Current World Environment

Studies on Tropics of Fish Along Upper Tungabhadra Channel, Ballari District, Karnataka

A. R. KULKARNI

College of Non-Conventional Vocational Courses For Women (CNCVCW),
affiliated to Shivaji University Kolhapur, Kolhapur, Maharashtra.

Abstract

Gut analysis is the tool to understand the feeding patterns of fishes and is an important aspect of fisheries management. It also provides the basis for understanding trophic interactions in aquatic food webs and to investigate the most frequently consumed prey or to determine the relative importance of different food types to fish nutrition. In the present study the gut content analysis was performed in Garra, Gobi, Notopterus and Tilapia fishes collected from Tungabhadra upper irrigation channel at Ballari, Karnataka. Bacillariophyceae showed maximum number in all the four fish species. Over all it showed 40 % followed by Detritus (30 %), Chlorophyceae (17 %), Cyanophyceae(7 %) and Zooplankton (6 %). Among fishes Garrashowed maximum food items (2272) followed by *Glossogobiusgiuris*(1538), *Notopterusnotopterus*(996) and *Oreochromismossambicus* (769). The relative abundance of food items in the guts also revealed the *Garra gotylastenorhynchus<Glossogobiusgiuris<Notopterusnotopterus<Oreochromismossambicus.* The variation is due to availability of foodorganisms during the study period and anthropogenic influence on channel water.

Introduction

Riverine fishery plays an important role in supporting livelihoods for millions than lacustrine fisheries. It is particularly important to the rural population accounting for direct and subsidiary employment.[1] The riverine fishery resources in India are immense as large numbers of productive rivers are present. Geotropically the wealth of stream fishes appears to be influenced by both the abiotic and the biotic factors.[2]

Research on feeding behavior of freshwater fishes certainly helps in developing a successful management programme respect to capture and culture fisheries.[3] Feeding is the major activity of fish to sustain the nature by increasing growth and

---

CONTACT A. R. Kulkarni ✉ drarkulkarni@siberindia.edu.in 📍 Rutgers University, The State University of New Jersey, Department of Human Ecology, Program in Science Learning, 59 Lipman Drive, Waller Hall 104, New Brunswick, USA.

reproduction in.[4, 5] The success of fishery business enterprise is mainly depends on scientific planning, species and food and feeding habits.[6, 7]

Studies on gut content composition provide useful information in positioning of fishes in an aquatic food web.[8-9] Intern the information on stomach composition of fish provides to establish a model in food content dynamics.[10] Food components of fish in the nature are of three types; 1. Constant elements (algae, mud, vegetable remains), 2. Recurrent elements (cladocerans, copepods, diatoms, malacostraca, gastropods and fish all of which appeared mainly in the flood) and 3. Infrequent elements (rotifers and ostracods). Biological information such as feeding behavior of fish obtained from natural systems can be used to study the performance of fish in controlled culture systems.

Tunga Bhadra river serves for 38,790 km^2 in Karnataka and 9037 km^2 in Andhra Pradesh and finally join river Krishna.[26] Most communities in rural areas of Tungabhadra basin rely on a mixed economy of agriculture and fishery related activities. It is important to consider dependency on this river and its resources from the perspective of families, households and communities. The amount of fish catch varies between 3 – 5 kg/day during lean season and about 10-20 kg/day during peak season. Around 89 fishes collected and identified from the Tungabhadra basin as recorded by Hora,[10] Bhimachar and Rau,[11] Bhimachar[12] and Rahimullah.[13]

Fish stomach analyses refer to methods of analyzing fish diet through assessment of availability of organisms and the growth rate of the fishes.[14] The present study describes the food items in the gut and feeding habits of *Garra gotylastenorhynchus, Glossogobius giuris, Notopterus notopterus* and *Oreochromis mossambicus* collected from upper Tungabhadra irrigation channel at Ballari, Karnataka.

