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Ecological Analysis of the Macrophytes of Oinampat Lake, Manipur

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Abstract: **- Oinampat is semi-terrestrial shallow water lake located at Oinam, Bishnupur district, Manipur at a distance of 22 km due south –west of Imphal. It lies at an intersection of 93º45' to 93º55' E longitude and 24º25' to 24º40' N latitude at an altitude of 782 m above mean sea level. In the present study, an attempt has been made to analyse the floristic composition, the life form, classification and the biological spectrum of the macrophytes of the Oinampat lake, Manipur. A total of 44 macrophytic species have been recorded during the present investigation. Five life form categories have been recorded viz. 1.Chaemaephytes(1 species)-2.3%, 2.Errant Vascular hydrophytes(11 species)-25%, 3.Hemicrptophytes(8 species)-18.2% and Therophytes(11 species)-25%. The biological spectrum of the lake revealed "Geo-Thero Errant Vascular Hydrophytic type of Phytoclimate".**

Keywords: Oinampat lake, macrophytes, biological spectrum, phytoclimate.

I. INTRODUCTION

Distinguished With the enormous increase in the population of the world, concomitant with the human demands and pressure, there are no pristine areas unexplored by man. The consequence is the gradual depletion in the natural resources of the world.. About three fourths of the Earth's surface has been occupied by the aquatic bodies, in the form of oceans, seas, lakes, rivers and ponds. The aquatic habitats have been categorised into freshwater, estuaries and marine systems. Freshwater habitats occupy relatively a very small portion of the Earth's surface (0.5%) although its importance to man is immense and indispensable. In the recent years, water resources have been the most exploited natural ecosystems through human interferences viz. over population poor land-use practices and habitat degradation thereby gradually deteriorating the water quality. It is also a well known fact that there can be no life without water.

Vegetation ecology covers the floristic composition, structure, ecology, dynamics/diversity, biotic interaction, distribution of plant communities with an emphasis on functional adaptation. Wetlands are considered to have unique ecological features which provide several product and service to human.

Investigation on the different ecological aspects of the ecology of the freshwater bodies started as early as 1960's. In North-eastern India information on the aquatic ecology are meagre. The bio-diversity resources of North east India which is included in the 36 "BIODIVERSITY HOTSPOTS" of the world (Conservation International 2005) has been much degraded at present.

Although, only about 55 lakes are found to exist at present viz., Loktak lake (Ramsar site), Ikop lake, Utrapat, Sanapat, Pumlenpat, Waithoupat, Lousipat, Khoidumpat, Oksoipat, Laisoipat, Oinampat, etc. Most of these lakes are very much degraded due to artificial eutrophication and they are on the verge of extinction.

Studies on aquatic and marsh land plants of India are well documented by many authors [1], [2], [3], [4], [5], [6]. Studies of the macrophytes of the wetlands of Manipur have been documented by many authors [7], [8], [9], [10], [11], [12], [13].

The lake under the present study is one of the threatened lakes. Therefore an attempt has been made to analyse the floristic distribution and the life form classification of the macrophytes of Oinampat lake. Oinampat is semi-terrestrial shallow water lake located at Oinam, Bishnupur district, Manipur at a distance of 22 km due south –west of Imphal. It lies at an intersection of 93º45' to 93º55' E longitude and 24º25' to 24º40' N latitude at an altitude of 782 m above mean sea level. The lake has an area of about 1.538 sq. km.

Methodology:

A regular monthly periodical survey and sampling of the vegetation has been done for a period of 12 months.

Floristic composition**:** Floristic studies of the macrophytic vegetation is a pre-requisites to understand the structure of a lake ecosystem. A detailed floristic composition was analysed, taking into consideration the form, habit, the nature of the perreniating buds along with the structure and seasonality of the crownfoliage and shoot system. The classification of vegetation on physiognomic basis has been done as per Raunkiaer's system modified by Ellenberg and Mueller-Dombois(1967) and Mueller-Dombois and Ellenberg(1974). Biological spectrum of the

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study area is determined by the dominant life forms and the same reflects the probable phytoclimate of the particular area. The biological spectrum of the study area has been compared with the normal spectrum of the world.

