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DIETARY SPECTRUM, DISPERSITY AND OVERLAPS OF BLUE CRAB (*Callinectes amnicola,* DE ROCHEBURNE) FROM SOUTHEAST NIGERIA

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ABSTRACT

Blue crabs *Callinectes amnicola* are primarily described as carnivores (with more than 70% of animal food content in stomachs), but an assessment of the stomach contents of 239 and 245 crabs from the Qua Iboe River (*QIRE*) and Imo River estuaries (*IRE*), respectively, from January – December 2008, indicate the species exhibited a generalist and unspecialized carnivore feeding habit with animal food content <70% (61.15% and 56.03% in *QIRE* and *IRE*, respectively) during the study period. Eighteen dietaries in seven main food categories were identified and classified into four trophic levels: nekton (fish bones and scales), detritus (sediments), plants (algae and sea grasses) and zoobenthos (molluscs and insects). Fish and sediments were the primary food resources for *QIRE* crabs. The dendrogram plot, using cluster analysis, indicated four groups. The crabs from *IRE* exhibited higher diet generalization, wider diet breadth (feeding on sediments, fish, plants and molluscs), higher feeding intensity and condition factor than those of *QIRE*. Crabs from both locations exhibited similar dietary quality (index of biotal dispersity, *IBD*>60%) but dissimilar dietary quantity since diet overlap (< 60%) and diet breadth (*B* < 1) were low. Hence, crab combines its ability to switch from one food category to another with a tendency for carnivore-detritivore in *IRE* to omnivore-carnivore in *QIRE*, relative to abundance of food/prey items in its environment.

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INTRODUCTION

Blue crab *Callinectes amnicola* (Portunidae) is one of the most economically important swimming crabs inhabiting the coastal waters of tropical, subtropical and temperate regions (Lawson and Oloko, 2013). It is an inshore demersal estuarine species found seaward in lower reaches of fresh water rivers, estuaries and coastal marine waters (Amadi, 1990; Nlewadim et al., 2009) inhabiting muddy bottoms in mangrove areas and river mouths (Defelice et al., 2001). It is one of the most abundant estuarine macro invertebrates that supports valuable commercial and recreational fisheries along the Gulf and Atlantic coasts (Guillory and Perret, 1998) and provides animal protein for coastal and riverine communities in Benin, Ghana, Ivory Coast and Nigeria in West Africa (Okafor, 1988; Lawal-Are and Kusemiju, 2000). They are present in most of the aquatic food chains, occupying different trophic levels (Amundsen et al., 1996).
The *QIRE* and *IRE* are located in the Niger Delta region of Nigeria which is viewed as the richest part of the country in terms of natural resources with large deposits of petroleum products (oil and gas) (Moffat and Linden, 1995). Similarly, the vast coastal features of the area which include forest swamps, mangroves, marshes, beach ridges, rivers, streams and creeks serve as natural habitat for various flora and fauna species (Jamabo, 2008), supporting a wide variety

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of fishery. *C. amnicola* is one of the main species of the 61 shellfish species of this region (Nlewadim et al., 2009). Blue crab commonly occurs at the two locations under study where it is mostly fished by women and children using traps made of baskets and clay pot or as non-target species of artisanal fishers.

Diets of fish represent an integration of many important ecological components such as behaviour, condition, energy intake, habitat use, inter/intra specific interactions (Zacharia and Abdurahiman, 2004). Blue crabs exhibit a variety of mouth parts that provide a diversified diet composition, including both mobile and sessile preys (Amundsen et al., 1996), hence accurate description of diets and feeding habits provide the basis for understanding trophic interactions in aquatic food webs. The quantitative assessment of the feeding habits of fish and other animals based on the analysis of stomach contents has become a standard practice (Hyslop, 1980) and is an important aspect of fisheries management (Zacharia and Abdurahiman, 2004).

Warner (1977) primarily classified portunid blue crabs as carnivores and opportunistic omnivores with predatory tendencies based on their diet and mouth parts. Blundon and Kennedy (1982) described them as omnivores and detritivores. Woods (1993) suggested the use of different strategies for food intake and feeding habit by blue crabs may be constrained by environmental characteristics added to the availability of prey. Hence, he classified blue crabs as dietary opportunist, feeding upon locally and seasonally available prey species with distinct temporal and spatial feeding patterns. A few published works on the food and feeding habit of this crab in Nigeria further illustrates the influence of environment, seasonality and prey availability as blue crabs were observed to be carnivores (Ezekiel and Bernard, 2014), predator carnivore (Emmanuel, 2008), scavengers and omnivores (Chindah et al., 2000), opportunistic omnivores (Lawal-Are and Kusemiju, 2000; Arimoro and Idoro, 2007; Lawal-Are, 2009), opportunistic carnivores (Lawal-Are, 2003), among others.

