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LARVAL REARING, NURSERY GROWING AND IMPLANTATION AT OYSTER PARKS OF THE ARGENTINIAN OYSTER, *OSTREA PUELCHANA* D'ORB.

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IFREMER

NOTE

This work could have not been done without the efforts of several persons. We are endeavoured to Dr. Luis Carriquiriborde, Director of our Laboratory in Argentina, to M. J.Y. Merian, Attaché Culturel et Scientifique of the French Embassy at Buenos Aires and to Dr. R. Olivier from CONICET, for their interest and aid in overcoming all sort of problems. We greatly appreciate the active support of M. F. Marazonof who was involved in the concretion of this project from the very beginning. We thank Henri Grizel for his advice, support and friendship.

The staff of the L.P.G.I.M. La Tremblade will be unforgettable for us. The warm welcome and the concrete aid received, made possible our almost immediate incorporation to active work with the feeling of having always belonged to the lab. It would be long and unfair to give names, we choose to extend our effusive thanks to all.

INTRODUCTION

The puelche oyster

The flat oyster, *Ostrea puelchana* D'Orbigny, 1841, is distributed from Southern Brazil to Northern Patagonia, Argentina (Castellanos, 1957). Relatively dense "beds" have been only reported in shallow waters of the northwest area of the San Matias Gulf (41° to 42° S, 63°30'W to 65°W) (Fig. 1) (Castellanos, 1957).

Two main beds could be identified and have been thoroughly surveyed during the last 4 years: "Banco Reparo", a shallow water bed located at the mouth of San Antonio Bay, and, "Bajo Oliveira-Las Grutas", a wide bed located at deep open waters of the Gulf (Fig. 1) (Pascual, Doc.Thes. In Prep.). Both beds show neat differences concerning physical, ecological and hydrobiological conditions. Banco Reparo, is a small population that shows a partial spatial overlapping with the populations of *Ostrea spreta*, a second non-commercial species that dominates the internal area of the Bay. The Banco Reparo bed extends from a depth of 1 to 5 m and the water temperature ranges from 7°C (June) to 23°C (January) (Fernandez, 1987). The annual recruitment to this bed is not very active and the predation pressure on newly settled spats, severe (Pascual, unpublished results).

The Gulf stock extends as a fringe occupying the northwestern area (Fig. 1) within a depth range of 3-30 m. It presents only an active recruitment area represented by the western extreme of the bed (Las Grutas, Fig. 1). Water temperature ranges from 8°C (June) to 23°C (January) (Fernandez, 1987).

Reproductive Biology

As all species of the genus *Ostrea*, *Ostrea puelchana* is a protandric hermaphrodite, with consecutive rhythmic sexuality (Coe, 1942). While fitting this general pattern, this species shows a unique breeding system (Morriconi & Calvo, 1979). Histological analysis of gonads shows that spawning takes place from mid November to mid March, at water temperatures above 17°C (Morriconi & Calvo, 1979). They did not found actual hermaphroditic gonads but dominance of male and female phases. During the reproductive season oysters smaller than 55 mm in height are predominantly males while larger oysters are predominantly females. These large oysters often carry small

individuals (up to 30 mm height) attached to a flat platform originating from the anterior edge of the concave shell. The anterior edge of the corresponding flat shell develops a matching thickening. The small epibiotic individuals mature as males at about 2 mm of shell diameter. The non-random distribution of these small epibiotic males led to the suggestion of the existence of a chemical released by the female, triggering a localized settlement response of the larvae (Calvo & Morriconi, 1978).

As in all *Ostrea* species, fertilization takes place in the mantle cavity, where the larvae are incubated.

Authors differ in their interpretation of the fate of small epibiotic males. Calvo & Morriconi (1978), based on the analysis of the size distribution, concluded that each year the small epibionts fall off naturally after reaching a size of 25 mm, being replaced by new settlers. Detached oysters presumably continue to live as free individuals. Fernandez Castro & Lucas (1987) reached instead the conclusion that small epibionts have a life span of one year. Further experimental research on the subject (Pascual et al.,1989) demonstrated that "carrier" females have a strong influence in retarding the growth rate of small epibionts which are able to live in this "dwarf" condition during long periods of their life.

This alternative mating system provides a greater success in fertilization and increases male fitness by reducing sperm losses. In addition, the risk of predation mortality of males might be minimized due to the tight shelter provided by the platform and the matching thickening of the flat valve of the carrier.

Aquaculture

There is no commercial activity related to the production of this species in Argentina. Nevertheless, there exists a growing private interest concerning oyster culture.

In 1980 the Instituto de Biologia Marina y Pesquera "Alte. Storni" sets out a research project with the goal of assessing the biological and economical feasibility of oyster culture in the San Matias Gulf.

Research carried out concerning spat collection and fattening demonstrates that the species can be easily reared using both standard rack technique and deep water suspended culture (Pascual & Bocca, 1986).

Massive spat supply actually remains as the clue factor to be solved in order to enable transfer to the private sector. Research carried out on this direction has resulted in the choice of flexible plastic as the best substratum regarding collection performance and selectivity (Pascual & Bocca, 1986). Nevertheless, and despite their regularity on time, fixation levels are still far from the international desired standards. Futur work will continue addressing this objective.

French-Argentinian Cooperation: Joining efforts

The present work has been done in the frame of the mutual interest of both countries concerning the development and enhancement of commercial oyster production. The French interest is focused on testing the resistance of alternative non-indigenous flat oyster species to the parasitic infections affecting the european *O. edulis*. The Argentinian interest is directed towards the training of local researchers in hatchery rearing as a future productive alternative for this species.

