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BIRDS OF DIU: FIRST AVIAN CHECKLIST OF DIU PREPARED FROM A PRELIMINARY SURVEY

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Abstract: An avifaunal survey was carried out in 5 specific locations in Diu: City Circuit House Campus, Fudam Bird Sanctuary, Dagachi Forest, Pawati Village and NaniVasravao Village during 2016. Observations were made during morning (0600-1000 hrs) and evening (1600-1800 hrs) hours. A checklist was prepared based on the observations. A total of 51 bird species from 15 orders and 27 familieswere recorded during the survey. Among the identified birds, four and three species belong to 'Winter Visitor' and 'Near Threatened' category respectively. Five categories of feeding guilds of the birds were also categorized. This is believed to be the first quintessential checklist of birds only for Diu.

Keywords : Avifauna, Checklist, Diu, Feeding guild, Migratory, Union territory.

Introduction

Birds are one of the most diverse and widely distributed lifeforms occupying almost all the available habitats and biomes (Olechnowski 2009, Bayani and Dandekar 2017). All over the world, avifaunas are considered as the key indicators of ecosystem health and stress (Taper et al. 1995) because of their different roles in ecosystem as scavengers, predators of insect pest and pollinators (Gregory et al. 2003, Padmavathy et al. 2010, Shah et al. 2016). There are about 9026 bird species distributed all over the world (Manakadan and Pittie 2001; Rasmussen and Anderton 2005). India is among the top ten global countries harboring maximum number of bird species (Lepage 2016, Praveen et al.2016), totaling, 1263 species from 106 families (Praveen et al.2016).

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Maintaining detailed accounts of avian species can act as an extremely valuable tool for conservation, especially in today's fast changing world (Prasad 2003). However, in India, the compiled three-part checklist of birds (Blyth 1850a,b, 1851) was first published during the erstwhile British Dominions in South Asia (Praveen et al.2016). After that, the practice continued and flourished in different regions, states and union territories of the country. Presently, there are 8 Union territories in India. The recent most Union territory of India is 'Dadra & Nagar Haveli and Daman & Diu', formed by merging 'Dadra & Nagar Haveli' and 'Daman & Diu' together by the inclusion of legislation 'The Dadra and Nagar Haveli and Daman and Diu (Merger of Union Territories) Act, 2019'. Previously, studies (Ganpule 2016, 2017) were carried out in Gujarat including the above-mentioned Union territories to compile the checklist of birds for Gujarat. However, this is the first attempt to prepare a preliminary checklist of Diu in particular.

Materials and Methodology

Study Area

Diu district is a small island of only 40 sq. km (Sharma and Sikarwar 2014) situated on the southern side of Gujarat Peninsula, between the latitude 20°44.567' N to 20°42.000' N and between the longitude 71°00.400' E to 70°52.433' E (Mitra et al. 2017). This island measures around 4.6 km fromnorth to south and 13.8 km from east to west (Mitra et al. 2017).The landscape of the area is mainly plainwith anapproximate altitude of 6 meters above the sea level (Mitra et al. 2017). The island is also surrounded by small hillocks of not more than 30 meters height (Sharma and Sikarwar 2014). On the north side, the district is bounded by Chasiriverthat disconnects the

island from the mainland of Junagadh district of the state of Gujarat (Sharma and Sikarwar 2014). Remaining boundaries of the district is embraced by the Arabian Sea. Climate of Diu is typically subtropical humid (Rao and Agarwal 1964) with average rainfall of 540 mm, temperature around 20°C to 36°C and relative humidity around 55%-87% throughout the year (Sharma and Sikarwar 2014).

Vegetation of the Diu district is somewhat related to the general flora of the coastal regions of the state of Gujarat, Maharashtra and Goa. Diu is devoid of Natural Forest as such covering an area of 517 ha (Sharma and Sikarwar 2014). The vegetation of this island varies due to various kinds of habitats- sand stone pits, soil filled rocky creeks, salt pans, sandy belt along sea shore, swampy back water areas and road sides. And therefore, plant communities and vegetation varying accordingly can be classified as Rocky strand vegetation, Sandy shore vegetation and Inland sandy plain vegetation (Sharma and Sikarwar 2014).

