Société Française de Malacologie
LES MOLLUSQUES MARINS. BIOLOGIE ET AQUACULTURE
Ifremer, Actes de Colloques, no. 14, 1992, p. 119-126

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LA CULTURE SUSPENDUE DE *CHLAMYS VARIA*, DE LA NOURRICERIE A LA TAILLE COMMERCIALE, EN GALICE (ESPAGNE)

CANCELO M.J., GUERRA A., FERNANDEZ A., GABIN C. et FERNANDEZ J.

Consellería de Pesca. Xunta de Galicia. Apdo. 208. VILAGARCIA DE AROUSA. Pontevedra. España

RESUME : *Chlamys varia* a un grand potentiel d'élevage en Galice. Cette espèce représente, avec d'autres pectinidés, un complément et une alternative à la culture suspendue de la moule, dominante dans cette région. Dans ce travail on étudie la croissance du naissain obtenu en écloserie, depuis la taille initiale de 6.45 ± 0.75 mm jusqu'à 15 mois. Ce naissain a été élevé à différentes densités et profondeurs. La longueur (H) finale est de 36.49 ± 0.56 mm pour le groupe élevé à une forte densité et en profondeur, tandis que pour le groupe élevé à une faible densité et en surface, elle est de 40.75 ± 0.55 mm. Les diverses densités l'élevage conduisent à des différences significatives en croissance ($p<0.001$) tandis que pour les groupes qui ont été suspendus à différentes profondeurs, ces différences n'existent pas. A la fin de la période, la mortalité est inférieure à 2% dans tous les cas étudiés.

Mots clés : *Chlamys varia*, engin flottant, croissance, mortalité

CHLAMYS VARIA, L. : RAFT CULTURE FROM NURSERY TO COMMERCIAL SIZE IN GALICIA (N.W. OF SPAIN)

ABSTRACT : Chlamys varia *has a great potential of culture in Galicia, and it is likely to be among the pectinids, both a complement and an alternative to raft mussel culture which is dominant in the region. The present work attemps to analyse the growth of nursery spat of 6.46 ± 0.75 mm reared in a raft during fifteen months in different depth and densities. The final average height is between 36.49 ± 0.56 mm in the group of high density in the bottom and 40.75 ± 0.55 mm in those of low density at the surface. Different culture densities have shown significant differences in growth ($p<0.001$). However different depths have not shown such differences. At the end of this period mortality is lower than 2% in all groups.*

Keywords : *Chlamys varia*, raft culture, growth, mortality

INTRODUCTION

Chlamys varia (L.) is a widely distributed species, living along all the Atlantic Coasts from Denmark to Portugal.

In Spain, overfishing of natural stocks has caused a great decrease of the fisheries of this species. No captures were registered in official statistics since 1978.

In Galicia this species, together with the two pectinids nowadays cultured in this area (*Chlamys sp*. and *Pecten sp*.), are the second in commercial importance in the group of the so called "secondary species". After mussels, the group is the more promising for culture. At the moment it has become (it may become) an alternative complement to mussel monoculture (250.000 Tm./year), which is the dominant culture in the region.

As a response to the increasing importance of the culture and production of this species, preliminar and recent studies were being carried out in order to know its distribution, natural recruitment, and raft culture. Similar previous works were done by SHAFFE (1980) who described growth and reproduction in Brest (France) and BURNELL (1983) in Ireland. LE PENNEC & DISS-MENGUS (1985) have succeded in the obtention of hatchery spat.

ROMAN et al (1987) and RAMONELL et al. (1990) analyise natural recruitment in Galicia. ACOSTA et al. (1990a) have studied methods of hatchery spat production, and ACOSTA et al. (1990b) and CANCELO et al. (1990) have analyised spat culture and fattening methods in order to reach a commercial production.

The present work aimed at the analysis of growth and production rates of spat reared in raft up to the legal commercial size for a significant part of the population.

MATERIALS AND METHODS

Spat of *Chlamys varia* obtained in a hatchery in April 1989 and after 3 months of growth, were transfered to a raft in San Ciprian (N. of Galicia) with an average size of 6.47±0.75 mm (x±s.e.). Initial stock was divided at ramdom in four groups in order to determinate the effect of density and depth on the culture, they were cultivated in plastic trays like those used in oyster culture. These trays, 40 cm in diameter and 10 cm high are divided into 4 quadrants on the inside, allowing prismatic boxes measuring 12*12 cm at the base and 10 cm in height, with covers and made out of 1.5 mm mesh lighweight plastic netting, to be placed in each (PEREZ-CAMACHO & CUÑA, 1985).

