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BASELINE STATUS FOR FLORA AND FAUNA WITH AQUATIC BIODIVERSITY IN DAHEJ AREA, DISTRICT BHARUCH GUJARAT

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Abstract: Floristic and Faunistic pattern of the area was studied based on inquiries from the local population, personal observation and forest officials. The study area falls under Dahej, Bharuch District of Gujarat state. Western part of the study area is occupied by the mud flats and Saltpans. There is almost plain without much undulation, a fallow land; hence not mush vegetation cover, except scattered *Prosopis juliflora* shrubs and few trees of *Prosopis cineraria.* Total 41 species of trees belong to 20 families are enumerated from the study area. Shrubs encountered during the present survey are 27 shrub species belong to 18 families are enumerated from the study area. The dominant shrub community in this area was represented by *Prosopis Juliflora* (Gando baval), *Calotropis procera*, *C. gigantea* (Akado), *Ipomoea fistulosa* (Nasarmo), *Lawsonia inermis* (Mendhi), *Abutilon indicum* (Khapat) and *Lantana camara* (Ganthai). Painted stork *(Mycteria leucocephala)* was observed which is grouped under near threatened birds by IUCN. Among the birds in the study area, Pea fowl (*Pavo cristatus),* is included in schedule I of Wild life protection Act (1972), while many other birds are included in schedule IV. Among the reptiles, Indian Cobra (*Naja naja*), and Common rat snake (*Ptyas mucosus)* were provided protection as per Schedule-II of Wild life protection act, (1972). Among mammals, Common Mongoose (*Herpestes edwardsi*), Jackal (*Canis aureus* (Linnaeus)) and Jungle cat (*Felis Chaus)* are schedule–II animals. Nilgai (*Boselaphus tragocamelus*) is protected as Schedule-III animal and Hares and five stripped squirrels are included in schedule IV of Wild Life Protection act 1972.
Keywords: Biodiversity; Endangered; Environmental impact assessment; Industrial development; Wild life.

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INTRODUCTION

The biodiversity we see today is the fruit of billions of years of evolution, shaped by natural processes. The vast array of interactions among the various components of biodiversity makes the planet habitable for all species, including humans. There is a growing recognition that, biological diversity is a global asset of tremendous value to present and future generations. At the same time, the threat to species and ecosystems has never been as great as it is today. Species extinction caused by human activities continues at an alarming rate. Protecting biodiversity is in our self-interest. Ecological impact assessment (EcIA) is used to predict and evaluate the impacts of development activities on ecosystems and their components, thereby providing the information needed to ensure that ecological issues are given full and proper consideration in development planning. Environmental impact assessment (EIA) has emerged as a key to sustainable development by integrating social, economic and environmental issues in many countries. EcIA has a major part to play as a component of EIA but also has other potential

applications in environmental planning and management (Kumar, 2014). Ecological Impact Assessment provides a comprehensive review of the EcIA process and summarizes the ecological theories and tools that can be used to understand, explain and evaluate the ecological consequences of development proposals. At the 1992 Earth Summit in Rio de Janeiro, world leaders agreed on a comprehensive strategy for sustainable development to meet our needs while ensuring that we leave a healthy and viable world for future generations. One of the key agreements adopted at Rio de Janerio was the Convention on Biological Diversity. Article 14 of Convention on Biodiversity (Impact Assessment and Minimizing Adverse Impacts), stressed the need to Introduce appropriate procedures of environmental impact assessment for proposed projects that are likely to have significant adverse effects on biological diversity with a view to avoiding or minimizing such effects. Environmental impact assessments have become an integral part of development projects in India ever since 1994, to formulate policies and guidelines for environmentally sound economic development. Proper assessment of biological environment and compilation of its taxonomical data is essential for the impact prediction (Kumar, 2013; Kumar *et al.,* 2013; Kumar and Aggarwal, 2013a).

EXPERIMENTAL

The baseline study, for the evaluation of the floral and faunal biodiversity of the terrestrial environment of the study area which comprises of 20 villages in Bharuch District has been conducted during March, 2012. The primary objective of survey was to describe the floral and faunal communities within the study area. The sampling plots for floral inventory were selected randomly in the suitable habitats (Anderson, 1867; Jain and Rao, 1983). The methodology adopted for faunal survey involve random survey, opportunistic observations, diurnal bird observation, active search for reptiles, faunal habitat assessment, active search for scats and foot prints, animal call, and review of previous studies. The aim was to set baselines in order to monitor and identify trends after the commissioning of the project. Emphasis has been placed on presence of endemic species, threatened species if any present in the study area. Desktop literature review was conducted to indentify the representative spectrum of threatened species, population and ecological communities listed by IUCN, WCMC, ZSI, BSI and Indian wild Life Protection Act, 1972 (Bentham and Hooker, 1862-1883; Hunter, 1879; Dixit, 1984; Ghosh *et al.,* 2004; Lushington, 1915; Wilson and Reeder, 1993; BirdLife International, 2000; BirdLife International, 2004a, b; Wilson and Reeder, 2005; BirdLife International, 2010; Kumar and Srivastava, 2012; Kumar, 2013; Kumar *et al.,* 2013; Kumar and Aggarwal, 2013a,b). The status of individual species was assessed using the revised IUCN/SSC category system (WCMC, 1988; IUCN, 1994; WCMC, 2000; IUCN, 2001, 2003, 2008, 2010). The villages covered for baseline study are given in the table 1.

