Turk J Zool
25 (2001) 461-468

Stomach Contents of the Catfish (*Clarias gariepinus* Burchell, 1822) in the River Asi (Turkey)

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Received: 31.05.2000

Abstract: Natural food items of catfish (*Clarias gariepinus* Burchell, 1822) were investigated in the River Asi from September 1996 to October 1998. Analyses of stomach contents showed that the catfish feed basically on Arthropoda, mostly Diptera larvae, and on plant materials to a considerable extent. A successful filter feeding was observed, especially during the summer period.

Key Words: The River Asi, the catfish, *Clarias gariepinus*, stomach content

Asi Nehri'nde Yaşayan Karabalığın (*Clarias gariepinus* Burchell, 1822) Mide İçerikleri

Özet: Asi Nehri'nde yaşayan karabalığın (*Clarias gariepinus* Burchell, 1822) doğal besinleri, Eylül 1996 – Ekim 1998 ayları arasında belirlendi. Analiz sonuçları bu balığın çoğunlukla Diptera larvası olmak üzere Arthropoda ile beslendiğini, bitkisel materyalin de çok fazla tüketildiğini gösterdi. Karabalığın başarılı bir şekilde filtrasyonla, özellikle yaz aylarında daha çok beslendikleri gözlendi.

Anahtar Sözcükler: Asi Nehri, karabalık, *Clarias gariepinus*, mide içeriği

Introduction

C. gariepinus (C. lazera; Cuv. and Val., 1840) is a widespread freshwater species, found in Turkey, the Middle East, and throughout Central and South Africa (1, 2). It inhabits natural lakes, fishponds, streams, and natural ponds in both deep and shallow waters. In Turkey catfish are found along the Mediterranean region stretching from Hatay to Antalya and around Eskişehir.

C. gariepinus is euryphagous and an omnivore or predator. The food composition of *C. gariepinus* in its natural habitat has been previously studied and a wide range of food components have already been observed in several parts of Africa (2, 3, 4, 5, 6, 7, 8). However, there seem to be no studies done on the stomach contents of this species in Turkey. The present study constitutes not only a database by providing preliminary information on the stomach contents of *C. gariepinus* in the River Asi, but also a comparison with other populations. Furthermore, the River Asi is the major water source in the Hatay region, and the catfish is one of the foremost commercial species by weight in the river. Hence, the study on the food chain components including fishes will help illuminate the ecological structure of this area.

Material and Methods

A total of 619 samples were caught with gill nets and traditional local nets from October 1996 to September 1998 at the 14 sampling stations located along the River Asi in Turkey (Figure 1). All the dimensional measurements of each fish were made with a measure board scaled to ± 1mm. In order to examine the food items, the fish abdomen was split with scissors from the anus to the throat, and the digestive system was removed with forceps. The stomach was then taken out by cutting of the elementary tract flash between the end of the oesophagus and the pylorus. The volume of the contents of each stomach was then measured and 4%

