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AN ECOLOGICAL STUDY OF THE VEGETATION OF THE KOLLERU LAKE

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ABSTRACT

Kolleru lake is a large fresh water body extending over 850 sq. km in the Krishna and West Godavari districts of Andhra Pradesh, between 81°40′ and 80°20′ E and 17°25′ and 16°28′ N. The entire lake being shallow, has only littoral vegetation with practically no limnetic and profoundal zones. As the lake receives rich nutrients as effluents from the several drains that empty into it, the vegetation is luxuriant. About nineteen species of hydrophytes belonging to thirteen angiosperm families are recorded. Data on the distribution of these hydrophytes in the lake and their frequency, relative frequency and abundance from different regions of the lake at different periods of the year, are presented.

INTRODUCTION

Fresh water macrophytes play a very important role in aquatic ecosystems. They provide food and shelter for a number of organisms including some economically important fish while an excessive growth of these plants may interfere with man's use of fresh water by obstructing water flow, navigation and fish production and may sometimes create problems for sanitaiton. The importance of fresh water macrophytes in the biological productivity has earlier been emphasized by Butcher (1933) and Welch (1935). The International Biological Programme has given an impetus for a global study of the primary productivity of the macrophytes.

However, in India the systematic and ecological study of aquatic macrophytes as a group has not received the necessary attention. Subramanyam's (1962) Aquatic Angiosperms is distinctive among the Indian literature on the aquatic macrophytes. Among other contributions on the subject may be mentioned Biswas and Calder (1937), Misra (1946), Mirashi (1954, 57, 58), Maheswari (1960), Chavan and Sabnis (1961) and Unni (1967). There appears to be no published work on the vegetation of Kolleru Lake except for the passing remarks in Subramanyam's Aquatic Angiosperms.

Data obtained from the study of the ecology and weed biology of Kolleru lake during the survey of the lake from June 1977 to February 1978 are presented.

THE AREA OF STUDY

Kolleru is a large fresh water lake in Andhra Pradesh situated between the Krishna river on the West and the Godavari river on the East. The lake has an area of about 904 square kilometer at +10 contour level, of which 260 square kilometer is in the Kaikaluru and Gudivada taluks of Krishna District and the rest in Eluru, Bhimavaram and Tadepalligudem taluks of the West Godavari District. The area lies between longitudes 81° 40′ and 80° 20′ in the East and latitudes 17° 25′ and 16° 28′ to the North. Geologically, it is be-

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lieved to be of recent origin formed by excessive silting of the Krishna and Godavari rivers, of an earlier lagoon separating it completely from the sea. The lake receives an inflow of more than 100,000 cusecs and its discharge to the sea by its only outlet the 'UPPUTERU' is much less. The lake is connected to the sea which is 32 kilometer away by this narrow waterway. The lake receives drainage from a catchment area of about 5200 square kilometer of which three-fourths is from upland area and a quarter from the delta area. Thus the lake expands during the rainy season inundating the neighbouring areas while during summer, a major part of the lake gets dried up. About 15 small canals or drains empty into the lake which has prolific growth of several aquatic weeds. The important streams and canals that join Kolleru lake are 1. Tammileru, 2. Ramileru, 3. Budameru, 4. L. S. drain of Neharalli channel, 5. Rallacodu, 6. Chandraiah drain, 7. L. S. of Moturu channel, 8. Polraj drain, 9. Pedapadu drain, 10. Vatluru drain, 11. Mandicodu drain, 12. Kovvali drain, 13. Takkalapalli drain, 14. Pandicodu drain and 15. Siddapuram drain (Map).

