

**Hirakud Wetlands:
A Little-known
Refuge For Breeding
And Wintering
Waterfowl And A
Potential Important
Bird Area In Odisha,
India**



Abstract

Ad libitum observations on the little-known avifauna of Hirakud wetlands, consisting of the 746 km² man-made reservoir and its surroundings were gathered from January 2010 onwards. Co-ordinated and systematic mid-winter waterfowl counts were taken up annually from 2010. A total of 112 species of waterfowl and water-dependent bird species were recorded during the five-year period, including 15 threatened species. The highest number of birds (79,344) was recorded during 2013 with an average yearly count of 63 species and 47,348 individuals. The results have been analysed, salient findings discussed, two case-studies narrated and conservation action points highlighted. As the site fulfils criteria A1 and A4iii of the IBCN guidelines, it is recommended that the site be included in the Important Bird Area (IBA) network of Odisha. Setting up a Bird Sanctuary / Conservation Reserve at Jarimuli uplands is also suggested.

Keywords : *Hirakud, reservoir, waterfowl, migratory birds, breeding birds, Odisha, Important Bird Area, threatened birds*

Introduction

According to the Ramsar Convention, "wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres (<http://www.wetlands.org>). The Modified National Wetland Classification system, followed in India for wetland delineation and mapping, comprises of 19 wetland classes which are organized under a Level III hierarchical system (Anon, 2010). Level one has two classes: Inland and coastal, which are further bifurcated into two categories : natural and man-made. In the said classification, Hirakud wetlands fall under the code 1201 category (man-made reservoirs/barrages). According to the State Fisheries Department, Odisha has a total waterspread of 2,56,000 ha in the form of major, medium and minor reservoirs.

Unfortunately, around the world wetland habitats are disappearing, and wetland birds, many of which were once common, are declining. Today, 17% of waterbird species are considered globally threatened (BirdLife International, 2008). Studies on wetland birds in Odisha are largely confined to the iconic Chilika lake (Balachandran *et al.*, 2009), the largest brackish water lagoon in Asia as well as Bhitarkanika mangroves (Gopi *et al.* 2007. On the contrary, published information on avifauna of Hirakud is non-existent apart from anecdotal newspaper reports quoting Forest Department census figures. However, an excellent historical perspective of the avifauna of the landscape (pre-dam scenario) is depicted in the comprehensive works of the renowned geologist and ornithologist Valentine Ball (Ball, 1876, 1877). Recent studies are rather scanty but for isolated observations on certain bird species (Ray, 1967, 1968). The most detailed recent study was on nesting birds of the area (Nair *et al.*, 2012). Hence, despite being one of the largest man-made water bodies in Asia, the birdlife of Hirakud reservoir and its adjoining wetland habitats remain virtually unknown. This wetland is neither in the list of seven Important Bird Areas of Odisha nor is it under the Protected Area network of the state.

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Preliminary observations by the authors during November-December, 2009 indicated substantial congregations of waterfowl and presence of certain threatened bird species in this wetland. Hence, to address the huge gap in bird-related information from this fascinating habitat, fringed by the deciduous forests of Debrigarh sanctuary, a monitoring programme was envisaged by Hiraakud Wildlife Division, Wildlife Wing, Forest Department of Odisha. The activity was initiated from January 2010 and is continuing till date. The preliminary results of the study are presented in this paper.

Study Site

Hiraakud is one of the earliest major multi-purpose river valley projects in India. The reservoir was commissioned in 1957, on the river Mahanadi a little below the confluence with its tributary Ib. It is situated within the geographical ordinates of 21° 30' and 21° 50' N, and 83°30' and 84° 05' E. From horizon to horizon the reservoir forms the largest artificial lake in Asia with an area of 746 km² and a shore line over 640 km (www.ordistricts.nic.in/district_profile). The 1,248 m long masonry dam has a height of 61 m and this, along with the earthen dams, has a combined length of 25.8 km. Besides having an installed capacity of 347.5 MW power generation, the reservoir serves the irrigation needs of 75,000 square kilometres of land (http://en.wikipedia.org/wiki/Hiraakud_Dam). The reservoir is fringed to the north and west by the forests of the Debrigarh sanctuary in Bargarh district, eastern side by fishing villages, cultivation and industrial areas of Jharsuguda district and in the south-eastern side by forested ridges and inhabited areas of Sambalpur district. About 120 km² of the reservoir is included in the jurisdiction of Hiraakud Wildlife Range for intensive management of avifauna. During construction of the dam, the entire valley portion with adjoining ridges and plateaus were submerged. Thus, the reservoir depth varies from place to place. The water regime of the reservoir can be compartmentalised into three zones. The shallow upper zone (18,621 ha) retains to a certain extent, lotic characteristics while the lower zone next to the dam (40,338 ha), is lacustrine in nature. The middle zone (13,004 ha) is largely a deep waterbody.

