IJMS 2024 11 (1): 11 - 26

International Journal of Multidisciplinary Studies (IJMS)
Volume 11, Issue 1, 2024

Diversity of Waterbirds and Potential for Promoting Avitourism in Selected Regions in the Jaffna Peninsula, Sri Lanka

Jayarathna D.[1] and Wijesundara C.S.[2*]

[1] Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka

[2] Department of Zoology, University of Peradeniya, Peradeniya, Sri Lanka

ABSTRACT

Jaffna is renowned for its diversity of waterbirds, and it is one of the four richest waterbird regions in Sri Lanka. Therefore, waterbirds can play a key role in developing avitourism ('bird-tourism') in the Jaffna peninsula. The primary aim of the present study was to assess the diversity of waterbird species in selected areas inside the Jaffna District and to estimate the capability for promoting avitourism. Waterbirds were censused from January-July 2018 by using a spotting scope and binoculars. Simpson's Index was used to estimate the waterbird diversity. The capacity to develop avitourism and availability of infrastructure were evaluated with a questionnaire survey from each neighborhood and foreign tourists, and from secondary information. Waterbird diversity was higher in the Island location (Simpson's Index 0.86) compared to the Peninsular location (Simpson's Index 0.78). The presence of rare species such as the Spotted-billed Duck (Anas poecilorhyncha) and high numbers of Greater Flamingo (Phoenicopterus roseus) increases the appeal for avitourists. It was found that most of the tourists (>50%) were unaware of the birding areas located in the Jaffna District. The supply of infrastructure such as accommodation, restaurant centers, telecommunication facilities, secure drinking water and sanitary facilities is at a medium to excessive level within the location (>50%). Bird watching centers and waste control centers are low within the vicinity (<50%). The high waterbird diversity and availability of infrastructure will help promote avitourism in Jaffna peninsula, especially at the sites included in the present study.

KEYWORDS: *Birding areas, bird-tourism, ecotourism, infrastructure facilities, Jaffna District, waterbirds*

Corresponding author: Wijesundara C.S., Email: chamindaw@sci.pdn.ac.lk

1 INTRODUCTION

1.1 Ecotourism and Avitourism

Ecotourism is one of the sub-components of sustainable tourism (Kiper, 2013). It is an alternative form of tourism (Fennell, 2008), which focuses on surroundings, a substitute form of holidays connected to nature that respects the local community (Chatzigeorgiou et al., 2015). Its goal is to conserve the assets, especially biodiversity, and maintain sustainable use of resources, which bring ecological benefits to tourists, preserve the ecological surroundings and profit from the economic benefits (Kiper, 2013). Avitourism may be defined as a part of ecotourism that focuses especially on birds along with bird watching activities (Sekercioğlu, 2002). It is becoming one of the fastest growing forms of nature-based tourism around the world. Avitourism, based on ecotourism principles, has the potential to contribute to neighborhood groups, train the local people about the immeasurable value of biodiversity and create neighborhood and countrywide incentives for the protection of birds and natural regions (Sekercioğlu, 2002). Avitourists are one of the best sources of ecotourism income, since they form the largest single group of ecotourists (Cordell and Herbert, 2002). The natural (non-human) environment or a feature of it, is the prime attraction for the ecotourist (Weaver, 2001). Avitourism is a growing sector of the broader nature-based tourism industry (Steven et al., 2015). Avitourism shares much of its industry infrastructure with other segments of the overall tourism market due to a part of general tourism market. Hence the infrastructure in avitourism has always overlapped with those of the other tourism infrastructures.

