Journal of Animal and Veterinary Advances 4 (10): 818-824, 2005

Some Aspects of the Feeding Habits of Commercially Important Penaeids from Part of Fao Fishing Zone 34

[1]O.A. Bello-Olusoji, [1]M.O. Afunmiso and [2]Y.M. Bankole
[1]Department of Fisheries and Wildlife, Federal University of Technology, PMB 704, Akure Nigeria
[2]Federal College of Agriculture, Moor plantation, Apata, Ibadan, Nigeria

Abstract: Stomach contents of 780 individual shrimps collected between March 2004 and February 2005, from FAO fishing area 34, comprising of four species; *P. kerathurus* (150), *P. notialis* (210), *P. atlantica* (210) *and P. longistrotis* (210) were analysed. Bacilillariophyceae had the highest frequency of occurrence of 39.13, 25.0, 28.89 and 15.39%, followed by Dinophyceae with of 8.7, 37.5 28.89, 46.15% and crustaceans with 26.09, 12.05, 11.11 and 17.95% in the diet of *P. kerathurus, P. notialis, P. atlantica and P. longistrotis* respectively. Diet composition differed slightly between shrimp species. The diet of *P.kerathurus* was dominated by *Coscinodiscus* and *Rotifera* while *Ceratium furca, Coscinodiscus* and *Chaetoceros* dorminated in the diet of *P. notialis.* The diet of *P. atlantica* was dominated by *Coscinodiscus, Cladorerans* and *Copepod*, while P. *longistriotis* diet was dorninated by *Cosinodiscus, Chaetoceros* and *Ceratium.* All the shrimp's species are primarily opportunistic omnivores in their feeding habits. The shannon index (H) indicated that *P. kerathurus* had the highest community diversity of H'-2163.88, followed by *P. atlantica* (H -1665.71), *P. notialis* (H'-1621.65) and *P. longirostris* had the least value ofH-1539.1. Species' diet diversity in *P. kerathurus* was about 7.13% greater than the value obtained for *P. atlantica*, about 7.76 and 8.95% greater than value obtained for *P. notialis* and *P. longistrotis* respectively. Obtained Index of Relative Importance (IRI) for *C. radiatus* was 2465.6, *C. excentricus*-1840.9 in *P. kerathurus* followed by *C. radiatus* (1476.6) in *P. notialis.*

Key words: Diet, shrimps, *Peneaus,* frequency, crustaceans, penaeids, stomach content, occurrence, phytoplankton

INTRODUCTION

The location of FAO fishing zone 34 is between 40°00' to 5°36'W and 6°00' to 36°00'N that is Atlantic Eastern central. More than one hundred species of shrimps are found in this area. The different species of shrimps has different geographical distribution. The total shrimp landing from this fishing zone from 1992-1998 is on the increase from 40.053 to 52.546 tones[1], especially the penaeid shrimps; *Penaeus duorarum* (pink shrimp), *Paraenaeopsis atlantica* (Guinea shrimp), *Penaeus kerathurus* (caramote prawn), *Penaeus notialis* (southern pink shrimp) and *Parapenaeopsis longirostis* (pink deep-sea shrimp). Virtually, most of the larger species are highly valued as human food. Penaeid shrimps are available in this FAO fishing zone 34; the most abundant is the pink shrimp[2]. These shrimps are mostly exploited by industrial shrimp fishery. Most of these species are favored because of their relatively large size and economic importance in the international market. The pink shrimp form the bulk of existing industrial shrimp fishery. The *P. notialis* is another dominant species in the commercial offshore trawl fisheries.

Nigeria broad coastline of about 850 Km which boarder the Atlantic Ocean in the Gulf of Guinea, lies within the FAO fishing zone 34. The total area of its continental shelf is approximately 41,000 Km^2 and the Nigeria Shrimpings ground lies east of longitude 5°E to Nigeria/Cameroon borders[3]. These areas include Niger-Delta which is characterized by a broad coast line with many estuaries and lagoons. The richest shrimp ground in Nigeria have the same existing ecological condition in the continental shelf area that are similar to those of the Gulf of the Mexico which at present contribute about 20% of the world output of shrimp[3].

