

The Morphology, Abundance, Size and Sex Distribution of *Callinectes amnicola* (De Rochebrune, 1883) from Okpoka Creek, Niger Delta, Nigeria

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Abstract: The morphology, abundance, size and sex distribution of callinectes amnicola from Okpoka Creek was studied for one year. *Callinectes amnicola* carapace is broad, moderately convex, ending laterally in a strong spine, preceded on the lateral margin by 9 distinct teeth. The length of the lateral spine is twice or more than that of proceeding tooth. The carapace width is about twice or slightly more than twice its length (2.0 – 2.3 times). Carapace upper surface is roughly granular. Epibranchial ridges are without distinct inflection in middle, almost straight. Four sub-median frontal teeth are well developed and are usually half or more than half as long as the outer pair. The chelipeds are strong, unequal and pincers with distinct ridges. As with other Portunids, the last (fifth) walking leg with propodus and dactylus is broad and flat, paddle-shaped to accommodate swimming. The crab species exhibit obvious sexual dimorphism. Male blue crabs have a T-shaped abdomen readily distinguishable from both juvenile and adult stages of the female. Female may be identified due to their triangular or rounded aprons. Immature females have triangular shaped abdomen with fused segments. However at the terminal or pubertal molt, the final ecdysis and onset of sexual maturity, the mature female abdomen becomes broad and rounded. It is also easily identified by its body color, which is generally described variously as olive-brown molted, and as blue or bluish with pink and pale legs. The highest number of male crabs was recorded in station 6 (24.50%) followed closely by station 5 (22.66%) then station 2 (15.97%), station 4 (15.76%), station 1 (10.77%) and station 3 (10.33%). Similarly, the females were most abundant in station 6 (23.90%), followed by station 5 (22.92%), station 4 (21.89%), station 2 (14.81%), station 3 (9.0%) and station 1 (7.47%) the least in abundance. The distributions were similar for both males and females. The size classes 30 – 39.99mm and 40 – 49.99mm were the highest in number for both sexes. The least number was recorded for size class 70 – 79.99mm. A total of 13,785 specimens of *Callinectes amnicola* comprising 45.5% males and 54.5% females were recorded. The crab's sizes ranged from 11mm to 74mm (males) and 12 to 76mm (females). The total weight ranged from 1.79g to 146.72g (males) and 1.17 – 151.62g (females). The largest size for the males (74mm, 146.72g) and females (76mm, 151.62g) were observed in December. The smallest size of the male (11mm, 1.79g) and the female (12.0mm, 1.17g) were recorded in October. The fairly higher body dimensions showed by males and females of *C. amnicola* in Okpoka is an indication that the creek is productive and environmentally stable.

Key words: *Callinectes amnicola*, morphology, abundance, sex and size distribution, Okpoka Creek and Nigeria

INTRODUCTION

Callinectes amnicola, one of the commonly consumed Crustaceans of the family Portunidae is found in the coastal areas of tropical, subtropical and temperate regions. Species of the genus *Callinectes* are widely distributed in the neotropics and subtropics, where they are a key resource in local fisheries. They are important in trophic relations of fish and organisms of sand and sandy mud bottoms. It has been reported that they provide an important potential link, transferring energy between benthic and pelagic food chains within the estuarine system (Longhurst, 1958; Scott, 1966; Pillay, 1967; Vankul, *et al.*, 1972; Warner, 1977; Baird and

Ulaanowicz, 1993). This crustacean is the most important food organism caught in the coastal (inshore) fishery and lagoons in west Africa (Lawal – Are *et al.*, 2000). The species is generally cherished source of protein and minerals in human diet and animal feeds (Chindah *et al.*, 2000 and Emmanuel (2008).

It is one of the most abundant estuarine macro invertebrates and supports valuable commercial and recreational fisheries along the Atlantic and Gulf coasts (Guillory and Perret, 1998). Recreational fishers often seek this interesting animal. Many physiologists have also used the blue crab as an experimental animal because of its ready availability, economic value, hardiness and complex life cycle (Miller and Houde, 1999; Smallegange and Jaap Van Der Meer, 2003).