In Diu, avifaunal surveys were mainly conducted in following locations

(I) City Circuit House Campus and surroundings (Coordinate: N 20°43.085' E 70°59.210', Elevation: 23.8 ft)

(ii) Fudam Bird Sanctuary (Coordinate: N 20°43.026' E 70°57.712', Elevation: 22.8 ft):

(iii) Dagachi Forest (Coordinate: N 20°43.210' E 70°54.312', Elevation: 108.7 ft):

(iv) Pawati Village near Dagachi School (Coordinate: N 20°43.483' E 70°53.771', Elevation: 26.5ft):

(v) NaniVasravao Village (Coordinate: N 20°43.188' E 70°53.684', Elevation: 34.4 ft):

Data Collection

Different species of avifauna were documented by direct observations (Bibby et al. 1992), random walks and opportunistic surveys in and around the study area. Field surveys were conducted during morning (0600-1000 hrs) and evening (1600-1800 hrs) hours for three days i.e. 12 September 2016 to 14 September 2016. Each team surveyed two different locations at a time, to avoid bias in keeping record of bird presence and number of birds in each location during specific times of the day. Birds were mainly observed with the help of Nikon 8X40 binocular. Birds were identified using Grimmett et al. (2011) field guidebook of birds. Photographs of birds were also taken with Nikon D700 camera, wherever it was possible. These photographs were further verified for accurate identification with the same field guide book.

The identified birds were classified into different migratory categories following the information available in Grimmett et al. (2011). Feeding guilds of the birds were also categorized on the basis of direct observations made when the birds were feeding and the information in the available literatures (Chatterjee et al. 2013, Rathod et al. 2015, Rathod and Padate 2017, Sharma et al. 2018, Sohil and Sharma 2019). IUCN Red List of threatened categories was followed to assign specific conservation status to the birds (IUCN, 2017). Endemic status of the birds was also verified using the literature Jathar and Rahmani (2006) that assigns endemic status to different Indian Birds.

Result

A total of 51 species of birds were observed during the present study. These 51 species belong to 15 orders and 27 families. IUCN Conservation status, migratory status, feeding guild of each of these species have been given in the Table 1. Out of the 51 species, pictures of 41 species were captured (Picture Courtesy: S. Das) while surveying different areas of Diu. Each of the captured photos has also been given in the section of Image 1- 41 respectively.

The present study indicates that, among these 51species of birds from 15 orders, maximum species of birds were recorded under Passeriformes (16 species i.e. 31.37%) and Pelecaniformes (11 species i.e. 21.57%) respectively. Similarly, maximum species of birds recorded during the survey belongs to Ardeidae family (7 species i.e. 13.74%) (Fig.1 & 2).

