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Food and Feeding Habits and Length–Weight Relationship of *Parachanna obscura* from Federal University of Agriculture Reservoir, Abeokuta, Ogun State, Nigeria

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ABSTRACT

Population increase, indiscriminate fishing, and others, threatening extinction of wild fish species is a major problems in Nigeria fishery. Hence, the food and feeding habits and quality of *Parachanna obscura* from Federal University of Agriculture Abeokuta (FUNAAB) Reservoir were investigated between the months of March and August, 2015. Food materials in fish stomach were analyzed using standard methods, while length and weight were obtained using standard measures. A total of 11 food categories were observed in the stomach of fish sample during the study period 2%, 28%, 9%, 32%, and 29% were empty, one-quarter full, half full, three-quarter full and full, respectively. 8.33% and 5.71% vacuity was experienced in the months of July and August, respectively. Total lengths of *P. obscura* ranged from 12-27 cm with a mean of 17.62 ± 0.27 cm while the weights ranged from 43-198 g with a mean of 102.63 ± 4.32 g. The highest abundance of specimens were observed in August (35%) followed by July (24%) with the lowest observed in March (6%), April (8%), May (12%), and June (15%). Linear regression of the analyzed data resulted in length exponent '*b*' of 2.45 while '*a*' was −1.16 and $r = 0.88$. Approximately 78% of the variance in body weights can be explained by total lengths ($r^2 = 0.78$). Condition factor ranged between 0.70 and 2.49 with a mean of 1.48 ± 0.51. The study confirms the carnivorous nature of *P. obscura* from this water. Also, findings will assist fisheries managers in making fisheries policy regarding appropriate time for fishing of the species.

Keywords: Carnivorous feeder, diet composition, euryphagous, FUNAAB reservoir, linear relationship, stomach contents

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INTRODUCTION

The differences in the mode of feeding showed by fish species could be attributed to evolutionary changes due to structural adaptation for getting food from great diversities of happenings in the wild (Lagler, Bardach, Miller, & Passino, 1977). Taming and culture of any animal species require the determination of feeding habit of such an animal in its natural habitat. Ipinmoroti, Olasunkanmi and Aransiola (2008) expressed their opinion that when studying the type of food and mode of feeding demonstrated by various species of fish for the sake of culture, it should be carried out to enable the identification of the food material that was most preferred by the species as the survival of the fish species in a closed environment depended on how much the natural ecosystem was simulated in the culture system. Fish species found in Inland waters have been observed to have greater access to different food organisms/items in the wild and thus giving room for food selection among these species (Komolafe &Arowomo, 2011). *Parachanna obscura* is a member of the Channidae family and has its root in West Africa (Whenu & Fagade, 2012). The species is commonly abundant in vegetative swamps especially at the offset of the rains when the water level has decreased. Teugels, Reid and King (1992) in their work posited that the species was common in stagnant water bodies in Cross River State of Nigeria - Cameroon. Bonou and Teugels (1985) stated that this species occupied a wide variety of habitats including streams, rivers, lakes, lagoons, and marshes but in flowing water they occupied calm areas. It is one of the two species of the family Channidae found in the coast of West Africa namely, *Channa obscura* and *Channa Africana* (Steindachner, 1879) (syn. *Ophiocephalus obscures* and *Ophiocephalus africanus* respectively). *Parachanna obscura* has been reported by previous studies to be carnivorous in nature (Ajah, Georgewill, & Ajah, 2006). They are observed to feed mainly on earthworms, tadpoles, shrimps, smaller fish, and other aquatic animals (Bonou & Teugels, 1985). Adebisi (1981) and Ajah et al. (2006) reported that adults fed mainly on other fish while the juveniles fed on zooplankton, earthworms, tadpoles, and shrimps. As the mouth part began to form properly, species sizes of 10–16 cm, were observed to feed primarily on detritus and insect larva (Victor & Akpocha 1992). The predatory and piscivorous nature of the species especially in the adult stage was reported by Bolaji, Mfon and Utibe (2011). Although, information regarding the biology of this species has been largely reported, there is however need to shed more light on some aspect of its biology. The present study therefore aims to contribute to the knowledge of the biology of *P. obscura* with a view to further developing its aquaculture.