Table 1. List of Villages for baseline study

S.No.	Village Name
1.	Akhod
2.	Aliabet
3.	Ambheta
4.	Atali
5.	Dahej
6.	Galendra
7.	Jageshwar
8.	Janiadra
9.	Jolva
10.	Kadodra
11.	Kaladrara
12.	Koliad
13.	Padariya
14.	Paniadra
15.	Rahiad
16.	Sambheti
17.	Suva
18.	Vadala
19.	Vav
20.	Veghani

Methodology for Inland water sampling

The samples for qualitative and quantitative analysis of planktons were collected from the sub surface layer at knee depth. Water samples were filtered through plankton net of

20µ mesh size (APHA, 1971). The filtered samples were concentrated by using the centrifuge. By using Lackey's drops method and light microscope (Lackey, 1938) the quantitative analysis was carried out for phytoplankton and zooplankton. The standard flora and other literature were followed for the qualitative evaluation of Plankton (Welch, 1948; Vollenweider, 1969; Edmondson, 1974).

RESULTS AND DISCUSSION

Terrestrial Floral and Faunal Components of the Study Area

The area of for the present biological baseline study falls under 20 villages of Dahej area in Bharuch District of Gujarat state. Western part is occupied by the mud flats and saltpans. The study area belongs to Dahej GIDC and almost plain without much undulation, a fallow land; hence not mush vegetation cover, except scattered *Prosopis juliflora* shrubs and few trees of *Prosopis cineraria* as dominant vegetation.

Figure 1. Habitat of the Study area

This part of Bharuch district is practiced only monsoon depended agriculture. Few villages in the study area are engaged in cotton and Tuver cultivation. Villages are scattered in between the large patches of agriculture lands. The tree cover in the study area is scanty restricted only in the habituated areas of the village and few along the boundary of the agricultural fields and road sides. It was observed that most of the villages in the study area is with large village talabs used in rain water harvesting. The village pond of Jholva village is the largest among them. The study area is also characterized by many water logged regions occupied by hydrophytes. Majority of the area covred in the present investigation is allready converted for industrial development under, Dahej GIDC, Dahej, SEZ-I and SEZ-II, hence the natural habitatas have ben restricted to very small portion of the study area.The area converted to industrial developments include, Jholva, Dahej, Ambetta, Vaddala, and Lakhigam villgages.

Figure 2. Agriculture and non agriculture land of study area. The last image showing the creek along with mangroves around it.

Almost entire southern part of the study area is occupied by Narmada estuary, Right bank of the Narmada near Suva village is occupied by

the large patch of scrub land with sparse population of *Prosopis juliflora*. The mangrove patches were observed besides the Dahej jetty and adjoining creeks. The mangroves here were represented by *Avicennia alba* along the banks of the creek and the Salvadora persica towards landward side of the creeks. The tree species, herbs and shrubs and major crops, were documented during this base line study. The list of floral species documented in the study area is enlisted in table 2-6.

Floral Diversity of the Study Area

The objective this floral inventory of the study area, is to provide necessary information on floristic structure in the study area for formulating effective management and conservation measures. The climatic, edaphic and biotic variations with their complex interrelationship and composition of species, which are adapted to these variations, have resulted in different vegetation cover, characteristic of each region (Ohasi, 1975). The tree species, herbs, shrubs, climbers and major crops, were documented during this base line study (Jain, 1968; 1991). The list of floral species documented in the study area is enlisted in table 2-5. The tree species observed in the study area is enlisted in the table 2.The undergrowth during this summer season was almost in dry state. The shrubs observed in the study are documented in the Table 3. Herbs and climbers in the study area are represented in Table 4 and Table 5 respectively.

Trees: The dominant trees in the study area are *Prosopis cineraria (*Khijado*.)*, *Azadirachta indica* (Limbado), *Mangifera indica* (Keri), *Salvadora oleoides* and *Salvadora persica (*Piludo). Total 41 species of trees belong to 20 families are enumerated from the study area.

