

Diet Overlap between Introduced *Catla catla*, *Labeo rohita* and the Native *Dawkinsia filamentosa* in Vellayani Freshwater Lake, Kerala Southwest Coast of India

Reenamole, G.R¹, George D'cruz, F²

^{1,2} Department Of Zoology, Zoology Research Centre, Fatima Mata National College, University Of Kerala

Abstract: The present study was undertaken to document the gut contents of the exotic species, *Catla catla* and *Labeo rohita* and the main indigenous fish *Dawkinsia filamentosa* in Vellayani Fresh water Lake at Thiruvananthapuram, so as to ascertain the possibility of dietary overlap between the indigenous and exotic fishes due to the introduction of non native fishes for enhancing fish stock has been going on in the lake from 2010 onwards. The study was carried out from August 2013 to July 2014. Gut content analysis was done by Points method (Hyslop, 1980). The extent of diet overlapping was assessed using Percentage of diet overlap. For *D. filamentosa*, the cyanophytes were the major component (43.82%), followed by chlorophytes (26.88%) and chrysophytes (19.76%). The major food items of *C. catla* and *L. rohita* were also cyanophytes, chlorophytes and chrysophytes. Percentage of diet overlap was found to be 60% showing that dietary overlapping is significant, and in the long run, this may lead to negative impacts on the breeding and reproduction of the native species.

Keywords: Dietary overlapping, Introduced species, Native fishes, Vellayani Freshwater Lake

1. Introduction

Intentional introduction of non native fish species into open waters is to manipulate the ecosystem through physical or biological actions to control unwanted organisms. There are several key aspects often considered in association with non-native fish introductions: predation, habitat degradation, competition for resources, hybridization and disease transmission. Worldwide, exotic fishes have disrupted natural ecological systems, often leading to the exclusion of native species (Isumbisho *et al.* 2006).

Vellayani Lake is one of the largest freshwater lakes in Thiruvananthapuram district of Kerala which is extensively used as a source of drinking water as well as agriculture. Since 2010, the Department of Fisheries, Government of Kerala has come up with a project to enhance the fish stock in Vellayani Lake, by introducing non native fishes, Indian major carps like *Catla* and *Rohu*. *D. filamentosa* is an indigenous and major food fish in this lake. They are the major small fish items in the commercial catches. The present study aims to document the gut contents of introduced species and the native species *D. filamentosa* in the lake and thereby attempts to draw conclusions on the possibility of dietary overlap between them.

2. Materials and Methods

2.1 Study Area

Vellayani Lake (8° 24' 09"- 8° 26' 30"N & 76° 59' 08"- 76° 59' 47" E) is one of the largest freshwater lakes, in Thiruvananthapuram district of Kerala. The lake is situated 29 meters above mean sea level. The length of the lake is about 3.15 km and its maximum width is about 1km, while the depth of the lake varies from 2 to 6 m. The site was

specifically selected for the dietary overlap studies due to the ongoing fish stock enhancement program of the Department of Fisheries, Govt. of Kerala by which Indian major carps, which is not a native fish of this lake, has been stocked with the indigenous fishes in the lake. Fig. 1 shows location map of the lake.

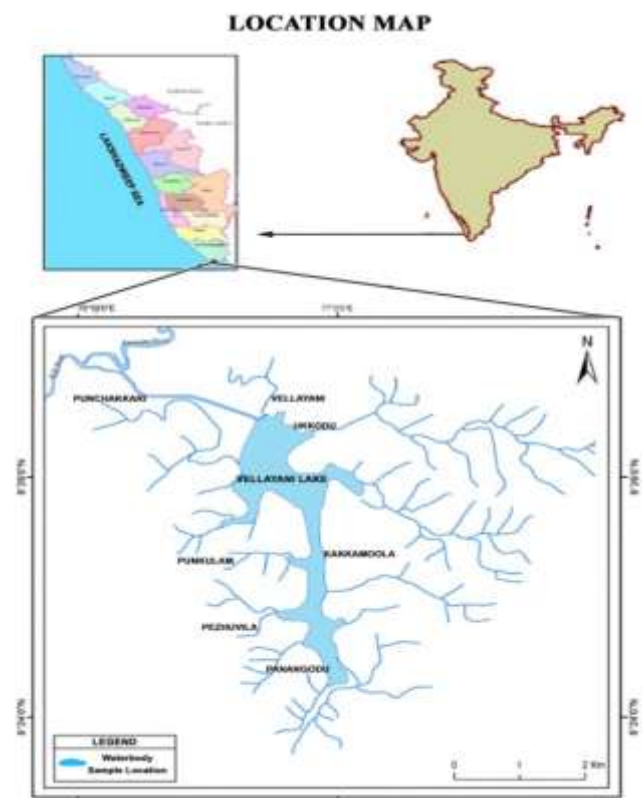


Figure1: Map of the Vellayani Freshwater Lake

2.2 Sample Collection

The study was carried out during one year period from August 2013 and July 2014 in Vellayani Lake. During the study period, fishes were sampled twenty five times. All samples were collected by 'Pattu Vala', a type of seine net, in the night (between 6 pm & 7 am). Specimens of this species were collected and brought to the Laboratory for taxonomic identification.

