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Cover: Coromandal Sacred Langur *Semnopithecus priam* - made with acrylic paint. © P. Kritika.

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COMMUNICATION

Importance of conserving a critical wintering ground for shorebirds in the Valinokkam Lagoon—a first study of the avifaunal distribution of the southeastern coast of India

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Abstract: Any new economic activity in a virgin area brings landscape changes, making it essential to document baseline biodiversity areas to understand the impacts on habitats. Avifaunal inventories are critical for previously undocumented areas like the Valinokkam Lagoon in the Ramanathapuram District of Tamil Nadu, which is an undocumented wintering site for shorebirds in the Central Asain Flyway (CAF). To formulate site and species-specific conservation management tools, the first bird baseline recorded 154 species of 16 orders and 46 families from August 2016 to February 2023. Order-wise, Charadriiformes (47 species) dominated the study area, followed by Passeriformes (39 species) and Pelecaniformes (20 species). Furthermore, according to the IUCN Red List Category, 11 Near Threatened (NT) species, one Endangered (EN) species (Great Knot *Calidris tenuirostris),* and one unassessed Hanuman Plover (*Charadrius seebohmi*) were recorded. The relative abundance indicated that 61 % (94 species) were Common (C), 26.6% (41 species) were uncommon (UC), and 12.3 % (19 species) were rare (Ra). Based on the residential status, winter visitors constituted 37.6 % (58 species) and one Passage Migrant (Rosy Starling *Pastor roseus*). This baseline data emphazises the importance of Valinokkam Lagoon as a crucial wintering site in the CAF on the southeastern coast of India for migratory shorebirds and the need for more conservation priorities for regional endemic birds like Hanuman Plover.

Keywords: Bird migration, Central Asian Flyway, Gulf of Mannar, Hanuman Plover breeding, over summering, waterbirds, winter visitors.

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INTRODUCTION

The documentation on avifaunal diversity and distribution is widely done in India (Ali & Ripley 1987; Rasmussen & Anderton 2005) and has helped to assess long-term landscape changes, ecological assessments, and conservation planning (Kati & Sekercioglu 2006), leading to new management ingenuities (Paul & Cooper 2005). The bird community structure of any area helps in understanding how the landscape changes over time (Kattan & Franco 2004). As a fast-growing economy, the country's push for economic development for population demand is ever-increasing, leading to landscape changes impacting the new virgin areas (Jha et al. 2000; Purvis & Hector 2000; Velenturf & Purnell 2021). Hence, there is a consistent need for monitoring new potential bird areas. For long-term management approaches, local bird monitoring is critical (Gadgil 1996), and baseline knowledge is fundamental (Peterson et al. 2000; Llanos et al. 2011). This helps in understanding the costs of habitation loss, dilapidation, and climate change (Llanos et al. 2011).

The southeast coast of India forms an important path in the Indian subcontinent of the CAF (Balachandran 2006; Sangha 2021), which is the shortest flyway among the migratory pathways (Stroud et al. 2006). Previous studies on the east coast of India revealed the declining trend of shorebird populations and their habitats (Sandilyan et al. 2010; Kannan & Pandiyan 2012; Rashiba et al. 2022; Byju et al. 2023a). The Gulf of Mannar Marine Biosphere Park (GoM) serves as a significant link for both migratory and resident shorebirds on the southeastern coast of India, along with the other Important Bird Areas (IBA) like Chilika Lake in Odisha, Pulicat Lake in Andhra Pradesh, and Point Calimere in Tamil Nadu (Balachandran 2006). Due to its geographical proximity to Sri Lanka, GoM is an important stopover site in the CAF for migratory waterbirds and passerines (Islam & Rahmani 2004). On the Sri Lankan side, there are four IBAs (Anatidal-Thondamannar, Araly South-Punale, Kaithady, and Kayts Island-Mandativu) in the Jaffna District about 10 km away (Anonymous 2003) and has recorded 315 avian species (Birdlife Internatonal 2022) including migratory shorebirds that migrate annually from the northern autumn-winter to the tropics along the CAF (Warakagoda & Sirivardana 2011) with the adjacent Indian mainland (Rasmussen 2005).

Ramanathapuram District of Tamil Nadu holds five bird sanctuaries, including two Ramsar sites and the GoM. Recently, sightings of Artic Skua *Stercorarius parasiticus* (Byju & Raveendran 2022a) and an unusual record of Light-mantled Albatross *Phoebetria palpebrata* (Byju & Raveendran 2022b) from the district highlight the need for continuous monitoring of birds in the rapidly depleting environment and the need of baseline surveys of populations from new extents. Updated avifaunal details from the district have been reported from the 21 islands of GoM (Byju et al. 2023a) and a new wintering site in Karangadu mangroves (Byju et al. 2023b). The intensive and continuous monitoring of shorebirds also revealed three breeding locations of newly elevated taxa Hanuman Plover *Charadrius seebohmi* from the subspecies *Charadrius alexandrinus seebohmi* (Niroshan et al. 2023) in the district (Byju et al. 2023c), which includes the present study site. These findings emphasize the need for baseline data from unexplored areas to help classify areas of conservation significance. This groundwork emphasizes the need to conserve this critical shorebird wintering site in the CAF and suggests elevating this site to protected status.