However, no information is available regarding some commercially important penaeids species, especially on the aspect that relates to the food and feeding habit of these shrimps. This can be used for the setting up of an effective feeding strategy policy. The intensive culture of most species would probably not be economically visible under present condition in Nigeria due mainly to the problem of larval rearing of some species that required brackish water for their development[3]. In many countries within this zone including Nigeria as indeed in most of the African countries, shrimps culture has not been attempted

Corresponding Author: O.A. Bello-Olusoji, Department of Fisheries and Wildlife, Federal University of Technology, PMB 704, Akure Nigeria Tel: 08036670765

on any serious scale. Many freshwater shrimps of economic importance have been identified as suitable species for aquaculture in Nigeria[4,5]. The focus of this study is to know more about the food and feeding habit of these penaeids shrimps available in the gulf of Genuine, part of FAO fishing zone 34, their diets composition and their diversity within the community.

MATERIALS AND METHODS

Collection of sample: The shrimps used for the project were collected from shrimpers with otter-trawl net (15 mm mesh size at the sides and 10mm at its end) and trawlers fishing on the fishing site (shrimp ground) within FAO zone 34 is between 40°00'W to 5°36'W and 6°00'S to 36°00'N (Atlantic Eastern central), between the month of March 2004 and February 2005. Sample collected were immediately preserved in iced-packed in Thermocline vacuum flask (25 L) and transported to the Limnology Laboratory in the Department of Fisheries and Wildlife, Federal University of Technology, Akure. In the laboratory the samples were immediately transferred to the Department Laboratory Freezer at -4°C till the commencement of the experiment.

All the collected shrimp specimens were weighed to the nearest 0.01 g with a weighing top balance (Mettler Toledo, PB8001). The Total Length (TL), from the tip of the rostrum to the end of the telson and the Carapace Length (CL), from the post-orbital margin to the posterior end of the mid-dorsal line of the carapace were measure to the nearest 0.01 mm using a vernier caliper. A careful opening of the carapace was done with the aid of the dissecting set to remove the stomach of the individual shrimps, the stomach content was emptied into a petri dish and the contents were used for the sample preparation. Distill water (2 mL) was mixed with the gut content to have a sample mixture in a petri dish. A drop of the prepared sample was dropped on a glass slide with the aid of a dropper, covered with cover slip and viewed under Binocular microscope to identify the various diet compositions. Numbers of occurrence of each diet items were recorded and were later identified to species level of organisms using identification chart. They were classified to the lowest possible taxonomic level. The following indices were used; i) Frequency of Occurrency (FOC): This was calculated as the number of stomach with a specific food item expressed as a percentage of the total number of stomachs containing food items[6,7], ii) Occurrence Index (OCI); this was calculated as the total number of specific individual food items counted in each stomach express as a percentage of the total number of individual in all stomachs containing foods items, iii) Stomach Capacity (%SC); this is the volume (mL^3) of each stomach (stomach capacity) was determined, after contents were emptied, the pyloric sphincter was tied off, the stomach was filled with water using calibrated syringe and needle until it became distended and water flowed over. The water was then poured into a graduated cylinder and measured to the nearest 0.01 mL. $\%SC=N/TN\times V_m$ where N is the number of individual prey items, TN is the total number of all prey items in all stomach examined and V_m is the volume of water measured to the nearest 10 mL. iv) Index of Relative Importance (IRI): This was calculated for all prey items with the formula as described by[8]. IRI = (OCI+%SC) x FOC, where OCI is number of occurrence index, %SC is the percentage of volume of the distill water used, FOC is the frequency of occurrence. v) Highest Community Diversity (H), this is the community diversity indices calculated from the mathematical formula (Shannon diversity index) that takes into account both species richness and percentage frequency of each prey in each shrimps specimen. The equation for the Shannon-weaver diversity index[9] used was; $H = {}^{-\Sigma}\rho_i \, l_n \, \rho_i$ whereH is Shannon diversity index, S is the total number of species of prey in the community, P_i is the % frequency of occurrence of each prey in each stomach (FOC) and Ln is the natural logarithm.

