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FOOD AND FEEDING HABITS OF THE STRAIGHTFIN BARB *BARBUS PALUDINOSUS* (PETERS, 1852) (PISCES: CYPRINIDAE) IN LAKE ZIWAY, ETHIOPIA

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ABSTRACT: The feeding habits of the straightfin barb *Barbus paludinosus* was studied in Lake Ziway, Ethiopia, from 504 gut samples collected from April to May (dry months) and July to August (wet months) of the year 2011. Gut contents were analyzed using the frequency of occurrence and volumetric analysis methods. Insects and detritus were the dominant food items and they occurred in 86.3% and 93.5%, and constituted 47.3% and 38.0%, of the total volume of food items, respectively. Macrophytes, phytoplankton, zooplankton and ostracods occurred in 36.1%, 40.3%, 32.7% and 15.5% of fish guts and volumetrically they constituted 4.8%, 4.7%, 3.9% and 1.3% of the food items, respectively. Insects, detritus and zooplankton were important food categories in the dry season while detritus, insects and phytoplankton dominated in the wet season. Insects were the dominant food items in all size classes followed by detritus. The proportion of macrophytes increased with size of fish while the importance of detritus and zooplankton declined with fish size. Based on these results, it was concluded that *B. paludinosus* in Lake Ziway has an omnivorous habit.

Key words/phrases: *B. paludinosus*, Diet composition, Fish feeding habit, Lake Ziway, Ontogenetic diet shifts.

INTRODUCTION

The straightfin barb *Barbus paludinosus* (Peters, 1852) is widely distributed in Africa ranging from Ethiopia in the north, through to the east and central Africa. In southern Africa, its distribution extends from Vungus, Kwazulu-Natal, and the southern Congo tributaries to the Quanza Angola and the Orange River (Skelton and Cambray, 1981; Skelton, 2001).

The characteristic features of this little fish is silvery to silvery gray and sometimes pale golden colour; has sub-terminal mouth shape with two pairs of short barbels (Rall *et al*., 2010). It is a benthopelagic fish that occupies a wide range of habitats including large rivers, both vegetated and rocky lagoons, small and large streams, marshes, pools and open waters (Rall *et al*., 2010). The species also thrives in well-protected littoral habitats covered with aquatic macrophytes, and this reduces predator encounter rates as well

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as swimming speed of large predators (Persson and Crowder, 1998). According to Zerihun Desta *et al*. (2008), even though *B. paludinosus* can live in profundal and pelagic habitats, it prefers littoral areas.

Barbus paludinosus is an omnivorous species able to utilize a wide range of food items including micro-crustaceans, insects, gastropods, algae, and detritus (Cambray, 1983; Brummett and Katambalika, 1996; Skelton, 2001). In addition, it also feeds on macrophytes, zooplankton and invertebrates in African inland waters (Bourn, 1973; Skelton, 1993; Mattson, 1999).

Zerihun Desta *et al*. (2008) have reported that *B. paludinosus* in Lake Hawassa, Ethiopia, consumed ostracods, zooplankton, molluscs, aquatic insects and fish. The same study pointed out that juveniles (<6.0 cm TL) fed on ostracods while medium-sized fish (6.0-10.0 cm TL) consumed more of other invertebrates. The diet of larger individuals (>10.0 cm TL) was dominated by a tiny cyprinidont fish (*Aplocheilichthys antinorii*).

In some parts of Africa, this species is economically important having significant contribution in the commercial landings. Njaya (2001) estimated the maximum economic yield of *B. paludinosus* in Lake Chilwa (Malawi) to be USD 3.4 million/year. Moreover, the fish serves as a prey for other commercially important fish species and fish-eating birds. Demeke Admassu and Elias Dadebo (1997) and Zerihun Desta *et al*. (2006) reported the importance of *B. paludinosus* as prey fish for the African big barb and the African catfish in Lake Hawassa, Ethiopia. In other parts of Africa, the African catfish, tigerfish, largemouth bream and birds prey upon the species (Skelton, 1993).

