Macrophyte Diversity of Paakootukulam, a rural Freshwater Pond in Kulasekaram Panchayat, Kanniyakumari District, Tamilnadu, India

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***Abstract*— Macrophytes are one of the biological factors used to measure the state of the environment. The present study conducted at Paakootukulam, a freshwater pond in Kalkulam taluk of Kanyakumari District, documented 26 macrophytes, belonging to 18 families and 24 genera which were identified under 3classes: Seven species of eight genera and seven families under the class dicotyledons, ten species of fourteen genera and eight families under the class monocotyledons andthree species of three genera under three families under the class pteridophytes. The present paper clearly indicates the availability of invasive alien species and phytoremediation species. Evaluating the sustainable use of ecologically and environmentally valuable aquatic flora, their threat status and conservation strategies of the Paakootukulam freshwater ecosystem of Kanyakumari District, may pave way for the implementation of appropriate measures to be taken to reduce the continued habitat loss due to anthropogenic activities.**

Index Terms: **Ecosystem, freshwater pond. Paakootukulam.**

I.INTRODUCTION

Aquatic Macrophytes are photosynthetic organisms large enough to view with the naked eye that grow underwater or grow vertically through the water surface or float on water on a regular or irregular basis [1].Aquatic macrophytes sometimes may be submerged in water body or may be partly emergent and they include largest plants having root, stem and leaves, which are sometimes found attachedto the bottom (benthic) of water body[1]. They are vital members of the aquatic ecosystem because they provide food, nutrients and habitat to other aquatic invertebrates, fishes, aquatic wild life and zooplanktons, hence preserving aquatic biodiversity[4], [2]. Macrophytes are thought to be good indicators of the health of aquatic ecosystems[3]. Aquatic plants and their communities may potentially be good markers of changes in lakes as a result of eutrophication and acidification induced by humans[5],[6]. When they develop in abundance, most aquatic macrophytes can become anuisance. They are therefore referred to as aquatic weeds, posing a problem for water management. They obstruct water flow, harbour mosquitoes, induce water loss, and rapidly eutrophicate lakes and water bodies. According to the National Biodiversity Action Plan, the Indian subcontinent is a home to about half of the world aquatic plants, although only a few have been examined in depth[7]. Various workers have done research on the macrophytes of different water bodies in India. [8]-[21].Some of themhave recently done relevant works on aquatic macrophytes [22]-[29].The present investigation was undertaken to study the species composition and distribution of aquatic macrophytes in Paakootukulam, a freshwater pond.

II.MATERIALS AND METHODS

A. Study area

Kanniyakumari district is a region blessed with a good number of fresh water ponds and dams harbouring a great variety of aquatic macrophytes. The present study was carried out in Paakootukulam, a freshwater pond in the Kalkulam Taluk, Kanyakumari District periodically from July 2019 to May 2020.Fig 1). The pond was visited regularly and the floristic study was carried out.

Fig.1 Map showing the study area

B. Collection of aquatic plants

During the study period the pond was visited and aquatic plants were collected. They were brought to the laboratory and photographed. The plant specimens (excised twig or uprooted entire plants) were pressed under blotting paper and were made herbarium following standard procedures. The plants were identified using the standard Flora of Madras Presidency by Gamble and were categorized on the basis of their family, morphological features and life forms.

III. RESULTS AND DISCUSSION

Aquatic plants were classified into five groups according to their growth forms such as free floating (FF), submerged floating (SF), rooted submerged (RS), rooted floating(RF) and rooted emergent(RE).

