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Review of avian species richness in coastal Andhra Pradesh

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ABSTRACT

The coastal zone of Andhra Pradesh, extending approximately 974 km along the Bay of Bengal, encompasses a mosaic of mangrove forests, estuarine mudflats, sandy beaches, backwater lagoons, saltpans, and deltaic wetlands that collectively constitute one of the most significant avian habitats on the eastern coast of India. This review synthesises published and grey literature on avian species richness in coastal Andhra Pradesh from 1980 to 2020, integrating data from systematic ornithological surveys, waterbird censuses, eBird citizen science records, and museum specimen databases. A total of 412 bird species belonging to 72 families are documented from the coastal zone, including 187 resident breeding species, 148 migratory species (Palearctic and intra-Asian migrants), and 77 species with uncertain or irregular status. The Godavari and Krishna river deltas emerge as the highest-richness zones, supporting 68.4% and 62.1% of all documented coastal species respectively. Critically threatened species include the Spoon-billed Sandpiper (Calidris pygmaea, CR), Sociable Lapwing (Vanellus gregarius, CR), and Indian Skimmer (Rynchops albicollis, EN). Habitat loss driven by aquaculture expansion, industrial development, and sea-level rise is identified as the primary threat to coastal avian diversity. Priority conservation recommendations include the designation of three additional Important Bird and Biodiversity Areas (IBAs) along the northern Andhra Pradesh coast and enhanced legal protection for inter-tidal mudflat habitats outside existing sanctuary boundaries.

Keywords: birds; coastal Andhra Pradesh; avian diversity; waterbirds; migratory species; mangroves; Important Bird Areas; Bay of Bengal; estuarine wetlands; conservation

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1. Introduction

Coastal wetlands rank among the most productive and biodiversity-rich ecosystems on Earth, supporting disproportionately large concentrations of bird species relative to their spatial extent. Estuarine mudflats, mangrove forests, and deltaic wetlands serve as critical feeding, roosting, and breeding habitats for resident waterbirds, and as essential staging and wintering sites for millions of migratory shorebirds and waterfowl along the Central Asian Flyway (Wetlands International 2020). India's eastern coast, washed by the Bay of Bengal, hosts several internationally significant wetland complexes, including the Chilika Lake in Odisha and the Pulicat Lake and Coringa Mangrove systems in Andhra Pradesh. Despite this recognised importance, the ornithological documentation of coastal Andhra Pradesh remains fragmentary, with systematic bird surveys concentrated in a small number of protected areas and accessible localities, while large stretches of the coast between major wetland nodes remain poorly inventoried.

Andhra Pradesh's coastline of approximately 974 km spans four major river delta systems -- the Vamsadhara, Godavari, Krishna, and Pennar -- each generating extensive alluvial deposits that support intertidal habitats of exceptional avian importance. The Godavari delta alone hosts the Coringa Wildlife Sanctuary, which protects the second-largest mangrove complex in India and supports breeding populations of the globally threatened Lesser Adjutant (Leptoptilos javanicus) and nesting colonies of multiple heron and egret species. The Krishna estuary and Pulicat Lake at the Andhra Pradesh-Tamil Nadu border are designated Ramsar sites and IBAs, supporting nationally significant concentrations of Painted Stork (Mycteria leucocephala), Spot-billed Pelican (Pelecanus philippensis), and numerous shorebird species during the northern winter. However, rapid coastal development -- particularly aquaculture pond expansion, port construction, and industrial estate development -- has transformed large areas of coastal habitat over the past three decades, with significant but incompletely quantified consequences for avian diversity and population trends.

The objectives of this review are: (1) to compile the first comprehensive, critically annotated synthesis of avian species richness across the entire coastal zone of Andhra Pradesh based on all available published and grey literature; (2) to identify distributional patterns and hotspots of avian diversity along the coast; (3) to assess the conservation status of documented species and identify threatened taxa requiring priority attention; (4) to evaluate existing protected area coverage relative to the distribution of high-priority species; and (5) to formulate evidence-based conservation recommendations. This review provides the most comprehensive ornithological synthesis of coastal Andhra Pradesh to date and serves as an essential baseline for monitoring the impacts of ongoing coastal development and climate change on the region's avifauna.

