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Conservation Status and Biodiversity of *Pelecanus onocrotalus* (The Great white pelican bird) at Manchar Lake, District Jamshoro, Sindh, Pakistan

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ABSTRACT

Diversity amongst birds occurs in so many forms, which captivates their appearances and peculiar distributions. Avifaunal species enhance the beauty of wetlands with their ecological and economic benefits. Manchar Lake is a wetland of much importance, as it serves as a distinguished habitat for a variety of bird species, many of these species might be yet unknown to the scientific community. **Objective:** To explore the distribution, diversity, and conservation status of the great white pelican (*Pelicanus onocrotalus*). For this purpose, South Asia's one of the largest natural lakes, Manchar located in Jamshoro, Sindh, Pakistan was investigated. **Methods:** *Pelecanus onocrotalus* was identified as a migratory species. Notably, a few specimens have been recorded for the first time all through the summer. According to the IUCN red list of endangered species, the conservation status of the great white pelican was recorded as least concern. The prevalence of the species was recorded highest from October to March and lowest from April to September. **Results:** A total of 50 specimens of *Pelecanus onocrotalus* (Great White Pelican) belonging to the genus Pelecanus and the family Pelecanidae were recorded. **Conclusions:** This fact-finding study aims to document the emergence of bird diversity and its association with the lake surroundings and other species. The research findings will be valuable for wildlife departments and future researchers as a useful literature resource.

INTRODUCTION

The great white pelican (*Pelecanus onocrotalus*) is a large water bird species known for its distinctive large beak with a pouch for catching fish. It is a migratory bird that breeds in Eastern Europe and Asia, and winters in Africa, the Middle East, and the Indian subcontinent [1]. *Pelecanus onocrotalus* primarily feeds upon fish, requiring between 0.9 to 1.4 kg of fish daily [2]. It often forages in groups, utilizing cooperative feeding techniques to corral fish, and can fly over 100 km in search of food [3]. In Pakistan, the great white pelican is found in various wetlands and lakes, including the Manchar Lake in Sindh province [4]. Wetlands provide essential habitats for a wide range of species, including many water birds, and play a vital role in ecological balance by supporting diverse plant and animal life [5-6]. Manchar Lake is the largest freshwater lake in Pakistan and one of the largest in Asia [7]. It is an important habitat for a diverse range of bird species, including migratory birds. The lake is oval-shaped and varies in size from 30 to 200 square miles depending on the season. It is a brackish water and semi-natural wetland that supports rich and diverse aquatic vegetation [8, 9]. The Manchar Lake regularly hosts over 20,000 water birds in winter and is a breeding and wintering area for a wide variety of water birds [10-12]. It is also an important roosting site for the Night Heron (*Nycticorax nycticorax*). However, the lake has faced severe pollution problems from toxic waste discharged through drains, which has reduced the number of migratory birds from 20,000-30,000 to much lower levels and made the water unsuitable for humans and fish [12]. Despite its ecological importance, there is limited research on the conservation status and biodiversity of the Great White Pelican and other bird species at Manchar