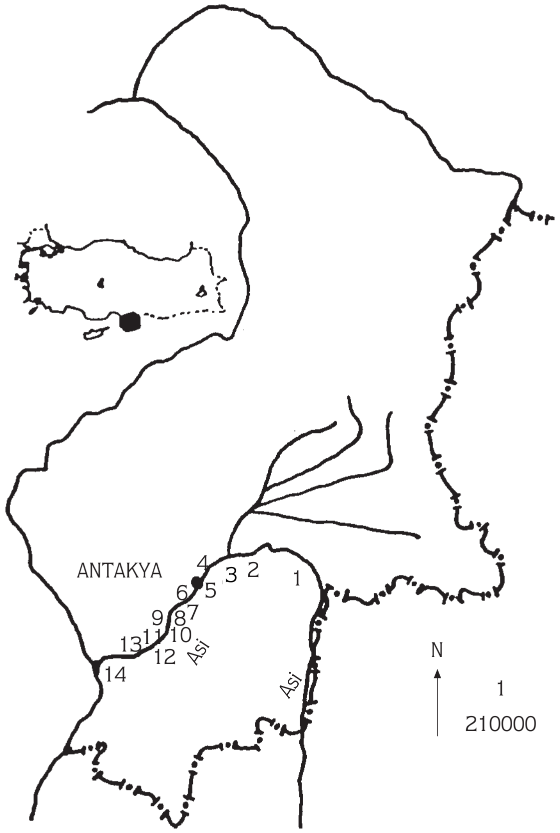

Figure 1. Map of the research area (1. Demirköprü 2. Üzümdalı 3. Güzelburç 4. Narlıca 5. Antakya centre 6. Antakya 7. Turunçlu 8. Subaşı 9. Şıhhasan 10. Meydancık 11. Tavlaköyü 12. Aşağıdöver 13. Sınanlı 14. Samandağ).

formaldehyde was added for conservation. The contents were then identified and counted under a stereoscopic binocular microscope (magnification x4) in petri dishes. To examine the microscopic food organisms, a light microscope (magnification x40) was used and the identified organisms were counted using Thoma lam. Then the number of microscopic food organisms was rationed to total stomach volume. The following references were used to identify the food items (9, 10, 11, 12, 13, 14, 15, 16, 17).

Food preferences were scored by two different methods, which are the frequency of occurrence, and the percentage of abundance. The preferences were then presented according to the total catfish population and for different length groups and seasons (18), since the proportion of plant and animal foods in the diet of a fish can change seasonally (19).

Results

It was observed that only 245 stomachs out of the 619 specimens caught had food organisms.

In stomachs, insect larvae (*Diptera*) dominated in frequency of occurrence (69.8%) while plant organisms like *Crysophyta* (31.43%) and *Chlorophyta* members (30.2%) were found in considerable amounts (Figure 2).

Using the method of percentage abundance, microscopic food organisms were investigated separately from macroscopic food organisms. It was observed that the most abundant microscopic food organisms were *Chrysophyta* members (66.57%) and the most abundant macroscopic food organisms were *Diptera* larvae (73.05%) (Figure 3).

Food preferences by fish length

Another important factor regarding food consumption is the diversity of the stomach contents in different size fish, which will in turn provide us with an idea about the intraspecific food competition of a population. The food preferences of catfish in different size groups are presented in Table 1 and 2 for prey species and groups. According to these tables; while *Diptera* larvae were frequently found in the stomachs of catfish smaller than 37cm, *Crysophyta* and *Chlorophyta* members were found to be as frequent as *Diptera* larvae or even more frequent in the stomachs of catfish longer than 37 cm. Among the macroscopic food organisms that were numerically most abundant in stomachs, *Diptera* larvae were most frequent in the stomachs of 25-32 cm-length catfish. Among the microscopic ones, *Crysophyta* appeared most frequently in the stomachs of 25-28cm and 33-40cm-length catfish.

Seasonal food preferences

The relative contribution of total prey abundance and the frequencies of nine major prey classes in different seasons are plotted in Figures 4 and 5. *Rotifera, Ostracoda, Copepoda, Aphasmida, Annelida, Limnesia, Asellus, Palaemonidae, Chilopoda*, other insects, and Pisces were taken in low proportions throughout the year. Macroscopic food organisms, mainly *Diptera* larvae, contributed a greater proportion of prey abundance in summer and autumn than in spring and winter. Microscopic food organisms were observed to be more abundant in the catfish stomachs in the summer than in other seasons.