1.2 Bird and Waterbird diversity in Sri Lanka

The avifauna of Sri Lanka includes 510 species recorded to date (MoMD&E, 2019; The National Red List, 2021). Among them are 244 breeding residents, 179 regular migrants, and 87 vagrants. According to the Ramsar convention, birds that are ecologically dependent on wetlands are known as waterbirds (or waterfowl) (UNESCO, 1994). They play an essential role in the productivity of wetland ecosystems (Wei et al., 2009). Approximately 164 species of waterbirds belonging to 23 families have been recorded in Sri Lanka (Wijesundara et al., 2017), with a total of 116 species of waterbirds recorded from the Northern Province (Wijesundara et al., 2017). Migrant birds start arriving in Sri Lanka in

September each year, and they return to their breeding grounds towards the end of April the following year (Wijesundara et al., 2017).

1.3 Northern Province

Jaffna, Mullaitivu, Kilinochchi, Vavuniya and Mannar are the five districts that belong to the Northern Province of Sri Lanka. It has a total area of 8,884 km^2. This province contains a number of lagoons. Of them, Jaffna lagoon (which is the largest), Chundikkulam lagoon, Uppu Aru lagoon are the prominent lagoons. The highest mean annual temperature is 28 °C (April – September). The highest average wind speed is 13 km/h and average humidity is 74%. From December to January, the environment is at its coldest. The mean annual rainfall is 500-1125 mm, brought on largely by the north-eastern monsoon rains. During this rainy season that lasts from October to January, there is a remarkable change in the vegetation and the environment as a whole. The presence of specific habitat types such as lagoons, mangroves, marshes, grasslands, man-made lakes and coastal mudflats determine the occurrence and prevalence of particular species of birds. During the migratory season, this area becomes a hotspot mainly for waterbirds (Wijesundara et al., 2017, Aloysius et al., 2023).

1.4 Aim of the Study

The present study is timely and in fact essential due to the fact that Jaffna was practically hidden from the tourism industry during the past 30 years as a result of civil warfare that prevailed in this region. The primary goal of the present research was to assess the diversity of waterbird species in selected regions in the Jaffna District and to estimate the potential for promoting avitourism. The specific goals were to assess the diversity of waterbird species (avitourism resource base), to identify tourists' view regarding the potential for developing avitourism, and to assess the assets available for avitourism in the Jaffna District.

2 MATERIALS AND METHODS

This research was conducted in the Jaffna peninsula, which is located in the Northern Province of Sri Lanka. Two areas in the peninsula *viz.* "Island Area" and "Peninsular Area" (Figure 1) were selected after preliminary observations on the abundance of waterbird species, specific habitats in the area and proximity to the sea. Waterbird species (both migrant and

resident) were the main target of the study. The present study was undertaken from January to July 2018, with two sampling days per month, in Mandativu, Allaipiddy, Mankumban, Araly Junction, Sarasalai, Anthanathidal and Kappoothu in the Jaffna district. Bird species and their abundance were recorded using point counts with unlimited distance. To observe birds, a Visionking 30 - 90 × 100 spotting scope, Nikon Action Ex 8×40 binoculars and a tally counter were used. Observations were taken at both sunrise and sunset, with the top counting hours from 0630 h to 1000 h and 1530 h to 1800 h (representing the times during which the birds are more active). Observations at every point lasted for about 20 minutes. Point transects were laid following Buckland et al. (2001), Sutherland (2006) and Wijesundara et al. (2017). During the observation period, each selected site was observed more than once to allow for temporal variation of bird diversity. To limit the time-of-day bias, each observation station was equally visited during different times of the day, on different counting days. An approximately equal amount of sampling was done in each station. Standard field guides such as Harrison (2011) and Warakagoda et al. (2012) were used to identify the bird species. A questionnaire was designed to collect data on the potential for avitourism and the infrastructure facilities of the study sites. These data were collected by interviewing both local and foreign tourists. The total sample size was 50 individuals. Information on the availability of infrastructure facilities was received from tourists and government statistical data. The bird diversity was determined using Simpson's diversity index:

$$D = \frac{\sum(n-1)}{(N-1)}$$

Where, n = The total number of birds in a particular species, N = The total number of birds of all species.