MATERIALS AND METHODS

Study Area

Valinokkam Lagoon (9.1661 °N, 78.6141 °E) is situated on the southeast coast of India, in the Kadaladi Taluk of Ramanathapuram District in Tamil Nadu. The lagoon is approximately 10.12 km long with an area of 1,145.84 ha and the salt pan adjacent to it constitutes around 1,197.34 ha (Figure 1). Invasive *Prosopis juliflora* and Palmyra Palm *Borassus flabellifer* trees surround the lagoon providing a habitat for a variety of land birds. The State Salt Corporation pumps extra water from the sea and stores in bunds for salt extraction forming a man-made lagoon. This region gradually transformed into a mudflat that was home to several species of birds. The salt pans which continuously harvest salt, contribute to the regular presence of birds in the study site. Fishing activities and prawn culture are found only during a few months when the water is plentiful. Along the edges of the lagoons halophytes can also be seen.

Bird survey method

In Valinokkam Lagoon, bird surveys were done from August 2016 to March 2019 and from August 2020 to February 2023. In the other periods mentioned, incidental bird records were collected through opportunistic encounters. The birds were observed during the peak hours of their activity, from 0600–1000 h and 1600–1800

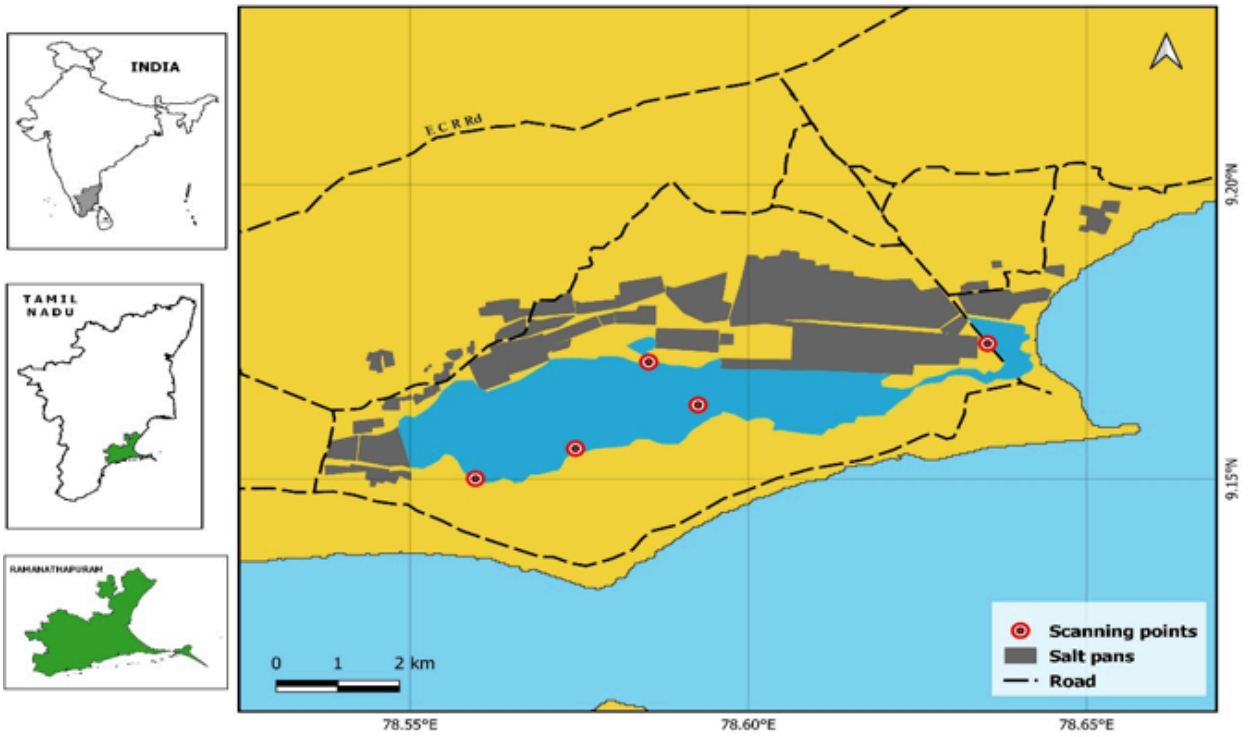

Figure 1. Map of Valinokkam Lagoon with scanning points and the adjacent salt pans.

h. Later, bird surveys were conducted using block count and direct visual count methods (Howes & Bakewell 1989; Bibby et al. 2000). In this method, five scanning points were identified based on the water availability throughout the year and the congregation with a varying distance of 600–1,500 m (Figure 1), and birds in the blocks were observed using Nikon binoculars (10 x 50) and photographed with a Canon 100–400 mm lens and identified with the help of field guides (Grimmett et al. 2011; Hayman et al. 2011). Since this is a man-made lagoon no impact of tides were there for the study. Bird counting started after five minutes at each scanning point to allow the waterbirds to settle down to the human presence. The observations recorded while moving from one scanning point to another were entered as incidental records. The residential status of the birds were grouped under different categories like Resident (R), Resident/ Not Breeding (R/NB)), Passage Migrant (PM), and Winter Visitor (WV) depending on their timing and duration of occurrence (Grimmett et al. 2011). The common name, scientific name, IUCN Red List status, and migratory status are followed (Praveen & Jayapal 2023). With regard to MacKinnon & Phillipps (1993), data were later analyzed for relative abundance based on the number of sightings: common (C) sighted seven to nine times; uncommon (UC) sighted three to six times; rare (Ra) sighted once or twice.

