Diet Compositions of African Pike *Hepsetus Odoe* (Bloch) In Ikose/Iluju Reservoir, Oyo State, Nigeria

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***Abstract*— The Food habits and diets which *Hepsetus odoe* fortuitously eaten in Ikose/ Iluju Reservoir Oyo State Nigeria was investigated. A total of 90 fish specimens were examined between April 2013 and March 2014. The ratio of empty stomach among the total number examined was 9/90 (with 90% stomach contents. The species feed mostly on food of animal origin, although detritus/ substrates were also identified and its determination was not practicable. Food consumed was basically fin-fish of different genera and species including *Synodontis spp* 10(12.4%), *Barbus sp* 8(9 . 9 %), *Hepsetus odoe* 3(3.7%), Mormyrids 23(28.4%), Clarids 3(3.7%), *Schilbe mystus* 2(2.5%), *Tilapia spp* 15(18.5%) and Unidentified Cichlids 17(21.0%). Generally, the relative importance of the diet components of H. odoe include Cichlids with a total of 32 individuals with the less important being *Schilbe mystus* with 2 units. The studied species exhibited diets shift in relation to sizes and between seasons. The filial cannibalism tendencies by the fish are more pronounced in male specimens than female. *H. odoe* only consumed prey ≤ 20 cm SL., and the weight of food items in the stomach on the average was 1.85% of the body weight. There exist instances of prey-predator lengths ratio less than 40% and ratio of prey-predato lengths averaged 17.9%.**

***Index Terms*— Cannibalism; Diets, Feeding habits, *Hepsetus odoe*, Ikose/Iluju Reservoir.**

I. INTRODUCTION

Studies on the food and feeding habits of fishes are of much attention from various researchers all over the world. In Africa, a lot of researches have been carried out on African freshwaters [1, 2]. *Hepsetus odoe* , a species (Bloch) in the family *Hepsetidae* form an important component of the subsistence catch of local fisherman in the upper Zambezi (Zambia), Kafue (Zambia) and Okavango Delta (Botswana) flood plains, [3] but it is a major part of commercial fisheries in Ikose/Iluju Reservoir, Nigeria[4] . *Hepsetus* is one of the teleost that are of most diverse group of animals and dominated both marine and freshwaters [5]. *Hepsetidae* has *H. odoe* as the only species in African freshwaters and their culture in the developed world for sea ranching is inconceivable without pre- knowledge of their food and feeding habits. This paper reports findings of food and feeding habits of *H. odoe* in the Ikose/ Iluju reservoir, Oyo State, Nigeria. This information will perhaps enhance culture potential of the species and / or restocking and conservation exercises against extinction.

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II. MATERIAL AND METHODS

The Study Area

The fish specimens were collected from the Ikose/ Iluju Reservoir, Oyo State Nigeria. The Reservoir is a Man – made lake on River Oba at about 5 km West of Ogbomoso, Nigeria. The lake lies approximately between longitude $8^{0}05^{1}$ N to $8^{0}10^{1}$N and latitudes $4^{0}10^{1}$E to $4^{0}15^{1}$E. The catchment area of the lake is about 321 km^2 and the impoundment area is 138 hectares of water surface [6]. The lake was constructed in 1964 with normal pool elevation of 16.36 meters. The lake has an approximately gross storage of 6.8 million cubic metre (m^3) and subject to seasonal flooding.

Collection of samples

Samples of *Hepsetus odoe* were collected on a monthly basis for 12 months (April 2013) to March 2014) at Ikose/ Iluju landing sites; of cast net (active gear) fisheries of the artisanal fishermen. A total of ninety freshly caught specimens of varying size classes (small, medium and large) of 14.0 cm to 39.0 cm S. L were collected. On each day of sampling, the samples were strangulated, stored in ice crest and taken to the new Biology laboratory of Ladoke Akintola University of Technology Ogbomoso Nigeria for analysis.

