if the site is possessing one of the species endemic to the area. 3. Biome-Research Assemblages. 4. Congregation of Birds. The Important Bird Areas (IBA) programme is about identifying and protecting areas that are home to a diversity and density of species, both floral and faunal. This makes best use of scarce resources available for conservation (Zafar-ul Islam, 2000). As major criteria for the declaration of an IBA include the Avifaunal attributes, it becomes very important for conservation of habitats like wetlands that support congregations of waterfowls. The present study is planned to gather the information necessary for identifying such areas for conservation, management and sustainable use.

Human beings are dependent on the wetlands and the local communities cannot be totally separated from the wetlands it is necessary to involve them for the conservation. The information gathered from this study is expected to be useful for the management and development of wetlands because of which local communities may be benefited. In the present study an attempt has been made to classify and categorize four wetlands in Vadodara district, Gujarat, India either as Important Bird Area, Nationally Important Wetland, Community Reservoir or as Recreation Site. This type of categorization would help the conservation of the wetlands, so as to maintain the balance of the ecosystem.

Wetlands of Vadodara:

The central Gujarat mainly includes three districts Dahod, Panchamahal and Vadodara. They fall in the semi arid zone of India (Fig.1) with monsoon type of climate. The rainfall received in this region is irregular. There are several small

and large wetlands in the area of which seventeen are regularly visited for the Asian Mid Winter Waterfowl Census, since 1995. Vadodara being in the Central Gujarat also falls in the migratory route and hence is known to support good migratory as well as residential bird population (Padate *et al.*, 2001). On the basis of this four water bodies in Vadodara district were selected for the present study.

STUDY AREA

According to Rodger and Panwar's (1990) biogeographic classification of India the part of Gujarat where study sites are located falls in the semi arid region (Fig.1). The four wetlands selected for study are located within 50 kms. radius around Vadodara and are located in the Central Gujarat (Fig. 2). Vadodara district lies between 21^0- 23^0 North latitude and 73^0- 74^0 10| East longitude. The climate in the area is characterized as tropical monsoon. The rainfall received in the area is comparatively low and irregular. The area mainly receives rains during South-West monsoon of Indian subcontinent from mid June to mid September. The irregularity of the rainfall some times results into shortage of water in turn resulting in the failure of the crop. To over come this problem several waterbodies are developed in this area, mainly as the water reservoir for human needs. However, being the water reservoirs, these water bodies support varied aquatic biota and many of them have now become important as they support good diversity of water fowls. Vadodara is rich with such water bodies with shallow waters that could be considered as wetland. These waterbodies/ wetlands are of various sizes as well as under various anthropogenic pressures. Many of these wetlands are part of irrigation reservoir or village ponds. Out of seventeen wetlands, that are regularly surveyed during Mid Winter Waterfowl Census of migratory as well as resident species of birds (Padate *et al.*, 2001), four wetlands selected are located in and around Vadodara city. Out of these four wetlands two

Figure 2

The Location of study area.