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Lake. A study conducted by WWF-Pakistan in 2011 recorded 128 bird species from the Manchar Lake area, including the great white pelican [13, 14]. The study also provided information on the conservation status and feeding habits of the recorded species [13]. Climate change leads to alterations in water bodies like lakes, rivers, and wetlands, which are crucial habitats for pelicans. Changes in precipitation patterns, increased evaporation rates, and the frequency of extreme weather events can reduce the availability and quality of these habitats [15]. Pelicans primarily feed on fish, and climate change can affect fish populations and distribution. Warmer water temperatures, altered water chemistry, and changes in aquatic vegetation due to climate change can impact fish breeding, leading to a decline in food sources for pelicans. Pelican breeding cycles and nesting success are closely linked to environmental conditions. Unpredictable weather patterns, such as unseasonal floods or droughts, can disrupt breeding seasons, leading to lower reproductive success and higher chick mortality rates [16]. Pelicans play a crucial ecological role in wetland ecosystems by acting as both predators and prey within the food web. They help control fish populations and contribute to nutrient cycling through their feeding habits and guano, which enriches the soil. Additionally, pelicans can influence the structure of aquatic communities by dispersing plant seeds and affecting the dynamics of other wildlife in their habitats. The population of water birds at Manchar Lake in Pakistan varies significantly between the summer and winter seasons. During the Asian Water-bird Census in 2000, 31,852. Water birds were recorded at the lake, dropping to only 1,183 birds by 2011-16. This drastic decline was attributed to heavy pollution impacts on the lake's water quality in recent years [17-20]. To ensure the long-term conservation of the Great White Pelican and other bird species at Manchar Lake, it is crucial to conduct regular monitoring and assessment of their populations and habitats. This information can help inform management decisions and guide conservation efforts to protect this important wetland ecosystem [13, 14]. Climate change leads to alterations in water bodies like lakes, rivers, and wetlands, which are crucial habitats for pelicans. Changes in precipitation patterns, increased evaporation rates, and the frequency of extreme weather events can reduce the availability and quality of these habitats. Pelicans primarily feed on fish, and climate change can affect fish populations and distribution. Warmer water temperatures, altered water chemistry, and changes in aquatic vegetation due to climate change can impact fish breeding, leading to a decline in food sources for pelicans. Pelican breeding cycles and nesting success are closely linked to environmental conditions. Unpredictable weather patterns, such as unseasonal floods or droughts, can disrupt breeding seasons, leading to lower reproductive success and higher chick mortality rates. include habitat restoration, pollution control, and community engagement to foster sustainable conservation practices [5].

METHODS

Manchar Lake is located approximately 18 kilometers from Sehwan town, at coordinates 67º 38 '39.46" East and 26º25'40.41" North, based on the global positioning system. Surveys were conducted over a period from May 2023 to April 2024. Observations took place daily, from early morning (06:30–09:30 hours) to late evening (17:30–19:00 hours), aiming to see the maximum number of white pelican birds (Pelecanus onocrotalus).

- **Equipment:** Binoculars: Bushnell, Model 133450.
- **Observers:** Each survey was conducted by two observers independently.
- **Coverage:** Observations were made within a 150-meter strip on each side of the lake's bank, making each survey strip 300 meters wide.
- **Observation Points:** A stationary point was selected to keep a continuous watch.
- **Observation Methods:** Counting Methods, Direct Counting.
- **Close View:** Individual birds were counted as 1, 2, 3, 4, 5, and 6, etc., using binoculars for a close view.
- **Distant View:** Flocks were visually divided into smaller groups and counted. Groups were summed to obtain the final count.
- **Multiples Counting:** Birds were counted in multiples such as 3, 6, 9, 12, 15, or 2, 4, 6, 8, 10, etc., depending on their distribution. This method was applied to both evenly and unevenly distributed water-birds.
- **Flight Counting:** Birds in flight along the coast moving to roost sites were counted repetitively in large flocks.
- **Data Analysis:** Shannon-Weaver Diversity Index.

The Shannon-Weaver diversity index (also known as Shannon-Wiener index or Shannon index) was used to determine the distribution and biodiversity of white pelicans in the ecosystem. The steps involved were:

- **Selection of Sample Population:** A sample population of white pelicans was selected within the chosen area.
- **Species Count:** The species were counted within the sample population.
- **Richness Assessment:** The richness of species in the population was assessed to calculate the Shannon index, an important measure of bird biodiversity. The methods and steps described were adapted from Howes, J. and Backwell, D. (1989) for accurate and consistent data collection on white pelican populations at Manchar Lake.

Let's use our sample data (1 species, 50 total individuals) and calculate D i.e. to calculate the Shannon-Weaver Diversity Index (H') for the winter count of Pelecanus

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onocrotalus, need to follow these steps:

- **Determine the proportion (pi) of each species:** Since we have only one species, the proportion (pi) will be 1.
- **Calculate the natural logarithm (ln) of each proportion (pi):** Again, since pi is 1, ln(pi) will be 0.
- **Multiply each pi by its ln (pi):** This will result in 0 for each species as ln(1) is 0.
- **Sum the results:** The sum of pi * ln (pi) will be the Shannon index (H').

