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Management Implications of Sex Ratios of Three Palaemonid Shrimps in the Cross River Estuary, South-East, Nigeria

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ABSTRACT

Information on sex composition of fish/shellfish species is important in determining reproductive potentials and estimating size structure of a given stock. Sustainable fisheries management options and policies usually rely on this aspect of the reproductive biology. In the present study, the sex ratios of three palaemonid shrimps, *Macrobrachium macrobrachion*, *Macrobrachium vollenhovenii* and *Macrobrachium equidens* were studied over an annual cycle with respect to gear type. Male:female relationship for *M. macrobrachion* caught with beach seine, pushnet and trap were 1:2.2, 1:2.1 and 1:2.15, respectively, while the M:F ratios for *M. vollenhovenii* were 1:1.27 (beach seine), 1:1.32 (pushnet) and 1:1.64 (trap). The overall M:F ratios during the annual cycle were 1:2.15 (*M. macrobrachion*), 1:1.47 (*M. vollenhovenii*) and 1:1.74 (*M. equidens*). The monthly sex ratios indicated that there were more females than males during the period, except for *M. equidens* which had a ratio of 1:0.78 in the month of August. This is advantageous for the stock dynamics of the species, especially if the males could mate with more than one female during any reproductive season.

Key words: Reproductive season, sex ratios, fisheries management

INTRODUCTION

The reproductive biology of fish and shellfish species is essential to developing management policies for the fisheries. Understanding sex ratio (i.e., male-female relationship in terms of number), is particularly important where a fishery is being exploited with multiple gears. In this respect, any sex selection could lead to a reduction in the ability of the stock to sustain itself over time. Sex ratio is important in estimating stock size and reproductive potential (King, 1995; Vazzoler, 1996), determining adaptation, direction and rate of genetic processes in animal populations.

Barros (1995) estimated the sex ratio of *Macrobrachium olfersii* in Vigia Beach, Brazil at 1:1.98 (male:female), while Guzman-Arroyo *et al.* (1982) worked on the species *M. tenellum* in the coastal lagoons of Mitla and Tres Palso, Mexico. They found a sex ratio of 1:1, but observed that the female ratio increased during the reproductive period (June-November). Inyang (1984) obtained a sex ratio of 1:1.11 for *Macrobrachium felicinum* in the lower Niger river, Nigeria, while in the Lagos lagoon, Marioghae (1982) reported sex ratios of 1:1.4 and 1:1 for *M. macrobrachion* and *M. vollenhovenii*, respectively.

The present paper reports the sex ratios of *Macrobrachium macrobrachion*, *M. vollenhovenii* and *M. equidens* in the Cross River Estuary. This study covers all three gears exploiting the fishery, as well as the monthly sex variations over an annual cycle.

MATERIALS AND METHODS

Samples of the *Macrobrachium* species used for this study were obtained from the artisanal commercial landings at Akpan's beach, Calabar (Fig. 1). The *Macrobrachium* fishery of this Estuary

