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CULTURE OF THE MANILA CLAM(*VENERUPIS SEMIDECUSSATA* REEVE) FROM HATCHERY-REARED SPAT

by

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ABSTRACT.

Culture of Venerupis semidecussata achieved in Rade de Brest from hatchery-reared spat, include three stages, according to the size of the individuals. From 2 to 10 mm : culture in nursery ; from 10 to 20 mm : off-bottom or suspended culture in the wild ; from 20 to 40 mm : suspended or on-bottom culture. The latter stage was not dealt with in the present paper.

In the nursery, 12 major factors affecting the growth rate were considered. For each experiment in the nursery, the particulars of those factors were noted and the influence of five of them was analysed at length. Monthly weight growth rates over 100 % were obtained in spring, autumn and winter.

Suspended culture in partitioned creels made it possible to obtain, in summertime, monthly weight growth rates ranging from 37 % to 133 %, whereas, in the same period of time, with samples of same origin, this rate was only of 7 % to 19 % for off-bottom cultures in screened boxes.

RESUME.

Les cultures de Venerupis semidecussata réalisées en Rade de Brest, à partir de naissain d'écloserie, comportent 3 phases selon la taille des exemplaires. De 2 à 10 mm : culture en nurserie ; de 10 à 20 mm, culture en surélévation ou en suspension en mer ; de 20 à 40 mm, culture en suspension ou dans le sol. Cette dernière phase n'a pas été examinée dans la présente étude.

Dans la nurserie, 12 facteurs principaux agissant sur le taux de croissance ont été retenus. Pour chaque expérience dans la nurserie, les caractéristiques de ces facteurs ont été notées et l'influence de 5 d'entre eux a été analysée en détail. Des taux de croissance pondérale mensuelle, supérieurs à 100 % ont été obtenus au printemps, en automne et en hiver.

L'élevage en suspension dans des casiers compartimentés, a permis d'obtenir pendant l'été, des taux de croissance pondérale mensuelle allant de 37 % à 133 %, tandis qu'à la même période, sur des exemplaires de même origine, ce taux n'était que de 7 % à 19 % pour des cultures en surélévation en caisses grillagées.

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INTRODUCTION.

The subject experiments in culturing "Palourde" (*Venerupis semidecussata*) were carried out in "Rade de Brest", Brittany, from 1974 to 1977. SATMAR, Barfleur (France) supplied the hatchery-reared spat from genitors produced at Puget Sound, Washington State, (USA). Most batches numbered 100 000 individuals, with a mean size on delivery varying between 2 to 4 mm. In all cases, the initial growth from 2 to 10 mm was carried out in the Tinduff nursery (Rade de Brest), the actual growth from 10 to 20 mm was achieved either on fittings raised 50 cm above intertidal ground (off-bottom culture) or suspended from floats (suspended culture), and the final growth was undertaken either in suspended culture or on-bottom.

I - THE INITIAL GROWTH IN NURSERY.

The fittings of the nursery and its operation have already been described (LUCAS, 1976). As a reminder, the nursery consists of a 162-square-meter greenhouse housing : 1) - two sea-water storage tanks (totalling 18 m^3) and six algal culture tanks (totalling 7 m^3) and 2) - eleven raceways (totalling 25 m^3).

The water circulation principle is described in Figure 1. The water is heated through the greenhouse effect - most noticeable from February to July (see Figure 2) - and enriched with monocellular algae from cultures carried out in the greenhouse, the quantity of supplied algae (in addition to those already existing in natural sea-water) varying throughout the year.

1.1. Environmental factors affecting the growth of "palourdes".

In the nursery, growth rates of *Venerupis semidecussata* of a size ranging from 2 to 10 mm are correlated with various factors, among which the most important are :

(1) - the fittings of the raceways ;
(2) - the population density of the rearings ;
(3) - the flow rate of sea water ;
(4) - the quality of sea water (subject to seasonal variations) ;
(5) - the quality of the food supplement (subject to seasonal variations) ;
(6) - the quantity of the food supplement (subject to seasonal variations) ;
(7) - temperature (subject to seasonal variations) ;
(8) - salinity (subject to seasonal variations) ;
(9) - distribution of the lanterns in the raceways ;
(10) - frequency of the handlings (washing, brushing, etc...) ;
(11) - the feeding rate which can be continuous or discontinuous ;
(12) - the light and, consequently, the fouling.

Various types of fittings were tested in the raceways (LUCAS, 1976), but only one type, sketched in Figure 3, where the palourdes are laid out in square nets called "lanterns" will be dealt with in the present study.

