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GUIDE TO THE TOUR OF THE CENTRES OF OYSTER AND MUSSEL CULTURE

IN FRANCE

adapted and translated from contributions by:

J. le Dantec "Renseignements essentiels sur l'ostréiculture dans le département de la Gironde."

P. Trochon "L'Ostréiculture dans la région de Marennes-Oléron."

L. Marteil "Note sur l'ostréiculture en Bretagne-Sud."

J. Audouin "La mytiliculture en Baie de l'Aiguillon."

by

P. Korringa

I. OYSTER CULTURE IN FRANCE

General Outline

1) Cultivation of Ostrea edulis, the European flat oyster:

The coasts of France were once fringed by very important natural beds of the European flat oyster, Ostrea edulis, yielding well over a 100,000,000 oysters annually. Overfishing and wasteful methods led to depletion and destruction of this natural resource. In the middle of the 19th century, the situation became so alarming that the emperor Napoleon III invoked the assistance of Professor Coste of the Paris university. Professor Coste made a careful survey and advised - inspired by a system of oyster culture he saw in the Lago Fusaro near Naples - to suspend the fishing of oysters on the badly depleted beds and to initiate the cultivation of oysters. This advice, given 100 years ago, and the large scale experiments following it, led in due course to a remarkable revival of the French oyster industry. Year upon year collectors, adapted to local conditions, are immersed in the water to offer the oyster larvae a site for attachment. The young oysters thus produced are grown on duly protected private beds until they approach the marketable size. The next phase of cultivation consists of the fattening procedure through which the oysters should acquire a prime condition and an outstanding flavour.

The three phases of oyster culture in France - spat production, growth, and fattenin are not necessarily carried out in one and the same area. In fact spat production in Ostrea edulis is almost entirely confined to two districts: the estuaries and inlets of the Morbihan (on the S.W. coast of Brittany) and the Basin of Arcachon (40 km S.W. of Bordeaux). In these two centres hydrographical and biological conditions are very conducive to the production of oyster spat. The type of collector used is predominantly the limecoated roofing tile. After detachment from the tiles the oysters are grown on well kept beds or parcs. When the oysters thus produced are two or three years old, many of them are transferred to parcs in other areas where conditions for growth and fattening are more promising, e.g. to the numerous parcs in the Charente Maritime (Marennes, Le Tremblade, Isle of Oléron) and to beds in various estuaries of northern Brittany. Few bodies of water are conducive for a perfect fattening of the marketable oysters, fewer still for the development of the much sought after flavour accompanying a green coloration of the oyster's gills and mantle. The Marennes district with its claires (fattening ponds) and the beds of the Belon river in Brittany are renowned; but also the hanging cultures of the Etang de Thau (on the Mediterranean coast of France) may yield oysters of excellent quality.

2. Cultivation of Gryphaea (Crassostrea) angulata, the Portuguese oyster:

The penury of flat oysters caused by the serious depletion of the natural beds in the 19th century led some Arcachon oystermen to import Portuguese oysters to stock their beds. The Portuguese oyster from the Tagus estuary differs, in many respects, from the flat oyster native in France. Flat oysters are larviparous, prefer rather clear water of high salinity, and prefer to live at low water level or deeper still. The Portuguese oyster, on the other hand, is oviparous and resembles in many other respects the American Atlantic oyster (G.virginica) and the Japanese oyster (G.gigas). It requires higher water temperatures for the initiation of spawning than Ostrea edulis, the flat oyster, thrives in rather turbid water, can stand rather low salinities, and lives in the intertidal zone. In many respects it is a typical estuarine species. It is hardier and of faster growth rate than the flat oyster, but does not acquire the supreme flavour of the latter.

In 1868 a shipload of Portuguese oysters, destined for Arcachon, was dumped in the Gironde estuary. The ship had sought shelter for a gale, and the oysters began to deteriorate. The surviving oysters met with highly conducive conditions, and before long the rocks in the intertidal zone became covered with Portuguese oysters. Soon the species spread further North to the area of La Rochelle and the Isle de Ré, later to the entire coast of the department Charente Inférieure. Finally the rapid spreading came to a stand still at the mouth of the Loire river. Further North its reproduction becomes erratic and winter kills may be excessive in the intertidal zone, so that there is little reason to fear that the flat oyster of Brittany will be ousted by the Portuguese oyster.

Several of the newly developed natural beds of the Portuguese oyster became so productive and important that they could nourish a new industry, the cultivation of the Portuguese oyster. The oysters taken from the natural beds are reteid on parcs and in

claires, predominantly in the Charente Maritime (e.g. Marennes, Le Tremblade, Isle of Oléron). In the Basin of Arcachon one collects spat of the Portuguese oyster with tile collectors. Adequate selection of time and place to immerse the collectors renders it possible to produce spat of either Ostrea edulis or Gryphaea angulata in the Basin of Arcachon.

Because of its lower costs of production, the marketable Portuguese oysters are considerably cheaper than the flat oysters. In our time production and consumption of Portuguese oysters in France surpasses by far that of the flat oyster. The Charente Maritime and the Basin of Arcachon are the main centres of production. Few are grown and fattened in Brittany.

