LENGTH-WEIGHT RELATIONSHIP, FEEDING HABIT, AND INTESTINAL PARASITES OF *LUTJANUS GOREENSIS* AND *LUTJANUS ENDECACANTHUS* FROM QUA IBOE RIVER ESTUARY, AKWA IBOM STATE, NIGERIA

[*1]Usip, Lawrence P. E.[1], Afia, Ofon E.[2] and Akpan, Mfonobong G.[1]

[1]DEPARTMENT OF ANIMAL AND ENVIRONMENTAL BIOLOGY, FACULTY OF SCIENCE, UNIVERSITY OF UYO, UYO-NIGERIA
[2]DEPARTMENT OF FISHERIES AND AQUATIC ENVIRONMENTAL MANAGEMENT FACULTY AGRICULTURE, UNIVERSITY OF UYO, UYO-NIGERIA
***Corresponding** author email: usiplaw01@gmail.com and usiplaw@yahoo.com

ABSTRACT

The length-weight relationship, feeding habit, and intestinal parasites of *Lutjanus goreensis* and *Lutjanus endecacanthus* from Qua Iboe River Estuary was conducted between July – December 2015, using relative frequency of occurrence and dominance method to assess their gut content. A total of 154 specimens of *Lutjanus goreensis and* 156 specimens of *Lutjanus endecacanthus* were examined during the period. Out of 154 specimen of *Lutjanus goreensis,* 119(77.3%) stomachs contained food and 35(22.7%) stomachs were without food in *Lutjanus goreensis* while there were 123(78.8%) stomach with food and 33(21.2%) stomach without food in *Lutjanus endecacanthus.* Analysis of food items showed that *Lutjanus goreensis* and *Lutjanus endecacanthus* are carnivores that feed mainly on Crayfish 79(51.3%) in *Lutjanus goreensis* and 88(56.4%) in *Lutjanus endecacanthus* while fish 17(7.1%) and 17(10.9%), detritus 55(35.7%) and 38(24.7%), clam 11(7.1%) and 15(9.6%), crab 13(8.4%) and 12(7.7%), an unidentified crustacean 18(11.6%), and 11(7.1%) were the secondary food items in both *Lutjanus goreensis and Lutjanus endecacanthus* respectively. Out of 310 *Lutjanus* species examined for gut parasite, 85(27.49) were infected with nematodes 45(14.5%) and Copepod 40(12.9%). The nematode included *Pseudoterranova decipiens* 20(42.6%), *Metabroneium sp* 10(21.3%), *Capillaria sp* 12(25.5%) and *Eustrongylides africanus* 5(10.6%) while the copepod included *Eargasilus latus* 28(70%) and *Lernaea sp* 12(30%). The result of the length weight analysis showed that *Lutjanus* species exhibited allometric growth pattern with regression exponent (b) values less than 3.5 while correlation coefficient (r) which ranged between 0.352 – 0.9649 revealed positive correlation between length and weight.

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INTRODUCTION

Fish is regarded as the cheapest source of protein among the urban and rural populace (Usip *et al*, 2014). Fish plays an important role in the development of a nation. Apart from being the cheapest source of highly nutritive protein, it also contains other essential nutrients required by the body (Anene, 2005).

Fish in the family *lutjanidae* are referred to as snappers. They are mostly large and voracious fishes, found in nearly all warm seas. They are typically marine fish but several species enter or live in estuarine and other brackish regions, some enter fresh water to feed, they are important food fish (Anderson 2002).

Lutjanus are caught with bottom long line, hand line traps, variety of nets and trawls (Froese *et al*,2006). Young specimens are caught in lagoons by spiral hand-nets (Anderson 2002).
Lutjanus goreensis (Valenciennes 1830)

Lutjanus goreensis has five to seven scale rows above lateral line, below middle of spinous dorsal fins and are generally 7- 10cm long in lagoons but grows to 6ocm or more. Their general colour is khaki brown. *Lutjanus goreensis* is very common in Nigeria waters (Madu, 1999) and they can be fed with trash fish and artificially compound fish of 35-40% crude protein content. In its natural environment, it matures after 4years and can attain total length of 50-80cm (Madu, 1999). They are dioeious and gonochoric but exhibit no distinct sexual dimorphism and Sexes can be identified by milt/egg on gentle manual pressure (stripping). The gorean Snapper (*L. goreensis*) is a multiple spawner and they spawn mainly in the rainy season. It responds to most breeding hormone and can also be breeded by hormone induced natural spawning using two males and one female sex ratio. The eggs are pelagic and non sticky and hatch after 16 – 20 hours at 28/29^{o}c (Madu, 1999).

Lutjanus endecacanthus (Bleeeker, 1863)
Lutjanus endecacanthus is also known as guinea snapper. They live in marine and reef – associated brackish water. They are found in eastern Atlantic (Allen 1986) and have maximum length of 85.0cm (Allen, 1985). Adult occur on rocky bottom and coral reef as well as in brackish lagoon and sometimes in rivers. They are harmless to human (Allen 1985).

Length Weight Relationship

Length-weight relationship is very important for proper exploitation and management of the population of fish species (Anene, 2005). The relationship between total length and other body weights are also very much essential for stabilizing the taxonomic characters of the species (Usip *et al*, 2013). A change in length tells the age and year/classes of fishes, which are important in fisheries and data on length and weight relationship, can provide important clues to climate and environmental changes and the change in human subsistence practices (Ndome and Eteng, 2010). The data can also be used to estimate the mortality rate, as well as assessing the sustaining power of a fisheries stock. (Ecoutin *et al.*, 2005). Length – weight relationships are also useful for comparing life history and morphological aspects of population inhabiting different regions (Stergiou and Motoupoulos, 2001) and are of great importance in fisheries research because they provide information on population parameters (King, 1996 and Ecoutin *et al.*, 2005). Length and weight data are a useful and standard result of fish sampling programs (Usip *et al*, 2013). Length weight relationships allow fisheries scientist to convert growth- in- length equation to growth –in-weight in stock assessment model (Santes, 2001).

Food and Feeding Habit

Food is one of the important factors regulating or influencing the growth, fecundity, migration and abundance of fish stock. Seasonal and diurnal abundance of favourite food of organism may be responsible for the horizontal and vertical movement of the fish stocks. The food and feeding habits can lead to an awareness of even minor difference in the structure and position of mouth (Bone *et al* 2004).

Over the years aquaculture had gained a rapid interest due to the important of fish as a cheap source of animal protein. Fish, like any animal require adequate nutrition for proper growth and survival. In the wild, nature offers a great diversity of food including a host of animals and plants. However, in ponds natural food is not sufficient to sustain the fish especially in high density ponds. Therefore, for efficient and cost effective fish farm management, there is need for effective nutritional strategies which can only be achieved through proper understanding of the food and feeding habits of the fish to be cultured (Offem *et al*, 2009).

Fish Parasites

Parasite infestation on fish is usually internal or external and parasites often increase in abundance and diversity in polluted waters, (Usip *et al* 2014). Parasites are of great concern since they often produce a weakening of the host's immune system thereby increasing their susceptibility to secondary infection resulting in the nutritive devaluation of fish and subsequent economic losses. Also there is possibility of disease being transmitted from fish to humans through consumption of poorly cooked fish (Hernandez-orts *et al*, 2013). Parasites also compete for food, thereby dispriving fish of essential nutrient and inhibiting growth leading to morbidity and mortality with consequent economic losses (Khalil and Polling 1997).

Fish in marine environment are parasitized by a large group of parasites which includes Nematode, Acanthocephala, Bacteria and Copepod (Ekpenyong, 1977). Nematodes are the largest group of organism parasitic on fishes. Some species of nematode show various adaptation of parasitism. Nematode may survive in raw fish flesh for several days but are killed when heated to temperature of 70^{o}c for 7 minutes or when frozen for 24 hours.

