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A study on seasonal fluctuations of avian diversity in Pat Wetland, Kudal, Sindhudurg

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Abstract
Pat wetland act as feeding, roosting, and breeding grounds for a wide variety of resident and migratory birds, while also contributing to ecosystem services such as nutrient cycling, hydrological regulation, and biodiversity maintenance. Recognizing the importance of such habitats, a systematic study was conducted from 2019 to 2024 to assess fluctuations in avian diversity with respect to seasonal variations and conservation significance. A total of 142 bird species, representing 56 families, were recorded during the survey period. Of these, 102 species were resident, 31 were local migratory, and 21 were long-distance migratory species, reflecting the wetland's function as both a permanent habitat and a migratory stopover site. Among the documented species, several species hold global conservation importance. Five species were categorized as Near Threatened and three species of hornbill were categorized as Vulnerable. The occurrence of these species highlights the wetland's high conservation value within the Konkan landscape. Clear seasonal patterns were observed: winter months (November-February) showed higher abundance of ducks, coots, and jacanas, coinciding with the arrival of migratory waterfowl. The monsoon season (June-September) supported breeding activity in herons, water hens, and jacanas, while summer (March-May) recorded reduced species richness, largely due to a decline in water levels and associated habitat shrinkage. Despite its ecological value, Pat Wetland faces multiple anthropogenic. The findings of this study provide a baseline avifaunal checklist and demonstrate the urgent need for conservation strategies.

Keywords: Avian diversity, Seasonal, Wetland, Sindhudurg, Migratory

Introduction
Wetlands are among the most productive ecosystems on Earth, providing crucial ecological services including water purification, flood regulation, groundwater recharge, carbon sequestration, and biodiversity conservation (Mitsch & Gosselink, 2015) [7]. India, with its diverse geographical and climatic features, hosts a wide array of wetlands, many of which support unique assemblages of flora and fauna (Prasad *et al*., 2002) [9]. Avifauna, in particular, are highly dependent on wetlands, as these ecosystems serve as breeding, feeding, and roosting grounds (Ali, 1996) [1]. Sindhudurg district, located in the Konkan region of Maharashtra, is endowed with coastal wetlands, estuaries, mangroves, and freshwater lakes that sustain rich bird communities. Pat Wetland, a prominent freshwater wetland in Kudal taluka, holds significant ecological and conservation value due to its ability to support both resident and migratory bird species. Despite this importance, wetlands in the region remain poorly studied and face increasing anthropogenic pressures (Kumar *et al*., 2017) [6]. This study aims to document the seasonal fluctuations in avian diversity at Pat Wetland, assess its role in supporting migratory species, and identify conservation threats. The findings provide baseline data that can guide conservation management in Sindhudurg.

Materials and Methods
Study Area
Pat Wetland is located in Kudal taluka of Sindhudurg district, Maharashtra (16°01′ N, 73°42′ E). The wetland extends over an area of approximately 20.54 hectares and is primarily rain-fed, receiving additional seasonal inflow from surrounding catchments. Its heterogeneous landscape includes aquatic vegetation, agricultural fields, and open water patches, creating diverse habitats that support a rich assemblage of avifaunal species. The wetland is bordered

by agricultural land on one side, a coastal road on another, and grass-dominated areas used for cattle grazing. The broader village landscape consists of cultivated fields, low-elevation terraced plateaus, seasonal and perennial forest patches, and grasslands. Two major streams feed the system, ensuring periodic replenishment of water. Historically, Pat Lake was created nearly 500 years ago when the communities of Pat, Kochara, and Mhapan villages collectively transformed the site to support agriculture. Even today, the lake water continues to be an essential resource for farming and horticulture, linking human livelihood with ecological sustainability. This wetland not only supports agriculture but also plays a vital role in sustaining biodiversity. The mosaic of habitats around the wetland attracts resident as well as migratory bird species, emphasizing its ecological importance.

Field Surveys

Avifaunal surveys were conducted for a period of five years, from July 2019 to December 2024. Observations were carried out during winter, summer, and monsoon seasons, with seven survey days scheduled each month. Fieldwork was conducted during early morning hours (06:00-10:00) and in the evening (15:00-17:00). Birds were recorded through direct sightings using binoculars (Olympus 80x) and photographed with Canon 200D and Canon 760 D cameras equipped with Tamron 150-600 mm and 55-250 mm lenses. Species identification was carried out using standard ornithological field guides, particularly *Bird Life of Sindhudurg* (Grimmett, Inskipp & Inskipp, 2011) [3]. Bird watching and systematic recording were consistently maintained throughout the study period.Data on abundance were recorded, and graphical representation to assess seasonal variations in diversity.