Barbus paludinosus is not of any commercial importance in the fisheries production of Ethiopia in general and in the local fisheries production of Lake Ziway in particular, but it is ecologically important because it is used as a prey fish by some commercially important fish species such as the African big barb and the African catfish (Elias Dadebo, 2000; Zerihun Desta *et al*., 2006; 2007). So far, no published information is available on the biology and ecology of *B. paludinosus* in Lake Ziway. The aim of the present study was, therefore, to provide basic information on diet composition, seasonal variation and ontogenetic dietary shifts of the species in Lake Ziway.

MATERIALS AND METHODS

Description of the study area

Lake Ziway (Latitude: 7° 52' to 8° 8' N and Longitude: 38° 40' to 38° 56' E) is the most northerly of the lakes in the Ziway-Shala basin (Fig. 1). It is situated about 160 km south of the capital city, Addis Ababa, at an elevation of 1,636 m above sea level. The region is characterized by semi-arid to sub-humid climate with mean annual precipitation and temperature of 650 mm and 25°C, respectively (Lijalem Zeray *et al*., 2007). The dry season extends from October-May but sampling was done only during April and May (dry months). The wet season extends from June to September but sampling was done during July and August (wet months). The lake has a total catchment area of about 7,444 km^2, a maximum length of 32 km, a maximum width of 20 km, a maximum depth of 9 m and a mean depth of 2.5 m (Dawit Garoma *et al*., 2013). The lake has two main inflow rivers, Meki and Katar, flowing into the lake from the north and east and River Bulbula flows out of the lake into Lake Abijata (Fig. 1). According to Getachew Beneberu (2005), the lake is polymictic shallow freshwater lake.

The major groups of phytoplankton of the lake are dominated by blue-green algae (*Microcystis*, *Lyngbya*, *Coelospharium*, *Merismopedia*, *Chroococcus*, *Anabaena*), diatoms (*Naviculla*, *Cymbella*, *Surirella*, *Gyrosigma*, *Nitzschia*, *Synedra*, *Pinnularia*) and green algae (*Scenedesmus*, *Spirogyra*, *Pediastrum*, *Ankistrodesmus*, *Cosmarium* and *Botryococcus*) (Alemayehu Negassa and Padanillay, 2008). The zooplankton community of the lake is composed of cyclopoid copepods (*Thermocyclops* and *Mesocyclops*), cladocerans (*Moina*, *Diaphanosoma*, *Ceriodaphnia*, and *Bosmina*) and rotifers (*Brachionus* and *Keratella*). The bottom fauna comprises gastropods (*Anisus natalensis*, *Biomphalaria sudanica*, *Bulinus forskahlii*, *Lymnea natalensis* and *Mellanoides tuberculata*), different kinds of insects, ostracods, and nematodes (Alemayehu Negassa and Padanillay, 2008).

The indigenous fish species currently thriving in the lake include the Nile tilapia *Oreochromis niloticus* Linnaeus, 1758, the African big barb *Labeobarbus intermedius* Rüppell, 1835, *B. paludinosus*, the stone lapping *Garra quadrimaculata* Peters, 1881 and the black lampeye *Aplocheilichthys antinorii* Vinciguerra, 1883. The barbus species could be more diverse than mentioned above. The crucian carp (*Carassius carassius* Linnaeus, 1758) and the redbelly tilapia (*Tilapia zillii* Garvias, 1848) are exotic species introduced into the lake several decades ago with the aim of boosting the productivity of the lake (LFDP, 1997). The African catfish (*Clarias* *gariepinus* Burchell, 1822) was introduced accidentally as live fish were being transported from Lake Langeno to the cold storage site at the vicinity of Lake Ziway (LFDP, 1997).

It is estimated that the maximum sustainable yield of the lake is between 3,000 and 6,680 tonnes/year (LFDP, 1997; Felegeselam Yohannes, 2003). The landings used to be dominated by *O. niloticus*, but during the last ten years *C. carrasius* and *C. gariepinus* are increasingly becoming part of the catch. Current estimates put the composition of the stock to be about 70% *O. niloticus*, 20% *C. carrasius* and 10% *C. gariepinus* (Spliethoff *et al*., 2009).

