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Aspects of the Fishery and Reproduction of *Nematopalaemon hastatus* (Crustacea: Palaemonidae) in the Cross River Estuary, Nigeria

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Abstract

The fishery and reproductive cycle of *Nematopalaemon hastatus*, the species on which the artisanal shrimp fishery in the Cross River estuary is based, was investigated over a 14-month period. The mean catch composition (by weight) was 70% *N. hastatus*, 14% *Parapaeniopsis atlantica*, 3% *Exhippolysmata hastatoides*, and 14% bycatch. The catch per unit effort peaked in May and November at the beginning and end of the rainy season, although there was no correlation between CPUE and rainfall. The species breeds throughout the year but with peaks in June and November. At the major breeding peak in November about half of the total numbers of *N. hastatus* were gravid females. The significance of this and the trends in variation of CPUE are discussed.

Key words: estuarine fishery, catch composition, catch rate,spawning, *Nematopalaemon hastatus*

Introduction

Nematopalaemon hastatus Aurivillius occurs in the lowere estuarine and neritic zones of the Nigerian coast, and its range in West Africa extends from Senegal to Angola (Holthuis, 1980). Because of its relatively small size, it is not eaten as table shrimp but smoked or sun-dried. The dried product, known as "crayfish," is ground into powder to be used as an indispensable ingredient in nearly all indigenous Nigerian dishes. These shrimps are mostly caught in unbaited, stationary traps (*Onyima*, *Kokobi* and *Iseke* nets) placed with their open ends facing against and filtering the tidal current, but they are also caught in seines. The major shrimp fisheries in south-eastern Nigeria are in the Cross River estuary and the Niger delta. The Cross River fishery was dominated by *N. hastatus*, which made up 815 of the total catch (Enin *et al*., 1991) and it accounts for 11% of the landings in Nigeria's marine fisheries (Nsentip, 1985).

In the New Calabar River *N. hastatus* is not exclusively pelagic because it occurs in the stomachs of both benthic and pelagic predators in equal proportions (Marioghae, 1980). Gut content analyses indicate that *N. hastatus* inhabits river mouths and large creeks with salinity of 15‰ and above and is both carnivorous and detritivorous, with a semi-lunar spawning rhythm. In the Lagos area it had spawning peaks between June and September, and inhabited water with a salinity ranging from 1‰ to 25‰ (Sagua, 1980). Sexual segregation, with one sex dominating the catch has been reported and in the Lagos are catches were dominated by females with a sex ratio of 5:1. Ecologically, *N. hastatus* is important because it is the food of such fish as sciaenids, pomadasyids, trichurids, carangids, lutjanids, and ariids as well as other shrimps such as penaids and portunids (Longhurst, 1957; Sagua, 1966; Onyia, 1973; Marioghae, 1980). It is also favoured by fishermen as bait.

The *N. hastatus* fishery in south-eastern Nigeria is productive and the mean catch per unit effort in the cross River estuary was estimated to be 2.3 kg net-1 day-1 (Enin *et al*., 1991). Peak catches were observed in March-June and October-November with maximum values of 5.3 kg net^{-1} being recorded. In spite of its economic importance, this fishery has not been studied in detail, apart from some earlier reports that were based on extrapolations from other

areas and conclusions based on observations and studies with a low sampling frequency or done over a short period. This paper is part of an empirical investigation of the artisanal *N. hastatus* fishery and considers aspects that can assist in the management of this fishery.

Methods

The Cross River estuary is located in the south-eastern corner of Nigeria (4°30' - 4°58'N: 8°09' - 8°30'E). The choice of fishing ground is determined by weather; in calm weather the fishermen venture further offshore but fishing effort is reduced during rough weather. The fishing village of Okposso, located on the southern tip of the swamp fringing the estuary, is one of the few permanent fishing settlements in the estuary, with most others being located on sandy outcrops, and since more than 70% of the shrimp fishing boats land their catches there it was chosen as the sampling site. The village was visited twice a week, mostly at three-day intervals, from February 1989 to March 1990.

The catch per unit of effort (CPUE) was the catch per net per day and determined by weighing the catch from each set of nets in a boat as it returned from fishing, with mean being the CPUE for that boat. The CPUE was determined for several boats and the mean of all values was taken as the mean CPUE for the day. A sample weighing from 1.8-2.0 kg was taken from several boats on each visit, and these were fixed in 10% formalin and sorted into species using the the identification keys in Fischer *et al*. (1981) and Powell (1982). Gonadal maturity stages were determined according to the criteria in Kunju (1979) and Sagua (1980), and their postorbital carapace lengths were measured to the nearest 0.5 mm. All females with visually mature ovaries, corresponding to stages II and OR of ovarian development according to Kunju (1979) and Sagua (1980) respectively were noted. Monthly rainfall for the study area was obtained from the Department of Geography and Regional Planning, University of Calabar.