This study seeks to evaluate the spatial and potential patterns of trophic segregation, feeding performances, in addition to diet breadth, overlap and comparison (how dispersed or similar they are) of blue crab *C. amnicola* between two mangrove locations in southeast Nigeria. The results of this study would further increase understanding of trophic ecology of this crab for proper management of the resource in Nigeria.

MATERIALS AND METHODS

Crabs were obtained monthly from artisanal fishers (January – December 2008) at Ukpenekang beach, Ibeno along the Qua Iboe River estuary, *QIRE,* and at Uta Ewa beach, Ikot Abasi along the Imo River estuary, *IRE*, both in southeast Nigeria (Fig. 1.). Specimens were fixed in 10% formalin after collection prior to analysis. Carapace length and weight of the specimens were taken and the specimens were eviscerated. The stomachs of the specimens were excised and the contents weighed. The stomach contents were examined macroscopically and microscopically and the alimentary items were identified to the lowest possible taxonomic level. Diet composition was assessed using the point and frequency of occurrence methods (Hyslop, 1980). The stomachs were sorted out visually and allocated points of 0, 5, 10, 15 and 20 corresponding to empty, 25% full, 50% full, 75% full and fully distended stomachs. These points were shared among various contents, taking into account their relative proportion by volume. The percentage point (*PP*) was evaluated by expressing the point scored by each food item as a percentage of the total points scored by all stomach contents. The percentage relative frequency (*RF*) was calculated by expressing the number of each prey item in all non-empty stomachs as a percentage of the total number of food items in all non-empty stomachs (Hyslop, 1980). The percentage points (*PP*) and percentage relative frequency (*RF*) calculated were used to estimate the relative importance of food items, while the overall importance was expressed by the index of food dominance (*IFD*) (King et al., 1990). This index is scaled between 0 and 100%; items with $IFD \geq 10\%$ were considered as primary dietaries, those with *IFD* of 1-9.9% were considered as secondary dietaries and those with $IFD \geq 1.0\%$ as incidental dietaries. TROPH values and their standard errors, SE, were estimated from quantitative diet composition data using *TrophLab*, a stand-alone application (Pauly et al., 2000) with *IFP* of food categories classified into four trophic levels - nekton (fish bones and scales), detritus (sediments), plants (algae and sea grasses) and zoobenthos (molluscs and insects) as input values. For purpose of comparison, TROPHs were also estimated from the "qualitative approach" using list of prey items found in the diet. TROPH values vary between 2.0 for herbivorous/detrivorous and 5.0 for piscivorous/carnivorous organisms (Pauly et al., 1998; Pauly and Palomares, 2000).

Ecological biotic indices of Shannon-Weiner Diversity, *H* (Shannon and Weaver, 1963), Simpson Dominance, *D*, Diversity, *1-D*, Evenness, e^H/S, and Equitability, *J*, indices (Odum, 1971) and Margalef index, *d* **(**Margalef, 1968**)** were used to describe the trophic structure and compare the sampling stations based on the percentage point (*PP*) of dietaries**.** The Bray Curtis two-way paired groupcluster analysis was performed on stomach content data (*PP*) to yield a dendrogram identifying hierarchy of association and natural grouping or clustering of dietaries (Ter Braak, 1986). The average stomach fullness and the stomach repletion index, calculated as the number of stomachs containing food expressed as a percentage of the total sample, were determined and used to evaluate the pattern of feeding activity.

