XXXII.—AN ACCOUNT OF THE PORTUGUESE AND FRENCH OYSTERS CULTIVATED IN THE BAY OF ARCACHON.

By J. RENAUD.*

A.—AN ACCOUNT OF THE PORTUGUESE AND FRENCH OYSTERS.

The oyster (*Ostrea edulis*) is a mollusk belonging to the class of *Lamellibranchiates*. To form an adequate idea of its admirable conformation, it is necessary to study it with the microscope.

The oyster is widely distributed in nature, each marine province counting one or more species in its fauna. Usually grouped in places most favorable to their development, they form considerable accumulations, known under the name of *Banks*. The immense consumption of this mollusk, principally in Europe and America, may give some idea of its fecundity, for its abundance does not seem to diminish in spite of the large quantities taken from the sea.

The oyster which we now call the Portuguese was known to, and esteemed by, the ancients; the citizens of Athens regarded it as a dainty, and used its shell to write their votes upon. Subsequently, among the Romans, we find Pliny congratulating one of his friends on being at Marseilles, where he could have fresh oysters.

The shell of the oyster is especially recognized by its irregularity; living attached to sub-marine bodies it takes the imprint of them, and individuals of the same species are infinitely modified in consequence of the numberless accidents of position which they assume on the bodies to which they are attached. It is, therefore, necessary to examine a large number of individuals in order to recognize a species and learn its distinctive characteristics. One characteristic of oysters is the inequality of their valves, the one which adheres to foreign bodies being always the larger. These valves have received the name of upper and lower, in consequence of the usual position of the oysters; the lower valve is the larger, the upper one is also called the operculum. Nevertheless, in the study of this mollusk, I shall follow the rule laid down by zoölogists for the study of bivalve shells in general, that is to say, I will suppose the animal to be standing upright before me. In this position the large valve is on the left, the small one on the right, while the

*Notice sur L'Huitre Portugaise et Française cultivée dans la Baie d'Arcachon. Arcachon, Imprimerie E. Faure et V. Aumassanne, 1878. Quarto pamphlet, 33 pp.

upper edge, comprising anteriorly the hinge which unites the shells, is extended as two somewhat conical prominences called umbos or beaks. The beaks in the Portuguese oyster are unequal in the two valves; the left one is always the larger. They are each marked by a groove, varying in size, in which an elastic ligament, for opening and shutting the valves, is firmly fastened. This groove is also frequently marked with ridges and furrows, of greater or less width, which follow its direction and indicate the successive lines of growth.

The edges of the valves in the Portuguese oyster present very considerable variations; sometimes that of the larger valve is undulated, striated, or denticulated. If the oyster is an old one, the smaller valve partakes of the modifications undergone by the larger one, so that it often happens that the shells are marked by corresponding indentations. Their interior surface is smooth, almost always white, and often pearly toward the center; a little back of and above the center, however, there exists an oval depression. This is the point of attachment of the central muscle which connects the valves together. In studying the structure of the shell of the Portuguese oyster, it is sufficient to saw or break the shell in two, in order to become convinced that its structure is foliaceous, that is, formed of successive layers. There are two reasons why the specific gravity of this shell is not high. The first is, that rather broad spaces often intervene between the laminæ of which the shell is formed; the second is, that the laminæ themselves are to a large extent composed of a white, porous substance whose specific gravity is exceedingly low. In the Portuguese oyster the laminæ, which are irregularly distinct, are piled upon one another like partitions. This laminated structure arises necessarily from the organization of the animal, and it is known that the interspaces contain an acrid water, resulting from a depuratory secretion. This phenomenon is, moreover, common among the mollusks.

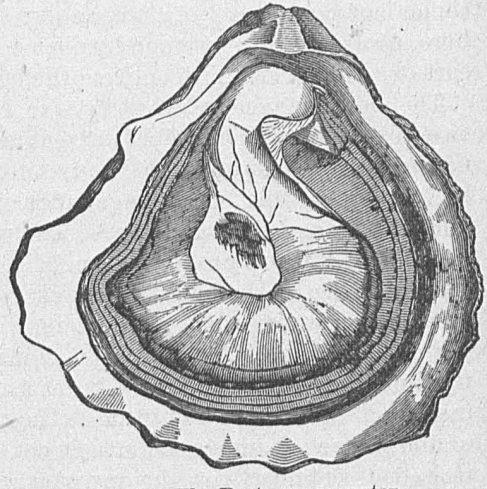

FIG. 1.—The Portuguese oyster.

