Revista Ciência Agronômica, v.36, n.3, p. 400-403, 2005
Centro de Ciências Agrárias - Universidade Federal do Ceará, Fortaleza, CE
www.ccarevista.ufc.br ISSN 0045-6888

Allometric growth on mangrove oyster *Crassostrea rhizophorae* (Guilding, 1828), cultured in Southern Brazil[1]

Crescimento alométrico em ostra-do-mangue *Crassostrea rhizophorae* (Guilding, 1828), cultivada no Sul do Brasil

Guilherme Bastos Maccacchero[2], João Guzenski[3] e Jaime Fernando Ferreira[4]

Abstract - The allometric growth was studied in cultured mangrove oysters *Crassostrea rhizophorae*, during about 5 months, under different wash cleaning management treatments (each 7 or 14 days) and densities (1,000 and 2,000 oysters/lanternet) commonly used by producer fishermen in southern Brazil, starting with 9 mm animals. In all treatments the oysters grew fast, going to more than 50 mm. The highest stock density and 14 days wash cleaning treatment had yielded the best growth on shell height. However, when we focus the analysis of volume, the best treatment was the 7 day wash cleaning management and lowest stock density. These results clearly demonstrate the allometric growth rate in oysters and the importance of using biometric parameters other than height to analyse the growth results in oysters where there are a strong relationship between shell growth and shape definition, stock density and culture management.

Index terms: allometric growth, *Crassostrea rhizophorae*, density, management, washing treatment, culture.

Resumo - O crescimento alométrico na ostra-do-mangue (*Crassostrea rhizophorae*) foi estudado durante cerca de 5 meses de cultivo, em dois tratamentos de manejo por lavação com água (cada 7 ou 14 dias) e duas densidades (1.000 e 2.000 ostras/lanterna) comumente utilizadas por produtores artesanais na região sul do Brasil, iniciando com animais de 9 mm. Em todos os tratamentos as ostras cresceram rápido, atingindo mais de 50 mm. O tratamento de maior densidade de estocagem e 14 dias de lavação alcançou o melhor crescimento de altura de concha. Entretanto, quando analisado o crescimento em volume, o melhor tratamento foi o de baixa densidade e 7 dias de lavação. Esses resultados demonstram claramente o crescimento alométrico em ostras e a importância em usar outros parâmetros biométricos, além da altura para analisar resultados de crescimento nesses bivalves, onde há uma forte relação entre o crescimento, definição de formato de concha e densidade de manejo em sistemas de cultivo.

Termos para indexação: crescimento alométrico, *Crasostrea rhizophorae*, densidade, manejo, tratamento de lavação, cultivo.

[1] Recebido para publicação em 21/06/2004; aprovado em 13/05/2005.
Parte da dissertação apresentada pelo primeiro autor ao Dep. de Eng. de Pesca-CCA/UFC.
[2] Bacharel em Ciências Biológicas, M. Sc., Laboratório de Moluscos Marinhos, Rua dos Coroas s/n, Barra da Lagoa, CEP 88061-600, Florianópolis, SC - Brasil, g_maccacchero@hotmail.com
[3] Oceanólogo, M. Sc., Agente Técnico da Emp de Pesquisa Agropecuária de Santa Catarina, guzenski@epagri-rct.br
[4] Bacharel em Ciências Biológicas, D. Sc., Prof. Adjunto da Dep. de Aqüicultura, UFSC, SC, jff@cca.ufsc.br

Introduction

Mangrove oysters of the genus *Crassostrea* spp. have been exploited in oyster culture all along the Brazilian coast under different cultivation systems, almost all with low technical improvement along many years. However, the correct management on culture stock densities represents a great importance on the final commercial value for this recent successful activity throughout different parts of the Brazilian coast (Nascimento, 1994; IBAMA/SE e FIPERJ/RJ, 1997; Oliveira et al. 1998; Bastos et al., 1998; Guzesnki, 2000).

In an informal way, it is known among Brazilian fishermen in oyster culture activity, the influence of stock density on the aspect of oyster and valve dimensions, what has a strong influence in the shape and consequently in the commercial value of the oyster, according to the market acceptance. The shell growth pattern and consequently the allometric relationships also play important role in the definitions of growth patterns of the soft body tissues and the total meat for consumption (Wilbur e Owen, 1964). However, the correct density and management vary according to the culture system and the environmental conditions of the region. The definitions of these aspects are not well defined for oysters cultured in southern Brazil, affecting the growth rates and commercialization.

The objective of this study was to collaborate with the study of the influence of stock densities on the growth rate and allometric relationships in cultured native oysters, to be used as recommendation for the fishermen in oysterculture projects with the mangrove oyster, *Crassostrea rhizophorae* at southern Brazil.