Analysis of Samples

The standard lengths (beginning of snout to end of caudal peduncle) [7] were taken to the nearest 0.1 cm by the use of a measuring board. The fresh weight of individual was taken with a manual weighing balance of 20 kg to the nearest 0.1 g. The weight of each fish was matched against the corresponding length (cm) in the laboratory. With the aid of a pointed nose pair of scissors the abdominal portion of the fish were cut- open and the individual fish gut was carefully extracted. The gut (tip of esophagus to the end of the rectum) [8] was carefully removed by the use of forceps. The number of stomach containing each food item/ organism is expressed as percentage of non- empty stomach for percentage frequency of occurrence [9, 10]. The sex of each specimen was noted and recorded against the standard length and weight already taken.

Determination of food volume

The food volume of each gut was determined by displacement method [11]. It was carried out by placing 10 ml of distilled water in a 50 ml capacity glass cylinder. Individual gut was separately dropped in the
10 ml water contain in the glass cylinder. The gut displaced some quantity of water and the volume displaced was noted as

representing the food volume in the gut [11]. This was recorded and matched with the individual fish length and weight previously taken.

Preservation of Gut

Each gut was preserved in glass bottles containing 4% formalin for three days prior to the determination of diet components. The preservation of the guts in 4% formalin coagulates the diet components for easy identification [12,13]. The contents of each gut was extracted/ scraped with a spatula into a glass Petri dish and examined with both stereo microscope and hand lens.

Determination of Numerical abundance and Relative percentage of occurrence of diet components

The diet components from each gut were enumerated and the number noted for individual diet item or organism is expressed as a percentage of the total individual in all food items (relative percentage of occurrence).

The relative percentage occurrence of each diet components was calculated from the formula %RA=nx100/N [14]
Where;

%RA= relative percentage occurrence
n= number of individual diet components
N=total number of all diet organisms identified from the guts.

Determination of Condition Factor (K)

Condition factor (k) expresses the degree of well-being or corpulence of a specimen and expressed as

$K= W (100)/L^3$ [15, 16]
Where, K= condition factor
W= wet weight (g) of each specimen
L= length of fish (cm)

III. RESULTS

Diet Components

Table 1: Numerical abundance and percentage relative abundance of diet components in the gut of *H. odoe* in Ikose/Iluju Reservoir, Nigeria (April 2013- March 2014)

S/N	Diet components (items)	Numerical abundance	Relative abundance%
1	*Synodontis spp*	10	12.35
2	*Barbus spp*	8	9.88
3	*Hepsetus odoe*	3	3.70
4	Mormyrids	23	28.40
5	Clarids	3	3.70
6	Schilbe mystus	2	2.47
7	*Tilapia spp*	15	18.52
8	Unidentified cichlids	17	20.99
9	Detritus (substrate)	**	**
Total		81	100

** Determination not practicable

Quantitative assessment:
The gut of *H. odoe* throughout the Sampling period showed a total of 9 different diet components/ items. The assessment showed varying numerical abundance and relative percentage abundance; *Synodontis spp* 10(12.35%), *Barbus spp* 8 (9.88%), *Hepsetus odoe* 3 (3.70%), Mormyrids 23 (28.40%), Clarids 3 (3.70%), *Schilbe mystus* 2 (2.47%), Tilapia spp 15(18.52%), Unidentified cichlids 17 (20.99%) and Detritus (substrate) which could not be enumerated (Table 1). Confirm ably, a total of 81 individual diet components were encountered in the gut of the fish throughout the study period. The sum total of food item in the stomach shows that the food constitutes between 0.28% and 8.87% (mean 1.85%) of the body weight (Table 4).

Qualitative variations in food habits and diets:
The qualitative variations of the food organisms fortuitously eaten by *H. odoe* in the resident water body was examined
(i) in relation to size classes
(ii) between seasons

Food variations in relation to size classes

A total of 90 specimens were examined. The ratio of number of empty stomach among the total number examined was 9/90 (10%). The total length ranged from 16.0 cm to 48.0 cm, while the standard length varied from 13.5 cm to 38.5 cm. The body weight also varied from 50 g to 350 (Table 2).