The blue crab also plays a crucial role in the estuarine food webs, providing food for many species (Laughlin, 1979; Hines *et al.*, 1987, Orth and Van Montfrans, 1990; Thomas *et al.*, 1990; Heck and Coen, 1995). From a historical perspective, crabs in general have been viewed with disdain or infamously. William Warner, in his classic book "Beautiful Swimmers", noted that crabs are often classified as unpleasant and bellicose animals (Rugolo, *et al.*, 1994; Stehlik *et al.*, 1998 and US Fish and Wildlife Service, 1989).

The word 'crab' has been considered synonymous with a nasty or complaining disposition in many languages. The Latin word for crab, "cancer" describes the world's most deadly disease. While the scientific name *Callinectes* aptly describes the crab and was derived from Latin and Greek words. *Calli* meaning beautiful and *nectes* (ie swimmer). This is literally translated as "Beautiful swimmer".

Morphology, abundance and size distribution form the basis for fish stock assessment. Fish stock assessment evaluates the effect of fishing on a fishery as a basis for fishery decision. Sex and size distribution provides information on productivity, longevity, period of maturity, recruitment of various classes and determination of potential yield.

The Okpoka creek is one of the most numerous creeks in Niger Delta. The Niger Delta estuarine waters cover an area of about 680km². The Bonny/ New Calabar river systems formed about 39% of the total area (Sott, 1966). The Niger Delta area is the richest part of Nigeria in terms of natural resources with large deposits of petroleum products (oil and gas); (Moffat and Linden, 1995; Braide *et al.*, 2006). Similarly, the vast coastal features which include forest swamps, mangrove, marsh, beach ridges, rivers, streams and creeks serve as natural habitats for various species of flora and fauna (Alalibo, 1988 and Jamabo, 2008).

Consequently, several studies have been carried out in this regard for finfish species and crustaceans from other water bodies. Notable among these are the reports of Stickney, (1972) on fishes and invertebrates in Georgia Coastal water, Georgia. Olmi and Bishop, (1983) on the blue crab *Callinectes sapidus* Rathbun from the Ashley River, South Carolina; Prasad, *et al.*, (1989) on three Portunid crab species. There is a dearth of information on the morphology, abundance, sex and size distribution on the swimming crabs (Genus *Callinectes*) from Nigerian waters particularly from the Okpoka creek in particular and generally the Niger Delta estuarine waters for the evaluation of its ecology with a view to effectively manage the resources for sustainable supply to the citizenry.

MATERIALS AND METHODS

Study Area: The study was carried out in Okpoka creek, which is one of the several adjoining creeks off the Upper Bonny River estuary in the Niger Delta (Fig 1). The

Bonny River Estuary lies on the Southeastern edge of the Niger Delta, between longitudes 6°58' and 7°14" East, and latitudes 4°19" and 4°34' North. It has an estimated area of 206Km² and extends 7Km offshore to a depth of about 7.5 metres (Irving, 1962, Scott, 1966 and Alalibo, 1988). The Bonny River is a major shipping route for crude oil and other cargoes, and leads to the Port Harcourt quays, Federal Ocean Terminal, Onne, and Port Harcourt Refinery company terminal jetty, Okirika. Specifically, the Okpoka creek lies between Longitudes 7°03' and 7°05' East and Latitudes 4°06' and 4°24' and it is about 6 kilometers long.

Characteristically, the area is a typical estuarine tidal water zone with little fresh water input but with extensive mangrove swamps, inter-tidal mud flats, and influenced by semi-diurnal tidal regime. In the Bonny River estuary, the salinity fluctuates with the season and tide regime is influenced by the Atlantic Ocean (Dangana, 1985). Tidal range in the area is about 0.8m at neap tides and 2.20m during spring tides (NEDECO, 1961).

It is strategically located southwestern flanks of Port Harcourt and Okirika of Rivers State. The creek is bounded by thick mangrove forest dominated by *Rhizophora species* interspersed by White mangrove (*Avecinia sp.*) and *Nypa* palm. Along the shores of the creek are located the Port Harcourt Trans- Amadi Industrial layout, several establishments, markets, the main Port Harcourt Zoological garden and several communities. The communities are Oginigba, Woji New layout, Azuabie, Okujagu- Ama, Ojimba- Ama, Abuloma, Okuru- Ama, Oba-Ama and Kalio- Ama.

Artisanal fishers mainly exploit the fisheries. The fishers use wooden/dug-out canoes ranging in size from 3 to 8m long. The canoes are either paddled or powered by small outboard engines, and manned by an average of two men. From these boats, the fishers operate their cast nets, hook and lines, gillnets, crab pots, etc.