Let us now carefully open the Portuguese oyster. In the first place we must break the solid, dark-brown ligament which, like a hinge, attaches the two valves together. But even now the valves do not separate. A sharp instrument must be inserted between them, so as to cut the cylindrical muscle connecting them near the center.* The ani-

[* This is not the way oysters are opened in America. The process is reversed; the muscle is first cut with a knife when the hinge is broken apart.—ED.]

mal then appears to have nearly the form of its shell, being usually oval in shape, and with its anterior extremity towards the narrow part of the shell. If after death, it is placed in water, so as to allow its parts to float, one sees in the center a mass of organs, separated by the contractor muscle noticed above, around which are attached large striated and whitish laminæ, which may be compared to the gills of fishes. Finally, the entire body is covered with a thin, transparent skin, whose edges are blackish in color and thickened, and correspond to the edges of the shell during the life of the animal. This membranous envelope, which is called the mantle, has its edges free and detached throughout almost the entire circumference of the body. On the sides it adheres to the principal organs constituting the abdominal mass. It serves at the same time to cover the oyster and to secrete its shell. Its thickened edges are of a muscular nature, and are also provided with secretory glands. Its main portion is formed of two very thin membranes united by a vascular tissue, which, when injected, presents to view a beautiful network of fine ramifications. In that portion of the mantle which is in contact with the shell there is also to be seen an organic web, in which calcareous granules are secreted in great abundance. It is these secretions, which, becoming detached, together with the organic matter enveloping them, increase the thickness of the shell, forming one by one the laminæ above described. If one tries to open the mantle he can turn back its lobes as far as the central muscle, but from here inwards to the anterior extremity, where the mouth is, it forms a sort of cowl inclosing the other organs of the mollusk.

The mouth is recognized at once by its transverse position and by the two thin membranous lobes accompanying it. These lobes are continued on each side of the body into a pair of narrow, lance-shaped labial palps or lips, which are smooth on the outside and marked with oblique striations on the inside. The mouth is a simple opening, which the animal can contract by means of a small sub-circular muscle; it is followed by a very short œsophagus ending in an ovoid pouch with membranous walls (the stomach), into which open the bile ducts from the liver. A more important opening near the lower extremity of this stomach is the entrance to the pylorus. Here begins a slender intestine, which descends through the thick portion of the liver, in front of and somewhat under the muscle connecting the valves together; then it ascends obliquely towards the back, passes above the stomach till on a level with the mouth, and finally, bending upon its course, returns, passing over the upper side of the muscle, at the middle of which it terminates in an anus, situated between the lobes of the mantle. The liver, which is the principal organ of the oyster, constitutes a considerable portion of the visceral mass and is easily recognized by its dark greenish color. The organs of circulation and respiration can only be examined after they are injected with mercury. The heart is easily distinguished by the blackish color of its auricle, and from the fact—very rare

among acephalous mollusks—of its being entirely independent of the digestive system; although placed in the ventral region, it has no connection with the intestines. The gills, or breathing organs, four in number, are in the shape of large laminæ nearly equal in size and with transverse striations; they are arranged symmetrically, two on each side of the body. When viewed from behind, four rows of large and perfectly regular quadrangular openings are seen. These openings pass through the gills in the form of canals, in which the fecundated eggs accumulate at the spawning time, in order to undergo a sort of incubation.

The organs of reproduction consist of an ovary placed along the sides and upper portion of the head end of the body, and which finally, as it becomes developed, almost entirely covers the abdominal mass. The oyster is hermaphrodite, that is to say, combines the two sexes in one and the same individual. The organ of generation, which is scarcely visible during the winter, is nevertheless distinguishable in the form of a milky spot covering a portion of the liver. In the spring almost the entire upper portion of the creature has assumed a whitish color; the zoosperms appear; and their presence effects fecundation. The oyster yields from 50,000 to 60,000 eggs, more or less.* They are spherical and can only be seen by the aid of a microscope The embryo develops rapidly, is soon provided with vibrating cilia at the anterior end and swims round and round; finally it settles upon some solid object, perhaps on an oyster shell, to which it attaches itself and begins to grow. At this time the body of the oyster, being extremely soft and its shell very thin, the valves take the impress of the body upon which it happens to fall and fix itself, and preserves the shape so assumed ever after.

B.—A NEW MIXTURE TO BE PLACED UPON COLLECTORS.—PRESERVATIVE BOXES.

