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# Sex Ratio of Purple Lagoon Crabs Goniopsis Pelii (Herklots, 1851) From the Lagos Lagoon - Nigeria

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**Abstract**
The sex ratio of the mangrove crab, *Goniopsis pelii* was studied in Lagos lagoon southwest Nigeria, from February to July 2012. The crab species was sorted in sexes. The research is to provide a base line data on the percentage of male and female species of *Goniopsis pelii.* The product of the investigation shows that the number of females was found to be more abundant than the males in the study which implies that the lagoon is a breeding ground for crabs. The highest number of female crabs was proof for the month of May (39) followed by April and July (37), then February (36), June (34) and March (24). While the male was most profuse for the month March (36) followed by June (26), then February (24), April and July (23) and May (21). The sex ratio was high despite the polluted nature of the site. The calculated Chi-square ($X^2$) test shows that female *Goniopsis pelii* were significantly more abundant than the male ($P \leq 0.05$). The total number of male crabs is 169 while the female crabs are 191. The ratio for the male to female *Goniopsis pelii* is 1:1.
**Keywords**: Lagoon crab, Sex ratio, Lagos, *Goniopsis pelii.*

## INTRODUCTION

Purple lagoon crabs *Goniopsis pelii* (HERKLOTS, 1851) among crabs are decapods in brachyuran infra order and belong to the family Grapsidae. The family comprises more than 14,750 species. They are known for to be ten legged creature (decapods) and occur regularly in the mangrove area, especially in the Lagos lagoon. Crabs are mostly marine although there are some freshwater and brackish water forms occupying the littoral, supra littoral and even up shore zones. They were found at even 6000m depths to seas shore and are dominant in many estuarine habitats where salinity and temperature can fluctuate dramatically daily. (Ng *et al*., 2008). They inhabit both tropical as well as temperate region. The purple crab are highly mobile opportunistic predators that occupy lagoon habitats. The greatest desire of an aqua culturist is to increase the productions of crabs because crabs are economically important shellfishes.

The arthropods with other successful animals with exoskeletons such as insects and spider with 420,000 extant species are by far the most successful phylum of animals, both in diversity of distribution and in numbers of species and individuals. They have conquered land, sea and air, and make up over three-fourths of all currently known living and fossil organisms, or over one million species in all. The phylum Arthropod is the largest phylum in the animal kingdom and more than 75% of all living organisms are arthropods (Cannicci *et. al*, 1995). Few studies have been carried out on crabs in the Lagos lagoon, such as Assessment of the response to crude oil in static bioassay (Ekwu *et al*., 2012), Length-Weight Relationship and Condition Factor (Oluwatoyin, *et al*., 2013), Habitat Diversity and Species Richness (Onadeko *et al*., 2015), Morphometric and Meristic Studies (Akin-Oriola *et al* 2005).

The sex ratio is the ratio of males to females in a population, in most sexually reproducing species the ratio tends to be close to 1: 1. Kendall *et al* 2002 define Sex ratio as the abundance of mature individuals of one sex in relation to the other of a population while Rondeau and Santa-Marie (2001), simply defines sex ratio as the number of available adult males to fertilezable females. Information on the sex ratio is therefore essential to understanding of the ecology and evolution of in any reproducing population (Jeng *et al*., 2004). This study aimed to provide a baseline data on the sex ratio of *Goniopsis pelii* from the Lagos lagoon, an important fishing region to inhabitant of the neighbourhood and metropolitan Lagos at large with particular emphasis on the sex ratio for evaluation of its ecology with a view to effectively manage the resources for sustainable supply to the population.

## MATERIALS AND METHODS

### Descriptions of study area

The study was carried out in the coast and mangrove environment of University of Lagos lagoon south western, Nigeria. Located on the geographical dais of 6°26'N and 6°39'N and longitude 3°29'E and 3°50'E (Google Earth 5, 2009) (Figure 1). The lagoon is separated from the ocean by a narrow strip of barrier bar complex, opens into the sea through the Commodore channel all year round and is therefore exposed to semi-diurnal tides associated to the West African Coast (Fagade, 1969).

The lagoon is drained by four main rivers: Ogun, Agboyi, Majidun and Aye. It is fed in the north by Ogun River. River Ogun is the major source of water, it discharges a large volume of water into the Lagoon and

 

as a result of this the salinity is very low during the rainy season (Solarin, 1998; Lawson, 2001).
The Lagos lagoon like many coastal lagoons serves as a place of abode and recreation, means of livelihood and transport, a site for both fin and shell fisheries, dumpsite for residential and industrial discharges and a natural shock absorber to balance forces within the natural ecological system.