Sampling stations: Six sampling stations were established along a spatial grid of the Okpoka creek covering a distance of about six kilometers. The sampling stations were established based on ecological settings, vegetation and human activities in the area. The sampling station is about one kilometer apart from each other.

Station 1: Located upstream of the Port Harcourt main abattoir at Oginigba waterfront with living houses on the left flank of the shoreline. Vegetation is sparse with mainly red mangrove (*Rhizophora sp.*) white mangrove, *Avicenia sp.* and *Nypa palm (Nypa fruticans)*.

Station 2: Situated at Azuabie / Port Harcourt main abattoir waterfront. It is located downstream of Station 1. The bank fringing the Azuabie/abattoir is bare with no visible plants except toilet houses, residential houses, animal pens, boats and badges, while at the opposite side there are few mangrove and *Nypa* palm. Human activities

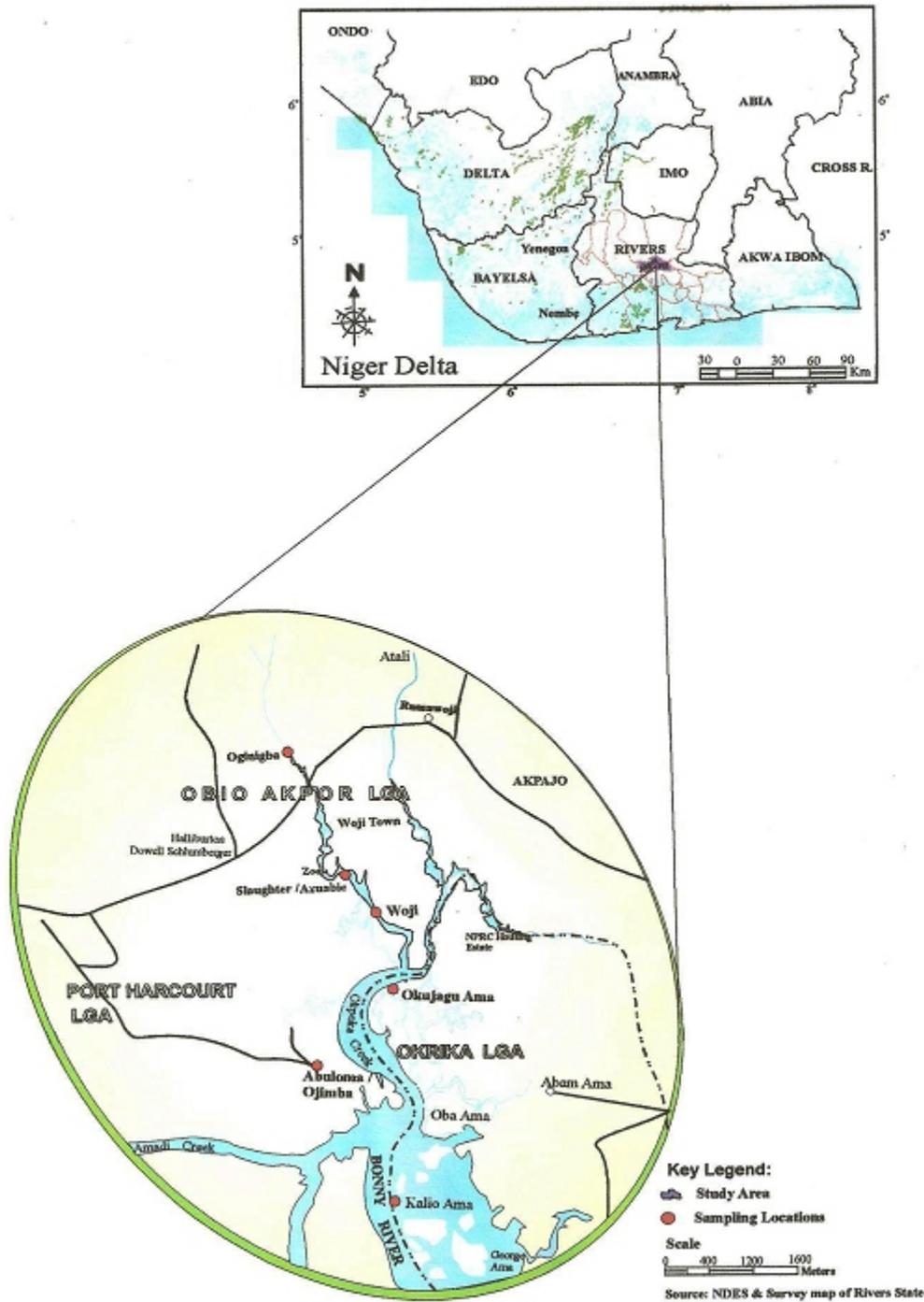


Fig 1: Map of Niger Delta showing Rivers State and the Study Area

here include slaughtering of animals, marketing, fishing and boat building. It is located downstream of station 1 and it is main collection point of abattoir wastes and other human and market wastes.

Station 3: It is downstream from the Port Harcourt

abattoir at the Woji sand-Crete. It is about one kilometer away from Station 2. The major activities here included sand mining and loading.

Station 4: This station is located at Okujagu-Ama area. There are no industrial activities here. Mainly fishers

occupy the area. *Nypa* palm dominates the marginal vegetation while the opposite side is thickly populated with red mangrove forest. *Rhizophora racemosa* and *Rhizophora mangle*. The main activity is fishing, boat ferrying and occasional sand moving.

Station 5: Is situated at Ojimba cum Abuloma waterfronts. There are no commercial activities apart from ferryboats operations. The shoreline fringes have mainly *Nypa* palm. The area is shallow and at low tide, the greater part of the bottom mud flat is exposed.

Station 6: Is located in front of Kalio-ama directly between Okpoka and Amadi creeks. The human activities here include jetty operations, oil and non-oil industrial activities, boat traffic and fishing. Vegetation is few dominated by red mangrove interspersed with white mangrove *Avicenia africana*.

