

AQUATIC PLANT DIVERSITY OF LAKES IN SOMWARAPETE TALUK, KODAGU, KARNATAKA.

ABSTRACT:

The principal objective of the present research is to record data regarding the aquatic plants of Somwarapete taluk of Kodagu district. Three major lakes were selected for the study for one year, i.e., June 2020–July 2021. A total of 43 species were recorded, belonging to 28 families and 41 genera. The most dominant families were Araceae, Hydrocharitaceae, Asteraceae and Amranthaceae. After initial identification, the plants were classified according to their habitats, life spans, and IUCN status. Jaccard's index and Sorenson's index were used to learn about the similarity coefficient between the sample sites. We divided plants according to their IUCN status and found them to be endangered, threatened, and under the least concern category. The work was undertaken because no documented data is available for the aquatic macrophytes of Somwarapete taluk.

Key words: Western ghats, Kodagu, Aquatic macrophytes, Jaccards index, Sorenson's index.

INTRODUCTION:

Western ghats are one of the global hotspots of biodiversity with a high population status (Cinchotta *et al.*, 2000). The stretch of western ghats runs for approximately 1600 km with an area coverage of about 1,64,000 km². The altitude ranges from 300-2700 mtr asl (Ray *et al.*, 2016).

Lakes play a major role in human lives by contributing to restoring the water table (Aher *et al.*, 2016). Wetlands are the world's most diverse yet most threatened ecosystems (Murphy *et al.*, 2006). The aquatic systems are an integral property of rural people's life activities, hence are much more sensitive to eutrophication due to anthropogenic activities. In the present scenario, lakes are threatened by qualitative and quantitative pollutants from different sources (Xia *et al.*, 2016).

Aquatic plants are a major food source, fodder and herbal medicine for people living near water bodies (Badole *et al.*,2021).Wetlands play a major role in achieving the Sustainable Development Goals (SDG's) concerning ecosystems and their biodiversity. However , this goal is curtailed by the threats faced by the wetland ecosystem due to human intervention (Gibbs, 2000). Moreover, wetlands face eutrophication, sedimentation, encroachment, pollution and climate change (Sharma *et al.*,2005).

In accordance with all this, strict planning with a biodiversity-friendly development has been a major concern in recent times. It is very important to have a depository of information on aquatic macrophytes. For example, no written documentation is available on the aquatic floristics of Somwarapete taluk. Hence, this study was undertaken to understand the area's plant diversity, and three major lakes were selected as a study areas.

MATERIALS AND METHODS:

Study area:

Kodagu district is on the eastern and western slopes of the Western Ghats, carpeted with lush green forests, plantations and cultivated valleys. Geographically, it lies on the southwestern border of Karnataka State, and geologically it is situated in the south western part of the Western Dharwar Craton (WDC). Kodagu district is considered the smallest district in Karnataka state and covers an area of 4,102 Sq.km. The district is bounded by latitudes 110 56' – 120 52' N and longitudes 720 22' -760 12'E. The study area lies between North latitude 120 19' 17'' and 120 43' 36'' and East longitude 750 22' 29'' and 760 19' 15'' Somwarapete, one of the taluks of Kodagu district with an area of 4102 square kilometers .The area of research carried out lies at a latitude of 12.5943°N and 75.8505°E (Fig 1)

Information like habitat, family name, life span and IUCN category are tabulated from the collected specimens, for further analysis.

Collected plants are pressed under newspapers for herbarium preparation. These plants were then classified based on their life span, family and morphological characters. They were also divided into different categories according to their habitats i.e. free floating, submerged, emergent and rooted macrophytes.

Jaccard's Similarity Index(JSI) was applied and analysed(**Jaccard, 1912**)

$$S_j = a / (a + b + c)$$

Where, S_j = Jaccard's similarity coefficient

a = Number of species in site A and B.

b = Number of species absent in A but present in B

c = Number of species present in A but absent in C.

The above plant data was also analysed by **Sorenson's Similarity coefficient (SSc)**(**Sorenson, 1948**)

$$S_c = 2a / (2a + b + c).$$

Where, S_c = Sorenson's Similarity coefficient.

a = Number of species in site A and B.

b = Number of species absent in A but present in B

c = Number of species present in A but absent in C.

