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Review Article

A Review of Chronological Description of Food and Feeding Prototype of *Labeo calbasu* (Hamilton, 1822) With Special Reference to the Cleaning of Bottom (Substratum)

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Abstract

Fishes play a critical role in the food web and food chain as both intermediate trophic levels and top predators in the all ecosystems. This review article provides the earliest chronological description of the feeding behavior of *Labeo calbasu* with special reference to cleaning of bottom. The feeding nature of fishes varying to stage of life cycle, season, locality, structure of food web, food supply, richness of species in water bodies, base of sexes (male or female) and organic load in the ecosystem. Feeding nature acting an important role in estimate of growth rate, productivity potential of water, habitat predilection, baseline data for culture and conservational strategies programme. It can be concluded that *L. calbasu* is primarily a detritus feeder and herbivorous. Thus, it feeds in the bottom (bottom feeder) of the water bodies (e.g., ponds, rivers, canals and reservoirs). It is also contributing to the cleaning of bottom substrates (aquaculture ponds and river bed) through feeding nature (detritus feeder). As a result, feeding nature of *L. calbasu* may have been helping increase aquaculture production especially Asian countries or native places. Therefore, it is essential to recognize *L. calbasu* as a cultivable species in the ponds and reservoir and this will require closer collaboration between aquaculture scientists, fish farmers and environmental managers (example river sector).

Introduction

Fishes play an important role in the human nutrition with food security and maintain aquatic ecosystem with proper food supply in the food web. Fishes are fundamental to aquatic ecosystems and regulate to food chain, food web and formed healthy food for living aquatic organism in same habitat [1-3]. *Labeo calbasu* (Kalbasu) is belonging to the carp group and classified as a key species in aquaculture farming especially Asian countries. *L. calbasu* is a mainly riverine fish species, but too strongly established in the natural lakes, manmade reservoirs, canals, wetlands and ponds [4,5]. But, Its stocks have declined mainly due to competition (example food, space and breeding ground) by due to the introduction of exotic fish species such as *Cyprinus carpio* and *Oreochromis niloticus* from the rivers especially in the Ganga river system [6-8]. The extensive natural distribution of *L, calbasu* is in throughout India, Pakistan, Bangladesh, Burma and Nepal [9-10]. *L. calbasu* is a very popular fish species that takes high market price at Ganga basin, Varanasi, Prayagraj, Kaushambi and Pratapgarh districts, Uttar Pradesh, India [11-15]. In general, it is acknowledged as a prospective aquaculture fish farming species with Indian Major Carp (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*) and Exotic Major Carp (*Hypophthalmichthys molitrix*, *Ctenopharyngodon idella*, *Cyprinus carpio*) in various parts of the planet including India, Nepal, Pakistan, Bangladesh, Myanmar and other southern Asian countries [12,16-18].

River fisheries are responding to changes in the form and function of rivers and to the high fishing pressures that are current in Asia, Africa and parts of Latin America by progressing through the fishing down process. Riverine ecosystems have been profoundly altered with industrial, agriculture and urban pollution, water abstraction and regulation of exotic species

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and relation of riparian habitat and natural hydro-morphology. *L. calbasu* forms an important economically fishery in lotic and lentic water bodies in Indian subcontinent [19]. It is very common in the commercial catch of the Narmada, Godavari, Yamuna and Ganga rivers and Vindhyan region, India [10,20-24]. The average annual catch from the Narmada during the period 1958-59 to 1965-66 was 4.1% of the total 60.4% carp landings which is much more than the other major carps [25]. *L. calbasu* catches from the upper stretches of the Ganga and Yamuna rivers was sizeable, with an average yield during 1972-76 being 7.38 tonnes, 1.03 tonnes and 9.57 tonnes at Agra, Kanpur and Prayagraj, respectively. Out of 8.73-11.14% of the major carp landing from these rivers kalbasu alone composed 1.82% - 3.07% [26]. [10] stated that the *L. calbasu* was sizably proportion catches from the Vindhyan region (namely Ken, Paisuni and Tons rivers). In terms of yield from the Nagarjuna Sagar reservoir, *L. calbasu* fishery is remarkable higher than that of Indian Major Carp (IMC).

The study of food and feeding nature of fishes is valuable tool for fishery management, conservation and ecological studies [1,27-29]. The style of feeding nature is powerfully correlated with its internal and external morphological characters as like mouth shape, body shape, tooth and fins shape and placement, gut length, gill raker shape and size. In general, the interest in studying feeding ecology of fish is to understand the natural history of a species and its role in the trophic ecology of aquatic ecosystems [30]. The knowledge of food requirements of fish is helping in understating many aspects of fish biology. The diets of most fish species changes with age, growth and abundance of species in respect of season and climatic condition [1,31]. A thorough knowledge on the food and feeding habit of fishes provide key for the selection of culturable species and the importance of such information is necessary for successful fish farming especially composite fish farming/polyculture.