MATERIALS AND METHODS

Description of Study Site

The study was carried out at the Federal University of Agriculture, Abeokuta (FUNAAB) reservoir (Figure 1) that was constructed in 1994 using excavator, D6-

buldozer and other equipment (inlet and outlet devices). The area and volume of the reservoir are 30,510 m^2 and 63,308,250 L. It lies on latitude 7°13'N and longitude 3°2'E with a prevailing tropical climate and ambient temperature that ranges between 29°C in February and 33°C in May at an average of 31°C. Prior to dam construction, various fish families were observed in the water body; however, no attention or study was carried out to investigate the individual families. The dominant families of fish found in the reservoir include Channidae, Claridae, Cichlidae, Hepsetidae, and Cyprinidae (Adeosun et al., 2012).

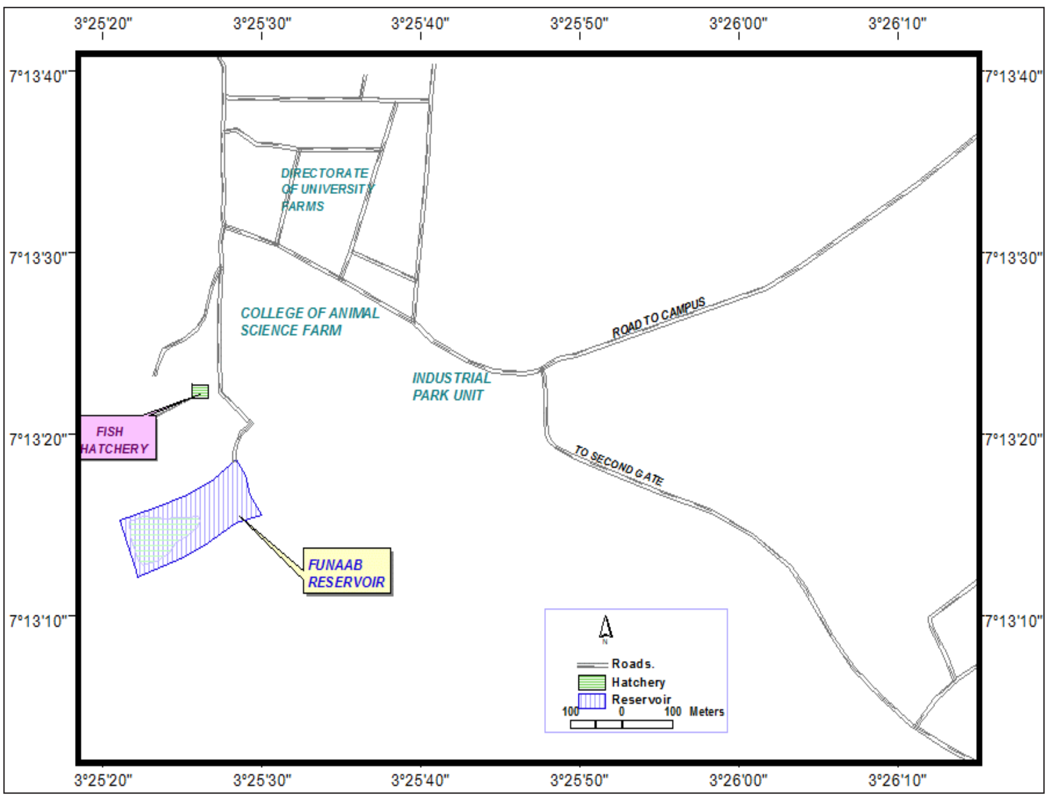

Figure 1. Map of FUNAAB showing the reservoir

Collection of Specimens

A total of 100 fish samples were collected fortnightly between the months of March and August, 2015 with the assistance of Fishermen using gill nets, cast nets, set nets, baskets, and so on. The samples were serially labeled using numbered tag (A_1, A_2,…, B_1, B_2) after which they were transported alive in ice chest to the laboratory for subsequent treatment.

