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

By DR. P. BROCCHI.

The following explanatory remarks were prefaced to the copy of Dr. Brocchi's report printed in the *Journal Officiel:* *

"In response to a request long since made by the oyster-culturists of the Bretagne region, and to the wish expressed by the senatorial commission on the replenishing of the waters, the minister of agriculture and commerce, following out a decision dated the 30th of June last, has established a course in oyster and fish culture, in the laboratory founded by Coste at Concarneau (Finistère). This course, which was intrusted to M. Brocchi, lecturer on zoology at the National Institute of Theoretic Agriculture (*Institute National Agronomique*), began September 5, and has continued a month.

"Independently of the oral instruction, M. Brocchi is charged with the making of researches throwing light upon the important questions treated of in his course. He now addresses to the minister of agriculture and commerce his first report upon his observations regarding the present state of oyster-culture."

The preparation of the course of lectures on oyster-culture has led me to visit the principal oyster-cultural centers of France. It seems highly proper to render an account of what it has been given me to observe during this exploration and to present the actual state of oyster-culture in our country.

ORIGIN OF OYSTER-CULTURE IN FRANCE.

This industry, so new and so essentially French, has made rapid progress. It is not here necessary to give the history of oyster-culture. Its origin, however, is of recent date. Indeed, it was only after the publications and the efforts of M. Coste (1856–1858) that the attention of the inhabitants of our coasts was drawn to the possibility of raising oysters artificially. These experiments, to which the state had dedicated considerable sums, led to many others. M. Coste, with an enthusiasm which was perhaps excessive, but which, after all, produced happy results, then declared that this industry would become a new source of wealth to France. The attempts made simultaneously in the ocean and in the Mediterranean for the most part failed. However, and it has been too much forgotten, the experiment tried in Arcachon Bay was crowned with success. From that time the start was given and the oyster-cultural industry made rapid progress.

Journal Officiel de la République Française, Novembre 8, 1881, pp. 6181-6186.

BRANCHES OF OYSTER-CULTURE.

Oyster-culture comprehends two very distinct branches; on the one hand, production; on the other, raising and fattening.

The production is the gathering of the embryos of the oysters, and the saving thus of a great number, the loss of which would be inevitable without the intervention of man.

Every one knows that at the time when it is born the young oyster is furnished with locomotive apparatus by which it is enabled to swim in the bosom of the sea. After having wandered a certain time the animal fixes itself on some extraneous body, loses forever its organs of locomotion, and becomes the mollusk well-known to all. But these embryos cannot fix themselves indifferently upon any substance which comes within their reach. It is necessary for the latter to be sufficiently smooth and clean. So it happens, in the natural condition of things, that a great quantity of these little beings, this *naissain*,* find no objects to which they can adhere, fall on the bottom of the sea, and soon perish. At last, those which have been able to fix themselves under favorable conditions find themselves exposed for a long time to many dangers. It is to obviate these perils that oyster-culturists place in the vicinity of natural beds various objects, designated under the name of collectors, destined to gather and preserve the spat. When the latter has attained a sufficient development, it is detached and delivered to the raiser.

The raising consists in supplying to the spat the conditions best calculated to promote its rapid growth, and, at the same time, sheltering it as much as possible from the attacks of its natural enemies.

Next, they proceed to the fattening; that is to say, they exert themselves to give to the animal that physical condition which makes it sought after by the epicures.

CENTERS OF PRODUCTION.—It remains for me to consider successively the most important centers of production and raising. The two points in France where production is carried on upon a large scale are, first, Arcachon; second, the Morbihan.

ARCACHON BAY.

In 1853 the oyster-cultural industry did not exist in Arcachon Bay. At that period, in fact, one of our most distinguished pisciculturists, M. Chabot Karlen, published a report on this part of France, in which one may read that the production of oysters was then absolutely neg-

*The term *naissain* applied to oysters during all the earlier stages of their existence is of frequent occurrence in French oyster-cultural literature, and is used many times in the course of the present article. When the mollusks are referred to in their pelagic or free condition *naissain* will be found to have been translated "fry" or "spawn," while in those instances in which they are spoken of after fixation, the word has been uniformly rendered into "spat," familiar words in the American oyster-dialect, and less ambiguous than any others.—TRANSLATOR.

lected in the bay. It is just to add that M. Chabot foresaw then the possibility of raising oysters upon the tide-flats.*