Food the bottlenecks theory: There are two broad topics conventionally addressed although discussing feeding nature of animals in natural system. These are: (i) diet that comprises of the food habitually eaten by the animal as basic food or primary food; (ii) the mode of feeding or ingesting diet in a particular spatio-temporal dimension as secondary food. Examining the food and feeding habits of a species is important for evaluating the ecological role and position of the species in the food web of ecosystems.

Fishes have become adapted to a wide variety of food items in the feeding. The feeding nature of fishes is the spotlight of research in fish farming, ecology, aquatic biology, conservation technique, fisheries and restoration of fishes at different seasons of the year [32,33]. The climate changes, invasion of species, fishing pressure and mining all things have the potential to alter the ecosystem function and their food chain and food web at an impressive scale. The study of food and feeding nature of *L. calbasu* is an area of continuous research as it forms the basis for the development of successful fisheries managing programme, restoration and stock maintenance on riverine fishery.

Literature summary

The food and feeding nature of *L. calbasu* have been considered by a number of researchers or scientist from lentic and lotic ecosystem namely [2,34-49] form the different habitats or environmental conditions especially Asian countries. Published research papers by these researchers were reviewed and conclude on the respect of habitat, food items and environmental conditions of the water resources (Example India, Mayanmar, Bangladesh and Pakistan). Yet, there is no definitive study on the food and feeding habits of *L. calbasu* on natural resources. From the earlier reports so far available, generally describe its primary diet as organic detritus but food and feeding nature fluctuated from river to river and season to season.

Comparative analysis

Examining the food and feeding habits of a species is important for evaluating the ecological role and position of the species in the food web of ecosystems [50]. The findings of the present study indicate that in both the rivers and reservoirs water bodies plays a crucial role in the feeding nature of *Labeo calbasu* in relation to the ecological conditions of the environment (Example stagnant and running water bodies). The feeding nature and food item varies between species depending on the season and life stage in the life cycle stages [1,15,51]. Based on food composition, the fishes are classified as deteritivores, herbivores, carnivores and omnivores [52].

The analysis of the food of *L. calbasu* showed place to place and river to river varied but mostly detritus and decaying organic matter contributed the majority percentage (Figure 1). According to Munny FJ, et al. [49] the *L. calbasu* in Dekhar haor of Sunamgonj district, Bangladesh, the detritus item was accounted for the highest proportion at 70.88% while other items contributed small proportion mud 11.81%, Bacillariophyceae 8.3%, Chlorophyceae 6.75%, Cyanophyceae 1.73%, Rotifera 0.45%, Crustaceans 0.24% and miscellaneous 0.08%. Mookerjee HK, et al. reported details of food and feeding nature of juvenile, immature young and adult consume (180 mm to 480 mm) partially decomposed aquatic plant debris (parts of petiole of Nymphaea; leaves of Vallisneria, Lemna, Hydrilla,

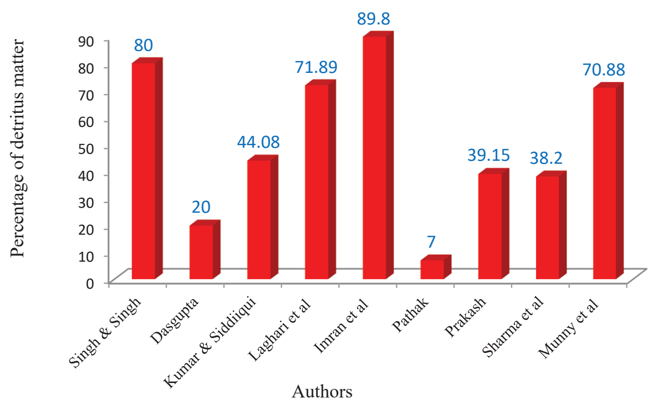

Figure 1: Percentage composition of detritus matter observed by various researchers in *L. calbasu*.

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etc.; and some vegetable debris in the form of gelatinous mass); mosquito and other insects larvae (Agrionid larvae, Ephaemerid larvae, part of some insects larvae). Occasionally they may consume some mollusc (Viviparus bengalensis, Melanoides tuberculatus, etc.) along with the shell and showed a preference for crustaceans such as *Spongilla* (Porifera).

The available literatures on food and feeding pattern of *L. calbasu* in substrate based or substrate free situations explained a kind of niche sharing by *L. calbasu* towards different food types along with its ontogenic development (Example behavioral feature from the earliest stage to maturity of the life cycle). The microorganism as well as macroorganism in natural ecosystem provides a great diversity offers a variety of food for fishes [29,53]. The differences of the diverse food items mainly depend upon their accessibility revealed by the fish, as also the intensity of feeding which is influenced by the growth increment and maturation stages in many fishes. The feeding nature of fishes varies according to season and locality [54,55]. Mookerjee HK, et al. classified *L. calbasu* as an omnivorous fish species, having the composition of food items adult as plant items 58% while 12% protozoa, 10% crustacean, 5% mollusks and rest mud and sand with 15%. [35] stated that the Kalbasu feed on algal matter and macrocrustacea from south Indian waters. [36,37] explained the *L. calbasu* as a bottom feeder that feed on worms and snails, which found at the bottom of pond.