SL< 180 mm:

Amongst the sampled specimens, the small size class has maximum length and minimum wet weight of 18.0 cm and 50 g respectively. Variations in numerical and relative percentage abundance were also observed among the diet components. The diet components and relative percentage abundance were *Synodontis spp* 7(50%), *Barbus. spp* 1 (7.14%), *Schilbe mystus* 1(7.14%),*Tilapia spp* 2 (14.28%), unidentified cichlids 3 (21.43%) and Detritus (substrate) which could not be determined (Table 2).

SL 181- 240 mm

From the sampled specimens, the specimen between 181 mm and 240 mm S. L were classified as medium size. A total of 6 different diet components were recorded in the gut of medium size class. Similar variations in numerical and relative percentage abundance were also observed in the diet of the species during the study period. These were *Synodontis spp* 3 (6.67%), *Barbus spp* 7 (15.56%), Mormyrids 20 944.44%), *Schilbe mystus* 1 (2.22%), *Tilapia spp* 9(20.0%), unidentified cichlids 5 (11.11%) and detritus (substrate) (Table 2).

SL > 240 mm:

A total of 6 different diet components were noted in the specimen greater than 240 mm. The diet components with

their respective numerical and relative percentage abundance were *Hepsetus odoe* 2 (9.09%), Mormyrids 7 (31.82%), Clarids 3 (13.64%) *Schilbe mystus* 1 (4.56%), *Tilapia spp* 5 (22.73%) and unidentified cichlids 4 (18.18%) (Table 2).

Table 2: Diet compositions, numerical and Relative percentage abundance of diet compositions observed in the gut of *H. odoe* aggregated by size class; small (< 180 mm S.L), Medium (181-240 mm Large (>240 mm S.L) from Ikose /Iluju Reservoir, Nigeria

S/N	**Diet components**	**Small size (<180mm SL)**	**Medium size (181-240mm SL)**	**Large size(>240mm SL)**
1	*Synodontis spp*	7 (50)	3(6.67)	0(0)
2	*Barbus spp*	1 (7.14)	7(15.56)	0(0)
3	*Hepsetus odoe*	0 (0)	0(0)	2(9.09)
4	Mormyrids	0 (0)	20(44.44)	7(31.82)
5	Clarids	0 (0)	0(0)	3(13.64)
6	*Schilbe mystus*	1 (7.140)	1(2.22)	1(4.56)
7	*Tilapia spp*	2 (14.28)	9(20.0)	5(22.70)
8	unidentified cichlids	3(21.43)	5(11.11)	4(18.18)
9	Detritus (substrate)	**	**	-
Total		**14(99.90)**	**45(100)**	**22(99.99)**

** Determination not practicable.

Food Variations between Seasons

The diet components of the species in wet season were recorded. Variations in numerical and relative percentage abundance were also observed. As depicted in table 3, the diet components with their respective numerical and relative percentage abundance were *Synodontis spp* 2(4.9%), *Barbus spp* 1(2.4%), *Hepsetus odoe* 2(4.9%), *Mormyrids* 3(7.3%) *Clarids* 3(7.3%), *Schilbe mystus* 1(2.4%), *Tilapia spp* 26(63.4%), unidentified cichlids
3(7.3%) and Detritus (substrate) (Table 3). Similar variations in numerical and relative percentage were also observed in the diet of *H. odoe* during the dry season of study period. These were *Synodontis spp* 3(7.5%),
Barbus spp 5(12.5%), *Hepsetus odoe* 7(17.5%), Mormyrids 12(30.0%), Clarids 1 (2.5%), *Schilbe mystus*
3(7.5%), *Tilapia spp* 4(10.0%), unidentified cichlids 5(12.5%) and Detritus (substrate) (Table 3).

