

# Studies of Avifaunal Diversity in Sasihithlu Estuary of Dakshina Kannada, Karnataka, India

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**Abstract** Birds are excellent bio indicators of environment. Avifaunal diversity provides various ecological, environmental and scientific services to mankind. The present study is aimed at the primary assessment of avian diversity of Sasihithlu estuary in Dakshina Kannada. The study was conducted from January 2018 to January 2019. Field exploration in different bioregions of estuary was undertaken during different seasons. A total of 138 species of birds were recorded belonging to 17 orders and 49 families. This includes 86 resident species and 52 migratory species. Of the recorded species, one is Endangered, one is Vulnerable and eight are Near Threatened species. A greater diversity of bird species was recorded during November to January and a lesser diversity was recorded during June to October.

**Keywords:** avifauna, wetland, estuary, mangrove, Sasihithlu

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## 1. Introduction

The quality of ecosystems can be assessed by studying its avian diversity [1,2,3]. The status of habitats can be evaluated by observing behavioural and reproductive pattern of birds as they are excellent bio monitors of environment [4,5]. Birds play an important role in maintaining the species diversity, its population and ecological balance of an area [6,7]. Destruction of natural habitat and growing human intervention coupled with intense human activities has led to the decline of avifaunal diversity and population [6]. Studies have showed a significant impact of urbanisation on species richness and abundance of birds [8]. Occurrence of birds, their diversity and population serves as an important tool to study the health of an area and to assess habitat alterations [9,10,11]. Studying the avian diversity helps in understanding the structure and functioning of ecosystem [12,13]. This can also be used to access the degree of pollution of an ecosystem [14,15,16].

Wetlands are some of the most productive ecosystems and among them, estuaries are considered as the second most productive ecosystem of the world. Unique conditions of the estuaries harbour mangroves. Mangroves are a special group of flora which are adapted to grow in estuarine conditions [17,18]. High diversity and density of life is supported by wetlands and estuaries. They are one of the most important avian habitats and they sustain a very high diversity of avifauna, migratory water birds in particular [19,20,21,22]. Estuaries and wetlands are represented by avian species which are restricted to such

conditions [17,23,24]. Contrary to this, wetlands are severely disturbed, damaged and destroyed by humans. Rising human population and resulting urbanisation along with environmental pollution and other anthropogenic activities are responsible for the degradation of wetlands which results in decreased biodiversity [25,26]. Mangrove ecosystems are deeply impacted by rising sea level resulting from climate change [27,28,29]. Wetlands have been reduced to half in the last century [30,31]. With high productivity, these areas are definitely rich in biodiversity and there is a lot of scope for conservation related research [32]. There are lots of opportunities for new discovery and documentation. Estuarine avifaunal diversity in India has not received much attention [17,33]. As documentation of avifaunal diversity in coastal areas of Karnataka is lacking, an attempt has been made in the present study focussing on documentation of avifaunal diversity along with the threats and factors for their occurrence and distribution. The baseline data from this study offers scope for management of estuary and formulating conservation strategies which in turn helps in avifaunal conservation.

## 2. Study Area

Sasihithlu is an estuary which is a confluence point of two rivers, Nandini and Shambhavi as shown in Figure 1. It is located 25 kms north of Mangaluru (13.02° N & 74.47° E) and has an elevation of 3 m above sea level. The climate and weather pattern is typical to that of coastal area. The temperature of the region varies from 26° C to 42° C with an annual precipitation of about 3,500 mm.

The area is greatly influenced by tidal activity. The area has a diverse vegetation type which includes both natural and cultivated flora and also has a significant growth of mangroves. Floral diversity of the area was taken into account to understand the bird - vegetation association. Five sampling sites were selected as mentioned in Table 1,

with a minimum distance of 500 m from each other to ensure Quasi Independence [34]. The sites were selected in Delta Point (mouth of the estuary), Hejmady and Chitrapu (parts of Shambhavi river) and Kollachikambla (part of Nandini river) which are the main zones of Sasihithlu estuary.