The instantaneous monthly rate of growth, (K), was calculated as follows (ASKEW, 1978; SHAFFE, 1980),

$$b = \frac{(Ht+1)-Ht}{Ht} \times \frac{30}{N} \qquad \text{and} \qquad K = \text{Ln}\,(b+1)$$

Ht= Average height at the beginning of a sample period.

Ht+1= Average height at the end of a sample period.

N= Number of days between samples.

Ln= Natural logarithm.

Changes in the morphometric relations between L(length)/H(height) were analized by regression equations, after six and fifteen months.

At the end of the culture period, the effect of depth (1 and 7 m) and density, initial densities were 200 units/quadrant dividing them in october-89 (100 and 200 units/quadrant) and january-90 (50 and 100 units/quadrant)(CANCELO et al., 1990) over the growth (weigh and height), was analysed by a two ways ANOVA. The percentage of individual reaching the legal commercial size (H> 40 mm.) was also calculated.

RESULTS AND DISCUSSION

Figuer 1 shows the variations in temperature and salinity at the surface of the water all along the period of culture. The ranges of average temperatures varies between 11.9°C in January and 18.8°C in August. As for the average salinity, it varies from 25.7‰ in January and 30.8‰ in April. These data are similar to those given by MARTINEZ et al (1990) in this area during the period 1989-90.

Figure 2 shows the instantaneous growth rates for the groups reared at different density conditions. For two groups, growth was similar. The K values were high in spring, this agrees with the maxima of chlorophila indicated by MARTINEZ et al (opus cit), and lower in autumn and winter. A similar evolution was found by SHAFEE (1980) in Brest and ACOSTA et al. (1990) in the Ria de Arosa (Galicia).

The lower growth rates in groups of high and low density were reached in Dec/Jan (0.00, 0.06) and Jul/Aug (0.03, 0.06), and the highest, in Oct/Dec (0.20, 0.21) and Mar/Apr (0.14, 0.16). This could be associated to the food availability in the water, mainly in spring (MARTINEZ, et al., 1990 and ACOSTA et al. 1990b). Growth rates in weight (W) in the same period were higher than thosefor the height (H). Nevertheless they have a similar evolution, as it is usually observed in most bivalve molluscs (CLAUS, 1981).

Figure 3 shows the L/H relations in two periods of the culture corresponding to different density. At the first period (Dec-89), the regression coeficients indicated a negative allometry (L/H). In the second period studied a tendency to isometry appeared as the size increased.

The ANOVA of Table 1 and 2 present the effects depth and density factors have produced in the variables H and W produced by after 15 months of raft culture. Significant differences was found between densities in H ($p<0.001$) and also in W ($p<0.001$). No significant difference were found between depths in the studied period (the last 8 months). Interaction of the two factors has a significating level ($p<0.01$) in weight and ($p<0.0$-01) in height.

In a previous work CANCELO et al. (1990) found significant differences in growth between groups when maintained at high or low density; this effect is shown in Figure 4 which represents the size frequency distribution after 15 months in the raft. Mean size of high density group in the bottom (36.59±0.56 mm.) and in surface (34.40±0.65 mm.) are lower than those reared at low density in bottom (38.65±0.60 mm.) or in surface (40.75 ± 0.55 mm.). In the last group more than 67% of individuals reached the commercial size (40 mm).

The great raft culture potential in the Galician coast, together with the commercial importance of this species and its culture response (nursery spat reached commercial size in 15 months in raft, mortality -lower than 2% in all groups in the studied period-), point out that this species as suitable for a commercial production.

