



## QUANTITATIVE ANALYSIS OF AQUATIC MACROPHYTES IN CERTAIN WETLANDS OF KACHCHH DISTRICT, GUJARAT

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### ABSTRACT

A study was conducted for the aquatic macrophytes and its ecological attributes of the Kachchh district of Gujarat. In Kachchh many natural and manmade seasonal wetlands are present which serve as important gateways for the migratory waterfowl. In the present study six wetlands viz. Godhatad dam, Luna dhandh, Chhari dhandh, Pragsar lake, Changadasar talav and Jakhau intertidal were studied for western Kachchh district during 2007- 2009. The number of quadrates sampled varied according to the extent of area under vegetation cover and the size of wetlands. A number of sample plots were collected then analyzed in a nested sampling quadrat. Fifty seven different species of Aquatic macrophytes were recorded from the studied wetlands, which have included one free floating, one rooted floating, six submerge and 47 emergent species. Significantly 11 aquatic macrophyte species have been found to occur throughout the year, while other species recorded in a gap of 5 to 6 months. *Cynodon dactylon*, *Cyperus sp.* and *Creesa cretica* showed wider distribution in Kachchh wetlands. Some ecological parameters such as Species richness, Dominance, Diversity and Evenness status have been discussed in this paper.

**Key words :** wetlands, Kachchh, aquatic macrophytes

### INTRODUCTION

Wetland is the area covered by shallow water. These shallow areas are transitional zones between land and water. Vegetation studies - specific to wetlands of Gujarat are limited. The importance of aquatic macrophytes to the functioning of fresh water ecosystems has been under scored during the last few decades [1, 2, 3] because they harbor high biodiversity and influence biomass production, nutrient cycling and community dynamics [4]. Aquatic plants are key components for the well functioning of wetland ecosystem for biological productivity and support diverse organisms and there by provide lots of goods and services for the dependent people.

The western most part of the Gujarat state is recognized as the gateway of migratory waterfowl that come into the sub-continent. In spite of being arid, Kachchh district covers maximum area under wetlands.

Based on the distribution, the wetlands of Kachchh can be divided into three major types; the central inland wetlands (man-made), coastal wetlands in the southern and western region and saline wetlands (Ranns and Banni) in the northern limit. These are highly dependent on the village tanks and storage reservoirs. Kachchh being an arid area, the vegetation there is already faced with extremes of climatic and edaphic condition and it is more important to know the existing aquatic plants. In the absence of information on wetland vegetation for Kachchh region, an attempt was made to understand the baseline status of vegetation in and around the six selected wetlands. All these selected wetlands cover major types of wetland distribution in Kachchh. Information on aquatic macrophytes in any waterbody is of immense importance to understand the wetland ecosystem.

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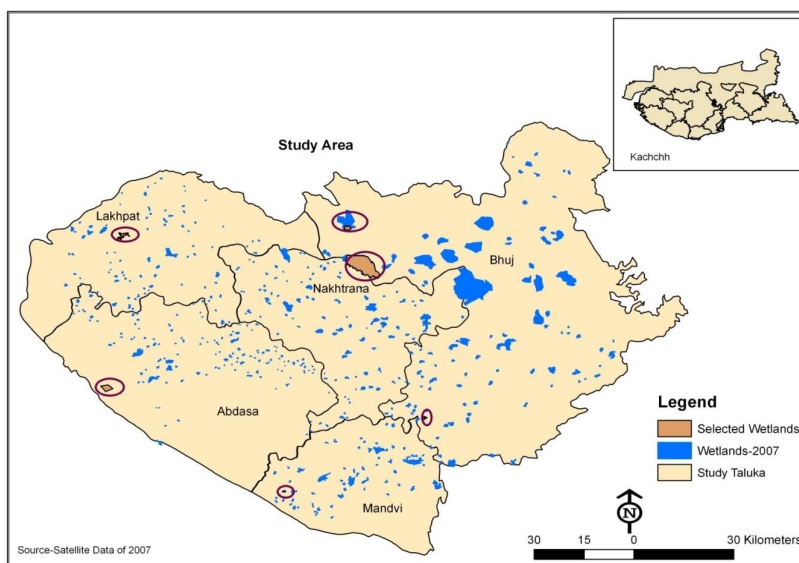


Fig. 1 Different wetlands of western Kachchh.