[45] was observed that the gut content of *L. calbasu* have maximum contribution of decay matter with 39.15% and remaining 20.07% zooplankton, 16.18% phytoplankton. The plant materials and insects items also shared notable proportion 14.41% and 10.19%, respectively. *L. calbasu* feeds chiefly organic detritus materials with more than 80% throughout research work with monthly variation from the Ganga river [40]. He also observed that the gut content varied monthly. [42] reported that the 60%, 10%, 5%, 20% and 8% of the vegetable matter, microphyte tissue, filamentous algae, roots of macrophyte and detritus, respectively in the gut of *L. calbasu* from Nadia District, West Bengal. [39] estimated that decaying organic matter (44.08%), mollucs (19.52%), sand and mud particles (12.24%), diatoms (8.34%), in the gut content of *L. calbasu* from the Ganga river whereas 45.2% decaying organic matter, 19.27% mollucs, 11.76% sand and mud particles and 8.24% diatoms from the Yamuna river. According to [44] reported that the *L. calbasu* consumed 71.98% predominantly on organic debris followed by 8.56% sand and mud particles from Keenjhar Lake District Thatta, Sindh, Pakistan.

Species with lower dietary specialization (low number of species) have a wider range of food sources than do high consumers. The food resources and food web alterations are mostly caused by climate change [56-58]. These variables may affect fish growth by changing the quantity and quality of fish food items [59-61]. In general, the growth of a fish is influenced by the quality and quantity of food materials available in ecosystem and consumed.

Food items plays one of the most vital roles in the life history of fishes by way of controlling their abundance, growth, maturation, fecundity and migration [15,62-67]. Major food items of *L. calbasu* were based on detritus which comprised about 91.80% from the Yamuna river [2]. [46] observed that the detritus (38.2%) dominated the gut contents of *L. calbasu* followed by diatoms (20.8%), green algae (18.5%), blue green algae (15.0%) and others (7.5%) from Jawahar Sagar Lake (Rajasthan). While, [46] reported that the gut contents of *L. calbasu* were dominated by diatoms (36.5%) followed by detritus (35.9%), green algae (18.9%) and blue green algae (8.9%) from inhabiting Kishore Sagar Lake (Rajasthan).

According to [38] *L. calbasu* is a bottom feeder fish species in habit. The nature of diet in juvenile and adult fishes from Loni reservoir (Madhya Pradesh, India) was same but zooplankton, which occurred in negligible quantities in the adult, is the most preferred item in the diet of juvenile and the decayed organic food, which composed maximum in the adult, ranked fifth in juvenile. The food of juvenile was zooplankton (39.5), diatoms (22.2%), algal matter (4.4%), plant (7.6%), decayed organic food (7.0%) and sand and mud (4.4%).

In fact, as a true bottom feeder *L. calbasu* mouth protrudes downwards when open and has a distinct fringe on the upper lip. [33,41] observed that the *L. calbasu* was helped to transfer nutrients from bottom sediment to the water column via bioturbation of benthic organic matter. *L. calbasu* is herbivore as well as detritivore in nature and feeds on plants, decaying organic matter, rotifer, diatom and mollusks [43]. [48] stated that the food item of *Labeo calbasu* consists of phytoplankton, zooplankton, algae, plant material and mud and sand. All the food items examined, the highest composition was phytoplankton (60%) and the lowest was algae and plant material (20%).

Interestingly, the diet of fishes are important in ecological research as it reveals potential competition for the available food resources, exploitation pressure and predator-prey interactions [68-70]. The maximum size of fishes is also regulated by feeding intensity [71-74]. The diet of fishes are contribute to the understanding of the ecosystem's structure, the trophic dynamics in the food webs, growth increment, fecundity potential and changes in abundance and diversity of organisms [75-82] and highest total length [83-87].

Basic food of *L. calbasu*: Decaying organic matter →Sand→ Mud

Nutrient transfer by *L. calbasu*:Bottom sediment→ water column

Applications

The comparative diet analysis of *L. calbasu* will help in understanding of the ecosystem's structure, the trophic dynamics in the food webs, growth increment and estimation of fecundity potential. The results also helped in the understanding of the changing patterns of *L. calbasu* abundance, richness and total length of fishes (example ecosystem to ecosystem or lotic to lentic).

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Gaps

Further research is needed to better estimate the feeding behavior of *L. calbasu* in aquaculture ponds in relation to natural food availability.

Conclusion

It may be concluded that the *Labeo calbasu* is mostly detritus feeder. But, it feeds in the bottom (bottom feeder) of the water bodies (Example ponds, rivers and reservoirs). Its feeding nature is helping for the cleaning of the bottom (aquaculture ponds and river bed). As a result, the feeding nature of *L. calbasu* may have contributed to increased aquaculture production, especially in Asian countries and its native regions, due to the use of large quantities of supplemental feed, such as artificial feed ingredients, in culture ponds. Therefore, *L. calbasu* should be considered a viable candidate for pond and reservoir cultivation in the ponds and reservoir and this will require coordinated efforts among aquaculture scientists, fish farmers, and environmental resource managers, particularly in riverine systems.