Oysters had once existed in a natural state in Arcachon Bay, but there, as everywhere, ignorance and improvidence had produced sad results. The natural beds were choked up with mud, and the oysters were disappearing rapidly. It was under these circumstances that, in 1860, M. Coste resolved to establish in this region some model parks. Three places in the bay were chosen, and in all the success was complete. As a result, one of the new parks, that of Lahillon, with an area of four hectares (9.88 acres), furnished, in 1866, more than 5,000,000 oysters. Now, at the time when the work commenced at that point there was nothing there but mud. After having cleaned the earth they placed there 400,000 oysters (1865), and, as I have just said, in the following year the product surpassed 5,000,000. Such examples were well calculated to impress the coast population. Applications for concessions immediately became numerous, and, as I will shortly show, are continually increasing in numbers. Some years later the Government, finding its example no longer necessary, conceded its model parks to the *Société central des naufragés*, only reserving a certain extent of oyster-beds which serve to supply the environing concessions with spawn. The reserved beds occupy an area of 200 hectares. No fishing is allowed in them except about once in three years, and after a committee, in which the fishermen and the owners of parks are both represented, has given its consent. The maritime administration is very careful of this reserve. Every year 240 cubic meters of little shells are thrown on the surface of the parks, and so form natural collectors. At the time it was last fished (1879) the reserve furnished 25,000,000 oysters, representing a value of about 250,000 francs [$50,000]. In the month of April, 1881, when I was able to visit it, the beds were covered with beautiful oysters, and appeared to me in excellent condition.

The collectors employed at Arcachon consist almost exclusively of tiles, previously limed, and arranged in hives. Ten million tiles are put out each year. The most favorable season for placing the collectors seems to be, in this region, from the 12th to the 15th of June. The hives remain in place until the month of October; some oyster-culturists, however, allow the collectors to remain the whole winter in the basin. The latter is a dangerous practice, the spat being liable in that case to be destroyed by the frosts. However that may be, the young oysters are placed either in claires or in nursing-boxes. The claires of Arcachon have been so often described† that it does not seem to me

* In the original the author quotes the words of M. Chabot, "*dans la grande eau sur les Crassats*"; *crassats* being a local term for certain portions of the Arcachon Bay, which are laid bare at each tide. These *crassats*, upon which numerous parcs are now located, are separated from each other by channels formed by the currents which cross the bay in every direction.—TRANSLATOR.

† See Report of Commissioner for 1880, pp. 939, and *post*, pp. 957.

necessary to return to them here. I will, however, recall the fact that their depth varies, according as they are designed to receive the spat already detached or the tiles yet charged with young oysters. Indeed, a certain number of park owners leave the spat to develop for quite a while on the tiles themselves. The use of nursing-boxes [*caisses*] is general at Arcachon; but, as they are very expensive, some oyster-culturists have been obliged, in the interests of economy, to dispense with them. In return, some establishments possess a considerable number of them. Thus, in the month of April last, 4,000 boxes might be seen in a single park.

It does not seem to me, however, Mr. Minister, that this is the place to enter into the details of the industry. I desire only to put before you the proof of the importance of oyster-culture in this part of France. The following figures, which I owe to the courtesy of M. Lhopital, naval commissary, have an interest, from this point of view, of the first order:

Statistics of the oyster-cultural industry in Arcachon Bay.

Years.	Number of parks.		Number of oysters exported.	Value.	Mean prices per thousand.
	Conceded.	Existing.			
				Francs.	*Francs.*
1865	297	297	10,584,550	338,705	40
1866	4	301	7,052,000	282,070	40
1867	39	340	4,921,210	191,175	16
1868	94	434	8,599,675	319,186	37
1869	30	464	10,145,687	419,784	45
1870	21	485	6,511,140	352,666	58
1871	276	761	4,897,500	268,332	55
1872	371	1,132	10,796,740	537,515	50
1873	106	1,238	25,711,750	1,159,397	41
1874	1,175	2,413	42,542,650	1,745,050	45
1875	626	3,039	112,715,233	2,817,630	25
1876	306	3,345	196,885,459	3,941,309	20
1877	301	3,646	202,392,225	4,450,288	22
1878	285	3,931	176,500,225	4,426,500	25
1879	184	4,115	160,197,275	3,944,249	25
1880	144	4,259	195,477,357	4,254,466	25

It may be seen by an examination of the figures, *first*, that the number of parcs, which in 1865 was only 297, was 4,259 in 1880; *second*, that, during the same period, the number of oysters exported has risen from 10,584,000 to 195,477,375, representing a value of 4,254,465 francs; *third*, that the total number of oysters exported from 1870 to 1880 has exceeded 1,000,000,000, and it must be noted that no oysters can be sold outside of the country until they have obtained a minimum diameter of five centimeters.

THE PORTUGUESE OYSTER IN ARCACHON BAY.

