Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.6, No.21, 2016

Diet Composition of Purple Lagoon Crab Goniopsis pelii (Herklots, 1851) from South West Nigeria

Nicholas Eteobong[1] Aderonke Lawal-Are[2] Edah Bernard[1]
1.Nigerian Institute for Oceanography and Marine Research (N.I.O.M.R) P. M. B. 12729, 3-Wilmot Point Road, Victoria Island, Lagos, Nigeria
2.Department of Marine Sciences, University of Lagos, Nigeria

Abstract
The crab family is the largest of the invertebrate phylum, the purple mangrove crab *Goniopsis pelii* (Herklots, 1951) collected from Lagos lagoon south west Nigeria were studied for insight in to their diet composition for the period between February and July, 2012. Of the three hundred and sixty (360) crabs examined (14.6%) had empty stomach while (85.4%) comprised of partially filled and filled stomach. The stomach contents of the crabs showed that they fed mainly on diatoms with a percentage occurrence of 42.4% and a numeric count of 40.3% while the least ingested food item was nematodes with a percentage occurrence of 0.2% and a numeric count of 0.09%. Other food items observed included algae, annelids, mollusc, plant parts, detritus, debris, crustaceans, fishes and sand grains. This research reveals the opportunistic dietary preference of *Goniopsis pelii*. The results will aid the understanding of the food ecology of *Goniopsis pelii* and will certainly provide a database for the food web dynamics of this lagoon crab in Nigeria.
Keywords: Purple Lagoon Crab, Lagos Lagoon, Diet.

INTRODUCTION

The arthropods occur at altitudes of over 20,000 feet on mountains and crustaceans to depths of more than 32,000 feet in the sea (Thompson, 1994). The largest group of arthropods is insects and the next is crustaceans including crabs. Crabs like *Cardiosoma sp*. (land crab) and *Callinectes sp* (swimming crab) are exploited commercially for food (Barnes, 1986). The crabs have 50 families and over a thousand species worldwide. Most crabs are of marine origin occurring in all oceans from the edge of the sea to the greatest depth of the ocean. There are few crab species that inhabit the fresh water example is *Pseudonotis africana* and some others are found in mangrove forests, inhabiting crevices, logs and living branches of mangrove trees and also walking on the substratum example is *Goniopsis pelii* (Melo, 1996).

Primitively, crabs were opportunistic omnivores with predatory tendencies. This feeding pattern is still followed by the majority of species and extreme specialization is relatively rare. Most species deal with the ability to deal with a variety of foods and the only specialization shown is by tendencies towards particular diet type. The commonest form of predation is probably the eating of mollusc, the shells are cracked and the meat is picked out of the shell and eaten (Oduro *et al,* 2001).

Crabs are one of the nutritious foods along the coast of Lagos state, Nigeria (Lawal-Are and Kusemiju 2000). According to Warner (1977), the raw white meat contains about 20% protein, 1-2% minerals which include Zinc (Zn), calcium (Ca) and Iron (Fe) with little fat and hardly any carbohydrate. The purple mangrove crab *Goniopsis pelii* is found in the Graspid community occurring in marshes and mangrove flats (Costa *et al.* 2006). *Goniopsis pelii* inhabits the mangroves, and a very agile animal, capable of moving rapidly between the roots and trunk of trees. The aim of this research is to provide a base line data on diet composition of *Goniopsis pelli.*

MATERIALS AND METHODS

Descriptions of study area

The study area was carried out in the coast and mangrove environment of the University of Lagos lagoon, south west Nigeria located on latitude 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, opend 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, 1983).

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).

Nutrient level are significantly higher in wet season, there is an inverse relationship between nutrient levels and salinity, nutrient level drop with increase in salinity. The fauna is composed of fresh, marine and brackish water species depending on the season. Among the fauna exploited for commercial purposes are crabs, shrimp, prawn, oyster, pelagic and demersal fishes (Longhurst, 1958).

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.