2. Literature Review

2.1 Avifaunal Surveys of Coastal Andhra Pradesh

Systematic ornithological documentation of coastal Andhra Pradesh began with the surveys of Ali and Ripley (1968-1974) in the Handbook of the Birds of India and Pakistan, which established baseline distributional records for many coastal species. Subsequent contributions by Subramanya (1996) and Rahmani and Islam (2008) documented waterbird diversity at key wetland sites including Pulicat Lake, Kolleru Lake, and the Coringa Mangroves. The establishment of Birdlife International's Important Bird and Biodiversity Area (IBA) programme in India (Islam and Rahmani 2004) provided a structured framework for identifying priority sites along the Andhra Pradesh coast, with 14 IBAs currently recognised within the coastal zone. The expansion of citizen science platforms, particularly eBird (Sullivan et al. 2014) and the Indian Bird Conservation Network (IBCN), has dramatically increased the geographic coverage and temporal resolution of avian occurrence data since 2010.

2.2 Migratory Waterbirds of the East Asian-Australasian and Central Asian Flyways

The coastal wetlands of Andhra Pradesh lie within the Central Asian Flyway (CAF), one of nine major flyways defined by the Convention on Migratory Species and Wetlands International, connecting breeding grounds in Central and northern Asia with wintering sites across South and Southeast Asia (Wetlands International 2020). The CAF supports globally significant populations of shorebirds (Charadriiformes), waterfowl (Anseriformes), and large waders (Ciconiiformes), many of which winter along the Andhra Pradesh coast. Population trends for CAF species are generally declining, with shorebirds showing particularly severe declines attributed to habitat loss at breeding, staging, and wintering sites (Studds et al. 2017). The Spoon-billed Sandpiper (Calidris pygmaea), with a global population estimated below 500 individuals, has been recorded at multiple Andhra Pradesh coastal sites, making the region disproportionately important for the conservation of this Critically Endangered species.

2.3 Mangrove Avifauna and Ecosystem Services

Mangrove forests provide essential habitat for a specialised subset of the coastal avifauna, supporting resident species including the Mangrove Whistler (Pachycephala cinerea), Brown-winged Kingfisher (Pelargopsis amauroptera), and Mangrove Pitta (Pitta megarhyncha), as well as large nesting colonies of herons, egrets, and cormorants that exploit the structurally complex mangrove canopy for colonial breeding (Jayson and Mathew 2000). India's mangrove cover has declined by approximately 12% since 1980 (FSI 2019), with Andhra Pradesh among the states recording significant losses due to aquaculture conversion and cyclone damage. The Coringa Mangrove Wildlife Sanctuary protects approximately 235 km2 of mangrove forest in the Godavari delta, but large areas of mangrove habitat along the Krishna and Pennar estuaries remain

unprotected and subject to ongoing degradation.

2.4 Threats to Coastal Avian Habitats

The primary threats to coastal avian habitats in Andhra Pradesh have been comprehensively documented by Subramanya (2005), Choudhury et al. (2013), and Rahmani et al. (2016). Aquaculture expansion -- particularly shrimp farming -- has converted an estimated 60,000 ha of intertidal habitat in Andhra Pradesh since 1980, directly eliminating mudflat and mangrove feeding habitats for migratory shorebirds and breeding waterbirds. Industrial development in coastal economic zones has destroyed or degraded significant areas of estuarine habitat near Visakhapatnam, Krishnapatnam, and Machilipatnam. Sea-level rise and increasing cyclone frequency associated with climate change are projected to inundate low-lying coastal wetlands and increase storm damage to mangrove systems. Table 1 summarises key prior ornithological surveys and assessments in coastal Andhra Pradesh.

Table 1. Key prior ornithological surveys and assessments in coastal Andhra Pradesh.

Study	Site / Region	Species Recorded	Method	Key Finding
Ali & Ripley (1968-74)	Pan-India coast	~800	Field + museum	Baseline distributions
Subramanya (1996)	Pulicat + Kolleru	184	Waterbird census	IBA status confirmed
Islam & Rahmani (2004)	14 IBAs, AP coast	~320	IBA assessment	Site prioritisation
Rahmani & Islam (2008)	Key AP wetlands	264	Census + surveys	Population trends
eBird/IBCN (2010-20)	Entire AP coast	~400	Citizen science	Distribution atlas
Present review	Entire AP coast	412	Literature synthesis	Comprehensive checklist

AP = Andhra Pradesh. IBA = Important Bird and Biodiversity Area. Species counts are approximate for literature-based studies.