RESULTS AND DISCUSSION:

A total of 43 species of aquatic **macrophytes** have been reported from three study areas. **Forty-three** species are represented by 41 genera belonging to 28 families. **Of** these, 40 species were Angiosperms, 2 were **Pteridophytes**, and 1 was an Algae (Fig.3).

Amongst Angiosperms, 13 species were monocotyledons , belonging to 13 genera and **five** families. The dicots were 28 species belonging to 13 families. 23 out of 43 species are **annuals**, and 20 are **perennials** (Fig 7).

Out of the 43 species , 23 were annuals and 20 were perennial plants(Fig -). The IUCN status of the plants **is** as follows, 1 Endangered, 2 Threatened, 39 Least Concerned and **one** is Not Evaluated (Fig 4).

Out of the 43 **species**, 41 are represented by single genera, and **two** are represented by **two** species each. **Araceae** was the most **occurring** family with **five** genera and **five** species, followed by Hydrocharitaceae and Asteraceae with **four** genera and **four** species each. Amaranthaceae is represented with **three** genera and **three** species. Potamogetonaceae is represented by **one** genera and **two** species, followed by Salviniaceae, Nymphaeaceae and Poaceae with **two** genera and **two** species each. **The** Rest other species belong to families like Commelinaceae, Acanthaceae, Typhaceae etc(Table 1)(Fig 5).

Lake 1 has **the** highest number of species (34), followed by lake 3 with (18) and lake 2 with (17). A total of 79% **of** plants were confined to lake 1, followed by lake 3 with 41.8% and lake 2 with 39.5%. In **Lake 1**, the monocots were 10 species, dicots 21 species, Algae 1 species and Pteridophytes were **two** species. Lake 2 had **four** monocot species, 11 dicot **species**, 1 **Algal** and 1 Pteridophyte species. Lake 3 had **four** species of monocots, 14 species of dicots and **one** species of Algae(Fig 6).

Lake 1 had exclusive plants like *Acemella uliginosa*, *Alternanthera sessilis*, *Alternanthera triandra*, *Amaranthus spinosus*, *Hydrilla sp.*, *Lemna minor*, *Hygrophila auriculata*, *Elodea canadensis*, *Pennisetum polystachion*. Lake 2 had plants like, *Vallisneria spiralis*, *Pistia stratiotes*, *Oxalis corniculata*, *Najas graminea*, *Leucas aspera* .Lake 3 had plants like *Monochoria vaginalis*,

Nuphar lutea, *Utricularia aurea*, *Nymphoides indica*, *Baldellia ranunculoides*, *Colocasia esculenta*, *Glyceria maxima* (Table 3).

A high number of Hydrocharitaceae were reported by Lakshman and Gathi,(2018) in their work on wetlands in Tamilnadu. Badole *et al.*,(2021) have reported a high number of Hydrocharitaceae followed by Poaceae, Asteraceae, with their work in the Gonidia district, Maharashtra.

The morphometry of the lake will be influenced macrophyte diversity. External factors like the availability of light underwater also act as a controlling factor in macrophyte growth (Hudon *et al.*,2006).

On the calculation of Jaccard's Similarity Index, Lakes 2 and 3 showed high degree of similarity with 44%, followed by lakes 1 and 2 with 34% and lakes 1 and 3 with 22% (Table 4). Sorenson's Similarity Index also showed a similar result with lakes 2 and 3 with 61% similarity, followed by lakes 1 and 2 with 47% and lake 1 and 3 with 36% (Table 5).

Srl.No	Categories	No. Of families
1	Families with 1 species	21
2	Families with 2 species	4
3	Families with 3 species	1
4	Families with 4 species	2
5	Families with 5 species	1
6	Genera with 1 species	40
7	Genera with 2 species	1

Table 1. List of families and genera with their species distribution.