Much work has been documented on length weight relationship, Food and parasites of other fishes, but there is little or no information on length weight relationship, Food and parasites of *Lutjanus* species especially from Qua Iboe Estuary. The lapses in information provoke my choice of the *Lutjanus* species and therefore give the enthusiasm to carry out this study.

Aim and Objectives of the Study

The aim of the study was:

1. To investigate the length weight relationship, food, feeding habit and parasites of *Lutjanus goreensis* and *Lutjanus endecaranthus.*

The specific objective of the study were to:

1. identify the species of *Lutjanus* found in Qua Iboe river estuarine
2. determine length weight relationship of *Lutjanus* species.
3. identify the food and feeding habit of *Lutjanus* species.

4. identify the intestinal parasites found in Lutjanus species.

MATERIALS AND METHODS

Study Area Description

The study was conducted at Qua Iboe River Estuary Ukpenekang in Ibeno Local Government Area in Akwa Ibom State. Ibeno is located in South East of Nigeria. Ibeno town lies on the eastern side of Qua Iboe River about 3km from the river mouth between latitude 4.30N- 4.39N and longitutde 7.40^0E and 8.16^0E and is one of the largest fishing settlements on the Nigeria coast (Andem *et al*., 2013). The Ibeno estuary is one of the most important rivers systems in Niger Delta, providing, nursery and breeding ground for large variety of fish. Fishing in the estuary is intense and catch per unit effort is low. The estuarine area of Ibeno, the low lying terrain may be submerged occasionally during the month of June to October. The climate is typically tropical, hot and humid, with a long wet season lasting from March to October and a shorter dry season that lasts from November to February. The major land use types in the Ibeno include Fishing, oil exploitation, forestry and agriculture in the coastal area (Andem *et al*., 2013). Due to natural effort towards speedy industrialization and other human activities the river is degraded. Fishing is carried out indiscriminately with gillnets, cast net, hook and traps. Catch is sold fresh or smoked.

Sample Collection and Procedure

Monthly samples of fish were collected at Ukpenekang fish settlement over a 6-month period. A total of 154 *Lutjanus goreensis* and 156 *Lutjanus endecacanthus* were procured from artisanal fishers and local fisher at the fishing terminal in Ibeno fishing port.

Immediately after purchase, the fishes were taken to the University of Uyo Animal and Environmental Biology Laboratory in a cooler containing ice blocks for identification and laboratory analysis.

Identification and Laboratory Procedure

The fish samples were identified with the aid of key provided by Holden & Reed (1972) and FAO (2012).

Fish specimens were later removed and biometric data such as body weight, (BW) were taken using an electric weighing balance to the nearest 0.01g and total length (TL) and standard length (SL) were recorded using a measuring board, to the nearest 0.01cm for each of the specimen. The total length was taken as the distance from the snout with the mouth closed to the tip of the caudal fin and the standard length is distance from snout to caudal peduncle.

Analysis of the Gut Contents

Each specimen of the *Lutjanus goreensis* and *Lutjanus endecacanthus* was dissected and the stomachs were slit opened and each fish was assigned a reference number after length-weight measurement to ensure proper documentation of records obtained.

The stomach contents were studied following the method by Hyslop (1980). Stomach content of each specimen were placed in a Petri dish and dispersed with small amount of distilled water. Sub-samples of these were taken for macroscopic and microscopic examination respectively. The content were sorted, identified and categorized.

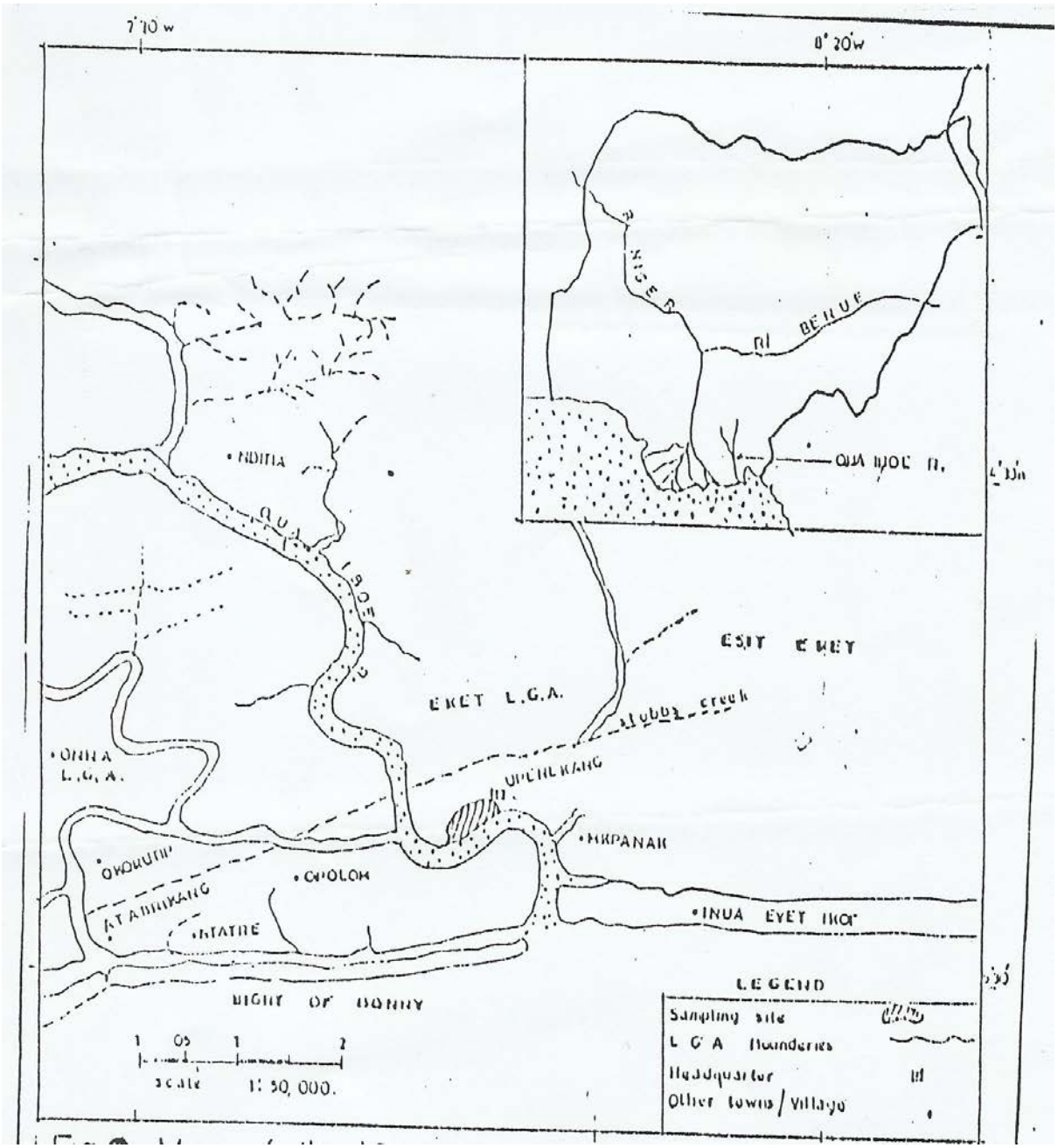


Figure 1: Map of the Qua Iboe River Estuary showing sampling site (Ukpenekang).

Plate 1: showing a sample of *L. goreensis* from Qua Iboe River Estuary.

Plate 2: showing sample of *L. endecacanthus* from Qua Iboe River Estuary

Identification of Parasite and Food Items

All the recovered gastro intestinal parasite were identified with the help of pictorial guide and key of Hoffman and Bauer (1971) and Khali (1971). The parasites and food were preserved with 5% formalin Paperna (1996).