Results

The study of Pat Wetland in Kudal, Sindhudurg, recorded 142 bird species belonging to 56 families, showing significant seasonal variation in abundance and diversity (Table 1). The most dominant family was Ardeidae with seven species including *Egretta garzetta*, *Ardea intermedia*, *Bubulcus ibis*, *Ardeola grayii*, *Ardea cinerea*, *Ardea purpurea*, and *Nycticorax nycticorax*, totaling 2,598 individuals across seasons. This was followed by Accipitridae with six species and 215 individuals, and Columbidae with five species and 186 individuals, while several families were represented by only a single or a few species such as Apodidae, Podicipedidae, Alcedinidae, Bucerotidae, Dicruridae, Hirundinidae, Oriolidae, Prunellidae, Sylviidae, and Motacillidae. Seasonal counts showed 5,139 individuals in winter, 5,607 in monsoon, and 3,827 in summer, with *Bubulcus ibis*, *Ardeola grayii*, *Ardea cinerea*, *Ardea purpurea*, *Egretta Alba*, *Egretta garzetta*, *Dendrocygna javanica*, and *Ceyx erithaca* being the most abundant at different times. The community comprised 102 resident, 31 local migratory, and 21 long-distance migratory species, with higher abundance of Anatidae, Rallidae, and Jacanidae in winter due to the arrival of waterfowl from Central Asia, increased breeding activity of herons, egrets, and jacanas in the monsoon, and reduced diversity in summer owing to shrinking water levels. Conservation concern was reflected by the presence of Near Threatened species such as *Mycteria leucocephala*, *Ciconia episcopus*, *Threskiornis melanocephalus*, *Anhinga melanogaster*, and *Anthracoceros coronatus*, along with vulnerable species like *Ocyceros birostris*, *Buceros bicornis*, and *Anthracoceros coronatus*, emphasizing the global ecological significance of Pat Wetland for avian diversity.

Discussion

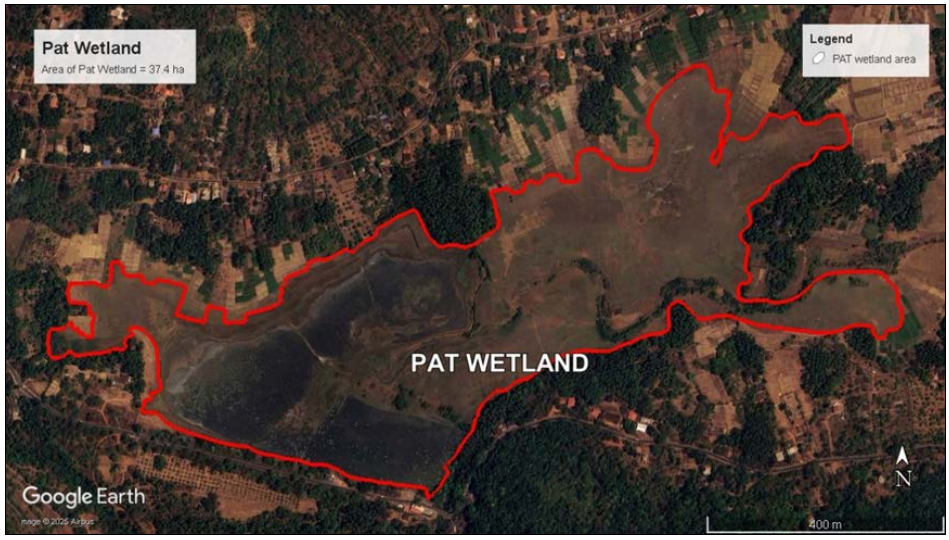
The present study provides baseline information on avian diversity in Pat Wetland, Kudal, Sindhudurg, documenting a total of 142 bird species belonging to 56 families, which significantly contributes to regional avifaunal diversity. Among the recorded families, Ardeidae was the most diverse, represented by seven species, all of which are generally resident but also exhibit local movements, indicating that Pat Wetland provides stable and suitable resources for birds throughout the year. Analysis of residency and migration status revealed 102 resident species, 31 local migratory species, and 21 long-distance migratory species, underscoring the wetland's role as both a permanent habitat and an important stopover for migratory birds along regional and international flyways, particularly the Central Asian Flyway. Seasonal patterns were evident, with higher abundance of ducks (Anatidae), coots (Rallidae), and jacanas (Jacanidae) during winter, coinciding with the arrival of migratory waterfowl from Central Asia, monsoon months supporting breeding activities in herons (Ardeidae), waterhens (Rallidae), and jacanas due to the availability of nesting sites in aquatic vegetation, and summer witnessing reduced water levels that caused habitat shrinkage, leading to a decline in both species richness and abundance, emphasizing the reliance of bird diversity on seasonal hydrological cycles. The wetland also hosts species of global conservation importance, with five species, *Mycteria leucocephala*, *Ciconia episcopus*, *Threskiornis melanocephalus*, *Anhinga melanogaster*, and *Anthracoceros coronatus* classified as Near Threatened, while three hornbill species, *Ocyceros birostris*, *Buceros bicornis*, and *Anthracoceros coronatus* are categorized as Vulnerable, highlighting the ecological and conservation significance of Pat Wetland within the Konkan region. Despite its importance, Pat Wetland faces several anthropogenic threats, including plastic pollution, agricultural runoff, cattle grazing, habitat encroachment, construction around the wetland, water extraction, recreational activities, and periodic inflow of sediments, all of which adversely impact bird populations, nesting and foraging opportunities, and overall habitat quality. The study emphasizes the significance of Pat Wetland as a critical habitat for both resident and migratory avifauna, with seasonal fluctuations reflecting the strong dependence of bird diversity on hydrological cycles, winter influx of migratory species underscoring the wetland's role as a stopover site along the Central Asian Flyway, monsoon breeding confirming the importance of aquatic vegetation in supporting nesting colonies, and summer declines aligning with previous findings that shrinking wetlands reduce avifaunal abundance. Based on these findings, there is an urgent need for conservation measures, including habitat restoration, wetland protection, community engagement, eco-tourism initiatives, awareness programs, and policy-level interventions to maintain the ecological integrity of the wetland and sustain its role as a key site for both resident and migratory birds.