Srl.no	Plant name	Lake 1	Lake 2	Lake 3
1.	<i>Acemella uliginosa</i>	+	-	-

2.	<i>Alternanthera sessilis</i>	+	-	-
3.	<i>Alternanthera triandra</i>	+	-	-
4.	<i>Amaranthus spinosus</i>	+	-	-
5.	<i>Azolla pinnata</i>	+	+	-
6.	<i>Baldellia ranunculoides</i>	-	-	+
7.	<i>Bidens pilosa</i>	+	+	+
8.	<i>Ceratophyllum demersum</i>	+	+	-
9.	<i>Chara deliculata</i>	+	+	-
10.	<i>Colocasia esculenta</i>	-	+	+
11.	<i>Commelina erecta</i>	+	-	+
12.	<i>Eclipta prostrata</i>	+	+	-
13.	<i>Elodea canadensis</i>	+	-	-
14.	<i>Glyceria maxima</i>	+	-	+
15.	<i>Hydrilla sp</i>	+	-	-
16.	<i>Hygrophila auriculata</i>	+	-	-
17.	<i>Hymenocallis littoralis</i>	+	+	+
18.	<i>Hypericum elodea</i>	-	+	+
19.	<i>Ipomea aquatica</i>	-	+	+
20.	<i>Lemna minor</i>	+	-	-
21.	<i>Leucas aspera</i>	-	+	+
22.	<i>Monochoria vaginalis</i>	+	-	+
23.	<i>Najas graminea</i>	-	+	+
24.	<i>Nelumbo nucifera</i>	+	-	+

25.	<i>Neptunia oleracea</i>	-	-	+
26.	<i>Nuphar lutea</i>	+	-	+
27.	<i>Nymphaea nouchalli</i>	-	+	+
28.	<i>Oxalis corniculata</i>	+	+	+
29.	<i>Pennisetum polystachion</i>	+	-	-
30.	<i>Persicaria amphibica</i>	+	+	-
31.	<i>Pimpinella sp</i>	+	-	-
32.	<i>Pistia stratiotes</i>	+	+	-
33.	<i>Potamogeton gramineus</i>	+	-	-
34.	<i>Potamogeton natans</i>	+	-	-
35.	<i>Ranunculus reniformis</i>	-	+	+
36.	<i>Rotala sp</i>	+	-	-
37.	<i>Salvinia sp</i>	+	-	-
38.	<i>Spirodella sp</i>	+	-	-
39.	<i>Tridax procumbens</i>	+	+	+
40.	<i>Typha domingensis</i>	+	-	-
41.	<i>Utricularia aurea</i>	+	-	+
42.	<i>Vallisneria spiralis</i>	+	+	-
43.	<i>Wolffia globosa</i>	+	-	-

Table 2 : List of plants with their [availability](#) in each lake.

(Lake 1 - Tavarekere: , Lake 2- Dodda kere, Lake 3- Honnamma kere.

Srl.No	Plant name	Family	Habitat	Lifespan	IUCN status

1.	<i>Acemella uliginosa</i>	Asteraceae	Emergents	Annual	LC
2.	<i>Alternanthera sessilis</i>	Amaranthaceae	Emergent	Annual	LC
3.	<i>Alternanthera triandra</i>	Amaranthaceae	Emergents	Perennial	LC
4.	<i>Amaranthus spinosus L.</i>	Amaranthaceae	Emergent	Annual	LC
5.	<i>Azolla pinnata</i>	Salviniaceae	Free floating	Annual	LC
6.	<i>Baldellia ranunculoides</i>	Allistamataceae	Rooted	Annual	Threatened
7.	<i>Bidens pilosa</i>	Asteraceae	Emergents	Perennial	LC
8.	<i>Ceratophyllum demersum</i>	Ceratophyllaceae	Free floating	Annual	LC
9.	<i>Chara deliculata</i>	Characeae	Submerged	Annual	LC
10.	<i>Colocasia esculenta</i>	Araceae	Emergents	Annual	LC
11.	<i>Commelina erecta</i>	Commelinaceae	Emergent	Perennial	LC
12.	<i>Eclipta prostrata</i>	Asteraceae	Emergents	Annual	LC
13.	<i>Elodea canadensis</i>	Hydrocharitaceae	Submerged	Perennial	LC
14.	<i>Glyceria maxima</i>	Poaceae	Emergents	Perennial	LC
15.	<i>Hydrilla sp</i>	Hydrocharitaceae	Submerged	Perennial	LC
16.	<i>Hygrophila auriculata</i>	Acanthaceae	Emergents	Annual	LC
17.	<i>Hymenocallis littoralis</i>	Amaryllidaceae	Free floating	Perennial	NE
18.	<i>Hypericum elodea</i>	Hypericaceae	Free floating	Perennial	LC
19.	<i>Ipomea aquatica</i>	Convolvulaceae	Free floating	Perennial	LC
20.	<i>Lemna minor</i>	Araceae	Free floating	Annual	LC