RESULTS

A total of 780 individuals of four shrimp species were analysed, these comprised of *P. kerathurus* (150), *P. notialis* (210), *P. atlantica* (210) and *P longistrotis* (210). The length of individual shrimp species range from 21.20 to 24.90 cm, 15.20 to 18.20 cm, 11.50 to 14.50 cm, 14.20 to 15.60 cm for *P. kerathurus*, *P. notialis*, *P. atlantica* and *P. longistrotis*, respectively.

Stomach content from the 780 shrimps examined contained at least one identifiable prey item. Seven species of crustacean, 1 specie of monogononta, 9 species of Dinophyceae, 1 specie each of Actinopterygii, leptomedusa, polychaeta and Prasinophyceae, 5 species of Bacilillariophyceae, 4 species of Coscinodiscophyceae and 4 species of Fragilaphceae were observed. A total of 34 different prey species were observed in all the four shrimp species (Table 1). These were classified into 10 major classes along with their Frequency of Occurrence (FOC) and Occurrence Index (OCI) as shown in Table 2. The foods items varied according to species. For *P. kerathurus,* Bacillariophyceae and the crustaceans were the most abundant prey appearing in 39.13 and 26.09%, respectively of the stomach analysed and representing 53.0 and 17.28%, respectively of the

Table 1: Index of relative importance (IRI) of prey items consumed by the shrimps

