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DIVERSITY OF WATERBIRDS FROM COASTAL AGROECOSYSTEM, CENTRAL KERALA, INDIA

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AUTHOR'S CONTRIBUTION
The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

Coastal Agroecosystem (Pokkali Farming) has been identified with a high waterbird density. In this study, we analysed the waterbird diversity and their current threats in Pokkali farming during February 2021- January 2022. Bird survey was carried out using the Direct Observation Method, Point Count Method and Line Transect Method. A total of 31 species of waterbirds belonging to 8 orders and 14 families were recorded. All bird species are included in Least Concern of the IUCN Category except three species. Three bird species are Globally Threatened ones and these are recorded from Pokali wetland. They are: Oriental Darter (*Anhinga melanogaster*), Spot-billed Pelican (*Pelecanus philippensis*) and Black headed Ibis (*Threskiornis melanocephalus*). Most threats to birds are the cause of human actions. The leading threats observed in our sampling site are Habitat destruction, Electric lines, Fishing nets inside the water affects mainly cormorants, Feral dogs and other Predators, Communication tower, flood, climate change, hunting of waterbirds,, hunting, loss of employees, Solid waste, plastics, water hyacinth, water and soil pollution.

Keywords: Pokkali wetland; waterbirds; current threats.

1. INTRODUCTION

Coastal Agroecosystem is a unique system of Rice cultivation found only in the coastal areas of Central Kerala [1]. It is a traditional and organic method of rice farming practices in Ernakulum, Alappuzha and Thrissur districts bordering the Arabian Sea [2]. Wetlands are highly productive ecosystems [3] and it provides the home of many threatened waterbird Species [4]. Birds are one of the indicators for concentrating on ecological issues [5]. Wetlands support different activities of birds like foraging, feeding, moving, resting, calling, preening, chasing etc. [6]. The Pokkali system utilizes the relationship between Rice farming and Shrimp or fish farming [7]. Rice cultivation is not profitable but the pokkali farming includes both rice and prawn cultivation and it is highly profitable [8]. The economic importance

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of Pokkali is high. Pokkali requires no pesticides or fertilizers through their farming time. Pokkali is an organic salt resistant rice variety [9]. Rice cultivation can start in June and end in September or the first week of October. In April and May, the farm can be prepared for Rice cultivation. October, it can be ready for prawn or fish farming. Prawn or fish farming starts in November and end in March. The present study was aimed to document the waterbird diversity, globally threatened waterbird species during February 2021 to January 2022 and their current Threats in pokkali farming, Central Kerala.

2. MATERIALS AND METHODS

2.1 Study Area

The Pokali field (Kochuvavakkad padashekharam) was located near Pallithode Bridge (9° 46' 35.99"N, 76° 17' 9.71"E), Thuravoor. Pallithode is a village in the Alappuzha district of the state of Kerala, India, on the shores of the Arabian Sea. Pallithode is within the Gram Panchayat of Kuthiathode, Pattanakkad Block of Cherthala Taluk. It is a green, palm-fringed, scenic village in the coastal region of Kerala, on a narrow strip of land, with white, sandy beaches bordering the Arabian Sea to the west, and a lake (kayal), the Pallithode Pozhi, a part of the Cochin estuary to the east, as well as extensive, interconnected paddy fields and backwaters to the east of the Pozhi. Chappakadavu beach, in South Pallithode, provides local fishing boats access to the sea. Chellanam is to the north; Valiathode, Parayakad, Chavadi, and Thuravoor are to the east; Andhakaranazhy (4 kilometres (2.5 mi) west of National Highway 66 at Pattanakad), Manokkam Harbor, Azheekal, and Ottamassery are to the south

2.2 Methodology

The study site was observed four times in a month during 6:00h–12:00 h. The present study was conducted during February 2021 to January 2022. Observations were made using binoculars (10 × 50 Nikon) and 4k series DSLR Video Camera (Nikon Coolpix p1000). Data were collected in the following methods - Direct Observation method [10], Point Count [11,12] and Line Transect Method [13]. Bird species can be identified with the help of Field Guide [14,15]. Different activities of birds were recorded as foraging and feeding, moving, resting, calling, preening, chasing etc. [6]. Using the Point count method the observer reaches at the Centre of the point count plots and records all birds seen or heard for a period of 10 to 15 minutes [16]. Point counts were performed in the morning, beginning with high bird activity. To avoid performing point count in days with heavy rain and stronger wind [17]. Line Transect method walk through a transact will be used to record the total number of water birds from one scanning point to adjoin one (approximately 500m) along a designated transact line [13]. When standing at each transacted sample point for a ten minute period, birds seen or heard were recorded [18].

