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Comparative analysis of potential Ramsar wetlands in coastal India based on biodiversity and ecological parameters

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Abstract

The Ramsar designation is crucial in protecting wetlands of international importance, recognizing their ecological significance, and promoting their conservation. As these vital ecosystems face increasing threats worldwide, the need to identify and nominate new Ramsar sites becomes crucial. This study aims to evaluate and compare the ecological importance, biodiversity significance, and conservation status of four wetlands in Goa, a southwestern coastal state of India. The methodology includes data collection for ecosystem services and biodiversity assessments, mapping study areas using ArcGIS software, and interview of the Goa State wetland officials. Finally, the assessments were carried out through comparison of ecosystem services, biodiversity, conservation status, and area coverage of these wetlands. The study shows Lake Carambolim is the strongest candidate for the next Ramsar designation in Goa which is a diverse ecosystem with numerous plant and animal species, serving as a water source for agriculture, supporting wildlife, including migratory birds, and offering cultural and recreational value. The study also found that no health cards are available for these wetlands, while wetland health cards are extremely important to assess the ecological health of wetlands based on their physical features, invasive vegetation, species, water quality, and outflows.

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Introduction

Wetlands are ecosystems that are found at the interface of land and water, and they can be either man-made or naturally occurring. These areas can be regularly or intermittently submerged in shallow water, or they may have soil that is consistently saturated with moisture. (Junk et al., 2014). Wetlands are an essential component of our natural ecosystem. They absorb pollutants, enhance water quality, and shield our shorelines from wave activity. They also lessen the effects of floods. Many sustain a wide range of life, including regionally specific plants and animals, and they act as a habitat for both animals and plants

(Mazid, 2019). Wetlands play a crucial role in ecosystem health and sustainability, serving as natural carbon sinks that help mitigate climate change. It usually serves as carbon dioxide sinks, but if adequate wetland management is not done frequently, it might start to release carbon (Biswas et al., 2017). Wetlands, while significant carbon sinks, could soon become carbon emitters if not managed properly.

Wetland degradation is a significant issue nowadays. Salinization, nutrient enrichment, pesticides, heavy metal contamination, and the introduction of alien species are significant causes of wetland loss. (Davis and Froend, 1999). The wetland resources of countries have significantly decreased due to human population growth, land use change, development projects, and poor watershed usage. (Zedler and Kercher, 2005). Wetlands in India face threats from human population growth, land use changes, development projects, and improper watershed management. These threats lead to significant depletion of resources, disturbances in hydrology, pollution, and degradation. Industrial, agricultural, and urban developments also contribute to these issues. Unsustainable grazing and fishing activities exacerbate the problem (Prasad et al., 2002). Restoring wetlands that others have converted for different uses poses a challenge. As a result, there is a high demand for goods from wetlands, including water, fish, timber, fibre, and medicinal plants, which will rise as the population grows (Foote et al., 1996). Hence, protection of these important ecosystem is necessary, therefore the Ramsar Convention, established in 1971, aims to promote the wise use of wetlands globally. It focuses on designating and managing important wetlands, promoting overall wise use, and encouraging international cooperation (Kingsford et al., 2021).

The Ramsar designation provides international support for conservation efforts and prioritizes risks to these valuable ecosystems. Beside this, India's 2023-2024 budget includes schemes like the Amrit Dharohar Yojana and Mishti Yojana, focusing on sustainable ecosystem development in Ramsar sites and promoting mangrove conservation to prevent coastal erosion and flooding. G20 countries, with numerous wetlands and water bodies, should prioritise wetland management as a crucial policy for achieving net zero targets and carbon sequestration (Bhattacharya et al., 2023).These initiatives demonstrate India's role in protection of wetlands and preserving these natural resource.

For protection of wetlands, the major challenges include increasing the number and area of Ramsar Sites, improving representation, and enhancing management and reporting (Kingsford et al., 2021). Hence, conservation of wetlands has been necessary for research and environmental policy worldwide. Since, the establishment of Ramsar Convention for protection of wetlands in 1971, designation of wetlands has been conducted to identify and protect wetlands. These sites are recognized not only for their biodiversity and ecosystem services but also their cultural and socioeconomic importance.

Ramsar site of wetlands with international importance and designation

The Ramsar Convention is an international treaty that aims for wetlands conservation, wise use, and sustainable development through local and national actions and international cooperation (The Convention on Wetlands and Its Mission, 1994). The agreement officially adopted in 1971 bears the name Ramsar, derived from the city in Iran and is also known as the Convention on Wetlands.

According to Article 2.2 of the Ramsar Convention, "wetlands should be selected for the list on account of their international significance in terms of ecology, botany, zoology, limnology, or hydrology" and indicates that "in the first instance, wetlands of international importance to waterfowl at any season should be included" (Secretariat, 2016). Ramsar Site' is identified by demonstrating that it meets at least one of the nine qualifying criteria. The criteria are based on representative, rare, or unique wetland types, important ecological communities, and a wide range of wetland-

dependent species (Ramsar Regional Center, 2017).

There are two groupings of the nine criteria—one based on wetland types and the other on various facets of wetland biodiversity at the ecological community and species levels—that are used to organize them.

The following are the nine criteria for recognizing Wetlands of International Importance:

Table 1. Nine Criteria for recognizing Wetlands of International Importance (The Ramsar sites Criteria, n.d.).

Group A: Sites with representative, rare, or distinctive wetland types	
Criteria 1:	If a wetland has a representative, uncommon, or exceptional instance of a natural or nearly natural wetland type occurring in the relevant biogeographic area, it should be regarded as internationally significant.
Group B: Internationally significant locations for preserving biological diversity	
Criteria based on biological communities and species	
Criteria 2:	A wetland should be considered internationally significant if it protects threatened ecological communities or fragile, endangered, or severely endangered species.
Criteria 3:	A wetland should be regarded as having worldwide significance if it harbors populations of plant and animal species crucial to preserving the ecological diversity of a specific biogeographic area.
Criteria 4:	A wetland should be regarded as having worldwide significance if it offers protection from harsh circumstances or sustains plant and animal species at a crucial stage of their life cycles.
Criteria specifically focused on waterfowl.	
Criteria 5:	A wetland can be classified as globally significant if it sustains 20,000 or more water birds regularly.
Criteria 6:	A wetland is considered internationally significant if it regularly shelters 1% of a single water bird population's individuals or subspecies.
Criteria that are specific to fish.	
Criteria 7:	A wetland can be classified as globally significant if it contains a noteworthy amount of native fish subspecies, species, or families, as well as life-history stages, species interactions, and populations that represent the benefits and values of wetlands. This contribution to global biological diversity is what makes it essential.
Criteria 8:	A wetland can be considered internationally important if it serves as a food source, spawning ground, nursery, or migration path for fish stocks that depend on it.
Criteria that are based on other taxa in particular	
Criteria 9:	A wetland can be internationally important if it regularly supports 1% of a non-avian wetland species population.

Objectives of this research

This study focuses on the importance of international recognition in conservation efforts of wetlands, particularly through the Ramsar Convention, which aims to protect and sustainably use important wetlands globally. Designation as a Ramsar site is an official recognition of a wetland's biological importance, providing increased protection, research opportunities, and international cooperation and funding for conservation. The study examines potential Ramsar site wetlands in Goa to demonstrate how this designation can be a crucial tool in wetland conservation, benefiting the ecosystem and communities reliant on it. Recognizing the vital role wetlands play in maintaining ecological balance, biodiversity, and protecting communities from natural disasters, the research aims to identify the most suitable wetlands in Goa for Ramsar site designation. By understanding the importance of international recognition like the Ramsar status, the study highlights the methods for selecting the next Ramsar site in Goa based on specific criteria. Ultimately, the research seeks to promote global conservation ideals while respecting local conservation goals in preserving wetland.