Relative Abundance (%) of bird species was calculated using the expression:

$$RA = \frac{n}{N} \times 100$$

Where, n = Number of individuals of a bird species, N = Total abundance

The potential for avitourism and the availability of infrastructure facilities were analyzed using Microsoft Excel (2007). It was also used to represent graphical information.

Figure 1: Locations of the study sites in Jaffna peninsula
Sampling points in Island Area: 1. Mandaitivu, 2. Allaipiddy, 3. Mankumban, 4. Araly Junction.
Sampling points in Peninsular Area: 5. Sarasalai, 6. Anthanathidal, 7. Kappoothu

3 RESULTS AND DISCUSSION

During the present study, 55 species of waterbirds were identified. The highest waterbird diversity was recorded from Sarasalai area (Table 1). Table 2 shows the monthly variation of waterbird diversity at the two study sites. Compared to the Peninsular Area, the Island Area had a higher diversity. Many species of waterbirds occurring in the Jaffna peninsula were migrants. In the Island Area, Mankumban had the highest abundance of waterbirds whereas Allaipiddy had the lowest (Figure 2). In both Mandativu and Allaipiddy, Eurasian Wigeon (*Anas penelope*) had the highest relative abundance (15.95% and 18.66% respectively). However, in nearby Mankumban, Black-tailed Godwit (*Limosa limosa*) had the highest relative abundance (16.58%) while at Araly Junction, the Common Coot (*Fulica atra*) (16.28%) was the most abundant. In Sarasalai in the peninsular area, Greater Flamingo (*Phoenicopterus roseus*) had the highest relative abundance (21.28%) among the waterbirds. In Anthanathidal, Eurasian Wigeon (25.2%) had the highest relative abundance; while Painted Stork (*Mycteria leucocephala*) was the most abundant (18.01%) waterbird species in Kappoothu (Figure 3).

Table 3 shows the results of the analysis of tourists' responses. Two types of tourists

were sampled, namely, local (or domestic) tourists and foreign (or international) tourists. The age category of tourists was analyzed as 20-30 years and 31 or above. Most of the tourists were below 31 years. There were more female tourists than male. It was found that most of the tourists were employed. The avitourism potential for different study sites was analyzed based on the tourists' point of view, infrastructures, abundance of water birds and presence of rare species (Figure 4). Tourist satisfaction on the infrastructure facilities is given in figure 5. About 10-20% of tourists are not satisfied with the infrastructure available for avitourism in this area. In particular, 40-70% were not aware of the availability of skilled guides, eco guide books, bird watching towers and hiding places for birding. Conversely, 10-30% were highly satisfied with the available facilities.

Table 1: Diversity of waterbirds at the study sites (Simpson's Diversity Index)

Study area	Diversity	No. of birds
Mandativu	0.66	3448
Allaipiddy	0.76	793
Mankumban	0.50	5616
Araly Junction	0.69	2046
Sarasalai	0.85	1424
Anthanathidal	0.72	3924
Kappoothu	0.57	3081

Table 2: Monthly variation in the diversity of waterbirds in Island and Peninsular Areas (according to Simpson's diversity index)

Month	Diversity	
	Island	Peninsular
January	0.89	0.61
February	0.91	0.87
March	0.90	0.83
April	0.88	0.81
May	0.78	0.65
June	0.84	0.92
July	0.83	0.75

Table 3: Summary of the visitor information of sampled tourists during present study period

Character	Subcategory	Tourists' percentage (%)
Type of tourist	Local	50
	Foreign	50
Age	20-30 years	70
	31 or above	30
Gender	Male	42
	Female	58
Employment	Employed	64
	Unemployed	18

