Bulletin of Environment, Pharmacology and Life Sciences Bull. Env. Pharmacol. Life Sci., Vol 11 [9] August 2022 : 39-49 ©2022 Academy for Environment and Life Sciences, India Online ISSN 2277-1808 Journal's URL:http://www.bepls.com CODEN: BEPLAD ORIGINAL ARTICLE



Avian diversity and Physio-chemical parameters of Chhaya wetland, Porbandar, Gujarat, India

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ABSTRACT

Wetlands support a tremendous floral and faunal diversity by providing habitat along with food and water. During adverse conditions of drought and flooding they act as a natural sponge that purifies and replenishes water. Chhaya is one such wetland located at Porbandar city in the western part of Gujarat state in India. Rain water is the major source of water for Chhaya Wetland, hence environmental conditions get adverse with decreasing water levels. The present study focuses on Avian diversity and Physico-chemical parameters of water, this study will help to understand water quality of wetland that is being preferred by the birds. Birds from 19 orders and 46 families were identified. As per IUCN status, birds from 3 types of IUCN categories: vulnerable (VU), near threatened (NT) and least concern (LC) category. The Scolopacidae family contributed the highest number of species i.e., 18 species followed by Anatidae and Laridae. During the research, we observed that the Chhaya wetland, although present in the urban area and affected by various anthropogenic activities, still remains a preferred site for the winter migrants, as these winter visitors account for more than half of its Avian diversity.

Keywords: Winter migrants, Avian diversity, Physico-chemical parameters, Chhaya wetland

Received 22 .04.2022

Revised 20.06.2022

Accepted 06.07.2022

INTRODUCTION

Wetlands are one of the most useful environments on the earth, offering numerous significant types of assistance to human culture but are highly ecologically sensitive [8, 27, 26]. These wetlands occur in all heights from tropical desserts to cold tundra, at all elevations from beneath the ocean level to around 6000 m high in the Himalaya [4]. Wetlands share just 0.0001% of the total fresh water assessable involving 6.45% of the world's surface. Regardless of the critical natural, hydrological and financial qualities played by them, wetlands have been confronting dangers from a varried man-made instigated factors. Among the Indian states, Gujarat positions first with an absolute wetland area of around 3.47 m ha (around 23 % of the complete Indian wetland region) [18].

Being an unloading ground of anthropogenic release, these wetlands brought about a special biological system by eutrophication and subsequently support expanding biomass of phytoplankton, gelatinous zooplankton, benthic and epiphytic algae. This unique environment likewise upholds an enormous variety of microbes, hardy fish species, crustaceans and molluscs that allure fauna particularly birds which feed upon them [12]. Nonetheless, since the start of the twentieth century, almost 60-70% of all wetlands worldwide have been lost because of rural seepage and urbanization [5], and of those remaining, many are degraded [32]. Thusly, it is proposed that the decay of wetland biodiversity is more prominent than that in terrestrial systems [6]. Among avian wetland species, around 55% are declining around the world, although large herbivorous waterbirds are on rise [31, 19]. Living organisms, plants and animals are dependent on the environment of their habitat [14].

Birds are the critical parts of these ecosystems which can indicate their ecological circumstances and assume a crucial part in improving their biodiversity [22]. Birds are excellent indicators of the state of a healthy environment and form an integral component of agricultural ecosystem [13]. Wetlands are well known to support high concentrations of birds [23] and are considered as paradise for birds [3]. They play an enormous part in ecosystem services like pollination, pest control, seed dispersal, scavenging, cycling the nutrients, and so forth [30]. Furthermore, Birds support various other taxa and act as

indicator species of various natural surroundings. There are 11,158 extant species of birds reported worldwide. Out of which 1341 species (26 orders, 113 families and 489 genera) are recorded from India [21]. 14 of which 612 species are recorded from Gujarat [7]. The diversity of these organisms is one of the most important ecological indicators to evaluate the quality of habitats [16].

The quality of water is vital for the evaluation of waterbird habitat, as numerous physical and chemical factors interacting can influence the primary productivity of the aquatic environment and thus affect overall biomass across the water food web [29], Physicochemical parameters of water showed significant variations with water bird density, diversity, richness, and evenness [1].