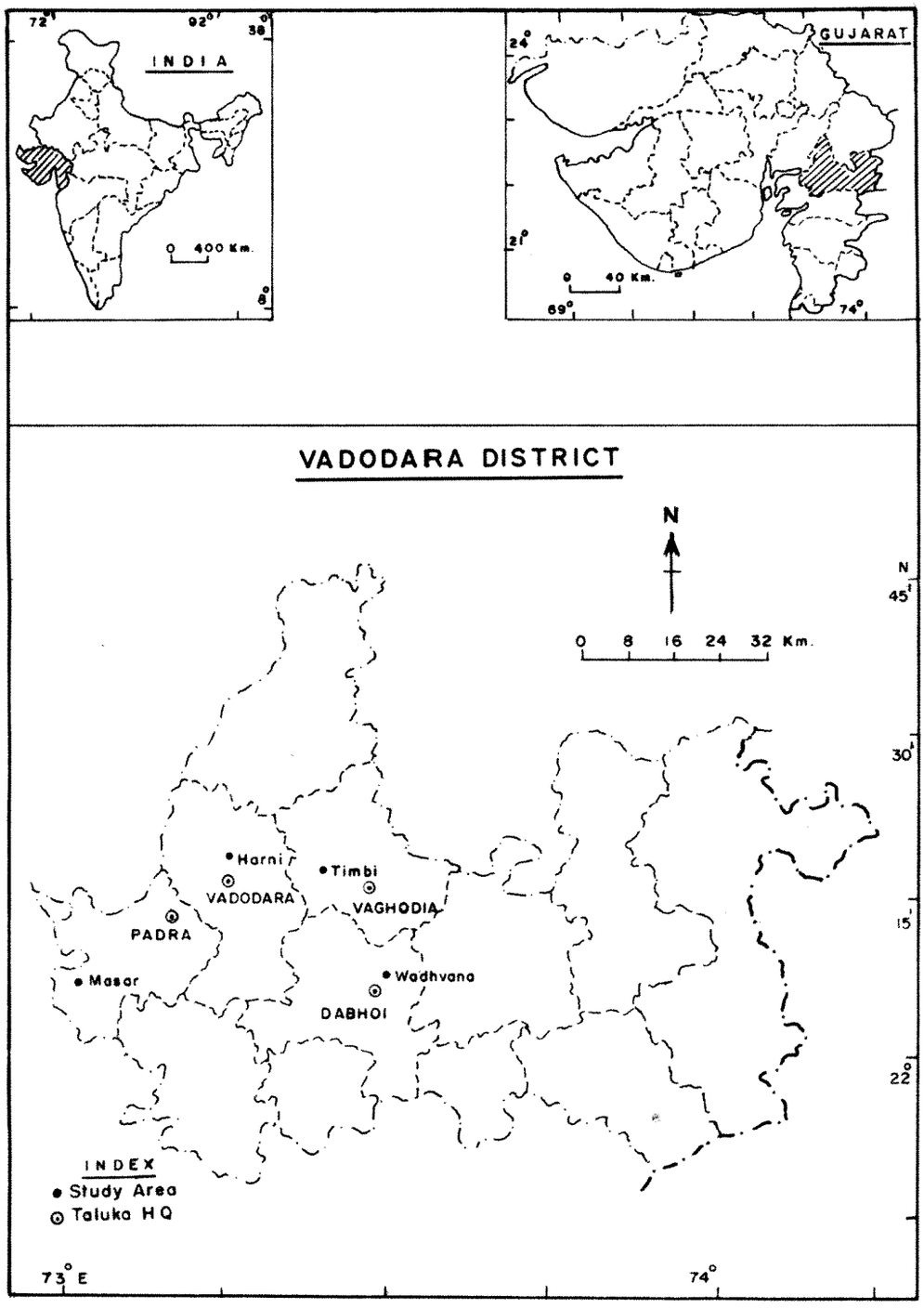


Plate: I

A: Google image of WIR (At:10.05 kms. Altitude)

B: Google image of TIR (At:1.29 kms. Altitude)

Plate: II.

A: Google image of MVP(At:1.47 kms. Altitude).

B: Google image of HVP(At:1.12kms. Altitude).

Plate III

A: Summer water level at WIR before Narmada inundation started.

B: Summer water level at WIR after Narmada inundation.

Plate IV

A: High Water level at WIR during Monsoon.

B: Flooded fields and irrigation canal during monsoon at WIR.

Plate V

A: Winter aggregation of Birds before inundation with Narmada Water at WIR.

Plate B: Winter aggregation of Birds after inundation with Narmada Water at WIR.

Plate VI

A: Resident ducks aggregation at WIR

B: Bird aggregation in winter at WIR

Plate VII

A: Shallow waters at TIR during summer.

B: High water level during Monsoon at TIR.

Plate VIII

A: Flushed out earthen dam during monsoon at TIR.

B: Exposed dam site in shallow waters of TIR during winter.