This research paper compares four potential Ramsar site wetlands in Goa, India, considering ecological importance, biodiversity, representativeness, and

conservation status. The study focuses on four distinct wetlands: Carambolim Lake, Durga Lake, Batim Lake, and Sarzora Lake. These wetlands were chosen based on data availability, extensive wetland areas and exceptional biodiversity, which supports diverse ecosystems including a wide range of plant and animal species, making them ecologically significant. The goal is to identify the best candidate for Ramsar sit designation, to enhance their conservation and sustainable management.

Materials and Methods

Study Area

Goa is located on the western coast of India, known as the Konkan, extending from 14° 54' and 15° 48' north latitude and 73° 41' and 74°20' east longitude. It is the country's second-smallest state, occupying 3702 square kilometers, as shown in Figure 1. Goa has over forty estuaries, eight marines, and ninety riverine islands. The low-lying area is mainly coastal. The height of plateau land ranges from 30 meters to 100 meters. The state of Goa has a warm and humid climate for most of the year in terms of the development of its soils. Geographic location, geology, vegetation, and climate have all been significant factors. The principal rivers are the Mandovi, Zuari, Terekhol, Chapora, and Sal.

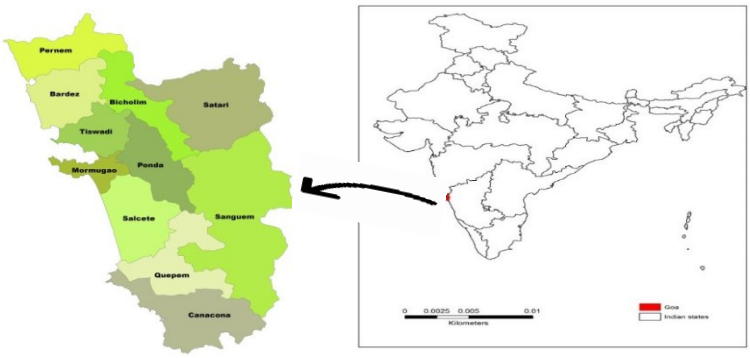

Figure 1: Geographical Location of Goa on the Map of India

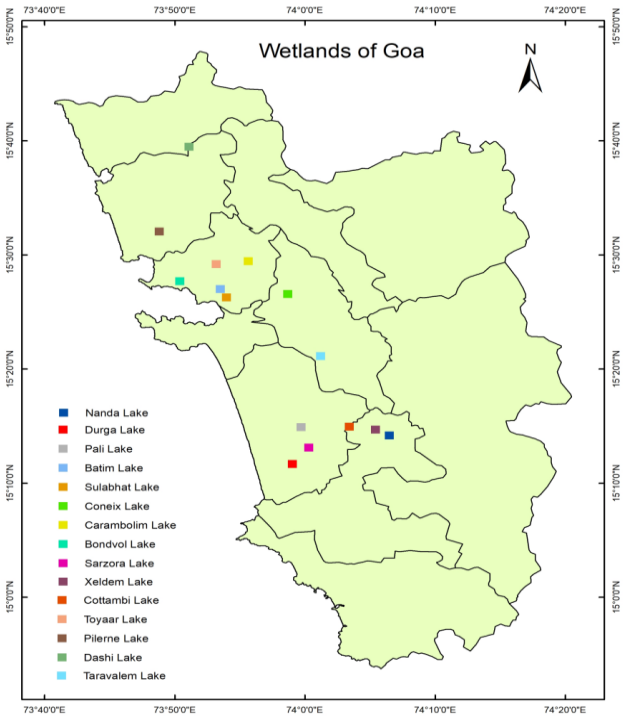

Figure 2: Notified Wetlands in Goa

The Goa State Wetland Authority (GSWA) has notified the 15 wetlands under the Wetland (Conservation and Management) Rules 2017. These are Dashi Lake, Pilerne Lake, Toyaar Lake, Cottambi Lake, Xeldem Lake, Nanda Lake (Ramsar site), Sarzora Lake, Bondvol Lake, Carambolim Lake, Coneix Lake, Sulabhat Lake, Batim Lake, Pali Lake, Durga Lake, and Tarvalem Lake, as shown in Figure 2. The chosen wetlands for this study are Carambolim Lake, Durga Lake, Batim Lake and Sarzora Lake as shown in Figure 3.

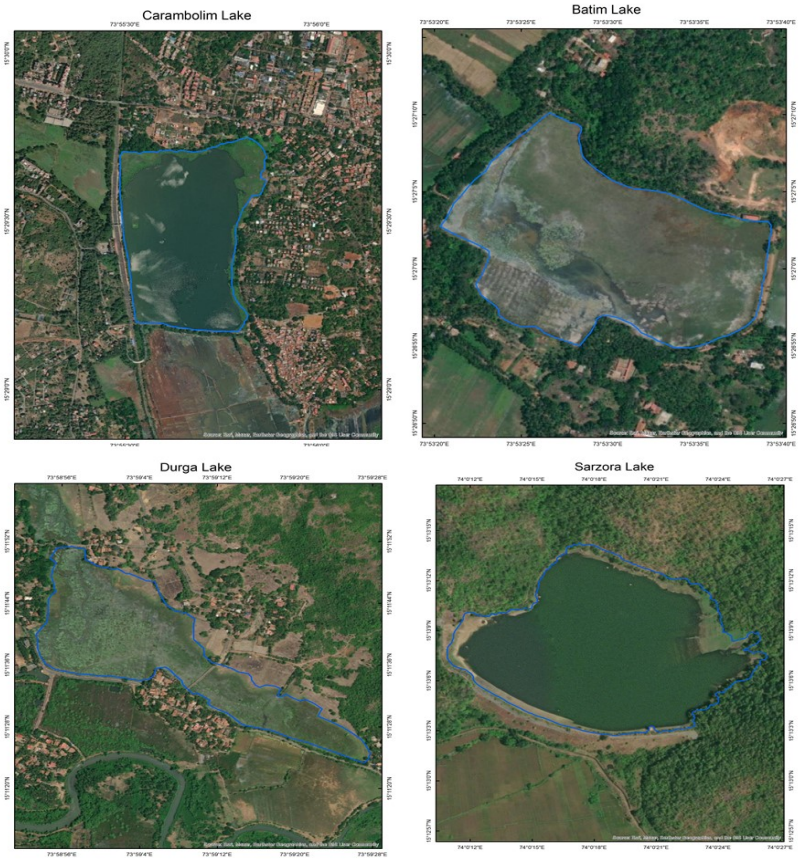

Figure 3: Geographic Location of Carambolim Lake, Batim Lake, Durga Lake, and Sarzora Lake (Source: Data Generated Through ArcGIS Mapping)

Description of selected wetlands for study

Following is a brief description of these selected lakes in Goa:

Carambolim Lake

Carambolim Lake, a 74.2-hectare permanent wetland in Carambolim village, North Goa, is a vital ecological asset. Its permanent water source, primarily rainfall and catchment runoff, replenishes groundwater and nourishes surrounding catchment areas. The lake's diverse plant and animal species contribute to the ecosystem's balance and provide habitats for aquatic organisms. The lake also supports a diverse range of animal species, including the flamingo, purple moorhen, and marsh crocodile. Fish and amphibian species thrive in the lake, and frogs also inhabit the area.

Durga Lake

Durga Lake, a 39.89-hectare permanent lake in Chinchinim, South Goa, is an important ecosystem resource. Its water comes from various sources, including rainfall, groundwater, catchment runoff, and natural springs. The lake's resilience is due to its diverse water sources. It serves as a water source, regulating water flow and maintaining hydrological balance downstream. The lake is home to otters,

crocodiles, and jackals, contributing to its ecological diversity. Additionally, it supports diverse wildlife, making it a valuable natural asset in the region. Its contribution to the downstream catchment and its support for diverse wildlife make it a cherished landscape feature.

