

**Trophic Relationships
of the White Estuarine Prawn**
Nematopalaemon hastatus
(Aurivillius, 1898)
(Decapoda, Palaemonidae)

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ABSTRACT

A total of 100 prawns with full stomachs were examined between March and November 1980. *Nematopalaemon hastatus* was found to be carnivorous. Prawns above 25 mm (total length), fed mainly on mysids, while those below 25 mm (total length) fed mainly on copepods. There was no noticeable difference between its day and night-time diets. The preferential use of mysids by prawns above 25 mm (TL) and of copepods below, is thought to be either some form of niche separation or possibly a predator/prey size adjustment.

Stomach contents of estuarine fish derived from nine families were examined. Seven families had individuals preying on *N. hastatus*, the *Sciaenidae* being foremost. Of the four Decapod crustaceans examined, only *Parapenaeopsis atlantica* and *Callinectes amnicola* prey on *N. hastatus*.

KEY WORDS : West Africa — Nigeria — Estuaries — Decapoda — *Nematopalaemon hastatus* — Food chains.

RÉSUMÉ

LES RELATIONS TROPHIQUES DE LA CREVETTE D'ESTUAIRE *NEMATOPALAEMON HASTATUS* (AURIVILLIUS 1898)

Un total de 100 crevettes ayant l'estomac plein ont été examinées entre mars et novembre 1980. Nous avons observé que *Nematopalaemon hastatus* est une espèce carnivore, les individus de plus de 25 mm (longueur totale) se nourrissant principalement de *Mysidacae*, et de copépodes en dessous de 25 mm. Il n'y a guère de différence remarquable entre l'alimentation de jour et de nuit.

Leur choix de *Mysidacae* par les crevettes de plus de 25 mm (LT) et de copépodes par les crevettes de moins de 25 mm (LT) est considéré comme une sorte de séparation de niche ou peut-être un ajustement de la taille de la proie par rapport à l'espèce prédatrice.

Les contenus stomaques de poissons de l'estuaire appartenant à neuf familles ont été examinés. Sept familles choisissent comme proie *N. hastatus*, en particulier les *Sciaenidae*. Des quatre crustacés décapodes examinés, seuls *Parapenaeopsis atlantica* et *Callinectes amnicola* consomment *N. hastatus*.

MOTS-CLÉS : Afrique de l'Ouest — Nigeria — Estuaires — Decapoda — *Nematopalaemon hastatus* — Relations trophiques.

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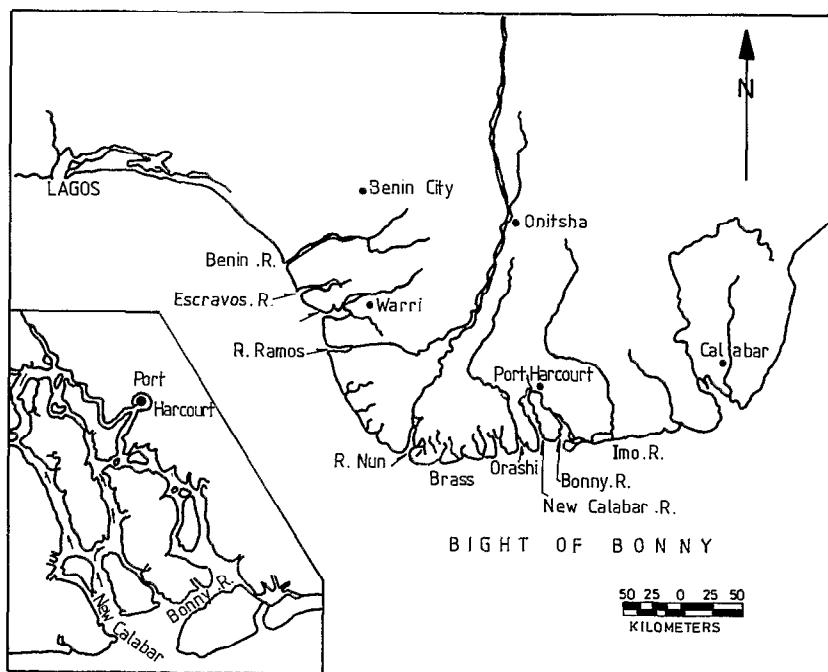