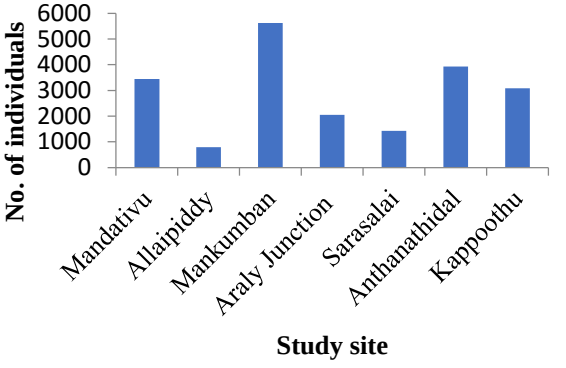

Figure 2: Variation in waterbird abundance in study sites during January - July 2018

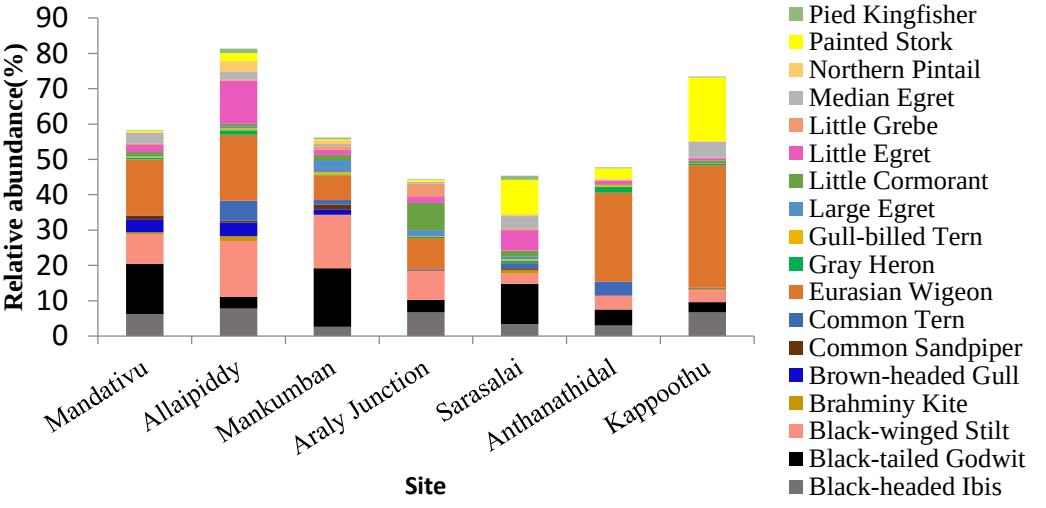

Figure 3: Relative abundance of waterbirds which showed >0% for all study sites

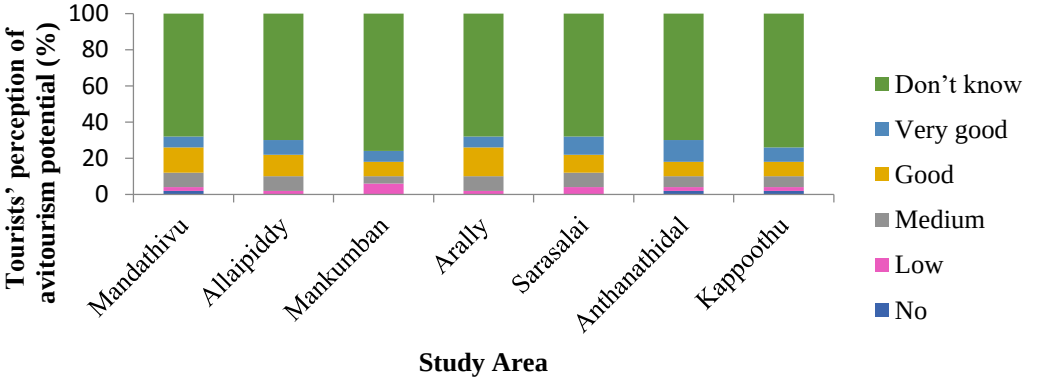

Figure 4: Avitourism potential for study areas (Tourists' point of view)