Materials and Methods
Five fishes of each species i.e. *Garragotylastenorhynchus,Glossogobius giuris, Notopterus notopterus* and *Oreochromis mossambicus were* collected from the Tungabhadra Upper irrigation Channel at Ballari by using Cast net (throw net) during the months of November and December 2018. The represented fish samples were identified with the help of standard reference keys.[15]

All the five represented fishes of each species were dissected and the alimentary canals were removed. The contents of each gut was scrapped with a spatula into a glass Petri dish containing five ml of distilled water. The sample contents were examined under stereo microscope. Large food items were identified visually and also used microscope (magnifications: 6X to400X) for identification of microscopic algae and diatoms. They were grouped to their lowest taxa. Analysis of the gut contents were made using total numbers, occurrence and fish composition.[16]

Results and Discussion
Tungabhadra Upper irrigation Channel at Ballari has become recreational spots for localities. It is unfortunate that people use this water source illegally for many purposes. In this paper, an attempt was made to assess the fish food organisms in the study area at different sites.

Table 1: Numerical abundance and composition of food organisms in the stomach contents

Food Item	Garra		Gobii		Notopterus		Tilapia	
	Total	% Comp.	Total	% Comp.	Total	% Comp.	Total	% Comp.
Chlorophyceae	320	14.08	210	13.65	122	12.24	210	27.30
Cyanophyceae	124	5.45	87	5.65	26	2.61	86	11.18
Bacillariophyceae	1011	44.49	652	42.39	458	45.98	214	27.82
Zooplankton	26	1.14	43	2.79	181	18.17	43	5.59
Detritus	791	34.81	546	35.50	209	20.98	216	28.08
	2272	100	1538	100	996	100	769	100

**Table 2: Relative abundance of food
items in the fish stomach**

Food Item	Garra	Gobiid	Notopterus	Tilapia
Chlorophyceae	0.14	0.14	0.12	0.27
Cyanophyceae	0.05	0.06	0.03	0.11
Bacillariophyceae	0.44	0.42	0.46	0.28
Zooplankton	0.01	0.03	0.18	0.06
Detritus	0.35	0.36	0.21	0.28

% Composition
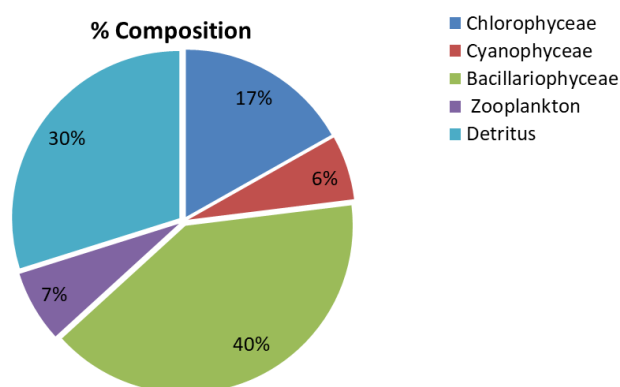
Fig.1: Percentage of food items in all fishes
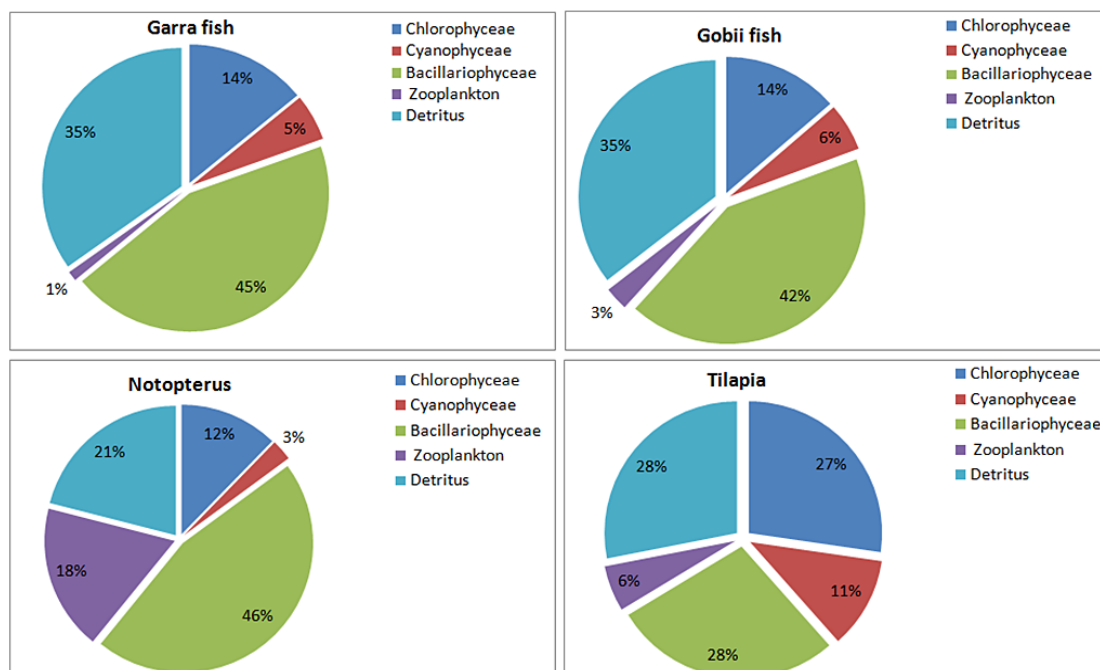
Fig.2: Percentage of food items in individual fish