It can also be seen that the mean price per thousand has very much diminished of late years. This results from the great quantity of Portuguese oysters which have been introduced. And, in this connection, Mr. Minister, I cannot pass in silence the excitement which was felt in the oyster-cultural world following the introduction in our waters of the

Portuguese mollusk. Some distinguished oyster-culturists have, in fact, held that the Portuguese oyster is liable to cross with the *Ostrea edulis*, thus impairing the purity and diminishing the value of our indigenous oyster. These persons even announced that they had observed unequivocal traces of this hybridization in the oysters coming from Arcachon. This statement caused so much interest among the oyster-culturists of Arcachon that one of the fishing inspectors in England urged his countrymen to buy no more oysters coming from the Arcachon Bay.

Allow me, Mr. Minister, to lay before you the result of my observations on this point. The mollusk known under the name of the Portuguese oyster does not belong to the same genus as our indigenous oyster. While the latter ranks among the mullusks belonging to the genus *Ostrea*, the Portuguese oyster takes place among those which compose the genus *Gryphée*, the species called *Gryphée anguleuse* (*Gryphæa angulata*, Lamarck). In other words, the Portuguese oyster is not an oyster from a zoological point of view. To give any basis for the theory of hybridization between the two mollusks, it would be first necessary to prove that the zoologists have made a mistake in creating these two genera, and that Lamarck was wrong in separating the gryphæas from the oysters properly so called. Really, in the present state of science, it is impossible to admit the crossing of two species belonging to different genera. On the contrary, all that we know is opposed to the possibility of such a hybridization. So that, I repeat, until it is demonstrated that the genera *Gryphæa* should be struck out from our classifications, the fact of cross-breeding between the mollusk of the Tagus and our edible oyster cannot be admitted. Even admitting the generic identity of the two mollusks, the characters appealed to by those who believe in their hybridization do not seem to have any great scientific value. These characters, in fact, only relate to the coloring of the shell, and no one is ignorant what a variation of color there may be in animals belonging, incontestably, to the same species. Finally, to pass nothing in silence, I will add that from experiments made by MM. de Montaugé and Bouchon-Brandely (experiments which do not appear to me to have been conducted with enough scientific precision) it would seem that the spermatozoa of the Portuguese oyster cannot fertilize the eggs of *O. edulis*.

I can affirm, for my part, that during my stay at Arcachon I have not noticed anything which can make me believe in the deterioration of the oyster coming from that region.

To recapitulate, I do not believe in the crossing of the two mollusks; but I hasten to add that the introduction of the Portuguese oyster into our waters does not seem to me without danger. We know that when two species are placed side by side in a limited space there takes place between them what an illustrious naturalist has named the struggle for existence. This struggle must sooner or later terminate in the defeat, the disappearance, of the weaker species. Under these conditions, the

Gryphæa and the ordinary oyster finding themselves face to face, the latter must inevitably succumb. The Portuguese mollusk is incontestably more hardy, more resisting, and also, it seems to me, more prolific. The facility with which it propagates itself is, in fact, very remarkable. It is known in what manner the Portuguese oyster took possession of a part of our coast. Some hundreds of these mollusks, accidentally introduced at the mouth of the Gironde, soon formed considerable beds. I have this present year seen the collectors placed on the shores of the island of Oléron covered almost exclusively with Portuguese spat. I think then, Mr. Minister, that in most cases the culture of the *Gryphæa* practiced in the vicinity of parks of common oysters may be accompanied with grave disadvantages.

And yet, I must repeat, I have no evidence at Arcachon of the encroachment of the Portuguese oyster. Here is, moreover, the entirely disinterested testimony of M. Lhopital, naval commissary, to whom I communicated my fears upon seeing the introduction of the Portuguese oyster in Arcachon Bay daily increasing. M. Lhopital wrote to me lately:

"Before the question of hybridization arose, this question of the invasion of collectors by the Portuguese oysters had already agitated the maritime population of Arcachon Bay. Some park-owners had even asked that the introduction of this oyster into our waters be strictly prohibited, and at the beginning of 1878 the minister caused an inquiry to be made upon the subject. It is now recognized that the danger pointed out was not serious. For more than twenty years there have been continuously introduced great quantities of Portuguese oysters, coming either directly from the mouth of the Tagus, from the bay of La Corogne, from England, or from the mouth of the Gironde. Well, excepting perhaps one or two years, the reproduction of Portuguese oysters in the bay has been noticed to be very slight. The collectors that have been taken up this year contained none of them, so to speak, and I have had much difficulty in finding any specimens of Portuguese oysters on the reserved beds."

