Diversity of Aquatic Macrophytes of Four Lakes of Holalkere, Chitradurga District, Karnataka, India

Pallavi Mallappa
Kuvempu University
Parameswara Naik Takrya (maravanjiparameswara@gmail.com)
Kuvempu University

Research Article

Keywords: Aquatic macrophytes, Lakes, Emergent, Free floating, Submerged

Posted Date: October 20th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-2177790/v1

Abstract

The present investigation concerns the diversity of aquatic macrophytes in different lakes of Holalkere, Chitradurga district of Karnataka. Lakes are the natural habitat of macrophytic plants. Macrophytes are the common features of an aquatic ecosystem. Aquatic macrophytes play a prominent role in water ecosystems. Aquatic macrophyte diversity and its role in understanding the lake ecosystem dynamics have tremendous significance. Species composition of aquatic macrophytes, seasonal distribution in four lakes in Holalkere viz. Gangasamudra lake, Gowdihalli lake, Talikatte lake and Kudineerakatte lake were studied during 2019–2021. Fifteen different species of aquatic macrophytes were recorded from the studied lakes which include One free-floating, Eight Submerged, and Six Emergent Macrophytes present in the lake basin. *Hydrilla verticillate*, *Polygonum glabrum, Cyperus longus, and Ipomoea fistulosa* occur throughout the year. It indicates that aquatic macrophyte species are specific to environmental quality. The present findings revealed that the surface quality of the lakes is productive. The researches aiming to describe unknown species are still necessary.

Introduction

Aquatic macrophytes are photosynthetic organisms, that grow permanently or periodically submerged below, floating on, or growing up through the water's surface. It includes aquatic angiosperms, pteridophytes and bryophytes (Cook 1996, Chambers et al. 2008). Macrophytes serve as a link between the sediment, water, and (sometimes) atmosphere in wetlands, lakes, and rivers. The most notable function that plants serve is as primary producers. However, macrophytes are also involved in ecosystem processes such as biomineralization, transpiration, sedimentation, elemental cycling, materials transformation, and release of biogenic trace gases into the atmosphere (Carpenter and Lodge, 1986). The aquatic macrophytes occur mainly in the shallow region of lakes, ponds, pools, marshes streams and rivers, etc. macrophytes are of considerable ecological and economic importance as they help in the uptake of nutrients and hence help in maintaining the chemical integrity of the respective ecosystem. They contribute significantly to the productivity of water bodies, mobilize mineral elements from the bottom sediments and provide shelter to aquatic macroinvertebrates and fishes. They also respond to changes in water quality and have been used as indicators of pollution and are known as ‘bio-indicators’. When there is enough room for colonization and abundant availability of nutrients, macrophytes show a high growth rate. They assimilate nutrients directly into their tissues. Due to these, they were used to solve eutrophic problems of freshwater bodies and to remove pollutants (Sudarshan, P., M.K. Mahesh and T.V. Ramachandra.2017).

Aquatic environments with low nutrient content usually have vegetation dominated by relatively small plants. With moderate nutrient loading, the biomass and proportion of aquatic macrophytes increase and plants can fill the entire water column (Zingel et al., 2006). Aquatic macrophytes respond to changes in water quality and have been used as bio-indicator of pollution (Tripathi and Shukla, 1991). Aquatic plants are frequently used to reduce different kinds of pollutants from polluted water (Tripathi, 1992).

The purpose of the present study aims to observe aquatic macrophytes of Holalkere taluk, Chitradurga Dist, Karnataka. The water is used for drinking, washing, household purposes and agriculture by surrounding villagers. Four study stations were selected from where plants collected and checked during the investigation is to briefly summarize various macrophytes classifications, and cover in more detail numerous aspects of the macrophytes' role in the aquatic ecosystem.

Materials And Methods

Holalkere taluk, Chitradurga district, Karnataka state covering an area of 1108 sq km. It has an average elevation of 711 metres (2332 feet) and is located at longitudes 14.0541° N, 76.1958° E and is bounded by Chennagiri taluk towards west, Davanagere taluk towards the north, Chitradurga taluk towards the east, and Hosadurga taluk towards the south. The Location map of the taluk is in Fig. 1.