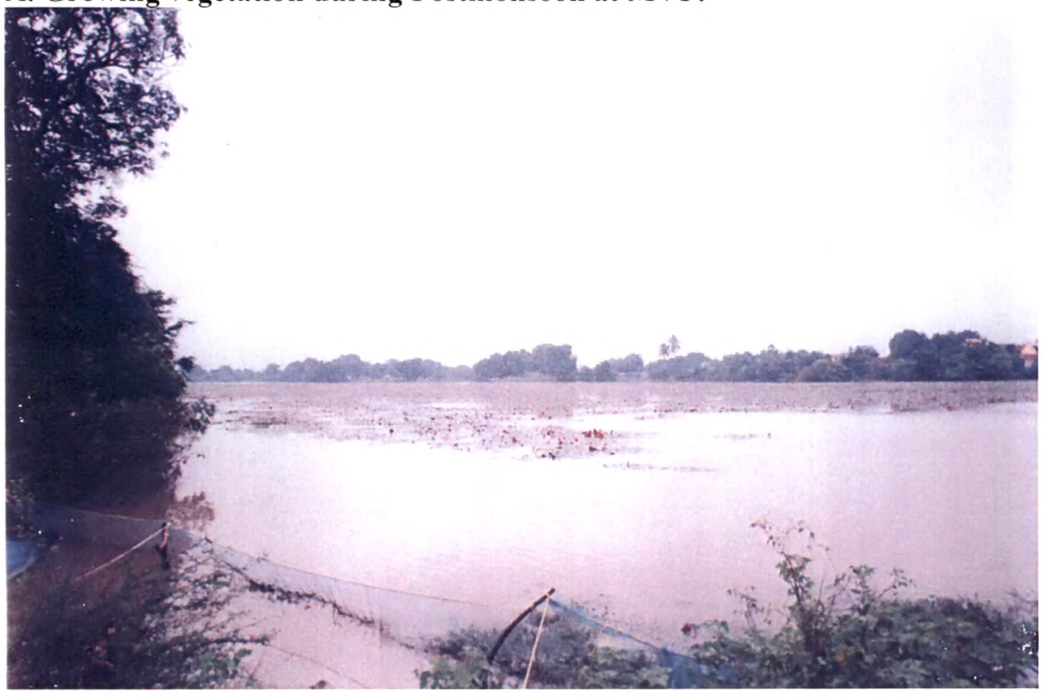
Plate IX

A: Shallow water during summer at MVP.

B: High water level and flood conditions during monsoon at MVP.

Plate X

A. Growing vegetation during Postmonsoon at MVP.



B: Water level during winter at MVP.

Plate XI

A: Shallow water during Summer at HVP.

B: High water level during monsoon at HVP.

are irrigation reservoirs and two are village ponds all being under various anthropogenic pressures. The location of these four wetlands is shown in Fig. 2. These wetlands are:

Wadhwana Irrigation Reservoir (WIR): (Plate I.A)

It is an irrigation reservoir, present 50 kms in the south- east direction of Vadodara (22° 10' N, 73° 30' E) (Fig. 2) This irrigation reservoir was constructed about 100 years ago in the year 1909-1910 by His Highness Shrimant Maharaja Sir Sayajirao Gaekwad III of erstwhile State of Baroda at the Wadhwana village, Taluka Dabhoi of Vadodara District, with a view to make the farmers independent of rain water dependency. The dam is mainly an earthen dam of 8.2 kms. and periphery of reservoir approximately of 11.2 kms. Water of Jojwa dam on Orsang river is brought to this reservoir. The full capacity of the reservoir is 5 billion cubic feet. It irrigates about 8815 hectare land of 25 villages surrounding the dam. On the basis of the waterfowls supported by this wetland it was declared as wetland of National Importance in 2005. Inlet and outlet canals are present with several sub canals distributing water throughout the agricultural area in the fields. In recent years, WIR has been receiving the water from the famous Sardar Sarovar on Narmada River. This has influenced the Anatidae (duck) distribution (Padate *et al.*, 2008). Because of Narmada inundation around the turn of Century, WIR has become a perennial water reservoir. Active voluntary community participation, in the form of a local organization named "PRAJIV" (Prakruti Jiv Sansthan Wadhwana) is notable at WIR. The voluntary participation of the members of this organization

plays an important role in the conservation of the biodiversity mainly waterfowls at WIR. To Create awareness regarding the biodiversity is one of the major aims of this organization.

The reservoir is given on lease for fish culture and hence the seedlings of fishes are added to the reservoir every year. The Fish harvesting is carried out every year during summer from March to May or some times extended till June. The species that are regularly harvested are Catla Catla (*Catla catla*), Rhou (*Labio rohita*), Mrigal (*Cirrhinus mrigala*) and Giant Prawns (*Macrobrachium rosenbergii*). The cattle grazing is moderate but as the reservoir is large, it does not influence the water significantly. However, no major source of pollution is observed at WIR.