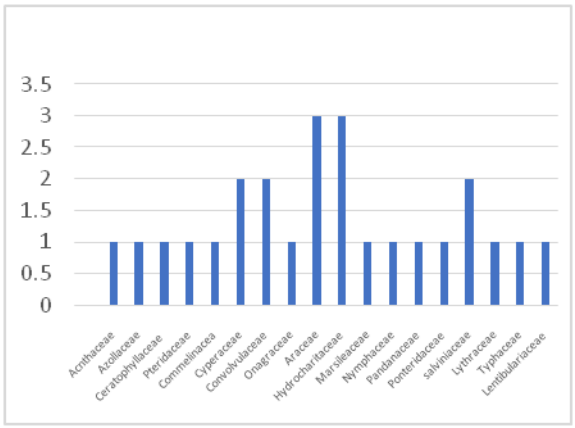

Fig.2Familywise distribution of macrophytes

In this present investigation, a total of 26 species belonging to 18 families and 24 genera were identified under 3classes. (Fig.2) Seven species of eight genera and seven families under the class dicotyledons, ten species of fourteen genera and eight families under the class monocotyledons, three species of three genera under three families belonging to the class pteridophytes were enlisted. Further, the aquatic macrophytes were classified in morphological group. Among five morpho-ecologic groups, submerged anchored with 13 species dominated the lake followed by emergent anchored (11), floating (7), floating leaved anchored and submerged with one species each. The most dominant families were Hydrocharitaceae and Araceaewith three species followed by Salviniaceae, Convolvulaceae and Cyperaceae with two species each. Only one species each was recorded for Acanthaceae, Azollaceae, Commelinaceae, Ceatophyllceae, Pontederiaceae, Onagraceae, Masileaceae, Pandanaceae, Nymphaceae, Ponteriaceae, Lythraceae, Typhaceae, and Lentibulariaceae. The morpho-ecological group of aquatic macrophytes is given in Table-2. The plants were photographed and are given in figure 1. Aquatic macrophytes in the pond occur as Free floating (31%), submerged floating (11%), Rooted submerged (8%), Rooted Floating (15%) and Rooted Emergent (35). (Figure3).

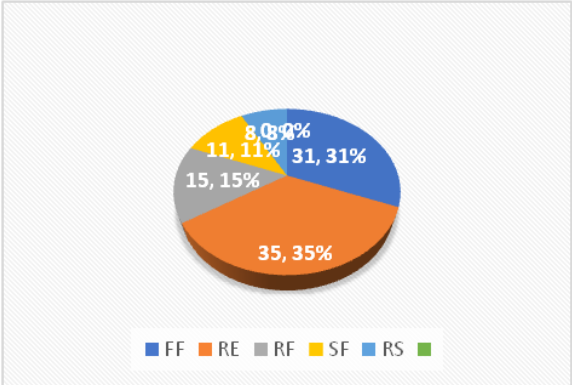

Fig.3 Morphoecological representation of macrophytes

Presence of Pistia and Ponteridiain the pond is a clear indicator of alien species invasion. Physicochemical characteristics determine species growth, distribution, indicator group, and pollution tolerant species [30]. Several researches have looked into the impact of water chemistry on aquatic plant diversity. The vegetation response to environmental conditions is not always linear [31].

Mesotrophic to slightly eutrophic lakes had the greatest diversity of macrophytes [32]. Freshwater macrophytes have an important ecological role in the aquatic ecosystem, assisting in the management and stabilisation of trophic status and mineral cycling [33],[34]. They act as bioindicators for the severity of the injury. The result of this study reveals that enriching shallow water with high bottom sediments creates anoptimal environment for luxuriant macrophyte growth. The same result has been recently reported on this as well [27].

Environmental conditions such as topography, season and rainfall are likely to create various ecological niches, resulting in a great diversity of aquatic plants [28]. The current study's finding sindicate that shallow water loaded with high bottom sediments provides an optimum home for luxuriant macrophyte growth which has been confirmed previously [35].

Monocots outnumbered dicots in terms of species, genus and family in current study. A number of studies have already highlighted monocots dominance over dicots in aquatic systems [36],[37]. Monocot dominance in an aquatic habitat is owing to owes to a high degree polyploidisation, which increases seed size, the ability to reproduce vegetatively and herbivore tolerance[38]. With eutrophication, emergent growth becomes extremely dense [39] and as lake alkalinity rises, floating leaf species are replaced by emergent macrophytes [40]. The pond under investigation is a shallow freshwater basin that provides ideal conditions for the establishment of emergent plant [41].

IV.CONCLUSION

The relevance of flora and fauna is unknown to those who live around the pond. In order to safeguard the native biota, maintain the quality of water and disqualify the efforts of alien species to infiltrate a qualitative and quantitative floristic survey, continual monitoring and protection of lentic and lotic ecosystems are urgently needed.

REFERENCE

[1] Paresh Lacoul and Bill Freedman. (2006)Environmental influences on aquatic plants in freshwater ecosystems. Environmental Reviews https://doi.org/ 10.1139 /a06-001

[2] Chambers, P., Lacoul, P., Murphy K.J. and Thomas,S.M.(2008)Global diversity of aquatic macrophytes in freshwater.Hydrobiologia 595, 9 – 26

[3] Horst Trempand Alexander Kohler. (1995) The usefulness of macrophyte monitoring-systems, exemplified on eutrophication and acidification of running waters, Acta Botanica Gallica, 142:6, 541-550, DOI: 10.1080/12538078.1995.105 15277

[4] Agostinho, A.A., Pelicice, F.M., Petry, A.C., Gomes, L.C.andJulioJr, H.F. (2007).Fish diversity in the upper Parana River basin:habitats, fisheries, management and conservation. Aquatic Ecosystem Health & Management;10(2):174-186.