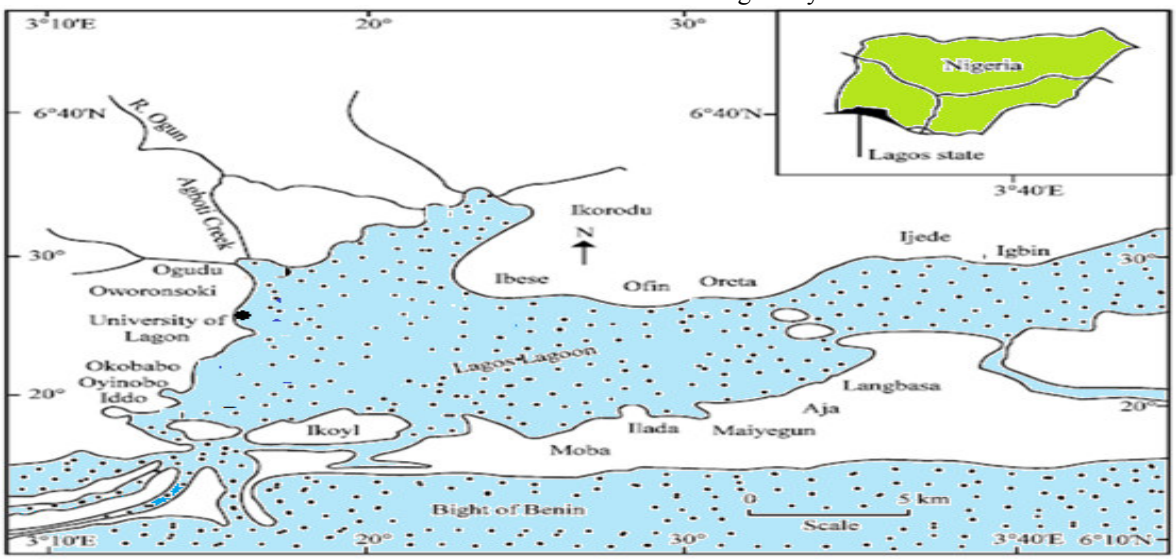


Fig.1: Map of Lagos Lagoon showing sampling location {• sampling location}

Collection method

Samples were caught between the hours of 8pm – 12am and allow for precise readings and analysis of the samples. The sampling exercise was done at random for a period of six months (February, March, April, May, June and July, 2012) in order to allow all the members of the population to have an equal chance of appearance in sample. A total number of 360 specimens were used and the specimens were cleaned and preserved in a frozen iced chest and conveyed immediately to the laboratory of the Department of Marine Sciences, University of Lagos.

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

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

Laboratory procedure

The specimens were brought out and allowed to thaw completely before examination. Excess water was removed with the use of filter paper.

STOMACH CONTENT ANALYSIS

The stomach or proventriculus is a bulging, transparent, thin-walled sac lying dorsally on the midline in the anterior thorax. It is an exceptionally complex structure whose walls bear some calcareous ossicles and 80 muscles. The stomach is the largest and most conspicuous part of the gut and consists of the large, dorsal cardiac stomach and a smaller, ventral pyloric stomach. Each stomach was studied as a unit in order to provide information on individual variation. The stomach is greenish in colour and located underneath the carapace. The stomach content of *Goniopsis pelii*, was removed by dissection or opening of the ventral side using a dissecting scapula. It is mixed with little amount of water in the Petri dish and interpreted according to its fullness as follows:

°/4 = Empty
1/4 = One-quarter full
2/4 = Half full
3/4 = Three-quarter full
4/4 = Full

After this, the contents were viewed under the microscope for the identification and counting of the food items present. The numerical and frequency of occurrence method was used for the food analysis method.

Numerical Method

Percentage number of a food item = $\frac{\text{Total number of the particular food item}}{\text{Total number of all food items}} \times 100$

The number of food content in the stomach of each crab was counted. They were summed up to give a total for each kind of food items in the whole stomach. Then the grand total of all food items was obtained. The total of each food item was expressed as a percentage of the grand total. The advantage of the numerical method is that one can draw conclusion as to the relative significance of the different food items. This method has a major disadvantage as organisms occurring in the largest number not necessarily constitute the most important food (Lagler, 1978 and Hyslop, 1980).

Occurrence Methods

Percentage occurrence of a food item=

$$\frac{\text{Total number of stomachs with the particular food item}}{\text{Total number of stomachs with food}} \times 100$$

The stomach contents were examined and the individual food items sorted and identified. The number of stomachs in which each food item occurred and expressed as a percentage of the total number of the stomach containing food examined. The advantage of the method is that it gives the information on various types of organisms present or fed upon and the disadvantages is that it does not give information on the quantities of the

food items, the accumulation of food organisms which are resistant to digestion, is not also taken into consideration. (Lagler, 1978 and Hyslop, 1980).