FIG. 1. — Map of coastal Nigeria with New Calabar River Inset
Carte côtière (de la côte) du Nigeria — avec la rivière New Calabar Carltonique

INTRODUCTION

The genus *Nematopalaemon* (Holthuis, 1950) comprises of *Nematopalaemon tenuipes* (Henderson, 1893), *Nematopalaemon schmitti* (Holthuis, 1950), *Nematopalaemon colombensis* (Squires and Mora, 1970) and *Nematopalaemon hastatus* (Aurivillius, 1898) which is endemic in the estuaries and near shore marine zone of tropical West Africa.

N. hastatus is a pelagic species (MARIOGHAE, 1980), which attains a maximum total length of 74 mm (HOLTHUIS, 1980). GRUVEL (1912) assessed *N. hastatus* as "une forme comestible" while BASSINDALE (1961) reported that in Ghana, the species was "sufficiently abundant in the sub-littoral to be fished and marketed". CROSNIER and DE BONDY (1967) found that in the Niger Delta, *N. hastatus* was caught during the rainy season "en quantités parfois importantes". MONOD (1967), LONGHURST (1970) and LEFEVERE (1970) were impressed by the commercial potentials of the prawn which they reported as supporting various local fisheries.

In spite of this longstanding recognition of the prawn's economic potentials, only SAGUA (1980) attempted a preliminary study of its ecology and aspects of its reproduction. This paper is based on a study carried out on specimens obtained from the

New Calabar river estuary in the eastern Niger Delta, between January and November, 1980. It sets out findings on the food of the prawn, and its predators. A food web is constructed to demonstrate the prawn's trophic relationships.

MATERIALS AND METHODS

Specimens for this study were selected between January and November 1980 from preserved fortnightly samples obtained from a prawn fisherman using small conical drift nets (Iseke) in the New Calabar river estuary (Fig. 1). Seventy-four prawns of all sizes with full stomachs were examined. Their foreguts were opened under a dissecting microscope, and their contents were carefully examined and identified. The type of food found in each stomach was recorded, but not the quantity.

Another batch of twenty-six prawns was examined in the course of one day; 13 from the late afternoon catch (3-4 pm) and 13 from the late night catch (4-5 am), in order to determine whether the food of the species varied diurnally.

The gut contents of fish commonly caught in the estuary were also examined. Specimens chosen for

examination were those obtained from cast nets, set nets, beach seines, maze traps, and refuge traps.

The gut contents of the prawns *Penaeus notialis*, *Penaeus kerathurus*, *Parapenaeopsis atlantica*, and the swimming crab *Callinectes amnicola* were examined to find out whether they preyed on *N. hastatus*.

RESULTS

The major food items found in the guts of the prawns examined, and the frequency of their occurrence is set out in Table I. It shows that *N. hastatus* fed mainly on other smaller crustaceans, mysids and copepods. The mysids were mostly *Rhopalophthalmus africanus* (O. Tattersal), which is common in the estuary, and the copepods were mostly calanoid.

TABLE I

Major food items of *N. hastatus*; frequency of their occurrence in relation to the size (tip of rostrum to tip of telson) of the prawn

Aliments principaux de N. hastatus; fréquence d'occurrence des proies en fonction de la taille des crevettes (longueur totale)

Rostrum-Telson length of prawns examined	Above 25 mm	Below 25 mm	Total
Number examined	60	14	74
Mysids	Number	52	2
	%	87	14
Copepods	Number	6	10
	%	10	71
Fish scales and bones	Number	8	1
	%	13	7
Vegetable Matter	Number	42	6
	%	70	43

Statistical χ^2 values for the frequency of occurrence of mysids and copepods in the diet of adult and juvenile prawns (above and below 25 mm total length respectively) are significant at the 99.9% level, indicating that consumption of mysids and copepods are linked to the size of the prawn.

