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Full Length Research Paper

Habitats and food habits of *Protopterus annectens* (Owen 1839) on the lower Benue river basin

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40 specimens of *prototerus annectens* were obtained from Abinsi fishing ground in July 2018 from fishers on special arrangements to collect them immediately after catch; most of the fishes were caught from the cut-off lakes and swamps of the lower Benue river basin around Guma local government area of Benue state. The food materials in the fish stomachs were identified and the stomach contents were analyzed using frequency of occurrence (%). Food items found and the % frequency shows, plants to be 24.16 fish parts 6.12, sand/mud 33.07, crustaceans 8.57 insects 8.13, worms 0.22 cyst 0.11 detritus 6.12 unidentified items 13.47%. The numerical method of frequency of occurrence (%) showed 32.42, 16.35, 32.21, 4.90, 2.79, 0.73, 0.15, and 6.30. The fish has preference for lentic waters (stagnant swamps and lakes habitats), it is hardy and can tolerate extreme conditions of low oxygen content and low water level to complete drought conditions, it is highly recommended for aquaculture farm fish especially in earthen fish ponds. Further studies are also required to assess their feeding adaptation, nutritional requirements, feed conversion ratio and growth rate.

Keywords: Habitat, food habits, Benue River basin

INTRODUCTION

The lower Benue River as defined by Reid and Sydenham, (1979) as the Benue River Basin downstream of the faro Benue confluence, an area, which is contained within the Federal Republic of Nigeria. The study was carried out in the cut-off lakes on the positions of 8° 31'N and 7° 35'E (Figure 1). The lower Benue strongly flows through an extensive alluvial plain which stretch for many kilometres along the river route. The river's largest tributary is the Mayo Kébbi, which connects it with the Logone River during floods. Other tributaries are Taraba River, Donga and Katsina-Ala Rivers. The fish, *protopterus annectens* (Richard Owen, 1839) is a single species in the genus Protopterus and the family Lopidosirenidae, also commonly known as African lungfish it is the only species found in West Africa of the primitive family of lopido sirenidae. They are survivors from a very ancient group only remotely related to modern fish and in fact the only representative of the cartilaginous fresh water fishes in the class Chondrichthyes, this is also highlighted by Ipinijolu et al (2004), Ikomi, (1996), and Laevastu, (1965).

The elongated, sub-cylindrical body comes to a point at the tail where the dorsal and anal fins meet. Its paired fins or limbs are peculiar, long and slender, rope-like appendages with a dermal fringe consisting of very thin rays, especially on the front pair. The body is covered with thin cycloid scales which are completely embedded in the slimy skin.

Protopterus annectens possess a pair of true lungs which are used for breathing seemingly in preference to their gills and when kept in a well-oxygenated aquarium they will nevertheless surface occasionally to take a gulp of air. The nostrils are situated under the upper lip and are concealed when the mouth is closed. The cloacal opening is at the base of the pelvic fins. At the young stage, the fish has external opercular gills.