Materials and Methods

Hatchery (initial 9 mm) reared seeds of *Crassostrea rhizophorae* had been cultured under suspended raft culture at the Sambaqui beach, Florianópolis, Southern Brazil (Figure 1). Oysters were stocked based on two densities, 1,000 and 2,000 seeds per lanternet (representing 200 or 400 oysters per floor, in five floor lanternets), commonly used by fishermen in that subtropical region. The oysters where submitted to two wash cleaning treatments with a water pressure equipment, each 7 or 14 days. All structures with their respective treatments were taken under triplicates.

In order to evaluate the growth rate, we measured the height (in mm) of 50 oyster random samples, around 30 days of culture, during about five months (160 days) and also, the total volume of the oysters in each treatment.

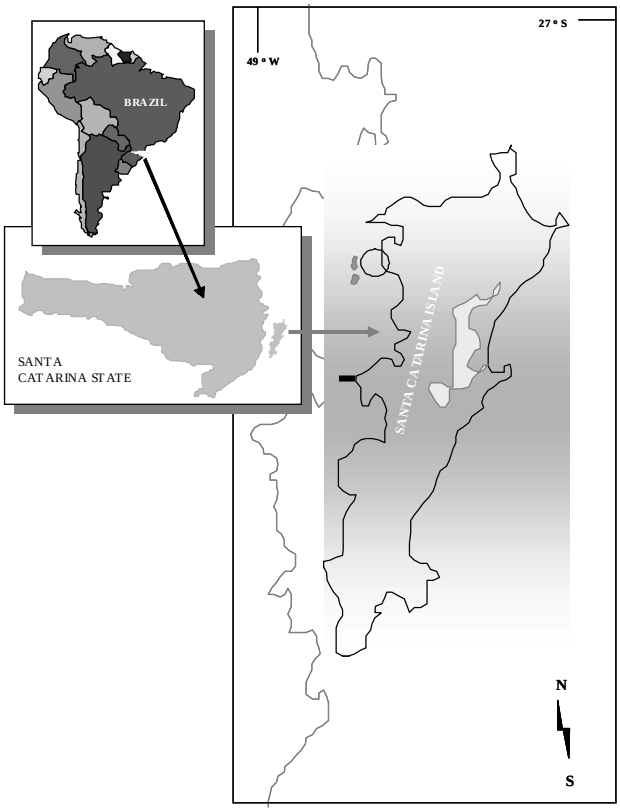

Figure 1 – Map of the experimental region in southern Brazil. The circle indicates the experimental area in the Sambaqui beach.

The best height growth was expressed using regression and a comparison between final growth in height and angular coefficients of volume was made with ANOVA and mean analyses according to the Tukey method (5%). The analyses of volume results were also expressed using regression and linear coefficients.

Results and Discussion

The general growth of the traditional tropical oyster on the subtropical region was outstanding because it has expressed the advantages of the great selection into the hatchery. Both stock density treatments presented strong growth during the experimental period (Figures 2 and 3).

All treatments expressed great final size with mean shell heights between 49 mm and 58 mm. Regression analyses measurement may be observed in the Figure 3. As can be seen in Table 1, the highest stock density and 14 days wash cleaning treatment had yielded the best growth on shell height. However, when we focus the analysis of volume in Table 2, the best treatment was the 7 day wash cleaning management and the lowest stock density.

Many aspects must been evaluated on this single reason of oyster's growth. On the physiological and