3. RESULTS

A total of 31 species of waterbirds were recorded (Table 1). Waterbirds belong to 8 orders and 14 families. The different water birds are Cotton Pygmy Goose (*Nettapus coromandelianus*), Lesser Whistling Duck (*Dendrocygna javanica*), Garganey (*Spatula querquedula*), White – throated kingfisher (*Halcyon smyrnensis*), Stork – billed kingfisher (*Pelargopsis capensis*),Common kingfisher (*Alcedo atthis*), White breasted waterhen (*Amaurornis phoenicurus*), Purple swamphen (*Porphyrio porphyrio*), Oriental darter (*Anhinga melanogaster*), Little cormorant (*Microcarbo niger*) Great cormorant (*Phalacrocorax carbo*), Indian cormorant (*Phalacrocorax fuscicollis*), Little egret (*Egretta garzetta*), Great egret (*Ardea alba*), Median egret (*Ardea intermedia*), Indian pond heron (*Ardeola grayii*), Grey heron (*Ardea cinerea*), Purple heron (*Ardea purpurea*), Western reef heron (*Egretta gularis*), Cattle Egret (*Bubulcus ibis*), Spot – Billed Pelican (*Pelecanus philippensis*), Black-headed ibis (*Threskiornis melanocephalus*), Painted stork (*Mycteria leucocephala*), Little grebe (*Tachybaptus ruficollis*), Green sandpiper (*Tringa ochropus*), Wood sandpiper (*Tringa glareola*), Whiskered tern (*Chlidonias hybrid*), Little ringed plover (*Charadrius dubius*), Red wattled lapwing (*Vanellus indicus*), Yellow wattled lapwing (*Vanellus malabaricus*), Black-winged stilt (*Himantopus himantopus*).

All bird species are included in Least Concern of the IUCN Category. In India, 153 bird species are Globally Threatened [19]. Three globally threatened waterbird (Table 2) species were recorded from Pokkali wetland. They are: Oriental Darter (*Anhinga melanogaster*), Spot-billed Pelican (*Pelecanus philippensis*) and Black headed Ibis (*Threskiornis melanocephalus*). The Abundance of waterbirds can be categorised into (COM) – seen on most of the visits, Uncommon (UC) – seen on a few visits and Rare (R) – seen once or twice. About 32.26% of the waterbirds are Uncommon to the area, 48.39% of birds are common and 19.35% are Rare ones (Fig. 1).

Table 1. Checklist of waterbirds recorded in the Pallithodu area

Sl. No.	Order & Family	Scientific Name	Common Name	Abundance	IUCN
1.	**Anseriformes**				
	Anatidae	*Nettapus coromandelianus*	Cotton Pygmy Goose	UC	LC
		Dendrocygna javanica	Lesser Whistling Duck	COM	LC
		Spatula querquedula	Garganey	UC	LC
2.	**Coraciiformes**				
	Alcedinidae	*Halcyon smyrnensis*	White – throated kingfisher	COM	LC
		Pelargopsis capensis	Stork – billed kingfisher	UC	LC
		Alcedo atthis	Common kingfisher	UC	LC
3.	**Gruiformes**				
	Rallidae	*Amaurornis hoenicurus*	White breasted waterhen	COM	LC
		Porphyrio porphyrio	Purple swamphen	COM	LC
4.	**Suliformes**				
	Anhingidae	*Anhinga melanogaster*	Oriental darter	UC	NT
	Phalacrocoracidae	*Microcarbo niger*	Little cormorant	COM	LC
		Phalacrocorax carbo	Great cormorant	R	LC
		Phalacrocorax fuscicollis	Indian cormorant	R	LC
5.	**Pelecaniformes**				
	Ardeidae	*Egretta garzetta*	Little egret	COM	LC
		Ardea alba	Great egret	COM	LC
		Ardea intermedia	Median egret	COM	LC
		Ardeola grayii	Indian pond heron	COM	LC
		Ardea cinerea	Grey heron	COM	LC
		Ardea purpurea	Purple heron	COM	LC
		Egretta gularis	Western reef heron	R	LC
	Pelecanidae	*Bubulcus ibis*	Cattle egret	R	LC
	Threskiornithidae	*Pelecanus philippensis*	Spot-billed pelican	UC	NT
		Threskiornis melanocephalus	Black-headed ibis	UC	NT
6.	**Ciconiiformes**				
	Ciconiidae	*Mycteria leucocephala*	Painted Stork	R	LC
7.	**Podicipediformes**				
	Podicipedidae	*Tachybaptus ruficollis*	Little grebe	UC	LC
8.	**Charadriiformes**				
	Scolopacidae	*Tringa ochropus*	Green sandpiper	COM	LC
		Tringa glareola	Wood sandpiper	COM	LC
	Laridae	*Chlidonias hybrid*	Whiskered tern	COM	LC
	Charadriidae	*Charadrius dubius*	Little ringed plover	R	LC
		Vanellus indicus	Red wattled lapwing	UC	LC