Laboratory Procedure

Fish samples were anesthetized using 4% of chloroform and left for 20 min after which they were arranged and weighed individually to the nearest gram with the aid of Citizon electronic balance. The total and standard lengths of each sample were taken to the nearest 0.01 cm with the aid of measuring meter board. Using a pair of scissors, fish samples were dissected ventrally from the anal opening to the head and stomachs were removed carefully. After observing and recording the degree of fullness as 0/4 for empty stomach, ¼ for one quarter full stomach, ½ for half full stomach, ¾ for three-quarter full stomach and 4/4 as fish with full stomach, weights of each stomach and intestine were measured and recorded (Ugwumba, 1988). Identification of food items (zooplankton and phytoplankton) was done using identification guide by Needham and Needham (1962). About 10% formalin was used to preserve each stomach and its content in a specimen bottle labeled correspondingly with the tag number of each fish sample. Food items were later analyzed using the methods reported by Hynes (1950) and Hyslop (1980).

Analysis of Food Items

Numerical. Stomach contents were poured into a petri dish and placed under different magnifying lens of a binocular microscope. The number of food items present in the preserved stomach of each sample were counted and summed up in other to obtain the grand total number of all food items found in the preserved stomach. The dietary items were identified to taxonomic categories using checklist; the number of each food item was then expressed as a percentage of the grand total number of food items. It is usually express as:

% number of food items =

$$= \frac{\text{Total number of the particular food items}}{\text{Total number of all food items}} \times \frac{100}{1}$$

Frequency of Occurrence. The total number of stomach with particular food item was counted and expressed as a percentage of the total number of the stomachs with food (empty stomach excluded). This is usually expressed as:

% Frequency =

$$= \frac{\text{Total number of stomach with particular food item}}{\text{Total number of stomach with food}} \times \frac{100}{1}$$

Index of Fullness

Fullness index was estimated using the formula:

$$\text{Fullness index} = \frac{\text{Dry weight of stomach content}}{\text{Fresh weight of fish}} \times \frac{100}{1}$$

It is usually expressed as parts per 10,000 (% 00, or parts per decimal).

Length–Weight Relationship

Length–weight relationship was expressed by the equation:

$W = aL^b$
(Sparre & Venema, 1998, pp. 450)

Where,

W = weight, L= length, 'a' and 'b' are regression constants.

L = total length (cm) and b = regression (growth) coefficient.

Condition Factor

Fulton's condition factor was computed in conformity with Ricker (1975) using the equation:

$K = 100\ W/L^3$
(Bagenal & Tesch, 1978)

Where K = condition factor, W = total weight (g), L = total length (cm) and b = regression (growth) coefficient.

RESULTS AND DISCUSSION

Stomach Fullness and Index of Prey Abundance

No empty stomach was observed from March to April while 8.33% and 5.71% vacuity was observed in the months of July and August, respectively (Figure 2). These coincided with the peak of the rains. Of the 100 stomachs of *P. obscura* examined, 2%, 28%, 9%, 32%, and 29% were empty, one-quarter full, half full, three-quarter full and full, respectively (Figure 3). The monthly variation observed in the index of fullness conducted for the species shows that food items were more abundant during the dry season than the wet season. This result is in conformity with the findings of Odo, Onoja and Onyishi (2012) in his survey of 550 samples of *P. obscura* from the lower reaches of Anambra River, Southeastern Nigeria. This accounts for the stomach emptiness observed in some specimen in the months of July and August. Of the fish samples examined, over half had full

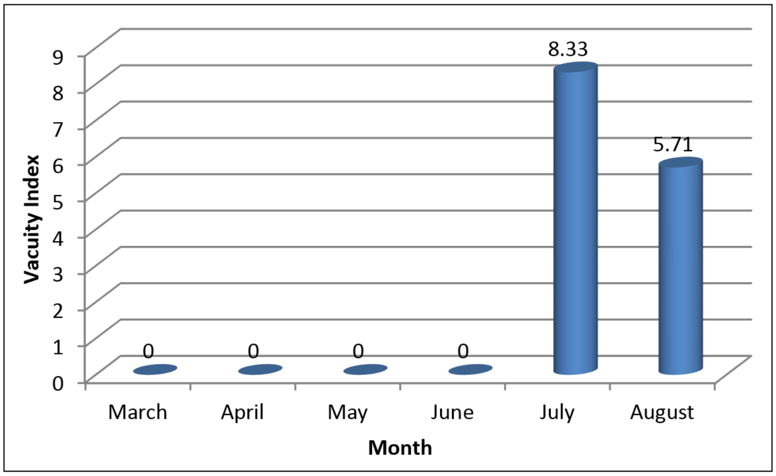

Figure 2. Monthly variation in the number of empty stomachs in *P. obscura* from FUNAAB reservoir