RESULTS AND DISCUSSIONS

Avifauna structure

A total of 154 species of birds belonging to 46 families under 16 orders were recorded from the Valinokkam Lagoon (Table 1) (Image 1–10). Order-wise, Charadriiformes dominated the study site with 47 species, followed by Passeriformes (39 species) and Pelecaniformes (20 species), with the lowest being Pheonicopteriformes, Caprimulgiformes, Bucerotiformes, and Psittaciformes sharing one species each (Figure 2). The highest number of bird species was found to be represented by the family Scolopacidae (22 species), followed by Laridae (12 species), Ardeidae (10 species), Anatidae (nine species) and Charadriidae (nine species) (Figure 3).

The residential status of the birds was: winter visitors (WV) constituted 37.6% (58 species) and one passage migrant (PM) Rosy Starling *Pastor roseus*. The relative abundance indicated that (61%) 94 species were common, 26.6% (41 species) were uncommon, and (12.3%) 19 species were rare. Eleven 'Near Threatened' (NT) species: Bar-tailed Godwit *Limosa lapponica,* Black-headed Ibis *Threskiornis melanocephalus,* Black-tailed Godwit *Limosa limosa*, Curlew Sandpiper *Calidris ferruginea,* Eurasian Curlew *Numenius arquata,* Great Stone-curlew *Esacus recurvirostris*, Oriental

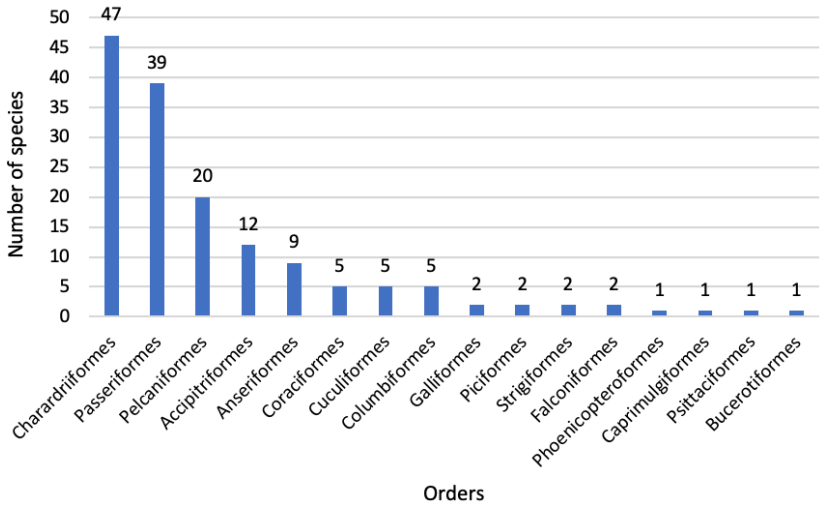

Figure 2. Order-wise representation of bird species at Valinokkam Lagoon.

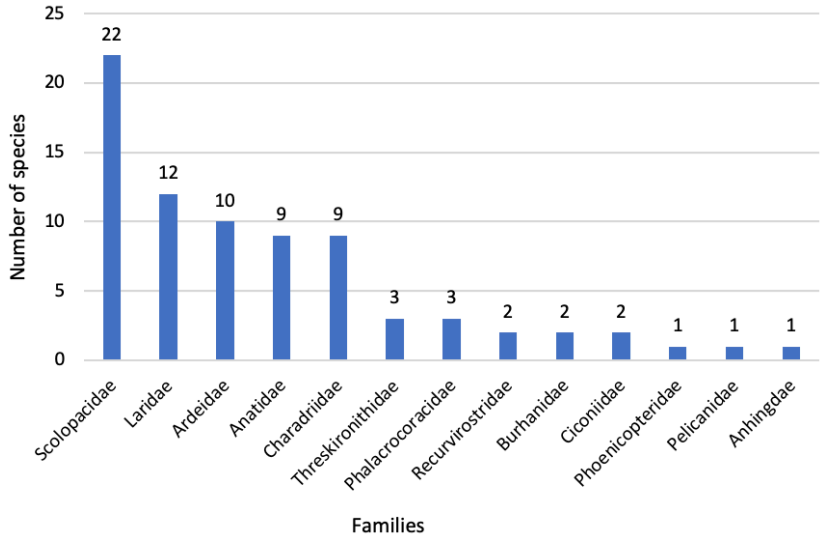

Figure 3. Family-wise representation of waterbirds at Valinokkam Lagoon.

Darter *Anhinga melanogaster*, Painted Stork *Mycteria leucocephala*, Red-necked Stint *Calidris ruficollis,* Red Knot *Calidris canutus,* Spot-billed Pelican *Pelecanus philippensis,* one 'Endangered' (EN) Great Knot *Calidris tenuirostris*, one unassessed Hanuman Plover *Charadrius seebohmi,* and the rest of 141 were of 'Least Concern' (LC) according to the IUCN Red List category.