Sample Collection

Sample collection was carried out from June 2019 to May 2021. During the study period, aquatic macrophytes were collected from different stations of the selected lake. To collect Macrophytes during three different seasons, such as rainy, winter and summer seasons. The aquatic macrophytes were collected and transferred into large polythene covers and brought to the laboratory for further identification. Collected materials were identified with the help of standard literature Flora of Presidency of Madras and confirmed in the herbarium of the Botanical Survey of India. The collected macrophytes photographs are in Fig. 2.

Result And Discussion

The study on aquatic macrophytes was documented with 15 species of aquatic macrophytes belonging to 11 families. (Tables 1 and 2). Out of 15 macrophytes, one species belongs to a free-floating, six species belong to emergent and eight species of submerged. The present enumeration deals with 15 species of Aquatic macrophytes belonging to Three different categories Bryophytes, Pteridophytes and Angiosperms which depend on their contact with soil, water and air and are classified into the following groups Free Floating, Submerged, Emergent, Floating Leaved.

Table 1
List of Aquatic Macrophytes and Family

Sl no.	Name of a Species	Family
1	*Nitella species*	Characeae
2	*Cyperus longus*	Cyperaceae
3	*Stuckenia pectinate*	Potamogetonaceae
4	*Callitriche palustris*	Plantaginaceae
5	*Potomogeton species*	Potamogetonaceae
6	*Azolla pinnata*	Salvinaceae
7	*Najas marina*	Hydrocharitaceae
8	*Alternanthera sessilis*	Amaranthaceae
9	*Ipomoea fistulosa*	Convolvulaceae
10	*Polygonum glabrum*	Polygonaceae
11	*Utricularia minor*	Lentibulariaceae
12	*Cyperus aggregatus*	Cyperaceae
13	*Portulaca oleracea*	Portulacaceae
14	*Hydrilla verticellata*	Hydrocharitaceae
15	*Ottelia alismoides*	Hydrocharitaceae

Table 2
List of Seasonal Variations of Aquatic Macrophytes in Four Sites.

Sl no.	Species Name	Rainy				Winter				Summer			
		S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
1	*Nitella species*	+	-	-	-	+	+	+	+	+	+	-	+
2	*Cyperus longus*	+	+	+	+	+	+	+	+	+	+	+	+
3	*Stuckenia pectinata*	+	-	-	-	+	-	+	+	+	+	-	+
4	*Callitriche palustris*	+	+	+	-	+	+	+	+	+	+	+	+
5	*Potomogeton species*	+	+	-	-	+	+	+	+	+	+	+	-
6	*Azolla pinnata*	-	-	-	-	+	+	+	-	+	+	+	+
7	*Najas marina*	+	+	-	-	+	+	+	+	+	+	+	-
8	*Alternanthera sessilis*	+	+	-	+	+	+	+	+	+	+	+	+
9	*Ipomoea fistulosa*	+	+	+	+	+	+	+	+	+	+	+	+
10	*Polygonum glabrum*	+	+	+	+	+	+	+	+	+	+	+	+
11	*Utricularia minor*	+	-	-	-	+	+	+	+	+	+	+	-
12	*Cyperus aggregatus*	+	+	+	+	+	+	+	+	+	+	+	+
13	*Portulaca oleracea*	+	-	-	-	+	-	+	-	+	-	+	-
14	*Hydrilla verticellata*	+	+	+	-	+	+	+	+	+	+	+	-
15	*Ottelia alismoides*	+	-	-	-	+	-	+	+	+	-	+	-

