GROWTH OF THE MANGROVE CRAB *Ucides cordatus* (LINNAEUS, 1763) (CRUSTACEA, BRACHYURA, OCYPODIDAE)

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Resumo: Durante coletas mensais, entre setembro/1998 a agosto/2000, foram coletados 3.600 espécimes de *Ucides cordatus* (2.054 machos e 1.606 fêmeas), distribuídos em classes de tamanho para determinar as equações de crescimento-idade para cada sexo. *U. cordatus* é uma espécie com crescimento lento, com as fêmeas mostrando uma grande oscilação sazonal do crescimento, justificando o uso do modelo de crescimento sazonal de Von Bertalanffy para cada sexo. As constantes CW_∞ e k foram muito similares entre os sexos ($CW_{\infty\ Machos}$ = 90,3mm; $CW_{\infty\ Fêmeas}$ = 88,6mm; k_{Machos} = 0,28; $k_{Fêmeas}$ = 0,26). Essa baixa taxa de crescimento está relacionada com a pobre qualidade do alimento em termos da composição bioquímica das folhas senescentes, promovendo redução e inclusive a detenção do crescimento sazonal.
Palabras chave: Crescimento, Mangue, Caranguejo, Ocypodidae, *Ucides*

Abstract: During monthly samplings between September/1998 to August/2000, 3,660 specimens of *U. cordatus* (2,054 males and 1,606 females) were obtained and distributed in size class to determine sex-specific growth-age equations. *U. cordatus* is a slow growing species, in which females undergo greater seasonal growth oscillations justifying the use of both seasonal and non-seasonal von Bertalanffy growth models to either sex. The constants CW_∞ and k were very similar between sexes ($CW_{\infty\ Male}$ = 90.3mm; $CW_{\infty\ Female}$ = 88.6mm; k_{Male} = 0.28; k_{Female} = 0.26). This slow growth rate may be related to a poor food quality in terms of biochemical composition of senescent leaves promoting growth reduction and even seasonal growth cessation.
Key words: Growth, Mangrove, Crab, *Ucides*, Ocypodidae

There is some controversy regarding the growth pattern of *Ucides cordatus*, which has been labeled as either fast-growing (IVO *et al.*, 1999; VASCONCELOS *et al.*, 1999) or slow-growing (DIELE, 2000). Elucidating the actual growth type of *U. cordatus* is of most importance to allow an adequate management of this fishery resource, intensively exploited along the Brazilian coast. The objectives of the present study are: 1) determine the growth curves according to both size and weight, and 2) estimate the age at which the studied population achieves sexual maturity and marketable size.

Crabs were monthly collected from September/1998 to August/2000 at the mangrove areas in the Iguape county (SP). For each specimen obtained, sex, size and weight were recorded. A vernier caliper was used to measure their carapace width (CW) to the nearest 0.05mm and an

analytical balance (0.01g) to determine their weight (W = total wet weight). Size frequency distributions were decomposed into their normal components using FiSAT software. An analysis of residuals was performed to verify if there are significant seasonal growth trends (t-test; α=0.05). Longevity ($t_{máx}$) was estimated to each sex by using the maximum size of field-caught individuals as an input in the inverse von Bertalanffy function. The age of largest individuals (CW_{max}), marketable crabs (CW_{com}) and onset of sexual maturity to each sex (CW_{fm}) were also estimated. For the latter, the size estimates of 51.3 e 43mm for males and females, respectively (PINHEIRO, 2001) were used. Growth curves based on weight were based in WxCW relationships by PINHEIRO (2001).

A total of 3,660 specimens (2,054 males and 1,606 females) were grouped in each four-month period to ensure meaningful modal groups. Males were distributed up to a larger size class (80-85mm) than females (75-80mm). In figure 1, two to three year-groups may be distinguished. The female growth presented a larger oscillation range during spring / summer (C≥1), and may be represented by the growth function: $CW_t = 88.6[1 - e^{-0.26t - 0.041\{\text{sen}[2\pi(t+0.18)] - \text{sen}[2\pi(0.18)]\}}]$. In males the oscillation parameter is less expressive (C<0.3) and their growth may be depicted as $CW_t = 90.3[1 - e^{-0.28t}]$ (Fig. 2). Males presented a slightly higher growth rate (k=0.28) and asymptotic size (CW_∞=90.3mm) than females (k=0.26 and CW_∞=88.6mm). Longevity based on the age of largest individuals (CW_{Male}=83.4mm; CW_{Female}=78.1mm) is higher in males (9.2 yr.) than females (8.3 yr.). Functional maturity is achieved in 3.0 yr. in males and 2.8 yr. in females. The age at minimum legal size at Iguape (60mm, according to Portaria IBAMA #70/2000) is 3.8 yr. in males and 4.7 yr. in females.