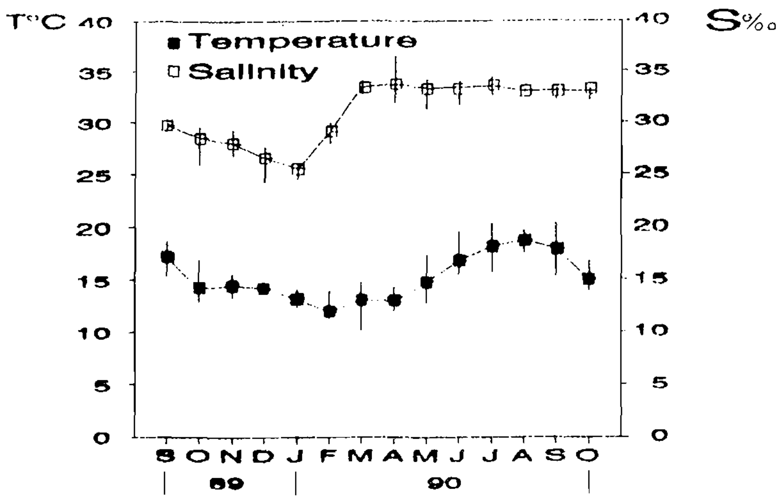

FIG. 1: Evolution of the monthly average values of tmeperature and salinity during the culture. Verticla lines indicate maximal and minimal values each month.

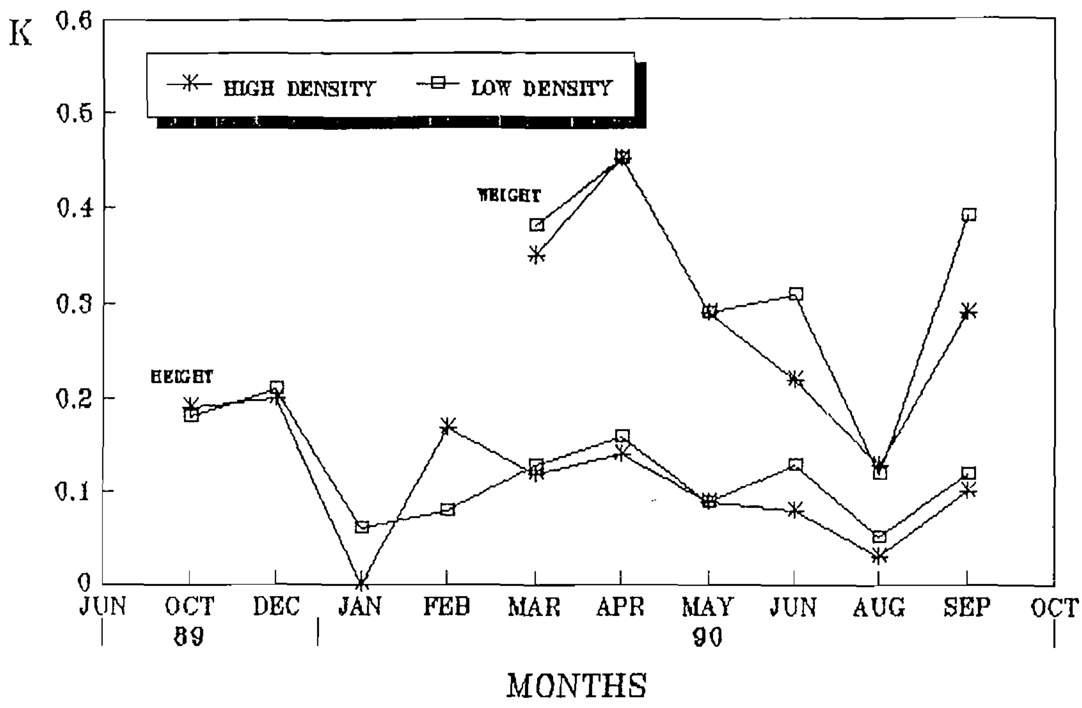

FIG. 2: Instantaneous growth rates in height (H) and weight (W) of different groups of C. varia during the period 1989 - 1990.