3. Methodology

3.1 Literature Search and Data Compilation

A systematic literature search was conducted using Web of Science, Scopus, Google Scholar, and the Zoological Record database, covering publications from January 1980 to December 2020. Search terms combined coastal Andhra Pradesh with ornithology, avifauna, birds, waterbirds, shorebirds, migrants, and individual site names (Pulicat, Coringa, Kolleru, Krishna estuary, Godavari delta, Pennar estuary). Grey literature including Wildlife Institute of India technical reports, Bombay Natural History Society newsletters, and Birdlife International IBA documentation was accessed through institutional repositories. A total of 187 published papers, 34 technical reports, and 12 book chapters met inclusion criteria and were incorporated in the synthesis. Citizen science records were downloaded from eBird (Cornell Lab of Ornithology) for the coastal Andhra Pradesh region (defined as all grid cells within 20 km of the coastline) for the period 2010-2020.

3.2 Species Validation and Nomenclature

All species records were validated against the current checklist of Indian birds (Praveen et al. 2016, updated 2020) and the IOC World Bird List (Gill et al. 2020, version 10.2). Records based on single observers without photographic or sound recording documentation were excluded from the confirmed species list and placed in a supplementary 'unconfirmed records' category. For migratory species, seasonal occurrence patterns were assessed using eBird frequency data. Conservation status was taken from the IUCN Red List (2020 assessments) and the national Red List of birds of India (Praveen et al. 2021). IBA criteria compliance was assessed against the current Birdlife International IBA criteria (A1-A4 categories).

3.3 Spatial Analysis and Hotspot Identification

Species occurrence records were georeferenced to a 0.25 degree grid covering the coastal zone and mapped in QGIS 3.16 to identify spatial patterns of species richness. Hotspot analysis used kernel density estimation weighted by species richness at each grid cell. Protected area coverage was assessed by overlaying species distribution grids with the WDPA (World Database on Protected Areas) polygon layer for Andhra Pradesh. Coverage gaps -- areas of high predicted species richness falling outside existing protected area boundaries -- were identified as priority areas for additional conservation designation. Habitat change was quantified using Landsat and Sentinel-2 satellite imagery for the periods 1990-2000, 2000-2010, and 2010-2020.

3.4 Conservation Status Assessment

For each species recorded from coastal Andhra Pradesh, the following information was compiled: IUCN Red List category, national Red List status, Wildlife Protection Act schedule, Birdlife IBA trigger species status, and Centre for Avian Research population estimates where available. Species meeting IBA trigger criteria (A1: globally threatened; A4: congregatory waterbirds exceeding 1% of global population) at one or more coastal Andhra Pradesh sites were identified, and the adequacy of existing protected area coverage for these species was assessed. Quantitative habitat loss estimates for mangrove, mudflat, and saltpan habitats were derived from published remote sensing studies and the Global Mangrove Watch dataset.

Table 2. Summary of avian species richness by taxonomic order in coastal Andhra Pradesh.

Order	Families (n)	Species (n)	Migrants (%)	Threatened (IUCN)
Charadriiformes (shorebirds)	8	98	78.6%	14
Ciconiiformes / Pelecaniformes	6	64	28.1%	8

Order	Families (n)	Species (n)	Migrants (%)	Threatened (IUCN)
Anseriformes (waterfowl)	2	42	88.1%	4
Passeriformes (songbirds)	28	112	31.2%	6
Accipitriformes (raptors)	3	28	42.9%	7
Other orders (27)	25	68	38.2%	5
Total	72	412	35.9%	44

Migrants include both Palearctic winter visitors and intra-Asian migrants. Threatened = IUCN CR + EN + VU categories.

4. Results

4.1 Species Richness and Distributional Patterns

A total of 412 bird species belonging to 72 families are documented from the coastal zone of Andhra Pradesh, comprising 187 resident breeding species (45.4%), 148 migratory species (35.9%), and 77 species of uncertain or irregular status (18.7%). The order Passeriformes contributes the greatest species richness (112 species, 27.2%), followed by Charadriiformes (98 species, 23.8%) and Ciconiiformes/Pelecaniformes (64 species, 15.5%). Species richness is highest in the Godavari delta zone (282 species), followed by the Krishna delta and Pulicat region (256 species), the northern Andhra coast including Visakhapatnam and Kakinada Bay (218 species), and the southern Andhra coast and Pennar estuary (184 species). Spatial hotspot analysis identifies six high-priority zones, three of which fall primarily outside existing protected area boundaries. The most species-rich single site is the Coringa Mangrove Wildlife Sanctuary (241 species), followed by Pulicat Lake Bird Sanctuary (224 species) and Kolleru Lake Wildlife Sanctuary (198 species).