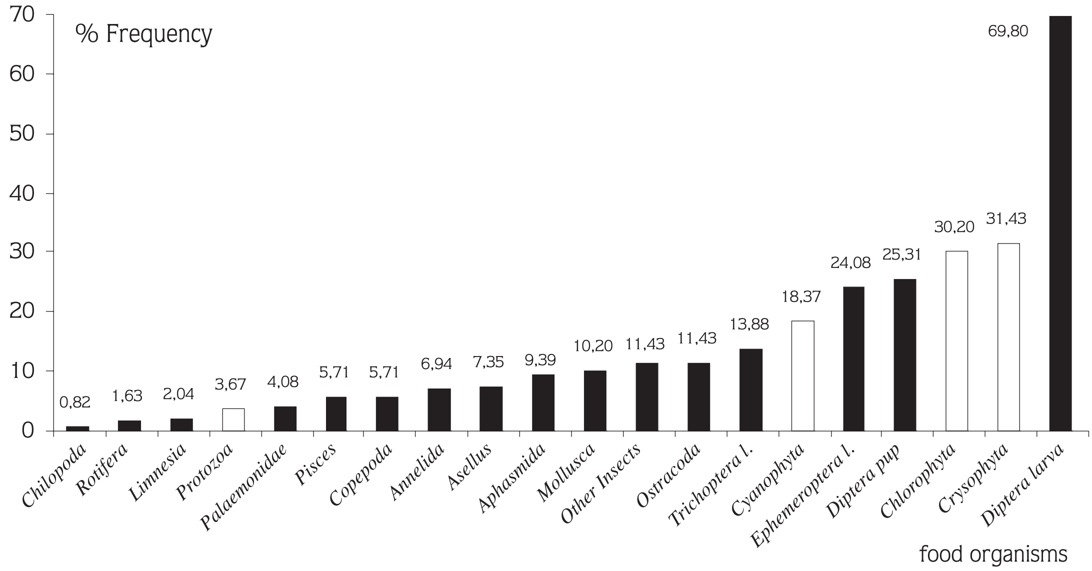

Figure 2. Frequency of occurence of food organisms removed from the catfish stomachs in the River Asi.

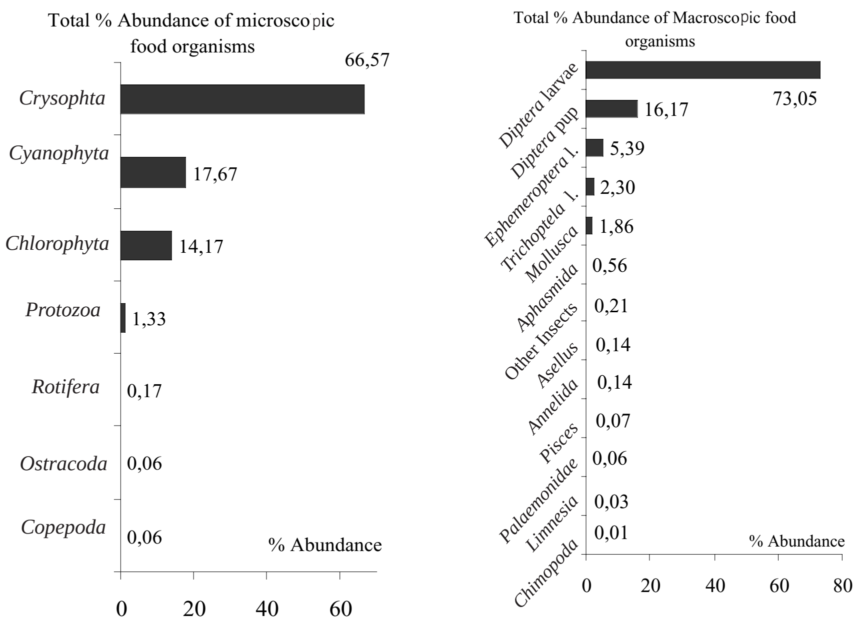

Figure 3. Percentage Abundance of microscopic and macroscopic food organisms removed from Catfish stomachs from the Asi River.

Discussion and Conclusions

Stomach analyses indicated that *C. gariepinus* fed on a wide range of food items as supported by (2), (3), (5), (6), (7), in many parts of South Africa. In addition to benthos and nekton, from 1 to 10 species of food organisms were identified in the catfish of the River Asi. Similar findings by Bruton (1979) reported that catfish are euryphagous, and catfish stomachs contained up to 10 and, in rare cases, 13 different food species (6).