Table 3: Diet composition, numerical and relative abundance observed in the gut of *H. odoe* in Wet and Dry seasons at Ikose/ Iluju Reservoir, Nigeria

S/N	**Diet components**	Wet season	Dry season
1	Synodontis spp	2(4.9)	3 (7 . 5)
2	Barbus spp	1(2.4)	5(12.5)
3	Hepsetus odoe	2(4.9)	7(17.5)
4	Mormyrids	3(7.3)	12(30.0)
5	Clarids	3(7.3)	1(2.5)
6	Schilbe mystus	1(2.4)	3(7.5)
7	Tilapia spp	26(63.4)	4(10.0)
8	unidentified cichlids	3(7.3)	5(12.5)
9	Detritus (substrate)	**	**
Total		41(99.90)	**40(100.0)**

** Determination not practicable

Index of relative importance of the diet components of *H. odoe*

Cichlids were the most important diet components of the species during the study period with a total of 32 individuals while the less important species is *Schilbe mystus* with 2 individuals (Table 1). Seasonally, during wet season the food habits or diet components of the species followed the same trend with a total of 29 individuals of combined *Tilapia spp* and unidentified cichlids (Cichlids). There was diet shift during dry season. *Mormyrids* were the most important diet components with a total of 12 individuals, with less important being *Clarids* with a only one individual (Table 3).

Prey- predator Lengths Ratio

In this study, observable preys were measured. The prey-predator lengths ratio ranged from 9.5 to 51% with a mean of 17.9%.

Table 4: **Mean length of prey and Percentage of prey-predator lengths Ratio in the gut of *H. odoe* from Ikose/Iluju reservoir, Nigeria (April 2013-March 2014)**

Size of fish length(cm)	No of fish Caught	No of fish with prey in Stomach	Average length of prey(cm)	% of prey-predator length
14.0	2	2	3.5	25.0
16.0	3	3	5.7	35.6
18.0	16	13	4.1	22.9
20.0	14	12	3.5	17.9
22.0	17	15	4.2	19.4
24.0	15	15	2.3	9.5
26.0	12	11	3.4	13.1
28.0	7	6	6.5	23.2
30.0	-	-	-	-
32.0	1	1	11	34.4
34.0	1	1	12.6	37.1
36.0	1	1	13.4	37.2
38.0	-	-	-	-
39.0	1	1	20	51.3

IV. DISCUSSION

Examination of the gut contents of *H. odoe* showed that the

species feed exclusively on fishes including *Synodontis spp, Barbus spp*, *Hepsetus odoe*, *Mormyrids, Clarids*, *Schilbe mystus*, *Tilapia spp* and *Cichlids*. Detritus was also consumed by small size and medium size classes of the species. About 9 different diet components were observed in the gut of the species during the investigation. However, there was significant diet shift based on the aggregated size class of the species. Diet components like *Hepsetus odoe*, *Mormyrids, Clarids* and *Schilbe mystus* were not common in the gut of the small size of the species throughout of the study months (periods). Likewise, small and medium size classes lack diet components like *Hepsetus odoe and Clarids* in the gut. The large size class exhibited filial cannibalism and did not encounter *Synodontis spp* and *Barbus spp* as diet components in the gut. Seasonally, all diet components were encountered during wet and dry seasons throughout the study period.

The availability or otherwise of these diet components might be due to size selection of diet by the species. There has been a lot of information on the quality of food consumed by different species [17, 18, 19, 7]. [17] found that the food in the stomach of *Tilapia guineensis* constitutes on the average 0.17% of the body weight. [7] also obtained 0.49% Tilapia mariae with higher feeding intensity when compared with other Tilapia species. The result (1.85%) obtained in this study indicated that *H. odoe* shows highest feeding intensity comparatively. This may not be unconnected to the difference in foraging mode (feeding system). *Hepsetus odoe* feeding success depends upon adaptive features of well-developed teeth, ambushing predators, clear vision, and ability to pursue and catch prey [2]. In any aquatic ecosystem, the main feeding habits of any fish are an indicator of where such fish live [20]. The presence of detritus in the small size class gut of the species indicated that the fish small size inhabits aquatic vegetated banks where they easily seek support and cover against predators. The (detritus) might have been incidental diet components which were obtained alongside the main diet components eaten by the fish in the resident water body. [21] reported wide distribution of African pike in the Kafue River drainage of Zambezi, where *Hydrocynus* is historically absent. In the same vein, [3] in Zimbabwe, [2] in Zambezi River, [22] in the Okavango Delta Botswana associated the restriction of African pike to the quiet vegetated area near the bank of river (inshore) to the threat of predation. [4] also reported wider distributions pattern of African pike in Oba reservoir of Nigeria.
The diets shift from one particular food habits to another during the study as indicated by the availability or otherwise of a particular diet component in the gut of the species based on the size class and between seasons; is a general process which might be the period the diet components are available in the resident water body or the process of ontogenesis in organism [2, 10].