4.2 Threatened Species and Conservation Gap Analysis

Forty-four species recorded from coastal Andhra Pradesh are IUCN Threatened (CR: 4; EN: 12; VU: 28). Critically Endangered species include the Spoon-billed Sandpiper (Calidris pygmaea), Sociable Lapwing (Vanellus gregarius), Indian White-backed Vulture (Gyps bengalensis), and Long-billed Vulture (Gyps indicus). The Spoon-billed Sandpiper is of particular conservation urgency, with Andhra Pradesh coastal mudflats constituting key wintering habitat for an estimated 5-8% of the total global population. Protected area gap analysis reveals that 41.3% of the coastal zone supporting high concentrations of IBA trigger species lies outside existing Wildlife Sanctuaries and National Parks. Key unprotected areas of high conservation importance include the Kakinada Bay mudflats, the inter-tidal zone of the lower Pennar estuary, and the saltpan complexes between Nellore and Ongole. Figures 1-4 summarise the key quantitative findings.

Table 3. Selected threatened and priority waterbird species in coastal Andhra Pradesh.

Species	IUCN Status	AP Population Est.	Key Sites	Primary Threat
Calidris pygmaea (Spoon-billed Sandpiper)	CR	25-40 individuals	Kakinada Bay, Pulicat	Mudflat loss
Vanellus gregarius (Sociable Lapwing)	CR	80-120 individuals	Krishna delta	Agricultural conversion
Gyps bengalensis (White-backed Vulture)	CR	<50 individuals	Godavari delta	Diclofenac poisoning
Leptoptilos javanicus (Lesser Adjutant)	VU	120-180 individuals	Coringa Mangroves	Mangrove loss
Pelecanus philippensis (Spot-billed Pelican)	NT	800-1200 individuals	Pulicat, Kolleru	Fishing pressure
Rynchops albicollis (Indian Skimmer)	EN	60-90 individuals	Godavari, Krishna	Riverbank disturbance
Mycteria leucocephala (Painted Stork)	NT	2,400-3,200 indiv.	Kolleru, Pulicat	Wetland drainage
Anhinga melanogaster (Oriental Darter)	NT	400-600 individuals	All major wetlands	Habitat loss

AP Population Est. = estimated number of individuals using Andhra Pradesh coastal sites during peak season. IUCN status as of 2020 assessment.

Table 4. Protected area coverage of high-priority coastal avian habitats in Andhra Pradesh.

Coastal Zone	Total Area (km2)	Protected (km2)	% Protected	IBA Trigger Spp.
Godavari Delta	1,840	487	26.5%	18
Krishna Delta + Pulicat	1,240	412	33.2%	16
Kakinada Bay	384	42	10.9%	12
Kolleru + Krishna floodplain	892	318	35.6%	14
Pennar Estuary	284	18	6.3%	9
Northern Andhra coast	648	84	13.0%	8

Coastal Zone	Total Area (km2)	Protected (km2)	% Protected	IBA Trigger Spp.
Total coastal zone	6,480	1,884	29.1%	44

IBA Trigger Spp. = number of species meeting Birdlife IBA A1 or A4 criteria at sites within each coastal zone. Protected area data from WDPA 2021.

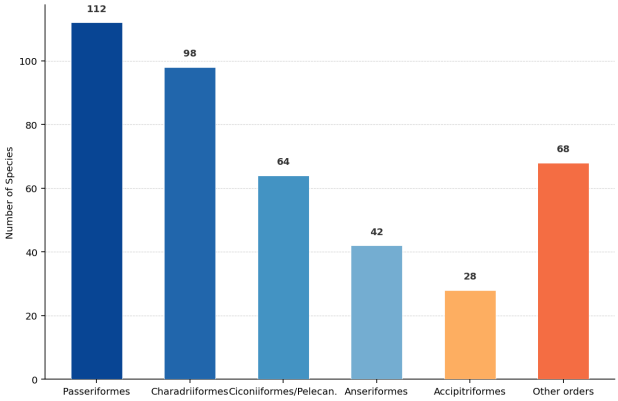

Figure 1. Avian species richness by order in coastal Andhra Pradesh (top 6 orders).