3. Character of the French oyster industry.

Both the cultivation of flat and Portuguese oysters in France is predominantly in the hands of a great number of private oyster farmers, each of them having at his disposition a limited acreage of oyster parcs or claires. Large firms are virtually non existent. With the exception of the hanging cultures in the Etang de Thau (Mediterranean coast of France) virtually all the oysters are grown in the intertidal zone and practically all the work (spat collection,/and fishing of oysters) is done by hand at low tide, with the aid of small boats for transportation purposes. Therefore the prize of the oysters is in the very first place dependent on the costs of manual labour.
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II. OYSTER CULTURE IN THE DEPARTMENT GIRONDE

A. The Basin of Arcachon.

The Basin of Arcachon, situated 40 km S.W. of Bordeaux on the Atlantic coast of France, is a rather shallow body of water with a surface of over 15,000 ha (i.e.37,000 acres). 10,000 ha belongs to the intertidal area, so important for oyster cultivation. The perimeter of the Basin is over 80 km. Each tide the Atlantic Ocean pours into the Basin some 150 to 300 million m^3 of water through a channel about 6 km long (les Passes). This water is received by a great number of branching secundary channels, and flows ultimately, steadily decreasing in current velocity, over the extensive intertidal flats.

Historical:

The natural beds of flat oysters in the Basin of Arcachon date from prehistorical times and were once very productive. A special type of flat oyster, the highly esteemed "gravette" abounded here. The annual production, being about 75 million oysters early in the 19th century, showed a rapid and alarming decline in the middle of that century. A turning point came 100 years ago. On Coste's advice the Government provided a strict surveillance of the remains of the natural beds. Many millions of oysters were purchased (especially on the North coast of Spain, which led in its turn to a serious depletion of the local beds!) to restock the depleted beds, and various types of collectors were used in effort to step up the production of spat. The Government installed several model oyster farms to demonstrate the oyster fishers how to become an oyster farmer. Though the production of the natural beds in Arcachon did never regain its former importance, the output in cultivated oysters soon reached a remarkable height, especially after the development of the lime-coating of tile collectors, an invention of an Arcachon oysterman named Michelet (1867).

In the same period the Portuguese oyster was introduced in the Basin of Arcachon. After the incidental establishment of prolific natural beds in the Gironde estuary, the Arcachon oystermen obtained their Portuguese stock from the Gironde, and no longer directly from Portugal. About 1875 they relaid some 25 to 30 million Portuguese oysters from the Gironde estuary on their 1100 parcs (together 800 ha.) in the Basin. The cultivation of Portuguese oysters became so important in the Basin of Arcachon that measures have been taken to protect the cultivation of flat oysters (1914, 1921). The imposed boundary did, however, not lead to a serious reduction in the stock of Portuguese oysters in the Basin. This was fortunate for the oystermen when the flat oysters suffered terrible losses during the disastrous mortality of 1920-1921. The decrees imposing restrictions in the cultivation of Portuguese oysters have been revoked (1925,1933). The stock of flat oysters has been replenished with Brittany oysters, and nowadays both species thrive in the Basin.

The present day situation:

In 1952 the number of parcs (concessions) in the Basin of Arcachon mounted to 5,600, covering some 1300 ha. Of those some 500 parcs, covering 120 ha are used for the cultivation of flat oysters. 1800, predominantly small parcs (together 130 ha) are used for the production of spat. The other 3800 parcs (1170 ha) are used for the rearing of young oysters to marketable oysters to oysters for relaying in other districts. The concessions are in the hands of 2400 lease-holders (of which 1461 are mariners, "inscrit maritimes") using a total of 2098 boats. To which extent the cultivation is in the hands of small oyster farmers is demonstrated by the following figures:

Acreage exploited by the Arcachon oystermen:

Acreage	under	0.70 ha	1164 holders
"	"	0.70-1.00 ha	1050 "
"	"	1.00-1.50 "	153 "
"	"	1.50-2.00 "	28 "
"	over	2.00 ha	5 "

Over 15,000 tons of oysters are sold annually, of which only about 10% are flat oysters. Part of the oysters are destined for the consumption in France and abroad, others are sold as oysters for relaying to other centres of oyster cultivation.