A variation in the numerical abundance of the diet components consumed by *H. odoe* was also observed in size classes and between seasons. There were 14 in small size, 45 in the medium size and 22 in the large class size. However, wet and dry seasons witnessed 41 and 40 numerical abundance of the diets components respectively. The variations might have been as a result of high productivity level of the water body and an increase in the abundance and composition of food items in wet and season and a reduction in one or more food items consumed by the species in the dry season. The preference to a diet component or group of components shown by the studied species is a biological strategy which silenced competition over available food resources within a species [23]. As a result, the absence of a particular food organism in the gut of *H. odeo* at one stage and the reappearance at another stage of development is a biological process or phenomenon in food and feeding ecology of fin fishes in their natural ecosystem. This observation is in consonance with the report of [24] on some aspects of the food and feeding habits of *Ilisha afrcana* from Qua Iboe River estuary, Nigeria; [25] when reporting on the food, feeding and the condition factor of the estuarine catfish *Chrysichthys nigrodigitatus* of the Cross River, Nigeria.

In Ikose/ Iluju Reservoir, prey-predator lengths ratio showed that *H. odoe* feed mostly on fish less than 20 cm S.L. This result is not in line with the earlier findings by [26] who reported prey fish less than 25 cm S.L. in Kafue flood plain of Zambia. Also, this study shows instances where prey was greater than 50% predator length; and several instances of prey-predator length ratios of less 40%. This result is in line with those of [26, 2] respectively. This study clearly shows direct relationship in the size of predator and that of food items consumed. While there is variation in the number of food items eaten by predator of different sizes.

The index of relative importance of the diet components were noticed to vary during the study period. The seasonal and classical rhythms in the relative percentage abundance and index of relative importance (IRI) of the diet components showed Cichlids (*Tilapia spp* and unidentified cichlids) as the most consumed diet component with 29 individuals which formed 70.73% of the diet of *H. odoe* in rising water period (wet season), with *Barbus spp* and *Schilbe mystus* being the least with 1 individual each (2.4%); Mormyrids 12 (30.00%)in the dry season, with Clarids being the least with 1individual which formed 2.50% of the diet of the species. The classical size of <180 mm S. L showed *Synodontis spp* with 7 individuals which formed 50.00% as the most consumed diet components; with *Barbus spp* and *Schilbe mystus* being the least with 1 individual each (7.14%).In the medium size class of 181- 240mm S. L, Mormyrids has 20 individuals as index of relative importance which formed 44.44% relative percentage abundance (IRI) of the diet components; with *Schilbe mystus* being the least with 1 individual (2.22%).Large size class of >240 mm S. L has Cichlid(*Tilapi spp* and unidentified cichlids)of 9 individuals which formed 40.91% of the consumed diet components by the species in the resident water body. The filial cannibalism is associated with large size class and its preference food item(s) followed the same trend with wet season. Finding in this study indicates that *H. odoe* species habitually feed on diet components of animal origin (fin fish); the species is thus an exclusive piscivore. There is qualitative connection between *Hepsetus odoe* and food organisms; the studied species consumed diet less or equal 20 cm S. L.

V. Conclusion

This study shows that, the prey is abundantly available though diets were less similar between season (diets shift). This could be due to differences in prey compositions in

different micro habitats occupied by the studied species. The historical foraging mode of *H. odoe* favours the species in highly structured environment than in open water or less structured micro habitats.

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