Several author such as [20, 24, 25, 1] have studied Bird Diversity and Physico-chemical parameters of the selected wetlands and have observed that these wetlands provide an excellent habitat for these magnificent winged-creatures. They also observed that it is very important to understand avian diversity along with the physico-chemical parameters of these wetlands.

Our Present research work was to assess Avian diversity and Physico-chemical parameters of Chhaya wetland, as this is a very important and preferred site of winter birds. It is home to a good number of bird species therefore by conserving Chhaya wetland, we can save all floral and faunal diversity along with avian diversity. As there was no systematic data available regarding Avian diversity and Physico-chemical parameters; we attempted to fill the research gap by preparing a detailed report on diversity of aves and physico-chemical parameters of Chhaya wetland, which would be helpful in further references as well.

MATERIAL AND METHODS

Study area:

The Research was conducted on Chhaya wetland (21°37'51.72"N, 69°37'42.60"E)which is located at Porbandar city in the western part of Gujarat state in India. The wetland covers a zone of 2.17 km². It is 3.34 km long and 0.58 km wide. The major source of water is rainwater which nourishes the wetland and other secondary water sources apart from rain waterwere sewage water,waste water and industrial effluents from nearby households and industry respectively. The fundamental cause behind the water evaporating of this wetland is because of precipitation and surface run-off. The atmosphere of the territory is semi-arid (yearly rainfall is between 200 – 700 mm).



Figure 1: location of study site: Chhaya wetland, Porbandar, Gujarat, India (Source: https://earth.google.com/web/]

Data Collection:

The present research was conducted for the tenure of one year i.e., from January 2021 to December 2021. The study area was surveyed twice a month and a total of 24 visits were made during the study. The field visits were scheduled in the morning (6:00 to 9:00 hrs) and evening (16:00 to 19:00 hrs) as birds showed higher activities during these times. Birds were observed with the help of Nikon Binoculars (ACULON A211 10x50).Birds were identified using available scientific references, field guide (Grimmett et al., 2011) and other published literature. Random sampling and point-count observation methods were used for data collection of birds. Water sample for the analysis of physico-chemical parameters were also collected during the field visit.

Data Analysis:

As per the data collected during the study, we categorised residential status of birds as Resident (RE), and Winter migrant (WM). The occurrence of species in the study area was also reported based on the number of sightings during the study period as Very Common(\geq 8 sighting), Common (5-7 sighting), Uncommon (3– 4 sighting), and Rare (1–2 sighting).Each identified species was cross referenced with the latest IUCN status and were categorised into vulnerable (VU), near threatened (NT) and least concern (LC) category (IUCN 2022). Diversity indices such as Simpson diversity 1/D; 1-D; Shannon diversity –H', evenness - e^H/S, Margalef's species richness (d), and Fisher alpha diversity (α) were computed using software PAST (Hammer et al., 2001). pH andT.D.S. was measured using pH and TDS meter respectively. T.S, TSS, D.O., B.O.D., analysis was done as per the standard method available in [2].

RESULTS

During our research a total of 149 species from 19 orders and 46 families were recorded (Table.1).Order Passeriformes represents 17 families followed by Charadriiformes with 6 families (Figure.2). Scolopacidae family contributes 18 species which is highest among all the families, Anatidae and Laridae recorded 14 and 10 species respectively. Chhaya wetland is home to several winter migratory birds, 77 species (52% of the total Avian Diversity) are winter migrants (WM)& 72 species (48%) were residents(figure.4). This wetland provides habitat to birds from three IUCN Categories: 2 species (Common Pochard Aythya farina ,River Tern Sterna aurantia)belong to Vulnerable (VU) category, 11 species belong to Near threatened (NT) category and 136 species belong to least concern (LC) category(figure.5). As per abundance status Bird were categorised into 4 categories: 34% (50 species) were Very Common and 29% (44 species) were Common, 34% (50 species) were Uncommon and 3% (5 species) were Rare (figure.3). During the Physico-chemical analysis highest pH was recorded in the month of January (8.62) while lowest was recorded in the month of June (6.5), highest DO (mg/L) was recorded in the month of August (7.64 mg/L) while lowest was recorded in the month of May (3.45 mg/L), highest BOD (mg/L) was recorded in the month of January while lowest was recorded in the month of May, highest TS (mg/L) was recorded in the month of May (977 mg/L) while lowest was recorded in the month of September (604 mg/L), highest TDS (mg/L) was recorded in the month of May (425 mg/L) while lowest was recorded in the month of September(246 mg/L), highest TSS (mg/L) was recorded in the month of May (552 mg/L) while lowest was recorded in the month of September (358 mg/L) (table.2).Lower values of Dominance_D and Berger-Parker and Higher values of Simpson_1-D, Shannon H, Margalef and Fisher_alpha indicate a good diversity of Avian fauna is observed at Chhaya wetland (table.3).