The present work briefly reports the results of the transport and maturation of a stock of Argentinian oysters, larval rearing and nursery growing of juveniles at the hatchery of L.P.G.I.M. (IFREMER) La Tremblade and at a private nursery, and the implantation of the species in oyster parks at differents points of the French coast.

MATERIAL AND METHODS

The parent stock: maturation and spawning

Oysters were randomly collected by diving at Banco Reparo and Las Grutas (Fig.1) during the first week of September 1988 and placed in plastic boxes intertidally at San Antonio Bay. The stock was recuperated in October 23 and prepared for transport in thermic cages. The lot arrived to the hatchery of L.P.G.I.M. La Tremblade on October 26 and was inmediately placed in running seawater for quarantine at 13-15°C and fed daily with a mixed diet of *Isochrysis galbana*, *Chaetoceros calcitrans* and *Tetraselmis suecica*.

The transported stock consisted of 500 free living oysters (size ranging from 23 to 107 mm of total height), 50 "carrier" females (size ranging from 60 to 90 mm) and 64 small epibiotic males (size ranging from 10 to 25 mm) detached from sacrificed carrier females.

Lot A: non-carrier females and free males

Six lots of non-carriers were matured between November 1988 and April 1989. We will here describe the process of maturation in only one of the six lots.

On November 8, a lot of 50 non-carrier oysters of mixed sizes was separated from the mother stock and conditioned for maturation in a 100 l raceway always at the quarantine room. Water temperature was gradually rised to 20°C and the daily diet fixed alternativelly to *I.galbana/T. suecica* (140 cel/µl : 20 cel/µl) and *Ch. calcitrans/T. suecica*(120 cel/µl : 20 cel/µl). Algal food supply was performed using a continuous drop to drop system and seawater in the raceway was daily renewed.

Stimulation to spawning was firstly attempted on November 28. Oysters were carefully brushed and rinsed, remaining out of the water during one hour at room temperature. The lot was then alternately inmersed at 30 mn intervals in cold (15°C) and warm (25°C) non-aerated, 1 µm-filtered seawater. In case of no response to thermic shocks, stimulation with sperm of a conspecific male was also attempted.

In the case of group fecundation of non-carriers, males were allowed to spawn freely in the tank and were separated immediately after the end of spawning. Seawater in the tank was completely renewed one hour after the last spawning and the maturation conditions were re-established. A larval recuperation system consisting in a 75 µm mesh plastic cage was connected to the raceway. The stimulated parent lot was transferred to storage at low temperature (13°C) following larval release.

Individual maturation by couples

Lot B: non-carrier female and epibiotic male

12 small 2 l aerated containers each lodging one non-carrier female ("non-carrying" being previously verified by valvotomy) and an epibiotic detached male, were

placed in a maturation table on November 12. Maturation conditions were equal to Lot A (non-carriers) except for the modus of food supply that was performed twice a day, closing temporarily the water circuit and pooring directly the whole algae volume into each container. The lot was stimulated (always into the individual containers) on January 17 and the open water system was replaced by daily water renewal so as to avoid larval losses in case of spawning. Larvae were recuperated filtering directly the water of the container and carefully rinsing with UV-sterilized water before beggining tank larval rearing. Parent couples were identified and separated from the rest of the lot.

Lot C: carrier females

11 carrier females (that means adult oysters whose epibiotic male could be seen from outside) were arranged in the same way that the couples in Lot B for individual maturation. Conditions and modus operandi were the same as for Lot B.

Larval rearing

We will describe here the methodology used in larval rearing which was essentially the same despite larval origin.

The recuperated lot of larvae was filtered through a 150 µm mesh in order to separate undesired material coming from the parent's water. The larvae were transferred to a 2000 ml container, mixed thoroughly until complete homogenization and 8 to 12 samples (100 µl) were taken in order to estimate the total number of larvae. Larvae were then transferred to 150 l tanks at densities fluctuating from 1 to 5 larvae/ml (Table 1).

The water was 1 µm-filtered and furtherly UV-sterilized. The tanks were filled well in advance so as to leave water strongly bubling for at least 2 hours in order to eliminate peroxids toxic for the larvae.

Water was changed each 48 h and tanks were carefully sponge-washed with hot tap water. During each water change, larvae were counted as described above and a sample conserved in 10 % formalin for growth measurements.

The usual daily diet consisted in *I. galbana* (50 cel to 60 cel/µl) but mixed diets adding *Ch.calcitrans*, *T. suecica* or *Pavlova lutheri* (*Monochrisis lutheri*), during the last period of larval life, were also tested.

Antibiotics were routinely employed. Alternately, chloramphenicol (5ppm) and gentamicin (10 ppm) were added during each water change.

Table 1 summarizes the information concerning conditions under which the main standard rearings were performed between December 1988 and April 1989.

Larval settlement

Once eyed larvae appeared, daily samples were taken from the tanks in order to control the proportion of pediveligers in the lot. Larvae were transfered to the fixation raceways when 50 % of pediveligers was detected. Density in the sieves was fixed at 65 larvae per square centimeter.

Settlement system consisted in two 100 l raceways where plastic sieves (100 µm) were disposed. A 500 l bac filled with aerated water enriched in phytoplancton was connected to the raceway by a plastic pipe through which water is pumped falling in a rainy fashion over the sieves. Circuit is closed by the continuous water flow from the raceways to the tank. Temperature in the water tank was regulated to 24°C, filtered adult water was added to induce settlement and food ration was doubled. Fragments of oyster shell (300-500 µm) were used as collecting substrate. The internal walls of the sieves were painted with vaseline in order to discourage undesired settlement.