The wideness of dispersion of food items between the

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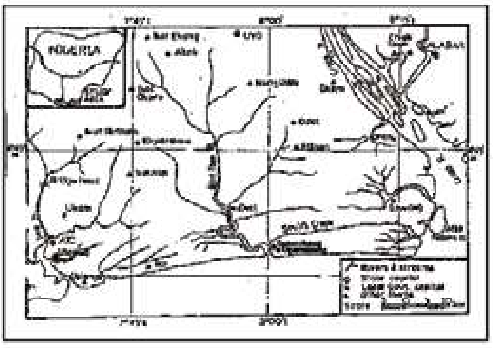

Fig 1. The coastal zone of southeastern Nigeria showing sampling points (•) along the Qua Iboe River and Imo River estuary (Inset: Map of Nigeria showing the study area; ATC represents African Trading Company)

locations was determined using the index of biotal dispersity (IBD) as given by Koch (1957):

$$IBD = \frac{(T - S) \times 100}{S\,(n - 1)} \qquad (1)$$

Where *T* = arithmetical sum of dietaries in each of the n compared locations; *S* = Total list of dietaries in the n compared location. *IBD* ranges from 0 (for completely different set of dietaries in both locations) to 100% (for identical set of dietary in both locations).

Levins' niche breadth was used to integrate the number of prey categories present and their relative proportion in the diet, thereby determine diet specialisation of the crab from the two locations. Diet breadth ranges from 0 – 1.0, where values close to 0 indicate specialisation (when no resource state is shared by species from the two locations), while values close to 1.0 indicate generalisation (when crab species from both locations utilize each resource state in proportion to its abundance) and a value >1.0 if the species utilizes certain resource states more intensively than others and the utilization functions of the species at both locations tend to coincide (Hurlbert, 1978). We calculated the standardized diet breadth (Hurlbert, 1978) as:

$$B = \left[\left(\sum_{i=1}^{n} P_i^2\right)^{-1} - 1\right] / n-1 \qquad (2)$$

Where *B* = diet breadth; P_i = proportion of the diet comprised by resource type *i*; *n* = number of food types eaten.

Dietary overlap or similarity in diet composition of crabs from the two locations was assessed using percentage similarity coefficient (*S*) (Moss and Eaton, 1966) to determine the intensity of the interaction between species location pairs:

$$k = \sum_{i-1}^{n} \min\,(x_i y_i) \qquad (3)$$

Where X_i and Y_i = proportions of the components of the nth item comprising the diets of *X* and *Y*. This index ranges from 0 (totally dissimilar dietary components) to 100% (identical diets). A value of 60% was used as threshold to delineate similar (>60%) from distinct feeding niches (<60%) for both index of biotal dispersity, *IBD,* and dietary overlap or similarity, *S*.

The general wellbeing of the crabs was evaluated using Foulton's condition factor, *K* (Htun- Han, 1978);

$$K = (W \times 100) \,/\, L^3 \qquad (4)$$

Where *W* = Weight (g) and *L* = carapace length (cm)

RESULTS

A total of 239 specimens of *Callinectes amnicola* ranging from 2.61 – 8.91 (6.57 ± 0.20 cm) in carapace length (CL) and 30.00 – 216.00 (118.04 ± 4.06 g) in total weight (TW) were obtained from *QIRE* and a total of 245 specimens ranging from 2.18 – 8.13 (6.37 ± 0.06 cm) in length and 53.00 - 262.00 (137.50 ± 3.73 g) in weight were obtained from *IRE,* as shown in Table 1.

Eighteen dietaries in seven main food categories were identified and classified into four trophic levels as: nekton (fish bones and scales), detritus (sediments), plants (algae and sea grasses) and zoobenthos (molluscs and insects), as shown in Table 2 and further illustrated in the dendogram of the cluster analysis (Fig. 2.), each main group with several subgroups; the smaller the existing gap, the closer the relationship and *vice versa*.

The food richness or variety of items consumed was 18 in *IRE* and 17 in *QIRE* (when unidentified food items were excluded). *C. amnicola* from *QIRE* fed primarily on fish and

Table 1. Sizes, body condition, indices of feeding activity, diet breadth and indices of diet dispersity and similarity of *Callinectes amnicola* from the Qua Iboe River (*QIRE*) and Imo River Estuaries, Nigeria (*IRE*)

Location	*N*	*CL* (cm)	*W* (g)	*K*	*AGF*	*R*	*B*	*IBD%*	*S%*
			Mean ± SE						
QIRE	239	6.57 ± 0.20	118.04 ± 4.06	50.69 ± 2.38	0.69	40.00	0.12	94.74	55.72
IRE	245	6.37 ± 0.06	137.50 ± 3.73	61.46 ± 9.48	0.88	49.03	0.22		

Where: *CL* = Carapace Length, *W* = weight, *K* = condition factor, *AGF* = Average gut fullness, *R* = stomach repletion index, *B* = Diet breadth index, *IBD* = Index of Biotal Dispersity, *S* = percentage similarity coefficient