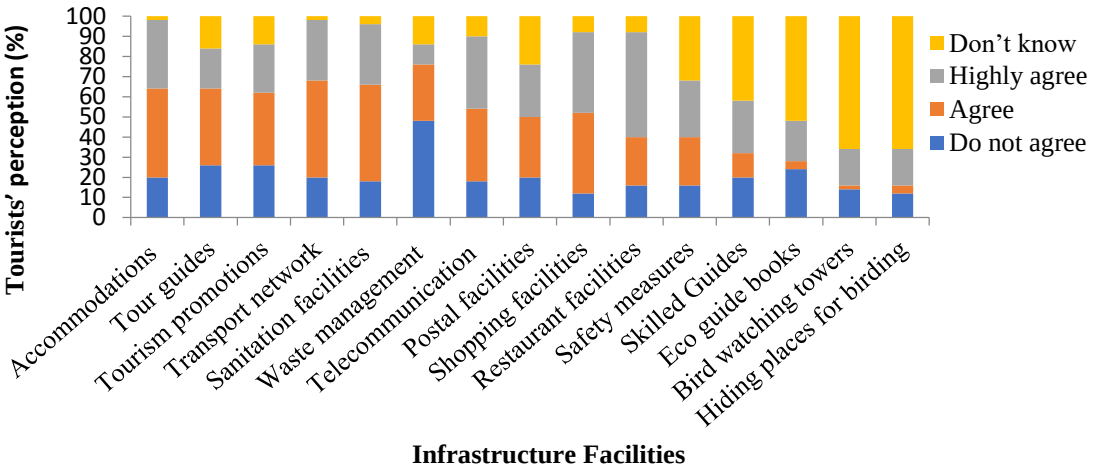

Figure 5: Availability of infrastructure facilities in the Jaffna (Tourists' point of view)

3.1 Waterbird Diversity

Jaffna peninsula is one of the four richest waterbird regions in Sri Lanka (Wijesundara et al., 2017). Out of the 116 species of waterbirds recorded in the Northern Province to-date (Wijesundara et al., 2017), the present study recorded over half of these species within the selected areas in the Jaffna peninsula. Furthermore, those selected areas cover only a small proportion of the Jaffna peninsula. Due to the fact that the present study area covers an end point of the Central Asian Flyway of migratory bird species, the area regularly harbors a large number of migratory species in very high densities (Warakagoda and Siriwardana, 2006; Wijesundara et al., 2017). Mandaitivu in particular is significant for its bird variety and diversity among the other regions within the Jaffna peninsula, in addition to being a main mangrove habitat in the area. The dominant varieties of flora on Mandaitivu are salt marshes and mangroves habitats, which provide suitable habitats for migratory birds (Rajkumar and Wijesundara, 2014).

According to the findings of the present study, the abundance of waterbirds varies among the study sites. In general, the Island Area had a higher waterbird abundance compared to the Peninsular Area. The reasons are the differences in the terrain, mangrove structure, etc. (Rajkumar and Wijesundara, 2014). Mandativu had the highest abundance of waterbirds probably due to the fact that the area is covered with high vegetation with mangroves and the presence of large water bodies compared to other study sites.

However, it was found that both study areas have high species richness of waterbirds due to the availability of niches, optimum climatic conditions, waterbodies, food availability, large extents of mangroves and salt marsh associated habitats (Rajkumar and Wijesundara, 2016; Rajkumar et al., 2018). Also, the waterbird diversity is variable according to the period of the year. In general, towards the middle of the year (May-July), there was a decrease in the diversity of waterbirds for obvious reasons – due to the absence of migratory species. According to the findings of the present study, it was found that the highest diversity was shown from February to April. However, there was comparatively low waterbird diversity in January, even though it is within the migratory season. The reason may be that due to the heavy rainfall experienced by the Jaffna peninsula from mid-October to end of January (from the North-East monsoons), most of the water bodies get filled to their capacity during that time. Hence the wading birds may find it difficult to forage in these water bodies during this time, and they may find refuge elsewhere where there are areas with low water levels, e.g., Nagar Kovil, Maruthankeny, Chundikkulam, etc.

