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Original Article

Biology of the West African fiddler crab, *Uca tangeri* (Eydoux, 1835) (Decapoda: Ocypodidae) from a mangrove wetland in Lagos, Nigeria

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Abstract: The size distribution, allometric growth pattern, stomach analysis and sex ratio of the West African fiddler Crab, *Uca tangeri* in a mangrove wetland were investigated. The carapace length ranged from 1.11-3.7 cm and the weight 7.7-25.5 g. The crab exhibited negative allometric growth (b<3). No linear relationship was found between length and weight of *U. tangeri* as correlation coefficient (r) was 0.2464 for combined sexes. The condition factor ranged between 4.7 and 12.1, varying in relation to size and sex. The crabs fed mainly on detritus, diatoms, and algae with higher preference for plant materials. The males were significantly more numerous than females with the ratio 1:0.6. *Uca tangeri* is an ecologically important species in our marsh. Therefore, mangrove ecosystem should be effectively monitored for the conservation of this species.

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Introduction

Crabs of the family Ocypodidae are characterized by their sexually dimorphic claws; the males' major claw is much larger than the minor one while the females' claws are both the same size (Levinton et al., 1995). The subfamily Ucinae known as fiddler crabs are composed of small crabs (Callander et al., 2013), found along sea beaches and brackish inter-tidal mud flats, lagoons and swamps. The West African fiddler crab, *Uca tangeri*, lives in the eastern Atlantic Ocean. Its carapace is violet to black, or sometimes yellowish in females, while the appendages are yellowish brown. The abdomen is small and greatly reduced. It is carried permanently fixed below the cephalothorax into which it fits tightly within a shallow depression. The movement of the smaller claw from ground to mouth during feeding explains the crabs' common name; it looks as if the animal were playing the larger claw like a fiddle (Levinton et al., 1995).

Although, the West African fiddler crab does not constitute a food item for the coastal communities but it has played ecological role in the mangrove ecosystem where it helps to clean up the mangrove areas by its feeding habits on the fallen leaves (Olafsson et al., 2002). Therefore, the aim of this study is to provide baseline data on the biology of the West African fiddler crab in the mangrove swamps of Abule-Agege Creek with particular emphasis on the size distribution, growth pattern, food and feeding habits and sex ratio.

Materials and Methods

Study site and sampling: The study was carried out along the mangrove area lining the Abule-Agege creek, which is one of the several adjoining creeks of the Lagos Lagoon with latitude 6°26'-6°37'N and longitude 3°23'-4°20'E. The sampling area is a typical estuarine water zone with extensive mangrove but low transparency and alkaline (pH>7) in nature (Moruf and Lawal-Are, 2015). One hundred and twenty two specimens of *U. tangeri* (Fig. 1) were collected with hand and hand-net on weekly basis at the station between the hours of 6-8 am. Specimens were immediately placed in an ice-chest and transported to

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Figure 1. West African fiddler crab, *Uca tangeri.*

the laboratory. They were then stored in the freezer (-20°C) after identification based on Schneider (1990). The crabs were removed from the freezer, allowed to thaw and a towel was used to remove excess moisture from their body. After sex determination based on Kwei (1978), the carapace length (CL) (from the edge of the frontal region to the tip of the carapace back wall) was measured using a 0.05 cm precision Venier caliper. The total weight was taken to the nearest 0.1 g on a Sartorius top loading balance (Model: DT1001A).

Length-Frequency Distribution: The lengths of the crabs were plotted against their respective frequencies.

Carapace-length/weight relationship: The carapace-length/weight relationship was expressed using the equation (Pauly, 1983):

$$W=a\,L^{b}$$

Where, W=weight of the crabs in grams, L=total length of the crabs in cm, a=regression constant and b=regression coefficient. The values of constant "a" and "b" were estimated from log transformation equation as follow (Parsons, 1988):

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

The condition factor (K) of the crab was determined using the formula (Bannister, 1976):

$$K=100W/L^{b}$$

Where, K=condition factor, W=weight of the periwinkle (g), L=length of the periwinkle (cm) and b = regression coefficient.

Food and feeding habits: The cardiac stomach of each specimen was dissected and the contents were extracted into a Petri dish. The extracted contents were mixed with little water and examined under a binocular microscope for the food types using the numerical and occurrence methods based on Hyslop (1980).

Sex ratio: The sex ratio was tested for any deviation from the expected 1:1 ratio using chi-square analysis. Level of significance was tested at 5% level of significance ($P<0.05$). The chi square value (χ^2) was calculated using the formula:

$$\chi^2 = \frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}$$

Where, Observed=number of females in the sample and Expected=the total number of males in the sample.

