

CHAPTER 1

INTRODUCTION

1.1 Background

Wetlands are specialized ecosystems which perform important ecological functions and have many ecological, socio-economic and cultural values. Wetlands have been extensively used and abused; they have been appreciated for their serene beauty and treated with contempt for harbouring disease causing organisms and their vectors. Ecologically speaking, Wetland of particular importance also needs to be protected not only for direct benefits to mankind but also for other life on earth. Wetlands sustain varied and distinct micro habitats. They are considered to be a vital part of hydrological cycle and are highly productive systems in their natural forms. Wetlands not only support large biological diversity but also provide a wide array of ecosystem goods and services (Wetlands Rules, 2017) such as water purification, water flow regulation, fisheries, habitats for plants, animals and micro-organisms, recreation and tourism opportunities etc. Inland wetlands recharge and replenish groundwater. They provide multiple services like irrigation, domestic water supply, as well as flood control, carbon sequestration and pollution abatement.

However, in general, management of wetlands has received inadequate attention. Therefore, many of the wetlands in urban and rural areas are subject to anthropogenic pressures like land use changes in the catchment area, pollution from industries and households, encroachments, tourism and over exploitation of their resources. The exact role a wetland can play depends on several site specific

features, including the type and location. Wetland water is influenced by activities upstream and the use of water in a wetland has an impact on the water quality and quantity downstream (Wetlands and People: International Water Management Institute, 2014). One of the main impacts is disruption to wetland hydrology. For example, intense drawing out of water for agricultural use will affect the amount of water flowing out of a wetland and also that remains in the wetland itself. Also, human activities within the wetland as well as in the catchment area can alter the natural processes threatening the wetland's sustained existence. Many wetlands are drained so as to use the land for growing crops. Pesticides, Fertilizers and other agrochemicals can pollute the water in a wetland. Agricultural practices may also increase surface runoff and soil erosion, thereby increasing the amount of sediment entering a wetland. This affects the foraging habits and feeding efficiency of shoreline birds especially which require shallow (1–10 cm deep) water for feeding and ultimately leading to decline in their populations (Wetlands and People: International Water Management Institute, 2014). Thus, the abundance and distribution of wildlife in a habitat depends on distribution and extent of water-bodies. Ministry of Environment, Forest and Climate Change, Wildlife Division has recently came out with India's National Action Plan for Conservation of Migratory Birds and their Habitats along Central Asian Fly way (2018-2023) and one of the important aspect underlined in this CAF National Flyway Action Plan 2018 is the importance of allocation of sufficient water of adequate quality at right time and in right pattern in wetlands for ecological health

and functioning (MoEF & CC 2018). Hence, it is necessary to periodically monitor the ecological health of wetlands especially the water quality.

1.2 Glimpse of Significant Activities in and around Thol Wetland

Thol Wildlife Sanctuary, having a wetland with a potential of internationally importance and among the eight national wetland sites has been identified and declared for conservation. This wetland is also found to be facing human disturbances like Oil drilling by ONGC, live stock grazing, wood extraction, agriculture in nearby areas and withdrawal of water for irrigation (**Plates 1.1 A to J**). During field visits carried out all through the study period, following types of anthropogenic pressures were observed.

Cattle wading and Cattle grazing: The livestock like buffalo, sheep and goats were finding their way from the open side (catchment area) into the sanctuary area and were grazing on the dry region especially on the mid to Northern area of the TWS wetland. Cattle wading were observed mainly in the stagnant water (almost 3 feet deep) towards South - East corner of TWS wetland.

Cloth Washing: Cloth washing activity (very small scale) was going on towards the North West side and South - East side of TWS wetland on few of the occasions.