Sampling and measurements

Samples of *B. paludinosus* were captured using nylon monofilament gillnets (4.0-10.0 cm stretched mesh size) (Appelberg *et al*., 1995) in the shallow parts of the lake. A total of 534 fish samples were collected from April to May (dry months), and from July to August (wet months), of the year 2011. Gillnets were set every day early in the morning around 7:00 am and retrieved around 2:00 pm in the afternoon. Fish were removed from the gillnets shortly after capture and serially numbered. Then, the total length (TL) was measured to the nearest centimetre using a measuring board and the total weight (TW) was measured to the nearest 0.1 g using a Scaltec Digital Balance (Model 23565, USA). Since *B. paludinosus* has no distinct stomach, contents of the entire gut were preserved in 5% formalin in labelled sampling bottles prior to analysis in the laboratory.

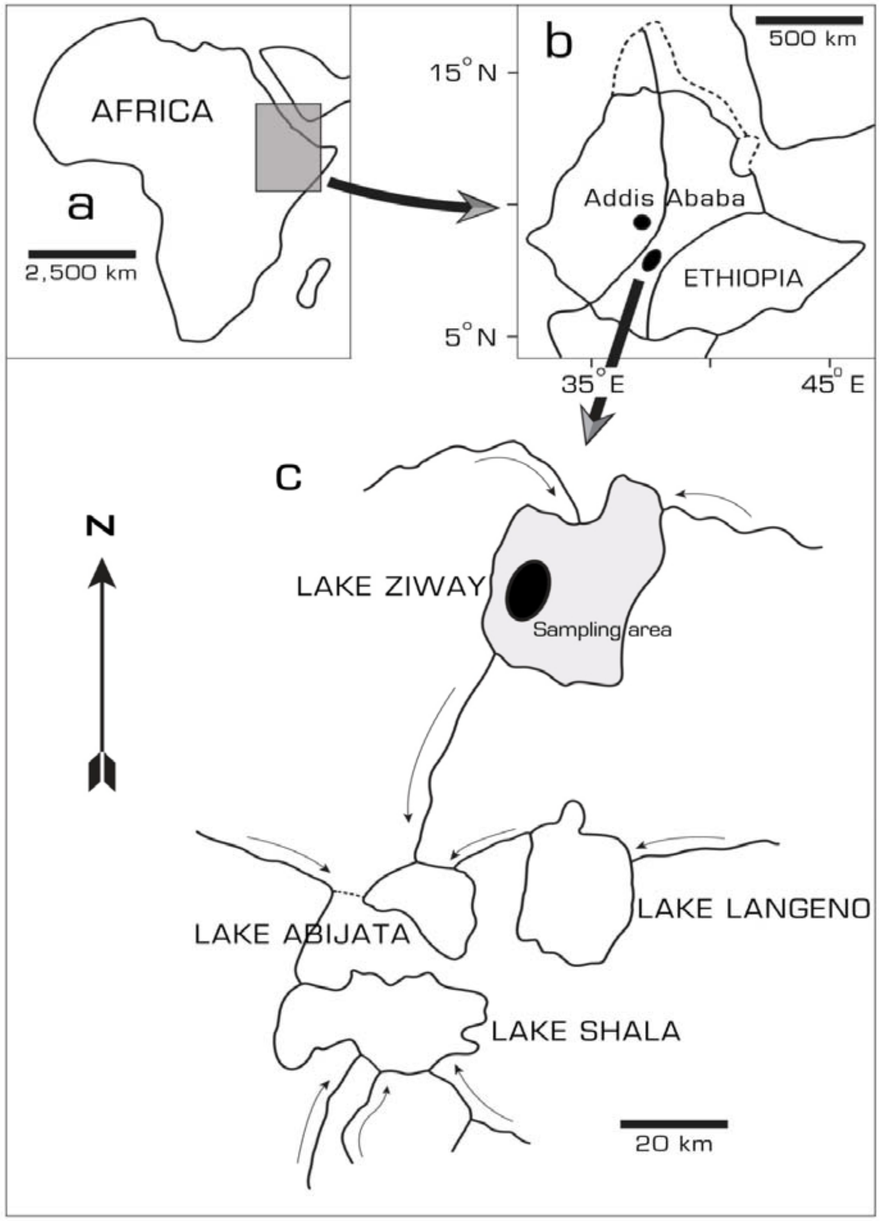

Fig. 1. Map of Africa with (a) the relative position of Horn of Africa highlighted, (b) map of Ethiopia with the relative position of central Ethiopian Rift Valley lakes indicated and (c) map of the Ziway-Shala basin lakes (with the sampling area in Lake Ziway indicated).

Gut content analysis

In the laboratory, gut contents were emptied into a petridish to identify each prey item. Identification of large food categories was done visually whereas microscopic food items were identified using a dissecting microscope (Leica, MS5, magnification-10x) and a compound microscope (Leica DME, magnification-100x). The relative importance of each food item was assessed using frequency of occurrence and volumetric analysis methods (Hyslop, 1980; Bowen, 1983). In frequency of occurrence, the number of gut samples containing one or more of a given food item was expressed as a percentage of all non-empty guts examined. In volumetric analysis, food items were sorted into different categories and the water displaced by a group of items in each category was measured in a partially-filled graduated cylinder. The volume of water displaced by each category of food items was expressed as a percentage of the total volume of the gut contents.