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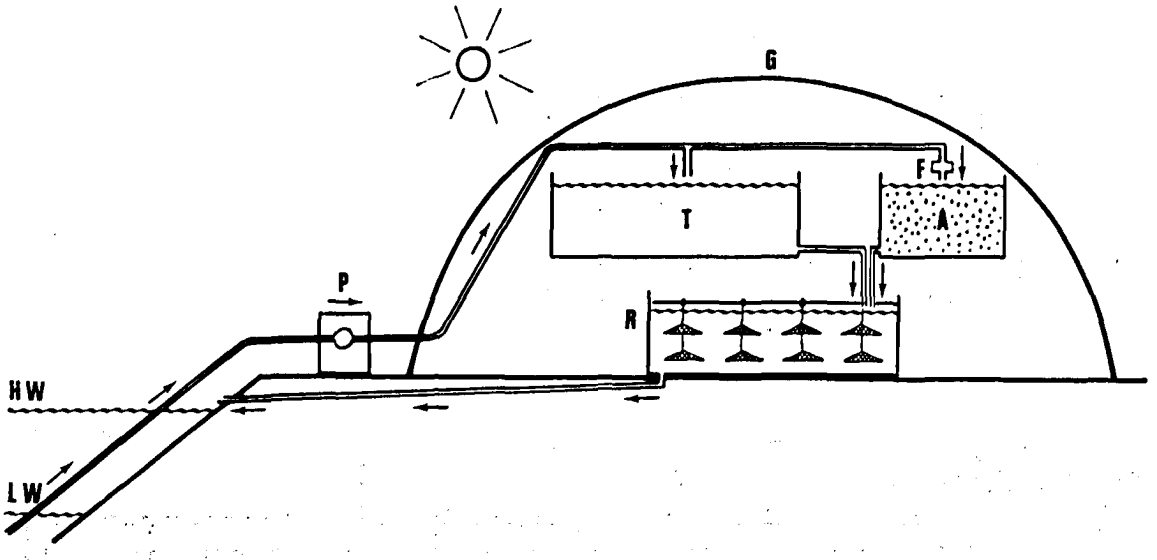

FIGURE 1 : *Diagram of the circulation and processing of sea water in the nursery.*

From left to right : HW = High Water ; LW = Low Water ; P = Pump ; R = Raceway used in rearing the spat, which is supplied sea water from the storage tank (T) and algal cultures (A) carried out in water filtered beforehand (F) ; the entire fittings are housed in a polyethylene greenhouse (G).