$H' = -\sum(pi \times \ln(pi))$ H′=−∑(pi×ln(pi)

Since we have only one species (*Pelecanus onocrotalus*) and pi is 1, the Shannon index H' for this single-species count is: H′=−(1×0)=0H′=−(1×0)=0 Therefore, the Shannon-Weaver Diversity Index (H') for the winter count of *Pelecanus onocrotalus* is 0. This result is expected because the Shannon index is higher when there is greater species diversity, and in this case, there is only one species present. Shannon Diversity Index, ni refers to the number of individuals of species (Table 1).

Table 1: Shannon Index (Bird Diversity) For Winter Count

Species	*ni* (population size)	Pi	ln(pi)	pi * ln(pi)
Pelecanus onocrotalus	40	1	0	0

Methodology of observations:

1. Direct Field Observations: Observations were conducted in early morning and late evening, likely to coincide with peak bird activity, and counted birds using binoculars (10x50 magnifications).

2. Capture Techniques: Birds were captured for closer study using fishing nets. Bird sounds were recorded and analyzed to help in identification and counting. Local children assisted in capturing and possibly identifying birds, utilizing their familiarity with the area and the species.

Howes, J. and Backwell, D. (1989): This reference suggests a methodology focusing on systematic counting and observing, ensuring reliable data collection through standardized techniques. The use of binoculars aligns with general search of birds, it practices to reduce disturbance at the same time as it maximizes the identification of the bird in question. This method helped in accurate monitoring of *Pelecanus onocrotalus* at Manchar Lake, contributing valuable information to the ornithological research and conservation status. During study 25 specimens of the great white pelican bird from Manchar Lake have been captured and identified.

Laboratory Analysis and Identification

Duration of research: Captured specimens were kept under observation for a few weeks in the Vertebrate zoology laboratory to take a closer look of the detailed work.

Body parameters Measurement and identification: Measurement of body parameters were taken such as weight of body, length of body, length of wings, length of tail Length of Head, neck, and tail feathers, width of web, and other relevant morphological features.

Physical characters: Identification of distinctive characteristics was done, such as plumage patterns, coloration, and other relevant traits that would aid further details in species identification.

Morphological parameters: Study of external structures adding further details in the identification of species such as; shape of feathers, eye coloration, leg coloration and length was done.

Species Identification Keys: Identification keys have been prepared by using international literature, ensuring accuracy and consistency. The references encompass: Harrison, 1966; pioneering work on chook identity and category. Boyd, 1987; contributions to ornithological studies and species differentiation. Dunning, 1992; Reference on avian frame measurements. Ali, 1993; Comprehensive guide on Indian birds, which include migratory species. Jonsson, 1996; Field guide specializing in hen identification. Rookmaaker & Pieters, 2000; Studies on bird morphology and taxonomy. Clements, 2007; renowned checklist of bird species. McCaffery *et al.*, 2010: Research on bird populations and their habitats. Bird Life International, 2019: Authoritative resource on bird conservation and species status. Jobling, 2010: Dictionary of bird names and their meanings. Amat *et al.*, 2011: Study on the behavior and ecology of water birds. Hancock & Kushlan, 2010: Detailed work on herons, which share habitats with pelicans.

RESULTS

The conservation status and biodiversity of *Pelecanus onocrotalus* at Manchar Lake likely involved several methodologies based on common practices in ecological and ornithological studies. Systematic surveys were conducted to count the population of Great White Pelicans and other water birds at Manchar Lake. This involved point counts, transect surveys, or aerial surveys to estimate bird populations and distribution. Evaluations of habitat quality, including water levels, vegetation cover, and food availability, were conducted to understand the environmental conditions affecting pelican populations. Studies on the white pelican birds at Manchar Lake, conducted from May 2023 to April 2024, utilized direct field observations based on the methodology of Howes and Backwell-1989. The huge occurrence of *Pelecanus onocrotalus* (The Great White Pelican) at Manchar Lake highlights the importance of this habitat not only as a permanent residence but also as a migratory refuge (Figure 2), belonging to family pelecanidae. Measurement of body parameters recorded are as: Body Length 140 to 182 cm (55