Methods of oyster cultivation:

a) Spat production ("captage"):

From the time that the Arcachon oysterman Michelet invested the lime coating of the semi-cylindrical tiles, so that any spat caught could be easily and safely detached in a later phase of the cultivation, without damaging the tile, tiles are virtually the only collector used in the Basin of Arcachon. The number of tiles used increased steadily:

1869	286,600	tiles
1870	1,574,500	"
1871	2,439,400	"
1872	5,065,000	"
1873	5,300,000	"
1936	7,000,000	"
1952	17,000,000	"

The coating consists of a mixture of sand and lime. Some 100 to 120 tiles are piled up in open work wooden crates, measuring about 200 x 80 cm, at the banks of the channels. Thus a maximum of free surface is offered to the oyster larvae. The crates filled with tiles are locally called "ruches". Whether spat of flat oysters or of Portuguese oysters settles on the tiles depends to a large extent on time and place the tiles are exposed, the spat of Portuguese oysters settling several weeks later than that of the flat oyster. Every oysterman uses on an average about 6,000 tiles. In years with an excellent spatfall some 250 to 300 young oysters may be counted per tile (e.g. 1953).

b) Rearing of oysters ("élevage"):

In spring (april, May) the spat is detached from the tiles by manual labour. It is scattered on beds in the intertidal zone at a rate of about 1000 per m^2 (1000 spat weigh on an average from 1 1/2 to 2 kg). These beds are fenced in by wire netting (30 cm high) topped with board and surrounded by densely placed pine stakes("pignots") to keep out crabs and voracious fishes. In the course of their second winter the oysters are taken from the beds to be graded and to break up the clusters ("désatroquage"). The oysters are then about 18 months old. Flat oysters weigh from 6 to 10 kg per 1000 at 18 months, Portuguese oysters on an average 15 kg per 1000. Then the oysters are relaid at a rate of 200 to 300 per m^2. The oystermen do their utmost to protect the oysters against their enemies and to promote their growth. When the oysters threaten to become smothered by sand or silt, they turn them with a fork. Sea weeds, starfishes and drills (Murex) are repeatedly removed from the beds.

The fastest growers among the Portuguese oysters can be marketed at an age of 2 years, but more often the oysters are thinned out again and relaid at a rate of 100 to 120 per m^2 ("dédoublement"), which promotes their growth. Such oysters can be marketed at an age of 3 years. Flat oysters are somewhat slower. In both types of oysters there are, however, noticeable yearly variations in growth, which can only partly be explained in terms of density of population.

Problems of the Arcachon oyster industry:

1. Information is given on setting prospects in the course of the summer season.
2. Efforts are made to apply copper, D.D.T., and the like to control fouling of the tile collectors.
3. Cardboard collectors are used on an experimental scale in order to reduce manual labour in spat production.
4. Noticeable differences in growth (yearly and local differences) give reason for concern. Efforts are made to study the influence of the factors: population density and mineral enrichment experimentally. Experimental "claires" (fattening ponds) did not lead to success here.
5. Shell disease is rare in Arcachon - it only occurs in some oysters from the natural beds.
6. Some years the oysters are weak in autumn, which requires special care in keeping the oysters in storage basins prior to shipment.
7. Mollusc eating fishes (Trygon pastinaca, Leiobatus aquila, Leptocephalus congor, Pagellus centronotus) may cause havoc on the oyster beds. Efforts are made to keep them out effectively.
8. Some natural beds of Portuguese oysters in the eastern channels are maintained and protected because they are considered an essential factor in the production of spat.

B. The Left Bank of the Gironde Estuary.

In the year 1868 a shipload of Portuguese oysters (Gryphaea angulata) destined for Arcachon, but deteriorating while the ship sought shelter from a persistent gale, was dumped in the Gironde estuary. Not all the oysters were dead, and the survivers met with hydrographical and biological conditions so conducive for their well-being, that the rocks of the estuary became covered by Portuguese oysters. Important natural beds of this oyster came into being. In due course oysters for relaying could be harvested annually and on a large scale. Extensive natural beds, interrupted by few sand bars only, occupy the left bank of the Gironde estuary (belonging to the department Gironde) from Verdon (at the mouth) to Port de By (25 km upstream). These beds (the "crassats") rest on a silt bottom hardened by shells and some stones. The deepest parts of the beds form a natural reserve, for they are well below low water spring level, and currents are too strong there to use the dredge. On the shallow parts of the beds oyster collecting by fishermen on foot is allowed from November to April. The utensils used are "pichons" (picks with 2 or 3 teeth) and the "main de fer" (a kind of iron dipnet). On the somewhat deeper beds the use of dredges is allowed for a period of 15 days in April.

In the season 1953-54 about 3000 fishermen on foot working with some 450 "calups" (flatbottomed boats 6 m long, loading about 35,000 oysters) collected approximately 100 million oysters (1300 tons) to be used for relaying. About 80 dredgeboats from the left bank fishing ports fished in 10 days about 50 million oysters, weighing about 670 tons. In the same period 170 boats from the right bank fishing ports fished about 170 million oysters on the left bank beds, weighing about 2400 tons.

The total quantity taken from the public beds on the left bank in the season 1953-54 is therefore well over 4000 tons, i.e. over 300 million oysters for relaying. The fishermen are obliged to grade and decluster the oysters in the 300 "cabanes" (sheds) of the local oyster fishing ports, and to return empty shells and spat attached to those to the beds. The declustered and graded oysters are next shipped by commission agents to the centres of oyster rearing in the Basin of Arcachon, in the Charente Maritime (Marennes, Le Tremblade, Oléron) and in Brittany. Some 10% of the oysters fished on the natural beds are relaid on private parcs in the intertidal zone of the left bank of the Gironde, situated immediately above the natural beds. Some of these parcs are used to collect spat of Portuguese oysters with artificial collectors (limestone and iron).