Growth curves based on weight for males and females were; $W_t = 281.74[1 - e^{-0.28t}]^{2.99}$ and $W_t = 259.45[1 - e^{-0.26t - 0.041\{\text{sen}[2\pi(t+0.18)] - \text{sen}[2\pi(0.18)]\}}]^{2.86}$, respectively. Weight at maximum age ($t_{máx}$) of males and females rendered estimated values of 222.38g and 180.39g for males and females, respectively.

The present results support DIELE's (2000) report describing a slow growth pattern. In contrast we found no corroboration to the results obtained by IVO *et al.* (1999) and VASCONCELOS *et al.* (1999), who obtained a growth constant (k) on average five-fold higher

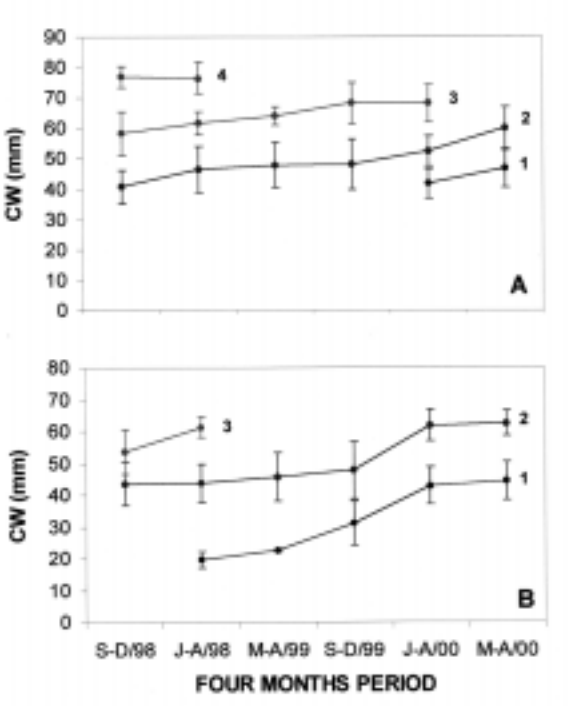

Figure 1 – Age cohorts of males (A) and females (B) of *U. cordatus*, based on modal progression analysis through four-month periods at Iguape mangroves (CW = carapace width).

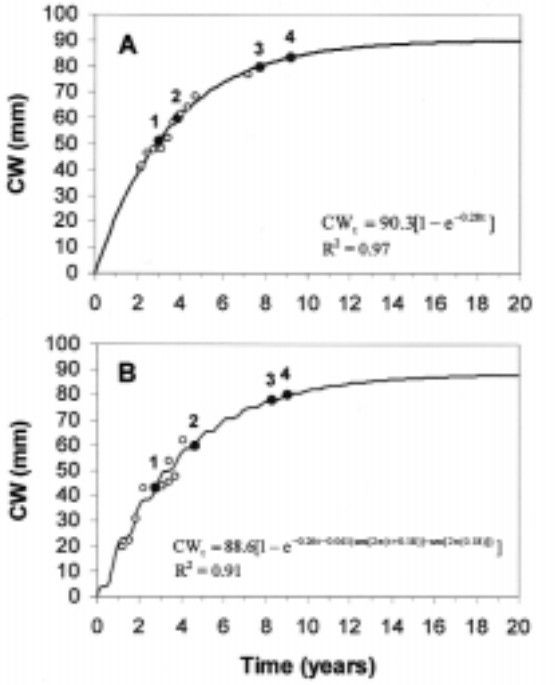

Figure 2 – Growth equations based on *U. cordatus* size increments (CW) of males (A) and females (B). 1 = size at functional maturity; 2 = minimum size according to the IBAMA rules; 3 = longevity at CW_{max}; 4 = average commercial size.