### Study area

Kachchh is the second largest district in the country, covering a total area of 45,652 km<sup>2</sup> and located in the north-western region of Gujarat state. Due to its unique ecological settings and geographical situation, Kachchh is classified under biotic province "3 A" (Kachchh desert) of bio-geographic zone of Indian Desert of the country [5] experiencing tropical arid climate. Most of the wetlands in arid and semi arid regions are man-made, and other natural wetlands are highly seasonal; however, they play vital role in the arid ecosystem. In some wetlands herbaceous vegetation and in certain cases, trees constitute essential grazing resources for stock farming. Since arid and semi-arid regions receive very low and erratic rainfall and experience frequent drought, livestock farming is the

predominant source of their economy. During drought period, most of the wetlands act as the natural fodder bank. This situation is true in Kachchh and especially in Banni.

Present intensive study of six wetlands Viz. Chhari Dhandh (CD), Luna Dhandh (LD), Changadasar Talav (CT), Godhatad Dam (GD), Pragsar Lake (PL) and Jakhau Intertidal (JI) (Fig. 1) was carried out in the western part of Kachchh district.

**MATERIALS AND METHODS**

Seasonal survey was done by quadrat method [6, 7] for collecting aquatic macrophytes from January 2007 to January 2009.

Plants were collected from the study area, during different seasons of the year i.e., in winter, summer and monsoon. Plant species were identified from the flora of Gujarat state [8]. The quadrat sampling method is the most popular method for ecological research and wetland delineation purposes.

The number of quadrates sampled varied according to the extent of area under vegetation cover and the size of wetlands. GPS readings were taken in each

quadrat. The number of quadrat studied were 15-20 in larger wetland, 12-15 in medium and 8-10 in small wetlands. In addition, number of sample plots also varied depending on the topography, terrain and accessibility conditions.

Status of vegetation was assessed using analysis. Species richness was obtained by enumerating the total number of species and diversity status of the aquatic macrophytes was studied using Shannon-Weiner Diversity Index and Evenness analysis was studied through statistical analysis [9, 10, 11] and "Past" software package [12].

**Shannon-Weiner Diversity Index** is calculated by using following formula.

$$\sum p_i (\log p_i) = H'$$

where  $p_i = \frac{\text{Total number of individuals of the species}}{\text{Total number of individuals of all the species}}$

**Species evenness** is calculated by using following formula.

$$J' = \frac{H'}{H'_{\max}}$$

Where  $H'$  is the number derived from the **Shannon diversity index** and  $H'_{\max}$  is the maximum value of  $H'$ , equal to:

$$H_{\max} = - \sum_{i=1}^S \frac{1}{S} \ln \frac{1}{S} = \ln S.$$

**Simpson's dominance index** is calculated by using following formula.

$$c = \sum_{i=1}^S \left( \frac{n_i}{N} \right)^2$$

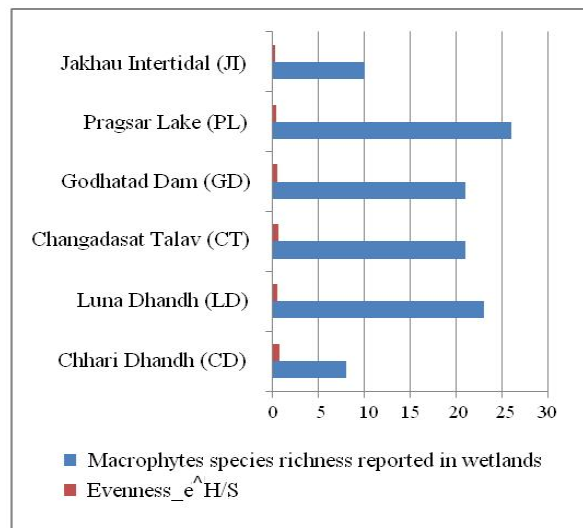
Where  $n_i$  = number of individuals in the species  
 N = total number of individuals  
 S = total number of species

**Table - 1** Detail of sample plots in and around wetlands.

| Name of Wetlands       | Area in Ha | Total no. of Plots/ Points |
|------------------------|------------|----------------------------|
| Chhari Dhandh (CD)     | 3670.53    | 70                         |
| Luna Dhandh (LD)       | 184.87     | 50                         |
| Changadasar Talav (CT) | 14.07      | 48                         |
| Godhatad Dam (GD)      | 217.51     | 65                         |
| Pragsar Lake (PL)      | 79.68      | 55                         |
| Jakhau intertidal (JI) | Open Coast | 60                         |
| <b>Total</b>           |            | <b>348</b>                 |