Results and Discussion:

The floristic analysis of the Oinampat lake revealed the occurrence of 44 (forty four) macrophytic species. The macrophytes were categorised into- (1) Emergent(19 species), (2) Free floating(5 species), (3) Submerged(9 species), (4) Rooted submerged(3 species) and (5) Rooted with floating leaves(8 species). The floristic distribution has been incorporated in the pie chart. The floristic composition in the present study is very much in conformity with the finding of Oksoipat lake. [14] A comparatively higher number of macrophytic species as reported by [15] (1993) with 86 species in the Loktak lake, Manipur out of which 73 species were emergents from the phumdi (floating mat) zone, while 13 species were reported from the non-phumdi zone, of which 6 species were submerged, 4 species in the free floating and 3 species in the rooted with floating leaved species. [15] (1993) reported 35 species from the Waithou lake, Manipur of which 18 species were emergent, 5 free floating, 6 with rooted floating leaved species. [16] and [17] (1982) reported 58 species in the wetlands of Kashmir out of which 23 species were emergent category, 21 in the ground layer species, 7 species in floating leaved and 7 species in the submerged category. [18] and[19] (1982) reported lower number of macrophytic species with only 14 species of which 3 were floating leaved, 7 submerged and 4 in the emergent category. In Haukarsar lake in Kashmir, [18] and [19] (2005) recently reported highest number of emergents (30 emergents, 7 rooted floating, 2 free floating, 7 submerged) out of 46 macrophytic species. The macrophytes in the present study comes under 21 families as shown in table 1.

Table 1. Family-wise distribution of Macrophytes of Oinampat lake.

Name of species	Family	Life-forms
Alternanthera philoxeroides	Amaranthaceae	Th
Alternanthera sessilis	Amaranthaceae	Th
Andropogon ascinoides	Poaceae	G
Azolla pinnata	Salvinaceae	EVH
Carex cruciata	Cyperaceae	Th
Centella asiatica	Apiaceae	H
Ceratopteris thallictroides	Polypodiaceae	Ch
Ceratophyllum demersum	Ceratophyllaceae	EVH
Chara zeylanica	Characeae	EVH
Commelina benghalensis	Commelinaceae	H
Cyperus rotundus	Cyperaceae	Th
Echinochloa colonum	Poaceae	Th
Eichhornia crassipes	Pontederiaceae	EVH
Eleocharis palustris	Cyperaceae	Th
Enhydra fluctuans	Asteraceae	H
Eragrostris pectinacea	Poaceae	Th
Euryale ferox	Nymphaceae	G
Hydrilla verticillata	Hydrocharitaceae	H
Hydrocharis cellulosa	Hydrocharitaceae	G
Hygroryza aristata	Poaeceae	H
Ipomoea aquatica	Convolvulaceae	H
Jussiaea repens	Onagraceae	Th
Jussiaea suffruticosa	Onagraceae	Th
Limnophylla heterophylla	Scrophulariaceae	H
Ludwigia adcendens	Onagraceae	Th
Marsilia quadrifoliata	Marsiliaceae	EVH
Myriophyllum tuberculatum	Haloragaceae	EVH
Nelumbo nucifera	Nymphaceae	G