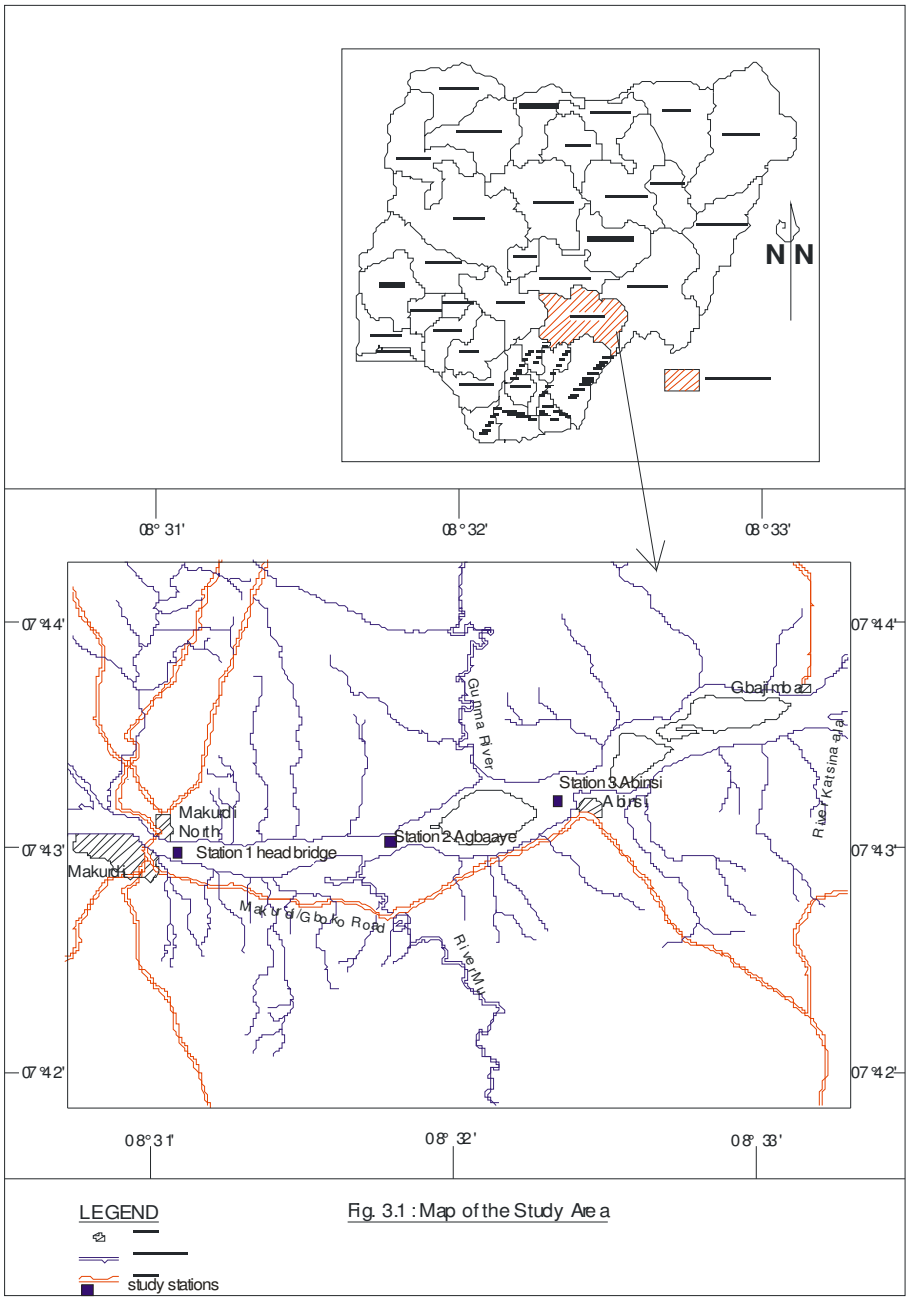

Figure 1. Map of Nigeria and the study area.

The body is grayish-black in colour, darker on the back and lighter ventrally. There are many dark spots and blotches which are large on the back and small on the belly (Holden *et al.*, 1972). Protopterus spawn in the swamps during the wet season and a few specimens examined during June and July contained well-developed ovaries. The eggs which number only several hundreds as observed by Reed *et al.* (1967)) and Needham et al. (1962) are white in colour and about 4 mm diameter, lungfish build nets in which the eggs are laid. It has been recorded that the young are cared for by the males.

They have reputation for feeding on frogs, fish, mollucks and plant seeds, which their strong jaws and solid teeth forming powerful bony ridges in each jaw are well suited for cracking (Reed et al., 1967). The lungfishes are found only in swamps and small creeks, some of which are completely dry for severed months of the dry season.

When this happens they bury themselves in a built cocoon from mud and the copious slime secreted by their own skin, and in this they can survive for many months without water until the onset of another wet season, when the cocoon dissolves to release them from their self-made shelter. The cocoon has a small opening near the mouth and lungfish aestivate in a curled position, with the tail near to the mouth. This specie grows to a length of about 1 metre and could weigh up to 10 kg (Reed, 1967) *Protopterus annectens* is a commercially valued fish by consumers in Benue state so fish sellers press high cost on it.

Many fishes have been recommended for aquaculture farming but it is not yet recommended to our knowledge, this study intend to reveal most of its biological qualities to see if it could be used as aquaculture farm fish. The main objective of this study is to know the ecology and feeding habit of *Protopterus annectens* with a view to enlisting it among farm cultured fishes in Aquaculture.