III. OYSTER CULTURE IN THE DEPARTMENT CHARENTE MARITIME

The oyster districts of the Department Charente Maritime:

Of considerable importance for the oyster cultivation in the Department Charente Maritime are the extensive tidal flats along the eastern shore of the isle of Oléron, between the villages Boyardville and Saint Trojan. Further, the intertidal zone along the continental coast between the mouth of the Charente river in the North and the Pointe du Galon d'Or (South). Next, the beds of the Seudre river from its mouth to the village l'Eguille, some 20 km upstreams.

The total number of parcs used for placing collectors ("parcs à collecteurs") and for the rearing of oysters ("viviers") amounts to 22,500. As a rule the bottom of the parcs consists of rather soft silt, occassionally of a mixture of sand and silt. All the ground belongs to the "Domaine Public Maritime" and is leased to the oystermen for periods of 25 years by the administration of the "Marine Marchande". Usually the parcs measure from 0.10 to 0.15 ha (0.25 to 0.35 acres). Larger concessions are rare. The total surface of the parcs amounts to 2,500 ha (6,000 acres).

Many parcs suffer from perpetuel sedimentation. Whenever the level of the parcs becomes too high, they are abandoned; sometimes the oystermen undertake the ardous job to free such parcs from superfluous silt. To avoid congestion of the beds which remain in exploitation, one tries to create new parcs somewhere in the vicinity.

The fattening ponds or "claires" are situated at a higher level than the oyster parcs. Many claires are located at both banks of the Seudre river, others further seawards near Marennes and Le Chapus, others again on the isle of Oléron. The claires have been dug in a fertile clay soil; many were formerly exploited as salines. A system of channels and ditches connects the claires with the open sea, but only at high tides (coefficient over 70) fresh sea water pours into them. The total acreage of the claires, on both public and private property, amounts to 2,000 ha (5,000 acres).

The natural oyster beds of the Department Charente Maritime:

There are no more natural beds of flat oysters in the Department Charente Maritime, but the beds of Portuguese oysters are thriving. Fishery on these beds is strictly regulated.

In the north one finds the extensive beds of Port-des-Barques, situated on the rocks at the mouth and in the downriver section of the Charente river. Less important are the beds in some channels and affluents of the Seudre river. All these beds are exploited by fishermen on foot.

Further south one finds the important beds of Portuguese oysters of the right bank of the Gironde estuary. From Terre-Nègre (18 km upstreams of Royan) to Talmont one finds on a rocky bottom a nearly uninterrupted series of beds, often adjoining great depths. The deeper beds of Deau and le Boeuf are exploited by dredging.

Some boats of the Marennes and Oléron fishermen pass through strait Maumusson to reach the Gironde estuary to dredge there on the important natural beds near Verdon on the left bank (Department Gironde).

The Marennes oysterman also collect some Portuguese oysters for relaying from natural beds near La Rochelle, in the northern part of the department Charente Maritime.

Thus the natural beds yield the oysters for relaying on the parcs of Marennes and Oléron. In the same time the natural beds are of importance as producers of the oyster larvae which settle on the artificial collectors placed in this department.

Important transactions between oyster-fishers and oyster-farmers are accomplished in the colder season (October-March) through mediation of commission agents.

Artificial collectors:

Various types of collectors are used in the department Charente Maritime to collect spat of the Portuguese oyster; tiles devoid of lime coating, poles, slates, iron bars, branches of sweet-chestnut or walnut trees stuck in the mud, blocks of calcareous rock, oystershells strung on a wire or put in sacks of wire netting, kept above the muddy bottom by supporting them on racks ("berceuses"). The strength of the currents, the nature of the subsoil and the degree of sheltering influence the choice of the type of collector to be used. The collectors are placed in the mouth of the Charente River near Port-les-Barques; on the N.E. coast of the isle of Oléron; in the coastal area between the channels of Brouage and of Mérignac (due north of Marennes); and along the banks of the Seudre river. The collectors are placed late in June, in July (predominantly), sometimes as late as August. The Fisheries Institute provides information on setting prospects based on elaboration of plankton samples in the period May-October.

Contrary to the practice in collecting oyster spat with the aid of lime coated tiles in the Basin of Arcachon and in the Morbihan district, the young oysters produced in the department Charente Maritime are not detached from the collectors after their first winter. The young oysters are here detached and declustered after their second or third winter. This system is selected because the nature of the subsoil is in this district as a rule not suitable to rear small oyster spat on the bottom. A noticeable disadvantage is, however, that many young oysters settled on oyster shells or slates are smothered, and that others often develop disfigured shells through overcrowding. This makes the present system of spat collecting rather wasteful.

Cultivation of flat oysters (Ostrea edulis):

All the flat oysters reared and fattened on the parcs and in the claires of the department Charente Maritime are purchased as oysters for relaying of 2, 3 sometimes 4 years old, predominantly in Brittany (Morbihan), sometimes in Arcachon.