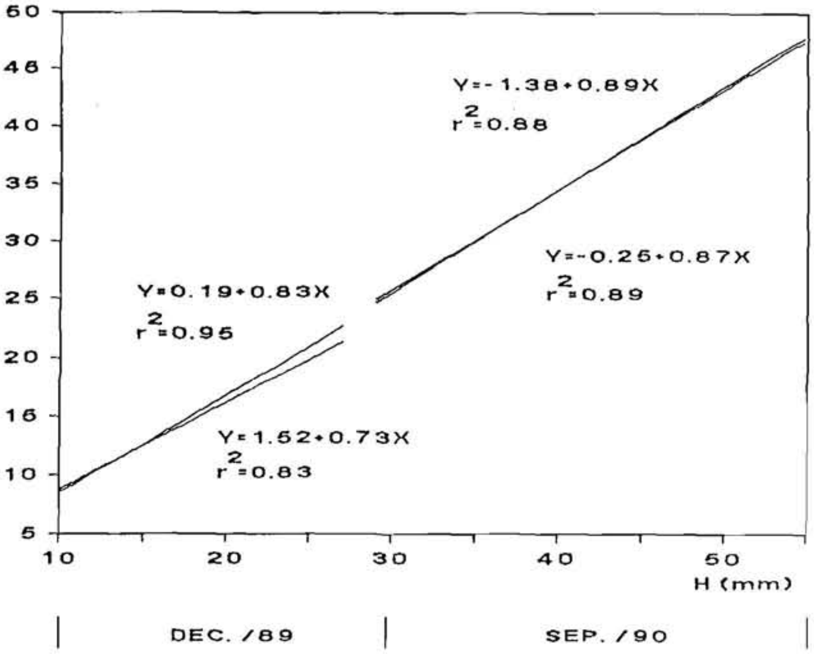

FIG. 3: Morphometric relations (H/L) in two periods of the culture cycle (Dec/89 and Sep/90).

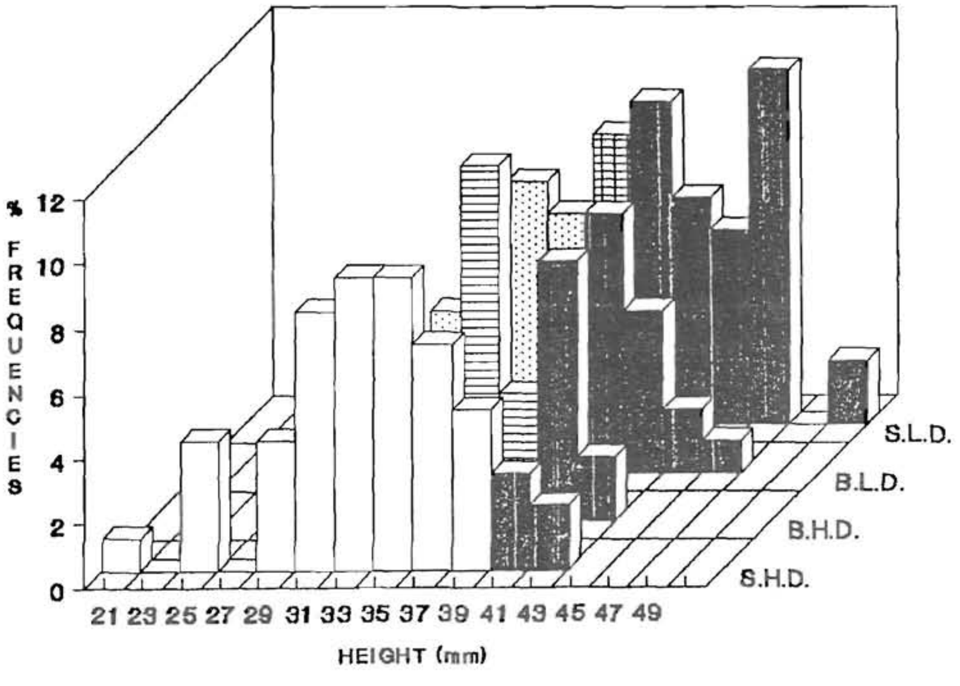

FIG. 4: Height frequency distribution of different groups of C. varia after 15 months in the raft (S.H.D. Surface High Density, B.H.D. Bottom High Density, S.L.D. Surface Low Density, B.L.D. Bottom Low Density). ▓ Commercial black scallops (H $\geq$ 40 mm).

SOURCE	D.F.	SUM SQUARES	MEAN SQUARE	F-RATIO
Depth	1	0.105	0.105	0.01 (NS)
Density	1	819.729	819.729	46.10 (***)
Interaction	1	212.597	212.597	11.96 (***)
Error	185	3289.803	17.782	
Total	188	4437.662		

NS= no significative; *** p<0.001

TABLE I. ANOVA between depth and density in height (H).

SOURCE	D.F.	SUM SQUARES	MEAN SQUARE	F-RATIO
Depth	1	4.040	4.040	0.61 (NS)
Density	1	394.560	394.560	59.28 (***)
Interaction	1	49.483	49.483	7.43 (**)
Error	185	1231.298	6.655	
Total	188	1722.151		

NS= no significative; ** p< 0.01; *** p<0.001.

TABLE II. ANOVA between depth and density in weight (W).

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