Sl. No.	Order & Family	Scientific Name	Common Name	Abundance	IUCN
		Vanellus malabaricus	Yellow wattled lapwing	COM	LC
	Recurvirostridae	*Himantopus himantopus*	Black-winged stilt		

Abundance
COM- COMMON
UC – UNCOMMON
R - RARE

Table 2. Globally Threatened waterbirds from Pokkali wetland

Sl. No.	Species (Common Name)	Scientific Name
1.	Oriental Darter	*Anhinga melanogaster*
2.	Spot-billed Pelican	*Pelecanus philippensis*
3.	Black headed Ibis	*Threskiornis melanocephalus*

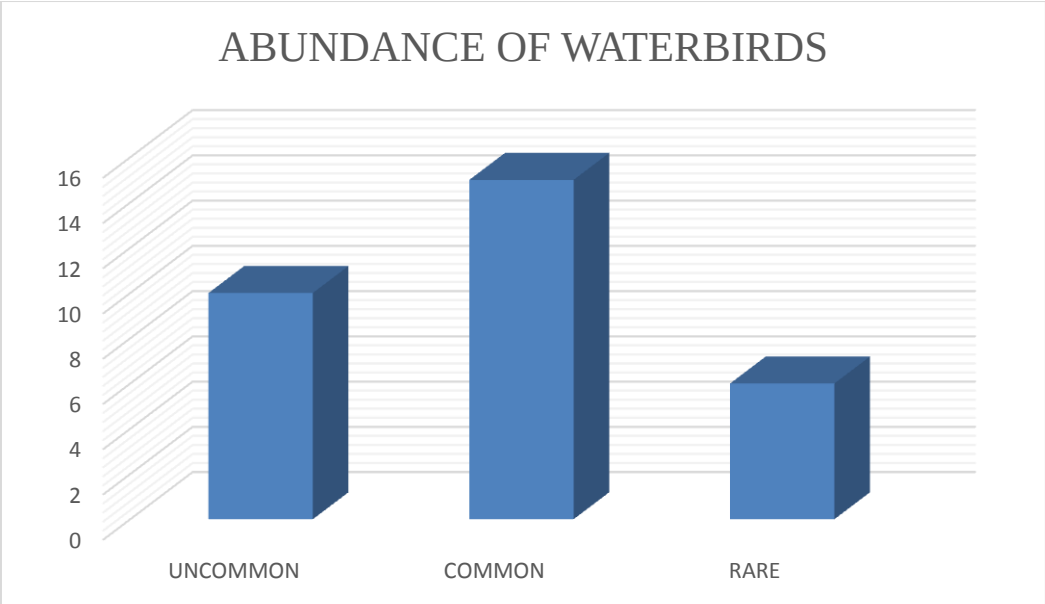

Fig. 1. Abundance of waterbirds

Fig. 2. Nest of spot billed Pelican

During the winter season (2021-2022), we have observed a few nests of Spot-billed Pelicans (Fig. 2). The nesting and parental care of Spot-billed Pelicans are very interesting. Using their large beaks they damage the top of coconut trees and construct their nest. Interesting behaviour about that, all the time they care for their family members and young ones. In addition to water birds we counted the shorebirds also. They are Green Sandpiper, Wood Sandpiper, Whiskered tern, Little ringed plover, Red wattled lapwing, Yellow wattled lapwing and Black winged stilt.

Many factors which threaten the bird population were identified during the study. Most threats are the cause of human actions. The leading threats observed in our sampling sites include Habitat destruction, Electric lines (Fig. 6), feral dogs and other Predators (Fig. 3), Communication tower, flood, climate change, hunting, loss of employees, Solid wastes, water hyacinth (Fig. 7), plastics (Fig. 5), water and soil pollution, Fishing net (Fig. 4). Two types of fishing nets were used in the sampling area. One is covered by water sources (Prawn farming) and other is dipped inside the water. Both type of nets affect the Open water species like Cormorants and Darters.