The identified specimen is preserved at the Laboratory of the Fatima Mata National College, Kollam, under the University of Kerala.

Collection of gut content: The body cavity of each fish was carefully opened. The anterior gut was opened up to the duodenum and the contents were carefully preserved immediately in 10% Formalin for further analysis. The preserved gut content was then examined under simple and compound microscopes. The gut content analysis was done by Numerical method proposed by Hyslop (1980). Food items were identified to genus level and quantified. Keys used to identify plankton were those of Datta *et. al* (2010), Pentecost (1984) and Adoni *et. al* (1985). The diet overlap was assessed using Percentage of diet overlap.

3. Results and Discussions

The samples included the exotic groups *Catla catla*, *Labeo rohita* and the indigenous fish *D. filamentosa* (Figs. 2 to 4).



Figure 2: *Catla catla*



Figure 3: *Labeo rohita*



Figure 4: *Dawkinsia filamentosa*

Components of gut content

The gut contents of sampled fishes from Vellayani Lake were grouped into thirteen categories. They are Cyanophytes (Blue green algae), Chlorophytes (Green algae), Chrysophytes, Macro Hydrophytes (Chlorophytes), Protozoans, Rotifers, Cladocerans (water fleas), Copepods, Nematodes, Annelids, Molluscs, Insects and Larvae and Detritus matters. Table 1 shows the percentage of preferred food groups of *Catla catla*, *Labeo rohita* and *D. filamentosa*. Table 2 shows the diet overlap between the non native *C. catla*, *L. rohita* and the native *D. filamentosa*.

Table 1: % of preferred food groups of selected fishes

% Food groups of fish species			
Food species	<i>C. catla</i>	<i>L. rohita</i>	<i>D. filamentosus</i>
Cyanophytes	30.05	37.05	43.82
Chlorophytes	35.61	36.2	26.88
Chrysophytes	21.24	18.32	19.76
Macrohydrophytes	2.64	2.26	2.2
Protozoans	1.39	0	0.1
Rotifers	0.39	0	0
Cladocerans	1.03	0.14	0.69
Copepods	2.82	1.75	2.87
Annelids	0.53	0.12	0
Molluscs	0.4558	0.23	0
Insects and larvae	1.4875	1.19	0.37
Detritus matters	2.31258	2.6	3.29

Table 2: Diet overlap between non native and native fishes

% of diet overlap		
Food groups	<i>C. catla</i> and <i>D. filamentosa</i>	<i>L. rohita</i> and <i>D. filamentosa</i>
Cyanophytes	68.57	84.55
Chlorophytes	75.48	74.25
Chrysophytes	93.03	92.71
Macrohydrophytes	83.33	97.35
Protozoans	7.19	0
Rotifers	0	0
Cladocerans	66.99	20.3
Copepods	98.25	60.98
Annelids	0	0
Molluscs	0	0
Insects and larvae	24.83	31.09
Detritus matters	69.91	79.03

D. filamentosa is the food fish of commercial importance in the lake and hence the comparisons were done against the gut content of non native species. The major food items present in the gut content of *D. filamentosa* are the Cyanophytes (43.82%) followed by Chlorophytes (26.88%) and closely followed by Chrysophytes (19.76%). In the gut contents of *C. catla*, the major food item was Chlorophytes (35.6%) followed by Cyanophytes (30.1%). Chrysophytes were present up to 21.2%. The major food items in the gut contents of *L. rohita* are Cyanophytes (37.1%) and Chlorophytes (36.2%). A quantity of 18.4% of Chrysophytes is also present in the food items of this.

Comparison of the gut content between introduced species and *D. filamentosa*

All the major food items of *D. filamentosa* were found to be forming a part of the food of the two introduced species. The comparison is presented in Table 2. Major gut components of *D. filamentosa* like Cyanophytes, Chlorophytes and

Chrysophytes were found to be consumed in equal quantities or more by the introduced species. The results give clear indication of dietary overlap between the species under consideration. Similarity between diets and dietary overlap between two species indicates their potential for trophic interactions (Qin *et al* 2007). High diet overlap between two species may indicate competition only where and when available food resources are limited (Pianka 1974; Sale 1974). There are also evidences for competition between the introduced and native fishes for the preferred food organism, when there was a dietary overlap (Copp *et al* 2008). In the present study, the diet overlap between the major food items of *D. filamentosa* and *C. catla* were Cyanophytes 68.57%, Chlorophytes 75.48%, and Chrysophytes 93.03%. In the case of diet overlap between *D. filamentosa* and *L. rohita*, Cyanophytes were 84.55%, Chlorophytes were 74.25%, and Chrysophytes were 92.71%. The results clearly show that there is dietary overlap; which in the long run may lead to negative impacts on the breeding and reproduction of the native species.

The Percentage of diet overlap is considered significant when its value exceeded to 60%. In the present study also, found to be significant as the Percentage of diet overlap for all the major food items and the percentages were always above 60. From this study, all the diets of both the introduced species are similar to that of the primary native species in the lake.