MATERIALS AND METHODS

40 specimens of *P. annectens* were obtained from Abinsi fishing ground in July 2018 from fishers on special arrangements to collect them immediately after catching the fish. Most of the fishes were caught in from the cut-off lakes and swamps of the lower Benue river basin around Guma local government area of Benue state. The samples were examined fresh, and transported to the Biological Science Laboratory of Akperan Orshi College of Agriculture Yandev Gboko Benue State. The stomachs were preserved for detailed laboratory examinations in the laboratory. A total of twenty (20) specimens were examined. The total length (TL cm) of each sample was measured; gut of the fish was removed by making a longitudinal incision along the mid ventral line from the mouth to the anus to expose the visceral organ. The gut was removed carefully by detaching it from the abdominal cavity and other internal organs. The gut length (GL) was then measured to the nearest cm on a graduated measuring board. The stomach was cut off from the gut and weighed on an electric top-loading sensitive balance (Sartorius) to obtain the stomach weight (SW). The stomachs were scored 0,25,50,75, and 100% according to its fullness as described by Olatunde, (1979). Each stomach was split open and the content emptied into a petri-dish. The contents were then observed under magnifying hand lens for larger particles monocular microscope. The food materials were identified with the aid of keys provided by Mellanby, (1975); Odum (1975) and Standard methods 15th edition (2005). The stomach contents were analyzed based on the frequency of occurrence and numerical method as described by Hynes, (1950). Each food item was identified and number of stomachs in which each food occurs was counted and expressed as a percentage of stomach containing food.

That is P= (b/a) x100

Where a= total number of fish examined with food in the stomach.
b= number of fish containing a particular food item,
p= percentage of occurrence of each food item.

The relationship between the fish TL and GL was computed using a linear regression model GL= a + bTL where GL is Gut length (cm) TL is fish total length (cm) and b is a constant as exponent.

RESULTS AND DISCUSSION

Food contents analysis for the fullness of stomach showed that 92.5% had food contents while 7.5 % were empty stomachs as shown in (Table 1). The percentage of stomach with food was highest in August and lowest in October.

The analysis of stomach content for prototerus annectens, using frequency of occurrence (%) for food items based on its frequency of occurrence shows as follows; that, plants 24.16 fish parts 6.12, sand/mud 33.07, crustaceans 8.57 insects 8.13, worms 0.22 cyst 0.11 detritus 6.12 unidentified items 13.47% (table 2 and Figure 2). The numerical method of frequency of occurrence (%) showed 32.42, 16.35, 32.21, 4.90, 2.79, 0.73, 0.15, 6.30 abundance and good feeding habits. This result shows the need to preserve the fish samples immediately after capture. The result on the fish stomach content analysis shows the food preference of *P. annecten* in natural ecosystem, which may be useful in satisfying their food requirement under pond management. This diversity of food substances identified in both aquatic and terrestrial origin depend on the availability and is influenced by seasons, size class and water body.

The gut length ranged from 17.40 cm in an individual that measured 26.1 cm length to 46.50 cm in another that measured 43.1 cm total length, the mean gut length was 30.10±4.44 SD, Mean TL =28.21±4.04SD. The fish total length to gut length ratio was TL= GL 1:1.2 the gut lengths appeared to be of medium size. The correlation coefficient for the relationship between the total length and gut length was GL =3.16+57TL (r=0.68; se (b) =0.04) and P (0.01). The variety of food substances found in the stomach of *Protopterus annectens* shows that the species is an omnivore feeding on animal materials such as fish remains, crustaceans, insect parts annelids and plants food substance such as leaf plants, phytoplankton diatoms and plants tissues. Items such as sorghum grains and rice grains were also found. These may have been washed into the river from nearby farms close to the water body. This agrees with the reports of early investigation on the species from other places that protopterus are primary omnivorous Jonnels and Svensson,

Table 1. Assessed stomach fullness for species.

Stomach fullness	Samples	Percentage
0 (empty)	3	7.5
25	7	17.5
50	19	47.5
75	11	27.5
100	40	100.00

After Lagler (LAGLER, (1978).

Table 2. Frequency for food classes in stomach content.