The claires (fattening ponds) must be specially prepared before oysters can be put in them. In the month of March the claires are drained, the superficial bottom layers are taken away, and the clay walls of the ponds are restored. The soil, exposed to the sun, dries out and cracks. Next a little bit of sea water is let in to saturate the bottom, later more. The bottom soon develops a homogeneous silt deposit. In the month of May oysters are laid out in the claires at a rate of 2 or 3 per m^2 and under some 30 to 40 cm of sea water, which does not drain away at low tide. Temperature and salinity are rather high in the claires, food is abundant, and in a good claire the oysters double their weight (initially 30 to 50 kg per 1000) within 6 months time. In a perfect claire the oysters develop an excellent creamy condition and often a green coloration of the gills. Thus are produced the world renowned Marennes oysters. The oysters in the claires do often, but not always develop the green coloration of the gills. The green pigment is derived from a small green diatom, Navicula ostrearia, which sometimes, but rather capriciously, carpets the bottom of the claires. Oysters grown in such claires develop within a short time the sought-after green pigmentation, and the accompanying special flavour, which increases their market value considerably.

Excessive evaporation in warm summers, and incidental drainage of the claires through perforation of walls and dams by crabs, may give reason for concern.

The limited total acreage of the claires and the small number of oysters grown in those per m^2 necessitate to grow large numbers of oysters in the parcs. The parcs (locally called "viviers") for flat oysters (450 parcs, together 63 ha or 150 acres) are nearly all to be found on the east coast of the isle of Oléron not far from the tower of Juliard in the places called "La Casse Dufour" and "La Casse Emeline". These parcs decover at low spring tides only (coëfficient over 90). The flat oysters are kept in these parcs for 1 or 2 years. They grow well as a rule, but do not fatten as well as those kept in the claires, and never develop the green pigmentation. A short sojourn in the claires, prior to shipment, may greatly improve their quality. Still, they cannot cope with oysters kept in the claires throughout the summer season.

The cultivation of Portuguese oysters:

The Portuguese oysters produced with artificial collectors or taken from the natural beds are relaid on parcs on the intertidal flats, at a low or medium level. The number planted per m^2 varies according to their size but on terminating their growth they may at most touch each other, but should never pile up on top of each other. They remain for

2 or 3 years on the parcs. In this period they are repeatedly raked up at low spring tides to promote a regular growth, to counteract smothering by silt or sand, to avoid their getting piled up through the action of waves or gales, and to free them from algae. The raking is done with a long shafted rake, or in the large parcs, with a harrow drawn by a motor boat. In the area exposed to strong currents and gales the parcs are surrounded by stone walls or fences of poles, some 30 to 40 cm high. Unfortunately the walls and hedges promote the silting. Therefore the Fisheries Institute advises to replace them by wire netting fences. Their growth completed the oysters are brought to parcs higher up in the intertidal zone called "depots", until they are either marketed or transferred to claires for further fattening ("affinage").

There are two types of Portuguese oysters from the claires. The "spéciales de claires" which sojourn from May until the next winter season in a claire at a rate of 5 to 6 per m^2, and the "fines de claires" which live in the claires from July to September at a rate of about 10 per m^2.

Like flat oysters Portuguese oysters may be put in green claires to give them in a rather short time the sought-after flavour accompanying the green pigmentation.

The marketing of oysters:

The oysters destined for the market, whether grown on parcs or in fattening ponds, are compulsory treated in a storage basin. In a "dégorgeoir", a basin made of bricks or concrete and filled with decanted sea water, the oysters throw out any silt which may be enclosed between the valves. Next they are washed exteriorly, often with water under pressure, graded (sometimes mechanically) and packed in wicker baskets or boxes woven of thin strips of wood. The packing is done in a special packing shed("cabane"). The "Service des Contrôles de l'Institut des Pêches" watches carefully over sanitary conditions in storage basins and packing sheds. From September through March daily samples are taken of oysters and water, which samples undergo bacteriological and chemical analysis. This work reaches a height in the month of December.

Only after a thorough topographical and bacteriological investigation a storage and packing establishment for consumption oysters may be inscribed in the "Casier Sanitaire" and receives a sanitary number. Any package with oysters leaving the packing shed should bear a special sanitary label on which the sanitary number and the date of shipment should be recorded.

The department Charente Maritime with its 713 establishments ships annually some 30,000 tons of oysters (both Portuguese and flat oysters) which amounts to nearly 60% of the French consumption.

Future development:

Oyster culture in the department Charente Maritime (Marennes, Oléron) is characterised by its traditional technique, its small private companies, and its excess of manual labour. It is true that transportation on the water and by road is practically completely motorised nowadays. Some machines made their appearance for washing and grading the oysters, next to pumps and conveyor belts. A machine to dig the claires has been constructed recently. New flexible types of collectors are tried out in order to develop a system of mechanical detachment of the young oysters to replace the costly and time devouring manual detachment and declustering. It is hoped that the near future will give the development of machines to fish the oysters in the claires, to grade the oysters rapidly, to count and pack the oysters and to label the packages. Mechanisation of all stages of the cultivation, from spat collecting to shipment will increase the production.