which is apparently an overestimation, since both the present account and the data presented by DIELE (2000) were all obtained in populations at comparable latitude. Besides, seasonal reproduction in *U. cordatus* (PINHEIRO, 2001) and the possibility of reliably predict the hatching, settlement and growth seasons (FREIRE, 1998; DIELE; 2000; PINHEIRO, 2001), show that juvenile crabs around 17 mm in July are certainly the offspring generated from females breeding in late November of the preceding year, therefore 8 months-old, further supporting the slow-growing pattern.

Life span using the size of largest captured crabs provided meaningful age estimates, although the application of the same procedure to DIELE's (2000) data rendered three-fold longevity estimates (27.2 to 27.6 yr.). The same method applied to authors suggesting fast-growing patterns, renders longevity estimates from 1.9 to 3.1 yr., incompatible to this species' biology.

Herbivory and preference for senescent leaves are probable causes of slow growth in this species since this food resource has low nutritional value, in addition to a higher content of polyphenols and reduced content of nitrogen (CONDE *et al.*, 1995) reported in senescent leaves

thus indicating this to be a low-quality food item. Primarily feeding on such resources may limit or even prevent growth at all in arthropods, and may be the main causes of reduced growth rates in *U. cordatus*.

It is urgent to establish a management plan for the preservation of *U. cordatus* stocks in order to avoid a depletion of natural populations and reduction of average crab size. Difficulties in larval rearing impose serious problems on eventual efforts to provide artificial crab recruitment in areas anthropogenically impacted. The management of natural populations is at present still the better solution towards the preservation and sustainability of this resource.

CONDE, J.E.; ALARCÓN, C.; FLORES, S. & DÍAZ, H. 1995. Nitrogen and Tannins in mangrove leaves might explain interpopulation variations in the crab *Aratus pisonii*. *Acta Científica Venezolana*, *46*: 303-304.

D'INCAO, F.; RUFFINO, M.L.; SILVA, K.G.; BRAGA, A.C. & MARQUES, L.H.C. 1993. Crescimento de *Chasmagnathus granulata* Dana, 1851, em um marisma do estuário da Lagoa dos Patos, RS (Decapoda: Grapsidae). *Rev. Bras. Biol*., *4*: 637-643 .

DIELE, K. 2000. **Life history and population structure of the exploited mangrove crab *Ucides cordatus cordatus* (Linnaeus, 1763) (Decapoda: Brachyura) in the Caeté Estuary, North Brazil.** Universidade de Bremen, Bremen, Alemanha, 116p. (*Tese de Doutorado*)

FREIRE, A.S. 1998. **Dispersão larval do caranguejo do mangue *Ucides cordatus* (L. 1763) em manguezais da Baía de Paranaguá, Paraná.** Instituto Oceanográfico da Universidade de São Paulo (IO/USP), São Paulo, SP, 67p. + XXVI tabs. + 27 figs. (*Tese de Doutorado*)

IVO, C.T.C.; DIAS, A.F. & MOTA, R.I. 1999. Estudo sobre a biologia do caranguejo Uçá, *Ucides cordatus cordatus* (Linnaeus, 1763), capturado no Delta do Rio Parnaíba, Estado do Piauí. *Bol. Tec. Cient. CEPENE*, Tamandaré, 7(1): 53-84.

PINHEIRO, M.A.A. 2001. **Biologia do caranguejo-uçá *Ucides cordatus* (Linnaeus, 1763) no litoral sul do Estado de São Paulo.** Relatório Científico Final – FAPESP (Proc. 98/6055-0), Jaboticabal, SP. 211p.

VASCONCELOS, E.M.S.; VASCONCELOS, J.A. & IVO, C.T.C. 1999. Estudo sobre a biologia do caranguejo Uçá, *Ucides cordatus cordatus* (Linnaeus, 1763), capturado no estuário do Rio Curimatau (Canguaretama) no Estado do Rio Grande do Norte. *Bol. Tec. Cient. CEPENE*, Tamandaré, *7*(1): 85-116.