Batim Lake

Batim Lake, a 26.56-hectare natural inland wetland in Batim, North Goa, is a seasonal or intermittent lake with a maximum depth of 2.5 meters. Its water sources include rainfall, groundwater, and catchment runoff, causing varying water levels over time. The lake's intermittent presence helps recharge groundwater, maintain the local water table, and support downstream catchments. It is home to notable animal species like marsh crocodiles and Indian pond terrapins, as well as fish species like guppies, Tigur, and Pittol, enriching the wetland's biodiversity and ecosystem dynamics. Batim Lake's unique seasonal nature and diverse animal and fish species contribute to its ecological balance and the overall biodiversity of the area. Its importance as a habitat and a contributor to the overall biodiversity of the area is significant.

Sarzora Lake

Sarzora Lake, a 10-hectare permanent lake in Sarzora, Salcete Taluka, is a vital natural asset that sustains the local ecosystem. Its water comes from rainfall, groundwater, catchment runoff, and natural springs, ensuring consistent supply and supporting the local water table. The lake's permanent presence maintains water levels, supporting the local ecosystem and downstream catchment areas. The wetlands habitat includes plant species like Acacia, Matti, and Cashew and animal species like leopards, foxes, mongoose, and checkered keelback snakes. Sarzora Lake's consistent water presence and role in supporting groundwater and downstream catchment areas make it an essential contributor to the local ecosystem and a vital part of the landscape.

Methodology

The following key steps are taken in a methodology to study the potential Ramsar designation of Goa wetlands:

Data collection for biodiversity assessment

- **Assessment of plant and animal species:** Detailed information was gathered from sources such as the Goa State Wetland Authority's official documents and online resources like eBird, which provided an overview of important plant and animal species in the selected wetlands.
- **Endangered species evaluation:** The status of animal species was assessed to identify those that were vulnerable, threatened, or endangered according to the IUCN Red List criteria. This assessment provided critical information on the conservation significance of the wetlands.
- **Conservation status evaluation:** Activities proposed to be regulated and prohibited by the Government of Goa were assessed. The relevant department or agency responsible for the regulation or prohibition of these activities on the wetlands of Goa was also identified.

Mapping of study area wetlands

The boundaries of the selected wetlands were precisely mapped, and surrounding land use and land cover were analyzed. After collecting all necessary information on the study area wetlands, ArcGIS software and tools were used to visualize the geographical location of the lakes and the surrounding areas, including settlements, agricultural land, and vegetation.

Interview with government officials

The study was initiated by conducting interviews with relevant officials from the Goa State Wetland Authority regarding the health card aspect of the lakes in Goa and other relevant information. The Goa State Wetland Authority provided valuable information on the wetlands in Goa, including the "health card" status of these lakes. Their cooperation allowed access to this crucial information, confirming data related to the studied wetlands.

Identification of a suitable Ramsar site through ecological and biodiversity significance

- **Ecological and biodiversity significance:** The ecological and biodiversity significance of each wetland was assessed using the collected data. The significance of these wetlands was evaluated by considering factors such as biodiversity, ecosystem services, and their role in supporting migratory species.

Identification of the next probable Ramsar site in Goa

- **Selection Criteria:** Based on the assessment, the wetland that demonstrated the highest ecological and biodiversity significance was identified. This wetland was considered the prime candidate for Ramsar designation.
- **Criteria evaluation**: The chosen wetland was compared with Ramsar criteria to ensure it fulfilled the necessary requirements for designation.

Results

Assessment of the ecological and biodiversity significance of wetlands

The ecological and biodiversity comparisons of selected study area wetlands are given below:

Table 2: Ecosystem services of studied wetlands (Source: Goa state wetland authority – Brief documents)

Ecosystem services:	Carambolim Lake		Durga Lake		Batim Lake		Sarzora Lake	
	Yes	No	Yes	No	Yes	No	Yes	No
1. Source of drinking water for people living and around		✓		✓		✓	✓	
2. Source of water for agriculture	✓		✓		✓		✓	
3. Fisheries		✓		✓		✓	✓	
4. Cultivation of aquatic food plants		✓		✓		✓		✓
5. For buffalo wallowing and use of domesticated animals	✓		✓		✓			✓
6. Medicinal plants		✓	✓		✓			✓
7. Is a recreational site	✓		✓		✓			✓
8. Buffering communities from extreme events as floods and storms	✓		✓		✓			✓
9. Ground water recharge	✓		✓		✓		✓	
10. Water purification	✓		✓		✓		✓	
11. Acts as a sink for sediments	✓		✓		✓		✓	
12. Has significant cultural and religious values	✓			✓		✓		✓
13. Is a site for recreation and tourism	✓		✓		✓			✓
14. Supports noteworthy plants species	✓			✓		✓	✓	
15. Supports noteworthy animal species	✓		✓		✓		✓	
16. Site of high congregation of migratory water birds	✓		✓			✓	✓	
17. Supports life cycle of fish or amphibians	✓		✓		✓		✓	

Ecological Importance Comparison through provision of various Ecosystem Services

The wetlands of Carambolim, Durga, Batim, and Sarzora Lakes offer distinct ecosystem services showcasing their ecological importance as shown in table 2. Carambolim Lake supports migratory birds and unique plant species with cultural and recreational values. Durga and Batim Lakes provide various services like groundwater recharge, water purification, and support for fish and amphibians. Sarzora Lake serves as a drinking water source, fisheries site, and habitat for plants and migratory birds. Together, these wetlands highlight the diverse ecological roles wetlands play.

Biodiversity Significance Comparison

The four wetlands—Carambolim Lake, Durga Lake, Batim Lake, and Sarzora Lake—exhibit varying degrees of biodiversity significance based on their notable plant and animal species as shown in table 3. Carambolim Lake stands out for its high biodiversity, supporting multiple vulnerable and near-threatened species, such as the Indian Spotted Eagle (Clanga hastata), Greater Spotted Eagle (Clanga clanga), and White-rumped Vulture (Gyps bengalensis). Durga Lake, while rich in plant diversity, also provides habitat for important bird species like the Lesser Adjutant (Leptoptilos javanicus) and the Indian Spotted Eagle. Batim Lake, like Carambolim, harbors a significant number of vulnerable and near-threatened species, including the Marbled Teal (Marmaronetta angustirostris) and the Greater Spotted Eagle. Sarzora Lake, though having fewer species, still supports species of concern like the Leopard (Panthera pardus) and the Brahminy Kite (Haliastur indus).

Table 3: Notable plant and animal species present in studied wetlands Goa state wetland authority – Brief documents; eBird)

S. No.	Name of Wetland	Notable Plant Species	Notable Animal Species and their status		
1.	Carambolim Lake	*Salvinia molesta* Hydrilla sp Chara sp *Eichhornia crassipes* (Water hyacinth) *Nymphea alba* (Water lily)	*Phoenicopterus ruber* (Flamingo) - LC	*Anhinga melanogaster* (Oriental Darter) - NT	*Aythya nyroca* (Ferruginous Duck) - NT
			Porphyrio porphyrio (Purple moorhens) - LC	*Prinia socialis* (Ashy prinia) - LC	*Sterna aurantia* (River Tern) - V
			Metopidius indicus (Bronze winged jacana) - LC	*Columba livia* (Rock pigeon) - LC	*Clanga hastata* (Indian Spotted Eagle) - V
			Hydrophasianus chirurgus (pheasant-tailed jacana) - LC	*Meerops orientalis* (Asian Green Bee eater) - LC	*Numenius arquata* (Eurasian Curlew) - NT
			Cecropis daurica (Red rumped swallow) – NI	*Neptis hylas* (Common sailor) - NI	*Ocyceros griseus* (Malabar Gray Hornbill) - V
			Dendrocygna javanica (Lesser whistling teal) - LC	*Danaus chrysippus* (Plain tiger) - LC	*Psittacula eupatria* (Alexandrine Parakeet) - NT
			Spatula querquedula (Garganey) - LC	*Euploea core* (Common crow) - LC	*Brachypodius priocephalus* (Gray-headed Bulbul) - NT
			Crocodylus palustris – V	*Limosa limosa* (Black-tailed Godwit) - NT	*Gyps bengalensis* (White-rumped Vulture)- CE
			Anastomus oscitans (Open-billed storks) - LC	*Mycteria leucocephala* (Painted Stork) - NT	*Clanga clanga* (Greater Spotted Eagle) - V
			Melanochelys trijuga (Indian pond terrapin) - LC	*Limosa lapponica* (Bar-tailed Godwit) - NT	*Halcyon pileata* (Black-capped Kingfisher) - V