Results of the present study indicated that a total of 5575 food items were counted in all four fishes. Among the total food items, *Garragotylastenorhynchus* showed maximum number (2272) followed by *Glossogobiusgiuris*(1538), *Notopterusnotopterus* (996) and *Oreochromismossambicus* (769). The results also indicated that Bacillariophyceae constituted 40%.Pinnularia, Gomphonema, Asterionella, Tabellaria, Navicula, Fragilaria, Cymbella, Achnanathes, Nitzschia, Frustulia, Cocconeis, Amphora, Brachysira, Eunotia, Encyonema, Frustulia, and Mastagloia were the major food items in the guts of different fishes. The diatoms which had been eaten by the fish indicated the type of substratum on which the fish fed. Detritus (30%) was found to be the second large food items. In Chlorophyceae (17%), the major items were Chlamydomonas, Oedogonium, Pediastrum, Spirogyra, Zygnema, Chlorella, Chara and Desmids found in fishes. Zooplankton constituted (7%) Keratella, Daphnia, Copepods and some larval forms of insects. Whereas, Cyanophyceae with 6% constituted Nostoc, Anabena, Spirulina and Oscillatoria. In general, the guts of *Garra* and *Glossogobius giuris* contains pelagic and sedentary diatoms. Whereas, in case of *Notopterus notopterus* and *Oreochromis mossambicus* the attached diatoms occurred almost exclusively. It is indicated that the fishes fed on the sediments and occasionally algal mats too. Perhaps, this was correlated with the habitat preferences and the exploitation of the specific zooplankton in the habitats.[17] According to Ojha[18] *Garra*species feed primarily on algae belonging to the families Chlorophyceae, Xanthophyceae and Bacillariophyceae. Das and Goswami[16] also revealed the association of Bacillariophyceae, Chlorophyceae, Euglenophyceae and Myxophyceae. In the present study Bacillariophyceae were the most dominant species followed by detritus and Chlorophyceae. In contrast, Kanwal and Pathani19 observed the Chlorophyceae was the dominant group followed by Bacillariophyceae in *Garra* species. Difference in number, composition and variation of food items in all four fishes is mainly depends on the food availability and preference of feeding.[20]

According to Kanwal and Pathani[19] diatom predominated in gut contents of *Garra* sp. and Chlorophyceae showed maximum relative abundance (0.41) (Table 1 and 2). Bahuguna and Badoni[21] also reportedthat Spirogyra, Hormidium, Binnuclearia, Rizoclonium, Zygnema and Scenedesmus are the food of *Garra* fishes. The composition of food items in *Garra* fish indicated that Bacillariophycea composed of 45 % followed by Detritus (35%), Zooplankton (18%), Chlorophyceae (12%) and minimum was Cyanophyceae (3%) (Fig.1).

The food items found in the stomach of *Glossogobius giuris* was composed of copepods, insects larvae, algae[22] which is the second maximum food item constituting the relative abundance of 0.28. However, zooplankton composition was found to be slightly more as it is in *Garra* (Fig. 1). Natarajan *et al.,*[23] based on the observations made on Konar and Tilayar reservoirs reported that juveniles of *G. giuris* are planktonic feeders but adults gradually become carnivorous, surviving on insect larvae up to certain stage (51-100 mm) and then turn predatory by consuming on fish.