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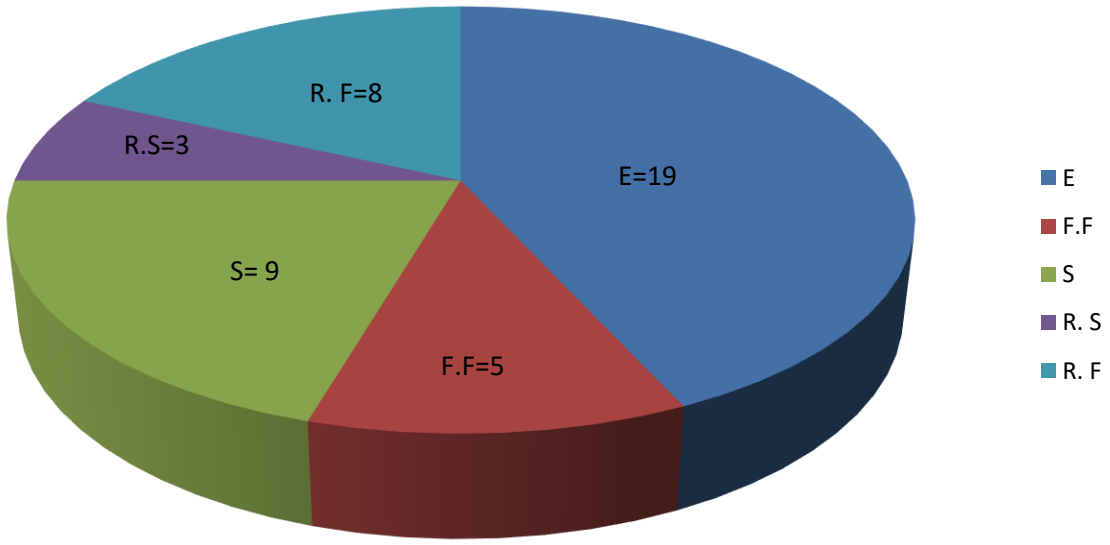
Nymphaea nouchali	Nymphaceae	G
Nymphaea pubescens	Nymphaceae	G
Nymphaea stellata	Nymphaceae	G
Nymphoides cristatum	Nymphaceae	G
Nymphoides indicum	Nymphaceae	G
Pistia stratiotes	Araceae	EVH
Potamogeton crispus	Pontederiaceae	G
Potamogeton natans	Pontederiaceae	G
Pseudoraphis spinescence	Poaceae	H
Salvinia cucullata	Salvinaceae	EVH
Salvinia natans	Salvinaceae	EVH
Scirpus supinus	Cyperaceae	Th
Trapa natans	Trapaceae	G
Utricularia exolata	Lentibulariaceae	EVH
Utricularia flexuosa	Lentibulariaceae	EVH
Zizania latifolia	Poaceae	G

Abbreviation: EVH =Errant Vascular Hydrophytes, Th =Therophytes, G= Geophytes, H=Hemicrptophytes, Ch = Chaemaephytes.

Groupwise Distribution of macrophytes is highlighted in the pie diagram.



Abbreviation: E= Emergent, F.F=Free Floating, S=Submerged, R. S=Rooted Submerged & R. F=Rooted Floating

Life Forms: In the present study, 44 macrophytic species

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were categorised into five life form categories - Chaemaephytes(1 species), Errant vascular hydrophytes(11 species), Geophytes(13 species), Hemicryptophytes(8 species) and Therophytes(11 species). The different life-forms along with the percentage composition of the various macrophytes of the Oinampat have been incorporated in the table 2. The percentage composition of the plants in the different life-form classes are termed as the Life-Form Spectrum or the Biological Spectrum. The biological spectrum of Oinampat lake is shown in table 3. The biological spectrum of the present study has been found to be Geo-Thero-Errant Vascular Type of Phytoclimate. When the life-form spectra of a particular plant community is compared to the normal life-form spectrum (Raunkiaer 1934) [18], the adaptational capabilities of the plants to the adverse climate condition are revealed. From a comparison with the normal Biological spectrum of Raunkiaer(1934), it is evident that the percentage of Geophytes in the present study is 4-5 times that of the normal Biological Spectrum, while the percentage composition of Therophytes are 2 times that of the normal spectrum whereas the percentage value of Chaemaephytes is comparatively lower than that of the normal spectrum. The present findings are in conformity with the finding of Kaul et al (1978) [14] 8 species in the submerged group, 7 species in the rooted with floated leaf and 28 species were found to belong to the emergent group. Comparative study of Life-Form spectrum & Phytoclimate of some wetlands are shown in table 4.