Without wishing to repeat what is already known or to treat of a subject which has been handled by others, I shall in a few lines render homage to those intelligent and laborous workers who by the rational application of new methods have greatly contributed to the development of oyster culture. I propose to speak of the new collector or apparatus for collecting the "fry," as soon as it is set free by the parent oysters and preserving it from destruction.

It is but a few years since the only methods in use were the following: In Lake Fusaro, in the province of Naples, where the oldest artificial oyster banks were established, and on our coasts of Brittany, Cancale, Saint-Brieuc and Arcachon, the oysterculturists did nothing to collect the spat beyond placing bundles of whitewashed fagots in the water, anchoring them by means of stones. The spat lodged upon these fagots, after which the breeder had only to take them from the water, when as

[*Now known to yield a much greater number.—ED.]

they were shaken many of the young oysters fell off. I leave it to the reader to imagine what quantities must have been lost in this primitive and imperfect practice. Stone blocks were also used, as were tiles, slates, and wooden shingles, but all these collectors were defective and insufficient. It was almost impossible to detach young oysters adhering to a very hard body without breaking them, or at least doing them much damage; wooden collectors present contrary disadvantages; the point of attachment of the oyster being too weak renders them too easy a prey to the crab, their most dreaded enemy, which, with its very delicate instinct, always attacks this mollusk in its most sensitive part.

Mr. Michelet, an oysterculturist of Arcachon, and a thoroughly practical man, wishing to remedy these two serious inconveniences, conceived the idea of covering the collectors with a mortar, consisting of lime and sand mixed with a small amount of cement. In this mixture half-cylinder tiles are soaked until they are covered with one or more layers of it. These tiles thus prepared are dried for several days in the sun, and are then carried to the park, where they are placed in five or six rows, forming hives of from fifty to sixty tiles; these hives are surrounded by strong stakes, which are firmly fixed to prevent their being overturned or carried away by the rapid currents. The water passing through these tiles is arrested there and an eddy formed, which permits the young oyster to attach itself to the collectors by means of its little vibrating cilia. There the embryo becomes developed, increases in size, and attains the adult age, which is a year and a half, and not three years,

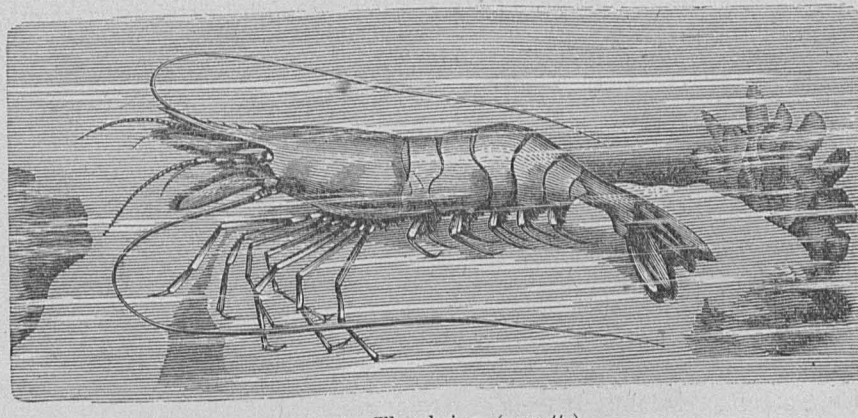

FIG. 2.—The shrimp (*crevette*).

as has been stated by certain parkers, whose opinion in the matter (as we know from numerous and thorough experiments) is entirely erroneous. Towards the close of the year women detrocate them (this term, when used in oyster culture, signifies detaching the oyster) by means of knives designed for this purpose, which they very carefully insert between the young mollusks and the tile to which they are attached. The young oyster, thanks to the covering of mortar, is easily loosened without suffer-

ing much damage. When this industry was in its infancy, and especially after the first trials of these implements, before hard experience had yet taught its costly lessons to the imprudent, a great many producers threw these young oysters, improperly detached, into their basins. Either because the tiles were not properly covered, or because the oyster had been injured in detaching, a majority of the persons engaged in this industry lost almost their entire work through the ravages of the crab, the *cormailho*, the shrimp, the *vive*,* and the numerous other enemies of the oyster.