Sample collection: The crabs for study were collected fortnightly for twelve (12) calendar months (January to December, 2007) using the square lift net trap (Plate 1) at each of the sampling stations along the Okpoka creek. The lift net trap has a square structure made of wooden stick of about 4cm thick and an area of 4.9m². The mesh sizes of the bag-like net were 1.2cm to 2.0cm multifilament nylon. The length of the bag is 40 to 60 cm. Strong nylon cords were woven in a net-like fashion from the centre to the middle of each of the four edges. A twine of about 6m long was attached to the centre and the other free end of the twine was tied to a floater, which served as a marker on the water surface to show the position of the gear.

The lift net trap was baited at the centre with animal offal and fish. The trap was operated from a hand-paddled canoe manned by two persons; one rowing while the other sets and hauls the trap into and from the water. The crabs were trapped and most of them were observed feasting on the bait until they were hulled into the boat. Sampling lasted for 4 hours on every sampling day and samples were collected between low ebbing and low flooding tide periods. The catches were taken to the laboratory in a cooler and stored in a deep freezer for further analysis.

Crabs were identified to species level carried out using photo cards and available identification keys (Fischer; 1978; Williams; 1974 and Schneider; 1990). Therefore each crab was sorted into species, sex and the required metric measurements were taken.

The carapace width and length were measured with a 0.5mm precision vernier caliper to the nearest millimeter (mm) while weight measurement was done using a 0.001g precision Adam (PGW series) weighing balance to the nearest grams (g).

RESULTS

Plates 2 and 3, present the morphology of *Callinectes amnicola* from Okpoka creek. The carapace is broad, moderately convex, ending laterally in a strong spine,



Plate 1: Crab traps and other fishing materials



Plate 2a: The Dorsal view of Male *Callinectes amnicola*



Plate 2b: The ventral view of Male *Callinectes amnicola*

preceded on the lateral margin by 9 distinct teeth. The length of the lateral spine is twice or more than that of preceding tooth. The carapace width is about twice or slightly more than twice its length (2.0 – 2.3 times). Carapace upper surface is roughly granular. Epibranchial ridges are without distinct inflection in middle, almost straight. Four sub-median frontal teeth are well developed and are usually half or more than half as long as the outer pair.