The leading threats to bird survival include:

Fig. 3. Predator (feral dog)

Fig. 4. Fishing net

Fig. 5. Plastics

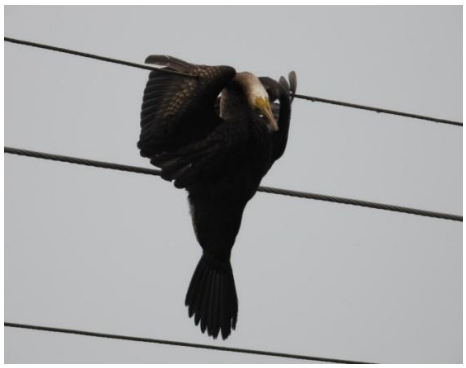

Fig. 6. Electric lines

Fig. 7. Water hyacinth

4. DISCUSSION

The present study documented the waterbird diversity of different sampling sites from February 2021 – January 2022. Along with that, we had observed different types of shore birds and globally threatened ones. Sampling site are the major feeding grounds of many Egrets, Herons, Cormorants and other waterbirds. The abundance of waterbirds is high in the Saline agroecosystem. Saline Agroecosystem consists of two farming practices (Pokkali farming) – Rice farming and Prawn farming. Most of the time the farm contains water sources. All water birds prefer their habitat in Open water and Water edges. This is the reason where the most waterbirds are observed in saline Agroecosystem.

Diversity of avifauna is one of the most important ecological indicators to evaluate the integrity and stability of ecosystem structure and functions [20]. Wetlands are very important for the conservation of waterbirds. Many avian species are very limited in population and hence these are very close to extinction because of disturbance, destruction or conversion of their habitats and pouching by humans and animals [21]. Due to past and ongoing destruction and degradation of coastal and inland wetlands, many of these species are now threatened with extinction. Habitat protection is important to conserve bird communities. Large wetlands normally receive all the importance while smaller and isolated wetlands receive least attention and are often neglected from conservation priorities [22].

In India, 153 bird species are Globally Threatened [19]. Of these, Common pochard (*Aythya farina*), Marbled duck (*Marmaronetta angustirostris*), White-headed duck (*Oxyura leucocephala*) are three globally threatened waterbirds collected from Morocco at winter time [23]. Three species of waterbirds are Globally Threatened and these are observed from our sampling sites. They are: Oriental Darter (*Anhinga melanogaster*), Spot-billed Pelican (*Pelecanus philippensis*) and Black headed Ibis (*Threskiornis melanocephalus*). 13 species of globally threatened shorebirds had been observed at Nijhum Dwip National Park [24]. The Blue winged Goose (*Cyanochen cyanoptera*) observed from Lake Arekit, Southern Ethiopia. The abundance of globally threatened waterbirds has been reduced by the effect of invasive plant species, water hyacinth in Nepal [25]. Globally threatened waterbirds are mainly threatened from anthropogenic factors [23].

The different shorebirds had been observed in rice paddies, i.e., black-tailed godwits (*Limosa limosa*), common greenshanks (*Tringa nebularia*), and wood sandpipers (T. *glareola*) [26]. Lesser Yellowlegs (*Tringa flaviped*) is a medium sized shorebird and it can be identified from interior Alaska [27]. 12 Plovers including Piping Plover (*Charadrius melodus*) from Michigan's Lake Superior Shoreline [28]. Shorebirds are migratory and resident birds inhabiting different ecological conditions, mainly shorelines, inland and coastal wetlands, agricultural fields [29] and interior grasslands [30].

Habitat protection is important to conserve bird communities. Major threats being faced by the wetlands are Habitat loss [32], Climate change [33], Solid waste dumping [34], Reclamation [35], Pollution [36,37], waterfowls hunting at wetlands [28], Use of chemical pesticides [39], Flood or sea level rise [40], waste disposals, siltation, and intensive agricultural expansion [41], building dams [42], Disturbance by livestock [43], accidental bycatch shore fishing nets [24] results in the decline in bird population. Migrant birds were disturbed by the action of tourists and local fishermen [34], Poaching [36], Illegal killing (deliberate hunting, poisoning and trapping) [44]. Threats identified for the shorebirds are trapping, lime shell mining, pesticide contamination [45] and shorebirds in fishing gear (Chowdhury et al 2021).

5. CONCLUSION

Wetlands are the most productive ecosystems and it is the home of many waterbirds, shorebirds and globally threatened birds. It helps in maintaining the biodiversity of flora and fauna. Waterbirds use the wetland habitat for feeding, roosting, preening and parental caring, etc. Wetland ecosystems are important for feeding and roosting area of many egrets, herons, cormorants, Shorebirds and other migratory birds and also support important populations of Globally Threatened waterbirds - Oriental Darter, Spot-billed Pelican and Black headed Ibis.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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