Fixation rates could not be estimated immediately after settlement because of the system employed (shell fragments). In order to obtain this information an experience using nylon film as substratum was performed. Nylon bags were included inside three 1 l containers furtherly filled with seawater and a known number of larvae pediveligers (concentration: 1 larvae/ml). Fixation rate was estimated by total countings on the nylon film, 48 h after, using a binocular microscope. The efficiency of nylon film as collecting substrate had been previously not quantitatively tested submersing nylon tiers in the fixation sieves.

In the case of sieves used for massive settlement, fixation rates were estimated 2 months after fixation. Spats were freed by sieving from shell fragments and a known weight of spats was sampled three times for countings. Total numbers were then estimated straightforward from total weight.

Nursery treatment

Once settled, the spats were transferred in their fixation sieves to the nursery room. Water temperature was regulated to 20°C and a water fall system was set out in order to eliminate gas excess derived from the artificial warming of the incoming water. Algae were added daily through a continuous drop to drop system. Algal concentrations were standardized at 100-140 cel/µl (*Ch. calcitrans* or *I. galbana*) plus 20-40 cel/µl (*T. suecica*).

Spats were commonly invaded by Vorticellids during the first week following fixation. A treatment of submersion of the sieves during 10 seconds in 0.03 % chlorine-concentrated freshwater was used for elimination.

The descendants of the different kinds of crossings were maintained always separated.

Nursery growing was performed at two different places and culture systems. Two thirds of the total number of spats were transfered on May 25th to a private enterprise at Marennes (Yann Boisard, owner). The rest of the juveniles remained at the hatchery of La Tremblade. At Boisard's nursery, spats were sieved at two different mesh sizes (2 mm and 5 mm) and three size groups were established. Cylindrical sieves (diam: 350 mm) were hang in running seawater tanks, spats receiving nourriture by upflow (upwelling system). Initial densities were standardize for each group at (1) 32 spat/cm2 (mean indiv. size: 1.95 mm, SD: 0.66; mean indiv. weight: 0.005 g) , (2) 10.5 spat/cm2 (mean indiv. size: 5.37 mm, SD: 1.38 ; mean indiv.weight: 0.02 g) and (3) 3.5 spat/cm2 (mean indiv.size: 10.39 mm, SD: 2.68 ; mean indiv. weight: 0.08 g).

At La Tremblade a similar system was used. In this case the water flew through a pipe that poured directly over the sieves. Initial densities were established in the same way.

Growth in size and weight was measured periodically on fixed sieves, on the two sites.

Transfer of juveniles to oyster parks

The first lot of 160,000 juveniles was transfered on June 1989 to the region of Bretagne. Three sites were chosen: Baie du Quiberon and St. Philibert - both in the south of Bretagne - and Penze, in the north. The juveniles were included in "poches", identified by the kind of descendance and size group.

The second lot (31,000 juveniles) was transfered to the Bassin d'Arcachon on July 1989. The methodology employed was the same with some slight changes in the rack system adapted to the local traditional technique.

The third lot of 20,000 juveniles was transfered to Sête, in the Mediterranean, on August 1989. The spats here were placed in a deep water culture system.

The last lot will be transfered to rack system at the Basin of Marennes-Oleron.

In each of the four implantation sites the experimental lots will be -from hereon- under the responsability of local researchers.

RESULTS AND DISCUSSION

Maturation - Spawning

Lot A: non-carriers maturated and stimulated in groups remained from 20 to 40 days in maturation conditions. The first stimulations -carried out 20 days after set out of the experience- produced only male spawning (80 % of the individuals). This was interpreted as the result of food deficiency and, therefore, the daily diet was doubled. One week later, successful fecondation was obtained.

Lot B: stimulation was essayed several times before obtaining fecondation in this group. Three of the 12 couples released larvae at the end of January.

Lot C: the carrier females was the group of slower maturation. Only 2 produced larvae during the first week of February.

Larval rearings

Table 1 summarizes the raw data concerning the main results obtained on standard rearings. We omitt here the results of special manipulations (effect on growth and survival of different diets, effect of the elimination of the smallest fraction on total survival, different antibiotic concentrations) not yet processed.

At water temperatures ranging from 18 to 20°C, larval life lasts 20 to 24 days, result comparable to previous essays (Zampatti, unpublished results). A significant reduction in larval period was obtained when temperature was regulated to 23-25°C (Table 1: Lot 1E). The maximal larval periods (29 and 31 days; Table 1) were reported at temperatures ranging from 17 to 19°C.

Mean total mortality was always at acceptable levels with the exception of rearing 2A (Table 1) where a bacteriosis accounted for a sharp decline in larval numbers. Preliminary data analysis does not show differences in mortality rates among larval lots of different origin.

Larval size range at settlement was the same for all rearings with the exception of 1E where the higher water temperature accounts for an advance in metamorphosis (Table 1).

Growth is lineal during larval period. Figure 2 shows three type curves each one representing a different kind of descendance. No striking differences in growth rates were detected in relation to larval origin, although a serious statistical treatment of data is necesary before arriving to definitive conclusions.

Special treatment to larval lots were only applied during the period II/12-II/29 where a severe bacteriosis affected a lot of larvae (lot 2A; Table 1). The affection was manifested as a white foam invading the larvae, critically the smallest fraction of each lot. This rod-bacterium was detected as well in algal cultures (*I. galbana*) and presented

the peculiarity of basifing the culture media (TCBS) (T. Nöel, pers. comm.). The treatment consisted in increasing the dose of antibiotics (chloranphenicol: 15 ppm; gentamicine: 10 ppm) and rinsing the larvae during 1-2 min with tap freshwater regulated to the same temperature of the culture jar to avoid thermic shocks. Water change was daily performed until bacteriosis was definitively over.