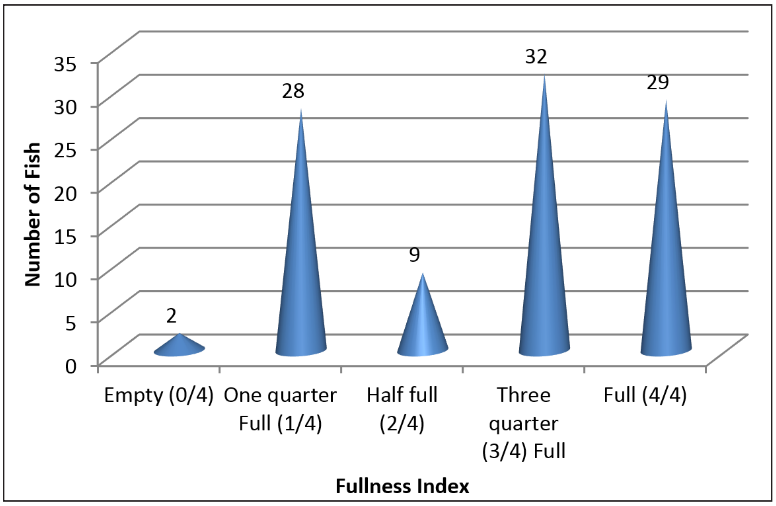

Figure 3. Stomach fullness in *P. obscura* from FUNAAB reservoir

stomachs (Figure 2). However, Komolafe and Arowolo (2011) reported no variation in the fullness of this species in the dry and wet seasons alike. Variation in fullness index observed in this study could be due to the concentration of food items in the dry season than the wet season when the food items are well distributed in the reservoir.

A total of 11 food categories were observed in the stomach of fish samples during the study period (Table 1). These include the green algae, diatoms, protozoa, rotifers, crustaceans, nematodes, fish parts, insect remains, green algae, unidentified food, and desmids. The dietary composition of the stomach of *P. obscura* suggests that the species is a carnivorous feeder as animal materials were observed to be most abundant both in frequency of occurrence and in number. This result corroborates earlier work on the feeding habits of the species (Adebisi, 1981; Ajah et al. 2006). However, the wide range of food items present in the stomach of the species affirms other studies that the species is a euryphagus and non-selective feeder (Uwem, Ekanem, & Eni, 2011). This finding also agrees with the reports of Olaosebikan and Raji (2004) who posited that the species was a carnivorous feeder and prefers food of animal origin.

Table 1
The percentage occurrence and numerical abundance of dietary items in stomachs of P. obscura *samples*

Food Items	Number	% N	Occurrence	% O
Zygnema sp.	457	7.9	33	6.84
Pediastrum sp.	67	1.15	20	4.14
Coelastrum sp.	3	0.05	3	0.62
Closmarium sp.	6	0.1	6	1.24

Table 1 *(continue)*

Food Items	Number	% N		Occurrence	% O
Green Algae	**533**	**9.2**		**62**	**12.84**
Desmids (Gonatozygon)	**230**	**3.97**		**20**	**4.14**
Pinnularia sp.	644	11.14		95	19.7
Nitzschia sp.	65	1.1		15	3.11
Amphora sp.	18	0.31		7	1.45
Cyclotela sp.	2	0.03		2	0.41
Diatoms	**729**	**12.58**		**119**	**24.67**
Oscillateria sp.	56	0.96		7	1.45
Coelosphaerium sp.	11	0.19		3	0.62
Microcystis sp.	1	0.01		1	0.2
Blue Green Algae	**68**	**1.16**		**11**	**2.27**
			26.91		**43.92**
Spirotomum sp.	12	0.2		4	0.82
Cladocerans sp.	3	0.05		1	0.2
Paramecium sp.	2	0.03		2	0.41
Amoeba sp.	1	0.01		1	0.2
Protozoans	**18**	**0.29**		**8**	**1.63**
Filinia sp.	2	0.03		2	0.41
Branchious sp.	3	0.05		1	0.2
Rotifers	**5**	**0.08**		**3**	**0.61**
Crayfish parts	1140	19.72		58	12.03
Copepod	110	1.9		35	7.26
Crustaceans	**1250**	**21.62**		**93**	**19.29**
Nematodes	**520**	**8.99**		**41**	**8.5**
Insect remains	**1020**	**17.65**		**57**	**11.82**
Fish parts	**1360**	**23.53**		**60**	**12.44**
			72.16		
Unidentified food	**46**	**0.79**		**8**	**1.65**