The percentage composition of food items in *Notopterus notopterus* showed more items belonging to diatoms (46%) followed by Detritus (21%), Zooplankton (18%) and Chlorophyceae (12%) (fig.2).However, Cyanophyceae composed of 3% and showed 0.18 relative abundance value (table 1 and 2). Similar results were reported by Vijay *et al.,*[24] who revealed that the some fishes may be of carni-omnivorous, euryphagic, bottom feeder which feeds on aquatic insects, small fishes, prawns, nematodes, aquatic weeds, sand and mud, in the order of preference.

Tilapia is a omnivorous fish, feeds on phytoplankton, zooplankton, insects and aquatic plants. The gut content of tilapia indicated predominance of Diatoms, Chlorophyceae and Detritus followed by Cyanophyceae and Zooplankton (Table 1). The percentage composition of food items showed maximum Detritus and Bacillariophyceae (28% each) followed by Chlorophyceae (27%), Cyanophyceae (11%) and Zooplankton (6%) (fig.2).The fish also showed very less relative abundance (0.14) compared to other three fishes (Table 2). This could be due to the availability of food during the study period and preference of feeding of Tilapia. Diana Arfiati[25] also observed that Tilapia gut contained Chlorophyta, Chrysophyta and Cyanophyta, and

Zooplankton but prefer to consume phytoplankton specifically Chlorophyta. In the present study the younger fishes showed much varied food items and consumed more food. Adult fish showed maximum feeding intensity which when compared to their body weight was very low. In the present study all the four fishes of different size groups were found to feed on the same type of food. However, the relative feeding rate varied and it is not constant. From the results it is also clear that anthropogenic activities were influencing on the reduction in plankton population in the water flow. The chemicals washed out from domestic activities like automobile especially mining trucks washing, dish and cloth washing enter waterways can harm or kill fish and also plankton, etc.[27] Domestic waste matter can impair ability of fishes to smell and locate the food in flowing water[28] further this might affect on fishes and other aquatic organisms.[29] The present results indicated that the slight intrusion of waste matter due to some domestic activities varied feeding pattern which clearly showed by analyzing the gut content of different fish species. However, it is required the enumeration of water quality and food organisms more often. The hitherto study showed the sign of demanding a proper conservation and management strategies in the study area.

Conflict of Interest

The authors do not have any conflict of interest.

References

1. FAO. Decent rural employment for food security": A case for action, Gender, Equity and Rural Employment Division Economic and Social Development Department, 2012, FAO Rome.
2. TimothJ, Woottonand Mark Oemke P. Latitudinal differences in fish community trophic structure, and the role of fish herbivore in a Costa Rican stream. *Environmental Biology of Fishes*1992; 35, 311–319.
3. Oronsaye C.G. and Nakpodia F.M.A comparative study of the food and feeding habits of Chryichthysnigrodigitatus (Lecepede) and Brycinus nurse in a Tropical River. *Pakistan Journal of Scientific and Industrial Research*2005; 48, 118-121.
4. Royce W.F. Introduction to the Fishery Science. Academic Press, New York, San Francisco, London, 1972; 251.
5. Begum M,Alam M.J, IslamM.A,and Pal H.K. On the food and feeding habit of an estuarine catfish (Mystusgulio Hamilton) in the South-West Coast of Bangladesh. *Univ. J. Zool.* Rajshahi Univ.,2008; 27 91-94.
6. SarkarU.K, and Deepak P.K. The diet of clown knife fish Chitalachitala (Hamilton-Buchanan) an endangered notopterid from different wild population (India). *Electron. J. Ichthyol,* 2009;1:11-20.
7. Khan A.A. and Fatima M. Feeding ecology of the Grey mullet, Rhinomugilcorsula (Hamilton) from the river Yamuna, North India". *Asian Fisheries Science*. 7: 259-266. Algology, ICAR New Delhi. 1994; 272-29.
8. JosephY.J, and Djama T. Food habits of two sciaenid fish species Pseudotolithus and Pseudotolithus senegalensis off Cameroon. NAGA ICLARM 1994; 2:40- 41.
9. Palmores M.L.D,Garces L.R,Sia II Q.P,and VegaM.J.M. Diet composition and daily ration estimates of selected trawl caught fishes in San Miguel bay, Philippines NAGA, the ICLARM 1991;2 35 – 40.
10. HoraS. L, On three Collections of Fish from Mysore and Coorg, South India, IBID., 1937; 39, 5-28.