Valinokkam is a crucial wintering site on the southeastern coast

Tamil Nadu is home to 535 bird species according to Praveen & Jayapal (2023), and Valinokkam recorded 154 species (28.78%). A total of 77 waterbird species reported from this study site, including 35 species of shorebirds, 21 species of large wading birds, nine species of ducks, four species of gulls, and eight species of terns. Six of the nine duck species were winter visitors: Common Teal *Anas crecca*, Bar-headed Goose *Anser indicus*, Greylag Goose *Anser anser*, Garganey *Spatula querquedula,* Northern Shoveler *Spatula clypeata*, and Northern Pintail *Anas acuta*, and the remaining three were residents/not breeding (R/NB) in the area: Knob-billed Duck *Sarkidiornis melanotos*, Indian Spot-billed Duck *Anas poecilorhyncha*, and Lesser Whistling Duck *Dendrocygna javanica*. Except for the Northern Pintail, which was rare, all the other taxa were uncommon among the ducks.

Among the 21 species of large wading birds, including

Table 1. Avifaunal checklist of Valinokkam Lagoon, Ramanathapuram, Tamil Nadu, India.

	Order/Family/Common name	Scientific name	IUCN Red List status	Resident status	Relative abundance
	Anseriformes: Anatidae				
1	Knob-billed Duck	*Sarkidiornis melanotos*	LC	R/NB	UC
2	Common Teal	*Anas crecca*	LC	WV	UC
3	Bar-headed Goose	*Anser indicus*	LC	WV	UC
4	Greylag Goose	*Anser anser*	LC	WV	UC
5	Garganey	*Spatula querquedula*	LC	WV	UC
6	Northern Shoveler	*Spatula clypeata*	LC	WV	UC
7	Indian Spot-billed Duck	*Anas poecilorhyncha*	LC	R/NB	UC
8	Lesser Whistling Duck	*Dendrocygna javanica*	LC	R/NB	UC
9	Northern Pintail	*Anas acuta*	LC	WV	Ra
	Phoenicopteriformes: Phoenicopteridae				
10	Greater Flamingo	*Phoenicopterus roseus*	LC	R/NB	C
	Columbiformes: Columbidae				
11	Rock Pigeon	*Columba livia*	LC	R	C
12	Spotted Dove	*Spilopelia chinensis*	LC	R	C
13	Eurasian collared Dove	*Streptopelia decaocto*	LC	R	C
14	Laughing Dove	*Spilopelia senegalensis*	LC	R	C
15	Red Collared Dove	*Streptopella tranquebarica*	LC	R	UC
	Caprimulgiformes: Apodidae				
16	Asian Palm Swift	*Cypsiurus balasiensis*	LC	R	C
	Cuculiformes: Cuculidae				
17	Asian Koel	*Eudynamys scolopaceus*	LC	R	C
18	Common Hawk Cuckoo	*Hierococcyx varius*	LC	R	Ra
19	Greater Coucal	*Centropus sinensis*	LC	R	C
20	Blue-faced Malkoha	*Phaenicophaeus viridirostris*	LC	R	C
21	Pied Cuckoo	*Clamator jacobinus*	LC	R/NB	C
	Galliformes: Phasianidae				
22	Grey Francolin	*Ortygornis pondicerianus*	LC	R	C
23	Indian Peafowl	*Pavo cristatus*	LC	R	C
	Pelecaniformes: Ciconiidae				
24	Asian Openbill Stork	*Anastomus oscitans*	LC	R/NB	C
25	Painted Stork	*Mycteria leucocephala*	NT	R/NB	C
	Pelecanidae				
26	Spot-billed Pelican	*Pelecanus philippensis*	NT	R/NB	C
	Ardeidae				
27	Black-crowned Night Heron	*Nycticorax nycticorax*	LC	R/NB	C
28	Cattle Egret	*Bubulcus ibis*	LC	R/NB	C
29	Purple Heron	*Ardea purpurea*	LC	R/NB	UC
30	Grey Heron	*Ardea cinerea*	LC	R/NB	C
31	Indian Pond Heron	*Ardeola grayii*	LC	R/NB	C
32	Intermediate Egret	*Ardea intermedia*	LC	R/NB	C
33	Great Egret	*Ardea alba*	LC	R/NB	C
34	Little Egret	*Egretta garzetta*	LC	R/NB	C