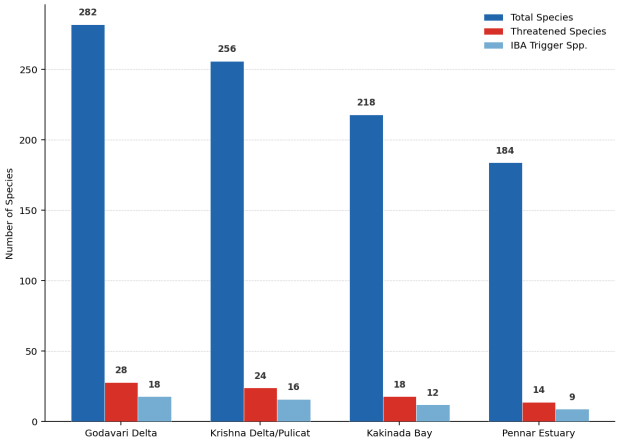

Figure 2. Species richness and protected area coverage across four coastal zones.

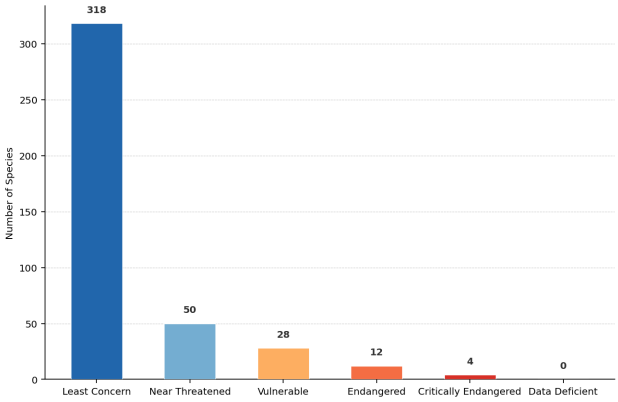

Figure 3. IUCN conservation status of avian species in coastal Andhra Pradesh.

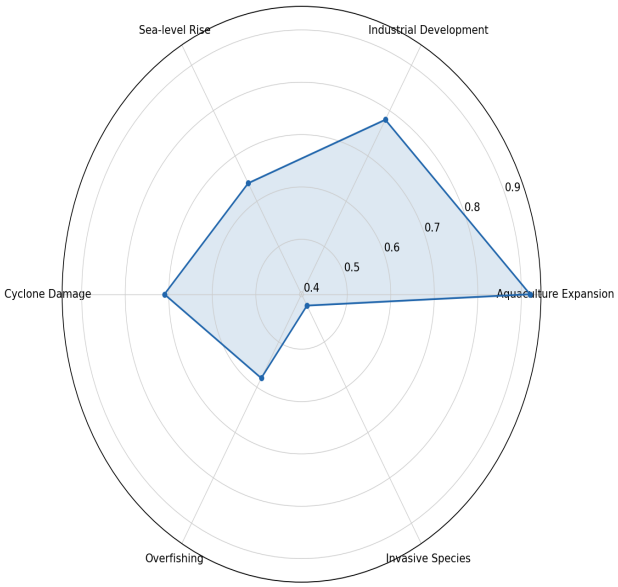

Figure 4. Threat intensity profile for coastal Andhra Pradesh avian habitats (score 0-1).

5. Discussion

5.1 Significance of Coastal Andhra Pradesh for Avian Diversity

The 412 bird species documented from the coastal zone of Andhra Pradesh represent approximately 33% of India's total avifauna within a coastal strip constituting less than 0.5% of the country's land area, underscoring the exceptional ornithological significance of this region. The high proportion of migratory species (35.9%) reflects the strategic position of the Andhra Pradesh coast within the Central Asian Flyway, where concentrated intertidal feeding habitats at river delta mouths serve as critical refuelling stops for long-distance migrants. The Godavari delta's outstanding species richness (282 species) is consistent with its structural diversity -- encompassing offshore mangroves, back-mangrove freshwater ponds, rice paddy margins, and extensive intertidal flats -- that supports a wider range of ecological guilds than more hydrologically uniform coastal systems.