Statistical Analysis Methods for Gut Content Analysis.

The length weight relationship was determined using the software IBM SPSS and correlation regression was employed. The stomach contents were examined both qualitatively (types of organism) and quantitatively (number of organism) by using dominance method and frequency of occurrence method.

Plate 3: A picture of an unidentified crustacean (mantis shrimp).

Plate 4: A picture of a food item - *penaeus notialis* (crayfish).

Plate 5: A picture of one of the food items *Nematopalaemon nastatus* (crayfish).

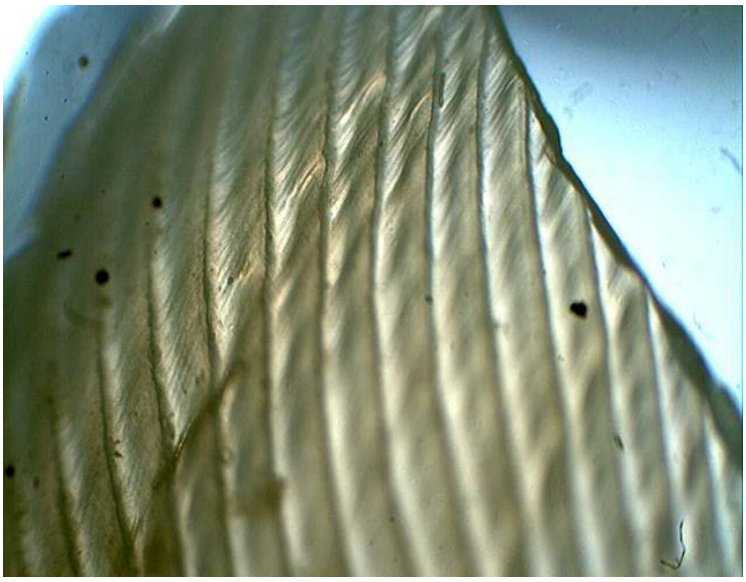


Plate 6: photomicrograph of shell of a clam.

Plate 7: A picture of the shell of clam and whole clam.

Plate 8: A picture of *Pseudoterranova decipiens* (nematode) found in the stomach and intestine.

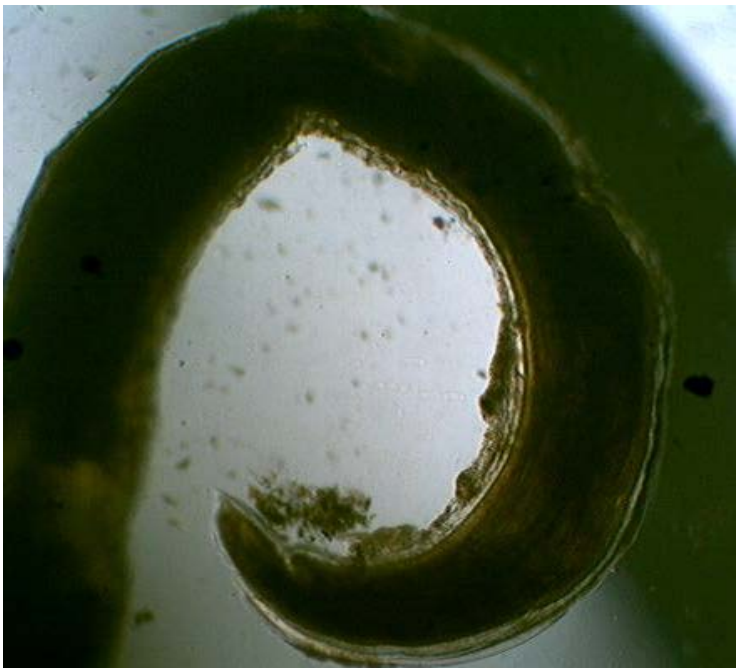


Plate 9: Photomicrograph of anterior end of *Pseudoterranova decipiens* x40.

Plate 10: Photomicrograph of the middle part of *Pseudoterranova decipiens* x40.

Plate 11: photomicrograph of posterior end of *Pseudoterranova decipiens* x40.

RESULTS

A total number of 310 *Lutjanus* sp comprising of 154 *Lutjanus goreensis* and 156 *Lutjanus endecacanthus*, were purchased from artisanal fishermen, gotten from Qua Iboe River Estuary in Ibeno and were examined for their various food composition and intestinal parasites from the months of July to December 2015.

The total number of *Lutjanus goreensis* examined had an average total length of fishes ranged from 14.0 to 36.0cm (TL) and average total weight of 46 to 383.6g (B.W). The total number of *Lutjanus endecacanthus* examined had an average total weight of 48.2 to 344.7g (B.W). Food and parasites were found in the stomach and they include Crayfish, detritus, and fish parts such as fish bones, spines, and skin etc., crab, clam, fish, periwinkle, unidentified crustacean. The intestinal parasites were nematodes namely *pseudoterranova decipiens, Metabroneium sp, capillaria sp, Eustrongylides africanus* and copepods namely *Eargasilus latus and Lernaea sp.*

Table 1a: Ranges (min-max), mean and standard deviation values of length and weight of *Lutjanus goreensis* from July to December 2015

N	Standard length			Total length			Weight		
	X ±SD	S.E	Min-max	X± S.D	S.E	Min-max	X ±S.D	S.E	Min-max
30	21.29± 2.82	0.51	14.0-28.5	27.21± 3.17	O.58	20.2-36.0	194.41± 69.51	12.69	46- 345.6
24	21.65± 2.21	0.45	16.3-26.6	27.33± 2.48	0.51	22.0-32.8	192.57± 63.66	12.99	81.3-312.8
24	21.67± 2.43	0.49	16.9-24.7	26.41± 2.56	0.52	21.3-31.4	165.95± 36.6	7.48	113 -246.3
29	19.85± 2.55	0.47	15.5-25.0	24.85± 3.99	0.74	19.0-39.9	155.36± 44.91	8.34	80 – 264
29	18.75± 2.09	0.39	14.8-24.9	23.69± 2.43	0.45	18.4-31.0	172.18± 68.92	12.79	83.8`-383.6
18	21.18± 3.41	0.80	15.5-27.2	25.83± 3.36	0.79	19.4-31.3	175.6± 61.84	14.58	91.5 – 335

Table 1b: Length-weight relationship parameter of *Lutjanus goreensis*

Species	Months	N	Length-weight Relationship		
			a	b	r
L. goreensis	July	30	0.229	1.913	0.352
L. goreensis	August	24	0.276	1.775	0.448
L. goreensis	September	24	0.722	1.054	0.567
L. goreensis	October	29	0.285	1.362	0.682
L. goreensis	November	29	2.343	3.324	0.965
L. goreensis	December	18	0.136	1.481	0.594

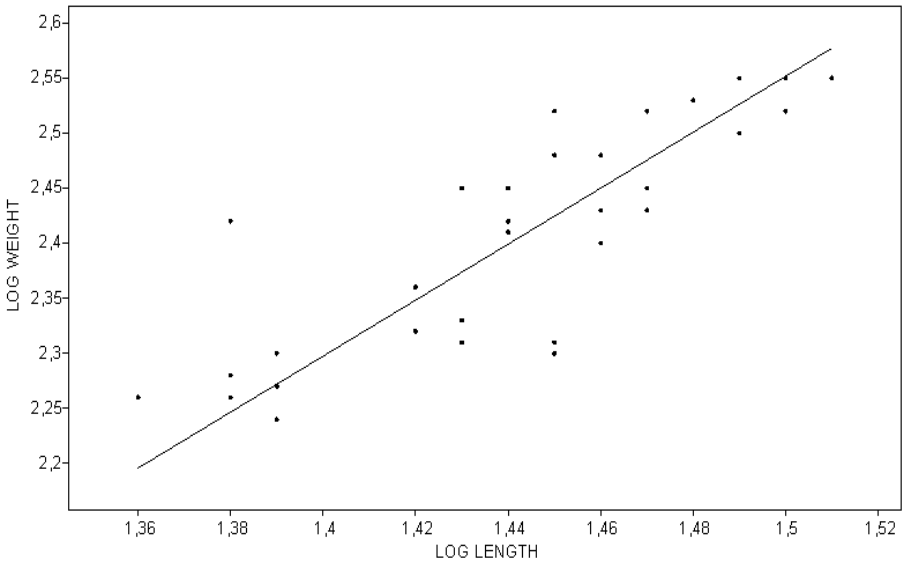
Table 2a: Ranges (min-max), Mean and Standard Deviation Values of Length and Weight of *Lutjanus endecacanthus* from July to December 2015