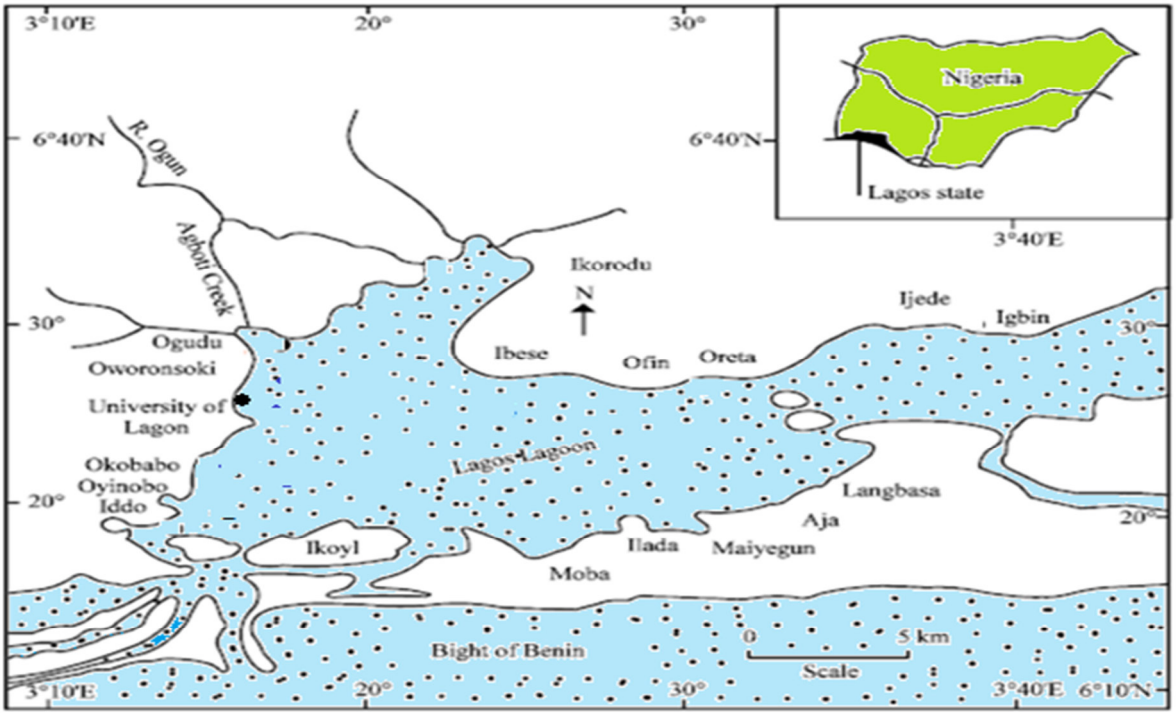


Fig.1: Map of Lagos Lagoon showing sampling site {• sampling site} (Elijah & Isa, 2015).

The materials used for this experiment includes; electronic weighing balance, binoculars microscope, hand lens, Vernier caliper, tape, meter rule, dissecting set, Petri dish, containing little water and 360 specimens of *Goniopsis pelii.*

**COLLECTION METHOD**

*Goniopsis pelii* specimens were collected at the mangrove area of the Lagos Lagoon near University of Lagos, Nigeria. 60 specimens were caught monthly between the hours of 10am - 3pm to allow for precise readings from the analysis of the samples. Crabs were collected with hand and crab pot for each sampling period. The sampling exercise was done at random for a period of six months (February -July, 2012) to allow all the members of the population to have an equal chance of appearance in sample. A total number of 360 specimens were collected and the specimens were cleaned and preserved immediately in the laboratory of the Department of Marine Sciences, University of Lagos deep freezer after the catch to avoid post humus digestion.

