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Diversity and identification of aquatic macrophytes of four lakes of Holalkere Region, Chitradurga District, Karnataka, India

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Abstract

The present investigation concerns the diversity of aquatic macrophytes in different lakes in the 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 ecosystems. Aquatic macrophyte diversity and its role in understanding 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 research aimed at describing unknown species is still necessary.

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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 (P.A., Lacoul, P., Murphy, K.J. and Thomaz, S.M. 2008. Carpenter, S. R., Lodge, D. M. 1986). 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 (Sudarshan, P., M.K. Mahesh and T.V. Ramachandra. 2017). The plants vary greatly in the degree to which they have become truly aquatic and present in an interesting series of gradations from those which are little more than amphibious, living at the edge of the water in very moist or water-saturated soil. Aquatic plants are that unwanted and undesirable vegetation which reproduce and grow in water and if left unchecked may choke the entire body of water posing a serious menace to pisciculture.

The aquatic macrophytes occur mainly in the shallow regions of lakes, ponds, pools, marshes, streams, 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 (Chambers report 126).

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, P., Noges, P., Tuvikene, L., Feldmann, T., Jarvalt, A., Tonno, I., Agasild, H., Tammert, H., Luup, H., Salujoe, J. and Noges, T. 2006).

Aquatic macrophytes respond to changes in water quality and have been used as bio-indicator of pollution (Tripathi, B.D. and Shukla, S.C. 1991). Aquatic plants are frequently used to reduce different kinds of pollutants from polluted water (Tripathi, B.D. 1992). Aquatic plants are often an integral component of aquatic ecosystems and can be of ecological importance since they represent the major structural component of littoral habitats, acting as shelter, nesting, and feeding grounds for a wide variety of micro-organisms, fish and waterfowl (Hudon C., Lalonde S., and P. Gagnon. 2000).

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

Materials and methods

Study Area

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. It 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.

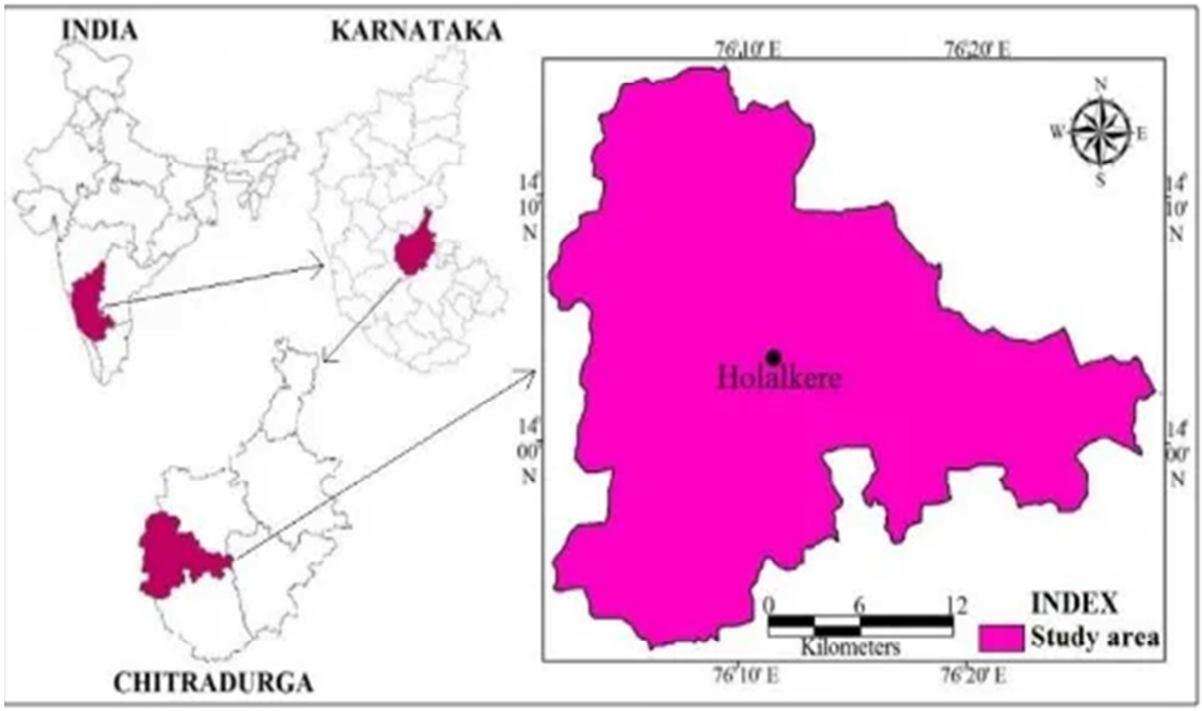

Fig. 1. Study Site of Holalkere Taluk.