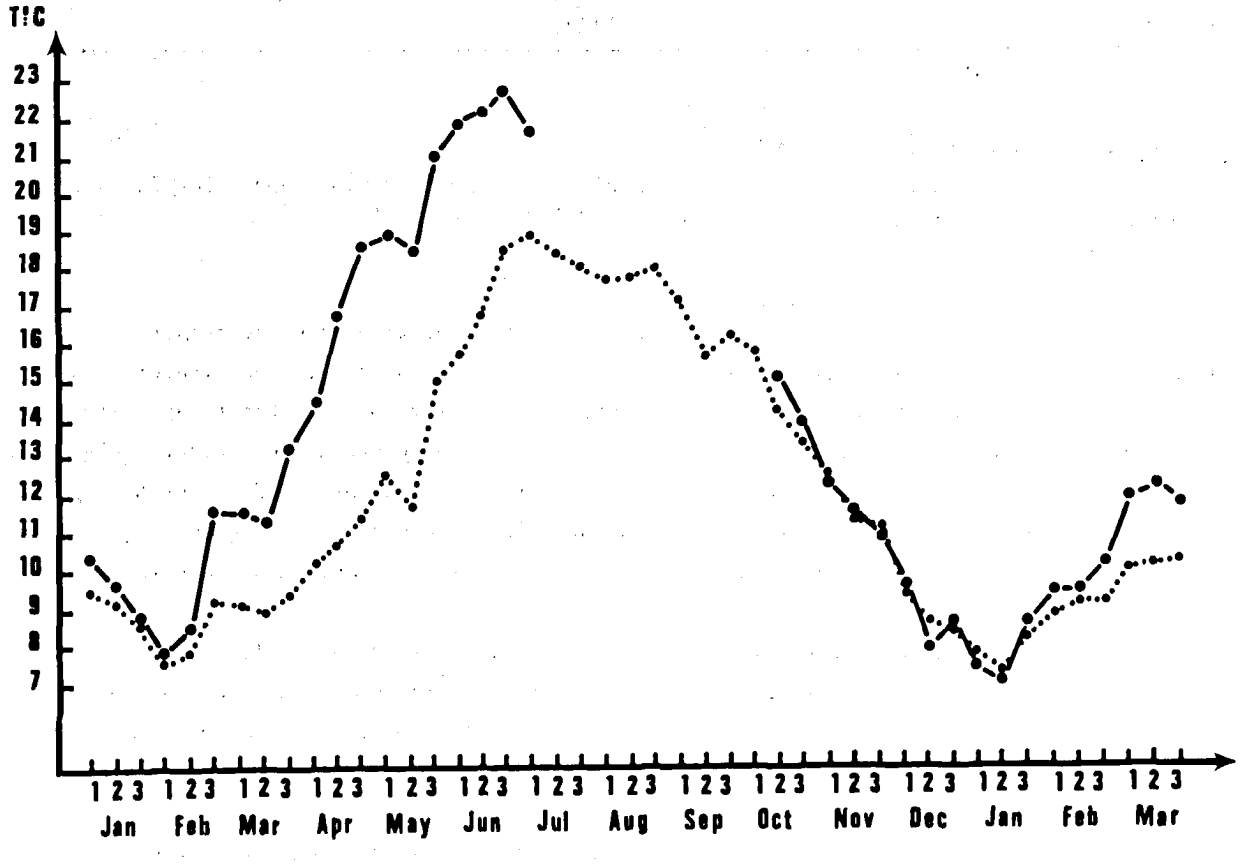

FIGURE 2 : *Temperature fluctuations (Mean value computed on the time basis of 10 days) in the nursery raceways (full line) and in the wild (dotted line), from January 1976 to March 1977.*

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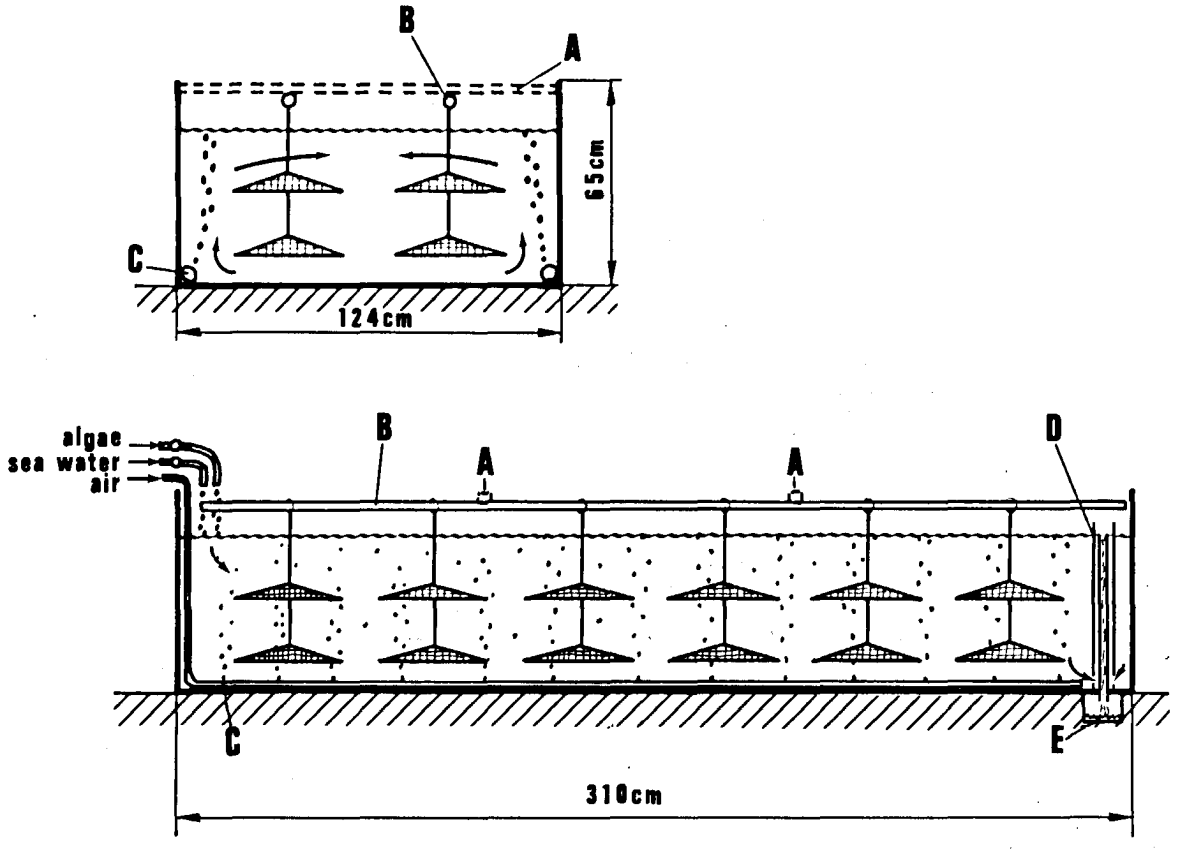