The Chi-square formulae: Chi square = $\frac{(\text{Observed} - \text{Expected})^2}{\text{Expected}}$

Plate 1: Dorsal view of (purple crab) *Goniopsis pelii*

 

Plate 2: Ventral view of female (purple crab) *Goniopsis pelii*

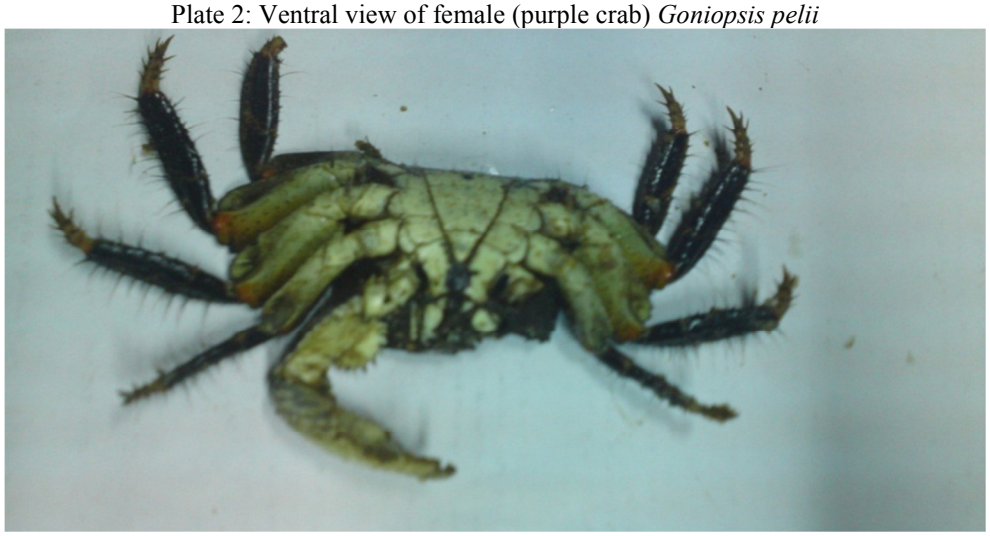

Plate 3: Ventral view of juvenile female (purple crab) *Goniopsis pelii*

**LABORATORY PROCEDURE**

The specimens *Goniopsis pelii* were brought out of the freezer and allowed to thaw completely before examination. Excess water was removed with the use of filter paper. The male and female were identified using the method described by Kwei (1978).

**Sex Ratio**

In determining the sex of species of these crabs, the shape of the abdomen was used. The male crab has an inverted T-shaped abdomen; the female crab has an inverted "U"-shaped abdomen (plate 2) while the juvenile female crab has an inverted "V"-shaped abdomen (plate 3)

The crabs were sorted out and sexed by the shape of the abdomen with an inverted U-shaped abdomen for adult females, inverted V-shape for the males. In males, the abdominal segments were present only on the first and second abdominal somites and are modified to form copulatory organs. In females, the somites move freely and there is a pair of segment or appendages on each of the 2$^{nd}$, 3$^{rd}$, 4$^{th}$, and' 5$^{th}$somites. These form swimmerets on which eggs are attached in berried crabs.

**RESULT**

The study of the purple mangrove crabs *Goniopsis pelii* (plate 1 to plate 3) were examined for six month February – July 2012. A total of (three hundred and sixty) 360 crabs species was investigated for their sex ratio. Table 1 shows monthly composition and abundances of crabs per month.

 

Table 1: The number of crabs per month and the overall total for the 6 months (February - July, 2012)

| Months/Year | Number collected |
|---|---|
| February, 2012 | 60 |
| March, 2012 | 60 |
| April, 2012 | 60 |
| May, 2012 | 60 |
| June, 2012 | 60 |
| July, 2012 | 60 |
| Total | 360 |

Table 2: The frequency distribution by size range of *Goniopsis pelii* in Lagos Lagoon from February to July, 2012

| Carapace width Range (m) | No of Male | Number of female | Percentages (%) Male | Percentages (%) female | Combine sex |
|---|---|---|---|---|---|
| 1.5 – 2.4 | 19 | 22 | 11.5 | 11.4 | 41 |
| 2.5 – 3.4 | 26 | 20 | 15.6 | 10.4 | 46 |
| 3.5 – 4.4 | 32 | 34 | 19.2 | 17.6 | 66 |
| 4.5 – 5.4 | 26 | 36 | 15.6 | 18.7 | 62 |
| 5.5 – 6.4 | 54 | 64 | 32.3 | 33.2 | 118 |
| 6.5 – 7.4 | 10 | 17 | 6.0 | 8.8 | 27 |
| Total | 169 | 191 | 100 | 100 | 360 |