In view of these serious disasters, numerous experiments were made by the various oysterculturists, but generally without success. After many attempts and trials, M. Michelet fortunately invented a wooden box, about one meter in length, by half a meter in width ($3\frac{1}{4}$ by $1\frac{5}{8}$ feet), covered at the top and bottom by a rather fine metallic netting, which permitted the water to circulate freely, and bring to the oyster sufficient nourishment while protecting it against the voracity of its numerous and dangerous enemies. In this connection we will reproduce a few lines taken from a work on oysterculture, printed in 1866, with which, on this point alone, we are entirely at variance. This passage, which we will quote in full, asserts that the enemies of the oyster are innumerable, but that they can do nothing in the face of the immense power of reproduction of the oyster. Many oyster breeders might reply to this assertion by figures, showing conclusively the serious and irreparable losses resulting from these numerous enemies of the oyster, which the following lines appear to disregard, although certainly without reason.

M. Davaine says, in a treatise which we have before us, page 78: "Of mollusks, *Nassa reticulata*, *Murex tarentinus*, and probably several other

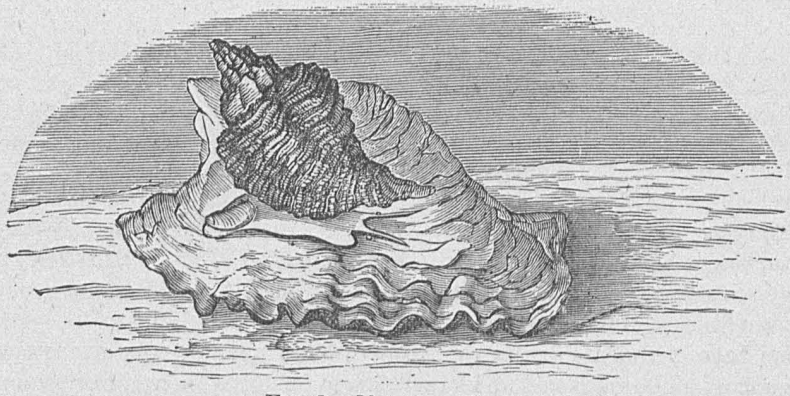

FIG. 3.—*Murex tarentinus.*

related species perforate the shells by means of their lingual teeth, introduce their proboscis and suck the oyster through this little opening; the latter becoming sick or weakened partially opens its valves; the crab comes * * * and others with him, and all disappears.

[*Probably *Trachinus draco*, Linn.—ED.]

"Now, let us at once declare that these numerous, implacable, and bitter enemies are not to be feared; they neither increase nor diminish—they are always the same, to-morrow as to-day, as yesterday; they will devour in vain, for they will be powerless to stop the prodigious multiplication of the oyster.

"Their number can only be compared to the grains of sand on the sea-shore, yet the spat is infinitely more numerous.

"Moreover, every imaginable means that could be used against these enemies would be illusory and powerless. It is in vain to struggle against a natural law.

"The evil does not exist."

In 1866 when the above lines were written, this theory might perhaps have been admissible, and it was possible for an oysterculturist to express himself thus; but now, in 1876, the progress and extent of oyster-culture, the invention of the covering for collectors, and of preservative boxes, are the most direct refutations that we can array against the passage quoted. In order fully to convince the reader and to prove to him that we are right, we will say a few words concerning the boxes and their use. M. Michelet calls his boxes *ambulances ostréophiles*, their principal object being to serve as infirmaries for the oysters that may have been injured by the knife of the clumsy *detrocatrix;* and by isolating them, to permit them to repair the damage done to their shells. After remaining for a few days in these reparative boxes, the oysters are thrown into basins called *claires*, where they grow until the time for selling arrives, when, leaving their protective asylum, they go to enrich the tables of the epicures of Europe and America, who, when tasting them, little think of the amount of care and labor which they cost their producers before reaching the palace of the gastronomer.

C.—THE PORTUGUESE OYSTER FROM A COMMERCIAL AND OYSTERCULTURAL POINT OF VIEW.

The Portuguese oyster has already become of great importance as an article of food and of commerce.

Not long ago Messrs. Garrelon, Grenier and Dasté, oysterculturists of the basin of Arcachon, all of whom are now known as maritime culturists at the head of the basin, were engaged in its cultivation on a large scale, and derived great profit therefrom. Several have been so pleased with their success in this line that they have said to me within a few days, "if the Portuguese Government would send us a few cargoes of oysters, we could, after selling them, give them a fair share of the profits." These words, which are from very competent oysterculturists, demonstrate sufficiently, that in spite of its detractions the Portuguese oyster is sold in large quantities and with profit, since the great quantity raised is insufficient to meet the demands of its numerous consumers.