METHODS OF STUDY

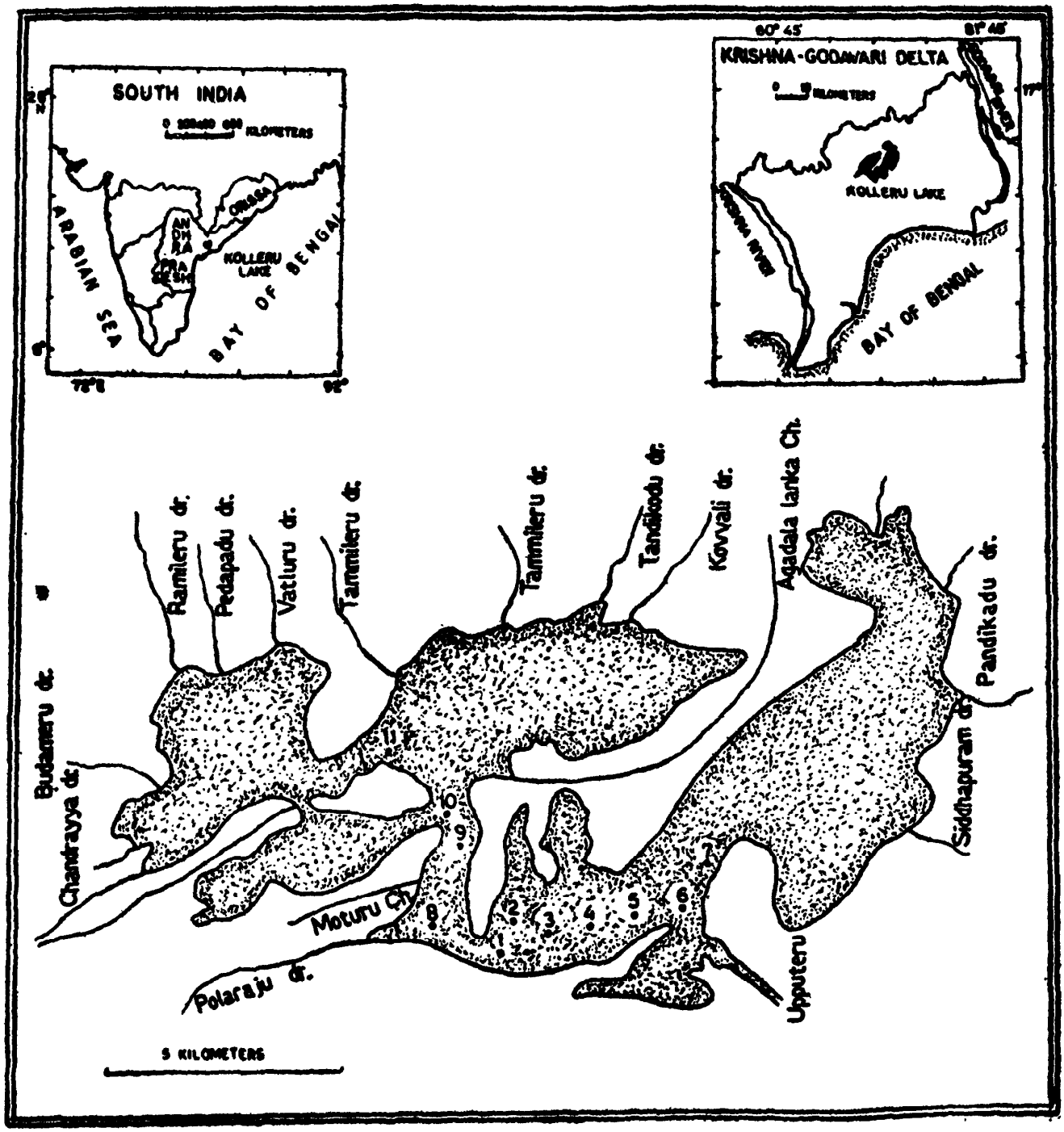
The vegetation of the lake mainly consists of emergent, submerged and free floating forms of intermingled mats. Thus quantitative sampling of vegetation of the lake posed a very serious problem both for approach to the area and for sampling. Different types of macrophyte samplers have been designed, fabricated and tested during this period. Of the various samplers tested, a rotatory sampler similar to one described by Howard-Williams and Longman (1976) has been used with good results. Each collection was washed and sorted out for the different species and their fresh weight was determined after removing excessive adherent water. Quantitative estimations were made on the basis of fresh weight of the species that occurred in that particular quadrat as it was not possible to count the individual number of species occurring in each quadrat. Sampling was done along two transects selecting some field stations in each transect. Only one transect could be covered in a day. The field stations that were visited are marked in the Map. The quantitative characters of the vegetation were analysed based on the overall sampling of the vegetation in each of the transects and the number of quadrats sampled in each transect varied from 15 to 30.