Larval settlement

Larvae showed a marked gregarious behaviour when transfered to the fixation sieves. Even when carefully spread over the surface, they reagrupated in certain areas. It was necessary to dislodge larval patches with a strong jet of water in order to avoid multiple fixation and overspatting.

Vaseline painting of the sieve's walls efficiently avoided settlement.

Fixation rates obtained on the nylon film were 68.2 % , 63.9 % and 48.7 % for the three replicates.

Fixation rates post-estimated by spat countings range from 38 to 98 % (Table 2). We validate the use of these data as an aproach for estimating fixation rates because no mortality was detected during the periodic sampling of the sieves. The lot of spats corresponding to the first fixation performed (January 11th) was excluded due to the great mortality produced by effect of "bubbling disease" during the first week following settlement. Only a 12 % of the spats in this lot survived. This disease is recognized by an gaz bubble located near the digestive gland. An excess of nitrogen in water was the result of having increased the temperature of incoming water from 8°C to 20°C. The problem was solved by a water fall system which eliminates gaz excess.

Nursery treatment

Nursery growth was affected by several problems. Due to the winter season during which the experience was performed, food supply had to be artificially provided. Spat density at the hatchery of Ronce surpassed food availability, densities being far more elevated than those recommended for reaching a good growth rate. Space and food became a critical factor. In April seawater temperature reached 16°C and the water circuit was openned in continuous. Figure 3 shows the growth of juveniles in their fixation

sieves from January to May at Ronce. As spat mean size increased, dispersion of values also increased probably as a result of high density and deficient food supply.

In May total number of spats was estimated in 800,000 and a lot was transfered to private nursery in order to improve growth rates and accelerate transfer to oyster parks. Table 3 presents the results of growth and mortality of juveniles for comparable lots grown at Marennes (private nursery) and Ronce-les Bains (IFREMER) during the period May 25 - June 24. Growth rate was higher at Marennes. In a month period spats almost doubled their initial size. Growth is better expresed in terms of weight: the weight of 100 individuals increased 6.65 times at Marennes while it increased 3.3 times at Ronce (Table 3). On the other hand, mortality was higher at Marennes (27.71 % vs. 12.06 %).

The different conditions at both sites may explain these results. Water temperature was always higher at Marennes (Figure 5) than at Ronce (Figure 4). Water flow was also higher at Marennes (1500 l/h/sieve compared to 50 l/h/sieve at Ronce). This resulted in values of 10.3 l per spat per day (Marennes) and 0.34 l per spat per day (Ronce).

By June, mortality -mainly at the private nursery- reached 30 % . It is interesting to note that this result corresponds to non-carrier descendants, while the other two groups did never superate a value of 5 % of total mortality. This suggests that the descendants of epibiotic males may have a diferential susceptibity to extreme conditions. An identical result was achieved at Ronce.

A transfer to Bretagne was inmediatly decided in order to provide spats better growing conditions.

Transfer to oyster parks

We will present here the protocol employed at each transplantation site (Tables 4 and 5) and the planned control of oysters (growth, mortality and pathological analyses) until the arrival to commercial size.

Spat volumes were unequally allocated among regions following the requirements of IFREMER. The greatest volume was transfered to Bretagne because of the endemism of Bonamia and Marteilia infection in this region.

At Bretagne, controls of growth, mortality and pathological analyses will be done each six months. During each control date, a sample of 50 individuals will be conserved in order to return for hystological analyses in case that catastrophic mortalities were furtherly detected.

At Arcachon, controls will be done each two months. The protocol will be the same than at Bretagne. At both sites juveniles are grown intertidally, on iron racks.

At Palavas (Sête), "poches" were fixed to containers placed in deep waters (30 m), following the local experimental culture conditions. Controls will be done each two or three months.