FIGURE 3 : *Fittings of the raceways.*

Top : cross section ; Bottom : longitudinal section. A = Cross support bars ; B = Tubes where the lanterns are hooked ; C = Air-bubble spout ; D = Over-flow outlet well ; E = Sea water drain.

The population density of the rearings is correlated with both the number of individuals and their respective weight. Density interferes at two levels : in the "lantern" (d) and in the raceway (D). In all the experiments, density per raceway (D) amounted to approximately 100,000 six-millimeter individuals (which implies that the raceway contained other individuals than those under experimentation). We may then consider it a constant. As for density (d), it has a considerable importance as will be demonstrated in the experiment to be related hereinafter (cf. 1.6.). Therefore, its value will be indicated for each experiment described.

The flow rates of sea water, controlled manually, are not strictly equivalent from one raceway to the other, but, statistically, it balances in the end, since the taps are checked twice a day. In all our experiments, we worked on the basis of a complete turn-over of the water of each raceway in 24 hours, say 2,100 liters/day or 87.5 liters/hour.

The quality of sea water was not tested regularly ; we only know that the phytoplankton density becomes considerable starting in April and on to September. In May-June 1975, the mean algal density reached 18.10^3 cell/ml (LUCAS, 1976).

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The types of algae that were cultured were : *Tetraselmis suecica, Phaeodactylum tricornutum* and *Monochrysis lutheri*. The quantity of food varied mostly in correlation with the flow rates and, for a lesser part, with algal densities. For instance, from October 8, 1976, to March 23, 1977, the supply of food was interrupted during 16 days (over 167) ; flow rates varied from 213 l/h to 18 l/h, *T. suecica* algal density varied from 8.10^4 cell/ml to 15.10^4 cell/ml, that of *P. tricornutum* from 8.10^5 cell/ml to 13.10^5 cell/ml and that of *M. lutheri* from 27.10^4 cell/ml to 33.10^4 cell/ml.

Temperature and salinity readings will be indicated for each experiment (mean values calculated on the time basis of 10 days).

Following is a detailed account of experiments conducted on the influence of factors (9), (10), (11) and (12) on the growth of *Venerupis semidecussata*, as well as of an experiment on density.

In those experiments, for one thing, all batches compared were strictly identical : same origin, same rearing method up to the time of the experiment, same weight, same number ; for another thing, the constituents of the medium, with the exception of the factor under study, were extremely close, even when experiments were carried out simultaneously in two raceways.

From here on, the following symbols will be used in the present report :

- N = number of individuals involved in each experiment
- Wm = mean weight of the individuals (in mg)
- Lm = mean length (measured in mm from the anterior to the posterior edge of the valves)
- G/m = relative rate of weight increment calculated on a time unit of a month (30 days), in percentage
- Z/m = relative rate of mortality calculated on a time unit of a month (30 days), in percentage
- d = number of individuals per square meter (surface of a lantern = 0.1225 m^2 ; of a screened box = 0.1539 m^2 ; of one cell in a suspended creel = 0.025 m^2).

NOTA : *In the tables given hereafter, the growth rates are computed from weight readings which vary more markedly than length readings. However, in establishing the homogeneity statistical tests, we used the mean lengths that were computed from a hundred or so individual readings (which cannot be the case for weights since individuals are too small for individual weighings). The statistical tests could be applied to 4 experiments only.*

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1.2. Influence of the distribution of the "lanterns" in the raceway.

With a view to determine the influence of the distribution of the "lanterns" in the raceway, we compared the weight increments in the first, second, third, fourth and fifth rows of "lanterns" (four lanterns per row) in the same raceway, the first row being closest to the food and sea water intake. The experiment took place from October 21, 1976, to February 8, 1977, with a control on December 7, 1976. Results are given in table 1.