N	Standard length			Total length			Weight		
	X ± S.D	S.E	Min-max	X ± S.D	S.E	Min-max	X± S.D	S.E	Min-max
30	19.1± 2.54	0.46	14.7-25.3	23.97± 2.65	0.48	0.0-30.6	152.91± 54.34	9.92	48.2 - 312.7
24	20.11± 2.67	0.67	17.0-25.5	25.18± 3.16	0.79	21.0-30.6	178.76± 72.71	8.18	114.3- 312.8
24	21.0± 3.32	0.73	15.6-26.0	25.34± 3.19	0.69	19.8-30.5	156.76± 40.64	8.87	91.5 - 247.7
29	21.65± 2.68	0.48	15.7-26.0	26.82± 2.48	0.45	21.7-31.4	143.91± 35.13	6.31	66.2 – 219
29	22.55± 3.35	o.65	14.7-29.8	28.22± 3.71	0.73	20.2-36.6	176.55± 67.47	13.23	48.2 – 314.2
18	21.53± 3.58	0.63	15.7-29.9	26.89± 3.83	0.68	21.3-36.7	162.33± 68.48	12.11	43.5 – 350.2

Table 2b: Length-weight relationship parameter of *Lutjanus endecacanthus*

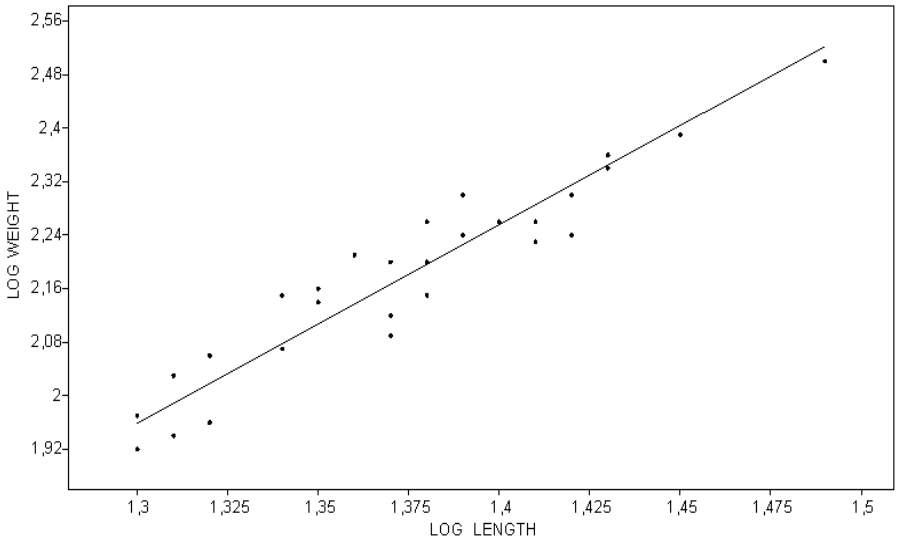
Species	Months	N	Length-weight Relationship		
			a	b	r
L. endecacanthus	July	30	0.376	1.839	0.540
L. endecacanthus	August	16	0.720	2.110	0.767
L. endecacanthus	September	21	0.300	1.344	0.674
L. endecacanthus	October	31	0.400	1.532	0.532
L. endecacanthus	November	26	2.110	2.991	0.935
L. endecacanthus	December	32	0.065	1.481	0.477

Table 1a-2b shows the length characteristics and length-weight parameter of *L goreensis and L .endecacanthus.* The values of b ranged between 1.054 to 3.324 in *L goreensis* while the b values of *L .endecacanthus* ranged from 1.344 to 2.991. The regression coefficient ranged from 0.352 to 0.964 and 0.532 to 0.935 in *L. goreensis and L. endecacanthus* respectively.



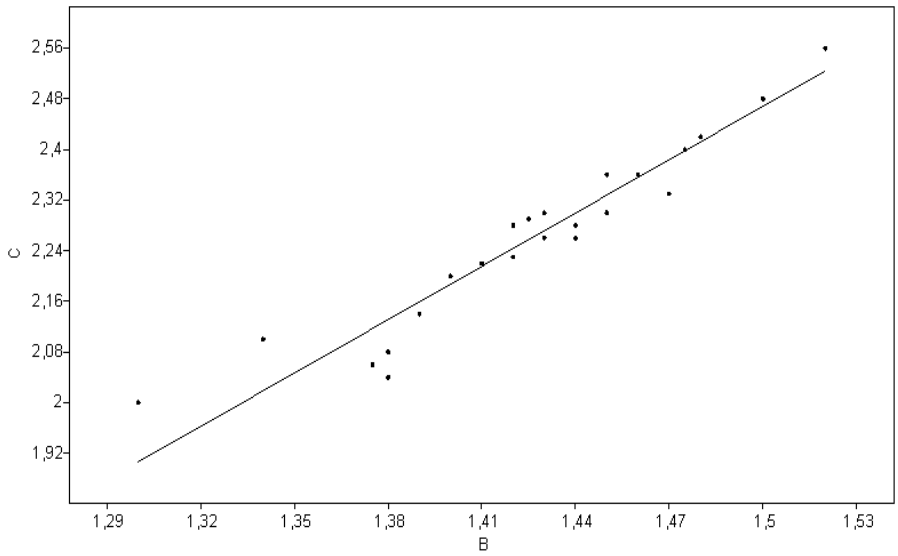
R^2 Linear = 0.125

Figure 2: Length weight relationship of *Lutjanus goreensis* for the month of July.



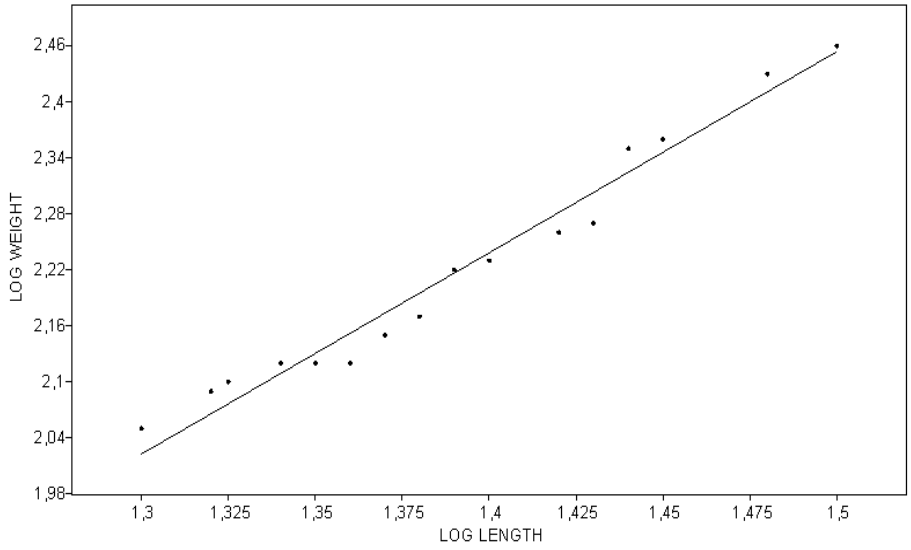
R^2 Linear = 0.292

Figure 3: length weight relationship of *Lutjanus endecacanthus* for the month of July.