Table 1: Checklist of Wetland birds with seasonal fluctuation

Family	Common Name	Scientific Name	Status	IUCN	Winter	Monsoon	Summer	Total
Phasianidae	1. Jungle Bush Quail	*Perdicula asiatica*	R	LC	12	8	15	35
	2. Red Spurfowl	*Galloperdix spadicea*	R	LC	4	-	-	4
	3. Grey Junglefowl	*Gallus sonneratii*	R	LC	3	-	4	7
	4. Indian Peafowl	*Pavo cristatus*	R	LC	4	2	2	8
Dendrocygnidae	5. Lesser Whistling Duck	*Dendrocygna javanica*	LM	LC	137	158	92	387
Anatidae	6. Indian Spot Billed Duck	*Anas poecilorhyncha*	LM	LC	12	8	3	23
Podicipedidae	7. Little Grebe	*Tachybaptus ruficollis*	R	LC	48	55	32	135
Ciconiidae	8. Asian Openbill	*Anastomus oscitans*	R	LC	43	65	30	138
	9. Painted Stork	*Mycteria leucocephala*	M	NT	14	16	65	95
	10. Woolly-Necked Stork	*Ciconia episcopus*	LM	NT	16	18	65	99
Threskiornithidae	11. Black -Headed Ibis	*Threskiornis melanocephalus*	LM	NT	36	55	34	125
	12. Red-Naped Ibis	*Pseudibis papillosa*	LM	LC	4	-	3	7
	13. Glossy Ibis	*Plegadis falcinellus*	LM	LC	31	3	45	79
Ardeidae	14. Black Crowned Night Heron	*Nycticorax nycticorax*	LM	LC	78	98	56	232
	15. Indian Pond Heron	*Ardeola greyii*	R	LC	113	165	120	398
	16. Grey Heron	*Ardea cinerea*	R	LC	116	187	65	368
	17. Purple Heron	*Ardea purpurea*	R	LC	109	165	43	317
	18. Cattle Egret	*Bubulcus ibis*	R	LC	245	354	187	786
	19. Great Egret	*Casmerodius albus*	R	LC	134	156	98	388
	20. Intermediate Egret	*Mesophoyx intermedia*	R	LC	76	98	54	228
	21. Little Egret	*Egretta garzetta*	R	LC	65	67	98	230
Phalacrocoracidae	22. Little Cormorant	*Phalacrocorax niger*	R	LC	108	176	87	371
	23. Indian Cormorant	*Phalacrocorax fuscicollis*	R	LC	87	105	65	257
Anhingidae	24. Oriental Darter	*Anhinga melanogaster*	LM	NT	67	65	62	194
Accipitridae	25. Oriental Honey Buzzard	*Pernis ptilorhynchus*	LM	LC	5	3	2	10
	26. Black Winged Kite	*Elanus caeruleus*	R	LC	7	5	3	15
	27. Black kite	*Milvus migrans*	R	LC	5	3	5	13
	28. Brahminy Kite	*Haliastur indus*	R	LC	17	56	32	105
	29. White bellied Sea Eagle	*Haliaeetus leucogaster*	R	LC	9	7	4	20
	30. Crested Serpent Eagle	*Spilornis cheela*	R	LC	7	5	4	16
	31. Shikra	*Accipiter badius*	R	LC	6	5	3	14
Rallidae	32. Slaty legged Crake	*Rallina eurizonoides*	R	LC	3	16	3	22
	33. White-Breasted Waterhen	*Amaurornis phoenicurus*	R	LC	34	54	23	111
	34. Common Coot	*Fulica atra*	LM	LC	23	45	32	100
	35. Grey-Headed Swamphen	*Porphyrio poliocephalus*	LM	LC	87	176	65	328
Burhinidae	36. Great Thick Knee	*Esacus recurvirostris*	LM	NT	1	-	-	1
Charadriidae	37. Yellow-Wattled Lapwing	*Vanellus malabaricus*	LM	LC	3	7	-	10
	38. Red Wattled Lapwing	*Vanellus indicus*	LM	LC	34	65	32	131
	39. Pacific Golden Plover	*Pluvialis fulva*	M	LC	4	-	6	10
	40. Grey Plover	*Pluvialis squatarola*	LM	LC	8	2	4	14
	41. Kentish Plover	*Charadrius alexandrinus*	M	LC	5	-	-	5
	42. Little Ringed Plover	*Charadrius dubius*	M	LC	3	-	-	3
Jacanidae	43. Pheasant Tailed Jacana	*Hydrophasianus chirurgus*	LM	LC	76	89	54	219
	44. Bronze Winged Jacana	*Metopidius indicus*	LM	LC	98	105	58	261
Scolopacidae	45. Common Sandpiper	*Actitis hypoleucos*	LM	LC	23	36	12	71
Laridae	46. River Tern	*Sterna aurantia*	LM	LC	45	67	32	144
Columbidae	47. Rock Pigeon	*Columba livia*	R	LC	35	54	21	110
	48. Spotted Dove	*Stigmatopelia*	R	LC	33	56	15	104