Detritus of vegetable origin also had a high frequency of occurrence, 70% and 43% respectively for adult and juvenile prawns. However χ^2 analysis revealed no significant difference in the frequency of its occurrence in both sizes of the prawn. In other words, ingestion of detritus occurs during the whole life of the prawn.

Incidence of fish bones and scales was low. However on two occasions, several bones of piscine vertebral column still joined to one another were observed; an indication that *N. hastatus* does prey on larval fish.

Table II summarises the food occurring in the day and night samples of *N. hastatus* caught in the estuary. Statistical χ^2 analysis shows that there was no significant difference in the food types and quantities utilised in the daytime and at night. The study, also revealed that at least seven fish families found in the estuary (Table III) had individuals which preyed on *N. hastatus*. Of all the families, the Sciaenidae apparently fed mostly on *N. hastatus*; almost every specimen examined had *N. hastatus* prey. Of the four Decapod crustaceans examined, only *Parapenaeopsis atlantica* and *Callinectes amnicola* had *N. hastatus* prey.

TABLE II

Food occurring in day and night samples *N. hastatus* examined
Comparaison jour/nuil de l'alimentation de N. hastatus

Time of day	Daylight	Night	Total
Number examined	13	13	26
Mysids	Number	9	11
	%	69	85
Copepods	Number	1	2
	%	8	14
Fish scales and bones	Number	3	2
	%	23	14
Vegetable Matter	Number	7	5
	%	54	39

TABLE III

Common estuarine fish and Decapod crustaceans of the New Calabar river examined for *N. hastatus* prey
Les prédateurs potentiels de N. hastatus dans la rivière New Calabar

PREDATORS	Number examined	Number with <i>N. hastatus</i>
<i>Trichiurus lepturus</i> (Trichiuridae)	5	2
<i>Galeoides decadactylus</i> (Polynemidae)	4	1
<i>Polydactylus quadrifilis</i> (Polynemidae)	4	1
<i>Pomadasys jubelini</i> (Pomadasytidae)	4	3
<i>Pseudotolithus typus</i> (Sciaenidae)	5	5
<i>Pseudotolithus senegalensis</i> (Sciaenidae)	5	5
<i>Pseudotolithus elongatus</i> (Sciaenidae)	10	8
<i>Caranx hippos</i> (Carangidae)	3	1
<i>Lutjanus goreensis</i> (Lutjanidae)	4	2
<i>Lutjanus dentatus</i> (Lutjanidae)	2	1
<i>Arius heudelotii</i> (Ariidae)	5	0
<i>Arius latiscutatus</i> (Ariidae)	5	0
<i>Ethmalosa fimbriata</i> (Clupeidae)	6	0
<i>Pellonula vorax</i> (Clupeidae)	3	3
<i>Bathygobius</i> sp. (Gobiidae)	2	2

DECAPOD CRUSTACEANS

<i>Penaeus notialis</i> (Penaeidae)	10	0
<i>Penaeus kerathurus</i> (Penaeidae)	4	0
<i>Parapenaeopsis atlantica</i> (Penaeidae)	10	2
<i>Callinectes amnicola</i> (Portunidae)	8	2