Figure 1. Map and google image of the study area

Table 1. Details of the sampling sites

Sl No.	Study Sites	Habitat	Latitude	Longitude	Elevation (m)
1.	Site 1	Mangroves and associated wooded area	13° 3'45.29"N	74°46'45.69"E	4
2.	Site 2	Mangroves and associated wooded area	13° 4'13.91"N	74°46'43.86"E	2
3.	Site 3	Mangroves and sandbanks	13° 4'38.23"N	74°46'47.72"E	2
4.	Site 4	Mangroves and associated wooded area	13° 4'46.88"N	74°47'4.71"E	6
5.	Site 5	Mangroves and associated wooded area	13° 4'51.24"N	74°46'28.09"E	3

### 3. Materials and Methods

Periodic field work was conducted from January 2018 to January 2019. Bird surveys were made for three to four days every month. The data was collected from 05:30 am to 08:30 am and 04:30 pm to 07:00 pm which corresponds with the peak time of avifaunal activity [35,36,37,38]. Direct Count Methods like point count method and area search methods were used for the survey. Regular sampling was done by walking at a constant pace in fixed routes in the sampling sites. Birds were documented based on visual and audio data.

Canon EOS 70D and 600D DSLR cameras with 18 - 135 mm and 75 - 300 mm lens were used to photograph the birds. Bird calls were recorded using the voice recorder in Samsung Galaxy M30 mobile phone. Celestron binoculars were used to observe and monitor the

birds from a distance without disturbing their activity. Garmin Etrex 30X GPS machine was used to take the waypoints (latitude and longitude) and altitude of the area. Field Guides were used for bird identification [39,40,41].

### 4. Results and Discussion

Sasihithlu Estuary harbours a rich avifaunal diversity. Perennial supply of fresh water from the rivers Nandini and Shambhavi and an ample forest cover composed of mangroves, its associates and other native flora provides a suitable habitat for avifauna. The study area in and around estuary has revealed the presence of 138 species of birds belonging to 17 orders and 49 families as mentioned in Table 2.