		chinensis						
	49. Emerald Dove	*Chalcophaps indica*	R	LC	26	34	25	85
	50. Grey-Fronted Green Pigeon	*Treron (p) affinis*	R	LC	8	-	5	13
	51. Yellow Footed Green Pigeon	*Treron phoenicopterus*	R	LC	9	-	-	9
Psittacidae	52. Vernal Hanging Parrot	*Loriculus vernalis*	R	LC	6	-	-	6
	53. Rose-Ringed Parakeet	*Psittacula krameri*	R	LC	7	--	8	15
	54. Plum-Headed Parakeet	*Psittacula cyanocephala*	R	LC	6	-	5	11
Cuculidae	55. Jacobin Cuckoo	*Clamator jacobinus*	LM	LC	6	19	5	30
	56. Common Hawk Cuckoo	*Hierococcyx varius*	LM	LC	3	8	3	14
	57. Asian Koel	*Eudynamys scolopaceus*	R	LC	6	15	4	25
Centropodidae	58. Southern Coucal	*Centropus s parroti*	R	LC	7	9	6	22
Tytonidae	59. Barn Owl	*Tyto alba*	R	LC	2	-	-	2
	60. Brown Wood Owl	*Strix leptogrammica*	R	LC	1	-		1
Strigidae	61. Brown Fish Owl	*Ketupa zeylonensis*	R	LC	6	3	6	15
	62. Spotted Owlet	*Athene brama*	R	LC	7	8	2	17
Caprimulgidae	63. Indian Nightjar	*Caprimulgus asiaticus*	R	LC	13	26	32	71
	64. Jerdon's Nightjar	*Caprimulgus atripennis*	R	LC	5	4	3	12
Apodidae	65. Little Swift	*Apus pacificus*	R	LC	15	32	15	62
Coraciidae	66. Indian Roller	*Coracias benghalensis*	R	LC	25	-	-	25
Halcyonidae	67. Stork Billed Kingfisher	*Pelargopsis capensis*	R	LC	65	87	65	217
	68. White-Throated Kingfisher	*Halcyon smyrnensis*	R	LC	76	63	78	217
Alcedinidae	69. Common Kingfisher	*Alcedo atthis*	R	LC	89	76	59	224
	70. Oriental Dwarf Kingfisher	*Ceyx erithaca*	M	LC	83	69	84	236
	71. Blue Eared Kingfisher	*Alcedo meninting*	LM	LC	12	24	2	38
Cerylidae	72. Pied Kingfisher	*Ceryle rudis*	R	LC	16	12	23	51
Meropidae	73. Green Bee-Eater	*Merops orientalis*	R	LC	98	66	47	211
	74. Blue Bearded Bea-Eater	*Nyctyornis athertoni*	LM	LC	4	-	1	5
	75. Blue-Tailed Bee-Eater	*Merops philippinus*	LM	LC	5	-	2	7
Bucerotidae	76. Malabar Grey Hornbill	*Ocyceros griseus*	R	VU	2	4	2	8
	77. Great Hornbill	*Buceros bicornis*	R	VU	8	15	2	25
	78. Malabar Pied Hornbill	*Anthracoceros coronatus*	R	NT	27	23	5	55
Megalaimidae	79. White-Cheeked Barbet	*Megalaima viridis*	R	LC	8	-	-	8
	80. Brown Headed Barbet	*Megalaima zeylanica*	R	LC	9	3	2	14
	81. Coppersmith Barbet	*Megalaima haemacephala*	R	LC	8	4	2	14
Picidae	82. Yellow Crowned Woodpecker	*Dendrocopos mahrattensis*	R	LC	5		-	5
	83. Rufous Woodpecker	*Micropternus brachyurus*	R	LC	5	8	6	19
	84. Lesser Goldenback	*Dinopium benghalense*	R	LC	8	6	4	18
Pittidae	85. Indian Pitta	*Pitta brachyura*	M	LC	2	19	3	24
Tephrodornithidae	86. Common Woodshrike	*Tephrodornis pondicerianus*	M	LC	5	15	8	28
	87. Bar-Winged Flycatcher Shrike	*Hemipus picatus*	M	LC	8	7	15	30
Artamidae	88. Ashy Woodswallow	*Artamus fuscus*	M	LC	12	8	16	36
Aegithinidae	89. Common Iora	*Aegithina tiphia*	R	LC	4	-	-	4
Campephagidae	90. Orange Minivet	*Pericrocotus flammeus*	R	LC	4	1	15	20
	91. Small Minivet	*Pericrocotus cinnamomeus*	R	LC	7	4	8	19
Laniidae	92. Brown Shrike	*Lanius cristatus*	R	LC	5	6	3	14
	93. Bay-Backed Shrike	*Lanius vittatus*	R	LC	3	7	2	12
	94. Long tailed Shrike	*Lanius schach*	R	LC	4	5	3	12
Oriolidae	95. Indian Golden Oriole	*Oriolus (oriolus) kundoo*	R	LC	13	2	19	34
	96. Black Hooded Oriole	*Oriolus*	R	LC	17	8	4	29