	P. kerathurus				*P. notialis*				*P. atlantica*				*P. longirostris*			
	FOC	%SC	OCI	R	FOC	%SC	OCI	R	FOC	%SC	OCI	1R1	FOC	%SC	OCI	R
Class-Crustacea																
Daphnia pullex	40.00	8.64	0.34	359.2	-	-	-	-	10.00	2.54	0.05	25.90	-	-	-	-
Water flea	80.00	8.64	0.34	718.4	-	-	-	-	20.00	1.70	0.03	34.60	-	-	-	-
Ostracod	-	-	-	-	10.00	0.91	0.03	9.40	-	-	-	-	10.00	1.03	0.02	10.50
Cladocera	-	-	-	-	20.00	2.75	0.09	56.8	10.00	1.70	0.03	17.30	-	-	-	-
Zoea larval/crab	-	-	-	-	10.00	0.91	0.03	9.40	-	-	-	-	-	-	-	-
Copedod	-	-	-	-	10.00	2.75	0.09	28.4	10.00	3.39	0.07	34.60	40.00	8.25	0.17	336.80
Amphipod	-	-	-	-	-	-	-	-	-	-	-	-	20.00	2.06	0.04	42.00
Class-Monogononta																
Rotifera nepturis	60.00	13.58	0.54	847.20	-	-	-	-	20.00	3.39	0.07	69.20	10.00	2.06	0.04	21.00
Class-Dinophyceae																
Ceratium furca	20.00	4.94	0.20	102.80	60.00	11.93	0.38	738.60	30.00	7.63	0.15	233.40	70.00	19.59	0.39	1398.60
C. fusus	-	-	-	-	30.00	7.33	0.24	227.10	10.00	2.54	0.05	25.90	30.00	7.22	0.14	220.80
C. hinundinella	-	-	-	-	-	-	-	-	10.00	0.85	0.02	8.70	-	-	-	-
C .decipiens	-	-	-	-	10.00	2.75	0.09	28.40	30.00	8.48	0.17	259.50	20.00	5.15	0.10	105.00
C. affines	-	-	-	-	10.00	0.91	0.03	9.40	10.00	1.70	0.03	17.30	20.00	7.22	0.14	147.20
C. laciniosum	-	-	-	-	-	-	-	-	-	-	-	-	10.00	1.03	0.02	10.50
C. sociale	20.00	1.24	0.05	25.80	-	-	-	-	20.00	5.09	0.10	103.80	30.00	12.37	0.25	378.60
C. danicum	-	-	-	-	30.00	7.33	0.24	227.10	10.00	0.85	0.02	8.70	-	-	-	-
Class Bacilillar-iophyceae																
C. radiatus	80.00	29.63	1.19	2465.60	60.00	23.85	0.76	1476.60	60.00	22.03	0.94	1348.20	10.00	5.15	0.10	52.50
C.excentricus	80.00	22.22	0.89	1840.90	20.00	8.26	0.26	170.40	50.00	16.10	0.32	821.00	20.00	7.22	0.14	147.20
C. conchinus	-	-	-	-	20.00	6.42	0.02	132.60	20.00	2.54	0.05	51.80	-	-	-	-
C. lineatus	-	-	-	-	-	-	-	-	-	-	-	-	30.00	9.28	0.19	284.10
Fish Egg	20.00	3.70	0.15	77.00	20.00	3.67	0.12	75.80	10.00	1.70	0.03	17.30	40.00	6.19	0.12	252.40
Class-Leptomedusa																
Leptomidusa	-	-	-	-	10.00	0.91	0.03	9.40	-	-	-	-	-	-	-	-
Class-Polychaeta																
Polychaete worm	-	-	-	-	30.00	3.67	0.12	13.70	10.00	0.85	0.02	8.70	10.00	1.03	0.02	10.50
Class-Prasinophyceae																
Halosphera viridis	-	-	-	-	-	-	-	-	-	-	-	-	10.00	2.06	0.04	21.00
Nitzschia-closterium	20.00	1.24	0.04	25.80	-	-	-	-	-	-	-	-	-	-	-	-
Ankistrodermis-falcatus	-	-	-	-	10.00	3.67	0.12	37.90	10.00	1.70	0.03	17.30	-	-	-	-
Class Coscino-discophyceae																
Guinardia -flaccida	-	-	-	-	10.00	1.84	0.06	19.00	-	-	-	-	-	-	-	-
Rhizosolenian shrubsolei	-	-	-	-	-	-	-	-	10.00	0.85	0.02	8.70	-	-	-	-
R. stolterfettii	-	-	-	-	-	-	-	-	10.00	0.85	0.02	8.70	-	-	-	-
Peridinium pellucidum	-	-	-	-	-	-	-	-	10.00	2.54	0.05	25.90	-	-	-	-
Class-Fragilap-hyceae																
Tabellaria flocculosa	-	-	-	-	20.00	5.51	0.18	113.80	10.00	0.85	0.02	8.70	-	-	-	-
T. fenestrate	20.00	4.94	0.20	102.8	-	-	-	-	50.00	9.32	0.19	475.50	10.00	3.09	0.06	31.50
T. nitschioides	-	-	-	-	10.00	1.84	0.06	19.00	10.00	0.85	0.02	8.70	-	-	-	-
Asterionella Formosa	20.00	1.24	0.05	25.80	-	-	-	-	-	-	-	-	-	-	-	-

IRI was calculated as described by Pinka *et al*.[8] and Frequency (FOC) is the percent of stomachs that contained food items. Number (%SC) is the percent of available number of prey in each stomach to the total number present in all stomachs analysed.

total items found (Table 1). In the gut of *P. notialis,* Dinophyceae and Bacilillariophyceae were the most abundant prey appearing in 37.5 and 25.0%, respectively of the stomach analyzed and representing 34.89 and 39.64%, respectively of the total items found (Table 1).

In the gut of *P. atlantica,* Dinophyceae and Baciliollariophyceae appeared most in abundant of prey followed by Fragilaphyceae. They appears in 28.89, 28.89 and 15.56%, respectively of the stomach analyzed and representing 28.83, 40.65 and 11.02%, respectively of the

Table 2: Frequency of occurrence and occurrence index of the classes of the diet species of shrimp specimens