Table 2. Checklist of birds recorded during the study

Sl No.	Order	Family	Common Name	Scientific Name	Conservation Status	Status
1.	ACCIPITRIFORMES	Accipitridae	Brahminy Kite	<i>Haliastur indus</i>	LC	R
			Black Kite	<i>Milvus migrans</i>	LC	R
			Booted Eagle	<i>Hieraaetus pennatus</i>	LC	WM
			Shikra	<i>Accipiter badius</i>	LC	R
			Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	LC	WM
			White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>	LC	R
		Pandionidae	Osprey	<i>Pandion hilaetus</i>	LC	WM
2.	ANSERIFORMES	Anatidae	Lesser Whistling Duck	<i>Dendrocygna javanica</i>	LC	R
3.	APODIFORMES	Apodidae	Asian Palm Swift	<i>Cypsiurus balasensis</i>	LC	R
			Alpine Swift	<i>Tachymarptis melba</i>	LC	R
			Indian Swiftlet	<i>Aerodramus unicolor</i>	LC	R
4.	CHARADRIIFORMES	Charadriidae	Pacific Golden Plover	<i>Pluvialis fulva</i>	LC	WM
			Grey / Black-bellied Plover	<i>Pluvialis squatarola</i>	LC	WM
			Kentish Plover	<i>Charadrius alexandrinus</i>	LC	WM
			Lesser Sand Plover	<i>Charadrius mongolus</i>	LC	WM
			Greater Sand Plover	<i>Charadrius leschenaultii</i>	LC	WM
			Little-ringed Plover	<i>Charadrius dubius</i>	LC	R
			Red-wattled Lapwing	<i>Vanellus indicus</i>	LC	R
			Crab Plover	<i>Dromas ardeola</i>	LC	WM
			Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	NT	WM
			Pallas's Gull	<i>Ichthyaeetus ichthyaeetus</i>	LC	WM
		Laridae	Black-headed Gull	<i>Chroicocephalus ridibundus</i>	LC	WM
			Brown-headed Gull	<i>Chroicocephalus brunnicephalus</i>	LC	WM
			Slender-billed Gull	<i>Chroicocephalus genei</i>	LC	WM
			Lesser Black-backed Gull	<i>Larus fuscus</i>	LC	WM
			Caspian Tern	<i>Hydroprogne caspia</i>	LC	WM
			Greater Crested Tern	<i>Thalasseus bergii</i>	LC	WM
			Lesser Crested Tern	<i>Thalasseus bengalensis</i>	LC	WM
			Sandwich Tern	<i>Thalasseus sandvicensis</i>	LC	WM
		Gull-billed Tern	<i>Gelochelidom nilotica</i>	LC	WM	
		Recurvirostridae	Black-winged Stilt	<i>Himantopus himantopus</i>	LC	WM
		Rostratulidae	Greater Painted-snipe	<i>Rostratula benghalensis</i>	LC	R
		Scolopacidae	Common Sandpiper	<i>Actitis hypoleucos</i>	LC	WM
			Terek Sandpiper	<i>Xenus cinereus</i>	LC	WM
			Wood Sandpiper	<i>Tringa glareola</i>	LC	WM
			Green Sandpiper	<i>Tringa ochropus</i>	LC	WM
			Broad-billed Sandpiper	<i>Calidris falcinellus</i>	LC	WM
			Ruddy Turnstone	<i>Arenaria interpres</i>	LC	WM
			Common Greenshank	<i>Tringa nebularia</i>	LC	WM
			Common Redshank	<i>Tringa totanus</i>	LC	WM
			Whimbrel	<i>Numenius phaeopus</i>	LC	WM
			Eurasian curlew	<i>Numenius arquata</i>	NT	WM
			Great Knot	<i>Calidris tenuirostris</i>	EN	WM
			Dunlin	<i>Calidris alpina</i>	LC	WM
Sanderling	<i>Calidris alba</i>		LC	WM		
Curlew Sandpiper	<i>Calidris ferruginea</i>		NT	WM		
Little Stint	<i>Calidris minuta</i>	LC	WM			
Bar-tailed Godwit	<i>Limosa lapponica</i>	NT	WM			