Experiments to promote the growth of the oysters, in order to increase the output, will be continued. The knowledge on the oyster's heredity and an ensuing selection, which has led to such magnificent results in other cultures, will probably lead in due course to stalwart types of oysters, resistant to diseases, and with improved market qualities.

IV. CONCISE OUTLINE OF OYSTER CULTIVATION IN SOUTHERN BRITTANY (not to be visited)

The Morbihan district in southern Brittany is by far the most important centre for the production of Ostrea edulis, the European flat oyster.

With the aid of about 12,000,000 tile collectors the oystermen produce annually some 150 to 400 million spat ("naissain") of flat oysters. In this 10 or 12 semi-cylindrical tiles are united to a "bouguet" with the aid of iron wire, and attached to a rather thin pole ("piquet"), next provided with a lime coating. When the lime is perfectly dry, and setting prospects are good, the "piquets" are stuck in 4 or 5 rows in the muddy banks of the Morbihan estuaries, so that the tiles are permantly kept above the mud. On an average every oyster farmer uses some 30,000 to 50,000 tiles. Detachment of the spat begins in November, and reaches a height in early spring.

The detached spat is reared on parcs in the intertidal zone. There are some 3,500 parcs, together 1800 ha (4,400 acres). Most of the oysters thus produced are sold to fattening districts (e.g. Belon river, estuaries of northern Brittany, department Charente Maritime) as oysters for relaying. Such oysters are 2, usually 3 years old, and about 3,000 tons of oysters for relaying leave the Morbihan district each year. Further, some 500 tons of consumption oysters are marketed directly.

There are two important fattening centres in Southern Brittany: the rivers Belon and Aven. Every year some 600 to 700 tons of flat oysters, 3 years old, are relaid on the parcs in these rivers, and marketed some 10 months later.

Most of the former natural beds of flat oysters disappeared completely, but serious efforts are made to revive some of them. The natural bed in the Pénerf is thriving and yields 30 to 50 tons of oysters annually.

The main enemies of the oyster are in the Morbihan district: the drill (Murex erinacea); the crab Carcinides maenas, which may cause havoc among the newly detached spat; the starfish Asterias rubens(locally), the oyster eating fish Myliobatis aquila and Polydora, the latter especially in the muddy upriver sections of the estuaries. Shell disease occurs locally. Anomia, Balanus, Serpulids and Ascidians are competitors for space and food on the tile collectors.

Since 1948 cultivation of Portuguese oysters is allowed in the rivers Pénerf en Ethel. Portuguese oysters 18 months old are relaid on about 100 ha (250 acres) of parcs in these river, yielding some 2,500 tons oysters annually, which are either shipped to fattening districts or marketed directly. This industry gains in importance.

V. MUSSEL CULTURE IN THE BAIE DE L'AIGUILLON

Origin and nature of the "bouchots":

The story goes that the "bouchots"-rows of stakes used in mussel cultivation in the Bay of Aiguillon - date back to the year 1235, and were originally created by the Irishman Patric Walton, who settled at Esnandes after being shipwrecked there. He observed that mussels settled profusely on the poles supporting his seabird-nets and switched over from bird-catching to mussel-farming.

Up to 1860 all the bouchots were V-shaped rows of stakes, 100 m long, which served in the same time as fish-weirs. One distinguished then 3 rows of bouchots, one inshore ("L'amont"), the second mid-way ("mi-loin") and the third seawards ("d'aval"), each row consisting of a series of V-shaped bouchots of similar size, placed parallel to each other.

When it was no longer allowed to use the bouchots as fish weirs, the V-shape was abandoned, and straight line bouchots made their appearance. Two types of bouchots are to be distinguished, the one 50 m long and consisting of a single row of stakes only is destined for collecting the mussel seed; the other 100 m long and with a dense wattlework of branches between the stakes serves for the rearing of mussel-seed to marketable mussels.

There are now 4 groups of bouchots in the Bay of Aiguillon:

1) The bouchots of the Passe d'Esnandes, l'Orpineau and la Carrelère. These can be subdivided in:

   a) the ancient bouchots.
   b) the rearing bouchots (with wattle-work); 5 lines of 100 m long, 25 m apart from each other.
   c) the collector bouchots, simple rows of stakes 50 m long, 25 m apart from each other, and 100 m apart from the rearing bouchots.

2) The bouchots of the right and left bank of the Sèvre river and of the Chenal Vieux:
   These are of rather ancient origin and are usually placed in one single row only. It is rearing bouchots on which the mussels grow particularly well, which is ascribed to a supply of fresh-water plankton.

3) The bouchots of the Pointe de l'Aiguillon:
   The first bouchots were placed here in the year 1890. Gradually more and more bouchots appeared and in the year 1950 there were already 13 of them. It was then observed that the growth of the mussels was poorer than before. The area was considered as "saturated" and a plan was made and executed to improve conditions by cutting out the 2nd and 6th row.