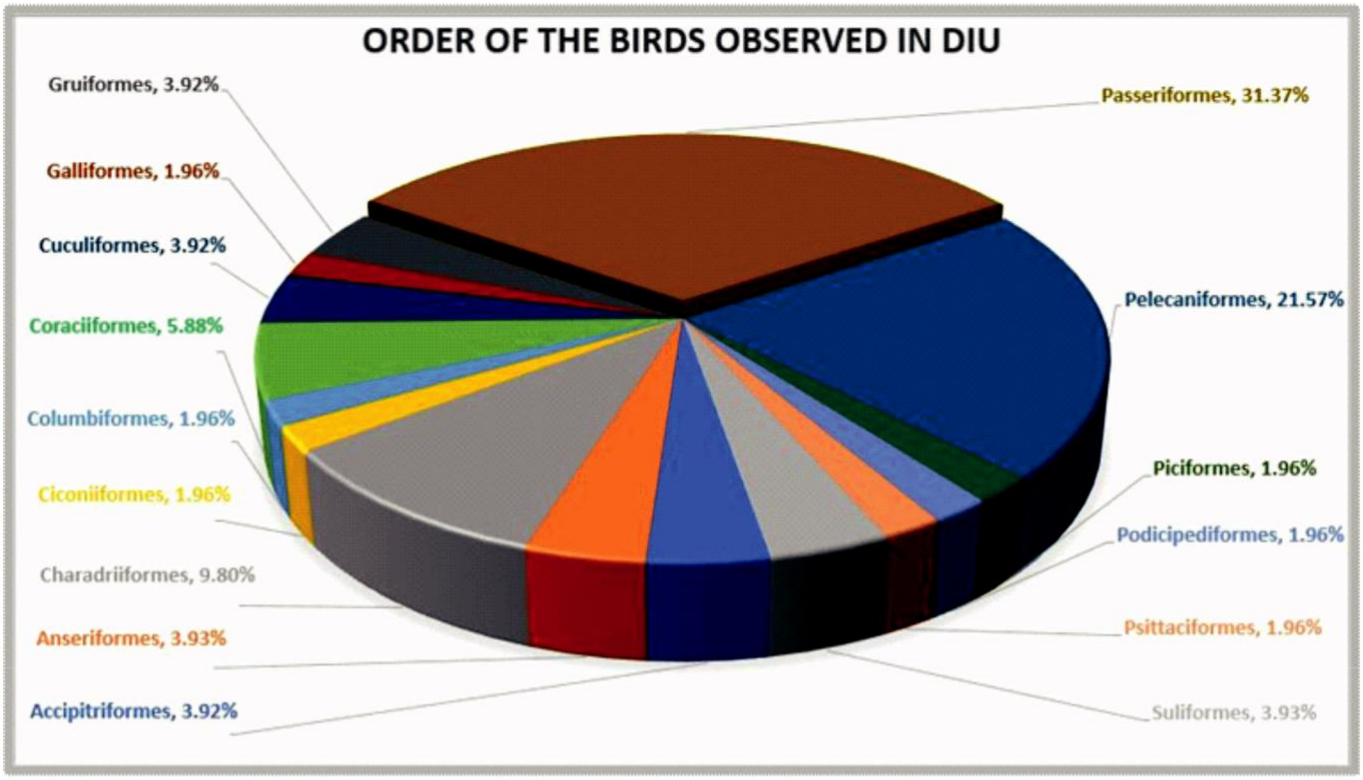

Figure 1: Pie Chart indicating percentages of different orders of birds observed in Diu (12/09/2016-14/09/2016)

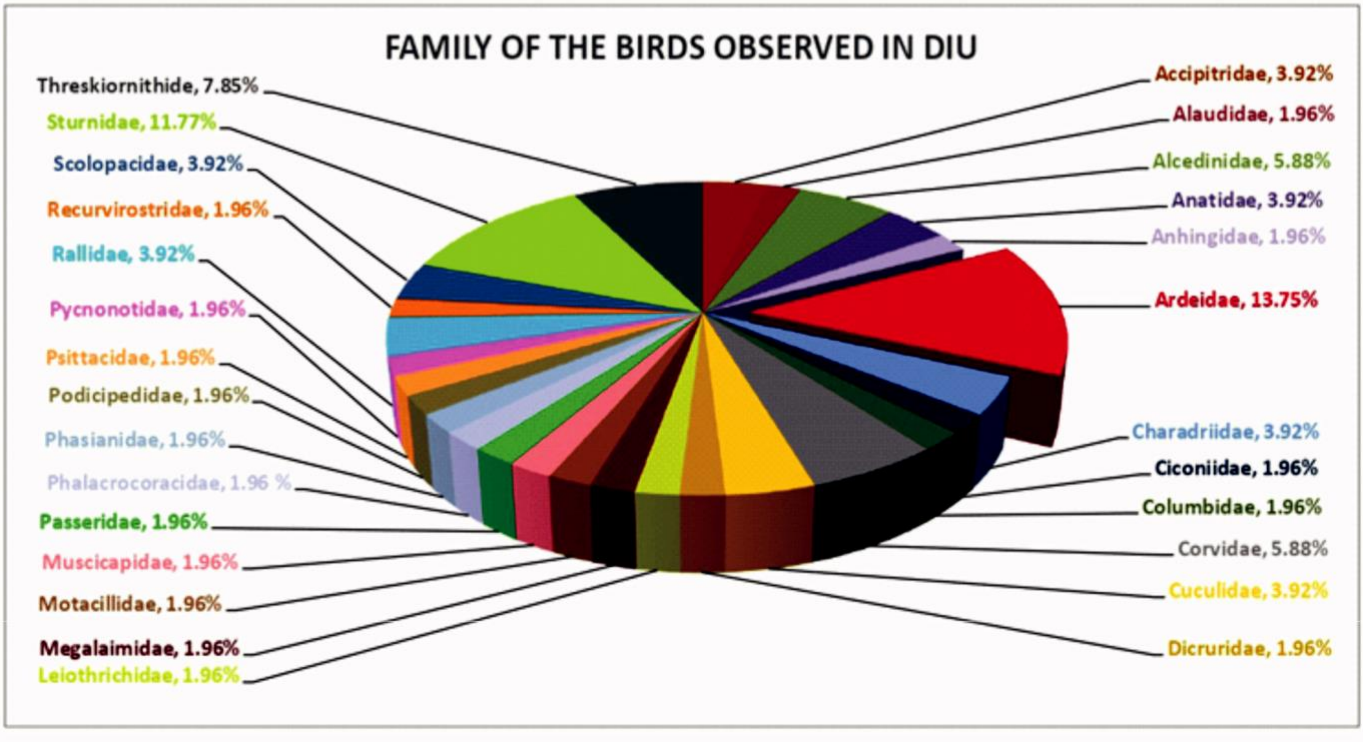

Figure 2: Pie Chart indicating percentages of different families of birds observed in Diu (12/09/2016-14/09/2016)

In the checklist, we tried to figure out the IUCN conservation status of the birds observed in Diu. Maximum species of birds (48 species i.e. 94.12%) observed during the survey belong to 'Least Concern' category of IUCN Conservation Status, except three species (5.88%) i.e. Painted Stork (*Mycteria leucocephala*), Black-headed Ibis (*Threskiornis melanocephalus*) and Darter (*Anhinga melanogaster*). These three species belong to 'Near Threatened' category of IUCN Conservation Status (Fig.3).