11. Bhimachar and Rau, The Fishes of Mysore State, *J. Mysore Univ.* 1941; 1, 141-52.

12. Bhimachar,Report on a survey of the fisheries of the Mysore State*, Bull. Dep. Agric.*, Mysore, 1942; 1, 1-39.

13. Rahimullah M. Fish Survey of Hyderabad State--Part I A," *J. Bombay Nat. Hist. Soc.,* 1943;43, 643-53.

14. WernerR.G. Habitat requirements. In fishery science: the unique contributions of early life stages. (EDS La Fuiman and RG Werner). Blackwell Science. Oxford.2002.

15. Talwar P.K and JhingranA.G. Inland Fishes of India and Adjacent Countries. Oxford-IBH Publishing Co. Pvt. Ltd., New Delhi, 1991; 1158 p.

16. Das Balendra K. R. and GoswamiUmeshC, Food spectrum and feeding intensity of Accrossocheilushexagonolepis (McClelland), an enedemicrheophilicteleost of commercial importance of Assam Himalayas. *Indian Journal of Fisheries*,1997; 44(3): 295-300.

17. De SenerpontDomisL. N,Elser J,Gsell A.S,Huszar V.L.M,Ibelings B.W, Jeppesen E,LürlingM, "Plankton dynamics under different climate conditions in tropical freshwater systems (a reply to the comment by Sarmento, Amado &Descy", 2013). Freshwater Biology, 2013; 58(10), 2211-2213.

18. Ojha J. Biology of Hill stream Fishes. Narendra Publishing House, Delhi. 2002.

19. Kanwal B.P.S. and Pathani S.S. Food and Feeding Habits of a Hill Stream Fish, *Garra*lamta (Hamilton-Buchanan) in some Tributaries of Suyal River, Kumaun Himalaya, Uttarakhand (India)". *International Journal of Food and Nutrition Science*, 2012; 1(2): 16-22.

20. Sonawane S,Gedam A,Anand S,Pawar S, Food and feeding habits of Channa punctatus from KaigaonToka Dist. Aurangabad (M.S.) in relation to biochemical studies". *Journal of Experimental Sciences*2012; 3(8):7-13.

21. Bahuguna S.N, and Badoni A.K. Qualitative and quantitative productivity of fish food from three important tributaries of river Alaknanda, Him. *J. Env. Zool.* 2002; 16(2); 56-60.

22. Md. ShakhawateHossain, Animesh Roy and Mohammad LutfarRahman, Food and feeding habit of BeleGlossogobius*giuris* (Hamilton and Buchannan, 1822) Collected from MithamainHaor of Kishoreganj districts, northeastern Bangladesh. *International Journal of Fisheries and Aquatic Studies*, 2016; 4(5): 84-88.

23. Natarajan A.V,Ramakrishnaiah M,KhanM.A, The food spectrum of trash fishes in relation to major carps in Konar and Tilaiyar reservoirs (Bihar). *J Inland Fish Soc India.* VII: 1975; 65-75.

24. Vijay Kiran, SaralaWaghray, Food and feeding habits of *Notopterus notopterus* (Pallas) of Saroornagar Lake, Hyderabad (A.P.). *Indian J. Fish.*,1998; 45(3): 355-359.

25. DianaArfiati, FadillaSeptiKertikasari, NunikCokrowati, and AsthervinaWidyastam iPuspitasari, Gut content analysis of tilapia (Oreochromisniloticus) from Jagir River, Surabaya City, East java, AIP Conference Proceedings , 2019; 2120 (1).

26. Manasi S,Latha Nand Raju K.V. Fisheries and Livelihoods in Tungabhadra Basin, India: Current Status and Future Possibilities, The Institute for Social and Economic Change, Bangalore, 2009; working paper 217.

27. Svobodová Z,LloydR, Máchová J, and VykusováB.Water quality and fish health. EIFAC Technical Paper. 1993.No. 54. Rome, FAO. 59 p.

28. Vámos R and Szöllözy G. There is not a danger of ammonia intoxication of fish if there is enough oxygen in water. Halászat, 1974; 20 (4). 124 (In Hungarian).

29. Wedemeyer G.A andMcLeayO.J, Methods for determining the tolerance of fishes to enviromental stressors. In: Pickering: Stress and fish. Academic. Press, London, N.J., Toronto, Sydney, San Francisco, 1981; 247–275.