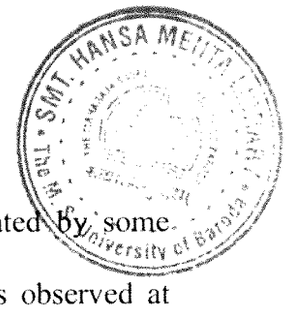
Timbi Irrigation Reservoir (TIR): (Plate I.B)

This is also an irrigation reservoir, present about 15 kms east of Vadodara city (22°18' N 73°16' E) (Fig. 2). This reservoir was also constructed by the grants given by His Highness Shrimant Maharaja Sir Sayajirao Gaekwad III of erstwhile State of Baroda at the village Shripor Timbi of Waghodia Taluka, District Vadodara during 1947-48. The reservoir spreads in 100.5 acres. The water from this reservoir is supplied to agricultural fields of eight villages surrounding Shripor Timbi village. It is an earthen dam which has a periphery of approximately 3 kms. Due to heavy rains in the monsoon of 2005, the part of earthen dam was washed away resulting in the loss of water from the reservoir and a flood condition at Shripor Timbi village (Plate VIII.A). This reservoir has also started receiving Narmada water in recent years has became perennial. TIR is also given on lease

for fishing and the major species that are harvested are Catla (*Catla catla*), Rhou (*Labio rohita*) and Mrigal (*Cirrhinus mrigala*). The drier areas of the reservoirs, are used for cattle grazing. No major source of pollution is observed at TIR however moderate domestic dependency in the form of washing clothes and taking bath is observed. As it is near to Vadodara city various institutes are developing in the area increasing anthropogenic movements.

Masar Village Pond (MVP): (Plate II.A)

In the semi arid zone of Gujarat, before the construction of the major reservoirs village ponds were constructed to overcome the water shortage. Thus every village in the area has a pond on its outskirts. One of such village pond is Masar village pond (22° 08' N, 72° 54' E) located at Masar village of Padra Talluka, or District Vadodara. It is about 45 kms. South- West of Vadodara city (Fig. 2) on Jambusar road. It spreads only in 4 acres. Mahi River estuary in Gulf of Khambhat is just about 15-18 kms. away from MVP. The village pond gets dried during summer and water is confined only in certain areas, forming few puddles. This village pond is also given on lease for fishing and the fishes are harvested every alternate year. The major species are same as those of WIR and TIR, Catla, Rhou and Mrigal. This water is also used for irrigation purpose. The water is taken out from the pond with the help of mechanized water pumps. Due to heavy rainfall during monsoon of both the years of study, there was overflowing of the water and as a result the edge of pond was washed off resulting in the loss of biota along with water. Masar village is present on the west side of pond whereas state highway



between Vadodara and Jambusar runs on the Eastern side separated by some agricultural fields and large trees. No major source of pollution is observed at MVP. The domestic dependency on the village pond water is observed for washing cloths and utensils and the wallowing of cattle. The cattle grazing is observed during summer when part of the pond dries off. The local community is aware of the importance of waterfowl and though not involved in active conservation of the species, they are not harming the birds inhabiting the village pond.

Harni Village Pond (HVP): (Plate II.B)

The Harni village pond is located in the North- East part of Vadodara city (22° 20' N, 72° 84' E) (Fig. 2). Initially it was out of the Vadodara city limits, but because of the expansion of the city limits, due to population growth it now falls within city limits. HVP is a typical rural wetland and undergoing urbanization very rapidly and hence is loosing its natural characteristics and also the area. The area of the pond which was 45 acres in 1950s (Pathak and Satakopan, 1957) had decreased to 20 acres in 1990s (Padate and Sapna, 1996) and now it spreads in approximately 2 acres only. Small industries, factories and residential societies are rapidly coming up around HVP, this is not only covering the pond area but is also increasing the pollution level. Runway of Vadodara airport is located on the South eastern side of the pond. The area is now having great commercial as well as the residential importance. Recently houses are constructed just about 5 feet away from the pond. Pollution in the form of domestic waste as well as sewage is

observed at HVP. Direct sewage outlets of this area pours sewage in the water at HVP (Plate XII). The pond is now thought to be of a nuisance by the locals and they are of a vote to drain the wetland and convert it to land. Though the pond is not given on lease for aquaculture occasional fishing by the locals is carried out at HVP. In 1990s more than 130 species of birds were listed in the area by Padate and Sapna (1996).