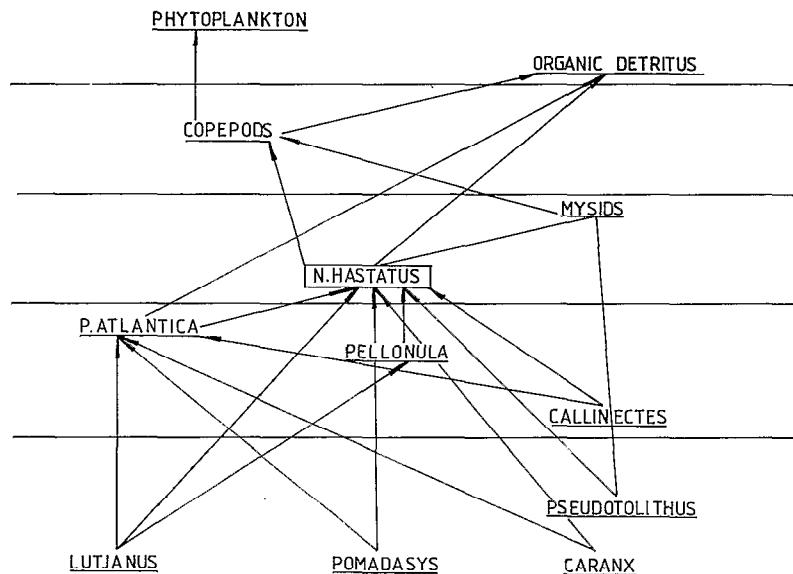


FIG. 2. — Food web illustrating the trophic relationships of *Nematopalaemon hastatus* in the New Calabar river estuary
Schéma nutritionnel illustrant les relations trophiques de la crevette estuarienne *Nematopalaemon hastatus* dans la rivière New Calabar

DISCUSSION

The major food items recovered from the guts examined — mysids, copepods, scales and bones — show that *N. hastatus* is primarily a carnivore. This is in agreement with the observation by SAGUA (1980) that the gut contents consisted of "unidentifiable pieces of chitinous skeletons of crustacea, probably zooplankton". The carnivorous disposition of some Caridean prawns in estuarine and coastal situations appears to be common, and has been reported for *Crangon vulgaris* by LLOYD and YOUNGE (1947), for *Crangon allmani* (Kinahan) by ALLEN (1960), for *Crangon septempinosa* by WILCOX and JEFFRIES (1974) and for *Crangon franciscorum* and *Palaemon macrodactylus* by SITTS and KNIGHT (1979). Major prey reported for the last two prawns were also mysids and copepods. The selective usage by adults and juveniles of mysids and copepods respectively appears to be a form of niche separation between adults and juveniles and may simply be the result of new predation capacities by the larger adults. Although it could be suggested that the prawns change their geographical position at maturity, all sizes of the prawn were usually caught in the same drift-net type of traps. The high incidence of vegetal detritus reported here is contrary to the findings of SAGUA (1980) who observed the prawns and reported that "they never fed on detritus, but accepted pieces of finely chopped crustacea". It could be either that

the right type of particles were not available in the aquarium or that the need did not arise, since food was provided. WILCOX and JEFFRIES (1974), confronted with similar results, argued that the detritus should be regarded as a dietary constituent, pointing out that "the resistance of chitin, shell and setae to digestion and the slow passage of these items through the digestive tract may bias the results towards a carnivorous feeding". While the bias postulate may be true, it is also true that cellulose, a major detritus component, is probably just as resistant to trituration and digestion as are chitin, shells and setae. Moreover, as suggested by SITTS and KNIGHT (1979), some of the detritus items could have originated in the guts of the prey consumed. Pending further work, the only sustainable conclusion for now is that detritus occurred in a significant number of prawns of the estuary.

The wide range of fish and Decapod crustaceans preying on *N. hastatus* in the estuary, suggests that the prawn is easy to capture, and secondly that the population is large. The large population is probably sustained by the year-long breeding pattern, observed in the population.

Of the many fish predators reported, POLL (1954) and LONGHURST (1957) reported on the Sciaenids of the genus *Pseudotolithus*, while ONYIA (1973) and TOBOR (1979) reported on the Polynemid *Galeoides decadactylus*. Other predators mentioned in the literature include *Brachydeuterus auritus* by SAGUA

(1966) and *Chloroscombrus chrysurus* by TOBOR (1979). None of the Ariid catfishes examined had *N. hastatus* prey although TOBOR (1969) had found evidence of their preying on *N. hastatus* in the Lagos area. This study however confirmed OBAKIN's (1968) report that *Parapenaeopsis atlantica* preys on *N. hastatus*. The predators are fairly evenly distributed between the pelagic and benthic communities, which could mean that *N. hastatus* is involved in some form of vertical migration. This probably is in the attempt to catch its principal food organisms which are involved in this type of migration. This foodweb (Fig. 2) constructed from the available information on the prey organisms and predators of *N. hastatus* clearly shows that the prawn plays an important role in the trophic relationship of the estuary. A reduction in the population of *N. hastatus*

would most probably affect the entire estuarine fishery adversely, particularly the Sciaenid community which depends largely on *N. hastatus* for food.

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