All the plants were categorized as submerged 53%, emergent 40%, and free-floating 7% (Fig-2). Submerged plants represented by 8 species viz. *Nitella species, Stuckenia pectinata, Callitriche palustris, Potomogeton species, Najas marina, Utricularia minor, Hydrilla verticellata, and Ottelia alismoides*, followed by emergent anchored with 6 species viz. *Cyperus longus, Alternanthera sessilis, Ipomea fistulosa, Polygonum glabrum, Cyperus aggregatus, Portulaca olaracea* and Free-Floating plants were *Azolla pinnata*. Species diversity at different stations has shown in Table 2. *Ipomoea fistulosa,*

Polygonum glabrum, Cyperus longus, Cyperus aggregatus, Callitriche palustris, Alternanthera sessilis, and *Hydrilla verticellata.* were found to be grown in all the stations. *Ipomea fistulosa* is a common aquatic fern in tropical regions. The upper surfaces of *Hydrilla verticellata* plants' leaves are water repellent and, if completely submerged.

classified macrophytes based on the habitat of macrophytes. The aquatic macrophytes are classified as submerged, floating and emergent growing in and covered by at least 25cm of water. However, the other newly recorded macrophyte species pose a major threat to the lake's existence. (Chambers et al., 2010) were studied on the world checklist of macrophyte species.

Conclusion

In the present study, a total of 15 aquatic macrophytes were selected from four different lakes of Holalkere taluk, Chitradurga dist. Macrophytes are considered an important component of the aquatic ecosystem not only as the habitat and food source of aquatic life of ecosystem, but the presence of excessive nutrients in any water body is also the root cause of eutrophication which can be checked by macrophytes as they have the potential to eliminate these excessive nutrients. Various macrophytes have the potential to remove the contamination of water and to improve the water quality by absorbing heavy metals from water. It is important to enlist the aquatic macrophyte biodiversity to monitor the water quality and environment of these lakes.

Declarations

Acknowledgements

The authors are extremely thankful to Mr Rajashekar G.C. for his support throughout the manuscript preparation. Also, the authors acknowledge the Ministry of Tribal Affairs for providing the NFST scholarship to conduct this research work.

Financial Disclosure Statement

The author(s) received no specific funding for this work

Ethics approval is Not applicable.

Consent to participate is Not applicable.

Consent for publication is Not applicable.

Conflict of interest The authors declare no competing interests.

References

1. Carpenter, S. R., Lodge, D. M..1986. Effects of submersed macrophytes on ecosystem processes. Aquatic Botany 26, 341–370.
2. Chambers, P.A., Lacoul, P., Murphy, K.J. and Thomaz, S.M.2008. Global diversity of aquatic macrophytes in freshwater. Hydrobiologia 595, 9–26.
3. Chambers, P.A., P. Lacoul, K.J., Murphy, S.M., Thomaz and Z. Duggan. 2010. World Checklist of macrophyte species. published on the internet; http://fada.biodiversity.be/group/show/60 accessed
4. Cook C.D.K., Aquatic and Wetland Plants of India, Oxford University Press. Delhi,22–370 (1996).
5. Crowder, A. A., and J. M. Bristow.1988. The future of waterfowl habitats in the Canadian lower Great Lakes wetlands. Journal of Great Lakes Research 14, 115–127.
6. Sudarshan, P., M.K. Mahesh and T.V. Ramachandra.2017. Macrophytes of Bangalore wetlands. ENVIS technical report 126. Energy and Wetlands Research Group, CES, Indian Institute of Science, Bangalore.
7. Tripathi, B.D. 1992. Utilization of aquatic plants for sewage treatment, Austrian NFP/UNEP Vienna, Austria, B/BD, 310-1
8. Tripathi, B.D. and Shukla, S.C. 1991. Biological treatment of wastewater by selected aquatic plants. Environmental Pollution 6, 69–78.
9. Zingel, P., Noges, P., Tuvikene, L., Feldmann, T., Jarvalt, A., Tonno, I., Agasild, H., Tammert, H., Luup, H., Salujoe, J. and Noges, T., 2006. Ecological processes in macrophyte- and phytoplankton-dominated shallow lakes. Proc. Estonian Academy of Science, Biology, Ecology 55, 4, 280.307.