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to 72 in); Bill Yellow, measuring 29 to 36 cm (11.5 to 18.5 in); gular pouch is dull to pale yellow; Wingspan length 226 to 360 cm (7 ft 5 in to 11 ft 10 in); Weight: 8 to 16 kg (20 to 33 lb); Sexual dimorphism was seen. Female pelican having Bill Length of 28.9 to 40.0 cm (11.4 to 15.7 in); Body Length about 147 cm (55 in); Weight was recorded 5.5 to 9.5 kg (12 to 21 lb); Plumage was predominantly white with a yellowish base on the fore neck and a faint pink tinge on the neck; Primary Feathers were black, with white shafts at the bases and occasionally paler tips and narrow fringes; Secondary feathers were black with a whitish fringe.24. Legs and Feet were fleshy-yellow legs; short, strong legs and webbed feet facilitate aquatic life. It was observed during study that this bird, the great white pelican is well- adjusted for aquatic environments, by using its strong webbed feet it propels through water and also assists in powerful takeoff. During the powerful flight *Pelecanus onocrotalus,* holds its head near and aligned with the body for the maximum duration of flight. The breeding sites of the great white pelican are South Eastern Europe through Asia and Africa, commonly in swamps and shallow lakes. Figure 1 shows the scientific key used to identify the species in the field which includes four steps. Pelicans are large birds, typically characterized by their long necks, stout bodies, and large wingspans. The size can vary significantly among species, with the Australian pelican being one of the largest, reaching up to 1.83 meters in length and a wingspan of about 3 meters-24. One of the most distinctive features of pelicans is their long, down curved bills and large gular pouches. The pouch is used for catching fish and can hold a significant amount of water. Note that the bill length can vary, with some species like the Australian pelican having bills that can grow up to 0.5 meters long-24. Most pelicans have predominantly light-colored plumage, although the brown and Peruvian pelicans are exceptions with darker feathers. During the breeding season, the bare facial skin and throat pouch of pelicans often change color, becoming more vibrant-24. Pelicans are typically found near water bodies such as lakes, rivers, and coastal areas. Observing the habitat can help narrow down the species, as different pelicans may prefer specific environments 24. By combining these keys—size and shape, bill characteristics, plumage and habitat you can effectively identified pelicans and distinguish between them as different species within the genus Pelecanus (Figure 1).

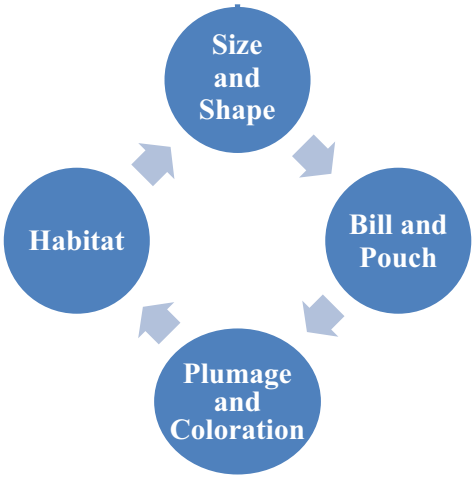

Figure 1: The Scientific Key

A total number of specimens collected that were fifty in total, out of which 10 specimens were collected in summer and forty were collected in the summer season (Table 2).

Table 2: Number of specimens collected during summer and winter season

Pelecani-formes	English name	Scientific name	Status	Occurrence	Count Summer /winter	
	White Pelican	*Pelecanus onocrotalus*	Winter visitor	Scarce	10	40

The prevalence of collected specimens in graphical form (Figure 2).