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References

1. Alam A, Das SCS, Joshi KD. Feeding and reproductive behaviour of the river catfish Rita rita (Hamilton, 1822) in the river Ganga, India. Indian J Anim Sci. 2016;86(6):736-40. Available from: https://www.researchgate.net/profile/Shyamal-Chandra-Das/publication/317661976
2. Imran M, Khan AM, Wasim M. Dietary overlap between native and exotic fishes revealed through gut content analysis at Head Baloki, Punjab. Pak J Bioresour Manag. 2021;8(1):91-105. Available from: https://doi.org/10.35691/JBM.1202.0169
3. Tripathi S, Gopesh A, Dwivedi AC. Food and feeding habit of commercially important catfish, Clupisoma garua (Hamilton, 1822) from the middle stretch of subtropical the Ganga river, India. J Nehru Gram Bharati Univ. 2023;12(2):13-23.
4. Singh PR, Dobriyal AK, Singh HR. Study of age and growth of Labeo calbasu (Ham.) from the Ganga river system at Allahabad. J Mountain Res. 2017;12:1-12.
5. Dwivedi AC, Nautiyal P. Age and growth increment of Labeo calbasu (Hamilton 1822) from the Vindhyan region, Central India. Int J Aquac Fish Sci. 2021;7(2):010-13. Available from: https://dx.doi.org/10.17352/2455-8400.000067
6. Mishra N, Dwivedi AC, Mayank P. Invasion potential, impact and population structure of non-native fish species, Cyprinus carpio (Linnaeus, 1758) from the tributary of the Ganga River, Central India. Aquac Fish Stud. 2021;3(3):1-4. Available from: https://doi.org/10.31038/AFS.2021332
7. Mayank P, Mishra N, Dwivedi AC. Invasive potential of Nile Tilapia, Oreochromis niloticus (Linnaeus, 1758) from the tributary of the Ganga River, Central India. J Earth Environ Sci Res. 2021;SRC/JEESR-175. Available from: http://dx.doi.org/10.47363/JEESR/2021(3)152
8. Dwivedi AC, Mishra N. Health of stock of commercially exploited non native fish species, Cyprinus carpio (Linnaeus, 1758) from the tributary of the Ganga River, Central India. Geol Earth Mar Sci. 2023;5(1):1-3. Available from: https://doi.org/10.31038/GEMS.2023514
9. Chondar SL. Biology of Finfish and Shellfish. Howrah (India): SCSC Publishers; 1999;1-514.
10. Nautiyal P, Dwivedi AC. Fishery in the tributaries of Yamuna river (Ken river, Paisuni rivers) and Ganga river (Tons river). J Mountain Res. 2019;14(2):19-36. Available from: http://dx.doi.org/10.51220/jmr.v19i2.3
11. Dwivedi AC. Age structure of some commercially exploited fish stocks of the Ganga river system (Banda-Mirzapur section) [thesis]. Prayagraj (UP): University of Allahabad, Department of Zoology; 2006;138.
12. Jha DN, Joshi KD, Dwivedi AC, Mayank P, Kumar M, Tiwari A. Assessment of fish production potential of Chitrakoot district, Uttar Pradesh. J Kalash Sci. 2015;3(3, Special Vol):7-10. Available from: https://www.researchgate.net/publication/320728667
13. Dwivedi AC, Nautiyal P. Alien fish species, Cyprinus carpio (common carp) as a invader in the Vindhyan region (Ken, Paisuni, Tons rivers), India. J Kalash Sci. 2013;2:133-9. Available from: https://www.researchgate.net/publication/292857537
14. Mayank P, Dwivedi AC. Resource use efficiency and invasive potential of non-native fish species, Oreochromis niloticus from the Paisuni River, India. Poult Fish Wildl Sci. 2017;5(1). Available from: https://www.longdom.org/open-access/resource-use-efficiency-and-invasive-potential-of-nonnative-fish-species-oreochromis-niloticus-from-the-paisuni-river-in-16145.html
15. Dwivedi AC, Jha DN, Shrivastava RS, Das BK, Mayank P, Kumar M, et al. Status of water resources and fish farming in Allahabad district, India. J Fish Livest Prod. 2018;6(2):274. Available from: https://doi.org/10.4172/2332-2608.1000274
16. Mishra P, Rao AP, Dwivedi AC, Mishra M, Upadhyay SK. Composite fish culture in district Faizabad: socio-personal, economic and cultural constraints among fish farmers. J Nat Resour Dev. 2007;2(1):32-7. Available from: https://www.researchgate.net/publication/381706580
17. Narejo NT, Rahmatullah SM. Studies on the grazing rate of Culibaush, Labeo calbasu (Hamilton) on Periphyton. Pak J Zool. 2010;42(1):53-6. Available from: https://www.researchgate.net/publication/268292909
18. Pal P, Kumar J, Dwivedi AC. Comparative study on plankton diversity of ponds (culture and non-culture) ecosystem in Prayagraj, Uttar Pradesh: a note. J Kalash Sci. 2023;11(1):14-24. Available from: https://www.researchgate.net/publication/372883578
19. Vinci GK, Sugunan VV. Biology of Labeo calbasu (Ham.) of the Nagarjunasagar Reservoir (AP). J Inland Fish Soc India. 1981;13(2):22-39. Available from: https://eurekamag.com/research/037/980/037980171.php
20. Tripathi S, Gopesh A, Dwivedi AC. Framework and sustainable audit for the assessing of the Ganga river ecosystem health at Allahabad, India. Asian J Environ Sci. 2017;12(1):37-42. Available from: http://dx.doi.org/10.15740/HAS/AJES/12.1/37-42
21. Tripathi S, Gopesh A, Dwivedi AC. Characterization and role of non-native fishes (Cyprinus carpio, Oreochromis niloticus) from the middle stretch of the Ganga river, India: Current knowledge and research needs. J Kalash Sci. 2024;12(1):27-35. Available from: https://www.researchgate.net/publication/384599828
22. Dwivedi AC, Mishra AS, Mayank P, Tiwari A. Persistence and structure of the fish assemblage from the Ganga river (Kanpur to Varanasi section), India. J Geogr Nat Disasters. 2016;6:159. Available from: http://dx.doi.org/10.4172/2167-0587.1000159