	Order/Family/Common name	Scientific name	IUCN Red List status	Resident status	Relative abundance
35	Striated Heron	*Butorides striata*	LC	R/NB	C
36	Western Reef Egret	*Egretta gularis*	LC	LM	UC
	Threskiornithidae				
37	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R/NB	C
38	Eurasian Spoonbill	*Platalea leucorodia*	LC	R/NB	C
39	Glossy Ibis	*Plegadis falcinellus*	LC	R/NB	C
	Phalacrocoracidae				
40	Great Cormorant	*Phalacrocorax carbo*	LC	R/NB	UC
41	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	R/NB	C
42	Little Cormorant	*Microcarbo niger*	LC	R/NB	C
	Anhingidae				
43	Oriental Darter	*Anhinga melanogaster*	NT	R/NB	UC
	Charadriiformes: Recurvirostridae				
44	Black-winged Stilt	*Himantopus himantopus*	LC	R	C
45	Pied Avocet	*Recurvirostra avosetta*	LC	WV	Ra
	Burhinidae				
46	Indian Stone-Curlew	*Burhinus indicus*	LC	R	C
47	Great Stone-Curlew	*Esacus recurvirostris*	NT	R	UC
	Charadriidae				
48	Black-bellied Plover	*Pluvialis squatarola*	LC	WV	C
49	Pacific Golden Plover	*Pluvialis fulva*	LC	WV	Ra
50	Lesser Sand Plover	*Charadrius mongolus*	LC	WV	C
51	Greater Sand Plover	*Charadrius leschenaultii*	LC	WV	C
52	Kentish Plover	*Charadrius alexandrinus*	LC	WV	C
53	Common Ringed Plover	*Charadrius hiaticula*	LC	WV	UC
54	Hanuman Plover	*Charadrius seebohmi*	NA	R	C
55	Little Ringed Plover	*Charadrius dubius*	LC	WV	C
56	Red-wattled Lapwing	*Vanellus indicus*	LC	R	C
	Scolopacidae				
57	Black-tailed Godwit	*Limosa limosa*	NT	WV	UC
58	Bar-tailed Godwit	*Limosa lapponica*	NT	WV	UC
59	Whimbrel	*Numenius phaeopus*	LC	WV	C
60	Eurasian Curlew	*Numenius arquata*	NT	WV	C
61	Temminck's Stint	*Calidris temminckii*	LC	WV	UC
62	Little Stint	*Calidris minuta*	LC	WV	C
63	Ruff	*Calidris pugnax*	LC	WV	UC
64	Curlew Sandpiper	*Calidris ferruginea*	NT	WV	C
65	Dunlin	*Calidris alpina*	LC	WV	Ra
66	Red necked Stint	*Calidris ruficollis*	NT	WV	Ra
67	Common Sandpiper	*Actitis hypoleucos*	LC	WV	UC
68	Ruddy Turnstone	*Arenaria interpres*	LC	WV	C
69	Green Sandpiper	*Tringa ochropus*	LC	WV	C
70	Marsh Sandpiper	*Tringa stagnatilis*	LC	WV	UC
71	Wood Sandpiper	*Tringa glareola*	LC	WV	UC
72	Common Greenshank	*Tringa nebularia*	LC	WV	C

	Order/Family/Common name	Scientific name	IUCN Red List status	Resident status	Relative abundance
73	Common Redshank	*Tringa totanus*	LC	WV	C
74	Terek Sandpiper	*Xenus cinereus*	LC	WV	C
75	Sanderling	*Calidris alba*	LC	WV	UC
76	Great Knot	*Calidris tenuirostris*	EN	WV	UC
77	Red Knot	*Calidris canutus*	NT	WV	UC
78	Common Snipe	*Gallinago gallinago*	LC	WV	UC
	Laridae				
79	Slender-bill Gull	*Chroicocephalus genei*	LC	WV	UC
80	Black-headed Gull	*Chroicocephalus ridibundus*	LC	WV	C
81	Brown-headed Gull	*Chroicocephalus brunnicephalus*	LC	WV	C
82	Lesser Black-backed Gull	*Larus fuscus*	LC	WV	UC
83	Common Tern	*Sterna hirundo*	LC	WV	UC
84	Little Tern	*Sternula albifrons*	LC	WV	UC
85	Caspian Tern	*Hydroprogne caspia*	LC	WV	C
86	Greater Crested Tern	*Thalasseus bergii*	LC	WV	C
87	Lesser Crested Tern	*Thalasseus bengalensis*	LC	WV	C
88	Sandwich Tern	*Thalasseus sandvicensis*	LC	WV	Ra
89	Gull-billed Tern	*Gelochelidon nilotica*	LC	WV	Ra
90	Whiskered Tern	*Chlidonias hybrida*	LC	WV	Ra
	Accipitriformes: Pandionidae				
91	Osprey	*Pandion haliaetus*	LC	WV	Ra
	Accipitridae				
92	Booted Eagle	*Hieraaetus pennatus*	LC	WV	UC
93	Black Kite	*Milvus migrans*	LC	R	C
94	Black-winged Kite	*Elanus caeruleus*	LC	R	C
95	Brahminy Kite	*Haliastur indus*	LC	R	C
96	Shikra	*Accipiter badius*	LC	R	C
97	Short-toed snake eagle	*Circaetus gallicus*	LC	R	C
98	Eurasian Marsh-Harrier	*Circus aeruginosus*	LC	WV	Ra
99	White-eyed Buzzard	*Butastur teesa*	LC	R	Ra
100	Oriental Honey-buzzard	*Pernis ptilorhynchus*	LC	LM	UC
101	European Honey-buzzard	*Pernis apivorus*	LC	WV	Ra
102	White-bellied Sea Eagle	*Haliaeetus leucogaster*	LC	LM	C
	Strigiformes: Strigidae				
103	Spotted Owlet	*Athene brama*	LC	R	C
104	Short eared Owl	*Asio flammeus*	LC	R	UC
	Bucerotiformes: Upupidae				
105	Common Hoopoe	*Upupa epops*	LC	R	C
	Piciformes: Picidae				
106	Black-rumped Flameback	*Dinopium benghalense*	LC	R	C
	Megalaimidae				
107	Coppersmith Barbet	*Psilopogon haemacephalus*	LC	R	C
	Coraciiformes:Meropidae				
108	Blue-tailed Bee-eater	*Merops philippinus*	LC	R	C
109	Green Bee-eater	*Merops orientalis*	LC	R	C