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Table 2. Dietary composition of *Callinectes amnicola* from the Qua Iboe River Estuary and Imo River Estuary

Food Items	Location					
	Qua Iboe River Estuary			Imo River Estuary		
	PP	*RF*	*IFD*	*PP*	*RF*	*IFD*
Plants						
Algae	10.5747	10.2310	5.7817	12.7650	8.8091	14.6033
Sea grasses	3.4483	3.6304	0.6690	6.0284	5.5465	4.3419
Total Plants	**14.0230**	**13.8614**	**6.4507**	**18.7943**	**14.3556**	**18.9452**
Detritus - Sediments						
Mud	22.0690	21.1221	24.9108	16.6667	13.5400	29.3042
sand grains	2.7586	2.6403	0.3892	8.51064	6.3622	7.0312
Total Detritus	**24.8276**	**23.7624**	**25.3000**	**25.1773**	**19.9021**	**36.3355**
Zoobenthos - Mollusca						
Gastropoda	3.9080	3.9604	0.8271	5.6738	5.5465	4.0865
Egaria radiata	0.9195	0.9901	0.0487	2.1277	2.2839	0.6310
Amphineura	0	0	0	1.0638	0.9788	0.1352
Shrimp parts	2.9885	2.9703	0.4744	5.6738	9.7879	7.2115
Total	**7.8161**	**7.9208**	**1.3501**	**14.5390**	**18.5971**	**12.0642**
Crustacea						
Anomura	0.9195	0.9901	0.0487	1.0638	0.9788	0.1352
Brachyura	0.2299	0.3300	0.0041	0.7092	0.8157	0.0751
Macrura	0.2299	0.3300	0.0041	0.7092	0.8157	0.0751
Total	**1.3793**	**1.6502**	**0.0568**	**2.4823**	**2.6101**	**0.2855**
Polycheata						
Cnidaria	0.9195	0.9901	0.0487	1.7731	0.6525	0.1502
Coelenterate	0.2299	0.3300	0.0041	1.0638	0.8157	0.1127
Porifera	0.2299	0.3300	0.0041	1.0638	1.6313	0.2254
Total	**1.3793**	**1.6502**	**0.0568**	**3.9007**	**3.0995**	**0.4883**
Insects						
Dipteran insect	0.9195	0.9901	0.0487	0.7092	0.6525	0.0601
Insect remain	0.9195	0.9901	0.0487	6.0284	3.9152	3.0649
Total Zoobenthos	**1.8391**	**1.98020**	**0.0973**	**6.7376**	**4.5677**	**3.1250**
Nekton/Fin-Fish						
Scale	29.8851	30.0330	47.9646	8.5106	5.5465	6.1298
Bone	18.6207	18.8119	18.7196	13.4752	9.2985	16.2710
Total Nekton	**48.5058**	**48.8449**	**66.6842**	**21.9858**	**14.8450**	**22.4008**
Unidentified items	0.2299	0.3300	0.0041	6.3830	7.6672	6.3551
Grand total	100	100	100	100	100	100
Trophic Level ± std error		**3.69±0.66**			**2.85±0.46**	

PP = percentage points, *RF* = percentage relative frequency, *IFD* = index of food dominance

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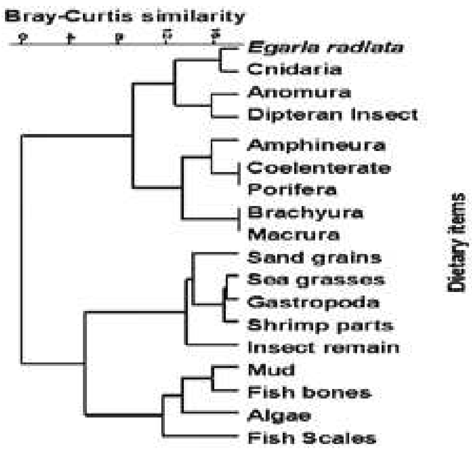

Fig 2. Dendrogram of Bray Curtis two-way paired groupcluster analysis of stomach contents of *C. amnicola* from the two mangrove habitats showing hierarchy of association and clustering of food content

Table 3. Ecological indices of the percentage proportion of dietaries of *C. amnicola* in the mangroves of Southeast Nigeria