Collection and Identification of Macrophytes

The Macrophytes 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 (rainy, winter and summer). The aquatic plants can be collected using a long-handled hook, nets or by hand. For quantification of the sample in a given area, the floating or sinking quadrates of known size, namely (1m x 1m) made up of PVC pipes are used. These quadrates are placed to mark the area from which the sample is to be taken. After collection, these plants are brought to the laboratory for identification. Collected materials were identified with the help of standard literature (the Flora of the Presidency of Madras) and confirmed in the herbarium of the Botanical Survey of India. Before the identification of these plants, they must be classified based on their habitat into the following classifications: 1) submerged, 2) emergent, and 3) free floating. The collected macrophyte photographs are in (Fig. N).

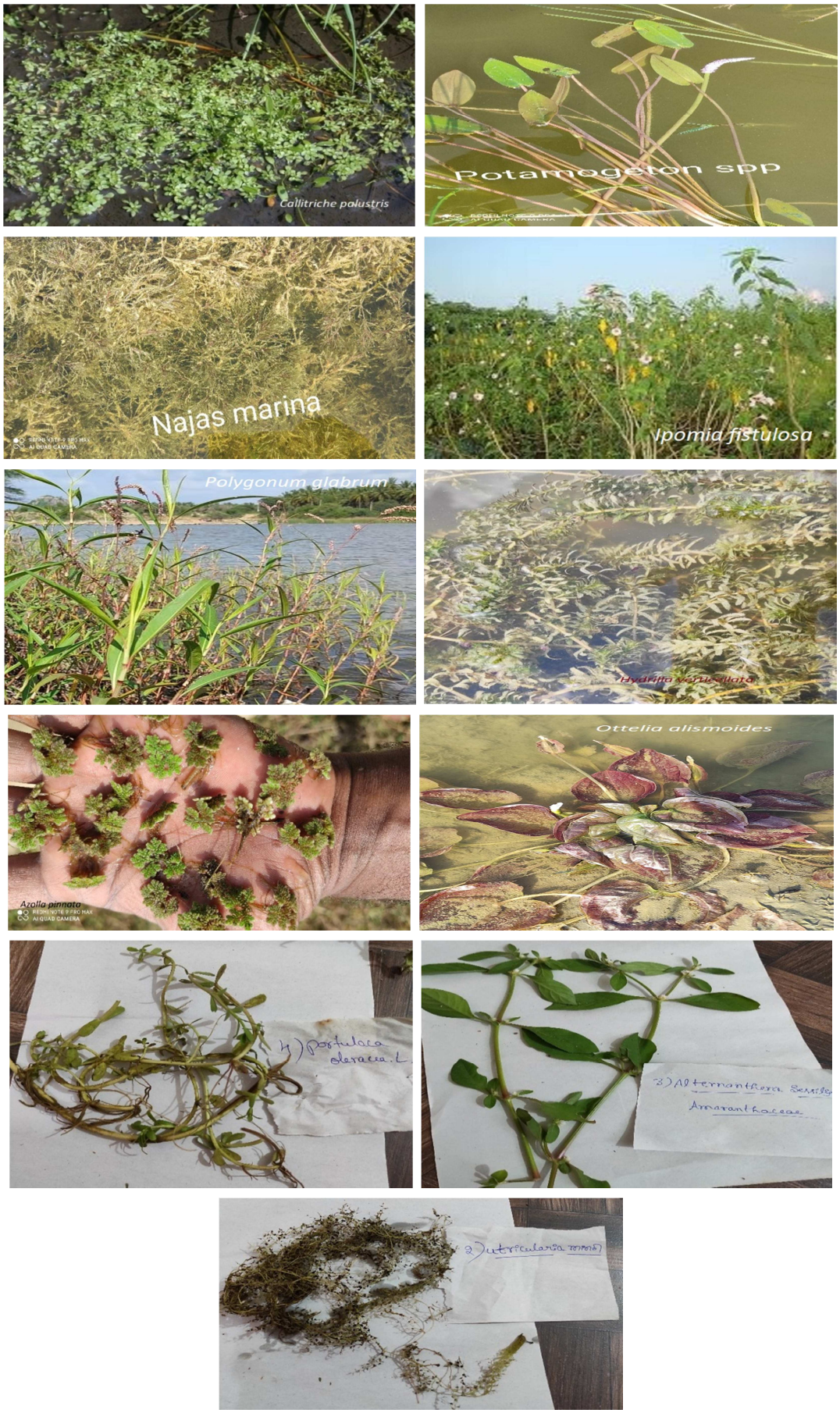

Fig. N: Macrophytes of Four Ecosystems under study.