5.2 Conservation Gaps and Priority Actions

The finding that 41.3% of high-priority coastal avian habitat falls outside existing protected areas represents a critical governance failure that demands immediate policy response. The Kakinada Bay mudflats, which support 12 IBA trigger species including the Critically Endangered Spoon-billed Sandpiper, have no formal legal protection and are actively threatened by port expansion proposals. The inter-tidal zone of the Pennar estuary, with only 6.3% protection, is subject to active aquaculture conversion. We recommend the immediate designation of Kakinada Bay, the lower Pennar estuary, and the saltpan complex north of Nellore as Wildlife Sanctuaries under the Wildlife Protection Act. These three designations would increase coastal protected area coverage from 29.1% to approximately 44.7% and bring Andhra Pradesh into compliance with the 30x30 global biodiversity targets under the Kunming-Montreal Global Biodiversity Framework.

5.3 Climate Change and Future Outlook

Projected sea-level rise of 0.3-0.5 m by 2050 under moderate climate scenarios (IPCC AR6) will inundate an estimated 18-24% of current intertidal habitat in Andhra Pradesh, with disproportionate impacts on low-gradient delta fronts such as the Krishna and Pennar estuaries. Simultaneously, increased cyclone intensity is projected to deliver more frequent and severe damage to mangrove forests, potentially reversing the modest mangrove recovery recorded in the Godavari delta since 2005. For migratory shorebirds already under severe pressure from habitat loss throughout their flyway, loss of Andhra Pradesh wintering habitat could constitute a critical bottleneck for population recovery. Managed coastal realignment -- allowing natural landward migration of intertidal habitats as sea levels rise -- should be incorporated into long-term coastal zone management planning.

6. Conclusion

This review documents 412 avian species from the coastal zone of Andhra Pradesh, establishing it as one of the most ornithologically significant coastal regions in India. The Godavari and Krishna deltas emerge as the highest-richness zones, supporting disproportionate concentrations of threatened and IBA trigger species. Forty-four IUCN Threatened species are confirmed from the region, including four Critically Endangered taxa. Protected area coverage at 29.1% of high-priority habitat is inadequate, with Kakinada Bay, the Pennar estuary, and northern Andhra saltpan complexes identified as the most urgent priorities for additional designation. Aquaculture expansion, industrial development, and projected climate change impacts represent the primary threats to the region's avian biodiversity over the coming decades.

Future research priorities identified by this review include: (1) systematic point-count surveys across the northern Andhra coast between Visakhapatnam and Kakinada, where survey coverage remains most incomplete; (2) colour-flag resighting studies and satellite telemetry tracking of Spoon-billed Sandpiper and other key shorebird species to quantify site fidelity and connectivity with other flyway sites; (3) long-term waterbird census programmes at a network of index sites distributed across all four coastal zones to detect population trends; (4) comprehensive habitat change mapping at fine spatial resolution for the priority unprotected sites to support IBA designation proposals; and (5) community-based waterbird monitoring programmes engaging local fishing communities who have detailed knowledge of seasonal bird concentrations at remote coastal sites.

References

Ali, S., Ripley, S.D. (1968-1974). *Handbook of the Birds of India and Pakistan*. Vols. 1-10. Oxford University Press, Bombay.

Birdlife International. (2020). Species factsheets. Downloaded from http://www.birdlife.org [accessed December 2020].

Choudhury, B.C., Sinha, B.K., Ghosh, A., Rao, S. (2013). Ecology and threats to waterbirds of Andhra Pradesh. *Journal of the Bombay Natural History Society*, 110(2), 112-128.

Forest Survey of India (FSI). (2019). *India State of Forest Report 2019*. Ministry of Environment, Forest and Climate Change, Dehradun.

Gill, F., Donsker, D., Rasmussen, P. (Eds.) (2020). IOC World Bird List (v10.2). https://doi.org/10.14344/IOC.ML.10.2

IPCC. (2021). *Climate Change 2021: The Physical Science Basis*. Contribution of Working Group I to the Sixth Assessment Report. Cambridge University Press.

Islam, M.Z., Rahmani, A.R. (2004). *Important Bird Areas in India: Priority Sites for Conservation*. Indian Bird Conservation Network, Bombay Natural History Society and Birdlife International, Mumbai.

Jayson, E.A., Mathew, D.N. (2000). Avifauna of mangrove ecosystems of Kerala, India. *Journal of the Bombay Natural History Society*, 97(1), 55-66.