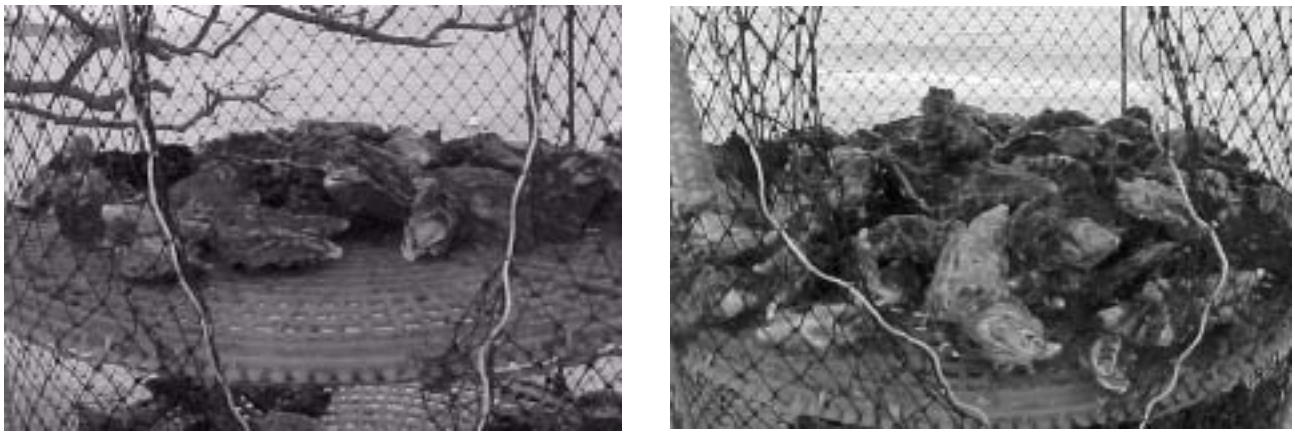

Figure 2 - Aspects of the lowest (A) and highest (B) stock density at the end of the experiment with oysters between 50 and 60 mm.

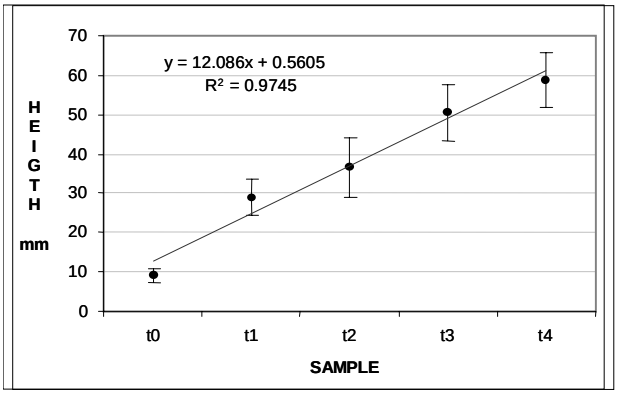

Figure 3 - Shell height of oysters during the sampling time on the highest stock densities and 14 days wash cleaning treatment.

ecological manifestation of the bivalve animals, it would preserve a 3-D space while the height growth lines eventually have been stimulated to induce it through a fusion form in highest stock density used.

Usually, native oysters have been widely distributed throughout the Brazilian coast. These animals always demonstrate odd dynamic populations in field production (Pereira et al., 2003).

Table1 - Total height growth and growth rate per day of culture obtained under two cleaning procedures (7 and 14 days) and two stock densities (1,000 and 2,000 seeds per lanternet).

Treatment	Final height (mm)	Growth rate (mm d^{-1})
Lowest density 7 days wash	54.16 ±7.46 [b]	0.33
Highest density 7 days wash	55.84 ± 7.41 [b]	0.34
Lowest density 14 days wash	49.81 ± 6.99 [c]	0.30
Highest density 14 days wash	58.83 ± 8.50 [a]	0.36

Small letters (a to c) represent statistical differences and similarities ($p<0.05$).

Table 2 - Volume (mL) growth obtained under two cleaning procedures (7 and 14 days) and two stock densities (1,000 and 2,000 seeds per lanternet) expressed according the regression analyses and linear coefficients.

	Lowest density		Highest density	
	7 days wash	14 days wash	7 days wash	14 days wash
a	-11.67.	-11.33	-11.64	-10.56
b	3.769 d	3.641 e	3.760 d	3.441 [f]
r	0.996	0.989	0.992	0.990

a = Linear coefficient (intercept); b = Angular coefficient (slope); r = Pearson correlation coefficient. Small letters (d to f) represent statistical differences and similarities ($p<0.05$).

Absher (1989) cited the height as the main dimension on oyster shell. It would have a great coefficient value in the determination of other growth parameters (Dame, 1972; Pereira et al., 1988), and among practical aspects, it would be the best parameter to indicate the other oyster biomass parameters (Pereira, 1996).

The best height growth in the treatment with the highest stock density, despite of food space competition, suggested that these animals usually provided as the biological manifestation of the biological response, maybe of benthonic organism filter feeding behaviour (Barrilè et al., 1997), suggesting real influence on the culture management.

Perreira et al. (2001) also reached the best growth in highest stock density with the native Brazilian oyster *Crassostrea brasiliana*; although Moromey e Walker (1999) *apud* Perreira et al. (2001) have predicted that the oyster culture food space competition should be avoided in the activity development.

Dame (1972) working with the American oyster *Crassostrea virginica* in intertidal and subtidal cultures, observed that the treatments produce no difference in the shell (valves) size, but significant differences on the wet

weight oyster biomass. These data can be correlated with our best results on volume growth leading to potential increase in total biomass at low density and more frequent wash management.

The data obtained on this research clearly demonstrated a correlation of this oyster shell height dimension and the variation of the practiced culture conditions. However, it is more dependent on the stock density management than on a single morphological dimension, despite the oyster's main growth axis line being situated on the shell height.