In determining the contribution of each group of food items in different size classes, the fish were categorized into three size classes: I - 4.5-6.4 cm TL, II - 6.5 cm-8.4 cm TL and III - ≥ 8.5 cm TL and the percentage mean volume of the food items was calculated using the method of Wallace (1981) for the different size classes. The importance of each category of food items was expressed as a percentage of total volume of food consumed in each size class.

Statistical analysis

Frequency of occurrence of the different food categories during the dry and wet seasons were compared using a Chi-square test. Similarly, the volumes of the different food categories eaten during both seasons were compared using the non-parametric Mann-Whitney's U test, because the data did not satisfy the assumption of equal variance to employ parametric test (Sokal and Rohlf, 1995).

Dietary overlap between different size-classes was calculated as percentage overlap using Schoener Diet Overlap Index (SDOI) (Schoener, 1970), based on the formula:

$$\alpha = 1 - 0.5\left(\sum_{i=1}^{n}\left|pxi - pyi\right|\right)$$

where α is percentage overlap, SDOI, between size classes x and y; pxi and pyi are proportions of food category (type) i used by size classes x and y, and n is the total number of food categories. Overlap in the index is generally considered to be biologically significant when α value exceeds 0.60 (Mathur, 1977).

RESULTS

Diet composition

From the total number of 534 gut samples, 30 (5.6%) had no visually observable food items while the remaining 504 (94.4%) contained some food items in their guts. Six taxonomic categories were identified and categorized as insects, detritus, macrophytes, phytoplankton, zooplankton and ostracods (Table 1). Insects and detritus were the dominant food items while macrophytes, phytoplankton, zooplankton and ostracods were less significant in their contribution to the diet of *B. paludinosus* (Table 1).

Table 1. Frequency of occurrence and volumetric contribution of different food items consumed by *B. paludinosus* in Lake Ziway (n=504). Note that the total volume of the major food categories in bold adds up to 100%.