RESULT

Frequency of Empty Stomach

The monthly variation of the empty stomach was examined as shown in Table 1; the month of April has the highest number of crabs with empty stomach which is 12 (26.7%) while June has the lowest number 4 (6.7%) of crab with empty stomach. The overall result of the empty stomach showed that, out of the 360 crabs examined, 45 (14.5%) had empty stomach.

The variation of empty stomach by size group was examined as well Table 2. Of the 61 small size crabs 8 (17.8%) had empty stomach, of 207 medium size crabs 35 (77.8%) had empty stomach and of 41 large size crabs 2 (4.4%) had empty stomach.

Table 1: Frequency of empty stomach in *Goniopsis pelii* from Lagos lagoon (Feb. - July, 2012)

Period (2012)	Number of crabs examined	Number with empty stomach	% Empty Stomach
February	60	10	16.7%
March	60	11	18.3%
April	60	12	20%
May	60	4	6.7%
June	60	3	5%
July	60	5	8.3%
Total	360	45	12.5%

Table 2: Frequency of empty stomach by size range of *Goniopsis pelii* from Lagos lagoon (February - July, 2012).

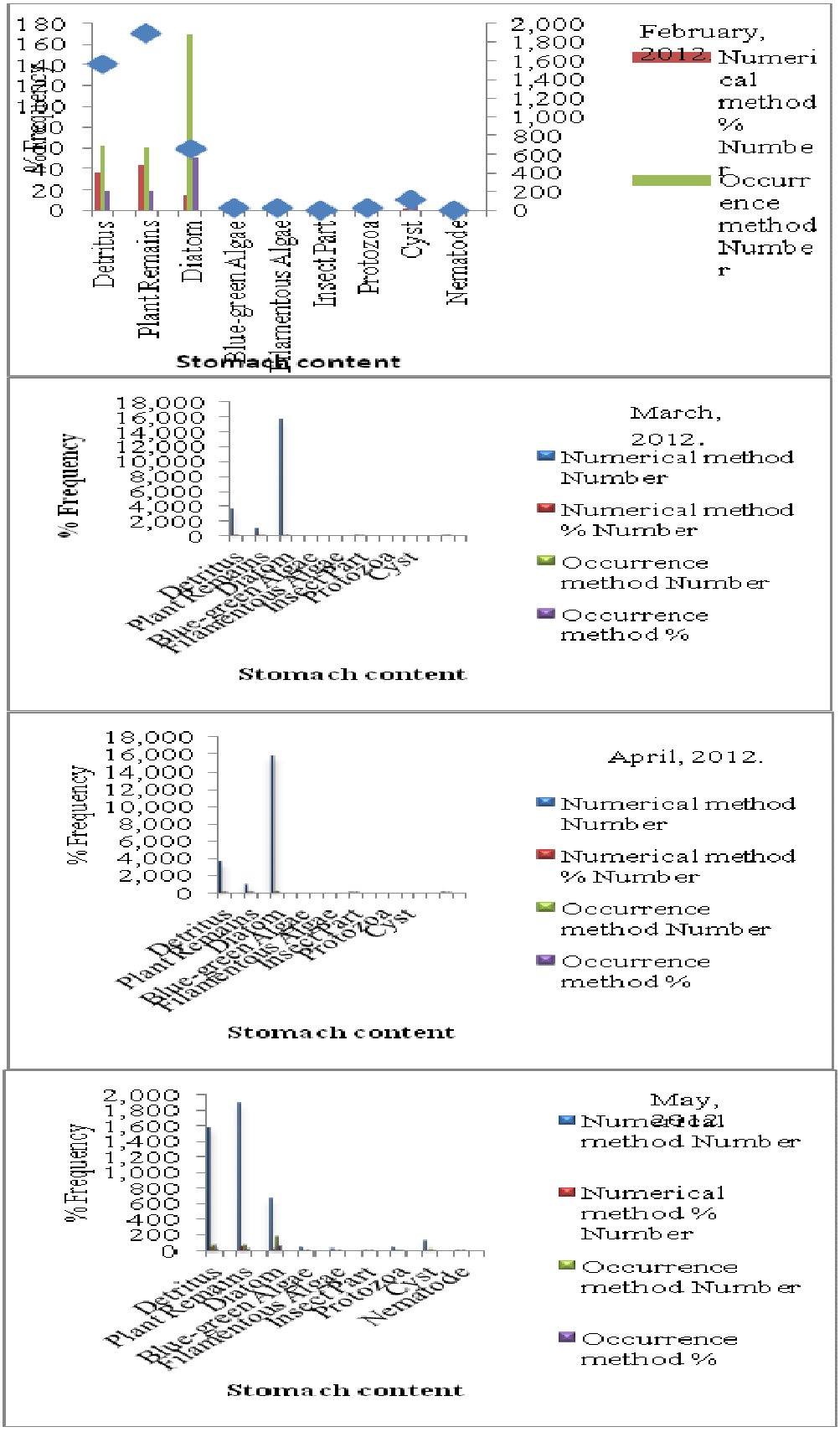
Carapace Width	Range (cm)	Number of crabs examined	Number with empty stomach	% Empty Stomach
Small	1.5 – 3.4	65	8	12.3%
Medium	4.5 – 5.4	250	35	14%
Large	5.5 – 7.4	45	2	4.4%
Total		360	45	125%