[5] Roelofs, J.G.M. (1983). Impact of acidification and eutrophication on macrophyte communities in soft waters in Netherlands I. Field Observations. Aquatic Botany 17, 139-155.

[6] Lehman, A. and Lachavanne, J.B. (1999). Changes in water quality of Lake Geneva indicated bymacrophytes. Freshwater Biology 42, 457-466.

[7] MoEF (Ministry of Environment and Forests, Government of India) 2008. National Biodiversity Action Plan, Accessed on April 09,2020.http://nbaindia.org/uploaded/Biodiversityindia/NBAP:pdf.

[8] Arya, M. Mishra, A and Bhat,M.H.(2018): Macrophyte diversity & tropic status of Sakhya Sagar lake, Shivpuri, Madhya Pradesh, India. Animal and plant sciences, pp. 2398-2402

[9] Chambhare, P.A.,Lacoul, E.P. and Murphy,E .(2008). Global university of aquatic macrophytes in freshwater. Hydrobiologia 2008; 595; 9-26.

[10] Chudamani, B. and Siddhi,B.K.(2004). Quantitative analysis of macrophytes of Beeshazar Tal, Chitwan, Nepal. Himalayan J. Sci;2(3); 37-41.

[11] Deka Upen and Sarma Sarada Kanta (2014) Present status of aquatic macrophytes of the wetland of Nalbari district of Assam, India. Asian Jounral of Plant Science and Research, 2014, 4(3): 67-75.

[12] Parveen,,M., Chatterjee, N.C. and Tah,,J. (2014). Study of macrophyte diversity with reference to their phyto Sociological study in Chupisar, West

Bengal. International Journal of Pure & Applied Bioscience. Pp131- 136

[13] Shashikumar and Chelak Prasad (2015). Survey of macrophytes diversity in different ponds of Ongargarh city of Chhattisgarh. Journal of Environmental Science, Toxiocology and Food Technology. Vol.I, pp 57-59

[14] Murkute and Chavan (2016). Macrophyte diversity of three freshwater ponds at Bramhapuri dist. Chandrapur (M.S.), India. Int. Journal of Research in Biosciences, Agriculture and Technology, pp 108-111.

[15] Sharma, R.C. and Singh,S.(2017): Macrophytes of sacred Himalayan lake Dodi Tal, India: quantitative and diversity analysis. Biodiversity Int. J. 2017;1(4);137-144.

[16] Shende, M.B., Deshmukh, U.B., Mithun Shende and Butle, A.J. (2016). Aquatic macrophyte diversity of mul lake from Mul taluka of Chandrapur district Maharashtra(India). International Journal of Research in Bioscience Agriculture and Technology pg140-145.

[17] Maitreya Bharat, B., (2015). Aquatic angiosperms of BorTalav (Gaurishankar lake) area of Bhavnagar city, Gujarat, India. International Journal of Scientific Research. Vol 4 (6): 680- 682

[18] Chunne S.C and Nasare P.N. (2018). Macrophyte Biodiversity assessment of Nandgaon and Arwat lakes of Chandrapur District, Maharashtra, India. International Journal of Scientific Research in Science and Technology:271- 273

[19] Sharma, P. and Dwivedi, H.S. (2016).Diversity of aquatic macrophyte of Govardhan sagar water body at Ujjain (M.P.) India. International Journal of Advanced Research in Biological Science. ;3(8):89-93

[20] Wahane, M.S., Deshmukh, V.B. &Gedam, Y.B.(2017): Study of aquatic macrophyte diversity of Skhavahi reservoir of Sakharwahi village, Chandrapur district, Maharashtra, India. IJRBT, Vol. 5. Pp. 467- 471.

[21] Mahajan, V.S. and Harney, N.V. (2018): Macrophytes Diversity of Mohabala lake of Bhadrawati, District Chandrapur (M.S.) India. Ayushi Intern. Interdisciplinary Research Journal, no. 26 pp. 35-37.

[22] Tenna Riis, Jennifer L., Tank, Alexander, J., Reisinger, Antoine Aubenau, Kevin, R., Roche, Peter, S., Levi, Annette Baattrup-Pedersen, Anette B.,Alnoee and Diogo Bolster. (2019). Riverine macrophytes control seasonal nutrient uptake via both physical and biological pathways. Freshwater Biology. 2019;00:1–15. vileyonlinelibrary. com/journal/ fwb, 2019 John Wiley & Sons Ltd.