23. Dwivedi AC, Mayank P, Tripathi S, Tiwari A. Biodiversity: the non-natives species versus the natives species and ecosystem functioning. J Biodivers Bioprospect Dev. 2017;4(1). Available from: https://www.researchgate.net/publication/322617802

24. Tiwari A, Dwivedi AC, Mayank P. Time scale changes in the water quality of the Ganga River, India and estimation of suitability for exotic and hardy fishes. Hydrol Curr Res. 2016;7(3):254. Available from: https://www.cabidigitallibrary.org/doi/full/10.5555/20173109173

25. Karamchandani SJ, Desai VR, Pisolkar MD. Biological investigations on the fish and fisheries of Narmada river. Bull Cent Inland Fish Res Instt Barrackpore. 1967;19:1-39.

26. Jhingran VG. Fish and Fisheries of India. 2nd ed. New Delhi: Hindustan Publishing Corporation; 1982. p. 1-727. Available from: https://agris.fao.org/search/en/providers/122621/records/647761c15eb437ddff7823a6

27. Woodward G, Hildrew AG. Food web structure in riverine landscapes. Freshw Biol. 2002;47:777-98. https://doi.org/10.1046/j.1365-2427.2002.00908.x

28. Simpfendorfer CA, Heupel MR, White WT, Dulvy NK. The importance of research and public opinion to conservation management of sharks and rays: a synthesis. Mar Freshw Res. 2011;62:518-27. https://doi.org/10.1071/MF11086

29. Alam A, Chadha NK, Joshi KD, Chakraborty SK, Sawant PB, Kumar T, et al. Food and Feeding ecology of the non-native Nile Tilapia Oreochromis niloticus (Linnaeus, 1758) in the river Yamuna, India. Proc Natl Acad Sci India Sect B Biol Sci. 2015;85(1):167-74. https://link.springer.com/article/10.1007/s40011-014-0338-3

30. Jordán F, Liu W, Davis AJ. Topological keystone species: measures of positional importance in food webs. Oikos. 2006;112:535-46. https://doi.org/10.1111/j.0030-1299.2006.13724.x

31. Laghari AM, Narejo NT, Jalbani S, Dastagir G, Khan P. Studies on food and feeding habits of Carp, Labeo calbasu from Keenjhar Lake district Thatta, Sindh, Pakistan. Sindh Univ Res J Sci Ser. 2016;47(1):79-82. Available from: https://sociology.usindh.edu.pk/index.php/SURJ/article/view/5074

32. Dwivedi AC, Mayank P, Mishra AS. Feeding structure of two exotic fish species Cyprinus carpio and Oreochromis niloticus from the Ganga river. J Kalash Sci. 2018;6(2):37-9. Available from: https://www.researchgate.net/publication/335174599

33. Rahman MM, Jo Q, Gong GY, Miller SA, Hossain MY. A comparative study of common carp (Cyprinus carpio L.) and calbasu (Labeo calbasu Hamilton) on bottom soil resuspension, water quality, nutrient accumulations, food intake and growth of fish in simulated rohu (Labeo rohita Hamilton) ponds. Aquaculture. 2008;285:78-83. https://doi.org/10.1016/j.aquaculture.2008.08.002

34. Mookerjee HK, Majumdar SR. On the life history of Labeo calbasu (Hamilton). J Dept Sci Calcutta Univ. 1944;1(4):59-69.