	Frequency of occurrence		Volumetric contribution	
Food items	**Frequency**	**Percent**	**Volume (ml)**	**Percent**
Insects	**435**	**86.3**	**7.1**	**47.3**
Diptera	406	80.6	5	33.3
Ephemeroptera	233	46.2	2	13.3
Plecoptera	19	3.8	0.1	0.7
Hemiptera	18	3.6	0.04	0.3
Coleoptera	5	1.0	0.01	0.07
Detritus	**471**	**93.5**	**5.7**	**38.0**
Macrophytes	**182**	**36.1**	**0.7**	**4.7**
Phytoplankton	**203**	**40.3**	**0.7**	**4.7**
Diatoms	155	30.8	0.4	2.7
Blue-green algae	150	29.8	0.2	1.3
Green algae	81	16.1	0.1	0.7
Euglenoids	14	2.8	0.01	0.07
Zooplankton	**165**	**32.7**	**0.6**	**4.0**
Copepods	155	30.8	0.5	3.3
Cladocerans	19	3.8	0.1	0.7
Ostracods	**78**	**15.5**	**0.2**	**1.3**

Insects occurred in 86.3% of the guts and volumetrically contributed to 47.3% of the total volume of food items. Diptera and Ephemeroptera were the most important insect groups occurring in 80.6% and 46.2% of the guts, respectively. Volumetrically, they accounted for 33.1% and 13.4% of the total volume, respectively. The contribution of the remaining insect groups were relatively less important (Table 1). Detritus and macrophytes occurred in 93.5% and 36.1% of the guts, respectively, and accounted for 38.0% and 4.8% of the total food volume, respectively (Table 1). Phytoplankton occurred in 40.3% of the guts and contributed 4.7% of the total volume of food. Among the phytoplankton groups, diatoms and blue-green algae were relatively important while the contribution of green algae and euglenoids were insignificant (Table 1). Zooplankton occurred in 32.7% of the guts and volumetrically accounted for 3.9% of the total volume of food. Copepods and cladocerans were the two groups of zooplankton consumed by *B. paludinosus*, out of which copepods were by far the most important in the diet. The contribution of ostracods was the lowest in that they occurred in 15.5% of the guts and constituted 1.3% of the total volume (Table 1).

Seasonal variations of the food items

The frequency of occurrence of insects, macrophyes, phytoplankton and zooplankton significantly varied during the dry and wet seasons (χ^2 test, $P<0.05$). Similarly, the volumetric contribution of insects and detritus significantly differed during the two seasons (U test, $P< 0.05$). On the other hand, both the frequency and volumetric contribution of all other food items did not significantly differ during the two seasons.

Insects were the most important food items during the dry months occurring in 93.4% of the guts and constituting 54.7% of the total volume (Table 2). During the wet months, the contribution of insects was relatively low in that they occurred in 77.0% of the guts and constituted 38.8% of the total volume (Table 2). Diptera and Ephemeroptera were the predominant insect groups during both seasons occurring in 86.1% and 57.5% of the guts, during the dry months and 73.3% and 30.9% during the wet months, respectively. Volumetrically, Diptera and Ephemeroptera constituted 37.4% and 16.9%, respectively during the dry months. During the wet months, Diptera and Ephemeroptera contributed 28.2% and 9.4% of the total volume, respectively (Table 2). The remaining insect groups, namely Hemiptera and Plecoptera were of less importance because they were found in few guts and accounted for relatively low volume. Coleoptera were present in the diet only during the dry months (Table 2).

The contribution of detritus was high during the wet months than the dry months. During the dry months, detritus occurred in 90.2% of the guts, but during the wet months its occurrence increased to 97.2% of the total guts. The volumetric contribution of detritus during the dry months was 28.2% (Table 2), but during the wet months its contribution increased to 49.7% of the total volume (Table 2). Macrophytes occurred in 43.9% and 25.8% of the total guts examined during the dry and wet months, respectively. Volumetrically, the contribution of macrophytes was 7.0% and 2.1% of the total volume during the dry and wet months, respectively (Table 2).

Table 2. The relative contribution (%) of different food items in the diet of *B. paludinosus* during the dry and wet months in Lake Ziway.