		xanthornus						
Dicruridae	97. Black Drango	*Dicrurus macrocercus*	R	LC	45	76	71	192
	98. Ashy Drongo	*Dicrurus leucophaeus*	R	LC	36	72	67	175
	99. Greater Racket Tailed Drongo	*Dicrurus paradiseus*	R	LC	47	43	12	102
Monarchidae	100. Black-Naped Monarch	*Hypothymis azurea*	R	LC	8	5	-	13
	101. Indian Paradise Flycatcher	*Terpsiphone paradisi*	LM	LC	17	-	3	20
Corvidae	102. Rufous Treepie	*Dendrocitta vagabunda*	LM	LC	25	25	29	79
	103. House Crow	*Corvus splendens*	R	LC	48	37	19	104
	104. Indian Jungle Crow	*Corvus macrorhynchos*	R	LC	17	2	5	24
Hirundinidae	105. Wire-Tailed Swallow	*Hirundo smithii*	R	LC	87	89	53	229
Cisticolidae	106. Grey Breasted Prinia	*Prinia hodgsonii*	R	LC	58	87	34	179
	107. Jungle Prinia	*Prinia sylvatica*	R	LC	78	98	54	230
	108. Ashy Prinia	*Prinia socialis*	R	LC	76	43	23	142
	109. Common Tailorbird	*Orthotomus sutorius*	R	LC	2	6	-	8
Pycnonotidae	110. Red Whiskered Bulbul	*Pycnonotus jocosus*	R	LC	56	57	46	159
	111. Red Vented Bulbul	*Pycnonotus cafer*	R	LC	78	83	56	217
	112. Yellow Browed Bulbul	*Acritillas indica*	R	LC	3	-		3
Timaliidae	113. Puff-Throated Babbler	*Pellorneum ruficeps*	R	LC	6	-		6
	114. Common Babbler	*Turdoides caudata*	R	LC	78	98	76	252
	115. Large Grey Babbler	*Turdoides malcolmi*	R	LC	12	32	23	67
	116. Jungle Babbler	*Turdoides striata*	R	LC	76	67	52	195
Zosteropidae	117. Oriental White-Eye	*Zosterops palpebrosus*	R	LC	3	-	-	3
Sturnidae	118. Jungle Myna	*Acridotheres fuscus*	R	LC	65	54	32	151
	119. Common Myna	*Acridotheres tristis*	R	LC	65	43	23	131
	120. Chestnut Tailed Starling	*Sturnai malbarica*	M	LC	87	54	43	184
Turdidae	121. Malabar Whistling Thrush	*Myophonus horsfieldii*	R	LC	78	71	34	183
	122. Orange Headed Thrush	*Zoothera citrina*	R	LC	98	65	54	217
Muscicapidae	123. Oriental Magpie Robin	*Copsychus saularis*	R	LC	67	43	65	175
	124. White Rumped Shama	*Copsychus malabaricus*	R	LC	62	53	56	171
	125. Indian Robin	*Saxicoloides fulicatus*	R	LC	98	76	43	217
	126. Common Stonechat	*Saxicola torquatus*	LM	LC	65	3	23	91
	127. Tickells blue Flycatcher	*Cyornis tickelliae*	R	LC	5	-		5
Dicaeidae	128. Thick-billed Flowerpecker	*Dicaeum agile*	LM	LC	8	-	3	11
Nectariniidae	129. Purple-**r**umped Sunbird	*Leptocoma zeylonica*	R	LC	82	36	65	183
	130. Crimson Backed Sunbird	*Leptocoma minima*	R	LC	67	53	37	157
	131. Purple Sunbird	*Cinnyris asiaticus*	R	LC	98	56	87	241
	132. Vigors's Sunbird	*Aethopyga siparaja vigorsii*	R	LC	5	-		5
	133. Little Spiderhunter	*Arachnothera longirostra*	R	LC	6	16	-	22
Passeridae	134. House Sparrow	*Passer domesticus*	R	LC	67	97	64	228
Ploceidae	135. Baya weaver	*Ploceus philippinus*	R	LC	98	106	54	258
Estrildidae	136. Scaly Breasted Munia	*Lonchura punctulata*	R	LC	34	89	43	166
	137. White-Rumped Munia	*Lonchura striata*	R	LC	86	78	32	196
	138. Black Throated Munia	*Lonchura kelaarti*	R	LC	96	58	63	217
Motacillidae	139. Citrine Wagtail	*Motacilla citreola*	M	LC	25	43	33	101
	140. Yellow Wagtail	*Motacilla flava*	M	LC	13	9	8	30
	141. White Wagtail	*Motacilla alba*	M	LC	5	4	8	17
	142. Paddyfield Pipit	*Anthus rufulus*	LM	LC	5	6	3	14
				Total	5139	5607	3827	14573