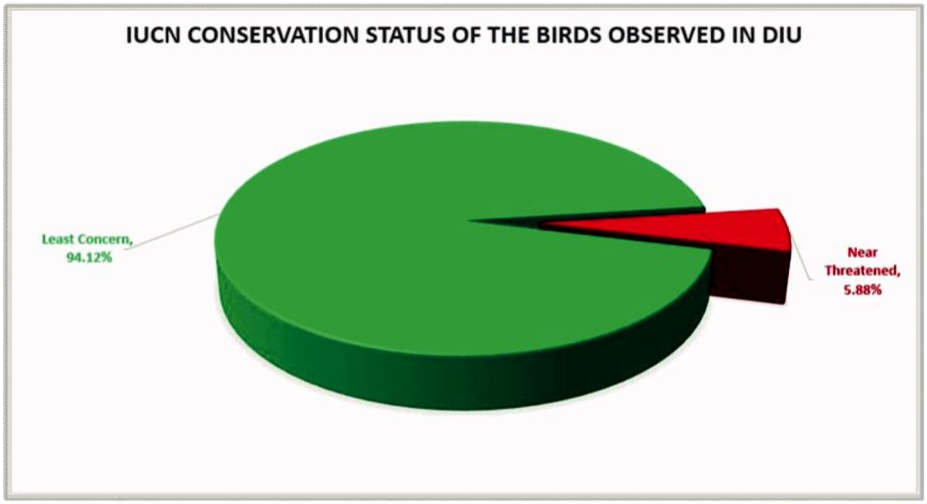

Figure 3: Pie Chart indicating percentages of IUCN Conservation Status of different birds observed in Diu (12/09/2016-14/09/2016)

Out of 51 species, 46 species (90.19 %) are 'Resident' to Diu and the remaining four species (9.81%) i.e. Common Redshank (*Tringa totanus*), Common Sandpiper (*Actitis hypoleucos*), Grey Wagtail (*Motacilla cinereal*) and Rosy Starling (*Pastor roseus*) are 'Winter visitors' to this area (Fig.4).

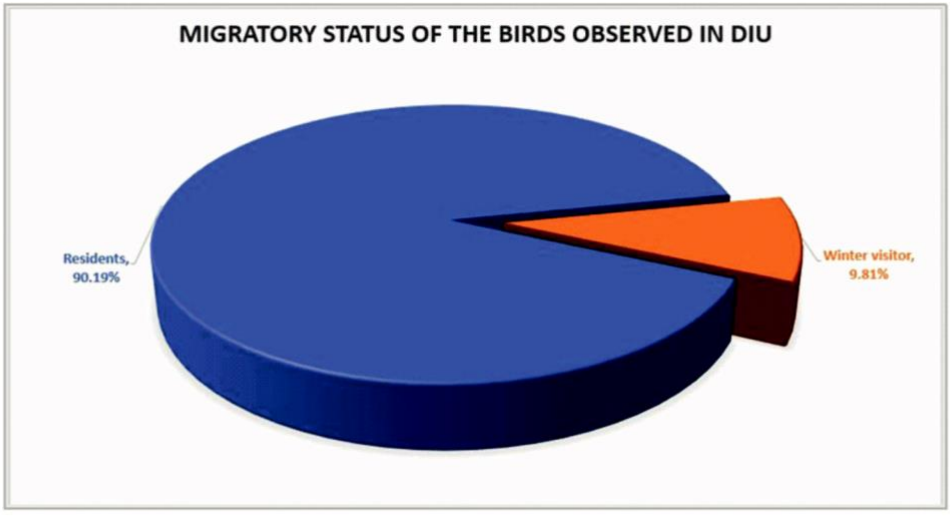

Figure 4: Pie Chart indicating percentages of Migratory Status of different birds observed in Diu (12/09/2016-14/09/2016)

As per our observation, the information available in different literatures, there are 5 feeding guilds of the identified birds in Diu: Omnivorous, Carnivorous, Frugivorous, Insectivorous and Granivorous. Among them most of the species are Carnivorous (22 species i.e. 43.14 %), followed by Omnivorous (9 species i.e. 17.65 %), Granivorous (8 species i.e. 15.69 %), Insectivorous