RESULTS AND DISCUSSION

The different aquatic macrophytes that are encountered are summarised in Table 1 and their distribution in Table 2. Information on frequency, relative frequency, density, relative density of all macrophytes of the lake, representing the average value for the entire lake, based on data from 117 quadrats studied during the entire period of the survey from all the field stations has been summarised in Table 3.

Among the different macrophytes in the lake, *Ottelia alismoides* (L.) Pers. showed maximum percentage frequency and relative frequency followed by *Ipomoea aquatica* Forsk. and *Nymphoides indicum* (L.) O. Kuntze. In spite of the fact that *Eichhornia crassipes* (Mart.) Solms. occurred in greater abundance in localities such as Pedayedlagadi etc., the frequency and relative frequency of this species is much lower and it occupied the 6th place in the order of importance. *Blyxa octandra*, (Roxb.) Planch. ex Thw., *Vallisneria spiralis* L. and *Phragmites karka* (Retz.) Trin. ex Steud. are highly restricted in their distribution being present only in Deyyampadu, Komatilanka and Kolletikota respectively.

It is interesting to note that the two common species *Ceratophyllum demersum* L., *Hydrilla verticillata* Royle are conspicuously absent in the lake. The lake being very



Map of Kolleru lake showing various field stations.
1. Atapaka. 2. Komatilanka. 3. Nattagullapadu. 4. Singapuram. 5. Chataka. 6. Urumullanka. 7. Kolletikota. 8. Kaikaluru. 9. Chintapadu. 10. Deyyampadu. 11. Pedayedlagadi.

shallow, there is no clear cut zonation of emergent, submerged and free floating species, all occurring in intermixed mats, though in some areas *Ottelia alismoides* (L.) Pers. occurred in continuous patches. Forsberg (1960) observed the such monospecific stands of submerged species in lake Osbysjon while Swindale & Curtis (1957) reported in Wisconsin lakes, the submerged vegetation as of heterogeneous composition. However, Unni (1971) reports both heterogeneous and monospecific stands of aquatic vegetation in

TABLE 1

LIST OF MACROPHYTES OCCURRING IN KOLLERU LAKE

Species	*Family*
I. HYDROPHYTES ATTACHED TO SUBSTRATUM	
(a) Emergent hydrophytes :	
1. *Phragmites karka* (Retz.) Trin. ex Steud.	Poaceae
2. *Typha angustata* Bory & Chaub.	Typhaceae
3. *Scirpus articulatus* L.	Cyperaceae
4. *Paspalidium geminatum* (Forsk.) Stapf	Poaceae
(b) Floating leaved hydrophytes :	
5. *Aponogeton crispum* Thunb.	Aponogetonaceae
6. *Nymphaea nouchali* Burm. f.	Nymphaceae
7. *Nymphoides indicum* (L.) O. Kuntze	Gentianaceae
8. *Ipomoea aquatica* Forsk.	Convolvulaceae
9. *Alternanthera sessilis* L.	Amaranthaceae
(c) Submerged hydrophytes :	
10. *Vallisneria spiralis* L.	Hydrocharitaceae
11. *Blyxa octandra* (Roxb.) Planch. ex Thw.	Hydrocharitaceae
12. *Ottelia alismoides* (L.) Pers.	Hydrocharitaceae
13. *Limnophila indica* (L.) Druce	Scrophulariaceae
14. *Nechamandra alternifolia* (Roxb.) Thw.	Hydrocharitaceae
II. FREE FLOATING FORMS :	
15. *Salvinia auriculata* Aublet	Salviniaceae
16. *Eichhornia crassipes* (Mart.) Solms.	Pontederiaceae
17. *Utricularia stellaris* L. f.	Lentibulariaceae
18. *U. flexuosa* Vahl	Lentibulariaceae
19. *Pistia stratiotes* L.	Araceae

TABLE 2

TABLE SHOWING THE DISTRIBUTION OF DIFFERENT AQUATIC MACROPHYTES OF THE LAKE
(Nos. 1 to 11 represent the field stations. See legend of Map for details).