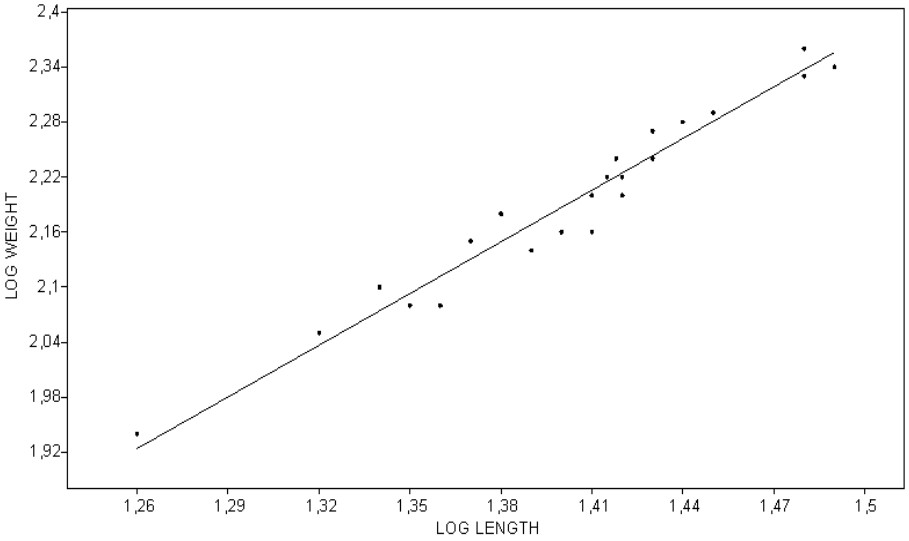
R^2 Linear = 0.235

Figure 4: length weight relationship of *Lutjanus goreensis* for the month of August.



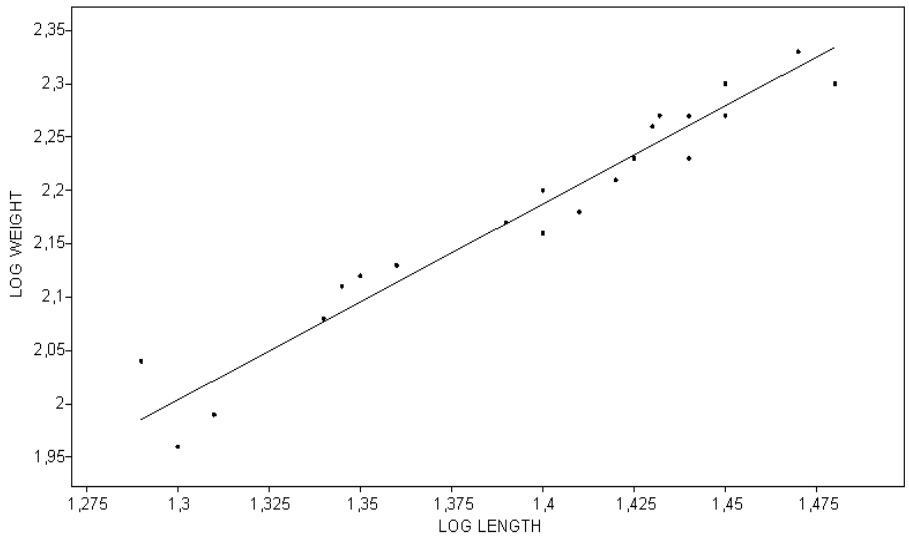
R^2 Linear = 0.589

Figure 5: length weight relationship of *Lutjanus endecacanthus* for the month of August.



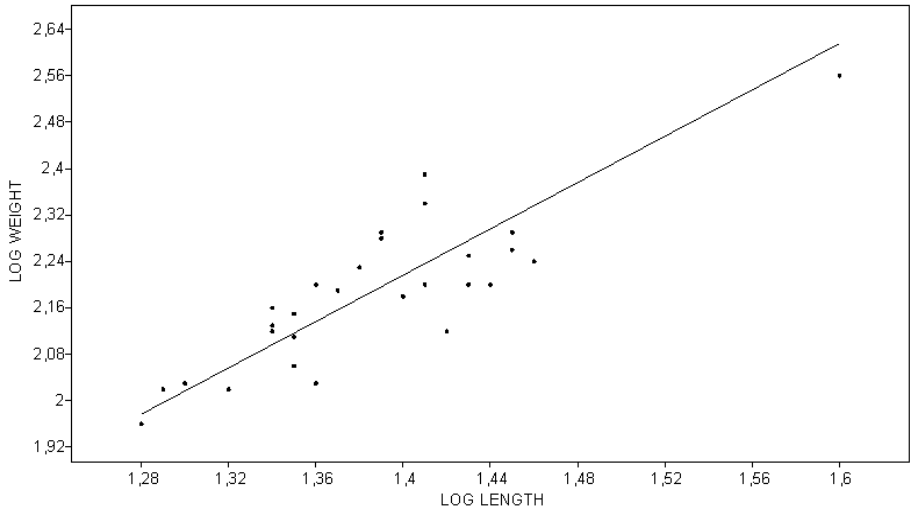
R^2 Linear = 0.312

Figure 6: length weight relationship of *Lutjanus goreensis* for the month of September.



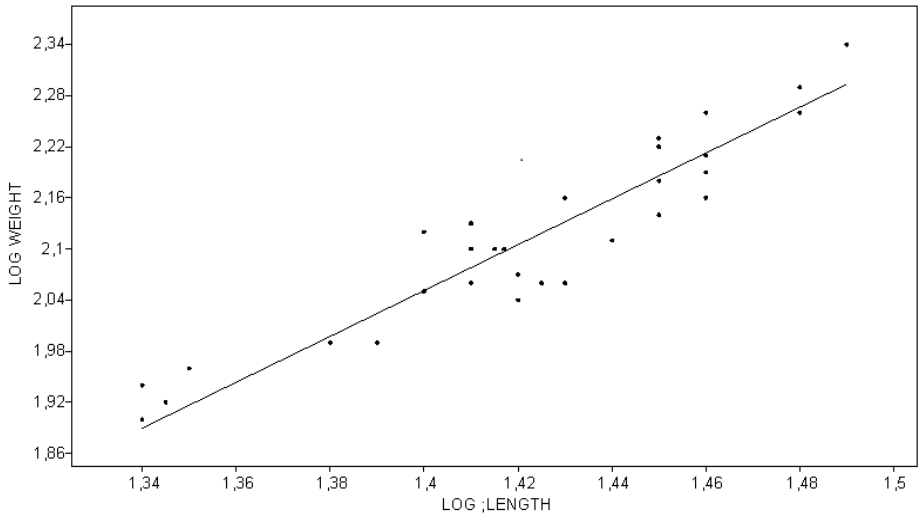
R^2 Linear = 0.454

Figure 7: length weight relationship of *Lutjanus endecacanthus* for the month of September.