	Frequency of occurrence (%)		Volumetric contribution (%)	
Food items	**Dry months**	**Wet months**	**Dry months**	**Wet months**
Insects	**93.4**	**77.0**	**54.7**	**38.8**
Diptera	86.1	73.3	37.4	28.2
Ephemeroptera	57.5	30.9	16.9	9.4
Plecoptera	2.1	6.0	0.1	0.7
Hemiptera	2.1	5.5	0.1	0.5
Coleoptera	1.7	-	0.2	-
Detritus	**90.2**	**97.2**	**28.2**	**49.7**
Macrophytes	**43.9**	**25.8**	**7.0**	**2.1**
Phytoplankton	**35.5**	**47.5**	**4.9**	**4.5**
Diatoms	31.0	30.4	3.1	2.2
Blue-green algae	26.5	34.1	1.3	1.6
Green algae	16.0	18.4	0.5	0.6
Euglenoids	-	6.0	-	0.1
Zooplankton	**36.6**	**27.7**	**4.5**	**3.2**
Copepods	35.5	24.4	4.3	2.3
Cladocerans	1.4	6.9	0.2	0.9
Ostracods	**13.6**	**18.0**	**0.7**	**1.7**

Phytoplankton occurred in 35.5% of the guts during the dry months (Table 2), but during the wet months their occurrence increased to 47.5% of the total number of guts examined (Table 2). The volumetric contribution of phytoplankton was similar during the dry and wet months in that they constituted 4.9% and 4.5% of the total volume of food items, respectively. Blue-green algae and diatoms were relatively important algal groups during both the dry and wet months occurring in 26.5% and 31.0% of the guts, respectively during the dry months and 34.1% and 30.4% during the wet months, respectively (Table 2). Volumetrically, blue-green algae and diatoms accounted for 1.3% and 3.1%, respectively, during the dry months (Table 2). During the wet months, blue-green algae and diatoms constituted 1.6% and 2.2% of the total volume, respectively (Table 2). The other algal groups, namely green algae and euglenoids were of little importance because they occurred in few guts and constituted negligible volume (Table 2).

Zooplankton occurred in 36.6% and 27.6% of the stomachs during the dry and wet months, respectively (Table 2). Volumetrically, they accounted for 4.5% and 3.2% during the dry and wet months, respectively. Copepods were more important than cladocerans. Ostracods were generally of low importance in the diet of *B. paludinosus* during both the dry and wet months. During the dry months, they occurred in 13.6% of the guts and accounted for 0.7% of the total volume. During the wet months, their occurrence increased to 18.0% and constituted 1.7% of the total volume (Table 2).

Ontogenetic dietary shifts

Schoener Diet Overlap Index (SDOI) revealed no significant variation in diet between size classes I and II (SDOI=99%), I and III (SDOI=91%) and II and III (SDOI=92%). Data on the diet composition of *B. paludinosus* exhibited slight ontogenetic diet shift during the life history of the fish. Except ostracods, all food items (insects, detritus, macrophytes, phytoplankton and zooplankton) were consumed by all size classes (Fig. 2). Ostracods were consumed by the smallest size classes. From the major food items, insects were consumed by all size classes with little differences, but the contribution of detritus progressively declined as the fish grew in length while the contribution of macrophytes increased with fish size (Fig. 2).