Status and Abundance						
Common Name	Scientific Name	Order	Family	IUC	Residential	Abunda
			-	IN	Status	nce
Black kite	Milvus migrans		Accipitridae	LC	R	VC
Black-winged Kite	Elanus caeruleus			LC	R	С
Brahminy Kite	Haliasturindus			LC	WM	UC
Eurasian Marsh- Harrier	Circus aeruginosus	Accipitriformes		LC	WM	С
Shikra	Accipiter badius	-		LC	R	VC
Osprey	Pandion haliaetus		Pandionidae	LC	WM	С
Common Pochard	Aythya ferina			VU	WM	UC
Cotton Pygmy- Goose	Nettapus coromandelianus	Anseriformes	Anatidae	LC	WM	R
Eurasian Wigeon	Marecapenelope			LC	WM	UC
Ferruginous Duck	Aythya nyroca			NT	WM	UC

Table.1: Checklist of Birds of Chhaya wetland Porbandar, Gujarat, India (January 2021 to December 202) showing Bird's Common name, Scientific name, Family, IUCN status, Residential

Gadwall	Mareca strepera			LC	WM	UC
Garganey	Anas querquedula			LC	WM	
Croop winged Teel	Anas garolinonsis			LC		00 C
Indian Crost hilled	Anus curonnensis			LC	VVIVI	L
Duck	Anas poecilorhyncha			LC	R	VC
Knob-billed Duck	Sarkidiornis melanotos			LC	R	VC
Lesser Whistling-	Dendrocygnajavanica			LC	WM	С
Northorn Dintail	Anas acuta			LC	W1M	UC
	Anas acuta			LC	VVIVI	UL C
Northern Snoveler	Spatula clypeata			LC	VV IVI	L
Ruddy Shelduck	Tadornaferruginea			LC	VV M	
Tuffed Duck	Aythya fuligula			LC	WM	UL
Asian Palm-Swift	Cypsiurusbalasiensis	Apodiformes	Apodidae	LC	R	C
Little Swift	Apus affinis	I	I	LC	WM	С
Eurasian Hoopoe	Upupa epops	Bucerotiformes	Upupidae	LC	wm	С
Great Thick-knee	Esacusrecurvirostris		Burhinidae	NT	R	UC
Indian Thick-knee	Burhinus indicus		Durminuae	LC	R	С
Greater Sand	Chanadrius loosh on aultii			LC	14714	UC
Plover	Charaanus leschenaulli			LC	VVIVI	UL
Kentish Plover	Charadrius alexandrinus			LC	WM	UC
Lesser Sand-Plover	Charadrius mongolus			LC	WM	С
Little Ringed Plover	Charadrius dubius		Charadriidae	LC	WM	VC
Pacific Golden- Plover	Pluvialis fulva			LC	WM	UC
Red-wattled	Vanellus indicus			LC	R	VC
Pheasant-tailed	Hydrophasia		Iacanidae	LC	14754	шс
Jacana	nuschirurgus		Jacanidae	LC	VVIM	UL
Black-headed Gull	Chroicocephalus ridibundus			LC	R	VC
Bridled Tern	Onychoprionanaethetus			LC	WM	UC
Brown-headed Gull	Chroicocephalusbrunnic enhalus			LC	R	С
Caspian Tern	Hydroproanecaspia			LC	WM	UC
Gull-hilled Tern	Gelochelidonnilotica		T 1	LC	WM	UC
Lesser Black-	delochendomnioticu		Laridae	ЦС	**1*1	00
backed Gull	Larus fuscus			LC	WM	UC
Pallas's Gull	Ichthvaetusichthvaetus			LC	WM	ſ
River Tern	Sterna aurantia			VII	R	VC
Slandar billad Cull	Chroicoganh gluggangi	Charadriiformes				
Whichered Term	Chlidaniaahuhrida			LC	VVIVI	
Dla ala suria da di Chilta				LC	VV IVI	
Black-willged Stilt	Himantopus himantopus		Recurvirostridae	LC	K	VL C
Pied Avocet	Recurvirostraavosetta			LU	VV IVI	L
Bar-tailed Godwit	Limosalapponica			NI	W M	UL
Black-tailed Godwit	Limosalimosa			NT	WM	C
Greenshank	Tringanebularia			LC	WM	UC
Common Redshank	Tringatotanus			LC	WM	С
Common Sandpiper	Actitishypoleucos			LC	WM	VC
Common Snine	Gallinaaoaallinaao			LC	WM	C
				NUT		
Curlew Sandpiper	Callaris ferruginea			NI	VV M	
Eurasian Curlew	Numenius arquata			NT	WM	00
Green Sandpiper	Tringaochropus		Scolopacidae	LC	WM	C
Little Stint	Calidris minuta			LC	WM	C
Marsh Sandpiper	Tringastagnatilis			LC	WM	С
Red-necked Phalarope	Phalaropuslobatus			LC	WM	R
Ruddy Turnstone	Arenaria interpres			LC	WM	UC
Ruff	Calidris puanax			LC	WM	UC
Spotted Redshank	Tringaervthropus			LC	WM	UC
Temminck's Stint	Calidris temminckii			LC	WM	UC
Terek Sandniner	Xenus cinereus			LC	WM	UC
Wood Sandniner	Trinaaalareola			LC	WM	IIC
Asjan Openhill	Anastomusoscitans	Ciconiiformes	Ciconiidae	IC	W/M	
risiali Opelibili	11111310111130301111113	Giconniornies	Giconnuae	ЪС	V V 1 V 1	06