Statistical analysis: Data were analyzed using Microsoft Excel 2010 and SPSS software.

Results

Size composition: The ranges of carapace length, width and weight were 1.l1-3.70 cm, 1.30-3.80 cm and 7.7-25.50 g, respectively. The crab exhibited unimodal size distribution, revealed from size frequency distribution (Fig. 2). The relative growth in *U. tangeri* showed no linear relationship between the length and weight. The length/weight relationship values for the male, female and combined sexes were given as follows:

For Male: Log W=Log 0.1002+1.1648 Log L (r=0.1338)

For Female: Log W=Log -0.2241+1.2019 Log L (r=0.3223)

For combined sexes: Log W=Log 0.0063+1.1761 Log L (r=0.2464)

The values of "b" were 1.1648, 1.2019 and 1.1761 for the males, females and combined sexes which showed that the West African Fiddler crabs exhibited a very low negative allometric growth pattern. The correlation coefficient (r) was 0.1338 for the males, 0.3223 for females and 0.2464 for combined sexes which showed a very low correlation (far from '1') between the carapace length and weight in *U. tangeri.*

Condition Factor: The variations in condition factor (K) by size and sex of *U. tangeri* from the Abule-Agege Mangrove Swamp are presented in Table 1.

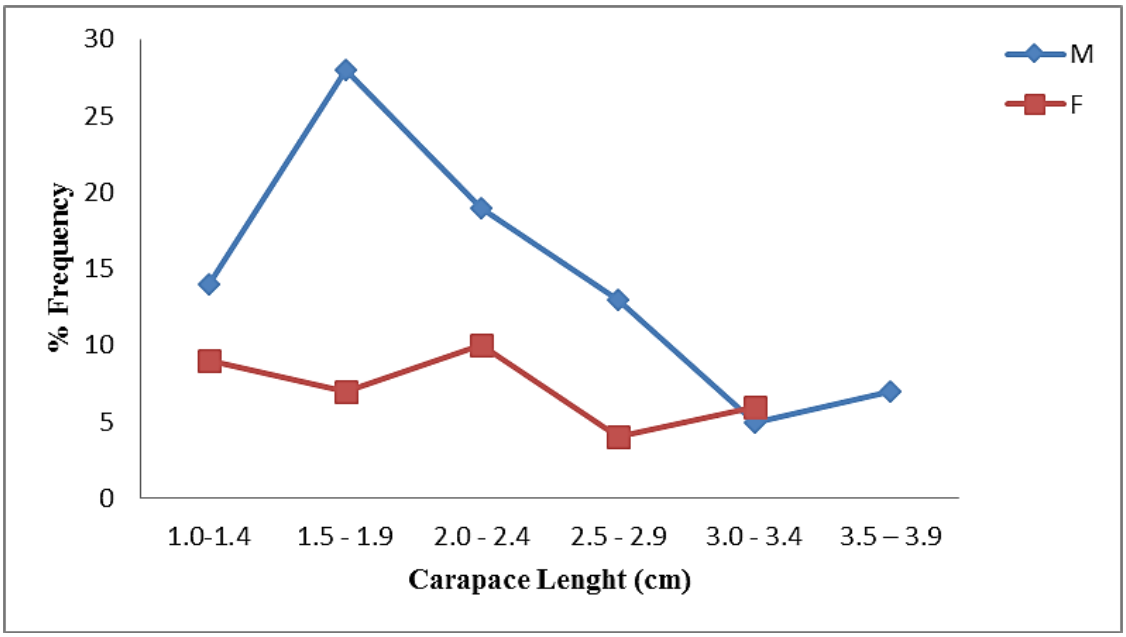

Figure 2. Carapace length frequency distribution of *Uca tangeri* from the Mangrove area of Abule-Agege Creek.

Table 1. Condition factor by sex and size of *Uca tangeri* from mangrove swamps of Abule-Agege Creek.

Carapace length (cm)	Male				Female				Combined sex			
	N	CL(cm)	WT(g)	K	N	CL(cm)	WT(g)	K	N	CL(cm)	WT(g)	K
1.0-1.4	14	1.2	1.8	10.4	9	1.2	1.7	9.8	23	1.2	1.8	10.4
1.5-1.9	28	1.6	2.7	6.6	7	1.5	2.4	7.1	35	1.6	2.6	6.4
2.0-2.4	19	2.1	10	10.8	10	2	9.7	12.1	29	2.1	9.9	10.7
2.5-2.9	13	2.7	13	6.6	4	2.7	11.1	5.6	17	2.7	12.1	6.2
3.0-3.4	5	3.1	18	6	6	3.1	16.4	5.5	11	3.1	17.2	5.8
3.5-3.9	7	3.5	20	4.7					7	3.5	20	4.7
	86				36				122			