	1st row	2nd row	3rd row	4th row	5th row
W (g)					
21.10.76	400.00	400.00	400.00	400.00	400.00
7.12.76	927.32	901.16	873.00	848.40	822.90
Wm (mg)					
21.10.76	30.80	30.80	30.80	30.80	30.80
7.12.76	71.40	69.38	67.22	65.32	63.36
G/m (%)	84.14	79.97	75.47	71.55	67.48
W (g)					
8.02.77	1,472	1,412	1,332	1,189	1,145
Wm (mg)					
8.02.77	113.34	108.72	102.56	91.55	88.16
G/m (%)	27.96	26.99	25.03	19.11	18.63

TABLE 1 : *Weight growth of V. semidecussata in correlation with the distribution of the lanterns in the raceway.*

At the beginning of the experiment : N = 12,987 (per batch) ; Lm = 4 mm ; d = 26,492 (say 100 g per lantern). In the course of the experiment, fluctuation of mean temperature : 15.0°C-7.0°C ; fluctuation of mean salinity : 33.8 °/oo - 29.0 °/oo. Mortality (Z/m) was non existent.

Analysis of variance F ratio = 21.46 > F 0.001 = 4.62. The differences between rows are highly significant.

We note that the distribution of the lanterns in relation to the food intake has a definite effect on the growth rate.

We may infer from the above that, for all comparative experiments, we must satisfy ourselves that the distribution of the lanterns is identical for all batches. In commercial rearings, a periodical shifting of the lanterns will be necessary to ensure homogeneous results.

1.3. Influence of the frequency of the handlings.

Cleaning the lanterns and raceways is a necessity. Yet, each handling slightly upsets the animals, hence the consequence of their frequency. With this object, we compared the weight growth of two batches, one submitted to daily handlings, the other submitted to weekly hand-

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lings (brushing and washing). Results are given in Table 2.

We note that a weekly frequency is clearly more favourable to growth than a daily frequency which is why we definitively elected it.

Handling frequencies	W (g)		Wm (mg)		G/m (%)	Z/m (%)
	27.04.76	25.05.76	27.04.76	25.05.76		
Daily	250.0	450.68	17.50	37.46	85.97	16.11
Weekly	250.0	519.84	17.50	42.40	115.09	15.43

TABLE 2 : *Weight growth of V. semidecussata in correlation with daily as opposed to weekly frequencies of cleaning handlings.*

At the beginning of the experiment : N = 14,285 (per batch) ; Lm = 2,3 mm ; d = 23,498 (say 50 g per lantern). In the course of the experiment, fluctuation of mean temperature : 18.7°C - 21.0°C; fluctuation of mean salinity : 33.0°/oo - 34.0°/oo.

Homogeneity test on the mean length : Pr ($|X_o| > 5.13$) = 0 %. The difference is significant at the 5 % level.

1.4. Influence of the frequency of the feedings.

The Tinduff nursery is devised for a continuous feeding and sea water circulation in the raceways. However, according to LANGTON and MacKAY (1974), discontinuous feeding is more favourable to the growth of *Crassostrea gigas*. That is the reason why we undertook a comparative study, between a raceway with a constant circulation of sea water and a continuous supplying of food on one hand, and a raceway drained and refilled every day with fresh sea water and food, on the other hand, respective quantities of sea water and algae being equivalent in both types of raceways. Results obtained are given in Table 3.

Feeding	W (g)		Wm (mg)		G/m (%)	Z/m (%)
	21.10.76	7.12.76	21.10.76	7.12.76		
Continuous	200.00	4,372.78	38.80	67.34	75.72	0
Discontinuous	200.00	3,880.70	30.80	59.76	60.01	0

TABLE 3 : *Weight growth of V. semidecussata under continuous feeding as opposed to discontinuous feeding.*

At the beginning of the experiment : N = 64,935 (per batch) ; Lm = 5 mm ; d = 26,504 (say 100 g per lantern). In the course of the experiment, fluctuation of mean temperature : 15.0°C-9.4°C ; fluctuation of mean salinity : 33.8°/oo - 29.0°/oo.

Homogeneity test on the mean length : Pr ($|X_o| > 6.37$) = 0 %. The difference is significant at the 5 % level.

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Growth is reduced in the case of discontinuous feeding : this result is not surprising, in view of the fact that, in discontinuous feeding, the algae are almost totally depleted within the first three hours. Moreover, a daily renewal of the water slightly upsets the animals from emergence and temperature and pH variation.

However, the method of discontinuous feeding can be improved through supplying food twice a day, for instance once in the morning and once in the evening. Then again, it seems that a daily renewal of the water might have a stimulating effect on some populations.

1.5. Influence of the light.

The raceways are normally covered to prevent fouling by filamentous algae. We wanted to evaluate the advantage of such a precaution.