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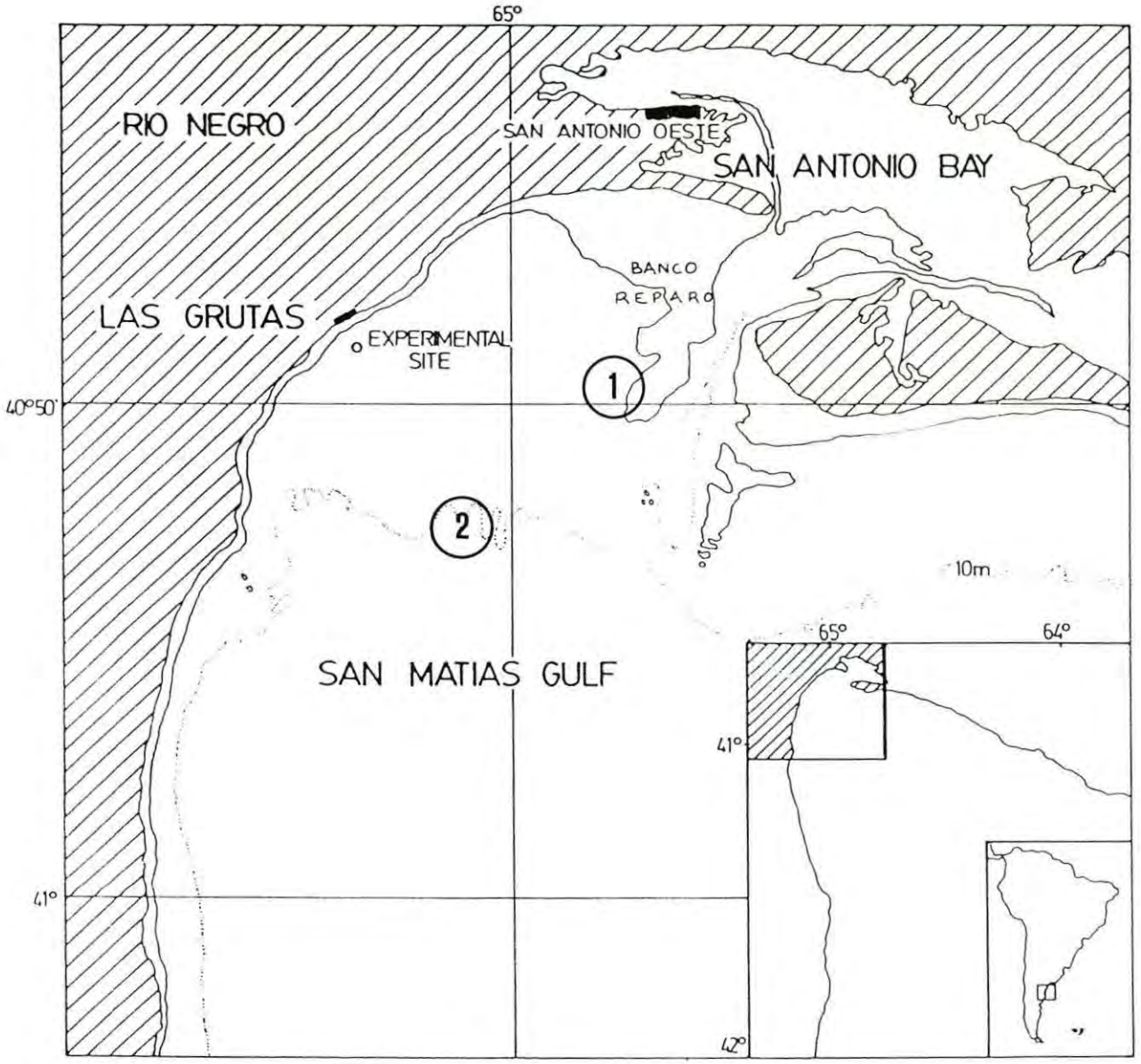
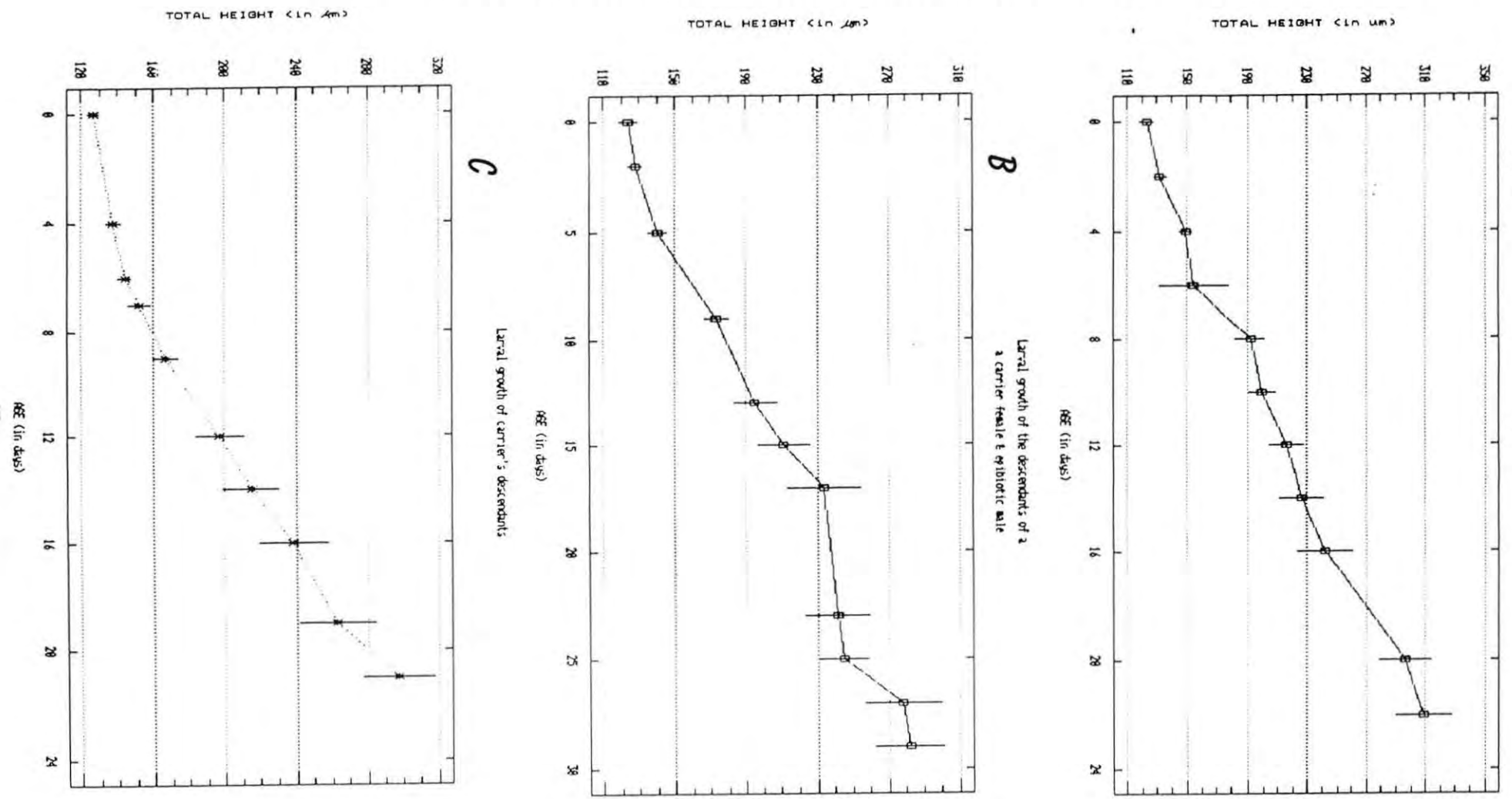


FIGURE 1: The natural grounds of Ostrea puelchana: geographic localization.