Figures

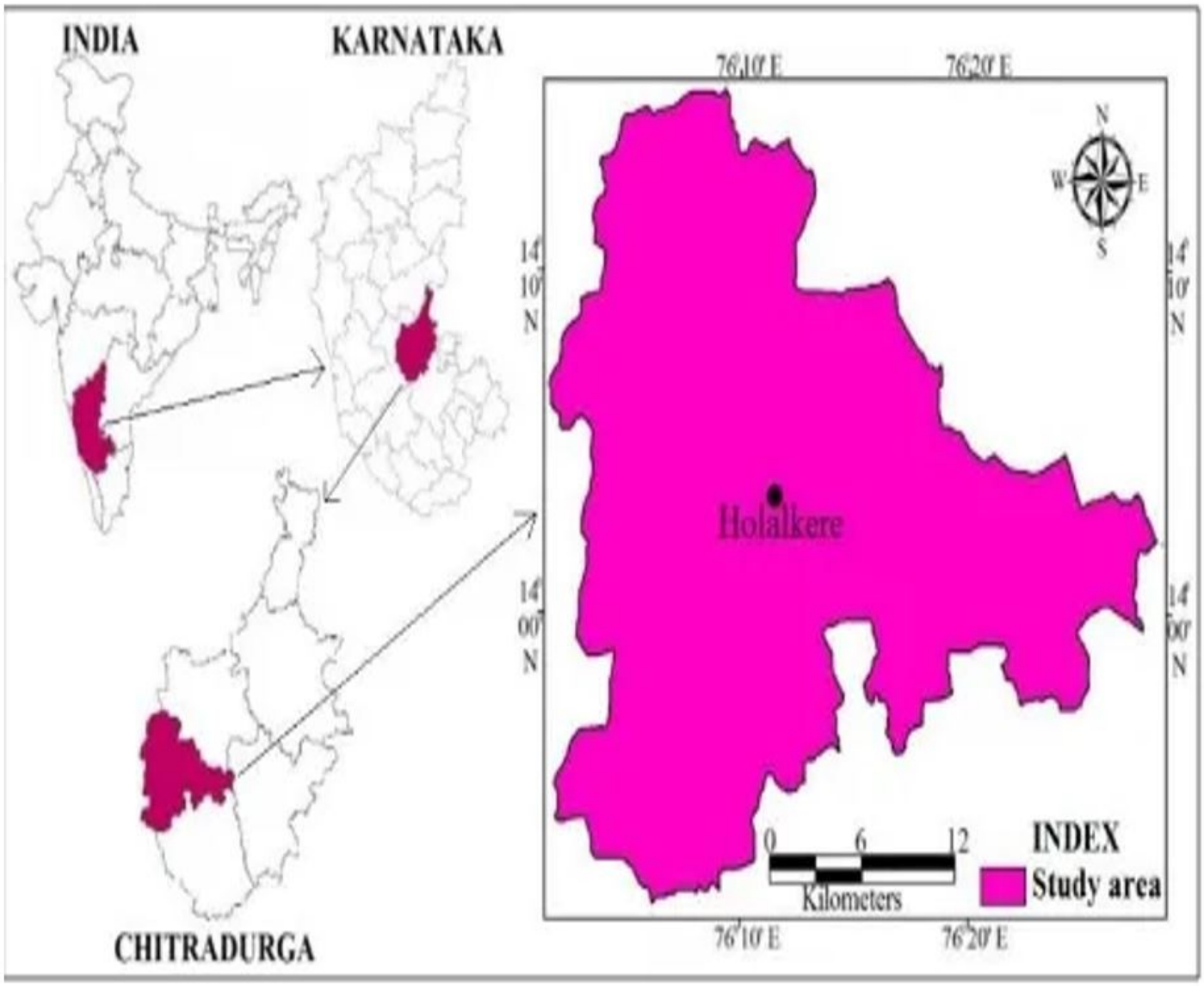

Figure 1

Study Site of Holalkere Taluk

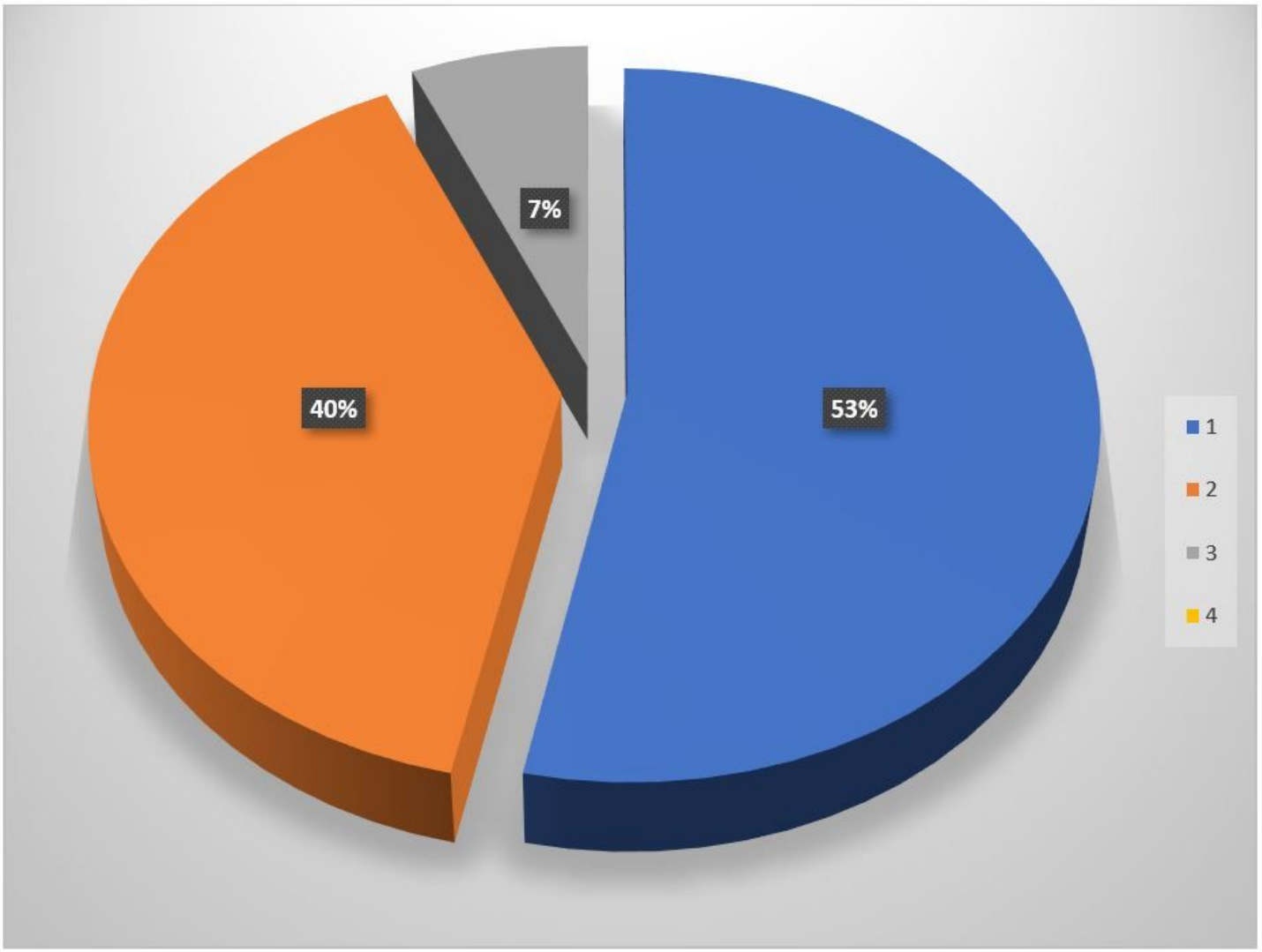

Figure 2

Life form of Aquatic Macrophytes.

Figure 3

Plant photos

Macrophytes of Four Ecosystems under study