Table 2. Trees in the study area

S.No.	Family and Scientific name	Vernacular name
1	**Anacardiaceae**	
1/1	*Mangifera indica* L.	Kari
2	**Annonaceae**	
2/1	*Polylathia longifolia* (Conn.) Thw.	Asopalav
3	**Apocynaceae**	
3/1	*Plumeria rubra* L.	Champo
4	**Arecaceae**	
4/1	*Cocos nucifera* L.	Narial
5/2	*Phoenix sylvestris*	Kajuri
5	**Avicenniaceae**	
6/1	*Avicennia alba* Blume	patcheradi
6	**Caesalpiniaceae**	
7/1	*Delonix regia* (Boj.) Raf.	Gaulmor
8/2	*Delonix elata* (L.) Gamble.	Sandsro
9/3	*Cassia fistula* L.	Garmalo
10/4	*Cassia siamea* Lam.	Kasid
11/5	*Peltophorum pterocarpum* (DC.) Backer ex Heyne	Sonmukhi
12/6	*Tamarindus indicum* L.	Amali
7	**Caricaceae**	
13/1	*Carica papaya* L.	Papaya
8	**Casuarinaceae**	
14/1	*Casuarina equisetifolia* L.	Sharu
9	**Combretaceae**	
15/1	*Terminalia catappa* L.	Badam
10	**Malvaceae**	
16/1	*Thespesia populnea* (L.) Sol.ex Corr.	Paras piplo
11	**Meliaceae**	
17/1	*Azadirachta indica* A.Juss	Limbado
18/2	*Melia azadirachta* L.	Bakanlimdo
12	**Mimosaceae**	
19/1	*Acacia auriculiformis* L.	Austrianbaval
20/2	*Acacia leucophloea* (Roxb) Willd.	Hermobaval
21/3	*Acacia nilotica* (L.) Del.subsp.indica (Bth.) Brenan	Baval
22/4	*Acacia Senegal* (L.) Willd.	Goradiobaval
23/5	*Leucaena leucocephala* (Lam.) De	Pardesi Baval
24/6	*Albizia lebbeck* (L.) Bth.	Siris
25/7	*Albizia procera* (Roxb.) Bth.	Kalo siris
26/8	*Pithecellobium dulce* (Roxb.) Bth.	Gorasmli
27/9	*Prosopis cineraria (L.)*	Khijado
13	**Moraceae**	
28/1	*Ficus benghalensis* L.	Vad
29/2	*Ficus religiosa* L.	Piplo
14	**Moringaceae**	
31/1	*Moringa oleifera* Lam	Sargavo
15	**Myrtaceae**	
32/1	*Eucalyptus sp.*	Nilgari
33/2	*Syzygium cumini (L.)*	Jambu

	Skeels.	
16	**Papilionaceae**	
34/1	*Erythrina variegata* L.	Pagario
35/2	*Pongamia pinnata* (L.) Pierre	Karanj
17	**Sapotaceae**	
36/1	*Manilkara hexandra* (Roxb.) Dub.	Rayan
37/2	*Manilkara zapota* (L.)	Chikoo
18	**Salvadoraceae**	
38/1	*Salvadora persica* L.	Pilva, Piludi
39/2	*Salvadora oleoides L.*	Piludi
19	**Simaroubaceae**	
40/1	*Ailanthus excelsa* Roxb.	Aurdso
20	**Rhamnaceae**	
41/1	*Zizyphus glabrata* Heyne ex Roth.	Bor

Shrubs: Shrubs encountered during the present survey are given in the Table 3. Total 27 shrub species belong to 18 families are enumerated from the study area. The dominant shrub community in this area was represented by *Prosopis Juliflora* (Gando baval), *Calotropis procera*, *C. gigantea* (Akado), *Ipomoea fistulosa* (Nasarmo), *Lawsonia inermis* (Mendhi), *Abutilon indicum* (Khapat) and *Lantana camara* (Ganthai). The shrubs observed in the study area are given in the table 3.

Table 3. Lists of Shrubs in the Study Area

S.No.	Family and Scientific name	Vernacular name
1	**Apocynaceae**	
1/1	*Nerium indicum*	Lalkaren
2/2	*Thevetia peruviana* Merr.	Pili karan
2	**Asclepiadaceae**	
3/1	*Calotropis gigantea* (L.) R. Br	Akado
4/2	*Calotropis procera* (Ait.) R.Br	Akado
3	**Balanitaceae**	
5/1	*Balanites aegyptiaca* (L.) Del.	Ingorio
4	**Bignoniaceae**	
6/1	*Tecoma stans* (L.) H.B.and K.	Peilafol
5	**Caesalpiniaceae**	
7/1	*Cassia auriculata* L	
6	**Capparaceae**	
8/1	*Capparis decidua* (Forsk.) Edgew	Kerdo
7	**Compositae**	
9/1	*Xanthium strumarium* L.	Gokhru
8	**Convolvulaceae**	
10/1	*Ipomoea fistulosa* Mart.ex Choisy	Nasarmo
9	**Euphorbiaceae**	
11/1	*Euphorbia neriifolia L.*	Thor
12/2	*Jatropha curcas L.*	Ratanjot
13/3	*Jatropha gossypifolia L.*	Pardesidevalo
14/4	*Ricinus communis L.*	Devalo
10	Lythraceae	
15/1	*Lawsonia inermis* L.	Mendhi
11	Malvaceae	
16/1	*Abelomoschus manihot (L.) Medic.*	Jagali bhindi
17/2	*Abutilon indicum (L.) Sw.*	Khapat
18/3	*Gossypium herbaceum*	Kapas
12	**Musaceae**	
19/1	*Musa paradisiaca L.*	Kela
13	**Mimosaceae**	
20/1	*Prosopis juliflora* DC	Gando baval
14	**Nyctaginaceae**	
21/1	*Bougainvillea spectabilis* Willd.	Bougainvel
15	Papilionaceae	
22/1	*Sesbania sesban* (L.) Merr.	Shevari
16	**Rhamnaceae**	
23/1	*Zizyphus nummularia* (Burm.f.) W. and.	Chanibor
17	**Solanaceae**	
24/1	*Datura metel* L	Daturo
25/2	*Solanum incanum* L	Ubhi ringan
18	**Verbenaceae**	
26/1	*Clerodendrum inerme (L.) Gaertn.*	Madhi
27/2	*Lantana camara* L.var. *aculcata* (L.) Mold.	Ganthai