After the migratory period, a few species stay around in Sri Lanka. The best instance is the Greater Flamingo (*Phoenicopterus roseus*) population within the Jaffna peninsula. According to recent research, it has been found that this species has stayed on in the Jaffna peninsula year-round consecutively for at least five years (Wijesundara et al., 2018). Greater Flamingo was recorded in large numbers in all study sites in the Peninsular Area. The reasons may be the presence of optimum salinity conditions which support a higher availability of food, especially plankton (Wijesundara et al., 2018, Hemraj et al., 2017).

Among the resident species, the Black-headed Ibis (*Threskiornis melanocephalus*) and Black-winged Stilt (*Himantopus himantopus*) showed the highest relative abundance; whereas among the migrants, Black-tailed Godwit (*Limosa limosa*), Eurasian Wigeon (*Anas penelope*), and Garganey (*Anas querquedula*) had the greatest abundance. Two migrant species, the Wigeon and Black-tailed Godwits were hardly recorded in Sri Lanka until a few decades ago (Legge, 1880; Wait, 1925; Henry, 1971). Since then, they have typically been recorded in the thousands during most seasons, though the Wigeon is

only found in Jaffna and Mannar (Henry, 1998). For example, in February 2016, over 4,000 Wigeon were recorded from Mankumban, Jaffna (Wijesundara et al., 2017). Black-tailed Godwits had also been recorded in huge numbers in Jaffna, with flocks of several thousand individuals (Wijesundara et al., 2017). The present study encountered over 2000 Black - tailed Godwits during the study period. During the present study, the Little Cormorant (*Phalacrocorax niger*), which is a resident species, was also recorded in great numbers in all study sites. The most abundant species was the Gull-billed Tern (*Gelochelidon nilotica*). Among the other abundant species were Common Sandpiper (*Actitis hypoleucos*), Black-tailed Godwit and Common Redshank (*Tringa totanus*). In general, in the present study, both Island and Peninsular Areas showed a higher abundance of migratory waterbird species than resident species. Species such as Black-headed Ibis, Black-tailed Godwit, Eurasian Wigeon and Painted Stork (*Mycteria leucocephala*) had high relative abundance within the Peninsular Area, but with lower values when compared to those for the island area. Some species could only be observed in the Peninsular Area due to dense vegetation. These include Common Moorhen (*Gallinula chloropus*), Purple Heron (*Ardea purpurea*), and White-breasted Waterhen (*Amaurornis phoenicurus*).

Among the resident waterbird species found in Sri Lanka, some rare species breed exclusively inside the northern region. These are Spot-billed Duck (*Anas poecilorhyncha*), Crab Plover (*Dromas ardeola*), Indian Courser (*Cursorius coromandelicus*), Sooty Tern (*Onychoprion fuscatus*), Bridled Tern (*Onychoprion anaethetus*), Saunders's Tern (*Sternula saundersi*), Brown Noddy (*Anous stolidus*), and Lesser Noddy (*Anous tenuirostris*) (Wijesundara et al., 2017). During the present study, only the Spotted-billed Duck was observed. Furthermore, the Crab Plover has very recently been removed from the breeding resident list, since positive evidence of its breeding has not been found (Weerakoon and Dayananda, 2021). Two species which had been once breeding residents and have become extinct as breeding residents about a hundred years ago, later reappeared as migrants in Sri Lanka: the Glossy Ibis (*Plegadis falcinellus*) and Comb Duck (*Sarkidiornis melanotos*) (Henry, 1998). At present, their largest numbers are recorded in the Jaffna and Mannar regions (Wijesundara et al., 2017). It is significant

that the glossy ibis was recorded in high numbers during the present research. Both these species hold high avitourism potential, given their rarity.