The chelipeds are strong, unequal and pincers with distinct ridges. As with other Portunids, the last (fifth)



Plate 3a: The dorsal view of Female *Callinectes amnicola*



Plate 3b: The ventral view of Female *Callinectes amnicola*

walking leg with propodus and dactylus is broad and flat, paddle-shaped to accommodate swimming. The crab species exhibit obvious sexual dimorphism. Male blue crabs (plate 2) have a T-shaped abdomen readily distinguishable from both juvenile and adult stages of the female. Females (Plate 3) may be identified due to their triangular or rounded aprons. Immature females have triangular shaped abdomen with fused segments.

However at the terminal or pubertal molt, the final ecdysis and onset of sexual maturity, the mature female abdomen becomes broad and rounded. It is also easily identified by its body color, which is generally described variously as olive-brown molted, and as blue or bluish with pink and pale legs.

The abundance of the different sexes of *C. amnicola* at the various stations of the Okpoka creek is presented in Figure 2. The highest number of male crabs was recorded in station 6 (24.50%) followed closely by station 5 (22.66%) then station 2 (15.97%) station 4 (15.76%), station 1 (10.77%) and station 3 (10.33%). Similarly, the females were most abundant in station 6 (23.90%), followed by station 5 (22.92%), station 4 (21.89%), station 2 (14.81%), station 3 (9.0%) and station 1 (7.47%) the least in abundance.

The length frequency distribution according to sex and size of the crabs are shown in Fig. 3. The distributions

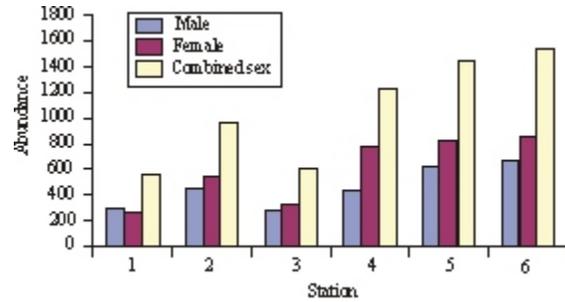


Fig. 2: Abundance of crabs at different station

were similar for both males and females. The size classes 30 – 39.99mm and 40 – 49.99mm were the highest in number for both sexes. The least number was recorded for size class 70 – 79.99mm.

A total of 13,785 specimens of *Callinectes amnicola* comprising 45.5% males and 54.5% females were recorded. The crab's sizes ranged from 11mm to 74mm (males) and 12 to 76mm (females). The total weight ranged from 1.79g to 146.72g (males) and 1.17 – 151.62g (females). The largest size for the males (74mm, 146.72g) and females (76mm, 151.62g) were observed in December. The smallest size of the male (11mm, 1.79g) and the female (12.0mm, 1.17g) were recorded in October.

DISCUSSION

The morphology of *Callinectes amnicola* from Okpoka creek did not vary from others (Pyle and Croinin, 1950; Warner 1977; Manning and Holthius, 1981; FAO, 1981, Powell, 1983; Gauld, 1960; Williams, 1984; FAO, 1981; Schneider, 1990). They also described as follows: The carapace as broad, moderately convex, ending laterally in a strong spine, preceded on the lateral margin by 9 distinct teeth. The length of the lateral spine was twice or more than that of proceeding tooth. The carapace width was about twice or slightly more than twice its length (2.0 – 2.3 times). Carapace upper surface was roughly granular. Epibranchial ridges are without distinct inflection in middle, almost straight. Four sub-median frontal teeth are well developed and are usually half or more than half as long as the outer pair. The chelipeds are strong, unequal and pincers with distinct ridges. As with other Portunids, the last (fifth) walking leg with propodus and dactylus is broad and flat, paddle-shaped to accommodate swimming.

They noted that the crab species exhibit obvious sexual dimorphism. Male blue crabs have a T-shaped abdomen readily distinguishable from both juvenile and adult stages of the female. Females may be identified due to their triangular or rounded aprons. Immature females have triangular shaped abdomen with fused segments. However at the terminal or pubertal molt, the final ecdysis and onset of sexual maturity, the mature female abdomen becomes broad and rounded. It is also easily identified by