[23] Ester Vieira Noleto, Marcus Vinícius Moreira Barbosa and Fernando Mayer Pelicice, (2019). Distribution of aquatic macrophytes along depth gradients in Lajeado Reservoir, Tocantins River, Brazil. Acta LimnologicaBrasiliensia Print version ISSN 0102-6712 On-line version ISSN 2179-975X

[24] Szymon Jusik and RyszardStaniszewski (2019). Shading of River Channels as an Important Factor Reducing Macrophyte Biodiversity. Pol. J. Environ. Stud. Vol. 28, No. 3 (2019), 1215-1222

[25] HanifeOzbay, Ahmet Emre YaprakandNesibeTuran (2019).Assessing water quality in the Ceyhan River basin (Turkey) with the use of aquatic macrophytes. Journal Chemistry and Ecology Volume 35, 2019 - Issue 10

[26] Rameshkumar, S., Radhakrishnan, K., and Aanand, S.(2019). Influence of physicochemical water quality on aquatic macrophyte diversity in seasonal wetlands. Appl Water Sci 9, 12 (2019) doi:10.1007/s13201-018-0888-2

[27] Patel Karuna and Dubey Sanjeev. (2019). Diversity and distribution of macrophytes in Govindgarh Lake of Rewa district (M.P.). International Journal of Advanced Science and Research ISSN: 2455-4227, www.allsciencejournal. com, Volume 4; Issue 2; March 2019; Page No. 20-22

[28] Prasad Nami and Das Tapati (2018). Diversity and distribution of aquatic macrophytes with special reference to invasive species in Barak Valley, Assam, Northeast India. NeBIO An international journal of environment and biodiversity Vol. 9, No. 1, March 2018, 102-108 ISSN 2278-2281

[29] Bhute,K.B. and Harney,N.V. (2017) Macrophytes biodiversity of Nagrala lake of Bhadrawati, district Chandrapur (M.S.), India.

Int. Res. J. of Science & Engineering, 2017; Vol. 6 (1): 17-19 http://www.irjse. in ISSN: 2322-0015

[30] Narayana, J and Somashekar, R.K. (2002). Macrophytes diversity in relation to water quality – Investigation on river Cauvery. In: Ecology and conservation of lakes, reservoirs and rivers. ABD Publishers, Jaipur

[31] Nicolas, S., Weber,S. and Shaw, B. (2000). A proposed aquatic plant community biotic index for Wisconsin lakes. Environ. Management. 26: 491-502.

[32] Murphy, K. J. (2002). Plant communities and plant diversity in soft waters lakes of Northern Europe. Aquatic Botany. 73: 287-324.

[33] Melzer, A. (1981).Veranderungen der Macrophyten Vegetation der starnberger Sees and ihredikatarischeBedeutung. Limnologica. 13: 449¬458.

[34] Wielgleb, G. (1984). A study of habitat conditions of the macrophytic vegetation in selected river systems in Western Lower Sexony (Federal Republic of Germany)., Aquatic Botany. 18 :313-352

[35] Rulik,M., Opatrilova, L., Jurajda, P., Spacek, J. andGrulich, V., (2020). Rivers in the Czech Republic: In: Zelenakova M., Fialov J. NegmA (eds), Assessment and protection of Czech Republic, Springer water, Springer Cham online ISBN 978-3-030-18363-9

[36] Anand, V. K. and Sharma, S. (1993). Occurrence, distribution and composition of aquatic and marshy plants of Jammu province. Environ. and Ecol., 11 (1): 109-114.

[37] Muenscher, W. L. (1994). Aquatic plants of the United States. Comstock Publ. Corp., New York.

[38] Kautsky, L. (1989). Seed and tuber banks of aquatic macrophytes in the Asko area, Northern Baltic proper. Holaract, Ecol., 13: 143-148

[39] Moss, B. (1979). Algal and other fossils evidence for major changes in Stumps haw Broad, Norfolk England in the last two centuries. Br. Phycol. J. 14: 253-283.

[40] Makela, S., Haitu, E. and Arvola, L. (2004). Spatial patterns in aquatic vegetation composition and environmental covariates along chains of lakes in Kokemaenjoki watershed (S.Finland). Aquatic Botany, 80: 253-269.

[41] Pandit, A. K., Mir, G. A. and Dilafroza Jan. (2010). Phytosociology of Macrophytes in MirgundWetland of Kashmir Himalaya. J. Himalayan Ecol. Sustin. Dev. 5: 150-156.