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Preliminary Study on the Food and Feeding Habits of *Raiamas senegalensis* (Steindachner, 1870) from Chakawa Reservoir, Mayo – Belwa, Adamawa State, Nigeria

Ali, M. E. [1&5]; **Danba, E. P.** [2]; **Useni, S. S.** [1]; **Nandom, N.** [3]; and **Dauda, I.** [4]

[1]National Biotechnology Research and Development Agency, Billiri, Gombe State, Nigeria. [2]Department of Biological Sciences, Taraba State University, PMB 1167 Jalingo, Taraba State, Nigeria. [3]National Biotechnology Research and Development Agency, Bogoro, Bauchi State, Nigeria. [4]National Biotechnology Research and Development Agency, Tunari, Taraba State, Nigeria. [5]Department of Fisheries, Modibbo Adama University, Yola, Adamawa State, Nigeria.

Corresponding author: mealikumbo@gmail.com

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Abstract

Food and feeding habits of *Raiamas senegalensis* from Chakawa Reservoir, Mayo – Belwa, Adamawa State was evaluated monthly for a period of one year. A total of 72 samples of *R. senegalensis* were collected, washed with clean water and preserved in ice crest to minimize any post – mortem changes, taken to the laboratory for stomach contents analysis, where stomachs were preserved in formalin solution of about four percent (4%). Stomach contents of each sample were identified and analysed using the numerical and frequency of occurrence methods. The diet of the *R. senegalensis* constituted of fish materials, insects, other materials such as sand particles and unidentified worms, plant materials which was the remains of plants, phytoplankton and zooplankton. Numerical analysis showed that insects were dominant and composed of 71.53% of the group of food items in the stomach, zooplankton 11.52%, other materials (unidentified worms) 8.15%, plants materials (remains of plants) 4.47%, phytoplankton 3.41% and fish materials were the least with 0.92%%. Frequency of occurrence indicated that *Cullicoides spp.* larvae were dominant and found in 58.82% of the stomach, *Cullicoides spp.* pupae, remains of insects and *Nauplius spp.* all in 57.35%, while the least was *Barbus spp.* in 19.11%. Findings from this study indicated that *R. senegalensis* is a predatory fish feeding mostly on insects, but also consumes fish, plants, phytoplankton and zooplankton. hence, could be considered as carnivore – insectivore. Further study should be carried out on the food and feeding habits of *R. senegalensis* from other freshwater bodies in Nigeria.

Keywords: Feeding Habit, *R. senegalensis*, Carnivore, Insectivore, Chakawa Reservoir.

Introduction

Raiamas senegalensis (Steindachner, 1870) also knowns as the silver fish or Senegal minnow belongs to the order Cypriniformes, family Cyprinidae and genus *Raiamas* (N'zi *et al.*, 2014). Olaosebikan and Raji (2013) reported the occurrence of only two species of the genus *Raiamas* in the freshwater bodies of Nigeria, these are *R. senegalensis* and *R. nigeriensis*

(Daget, 1959). Some of the distinct features of *R. senegalensis* include the body is coloured bright silver, the back grey and the belly white. The pectoral and ventral fins are transparent and the anal fin is sometimes reddish. The upper lobe of the caudal is yellowish orange and the lower one is bright orange or red. There are bluish black vertical bars on the flanks (Reed *et al.,* 1967). Olaosebikan and Raji (2013) reported the maximum length of about 245 mm standard length in Nigerian. *R. senegalensis* inhabits the freshwater lakes, reservoirs, rivers and streams. Olanrewaju *et al.* (2017) reported the occurrence of these fish species at Lake Alau, Borno State, Northern Nigeria and Olorunpomi *et al.* (2020) at Ikere Gorge – lake, Oyo State, Southern Nigeria. However, its contribution to the animal protein sources within many freshwater bodies of Nigeria is not significant, but it is widely used in aquarium and aquarium trades. Little or no data has been published concerning the food and feeding habits of *R. senegalensis* from the freshwater bodies of Nigeria despite the wide distribution of these fish species in the inland waters of Nigeria. The main objective of this study was to determine the food and feeding habits of *R. senegalensis* from Chakawa Reservoir, Mayo – Belwa, Adamawa State.