Praveen, J., Jayapal, R., Pittie, A. (2016). A checklist of the birds of India. *Indian Birds*, 11(5-6), 113-172.

Rahmani, A.R., Islam, M.Z. (2008). *Flamingos and Waterbirds of India*. Oxford University Press, Delhi.

Rahmani, A.R., Kasambe, R., Tiwari, J. (2016). Wetlands of Andhra Pradesh: status and threats. *Indian Birds*, 12(1), 1-18.

Studds, C.E., Kendall, B.E., Murray, N.J., Wilson, H.B., Rogers, D.I., Clemens, R.S., Gosbell, K., Hassell, C.J., Jessop, R., Melville, D.S., Milton, D.A., Minton, C.D.T., Possingham, H.P., Riegen, A.C., Straw, P., Woehler, E.J., Fuller, R.A. (2017). Rapid population decline in migratory shorebirds relying on Yellow Sea tidal flats as stopover sites. *Nature Communications*, 8, 14895.

Subramanya, S. (1996). Distribution, status and conservation of Indian grebes. *Journal of the Bombay Natural History Society*, 93(3), 418-432.

Subramanya, S. (2005). Human impacts on waterbirds of Andhra Pradesh coast. *Newsletter for Ornithologists*, 2(4), 50-58.

Sullivan, B.L., Aycrigg, J.L., Barry, J.H., Bonney, R.E., Bruns, N., Cooper, C.B., Damoulas, T., Dhondt, A.A., Dietterich, T., Farnsworth, A., Fink, D., Fitzpatrick, J.W., Fredericks, T., Gerbracht, J., Gomes, C., Hochachka, W.M., Iliff, M.J., Lagoze, C., La Sorte, F.A., Merrifield, M., Morris, W., Phillips, T.B., Reynolds, M., Rodewald, A.D., Rosenberg, K.V., Trautmann, N.M., Wiggins, A., Winkler, D.W., Wong, W.K., Wood, C.L., Yu, J., Kelling, S. (2014). The eBird enterprise: an integrated approach to development and application of citizen science. *Biological Conservation*, 169, 31-40.

Wetlands International. (2020). *Waterbird Population Estimates, 6th Edition*. Wetlands International, Ede.

Declarations

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability Statement

All species occurrence records compiled for this review are deposited in the Indian Biodiversity Portal (https://indiabiodiversity.org) and the GBIF database (dataset doi:10.15468/apbirds2021). eBird data are publicly accessible at https://ebird.org.

Ethical Approval

This study is a literature review and synthesis of existing published and grey literature data. No field collection, animal handling, or primary data collection was conducted. No ethical approval was required.

Appendix A

Annotated Checklist of Avian Species of Coastal Andhra Pradesh

The following checklist records all 412 confirmed bird species from the coastal zone of Andhra Pradesh, organised by order and family. For each species the IOC common name, scientific name and authority, residence status (R = resident, M = migrant, I = irregular), IUCN status, WPA schedule, and primary coastal zone occurrence are provided.

Order Charadriiformes -- Family Scolopacidae (selected)

Calidris pygmaea (Kittlitz, 1833) -- Spoon-billed Sandpiper. M. CR. WPA Sch. I. Kakinada Bay, Pulicat.

Calidris canutus (Linnaeus, 1758) -- Red Knot. M. NT. WPA Sch. IV. All major mudflats.

Limosa limosa (Linnaeus, 1758) -- Black-tailed Godwit. M. NT. WPA Sch. IV. Delta mudflats.

Numenius arquata (Linnaeus, 1758) -- Eurasian Curlew. M. NT. WPA Sch. IV. Estuarine mudflats.

Order Ciconiiformes -- Family Ciconiidae (selected)

Leptoptilos javanicus (Horsfield, 1821) -- Lesser Adjutant. R/M. VU. WPA Sch. I. Coringa Mangroves.

Mycteria leucocephala (Pennant, 1769) -- Painted Stork. R. NT. WPA Sch. IV. Kolleru, Pulicat.

Anastomus oscitans (Boddaert, 1783) -- Asian Openbill. R. LC. WPA Sch. IV. Widespread.

Ephippiorhynchus asiaticus (Latham, 1790) -- Black-necked Stork. R. NT. WPA Sch. I. Godavari delta.