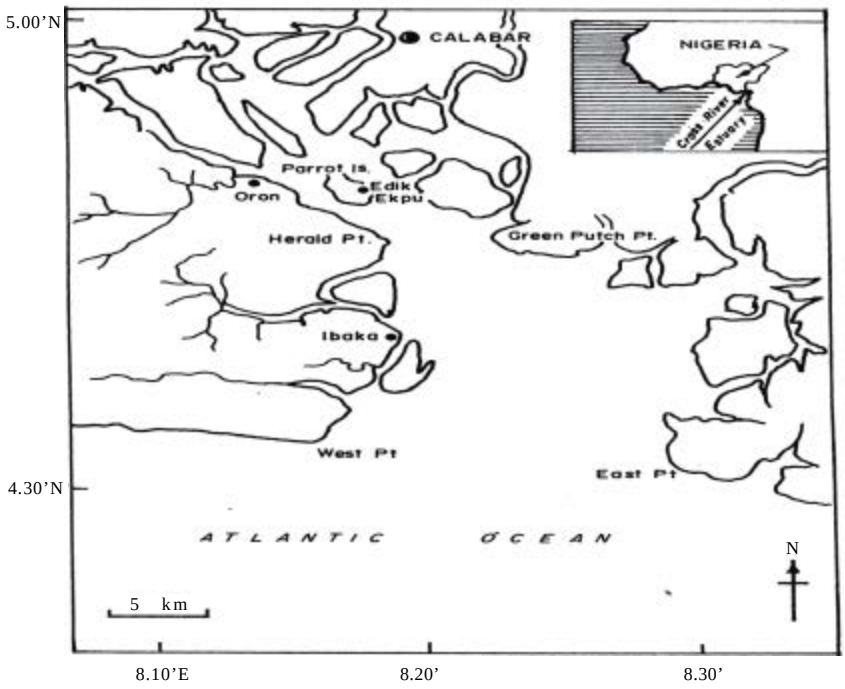

Fig. 1: Cross River Estuary, Nigeria showing Calabar the sampling site

is both multi-species and multi-gear related. Data were collected weekly from the three gear exploiting the fishery, namely, beach seine, pushnet (active) and trap (passive). These weekly samples were later pooled into monthly samples from January to December, 1997.

Samples were taken to the laboratory in 1 L containers identified by gear type. In the laboratory, the shrimps were sorted into species and sexes, using Holthuis (1980) and Powell (1982). The number for each species and sex was counted and the ratios calculated for each species by gear type and months. An overall sex ratio was calculated by pooling all gear and monthly data together by sex and species.

RESULTS AND DISCUSSION

The monthly sex ratios for the three *Macrobrachium* species are presented in Table 1. The Table shows that there were more females than males in the population. The proportion of female *M. macrobrachion* and *M. vollenhovenii* remained higher than that of the males through all the months, but sex ratio for *M. equidens* was 1:0.78 for the month of August. Sex ratios among the gears were as follows: 1:2.2 (beach seine), 1:2.1 (pushnet), 1:2.15 (trap) for *M. macrobrachion* and 1:1.27 (beach seine), 1:1.32 (pushnet), 1:1.64 (trap) for *M. vollenhovenii*.

The overall sex ratios calculated for the pooled monthly data over an annual cycle were: 1:2.15 (*M. macrobrachion*), 1:1.47 (*M. vollenhovenii*) and 1:1.74 for *M. equidens*.

The overall sex ratios of 1:2.15 for *M. macrobrachion*, 1:1.47 for *M. vollenhovenii* and 1:1.74 for *M. equidens*, differ from the reports of Marioghae (1982) for *M. macrobrachion* (1:1.4) and *M. vollenhovenii* (1:1) and Inyang (1984), for *M. felicinum* (1:1.11). The ratio of *M. equidens* (1:1.74) recorded in this study was however similar to the report of Barros (1995) for *M. olfersii* (1:1.98). In a general sense, these species showed a female dominance throughout the annual cycle.

Table 1: Sex ratios for *M. macrobrachion*, *M. vollenhovenii* and *M. equidens* from the Cross River Estuary, Nigeria sampled in 1997

Months	*M. macrobrachion*	*M. vollenhovenii*	*M. equidens*
January	1:1.64	1:1.29	1:1.96
February	1:1.94	1:1.15	1.2:0
March	1:1.29	1:1.24	1:1.62
April	1:2.33	1:1.04	1:4.28
May	1:2.06	1:1.34	1:2.94
June	1:2.08	1:1.29	1:1.58
July	1:2.21	1:1.60	1:1.43
August	1:3.02	1:1.57	1:0.78
September	1:3.19	1:1.55	1:1.67
October	1:2.19	1:1.25	1:2.50
November	1:2.35	1:1.29	1:1.23
December	1:1.83	1:2.35	1:1.64
Overall male:female ratio	1:2.15	1:1.47	1:1.74

However, Souza and Fontoura (1996) found a reverse of this trend, recording a male dominance of 1:0.82 for *Macrobrachium potiuna*. Their observation is similar to that made for *M. equidens* in August (Table 1).

Sex ratios varied markedly within the months. Stergiou *et al.* (1996) had reported that male:female ratio could differ with seasons due to sexual differences in growth rate, natural mortality rate and energy cost of reproduction. In this study, female ratio generally increased during the month of peak of reproduction i.e., May-November (Nwosu, 2000). In a similar study, Guzman-Arroyo *et al.* (1982) recorded the highest male ratio during the non-reproductive period, while the female ratio dominated during the reproductive period.