% N = percentage of number, % O = percentage of occurrence

Length–Weight Relationship

Linear regression of the transformed data resulted in length exponent '*b*' = 2.45 while '*a*' = −1.16 (Figure 4). Furthermore, a significant positive linear relationship existed between body weight and standard length in the examined samples ($r = 0.88$). Approximately 78% of the variance in body weights can be explained by total lengths ($r^2 = 0.78$). That is, the total length of the juveniles is a fairly good predictor of the body weight. Negative allometry is indicated by the fact that the '*b*' value obtained for the species was less than 3. This is an indication that samples are lighter than their body lengths (Wootton, 1998, p. 392) that implies poor growths of weight in relation to length. According to Bailey (1994, pp. 937–970), *P. obscura* could grow to the size of 35 cm and Egwui, Okeke and Ezeonyejiaku (2013) recorded a maximum size of 50 cm for the species. The species length as recorded in this study were however less than these values. This could be attributed to either overfishing of the species in this water body or the size of mesh used in capture. Olasunkanmi and Ipirontimi (2014) also recorded negative allometry for this species. This was also corroborated by the findings of Bolaji et al. (2011). The '*b*' value according to Bagenal and Tesch (1978) was however not exceeded as '*b*' values for the species were observed to fall within the growth exponent range of 2 to 4.

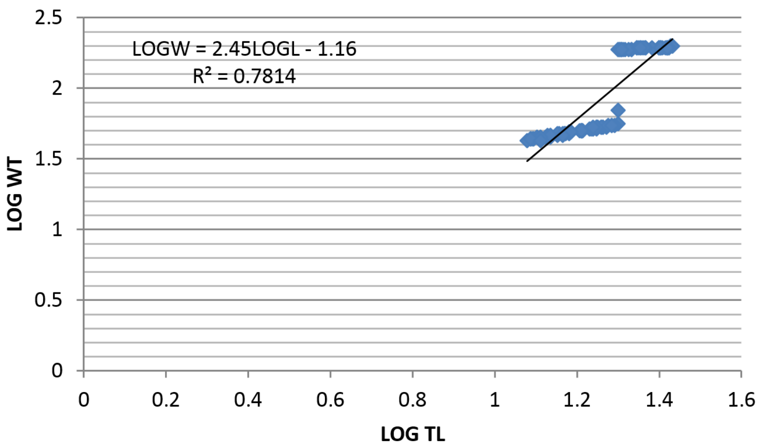

Figure 4. Length–weight relationship of *P. obscura*in FUNAAB reservoir

Length–Frequency Distribution and Abundance

Total lengths of *P. obscura* ranged from 12 to 27 cm with a mean of 17.62 ± 0.27 cm while the weights ranged from 43 to 198 g with a mean of 102 ± 4.32 g. The length histogram as presented in Figure 5 indicates that specimens with total length in the class 16.00–17.99 were the most abundant occupying 17% of the entire sample. The size class 24.00–25.99 cm were the least abundant at 8% frequency. The range of lengths captured in this study was smaller than that reported by Odo et al. (2012) for 550 specimens from Anambra River, Nigeria ranging from 23-28 cm with a mean of 25 ± 0.84. However, specimens examined in this study were weightier that may indicate a better condition. The highest abundance of specimens was observed in August (35%) followed by July (24%) with the lowest observed in March (6%), April (8%), May (12%), and June (15%), respectively (Figure 6).