**Table - 2** Wetland wise statistical analysis of the aquatic macrophytes.

| Name of Wetland        | Macrophytes species richness reported in wetlands | Dominance_D | Shannon_H | Evenness_e^H/S |
|------------------------|---|-------------|-----------|----------------|
| Chhari Dhandh (CD)     | 8   | 0.20        | 1.69      | 0.67           |
| Luna Dhandh (LD)       | 23  | 0.13        | 2.39      | 0.47           |
| Changadasar Talav (CT) | 21  | 0.09        | 2.55      | 0.61           |
| Godhatad Dam (GD)      | 21  | 0.14        | 2.21      | 0.43           |
| Pragsar Lake (PL)      | 26  | 0.16        | 2.30      | 0.38           |
| Jakhau Intertidal (JI) | 10  | 0.53        | 1.01      | 0.27           |



**Fig. 2** Wetland wise bar chart for evenness.

**RESULTS AND DISCUSSION**

Totally 348 quadrates were laid in and around the wetlands to record the macrophyte species. Out of 348 transect sampled, highest 70 transects were laid in Chhari Dhandh (CD) followed by 65 in Godhatad Dam (GD) and 48 in Changadasar Talav (CT) (Table - 1).

During the present study, overall 57 macrophyte species were recorded from various wetlands. Out of which 7 submerged species belonged to 7 genera and 6 families, 47 emergent species belonged to 39 genera and 22 families and one species from each rooted floating and floating pteridophytes. All the 57 Aquatic macrophyte species composition and seasonal distribution were prepared based on survey data. Out of that, only 11 species were found throughout the year.

Being mostly seasonal and dynamic, the wetland system of the Kachchh supports three major/dominant types of aquatic vegetation communities, namely 1) Submerged macrophytes such as *Hydrilla verticillata*, *Vallisneria spiralis* and *Eleocharis dulcis*, 2) Floating vegetation such as *Nymphaea sp.* observed only in two wetlands and 3) Emergent vegetation such as *Cyperus sp.* and *Cynodon dactylon*.

Aquatic macrophytes species richness was 26 in Pragsar Lake which is followed by 23 in Luna Dhandh. Changadasar Talav and Godhatad Dam showed species richness 21. The lowest species richness i.e. 8 was recorded in Chhari Dhandh. Changadasar Talav revealed highest value of Shannon-Weinner diversity index (Table - 2) which is followed by Luna Dhandh and Pragsar Lake where the diversity values were 2.39 and 2.30 respectively.

Godhatad Dam and Chhari Dhandh showed diversity index value was 2.21 and 1.69 respectively. Low diversity was recorded in Jakhau intertidal area, because of it's a coastal wetland and in fringes of coast lesser plantation. Higher species dominance was reported from Jakhau intertidal area (0.53) and lower from Changadasar Talav (0.09). Highest Evenness (0.67) was reported in Chhari Dhandh and lowest (0.27) in Jakhau Intertidal area (Table - 2).

In the present paper dominance is used to compare the same species in different wetland habitats.

Species diversity varies greatly through space and time in a given habitat and ecosystem [13]. In the present study diversity among the six wetlands the Changadasar Talav had 21 species with high diversity value of H<sup>2</sup>.55 and low dominance value 0.09 which indicates the many (6) species present with less than 20 individuals.

Due to the presence of high number of *Avicennia marina* dominance index was very high (0.53) with less evenness (0.20) in Jakhau intertidal wetland. Chhari Dhandh supported only 8 species where the diversity index was 1.69 but it has high evenness, *Cressa cretica* L. and *Cyperus exaltatus* Retz. var. *exaltatus* are the dominant species (Fig.2). Species evenness index from Luna Dhandh, Godhatad Dam and Pragsar Lake are almost similar, however, there were species representing and distributing with equal numbers.

## SUMMARY AND CONCLUSION

Out of 57 aquatic macrophytes observed in selected wetlands, 10 species were most common in study area occurred in 1 to 348 plots. *Ammannia baccifera*, *Cynodon dactylon*, *Cyperus rotundus*, *Phyla nodiflora* and *Vallisneria spiralis* were commonly observed as aquatic macrophytes in Kachchh wetlands. The outcome of the present study notes the association of rooted submerged species such as *Najas* sp. with water depth and its certain qualities. *Najas* sp. is found in association with deeper and clearer water. Emergent species grow as the periphery of the wetland gets dry. The *Typha* sp. was occurring at moderate or intermediate water depth. Submerged species like *Potamogeton* sp. were also commonly present where water depth is lower or shallow.

In the context of coastal wetlands, salt works, ports and jetty construction pose major threat to mangroves. Emergent vegetation can be useful for livestock, fishes, birds, reptiles, wild life and local people, shoreline vegetation is also important for smaller size class Crocodiles cover and food. For the inland water bodies, controlling and removing *Prosopis* would be an important task for wetland management.

This result shows that smallest wetlands in this study were habitat for infrequent species. Conserving only larger wetlands will not be sufficient to protect plant species richness.

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