	Order/Family/Common name	Scientific name	IUCN Red List status	Resident status	Relative abundance
	Coraciidae				
110	Indian Roller	*Coracias benghalensis*	LC	R	C
	Alcedinidae				
111	Pied Kingfisher	*Ceryle rudis*	LC	R	C
112	White-throated Kingfisher	*Halcyon smyrnensis*	LC	R	C
	Falconiformes:Falconidae				
113	Peregrine Falcon	*Falco peregrinus*	LC	WV	Ra
114	Eurasian Kestrel	*Falco tinnunculus*	LC	R	C
	Psittaciformes: Psittacidae				
115	Rose-ringed Parakeet	*Psittacula krameri*	LC	R	C
	Passeriformes: Artamidae				
116	Ashy Woodswallow	*Artamus fuscus*	LC	R	C
	Dicruridae				
117	Black Drongo	*Dicrurus macrocercus*	LC	R	C
118	Ashy Drongo	*Dicrurus leucophaeus*	LC	R	UC
	Laniidae				
119	Brown Shrike	*Lanius cristatus*	LC	WV	UC
120	Bay-backed Shrike	*Lanius vittatus*	LC	R	C
	Vangidae				
121	Common Woodshrike	*Tephrodornis pondicerianus*	LC	R	Ra
	Corvidae				
122	House Crow	*Corvus splendens*	LC	R	C
123	Rufous Treepie	*Dendrocitta vagabunda*	LC	R	C
124	Large-billed Crow	*Corvus macrorhynchos*	LC	R	C
	Nectariniidae				
125	Purple-rumped Sunbird	*Leptocoma zeylonica*	LC	R	C
126	Purple Sunbird	*Cinnyris asiaticus*	LC	R	C
	Ploceidae				
127	Baya Weaver	*Ploceus philippinus*	LC	R	C
	Estrildidae				
128	Indian Silverbill	*Euodice malabarica*	LC	R	C
129	Scaly-breasted Munia	*Lonchura punctulata*	LC	R	C
	Passeridae				
130	House Sparrow	*Passer domesticus*	LC	R	C
131	Yellow-throated Sparrow	*Gymnoris xanthocollis*	LC	R	UC
	Motacillidae				
132	Tawny Pipit	*Anthus campestris*	LC	WV	Ra
133	Paddy Field Pipit	*Anthus rufulus*	LC	R	C
134	White-browed Wagtail	*Motacilla maderaspatensis*	LC	R	C
135	Western Yellow Wagtail	*Motacilla flava*	LC	WV	Ra
	Alaudidae				
136	Ashy-crowned Sparrow-Lark	*Eremopterix griseus*	LC	R	C
137	Jerdon's Bushlark	*Mirafra affinis*	LC	R	C
138	Oriental Skylark	*Alauda gulgula*	LC	R	C
139	Sykes's Short-toed Lark	*Calandrella dukhunensis*	LC	WV	UC

	Order/Family/Common name	Scientific name	IUCN Red List status	Resident status	Relative abundance
	Cisticolidae				
140	Common Tailorbird	*Orthotomus sutorius*	LC	R	C
141	Plain Prinia	*Prinia inornata*	LC	R	C
142	Zitting Cisticola	*Cisticola juncidis*	LC	R	C
143	Ashy Prinia	*Prinia socialis*	LC	R	C
	Leiotrichidae				
144	Yellow-billed Babbler	*Argya affinis*	LC	R	C
	Acrocephalidae				
145	Blyth's Reed Warbler	*Acrocephalus dumetorum*	LC	R/NB	UC
146	Booted Warbler	*Iduna caligata*	LC	R/NB	Ra
	Hirundinidae				
147	Barn Swallow	*Hirundo rustica*	LC	WV	Ra
148	Red-rumped Swallow	*Cecropis daurica*	LC	R	UC
	Pycnonotidae				
149	Red-vented Bulbul	*Pycnonotus cafer*	LC	R	C
	Sturnidae				
150	Brahminy Starling	*Sturnia pagodarum*	LC	R	UC
151	Common Myna	*Acridotheres tristis*	LC	R	C
152	Rosy Starling	*Pastor roseus*	LC	PM	UC
	Muscicapidae				
153	Indian Robin	*Copsychus fulicatus*	LC	R	C
154	Pied Bushchat	*Saxicola caprata*	LC	R	C

IUCN Red list status: LC—Least Concern | NT—Near Threatened | EN—Endangered |NA: Not assessed | Resident status: WV—Winter Visitor | LM—Local Migrant | R—Resident | R/NB—Resident/Non-Breeding | Relative abundance: C—Common | UC—Uncommon | Ra—Rare.

herons, egrets, and ibises, only one was a local migrant (LM), Western Reef-Heron *Egretta gularis* and the rest were residents/not breeding on the site. Eighteen species were common, three species were uncommon, and two species were rare (Table 1). The most dominant waterbird species identified were Intermediate Egret *Ardea intermedia,* Little Egret *Egreta garzeta* and Indian Cormorant *Phalacrocorax fuscicollis*. Oriental Darter *Anhinga melanogaster*, Black-headed Ibis *Threskiornis melanocephalus*, Painted Stork *Mycteria leucocephala*, and Spot-billed Pelican *Pelecanus philippensis* are the other four waterbirds classified to be Near Threatened. The presence of Greater Flamingo *Phoenicopterus roseus* throughout the year is significant, as there is no breeding record from any nearby known locations on the peninsular India. The populations ranged from 200 to 8,000 individuals through out the period of observation. This also highlights that during December to March the high numbers is due to the arrival of migratory populations, which should be further investigated.