With this object, two batches were compared : one laid in a covered raceway and the other laid in an uncovered raceway, thus exposed to natural light. Results are given in Table 4.

We note that the batches that were exposed to day light show a slight reduction of their growth rate : this way result from the fact that water circulation through the lanterns is impeded by algal fouling, unavoidable despite vigorous brushings during the weekly cleanings, rather than from a direct influence of light.

Light	W (g)		Wm (mg)		G/m (%)	Z/m (%)
	8.02.77	8.03.77	8.02.77	8.03.77		
Exposed	2,444.0	2,962.0	91.66	111.09	22.7	0
Not exposed	2,444.0	3,081.5	91.66	115.57	27.9	0

TABLE 4 : *Weight growth of V. semidecussata exposed or not exposed to light.*

At the beginning of the experiment : N = 26,662 (per batch) ; Lm = 7.0 mm ; d = 18,137 (say 204 g per lantern). In the course of the experiment, fluctuation of mean temperature : 9.6°C - 12.0°C ; fluctuation of mean salinity : 27.8°/oo - 29.5°/oo.

1.6. Influence of density in the lanterns.

Two batches with different population densities were laid in the same raceway. Results are given in Table 5. We note that density per lantern is one of the factors most affecting weight growth. Thus, an equal distribution among the lanterns must be achieved in order to obtain regular production. Many more experiments remain to be carried out, however, to determine the optimal density, which varies with the age of the individuals. Thus, the present experiment can only be regarded as a preliminary one.

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Density (ind/m²)	W (g)		Wm (mg)		G/m (%)	Z/m (%)
	15.02.77	31.03.77	15.02.77	31.03.77		
31,531	1,000	2,328	25.92	60.27	90.54	0
63,062	2,000	3,620	25.92	46.85	55.22	0

TABLE 5 : *Weight growth of V. semidecussata in correlation with the population density in the lanterns.*

At the beginning of the experiment : N = 115,878 (in the 2 batches) ; Lm = 4.44 mm. There are 10 lanterns per batch. In the course of the experiment, fluctuation of mean temperature : 9.6°C 12.2°C ; fluctuation of mean salinity : 27.8°/oo - 29.8°/oo.

Homogeneity test on the mean length: Pr ($|X_o|$> 4,23) = 0 %. The difference is significant at the 5 % level.

2 - OFF-BOTTOM OR SUSPENDED CULTURES.

As soon as the palourdes reach approximately 10 mm (or 175 mg), they are transfered to the wild, for one thing because they take too much room in the nursery, for another thing because their size is then big enough to prevent them from washing through the mesh of the trays or screened boxes used in cultures in the wild.

2.1. Summary description of culture techniques.

Off-bottom cultures consists in laying the palourdes in screened boxes, secured to trestles about 50 cm off bottom. The fittings are completely uncovered at low waters of spring tides. They are covered by 5 to 7 meters of water at the highest waters (tidal range in Rade de Brest is 8 m).

In suspended culture, the palourdes are laid in creels, generally cylindrical and subdivided by various horizontal and radiating partitions (Fig. 4). Those creels, suspended from floating structures (rafts, buoys), are kept about one meter below surface and at the lowest waters, two to three meters off the bottom.

Both cultures methods may be applied to palourdes upon their leaving the nursery. They both require the purchase of comparatively expensive equipment. In both cases, the palourdes may suffer a fouling, especially the settlement on their shells of barnacles (Ex. : *Chtamalus stellatus*) and annelids (Ex. : *Pomatoceros triqueter*). This fouling varies with the sites ; it may be minor in some cases.

In suspended cultures, oyster-drills (*Ocenebra erinacea*) may attack the palourdes through the bottom screen of the boxes.

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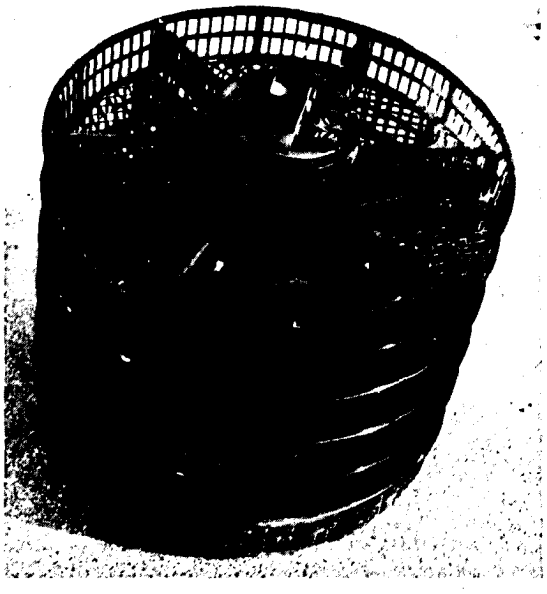