Results

The mean composition of the catch (by weight) was as follows: 70% *N. hastatus* (range = 21-100%), 14% *Parapanaeopsis atlantica* Balss (0-36%), 14% fish bycatch (0-40%) and 3% *Exhippolysmata hastatoides* Balss (0-17%). The minimum sizes (postorbital carapace length) of these shrimps were 3.5 mm for *N. hastatus*, 6.5 mm for *P. atlantica*, and 4.0 mm for *E. hastatoides*. No gravid females of *P. atlantica* were encountered during this study and neither were juvenilesor any other developmental stage of *Penaeus notialis* (Perez-Fartante).

The lowest daily CPUE recorded was 0.9 kg net^{-1} while the highest was 5.7 kg net^{-1}; the mean CPUE was 2.8 kg net^{-1} and 1.9 kg net^{-1} for catches made during the flood and ebb tides, respectively. The mean monthly CPUE rose to a peak of 3.3 kg net^{-1} day^{-1} in May 1989, falling to 1.6 kg net^{-1} day^{-1} in July, thereafter rising to a second peak 0f 3.7 kg net^{-1} day^{-1} in November (Figure 1a). These two peaks were near the beginning and end of the rainy season but there was no general correlation between CPUE and rainfall (r = 0.161, p > 0.05)

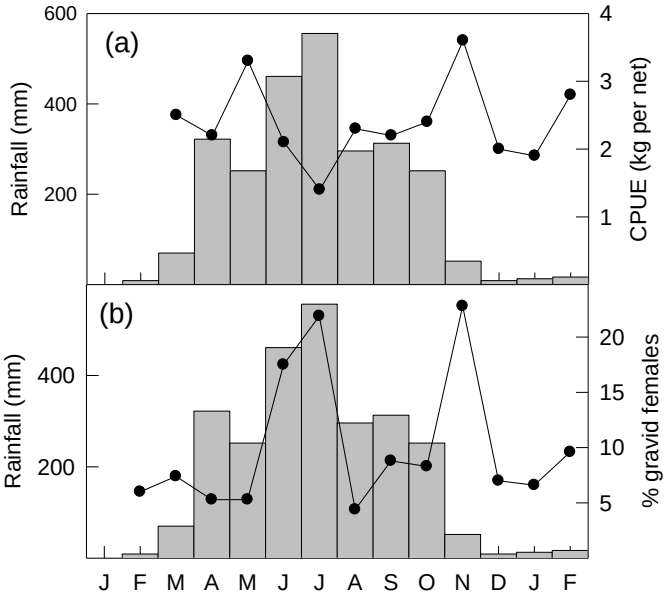

Figure 1. (a) The catch per unit effort (kg net^{-1}) of *N. hastatus* and (b) the proportion (%) of gravid females (points) in relation to rainfall (columns), Cross River estuary, Nigeria. Data are for February 1989 to February 1990.

There were two peaks in the proportion of gravid females, the first (15-19%) in June-July and the second (25%) in November, while the lowest proportion was noted in April-May (Figure 1b). there was no correlation between the abundance of gravid females and rainfall (r = -0.021, p > 0.05). the modal breeding length was from 8-5 to 10.5 mm, postorbital carapace length (Figure 2).

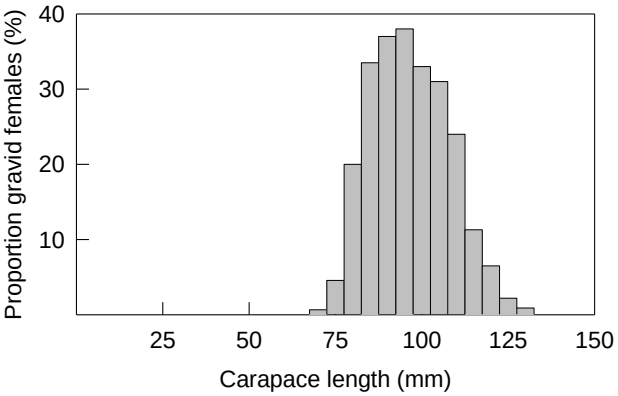

Figure 2. The proportion (%) of gravid female *N. hastatus* in each 5-mm size class, Cross River estuary, Nigeria, 1989-1990.

The bycatch from the shrimp fishery consisted mostly of juveniles of resident and transitory species (Table 1). They included clupeids (90% of which consisted of one species), sciaenids, squid, polynemids, trichurids, tetraodontids, cynoglossids, carangids, crabs, ephippids, bothrids and scombrids, in decreasing order of abundance.

Table 1. The composition (% by weight) of the bycatch in the *N. hastatus* fishery, Cross River estuary, Nigeria, 1989-1990. The data are means with standard deviation (SD).