Table 3 Summary of the stomach content of *Goniopsis pelii* from Lagos lagoon (February - July 2012)

Food items	Numerical method		Occurrence method	
	Number	%	Number	%
Detritus	14,721	30.5	434	23.1
Plant Remains	12,997	26.9	420	22.4
Diatom	19,414	40.3	794	42.4
Blue-green Algae	326	0.68	60	3.2
Filamentous Algae	135	0.28	60	3.2
Insect Part	168	0.35	55	2.9
Protozoa	133	0.28	10	0.5
Cyst	292	0.61	35	1.9
Nematode	41	0.09	4	0.2
	48,227		1872	

STOMACH CONTENT

The stomach content examined Table 3 showed that *Goniopsis pelii* feed on diatoms, blue-green algae, protozoan, detritus, filamentous algae, cyst and plant remains. They mostly feed on diatoms which has the highest occurrence method of 794 (42.4%) and 19,414 (40.3%) for the numerical method. Nematodes occurred least with the value of 4 (0.2%) for the occurrence method and 41 (0.09%) for the numerical method. Detritus, plant remains and blue-green algae has 434 (23.1%), 420 (22.4%) and 60 (3.2%) values respectively for the occurrence method. The variation in the stomach content of *Goniopsis pelii* is determined as shown in Figure 2. The monthly variation of food items of *Goniopsis pelii* was also determined as shown in Figure 3.


February, 2012.
Numerical method Number
Numerical method % Number
Occurrence method Number
Occurrence method %
Detritus
Plant Remains
Diatom
Blue-green Algae
Filamentous Algae
Insect Part
Protozoa
Cyst
Nematode
Stomach content
March, 2012.
April, 2012.
May, 2012.