Materials and Methods

Study area

Chakawa Reservoir is located at Mayo – Belwa local government area, Adamawa State of Nigeria. Mayo – Belwa LGA lies within latitude 9° 3′ 0′ north and longitude 12° 3′ 0′ east. It covers an area of 1768km² (682.63 sq. m) and is 75 km away from Yola, the state capital.

Specimen collection

A total of 72 specimens of *R. senegalensis* were obtained from monthly sampling for a period of one year, from December 2021 to November 2022. Fishing was done using gill nets as the fishing gear and canoe was used as fishing craft. The fish specimens were washed with clean water and preserved in ice crest to minimize any post – mortem changes and taken to the laboratory for analysis of the food contents.

Laboratory analysis of specimen

Each specimen was weighed to the nearest 0.01g using a top loading Sartorius balance (model BP310S) and standard length was measured in centimetres (cm) using measuring board. The specimen's body cavity was opened using a pair of scissors, beginning ventrally from the anus to the mouth, the entire visceral and intestinal organs such as the liver, fat and other organs attached to the intestine and stomach were gently removed and emptied into a dish, the length and weight of the stomach were measured and recorded. Thereafter, the visceral and intestinal organs were kept in formalin solution of four percent (4%) to avoid any form of deterioration and contamination of the stomach contents (Yusuf *et al*., 2023). The stomach contents were dissected using a pair of scissors and the complete stomach contents were emptied into petri – dish for examination and identification based on the work of Ali *et al*. (2024). The random samples of the stomach contents were taken

and dropped on a slide (counting chamber) with the aid of a dropping pipette and viewed under a light microscope. The general views were made with a binocular dissecting microscope Olympus SZ51 (0.80 – 4x). The stomach contents were studied and recorded. The stomach contents of each of the *R. senegalensis* samples were analysed using the numerical and frequency of occurrence methods as described by Balogun (2006).

In the numerical method (NM), the number of individuals in each food category was expressed as a percentage of the total individuals in all food categories:

$$NM\ (\%) = \frac{Total\ no.\ of\ a\ particular\ food\ item}{Total\ no.\ of\ all\ the\ food\ items} \times 100$$

In the frequency of occurrence method (FO), all stomach containing food were recorded and expressed as the percentage of the total number of stomachs examined:

$$FO\ (\%) = \frac{No.\ of\ stomach\ with\ a\ particular\ food\ item}{Total\ no.\ of\ fish\ examined\ with\ food\ in\ the\ stomach} \times 100$$

Statistical analysis

Data collected were analysed using descriptive statistics.

Results

Results from the 72 specimens of *R. senegalensis* collected from Chakawa Reservoir are given as follows: 43 specimens representing 59.72% had their stomach full with food while 25 individuals representing 34.72% were observed to have a half – filled stomach and 4 individuals representing 5.56% were observed to have an empty stomach (Table 1). The relative contributions of the food items are expressed by the numerical and frequency of occurrence methods. Six major groups of food items constituted the diet of *R. senegalensis* from Chakawa Reservoir. In the numerical method, insects were the dominant and composed of 71.53% of the group of food items in the stomach, zooplankton made up 11.52%, other materials (unidentified worms) were 8.15%, plants materials (remains of plants) 4.47%, phytoplankton 3.41% and fish materials were the least with 0.92%. In the frequency of occurrence method *Cullicoides spp.* larvae were dominant and found in 58.82% of the stomach followed by *Cullicoides spp.* pupae, remains of insects and *Nauplius spp.* all in 57.35%, while the least was *Barbus spp.* in 19.11% (Table 2).