Food Items	Qua Iboe River Estuary	Imo River Estuary
No of food items	17	18
Simpson's index of dominance, *D*	0.1896	0.1047
Simpson's index of diversity, *1- D*	0.8104	0.8953
Shannon Species diversity, *H'*	1.965	2.463
Evenness, e^H/S	0.4199	0.6519
Margalef index, *d*	3.476	3.745
Equitability, *J*	0.6937	0.852

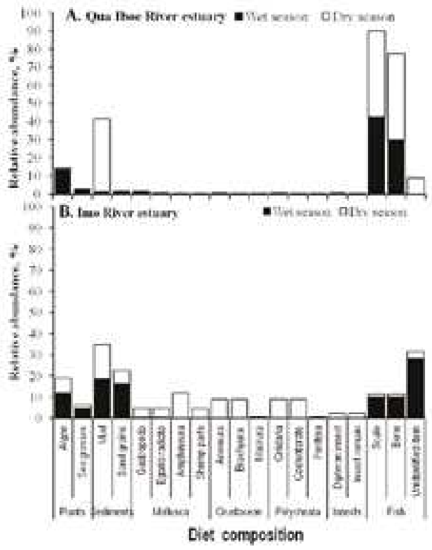

Fig 3. Seasonal pattern in diet composition of *C. amnicola* in the study area

sediments and secondarily on plants in order of decreasing importance (Trophic Level ± std. error = 3.69±0.66), while those from *IRE* primarily fed on sediments, fish, plants and molluscs and secondarily on insects (Trophic Level ± std. error = 2.85±0.46) in order of decreasing importance. The average gut fullness (*AGF*) was higher for *IRE* (0.88) than *QIRE* (0.69) and the stomach repletion index was higher for *IRE* (49.03) than *QIRE* (40.00), as indicated in Table 1. Crabs in *IRE* presented a wider dietary breadth (*B* = 0.22) compared to those of *QIRE* (*B* = 0.12) and also exhibited higher condition factor (K_{IRE} = 61.46 ± 9.48; K_{QIRE} = 50.69 ± 2.38), as shown in Table 1. The index of biotal dispersity was high (*IBD* = 94.74%), whereas the percentage similarity coefficient was low (*S*<60%) between *C. amnicola* from the both locations (Table 1). There were no significant differences between the proportion of prey items according to season and to habitat (Fig. 3.), however, crabs in Q*IRE* preferred items of higher trophic value like fish, exhibiting higher trophic level.

Table 3 provides the ecological indices of the trophic spectrum of *C. amnicola* in the studied mangroves. The diversity indices were generally high indicating a polydiverse diet content. The Simpson's dominance index (*D*) in *QIRE* was twice that of *IRE*. Simpson's index of diversity usually ranges from 0 (= no diversity) to 1 (= maximal diversity), i.e. the closer the index to one, the greater the sample diversity.

DISCUSSION

The trophology and feeding of blue crab comprise a wide food spectrum which may vary depending on aquatic system, season, diurnal activity, sampling periods, areas, depths, size groups and crab molt-classes, among others. A study by Chazaro-Olvera et al. (2000) on the gut content and feeding of *Callinectes similis* on the central continental shelf off Veracruz in the Gulf of Mexico revealed several groups of food items in the diet including: plant fragments, remains of fish, polychaetes, crustaceans (*Farfantepenaeus aztecus* and *Portunus gibbesii*), micromolluscs (*Mulinia lateralis*) and detritus. Warner (1977), Lawal-Are (1998) and Ezekiel and Bernard (2014) also observed that the stomach contents of *C. amnicola* include mollusc shell parts, fish scales and bones and shrimp appendages, but concluded that mollusc shell parts constituted the most important dietary material. An examination of the stomach contents of 809 king crabs *Paralithodes camtschatica* (Tilesius) from near Kodiak Island, Alaska, also revealed that mollusca (mainly the bivalves *Nuculana* spp., *Nucula tenuis* and *Macoma* spp.) and Crustacea (mainly barnacles), followed by fishes, were the dominant food groups in terms of percentage wet weight and frequency of occurrence (Jewett and Feder, 1982).