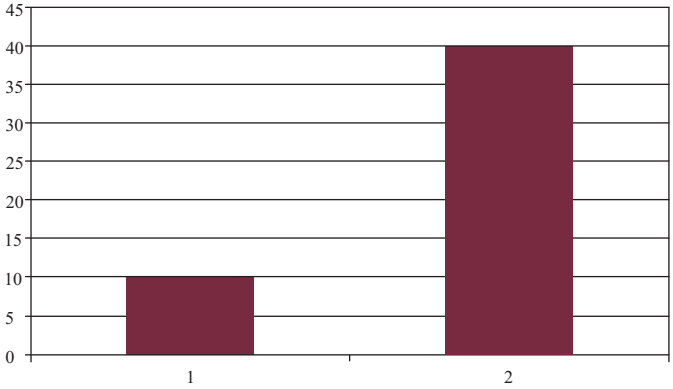

Figure 2: Prevalence of Collected Specimens in Summer and Winter

Detailed information on the white pelican bird (Table 3).

Table 3: Detailed account of Great white pelican bird

Scientific Name	*Pelecanus onocrotalus*
Common Name	White pelican
Family	Pelecanidae
Order	Pelecaniformes
Status on IUCN Red List	Least concern
Status as Migratory/Resident	Migratory
Diet	Carnivorous

The availability of great white pelicans at Manchar Lake during the winter and summer seasons (Figure 3).

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Figure 3: Occurrence of Pelican Birds at Study Area (Manchar Lake)

DISCUSSION

The study on the conservation status and biodiversity of *Pelecanus onocrotalus* (Great White Pelican) at Manchar Lake in Sindh, Pakistan, provides valuable insights into the ecological importance of this wetland ecosystem. [7,10,13,14] Manchar Lake is a significant habitat for a wide variety of water birds, including the Great White Pelican, which uses the lake as a breeding and wintering area. The lake regularly supports over 20,000 water birds during the winter season, making it globally important site for avifaunal biodiversity [5-6]. The study highlights the importance of Manchar Lake as a roosting site for the Great White Pelican. The presence of these birds indicates the lake's ability to provide suitable habitats and resources for their survival and reproduction. However, the study also identifies several threats to the biodiversity of Manchar Lake, including water diversion for rice cultivation, which has led to a decrease in the lake's size in recent years [3, 11]. Additionally, livestock grazing and the cutting of shrubs for fuel purpose challenges to the conservation of the lake's ecosystem [4]. To address these threats and ensure the long-term protection of *Pelecanus onocrotalus* and other avian species, the study emphasizes the need for effective management strategies and conservation measures. These may include regulating water usage for agriculture, controlling livestock grazing, and promoting sustainable practices in the surrounding areas [15]. Furthermore, the study emphasizes the importance of continuous monitoring and research to understand the trends in species composition and abundance at Manchar Lake. Satellite remote sensing and GIS techniques can be valuable tools for studying the spatial distribution of bird species and tracking changes in the lake's land cover over time [18]. In conclusion, the study on the conservation status and biodiversity of Pelecanus onocrotalus at Manchar Lake highlights the ecological significance of this wetland ecosystem and the need for comprehensive conservation efforts to protect the Great White Pelican and other avian species that rely on it [19]. By addressing the identified threats and implementing sustainable management practices, stakeholders can ensure the long-term preservation of Manchar Lake's rich biodiversity.

CONCLUSIONS

This comprehensive and rigorous approach ensured that the birds were thoroughly studied, with meticulous attention to detail in measuring and identifying morphological characteristics. The use of established international literature provided a robust framework for accurate species identification and furthered the scientific understanding of the white pelican population at Manchar Lake. It is a significant habitat for a wide variety of resident and migratory birds including the white pelican, which is an economically important species for the region. The liver oil of the white pelican is utilized for treating joint pain, and its flesh is highly valued for its medicinal properties, commanding high prices in the market. Despite these uses, the white pelican is classified as Least Concern (LC) according to conservation status. The lake supports a rich diversity of avifaunal species, encompassing both carnivorous and omnivorous birds.