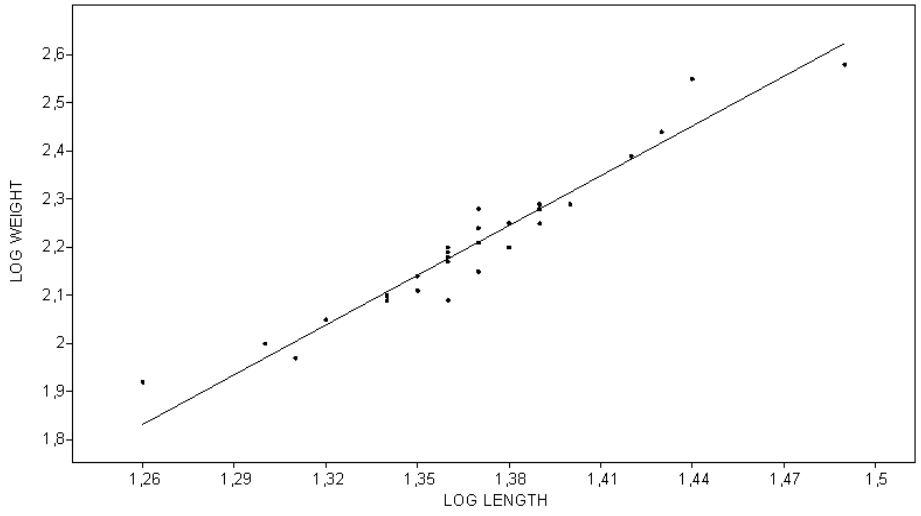
R^2 Linear = 0.466

Figure 8: length weight relationship of *Lutjanus goreensis* for the month of October.



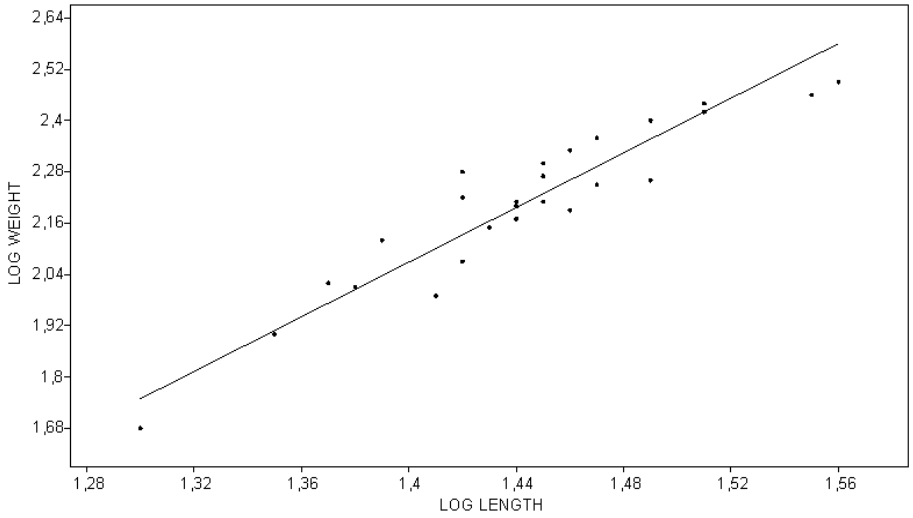
R^2 Linear = 0.283

Figure 9: length weight relationship of *Lutjanus endecacanthus* for the month of October.



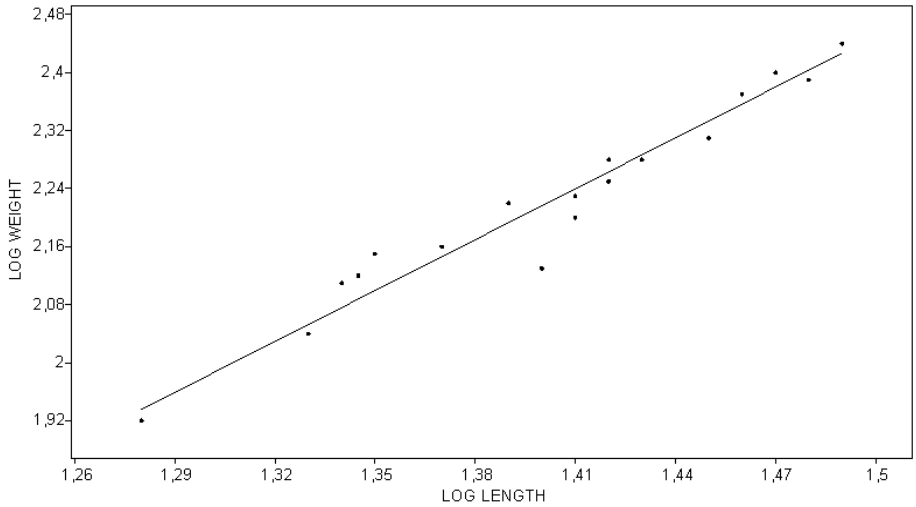
R^2 Linear = 0.931

Figure 10: length weight relationship of *Lutjanus goreensis* for the month of November.



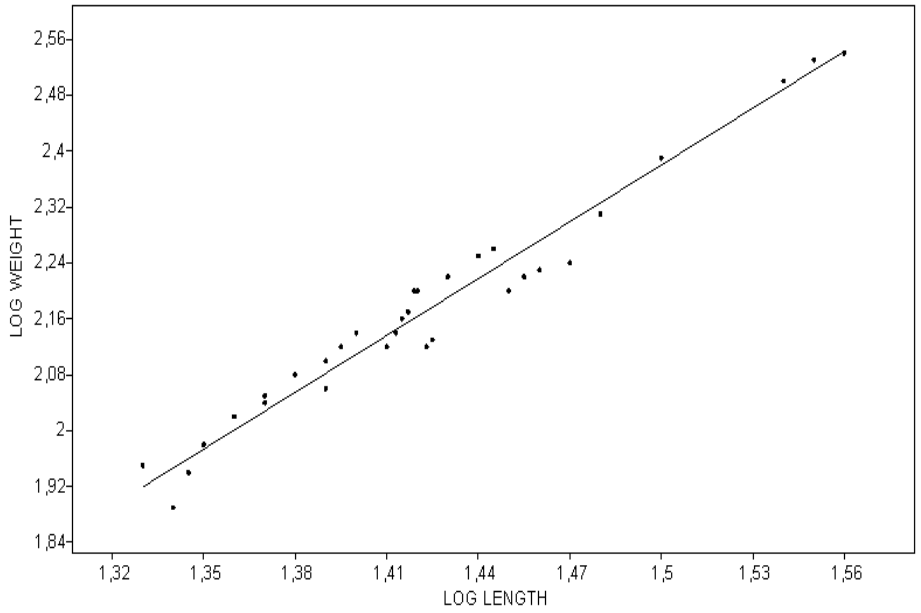
R^2 Linear = 0.875

Figure 11: length weight relationship of *Lutjanus endecacanthus* for the month of November.



R^2 Linear = 0.353

Figure 12: length weight relationship of *Lutjanus goreensis* for the month of December.



R^2 Linear = 0.227

Figure 13: length weight relationship of *Lutjanus endecacanthus* for the month of December.

Table 3: Monthly Analysis of Stomach with Food and Empty Stomach in *L. goreensis*

Month	Number of Stomach examined	Empty 0% Fullness	¼ 25% Fullness	½ 50% Fullness	¾ 75% Fullness	4/4 100 % Fullness
July	30	5 (16.6)	9 (30)	7 (23.3)	5(16.7)	4(2.6)
August	24	9(37.5)	9 (37.5)	1 (4.2)	2 (8.3)	3 (12.5)
September	24	7 (29.2)	3 (12.5)	4 (16.7)	7 (29.2)	3 (12.5)
October	29	2 (6.9)	8 (27.6)	7 (24.1)	8 (27.6)	4 (13.8)
November	29	8 (27.6)	5 (17.7)	5 (17.2)	7 (24.1)	4 (13.8)
December	18	14 (22.2)	7 (38.8)	1 (5.6)	3 (16.6)	3 (16.6)
Total	154	35(22.7)	41 (26.6)	25 (16.2)	32 (20.8)	21(13.6)

The result of analysis of stomach contents of *Lutjanus goreensis* using the fullness method were shown in Table 3. Out of 154 specimens examined, 35(22.7) had empty stomachs, 21(13.6) stomach were full while 41(26.6), 25(16.2), 32(20.8) were 25%, 50%, 75% fullness respectively.