Herbs: The herbaceous cover observed in this region is given in the table 4. As the most of the undergrowth was dried up, except near water logged regions and along the periphery of the village ponds, the herbaceous layer document in the report may be incomplete for this region.

Table 4. List of herbaceous species observed in the area

S.No.	Family and Scientific name	Vernacular name
1	**Acanthaceae**	
1/1	*Hygrophila auriculata (Schum.)*	Kanta shelio
2	**Asteraceae**	
2/1	*Blumea sps.*	
3/2	*Eclipta prostrata* (L.) L.	Bhangro
4/3	*Echinops echinatus* Roxb	Shulio
5/4	*Tridax procumbens L*	Pardesi

		bhangro
3	**Boraginaceae**	
6/1	*Trichodesma indicum l.*	Undha fuli
4	**Chenopodiaceae**	
7/1	*Suaeda nudiflora (*willd) Moq.	Moras
8/2	*S. fruticosa L.*	
5	**Cyperaceae**	
9/1	*Cyperus bulbosus* Vahl.	
10/2	*Cyperus difformis* L.	
11/3	*Cyperus stoloniferus* Retz.	
12/4	*Cyperus rotundus* L.	
6	**Lamiaceae (Labiatae)**	
13/1	*Ocimum basilicum* L.	Damaro
14/2	*Ocimum sanctum* L.	Tuli
7	**Liliaceae**	-
15/1	*Aloe barbadensis* Mill.	Kunvarpato
8	**Nymphaeaceae**	
16/1	*Nymphaea pubescens* Willd	Kamal
17/2	*Nymphaea stellata*	
9	**Nyctaginaceae**	
18/1	*Boerhavia diffusa* L.	
19/2	*Boerhavia chinensis* Druce	
10	**Papaveraceae**	
20/1	*Argemone mexicana* L.	Darudi
11	**Papilionaceae**	-
21/1	Cortalaria medicaginea Lam	Ran methi
22/2	*Indigofera oblongifolia* Forks.	
12	**Poaceae (Gramineae)**	
23/1	*Phragmites karaka* Steud	-
24/2	*Aleuropus lagopoides* Trin	-
25/3	*Cynodon dactylon* Pers.	-
26/4	*Sorghum bicolar L.*	Jowar
27/6	*Pennisetum typhoides (Burm.)*	Bajri
13	**Poligonaceae**	
28/1	*Poligonum sp.*	
14	**Pontederiaceae**	
29/1	*Eichhornia crassipes* (Mart.)	Kanphutti
15	**Potamogetonaceae**	
30/1	*Potomogeton* sp.	
16	**Solanaceae**	
31/1	*Solanum surattense Burm.*	Bhoringini
17	**Typhaceae**	
32/1	*Typha angustata* Bory and Chaub	
18	**Zygophyllaceae**	
33/1	*Tribulus terrestris* **L**	Gokhru

Climbers and Twiners: The climbers and twiners observed along the agricultural hedges and road side hedges of the study area are given in the table 5. Total 11 species of climbers/ twiners belongs to 4 families are recorded from the area.