SI No.	Order	Family	Common Name	Scientific Name	Conservation Status	Status
5.	CICONIIFORMES	Ciconiidae	Painted Stork	<i>Mycteria leucocephala</i>	NT	WM
			Open-billed Stork	<i>Anastomus oscitans</i>	LC	R
			Woolly-necked Stork	<i>Ciconia aeruginosus</i>	VU	R
6.	COLUMBIFORMES	Columbidae	Blue Rock Pigeon	<i>Columba livia</i>	LC	R
			Spotted Dove	<i>Spilopelia chinensis</i>	LC	R
			Yellow-footed Green Pigeon	<i>Treron phoenicoptera</i>	LC	R
7.	CORACIIFORMES	Alcedinidae	White-throated Kingfisher	<i>Halcyon smyrnensis</i>	LC	R
			Black-capped Kingfisher	<i>Halcyon pileata</i>	LC	R
			Small Blue Kingfisher	<i>Alcedo atthis</i>	LC	R
			Stork-billed Kingfisher	<i>Pelargopsis capensis</i>	LC	R
		Coraciidae	Indian Roller	<i>Coracias benghalensis</i>	LC	R
		Meropidae	Green Bee-eater	<i>Merops orientalis</i>	LC	R
			Blue-tailed Bee-eater	<i>Merops philippinus</i>	LC	WM
Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>		LC	R		
8.	CUCULIFORMES	Cuculidae	Asian Koel	<i>Eudynamis scolopacea</i>	LC	R
			Southern Coucal	<i>Centropus sinensis parroti</i>	LC	R
			Grey-bellied Cuckoo	<i>Cacomantis passerinus</i>	LC	R
9.	FALCONIFORMES	Falconidae	Peregrine Falcon	<i>Falco peregrinus</i>	LC	R
10.	GALLIFORMES	Phasianidae	Indian Peafowl	<i>Pavo cristatus</i>	LC	R
			Red Spurfowl	<i>Galloperdix spadicae</i>	LC	R
11.	GRUIFORMES	Rallidae	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	LC	R
			Ruddy-breasted Crake	<i>Porzana fusca</i>	LC	R
12.	PASSERIFORMES	Acrocephalidae	Clamorous reed Warbler	<i>Acrocephalus stentoreus</i>	LC	WM
			Blyth's reed Warbler	<i>Acrocephalus dumetorum</i>	LC	WM
			Green Warbler	<i>Phylloscopus nitidus</i>	LC	WM
			Common Iora	<i>Aegithina tiphia</i>	LC	R
		Alaudidae	Jerdon's Bushlark	<i>Mirafraga affinis</i>	LC	R
		Cisticolidae	Plain Prinia	<i>Prinia inornata</i>	LC	R
			Ashy Prinia	<i>Prinia socialis</i>	LC	R
			Grey-breasted Prinia	<i>Prinia hodgsonii</i>	LC	R
			Tailor Bird	<i>Orthotomus sutorius</i>	LC	R
			Zitting Cisticola	<i>Cisticola juncidis</i>	LC	R
		Corvidae	Common House Crow	<i>Corvus splendens</i>	LC	R
			Indian Jungle Crow	<i>Corvus macrorhynchos</i>	LC	R
			Rufous Treepie	<i>Dendrocitta vagabunda</i>	LC	R
		Dicaeidae	Pale-billed Flowerpecker	<i>Dicaeum erythrorhynchos</i>	LC	R
		Dicruridae	Black Drongo	<i>Dicrurus macrocercus</i>	LC	R
			Ashy Drongo	<i>Dicrurus leucophaeus</i>	LC	WM
			Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	LC	R
		Estrildidae	Scaly-breasted Munia	<i>Lonchura punctulata</i>	LC	R
			White-rumped Munia	<i>Lonchura striata</i>	LC	R
		Hirundinidae	Barn Swallow	<i>Hirundo rustica</i>	LC	WM
			Wire-tailed Swallow	<i>Hirundo smithii</i>	LC	R
			Streak-throated Swallow	<i>Petrochelidon fluvicola</i>	LC	R
		Laniidae	Brown Shrike	<i>Lanius cristatus</i>	LC	WM
			Long-tailed Shrike	<i>Lanius schach</i>	LC	WM
		Leiothrichidae	Jungle Babbler	<i>Argya malabarica</i>	LC	R
			Yellow-billed Babler	<i>Argya affinis</i>	LC	R
		Monarchidae	Asian Paradise Flycatcher	<i>Terpsiphone paradisi</i>	LC	R
		Motacillidae	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	LC	R
			Grey Wagtail	<i>Motacilla cinerea</i>	LC	WM
			Paddyfield Pipit	<i>Anthus rufulus</i>	LC	R
		Muscicapidae	Magpie Robin	<i>Copsychus saularis</i>	LC	R
			Pied Bushchat	<i>Saxicola caprata</i>	LC	R
			Siberian Stonechat	<i>Saxicola maurus</i>	LC	WM
			Red-breasted Flycatcher	<i>Ficedula parva</i>	LC	WM
		Nectariniidae	Loten's Sunbird	<i>Cinnyris lotenius</i>	LC	R
			Purple Sunbird	<i>Cinnyris asiaticus</i>	LC	R
			Purple-rumped Sunbird	<i>Leptocoma zeylonica</i>	LC	R
		Oriolidae	Indian Golden Oriole	<i>Oriolus oriolus</i>	LC	WM
			Black-hooded Oriole	<i>Oriolus xanthornus</i>	LC	R
		Passeridae	House Sparrow	<i>Passer domesticus</i>	LC	R
		Ploceidae	Baya Weaver	<i>Ploceus philippinus</i>	LC	R
		Pycnonotida	Red-vented Bulbul	<i>Pycnonotus cafer</i>	LC	R
Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>		LC	R		
White-browed Bulbul	<i>Pycnonotus luteolus</i>		LC	R		
Sturnidae	Common Myna	<i>Acridotheres tristis</i>	LC	R		
	Jungle Myna	<i>Acridotheres fuscus</i>	LC	R		
Turidae	Orange-headed Thrush	<i>Geokichla citrina</i>	LC	R		