Therefore, variations on the oyster shells growth data expressed by the relationship of management practices on both experiments are clearly observed along our experimental data. It can be proposed to fisherman aquaculture activity as a great biomass production prospect when the correct management practice is followed in southern Brazil.

Conclusion

The variation on the growth of bivalves are clearly allometric, correlated with the management practice (density and cleaning) on the culture conditions and should be analysed and computed considering different data of the animal's shell biometric parameters.

Acknowledgements

To all professionals and students of LMM-UFSC - Sambaqui for the great help during the experimental phase.

To Dr. Antonio Adauto Fonteles-Filho for his help in revising the manuscript and general suggestions.

For the financial support from: Canadian International Development Agency – CIDA, Brazilian Mariculture Linkage Program-BMLP (Canada), Programa Brasileiro de Agricultura Familiar-(PRONAF) e Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico- (FUNCAP-CE).

Bibliographic References

ABSHER, T. M. **Populações naturais do gênero** *Crassostrea* **do litoral do Paraná - desenvolvimento larval, recrutamento e crescimento**. 1989. 185 f. Tese (Doutorado em Oceanografia) - Instituto Oceanográfico, Universidade de São Paulo, São Paulo.

BARILLÉ, L.; PROU, J.; HÉRAL, M.; RAZET, D. Effects of high seston concentrations on the feeding and absorption of the oyster *Crassostrea gigas* (Thunberg). **Journal of Experimental Marine e Biology and Ecology.** v.212, p.149-172, 1997.

BASTOS, A. A.; TIAGO, G. G.; GODINHO, H. M. A Maricultura no Estado de São Paulo. In: SIMPÓSIO BRASILEIRO DE AQÜICULTURA, 10., Recife. **Anais…** Recife: SIMBRAQ, 1998. p.166.

DAME, R. F. Comparison of various allometric relationships in intertidal and subtidal americam oysters. **Fishery Bulletin**, v.70, n.4, p. 1121- 1126, 1972.

GUZENSKI, J. Cultivo de Ostra do Mangue – Perspectivas para o Brasil Anais de Congresso. In: SIMPÓSIO BRASILEIRO DE AQÜICULTURA, 12., 2000 Florianópolis. **Anais…** Florianópolis: UFSC, 1 CD-ROM.

IBAMA/SE; FIPERJ/RJ. **Manual técnico de ostreicultura**. Aracaju: IBAMA/SE-FIPERJ/RJ, 1997, 38p.

NASCIMENTO, I. A. Ostreicultura: uma nova e viável atividade produtiva no Nordeste Brasileiro. **TECBAHIA CEPED**, v.9, n.2, p.7-9, 1994.

OLIVEIRA, E.B.; ANDRADE, H. K.; FELSKY, F. N.; PINTO, A. T. Programa de Maricultura no Esperito Santo: histórico e Perspectiva. In: SIMPÓSIO BRASILEIRO DE AQÜICULTURA, 10., Recife. **Anais...** Recife: SIMBRAQ, 1998. p.165.

PEREIRA, O. M.; HERINQUES, M.B.: MACHADO, I. C. Estimativa da curva de Crescimento da ostra *Crassostrea brasiliana* em Bosques de mangue e proposta para extração ordenada no estuário de Cananéia-SP, Brasil. **Boletim Instituto de Pesca de São Paulo**. v.29, n. 1, p. 19-28, 2003.

PEREIRA, O. M., MACHADO, I. C., HERINQUES, M. B; YAMANAKA, N. Crescimento da ostra *Crassostrea brasiliana* semeada dobre tabuleiro em diferentes densidades na região esturino-lagunar de Cananéia-SP(25°S, 48°W). **Boletim Instituto de Pesca de São Paulo**. v.27, n.2, p.163-174, 2001.

PEREIRA, O. M.; SOARES, F. C.; AKABOSHI, S. Cultivo experimental de *Crassostrea brasiliana* (Lamarck, 1819) no canal da Bertioga São Paulo, Brasil. **Boletim do Instituto de Pesca**, v.15, n.1, p.55-65, 1988.

PEREIRA, O. M.; SOARES, F. C. Análise da criação de ostra *Crassostrea brasiliana* (Lamarck, 1819), no sítio Guarapari, na região lagunar estuarina de Cananéia. **Boletim do Instituto de Pesca**, v.23, (único), p.135-142, 1996.

WILBUR, K. M.; OWEN, G. Growth *In* Wilbur, K. M. Yonge, C. M. (Editors), **Physiology of Mollusca**, New York: Academic Press, 1964 v. 1, p. 211-242, 1964.