Painted Stork	Mycteria leucocephala			NT	R	VC
Eurasian Collared-	Strentoneliadecaocto			IC	R	VC
Dove	Streptopenudecuocto	Columbiformes	Columbidae	LC	K	VC
Laughing Dove	Spilopelia senegalensis	Gorambirorines	Gorambiaac	LC	R	C
Rock Pigeon	Columba livia			LC	R	VC
Pied Kingfisher	Ceryleruais		Alcodinidao	LC	K	Ĺ
Kingfisher	Halcyon smyrnensis	Coraciiformes	Alceuiniuae	LC	R	VC
Green Bee-eater	Meropsorientalis		Meropidae	LC	R	VC
Asian Koel	Eudynamysscolopaceus	C 1:C		LC	R	VC
Greater Coucal	Centropus sinensis	Cuculiformes	Cuculidae	LC	R	VC
Peregrine Falcon	Falco peregrinus	Falconiformes	Falconidae	LC	WM	UC
Gray Francolin	Ortygornispondicerianus	Galliformes	Phasianidae	LC	R	VC
Indian Peafowl	Pavocristatus	damformes	Thushamaac	LC	R	VC
Common Crane	Grus grus		Gruidae	LC	WM	R
Demoiselle Crane	Grus virgo			LC	WM	C
Baillon's Crake	Porzanapusilla			LC	VV M	
Eurosian Coot	Eulicaatra				WM	VC
Eurasian Moorhen	Gallinula chloronus	Gruiformes			R	VC
Grav-headed	Guillinaia chioropas	dranormes	Rallidae	LC	IX.	٧C
Swamphen	Porphyriopoliocephalus		Turrate o	LC	R	C
Little Crake	Porzana parva			LC	WM	R
White-breasted	Amaurornisnhoanicurus			IC	p	VC
Waterhen	Amuurormsphoemcurus			LC	К	٧C
Clamorous Reed Warbler	Acrocephalusstentoreus		Acrocenhalidae	LC	WM	VC
Paddyfield Warbler	Acrocephalusagricola		P	LC	WM	С
Common Iora	Aegithina tiphia		Aegithinidae	LC	R	С
Ashy-crowned	Eremopterix griseus			LC	R	VC
Crested Lark	Galerida cristata		Alaudidae	LC	R	C
Rufous-tailed Lark	Ammomanesphoenicura		mauaraac	LC	R	VC
Sand Lark	Calandrellaraytal			LC	R	UC
Common Tailorbird	Orthotomussutorius			LC	R	VC
Plain Prinia	Priniainornata		Cisticolidae	LC	R	VC
House Crow	Corvus splendens			LC	R	VC
Large-billed crow	Corvus macrorhynchos		Corvidae	LC	R	С
Rufous Treepie	Dendrocittavagabunda			LC	R	VC
Ashy Drongo	Dicrurusleucophaeus		Dicruridae	LC	R	UC
Black Drongo	Dicrurusmacrocercus		Dici ul luae	LC	R	VC
Indian Silverbill	Euodicemalabarica		Estrildidae	LC	R	VC
Bank Swallow	Riparia riparia			LC	WM	UC
Barn Swallow	Hirundorustica			LC	WM	UC
Dusky Crag-Martin	Ptyonoprogne concolor	Passeriformes		LC	K	C
Martin	Riparia chinensis	i abber ger mee	Hirundinidae	LC	WM	UC
Red-rumped Swallow	Cecropisdaurica			LC	R	С
Wire-tailed	Hirundosmithii			LC	R	С
Jsabelline Shrike	Laniusisahallinus		Laniidae	IC	WM	ШС
Common Babbler	Aravacaudata		Lannuae	LC	R	VC
Iungle Babbler	Arava striata		Leiothrichidae	LC	R	VC
Paddyfield Pipit	Anthusrufulus			LC	WM	UC
Tawny Pipit	Anthus campestris			LC	WM	UC
Western Yellow	Motacilla flava		Motacillidaa	LC	WM	С
White Waotail	Motacilla alba		motaciiiiude	LC	WM	VC
White-browed	Motacillamaderasnatens				-	
Wagtail	is			LC	R	С
Bluethroat	Luscinia svecica			LC	WM	UC
Indian Robin	Saxicoloidesfulicatus		Muscicapidae	LC	R	VC
Robin	Copsychussaularis			LC	R	VC