Table 5. List of Climbers Observed in the Study Area

S.No.	Family and Scientific name	Vernacular name
1	**Convolvulaceae**	
1/1	*Ipomoea pes-caprae*	Dariani vel
2/2	*Ipomoea obscura* (L.) Ker – Gawl.	Vad fudardi
2	**Cucurbitaceae**	
3/1	*Citrulus colocynthis (L)*	Indravarna
4/2	*Coccinia grandis* (L.) Voigt	Ghiloda
5/3	*Luffa cylindrica (L.) M.J.Roem*	Galku
3	**Cuscutaceae**	
6/1	*Cuscuta chinensis* Lam.	Amarval

Cultivated Plants in the Study Area: The Tuver (*Cajanus indica),* Wheat (*Triticum aestivum*) and Cotton (*Gossypium herbaceum*) are cultivated as major crops in this area. Bajra (*Pennisetum typhoides*) and Jowar (*Sorghum bicolar)* are cultivated in few areas immediately after monsoon period. The prevalent cropping systems of this area are the cumulative results of past and present decisions by individuals; these decisions are usually based on experience, tradition, expected profit, personal preferences and resources, and so on. The crop occupying the highest percentage of the sown area of this region is taken as the major crop and all other possible alternative crops which are sown in this region either as substitutes of the base crop in the same season or as the crops which fit in the rotation in the subsequent season, are considered as minor crop.

a. Major Crops: Major crops in the study area are Tuver (*Cajanus indica), Wheat (Triticum aestivum*) and cotton ((*Gossypium herbaceum*),

b. Minor crops: The minor crops of this region are Bajra (*Pennisetum typhoides*), Jowar (*Sorghum bicolar)* and Divel (*Ricinus communis)*

c. Major horticultural crops: Keri (*Mangifera indica* L.), Chikoo (*Manilkara zapota* (L.)), Papaya (*Carica papaya* L.) and Banana (*Musa Paradisiaca* L.).

Rare and Endangered Flora in the Study Area: The IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. With its strong scientific base, the IUCN Red List is recognized as the most authoritative guide to the status of biological diversity. Out of 17000 species of higher plants known to occur in India, nearly 614 higher plant species were evaluated by IUCN. Among them 247 species are under threatened category (IUCN, 2008). Among the enumerated flora in the study area, none of them were assigned any threat category by Red data book of Indian Plants (Jain and Sastry, 1984; Nayar and Sastry, 1987; 1988; 1990; Oldfield *et al.,* 1998; Kholia and Bhakuni, 2009) and Red list of threatened Vascular plants (IUCN, 2010).

Endemic Plants of the Study Area: De Candolle (1855), Swiss botanist, first used the concept of Endemic, which is defined as an area of a taxonomic unit, especially a species which has a restricted distribution or habitat, isolated from its surrounding region through geographical, ecological or temporal barriers. Out of 17000 species of known flowering plants of India nearly 5000 species are said to be endemic. Nearly 58 genera and 1932 taxa are found to be endemic to peninsular India (Nayar, 1980; Ahmedullah and Nayar, 1986; 1987; Jain 1992; Nayar, 1996; Vijaya Shankar *et al.,* 2005; Nautiyal *et al.,* 2009a,b; Shendage *et al.,* 2010). Among recorded plant species none can be assigned the status of endemic plant of this region.

Status of the Forest, Their Category in Study Area: No forest was observed in the study area except few scrub land and grazing lands with thick vegetation cover of *Prosopis Juliflora*. The mangrove patches were observed along the mud flats on the either side of Dahej jetty and few creeks along the coast.

Faunal Biodiversity of Study Area

For the documentation of the faunal biodiversity of the study area with respect to birds, reptiles, amphibians, and butterfly species, a baseline survey had been conducted. The study area falls under Bharuch District of Gujarat state. The area falls in 20 villages were covered for the present biological baseline study.

Birds: The sighting of bird species was very lass during the study period during March 2012. The most commonly spotted bird species of this area were; Cattle Egret, Intermediate Egret, Black-winged Stilt, Red-wattled Lapwing, Rock Pigeon, Eurasian Collared-Dove, Spotted Dove, Chestnut-headed Bee-eater, Bank Myna and Common Myna. 1,224 bird species reliably recorded from India, together with their status categories. In total there are 1219 extant native species including migrants and vagrants (but excluding 3 species now known to be extinct in the country, and 2 introduced species). There are 923 breeding species (911 residents, plus 12 suspected residents). IUCN evaluated 1254 bird species from India and categorized 77 species as threatened (13 species as critically endangered, 10 species as Endangered and 54 species as Vulnerable). Only one sighted birds were evaluated as near threatened by IUCN, 2010 and BirdLife International, 2010. A taxon is Near Threatened, when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable categories, but is close to qualifying or is likely to qualify for a threatened category in the near future. List of these, near threatened species is given in the table 6. Systematic account of the birds in the study area with the status of occurrence is given in the table 7.

Table 6. Near Threatened Birds of Study Area

Species	Habitat	Threat status IUCN
Painted stork *(Mycteria leucocephala)*	Shallow water bodies	Near threatened B-11

Source: IUCN Red list of threatened species, 2010 and Bird life international 2010.