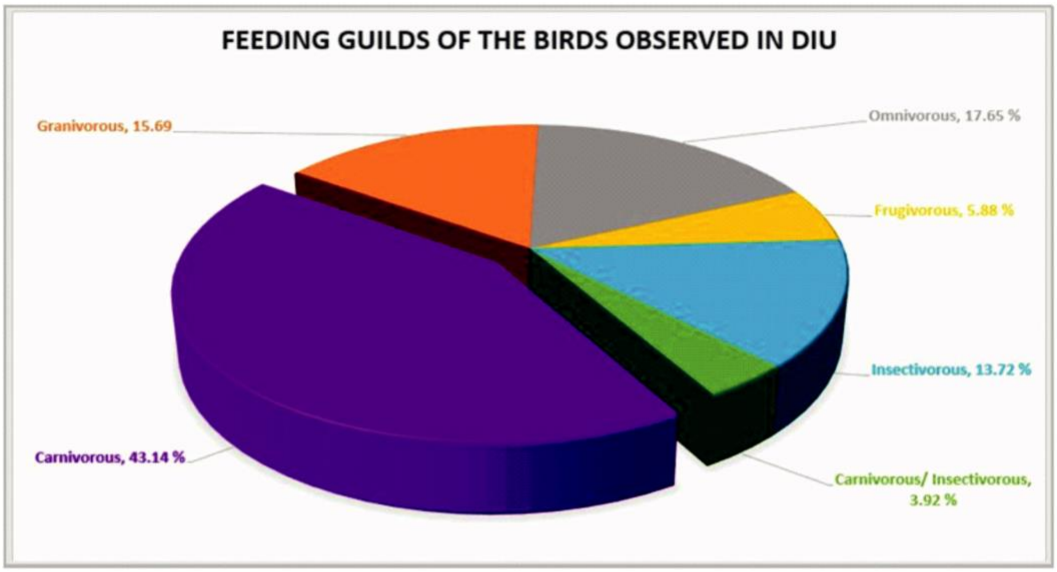

Figure 5: Pie Chart indicating percentages of different feeding guilds of birds observed in Diu (12/09/2016-14/09/2016)

Discussion

To determine the ecology and health of the local ecosystem or the regional landscape, knowledge of the composition of bird communities is extremely important (Nagya et al. 2017). Hence, an understanding of bird community structure and diversity is necessary for recognizing the importance of different landscapes for avian conservation (Kattan and Franco 2004).

Few avian surveys had been conducted in Gujarat (Dutta 2000, Parasharyaet al.2004, Ganpule 2016, 2017) and Goa (Baidya and Bhagat 2018), the two neighboring states of Diu. Particularly, the avian checklist prepared for Gujarat (Ganpule 2016, 2017) also includes 'Daman and Diu' and 'Dadra and Nagar Haveli'. However, no avian checklist has been prepared solely for Diu. This particular paper is an initial attempt to create a checklist of the birds found in Diu, based on the preliminary survey conducted in that island for a very short period (12/09/2016-14/09/2016).

The present study represents 51 bird species from 15 orders and 27 families. Passeriformes is the dominant order of different species of birds representing 31.37% of all the orders. Previous studies conducted in Gujarat (Ganpule 2016, 2017) also indicated similar results where Passeriformes was the dominant order with 39.16% of species. The avian checklist prepared for the Indian birds by Praveen et al. (2016) also indicates Passeriformes as the dominant order (i.e. approximately 54%). In fact, Olson (2001) believed that the dominance of the Passeriformes order of birds in different landscape of the worldcan be because of their reproductive adaptations. In another study on the birds of Ilgaz

Mountain National Park, Turkey, Kucuk et al. (2017) suggested that the dominance of Passerine birds in the study area was probably because these birds reproduce fast.

The study reveals that except three species all the birds observed during the survey belongs to 'Least Concern' conservation category. The other three species belong to 'Near Threatened' category. Avian checklist prepared for Goa (Baidya and Bhagat 2018) consists of 19 threatened species out of 473 species i.e. 4.02% which is almost similar to the proportion of threatened species observed in Diu (5.88%) during the survey. However, the checklist prepared in Goa, is on the basis of direct field observations and the records from museum specimens and photographic records (Baidya and Bhagat 2018). On the other hand, result of this study is based on the direct observations from a short preliminary survey, when no preliminary avifaunal data was available for Diu.

For India, 79 and 61 endemic species have been listed by Jathar and Rahmani (2006) and Praveen et al. (2016) respectively. After consulting aforementioned research papers with (Ganpule 2016, 2017), it has been concluded that there areabout 17 endemic species of birds found in Gujarat. However, most of these birds have been rarely spotted in Gujarat and it is very unlikely that all these endemic species will be found in Diu. Although, at least some of the species could be observed in Diu, still, in order to accomplish the said objective, rigorous avian survey is required in the same region.