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Mérona et al. (2008) classified specialized species as those having stomachs containing more than 70% of a single food item. The specialists include carnivores (stomachs with more than 70% of animal food content), herbivores (more than 70% of vegetal or detrital food content) or omnivores (similar amount of animal and vegetal food content). Other specialists include detritivores, carnivores, phytivores and invertivores. The generalists include omnivores and unspecialized carnivores or herbivores. Qualitatively, the crabs in this particular study were (unspecialized) generalist-carnivores. They consumed 61.15% and 56.03% animal food content, mainly nekton (fish bones and scales) - 48.7% and 28.4%, while detrital (sediments) and vegetal food contents (plants - algae and sea grasses) were 24.8% and 14.0%, and 25.2% and 18.8%, respectively, in *QIRE* and *IRE*, respectively. Their diets were mostly of autochtonous origin, > 65%. Molluscs, the traditional natural food component of portunid crabs (Warner, 1977), were the fourth preferred dietary item, being 7.8% and 14.5% in crab diets in *QIRE* and *IRE*, respectively. Higher preference by *C. amnicola* for fish bones and scales rather than molluscs was also reported by Lawal-Are and Kusemiju (2000) and Lawal-Are (2009) in the Lagos area, southwest Nigeria. As unspecialized carnivores, the species exhibit carnivorous diet with predatory, scavenger and herbivory affinities. The *IRE* crabs exhibit preference for fish, detritus, vegetal materials and molluscs (predators, scavengers and secondarily herbivores) in similar proportions, while the*QIRE* crabs exhibit a high consumption of fish remains and sediment/detritus (predators and scavengers), relative to abundance of prey items in their environment. The Shannon, Simpson's and Margalef diversity indices indicate crab dietaries were more diverse in *QIRE* and more even (Evenness and Equitability indices) in *IRE* (Table 3).

Crab diets were also similar (index of biotal dispersity, *IBD*> 60%, i.e. = 94.74%). Pair wise dietary similarity, *S* (overlap) and diet breadth, *B*, between both locations were generally low [< 60% (*S* = 55.71%) and *B*< 1, wider in *IRE* crabs (*B*= 0.22) than in *QIRE* (*B*= 0.12)], indicating quantitative dissimilarities in dietaries and suggesting trophic flexibility and partitioning of food resource.

Trophic segregation is a major mechanism structuring fish assemblages in aquatic ecosystems. Though alternating tidal movements and wet and dry seasons in estuaries change (qualitative and quantitative) availability of food resources, this does not modify the trophic spectrum and the feeding intensity of *Callinectes spp.* due to its unspecialized generalist-carnnivore feeding habit and ability to effectively and successively exploit or utilize different food resources seasonally and spatially in the mangroves in southeast Nigeria (Fig. 3.). Warner (1977) and Nelson et al. (1993) also observed temporal and spatial feeding patterns in trawl catches of portunid blue crabs in subtidal habitats with increased nocturnal feeding activity.

This ability for trophic flexibility is reported by different authors in their study of this species in Nigeria. Lawal-Are and Kusemiju (2000) and Lawal-Are (2009) described *C. amnicola* as opportunistic omnivores in Badagry and in the interconnecting Badagry, Lagos and Lekki lagoons in Lagos, southwest Nigeria, where the diet mainly consisted of fish bones and scales, sediments, plants (algae and sea grasses), molluscs and insects. Arimoro and Idoro (2007) hold a similar opinion on the feeding habit of *C. amnicola* in the Warri River, Midwest Nigeria. Lawal-Are (2003), however, described *C. amnicola* as opportunistic carnivore in contrast with the above opinions, while Chindah et al. (2000) described them as scavengers. In addition, Emmanuel (2008) reasoned that *C. amnicola* in the Lagos Lagoon is more of a predator than a scavenger with molluscs and crustaceans as its major food items. Ezekiel and Bernard (2014) reported stomach analysis of *C. amnicola* in the Lagos Lagoon constituted mainly of mollusc shell parts (86.4%), fish scales and bones and shrimp appendages, describing the species as a bottom carnivore. From the above reports, it is obvious that dietary spectra of *C. amnicola* vary with prey availability, seasonality, possible ambient environmental variations of the study area and sampling skills of the authors.