Table 7. Systematic Lists of Birds in the Study Area with Its Distribution and Migratory Status

Old Common name	New Common Name	Scientific Name	Dist.
I ORDER: APODIFORMES			
Family: Apodidae (swifts)			
Common Swift	Common Swift	*Apus apus*	**R**
House swift	Little Swift	*Apus affinis*	**R**
II ORDER: FALCONIFORMES			
Family: Accipitridae (vulture, Sparrow hawk, Eagle, Harrier, Kite and Vulture)			
Shikra	Shikra	*Accipiter badius*	**R**
Black-winged Kite	Black-winged Kite	*Elanus caeruleus*	**R**
III. ORDER: : CICONIIFORMES			
Family: Ardeidae (heron, Egret, Bittern)			
Cattle Egret	Cattle Egret	*Bubulcus ibis*	**R**
Median or Smaller Egret	Intermediate Egret	*Mesophoyx intermedia* *Egretta intermedia*	**R**
Little Egret	Little Egret	*Egretta garzetta*	**R**
Pond Heron	Indian Pond-Heron	*Ardeola grayii*	**R**
Family: Charadriidae (Plover, Stilt, Oystercatcher, Lapwing, Avocet)			
Black-winged Stilt	Black-winged Stilt	*Himantopus himantopus*	**R**
Red-wattled Lapwing	Red-wattled Lapwing	*Vanellus indicus*	**R**
Family: Ciconiidae (Open bill, stork, Adjutant)			
Painted Stork	Painted Stork	*Mycteria leucocephala*	**R**
Family: Threskiornithidae (Spoonbill and Ibis)			
Black Ibis	Red-naped Ibis	*Pseudibis papillosa*	**R**
IV ORDER: COLUMBIFORMES			
Family: Columbidae (Pigeon, Dove)			
Blue Rock Pigeon	Rock Pigeon	*Columba livia*	**R**
Ring Dove	Eurasian Collared-Dove	*Streptopelia decaocto*	**R**
Rufous Turtle Dove	Oriental Turtle-Dove	*Streptopelia orientalis*	**R**
Spotted Dove	Spotted Dove	*Streptopelia chinensis*	**R**
V : ORDER: CORACIFORMES			
Family: Dacelonidae (Kingfishers)			
White breasted Kingfisher	White-throated Kingfisher	*Halcyon smyrnensis*	**R**
Family: Coraciidae (Roller)			
BlueJay or Roller	Indian Roller	*Coracias benghalensis*	
Family: Meropidae (Bee Eater)			
Chestnut-headed Bee-eater	Chestnut-headed Bee-eater	*Merops leschenaulti*	**R**
Blue-cheeked Bee-eater	Blue-cheeked Bee-eater	*Merops persicus* *Merops superciliosus*	**R**
VI. ORDER: CUCULIFORMES			
Family: Centropodidae (Cocucal)			
Crow-Pheasant or Coucal	Greater Coucal	*Centropus sinensis*	**R**
Family: Cuculidae (cuckoo, Koel)			
Koel	Asian Koel	*Eudynamys scolopacea*	**R**
Indian Drongo Cuckoo	Drongo Cuckoo	*Surniculus lugubris*	**R**
VII. ORDER: GALLIFORMES			
Family: Phasianidae (Peafowl , Partridge, Quail, francolin, spur fowl, jungle fowl, Monal)			
Common Peafowl	Indian Peafowl	*Pavo cristatus*	**R**
Grey Partridge	Grey Francolin	*Francolinus pondicerianus*	**R**
VIII. ORDER: GRUIFORMES			
Family: Rallidae (Waterhen, coot, crake water cock, Moorhen, Rail)			
White-breasted Water hen	White-breasted Water hen	*Amaurornis phoenicurus*	**R**