Results obtained in this study showed that the most frequent food component (69.8%) is *Diptera* larvae. This result agrees essentially with the observation of some authors on *Clarias mossambicus* inhabiting Lake Victoria in South Africa (20). As shown in Table 3, previous studies made in certain parts of South Africa by some researchers revealed that the main food of *C. gariepinus*

Table 1. Percentage abundance of microscopic and macroscopic food organisms.

Length groups (TL)	13-16 N=10	17-20 N=36	21-24 N=43	25-28 N=39	29-32 N=30	33-36 N=34	37-40 N=18	41-44 N=21	45-48 N=8	49-52 N=6
Microscopic food organisms										
Protozoa	-	-	0,30	0,89	-	-	0,09	-	0,05	-
Cyanophyta	-	0,06	0,73	1,38	0,43	0,69	3,81	5,94	4,61	0,02
Crysophyta	0,15	1,19	8,56	12,81	1,41	12,72	19,22	4,99	5,35	0,15
Chlorophyta	-	-	2,03	1,32	0,06	3,50	4,87	1,24	1,15	-
Rotifera	-	-	0,16	-	-	-	-	-	-	-
Ostracoda	-	-	-	-	-	-	-	-	0,05	-
Copepoda	-	-	-	-	-	-	-	-	0,05	-
Macroscobic food organisms										
Aphasmida	0,04	0,05	0,05	0,12	0,12	0,02	0,09	0,06	-	-
Mollusca	-	-	-	0,65	0,02	0,97	0,03	0,01	0,02	0,15
Annelida	0,03	0,01	-	0,01	0,01	-	0,03	0,02	0,01	-
Limnesia	-	-	-	-	-	0,01	-	-	-	-
Asellus	-	0,01	0,03	0,03	0,05	0,01	-	-	-	-
Palaemonidae	-	-	0,04	-	-	0,01	-	-	-	-
Chilopoda	-	-	-	-	0,01	-	-	-	-	-
Diptera larva	1,04	5,79	19,02	17,32	11,33	2,36	7,34	3,88	3,78	1,19
Ephemeroptera l	0,02	0,31	0,09	0,52	1,32	2,64	0,04	0,32	0,05	0,05
Diptera pup	0,08	1,34	2,74	4,56	3,20	0,86	0,14	3,25	-	-
Trichoptera l	0,11	0,03	-	0,11	0,25	1,23	0,03	0,49	0,01	0,03
Other Insecta	0,01	0,05	-	0,02	0,02	0,03	0,01	0,04	-	-
Pisces	-	-	-	0,01	0,01	0,02	-	-	-	0,01

Table 2. Frequency of occurrence of food organisms removed catfish stomachs from the River Asi.