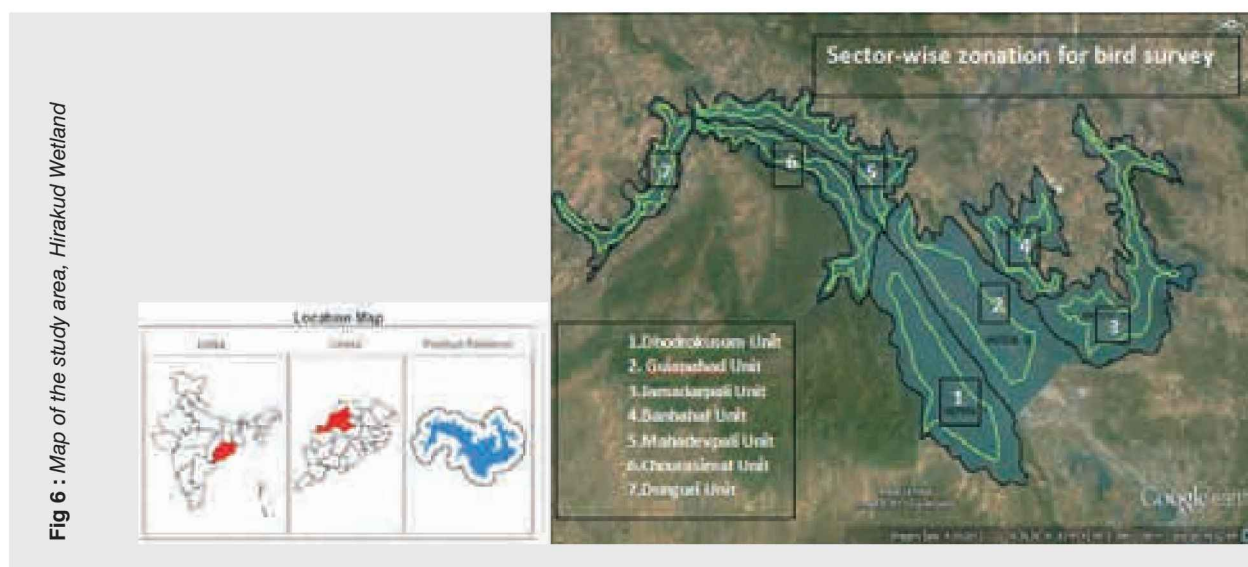
High transparency of water is a remarkable feature of the reservoir, especially during October to May. It decreases during the floods in June to September. Hiraakud, by virtue of its location within the tropics, is subjected to intense sunlight. Usually cloudless sky prevails from October to May. The reservoir, during this period, experiences algal blooms, chiefly of *Microcystis*. The high primary production rates (gross: 900-2 250 mg m⁻³ d⁻¹ ; net: 765-2025 mg C m⁻³ d⁻¹) suggest the rich density of primary producers in the reservoir. Physico-chemical variables of water also reflect the moderate to high productivity status of the reservoir (Yadava and Sugunan, 1992). The reservoir experiences a steep decline in water level during April to June. Based on satellite pictures, the reservoir area is estimated at 46 381 ha during pre-monsoon and 55 243 ha during post-monsoon seasons. Alternate drying and wetting of the margins help mineralization and adds to the nutrient content of the water. The mean depth of the reservoir is 11.3 m (Yadava and Sugunan, 1992). Deep waters are found near the main dam-site and the middle channel, while the north-western side has relatively shallow waters. Certain portions of the western and southern shoreline shows gradual slopes, while few ridge-tops which has remained exposed post-submergence has given rise to rocky island-hillocks, some clothed tree cover and some with grass and scrub. Near the extreme north-west situated in Jharsuguda district, surrounded by villages like Mahadevpali, Pujharipali, Mahulpali is situated an island upland covering an area of about 27 ha. This marshy island by name Jarimuli, which remains submerged during high floods and exposed during the summer, along with its surrounding shallow water area, attracts large congregations of waterfowl to its marshes and reed beds. Interestingly, along with this spatial heterogeneity, the waterfowl habitat here is temporally different during various times of the year. Post-monsoons, during the months of September, October and November, the reservoir remains full at what is termed High Flood Level (HFL) which is at 630 feet above MSL. During succeeding months, as rains stop and the water is released into the canals, the water level recedes to about a kilometer at places. By peak summer in mid May-June, the level reaches the minimum, at about 590 feet. During this time, the exposed shorelines, wherever soil cover is present get a dense growth of the doobh grass *Cynodon dactylon*, giving excellent forage for wild herbivores, leaving behind reed-filled ponds wherever low-lying depressions occur, giving an excellent habitat for a variety of waterfowl.

Methods

Migratory waterfowl

The studies on the waterbirds of the State got an impetus after the inception of the Asian Waterfowl Census (AWC) in 1987 (now the Asian Waterbird Census). The AWC is an annual event which takes place during the month of January every year across the Asia and is coordinated by Wetlands International. The field methodology of AWC is defined by Wetlands International (2010), updated continuously and the same is followed by all the volunteers. The data presented in this paper for migratory waterfowl is largely derived from the bird counts carried out during the annual Mid-winter Waterfowl Census in the Hiraakud Reservoir area, conducted by the Forest Department during the first/second week of January each year since 2010. As the wetland spans the jurisdiction of four Forest divisions viz. Hiraakud (Wildlife), Bargarh, Sambalpur and Jharsuguda Territorial divisions, all of which fall under Sambalpur circle, the counts were carried out jointly after a centralised training workshop for the participants. Apart from frontline staff, eminent bird-

watchers from NGOs, local and regional Nature clubs were also involved. The entire area was divided into 1. Reservoir area (comprising of 7 sectors), 2. Power Channel sector-A and 3. Power Channel sector-B, thus making a total of 9 census units (See Map). Each sector was enumerated by one Census team consisting of 3 to 6 members, equipped with census kits comprising of Binoculars, Bird Field-guide, Census sheets etc. The Census operations were carried out for the whole day from 8 am to 4 pm by following the direct count and block count methods. Thus, data for five consecutive years from 2010 to 2014, sourced from the Hirakud (Wildlife) Division has been analysed. A caveat to be noted is that the coverage during the first two years, viz 2010 and 2011 was only about 40% of the entire area and hence is not quite as extensive as the succeeding years. The results too reflect that fact. Summary statistics were derived from the raw data by MS-Excel software.



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Breeding waterfowl

Extensive reconnaissance surveys were first carried out to locate all evidences of breeding birds, based on information from local villagers and comprehensive reconnaissance surveys. Accordingly, three categories of breeding waterfowl were identified:

- a. Ground-nesting birds breeding on the shoreline and islands
- b. Colonial heronries on trees on village woodlots fringing the shore
- c. Isolated / Sporadic instances of birds nesting on reed-beds, dense marshes etc.

Subsequently, intensive nest counts were taken up in selected nesting sites to estimate the number of nests. Finer details such as nesting and hatching success were not attempted except in the first category (the results of which are outside the scope of the present article and will be dealt with in a separate detailed paper). The last category was enumerated during opportunistic sampling in likely areas following behavioural cues or information from local fishermen/villagers.

Ad libitum observations on birdlife

Apart from this, ad libitum observations were carried out during the breeding and non-breeding season, both in the wetland area as well as the Debrigarh sanctuary to get a holistic idea of the avifauna inhabiting the landscape. Special efforts were taken to record data on any interesting bird noticed during the authors' numerous boat trips inside the wetlands for patrolling and supervising ongoing departmental activities. The threatened status of bird species in this chapter follow the IUCN Red List of Threatened Species (BirdLife International, 2014) while the south Asian population estimates of waterbirds follows the 5th edition of the global Waterbird Population Estimates (Wetlands International 2012).

Results

An overview of the avifauna of the Hirakud wetlands

During the course of the bird studies from 2010 to 2014, a total of 319 species of birds were recorded from the Hirakud landscape, which also includes the Debrigarh sanctuary adjoining the reservoir (Nair, in prep.). However, of these, 112 species were either waterfowl or birds closely associated with wetlands, belonging to 20 families, the details of which have been presented in this paper (Annexure-I). Ducks & Geese (29%) constituted the largest group, followed by Plovers & Sandpipers (29%), Herons & Egrets (18%), Gulls and Terns (14%) and Rallids (10%) (Figure 1). Among the birds, 56 species were winter visitors, 42 were residents, 7 were breeding visitors, 4 were Passage migrants and the status of 3 were undetermined (Figure 2). The status of 3 species remains undetermined. Breeding birds constitute 45 and non-breeding 59 species with the status of 5 being doubtful (Figure 3).