M. Lhopital attributes this lack of reproduction on the part of the Portuguese oyster in Arcachon Bay to the purity of the water and to the absence of mud. I am much disposed to accept the explanation of the naval commissary. It is, indeed, remarkable that wherever one sees the Portuguese oyster propagate itself rapidly one can aver also the presence of mud in suspension in the water. However, it appears to me, Mr. Minister, that the oyster-culturists of Arcachon should take some precautions and watch attentively what takes place in their parks. Only a slight change in the currents would be sufficient to cause the water to become charged with mud and the Portuguese fry to invade the collectors. I do not think, however, that the state needs to interfere in this matter otherwise than by its advice.

Such is, at the present hour, the condition of the oyster-cultural in-

dustry in Arcachon Bay, a condition certainly remarkable and worthy of careful attention.

MORBIHAN.

Another important center for the production of the oyster exists on our Breton coast. It is known under the name of the oyster-cultural basin of Auray. The cultivation of the oyster in this region is of recent date. Collectors were first placed in the rivers of the Morbihan about fifteen or sixteen years ago. The center of the business is in the rivers and inlets which open into Quibéron Bay. The oyster-cultural establishments occupy successively, in going from east to west, the creek of Pô, the river of La Trinité, St. Philibert Creek, and Auray River. In most of these rivers natural beds exist. The most important are those of Auray River, which are about 22 kilometers long, and those of La Trinité River and of St. Philibert, which have a length of about 15 kilometers. Unhappily these beds are in bad condition. They have this present year been carefully explored, with the aid of scaphanders, and the results obtained are far from being satisfactory. Here is, moreover, a table showing the result of the oyster fishery in the Auray region from 1876 to 1881:

Statistics of the oyster fishery in the Auray region, 1876 *to* 1881.

Locality.	Years.	Number of persons engaged.		Number of boats.	Duration of the dredging.	Number of oysters taken.	Average price per thousand.	Total product of sales.
		Male.	Female.					
					hrs. m.		*Francs.*	*Francs.*
Auray River and its tributaries.	1876	1,782	.....	594	20 30	19,974,000	21.65	432,341
	1877	1,664	832	623	13 00	13,343,000	19.75	263,652
	1878	1,852	448	694	15 45	27,145,000	15.75	427,841
	1879	2,183	447	782	8 45	11,173,000	16.70	186,670
	1880	2,379	491	809	9 30	8,283,000	20.40	175,263
	1881	2,516	445	882	15 00	11,061,000	13.70	157,644
La Trinité River	1876	429	.....	133	10 30	2,042,000	17.00	34,722
	1877	273	.....	115	11 40	2,558,000	22.20	50,232
	1878	400	108	154	7 40	2,206,000	22.50	49,591
	1879	418	101	135	6 20	1,058,000	22.00	23,330
	1880	198	79	88	4 15	257,000	34.50	8,737
	1881	167	112	83	4 50	601,000	24.50	14,670

If we bring these figures to a single unit of measure, the number of oysters fished per hour by each person [*dragueur*,] the following results are obtained:

AURAY RIVER.

[1876.—Each person took per hour 546 oysters.]
1877.—Each person took per hour 411 oysters.
1878.—Each person took per hour 747 oysters.
1879.—Each person took per hour 485 oysters.
1880.—Each person took per hour 315 oysters.
1881.—Each person took per hour 262 oysters.

TRINITY RIVER.

1876.—Each person took per hour 453 oysters.
1877.—Each person took per hour 453 oysters.
1878.—Each person took per hour 712 oysters.
1879.—Each person took per hour 566 oysters.
1880.—Each person took per hour 322 oysters.
1881.—Each person took per hour 444 oysters.

We see then, clearly, that the beds are in a state of decadence. It is true that in the Trinity River the average rose somewhat in 1881, but when one reasons from such slender figures (the total number of oysters dredged in 1881 was only 601,000) averages become less reliable. Some part of the bed, perhaps, which had remained unexplored during the preceding years, was then fished, and gave a great number of oysters which rapidly raised the average.