Length groups (TL)	13-16 N=10	17-20 N=36	21-24 N=43	25-28 N=39	29-32 N=30	33-36 N=34	37-40 N=18	41-44 N=21	45-48 N=8	49-52 N=6
Protozoa	-	-	1,22	0,82	-	0,41	0,82	-	0,41	-
Cyanophyta	-	0,41	1,63	2,04	1,63	2,86	4,49	2,86	1,63	0,82
Crysophyta	0,82	1,22	2,45	5,71	3,67	4,49	4,90	4,49	2,04	1,63
Chlorophyta	0,82	0,82	2,86	4,49	2,86	4,90	4,90	4,90	2,45	1,22
Rotifera	0,41	-	0,41	-	-	0,41	0,41	-	-	-
Ostracoda	0,41	1,22	2,86	2,86	-	1,22	1,22	0,41	0,82	0,41
Copepoda	0,41	0,41	0,82	0,41	0,82	1,63	-	0,82	0,41	-
Aphasmida	1,22	1,22	1,63	0,82	1,63	0,82	0,41	1,63	-	-
Mollusca	-	-	0,41	2,45	0,82	2,45	1,22	0,82	0,82	1,22
Annelida	0,82	0,82	0,41	0,82	0,41	0,41	1,22	1,22	0,82	-
Limnesia	-	0,41	0,41	-	-	0,82	-	0,41	-	-
Asellus	-	0,82	2,04	1,63	2,04	0,82	-	-	-	-
Palaemonidae	0,41	-	2,45	0,41	-	0,82	-	-	-	-
Chilopoda	-	0,41	-	-	0,41	-	-	-	-	-
Diptera l.	3,27	12,24	9,39	12,65	8,98	10,20	4,49	5,71	1,22	1,63
Ephemeroptera l.	1,22	5,71	2,45	3,67	2,86	2,86	0,82	2,86	0,82	0,82
Diptera pup	1,22	7,35	4,49	4,08	3,27	1,22	2,04	1,63	-	-
Trichoptera l.	0,82	0,82	-	1,22	1,63	4,49	0,82	2,45	0,82	0,82
Other Insecta	0,82	1,63	0,41	2,04	1,22	2,04	0,82	1,63	0,41	0,41
Pisces	0,41	-	0,41	0,82	0,82	1,63	0,41	0,41	-	0,82

Table 3. Review of the main foods of some large African Clarias species (6).

Clarias Species	Water system	Predator length range (mm)	Number of stomachs examined (with contents)	Main prey	Other important food	References
	Jukskei river			Entomostracans &	Detritus	
C.gariepinus	Barberspan	124 – 228		Chironomids		
	Vaal River (All Transvaal)			*Clarias gariepinus*	Other fish, plankton	
			Total 104	Terrestrial invertebrates	Fish	(3)
	Shallow Pools (Rhodesia)	not given	not given	*Coleoptera* (aquatic adults)	*Hemiptera*	(24)
	Elandsriver, Marble	180<	299	Fish	Terrestrial insects, detritus	(25)
	Lake Kariba	216 - 865	34	Cladocera	*Copepoda*	(26)
	Pongola Pans (Zululand)	100 - 900	266	Fish	Aquatic insects, Gastropoda	Kok, pers. comm.. (6)
	Lake St. Lucia (Zululand)	353 - 462	12	*Assiminia bifasciata* (Gastropoda)	Glossogobius giurus	Whitfield, pers. comm (6).
	Hardap Dam (South West Africa)	242 - 1482	69	Fish	Zooplankton	(27)
	Lake Sibaya	21 - 1088	469	*Hymenosoma orbiculare*	*Sarotherodon mossambicus, Grandidierella lignorum*	(6)
	Lower Shire River, Malawi	not given	491	Plant detritus	*Cichlid*, filamentous algae	(28)
	Lake Kariba	49 - 542	37	P. adusta	*Cyclaestheria (Conchostraca)*, chironomid larvae	(29)
C.mossambicus	Lake Victoria	not given	55	Fish	Insect larvae, molluscs, oligochaetes, prawns and Zooplankton	(30)
	Lake Malawi (open waters)	not given	not given	*Haplochromis* spp.	*Tilapia* spp., small *Clarias*	(31)
	Lake Malawi (Sheltered creek)	330 - 570	8	Terrestrial insects	Seeds, Fish	(32)
	Stream, Lake Victoria	7 - 870	93	Chironomid larvae	Ostracoda, Anisopteran larvae	(20)
	Lake Victoria (main lake)	240 - 900	216	*Haplochromis* spp.	Plants, Gastropoda, *C. nilotica*, Anisopteran larvae	(20)
	Victoria Nile	100 - 240	5	Lithophilic insects	*Ostracoda*, chironomid larvae	(20)
	Victoria Nile	770 - 900	2	*Potamon* sp.	*P. adusta, Barbus alianalis*	(20)
	Uganda	not given	not given	*Haplochromis* spp.	Insect larvae, molluscs, plants	(33)
	Lake Chilwa	not given	not given	*Barbus paludinosus*	Aquatic insects, plant detritus	(34)
	Lochinvar lagoon, Kafue River	not given	2	Fish		(35)
C. lazera	Lake George, Uganda	not given	not given	*Haplochromis* spp.		(36)
C. gariepinus	Lake Kinneret, Israil	238 - 830	264	*Mirogrex terraesanctae*	Fish, Gastropoda, *Chironomidae larvae*	(2)
	Sterkfontein Dam, South Africa	300<	191	*Cladocera, Copepoda*	*Chironomidae*, plant material	(8)
	Asi River, Turkey	132 - 826	250	*Diptera* larvae *(Arthropoda)*	*Chrysophyta, Chlorophyta,*	This study