35. Chacko PI, Kurian GK. Feeding and breeding of the Labeo calbasu of south Indian. Indian Sci Congr. 1949;36(3):167.

36. Alikunhi KH. On the food of young carp fry. J Zool India. 1952;4:77-84.

37. Alikunhi KH. Fish culture in India. Farming Bull ICAR New Delhi. 1957;(20):144.

38. Pathak SC. Length-weight relationship, condition factor study of Labeo calbasu (Hamilton) from Loni reservoir (M.P.). J Inland Fish Soc India. 1975;7:58-64. Available from: https://www.sciepub.com/reference/157121

39. Khumar K, Siddiqui MS. Food and feeding habits of the carp, Labeo calbasu (Ham.) in north Indian waters. Acta Ichthyol Piscat. 1989;19:33-48. https://aiep.pensoft.net/article/25156/

40. Singh PR, Singh HR. Feeding biology of Labeo calbasu (Ham.). Proc Natl Acad Sci India B. 2000;70(2):179-83. Available from: https://eurekamag.com/research/003/445/003445675.php

41. Rahman MM, Kadowaki S, Balcombe SR, Wahab MA. Common carp (Cyprinus carpio L.) alters its feeding niche in response to changing food resources: direct observations in simulated ponds. Ecol Res. 2010;25:303-9. http://dx.doi.org/10.1007/s11284-009-0657-7

42. Dasgupta M. Morphological adaptation of the alimentary canal of four Labeo species in relation to their food and feeding habits. Indian J Fish. 2001;48(3):255-7. https://www.researchgate.net/publication/264840974

43. Mandal S, Ghosh K. Accumulation of tannin in different tissues of Indian major carps and exotic carps. Aquac Res. 2010;41:945-8. http://dx.doi.org/10.1111/j.1365-2109.2009.02371.x

44. Sadguru P. Seasonal variation in food and feeding habit of Indian major carp (Labeo calbasu) in Baghel Taal, Bahraich, U.P. Int J Fish Aquat Stud. 2015;3:483-6. Available from: https://www.fisheriesjournal.com/archives/2015/vol3issue2/PartF/8-5-20-298.pdf

45. Prakash S. Seasonal variation in food and feeding habit of Indian major carp (Labeo calbasu) in Baghel Taal, Bahraich, U.P. Int J Fish Aquat Stud. 2015;3(2):483-6. Available from: https://www.fisheriesjournal.com/archives/2015/vol3issue2/PartF/8-5-20-298.pdf

46. Sharma LL, Aery NC, Kumar A, Gupta MC. Diatoms as component of fish diet in natural aquatic environment. TRJ. 2016;2(3):11-15. Available from: https://nebula.wsimg.com/828d93c6ce1f8201642d11f18303c038?AccessKeyId=809C1E9E538F4C38BEAB&disposition=0&alloworigin=1

47. Vahneichong E, Das SK, Bhakta D. Foraging and bio-indices of Labeo calbasu (Hamilton, 1822) from wetlands of South 24 Parganas district of West Bengal. J Aqua Trop. 2017;32(3-4):353-60. Available from: https://www.proquest.com/docview/2023652724?sourcetype=Scholarly%20Journals

48. Khaing MM, Khaing KYM. Food and feeding habits of some freshwater fishes from Ayeyarwady River, Mandalay District, Myanmar. IOP Conf Ser Earth Environ Sci. 2020;416:012005. Available from: http://dx.doi.org/10.1088/1755-1315/416/1/012005

49. Munny FJ, Uddin MS, Islam MS, Alam MT, Suravi IN, Kawsar MA, et al. Gut content analysis of Labeo calbasu at different seasons in Dekhar haor, Sunamgonj, Bangladesh. Am J Agric Sci Eng Technol. 2021;5(2):297-308. Available from: https://journals.e-palli.com/home/index.php/ajaset/article/view/108

50. Allan JD, Castillo MM. Stream ecology: structure and function of running waters. 2nd ed. Springer; 2007;372.

51. Blaber SJM. Tropical estuarine fishes: ecology, exploitation and conservation. Queensland, Australia: Blackwell Science; 2000;372. Available from: http://dx.doi.org/10.1002/9780470694985

52. Moyle PB, Cech JJ Jr. Fishes: An introduction to ichthyology. 4th ed. Upper Saddle River, New Jersey: Prentice Hall; 2000;612. Available from: https://hero.epa.gov/hero/index.cfm/reference/details/reference_id/3123060

53. Olojo EAA, Olurin KB, Osiikoya OJ. Food and feeding habit of Synodontis nirgita from the Osum river, SW Nigeria. NAGA WorldFish Cent Q. 2003;26:421-4. Available from: https://digitalarchive.worldfishcenter.org/items/92ffa897-6883-47fc-af94-aea4ef676d97

54. Chipps SR, Garvey JE. Assessment of food habits and feeding patterns. In: Guy CS, Brown ML, editors. Analysis and interpretation of freshwater fisheries data. Am Fish Soc; 2006;473-514. Available from: https://www.researchgate.net/publication/275212023_Assessment_of_Diets_and_Feeding_Patterns

55. Hyndes GA, Platell ME, Potter IC. Relationships between diet and body size, mouth morphology, habitat and movements of six sillaginid species in coastal waters: implications for resource partitioning. Mar Biol. 1997;128:585-98. Available from: https://doi.org/10.1007/s002270050125