SI No.	Order	Family	Common Name	Scientific Name	Conservation Status	Status
13.	PELECANIFORMES	Ardeidae	Large Egret	<i>Casmerodius albus</i>	LC	R
			Median Egret	<i>Ardea intermedia</i>	LC	R
			Little Egret	<i>Egretta garzetta</i>	LC	R
			Western Reef Egret	<i>Egretta gularis</i>	LC	R
			Cattle Egret	<i>Bubulcus ibis</i>	LC	R
			Grey Heron	<i>Ardea cinerea</i>	LC	WM
			Purple Heron	<i>Ardea purpurea</i>	LC	R
			Black Crowned Night Heron	<i>Nycticorax nycticorax</i>	LC	R
			Indian Pond Heron	<i>Ardeola grayii</i>	LC	R
		Striated Heron	<i>Butorides striata</i>	LC	R	
		Threskiornithidae	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	NT	R
		Glossy Ibis	<i>Plegadis falcinellus</i>	NT	WM	
14.	PICIFORMES	Megalaimidae	White-checked Barbet	<i>Psilopogon viridis</i>	LC	R
			Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	LC	R
		Picidae	Lesser Goldenback Woodpecker	<i>Dinopium benghalense</i>	LC	R
15.	PSITTACIFORMES	Psittaculidae	Rose-ringed Parakeet	<i>Psittacula krameri</i>	LC	R
			Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	LC	R
16.	STRIGIFORMES	Strigidae	Spotted Owlet	<i>Athene brama</i>	LC	R
17.	SULIFORMES	Anhingidae	Oriental Darter	<i>Anhinga melanogaster</i>	NT	R
		Phalacrocoracidae	Little Cormorant	<i>Microcarbo niger</i>	LC	R
			Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	LC	R

**Note :** LC - Least Concern, NT - Near Threatened, VU - Vulnerable, EN - Endangered, R - Resident, WM - Winter Migrant.

The documented birds were categorised as residents and migrants as shown in Figure 6. Passeriformes was the dominant order with 21 families followed by Charadriiformes with seven families, Coraciiformes with three families, Accipitriformes, Pelecaniiformes, Piciformes, Suliformes with two families and Anseriformes, Apodiformes, Ciconiiformes, Columbiformes, Cuculiformes, Galliformes, Gruiformes, Psittaciformes, Strigiformes and Falconiformes were represented by one family. Great Knot (*Calidris tenuirostris*), an Endangered species, was documented once during the study period. one Vulnerable species, Woolly-necked Stork (*Ciconia aeruginosus*) was recorded from the study area. Eurasian Oystercatcher (*Haematopus ostralegus*), Eurasian curlew (*Numenius arquata*), Curlew Sandpiper (*Calidris ferruginea*), Bar-tailed Godwit (*Limosa lapponica*), Painted Stork (*Mycteria leucocephala*), Black-headed Ibis (*Threskiornis melanocephalus*), Glossy Ibis (*Plegadis falcinellus*) and Oriental Darter (*Anhinga melanogaster*) were the Near Threatened species which were documented during the study.