Siberian Stonechat	Saxicola maurus			LC	WM	С
Purple Sunbird	Cinnyris asiaticus		Nectariniidae	LC	R	VC
House Sparrow	Passer domesticus			LC	R	VC
Yellow-throated Sparrow	Gymnorisxanthocollis		Passeridae	LC	R	С
Common Chiffchaff	Phylloscopuscollybita		Phylloscopidae	LC	WM	UC
Red-vented Bulbul	Pycnonotuscafer		Pycnonotidae	LC	R	VC
Bank Myna	Acridotheresginginianus			LC	R	С
Common Myna	Acridotheres tristis		Sturnidae	LC	R	VC
Rosy Starling	Pastor roseus			LC	R	VC
Cattle Egret	Bubulcus ibis			LC	R	VC
Gray Heron	Ardea cinerea			LC	R	С
Great Egret	Ardea alba			LC	R	UC
Indian Pond-Heron	ArdeolaGreyii			LC	R	VC
Intermediate Egret	Ardea intermedia		Ardeidae	LC	R	VC
Little Egret	Egrettagarzetta			LC	R	VC
Purple Heron	Ardea purpurea		-	LC	R	С
Western Reef- Heron	Egrettagularis	Pelecaniformes		LC	R	С
Dalmatian Pelican	Pelecanus crispus		Delessides	NT	WM	UC
Great White Pelican	Pelecanusonocrotalus		Pelecanidae	LC	WM	UC
Plack headed ibia	Threskiornism			NT	D	C
DIACK-ITEAUEU IDIS	elanocephalus		Thugalianithid	IN I	К	L
Eurasian Spoonbill	Platalealeucorodia		ae	LC	R	С
Glossy Ibis	Plegadisfalcinellus			LC	WM	UC
Red-naped Ibis	Pseudibispapillosa			LC	R	VC
Greater Flamingo	Phoenicopterus roseus	Phoenicopteri-	Phoonicontoridao	LC	WM	UC
Lesser Flamingo	Phoeniconaias minor	formes	Filoeiiicopteriuae	NT	R	VC
Eared Grebe	Podiceps nigricollis			LC	WM	R
Great Crested Grebe	Podiceps cristatus	Podicipediformes	Podicipedidae	LC	WM	UC
Little Grebe	Tachybaptus ruficollis			LC	R	VC
Rose-ringed Parakeet	Psittaculakrameri	Psittaciformes	Psittaculidae	LC	R	VC
Chestnut-bellied Sandgrouse	Pteroclesexustus	Pterocliformes	Pteroclidae	LC	R	UC
Oriental Darter	Anhinga melanogaster		Anhingidae	NT	R	С
Indian Cormorant	Phalacrocorax fuscicollis	Suliformes	Phalacrocoracida	LC	WM	С
Little Cormorant	Microcarboniger		е	LC	R	VC