The 35 shorebird species reported included 30 winter visitors, and five species that were nesting locally. The breeding birds include the Indian Stone Curlew *Burhinus indicus*, Great Stone Curlew *Esacus recurvirostris* (one-time peak count of 12), Red-wattled Lapwing *Vanellus indicus*, Black-winged Stilt *Himantopus himantopus*, and the regionally endemic Hanuman Plover. Further, seven species of shorebirds recorded were in the IUCN Red Listed 'Near Threatened' category: Great Stone Curlew, Black-tailed Godwit, Bar-tailed Godwit, Eurasian Curlew, Curlew Sandpiper, Red-necked Stint, and Red Knot, and one species was in the 'Endangered' category—the Great Knot. The Lesser Sand Plover *Charadrius mongolus* (one-time peak count of 4,000) was the most dominant species among the shorebirds recorded, followed by the Little Stint *Calidris minuta* (one-time peak count of 3,000) and the Kentish Plover *Charadrius alexandrinus* (one-time peak count of 2,800).

Apart from the shorebirds and other waterbirds mentioned, four species of gulls, viz., Slender-billed Gull *Chroicocephalus genei*, Black-headed Gull *Chroicocephalus ridibundus,* Brown-headed Gull

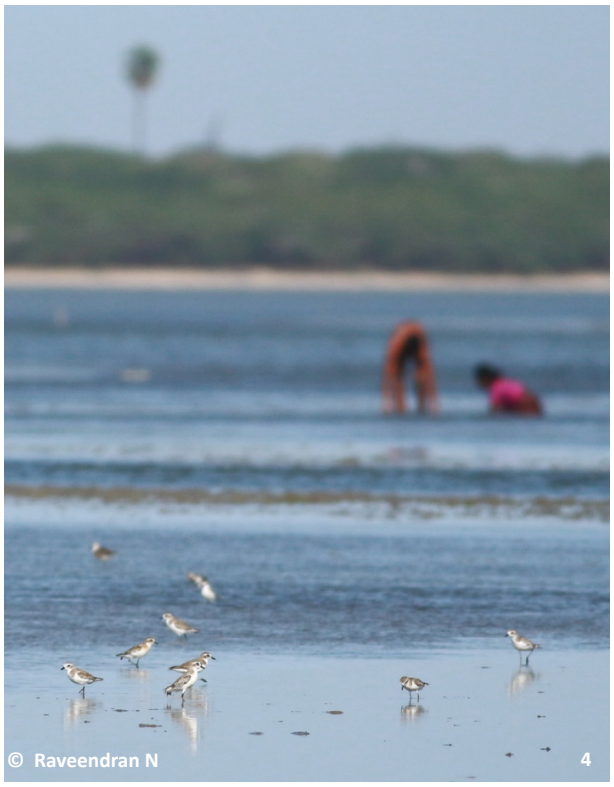

Image 1–6. Avifauna of Valinokkkam Lagoon: 1—Greater Flamingoes | 2—Caspian Terns | 3—Small Plovers- Little Stint, Kentish Plover, Lesser Sand Plover and Greater Sand Plover | 4—Shorebirds in front and traditional fishing in the background | 5— Mudflat with shorebirds and salt corporation pump set in the background | 6—Fishing activities in the lagoon.

Image 7–10. Avifauna of Valinokkkam Lagoon 7—Small Plovers with breeding plumage | 8—A flock of Spot bellied Pelican | 9—Sanderling | 10—Hanuman Plover chick

Chroicocephalus brunnicephalus, and Lesser Black-backed Gull *Larus fuscus*, were documented from this site. Of these, the most dominant ones were Black-headed Gull and Brown-headed Gulls. In addition, eight species of terns, viz., Little Tern *Sternula albifrons*, Gull-billed Tern *Gelochelidon nilotica*, Caspian Tern *Hydroprogne caspia*, Whiskered Tern *Chlidonias hybrida*, Common Tern *Sterna hirundo*, Greater Crested Tern *Thalasseus bergii*, Lesser Crested Tern *Thalasseus bengalensis,* and Sandwich Tern *Thalasseus sandvicensis* were also encountered. Through out the research period, Greater Crested Tern was the most prevalent species, followed by the Lesser Crested Tern.