Family: Gruidae (Crane)			
Common Crane	Common Crane	*Grus grus*	
Family: Rallidae (Waterhen, coot, crake water cock, Moorhen, Rail,)			
Indian Moorhen	Common Moorhen	*Gallinula chloropus*	**R**
XI. ORDER: PASSERIFORMES			
Family: Paridae (Tit)			
Grey Tit	Great Tit	*Parus major*	**R**
Family: Corvidae			
Large Cuckoo-shrike	Large Cuckoo-shrike	*Coracina macei* *Coracina novaehollandiae*	**R**
Raven	Common Raven	*Corvus corax*	**R**
House Crow	House Crow	*Corvus splendens*	**R**
Black drongo- King Crow	Black Drongo	*Dicrurus macrocercus* *Dicrurus adsimilis*	**R**
Tree Pie	Rufous Treepie	*Dendrocitta vagabunda*	
Family: Laniidae (shrike)			
Rufous backed Shrike	Long-tailed Shrike	*Lanius schach*	**R**
Grey Shrike	Northern Shrike	*Lanius excubitor*	**R**
Family: Muscicapidae (Short wing, Chat, Robin, Shama			
Indian Robin	Indian Robin	*Saxicoloides fulicata*	**R**
Pied Bushchat	Pied Bushchat	*Saxicola caprata*	**R**
Family: Nectariniidae (Sun Birds, Flower pecker, Spider hunter)			
Purple Sunbird	Purple Sunbird	*Nectarinia asiatica*	**R**
Small Sunbird	Crimson-backed Sunbird	*Nectarinia minima*	**R**
Family: Passeridae (Avadavat, Pipit, Wagtail, Munia, Snowfinch, sparrow, weaver , Accentor)			
House Sparrow	House Sparrow	*Passer domesticus*	**R**
Grey Tit	Great Tit	*Parus major*	**R**
Family: Pycnonotidae (Bulbul)			
Red-whiskered Bulbul	Red-whiskered Bulbul	*Pycnonotus jocosus*	**R**
Red-vented Bulbul	Red-vented Bulbul	*Pycnonotus cafer*	**R**
Family: Sturnidae (Myna, Starling)			
Bank Myna	Bank Myna	*Acridotheres ginginianus*	**R**
Indian Myna	Common Myna	*Acridotheres tristis*	**R**
Family: Sylviidae (Warbler, Browning, Fulvetta ,Babbler, Laughing thrash, Tailor birds)			
Common Babbler	Common Babbler	*Turdoides caudatus*	**R**
Jungle Babbler	Jungle Babbler	*Turdoides striatus*	**R**
Tailorbird	Common Tailorbird	*Orthotomus sutorius*	**R**
X. ORDER: PSITTACIFORMES			
Family: Psittacidae (Parrot and Parakeet)			
Rose-ringed Parakeet	Rose-ringed Parakeet	*Psittacula krameri*	**R**
XI ORDER: STRIGIFORMES			
Family: Strigidae (Owl and Owlet)			
Spotted Owlet	Spotted Owlet	*Athene brama*	**R**

Note: **R** = Widespread Resident, r = Very Local Resident, **W** = Widespread Winter Visitor, w = Sparse Winter Visitor**, RW** =Resident and winter visitor As per the distribution given in WCMC, Check list of Indian Birds

Butterflies from the study area: Butterflies observed during the present study are documented in the Table 9.

Table 9. Butterflies in the Study Area

Scientific name and family	Common name
Family Papilionidae	
Papilio polytes	Common Mormon
Family Pieridae	
Eurema hecabe	Common Grass yellow
Ixias Marianne	White orange tip
Family: Nymphalidae	
Danaus genutia	Stripped Tiger

Cramer	
Hypolimanas misippus	Danaid egg fly
Mycalesis perseus	Common bush brown

Herpetofauna: No amphibians were sighted during the study period during March 2012. The reptiles' document in the region is given in the table 10.

Table 10. Reptiles in the Study Area

S.No.	Common Name	Scientific name
1.	Common garden lizard	*Calotes versicolor* (Daudin)
2.	*Common rat snake	*Ptyas mucosus* (Linn.)
3.	Common Indian monitor	*Varanus bengalensis* (Daudin)
4.	House Gecko	*Hemidactylus flaviviridis* (Ruppell)
5.	Fan-Throated Lizard	*Sitana ponticeriana* (Cuvier)
6.	*Indian Cobra	*Naja naja* (Linn.)
7.	*Russell's Viper	*Daboia russelii* (Shaw and Nodder)
8.	*Common Indian Krait	*Bungarus caeruleus* (Schneider)

✶Not sighted but included as per the secondary information.

Mammals: The wild mammals observed other than the domesticated ones are given in the table below.

Table 11. Mammals in Study area

S.No.	Common Name	Scientific name
1.	Five striped Palm squirrel	*Funambulus pennanii* (Wroughton)
2.	Common Mongoose	*Herpestes edwardsii*
3.	Indian field mouse	*Mus booduga* (Gray)
4.	Hare	*Lepus sp.*
5.	Five striped Palm squirrel	*Funambulus pennanii* (Wroughton)
6.	Jackal	*Canis aureus* (Linnaeus)
7.	Nilgai	*Boselaphus tragocamelus* (Pallas)
8.	Jungle cat	*Felis Chaus (Guldenstaedt)*

Rare and Endangered Fauna of Study Area: The IUCN Red List is the world's most comprehensive inventory of the global conservation status of plant and animal species. It uses a set of criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. With its strong scientific base, the IUCN Red List is recognized as the most authoritative guide to the status of biological diversity. IUCN, (2008) has evaluated 1976 animal species from India, among them 313 have in recognized as threatened species. Among them one species is considered as extinct, while 44 species are in critically endangered(CR) category, 88 is in endangered category (EN), while 181 is considered as vulnerable (VU). As per IUCN Red list of threatened species (2010), Painted stork *(Mycteria leucocephala),* grouped under near threatened birds. Wild Life (Protection) Act, 1972, amended on 17th January 2003, is an Act to provide for the protection of wild animals, birds and plants and for matters connected therewith or ancillary or incidental thereto with a view to ensuring the ecological and environmental security of the country. Some of the sighted fauna was given protection by the Indian Wild Life (Protection) Act, 1972 by including them in different schedules. Among the birds in the study area, Pea fowl (*Pavo cristatus)* is included in schedule I of Wild life protection Act (1972), while many other birds are included in schedule IV. Among the reptiles, Indian Cobra (*Naja naja*), and Common rat snake (*Ptyas mucosus)* were provided protection as per Schedule-II of Wild life protection act, (1972). Among mammals; Common Mongoose (*Herpestes edwardsi)*, Jackal (*Canis aureus* (Linnaeus) and Jungle cat (*Felis chaus)* are a schedule –II animals. Nilgai (*Boselaphus tragocamelus*) is protected as Schedule-III animal and hares and five stripped squirrels are included in schedule IV of Wild Life Protection act 1972.