Table 2. Stomach Contents of *Uca tangeri* from the Mangrove Swamp of Abule-Agege Creek

Food items	Numerical Method		Occurrence Method	
	No	%	No	%
Detritus	2619	48.6	70	78.7
Algae	125	2.3	35	39.3
Diatom	176	3.3	43	48.3
Plant materials	2386	44.3	85	95.5
Sand grain/Pebble	-	-	36	44.4
Unidentified mass	86	1.6	76	85.4

The K-values ranged from 4.7-10.8 (male), 5.5-12.1 (female) and 4.7-10.7 (combined sexes). The highest K-values were recorded for the medium size (2.0-2.4 cm) group. In term of sex, the female has the highest K-value (12.1).

Food Analysis: A total of 33 (27%) of the 122 specimens of *U. tangeri* examined in this study had empty stomachs. The stomach contents consisted mainly of plant materials, detritus, algae, diatoms, pebbles and unidentified mass. The plant materials formed the most important food item occurring in 95.5% of the *U. tangeri* crabs examined. Detritus and diatoms occurred in 78.7% and 48.3% of the stomachs, respectively (Table 2).

Sex ratio: Using the species conspicuous external morphological features, 78 were males and 44 were females giving a sex ratio of 1:0:6. A Chi-square (χ^2) test indicated that this ratio was significantly (P<0.05)

different from the expected and theoretical ratio of 1male:1female. Therefore, male *U. tangeri* are significantly more abundant than female.

Discussion

The West African fiddler crab examined in this study showed a unimodal size distribution. Unimodal size frequency was reported by Lawal-Are and Nwankwo (2011) for *Sersema huzardii* from the same mangrove habitat. This result suggest that there was only one predominant generation of crabs sampled and the specimens belonged to the same year class.

The observed values of the regression coefficient (b) for the *U. tangeri* (1.1648-1.1761) which are less than 3 are indications of negative allometric growth. This result is in conformity with the findings of Moruf and Lawal-Are (2015) for the Mangrove prosobranch, *Tympanotonus fuscatus* but contrary to the positive allometric growth recorded for brachyuran crab, *Portunus validus* in Moruf and Lawal-Are (2017a).

The correlation coefficient (r), 0.1338 for the males, 0.3223 for females and 0.2464 for combined sex were not close to "1", indicating that there was no linear relationship between length and weight of *U. tangeri*. This is contrary to the high correlation between length and weight reported by Lawal-Are and Kusemiju (2000) for *Callinectes* sp.

The condition factor (K) for the West African Fiddler crabs ranged from 4.7 to 12.1 and varied in relation to size and sex of the crabs. Lawson and Oloko (2013) reported values of 2.14 to 9.48 for the lagoon crab, *Callinectes amnicola* from the Yewa River. In studies of population dynamics, high "k" values of a crab show favorable environmental conditions such as habitat and prey availability (Moruf and lawal-Are, 2017a). It was observed from this study that the average - sized group has the highest condition factors. This indicates successive growth as a result of molting activity. The older the crab, the more difficult it is for the crab to molt. On the average, the condition factors of the female of *U. tangeri* were higher than that of the male.

Stomach analysis revealed low percentage empty stomach which was due to the abundance food items during the season of collection. The crabs showed a carnivorous feeding habit as their stomach contents consisted of detritus, diatoms, algae and plant materials. They however showed preference for plant materials/ detritus. Lawal-Are and Nwankwo (2011) had a similar opinion on the feeding habit of *S. huzardii* from the same mangrove wetland. The presence of sediment balls near the entrance to a burrow is a good indication of its occupation, as it was evidence in the stomach contents of *U. tangeri* as sand grains. The feeding habits of fiddler crabs play a vital role in the preservation of wetland environments by sifting through the sands; they aerate the substrate and prevent anaerobic conditions.

The males were significantly more numerous than females. This observation however was in contrast with the work of Moruf and Lawal-are (2017b) who reported no significant difference in sexes (ratio of 1:0.98) of *C. amnicola* from Lagos Coast. Warner (1977) was of the opinion that sex ratio is one of the major factors that determines the population of tropical brachyuran crabs that breeds continuously throughout the year. He noted the greater the difference in ratio the lesser the population.

In conclusion, *U. tangeri* exhibits sexual dimorphism with males attaining larger sizes than females. Frequency histograms with unimodal distribution are typical of many brachyuran crabs. The determination of age and growth rate had not attracted much attention due to effect of ecdysis resulting in the absence of annular structures in crabs. Thus, no direct method of determination of ages in crabs. The mangrove ecosystem should be effectively monitored for the conservation of this species.

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