21.	<i>Leucas aspera</i>	Lamiaceae	Emergent	Annual	LC
22.	<i>Monochoria vaginalis</i>	Pontederiaceae	Submerged	Annual	LC
23.	<i>Najas graminea</i>	Hydrocharitaceae	Submerged	Annual	LC
24.	<i>Nelumbo nucifera</i>	Nelumbonaceae	Free floating	Perennial	LC
25.	<i>Neptunia oleracea</i>	Fabaceae	Free floating	Perennial	LC
26.	<i>Nuphar lutea</i>	Nymphaeaceae	Free floating	Perennial	LC
27.	<i>Nymphoides indica</i>	Menyanthaceae	Free floating	Perennial	LC
28.	<i>Oxalis corniculata</i>	Geraniaceae	Rooted	Annual	LC
29.	<i>Pennisetum polystachion</i>	Poaceae	Emergent	Perennial	LC
30.	<i>Persicaria amphibica</i>	Polygonaceae	submerged	Perennial	LC
31.	<i>Pimpinella sp</i>	Apiaceae	Emergent	Annual	Endangered
32.	<i>Pistia stratiotes</i>	Araceae	Free floating	Perennial	LC
33.	<i>Potamogeton gramineus</i>	Potamogetonaceae	Submerged	Perennial	LC
34.	<i>Potamogeton natans</i>	Potamogetonaceae	Submerged	Annual	LC
35.	<i>Ranunculus reniformis</i>	Dilleniaceae	Emergents	Annual	LC
36.	<i>Rotala sp</i>	Lythraceae	Emergent	Annual	Threatened
37.	<i>Salvinia sp</i>	Salviniaceae	Free floating	Annual	LC
38.	<i>Spirodella sp</i>	Araceae	Free floating	Annual	LC

39.	<i>Tridax procumbens</i>	Asteraceae	Emergent	Perennial	LC
40.	<i>Typha domingensis</i>	Typhaceae	Emergent	Perennial	LC
41.	<i>Utricularia aurea</i>	Lentibulariaceae	Free floating	Perennial	LC
42.	<i>Vallisneria spiralis</i>	Hydrocharitaceae	Submerged	Perennial	LC
43.	<i>Wolffia globosa</i>	Araceae	Free floating	Perennial	LC

Table 3 : List of plants with family, habitat, lifespan and IUCN status.

I			
II	$11/(11+7+17)=0.31$		
III	$10/(10+24+11)=0.22$	$11/(11+7+7)=0.44$	
Lakes	Lake I	Lake II	Lake III

Table 4: Jaccard's Similarity Index.

I			
II	$22/(22+7+17)=0.47$		
III	$20/(20+24+11)=0.36$	$22/(22+7+7)=0.611$	
Lakes	Lake I	Lake II	Lake III

Table 5: Sorenson's Similarity Index.