3.2 Avitourism Potential

The potential for the avitourism was also analyzed during the present study. Both local and foreign tourists visit Jaffna for various purposes. Most of them are mass tourists (not ecotourists or avitourists) who engage in any kind of activity for their pleasure. A handful may come for birding. Many of the tourists who expressed their willingness for birding (part of ecotourism) were in the age category of 20-30 years. Apart from birding, they expressed their willingness to engage in any kind of activity. Tourists of over 30 years of age in general were interested in mass tourism with all facilities. Their health conditions might be an aspect of this. According to the analysis, more female tourists were willing to engage in bird watching than male. A relatively higher number of tourists were employed, commonly as engineers and teachers, and they expressed their willingness to go birding during leisure time. One reason may be that, being well educated, they possessed a general idea of ecotourism and avitourism. Most of the tourists who were not employed were students of higher educational institutes, both local and foreign. They also had some understanding of avitourism and were willing to engage in bird watching.

Most of the tourists were unaware of the avitourism potential within the Jaffna peninsula. Both study sites had limited potential for avitourism, according to the tourists' point of view. This contrasts with the results of waterbird diversity analyses which show high avitourism potential for all study sites. Yet, with the tourists being largely unaware of this potential, birding grounds would attract only a low number. Infrastructure facilities are the types of facilities that are essential for the development of tourism in a particular area. In the present study, both local and foreign tourists preferred high availability of facilities such as accommodation, transport, communication, tour guides etc. where they visited. Avitourists (and ecotourists) are not inclined towards these types of facilities, although the availability of infrastructure facilities is likely to attract more avitourists to a particular area. For some avitourists, who spend weeks or months at a time searching for specific species of birds, good accommodation facilities at a low cost are necessary. The availability of tour guides,

skilled guides and tourism promotions are also important for the tourists. However, according to their opinion, these facilities are not sufficiently available in the area. It is essential to have good field guides or eco-guidebooks for species identification. While there are no such guides specifically written for the Jaffna area, there are some good field guides available in the market that cover all species in the area, e.g., Harrison (2011) and Warakagoda (2012); though it was found that many of the tourists were unaware of such resources. This unawareness may have caused a decrease in the tourist attraction to the area, especially in the case of avitourists.

There must be a good quality and conveniently accessible transport network for visiting Jaffna from the main airports for foreign tourists, as well as public bus and train services for both foreign and local tourists. In general, Jaffna has adequate accessibility via public transportation. For example, there is a good quality railway station and bus station in Jaffna town. All the present study sites are located some distance away from Jaffna town, though with good road access. Most of the tourists agreed that Jaffna has a medium-to-high quality and easily accessible transport network. Drinking water and sanitary facilities are a necessity for everyone, and visiting ecotourists expect to have access to safe freshwater. Waste management is also important for the attraction of tourists since improper waste disposal can render a place unpleasant and odorous, as well as affect its natural beauty. With regard to waste management, the condition in Jaffna is very poor. Other essential features for developing ecotourism in the area include telecommunication, postal, shopping and restaurant facilities. It was found that communication facilities were relatively well-developed in the area compared to other facilities. Most of the tourists were happy with the shopping facilities available in Jaffna town.

There are several other constraints to develop avitourism in the Jaffna peninsula. Apart from the facts discussed above, some of the climatic and environmental features of the region may not be favorable to a large number of tourists. However, avitourists and ecotourists may not view those obstacles as constraints. Starting from May to mid-October each year, there is a harsh dry season in the peninsula. During this season daytime temperatures may reach very high levels, and many of the water bodies dry out either completely or partly. This may result in a reduction of available

habitats for waterbirds and thus a reduction in their diversity and density.

The present study areas are especially rich in waterbird diversity and are easily accessible from Jaffna town. For the promotion of avitourism in this area, it is essential to popularize these birding areas among the tourists through the Internet, leaflets, social media, etc. Government interventions would further support these promotional activities. It is important to increase awareness about avitourism and of the avitourism potential of the area among tourists (both local and foreign). The University of Jaffna may be able to arrange birding events to promote avitourism, thus educating the tourists, since many tourists come to Jaffna during the migratory season.