Table 1: Stomach Fullness of *R. senegalensis* from Chakawa Reservoir

No. of Full Stomach	Percentage of Full Stomach	No. of Half Stomach	Percentage of Half Stomach	No. of Empty Stomach	Percentage of Empty Stomach
43	59.72%	25	34.72%	4	5.56%

Table 2: Stomach Contents of *R. senegalensis* from Chakawa Reservoir

Food items	Numerical method		Frequency of occurrence method	
	Number of Items	Percentage (%)	Number of stomachs	Percentage (%)
Fish materials:				
Barbus spp.	27	0.52	13	19.11
Fish parts	21	0.40	16	23.52
Insects:				
Anax spp. nymph	147	2.77	24	35.29
Chaoburus spp. Larvae	834	16.11	35	51.47
Chaoburus spp. Pupae	346	6.69	34	50.00
Chironomus spp. larvae	542	10.48	36	52.94
Chironomus spp. pupae	213	4.11	38	55.88
Cullicoides spp. Larvae	628	12.13	40	58.82
Cullicoides spp. Pupae	179	3.45	39	57.35
Remains of insects	817	15.79	39	57.35
Other materials:				
Sand particles	_	_	26	33.33
Unidentified worms	422	8.15	31	45.58
Plant materials:				
Remains of plants	231	4.47	19	27.94
Phytoplankton:				
Chlorella spp.	43	0.83	16	23.52
Diatomella spp.	49	0.94	17	25.00
Oscillatoria spp.	41	0.79	13	19.11
Phacus spp.	44	0.85	19	27.94
Zooplankton:				
Arcella spp.	82	1.59	31	25.41
Centropyxis spp.	89	1.71	37	54.41
Daphnia spp.	83	1.60	33	48.52
Diaptomus spp.	89	1.71	36	52.94
Moina spp.	85	1.67	34	50.00
Nauplius spp.	87	1.68	39	57.35
Rotaria spp.	81	1.56	30	44.11

Discussion

Analysis of the stomach contents indicated that the food items of *R. senegalensis* from Chakawa Reservoir consisted of fish materials, insects, other materials such as sand particles and unidentified worms, plant materials which was the remains of plants, phytoplankton and zooplankton being the most frequently consumed. Findings from the food and feeding habits of *R. senegalensis* from Chakawa Reservoir indicated that insects were the most preferable food items with an occurrence of 71.53% of the examined specimens through the numerical method. This fish species is predatory in nature, consuming mainly insects but also include fish (0.92%), plants (4.47%), phytoplankton's (3.41%), zooplanktons (11.52%) and unidentified worms (8.15%) also as preys in their food through the numerical method. They should be considered as carnivore with an insectivore tendency. However, a negligible fraction of sand particles was also found in very few stomachs. This could be understood to be accidental probably due to the voracious character of the species that swallows some sand when attacking its prey or may be the species is feeding directly on substrates, but the contribution sand to the nutrition of this species is not clear. The Findings about food and feeding habits of *R. senegalensis* from Chakawa reservoir in this study corroborated the findings of N'zi *et al.* (2014) who reported that diet of *R. senegalensis* from Bandama River Côte d'Ivoire composed of two categories of preys: fish and insects. However, this study indicates that juveniles and adults of *R. senegalensis* utilize insects, plants, phytoplanktons and zooplanktons as food while adults also consumed fish. The observed variations in the food items of adults and juveniles indicated age-specific dietary preferences in order to avoid intra-specific competition for available food. This is possibly an important strategy for survival and an advantage over the fish species competing for a specific food item. Reed *et al.* (1967) reported that as fish grow, they are able to feed on bigger preys, and larger prey becomes more profitable. In the process of fish growth, increasing prey size often resulted to taxonomic changes and these changes are revealed as ontogenetic diet switches (N'zi *et al.*, 2014).

Conclusion

Findings from this study indicated that the *R. senegalensis* from Chakawa Reservoir is a predatory fish which feed mostly on insects, but also consumed fish, plants, phytoplanktons and zooplanktons as second preys (food items) in their diets. However, they are considered as carnivore with an insectivore tendency.

Recommendations

Based on the findings of this research the followings were recommended:

- Further study should be carried out on the food and feeding habits of *R. senegalensis* from other freshwater bodies in Nigeria in other to compare and contrast with the findings from this study for ascertaining the true feeding habits of the fish.

- Further research should be carried out on the reproductive habits of this fish species as well.

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