Food item found	Percentage	Numerical percentage
Sand /mud	33.07	-
Plant materials	24.16	32.42
Unidentified	13.47	0.15
Crustaceans	12.73	32.24
Fish/fish parts	10.12	16.35
Insects	8.13	4.90
Detritus	6.12	6.30
Worms	0.22	2.79
Cyst	0.11	0.73
Total	100.00	

After Lagler (Lagler (1978).

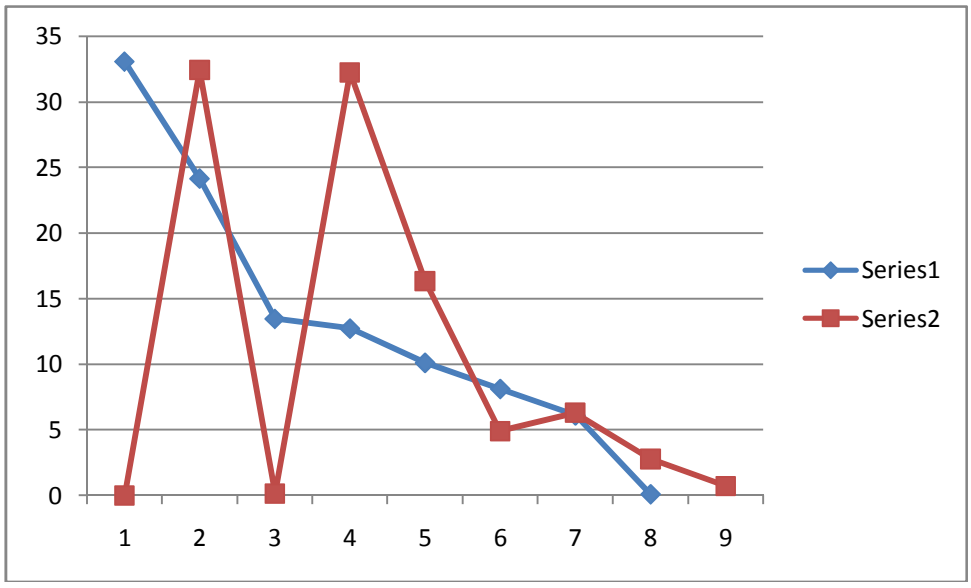

Figure 2. Comparative percentage and numerical composition of feed in stomachs Blue is percentage comp, Red is numerical composition.

(1954); Daffalla et al., (1985) and Shinkafi, (2008). Kees *et al.* (2002) reported that *P. annectens* in Lake Victoria showed selective preference for mulluscan diets, other studies like Shinkafi, (2008) shows *that P. annectens* in River Rima had preference for feeding on other fishes. Smaller fish samples of showed more indication towards leaf parts than larger samples, while samples > 30 cm exhibited a more versatile feeding nature. This indicate that the food preference of *P. annectens* change with age as they bigger and stronger, this characteristic is also exhibited by one of the most farmed fish (*Clarias gariepinus)* (Ayinla and Faturoti, 1990). The presence of

more full stomach and wider variety of food substances during these seasons may probably be due to explosive growth of plants, insects and fishes. Lowe- Mcconnel, (1975) observed that many fishes eat variety of food that are sometimes ingested with porter indigestible materials such as mud which they often influences gut length. Perhaps the presence of canine and bony ridge teeth is clear indication for breaking and learning of hard seeds, fruits and bones (Reed *et al*., 1967) straight primitive stomach, large liver, medium gut length and the variety of foods items found in the stomach clearly shows that the fish has omnivorous feeding habit.

Conclusion

Protopterus annectens is an omnivore, feeding on diverse plants and animal food substances. However, smaller samples showed more inclination towards leaf plants sand bottom deposits and detritus while the adult exhibited a more versatile and complex feeding habit. The fish explores food items of aquatic and terrestrial origin as shown by the presence of sorghum seeds and rice grains. This may be due to availability as influenced by seasonal water hydrology. It has a medium gut length that was 1.1 times its body length. Since the fish has preference for lentic waters (swamps and lakes habitats), it is hardy and can tolerate extreme conditions of low oxygen content to low water level to complete draught, it is highly recommended for aquaculture farm fish especially in earthen fish ponds. Further studies are also required to assess their feeding adaptation, nutritional requirements, food conversion and growth rate.

Authors' declaration

We declared that this study is an original research by our research team and we agree to publish it in the journal.

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