	P.kerathurus		P.notialis		P.atilantica		P.longirostris	
Class	FOC	OCI	FOC	OCI	FOC	OCI	FOC	OCI
Crustacea	26.09	17.28	12.50	7.53	11.11	9.33	17.95	11.34
Mongononta	13.04	13.58	-	-	4.35	3.39	2.56	2.06
Dinophyceae	8.70	6.18	37.50	34.89	28.89	28.83	46.15	52.58
Actinopterygii	4.35	3.70	5.00	3.78	2.22	1.70	10.26	6.19
Leptomedusa	-	-	2.50	0.94	-	-	-	-
Polychaeta	-	-	7.50	3.78	2.22	0.85	2.56	1.03
Prasinophyceae	-	-	-	-	-	-	2.56	2.06
Bacilillariophyceae	39.13	53.09	25.00	39.64	28.89	40.65	15.39	21.65
Coscinodisciphyceae	-	-	2.50	1.89	6.67	4.24	-	-
Fragilaphyceae	8.70	6.18	7.50	7.56	15.56	11.02	2.56	3.09

total items found (Table 2). Among the *P. longisrotis,* Dinophyceae *and crustacean* were the most abundant prey appearing in 46.15 and 17.95% of stomach analyzed and representing 52.58 and 11.34%, respectively of the total item found (Table2).

Among the class crustacean, the preferred prey by all the shrimp species except *P. kerathurus* was copepod (OCI = 2.75, 3.39 and 8.25% with FOC = 10.0, 10.0 and 40.0%). However, *D. pullux* was the most frequent prey species for *P. kerathurus* since it was present in 40.0% of the stomach analysed and 8.64% OCI (Table 1). In the Monogononta, *P. Kerathurus* had the highest frequency of occurrence of *Rotifera nepturis* prey specie present in 60.0% of the stomachs and 13.58% occurrence index compare to other three shrimps species (Table 1). Among the Dinophyceae, *P. longirostris* has the highest FOC of *C. furca* (70.0%), followed by *P. notialis* (FOC 60.0%). Thus showing *C. furca* as the mostly consumed by *P. longisrotis and P. notialis*. However, *P. kerathurus* does not take *C. fusus, C. hinundinella, C. decipiens, C. affines., C. danicum* and *C.. laciniosum* as food because it was not found in their stomachs when analysed (Table 2). The least prey consumed was the *C. laciniosum* (FOC=10.00 and 1.03% OCI) which was consumed by the *P. longirostris* alone (Table 2).

Fish eggs (Actinopterygii) were observed to be consumed by all the four shrimp species having highest FOC of 40.0% and OCI of 6.19% of by the *P.longirotris*. However, it was found to be consumed by *P. kerathurus* and *P. notialis* at the same FOC, 20.0 and 3.7% OCI (Table 2). *Leptomedusa,* was consumed by the *P. notialis* only at 10.0% FOC and 0.91% OCI respectively. Prasinophyceae, was also consumed by *P. longistrotis* only at a low percentage (FOC = 10.0%, OCI = 2.06%) as shown in Table 2. The class Bacilillariophyceae has different prey species of which *Coscinodiscus radiatus* and *C. excentricus* was found in all the stomachs analysed for all the shrimp species. *C. radiatus* was preferred by all the shrimp species with 80.0, 60.0, 60.0 and 10.0% FOC and 29.63, 23.85, 22.03 and 5.15% OCI for *P. kerathurus, P. notialis, P. atlantica* and *P. longistrotis*, respectively (Table 1). *C. lineatus* only occurred in the stomach of *P. longistrostis* at 30.0 % (FOC) and 9.28% (OCI) while *Ankistrodermis falcatus* had FOC 10% for the stomach analysed in both *P. notialis* and *P. atlantical* (Table 1). The class Leptomedusa was consumed by *P. notialis*. However none of this prey species was consumed by other shrimp species (Table 2). The class Fragilaphyceae occurs in all shrimp species at low percentages with variations among the species consumed and none in *P. kerathurus* (Table 2).

Comparing the diet of the four species, it was observed that *C. radiatus* and *C. excentricus* were found in the stomach of all the shrimps which shows that they all eat the prey and even prefers it most. This may actually be due to the fact that it is highly available across the locations of each shrimp's species. However, only the *P. longistrotis* consumes *H. viridis* which may as well be due to differences in their location as also observed in Leptomedusa above.