The migratory status of the observed birds was determined after investigating the same in Grimmett et al. (2011). Later all the birds recorded in Diu were again compared with the migratory status of the birds given in Ganpule (2016). There was not much of a difference in the information regarding the migratory status of the birds found in the previous two literatures, except for the fact that the information about resident and migratory status of birds observed in Gujarat, Daman and Diu, and Dadra and Nagar Haveli in Ganpule (2016) is more elaborate and explanatory. The little difference noticed in the aforementioned literatures are while Western Reef Egret (*Egretta gularis*) and Grey Heron (*Ardea cinerea*) were mentioned as 'resident' in Grimmett et al. (2011), the same species was designated as not only 'common resident' but also 'winter visitor' in (Ganpule 2016). Also, while Glossy Ibis (*Plegadis falcinellus*) was as 'winter visitor' in Grimmett et al. (2011), it had been described as 'common and uncommon resident and migrant' in Ganpule (2016).

Waders are considered as the indicator species of wetlands (Kazantzidis and Gounter 2008) and wetlands can support Carnivorous feeding guilds by delivering aquatic food like fish, molluscs, amphibians, etc. (Rathod et al. 2015) to the birds. Diu is a small island, almost completely delimited by ocean. Hence, our study recorded a significant proportion of birds from the order Pelecaniformes (21.57%; second dominant order) and family Ardeidae (13.74%; dominant family) in this island possibly because of better access to the food resources. Consequently,the feeding guild analysis of the Diu Birds indicates that the most of the birds are carnivorous (43.14%). However, this particular study was carried out for a very short timeduring the late monsoon. Therefore, various bird assemblages in terms of diverse feeding guilds could be recorded during different seasons in this particular region. We believe, more winter visitor species can also be recorded if the study can be conducted in winter season.

Island populations are at higher risk of extinction than mainland populations (Diamond 1984, Vitousek 1988, Flesness 1989, Case et al. 1992, World Conservation Monitoring Centre 1992, Smith et al. 1993, Frankham 1997). Myers (1979) postulated that only 20% of total bird species are found on islands, but 90% ofisland dwelling bird species were driven to extinction during historicalperiods. Frankham (1997) pointed out the fact that substantial proportions of endangered and vulnerable species were of insular species particularly, birds (49%). In fact, recorded extinctions since 1600 show that a majority of extinctions of birds (90%) were of insular forms (Frankham 1997). Endemic species are also particularly prone to extinction or endangerment (Frankham 1997).

Diu is a small and beautiful island that supports at least 51

species of bird of 15 orders and 27 families. We arrived at the conclusion that a lot of detailed studyneeds to be conducted to develop a comprehensive checklist of the birds found in this island, particularly because, we did not record any endemic or threatened bird species during this preliminary survey. In this way, we can understand present scenario regarding the real status of the birds in this island. After that proper conservation guidelines can be constructed accordingly. However, this particular

Acknowledgements

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Table

Sl. No.	Common Name	Scientific Name	IUCN Conservation Status	Migratory Status	Feeding Guild	Image
1. Order: Accipitriformes 1.1.Family: Accipitridae						
1	Brahminy Kite	*Haliastur indus* (Boddaert, 1783)	LC	R	C	Image 1
2	Shikra	*Accipiter badius* (Gmelin, 1788)	LC	R	C	Image 2
2. Order: Anseriformes 2.1.Family: Anatidae						
3	Lesser Whistling-duck	*Dendrocygna javanica* (Horsfield, 1821)	LC	R	O	Image 3
4	Indian Spot-billed Duck	*Anas poecilorhyncha* (Forster, 1781)	LC	R	O	Image 4
3. Order: Charadriiformes 3.1.Family: Charadriidae						
5	Red-wattled Lapwing	*Vanellus indicus* (Boddaert, 1783)	LC	R	I	Image 5
6	Little Ringed Plover	*Charadrius dubius* (Scopoli, 1786)	LC	R	C	Image 6
3.2. Family: Recurvirostridae						
7	Black-winged Stilt	*Himantopus himantopus (Linnaeus, 1758)*	LC	R	C	Image 7
3.3. Family: Scolopacidae						
8	Common Redshank	*Tringa totanus* (Linnaeus, 1758)	LC	WV	I	
9	Common Sandpiper	*Actitis hypoleucos* (Linnaeus, 1758)	LC	WV	I	