1: Banco Reparo
2: Bajo Oliveira

FIGURE 2: Type growth curves (raw data are mean values ± standard deviation). A: non-carrier descendants; B: descendants of non-carrier & epibiotic male and C: carrier's descendants.



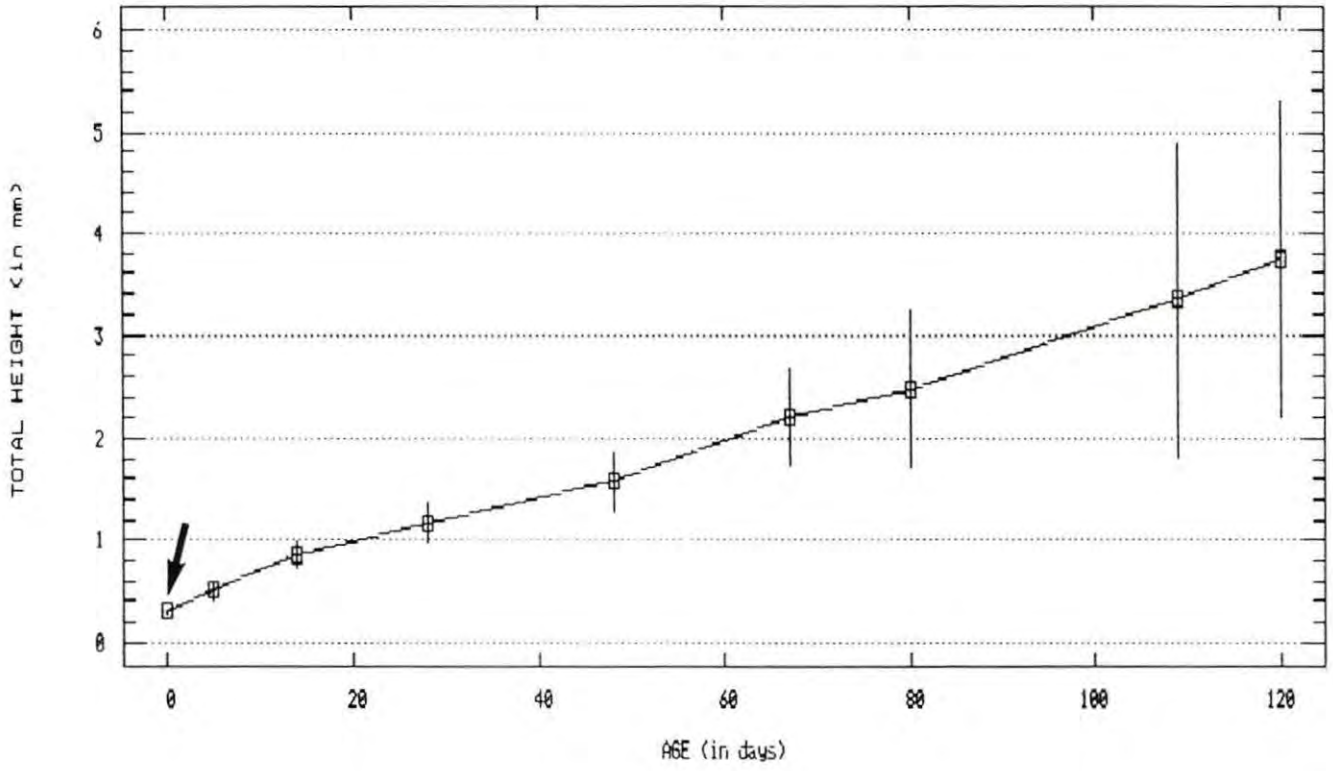


FIGURE 3: Growth of a lot of spats at the nursery of Ronce-les Bains (descendant of non-carrier females & free males). Values are mean sizes ± standard deviation. Black arrow indicates size at settlement.