Annexure-I Check-list of The Waterfowl & Water-dependent Birds of Hirakud Wetlands

Sl. No.	Species	Rel. abundance	Status / Breeding
PODICIPEDIDAE (GREBES)			
1	Great Crested Grebe <i>Podiceps cristatus</i>	W/A	×
2	Little Grebe <i>Tachybaptus ruficollis</i>	BV+R/C	P
3	Black-necked Grebe <i>Podiceps nigricollis</i>	P?/N	×
PELECANIDAE (PELICANS)			
4	Spot-billed Pelican <i>Pelicanus philippensis</i>	W/R	×
PHALACROCORACIDAE (CORMORANTS & DARTER)			
5	Little Cormorant <i>Phalacrocorax niger</i>	R/A	P
6	Indian Cormorant <i>Phalacrocorax fuscicollis</i>	W/O	×
7	Great Cormorant <i>Phalacrocorax carbo</i>	W/R	?
8	Oriental Darter <i>Anhinga melanogaster</i>	U/O	?
ARDEIDAE (HERONS, EGRETS & BITTERNS)			
9	Pond Heron <i>Ardeola grayii</i>	R/A	P
10	Purple Heron <i>Ardea purpurea</i>	R/C	P

SI. No.	Species	Rel. abundance	Status / Breeding
11	Grey Heron <i>Ardea cinerea</i>	U/O	?
12	Cattle Egret <i>Bubulcus ibis</i>	R/A	P
13	Little Egret <i>Egretta garzetta</i>	R/A	P
14	Median Egret <i>Mesophoyx intermedia</i>	R/C	P
15	Great Egret <i>Casmerodius albus</i>	R/C	P
16	Night Heron <i>Nycticorax nycticorax</i>	R/C	P
17	Great Bittern <i>Botaurus stellaris</i>	W/V	×
18	Black Bittern <i>Dupetor flavicollis</i>	R/O	P
19	Yellow Bittern <i>Ixobrychus sinensis</i>	R/O	P
20	Cinnamon Bittern <i>Ixobrychus cinnamomeus</i>	R/C	P
CICONIDAE (STORKS)			
21	Painted Stork <i>Mycteria leucocephala</i>	W/VR	×
22	Openbill Stork <i>Anastomus oscitans</i>	R/A	P
23	Woolly-necked Stork <i>Ciconia episcopus</i>	W/R	×
24	Lesser Adjutant <i>Leptoptilos javanicus</i>	W/VR	×
THRESKIORNITHIDAE (IBISES & SPOONBILL)			
25	Black-headed Ibis <i>Threskionis melanocephalus</i>	R/O	P
26	Black Ibis <i>Pseudibis papillosa</i>	W/R	×
27	Glossy Ibis <i>Plegadis falcinellus</i>	W/VR	×
ANATIDAE (DUCKS & GEESE)			
28	Lesser Whistling Duck <i>Dendrocygna javanica</i>	R/A	P
29	Fulvous Whistling Duck <i>Dendrocygna bicolor</i>	W/R	×
30	Greylag Goose <i>Anser anser</i>	W/R	×
31	Bar-headed Goose <i>Anser indicus</i>	W/R	×
32	Cotton Pygmy-goose <i>Nettapus coromandelianus</i>	R/O	P
33	Comb Duck <i>Sarkidiornis melanotos</i>	R/O	P
34	Common Teal <i>Anas crecca</i>	W/O	×
35	Garganey <i>Anas querquedula</i>	W/C	×
36	Northern Shoveller <i>Anas acuta</i>	W/O	×
37	Spot-billed Duck <i>Anas poecilorhyncha</i>	R/C	P
38	Gadwall <i>Anas strepera</i>	W/C	×
39	Eurasian Wigeon <i>Anas penelope</i>	W/C	×
40	Mallard <i>Anas platyrhynchos</i>	W/VR	×
41	Northern Pintail <i>Anas acuta</i>	W/C	×
42	Ruddy Shelduck <i>Tadorna ferruginea</i>	W/C	×
43	Common Pochard <i>Aythya ferina</i>	W/A	×
44	Red-crested Pochard <i>Netta rufina</i>	W/C	×
45	Ferruginous Duck <i>Aythya nyroca</i>	W/R	×
46	Tufted Duck <i>Aythya fuligula</i>	W/A	×
RALLIDAE (RAILS, CRAKES & COOTS)			
47	Ruddy-breasted Crake <i>Porzana fusca</i>	R/O	P
48	Baillon's Crake <i>Porzana pusilla</i>	R/O	?
49	Purple Swampphen <i>Porphyrio porphyrio</i>	R/A	P
50	Water Cock <i>Gallixrex cinerea</i>	R/O	P

SI. No.	Species	Rel. abundance	Status / Breeding
51	Common Moorhen <i>Gallinula chloropus</i>	R/O	P
52	White-breasted Waterhen <i>Amauromis phoenicurus</i>	R/A	P
53	Common Coot <i>Fulica atra</i>	R+M/A	P
ROSTRATULIDAE (PAINTED SNIPE)			
54	Greater Painted-Snipe <i>Rostratula bengalensis</i>	BV/O	P
SCOLOPACIDAE (WADERS)			
55	Common Snipe <i>Gallinago gallinago</i>	W/C	×
56	Common Redshank <i>Tringa totanus</i>	W/O	×
57	Common Greenshank <i>Tringa nebularia</i>	W/C	×
58	Green Sandpiper <i>Tringa ochropus</i>	W/C	×
59	Common Sandpiper <i>Tringa hypoleucos</i>	W/C	×
60	Wood Sandpiper <i>Tringa glareola</i>	W/C	×
61	Curlew Sandpiper <i>Calidris ferruginea</i>	P/O	×
62	Little Stint <i>Calidris minuta</i>	W/C	×
63	Black-tailed Godwit <i>Limosa limosa</i>	P/VR	×
64	Eurasian Curlew <i>Numenius arquata</i>	P/VR	×
65	Black-winged Stilt <i>Himantopus himantopus</i>	BV-W/C	P
66	Temminck's Stint <i>Calidris temminckii</i>	W/O	×
JACANIDAE (JACANAS)			
67	Bronze-winged Jacana <i>Metopidius indicus</i>	R/C	P
68	Pheasant-tailed Jacana <i>Hydrophasianus chirurgus</i>	BV/C	P
GLAREOLIDAE (PRATINCOLES)			
69	Oriental Pratincole <i>Glareola maldivarum</i>	BV/C	P
70	Small Pratincole <i>Glareola lactea</i>	BV/A	P
CHARADRIIDAE (LAPWINGS & PLOVERS)			
71	Pacific Golden Plover <i>Pluvialis fulva</i>	W/C	×
72	Grey Plover <i>Pluvialis squatarola</i>	W/R	×
73	Kentish Plover <i>Charadrius alexandrinus</i>	W/R	×
74	Little Ringed Plover <i>Charadrius dubius</i>	R/C	P
75	River Lapwing <i>Vanellus duvaucelii</i>	R/R	?
76	Red-wattled Lapwing <i>Vanellus indicus</i>	R/A	P
77	Yellow-wattled Lapwing <i>Vanellus malabaricus</i>	R/O	P
LARIDAE (GULLS, TERNS & SKIMMER)			
78	Pallas's Gull <i>Larus ichthyaetus</i>	W/C	×
79	Brown-headed Gull <i>Larus brunnicephalus</i>	W/A	×
80	Black-headed Gull <i>Larus ridibundus</i>	W/A	×
81	Gull-billed Tern <i>Gelochelidon nilotica</i>	W/O	×
82	River Tern <i>Sterna aurantica</i>	R/O	P
83	Black-bellied Tern <i>Sterna acuticauda</i>	R/R	?
84	Little Tern <i>Sterna albifrons</i>	BV/C	P
85	Whiskered Tern <i>Chlidonias hybrida</i>	W/A	×
86	Indian Skimmer <i>Rynchops albicollis</i>	W/VR	×