The result of the shannon index (H') indicates that the highest community diversity was discovered in *P. kerathurus* (2163.88), followed by *P. atlantica* (1665.71), *P. notialis* (1621.65) while the least value was obtained from *P. longirostris* (1539.16) (Table 1). The species of diet diversity in *P. kerathurus* is about 7.13% greater than the value obtained for *P. atlantica* and about 7.76 and 8.95% greater than value obtained for *P. notialis* and *P. longistrotis* respectively (Table 3). The Index of Relative Importance (IRI) for *C. radiatus* (2465.6), *C. excentricus* (1840.9) in *P. kerathurus* followed by *C. radiatus* (1476.6) in *P. notialis*. It was followed by *Ceratium furca* (1398.6) in *P. longistrotis*. This was followed by *C. radiatus* (1348.2) in *P. atlantica* (Table 2). These IRI values were the five orders of higher magnitude higher than IRI values for other prey items (Table 2).

Table 3: Highest community diversity of four shrimps specimens

	P.kerathurus		*P.notialis*		*P.atilantica*		*P.longirostris*	
Organisms	%F	PiLnPi	%F	PiLnPi	%F	PiLnPi	%F	PiLnPi
D. pullex	40.00	-147.56	-	-	10.00	-23.03	-	-
Water flea	80.00	-350.56	-	-	20.00	-119.83	-	-
Ostracod	-	-	10.00	-23.03	-	-	10.00	-23.03
Cladocera	-	-	20.00	-119.83	10.00	-23.03	-	-
Zoea larva/crab	-	-	10.00	-23.03	-	-	-	-
Copepod	-	-	10.00	-23.03	10.00	-23.03	40.00	-147.56
Amphipod	-	-	-	-	-	-	20.00	-119.83
R. nepturis	60.00	-245.66	-	-	20.00	-119.83	10.00	-23.03
C. furca	20.00	-119.83	60.00	-245.66	30.00	-102.04	70.00	-297.39
C .fusus	-	-	30.00	-102.04	10.00	-23.03	30.00	-102.04
C. hinundinella	-	-	-	-	10.00	-23.03	-	-
Fish egg	20.00	-119.83	20.00	-119.83	10.00	-23.03	40.00	-147.56
Leptomedusa	-	-	10.00	-23.03	-	-	-	-
Polychaete worm	-	-	20.00	-119.83	10.00	-23.03	10.00	-23.03
H. viridis	-	-	-	-	-	-	10.00	-23.03
C. radiatus	80.00	-350.56	60.00	-245.66	60.00	-245.66	10.00	-23.03
C. excentricus	80.00	-350.56	20.00	-119.83	50.00	-195.60	20.00	-119.83
C. conchinus	-	-	20.00	-119.83	20.00	-119.83	-	-
C .lineatus	-	-	-	-	-	-	30.00	-102.04
Nitzschia closterium	20.00	-119.83	-	-	-	-	-	-
C. sociale	20.00	-119.83	-	-	20.00	-119.83	30.00	-102.04
C. decipiens	-	-	10.00	-23.03	30.00	-102.04	20.00	-119.83
C. affines	-	-	10.00	-23.03	10.00	-23.03	20.00	-119.83
C. danicum	-	-	30.00	-102.04	10.00	-23.03	-	-
C. laciniosum	-	-	-	-	-	-	10.00	-23.03
A.falcatus	-	-	10.00	-23.03	10.00	-23.03	-	-
Guinardia flaccida	-	-	10.00	-23.03	-	-	-	-
Rhizosolenian shrubsolei	-	-	-	-	10.00	-23.03	-	-
R.stolterfettii	-	-	-	-	10.00	-23.03	-	-
Peridinium pellucidum	-	-	-	-	10.00	-23.03	-	-
Tabellaria flocculosa	-	-	20.00	-119.83	10.00	-23.03	-	-
T.fenestrata	20.00	-119.83	-	-	50.00	-195.60	10.00	-23.03
Thalossiothrix nitschioides	-	-	10.00	-23.03	10.00	-23.03	-	-
Asterionella Formosa	20.00	-119.83	-	-	-	-	-	-
ΣH^I	-----	2163.88 (1st)	-----	1621.65 (3rd)	-----	1665.71 (2nd)	----	1539.16 (4th)