This oyster, when young, differs in taste from the French oyster, that is to say, from the oysters of the basins of Cancale, Saint-Brieuc, and Arcachon; but it is nevertheless highly esteemed and much sought after in the interior of France, and in many districts in which the culturists have sold and are still selling considerable quantities. We might cite, for instance, a culturist of Arcachon, who, a few years ago, had buyers at Lyons, Limoges, Marseilles, Grenoble, and at all the great centers, whose purchases amounted to 27,000 francs ($5,200) during the oyster season, that is, during a period of six months. The Arcachon oyster has a finer and perhaps richer flavor, but the Portuguese, according to the testimony of physicians, contains more compounds of iodine and operates upon delicate and diseased chests more speedily and more beneficially, especially in the case of the various physical affections. It may, according to epicures, be seasoned and cooked in various excellent ways.

In oysterculture this oyster offers to breeders great advantages over the French oyster, as it speedily attains the adult size, and is thus sooner fitted for the market. In short, while the French oyster cannot be sold to consumers until it has reached its third year, the Portuguese oyster in two years attains the size and quality most favorable for its sale, for at that age it is always above the prescribed size of five centimeters (2 inches), and having become adult its flesh then is fine and delicate. In addition, it results from this rapid growth that at the age when the French oyster has still everything to fear from its natural enemies, such as the crab, *cormailho*, shrimp, &c., the Portuguese oyster has a shell of sufficient strength to protect it from the attacks of these animals, and there is no need of resorting to artificial means of protection, which are always so costly. For these reasons, the Portuguese oyster offers to breeders at least double the advantages of the French oyster.

Finally, allow me to pay it a tribute of gratitude in this little book. All oysterculturists know that during a period disastrous to our industry, the bays of Arcachon and Brittany were, from various causes, depopulated, oysters became scarce, and could hardly be obtained at all. Then France had recourse to the coasts of Portugal; we went there and obtained the precious mollusk in large cargoes, in order to restock our depleted oyster-beds. If, therefore, our parks are now so richly stocked, we owe it in a great measure to the Portuguese oyster, which, coming to the aid of the French oyster during the oystercultural season of that time, rendered it possible to restock our oyster-beds.

No one is ignorant of the fact that the shell of the Portuguese oyster is very useful for manufacturing purposes; it furnishes mother-of-pearl in abundance, from which beautiful fancy articles are made; it is also very serviceable to agriculture as a superior fertilizer, inasmuch as it contains a large quantity of phosphate of lime.

D.—PROTECTION OF "CLAIRES," OR OYSTER BASINS, BY MEANS OF OVERHANGING STRIPS AND WIRE SCREENS.

A large number of oysterculturists lose the greater part of their young oysters, or find them often endangered, from the want of proper means of protection. When spring arrives the *tère*, *thouy*,* and many other rapacious fish which are fond of oysters, invade our bays, and create great havoc. "But," some will say, "we have done everything, and our efforts have proved powerless against the numerous and voracious enemies; nothing can save us from them." After many attempts, I have just devised a method of protection, which may be easily arranged, and which serves to shield the mollusk from the attacks of crabs and other oyster-eating animals. The following means are apparently the best, and I will briefly describe them:

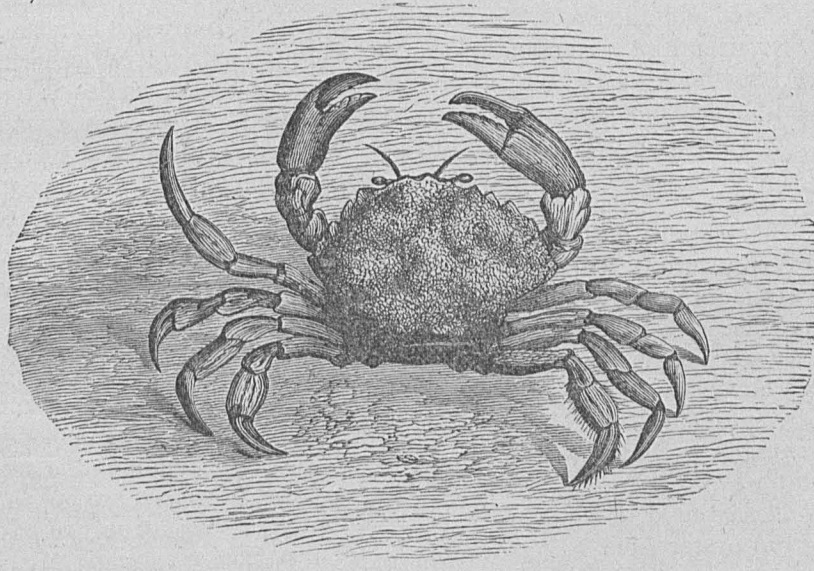

FIG. 4.—The crab.