Notwithstanding this bad condition the production of the rivers of Auray is not unimportant, as the following figures show:

Season.	Number of marketable oysters exported.	Number of fry.
1876–'77	7, 260, 000	46, 056, 000
1877–'78	8, 094, 000	46, 004, 000
1878–'79	7, 684, 000	40, 526, 000
1879–'80	10, 599, 000	37, 618, 000
1880–'81	33, 325, 000	155, 418, 000

Some observations are necessary at this point. It must be remarked that these figures are unavoidably below the reality. We are obliged to depend for them upon the statements of the oyster-culturists, who, continually fearing an increase of the license tax, are always inclined to conceal the amount of their business. The number of oysters exported, both from Bretagne and from other oyster-cultural centers, is evidently greater than that indicated by the interested parties. It should also be noticed that the spawn is furnished, not only by the natural beds, but also by the important reserves of oysters which are possessed by several oyster-culturists. This explains the fact that, notwithstanding the precarious state of the natural beds, the crop of young oysters does not cease to be abundant. Consequently, one can see from the figures which I have the honor to lay before you the marked increase of oyster production in the basin of Auray. In the season of 1876–'77, the number of oysters exported was only 7,260,000. In 1880–'81, it reached 33,325,000.

The oyster-culturists of this region have to struggle against a natural obstacle, the mud which abounds in the rivers and inlets of the Morbihan. Owing to the ingenious arrangement of the collecting tiles, they have succeeded in triumphing over this difficulty. The collectors arranged in hives rapidly become choked with mud, so this arrangement

has been discarded in favor of that which is known under the name of *bouquet* or *champignon* mushroom. A dozen or fourteen tiles pierced at each extremity are fastened together by means of iron wires. These are attached firmly to the top of a stake from 1 to 1½ meters long, 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 collectors from being choked with mud and of rendering the setting of these implements more easy and rapid. The time which appears to be most favorable for setting the tiles, in Bretagne, is from the 1st to the 20th of July. This date is a month later than that at which the setting takes place in Arcachon Bay. The discrepancy is easily explained by the difference in temperature which exists between these two parts of our coast.

The use of nursing-boxes is not so frequent in Bretagne as in the Bay of Arcachon. There are several reasons for this circumstance; the one of the most importance is that, while the oyster-culturists at Arcachon cannot export their oysters until they have attained the size of five centimeters, the Bretons have the right to sell them outside the country in the condition of spat, and need not occupy themselves with raising them.

The question of the cost, also, plays a great part, so much the more as the oyster-cultural industry is yet in its infancy in this region. Finally, a number of Breton oyster-culturists replace to a certain extent the use of boxes by the method which they call *l'huitre à tessons* (the oyster on potsherds). This is what should be understood by that expression: The young oysters are left on the tiles for a certain time; then, in place of taking them off, they break into fragments the collector itself. Each oyster is then adhering to one of these pieces—to one of these *tessons.* This system, invented by one of our most distinguished oyster-culturists, Dr. Greppy, offers the advantage of placing the oyster in the best condition to resist the attacks of its natural enemies, the crabs, for example. Other oyster-culturists leave the oysters fixed to the collectors two years. They place the tiles, charged with their harvest, into submersible basins or simply into claires. The loss which always follows the gathering of the tiles is thus greatly lessened, but, on the other hand, some oysters are arrested in their development on account of being too closely pressed against the others.

RAISING AND FATTENING CENTERS.

I will not here enter into further details, but will now apply myself to the raising and fattening centers, the most important of which are Marennes and La Tremblade.

MARENNES.—Marennes has been known for many years for the production of green oysters; but for some time this locality has been fur-

* For an illustration and further description of the bouquet collector see Report of Commissioner for 1880, pp. 959–962.—TRANSLATOR.

nishing to commerce great quantities of oysters from other parts of France, which are brought here to be raised and fattened.

The following figures, which I owe to the courtesy of M. Senné-Desjardins, show the importance of the Marennes trade for the years 1880–'81.

The number of oysters introduced at Marennes was one hundred and ninety million, of which one hundred and thirty million were placed in the live-boxes and depots, and sixty million were placed in the claires. Of the one hundred and thirty million in the rivers about forty million were Portuguese, and about ninety million French. The exportation of oysters from this place amounted to one hundred and fifty-one million. Of this number fifty-four million Portuguese and forty-seven million French came from the depots and rivers, and fifty million came from the claires.

So, then, Marennes has sent off this year one hundred and fifty-one million oysters, representing a value of 5,900,000 francs [$1,138,700]. For the reasons which I have already indicated, these figures should be increased rather than diminished. Marennes, outside of the oysters raised in its claires, has an important trade in these mollusks. Of the one hundred and ninety million imported in 1880–'81, only sixty million entered the claires. It is also impossible not to remark how much development the Portuguese oyster business has taken. The one hundred and fifty-one million oysters sold this year are estimated to include fifty-four million of the Portuguese species.

I must now dwell for an instant on the care taken of their claires by the oyster-culturists of this region. Not that I wish to repeat facts here which have been known for a long time, but because it appears to me that the management of the claires of Marennes could be imitated with advantage in other oyster-cultural centers.