Citation: Dwivedi AC. A Review of Chronological Description of Food and Feeding Prototype of *Labeo calbasu* (Hamilton, 1822) With Special Reference to the Cleaning of Bottom (Substratum). Int J Aquac Fish Sci. 2025;11(2):010-016. Available from: https://dx.doi.org/10.17352/2455-8400.000098

56. Piliere A, Schipper AM, Breure AM, Posthuma L, de Zwart D, Dyer SD, et al. Comparing responses of freshwater fish and invertebrate community integrity along multiple environmental gradients. Ecol Indic. 2014;43:215-26. Available from: https://doi.org/10.1016/j.ecolind.2014.02.019

57. Thackeray SJ, Henrys PA, Feuchtmayr H, Jones ID, Maberly SC, Winfield IJ. Food web de-synchronization in England's largest lake: an assessment based on multiple phenological metrics. Glob Chang Biol. 2013;19:3568-80. Available from: https://doi.org/10.1111/gcb.12326

58. Tao J, Kennard MJ, Jia YT, Chen YF. Climate-driven synchrony in growth-increment chronologies of fish from the world's largest high-elevation river. Sci Total Environ. 2018;645:339-46. Available from: https://doi.org/10.1016/j.scitotenv.2018.07.108

59. Mo WY, Cheng Z, Choi WM, Man YB, Liu Y, et al. Application of food waste based diets in polyculture of low trophic level fish: effects on fish growth, water quality and plankton density. Mar Pollut Bull. 2014;85:803-9. Available from: https://doi.org/10.1016/j.marpolbul.2014.01.020

60. Oronsaye CG, Nakpodia FA. A comparative study of the food and feeding habits of Chrysichthys nigrodigitatus and Brycinus nurse in a tropical river. Pak J Sci Ind Res. 2005;48:118-21. Available from: https://www.researchgate.net/publication/286356931_A_comparative_study_of_the_food_and_feeding_habits_of_Chrysichthy_nigrodigitatus_and_Brycinus_nurse_in_a_tropical_river

61. Dewan S, Shaha SN. Food and feeding habits of Tilapia nilotica (L.) (Perciformes: Cichlidae). II. Diel and seasonal patterns of feeding. Bangladesh J Zool. 1979;7(2):75-80.

62. Tripathi S, Gopesh A, Joshi KD, Dwivedi AC, Mayank P. Studies on feeding behaviour of Labeo bata (Hamilton, 1822) from the lower stretch of the Yamuna river, Uttar Pradesh. J Kalash Sci. 2013;(Special Volume):49-52. Available from: https://www.researchgate.net/publication/315798345

63. Dwivedi AC, Mayank P. Studies on the age, growth pattern and sex ratio of Cyprinus carpio var. communis from the largest tributary of the Ganga river, India. J Kalash Sci. 2013;(Special Volume):21-27.

64. Mayank P, Dwivedi AC, Tiwari A. Reproductive profile of Cirrhinus mrigala (Hamilton, 1822) and suggestion for restoration from the Yamuna river, India. Bioved. 2016;27(1):115-20. Available from: https://biovedjournal.org/bv27(1)/16%20abs.pdf

65. Mayank P, Dwivedi AC, Pathak RK. Age, growth and age pyramid of exotic fish species Oreochromis niloticus (Linnaeus 1758) from the lower stretch of the Yamuna river, India. Natl Acad Sci Lett. 2018;41(6):345-8. Available from: http://dx.doi.org/10.1007/s40009-018-0673-7

66. Nautiyal P, Dwivedi AC. Growth rate determination of the endangered Mahseer, Tor tor (Hamilton 1822) from the Bundelkhand region, central India. J Fish Res. 2020;4(2):7-11. Available from: https://www.researchgate.net/publication/349054753

67. Magana HA. Feeding Preference of the Rio Grande Silvery Minnow (Hybognathus amarus). Rev Fish Sci. 2009;17(4):468-77. Available from: http://dx.doi.org/10.1080/10641260902985096

68. Heath MR, Speirs DC, Steele JH. Understanding patterns and processes in models of trophic cascades. Ecol Lett. 2013;17(1):101-14. Available from: https://doi.org/10.1111/ele.12200

69. Baker R, Buckland A, Sheaves M. Fish gut content analysis: robust measure of diet composition. Fish Fish. 2014;15:170-7. Available from: http://dx.doi.org/10.1111/faf.12026

70. Moutopoulos DK, Stoumboudi MT, Ramfos A, Tsagarakis K, Gritzalis KC, Petriki O, et al. Food web modelling on the structure and functioning of a Mediterranean lentic system. Hydrobiologia. 2018;822(1):259-83.