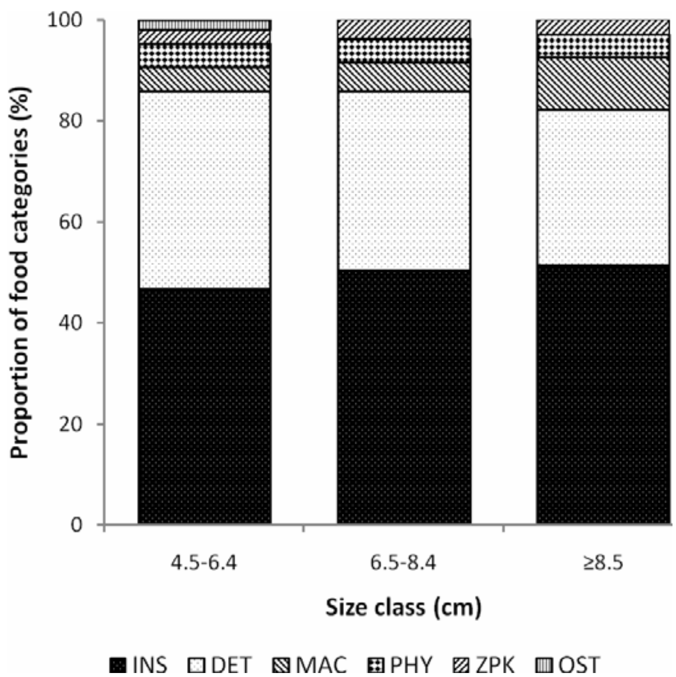

Fig. 2. Relative volume of food items utilized by different size classes of *B. paludinosus* from Lake Ziway (INS-Insects, DET-Detritus, MAC-Macrophytes, PHY-Phytoplankton, ZPK-Zooplankton and OST-Ostracods).

DISCUSSION

Barbus paludinosus in Lake Ziway fed on a variety of food categories including insects, detritus, macrophytes, phytoplankton, zooplankton and ostracods. From these food categories, insects and detritus were dominant while macrophytes, phytoplankton, zooplankton and ostracods had less importance in the diet of the fish.

The feeding behaviour of *B. paludinosus* has been well documented by various authors. Zerihun Desta *et al*. (2008) studied the diet compositions of *B. paludinosus* in Lake Hawassa, Ethiopia, and reported that the fish fed extensively on ostracods, zooplankton, molluscs, aquatic insects, algae and fish. The species had bottom-feeding habits by searching for different food items at the bottom of the lake using its sub-terminal mouth parts together with a pair of short barbells (De Vos and Thys van den Audenaerde, 1990). Several investigators have reported the diet composition and feeding habits of the species in different parts of Africa (Cambray, 1983; Brummett and Katambalika, 1996; Skelton, 2001). According to these authors, the species feeds primarily on micro-crustaceans, but also feeds flexibly on insects, small snails, algae, diatoms and detritus. *B. paludinosus* in Lake Ziway could be classified as an omnivorous species as the diet covers a wide spectrum of food ranging from various types of plankton to invertebrates and macrophytes. These results are in agreement with the results of Nagelkerke and Sibbing (2000) that grouped small *Barbus* species under omnivorous feeding guild. Demeke Admassu and Elias Dadebo (1997) studied the feeding habits of *Barbus* species in Lake Hawassa, Ethiopia, and grouped the species under omnivorous category in its feeding habits and it tended to be piscivorous above 30 cm TL. Zerihun Desta *et al*. (2008) conducted a detailed study on the feeding habits of *B. paludinosus* in Lake Hawassa and reported the omnivorous feeding habits of the species. These authors also confirmed that as the fish grows, it also leans towards predatory life by feeding on tiny cyprinidont fish (*A. antinorii*) (See also Mattson, 1999).

Cockson and Bourn (1973) and Cambray (1983) reported that *B. paludinosus* in Lake Chilwa, Malawi, was able to digest plant materials because of the digestive enzymes found in the gut. They also pointed out that the species was able to utilize a wide spectrum of food items including zooplankton, aquatic insects, non-filamentous green algae, some higher plant materials and fish eggs. All food categories reported by Cockson and Bourn (1973) and Cambray (1983), except fish eggs, were also identified from the gut contents of *B. paludinosus* in Lake Ziway. Other investigators working in various parts of Africa have also indicated that the species mainly feeds on phytoplankton, macrophytes, zooplankton and benthic invertebrates (Bourn, 1973; Skelton, 1993; Mattson, 1999).

Polling *et al*. (1992) studying the feeding habits of *B. paludinosus* in a sub-tropical South African impoundment pointed out that the change in the ratio of gut length to the standard length suggested a shift in diet as the fish fed more of plant materials as it grew older and as a result zooplankton and insects were replaced by phytoplankton. In the present study, however, such a shift from animal-source food items to plant materials was not observed. *B. paludinosus* consumed both plant and animal materials more or less in the same proportion in all size classes studied, placing the species as omnivorous feeding on both plant and animal materials throughout its life cycle.