The claires are located on the two banks of the Seudre. They are not, like those of Arcachon, submerged at every tide, but only at the height of the spring tides. Some are even quite a distance from the river banks. They are parceled out in such a manner that some are being prepared while the others are in operation. The preparation of the ground takes place generally in the month of March. It comprehends two operations, *gralage* and moistening. The *gralage* has for its object the purification of the soil by evaporation; it lasts about six weeks or two months. The claires are cut, that is to say, the retention of water is prevented, and they are no more visited by the sea except at the spring tides. They dry up in the sun, crack, and grale. When the claire is graled, in other words, covered with a very dry layer, fifteen days are spent in moistening it. A small quantity of water is caused to enter and remain. The dry crust splits (*sedélite*—breaks in the grain) in the water; it produces a sort of effervescence, and the final result is a uniform deposit on the claire of a creamy layer called humor. The oysters can then be put in place, and commence to become green at the end of a fortnight. This operation should be gone through every year. The oysters are placed

on the bottom of the claire and spaced with the hand. About five thousand are spread on a surface of thirty-three acres.

Until the present time the industry of Marennes has consisted exclusively in raising and fattening. We may hope shortly to see production introduced into this locality. In fact, the marine commissary of this district, M. Sennè-Desjardins, is applying himself actively to this question. Having lived a long time at Auray, M. Sennè-Desjardins is abreast of all the questions connected with oyster-culture. His intelligence, and the interest which he carries into his labors, give ground for the hope that this new undertaking will be successful.

COURSEULLES.—ADVANTAGE OF FRESH WATER.—On many other points of our shore the raising of oysters is carried on. I do not think that I ought to pass here in review all the localities where this industry is prosecuted. I will, however, ask your permission, Mr. Minister, to say a few words to you regarding one of these oyster-cultural centers which appears to me to possess a peculiar interest.

I wish to speak of the parks which have for a long time existed at Courseulles. These parks are situated in the neighborhood of the Seulles, a little water-course which empties into the sea in this part of our Norman coast. The canals, through which the oyster basins communicate with the sea, are so disposed that when the sea rises it cannot, during the neap tides, pass over their flood-gates. Consequently the water is not renewed during this period. During the spring tides the salt water can enter the canals, but only after mixing itself with the fresh water of the Seulle. Undiluted sea-water never penetrates into the parks.

Now it has been long noticed that the oysters placed in the basins of Courseulles fatten rapidly and become of a particularly delicate taste. I repeat these facts because it seems to me to result from all that I have learned of others, and from all that I have been able to observe by myself, that the mixture of fresh water with that of the sea is a condition which, if not indispensable, is at least most advantageous for the fattening of the oyster. At the same time, the currents incontestably exert a favorable influence on the raising, the growth, of these mollusks. French oysters transported to the mouth of the Thames, in water nearly fresh, speedily acquire qualities which make them sought for by epicures. A great quantity of mollusks sold under the name of Ostend oysters have no other origin. It has also been remarked that the oysters gathered in the Chesapeake Bay are much fatter than those fished on other portions of the American coast. It is quite probable that this favorable condition is due to the numerous streams of fresh water which empty into this bay. I think then that the fattening of the oyster should be recommended on all parts of our coast where the natural conditions are such that a mixture of fresh and salt water can be obtained. At Lorient several establishments, where this desideratum is realized, are on the broad road to prosperity. These examples could easily be

multiplied. They have endeavored, for some time, to practice raising and fattening in the basin of Auray. The oyster-culturists have here to struggle against the obstacle arising from the small degree of firmness which the soil presents. They succeed in triumphing over these bad conditions by macadamizing the mud. For that they cover the ground with sand and stones which end by forming a bed sufficiently resisting. I think that the Breton oyster-culturists will be able to thus raise oysters, but I very much fear that the fattening will not give good results in this region. In fact, except at a few privileged points, the want of fresh water will be a serious obstacle to perfect success.

MEDITERRANEAN COAST.

While oyster culture is comparatively flourishing on our ocean shores, it is not represented on our Mediterranean coast. All the attempts made in former times by M. Coste were without the desired results. I think that it is useless to dwell upon those unfortunate experiments, but there is some interest in examining whether the oyster industry should be finally abandoned in this part of France. Several species of oysters at present live in the Mediterranean. These species are the following:

I. The *Ostrea edulis* and its varieties. This oyster seems to live only with difficulty in the Mediterranean, at least in the part of it which washes our coast, and it never forms beds. Some individuals are found on a muddy bottom, at the depth of thirty to sixty meters, off the mouth of the Rhone.