71. Kumar D, Dwivedi AC, Kumar J, Kumar A, Tiwari S. Impact of fishing on size spectra of Wallago attu (Bloch and Schneider 1801) from the Rapti river, Uttar Pradesh, India. J Kalash Sci. 2024;12(1):37-40. Available from: https://www.researchgate.net/publication/383121941

72. Kumar D, Dwivedi AC, Kumar J. Maximum size of Helicopter catfish, Wallago attu (Bloch & Schneider, 1801) from the Rapti river, Uttar Pradesh, India. J Nehru Gram Bharati Univ. 2023;12(2):48-51. Available from: https://www.researchgate.net/publication/380629376

73. Kumar A, Dwivedi AC, Thakur VR. The record of the largest Fresh water Shark, Wallago attu (Bloch & Schneider, 1801) from the Sarayu river, Uttar Pradesh, India. J Kalash Sci. 2023;11(2):21-3.

74. Heuvel CE, Haffner GD, Zhao Y, Colborne SF, Despenic A, Fisk AT. The influence of body size and season on the feeding ecology of three freshwater fishes with different diets in Lake Erie. J Great Lakes Res. 2019;45(4):795-804. Available from: https://doi.org/10.1016/j.jglr.2019.05.001

75. Gopesh A, Tripathi S, Joshi KD, Dwivedi AC. Size composition, exploitation structure and sex ratio of Clupisoma garua (Hamilton) from middle stretch of the Ganga River at Allahabad, India. Natl Acad Sci Lett. 2021;44(4):309-11. Available from: https://doi.org/10.1007/s40009-020-01011-0

76. Dwivedi AC, Mishra N, Mayank P. Variations in the catchability and remarkable size-spectra stability of Cyprinus carpio (Linnaeus, 1758) with reference of ecology from the Tons river, Central India. Ecol Conserv Sci. 2023;2(3):555590. Available from: http://dx.doi.org/10.19080/ECOA.2023.02.555590

77. Tiwari D, Dwivedi AC, Alam A. Studies on age composition, age and growth of Indian major carp, Cirrhinus mrigala (Hamilton, 1822) from the Belan River, India. J Nehru Gram Bharati Univ. 2024;13(1):28-34. Available from: https://www.researchgate.net/publication/384066344

78. Dwivedi AC, Anupama, Bisht B, Khan S, Mayank P. Studies on the age and growth of Labeo calbasu (Hamilton) with an exploitation pattern from the Ganga river system, Uttar Pradesh. J Indian Fish Assoc. 2009;36:47-53. Available from: https://aquadocs.org/items/43afb283-bf22-40ec-9771-026547eb3d3c

79. Vagenas G, Stoumboudi MT, Petriki O, Andriopoulou A, Tsionki I, Karachle PK. Dietary patterns of five freshwater fish species in a large Mediterranean lake. J Freshw Ecol. 2022;37(1):203-20. Available from: https://doi.org/10.1080/02705060.2022.2034674

80. Dwivedi AC, Mayank P, Tripathi S. Size composition, exploitation structure and sex ratio of catfish, Rita rita (Hamilton) in the lower stretch of the Yamuna river at Allahabad. Flora Fauna. 2011;17(2):295-300.

81. Dwivedi AC, Mishra N. Impact of climate deviation on reproductive profile of Nile Tilapia, Oreochromis niloticus (Linnaeus, 1758) from the Tons River, India. Int J Aquac Fish Sci. 2024;10(4):031-7. Available from: https://dx.doi.org/10.17352/2455-8400.000093

82. Tiwari A, Kumar V, Dwivedi AC. Human health risk assessment via the consumption of the freshwater fishes Cyprinus carpio and Oreochromis niloticus collected from the Ganga River at Kanpur, India. J Kalash Sci. 2024;12(2):1-11.

83. Pal V, Kumar J, Dwivedi AC, Kumar D. Diversity of phytoplankton from the Ganga river at Rasulabadghat and Sangam, Prayagraj, Uttar Pradesh. J Inland Fish Soc India. 2024;56(2):145-54. Available from: http://dx.doi.org/10.56093/jifsi.v56i2.2024.163176

84. Mayank P, Dwivedi AC. Exploited population and structure of Labeo calbasu (Hamilton) in different seasons from the Ghaghara river at Faizabad region (U.P.). Aquacult. 2006;7(2):259-68.

85. Kumar A, Dwivedi AC, Thakur VR, Kumar D. Size spectra variation and exploitation structure of Wallago attu (Bloch and Schneider 1801) from the river Sarayu at Gorakhpur, Uttar Pradesh India. J Nehru Gram Bharati Univ. 2024;13(1):22-7.

86. Pathak RK, Gopesh A, Dwivedi AC, Joshi KD. Sex structure of commercially exploited fish species, Cyprinus carpio var. communis from the Ganga and Yamuna rivers at Allahabad, Uttar Pradesh. J Kalash Sci. 2014;2(1):43-6. Available from: https://www.researchgate.net/publication/297591015

87. Nautiyal P, Dwivedi AC, Mishra AS. Age structure of carp and catfish catch as a tool to assess ecological health of fished stocks from the Ganga River system with special reference to Mahseer Tor tor (Hamilton, 1822). J Threat Taxa. 2024;16(10):25979-89. Available from: https://doi.org/10.11609/jott.9051.16.10.25979-25989

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