On the other hand, the feeding habits of some small barbs were recorded by Eshete Dejen *et al*. (2006) in Lake Tana, Ethiopia. According to the authors, the diet of *B. tanapelagius* was dominated by zooplankton while the guts of *B. pleurogramma* showed an array of benthic food organisms. *B. humili* had the widest food niche, including both zooplankton and benthic invertebrates. *Labeobarbus brevicephalus* preyed predominantly on the large zooplankton (*Daphnia* species) and *B. tanapelagius* on small species like *Bosmina* spp. and cyclopoid copepods.

The effect of seasonality should be considered when studying the food and feeding habits of fish in natural environments because the seasonal changes of abiotic and biotic factors change the structure of the food web over the year. Since the type of food items and their abundance change at different times of the year, the fish often shows seasonal diet shifts (Kariman *et al*., 2009). Considering the feeding habits of *B. paludinosus* in Lake Ziway during the dry and wet months, some differences were noted in the proportion of certain food items. The proportion of insects and macrophytes was higher during the dry months while the proportion of detritus was greater during the wet months. The reason for this difference could be the difference in the availability and abundance of various food items in the environment during the two seasons. Large quantities of detritus may drain into Lake Ziway with run-off during the rainy season from the catchment area increasing the proportion of decomposed plant and animal materials in the diet of *B. paludinosus*. One of the plausible explanations for the higher proportion of insects during the dry season could be that the reproduction of the insect groups may take place during the dry season.

Generally, seasonal variation did not affect the feeding behaviour and the selection of prey organisms of *B. paludinosus* in Lake Ziway since there was no significant difference in the proportion of the dominant food items, except some variations on the composition, consumption, and occurrence of prey items in the gut of *B. paludinosus*. Unlike the present study, Elias Dadebo *et al*. (2013) reported marked seasonal variation in the diet of *L. intermedius* in Lake Koka, Ethiopia. On the other hand, Shrestha and Shrestha (2008) reported that omnivorous fishes do not show marked seasonal variations in feeding activity due to availability of one kind of food or the other throughout the year.

In the present work, slight ontogenetic diet shift was noted in the proportion of the food items consumed. The relative importance of detritus declined with the size of fish while the importance of insects increased. The proportion of macrophytes also increased as the fish increased in length. Ostracods were of minor importance in the diet of small size classes, but they were not encountered at all in the diet of the largest size class. Zerihun Desta *et al*. (2008) in Lake Hawassa, Ethiopia, observed the predominance of ostracods in the diet of small individuals (≤6.0 cm TL) of *B. paludinosus* in all habitats whereas in the medium-sized individuals (6.0-10.0 cm TL), the proportion of ostracods declined. The diet of larger individuals (>10.0 cm TL) was dominated by the small fish, *A. antinorii*. No fish prey was found in the gut contents of *B. paludinosus* in Lake Ziway. The reason for the absence of fish prey in the present work might be due to the absence of suitable-sized fish prey in the habitat where the fish thrives.

In conclusion, foods of both plant and animal origins were identified in the diet of *B. paludinosus* in Lake Ziway. Insects and detritus were the most important food items while macrophytes, phytoplankton, zooplankton and ostracods were less important in the diet of the fish. The contribution of insects, macrophytes and zooplankton were higher during the dry months than the wet months, but, the importance of detritus and ostracods was relatively high during the wet months. The contribution of phytoplankton was comparable in the dry and wet months. Ontogenetic dietary shift was slight during the present study. Insects were the dominant food items and their importance was comparable in all size classes. The importance of detritus and zooplankton slightly declined with size of fish while the importance of macrophytes increased with the size of the fish. Based on the results of the present study, it can be concluded that *B. paludinosus* is an omnivorous fish feeding on different varieties of food items of both plant and animal origin.

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