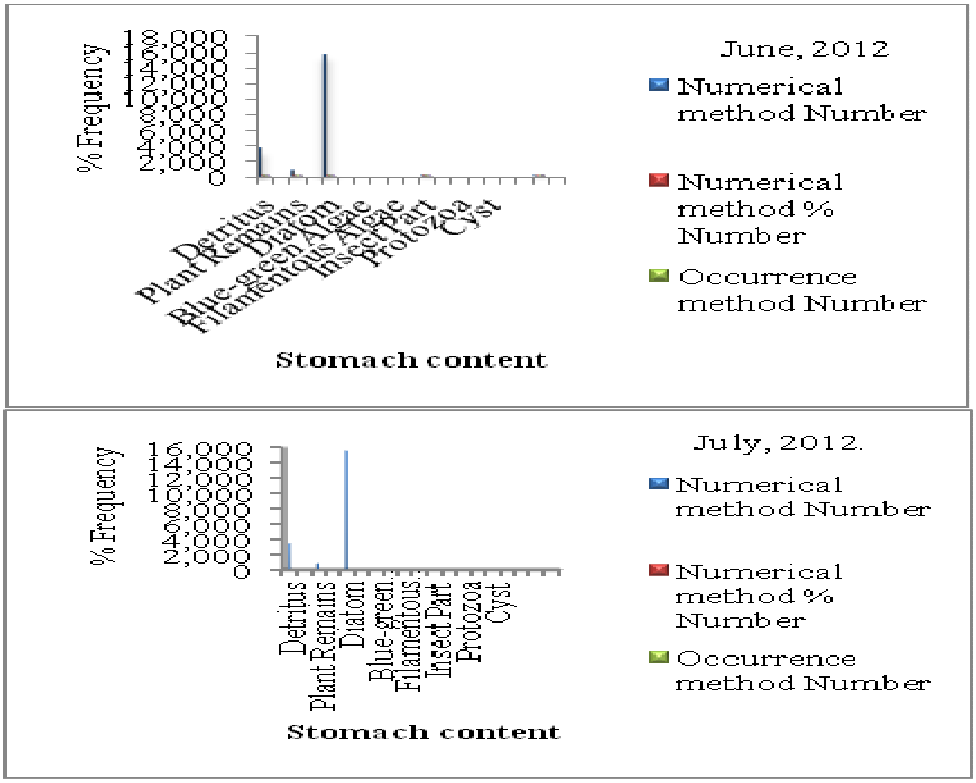


Figure 2: Stomach content of *Goniopsis pelii* from Lagos Lagoon Front from February to July, 2012

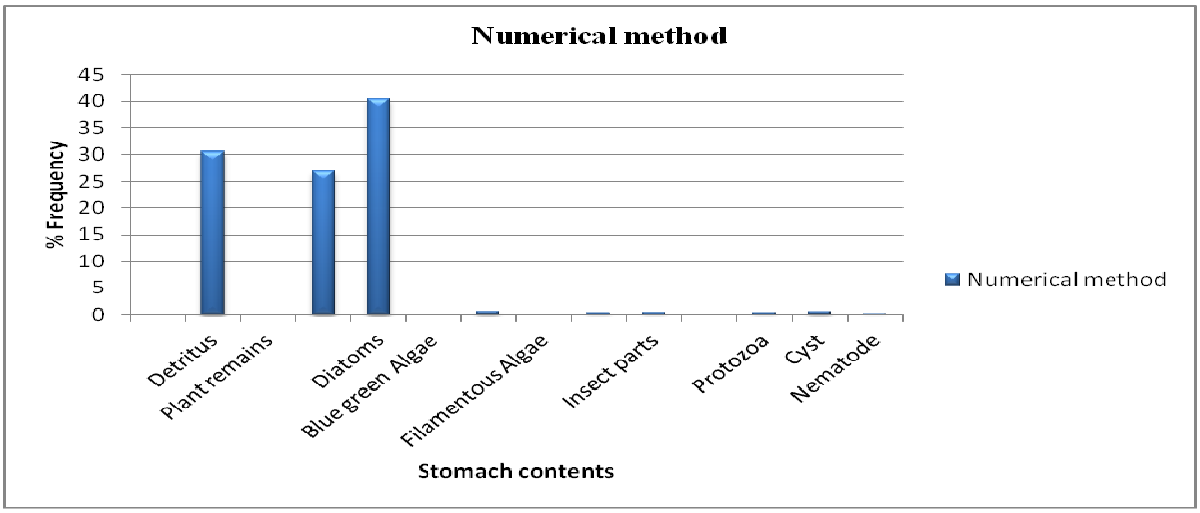


Figure 3: Summary of stomach contents in *Goniopsis pelii* from Lagos Lagoon Front (February - July 2012)