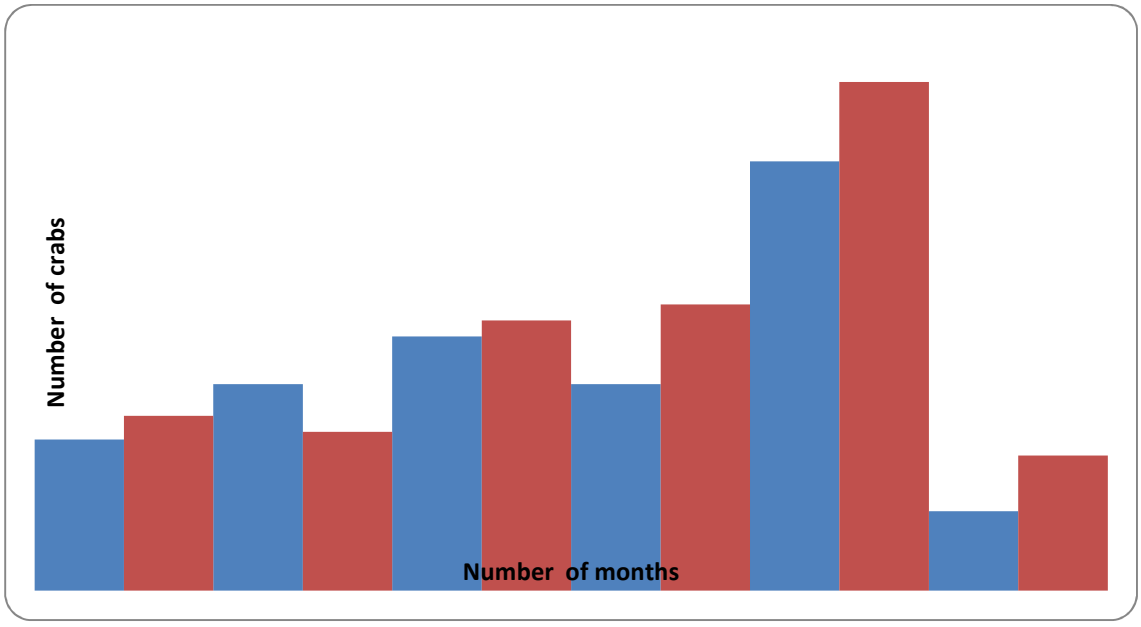


Figure 2: *Goniopsis pelii* by sex (male and female) Lagos lagoon from February – July 2012.

**SEX RATIO**

The sexes of the crab *Goniopsis pelii* were determined using the shape of abdomen. Plate 2 shows the ventral view of male *Goniopsis pelii* while Plate 3 shows the ventral view of the female crab.

The monthly sex ratio was determined as shown in Table 4. In February, there were 24 males and 36 females with the ratio of 1:1.5. In March, 36 were male and 24 were female with the ratio 1.5:1. There were 23 males and 37 female in April with a ratio of 1:1.6, in May, 21 were male and 39 were females with the ratio of 1:1.8, June had 26 male and 34 female with the ratio of 1:1.3 and July had 23male and 37 female with me the ratio of 1:1.6. The summary of the sex ratio was 1:1.3 male/female showing the dominant of female over male in the population

 

Table 4: Summary of sex ratio of *Goniopsis pelii* from Lagos lagoon front from February - July, 2012.

| Month (2012) | N | Male | Female | Sex Ratio | Chi- Square result |
|---|---|---|---|---|---|
| February | 60 | 24 | 36 | 1:1.5 | 2.4 |
| March | 60 | 36 | 24 | 1:0.6 | 2.4 |
| April | 60 | 23 | 37 | 1:1.6 | 3.2 |
| May | 60 | 21 | 39 | 1:1.8 | 5.4 |
| June | 60 | 26 | 34 | 1:1.3 | 1 |
| July | 60 | 23 | 37 | 1:1.6 | 3.2 |
| Total | 360 | 153 | 207 | 1:1.3 | 17.6 |