4. Order: Ciconiiformes 4.1.Family: Ciconiidae						
10	Painted Stork	*Mycteria leucocephala* (Pennant, 1769)	NT	R	C	Image 8
5. Order: Columbiformes 5.1.Family: Columbidae						
11	Common Pigeon	*Columba livia* (Gmelin, 1789)	LC	R	G	Image 9
6. Order: Coraciiformes 6.1. Family: Alcedinidae						
12	Pied Kingfisher	*Ceryle rudis* (Linnaeus, 1758)	LC	R	C	
13	White-throated Kingfisher	*Halcyon smyrnensis* (Linnaeus, 1758)	LC	R	C	
14	Common Kingfisher	*Alcedo atthis* (Linnaeus, 1758)	LC	R	C	
7. Order: Cuculiformes 7.1.Family: Cuculidae						
15	Greater Coucal	*Centropus sinensis* (Stephens, 1815)	LC	R	O	Image 10
16	Asian Koel	*Eudynamys scolopaceus* (Linnaeus, 1758)	LC	R	O	Image 11
8. Order: Galliformes 8.1. Family: Phasianidae						
17	Indian Peafowl	*Pavo cristatus* (Linnaeus, 1758)	LC	R	O	Image 12
9. Order: Gruiformes 9.1. Family: Rallidae						
18	Eurasian Coot	*Fulica atra* (Linnaeus, 1758)	LC	R	C/I	Image 13

19	Purple Swamphen	*Porphyrio porphyrio* (Linnaeus, 1758)	LC	R	O	Image 14
10. Order: Passeriformes 10.1. Family: Alaudidae						
20	Ashy-crowned Sparrow Lark	*Eremopterix griseus* (Scopoli, 1786)	LC	R	O	Image 15
10.2. Family: Corvidae						
21	House Crow	*Corvus splendens* (Vieillot, 1817)	LC	R	C	Image 16
22	Large-billed Crow	*Corvus macrorhynchos* (Wagler, 1827)	LC	R	O	Image 17
23	Rufous Treepie	*Dendrocitta vagabunda* (Latham, 1790)	LC	R	F	Image 18
10.3. Family: Dicruridae						
24	Black Drongo	*Dicrurus macrocercus* (Vieillot, 1817)	LC	R	I	Image 19
10.4. Family: Motacillidae						
25	Grey Wagtail	*Motacilla cinerea* (Tunstall, 1771)	LC	WV	I	Image 20
10.5. Family: Muscicapidae						
26	Indian Robin	*Saxicoloides fulicatus* (Linnaeus, 1766)	LC	R	I	Image 21
10.6. Family: Passeridae						
27	House Sparrow	*Passer domesticus* (Linnaeus, 1758)	LC	R	G	Image 22
10.7. Family: Pycnonotidae						
28	Red-vented Bulbul	*Pycnonotus cafer* (Linnaeus, 1766)	LC	R	F	Image 23

10.8. Family: Sturnidae						
29	Jungle Myna	*Acridotheres fuscus* (Wagler, 1827)	LC	R	O	Image 24
30	Common Myna	*Acridotheres tristis* (Linnaeus, 1766)	LC	R	G	Image 25
31	Bank Myna	*Acridotheres ginginianus* (Latham, 1790)	LC	R	G	Image 26
32	Asian Pied Starling	*Gracupica contra* (Linnaeus, 1758)	LC	R	G	Image 27
33	Brahminy Starling	*Sturnia pagodarum* (Gmelin, 1789)	LC	R	G	Image 28
34	Rosy Starling	*Pastor roseus* (Linnaeus, 1758)	LC	WV	G	Image 29
10.9. Family: Leiothrichidae						
35	Jungle Babblar	*Turdoides striata* (Dumont, 1823)	LC	R	I	Image 30
11. Order: Pelecaniformes 11.1. Family: Ardeidae						
36	Western Reef egret	*Egretta gularis* (Bosc, 1792)	LC	R	C	Image 31
37	Grey Heron	*Ardea cinerea* (Linnaeus, 1758)	LC	R	C	
38	Cattle Egret	*Bulbulcus ibis* (Linnaeus, 1758)	LC	R	C	
39	Great Egret	*Casmerodius albus* (Linnaeus, 1758)	LC	R	C	Image 32
40	Indian Pond Heron	*Ardeola grayii* (Sykes, 1832)	LC	R	C	Image 33
41	Purple Heron	*Ardea purpurea* (Linnaeus, 1766)	LC	R	C	