With respect to gears, sex ratios were only studied for *M. macrobrachion* and *M. vollenhovenii* as no specimens of *M. equidens* appeared in trap catches throughout the study period. *M. macrobrachion* did not show serious variations in male:female ratio for the three gears, irrespective of the difference in the operation of the gears (beach seine and pushnet-active, trap-passive). But for *M. vollenhovenii*, the female ratio was much higher in the trap (passive), 1:1.64. This difference could be behavioural. Probably, behavioural differences concerning active and passive gears are more obvious in *M. vollenhovenii* with the bigger body size compared with *M. macrobrachion*. Pauly and Ingles (1981) had explained the possibility of sex-related gear vulnerability from coral reef fisheries studies.

CONCLUSION

The preponderance of female specimens of the three species under study could be advantageous, especially if a single *Macrobrachium* male mates with more than one female during any reproductive season. This aspect is a subject of further investigation.

In implementing management measures for this fishery, the trap fisher should be main target for control measures.

REFERENCES

Barros, M.P., 1995. Biological data of *Macrobranchium olfersii* (Wiegmann, 1836) (Decapoda, Palaemonidae) on the Vigia Beach, Caropaba, Santa Catarina, Brazil. Biociencias, 3: 239-252.

Guzman-Arroyo, M.J.L., Rojas-Galaviz and L.D. Gonzales-Gonzale, 1982. Annual cycle of maturity and reproduction of the chacal *Macrobrachium tellenum* Smith and its relationships with environmental parameters in the coastal lagoons of Mitla and Tres Palos, Guerrero, Mexico (Decapoda, Palaemonidae). An. Inst. Cienc. Mar. Limnol. Univ. Nac. Auton. Mex., 9: 67-80.

Holthuis, L.B., 1980. FAO Species Catalogue. Vol. 1, Shrimps and Prawns of the World: An Annotated Catalogue of Species of Interest to Fisheries, Issue 125. Food and Agriculture Organization of the United Nations, Rome, ISBN: 92-5-100896-5, Pages: 271.

Inyang, N.M., 1984. On the biology of *Macrobrachium felicinum* Holthuis in Lower Niger River of South-eastern Nigeria (Crustacea, Palaemonidae). Rev. Zool. Afr., 98: 440-449.

King, M., 1995. Fisheries Biology: Assessment and Management. Fishing News Books Publ., Oxford, UK., ISBN-13: 978-0852382233, Pages: 341.

Marioghae, I.E., 1982. Notes on the biology and distribution of *Macrobrachium vollenhovenii* and *Macrobracchion* in the Lagos Lagoon (Crustacea, Decapoda, Palamonidae). Rev. Zool. Afr., 96: 493-508.

Nwosu, F.M., 2000. Studies on the biology, ecology and fishery impact on the *Macrobrachium* species of the Cross River Estuary, Nigeria. Ph.D. Thesis, University of Calabar, Calabar, Nigeria.

Pauly, D. and J. Ingles, 1981. Aspects of the growth and natural mortality of exploited coral reef fishes. Proceedings of the 4th International Coral Reef Symposium, Volume 1, May 18-22, 1981, Manila, Philippines, pp: 89-98.

Powell, C.B., 1982. Fresh and brackish water shrimps of economic importance in the Niger Delta. Proceedings of 2nd Annual Conference of the Fisheries Society of Nigeria, January 25-27, 1982 Nigeria, Calabar, pp: 254-284.

Souza, G.D. and N.F. Fontoura, 1996. Reproduction, longevity and sex ratio of *Macrobrachium potiuna* (Muller, 1880) (Crustacea, Decapoda, Palaemonidae) in the Sapucaia Stream, Gravatai, Rio Grande do Sul. Nauplius, 4: 49-60.

Stergiou, K.I., P. Economidis and A. Sinis, 1996. Sex ratio, spawning season and size at maturity of red bandfish in the western Aegean Sea. J. Fish Biol., 49: 561-572.

Vazzoler, A.E.A.M., 1996. Reproduction Biology of Teleostean Fishes: Theory and Practice. Brazilian Society of Ichthyology, Maringa, Brazil, Pages: 169.