Table 4: Monthly Analysis of Stomach with Food and Empty Stomach in *Lutjanus endecacanthus*

Month	Number of Stomach examined	Empty 0% Fullness	¼ 25% Fullness	½ 50% Fullness	¾ 75% Fullness	4/4 100% Fullness
July	30	5 (16.7)	6 (20)	7 (23.3)	6(20)	6(20)
August	16	6(37.5)	5(31.2)	2(12.5)	2(12.5)	1(6.25)
September	21	6(28.6)	5(23.8)	4 (19.0)	4(19.0)	2(9.5)
October	31	5(16.1)	6(19.4)	4(12.9)	9(29.0)	7(22.5)
November	26	4(15.4)	6(23.1)	7(26.9)	7(26.9)	2(7.7)
December	32	7(21.9)	9(28.1)	7(21.9)	4(12.5)	5(15.6)
Total	156	33(21.2)	37(23.7)	31 (19.9)	32(20.5)	23(14.7)

The result of analysis of stomach contents of *Lutjanus endecacanthus* using fullness method are shown in Table 4. Out of 156 specimens examined, 33(21.2) had empty stomach, 23(14.7) stomach were fully loaded while a total of 37(23.7), 31(19.9), 32(20.5) were 25%, 50%, 75% fullness respectively.

Table 5: Data of Food Content of *Lutjanus goreensis* from the Month of July to December 2016 N = 154

Food Items	No. of Fish Examined	Frequency of Occurrence	% of occurrence	No. of dominance	% of dominance
Crayfish	154	79	51.3	61	39.6
Detritus	154	55	35.7	20	12.8
Clam	154	11	7.1	6	3.9
Crab	154	13	8.4	3	1.9
Fish	154	17	11.0	14	9.0
Fish part	154	12	7.8	3	1.8
Unidentified crustacean	154	18	11.6	13	8.4
Periwinkle	154	5	3.2	3	1.9
Sand grains	154	5	3.2	-	-

Table 5 shows the summary of food items that constituted the diet of *Lutjanus goreensis.* The food item found in the stomach were as follows, Crayfish 79(51.3), detritus 55(35.7%), Clam 11(7.1%), crab 13(8.4%), fish 17(11.0%), fish parts 12(7.8%), unidentified crustacean 18(11.6%), periwinkle 5(3.2%), sand grain 5(3.2%). Crayfish showed the highest occurrence and dominated in most of the fish examined. The percentage dominance of crayfish was 39.60, detritus 12.8%, crab 3.9%, clam 1.9%, fish 9.0%, and fish part 1.8%, unidentified Crustacean 8.4%, periwinkle 1.9%.

Table 6: Data of Food Content of *Lutjanus endecacanthus* from the Month of July to December, 2015

Food Items	No. of Fish Examined	Frequency of Occurrence	% of occurrence	No. of dominance	% of dominance
Crayfish	156	88	56.4	87	53.8
Detritus	156	38	24.3	10	11.5
Clam	156	15	9.6	7	4.5
Crab	156	12	7.7	2	1.3
Fish	156	17	11.9	13	8.3
Fish part	156	11	7.1	5	3.2
Unidentified crustacean	156	11	7.1	7	4.5
Periwinkle	156	2	1.3	1	1
Sand grains	156	3	1.9	-	-

Table 6 shows the summary of food items that constituted the diet of *Lutjanus endecacanthus*. The food items were as follows; crayfish 88)56.4%), detritus 38(24.3%), clam 15(9.6%), fish part 11(7.1%), unidentified crustacean 11(7.1%) periwinkle 2(1.3%) and sand grain 3(1.9%). Crayfish also had the highest occurrence and dominated in the stomach of most of the *Lutjanus endecacanthus* specimens examined. The percentage dominance in crayfish was 55.8%, detritus, 11.5%, crab 4.5%, clam 1.3%, fish 8.3%, fish part 3.2%, unidentified crustacean 4.5%, and periwinkle 1%.

Plate 4- plate 12 shows pictures of the food items of both *Lutjanus* species.

Table 7: Monthly Prevalence of Parasitic Infection in *Lutjanus goreensis*

Month	No. of fish examined	No. of Fish Infected	% of Fish Infected
July	30	6	20
August	24	7	29.2
September	24	8	33.3
October	29	12	41.4
November	29	5	17.3
December	18	7	38.9
Total	154	45(29.2)	

This table shows that out of 154 specimens of *Lutjanus goreensis* that were examined for parasites, 45(29.12%) were infected. The lowest percentage of prevalence was shown in the month of November, 5(17.3%) followed by July 6(20.0%), August 7(29.2%), September 8(33.3%), December 7(38.9%), and the highest percentage of prevalence was in the month of October 12(41.4).

Table 8: Monthly Prevalence of Parasitic Infection in *Lutjanus endecacanthus*

Month	No. of fish examined	No. of Fish Infected	% of Fish Infected
July	30	5	16.7
August	16	6	37.5
September	21	4	19.0
October	31	9	29.0
November	26	7	26.9
December	32	9	28.1
Total	156	40(25.6)	

The result in the table show that out of 156 specimens of *Lutjanus endecacanthus* that were examined for parasites, 40(25.6%) were infected. August has the highest percentage of

prevalence 37.5% followed by October 29%, December 28.1%, November 26.9%, September 19%, and July had the lowest percentage of prevalence of 16.7%.

Table 9: Prevalence of Parasites Species on *Lutjanus* Species

S/N	*Lutjanus* species	No of fish examined	No(%) infected	No(%) of different parasite group		No(%) of combined infection
				Nematode	copepod	
1	*L. goreensis*	154	45(29.2)	25(16.2)	20(13.0)	10(6.5)
2	*L. endecacanthus*	156	40(25,6)	20(12.8)	18(11.5)	8(5.1)
	Total	310	85(27.4)	45(14.5)	40(25.6)	18(5.8)

The result in table 9 shows that out of 154 specimens of *Lutjanus goreensis* examined for gut parasites 45(29.2%) were infected with nematode 25(16.2%) and copepod 20(13.0%) respectively, while 10(6.5%) had combined infection. Out of 156 specimen of *L. endecacanthus* for gut parasite, 40(25.6%) were infected with nematode 20(12.8%) and copepod 18(11.5%) while 8(5.19%) had combined infection.

The overall prevalence of parasite in the two *Lutjanus* species revealed that 85(27.4%) of a total of 310 fish samples were infected with nematode 45(14.5%), copepod 40(25.6%) and combined infection 18(5.8%).

Table 10: Prevalence of Different Species of Parasites

Nematode	No %	Nematode	Copepod No %
Pseudoterranova decipiens	20(42.6%)	*Eargasilus latus*	28(70.0%)
Metabroneium sp	10(21.3%)	*Lernaea sp*	12(30.0%)
Capillaria sp	12(25.5)		
Eustrongyloides africanus	5(10.6%)		
Total	47(15.2%)		40(12.9%)

The species diversity of the parasites (table 10) shows that there were 4 species of nematodes namely *Pseudoterranova decipiens* 20(42.6%), *Metabroneium sp* 10(21.3%), *Capillaria sp* 12(25.5%) and *Eustrongyloides africanus* 5(10.6%) and two species of copepods namely *Eargasilus latus* 28(70.0%) and *Lernaea sp* 12(30.0%).
Plate 8 - 11 shows pictures of some of the nematodes found species found in *Lutjanus* sp.