ONGC oil wells: ONGC wells are not only scattered throughout the catchment area but also located in the Sanctuary itself especially towards the southeast and northern areas of the Sanctuary. There are total 21 numbers of oil wells out of which 13 are functional, polymer injection wells are 3 in number and chase water wells are 5 in numbers. The total oil production from Thol ONGC wells is about

105 tpd. Although no major oil spill or its consequent effects have been reported at Thol sanctuary, ditches filled with oil and soil stained with oil were observed during the study at more than one wells (**Plates 1.1 F**). The wells within the Wetland are elevated at a height of few meters; however during heavy rains or in worst case scenario, the oils from the said ditches might reach the Thol wetland waters and impair the aquatic life and the agricultural ecosystem as well (Sasikumar K., 2014).

Tourists visits: Tourists visits from nearby villages as well as from distant places like Ahmedabad. The number of tourist visit and revenue generation at Thol Wetland is as per **Table no. 1.1**. Tourists were seen roaming on ‘bundhs’ and on inner periphery of West–South side of the wetland and also playing games at some spots. According to a survey, 84% tourists came for picnic/recreation, 14% came for bird watching and only 2% came for photography/filming (Sasikumar K., 2014). This pattern undermines the real significance of Thol Wildlife Sanctuary among the tourists, especially as an important Bird destination site.

Table 1.1: Tourist Visit and Revenue Generation at Thol Wildlife Sanctuary

Sr. No.	Year	Number of Tourists Visited	Total Revenue (Rs. in Lacs)
1	2008-09	24162	6.92
2	2009-10	30188	11.03
3	2010-11	34167	13.02
4	2011-12	81035	19.07
5	2012-13	64941	29.53
6	2013-14	59012	30.80
7	2014-15	100001	38.74
8	2015-16	139463	71.63
9	2016-17	133621	74.53

(Source: Office of the DCF, Wildlife Division, Sanand)

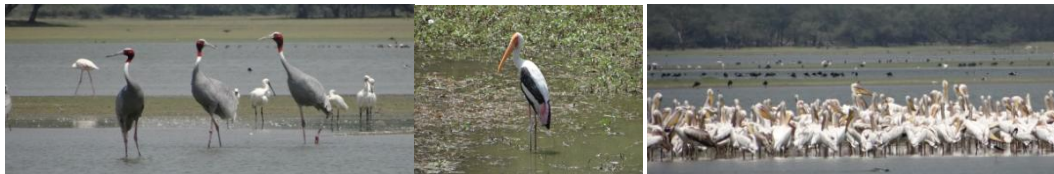
Plastic trash: The area is declared Plastic Free Zone by the Forest Department. Even though, some tourists were found littering on few spots by leaving their rubbish Plastic trashes like wrappers, fast food packages, bottles etc. However it was also noted that these plastic trashes were also being picked up by the daily wagers deployed by the Forest Department (**Plate 1.1 A to J**).

Industries: Industries are mainly located on downstream and upstream of TBS periphery. Most of these industries are small or medium scale industries comprising of mainly Chemical, Plastic, Ceramics and Paper and Packaging sectors.

Agriculture run off: There is a possibility of the pesticides and fertilisers used in the catchment area to find their way into the Thol wetland in the form of agriculture runoff. Leaching of fertilisers containing nitrogen and phosphorus contribute to the nitrates and phosphates could cause eutrophication in the wetland.



A. Tourists / Visitors Engrossed in Activities like Educational, Cycling, Bird Watching, Wildlife Photography, Camping, Playing, Recreation etc. at Thol Wetland



B. Common Crane, Painted Stork and White Rosy Pelican



C. Picking up of Plastic Wastes, Collection cum Burning Bin for Plastic Wastes



D. Washing Clothes inside the Wetland and Application of Fertilizers in surrounding Fields



E. Construction of Shallow Pools and Islands on Dry and Exposed Inner Part of Thol Wetland



F. ONGC Wells in TWS, Model Showing Locations of ONGC Wells with in Thol Wetland



G. Cattle Grazing in and around Thol Wetland and Cattle Wading in Thol Wetland



H. Water Lifting by Farmers and Water Release for Irrigation from Thol Wetland



I. Industry Beyond the Western Periphery of Thol Wetland



J. Hoardings / Banners / Signboards / Information Displayed at Strategic Locations by Forest Department

Plate 1.1 (A to J): Various Activities / Anthropogenic Pressures in and Around Thol Wetland