IUCN status: vulnerable (VU), near threatened (NT) and least concern (LC) category (Source: <u>https://www.iucnredlist.org/</u>).

Residential status: Resident (RE) and Winter migrant (WM).

Abundance status: Very common (VC), Common (C), Uncommon (UC) & Rare (R).



Figure.2:Order wise distribution of Avian fauna

Order Passeriformes represents highest no. of families (17)and species (41) of total Avian families followed by Charadriiformes with (6) families and (39) species. (Figure 2).



Figure.3:Abundance status

As per the abundance status of Avian diversity, (34%)species were Categorised as Very Common (VC), (29%) species as Common (C), (34%) species as Uncommon (UC) and (3%) species were Rare (R) (Figure 3)





As per the residential status of Avian diversity,(52%) species were winter migrant (WM),while (48%) species were resident (RE) (Figure 4)



Figure.5:IUCN Status

As per the IUCN status (91%) species belongs to Least concern category, (8%) species belongs to Near threatened and (1%) species belongs to Vulnerable category (Figure 5)





Figure 6: No of species (January 2021 to December 2021)

Maximum no of species was recorded in the month of February (149 species) and lowest no of species were recorded in the month of May (61 species) (Figure 6)

Table.2: Physico-chemical parameters of Chhaya wetland, Porbandar, Gujarat, India (January
2021 to December 2021)

Physical chamical Parameters	рН	DO	BOD	TS	TDS	TSS
Filysico-chemical Farameters	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
January	8.62	5.8	3.86	868	358	510
February	8.15	5.6	3.7	888	365	523
March	7.62	4.66	3.5	927	387	540
April	7.16	3.9	2.89	957	412	545
Мау	6.73	3.45	1.9	977	425	552
June	6.5	4.12	2.68	956	415	541
July	6.87	6.1	2.83	864	371	493
August	7.12	7.64	3.23	737	310	427
September	7.86	7.6	3.11	604	246	358
October	7.79	6.89	3.38	651	275	376
November	8.12	6.45	3.25	728	316	412
December	8.36	6.2	3.48	765	328	437

Table.3: Diversity indices					
Dominance_D	0.03683				
Simpson_1-D	0.9632				
Shannon_H	3.526				
Evenness_e^H/S	0.7228				
Brillouin	3.458				
Menhinick	1.321				
Margalef	6.44				
Equitability_J	0.9157				
Fisher_alpha	9.618				
Berger-Parker	0.08933				

DISCUSSION

During the study we recorded 149 species of birds (January 2021 to December 2021). 77 species were winter migrants Accounting to 52% species of total avian fauna at Chhaya wetland. This habitat attracts a good number of winter migrants. Highest species richness was observed during winter season, making Chhaya wetland a preferred site for winter visitors. Kushwaha et al., 2021 studied that the wetlands in Suhelwa Wildlife Sanctuary have strong potential to support the rich diversity of wetland birds, including the important migratory species.

Worldwide destruction of wetland is being experienced by many countries as reported by Davidson [5]. Similarly, Chhaya wetland is also under great pressure due to anthropogenic activities going around it.

Order Passeriformes were more abundant followed by charadiformes and Pelecaniformes. Gibru and Mengesha [9] recorded higher abundance of Charadiformes next to order Passeriformes during their study on Species composition, seasonal abundance and distribution of avifauna in the Eastern Wetland habitats.