II. The *O. cyrnusii.* This oyster very much resembles the *edulis.* It is principally distinguished by the greater length of the hinge-groove. It lives in the briny pools on the eastern coast of Corsica.

III. The *O. cochlear.* I cite this species simply for the sake of mentioning it. It is, indeed, a very small and rare mollusk, inhabiting great depths (100 to 140 meters). It possesses no interest from a gastronomic point of view.

IV. The *O. stantina.*—This is a small species, rather abundant at Toulon, more rare on the rest of our coast. It seems to prefer to inhabit impure waters.

Among these species only two are interesting from an oyster-cultural point of view, the *O. edulis* and the *O. cyrnusii.* All the attempts which have been made up to this time have related to the *O. edulis.* Thus M. Coste used for his experiments oysters coming from the coast of Bretagne. Now, as we have just said, this species of oyster seems to propagate itself with difficulty on the Mediterranean coast. Many zoölogists attribute this circumstance to the fact that the sea-water here is too salt. However that may be, it appears to me that new attempts should be made, directed this time to the oyster of the Corsican coast, the *O. cyrnusii.* I am led to think that this species would give good results if it was introduced into the lagoons which are so numerous along our southern coast, and to which I have already had the honor of directing your attention.

CONDITION OF OYSTER CULTURE AND DANGERS THREATENING IT.

Not only does the new industry place a great quantity of mollusks on the home market, but it also exports a considerable number. Thus, in the last year, the French oyster-culturists sent to London twenty-eight millions of oysters. Belgium, likewise, receives several million annually. However, I am convinced that oyster-culture could attain a much greater development if it could be protected from certain dangers that menace it, some of which, at least, are really grave. Permit me then to show you these dangers and the means which, in my opinion, should be put in operation to combat them. I have already had occasion to describe to you the rapid decadence of the natural beds. That is, without contradiction, the most formidable danger which threatens the oyster-cultural industry. It is important, then, to search for the causes to which should be attributed this state of decay.

Two principal facts can be appealed to. It is necessary first to cite the pillage of the beds, which is carried on incessantly. The thefts are committed in open day. The plunderers not only attack the reserved beds, but have even been seen to install themselves on parks belonging to particular persons, break the nursing boxes [*caisses, i. e., caisses ostréophiles*—nursing boxes, or cages], and carry off the contents. The employés of the navy, notwithstanding their good will and devotion, are not in a condition to oppose the depredations of these hardy robbers. In fact, the means which the maritime authorities have at their disposal do not permit them, under most circumstances, to follow and apprehend the robbers. Pirates of this kind, provided with rapid boats, knowing admirably the ground on which they operate, and always taking advantage of foul weather, are usually very difficult to arrest. Coast-guards cannot work with effectiveness except when they can have steam launches at their disposal. This means, already recommended by Mr. Senator Robin, appears to me the only one which can assure a serious surveillance. But this is not all. When, by a happy circumstance, the robber has been captured, the punishment which awaits him is really ludicrous. One may see a man who in a few hours has stolen oysters worth 200 or 300 francs, condemned to pay a fine of five francs!

Another quite important cause of the decrease of the natural beds is their too frequent dredging. We know that to arrive at marketable size the oyster needs a time which may be estimated at two or three years. On certain portions of our coast, and notably in the rivers of Auray, the dredging takes place every year. The fishermen are recommended, it is true, to throw back into the sea the oysters which are too small; but who cannot see that this recommendation has no effect? Necessarily, then, dredging should not be allowed on the same bed more than once in two or three years. Such is the practice adopted at Arcachon, and I have had occasion to say that its results are excellent.

Another cause which opposes the development of oyster-culture, in

Bretagne at least, is the too high rent, as I believe, which is exacted from the concessionaires of lands. In fact, while the rent at Arcachon is from thirty to forty-five francs per hectare, according to the position of the parcs, the Breton oyster-culturists pay not less than one hundred francs for the same extent of land. Now these lands are not adapted to any other use; they are absolutely valueless mud-sloughs (*vasères*). The charge of 100 francs per hectare is, then, much rather that of a leasing than that of a concession. This is really a considerable tax, which lights on a new industry that merits, in every respect, to be protected and encouraged. In fact, outside of the interest which it possesses in itself, it should not be forgotten that oyster-culture gives occupation every year to a great number of persons, women and children, who would not be able, without that circumstance, to engage in any work, ever so little remunerative.

GOVERNMENT ACTION REQUIRED.

I think it would be desirable for the Government, I. To place at the command of the coast-guards a number of steam launches, the only boats which can pursue with success the pillagers of our natural beds. II. To regulate the dredging of these beds in such a manner that none of them can be fished except once in three years. III. To recommend to the competent authorities a greater severity in the punishment of thefts committed to the prejudice of the oyster-culturists. IV. To diminish the rent required from the concessionaires of parks in the Breton region, so that the amount of this tax will not surpass that asked from those of Arcachon Bay.