			Microcabo niger (Little cormorant) - LC	*Calidris ferruginea* (Curlew Sandpiper) - NT	*Aythya ferina* (Common Pochard) - V
			Ardea purpurea (Purple heron) - LC	*Threskiornis melanocephalus* (Black-headed Ibis) - NT	*Columba elphinstonii* (Nilgiri Wood-Pigeon) - V
			Phalacrocorax fuscicollis (Great Indian cormorant) - LC	*Ciconia episcopus* (Asian Woolly-necked Stork) - NT	*Limnodromus semipalmatus* (Asian Dowitcher) - NT
			Bubulcus ibis (Cattle egret) - LC	*Anthracoceros coronatus* (Malabar Pied-Hornbill) - NT	*Circus macrourus* (Pallid Harrier) – NT
			Corvus splendens (House crow) - LC	*Leptoptilos javanicus* (Lesser Adjutant) – V	
2.	Durga Lake	*Nymphea sp. (Water lily) Calotropis gigantean (Crown flower) Ficus racemosa (Indian fig tree) Ixora sp Rauvolfia serpentina (Indian snakeroot)*	*Egretta garzetta* (Little egret) - LC	*Ardea purpurea* (Purple heron) - LC	*Canis aureus* (Golden Jackal) - LC
			Vanellus indicus (Red wattled lapwing) - LC	*Pavo sp.* (Indian Peafowl) - LC	*Threskiornis melanocephalus* (Black-headed Ibis) - NT
			Ceryle rudis (Pied kingfisher) - LC	*Milvus migrans* (Black kite) - LC	*Leptoptilos javanicus* (Lesser Adjutant) - V
			Microcarbo niger (Little cormorant) - LC	*Butorides striata* (Striated heron) - LC	*Ciconia episcopus* (Asian Woolly-necked Stork) - NT
			Hirundo rustica (Barn swallow) - LC	*Columba livia* (Rock pigeon) - LC	*Anhinga melanogaster* (Oriental Darter) - NT
			Haliastur indus (Brahminy kite) - LC	*Anas acuta* (Pintail) - LC	*Clanga hastate* (Indian Spotted Eagle) - V
			Ardeo lagrayii (Pond heron) - LC	*Ardea alba* (Great egret) - LC	
			Charadrius dubius (Little ringed plover) - LC	*Sterna aurantia* (River tern) - V	
3.	Batim Lake	*Nymphea alba (Water lily) Pistia stratiotes Hydrilla sp Salvinia sp Grasses*	*Crocodylus palustris*- V	*Sarkidiornis melanotos* (Comb Duck) - LC	*Brachypodius priocephalus* (Gray-headed Bulbul) - NT
			Melanochelys trijuga (Indian pond terrapin) - LC	*Anas poecilorhyncha* (Spot-billed Duck) - LC	*Limosa limosa* (Black-tailed Godwit) - NT
			Nettapus coromandelianus (Cotton pygmy goose) - LC	*Danaus chrysippus* (Plain tiger) - LC	*Calidris ferruginea* (Curlew Sandpiper) - NT
			Metopidius indicus (Bronze winged jacana) - LC	*Euploea core* (Common crow) - LC	*Marmaronetta angustirostris* (Marbled Teal) - NT
			Microcabo niger (Little cormorant) - LC	*Neptis hylas* (Common sailor) - NI	*Aythya ferina* (Common Pochard) - V

			Bubulcus ibis (Cattle egret) - LC	*Mycteria leucocephala* (Painted Stork) - NT	*Numenius arquata* (Eurasian Curlew) - NT
			Hirundo smithii (Wire tailed swallow) - LC	*Clanga hastate* (Indian Spotted Eagle) - V	*Anthracoceros coronatus* (Malabar Pied-Hornbill) - NT
			Ardeola grayii (Pond heron) - LC	*Clanga clanga* (Greater Spotted Eagle) - V	*Halcyon pileata* (Black-capped Kingfisher) - V
			Alcedo atthis (Common Kingfisher) - LC	*Threskiornis melanocephalus* (Black-headed Ibis) - NT	*Sterna aurantia* (River Tern) - V
			Dendrocygna javanica (Lesser whistling Duck) - LC	*Ciconia episcopus* (Asian Woolly-necked Stork) - NT	*Circus macrourus* (Pallid Harrier) - NT
			Lxobrychus sinesis (Yellow Bittern) - LC	*Anhinga melanogaster* (Oriental Darter) - NT	*Ocyceros griseus* (Malabar Gray Hornbill) - V
			Halistur Indus (Brahminy kite) - LC	*Aythya nyroca* (Ferruginous Duck) - NT	
			Milvus migrans (Black kite) - LC	*Leptoptilos javanicus* (Lesser Adjutant) - V	
			Porphyrio porphyrio (Purple Moorhen) - LC	*Psittacula eupatria* (Alexandrine Parakeet) - NT	
4.	Sarzora Lake	*Acacia Matti (Crocodile bark tree) Cashew*	*Euploea core* (Common Crow) - LC	*Charadrius dubius* (Little ringed plover) - LC	*Ploceus philippinus* (Baya weaver) - LC
			Danaus genutia (Striped Tiger Orange Butterfly) – NI	*Vanellus indicus* (Red wattled lapwing) - LC	*Alcedo atthis* (Common Kingfisher) - LC
			Golden Jackals- LC	*Pavo sp.* (India peafowl) - LC	*Herpestes edwardsi* (Indian Grey Mongoose) - LC
			Fowlea piscator (Checkered Keelback) - LC	*Ardea purpurea* (Purple heron) - LC	*Panthera pardus* (Leopard) - V
			Haliastur indus (Brahminy kite) - LC	*Microcarbo niger* (Little cormorant) - LC	
			Hirundo smithii (Wire tailed swallow) - LC	*Ardeola grayii* (Pond heron) - LC	

LC - Least Concern; V – Vulnerable; NT – Near Threatened; CE - Critically Endangered; NI – Not Included

Conservation status

The conservation status of Carambolim Lake, Durga Lake, Batim Lake, and Sarzora Lake is focused on regulating harmful activities like water withdrawal, resource harvesting, and grazing as shown in table 4. Durga Lake has the most restrictive conservation approach. All wetlands prohibit untreated sewage discharge, waste disposal, construction, and commercial extraction to maintain water quality and prevent habitat degradation. Multiple government departments work collaboratively to enforce these regulations.