(H^I) = - PiLnPi where ñi = %F

DISCUSSION

All the stomachs analysed contained one or more identifiable prey items. The four shrimp's species fed mainly on the Bacilillariophyceae (*C. radiatus, C. excentricus*) and the Dinophyceae (*C. sociale, C. decipiens, C. furca, C. fusus*) as shown in Table 2. This was which is also observed by Bello-Olusoji *et al.*[1] that larva of *M. vollenhovenii* were predominantly planktivorous with algae *(Nostoc, Coscinodiscus, Chaetoceros*) and diatoms. The crustaceans also formed a major part of the diet but were more importance in the diet of *P. notailis* and *P. antlantica*. This could be as a result of low level of availability of the diet in the location of *P.kerathurus and P.longistrotis*. *P. kerathurus* consumed mostly *D. pullex* among the crustaceans along with Bacilillariophyceae (*C. radiatus, C. excentricus,* Table 1 and 2) and less of Ostracod, Cladocera, Copepod, *C. hinundinella,* Leptomedusa, polychaete worm and *Amphipod*. Unlike other observation reported. It may be due to the fact that the availability of copepod, cladocera is at its minimum which makes the shrimps to feed on other prey species that were available, within its distribution range. The change in the diet can also be attributed to the migration of this shrimp's species into water where the available prey spectrums include more of crustaceans and Bacilillaiophyceae. It was observed in *P. notialis* that shrimps utilized a diversity of foods during their life cycle. It was found out it feed on Ostracod, Cladocera, Zoea larva, Copepod, *Ceratium furca, C.fusus*, Fish egg etc. Nearly all the observed prey were fed upon by this shrimp species. This observation was in line with Bello-olusoji *et al.*[10] and Hensinki[11].

However, *P. notialis* was observed to have a specie-specific feeding mode as observed, because *C. radiatus, polychaete worm, C. fusus* and *C. furca* were consumed at a higher rate. This shows that there is a higher signs of specie-specific in their feeding mode. *P. atlantica* also make good use of all the observed prey species but has a high preference for *C. radiatus* and *Tabellaria fenestrata*.

This was inline with the observation of Bielsa *et al.*[12]. *P. longistrotis* preys were generally observed to be high of copepods; *C. furca*, fish egg and *Chaetoceros* with less of other observed prey species. This also supports the views of Abuttena *et al.*[13] on the fauna composition of *P. monodon* culture pond in west coast of Peninsular Malaysia.

All the prey items observed in the four shrimp's species shows that there is a change in feeding habit from planktivorous to carnivorous. This was also supported by the observation derived from the study of various feeding habits exhibited by various matured prawns *M. rosenbergii* by Costa and Wanninayaki[14]. This shows that shrimps can function as primary consumer, secondary consumer and dentrivore in the aquatic environment; hence they are classified as omnivores. It was observed by Bello-Olusoji *et al.*[15] that bigger-sized shrimps fed on a wide variety of organism of both plants and also support the statement that shrimps can switch from one feeding mode to another when food availability changes[15].

The minimum increase in amount of plant matters indicated that adult shrimps relatively prefer it. This may be due to seasonality of abundance of prey species to predators availability that were fed by predator used for the experiment or effect of quick digestion. However, due to rapid digestion that takes place, not all eaten prey was easily identified.

Index of Relative Importance (IRI) of the highest magnitude recorded were *C. radiatus* was 2465.6, followed by *C. excentricus* -1840.9 in *P. kerathurus, C. radiatus* (1476.6) in *P. notialis, Ceratuim furca* (1398.6) in *P. longistrotis* and *C. radiatus* (1348.2) in *P. atlantica* (Table 1). Thus it revealed that these were preys that were highly consumed, more abundant in the different locations and readily available to the shrimp's species.

The Shannon index (H^1) indicates the highest community diversity among the prey species consumed by the four shrimp species as explained by[9] (Table 3).

This study has shown that penaeid shrimps are not selective in their feeding as seen also in penaeid prawns[16] which makes them to be mostly found in the fresh water environment and brackish water lagoons. Most shrimp's species appear to be opportunistic feeders consuming a large diversity of prey. However, shrimps generally move from being phytoplanktons feeders to carnivorous feeders.