SI. No.	Species	Rel. abundance	Status / Breeding
ACCIPITRIDAE (BIRDS OF PREY)			
87	Osprey <i>Pandion haliaetus</i>	W/O	×
88	White-bellied Sea Eagle <i>Haliaeetus leucogaster</i>	W/R	×
89	Pallas's Fish Eagle <i>Haliaeetus leucoryphus</i>	W/V	×
90	Eurasian Marsh Harrier <i>Circus aeruginosus</i>	W/C	×
91	Pallid Harrier <i>Circus macrourus</i>	W/O	×
92	Indian Spotted Eagle <i>Aquila hastata</i>	W/V	×
93	Pied Harrier <i>Circus melanoleucos</i>	U/R?	?
94	Greater Spotted Eagle <i>Aquila clanga</i>	W/VR	×
95	Brahminy Kite <i>Pandion haliaetus</i>	R?/R	×
FALCONIDAE (FALCONS)			
96	Peregrine Falcon <i>Falco peregrinus calidus</i>	W/O	×
STRIGIDAE (OWLS)			
97	Brown Fish Owl <i>Ketupa zeylonensis</i>	R/O	P
ALCEDINIDAE (KINGFISHERS)			
98	Common Kingfisher <i>Alcedo atthis</i>	R/A	P
99	White-throated Kingfisher <i>Halcyon smymensis</i>	R/A	P
100	Stork-billed Kingfisher <i>Halcyon capensis</i>	R/O	P
101	Pied Kingfisher <i>Ceryle rudis</i>	R/A	P
HIRUNDINIDAE (SWALLOWS)			
102	Barn Swallow <i>Hirundo rustica</i>	W/A	×
103	Wire-tailed Swallow <i>Hirundo smithii</i>	R/C	P
104	Grey-throated Sand Martin <i>Riparia chinensis</i>	W/R	×
105	Streak-throated Swallow <i>Hirundo fluvicola</i>	R/V	P
106	Red-rumped Swallow <i>Hirundo daurica</i>	R/R	P
MOTACILLIDAE (WAGTAILS & PIPITS)			
107	White Wagtail <i>Motacilla alba</i>	W/C	×
108	Yellow Wagtail <i>Motacilla flava</i>	W/A	×
109	Citrine Wagtail <i>Motacilla citreola</i>	W/O	×
110	Grey Wagtail <i>Motacilla cinerea</i>	W/C	×
111	White-browed Wagtail <i>Motacilla maderaspatensis</i>	R/C	P
112	Paddyfield Pipit <i>Anthus rufulus</i>	R/A	P
Keys to abbreviations :			
Status : BV=Breeding Visitor, R=Resident, W= Winter Visitor, U=Undetermined, P=Passage, ? = Suspected, Relative Abundance : A=Abundant, C=Common, O=Occasional, R=Rare, VR=Very Rare, V=Vagrant			

Migratory waterfowl congregations

Analysis of data from mid-winter waterfowl counts (2010 to 2014) revealed an average yearly count of 63 species and 47,348 individuals. However, as has been mentioned in the methods section, the data spread is too high reflecting the reduced sampling effort and area in the first two years (comprehensive coverage of all the sectors covering the entire reservoir was taken up only from 2013). An analysis of the number of species in each bird family revealed the following in descending order : Ducks and Geese (Anatidae = 19 species); Waders (Scolopacidae = 12 and Charadriidae = 7 totalling 19 species); Egrets and Herons (Ardeidae = 12); Gulls and Terns (Laridae = 9 species). Considering the mean figures for five years, the six most abundant species were Lesser Whistling Duck *Dendrocygna javanica*, Common Pochard *Aythya ferina*, Great Crested Grebe *Podiceps cristatus*, Tufted Duck *Aythya fuligula*, Brown-headed Gull *Larus brunnicephalus* and Red-crested Pochard *Netta rufina* (see Figure 4)

Breeding waterbirds

The breeding waterbirds were classified into the following categories for analysis:

a. Ground-nesting birds breeding on the shoreline and islands

One of the most interesting outcome of the study was the discovery of nesting colonies of ground-nesting birds. Eight colonies/locations were located. Breeding of seven species of waterbirds such as Black-winged Stilt *Himantopus himantopus*, Oriental Pratincole *Glareola maldivarum*, Small Pratincole *Glareola lactea*, Little Ringed Plover *Charadrius dubius*, Little Tern *Sterna albifrons* and Red-wattled Lapwing *Vanellus indicus* were recorded, either in single species or multi-species congregations. Such colonies of ground-nesting birds were hitherto unknown and forms the second such instance from Odisha, after Nalaban sanctuary in Chilika lake (Balachandran, 2009).