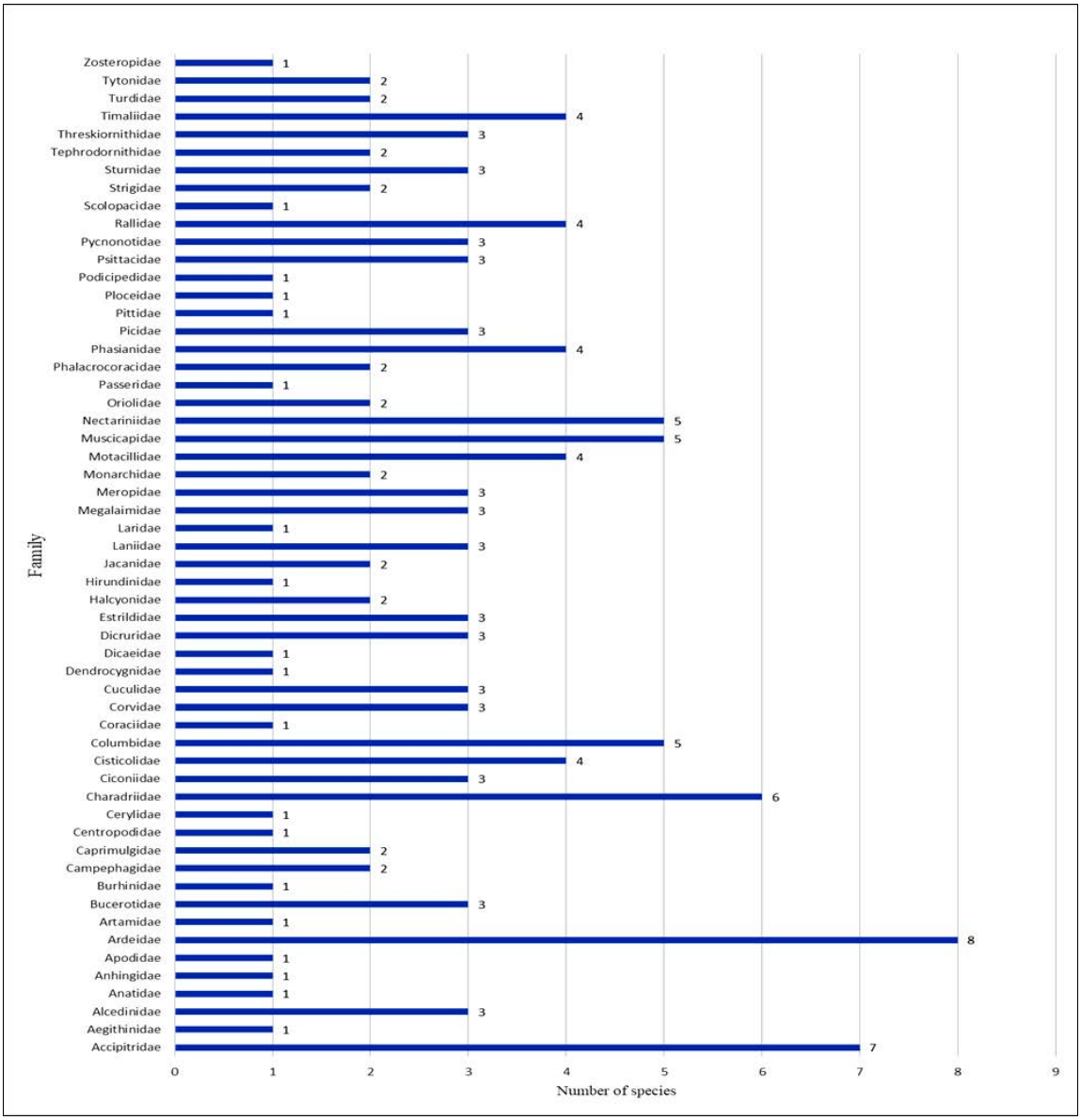


Fig 2: Family wise Graphical Represented

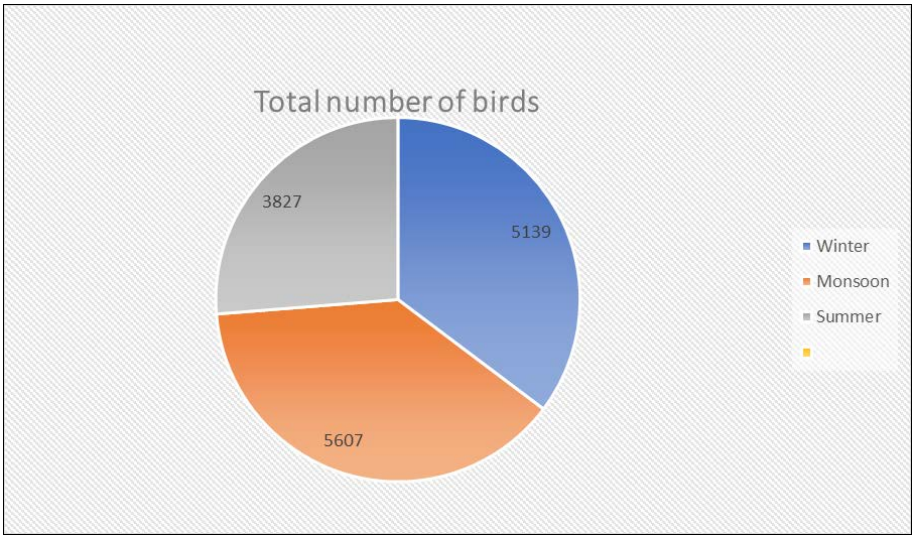


Fig 3: Total birds during different seasons

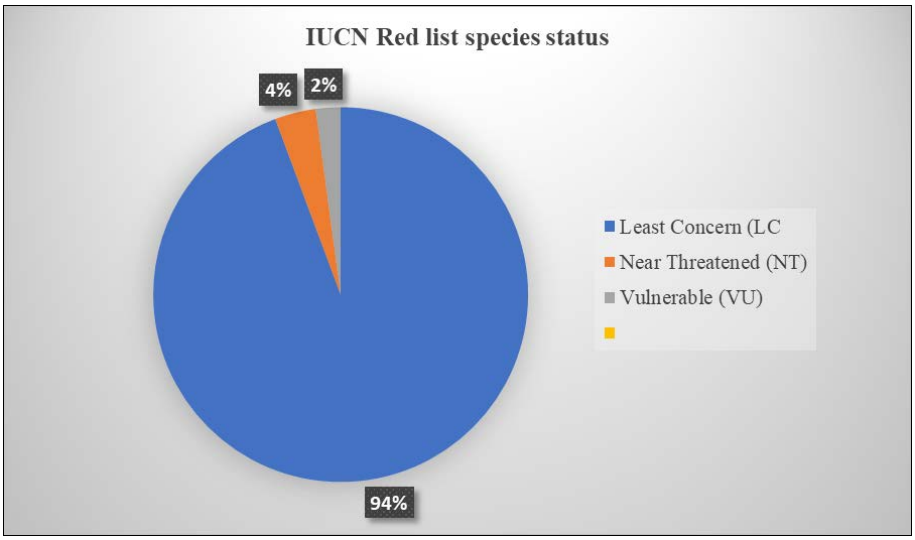


Fig 4: IUCN Red List status of the avian fauna of Pat Wetland

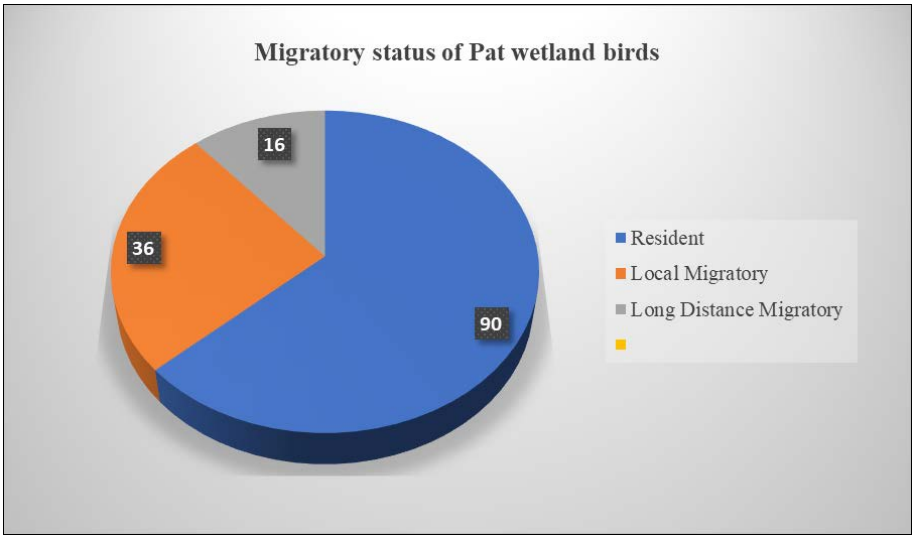


Fig 5: Migratory Status of Avian Species from Pat Wetland

Conclusion

Pat Wetland in Sindhudurg serves as an important habitat that supports a rich assemblage of both resident and migratory birds, making it a vital center of biodiversity in the region. The observed seasonal variations in bird abundance and composition reflect the strong influence of hydrological cycles, which create dynamic habitats necessary for feeding, breeding, and roosting. These findings underline the ecological significance of the wetland not only for local bird