Table 4: Activities Proposed to be regulated or prohibited (Source: Goa state wetland authority – Brief documents)

Activities Proposed to be Regulated or prohibited				
Activity	Carambolim Lake	Durga Lake	Batim Lake	Sarzora Lake
1. Withdrawal of water / impoundment/diversion or any other hydrological intervention	Regulated	Prohibited	Regulated	Regulated
Name of department / agency responsible for regulation / prohibition	Water Resource Department	Water Resource Department (WRD), Forest dept and Agriculture dept. and Panchayat.	Water Resource Department	WRD/ Agricultural dept.
2. Harvesting of resources (living / non-living)	Regulated	Prohibited	Regulated	Regulated
Name of department / agency responsible for regulation / prohibition	State Fishery Department	Agriculture dept., Forest dept.	State Fishery Department	Village Panchayat
3. Grazing	Regulated	Regulated	Regulated	Prohibited
Name of department / agency responsible for regulation / prohibition	State Forest Department	Animal husbandry.	State Forest Department	Animal husbandry & State Forest Dept.
4. Discharge of treated sewage/ effluent / wastewater	Prohibited	Prohibited	Prohibited	Prohibited
Name of department / agency responsible for regulation / prohibition	State Public Works Department	State Public Works Department	State Public Works Department	State Public Works Department
5. Construction of boat jetties, and facilities for temporary use, as pontoon bridges	Regulated	Prohibited	Regulated	Prohibited
Name of department / agency responsible for regulation / prohibition	Public Works Department	State Public Works Department	State Public Works Department	State Public Works Department
6. Aquaculture, agriculture, and horticulture activities within the wetland boundaries.	Regulated	Regulated	Regulated	Regulated
Name of department / agency responsible for regulation / prohibition	Fishery, Agriculture, Horticulture Department	Agriculture, Fisheries and local body.	Fishery, Agriculture, Horticulture Department	Agriculture Dept./ Forest Dept./ Village Panchayat
7. Disposal of solid waste/ untreated sewage	Prohibited	Prohibited	Prohibited	Prohibited
Name of department / agency responsible for regulation / prohibition	Municipality	Municipality	Municipality	Municipality
8. Construction activity	Prohibited	Prohibited	Prohibited	Prohibited
Name of department / agency responsible for regulation / prohibition	Panchayat/ Corporation/ Municipality	Panchayat/ Corporation/ Municipality	Panchayat/ Corporation/ Municipality	Panchayat/ Corporation/ Municipality
9. Extraction of soil, mud, rocks for commercial purpose	Prohibited	Prohibited	Prohibited	Prohibited
Name of department / agency responsible for regulation / prohibition	Panchayat/ Corporation/ Municipality	Panchayat/ Corporation/ Municipality	Panchayat/ Corporation/ Municipality	Panchayat/ Corporation/ Municipality

Health Card Report Prepared for Wetlands

The health card is a document that assesses the water body's condition, i.e., environmental features, vegetation, species, water quality, and its inflow and outflow. The Wetland Health Card is used to prioritise immediate threats and identify priority areas for future conservation efforts.

Health cards have not been prepared for Carambolim Lake, Durga Lake, Batim Lake, and Sarzora Lake as shown in table 5.

This absence indicates a lack of formal assessment of their ecological health. Health cards are crucial for monitoring and managing wetlands, providing insights into water quality, biodiversity, and threats. Without them, tracking changes, conservation prioritization, and stakeholder engagement become difficult. Developing health cards for these wetlands is essential for ensuring their long-term ecological integrity.

Table 5: Health card prepared for studied wetlands

Health Card	Carambolim Lake		Durga Lake		Batim Lake		Sarzora Lake	
	Yes	No	Yes	No	Yes	No	Yes	No
Health card prepared for Wetland		✓		✓		✓		✓

Total coverage area and maximum depth (m) in selected wetlands

The selected wetlands - Carambolim Lake, Durga Lake, Batim Lake, and Sarzora Lake - differ in total coverage area and maximum depth as shown in figure 4 and 5. Carambolim Lake is the largest at 74.2 hectares with a depth of 6 meters. Durga Lake, the second largest, covers 39.89 hectares and is 1.5 meters deep. Batim Lake is 26.56 hectares with a depth of 2.5 meters, while Sarzora Lake is the smallest at 10 hectares and 3 meters deep. These differences impact their ecological characteristics and biodiversity potential.

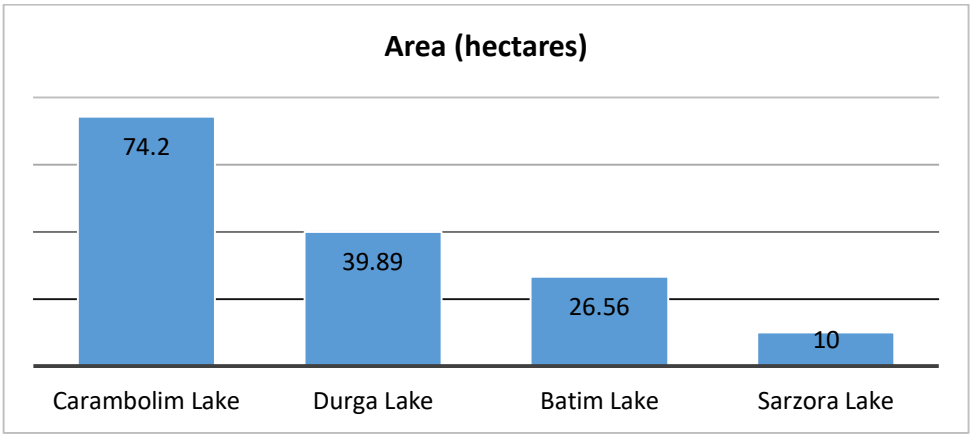

Figure 4: Area of a selected study area of Wetlands in Goa (Source: Goa state wetland authority – brief documents)

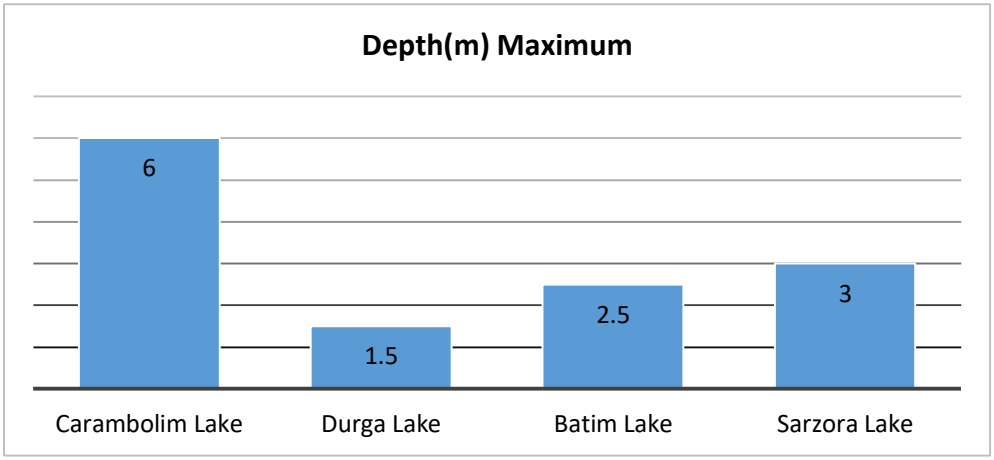

Figure 5: Depth of a selected study area of Wetlands in Goa (Source: Goa state wetland authority – brief documents)

Based on all the above assessments, it appears that Carambolim Lake has the highest potential to be designated as a Ramsar site. Its 74.2-hectare coverage area and 6-meter depth support diverse aquatic habitats and species, including the Indian Spotted Eagle and critically endangered White-rumped Vulture. It also serves as a hub for agriculture, supports animal activities, acts as a sediment sink, and offers cultural and recreational value This rich biodiversity highlights the lake's role as a vital habitat and its significance in regional biodiversity conservation efforts. Carambolim Lake also considered as Important Bird Area (IBA), which strengthens its potential for becoming a Ramsar site.

The following table 6 shows the Ramsar criteria that Carambolim Lake follows as Important Bird Area (IBA):

Table 6: Ramsar Criteria follows by Carambolim Lake

Site Name	Ramsar Criteria								
	1	2	3	4	5	6	7	8	9
Carambolim Lake		✓		✓	✓	✓			

Discussion

Identification of the next probable Ramsar site

Carambolim lake is one of the numerous minor irrigation tanks that have been developed in Goa for growing paddy. They are made by the impoundment of run-off during the monsoon (Shanbhag et al. 2001). Carambolim Lake demonstrates a rich variety of plant and animal species, including several notable and threatened species. Carambolim Lake and Dhado wetland complex is the one of the most important IBAs of Goa state (Anonymous, 2023). It serves multiple functions, such as being a source of water for agriculture, supporting diverse wildlife, including migratory birds, and having cultural and recreational value. The lake's role in water purification, sediment control, and supporting aquatic life cycles further highlights its ecological importance. The following criteria demonstrate how Carambolim Lake complies with the requirements for Ramsar Designation and highlight its significance as a wetland of worldwide importance.