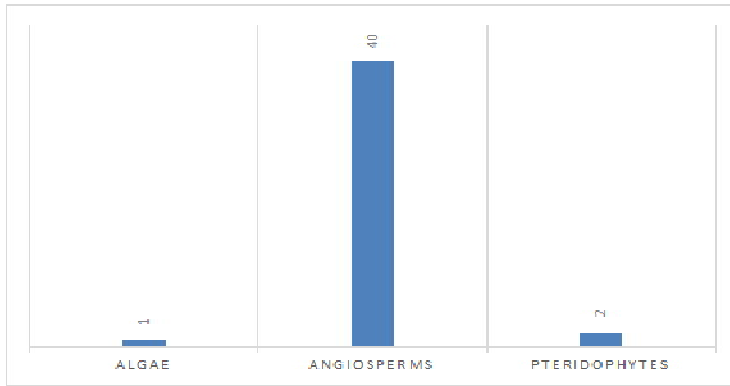


Fig 3 ; Distribution of aquatic plants

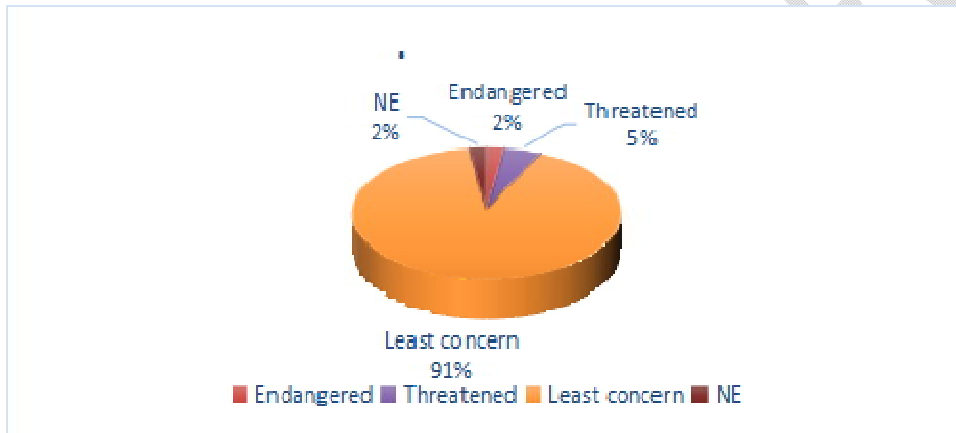


Fig 4; Distribution of macrophytes according to their IUCN status.

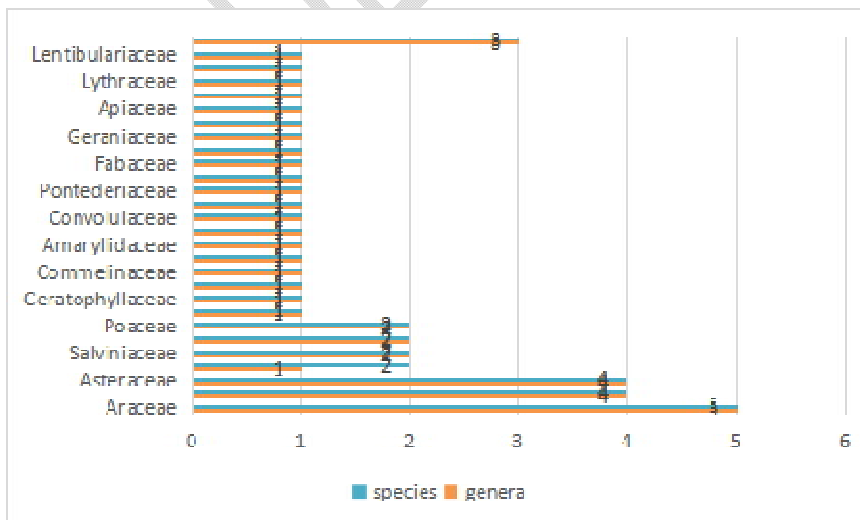


Fig 5 : Data on Families with number of genera and species.