populations but also for species migrating along international flyways. However, increasing anthropogenic pressures and climatic changes pose potential threats to its ecological balance. To safeguard this unique ecosystem, long-term scientific monitoring, active involvement of local communities in conservation initiatives, and the implementation of effective wetland management policies are necessary. Such integrated efforts will help preserve the ecological integrity of Pat Wetland and ensure its continued role in supporting avifaunal diversity and ecosystem services.

References

1. Ali S. The Book of Indian Birds. Mumbai: Oxford University Press; 1996.
2. Bibby CJ, Burgess ND, Hill DA, Mustoe S. Bird Census Techniques. London: Academic Press; 2000.
3. Grimmett R, Inskipp C, Inskipp T. Birds of the Indian Subcontinent. New Delhi: Oxford University Press; 2011.
4. IUCN. The IUCN Red List of Threatened Species. Version 2024-1. Available from: https://www.iucnredlist.org
5. Kumar A, Sati JP, Tak PC, Alfred JRB. Handbook on Indian Wetland Birds and Their Conservation. Kolkata: Zoological Survey of India; 2005.
6. Kumar P, Pandit S, Sharma R. Wetland ecosystems and

avian diversity in India: A review. Ecology, Environment and Conservation. 2017;23(2):955-962.
7. Mitsch WJ, Gosselink JG. Wetlands. New Jersey: John Wiley & Sons; 2015.
8. Paracuellos M. How can habitat selection affect the use of a wetland complex by waterbirds? Biodiversity and Conservation. 2006;15(14):4569-4582.
9. Prasad SN, *et al*. Conservation of wetlands of India - A review. Tropical Ecology. 2002;43(1):173-186.
10. Sundar KSG, Kittur S, Gopi GV. Wintering waterbird population trends in India. Biological Conservation. 2016;197:40-50.