4) The bouchots of la Faute:
   There are here only seed collecting bouchots, for wave action would smash any wattle-work to pieces. Some bouchots are easily accessible, other more deeply placed, at low spring tides with north-eastern winds only.

In the year 1927 one counted a total of 276 km of bouchots in the Bay of Aiguillon, nowadays over 400 km. Further extension is not expected.

Mussel cultivation with the aid of bouchots:

Collector bouchots:

Pine stakes of some 4 m long, bearing the bark, are stuck half way (thinner and downwards, and about 35 cm apart from each other) in the bottom. In soft bottom this is done by hand, with the aid of a mallet. In sand bottom a jet of water - created with a motor pump - is used to bring the poles down. The pine poles may last for some 3 years.

Rearing bouchots:

As a rule the rearing bouchots are made of oak poles or old pine wood, which are placed about 75 cm apart from each other. They are next connected by a wattle-work of branches of sweet chestnut, placed horizontally.

Spatfall and growth:

Mussel seed may settle during a prolonged period, beginning early in April. A previous settlement of the hydroid Tubularia mytiliflora is said to promote the settling of mussel-seed. Early in August the young mussels may measure from 5 to 30 mm, on an average about 20 mm. The larger ones are inclined to drop from the densely settled seed collecting poles, and would fall in the soft mud if the mussel farmers did not take care to transplant them to rearing bouchots, where the young mussels fix themselves rapidly in the wattle-work. Intermittently the musselmen collect the largest seed from the collector bouchots to transfer them to rearing bouchots. Ultimately some mussels are left on the collector bouchots to complete their entire growth there. The mussels are taken from the collector bouchots with a bent steel blade called "pêchoire". Groups of mussels mutually attached by byssus threads can be placed directly in the wattle-work of the rearing bouchots; separate mussels are packed in old fishing nets ("les poques") before they are transferred to the wattle-work of the rearing bouchots.

Observations on experimental poles placed by the Fisheries Institute indicate that the growth of young mussels may be influenced by a variety of factors, such as: the level of fixation on the poles, the density of their population, the site of placement of the poles (better growth in deeper water), the origin of the young mussels in relation to salinity, water temperature (retarded growth in winter).

The mussel farming communities along the Bay of Aiguillon:

Marsilly: the Marsilly musselmen have their concessions at l'Orpineau and la Carrelère. Collector bouchots, rearing bouchots, and expedition plants are close together, which facilitates exploitation. Small boats are used : "acon", very small amphibic boats pushed by one leg during trips over soft mud flats, and dinghy's ("Yoles").

Esnandes: The "boucholeurs" (mussel farmers) of Esnandes exploit bouchots at la Carrelère, at l'Orpineau, and at the Pointe d'Aiguillon. They too use "acons" and dinghy's but there are in addition a few small motor boats ("pinasses").

Charron: The Charron musselmen work all over the bay. Many of them exploit collector bouchots at la Faute and rearing bouchots in the Passe d'Esnandes. This obliges them to use motor boats, some of which can hoist a sail too.

L'Aiguillon-sur-Mer: The mussel farmers of l'Aiguillon-sur-Mer exploit concessions at the banks of the Lay, at the Pointe d'Aiguillon and at la Faute. The latter are to be reached on foot, the other places by motor boat.

Expedition plants:

As the marketable mussels cannot be collected at neap tides, the musselmen exploit some wet storage yards called "arches" (big wooden or concrete boxes) and "tamarinières" (pieces of tidal flat surrounded by a dense hedge). The"arches" are used at Marsilly and Esnandes. The musselmen at Charron and l'Aiguillon use both wooden "arches" and "tamarinières".