Keeping all above in mind, the study began with the preliminary survey of Thol wetland and a review on that, we found out there is a still a space and necessity for an organised study of various components for Thol Wetland. Especially, there is a deficiency on the study of 'Organic Load' reflecting parameters like BOD, COD, TOC, nutrient parameters & trace metals with a substantial sampling frequency and study duration. Thol Sanctuary is providing significant ecosystem services in terms of ground water recharge, erosion control, recreational values, educational value and aesthetic values. A part from the Wild Life propagation, the other clear-cut designated best use of the Thol wetland water is irrigation and WQI being a well accepted tool for water quality management; need was also felt for determination of WQI from irrigation point of view. Moreover, the concept of 'Biomonitoring of Thol wetland' encompassing integrated water quality evaluation using Benthic Macroinvertebrates and measurement of Aquatic Primary Productivity was also found needed. This is for the reason that these parameters can reflect the dynamic or static nature of the wetland. Furthermore, during water quality evaluation the Physico-chemical measurements provide a 'snapshot', i.e. they can provide valuable insight into the characteristics of a specific sampling site, but Biological Parameters (Biomonitoring and Photosynthesis-Respiration Ratio) being summary parameters their measurement is like making a 'video tape' (Prof. David M. Rosenberg). Therefore, an integrated approach was thought of whereby an attempt is made to study the Thol Wetland through important Ecological Characters like Components (Physical, Chemical and Biological parameters of water quality) as well as Process (Primary

Production and Photosynthesis Respiration Ratio) in context with Ecosystem Services (Wildlife propagation and Irrigation). Considering all these, the present work was planned with following Aim and Objectives.

1.3 Aim and Objectives

The aim is to know Thol Bird Sanctuary in terms of ecological characters like Water, Sediment, Primary Production and Benthic Macro invertebrate composition.

To achieve the Aim, following **objectives** were set forth.

1. To study seasonal variations of important Physico-chemical parameters.
2. To develop water quality index based on Physico-chemical parameters.
3. To study seasonal variations and composition, Saprobic Score and Diversity Score for Benthic Macro invertebrates and estimate the integrated water quality.
4. To study Primary Productivity of Thol Wetland Water.
5. To study the sediment quality in terms of Physico-chemical characteristics.

The study thus provided an opportunity to have an insight in knowing the status of benthic diversity apart from the water and sediment quality. This would be of use for conservation and management of the Thol wetland ecology in an integrated manner. The study will also help create awareness with regard to characterization of the wetland from Benthic Macro invertebrate diversity angle. With this study, wetland science in general will be supported in this region.



Review of Preliminary Visit Report by Dr. P. C. Mankodi, Research Supervisor and Finalizing the Sampling Locations



Sampling Location 1



N 23° 07' 53.9" E 72° 24' 46.7"



Sampling Location 2



N 23° 08' 01.8" E 72° 24' 01.3"



Sampling Location 3



N 23° 08' 26.0" E 72° 23' 35.0"

Plate 1.2 (A to H): Review of Preliminary Survey of Thol wetland and Deciding Sampling Locations

1.4 Flow of Thesis

The present Thesis is representing the work carried out with above specified Aim and Objectives set for the Thol Wetland. The document is presented in a systematic chapter format. It begins with the general introduction to the topic, and comprehensive review of literature followed by the methodology adopted for data acquisition, statistical applications, analytical results derived from the observations in the form of tables, figures, graphs, photographs etc., the discussions on the findings and finally encompass a summary to ensure inclusive coverage of all the aspects. The literature reviewed is recognized as bibliography.