Figure 1 : Relative proportion of six major waterfowl groups in Hirakud wetlands

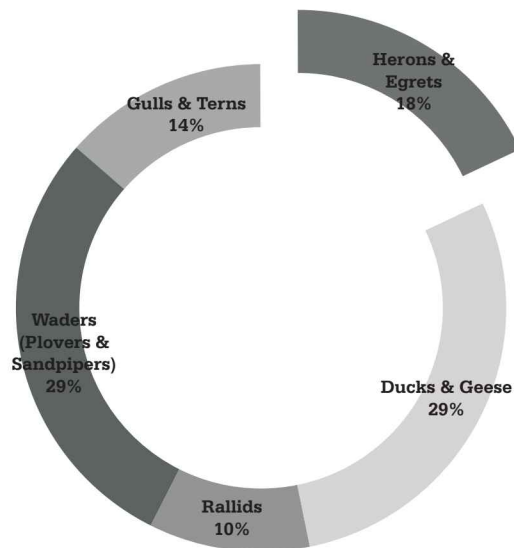
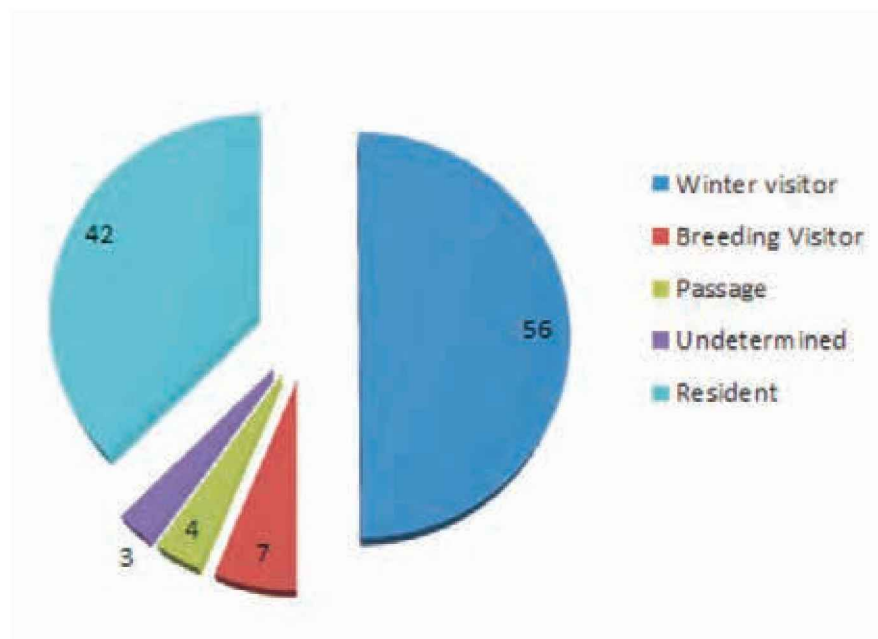


Figure 2 : Proportion of various categories of waterfowl in Hirakud



Hirakud Wetlands: A Little-known Refuge For Breeding And Wintering Waterfowl And A Potential Important Bird Area In Odisha, India

Figure 3 : Proportion of breeding and non-breeding waterfowl in Hirakud

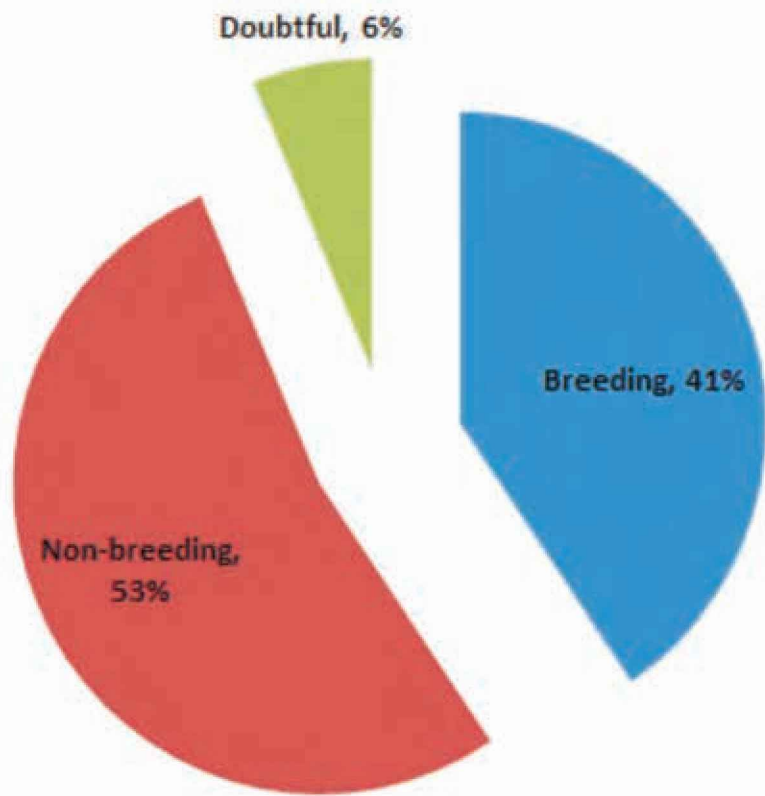
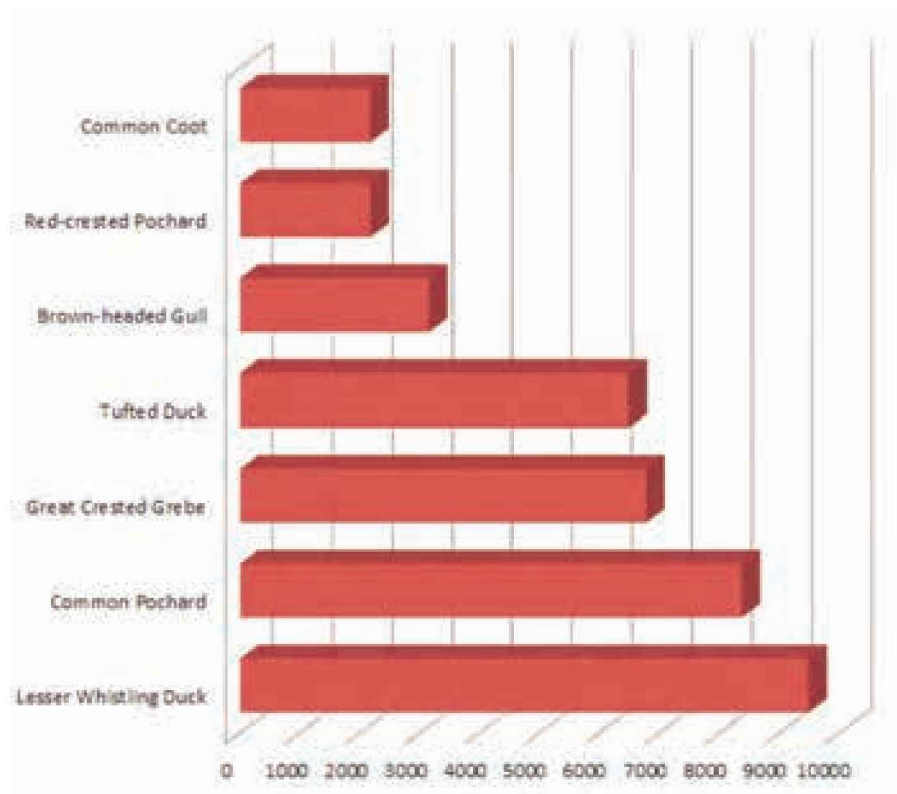


Figure 4 : Mean yearly count of seven most abundant waterfowl species in Hirakud



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A Little-known Refuge
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b. Colonial heronries on village woodlots fringing the shore

Following information received from local villagers, four heronries situated in village common lands with tree growth were located, where they were protected by local people. Birds such as Large Egret *Casmerodius albus*, Intermediate Egret *Mesophoyx intermedia*, Little Egret *Egretta garzetta*, Cattle Egret *Bubulcus ibis*, Pond Heron *Ardeola grayii*, Night Heron *Nycticorax nycticorax* and Little Cormorant *Phalacrocorax carbo* were found nesting. The largest among them, a traditional mixed heronry dominated by Open-billed Storks *Anastomus oscitans* had about 1200 nests belonging to seven species. Interestingly, two small single species colonies of Black-headed Ibis *Threskiornis melanocephalus* (a threatened species), having six and thirteen nests each, could also be discovered.

c. Isolated / Sporadic instances of birds nesting on reed-beds, dense marsh vegetation, village wetlands etc.