Discussion

There is wide variability in length-weight relationship parameter estimates for a *Lutjanus goneensis* and Lutjanus endecacanthus. This is due to the fact that the length-weight relationship is affected by many factors related to population variability and to sampling and estimation methods as was previously reported by Frota *et al*., (2004). Sampling related factors include sample size, length distribution in the sample and type of length measure, while nutritional conditions account for intrinsic biological variability (Ricker, 1975). Other factors include season, habitat, gonad maturity, sex, diet, stomach fullness, health, preservation techniques and annual differences in the environmental condition (Froese 2006; Bagenal and Tesch, 1978).

The values of b for *Lutjanus goreensis* which were less than 3.0 indicated negative allometric growth pattern while in the month of November, b value was greater than 3.0 indicating positive allometric growth pattern, this indicates a fish could express positive and negative allometric growth depending, probably, on seasonal or other environmental conditions (Ndome and Eteng, 2010). The values of b for *Lutjanus endecacanthus* were less than 3 indicating negative allometric growth pattern. Several authors have reported both isometric and allometric growth for different species from various water bodies.Oribhabor *et al* (2011) and Kumolu-Johnson *et al* (2010) reported negative allometric growth pattern for *L.goreensis.* Ameer Hamsa *et al* (1994) reported isometric growth pattern for *Lutjanus rivulatus.* King (1991) reported allometric growth patterns for *Tilapia* species from Umuoseriche Lake. This difference could be attributed to difference in sample size. Ekeng (1990) and Marcus (1984) reported isometric growth pattern for *Ethmalosa fimbrita* of Cross River Estuary, Cross River State, and coastal and brackish water of Akwa Ibom State respectively.

According to Oribhabor *et al* (2011), the weight of *L. goreensis* and *L.endecacanthus* which indicated allometric growth increased faster than the cube of their total length. This indicated that these species are part of the few finfishes that obeyed the cube law of growth which is rarely obeyed (Le Cren, 1951).

The results of food analysis showed that *Lutjanus goreensis* and *Lutjanus endecacanthus* from Qua Iboe River (Ibeno) are carnivorous, piscivorous predators and benthic feeders. Both species fed mainly on invertebrates such as crayfish, crab, clam, crustacean, periwinkle etc and fish. This finding agrees with the report of Oribhabor and Ogbeibu (2012), in Niger Delta Mangrove Creek, *Lutjanus goreensis* was found to be piscivorous. In the present study, it was observed that prawn juveniles were the dominant food items of *Lutjanus goreensis* and *Lutjanus endecacanthus* which compared favourably with the result of Oribhabor and Ogbeibu (2012) that prawn juvenile were the dominant food items of predatory fish in Niger Delta Mangrove Creek.

The abundant of these prawns could be attributed to the fact that unlike adults that live offshore and spawn in deeper waters, the juvenile forms inhabit estuaries (khan *et al*., 2001).

Stomach contents analysis based on fullness method revealed that out of 154 specimens of *Lutjanus goreensis* and 156 specimens of *Lutjanus endecacanthus*, only 35(22.7%0 and 33(21.2%) had empty stomach respectively. This could be attributed to the fact that predatory fish have irregular feeding habit and tend to take large meal when their prey is available (Fagade and Olaniyan 1973).

The prawn species in *Lutjanus goreensis and Lutjanus endecacanthus* were represented by *Glyphus marsupialis, Nematopalaemon hastatus, Parapenaeu longirostris* and *Penaeus notialis* which agree with the finding of Oribabor and Ogbeibu (2012).

One interesting point in the results of this study is the minor shift in food items of *Lutjanus goreensis,* when compared with the findings of Fagade and Olaniyan (1973) which *Lutjanus goreensis* was considered to be non-piscivorous predator and also compared with the finding of Oribhabor and Ogbeibu (2012) where plant part was one of the food item of *Lutjanus goreensis.* This could be attributed to differences in habitats, relative abundance of prey organism and individual species feeding habit. The availability of the food of fish species can influence their distribution (Oribhabor and Ogbeibu, 2012).

In this study, it was also noticed in the course of food identification that *L. goreensis* and *L. endecacanthus* practice cannibalism, as few of the fishes removed from some of the stomach (that contained fish) were fingerlings of *Lutjanus goreensis.* The result of this study reveals the incidence of parasitic infection in *Lutjanus goreensis and Lutjanus endecacanthus.* The infection of both species is caused by nematodes namely *Pseudoterranova decipiens, Metabroneium sp, capillaria sp, Eustrongylides africanus* and copepods namely *Eargasilus latus and Lernaea sp.*

According to Oribhabor and Ogbeibu (2012), Lutjanus species are benthic feeders and macro carnivores that feed on invertebrate such as fish, macro crustacean, mollusk, among these invertebrates, crustaceans are the first intermediate hosts of *pseudoterranova decipiens* which develops further in muscle of fish or under the skin. This agrees with the findings of Hernandez – Orts *et al*., (2013) that primary host of *Pseudoterranova decipiens* are benthic feeders (fish) which acquire the parasite directly from invertebrate hosts (crustacean). Pollution of surface water may enhance the prevalence of *Eustrongylides* nematode while *Capillaria sp and Metabroncium sp* could be picked up along with detritus due to its abundance in the habitat (Usip *et al,* 2010).

The distribution of *Pseudoterranova decipiens,* other nematodes and copepods showed that the majority of the parasites occurred in the intestine of Lutjanus species, this could be due to the conducive nutritional advantage presented by the host's intestine to the parasite and adult nematode inhabit the digestive tract and occur in abundance while causing a great advance of damage which include loss of weight and liver damage (Ndifon and Jimeta, 1990). Ugwuozor (1987) noted that wide distribution of nematode is attributed to their high survival rate.

It is thus revealed from this study that *Pseudoterranova decipiens* and other nematodes prefer the stomach, gut and intestine as their main site of preference which agrees with the finding of Hernandez-orts *et al*., (2013) and Usip *et al*., (2013).

The copepod may be due to the feeding and respiratory habit of fishes as previously reported b Usip *et al.,* (2010) that during respiration in fishes, the mouth opens to gulp water which passes over gills, copepod in the water are trapped by gill raker and are returned to gut.

Recommendation

We recommend that further and prolonged research should be carried out on food and feeding habit, host parasite relationship of *Lutjanus* species as only very few researches has been done. Detailed study should be made on anatomy and physiology of the digestive system of *Lutjanus goreensis* and *L. endecacanthus* as this will help in proper understanding of its feeding habit.

We also recommend that environmental conservation and monitoring should be employed to prevent perturbation and spread of parasites which are militating factors affecting fish. In achieving an efficient and profitable aquaculture venture fish farmers and parasitologist should not neglect the disease and problems encountered.

Also, during preparation of fish by fish processors, fish should be heated to 60^{o}c (not cold smoked), frozen at -20^{o}c for 24 hours, heavy salting should be done at -80^{o}c brine for 10 days but not lower concentrations, fish intended to be eaten cold smoked or lightly cured should be deep frozen.

Conclusion

Lutjanus goreensis and *Lutjanus endecacanthus* mostly exhibited negative allometric growth pattern. The correlation coefficient of length-weight relationship indicated positive correlation between length and weight.

The results of feeding habit of *Lutjanus goreensis* and *Lutjanus endecacanthus* has revealed that Lutjanus species are carnivorous in feeding habit as it consume a wide variety of dietary items of animal origins including mollusk and crustacean. Three major food taxa namely crustaceans, mollusk and Pisces constitute the greater proportion of the diet of both species, thus confirming their reputation as Carnivores.

Fish diseases including those caused by parasites are as a result of water pollution and poor environmental condition. The high water temperature, perturbation and organic content of tropical aquatic environment pollute the water and can enhance the life cycle and the spread of parasites. Therefore, the elimination of disease and parasites and other setback to fish farming means enhancement and elevation of fish production in Nigeria.

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