The four shrimp species fed actively on both phytoplankton and zooplanktons as their diet changed remarkably from species to species which may be influenced by several factors e.g. prey availability, migration, specie distribution contents, relative abundance of preys and other factors.

CONCLUTIONS

The stomach analysis of the four shrimp species show that shrimps utilized a diversity of food during their life cycle that ranges from phytoplankton to zooplanktons which has high level of essential amino-acid that helps in rapid growths and development.

REFERENCES

1. FAO., 2000. FAO Year Book Fishery Statistics Capture Production/FAO Vl 86/1 Rome/Roma, pp: 713.
2. Adetayo, J.A., 1982. Food and feeding habits of pink shrimp (*Penaeus duorarum)*. NIOMR Report, NIOMR, Lagos, pp: 53.
3. Pinkas, L.M., S. Oliphant and I.L. Kinversion, 1971. Food habits of albacore, bluefin tuna and bonito in California water. Fish Bull, 152; pp: 105.
4. Hyslop, E.J., 1980. Stomach content analysis a review of methods and their application. J. Fish Biol. 17: 411-429.
5 Bello-Olusoji, O.A., 2004. Ecology and Aquacultural Potentials of two commercially Important fresh water prawns in Nigeria. J. Applied Sci., 7: 4479-4483.
6. Holthius, L.B., 1980. FAO SPECIES Cataloque Vol.1. Shrimps and Prawns of the World. An annotated cataloque of Species of interest to Fisheries. FAO Fish Synop; 1: 271.
7. Cortez, T., B.G. Castro and A. Guerra, 1995. Feeding dynamics of Octopus mimus (mollusca Cephalopoda) in northern Chile waters. Mar. Biol. 123: 497 -503.
8. Marioghae, I.E., 1987. An appraisal of the cultivability of Nigerian palamonid prawns. ARAC/87/WP/4
9. Powell, C.B., 1982. Fresh and brackish water shrimps of Economic importance in the Niger Delta. Abstract of National Conference in Agriculture, River State University of Science and Technology, Port-Harcourt.
10. Bello-Olusoji, O.A., A.M. Balogun, O.A. Fagbenro and N. Ugbaja, 1995. Food and Feeding Studies of African River Prawn *Macrobrachium Vollenhovenii.* In larvii 1995 Fish and Shell Fish Larviculture Symposium Lavens, P., E. Jaspas and I. Roelants (Eds.). Europ.Aquac SOC., Special Publication 24: 1425-427.

11. Helsinki, 2001. Food selection and feeding behaviour of Baltic sea mysid Shrimps.
12. Bielsa, L.W., R.K. Murdich and Labiskes, 1983 Species profiles life histories and Environmental requirement of coastal fishes and invertebrate (South Florida) pink Shrimp, US Fish and Wildlife Service Biol. Rep., 82: 21.
13. Abuttena, M.K.O., K. Hshamuddis F. Misri, K.K. Abdullah and Loo, 2004. Benthic fauna composition of *Penaeus monodon* fabricius culture pond in crest coast of peninsular Malaysia.
14. Coasta, H.H. and T.B. Wanninayaki, 1986. Food, feeding and fecundity of the giant fresh water prawn *M. rosenbergii* from natural habitat in Srilanka. In The first Asian Fisheries Forum, Maclean Dizon, J.L.L.B and L.V Hosillos (Eds.) Asian fisheries Society, manila Philippines, pp: 555-558.
16. Abby-Kalio, N.J., 1990. Feeding and predation in penaeid shrimps of the bony and new Calabar Estuaries at 8th fisheries society of Nigeria, Akure 1990.
15 Prince P.W., 1997. Insect ecology 3rd Edn., Wiley, NYM. South Altantic Viitasalo and M. Rautio, 1998. Zooplanktivores by *Praunus flexuosus* (Crustacea: Mysidacea): functional responses and prey selection in relation to prey escape responses. Mar. Ecol. Prog. Ser., 174: 77-87.