Intensive ad libitum searches during the appropriate nesting season led to the discovery of several isolated/sporadic nesting records of species which nest inside dense reed-beds of Typha and Arundo donax stands in the Govindpur area and also the dense tall grass among the fringes and the islands. Small satellite waterbodies such as village ponds having floating aquatic vegetation scattered around the fringes of the reservoir also had a few species breeding in them. Species seen with evidence of nesting include Purple Heron *Ardea purpurea*, Black bittern *Dupetor flavicollis*, Yellow bittern *Ixobrychus sinensis* and Chestnut Bitterns *Ixobrychus cinnamomeus*; Spot-billed Ducks *Anas poecilorhyncha*; Lesser Whistling Duck; *Dendrocygna javanica*, Cotton Pygmy Goose *Nettapus coromandelianus*; Little Grebe *Tachybaptus ruficollis*; Purple Moorhen *Porphyrio porphyrio*; Common Moorhen *Gallinulachlorophus*; Common Coot *Fulica atra*; White-breasted Waterhen *Amourornis phoenicurus* and Ruddy-breasted Crake *Porzana fusca*, Pied Harrier *Circus melanoleucos* and Comb Duck *Sarkidiornis melanotos* are also suspected to be breeding there but no direct evidence could be obtained.

Discussion

Hirakud as a waterfowl habitat

Sprawling over a huge area encompassing various depth regimes with different habitat types, it is not surprising that these extensive wetlands constitute an excellent waterfowl habitat, supporting up to 112 species of waterfowl and water-dependent species belonging to 20 families. While the deeper portions of the reservoir is favoured as a safe daytime refuge by large rafts of diving ducks and grebes such as Common Pochards, Tufted Ducks and Great Crested Grebes, the shallower areas fringing the shore is a favoured foraging ground for a variety of dabbling ducks and teals such as Lesser Whistling Teal *Dendrocygna javanica*, Northern Pintail *Anas acuta*, Gadwall *Anas strepera*, Wigeon *Anas penelope*, Shoveller *Anas acuta*, Common Teal *Anas crecca* and Garganey *Anas querquedula*. These areas are also favoured by large congregations of gulls and terns which gather near fishing nets. During early summer till the onset of rains, the receding waterline leaves temporary fish-rich ponds and pools in some areas while exposing mudflats in some others. In suitable areas, the shores get carpeted with a new flush of *Cyanodon dactylon* grass and in moist areas sedges *Cyperus sp.*, giving foraging grounds for Geese. The islands with tree growth are good areas for roosting cormorants, darters and egrets. Few standing snags in the lake offer excellent perches for raptors such as Osprey *Pandion haliaetus*, Fish Eagles *Haliaeetus sp.*, Brahminy kite *Haliaeetus turindus* and Harriers *Circus sp.* The exposed mudflats which get exposed during summer is a favoured habitat for a number of waders such as stilts, sandpipers, shanks, stints, plovers and lapwings.

Threatened Birds of Hirakud

These wetlands give refuge to 15 threatened species listed in the IUCN Redlist (see Table I). Most of them are rare and occasional visitors and more detailed studies are required to get a more complete understanding of their status, distribution and habitat use. Black-bellied Tern (the only Endangered species in the list) and Indian Skimmer *Rhyncops albicollis* are occasional visitors from the Mahanadi river which flows downstream of the dam. While the former has been seen foraging in both the Chaurasimal creek and Right Dyke shores, just a couple of records exist for the latter, near the Main Dam site. River Lapwings too ascend the river from the lower stretches to make rare visits to the dam fringes during summer, especially near the Fisheries Dept. campsite, but are not regularly seen. Lesser Adjutant *Leptoptilos javanicus* is probably a very rare visitor and only two records have been obtained. Painted Stork and Spot-billed Pelican *Pelicanus philippensis* are occasionally met with during winter in the Jarimuliis land area, in the shallow creeks. Eurasian Curlew *Numenius arquata* and Black-tailed Godwit *Limosa limosa* have been seen foraging in the mudbanks and adjoining marshes. Oriental Darter *Anhinga melanogaster* and Black-headed Ibis *Threskiornis melanocephalus* are residents seen regularly, the population of the latter increasing during the summer months as they congregate along the receding shores, especially along the Right Dyke. Interestingly, the list also includes three raptor species, viz. Pallas's Fish Eagle *Haliaeetus leucorhynchus* along with Greater spotted eagle *Aquila clanga* and Indian Spotted Eagles *Aquila hastata*,

which possibly indicates a healthy prey base and an intact food chain. However, only two species viz. Black-headed Ibis and River Tern have been recorded breeding within the study area.

Table I : Threatened birds of Hirakud wetlands

S.No	Species	IUCN Category
1	Black-bellied Tern <i>Sterna acuticauda</i>	Endangered
2	Lesser Adjutant <i>Leptoptilos javanicus</i>	Vulnerable
3	Indian Skimmer <i>Rynchops albicollis</i>	Vulnerable
4	Pallas's Fish Eagle <i>Haliaeetus leucoryphus</i>	Vulnerable
5	Greater Spotted Eagle <i>Aquila clanga</i>	Vulnerable
6	Indian Spotted Eagle <i>Aquila hastata</i>	Vulnerable
7	Spot-billed Pelican <i>Pelicanus philippensis</i>	Near Threatened
8	Oriental Darter <i>Anhinga melanogaster</i>	Near Threatened
9	Painted Stork <i>Mycteria leucocephala</i>	Near Threatened
10	Black-headed Ibis <i>Threskionis melanocephalus</i>	Near Threatened
11	Ferruginous Duck <i>Aythya nyroca</i>	Near Threatened
12	Black-tailed Godwit <i>Limosa limosa</i>	Near Threatened
13	Eurasian Curlew <i>Numenius arquata</i>	Near Threatened
14	River Lapwing <i>Vanellus duvaucelii</i>	Near Threatened
15	River Tern <i>Sterna aurantica</i>	Near Threatened

Hirakud as an Important Bird Area (IBA)

Due to its vast area, varied habitat types and rich waterfowl diversity as discussed above, these wetlands have an enormous scope to be protected and managed for waterfowl conservation for posterity. However, though Hirakud has been included in the List of Prioritized inland Wetlands of Odisha (Prasad *et al.* 2004), it has not found a place in the list of seven Important Bird Areas (IBAs) of the state of Odisha (Islam and Rahmani, 2004) or in the potential Ramsar sites in the country (Islam and Rahmani, 2008). It is regrettable that the entire area as of now, does not enjoy any legal protection, despite the fact that about 120 km² of the reservoir is under the management of Hirakud Wildlife Division of the Forest Department. Analysis of the data collected during this study reveals that the wetland confirms to Criteria A1 (Threatened Species), A4iii (>20,000 waterbirds) of the Important Bird Area stipulations laid down by the Indian Bird Conservation Network (Islam and Rahmani, 2004). It is hence recommended that the site be included as an Important Bird Area of Odisha state. Further, the Jarimuli upland area (c.27 hectares of the upland with its marshlands, reedbeds and mudbanks together with the surrounding shallow water region, totalling about 5 km²) provides a fabulous place for foraging and resting for wintering waterfowl as well as nesting for resident birds. If the Forest department can initiate attempts towards declaring the area as a Bird Sanctuary / Community Reserve, it will go a long way in securing a safe haven for the birdlife of Hirakud in particular and western Odisha in general.