FIGURE 4 : *Sample of creel used in suspended culture. The creel is open to show the upper tray. The compartments of the tray are filled with screened cells in which the spat is laid. One of these cells can be seen in the figure.*

2.2. The use of aggregates.

In off-bottom or suspended cultures, sieved aggregates with a grain larger than the meshwork, may be added in the creels or in the boxes containing the palourdes. At a suggestion from P. WALNE (pers. comm.) we have applied this method to both types of culture, to determine if it affected the growth.

The experiments dealing with presence or absence of aggregates were numerous and varied with the density, the culture method, and the culture site. We do not think it useful to report at length the results obtained in each of them, in view of the similarity of the results obtained. Table 6 illustrates a typical example.

Creels	W (g)		Wm (mg)		G/m (%)	Z/m (%)
	19.06.77	6.09.77	19.06.77	6.09.77		
With aggregates	150	624	172.8	718.9	121.5	0
Without aggregates	150	653	172.8	752.3	128.9	0

TABLE 6 : *Weight growth of V. semidecussata cultured in suspended culture (Oberlah, Rade de Brest) with, as opposed to, without aggregates.*

At the beginning of the experiment : N = 868 (per batch), Lm = 9.5 mm, d = 11,520. In the course of the experiment, fluctuation of mean temperature : 18.5°C - 17.1°C ; fluctuation of mean salinity : 34°/oo - 35°/oo.

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After noting that growth is slightly slower when aggregates are used, we have discontinued this method, all the more so because it required an additional handling.

2.3. Influence of density on growth.

Some preliminary experiments allowed us to determine the influence of density in rearings in the wild. We are reporting results obtained in suspended cultures only, to be found in Table 7.

	W (g)		Wm (mg)		G/m (%)	Z/m (%)
	19.06.76	6.09.76	19.06.76	6.09.76		
Batch 1 : d=11,573ind/m^2 N=1,736 ind	300	1,277	172.8	735.6	132	0
Batch 2 : d=22,970ind/m^2 N=2,297 ind	400	1,232	174.1	536.3	80	0

TABLE 7 : *Weight growth of V. semidecussata in suspended cultures (Oberlah, Rade de Brest) Influence of population density. (Temperature and salinity fluctuations : see Table 6).*

2.4. Growth and mortality in off-bottom and suspended cultures.

Comparisons between suspended and off-bottom cultures can only be approximate, due to the numerous factors that differ from one to the other. For instance, the culture sites are not exactly the same, which infers that a whole serie of ecological factors are different in both batches under comparison. All our cultures, however, were located in the South of Rade de Brest, at Oberlah and Penn-al-Lann for suspended cultures, at Penn-al-Lann and Karreg Ruz for off-bottom cultures and we noted that the results obtained during the summer of 1976 varied little from one site to the other, for a same method of culture. This finding gives more value to differences in growth and mortality observed between one method and the other. Our experiments, in this matter, were numerous but we do not think it useful to report them in full. An average example is reported in Table 8. In this example, growth is considerably faster is suspended culture despite a higher density.

In general, the results obtained in suspended cultures were considerably better, Monthly weight growth rates varied from 132.9 % to 36.9 % for suspended cultures and from 18.8 % to 6.9 % for off-bottom cultures.

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Culture	N	W (g)		Wm (mg)		G/m (%)	Z/m (%)
		2.07.76	8.09.76	2.07.76	8.09.76		
Off-bottom d = 17,323 ind/m^2	7,998	1,200	1,549	150.0	194.8	10.0	0
		6.07.76	6.09.76	6.07.76	6.09.76		
Suspended d = 32,000 ind/m^2	4,000	630	1,136	157,0	284,0	80.0	0

TABLE 8 : *Weight growth of V. semidecussata in suspended (Oberlah) as opposed to off-bottom (Penn-al-Lann) cultures.*

At the beginning of the experiment : Lm = 9.5 mm. In the course of the experiment, fluctuation of mean temperature : 18.9°C - 17.1°C ; fluctuation of mean salinity : 34°/oo - 35°/oo.

The final growth concerns animals from 2 cm to commercial size : around 4 cm (legal minimum size : 3.5 cm). Suspended (or off-bottom) culture may be extended to the final growth but because of the fouling of the shells, we have undertaken on-bottom cultures. The results obtained so far are however too sporadic to be of significance.