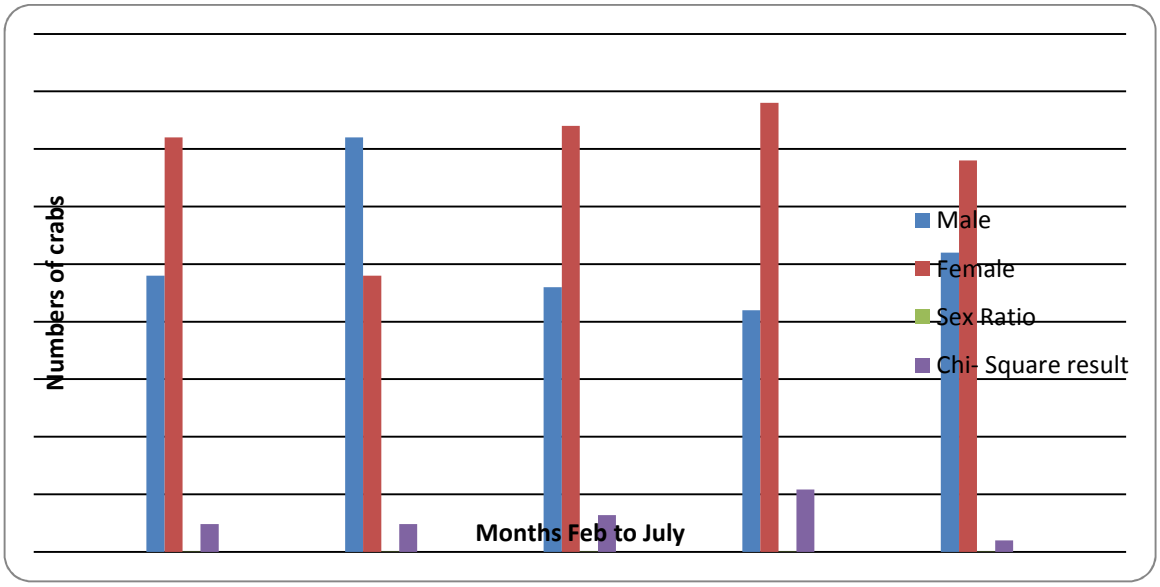


Figure 4: Summary of sex ratio of *Goniopsis pelii* from Lagos lagoon front from February - July, 2012.

**The Chi-square ($X^2$) test**

The Chi square is used to determine if there are any significant differences in the sex ratio of the crabs from the expected ratio of male and female (1:1) for the population.

The Chi square test was carried out monthly. There was a significant difference in the sex ratio from the expected 1:1 ratio throughout the population of *Goniopsis pelii* from Lagos Lagoon Front except in the month of March 2012, where the difference was not significant.

Table 5: Chi square text calculation on sex ratio of *Goniopsis pelii* from Lagos Lagoon Front for May, 2012.

| | Observed | Expected |
|---|---|---|
| Male | 21 | 30 |
| Female | 39 | 30 |
| Total | 60 | 60 |

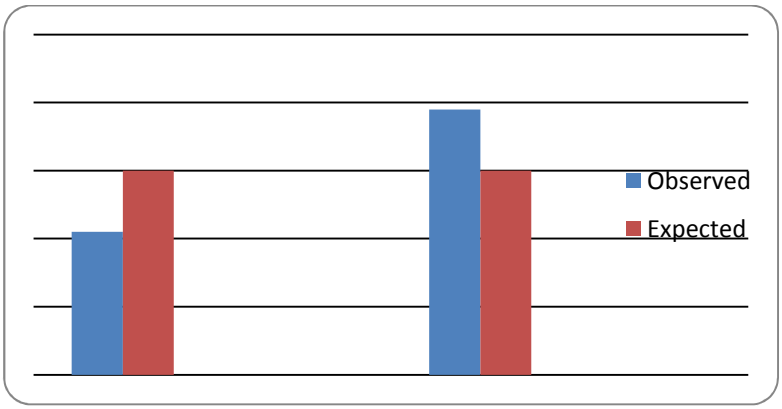


Figure 5: Chi square test calculation on sex ratio of *Goniopsis pelii* from Lagos Lagoon Front for May, 2012.

 

**Discussion**

The species collected and observed were three hundred and sixty species (360) of *Goniopsis pelii.* A total of sixty (60) species were collected for observation monthly for six (6) months (Table 1). They were sorted and well identified for their sexes. The results show that male and female species were represented in the community. The percentage of male within the carapace width range of (2.5-3.4) was observed to be the only range that males were abundant than female (Table 2) On the other hand the bigger size crabs species was observed to fall within the range (5.5-6.4). While the smallest size crabs species was within the range of (6.5-7.4) (Figure 2).