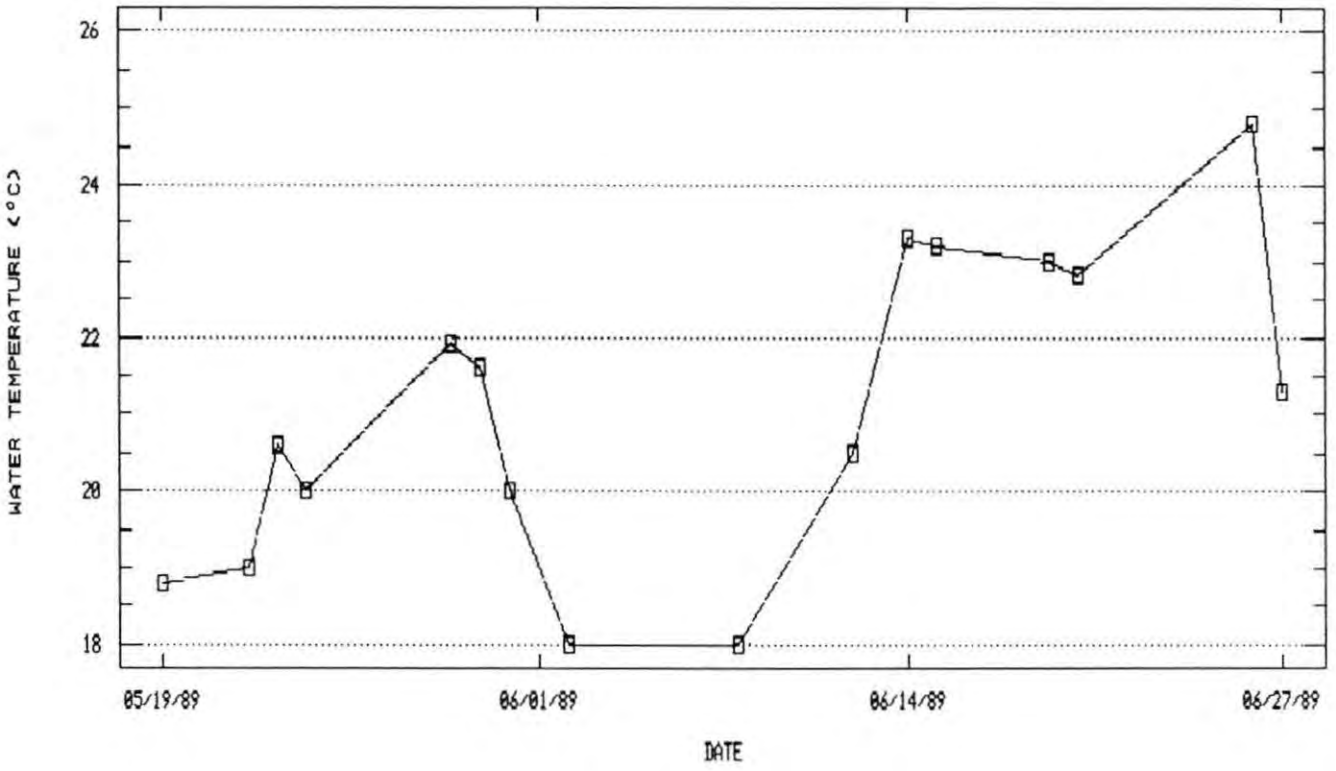


FIGURE 4: Incoming seawater temperature at the nursery (IFREMER- La Tremblade during the period May-June. Source: P.Phelipot (unpublished data).

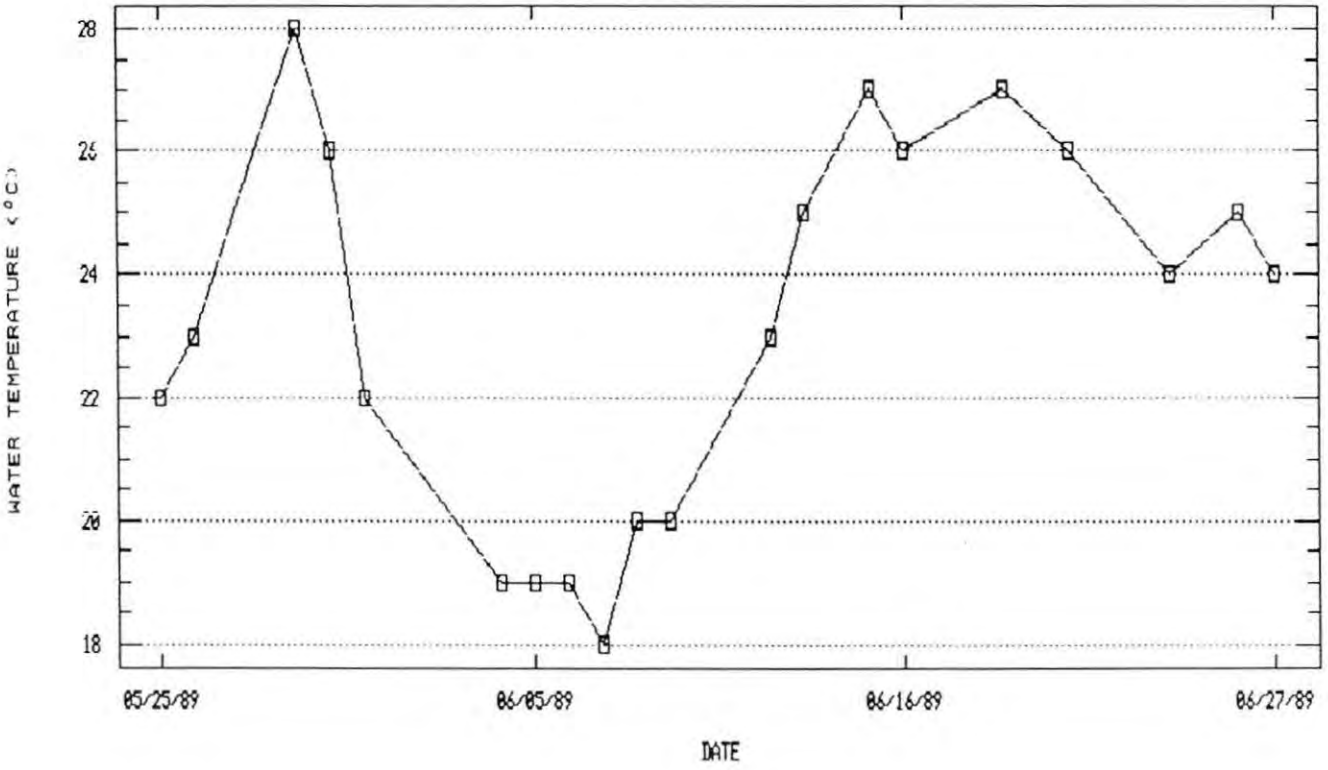


FIGURE 5: Incoming seawater temperature at the private nursery of Marennes during the period May-June. Source: I. Boisard.