The result of this study is in agreement with the primary classification of *C. amnicola* as carnivorous by Warner (1977), based on their mouth part and stomach content. However, Warner (1977) further pointed out that portunids are less able to crack large shells of molluscs (bivalve and gastropod) with their slim sharp-toothed chelae (when compared to better armoured *Cancer spp.*) and that within each trophic guild diets are unspecialized with portunids catching many different types of preys as reported in Bludon and Kennedy (1982) and Chindah et al. (2000). Blundon and Kennedy (1982) observed omnivory and detritivory in all size classes of *C. amnicola* studied. The wide food spectrum with seven major dietaries (in four trophic levels) recorded for *C. amnicola* in this study indicates the opportunistic and omnivory nature of the species coupled with trophic flexibility, switching from one food category to another in response to fluctuations in food abundance. The higher stomach repletion index obtained for crabs of *IRE* (49.03) when compared to those of *QIRE* (40.00) indicates greater foraging activity of crabs from *IRE* than those from *QIRE* and this is supported by the wider diet breadth, *B*, higher average gut fullness, *AGF,* and higher condition factor, *K,* of *IRE* than those obtained for *QIRE* (Table 1). Condition factor (*K*) is an estimation of the general wellbeing of an organism (Jones et al*.,* 1999). It is based on the hypothesis that heavier individuals of a given length are in better condition than the lighter ones (Bagenal and Tesch, 1978). *K* has been used as an index of growth and feeding intensity; a high *K* value attests to higher feeding intensity (Braga and Gennari-Filho, 1990). Therefore, a higher *K* value of IRE over those of *QIRE* is an indication of better wellbeing and higher feeding intensity of crabs of *IRE* compared to those of *QIRE*. However, the values of *K* for

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both locations were lower than those obtained for the same species (K = 68.33) from Ojo Creek, in Lagos, southwest Nigeria (Oluwatoyin et al., 2013). Variations in K values may be indicative of food abundance, adaptation to environment and gonadal development of the organism (King, 1995).

CONCLUSION

The results presented suggest that the habitat in which the study is conducted has influence on the spectrum and diversity of the diets of blue crabs. Qualitatively, the diets of blue crab from the two habitats compared were similar, while quantitative assessments suggest dissimilarity in dietaries. Hence, *Callinectes spp.* in the study area is an unspecialized carnivore with a tendency for carnivore-detritivore in *IRE* to omnivore-carnivore in *QIRE*, relative to abundance of food/prey items in its environment. This is a departure from the classical classification of *Callinectes spp.* as strictly carnivore based on mouth part and stomach content. The results also indicate blue crab has a high potential for resource utilization and is capable of surviving fluctuations in nutrient sources in aquatic ecosystems. Hence, it is also a good candidate for aquaculture.

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Sažetak

SPEKTAR, ŠIRINA I PREKLAPANJE PRIRODNE PREHRANE PLAVOG RAKA (*Callinectes amnicola*, DE ROCHEBURNE) IZ JUGOISTOČNE NIGERIJE

Plavi rakovi, *Callinectes amnicola*, prvotno su opisani kao karnivori (s više od 70% životinjskog materijala u želucima). Međutim, analiza sadržaja želuca 239 jedinki iz rijeke Qua Iboe (QIRE) i 245 jedinki rakova iz Imo riječnog ušća (IRE) od siječnja do prosinca 2008. ukazala je na općenitu i nespecijaliziranu karnivornu prehranu s udjelom životinjske hrane <70% (61,15% u QIRE i 56,03% u IRE) tijekom promatranog razdoblja. Utvrđeno je osamnaest različitih vrsta ishrane sa sedam glavnih hranidbenih svojti koje su klasificirane u četiri trofičke razine: nekton (riblje kosti i ljuske), detritus (sedimenti), biljke (alge i morske trave) i zoobentos (mekušci i kukci). Riba i sediment bili su glavni prehrambeni resurs za rakove QIRE. Dendrogramski prikaz pomoću klaster analize ukazuje na četiri skupine. Rakovi IRE pokazuju veću generalizaciju kao i hranidbenu širinu (hranjenje sa sedimentom, ribama, biljkama i školjkama), odnosno veći intenzitet hranjenja kao i kondicijski faktor nego kod rakova QIRE. Rakovi s obje lokacije pokazuju slične prehrambene navike (indeks biotičkog raspona, IBD> 60%), ali i razlike u količini ishrane, budući da su preklapanja ishrane (<60%) i raspon ishrane (B <1) bili niski. Dakle, ova vrsta rakova kombinira sposobnost prilagodbe prehrane, iz jedne kategorije hrane na drugu, s tendencijom karnivora-detritivora u IRE i svejeda-karnivora u QIRE, u odnosu na obilje hrane/svojti plijena u svojoj okolici.

Ključne riječi: prehrana, Crustacea, pridnene vrste, svojte plijena, razina trofije

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