Threats and Conservation Implications

Despite a variety of provisioning, regulating, cultural and supporting services, wetlands are often the first target of human interference and are among the most threatened of all natural resources. Hirakud is no exception. There is a serious concern about the discharge of alkaline effluents into the reservoir from three paper mills (Dash *et al.*, 1993) and rapid industrialisation on the northern side. Though the fishing rights of Hirakudis regulated by the State Fisheries Department through five sectors being leased out to cooperative societies, an increase in the use of zero mesh size fish nets pose a grave threat to juvenile fishes. The existing ban on fishing during the fish-breeding season in July and August by the Fisheries Department, though a admirable policy, suffers from lack of strict implementation.

Poaching and trapping of birds, though reportedly rampant a decade ago, has come down substantially especially in the western, southern and south-eastern sectors thanks to the enforcement by the local Forest Departments. However, the northern and north-eastern sectors still pose a problem. A very unique method of trapping birds using huge trap nets, have been noticed in the Govindpur island area, and it requires constant attention on part of the Forest Department.

Case Study I : Large scale trapping of waterfowl

In Jarimuliupland, when temporary water pools are formed during summer, large number of ducks and teal are attracted to them for resting and foraging. Local people erect long bamboo poles between these pools, often as high as 20-25 feet (along a straight line or semi-circle) and put up large mesh-sized nylon fishing nets across them. These net traps which run for 60 - 70 feet, are almost invisible from a distance and acts exactly as a normal mist-nets used for bird-capture. During dawn and dusk, while bird activity is the highest, hunters hide in strategic locations and on a signal, rush towards the ducks, clapping hands and shouting so as to drive them towards the waiting nets. The alarmed birds take off in a flurry and fly headlong into the traps and get entangled, from where they are later collected. Information from the poachers reveal that as many as 120 ducks can be caught in a single net during favourable conditions and the species most often trapped are Spotbill duck, Lesser Whistling teal, Garganey and Coot.

Regular patrolling by the staff of Hiraikud Wildlife Division along with dismantling and destroying the nets whenever they are encountered has put an end to the practice now. However sustained vigilance is required to maintain this and to prevent such occurrences in other areas within the reservoir.

Another pernicious threat is the collection of eggs of ground nesting waterbirds by local fisher men from the shores and uninhabited islands. This practice much prevalent over the area is gradually on the wane, following concerted awareness campaigns.

An interesting case-study involving people's participation which was encountered during the time of study has been documented in Nair *et al.*, 2012 is given below:

Case study II : From egg-collectors to bird-watchers

A group of small boys, primarily goat herders, used to collect large number of eggs of passerine birds which used to nest in the grass and scrubland along the bed and banks of Mahanadi, below the Hiraikud dam, near Sambalpur. This was more an innocuous source of amusement for them, but possibly also served the much-needed purpose of supplementing their otherwise protein-poor diet. These children were slowly persuaded to give away this pernicious habit by providing them with hen eggs as substitute, taking them for bird-watching walks and showing them wildlife films/documentaries on birds. Later they turned out to be our best and most reliable informers on nesting birds of the area.

Similarly, a documentary on local nesting birds made by Sri. S. M. Pradhan and A. K. Pradhan of Sambalpur and telecast by Odisha Doordarshan was instrumental in awakening interest in a large number of rural people living around the Hiraikud reservoir and its catchments on bird conservation. They later started providing valuable information about bird congregations, nesting sites etc. In addition, awareness campaigns aimed at fishermen hamlets inside the reservoir to prevent destruction of nests and collection of eggs of ground-nesting waterbirds also showed very encouraging results. These measures could result in a perceptible increase in the nesting success of these birds.

Suggested steps to be taken up for effective conservation

The following measures will go a long way in effective long-term conservation of this vast, magnificent and biologically rich wetland:

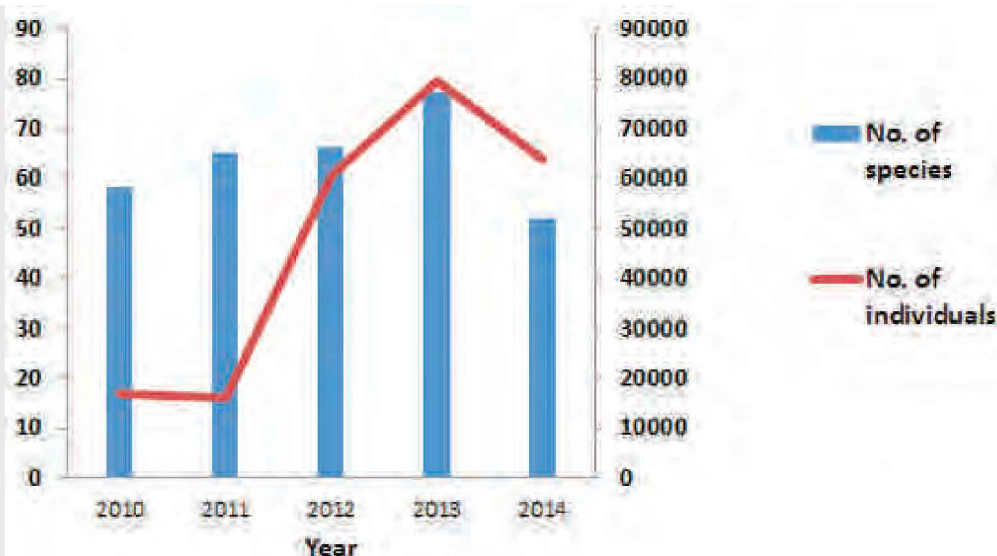
- a. Strengthen and institutionalise the existing system of unified waterfowl census involving four forest divisions by capacity building of staff and interested civil society members.
- b. Initiate regular monitoring programmes and long-term research projects in Hiraikud along the lines of what is being done in Chilika.
- c. Integrate Citizen Science initiatives to mobilise qualified manpower for regular census, monitoring and capacity building of staff.
- d. Sensitize departmental staff regarding waterfowl conservation and step up vigilance in vulnerable pockets to prevent poaching and in case of actionable intelligence to immediately conduct search, seizures, arrests and subsequent prosecutions.