Conclusion

The result of the present study shows that the dietary overlap between the native species and the introduced species is significant, and there is the possibility for negative impacts affecting the native species, *D. filamentosa* in the long run. However the long term impacts on the breeding and reproduction of *D. filamentosa* due to introduced species requires a long term monitoring of the dynamics of the fish stocks.

References

- [1] Adoni D, Gunwant J, Karthic G, Chourasia S K, Vaishya A K, Manoj Y and Varma H G., "Workbook on Limnology", Department of Botany, Dr. Harisingh Gour Vishwavidyalaya Sagar, Prathibha Publishers, Gour Nagar, India, 1985.
- [2] Allen Pentecost, "Introduction to Freshwater Algae", 1 ed. Richmond Publishing Co. Ltd, Orchard Road, Richmond, Surrey, England, 1984.
- [3] Hyslop, E. J., "Stomach contents analysis – a review of methods and their application", J. Fish Biol., 17: 411–429, 1980.
- [4] Isumbisho, M., Sarmiento H., Kaningini B., Micha, J. C & Descy, J. P., "Zooplankton of Lake Kivu, East Africa, half a century after the Tanganyika sardine introduction", J. Plankton Research., 28: 971–989, 2006.
- [5] Jayasree Datta Munshi, S., P. Roy and J. S., Datta Munshi, "Manual of Freshwater Biota", Narendra Publishing House, Delhi (India), 2010.
- [6] Pianka, E. R., "Niche overlap and diffuse competition". Proceed. National Academy of Sci. 71: 2141–2145, 1974.

- [7] Qin, J., Xu, J & Xie, P., "Diet overlap between the endemic fish *Anabarilius grahmi* (Cyprinidae) and the exotic noodle fish *Neosalanx taihuensis* (Salangidae) in Lake Fuxian, China". J. Freshwater Ecol., 22: 365 - 370. 2007.
- [8] Wallace, R. K., An assessment of diet-overlap indexes. Trans. Am. Fish. Soc. 110: 72 - 76. 1981

Author Profile



Reenamole.G.R received the B.Sc. degree in Zoology from H.H.M.S.P.B.N.S.S. College for Women, Neeramankara, Trivandrum. B.Ed in Natural Science has taken from Govt. Anchal College, Kollam. M.Sc. degree in Zoology took from Mahatma Gandhi College, Thiruvananthapuram. M. Phil in Aquatic Biology and Fisheries from the Department of Aquatic Biology & Fisheries in the University of Kerala, Kariavattom. All the degrees were received from the University of Kerala, Thiruvananthapuram, India. She has published 10 research papers and designed a text book of "Vellayani Fish Census- a Field Guide and Report" (Author : Dr. A. Biju Kumar & Dr. Pramod Kiran R.B) published by Dept. of Aquatic Biology and Fisheries, University of Kerala and Supported by Agency of Development of Aquaculture, Kerala (ADAK) 2013. During 2008-2009, she worked as a Project Fellow in Central Marine Fisheries Research Institute in Vizhinjam, Thiruvananthapuram, Kerala, India. She now is doing Ph.D in Zoology at Zoology Research Centre, Department of Zoology, Fatima Mata National College, Kollam, University of Kerala, India.



Dr. F. George D'Cruz took his B.sc, M.Sc, and Ph.D degrees from the University of Kerala, India. After Post graduation, he joined Fatima Mata National College (at present a leading Autonomous College in Kerala) under the University of Kerala as Lecturer in 1979. In 1998 he took his Ph.D in Zoology, through Part time Research, while serving as a Professor. In Zoology, his area of specialization was Fisheries and Environmental Toxicology, Biodiversity, Wetland Ecology and Fish Diversity. In 2008, he retired as the HOD of Zoology and at present holds the post of honorary director of the Zoology Research Centre, under the Department of Zoology in the same college. There are about 20 Research papers published in Research Journals and more than 50 scientific papers presented in Seminars, Symposia and other Public functions in his credit. At present he is guiding students for their Ph.D in Fish Diversity and Wetland Ecology. He has authored three books and co-authored three other books on various topics like Fisheries, Environmental Biology and Human Evolution, in addition to Scientific Articles in Popular Journals and Print media. There are 16 Radio talks through All India Radio and 15 talks through Radio Benziger, Kollam on various scientific topics under Fisheries, Biodiversity Conservation, Environmental Biology, etc. Dr. F. George D'Cruz's Contributions as Subject Expert Member in various State Government Bodies like District (Kollam) Monitoring Committee Kerala Forestry Project, Department of Forest (1996-2002), District (Kollam) Forest Extension and Information Centre, Department of Forest (1996-2002), Committee for Project Formulation and Implementation, Department of Fisheries (2002-2004), State Council of Educational Research and Training (1999-2005), Wetland Cell (2004-2006), etc., are noteworthy. He also served as the State Level Programme Co-ordinator of the Kerala State Biodiversity Board in Preparing People's Biodiversity Register (2009-2011). He had completed 3 projects on Research and Conservation of the State Government Agencies (Department of Fisheries, Department of Forest and Kollam Corporation).