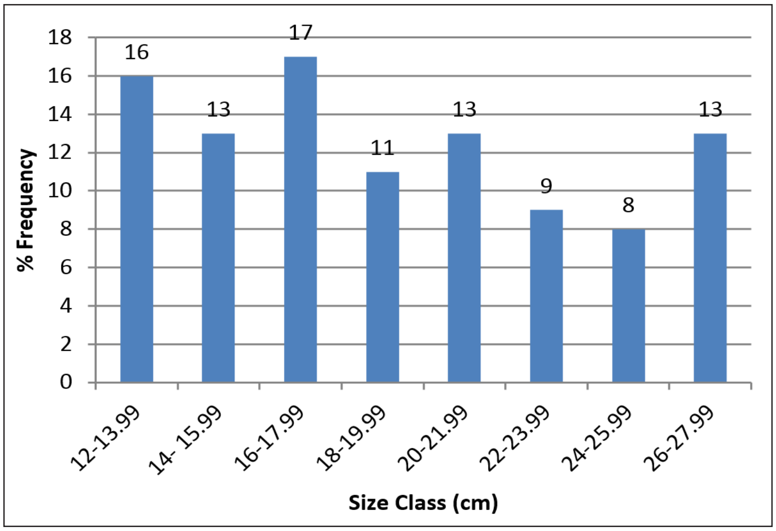

Figure 5. Length-frequency of *P. obscura* from FUNAAB reservoir

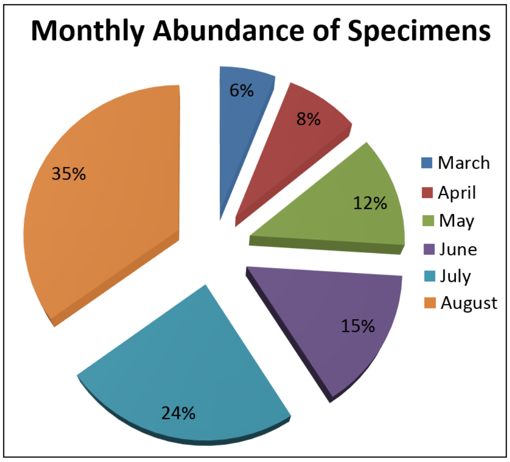

Figure 6. Monthly abundance of *P. obscura* from FUNAAB reservoir

Condition Factor

Condition factor for the 100 specimens of *P. obscura* ranged between 0.70 and 2.49 with a mean of 1.48 ± 0.51 (Figure 7).This is higher than the mean condition factor of the species reported by Odo et al. (2012) for *P. obscura* from Anambra River. It was observed that only 21% of the fish had condition factor greater than 2 while 63% had condition factors that fell between 1 and 1.99. It could therefore be said that the fish species water body in question was in good state of health. Although the fish seem to be well conditioned, since the value was greater than 1, the average value was less than that of other well-conditioned fishes. This may be an indication that the fish is likely to be easily affected if there is any alteration in the environmental condition as well as unavailability of prime food items.

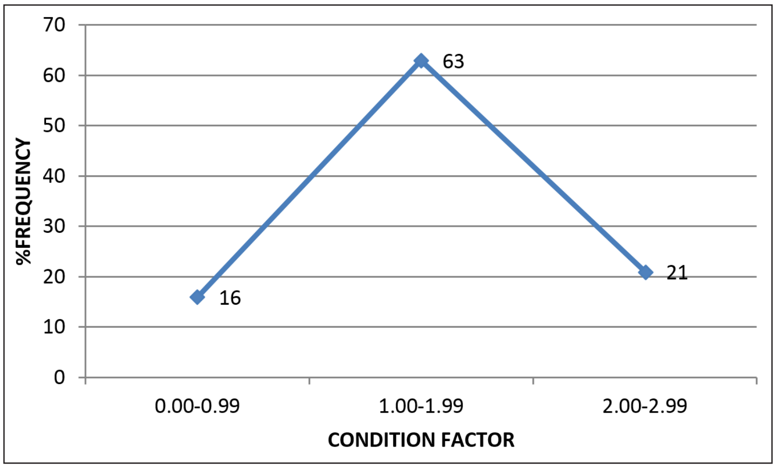

Figure 7. Condition factor of *P. obscura* from FUNAAB reservoir

CONCLUSION

The study concludes that there is abundance of food materials in this water body all year round. Findings will assist fisheries managers in making fisheries policy regarding appropriate time for fishing of the species thereby preventing overfishing and threat of extinction. The various groups of food items in the diet of *P. obscura* from this water body confirmed fish parts to be the prominent and most preferred food consumed by *P. obscura*. Base on this, the species will be good for polyculture as it can be used to control proliferation of cichlids. Also, it has a good quality with condition factor above 1.

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