Endemic Fauna of the Study Area: None of the sighted animal species can be assigned endemic species category of the study area.

Aquatic Biodiversity

Most of the villages in the study area are with large village ponds for rain water harvesting option as wells to recharge aquifers for better quality water in the wells at the periphery of these village ponds. The village ponds in Jholva village, Atali village, Ambetta village,

Suva village and Vallod village were sampled to document the plankton diversity. Biotic communities of the in an inland water body consist of Phytoplankton (plant plankton) includes minute photosynthetic cells and microscopic unicellular and multi cellular species of several phyla of true algae, which are either solitary or colonial. Phytoplankton is autotrophs, containing photosynthetic pigments. Most of the phytoplankton has a density greater than the water hence they tend to sink down. Water turbulence combined with other factors such as shape, and physiological state, reduce the sinking rate of non motile organisms. Motile phytoplankton, like most of the dinoflagellates may actively swim to compensate for sinking. Phytoplankton is of great ecological significance because they comprise the major portion of primary producers for all the consumers such as zooplankton and fishes. Zooplankton (animal plankton) includes a great variety of animals from single-celled protozoa to large invertebrates. Among the zooplanktons crustaceans of phylum Arthropoda easily predominate, these include numerous species within several categories. Zooplankton includes animals that are planktonic throughout their lives as well as larvae of animals that grow up to be nekton or benthos.

Table 13. Plankton Community of Inland Water bodies in five villages in Dahej Area

Plankton Community	Valod Village	Jholva village	Atali Village	Suva Village	Vav Village
Phytoplankton					
Sub Phylum Chlorophyceae					
Order: Chlorococcoccale					
Family:Scenedesmaceae					
Scenedesmus sp.	✓	✓	✓	✓	✓
Famiy:Hydrodictyacea					
Hydrodictyon sp	✗	✓	✗	✓	✓
Pediastrum sp.	✗	✓	✗	✓	✗
Order: Zygnematles					
Family: Zygnemataceae					
Spirogyra sp.	✓	✓	✓	✓	✓
Family : Desmidiaceae					
Closterium sp.	✓	✓	✓	✓	✓
Cosmarium sp	✓	✓	✓	✓	✓
Phylum: Euglenophyta					
Order Euglenales					
Family Euglenaceae					
Phacus sp	✗	✓	✗	✗	✗
Phylum: Chrysophyta					
Sub Phylum: Bacillariophyceae					
Order: Centrales					
Melosira sp	✗	✓	✗	✗	✗
Order: Pennales					
Family: Fragilariaceae					
Fragilaria sp					
Synedra sp.	✓	✓	✓	✓	✓
Family: Naviculaceae					
Navicula sp.	✓	✓	✓	✓	✓
Pinnularia sp	✗	✓	✓	✓	✗
Zooplankton					

Phylum Rotifera					
Class : Monogononta					
Order : Ploima					
Family : Brachionidae					
Brachionus sp.	✓	✓	✓	✓	✓
Nothalca sp.	✓	✓	✖	✓	✖
Keratella sp.	✓	✓	✓	✓	✓
Phylum: Arthropoda					
Class Brabchiopoda					
Order Cladocera					
Famliy Daphnidae					
Daphnia sp	✓	✖	✓	✓	✖
Class : Crustaceae					
Sub class Copepoda					
Order: Calanoida					
Family: Diaptominae					
Neodiaptomus sp	✖	✓	✓	✓	✖
Order: Cyclopoida					
Family: Cyclopidae					
Sub family: Eucyclopinae					
Eucyclops sp	✓	✓	✓	✓	✓
Ectocyclops sp.	✓	✓	✓	✓	✓
Nauplius larvae	✓	✓	✓	✓	✓

✓ Indicates presence; ✖ Indicates absence.

CONCLUSION

The current study reveals that the area of Dahej in Bharuch district of Gujarat has most of follow land. Western part of the study area is occupied by the mud flats and Saltpans. There is almost plain without much undulation, a fallow land; hence not mush vegetation cover, except scattered *Prosopis juliflora* shrubs and few trees of *Prosopis cineraria.* The area is notified industrial area by Gujarat Pollution Control Board and it has SEZ also. The ecology and biodiversity patterns reveal that there is no much vegetation and animals which is suitable for industrial development.

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