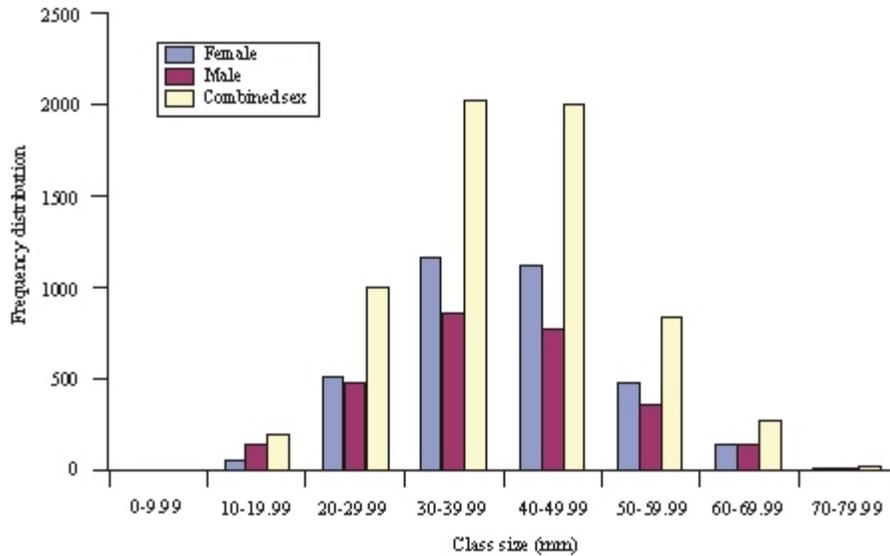


Fig. 3: Length frequency distribution according to sex and size

its body colour that is generally described variously as olive-brown molted, and as blue or bluish with pink and pale legs

The abundance of the different sexes of *C. amnicola* across the stations did not fluctuate widely. This may be due to the fairly stable water quality as well as the composition of the sediments, which is characteristically sandy. Pinheiro *et al.*, (1996) and Carmona-Suarez and Conde (2002) reported that the distributional patterns of portunids in Fertaleza Bay (Brazil) are driven mainly by the granulometric composition of the sediments. Also, Charcur and Negreiros-Fransozo (2001) in their study of spatial and seasonal distributions of *Callinectes danae* in Ubatuba bay, Sao Paulo, Brazil observed that the species was abundant in shallow water close to the discharge of estuaries where the bottom is composed of fine and very fine sand. Similarly, study of Dungeness crab (*Cancer magister*, Dana) living in Canada's Pacific waters revealed that the crab is sometimes found on mud and gravel but is most abundance on sandy bottoms (Jamieson, 2002).

The size distribution with carapace length ranging from 11mm to 74mm and total weight ranging from 1.79 to 146.72g for the male and 12.0mm to 76mm and weighed between 1.17 and 151.62g for the female varied from other reports. Lawal-Are, (2003) reported different size distribution of (3.5-16.8cm; 3.2-277.1g); (2.2-16.4cm; 4.4-252.6g) and (3.5-16.1cm; 3.4-262.7g) for the same species in the Lagos Lagoon, Badagry lagoon and Lekki lagoon respectively.

Emmanuel (2008) also reported carapace length ranging from 2.8 to 16.6cm and total weight (3.20-348.5g) for the same species from Lagos lagoon and its adjacent creek, Southwest Nigeria. The *C. amnicola* from the different water bodies of the Southwest, Nigeria therefore had relatively higher size class than that from the Okpoka Creek.

The variation in size of crabs used for this study and other previous studies may be indicative of high fishing mortality at the Okpoka creek. This is explained in Tagatz (1968); Murphy and Kruse, (1995) and Guillory (1997). They reported that direct fishing mortalities from illegal harvest of blue crabs and indirect fishing mortality have important management implications because many juveniles approaching crab size are impacted and probably resulted in reduced catch of larger size crabs.

Secondly, the lower proportion of adult *C. amnicola* in the crab population suggests a drastic adjustment, probably of a density-dependent compensatory nature, in the size of the crab cohort, during the early life history stages. Cannibalism has been identified as a feature in aquatic organisms that leads to density-dependent overcompensation (Rosas *et al.*, 1994).

Callinectes amnicola is said to be cannibalistic and this may be the principal cause of density-dependent mortality during the early life history stages of the species. Similar observation was made by Enin (1998) on *Macrobrachium vollehovenii* in his work on the status of the *Macrobrachium* fishery in the Cross River estuary. The fairly higher body dimensions showed by males and females of *C. amnicola* in Okpoka creek are probably due to the fact that the creek is productive and environmentally stable as reported by Silva-Castiglioni *et al.*, (2004).

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