the repression of robberies committed at the expense of the cultivators.
4. Lower the rents exacted from the concessionaires of *parcs* in the Brittany district, in such a way that the amount of this tax shall not exceed that which is demanded from cultivators in the basin of Arcahon.

As regards the recommendations to be made to the cultivators, they will naturally find their place in the course which you have thought it desirable to institute.

The persons who are engaged in this industry have it, moreover, in their power to do much for themselves. With this consideration I would suggest the formation of companies for oyster-cultivation. The cultivators of Auray have entertained the idea of such co-operation. Their reunion, which took the title of company for the cultivation of oysters in the basin of Auray, has already afforded excellent results.

This company publishes monthly a report of proceedings, and it has likewise founded a museum of oyster culture which possesses great interest for all persons engaged on questions relating to the production of oysters. This example ought to be followed by all centers of oyster-cultivation. Such are the facts to which I was desirous of inviting your serious attention.

In conclusion, permit me to say how greatly I have been aided in my researches by the agents of the *administration maritime*. M. Broquet, lieutenant in command of the *Moustique*, the following commissioners of marine, viz, MM. Senné-Desjardins, Lhopital, Gestain, and Castelin, have obtained for me invaluable information.

If in this report I have succeeded in bringing together any facts of interest, I owe my success to the courtesy I have received from the gentlemen whose names I have just mentioned.