According to Skagen & Knopf (1993), the diversity, abundance, and distribution of shorebirds are determined by the distinctive characteristics of diverse geographical locations, which are influenced by factors such as food availability, substrate character and quality, water quality, and other factors. In this present study, majority of shorebird species were recorded in the study area from late August through May, while other shorebird species were observed in smaller numbers during June and July. Species like Kentish Plover *Charadrius alexandrinus*, Common Redshank *Tringa totanus*, Common Greenshank *Tringa nebularia*, Black-bellied Plover *Pluvialis squatarola*, Curlew Sandpiper *Calidris ferruginea*, Ruddy Turnstone *Arenaria interpres,* Whimbrel *Numenius phaeopus,* Eurasian Curlew *Numenius arquata*, Lesser Sand Plover *Charadrius mongolus*, and Greater Sand Plover *Charadrius leschenaultii* were seen over-summering in most of the study years. We also observed that most of the over-summering birds were either juveniles or sexually unfit. In every year of the study, a few birds over-summed in breeding plumage, like the Kentish Plover, the Black-bellied Plover, the Ruddy Turnstone, and the Curlew Sandpiper (Byju et al. in press). The Lesser Crested Tern and Greater Crested Tern are both found throughout the year. Similarly, several over-summer shorebird species have been reported from Kadalundi Vallikkunnu Community Reserve (KVCR) (Aarif et al. 2020) and Changaram wetlands (Anand et al. 2023). Moreover, due to the periodic pumping of fresh seawater into it for salt extraction in response to the need for salt production, it can be deduced that the food supplies required for over-summering shorebirds are readily accessible throughout the year in this lagoon. Based on the above observations, it is evident that this habitat provides shelter and food resources for over-summering shorebirds.

On the east coast of India, 48 shorebird species have been reported (Sangha 2021). In Valinokkam, we documented 35 species (73%) among them, which explicates the criticality of this wintering site in the CAF for shorebirds. Mudflats on the eastern coast of India recorded higher density, diversity, and richness of shorebirds (Pandiyan & Asokan 2016; Aarif et al. 2021; Rao et al. 2022). The findings of Valinokkam also substantiate these studies, as 35 shorebird species were recorded when compared to 34 at Pulicat Lake (Kannan & Pandiyan 2012). The study of the abundance and spatiotemporal patterns of shorebird populations is necessary to devise management strategies for every ecosystem (Gourley et al. 2010). Therefore, in addition to the previously mentioned areas, it is important to perform extensive investigations to identify all crucial shorebird and stopover sites, seasons, and ecosystems along the Indian coast (Rao et al. 2022). Between breeding and wintering locations, stop-over sites are essential for supporting long-distance migratory shorebirds (Boere et al. 2006). Valinokkam is a critical wintering site since it is close to other significant wintering sites in Karangadu (Byju et al. 2023b), GoM, IBA s of Sri Lanka, and other significant eastern coast shorebird sites within the country on the CAF.

Conservation Significance

We assume that the unscientific removal of *Prosopis juliflora* from the peripheries of the lagoon in the last two years of study had dented the breeding population of Great Stone Curlew and Indian Stone Curlew in the area as we were unable to find the earlier population numbers during the later stages of the study. The breeding of the Short-toed Snake-Eagle *Circaetus gallicus* here on *Prosopis* is another important observation. Recent cutting of *Prosopis juliflora* exposed the lagoon to the public as the access from the nearby roads have become easier. Even though the area had not reported any poaching off late, some activities were reported earlier as per the locals.

Migratory shorebirds adapt to diverse coastal habitats, placing them as a global indicator species for habitat changes (Koskimies 1989; Piersma & Lindstrom 2004). Rashiba et al. (2022) emphasized the steady decline of shorebirds on the Indian east coast, including GoM over the past decade. In the Valinokkam lagoon, pumping sea water for salt production creates artificial wetlands that provide additional habitat for feeding, roosting, and breeding for shorebirds. Saline wetlands are also known to support a diverse array of plant and animal life, which can provide an abundant food source for shorebirds. The traditional salt pans with water storage ponds that form the artificial lagoon for the

state salt corporation are shallow and muddy, and the salinity is not much higher than the seawater, which is more used by shorebirds than the actual salt pans that are shallow evaporation ponds. This could be one of the reasons why small shorebirds prefer this site. Similar findings have also been reported from Thailand's salt pans (Isola et al. 2000; Warnock et al. 2002). Salt production companies can work with conservation organizations and researchers to develop management practices that are compatible with maintaining shorebird diversity. This will help balance economic development with environmental protection.

There are several advantages to having a basic avifaunal checklist in an unexplored area. It provides baseline data for identifying areas and species that need conservation and for creating awareness about the importance of birds and their habitats. In addition, it furthers research on the behaviour, ecology, and distribution of the birds. Moreover, it attracts bird watchers and promotes tourism with the help of local communities. The new wintering site in the CAF is also significant, as it helps conservationists develop strategies and take measures to mitigate threats such as habitat loss, pollution, hunting, and disturbance.

CONCLUSION

This pivotal study of a new avifaunal checklist from the wintering site of Valinokkam Lagoon offers crucial baseline data on bird species distribution that aids in the identification of sites with high conservation value and guides conservation and management decisions. Our understanding of the distribution and ecology of bird species can be enhanced by using this information to fill in knowledge gaps. Establishing this preliminary data might serve as foundation basis for tracking bird population changes over time, aiding conservation efforts. This work could also serve as a starting point for further research on habitat use and population dynamics, leading to a deeper understanding of the ecology and conservation needs of bird species, including migratory shorebirds and breeding studies of unassessed Hanuman Plovers from this critical wintering site on the southeast coast of India.

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