3 - DISCUSSION.

The comparative results that we provided so far illustrate the procedure we followed to devise a good rearing protocol in the nursery. However, they do not convey a precise idea on the advantage of the nursery as the transitional step between the hatchery and the wild. For this reason, we are providing hereafter global results obtained from three shipments of *V. semidecussata*, reared at densities of some 20 000 individuals/m^2.

First shipment : from April 24 to July 1, 1976 (say 68 days), for 105 943 individuals, the weight went from 1.8 kg to 9.3 kg, which means a monthly weight growth rate of 183 % despite a 17 % mortality during the period of time under consideration.

Second shipment : from October 7 to December 7, 1976, (say 61 days) for 137,592 individuals, the weight went from 2.4 kg to 8.6 kg which means a monthly weight growth rate of 127 % (non existent mortality).

Third shipment : from November 23, 1976, to February 15, 1977, (say 84 days) for 114,417 individuals, the weight went from 0.7 kg to 3.0 kg which means a monthly weight growth rate of 117 % (non existent mortality).

Thus, in spring, autumn and winter, we obtained, in the nursery, monthly weight growth rates well over 100 %.

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In "Artificial Upwelling Project in St Croix", where several types of bivalves were reared in raceways, *V. semidecussata* reaches a commercial size in 7-11 months, at a low density (1,292 ind/m^2) (ROELS & al., 1976). But it must be emphasized that this is a plant of exceptional size, located in a tropical area.

If we refer to a recent survey (PARTRIDGE, 1977), we note that nothing has been published on the growth of *V. semidecussata* in nursery, in temperate zones. We may, however, establish a comparison with results obtained with that same species, for similar sizes, by LATROUITE & CLAUDE (1976). These authors achieved off-bottom cultures of *V. semidecussata*, at a low density (2,175 ind/m^2). The experiment took place in Brittany, at Trinité-sur-Mer, and involved 4,350 individuals, supplied by SATMAR. From August 1974 to March 1975 (say 7 months), the mean size went from 4.5 mm to 11 mm. According to figures provided by the authors, this tallies with a weight growth from 30 g to 1,000 g, which means a monthly weight growth rate of some 46 %. Thus, although it benefited from low density, this batch is far from showing a growth rate as high as those achieved in nursery. However, we will not draw definite conclusions from this, since it involved different batches, reared at different dates and sites.

In appraising the results we obtained in suspended culture, we meet the same difficulties : to our knowledge, the application of this method has never led to any publication on *V. semidecussata* nor any other species of Veneridae. We can thus make comparisons with different methods only.

With 10-20 mm palourdes, LATROUITE & CLAUDE (1976) obtained the following results in off-bottom cultures : from March to September 1975 (say 6 months), the size of the samples went from 11 mm to 21 mm, which tallies with a mean-weight growth from 0.25 g to 1.9 g, which means a monthly weight growth rate of 110 %. These results are considerably better than those we obtained in off-bottom cultures (See Table 8). They are close to the results we obtained in suspended cultures (See Table 6 & 7), but it must be remined that the densities in our cultures were five times higher.

CHEW (1975) used another method in rearing Manila clam from hatchery-reared spat. Samples with a size of 2 to 4 mm and 8 to 10 mm were sown on the bottom in various areas at Puget Sound (USA). The author did not provide growth rates, but gave instead the rates of recovery of the planted individuals which vary from 27 % to 6 % after a year and a half. He thus demonstrates the main difficulty in on-bottom rearing, as MESSMER & SMITH already did (1974).

CONCLUSION.

According to the LATROUITE & CLAUDE experiment (1976) or WALNE basic study (1976), *Venerupis semidecussata* seems to be better suited to culture than the European species *V. decussata*. Likewise, the culture of *V. decussata* in the Tinduff nursery appeared very difficult (high mortality, slow and irregular growth).

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It thus seems that the culture of *V. semidecussata*, which has an excellent commercial potential, is bound to develop. In temperate countries, three methods were experimented so far on this species : seeding on the bottom (CHEW 1975), off-bottom culture (LATROUITE & CLAUDE, 1976), rearing in nursery (LUCAS, 1976). We have shown in the present paper the advantage of a fourth method : suspended culture in the wild.

In view of the results obtained, we shall maintain our protocol which includes a preliminary stage in nursery, followed by suspended culture. As for the final growth, we shall decide later between suspended and on-bottom culture.

Later on, we will try to improve the results by trying new fittings in the nursery as well as in the wild, the final goal being to reach marketable samples in two years of culture.

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