Criteria 2: Rare species and threatened ecological communities

Carambolim Lake meets Ramsar site criteria by supporting species that fall within the categories of vulnerable, endangered, critically endangered, or threatened. This diverse ecosystem plays a vital role in the preservation of these species. The list of vulnerable, endangered, and near-threatened species that Carambolim Lake supports is shown in table 3.

Criteria 4: Support during critical life cycle stage or in adverse conditions.

Carambolim Lake qualifies for Ramsar designation under Criteria 4 by providing crucial support to bird species during critical life cycle stages, particularly during the migratory season. The lake serves as a suitable habitat for various globally threatened or vulnerable species, offering suitable conditions for breeding and feeding. This ensures that the lake plays a significant role in sustaining bird populations during times when they are most vulnerable, thereby indicating its ecological importance and potential for Ramsar site designation.

Criteria 5: A. >20,000 waterbirds

Carambolim Lake qualifies this criterion of international significance as it regularly accommodates more than 20,000 water birds. Around 319 bird species are found in Carambolim Lake and Dhado wetlands complex area (Anonymous, 2023). This consistent and substantial presence of waterfowl underscores the lake's vital role as a crucial habitat for both migratory and resident bird species. It signifies Carambolim Lake's global importance in

preserving avian biodiversity and supporting the conservation of waterfowl populations. For a list of bird species found in Carambolim Lake, please refer to the appendices in Table 7.

Criteria 6: >1% waterbird population

Carambolim Lake meets the criteria of hosting a significant population of congregatory waterbird species, as it is known to regularly harbour more than 1% of the biogeographical population of such species. Recorded populations of several species found in Carambolim Lake, including 3,600 Lesser Whistling-Ducks, 3,000 Garganeys, 2,000 Gray-headed Swamphens, 1,000 Northern Pintails, 1,000 Small Pratincoles, and 800 Black-tailed Godwits (Carambolim Lake & Surroundings (IBA)- eBird Hotspot, n.d.). This observation underscores the lake's importance as a critical habitat for congregatory waterbirds, contributing significantly to their conservation and ecological significance.

In demonstrating its role in international efforts to conserve and protect the vital wetlands ecosystem, these common features strongly indicate Carambolim Lake as a strong candidate for Ramsar designation. According to our study, Carambolim Lake seems to be complying with four of the nine criteria identified in Criteria 2, 4, 5, and 6. Carambolim Lake has emerged as a probable Ramsar site due to its rich biodiversity, support for endangered species, significance of international bird populations, and the important role it plays in scientific research and conservation efforts that are compatible with Ramsar criteria, all of which contribute significantly towards ensuring global wetlands protection.

Conclusion

Ramsar designation is a crucial step in recognizing the ecological value of international wetlands and promoting their conservation, especially considering increasing global threats to these unique environments. Our research analysed the ecological significance, biodiversity importance, and conservation status of four prominent wetlands in Goa: Carambolim Lake, Batim Lake, Durga Lake, and Sarzora Lake. The study describes the importance of these wetlands to protect their ecological beauty and points out that Carambolim Lake is one of the main candidates for Ramsar status due to its unique environmental characteristics, considerable biodiversity contribution, and ongoing conservation measures.

In addition, the study also points out that there are no health cards or formal assessments of such wetlands and emphasises the need for documentation to monitor their ecological status and identify conservation needs. By increasing awareness, mobilising community involvement, and providing the necessary financial means to protect and manage wetlands, Indian government policies and initiatives such as the Amrit Dharohar Yojana, MISHTI (Mangrove Initiative for Shoreline Habitats and Tangible Incomes), Save the Wetlands campaign, etc. have made a significant contribution towards wetland conservation.

To combat the worldwide reduction of wetlands, the study emphasises the necessity for proactive conservation measures, such as the official Ramsar designation. The Ramsar Convention is emphasised for its long-term significance in protecting natural habitats, not only in Goa but also globally. By recognising, protecting, and monitoring the health of these wetlands through health cards and collaborating with government initiatives, we can collectively contribute to the conservation of these vital ecosystems for generations to come.

Appendices

Table 7: Bird Species of Carambolim Lake (Source: Goa state wetland authority – brief documents; eBird)

S.No.	Scientific Name	Common Name	S.No.	Scientific Name	Common Name
1.	*Phoenicopterus ruber*	Flamingo	21.	*Recurvirostra avosetta*	Pied Avocet
2.	*Porphyrio porphyrio*	Purple moorhens	22.	*Rostratula benghalensis*	Greater Painted-Snipe
3.	*Metopidius indicus*	Bronze winged jacana	23.	*Numenius arquata*	Eurasian Curlew
4.	*Hydrophasianus chirurgus*	Pheasant-tailed jacana	24.	*Calidris alba*	Sanderling
5.	*Cecropis daurica*	Red rumped swallow	25.	*Calidris alpina*	Dunlin
6.	*Dendrocygna javanica*	Lesser whistling teal	26.	*Pandion haliaetus*	Osprey
7.	*Spatula querquedula*	Garganey	27.	*Athene brama*	Spotted Owlet
8.	*Anastomus oscitans*	Open-billed storks	28.	*Ocyceros birostris*	Indian Gray Hornbill
9.	*Microcabo niger*	Little cormorant	29.	*Pericrocotus cinnamomeus*	Small Minivet
10.	*Ardea purpurea*	Purple heron	30.	*Aegithina tiphia*	Common Iora
11.	*Phalacrocorax fuscicollis*	Great Indian cormorant	31.	*Machlolophus aplonotus*	Indian Yellow Tit
12.	*Bubulcus ibis*	Cattle egret	32.	*Orthotomus sutorius*	Common Tailorbird
13.	*Corvus splendens)*	House crow	33.	*Phylloscopus trochiloides*	Greenish Warbler
14.	*Anhinga melanogaster*	Oriental Darter	34.	*Alcippe poioicephala*	Brown-cheeked Fulvetta
15.	*Prinia socialis*	Ashy prinia	35.	*Saxicola caprata*	Pied Bushchat
16.	*Columba livia*	Rock pigeon	36.	*Perdicula asiatica*	Jungle Bush-Quail
17.	*Meerops orientalis*	Asian Green Bee eater	37.	*Aerodramus unicolor*	Indian Swiftlet
18.	*Euploea core*	Common crow	38.	*Hieraaetus pennatus*	Booted Eagle
19.	*Plegadis falcinellus*	Glossy ibis	39.	*Haliaeetus leucogaster*	White-bellied Sea-Eagle
20.	*Limosa limosa*	Black-tailed Godwit	40.	*Upupa epops*	Eurasian Hoopoe
41.	*Acridotheres tristis*	Common Myna	67.	*Pelargopsis capensis*	Stork-billed Kingfisher
42.	*Mycteria leucocephala*	Painted Stork	68.	*Merops leschenaulti*	Chestnut-headed Bee-eater
43.	*Calidris temminckii*	Temminck's Stint	69.	*Coracias benghalensis*	Indian Roller
44.	*Passer domesticus*	House Sparrow	70.	*Psilopogon haemacephalus*	Coppersmith Barbet
45.	*Porphyrio poliocephalus*	Gray-headed Swamphen	71.	*Micropternus brachyurus*	Rufous Woodpecker
46.	*Anas acuta*	Northern Pintail	72.	*Oriolus xanthornus*	Black-hooded Oriole
47.	*Glareola lactea*	Small Pratincole	73.	*Dicrurus paradiseus*	Greater Racket-tailed Drongo
48.	*Anas crecca*	Green-winged Teal	74.	*Ammomanes phoenicura*	Rufous-tailed Lark
49.	*Hirundo rustica*	Barn Swallow	75.	*Chrysomma sinense*	Yellow-eyed Babbler
50.	*Ploceus philippinus*	Baya Weaver	76.	*Dicaeum concolor*	Nilgiri Flowerpecker
51.	*Ardea intermedia*	Intermediate Egret	77.	*Amandava amandava*	Red Avadavat
52.	*Ardea alba*	Great Egret	78.	*Motacilla maderaspatensis*	White-browed Wagtail
53.	*Calidris minuta*	Little Stint	79.	*Galloperdix spadicea*	Red Spurfowl
54.	*Egretta garzetta*	Little Egret	80.	*Phaenicophaeus viridirostris*	Blue-faced Malkoha