- e. Survey all the islands and potential shorelines along the reservoir for nesting colonies of nesting birds.
- f. Survey the fringe villages for traditional heronries / roosting sites and nests of water-dependent raptors.
- g. Initiate awareness programmes for local residents regarding the importance of wetland and waterfowl conservation with special targeted attention on campaigns for local fisher men to prevent poaching and egg collection.
- h. Include Hirakud wetlands in the list of Important Bird Areas in Odisha.
- i. Set the grounds and convince all stakeholders for the establishment of a Bird Sanctuary / Community Reserve in the Jarimuli upland and surrounding shallow water area of about 5 km².
- j. Leverage the enormous ecotourism potential of the site by promoting bird watching as an activity, involving local people as Bird Guides, encouraging home stays etc..The expertise already available with the Forest Department in running the successful participatory ecotourism model at Barakhandia ecotourism complex in Debrigarhsanctuary, can be tapped for this.

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Figure 5 : Annual abundance and species richness of waterbirds at Hirakud wetland



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Hirakud Wetlands:
A Little-known Refuge
For Breeding And
Wintering Waterfowl
And A Potential
Important Bird Area
In Odisha, India

Literature Cited

- Anon, (1992). *Handbook on Fisheries Statistics*, Dept.of Fisheries, Orissa. (1992-93)
- Anon, (2010). *National Wetland Atlas, Orissa, SAC/EPSA/AFEG/NWIA/ATLAS/28/2010*. Space Applications Centre (ISRO), Ahmedabad, India, 204p.
- Balachandran, S., Sathiyaselvam, P. & Panda, S. (2009). Bird atlas of Chilika. 1st ed. *Mumbai; Bhubaneswar: Bombay Natural History Society; Chilika Development Authority*. Pp. 13 pp., i-xx, 1-326.
- Ball, V. (1876). Notes on some birds collected in Sambalpur and Orissa. *Stray Feathers*. 4 (4,5 & 6): 231-237.
- Ball, V. 1877. Notes on birds observed in the region between the Mahanadi and Godavari Rivers. *Stray Feathers*. 5 (5&6): 410-420.
- Ball, Valentine (1880). *Jungle life in India; or the journeys and journals of an Indian geologist*. Thos. de la Rue & Co, London.
- BirdLife International (2008) *Threatened birds of the world*. CD-ROM. Cambridge, UK: BirdLife International.
- BirdLife International (2014) IUCN Red List for birds. Downloaded from <http://www.birdlife.org> on 07/12/2014.
- Gopi, G. V. & Pandav, B. (2007). Conservation of avifauna of Bhitarkanika mangroves, India. *Zoo's Print*. 22 (10) : 2839-2847.
- Grimmett, R., Inksipp, C. & Inksipp, T. (2011); *Helm Field Guides Birds Of Indian Subcontinent*. Second Edition. *Oxford University Press*. Pp. 528.
- Islam, M. Z. & Rahmani, A. R. (2004). *Important Bird Areas in India. Priority sites for conservation*. Indian Bird Conservation Network: *Bombay Natural History Society, Bird Life International*. Pp. xviii + 1133.
- Islam, M. Z. & Rahmani, A. R. (2008). *Potential and Existing Ramsar Sites in India*. Indian Bird Conservation Network: Bombay Natural History Society, BirdLife International and Royal Society for the Protection of Birds. Oxford University Press. Pp 592.
- Majumdar, N. (1980). New records of birds from Orissa. *Journal of the Bombay Natural History Society*. 76(1): 161-162.
- Nair, M. V., Pradhan, S. & Pradhan, A. K. (2012) : *Common nesting birds of Odisha - A Photographic Guide*, Wildlife Organisation, Forest & Environment Department, Government of Odisha, 160 pp.
- Nair, M.V. (1993): A flock of Kentish Plovers and a Tern. *Newsletter for Birdwatchers*. 33(5): 94
- Nair, M. V. (1994): Birds of Aakkulam-Veli back waters and environs. *Newsletter for Birdwatchers*. 34(1): 12-16.
- Nair, M. V. (1994): Dietary of Black Capped Kingfisher - an addition. *Newsletter for Birdwatchers*. 34(5): 119.
- Nair, M.V. (1996): Large Cormorant *Phalacrocorax carbo sinensis* (Shaw) breeding in the Nilgiris. *Journal of the Bombay Natural History Society*. 93(1): 89.
- Patnaik, H. P. (1984). Paradise Flycatchers in Sambalpur. *Newsletter for Birdwatchers*. 24(1-2): 18.
- Patnaik, H. P. 1985. Birds of Sambalpur (Orissa). *Newsletter for Birdwatchers*. 24(11-12): 7-9.
- Prasad, S. N., Jaggi, A. K., Tiwari, A. K., Kaushik, P., Vijayan, L., Murlidharan, S. & Vijayan, V. S. (2004) : *Inland wetlands of India - Conservation Atlas*. Salim Ali Centre for Ornithology and Natural History, Coimbatore, India.
- Rasmussen, P. C. & Anderton, J. C. (2012). *Birds of South Asia: the Ripley guide*. 2nd ed. *Washington, D.C. and Barcelona: Smithsonian Institution and Lynx Edicions*. 2 vols. Pp. 1-378; 1-683.
- Ray, M. R. (1967). Black-bellied Finch Larks. *Newsletter for Birdwatchers*. 7(11): 12.
- Ray, M. R. (1968). Correspondence. *Newsletter for Birdwatchers*. 8(3): 8.
- Wetlands International. (2006). *Waterbird Population Estimates - Fourth Edition*. Wetlands International, Wageningen, The Netherlands. 233p.
- Wetlands International. (2010). *Guidance on waterbird monitoring methodology: Field Protocol for waterbird counting*. Wetlands International.
- Wetlands International (2014). "Waterbird Population Estimates". Retrieved from wpe.wetlands.org on Sunday 14 Dec 2014.
- Yadava, Y. S. & Sugunan, V. V., (1992). Hirakud reservoir - Strategies for fisheries development. *Bulletin* 66. Central Inland Capture Fisheries Research Institute, Barrackpore, India pp. 18.

Web references

- http://www.ordistricts.nic.in/district_profile/travel_and_tourism/tp_details.php?id=182, Hirakud dam, District Portal, Sambalpur, Govt. of Odisha website.
- <http://www.ohpcltd.com/hirakud/index.asp?type=prj>, Hirakud Power System, Odisha Hydro Power Corporation Limited
- <http://wpe.wetlands.org/>: Wetlands International (2015). "Waterbird Population Estimates". Retrieved from wpe.wetlands.org on Thursday 1 Jan 2015.