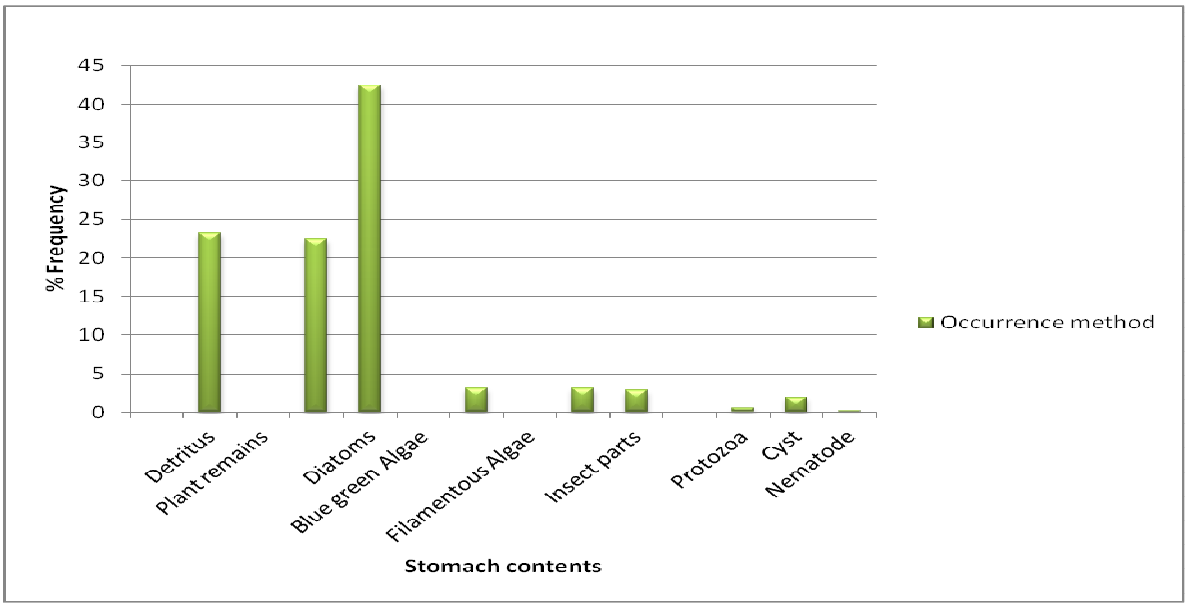


Figure 4: Summary of stomach contents in *Goniopsis pelii* from Lagos Lagoon Front (February - July 2012)

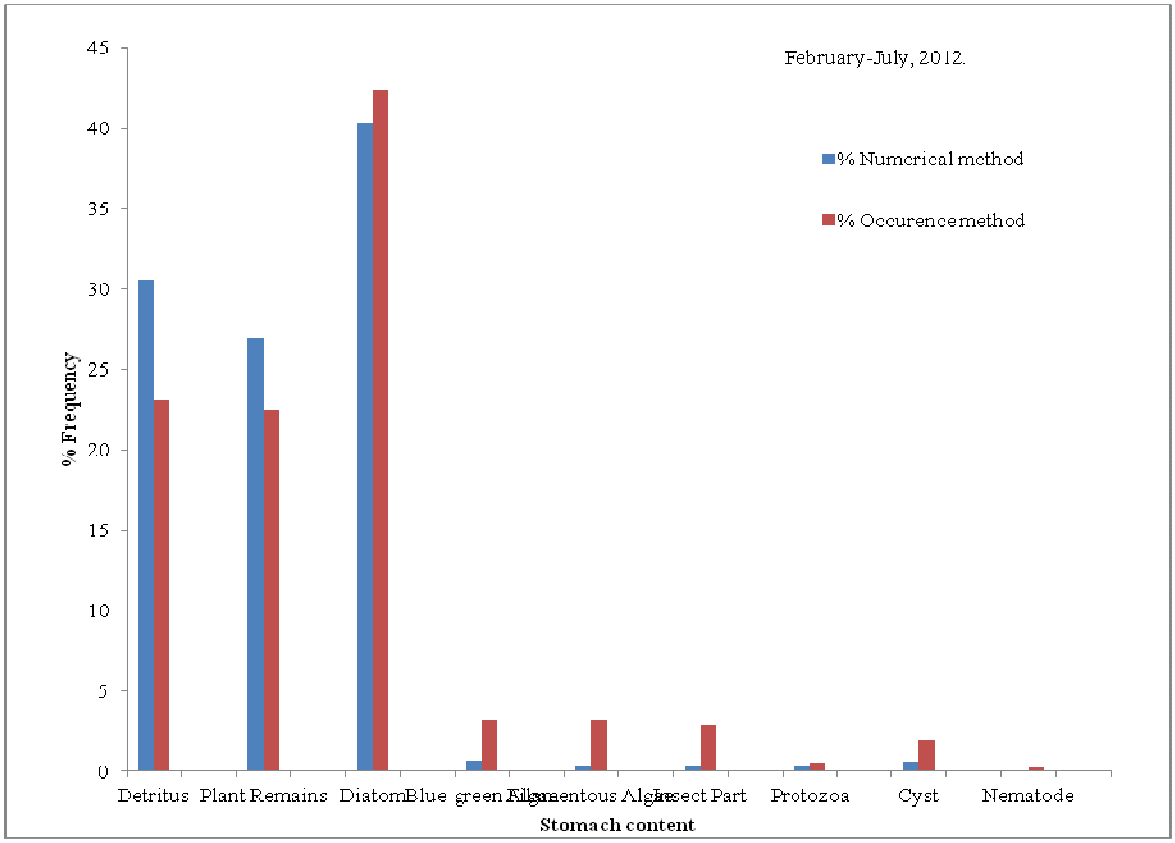


Figure 5: Summary of stomach contents in *Gonipsis pelii* from Lagos Lagoon (February - July 2012)