Species	1	2	3	4	5	6	7	8	9	10	11
Phragmites karka	—	—	—	—	—	—	+	—	—	—	—
Typha angustata	—	—	+	—	—	—	—	—	—	—	—
Scirpus articulatus	—	—	+	+	+	—	—	—	—	—	+
Paspalidium geminatum	—	—	+	+	+	—	—	—	—	—	—
Aponogeton crispum	+	+	+	+	+	+	+	+	+	+	—
Nymphaea nouchali	+	+	+	+	+	+	+	—	—	—	—
Nymphoides indicum	+	+	+	+	+	+	+	—	—	—	—
Ipomoea aquatica	+	+	+	+	+	+	+	+	+	+	+
Alternanthera sessilis	—	+	—	—	—	—	+	—	—	—	+
Vallisneria spiralis	—	+	—	—	—	—	—	—	—	—	—
Blyxa octandra	—	—	—	—	—	—	—	—	—	+	—

Species	1	2	3	4	5	6	7	8	9	10	11
Ottelia alismoides	+	+	+	+	+	+	+	+	+	+	+
Limnophila indica	+	–	+	+	+	+	–	–	–	+	–
Nechamandra alternifolia	+	+	+	+	–	–	–	–	+	–	–
Salvinia auriculata	–	+	+	+	+	–	–	–	+	+	–
Eichhornia crassipes	+	–	–	–	–	–	–	–	–	–	+
Utricularia spp.	+	+	+	+	+	+	–	–	–	–	–
Pistia stratiotes	+	+	+	+	+	–	–	–	–	–	–

TABLE 3

FREQUENCY, RELATIVE FREQUENCY, DENSITY AND RELATIVE DENSITY OF DIFFERENT AQUATIC MACROPHYTES OF KOLLERU LAKE

Name of the species	Total No. of quadrats studied	No. of quadrats of occurrence	Total wt. of the species (gm^{-2})	Percentage frequency	Relative frequency	Density (gm^{-2})	Relative density
Ottelia alismoides	117	63	44035	53.80	27.39	376.36	35.48
Ipomoea aquatica	117	58	42180	49.57	25.21	360.50	33.90
Nymphoides indicum	117	24	10105	20.51	10.43	86.36	8.14
Aponogeton crispum	117	10	1475	8.50	4.30	12.60	1.18
Nechamandra alternifolia	117	13	4055	11.11	5.65	34.65	3.20
Eichhornia crassipes	117	7	2220	5.98	3.04	18.97	1.78
Limnophila indica	117	7	1160	5.98	3.04	9.91	0.93
Utricularia spp.	117	8	830	6.83	3.40	7.09	0.66
Alternanthera sessilis	117	4	2620	3.40	1.73	22.30	2.11
Typha angustata	117	5	610	4.27	2.17	5.20	0.40
Vallisneria spiralis	117	2	435	1.70	0.86	3.70	0.35
Blyxa octandra	117	2	270	1.70	0.86	2.30	0.21
Phragmites karka	117	2	630	1.70	0.86	5.30	0.50
Najas spp.	117	5	1770	4.27	2.17	15.22	1.40
Scirpus articulatus	117	7	955	5.98	3.04	8.16	0.76
Nymphaea nouchali	117	3	2370	2.50	1.30	20.20	1.91
Chara with *Nitella*	117	10	8365	8.54	4.34	71.40	6.74

the Doodhadri lake. In proportion to the vast area occupied by the Kolleru lake the different number of species that the lake holds is much less; though these species occurred in greater density and abundance.

The distribution of vegetation in the lakes has been attributed to the characters of the soil by Pearsall (1920), Misra (1938) and Wilson (1937). The dense vegetation of the Kolleru lake can be attributed to its shallow nature with rich nutrients.

Among the different species that occurred in greater abundance *Ipomoea aquatica* Forsk. is of considerable importance since it has been used as cattle feed by the local people and it may be noted that it was cultivated as a vegetable crop in Hong Kong (Edies & Ho, 1969). The importance of such a luxuriant macrophytic vegetation in controlling the eutrophication of the Kolleru lake by removing the important nutrients needs no overemphasis (Boyd, 1970).

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