Life- form	Name of Species	Number of Species	Percentage Composition
Chamaephytes	*Ceratopteris thallictroides*	1	`2.3%
Errant Vascular Hydrophytes	*Azolla pinnata* *Ceratophyllum demersum* *Chara zeylanica* *Eichhornia crassipes* *Marsilia quadrifoliata* *Myriophyllum tuberculatum* *Pistia stratiotes* *Salvinia cucullata* *Salvinia natans* *Utricularia exolata* *Utricularia flexuosa*	11	25%
Geophytes	*Andropogon ascinoides* *Euryale ferox* *Hydrocharis cellulosa* *Nelumbo nucifera* *Nymphaea nouchali* *Nymphaea pubescens* *Nymphaea stellata* *Nymphoides cristatum* *Nymphoides indicum* *Potamogeton crispus* *Potamogeton natans* *Trapa natans* *Zizania latifolia*	13	29.5%

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Hemicryptophytes	*Centella asiatica* *Commelina benghalensis* *Enhydra fluctuans* *Hydrilla verticillata* *Hygroryza aristata* *Ipomoea aquatica* *Limnophylla heterophylla* *Pseudoraphis spinescence*	8	18.2%
Therophytes	*Alternanthera philoxeroides* *Alternanthera sessilis* *Carex cruciata* *Cyperus rotundus* *Echinochloa colonum* *Eleocharis palustris* *Eragrostris pectinacea* *Jussiaea repens* *Jussiaea suffruticosa* *Ludwigia adcendens* *Scirpus supinus*	11	25%

Table 2. Life Form classification of the Macrophytic species in Oinampat lake. (After Ellenberg and Mueller- Dombois, 1967 and Mueller-Dombois and Ellenberg, 1974).

Table 3. Biological spectrum of the Flora of Oinampat lake:

Parameters	**Life forms**						
	Th	G	H	Ch	Ph	EVH	Total
Total number of species	11	13	8	1	-	11	44
Life-form percentage	25%	29.5%	18.2%	2.3%	-	25%	100%
Raunkiaer's normal spectrum and composition (%)	13.00	6.00	26.00	9.00	46.00	-	100

(Abbreviation: Th= Therophytes, G= Geophytes, H= Hemicryptophytes, Ch= Chamaephytes, Ph= Phanerophytes, EVH= Errant Vascular Hydrophytes).

Table 4. Comparision of life form spectra and phytoclimate of some wetlands

Wetlands	**Life forms (%)**							**Phytoclimate**	**References**
	Th	**G**	**H**	**Ch**	**Ph**	**EVH**	**L**		
Loktak Non-phumdi	15.38	23.07	07.69	-	-	53.86	-	Errant Vascular Hydrophytes	Devi N B (1993)
Phumdi	46.57	10.96	20.55	09.59	1.37	-	10.96	Thero-Hemicryptophytes	Devi N B (1993)
Utrapat	30.8	23.	15.	-	-	30.	-	Thero-Errant	Devi &

	0	00	40			80		Vascular Hydrophytes	Sharma(1998)
Sanapat	29.4 1	43. 53	17. 65	-	-	29. 41	-	Thero-Errant Vascular Hydrophytes	Bebika & Sharma(2002)
Waithoupat	28.6 0	57. 10	-	-	-	14. 30	-	Geo-Therophytes	Okram *et al* (1996)
Ikop lake	24.1	31. 0	13. 8	3.5	-	27. 6	-	Geo-Errant Vascular Hydrophytes	Nivanonee C.(2002)
Oksoipat	22.5	27. 5	22. 5	2.5	-	25. 00	-	Geo-Errant Vascular Hydrophytes	Umeshwari S. (2008)
Oinampat	**25**	**29. 5**	**18. 2**	**2.3**	**-**	**25**	**-**	**Geo-Thero Errant Vascular Hydrophytes**	**Present work**

Abbreviation: Th= Therophytes, G= Geophytes, H= Hemicryptophytes, Ch=Chaemaephytes, Ph= Phanerophytes, EVH= Errant Vascular Hydrophytes and L= Lianas

CONCLUSION

It is noteworthy that Oinampat lake is the life- line of the peoples inhabiting around the lake. By studying the floristic composition of the lake under the present study, it can be concluded that the site has luxuriant growth of macrophytes with rich species diversity. The occurrence of the Geo -TheroErrant vascular hydrophytic type of Phytoclimate signifies that the lake is eutrophic. Such an observation substantiate the fact that enhances eutrophication has set in the lake and remedial measures to check the eutrophication in the lake has became indispensable.

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