	Mean	SD
Ilisha africana Bloch	34.1	21.2
Pseudotolithus elongatus (Bowdich)	19.3	17.5
Squids	11.7	13.4
Trichiurus lepturus L.	8.7	8.4
Pseudotolithus senegalensis Valenciennes	5.7	6.2
Tetraodontidae	5.4	9.1
Polydactylus quadrifilis (Cuvier)	4.7	6.4
Pseudotolithus brachygnathus Bleeker	2.9	3.3
Carangidae	1.8	5.6
Pentanemus quinquarius (L.)	1.7	2.7
Pellonula sp.	1.2	5.1
Pteroscion peli (Bleeker)	0.8	2.0
Crabs	0.7	2.2
Cynoglossus senegalensis (Kaup)	0.5	1.0
Pseudotolithus epipercus (Bleeker)	0.3	0.6
Scomberomorus tritor (Cuvier)	0.1	0.5
Tilapia sp.	0.1	0.2
Ethmalosa fimbriata (Bowdich)	0.1	0.4
Bothridae	0.1	0.4
Drepane africana Osório	0.0	0.1

Discussion

Throughout this study there was only one day (in July) when there was no fishing because of rough seas; other the N. hastatus fishery in the Cross River estuary operates and makes significant catches throughout the year. The bimodal peak of CPUE was similar to the findings of Enin *et al.* (1991) except that their major peak occurred in March-June, with a secondary one in October-November. At the present level of fishing effort the general pattern of variation in CPUE may be explained more as a combined effect of the widely inaccurate methods of locating the shrimps in the best of calm conditions, and the reduced accessibility of *N. hastatus* in the stormy seas of the rainy season when fishermen cannot venture into their usual fishing grounds. Marioghae (1980) observed similar trends in CPUE in the New Calabar River and suggested that they could be explained by variations in salinity although other factors were certain to have had some effect.

The population of *N. hastatus* in the Cross River estuary breeds all year round although the breeding cycle has two clearly defined maxima, constituting the main breeding seasons, in late June and late November. This agrees in part with the findings of Marioghae (1980) who found a small breeding peak in April-May and the "real" peak in October-November. During the latter peak ovigerous females constituted 32-35% (by numbers) of the commercial fishery catch. In the Lagos area *N. hastatus* spawned nearly year-round but with peaks between June and September (Sagua, 1980) as did *N. tenuipes* in India, also with a peak from July-October and secondary peak in March-April (Kunju, 1979). In this study, the main breeding peak occurred in the dry season with secondary peak occurring during the rains although before the period of maximum rainfall. These findings disagree with earlier studies on *N. hastatus* in Nigeria, where the main spawning peak occurred in the rainy season suggesting that rainfall was the main factor influencing reproduction in this species. This aspect requires further investigation, along with the movements of males and females which may also influence the catches.

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References

Enin, U., U. Lowenburg and T. Kunzel (1991). The *Nematopalaemon hastatus* (estuarine prawn) fishery in the outer estuarine region of the Cross-River, Nigeria. *Archiv für Fischereiwissenschaft* **41**: 67-88.

Fischer, W., G. Bianchi and W.B. Scott (1981). FAO species identification sheets for fishery purposes: Eastern Central Atlantic fishing area 34, 37. Volume VI. Food and Agriculture Organisation, Rome.

Holthius, L.B. (1980). FAO species catalogue, Volume 1. Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. *FAO Fisheries Synopsis* (125), Volume 1: 2251 pp.

Kunju, M.M. (1979). Studies on the biology of *Nematopalaemon tenuipes* Henderson on the Bombay coast. *Indian Journal of Fisheries* **26**: 65-81.

Kutkuhn, J.H. (1966). The role of estuaries in the development and perpetuation of commercial shrimp resources. American Fisheries Society Special publication (3). Symposium on Estuarine Fisheries, Part II: The estuary as a Habitat for Fishery Organisms: pp. 16-36.

Longhurst, A.R. (1957). The food of the demersal fish of a West African estuary. *Journal of Animal Ecology* **26**: 369-387.

Marioghae, I.E. (1980). The ecology and commercial fishery of *Palaemon (Nematopalaemon) hastatus* Aurivillius 1898. MSc thesis, University of Port Harcourt, Nigeria: 70 pp.

Nsentip, N.U. (1985). A review of the crayfish of Nigeria, with special reference to the Cross River State. In: Proceedings of the 4th Annual Conference of the Fisheries Society of Nigeria, Port Harcourt, November 1985: pp. 42-46.

Onyia, A.D. (1973). A contribution to the food and feeding habits of the threadfin *Galeoides decadactylus. Marine Biology* **22**: 371-378.

Powell, C.B. (1982). Fresh and brackishwater shrimps of economic importance in the Niger Delta. In; Proceedings of the 2nd Annual conference of the Fisheries Society of Nigeria, Calabar, 25-27 January: pp. 254-285.

Sagua, V.O. (1966). The food and feeding habits of the big-eye *Brachyduterus auritus* (Val. 1831) in relation to the condition cycle off Lagos. Report of the federal Fisheries Service, Nigeria 1966: pp. 37-42.

Sagua, V.O. (1980). Observations on the ecology and some aspects of reproductive biology of the small white shrimp *Palaemon hastatus* Aurivillius (Crustacea: Palaemonidae) in the Lagos area of Nigeria. *Bulletin de l'Institute Fondamental d'Afrique Noire, Serie* A **42**: 280-295