55.	*Milvus migrans*	Black Kite	81.	*Hierococcyx varius*	Common Hawk-Cuckoo
56.	*Limosa lapponica*	Bar-tailed Godwit	82.	*Ninox scutulata*	Brown Boobook
57.	*Acridotheres fuscus*	Jungle Myna	83.	*Ocyceros griseus*	Malabar Gray Hornbill
58.	*Ardeola grayii*	Indian Pond-Heron	84.	*Todiramphus chloris*	Collared Kingfisher
59.	*Gelochelidon nilotica*	Gull-billed Tern	85.	*Psilopogon zeylanicus*	Brown-headed Barbet
60.	*Fulica atra*	Eurasian Coot	86.	*Dinopium benghalense*	Black-rumped Flameback
61.	*Chroicocephalus brunnicephalus*	Brown-headed Gull	87.	*Psittacula eupatria*	Alexandrine Parakeet
62.	*Petrochelidon fluvicola)*	Streak-throated Swallow	88.	*Loriculus vernalis*	Vernal Hanging-Parrot
63.	*Tringa glareola*	Wood Sandpiper	89.	*Tephrodornis pondicerianus*	Common Woodshrike
64.	*Ploceus manyar*	Streaked Weaver	90.	*Hemipus picatus*	Bar-winged Flycatcher-shrike
65.	*Pastor roseus*	Rosy Starling	91.	*Rhipidura albogularis*	Spot-breasted Fantail
66.	*Charadrius mongolus*	Lesser Sand-Plover	92.	*Dicrurus caerulescens*	White-bellied Drongo
93.	*Nycticorax nycticorax*	Black-crowned Night-Heron	122.	*Dicrurus aeneus*	Bronzed Drongo
94.	*Tringa nebularia*	Common Greenshank	123.	*Dendrocitta vagabunda*	Rufous Treepie
95.	*Phalacrocorax fuscicollis*	Indian Cormorant	124.	*Brachypodius priocephalus*	Gray-headed Bulbul
96.	*Nettapus coromandelianus*	Cotton Pygmy-Goose	125.	*Leptocoma minima*	Crimson-backed Sunbird
97.	*Apus affinis*	Little Swift	126.	*Chloropsis jerdoni*	Jerdon's Leafbird
98.	*Gallinula chloropus*	Eurasian Moorhen	127.	*Motacilla cinerea*	Gray Wagtail
99.	*Tadorna ferruginea*	Ruddy Shelduck	128.	*Cacomantis passerinus*	Gray-bellied Cuckoo
100.	*Tringa stagnatilis*	Marsh Sandpiper	129.	*Caprimulgus atripennis*	Jerdon's Nightjar
101.	*Platalea leucorodia*	Eurasian Spoonbill	130.	*Gallicrex cinerea*	Watercock
102.	*Tringa totanus*	Common Redshank	131.	*Zapornia fusca*	Ruddy-breasted Crake
103.	*Psittacula krameri*	Rose-ringed Parakeet	132.	*Zapornia pusilla*	Baillon's Crake
104.	*Himantopus himantopus*	Black-winged Stilt	133.	*Glareola maldivarum*	Oriental Pratincole
105.	*Vanellus indicus*	Red-wattled Lapwing	134.	*Chroicocephalus ridibundus*	Black-headed Gull
106.	*Calidris pugnax*	Ruff	135.	*Elanus caeruleus*	Black-winged Kite
107.	*Sturnia malabarica*	Chestnut-tailed Starling	136.	*Gyps bengalensis*	White-rumped Vulture
108.	*Lonchura malacca*	Tricolored Munia	137.	*Clanga clanga*	Greater Spotted Eagle
109.	*Anastomus oscitans*	Asian Openbill	138.	*Halcyon pileata*	Black-capped Kingfisher
110.	*Spatula clypeata*	Northern Shoveler	139.	*Pitta brachyura*	Indian Pitta
111.	*Spilopelia chinensis*	Spotted Dove	140.	*Terpsiphone paradisi*	Indian Paradise-Flycatcher
112.	*Charadrius dubius*	Little Ringed Plover	141.	*Lanius isabellinus*	Isabelline Shrike
113.	*Calidris ferruginea*	Curlew Sandpiper	142.	*Lanius cristatus*	Brown Shrike
114.	*Haliastur indus*	Brahminy Kite	143.	*Acrocephalus stentoreus*	Clamorous Reed Warbler

115.	*Merops philippinus*	Blue-tailed Bee-eater	144.	*Phylloscopus occipitalis*	Western Crowned Warbler
116.	*Dicrurus macrocercus*	Black Drongo	145.	*Cyornis tickelliae*	Tickell's Blue Flycatcher
117.	*Calandrella dukhunensis*	Mongolian Short-toed Lark	146.	*Myophonus horsfieldii*	Malabar Whistling-Thrush
118.	*Hirundo smithii*	Wire-tailed Swallow	147.	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker
119.	*Pluvialis fulva*	Pacific Golden-Plover	148.	*Aethopyga vigorsii*	Vigors's Sunbird
120.	*Threskiornis melanocephalus*	Black-headed Ibis	149.	*Aythya ferina*	Common Pochard
121.	*Tachybaptus ruficollis*	Little Grebe	150.	*Gallus sonneratii*	Gray Junglefowl
151.	*Gymnoris xanthocollis*	Yellow-throated Sparrow	178.	*Streptopelia orientalis*	Oriental Turtle-Dove
152.	*Motacilla flava*	Western Yellow Wagtail	179.	*Streptopelia decaocto*	Eurasian Collared-Dove
153.	*Ciconia episcopus*	Asian Woolly-necked Stork	180.	*Clamator jacobinus*	Pied Cuckoo
154.	*Sarkidiornis melanotos*	Knob-billed Duck	181.	*Cacomantis sonneratii*	Banded Bay Cuckoo
155.	*Eudynamys scolopaceus*	Asian Koel	182.	*Batrachostomus monilige*	Sri Lanka Frogmouth
156.	*Chlidonias hybrida*	Whiskered Tern	183.	*Lewinia striata*	Slaty-breasted Rail
157.	*Chloropsis aurifrons*	Golden-fronted Leafbird	184.	*Vanellus malabaricus*	Yellow-wattled Lapwing
158.	*Lonchura punctulata*	Scaly-breasted Munia	185.	*Charadrius hiaticula*	Common Ringed Plover
159.	*Lonchura striata*	White-rumped Munia	186.	*Calidris subminuta*	Long-toed Stint
160.	*Actitis hypoleucos*	Common Sandpiper	187.	*Turnix suscitator*	Barred Buttonquail
161.	*Anas poecilorhyncha*	Indian Spot-billed Duck	188.	*Ixobrychus cinnamomeus*	Cinnamon Bittern
162.	*Treron affinis*	Gray-fronted Green-Pigeon	189.	*Pernis ptilorhynchus*	Oriental Honey-buzzard
163.	*Psittacula cyanocephala*	Plum-headed Parakeet	190.	*Spilornis cheela*	Crested Serpent-Eagle
164.	*Sturnia blythii*	Malabar Starling	191.	*Accipiter badius*	Shikra
165.	*Ardea cinerea*	Gray Heron	192.	*Glaucidium radiatum*	Jungle Owlet
166.	*Charadrius leschenaultii*	Greater Sand-Plover	193.	*Falco peregrinus*	Peregrine Falcon
167.	*Tringa erythropus*	Spotted Redshank	194.	*Pericrocotus flammeus*	Orange Minivet
168.	*Halcyon smyrnensis*	White-throated Kingfisher	195.	*Coracina macei*	Large Cuckooshrike
169.	*Oriolus kundoo*	Indian Golden Oriole	196.	*Lalage melanoptera*	Black-headed Cuckooshrike
170.	*Pycnonotus cafer*	Red-vented Bulbul	197.	*Hypothymis azurea*	Black-naped Monarch
171.	*Pycnonotus jocosus*	Red-whiskered Bulbul	198.	*Eremopterix griseus*	Ashy-crowned Sparrow-Lark
172.	*Cinnyris asiaticus*	Purple Sunbird	199.	*Iduna rama*	Sykes's Warbler
173.	*Corvus macrorhynchos*	Large-billed Crow	200.	*Locustella naevia*	Common Grasshopper Warbler
174.	*Alauda gulgula*	Oriental Skylark	201.	*Geokichla citrina*	Orange-headed Thrush
175.	*Phylloscopus nitidus*	Green Warbler	202.	*Muscicapa dauurica*	Asian Brown Flycatcher
176.	*Saxicola maurus*	Siberian Stonechat	203.	*Ficedula albicilla*	Taiga Flycatcher
177.	*Acrocephalus dumetorum*	Blyth's Reed Warbler	204.	*Dicaeum agile*	Thick-billed Flowerpecker
205.	*Copsychus saularis*	Oriental Magpie-	235.	*Cinnyris lotenius*	Loten's Sunbird