DISCUSSION

Numerous species of mangrove macrofauna are known to consume plant materials, including crabs (Smith 1987a, Micheli 1991, Steinke *et al.* 1993). Amongst these, crabs are thought to be major consumers and a key source of leaf and seedling mortality in mangrove (Clarke and Kerrigan 2002). Amongst mangrove macrobenthos, crabs are one of the most significant groups in terms of species numbers and total biomass. It is therefore important to understand their feeding habits and position in the food web (Macintosh 1988, Cannicci *et al.* 2008). Many species of crabs are known to consume a large proportion of the annual primary production of mangrove (leaves

and propagules) (Lee 1998). For example, in South Africa and Kenya Neosarmatium meinerti (Emmerson McGwynne 1992, Dahdouh Gueba *et al.* 1998), Goniopsis cruenata (Latreille)(Von Hagen 1977). Materials consumed by herbivorous crabs vary in size, state of composition, physical toughness, nutritional value and palatability (Robertson 1986, Micheli 1993). Fresh mangrove leaves material that have fallen from the tree are poor in nitrogen but rich in tannin, but most grasped crabs have been reported feeding on fresh leave materials on the floor or take entire leave into burrows (caching) (Robertson 1986, Micheli 1993). According to Gddins *et al.* (1986), crabs prefer decaying leaves to senescent or fresh leaves when given the choice. They also suggested that crabs allow leaves to decompose inside their burrows for many weeks before eating them, during this time tannins are lost from the leaves through leaching, while nitrogen concentration increases through bacteria action, resulting in a higher nutritional content. Other advantage of taking leaves materials into the burrow is to prevent them from being carried away by the tides (Robertson 1986) it create a safe environment for the crabs to eat without fear of predators, tidal inundation, high temperatures and low humidity (Wolcott and O'Connor 1992). Therefore catching might be frequent in areas with shortage of food supply and greater predator pressure. Many studies have examined gut contents to determine herbivore diet exclusively.

Stomach analysis carried out on *Goniopsis pelii* from Lagos lagoon indicated that the purple crabs are scavengers, bottom carnivores, detritivores and omnivores. The stomach content included plant materials (algae), animal material (annelids, fish and insect parts and crustaceans), organic matter. This conformed to the finding of Warner (1987). Also some of the food items analyzed compared favourably to the stomach content of *Goniopsis pelii* from Lagos lagoon examined by Lawal-Are, 2005. Steven, (2006) classified crabs general as scavengers, detritivores (eat decaying organic matters). Omnivores (eat other animals or plants) and carnivores (eat other animal such as fish, molluscs crustaceans including other crabs).

The different variety of food items found in the individual stomach of *Goniopsis pelii* showed that they are omnivores showing opportunistic predator tendencies which agrees with the findings of (Guillory 2000). The stomach contents include diatoms, blue-green algae, protozoan, detritus and plant remains.

REFERENCES

Cannicci S, Burrows D, Fratini S, Smith TJ, Offenberg J, Dahdouh-Guebas F (2008) Faunal impact on vegetation structure and ecosystem function in mangrove forests: A review. Aquatic Botany 89: 186-200

Clarke and Kerrigen (2002). The effect of seed predators on the recruitment of mangroves. Journal of ecology. Vol. 90 :4: 728-736

Costa TM, Silva AAJ, Negreiros-Fransozo ML (2006). Reproductive pattern comparison of *U. thayeri* Rathbun, 1900 and *U. uruguayensis* Nobili, 1901 (Crustacea, Decapoda, Ocypodidae), Brazilian Archives of Biology and Technology, 49(1): 117 123.

Dahdouh-Guebas (1998). Food preferences of Neosarmatium meinertide Man (Decapoda: Sesarminae) and it possible effect on the regeneration of mangroves. Kluwer Academic Publishers. Hydrobiologia 347:83-89,

Emmerson,W. D. & L. E.McGwynne, 1992. Feeding and assimilation of mangrove leaves by the crab *Sesarma meinerti* de Man in relation to leaf-litter production in Mgazana, a warm-temperate southern African mangrove swamp. J. exp. mar. Biol. Ecol. 157: 41–53.

Fagade, S.O. (1969). Studies on the biology of some fishes and the fisheries of the Lagos Lagoon. PhD Thesis, University of Lagos. 385pp.

