SEX RATIO ANALYSIS IN THE CRAB GONIOPSIS CRUENTATA (LATREILLE 1803) (CRUSTACEA: BRACHYURA: GRAPSIDAE) IN A MANGROVE AREA OF MACEIÓ, ALAGOAS, BRAZIL.

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INTRODUCTION

The red mangrove crab Goniopsis cruentata is commonly found in mangrove areas, on the upper beach, in burrows or between mangrove roots, occupying most of the microhabitats in the mangrove ecosystem (Cobo & Fransozo 2003).
Pianka (1995) defined sex ratio as the proportion of males in the population, distinguishing four types: primary, the ratio at conception; secondary, the ratio at the end of parental care; tertiary, the newly independent nonbreeding animals; and quaternary sex ratio, the ratio of the older breeding adult population.
Some authors, such as Wenner (1972) and Góes & Fransozo (2000), pointed out the sex ratio as being generally about 1:1 since it is favored by natural selection and, according to Pianka (1995), is strongly correlated with the ontogenetics of each species.
According to Wenner (1972), there are four patterns of sex ratio as a function of size: standard, reversal, intermediate and anomalous. This observation is not true for temporal analysis, when the expected proportion 1:1 always prevails. Temporal variation in sex ratio may be a function of reproductive cycle.

OBJECTIVES

The aim of the present study is to define the quaternary sex ratio pattern in G. cruentata through the analysis of the sexual proportions in size classes and the temporal relationship with the species' breeding period.

MATERIAL AND METHODS

Collections were accomplished monthly from August/2007 to July/2008 during low tides in a mangrove area of the Mundaú/Manguaba Estuarine Lagoon Complex (35º42'30"–35º57'30"W and 9º35'00"9º45'00"S). The crabs were captured by hand and placed into containers filled with alcohol 70%. In the laboratory, the crabs were counted, sexed according to abdomen morphology, and had their carapace width measured. The carapace width measurements were used to distribute the specimens into size classes. The Chi - square test (x^2) was used to search for significant differences in the sex ratio(males:females) among the size classes and also temporally.

RESULTS AND DISCUSSION

A total of 1123 crabs were collected (571 males and 552 females). The crabs were distributed into 9 size classes and occurred during the whole period of study. Males showed a higher mean carapace width ± SD (28,66 ± 5,39 mm) than females (27,72 ± 4,84 mm). Considering the temporal distribution, the sex ratio for each month did not differ significantly, except for August (ratio = 1,51;1, $\chi^2 = 4,72$, d.f = 1, $p > 0,05$). In the size class distribution, only the class 40—44 mm showed significant difference (ratio = 4:1, $\chi^2 = 4$, d.f = 1, $p > 0,05$). In the class 44—48 mm, females were not present, and so the ratio could not be obtained.
The overall sex ratio was around 1:1 (ratio = 096; $\chi^2 = 0,32$, d.f = 1, $p < 0,05$) and so the population is assumed to be at equilibrium. According to Pianka (1995), a population at equilibrium should allocate exactly half of its reproductive effort to producing progeny of each sex. This author also stated that, on average, the individual of the underrepresented sex leaves more descendents than the overrepresented one. Góes & Fransozo (2000) pointed out that, when the overall sex ratio does not differ significantly from 1:1 (in the temporal analysis), so rates of recruitment and mortality is not sex - dependent, what promote the equilibrium of a population.
In the size classes, the population observed seemed to fit the anomalous pattern, with males being more abundant in the two classes representing the largest sizes. That is not true at all, since in the anomalous pattern the overrepresented

sex in the largest classes is underrepresented in the smaller ones, which was observed by Wenner (1972).
This observation represents an interesting aspect of the reproductive features. Males, as their reproductive effort, increase in body size to copulate more successfully, guaranteeing a greater probability of leaving descendents. Females, on the other hand, invest a larger portion of the available energy to the production of eggs, and so cannot attain big sizes as males do. In this way, the reproduction strategy may affect sex ratio. This result corroborates the hypothesis raised by Díaz & Conde (1989) of the differential growth rate and life span as factors influencing the sexual proportions.
The fact that the ratio did not statistically deviate from the expected 1:1 proportion (except in August) in the temporal analysis supports the hypothesis that the ratio is principally a function of body size than of other factors such as nutrition, habitat and season (Wenner 1972). However, these factors may play a role, since slight deviations in the temporal sex ratio have been observed (Góes & Fransozo 2000). Differential habitat partitioning, migration and differential mortality in females, may influence sex ratio. However, this was not observed in the present investigation.

CONCLUSION

Sex ratio is principally a function of size, not being related to the breeding period. On the other hand, it is related to the reproductive characteristics of each sex, since males and females have differential growth. The quaternary ratio in size class seems to fit the anomalous pattern, since males prevailed in the largest classes. The temporal sex ratio keeps around the 1:1 proportion, since it is strongly correlated to ontogenetics.
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