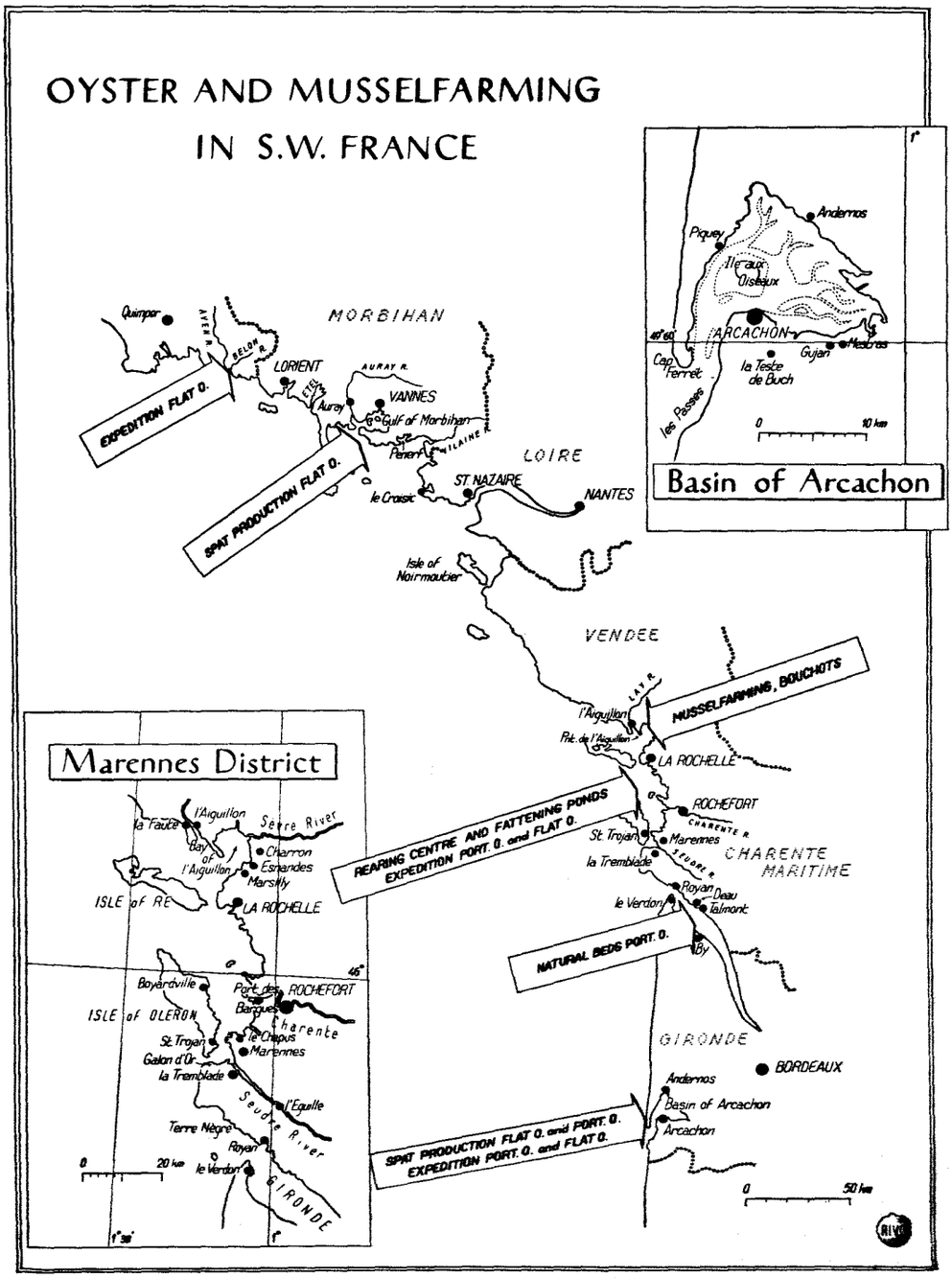
The collected mussels being of various sizes, grading is necessary. To this end one uses both flat grates and rotating sorters. Next the mussels are washed carefully and packed in wicker baskets of 25 or 50 kg contents, or in sacks. Shipment by road predominates nowadays.

In spring and summer the more important markets are Bordeaux, Toulouse, Niort, Périgueux, Limoges. In winter also Lyon, Marseille, Tarbes, Nice etc. Marsilly and Charron export considerable quantities of mussels to Algeria and Tunisia.

The annual production is evaluated at:

1951	7,000	tons
1952	10,000	"
1953	12,000	"

Charron and Esnandes participate in this with about 70%, Marsilly and l'Aiguillon with about 15% each.


OYSTER AND MUSSELFARMING
IN S.W. FRANCE
MORBIHAN
Quimper
AVEN R.
SELON R.
LORIENT
EVEL R.
AURAY R.
Auray
VANNES
Gulf of Morbihan
Penerf
VILAINE R.
EXPEDITION FLAT O.
SPAT PRODUCTION FLAT O.
LOIRE
ST NAZAIRE
le Croisic
NANTES
Isle of Noirmoutier
VENDEE
LAY R.
l'Aiguillon
Pte. de l'Aiguillon
MUSSELFARMING, BOUCHOTS
LA ROCHELLE
ROCHEFORT
CHARENTE R.
St. Trojan
Marennes
la Tremblade
SEUDRE R.
CHARENTE MARITIME
Royan
Deau
Talmont
le Verdon
NATURAL BEDS PORT. O.
REARING CENTRE AND FATTENING PONDS
EXPEDITION PORT. O. and FLAT O.
Marennes District
l'Aiguillon
la Faute
Sevre River
Bay of l'Aiguillon
Charron
Esnandes
Marsilly
ISLE of RE
LA ROCHELLE
Boyardville
Port des Barques
ROCHEFORT
ISLE of OLERON
Charente
St. Trojan
le Chapus
Marennes
Gaian d'Ur
la Tremblade
Seudre River
l'Eguille
Terre Negre
Royan
le Verdon
GIRONDE
0 20 km
1°30'
45°
Basin of Arcachon
Andernos
Piquey
Ile aux Oiseaux
ARCACHON
Gujan
Mestras
Cap Ferret
la Teste de Buch
les Passes
0 10 km
1°
GIRONDE
BORDEAUX
Andernos
Basin of Arcachon
Arcachon
SPAT PRODUCTION FLAT O. and PORT. O.
EXPEDITION PORT. O. and FLAT O.
0 50 km
RIVO