Giddins, R. L., J. S. Lucas, M. J. Neilson and G. N. Richards. 1986. Feeding ecology of the mangrove crab *Neosarmatium smithii* (Crustacea: Decapoda: Sesarmidae). Mar. Ecol. Prog. Ser. 33: 147–155.

Guillory, V. 2000. Relationship of Blue Crab Abundance to River Discharge and Salinity.

Hyslop, E.J. (1980). Stomach contents analysis and a review of the method and their application. J. of fish biology. **17:** 411-430.

Klärner, D. and Barnes, W. J. P. (1986). The cuticular stress detector (CSD2) of the crayfish. II. Activity during walking and influences on leg coordination. *J. exp. Biol.* **122**, 161–175.

Lagler, K. F. 1978. Capture, sampling and examination of fishes. Pages 7–47 *in* T. Bagenal, editor. Methods for assessment of fish production in fresh waters. Blackwell Scientific Publications, Oxford, UK.

Lawal - Are, A.O. (2005). The biology and culture of the blue crab, Callinectes amnicola, (De Rocherburne) 'from badagry. Lagos and lekki lagoons, south-west Nigeria. PhD Thesis, Department of Marine Sciences, University of Lagos 262pp.

Lawal - Are, A.O. and Kusemiju, K. (2000). Size composition, growth pattern and feeding haibits of the blue crabs, Callinectes amnicola (De Rocherburne) in the Badagry Lagoon, Nigeria. J.Sci. Res.Dev. **5:** 169-176.

Lee SY (1998) Ecological role of grapsid crabs in mangrove ecosystems: a review. Marine and Freshwater

Research 49: 335-343
Longhurst, A.R., 1957. The food of the demersal fish of a West African Estuary. J. Anim. Ecol., 26: 269-387.
Macintosh, D. J. 1988. The ecology and physiology of decapods of mangrove swamps. Symp. Zool. Soc. Lond. 59: 315–341.
MELO, G.A.S. Manual de identificação dos Brachyura (caranguejos e siris) do litoral brasileiro. São Paulo: Museu de Zoologia da Universidade de São Paulo/ Editora Plêiade/ FAPESP, 1996, 604p.
Micheli F, Gherardi F, Vannini, M (1991) Feeding and burrowing ecology of two East African mangrove crabs. Mar Biol 111: 247-254.
Oduro W, Ellis W, Oduro I, Tetteh D. Nutritional quality of selected Ghanaian crab species. *J Ghana Sci Ass* 2001; **3**: 37-40.
Robertson (1986). Feeding Habits of Non-Ocypodid Crabs From Two Mangrove Forests in Kenya. Bulletin of Marine Science, 64(2): 291-297
Smith (1987a). Feeding ecology of mangrove crabs in Cameroun. Applied Ecology and Environmental Research 12(4): 959-973
Solarin BB (1998). The hydrobiology, fishes and fisheries of the Lagos lagoon, Nigeria. Ph.D Thesis. University of Lagos. p. 235.
Steinke, T. D., A. Rajh&A. J. Holland, 1993. The feeding behavior of the red mangrove crab *Sesarma meinerti* de Man, 1887 (Crustacea: Decapoda: Grapsidae) and its effect on the degradation of mangrove litter. S. Afr. J. mar. Sci. 13: 151–160.
Stevens, N. J., O'Connor, P. M., Gottfried, M. D., Roberts, E. M., Ngasala, S. & Dawson, M. R. (2006): *Metaphiomys* (Rodentia: Phiomyidae) from the Paleogene of southwestern Tanzania. – Journal of Paleontology, **80**: 407-410.
Thompson JD, Higgins DG, Gibson TJ (1994) CLUSTAL W: improving the sensitivity of progressive multiple sequence alignment through sequence weighting, position specific gap penalties and weight matrix choice. Nucleic Acid Res 22: 4673–4680
Von Hagen, H. O. 1977. The tree climbing crabs of Trinidad. Pages 25–59 *In* Studies on the fauna of Curaçao and other Caribbean Islands, no.54.
Warner, G.F. (1977). The biology of crabs: The Gresham Press, Old working, Surrey Birminghan, Great Britain. 179pp.
Wolcott, D.L., O'Connor, N.J., 1992. Herbivory in crabs: adaptations and ecological considerations. Am. Zool. 32, 370–381.