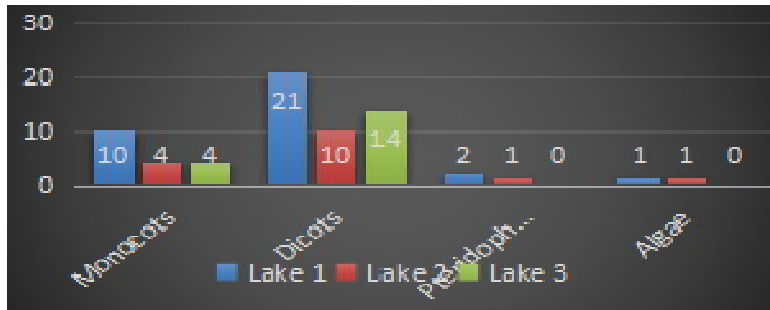
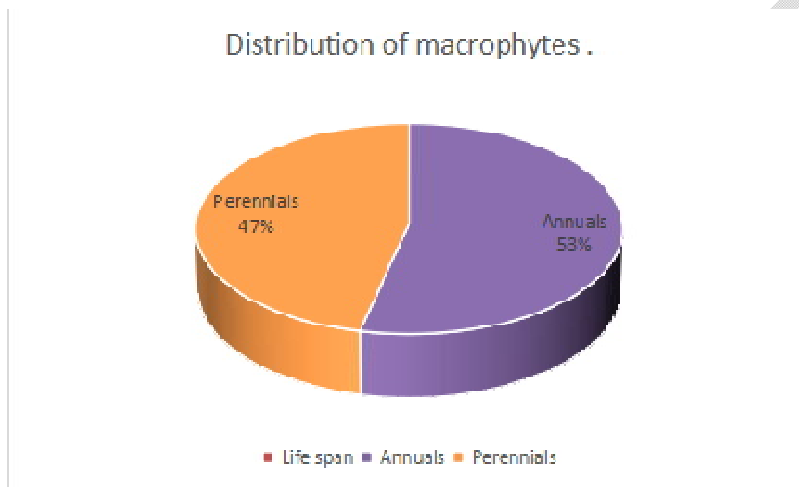


Fig 6; Distribution of aquatic plants in each of the study area.



Fig;7; Distribution of macrophytes according to their life span.

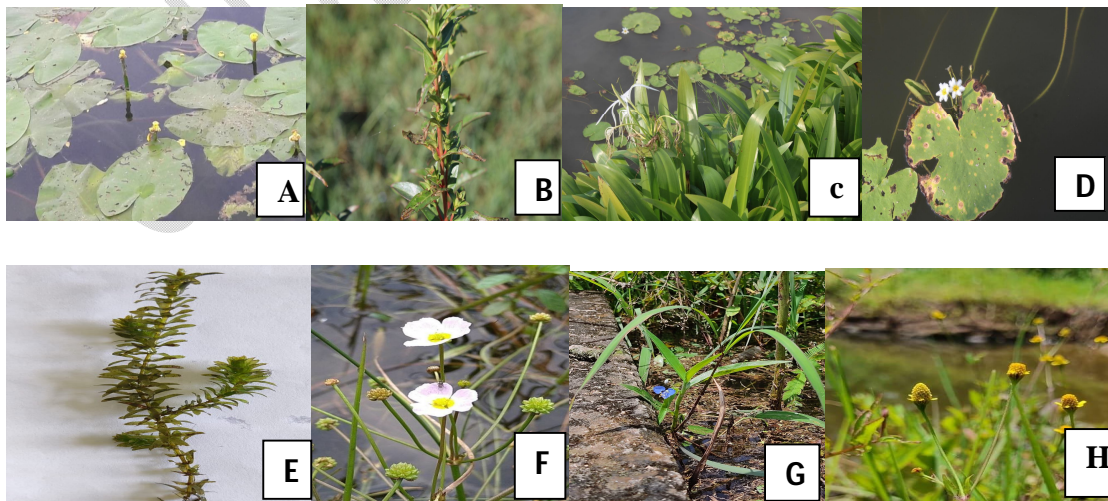


Fig 8; Some macrophytes from study area.

A. *Nuphar lutea*, **B.** *Hygrophila auriculata*, **C.** *Hymenocallis littoralis*, **D.** *Nymphoides indica*, **E.** *Elodea canadensis*, **F.** *Baldellia ranunculoides*, **G.** *Commelina erecta*, **H.** *Bidens pilosa*.

CONCLUSION:

The present study is a compilation of aquatic macrophytes from selected lakes of Somawarapete taluk of Kodagu district. The study was carried out to document the macrophytes which can be further as an authenticated baseline for further exploration and conservational studies of the local biodiversity. A total of 43 species representing 29 families were recorded. The IUCN status and lifespans are also recorded. The study areas were clear, without any invasive species. With this study, it is concluded that floristic aquatic diversity is a very important component in conserving the biodiversity of wetlands.

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