42	Little Egret	*Egretta garzetta* (Linnaeus, 1766)	LC	R	C	
11.2. Family: Threskiornithidae						
43	Red-naped Ibis	*Pseudibis papillosa* (Temminck, 1824)	LC	R	C	Image 34
44	Black-headed Ibis	*Threskiornis melanocephalus* (Latham, 1790)	NT	R	C	Image 35
45	Eurasian Spoonbill	*Platalea leucorodia* (Linnaeus, 1758)	LC	R	C	Image 36
46	Glossy Ibis	*Plegadis falcinellus* (Linnaeus, 1766)	LC	WV	C	Image 37
12. Order: Piciformes 12.1. Family: Megalaimidae						
47	Coppersmith Barbet	*Megalaima haemacephala* (Muller, 1776)	LC	R	F	Image 38
13. Order: Podicipediformes 13.1. Family: Podicipedidae						
48	Little Grebe	*Tachybaptus ruficollis* (Pallas, 1764)	LC	R	C	
14. Order: Psittaciformes 14.1. Family: Psittacidae						
49	Rose-ringed Parakeet	*Psittacula krameri* (Scopoli, 1769)	LC	R	G	Image 39
15. Order: Suliformes 15.1. Family: Anhingidaes						
50	Darter	*Anhinga melanogaster* (Pennant, 1769)	NT	R	G	Image 40
15.2. Family: Phalacrocoracidae						
51	Little Cormorant	*Phalacrocorax niger* (Vieillot, 1817)	LC	R	C/I	Image 41

IUCN Conservation Status: LC: Least Concern, NT: Near Threatened

Migratory Status: R: Resident WV: Winter Visitor

Feeding Guild: C: Carnivorous, I: Insectivorous, G: Granivorous, F: Frugivorous, O: Omnivorous

Images:

Image 1

Image 2

Image 3

Image 4

Image 5

Image 6

Image 7

Image 8

Image 9

Image 10

Image 11

Image 12

Image 13

Image 14

Image 15

Image 16

Image 17

Image 18

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Image 40

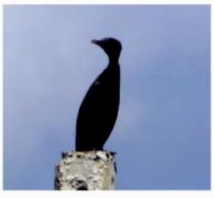

Image 41

Images: Birds observed in Diu:

Image 1: Brahminy Kite (*Haliastur indus),* **Image 2:** Shikra (*Accipiter badius),* **Image 3:** Lesser Whistling-duck (*Dendrocygna javanica)*, **Image 4:** Indian Spot-billed Duck (*Anas poecilorhyncha*), **Image 5:** Red-wattled Lapwing (*Vanellus indicus),* **Image 6:** Little Ringed Plover (*Charadrius dubius),* **Image 7:** Black-winged Stilt (*Himantopus himantopus),* **Image 8:** Painted Stork (*Mycteria leucocephala),* **Image 9:** Common Pegion (*Columba livia),* **Image 10:** Greater Coucal (*Centropus sinensis*), **Image 11:** Asian Kocl (*Eudynamys scolopaceus*), **Image 12:** Indian Peafowl (*Pavo cristatus*), **Image 13:** Eurasian Coot (*Fulica atra*), **Image 14:** Purple Swamphen (*Porphyrio porphyrio*), **Image 15:** Ashy-crowned Sparrow Lark (*Eremopterix griseus*), **Image 16:** House Crow (*Corvus splendens*), **Image 17:** Large-billed Crow (*Corvus macrorhynchos*), **Image 18:** Rufous Treepie (*Dendrocitta vagabunda*), **Image 19:** Black Drongo (*Dicrurus macrocercus*), **Image 20:** Grey Wagtail (*Motacilla cinerea*), **Image 21:** Indian Robin (*Saxicoloides fulicatus*), **Image 22:** House Sparrow (*Passer domesticus*), **Image 23:** Red-vented Bulbul (*Pycnonotus cafer*), **Image 24:** Jungle Myna (*Acridotheres fuscus*), **Image 25:** Common Myna (*Acridotheres tristis*), **Image 26:** Bank Myna (*Acridotheres ginginianus*), **Image 27:** Asian Pied Starling (*Gracupica contra*), **Image 28:** Brahminy Starling (*Sturnia pagodarum*), **Image 29:** Rosy Starling (*Pastor roseus*), **Image 30:** Jungle Babblar (*Turdoides striata*), **Image 31:** Western Reef egret (*Egretta gularis*), **Image 32:** Great Egret (*Casmerodius albus*), **Image 33:** Indian Pond Heron (*Ardeola grayii*), **Image 34:** Red-naped Ibis (*Pseudibis papillosa*), **Image 35:** Black-headed Ibis (*Threskiornis melanocephalus*), **Image 36:**Eurasian Spoonbill (*Platalea leucorodia*), **Image 37:** Glossy Ibis (*Plegadis falcinellus*), **Image 38:** Coppersmith Barbet (*Megalaima haemacephala*), **Image 39:** Rose-ringed Parakeet (*Psittacula krameri*), **Image 40:** Darter (*Anhinga melanogaster*), **Image 41:** Little Cormorant (*Phalacrocorax niger*).

Picture Courtesy: S. Das