**Figure 2.** Small Blue Kingfisher (*Alcedo atthis*) with a kill



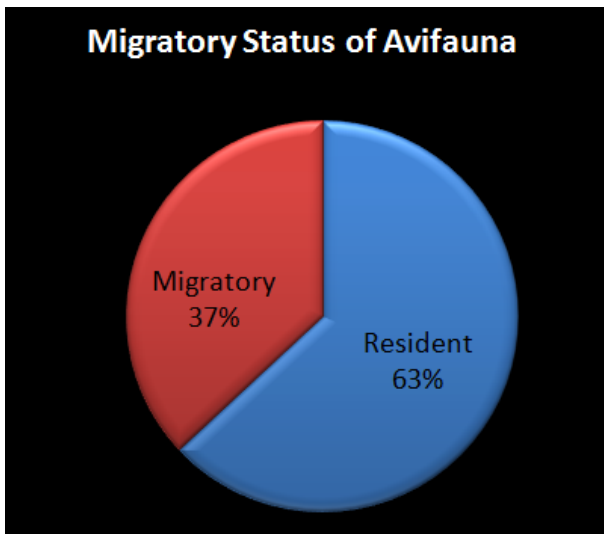
**Figure 3.** Greater Crested Terns (*Thalasseus bergii*) on exposed sandbanks



**Figure 4.** Lesser Black-backed Gull (*Larus fuscus*), Slender-billed Gull (*Chroicocephalus genei*), Brown-headed Gulls (*Chroicocephalus brunnicapillus*) along with Crested Terns (*Thalasseus Sps.*) during low tide



**Figure 5.** Eurasian Curlew (*Numenius arquata*), a Near Threatened species and Whimbrel (*Numenius phaeopus*)



**Figure 6.** Migratory status of birds

The Gulls and Terns were mostly seen on the exposed sandbanks during high and low tides as documented in [Figure 3](#) and [Figure 4](#). Sanderlings along with Plovers and Sandpipers were seen foraging and feeding near the water's edge on insects carried by water. Whimbrels, Eurasian Curlews ([Figure 5](#)), Egrets, Herons, Kingfishers and Ibises were mostly seen in the shallows adjacent to the mangroves. Majority of other birds were documented in the mangrove patches and associated areas with good tree cover. Studies have showed that the areas with a considerable green cover is an important factor which supports the avifauna [42] and the vegetation determines the avian community [43]. Forested regions along with a good diversity and density of trees sustain a rich avifaunal diversity [4,44,45]. Orioles, Drongos, Warblers, Bulbuls, Kites, Eagles and other birds of prey, Bee-eaters, Flycatchers, Swifts and Swallows and Sunbirds were predominantly documented in the wooded areas. Black Kite and Brahminy Kite, Lesser Sand Plover, Black-headed Gull and Brown-headed Gull, Small Blue Kingfisher ([Figure 2](#)) and White-breasted Kingfisher, Indian Jungle Crow, Lesser Crested Tern and Greater Crested Tern, Whimbrel, Common Sandpiper, Western Reef Egret and Striated Heron were the common birds of the estuary, whereas sightings of Black-capped Kingfisher, Stork-billed Kingfisher, Eurasian curlew,

Dunlin, Sanderling, Ruddy Turnstone, Eurasian Marsh Harrier, White-bellied Sea Eagle and Common Greenshank were uncommon. Crab Plover, Eurasian Oystercatcher, Sandwich Tern, Great Knot, Curlew Sandpiper and Bar-tailed Godwit were the rare birds of estuary. Few threats to the area and avifauna like habitat alteration and degradation, dredging which effects the normal flow of water, environmental pollution and intense anthropogenic activities were also documented during the study.

## 5. Conclusion

The studies have shown that Sasihithlu estuary is rich in terms of avifauna. The estuary and the associated wetlands serve as an important habitat for birds. It also provides favourable habitat for many migratory birds. Over fishing and extraction of shells, conversion of mangroves and wetlands into aquaculture ponds for fish and shrimp farming, dredging, solid waste deposition by rivers and sea, water pollution, riverine and coastal erosion and increased human interference caused by tourism are the major threats to the area and the avifauna. Habitat alteration has a significant impact on avian populations, its diversity and occurrence. As there were no studies undertaken in this area with regards to avifaunal conservation, the present study can be used as a baseline data to assess the status of avifauna and to formulate conservation strategies.

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## Conflict of Interests

There is no conflict of interest with respect to this research article.

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