During December, January and February, bird diversity as well as winter migrants observed abundantly. Meena *et al.*, [17] reported thehighest population of the migratory birds during the month of December January and February.

Two species (Common Pochard *Aythya farina*, River Tern *Sterna aurantia*) belong to Vulnerable (VU) category were reported at Chhaya Wetland making it an important site along with 11 species (Lesser Flamingo *Phoeniconaias minor*, Dalmatian Pelican *Pelecanus crispus*, Oriental Darter *Anhinga melanogaster*, Black-headed ibis *Threskiornismelanocephalus*,Eurasian Curlew *Numenius arquata*, Curlew Sandpiper *Calidris ferruginea*,Black-tailed Godwit *Limosalimosa*, Bar-tailed Godwit *Limosalapponica*, Painted Stork *Mycteria leucocephala*, Great Thick-knee *Esacusrecurvirostris*, Ferruginous Duck *Aythya nyroca*) belonging to Near threatened (NT) category.And 136 species belong to least concern (LC). Vargiya & Chakraborty,[28] recorded one (1.4% of all species) Vulnerable species (Common Pochard Aythya ferina), six (8.5%) Near Threatened species (Lesser Flamingo, Oriental Darter Anhinga melanogaster, Dalmatan Pelican Pelecanus crispus, Black-headed Ibis Threskiornism elanocephalus, Black-tailed Godwit Limosalimosa, and River Tern Sterna auranta), and 63 (82.9%) species listed as of Least Concern from Chhaya wetland.

Chhaya wetland has a good potential to become a Ramsar site due to high number of Waterbirds and winter migrants. As per the current situation the wetland is under the huge anthropogenic pressure, such as household construction and acquisition of land in the name of urbanization around the wetland. Vargiya & Chakraborty,[28]observed that The ChhayaRann wetland complex has been influenced by salt and soda ash from the past salt production. In recent years, the main source of water has been domestic sewage and rain water. As it appears that these conditions are still conducive to attract the flamingos and other waterbirds and in internationally important numbers (>20,000 individuals) as per Criterion five of the Ramsar Convention on Wetlands, it is important for the state and nationalauthorities to propose formal designation of the area as a Ramsar site.

Lower pH level in May and June maybe is an indication of high microbial activity due to increase in environmental temperature. Sonowal & Baruah, [25] reported the lower pH during monsoon is caused due to high turbidity, and in summers, the high temperature enhances microbial activity, causing excessive production of CO2 and reduced pH.

Lower levels of DO (Dissolved oxygen) was observed in the month of may and highest in the month of August. BOD (Biological oxygen demand) was highest in January and lowest in the month of May. As the birds of wetland depend majorly on the micro fauna, good amount of micro faunal activity may have been the reason for increased BOD, as both Bird diversity and BOD levels both are highest in the January and February. Similarly lower BOD levels and bird diversity was observed in the month of May.

CONCLUSION

This study on Chhaya wetland helped us understand the importance of Chhaya wetland as adecent habitat for Avian Fauna. A total of 149 species of birds were recorded during the study (January – December 2021) out of which 77 (52%) were winter migrants. Although the wetland is surrounded by housing colonies and industry, it still remains a preferred site for these winter birds. Thus, conservation of such habitat is highly recommended. Conservation of such wetland can help preserve the Avian diversity of the Chhaya wetland and other organism which are directly or indirectly related to the Avian diversity.

CONFLICT OF INTEREST:

The authors have no conflicts of interest to declare.

ACKNOWLEDGMENT

Authors acknowledge Bhakta Kavi Narsinh Mehta University, Junagadh for providing the infrastructure for conducting the experiments in the laboratory. VM is thankful to Government of Gujarat, for providing funds through 'ScHemeOf Developing High quality research' (SHODH) scholarship.

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CITATION OF THIS ARTICLE

Malay A. Vyas, Jatin V. Raval, Dhaval Vargiya & Ravi K. Patel. Avian diversity and Physio-chemical parameters of Chhaya wetland, Porbandar, Gujarat, India.Bull. Env.Pharmacol. Life Sci., Vol 11[10] August 2022 : 39-49.