Over the walls of my *claires*, which are built of tiles and a very resisting clay, I fasten from the base to near the middle boards, about twenty centimeters (7½ inches) in height, bound together on the inside by means of strong stakes driven in at a distance of a meter (3¼ feet) apart; and in this way I arrange a block of five or six *claires* touching one another, the continuity not being interrupted either below or between the boards. Along the upper edge of the boards, and jutting outward from them, I fasten a strip of zinc about eight millimeters (one-third inch) wide, which is firmly held in place by a small lath. The crab,

[*I have not been able to identify these fishes from their vernacular names.—ED.]

attracted by the young oysters in the *claires*, climbs along the board, but meeting with the little projecting band of zinc on which his claws can get no hold, he slides off and is precipitated outside the claire; he exhausts himself in vain efforts to enter, and the oyster meanwhile flourishes, secure from his attacks. This contrivance may be made either of wood or of zinc, according to the desire or means of the breeder; but zinc, although more costly, is far preferable.

But even now, protected from the crab, the oyster harvest is not yet sure; for there is much to fear from the predacious fish already referred to. These other enemies do not crawl, but swim; and at high tide pass over the obstacle just described; coming in large schools, they devour millions of young oysters in a single night; alas! we have just had a sad proof of this in the Arcachon basin. In order to arrest their invasion, I arrange small iron hooks along the zinc band at intervals of about twenty centimeters (7½ inches), and also at the same distance apart upon the two longitudinal sides of the *claires*, which are opposite to one another. The keeper of the park, bearing a large roll of galvanized iron wire upon his arm, attaches the extremity of the wire to the first hook; a second workman, unrolling the wire, carries it to a third upon the opposite side; the latter attaches it to the corresponding hook which is before him, and then fastens it securely to a second hook; the man with the wire carries it back to the keeper, who repeats the operation. This work is continued until all the *claires* are covered with this metallic net-work.

Oysterculture is still in its infancy, and it is only after many fruitless attempts that we have been able, by a slow course of study, to discover, successively, the collectors, the proper coverings for the tiles, the preservative boxes, and the different methods of raising and breeding, which have served as the fundamental basis of our oyster industry; and it is by pursuing the same course that we have demonstrated the immense advantages presented by the use of the zinc protector and metallic net-work for *claires*. In fact, the results we have just described are not the only ones secured by these arrangements, for they serve, not only to prevent the oyster from being devoured, but also from escaping. Many persons are tempted to consider this assertion as a pleasantry, yet nothing is more true. During the prevalence of extreme heat the basins are covered with a greenish growth, called "*gouëmon*," or "*Arbre de mer*" (sea tree), which becomes attached to the mollusk. This seaweed increases in size, and finally, by reason of its specific gravity floats, carrying with it the oyster to which it adheres, and transferring it from our basins to a neighboring park, or to the bottom of the channel outside. The metallic net-work prevents this escape; the *gouëmon*, or sea tree, raises the oyster as it did before, but, meeting with the wires which cover the *claire*, it attaches itself there, becomes dry in the sun or air, at low tide, and having no longer strength to retain its prey, the

oyster falls back into the *claire*, leaving it for the waves to carry off its ravisher at the next high tide.

To complete the enumeration of the advantages of our system, we will remark that there is still another one, not less important, to which we would call the attention of our readers; it is, that theft is rendered very difficult, if not impossible; oyster thieves can no longer dredge the *claires;* in order to rob them, they must cut or saw the metallic wires, which operation would require much time, would make a noise, and give the alarm to the guard, thus enabling him to defend the property entrusted to his care; a robbery of this kind would, moreover, come under the head of burglary. We will mention, as another advantage, the protection which the seaweed, stopped by this net-work, gives to the oyster by shielding it from the violence of the sun during the extreme heat of summer; for the heat of the sun may cause the loss of a great number of oysters, both large and small. We therefore persist in saying, and our own experience has sufficiently demonstrated the fact, that the zinc bands and the metallic net-work for *claires* are destined to become two efficient adjuncts of all the various kinds of apparatus which have thus far been used in oysterculture in our basin of Arcachon.

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