ADVICE TO OYSTER-CULTURISTS.

In regard to the advice to be given to the oyster-culturists, such advice will naturally find its place in the course which you have seen fit to institute. The persons who are engaged in this industry can, moreover, do much by themselves. In this order of ideas I will point out the foundation of oyster-cultural societies. The oyster-culturists of Auray have had the idea of grouping themselves together thus. Their reunion, which has taken the name of the Ostreacultural Society of the Bassin d'Auray, has already furnished excellent results. This society publishes a monthly bulletin, and, moreover, has founded an oyster-cultural museum of great interest to all those who concern themselves with questions pertaining to the cultivation of oysters. This example should be followed in all the oyster-cultural centers.

ACKNOWLEDGMENTS.

Such are the facts, Mr. Minister, to which I would desire to direct your kind attention. In concluding, permit me to tell you how much I have been aided in my researches by the agents of the maritime admin-

istration. M. Broquet, lieutenant commanding the man-of-war *Moustique*, MM. the naval commissaries Senné-Desjardines, Lhopital, Gestain, and Castelin, have procured for me valuable information. If I have been able to record in this report some facts possessing interest, I certainly owe it to the kind complaisance which I have met with from the persons whose names I have just mentioned.

PARIS, *October* 30, 1881.

47.—A NOTE ON THE CUBAN EEL.

By SETH E. MEEK.

In Poey's Synopsis Piscium Cubensium and Enumeratio Piscium Cubensium is recorded a species of the genus *Anguilla*, *Anguilla cubana* Kaup. With a view of testing the characters assumed to distinguish this from our species of the same genus. I have carefully compared specimens collected by Professor Jordan in Cuba with specimens from Wood's Holl and one specimen from Chewalla Creek, Alabama, and am unable to find any constant difference. I have also compared these specimens with a number brought from Venice by Professor Jordan last summer. They present the same difference found to exist in specimens from both sides of the Atlantic examined by me last May (Bull. U. S. Fish Comm. 1883, 430). In my opinion *Anguilla cubana* cannot be considered as a distinct species, but as strictly identical with the *Anguilla rostrata*. Below is given a table of eleven specimens, two from Cuba, three from Wood's Holl, one from Eufaula, Ga, and five from Venice. The proportions are given in hundredths of the length to end of last vertebra. All the specimens mentioned are in the museum of Indiana University. I am indebted to Professor Jordan for valuable aid.

Dimensions.	Locality.											Average of Cuban specimens.	Average of Venice specimens.	Average of Wood's Holl specimens.
	Havana.	Havana.	Wood's Holl.	Wood's Holl.	Wood's Holl.	Eufala, Ga.	Venice.	Venice.	Venice.	Venice.	Venice.			
Length of head	13	13 3/4	13 1/2	14 1/2	13	12 1/2	11 1/2	11 3/4	12 1/2	12	12 1/2	13 3/8	12 1/10	13 7/8
Distance from end of snout to front of dorsal	34 1/2	35 1/2	35 1/2	34 3/4	34	31	27	30	28	30 1/2	29	35	28 1/2	34 7/8
Distance from end of snout to front of anal	44 1/2	45	45 1/2	46	44	42 1/2	42	44	42	43 1/2	43 1/2	44 3/4	42 1/2	45 1/8
Distance from front of dorsal to front of anal	10	9 1/2	9 1/2	11 1/2	10	11 1/2	15	14	14	13 1/2	14 1/2	9 3/4	14 1/2	10 1/2
Length of mandible	5 3/8	6	6	6 1/2	5 1/2	5	4 1/2	4 3/4	5	5 1/2	5 3/8	5 3/8	5 1/10	6 3/8
Length of pectoral	4 1/2	4	4	4 1/2	4	4	3 3/4	3 3/4	4	4	4	4 3/8	3 1/10	4 1/16
Depth of body at front of anal	6	6	6	6	5 1/2	5 1/2	5 1/2	5 3/4	5 1/2	6 1/2	6 1/2	6	5 1/10	5 3/8
Distance from gills to vent	31 1/2	30	30 1/2	31 1/2	30 1/2	29	30 1/2	31	29 1/2	31 1/2	31 1/2	30 3/8	30 3/8	30 1/2
Length of specimen in inches	18. 1	16. 2	13. 1	21. 7	4. 45	7	11. 8	11. 5	9. 6	22. 4	21. 1	....	...	....