		Robin			
206.	*Cypsiurus balasiensis*	Asian Palm Swift	236.	*Motacilla alba*	White Wagtail
207.	*Amaurornis phoenicurus*	White-breasted Waterhen	237.	*Anthus richardi*	Richard's Pipit
208.	*Charadrius alexandrinus*	Kentish plover	238.	*Anthus campestris*	Tawny Pipit
209.	*Xenus cinereus*	Terek Sandpiper	239.	*Emberiza bruniceps*	Red-headed Bunting
210.	*Anthracoceros coronatus*	Malabar Pied-Hornbill	240.	*Tadorna tadorna*	Common Shelduck
211.	*Argya striata*	Jungle Babbler	241.	*Aythya fuligula*	Tufted Duck
212.	*Leptocoma zeylonica*	Purple-rumped Sunbird	242.	*Columba elphinstonii*	Nilgiri Wood-Pigeon
213.	*Anthus trivialis*	Tree Pipit	243.	*Chalcophaps indica*	Asian Emerald Dove
214.	*Leptoptilos javanicus*	Lesser Adjutant	244.	*Surniculus dicruroides*	Fork-tailed Drongo-Cuckoo
215.	*Gallinago stenura*	Pin-tailed Snipe	245.	*Cuculus canorus*	Common Cuckoo
216.	*Egretta gularis*	Western Reef-Heron	246.	*Rallus aquaticus*	Water Rail
217.	*Circus aeruginosus*	Eurasian Marsh-Harrier	247.	*Phoenicopterus roseus*	Greater Flamingo
218.	*Artamus fuscus*	Ashy Woodswallow	248.	*Porzana porzana*	Spotted Crake
219.	*Dicrurus leucophaeus*	Ashy Drongo	249.	*Rallina eurizonoides*	Slaty-legged Crake
220.	*Prinia hodgsonii*	Gray-breasted Prinia	250.	*Pluvialis squatarola*	Black-bellied Plover
221.	*Mareca strepera*	Gadwall	251.	*Numenius phaeopus*	Whimbrel
222.	*Treron bicinctus*	Orange-breasted Green-Pigeon	252.	*Limnodromus semipalmatus*	Asian Dowitcher
223.	*Apus melba*	Alpine Swift	253.	*Sternula albifrons*	Little Tern
224.	*Gallinago gallinago*	Common Snipe	254.	*Hydroprogne caspia*	Caspian Tern
225.	*Tringa ochropus*	Green Sandpiper	255.	*Thalasseus bergii*	Great Crested Tern
226.	*Butorides striata*	Striated Heron	256.	*Thalasseus bengalensis*	Lesser Crested Tern
227.	*Alcedo atthis*	Common Kingfisher	257.	*Ciconia ciconia*	White Stork
228.	*Ceryle rudis*	Pied Kingfisher	258.	*Phalacrocorax carbo*	Great Cormorant
229.	*Galerida malabarica*	Malabar Lark	259.	*Ixobrychus sinensis*	Yellow Bittern
230.	*Prinia inornata*	Plain Prinia	260.	*Circaetus gallicus*	Short-toed Snake-Eagle
231.	*Cisticola juncidis*	Zitting Cisticola	261.	*Nisaetus cirrhatus*	Changeable Hawk-Eagle
232.	*Acrocephalus agricola*	Paddyfield Warbler	262.	*Circus macrourus*	Pallid Harrier
233.	*Ptyonoprogne concolor*	Dusky Crag-Martin	263.	*Circus pygargus*	Montagu's Harrier
234.	*Pycnonotus luteolus*	White-browed Bulbul	264.	*Ketupa zeylonensis*	Brown Fish-Owl
265.	*Dumetia hyperythra*	Tawny-bellied Babbler	283.	*Nyctyornis athertoni*	Blue-bearded Bee-eater
266.	*Sturnia pagodarum*	Brahminy Starling	284.	*Yungipicus nanus*	Brown-capped Pygmy Woodpecker
267.	*Luscinia svecica*	Bluethroat	285.	*Leiopicus mahrattensis*	Yellow-crowned Woodpecker
268.	*Motacilla citreola*	Citrine Wagtail	286.	*Falco tinnunculus*	Eurasian Kestrel
269.	*Aythya nyroca*	Ferruginous Duck	287.	*Jynx torquilla*	Eurasian Wryneck
270.	*Copsychus fulicatus*	Indian Robin	288.	*Falco amurensis*	Amur Falcon
271.	*Centropus sinensis*	Greater Coucal	289.	*Arundinax aedon*	Thick-billed Warbler
272.	*Psilopogon viridis*	White-cheeked Barbet	290.	*Iduna caligata*	Booted Warbler
273.	*Anthus rufulus*	Paddyfield Pipit	291.	*Helopsaltes certhiola*	Pallas's Grasshopper Warbler

274.	*Emberiza melanocephala*	Black-headed Bunting	292.	*Riparia chinensis*	Gray-throated Martin
275.	*Sterna aurantia*	River Tern	293.	*Riparia diluta*	Pale Sand Martin
276.	*Clanga hastata*	Indian Spotted Eagle	294.	*Delichon urbicum*	Common House-Martin
277.	*Lanius schach*	Long-tailed Shrike	295.	*Phylloscopus collybita*	Common Chiffchaff
278.	*Pellorneum ruficeps*	Puff-throated Babbler	296.	*Turdus simillimus*	Indian Blackbird
279.	*Mareca penelope*	Eurasian Wigeon	297.	*Arachnothera longirostra*	Little Spiderhunter
280.	*Pavo cristatus*	Indian Peafowl	298.	*Anthus godlewskii*	Blyth's Pipit
281.	*Ficedula parva*	Red-breasted Flycatcher	299.	*Anthus hodgsoni*	Olive-backed Pipit
282.	*Otus bakkamoena*	Indian Scops-Owl			

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