Authors Contribution

Conceptualization: QM
Methodology: QM, KS
Formal analysis: QM, KS
Writing-review and editing: QM, KS

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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REFERENCES

[1] Knopf FL. and Evans RM. American White Pelican (Pelecanus erythrorhynchos), version 1.0. In Birds of the World. In: A. F. Poole, Editor. Cornell Lab of Ornithology, Ithaca, NY, USA. Available at: https://birdsoftheworld.org/bow/species/amwpel/c

DOI: https://doi.org/10.54393/mjz.v5i03.109

ur/introduction.
[2] Jobling JA. The Helm Dictionary of Scientific Bird Names. London: Christopher Helm; 2010.
[3] Linnaeus C. Systema Naturae per Regna Tria Naturae Editio Decima. Vol. 1. Stockholm: Lars Salvius; 1758.
[4] BirdLife International. Pelecanus erythrorhynchos. IUCN Red List of Threatened Species. 2016. [Last cited 7 Aug 2024] Available at: https://datazone.birdlife.org/species/factsheet/american-white-pelican-pelecanus-erythrorhynchos/details
[5] Sibley CG and Monroe BL. Distribution and Taxonomy of Birds of the World. New Haven: Yale University Press; 1990. p. 314-315.
[6] Johnson NK. Handbook of the Birds of the World, Volume 6. The Auk. 2002 Apr; 119(2): 573-4. doi: 10.1093/auk/119.2.573.
[7] Manchhar Lake Pakistan. Encyclopædia Britannica. 2020 Apr 20 [Last cited 7 Aug 2024]. Available at: https://www.britannica.com/place/Manchhar-Lake.
[8] Manchar Lake. Pakistantoursguide.com. 25 August 2012 [Last cited 7 Aug 2024]. Available at: https://www.pakistantoursguide.com/lake-manchar.html.
[9] McMahon BF and Evans RM. Nocturnal Foraging in the American White Pelican. Searchable Ornithological Research Archive. Feb 1992; 94(1): 101-109. doi: 10.2307/1368800.
[10] Mayr E and Cottrell GW. Check-List of Birds of the World. 2nd ed. Vol. 1. Cambridge (MA): Museum of Comparative Zoology; 1979. p. 189-190.
[11] BirdLife International. Pelecanus onocrotalus. IUCN Red List of Threatened Species. 2018. [Last cited 7 Aug 2024]. Available at: https://www.iucnredlist.org
[12] BirdLife International. Great White Pelican. BirdLife species factsheet; 2012 [Last cited 7 Aug 2024]. Available at: https://www.birdlife.org
[13] Beaman M and Madge S. The Handbook of Bird Identification: For Europe and the Western Palearctic. London : Christopher Helm; 1998.
[14] WWF-Pakistan. Biodiversity of Manchar Lake, Sindh, Pakistan. Karachi: WWF-Pakistan; 2011.
[15] Brown LH and Urban EK. The breeding biology of the great white pelican Pelecanus onocrotalus roseus at Lake Shala, Ethiopia. IBIS. 1969 Apr; 111(2): 199-237. doi: 10.1111/j.1474-919X.1969.tb02527.x.
[16] BirdLife International. Species factsheet: Pelecanus onocrotalus. 2023 Jul [Last cited 7 Aug 2024]. Available at: http://datazone.birdlife.org/species/factsheet/great-white-pelican-pelecanus-onocrotalus
[17] Wetlands International. Waterbird Population Estimates. 2022 Jul [Last cited 7 Aug 2024]. Available at: https://wpe.wetlands.org.
[18] IUCN. The IUCN Red List of Threatened Species. 2023 Jul [Last cited 7 Aug 2024]. Available at: https://www.iucnredlist.org
[19] All About Birds. Four keys to bird identification. [Last cited 7 Aug 2024]. Available at: https://www.allaboutbirds.org/news/four-keys-to-bird-identification.
[20] Boyd, B., 1987. "The Black-winged Stilts at Holme Norfolk Naturalists' Trust reserve". Twitching., 1(6): 148–150. Available at: https://wiki-gateway.eudic.net/wikipedia_en/Himantopus_melanurus.html.