Female were more than the male crab, males were 169 while females were 191 (Figure 3). White (1999) found that there was a net movement of *Portunus pelagicus* male from Geographe Bay into deeper water this could account for the fact that the fishery is characterized by disproportionably large ratio of females to males. Summer and Malseed (2004) reported that the high proportions of females in both commercial (85%) and recreational (81%) trap catches in 2001 and 2002 were possibly because female crabs tend to be more abundant in the shallow waters targeted by these fishers. However, offshore sampling regime yielded higher proportions of females in deeper waters.

The sex ratio in the month May shows the highest number of female and the least number of male (Figure 5). The Chi square test calculation on sex ratio in the month of may show 5.4. Perhaps the reason while female are more than male is that the male spent time fighting and killing each other while the female are on the breeding ground, since lagoon is known to be a breeding ground for most fish species.

**Reference**

Abowei J.F.N and George A. D. I (2010) The Morphology, Abundance, Sizes and Sex Distrubution of *Callinectes amnicola* (De Rocheburne 1883) from Okpoka Creek, Niger Delta, Nigeria. Current Research Journal of Biological Sciences 2(1): 27 – 34.

Aderonke O. L, Hilary N (2001) Biology of the Hairy Mangrove Crab, Sersema huzardi (Decapoda: Graspidae) from a Tropical Estuarine Lagoon and Science 9: 8

Alien, B. J., and Levinton, J. S. (2002). Fiddler crab fitness: Exercise and the cost of sex. Integrative and comparative Biology 42 (6): 1184

Catherine E. deRivera (2003) Causes of a male-biased operational sex ratio in the fiddler crab Uca crenulata. Journal of Ethology Vol. 21, 137-144pp.

deRivera, C. E. J Ethol (2003) Causes of a male – baised operational sex ratio in the fiddler crab Uca crenulata, Journal of Ethology vol. 21; 2 pp 134-144

deRivera C. E (1999) Conflit over mate rate searching in fiddler crabs PhD dissertation, University of Carlifonia, San Diego, La Jolla, Carlif

Fisayo Olakolu and Oluwafemi Fakayode (2014). Aspects of the biology of blue crab Callinectis amnicola (DE Rocheburen, 1883) in Lagos lagoon, Nigeria. International Journal of Aquatic Science Vol. 5:1, 77-82

Gbemisola A. O, Martins A. and Kemi O (2005). Morphometric and Meristic Studies in Two Crabs: *Cardiosoma armatum* and *Callinectes pallidus.* Turkish Journal of Fisheries and Aquatic Sciences. 5:85-89

Karl Blankenship (2012) Decreasing male-to-female blue crab ratio concerns scientists, Bay Journal

Kendall M.S, Wolcott D.L, Wolcott T.G, Hines A.H (2001) Reproductive potential of individual male blue crabs, *Callinectes sapidus,* in a fished population: depletion and recovery of sperm number and seminal fluid. Can Fish Aquat Sci 37: 945 – 956

Kendall, M. S., D. L. Wolcott, T.G, Wolcott and A. H. Hines, 20002. Influence of male size and mating history on sperm content of ejaculates of the blue crab, *Callinectes sarpidus*. Marine Ecology progress Series 230: 235 – 240.

Lawal – Are, A. O (2010). Reproductive Biology of the Blue Crab, *Callinectes amnicola* (De Rocheburne) in the Lagos Lagoon, Nigeria. Turkish Journal of Fisheries and Aquatic Sciences. 10: 1-7

Marina et al (2011) Reproductive period of the swimming crab *Callinectes datae* at the Santa Cruz channel, a highly productive tropical estuary in Brazil. ResearchGate 19 (2): 155-162

Marcelo et al (2003) Fecundity of the mangrove crab Ucides cordatus (Linnaeus, 1763) (Brachyyra, Ocypodidae). Invertebrate Reproductive and Development 43:1 (2003) 19-26

Olakolu F. C, Azubuike V. C and A. A. Hassan (2013) Sex Ratio Size At Maturity Of The Female Blue Crab Callinecties Amnicola (De Rocheburne) As Possible Indices Of Habitat Quality Of The Lagos Lagoon, Nigeria. ResearchGate

Richard C. Swainson (1976) Sex ratio as a function of size in the xanthurus crab, nearshore Sari, The University of Chicago Press Journals Vol. 110: 975

Rondeau, A., and B. Sainte - Marie. 2001. Variable mate – guarding time and Sperm Allocation by male snow crabs (*Chionectes opilio* In response to sexual competition and their impact on mating success of females. Biology Bulletin 201: 204 -21I