is mostly composed of small fish, crustaceans, sometimes insects and rarely plant materials. Additionally, Shoonbee (1969) stated that the dominant food items of *C. gariepinus* in Lake Barberspan, Western Transvaal, South Africa were zooplankton rather than fish (4). Bruton (1979) indicated that the catfish did not rely only on offshore fishes and benthic invertebrates at high lake level, but they readily switched their feeding to littoral fishes and invertebrates when these became abundant (6). Therefore, the observed preference of catfish living in the River Asi for *Diptera* larvae may be simply because they could find this prey in their habitat.

The result of microscopic investigation was that the other most abundant food types were plant materials, especially *Chrysophyta* members, in stomachs of *C. gariepinus* individuals living in the River Asi. Many authors emphasised that catfish feed on large amounts of plant material (2, 5, 7, 8, 21, 22). Catfish can accidentally consume algae filaments, macrophyte fragments and detritus from the bottom of the river, together with larvae of *Diptera* and other benthic organisms. Spataru et al. (1987) found the same results in Lake Kinneret (2). From the point of view of fish culture, the most important query is not whether they can digest cellulose but whether *Clarias* spp. can utilise plant protein. On this basic point (the ability of *Clarias* spp. to utilise plant material) the entire potential for future culture of the *Clariidae* rests (7).

Many of the authors pointed out in their studies carried out in South Africa, that catfish are piscivorous (Table 3). Tomasson et al. (1983) also indicated that *C. gariepinus* in Le Roux Dam changed to a piscivorous diet when they grew to about 40 cm length (23). In the River Asi, the only piscivorous catfish were those in the 17- 20 cm and 45-48 cm length groups.

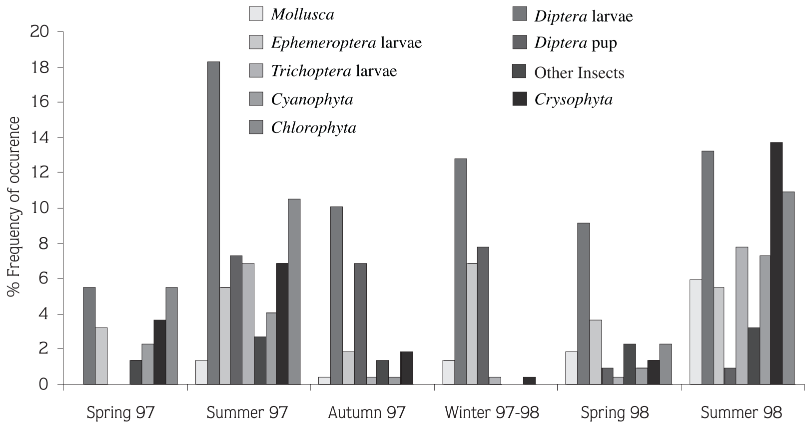

Figure 4. The relative contribution to frequencies of nine major prey classes in different seasons.