LOT	WATER TEMPERATURE	DIET	LARVAL DENSITY	INITIAL SIZE (mean totalheight)	FINAL SIZE (at settlement)	TOTAL MORTALITY (mean among replicas)	LARVAL LIFETIME	N° replicas
*1A	19-19,7°C	I.galbana 50 ♦ / ul I.galb./T.suec. 60 ♦:5 ♦/ul	1-5 larvae/ml	122.8 um (SD=4.25)	280-310 um	40 %	22 days	6
1B	19.5°C	I.galbana 50 - 60 ♦ / ul	2-5 larvae/ml	129.8 um (SD=3.34)	275-294 um	36 %	26 days	6
1C	18°C	I.galbana 50 - 60 ♦ / ul	2-3 larvae/ml	NO AVAIL.	NO AVAIL.	46 %	24 days	4
1D	19°C	Idem	1-2 larvae/ml	NO AVAIL.	NO AVAIL.	35.5 %	20 days	4
1E	23-25°C	Idem	3 larvae/ml	135 um (SD=3.44)	284 um	40 %	17 days	2
*2A	17-19°C	Idem	3-5 larvae/ml	123.6 um (SD=5.49)	260-280 um	60 %	29 days	4
2B	17-19°C	Idem	3-4 larvae/ml	NO AVAIL.	NO AVAIL.	50 %	31 days	3
*3A	20°C	Idem	3 larvae/ml	126.36 um (SD=3.02)	294-297 um	36 %	21 days	2

TABLE 1 : Conditions and raw results of larval rearings carried out in th period December 1988 - April 1989.

* Refers to the kind of descendants. 1: descendants of non-carrier females and free males fecondated in groups .

2: descendants of a non-carrier female anda detached epibiotic male.

3: descendants of carrier female fecondated by its own epibiotic male.

SETTLEMENT DATE	SAMPLING DATE	SURVIVAL RATE
01/16	03/28	38 %
01/18	03/28	50 %
01/20	03/28	98 %
01/23	03/29	99 %
02/03	03/31	65 %
02/06	03/30	51 %
02/06	03/31	48 %
02/10	03/31	95 %

Table 2: Survival of spats settled on shell fragments (post-estimation of fixation rates).

PRIVATE NURSERY

DATE	TOTAL HEIGHT (in mm)	MEAN WEIGHT/100 INDIV. (in gr)	TOTAL CUMULATIVE MORTALITY
05/25	10.39 SD= 2.68	-	
05/29	-	8.60 SD= 1.9	
06/08	13.8 SD= 2.34	20.83 SD= 1.10	
06/13	16.14 SD=2.91	29.0 SD= 2.17	
06/19	-	42.02 SD= 5.93	
06/24	17.80 SD= 2.51	57.17 SD= 4.13	27.71 %

NURSERY LA TREMBLADE

DATE	TOTAL HEIGHT (in mm)	MEAN WEIGHT/100 INDIV. (in gr)	TOTAL CUMULATIVE MORTALITY
05/25	10.39 SD= 2.68		
05/30	-	6.85 SD= 1.23	
06/09	12.70 SD= 2.91	14.29 SD= 1.9	
06/15	14.49 SD= 2.84	17.58 SD= 1.2	
06/20	-	19.36 SD= 3.54	
06/23	15.05 SD= 3.37	22.6 SD= 4.01	12.06 %

TABLE 3: Increase in size and weight of nursery grown oysters. Data corresponding to non-carrier's descendants.

SITE	GROUP 1*			GROUP 2*			GROUP 3*	
	I	II	III	II	III		I	II
St.Philibert	1000 o/p 750 g 26 poches	920 o/p 300 g 10 poches		1000 o/p 357 g 20 poches			1000 o/p 450 g 2 poches	1000 o/p 315 g 14 poches
Penzée		920 o/p 320 g 14 poches	1300 o/p 150 g 32 poches	1000 o/p 357 g 16 poches			1000 o/p 450 g 3 poches	1000 o/p 270 g 8 poches
Baie de Quiberon		920 o/p 300 g 1 poche	1300 o/p 150 g 1 poche	1000 o/p 357 g 1 poche	1000 o/p 200 g 1 poche		1000 o/p 450 g 1 poche	1000 o/p 270 g 2 poches

TABLE 4: Protocol of allocation of juveniles in oyster parks at three sites in Bretagne. * 1: descendants of non-carrier females & free males; 2: descendants of non-carrier female & epibiotic male; 3: descendants of carrier females. "o/p" means oysters per poche ; "poche" is the french name for the plastic bags used in rack culture.

SITE	GROUP 1*			GROUP 2*		GROUP 3*		
	I	II	III	II	III	I	II	III
ARCACHON	320 o/p 160 g 1 poche	890 o/p 45 g 3 poches	1690 o/p 80 g 5 poches	840 o/p 110 g 2 poches	1000 o/p 50 g 3 poches	330 o/p 180 g 1 poche	1200 o/p 55 g 3 poches	2200 o/p 58 g 5 poches

	GROUP 1		GROUP 2	GROUP 3	
	I	II	II	I	II
PALAVAS	380 o/p 450 g 2 poches	500 o/p 130 g 12 poches	350 o/p 350 g 5 poches	380 o/p 700 g 2 poches	500 o/p 295 g 6 poches

TABLE 5: Allocation of juveniles in oyster parks at Arcachon and Palavas. *: different kinds of descendants (idem Table 4).