Result and discussion

Result

The study on aquatic macrophytes documented with 15 species of aquatic macrophytes belonging to 11 families. (Tables 1 and 2). One species of macrophyte is free-floating, six species are emergent, and eight species are 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	Name of a Species	Family	Life form
1	*Nitella species*	Characeae	Submerged
2	*Cyperus longus*	Cyperaceae	Emergent
3	*Stuckenia pectinate*	Potamogetonaceae	Submerged
4	*Callitriche palustris*	Plantaginaceae	Submerged
5	*Potomogeton species*	Potamogetonaceae	Submerged
6	*Azolla pinnata*	Salvinaceae	Free floating
7	*Najas marina*	Hydrocharitaceae	Submerged
8	*Alternanthera sessilis*	Amaranthaceae	Emergent
9	*Ipomoea fistulosa*	Convolvulaceae	Emergent
10	*Polygonum glabrum*	Polygonaceae	Emergent
11	*Utricularia minor*	Lentibulariaceae	Submerged
12	*Cyperus aggregatus*	Cyperaceae	Emergent
13	*Portulaca oleracea*	Portulacaceae	Emergent
14	*Hydrilla verticellata*	Hydrocharitaceae	Submerged
15	*Ottelia alismoides*	Hydrocharitaceae	Submerged

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

SL	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 plants with 6 species viz. *Cyperus longus, Alternanthera sessilis, Ipomea fistulosa, Polygonum glabrum, Cyperus aggregatus, Portulaca olaracea* and Free-Floating plants were *Azolla pinnata*. The 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.

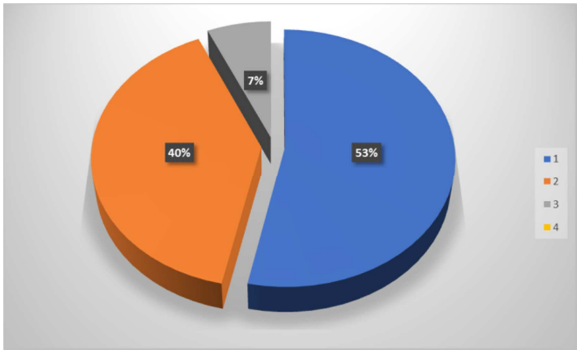

Fig. 2. Life form of Aquatic Macrophytes.

Discussion

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, P.A., P. Lacoul, K.J., Murphy, S.M., Thomaz and Z. Duggan. 2010). were studied on the world checklist of macrophyte species.

In the present study submerged aquatic macrophytes are rooted plants with flaccid or limp stems and most of their vegetative mass below the water surface, although small portions may stick above the water. Among the submerged macrophytes abundant in all sites showed the presence of all three seasons during most of the study period. Free-floating macrophytes are found suspended on the water surface with their root not attached to the substrate, sediment, or bottom of the water body. In this study, only one type of free-floating species was seen abundantly in three sites (S1, S2 and S3) in winter and summer. The emergent macrophytes are plants that are rooted in shallow water with vegetative parts emerging above the water's surface. During the study, the emergent macrophytes were seen at all the sites in all seasons.

Conclusion

In the present study, a total of 15 aquatic macrophytes were selected from four different lakes of Holalkere taluk, Chitradurga district. Macrophytes are considered an important component of the aquatic ecosystem not only as the habitat and food source of aquatic life, 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.

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Declarations

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

Carpenter SR, Lodge DM. 1986. Effects of submersed macrophytes on ecosystem processes. Aquatic Botany **26,** 341-370.

Chambers PA, Lacoul P, Murphy KJ, Thomaz SM, Duggan Z. 2010. World Checklist of macrophyte species. Published on the internet: http: //fada.biodiversity.be/group/show/60 accessed.

Chambers report. 126. Energy and Wetlands Research Group, CES, Indian Institute of Science, Bangalore.

Hudon C, Lalonde S, Gagnon P. 2000. Ranking the effects of site exposure, plant growth form, water depth and transparency on aquatic plant biomass. Canadian Journal of Fisheries and Aquatic Sciences **57,** 31-42.

Lacoul P, Murphy KJ, Thomaz SM. 2008. Global diversity of aquatic macrophytes in freshwater. Hydrobiologia **595,** 9-26.

Sudarshan P, Mahesh MK, Ramachandra TV. 2017. Macrophytes of Bangalore wetlands. ENVIS technical Cook C.D.K., Aquatic and Wetland Plants of India, Oxford University Press. Delhi 22-370. 1996.

Tripathi BD, Shukla SC. 1991. Biological treatment of wastewater by selected aquatic plants. Environmental Pollution **6,** 69-78.

Tripathi BD. 1992. Utilization of aquatic plants for sewage treatment, Austrian NFP/UNEP Vienna, Austria, B/BD, 310-1.

Zingel P, Noges P, Tuvikene L, Feldmann T, Jarvalt A, Tonno I, Agasild H, Tammert H, Luup H, Salujoe J, Noges T. 2006. Ecological processes in macrophyte and phytoplankton dominated shallow lakes. Proc. Estonian Academy of Science, Biology, Ecology **55,** 4, 280.307.