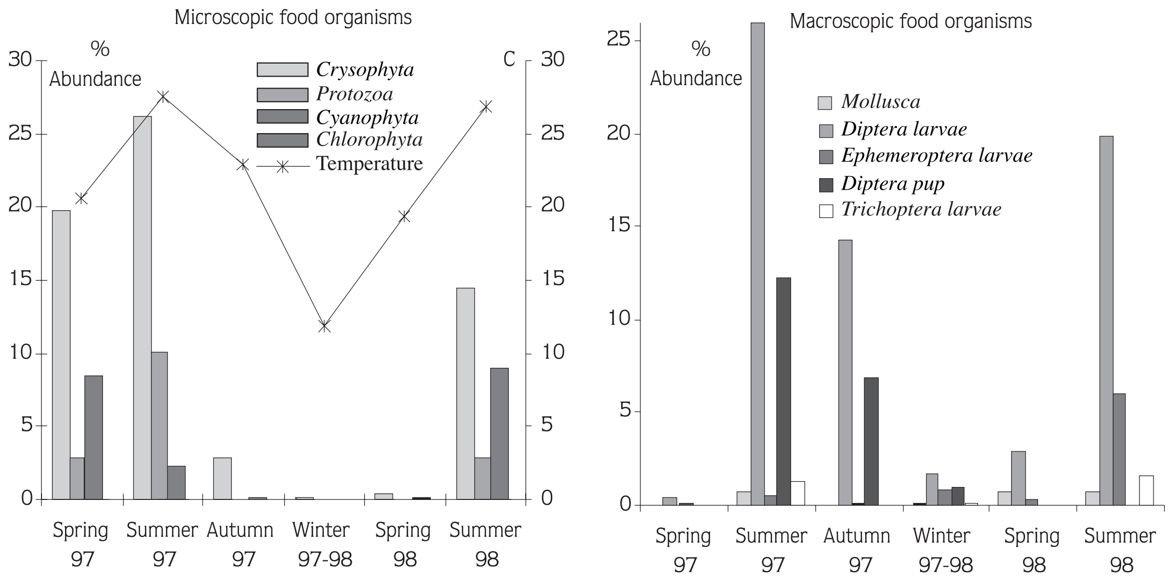

Figure 5. The relative contribution to microscopic and macroscopic prey abundance in different seasons.

Within the same species, differences in the diet composition at different stages in the life history or between populations can be reflected in morphological difference (19). *C. gariepinus* has a remarkable array of anatomical adaptations for feeding which allows it to take prey ranging in size from a minute zooplankter to a fish half its own length (6). Clay (1979) stated that young catfish (3-30 cm) did not filter feed in Lake McIlwaine, whereas under laboratory conditions with high zooplankton densities they did successfully filter-feed (7). In the River Asi, all the length groups consumed zooplanktons with almost equal frequencies; but microcrustacea (*Ostracoda* and *Copepoda*) were consumed more abundantly in the 45-48 cm length groups than in the other groups. This suggests that catfish living in the River Asi filter-fed as successfully as the population in Lake McIlwaine.

Bruton (1979) found that crustaceans contributed to prey weight in spring and summer more than in autumn and winter while fish, as main prey, are more abundant in autumn and winter in Lake Sibaya (6). Hence, Willoughby and Tweddle (1978) stated that the piscivorous role of *C. gariepinus* was only significant when the water level in the marsh was low during October and November in Malawi, South Africa (5). Dörgeloh (1994) also found that micronecton were preyed on to a large extent in autumn and summer while zooplankton (*Cladocera* and *Copepoda*) were consumed mainly in autumn and in spring. In addition, the highest proportion of plant material found in the stomachs was in summer in a clear artificial lake in South Africa (8). Similarly, in this study *Diptera* larvae were preyed upon more abundantly in spring and summer than in winter. Moreover, microscopic food organisms, mainly *Chrysophyta* members, were consumed more abundantly in summer than winter and autumn. As shown in Figure 4 before, temperature was the most effective ecological factor on feeding.

Acknowledgements

This study is part of a PhD Thesis and supported by the MKÜ Research Centre. I should like to express my gratitude to Prof. Dr. Miktat Doğanlar and Dr Tahir Atıcı for their esteemed contribution to the identification of invertebrates and algae.

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