The presence and high abundance of waterbirds have the potential to increase both economic and ecological value of this area. December - April can be recommended as the most suitable period for waterbird viewing in Jaffna. Initiating avitourism programs while incorporating sustainable tourism policies and practices would help to reap the economic benefits while safeguarding the bird communities of the area. It will ensure the integrity and health of lagoon ecosystems which will sustain both local livelihoods as well as natural biodiversity. Therefore, conservation measures focused on waterbirds can indirectly help achieving broader ecosystem level positive outcomes.

4 CONCLUSIONS

According to the findings of the present study, there is a high abundance and diversity of waterbird species in both study areas (Island Area and Peninsular Area) with a great potential to attract more avitourists to the area. With respect to the availability of infrastructure facilities, it could be said that the Jaffna peninsula holds a high potential for promoting ecotourism, particularly avitourism. Not only bird diversity, but also the unique scenic beauty of the Jaffna peninsula would likely attract large numbers of ecotourists to the area.

ACKNOWLEDGEMENT

The research was funded by a research grant secured by Dr. Chaminda S. Wijesundara (Grant No. URG/2016/57/S, University of Peradeniya). The authors thank Asela Weerawardana, Packiyanathan Rajkumar, Saumya Wanniarachchi, Tharangi Hettiarachchi, Supun Sewwandika and Tharanga Kahatapitiya for their assistance in the field.

REFERENCES

Aloysius, N, Madhushanka, S & Chandrika, C 2023, 'Avifaunal Diversity and Abundance in the Proposed Sarasalai Mangrove Reserve, Jaffna, Sri Lanka', *Birds*, Vol. 4, no. 1, pp.103-116.

Buckland, ST, Anderson, DR, Burnham, KP, Laake, JL, Borchers, DL & Thomas, L 2001, *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*, Oxford University Press, Oxford.

Chatzigeorgiou, C, Simelli, I, & Tsagaris, A 2015, 'Bird watching and ecotourism: An innovative monitoring system to project the species of lesvos island to potential ecotourists', *7th International Conference on Information and Communication Technologies in Agriculture*, Kavala.

Cordell, HK & Herbert, NG 2002, 'The popularity of birding is still growing', *Birding*, vol. 1, pp. 54-61.

Fennell, D 2008, *Ecotourism*, 3rd edition, Routledge Press, London.

Harrison, J 2011, *A field guide to the birds of Sri Lanka*, Oxford University Press, USA.

Hemraj, DA, Hossain, MA, Ye, Q, Qin, JG & Leterme, SC 2017, 'Plankton bioindicators of environmental conditions in coastal lagoons', *Estuarine, Coastal and Shelf Science*, vol. 184, pp. 102-114.

Henry, GM 1971, *A Guide to the Birds of Ceylon*. 2nd edition, Oxford University Press, London.

Henry, GM 1998, *A Guide to the Birds of Sri Lanka*. 3rd edition, K.V.G. de Silva and Sons, Kandy.

Kiper, T 2013, 'Role of Ecotourism in Sustainable Development', *Advances in Landscape Architecture*, vol. 1, pp. 773-802.

Legge, WV 1880, *A History of the Birds of Ceylon*, Published by the Author, London.

MoMD&E, 2019, *Biodiversity Profile - Sri Lanka, Sixth National Report to the Convention on Biological Diversity*, Biodiversity Secretariat, Ministry of Mahaweli Development and Environment, Colombo.

Platteeuw, M & Henkens, RJ 1997, 'Possible impacts of disturbance to waterbirds: individuals, carrying capacity and populations', *Wildfowl*, vol. 48, no.48, pp. 225-236.

Rajkumar, P & Wijesundara, C 2014, 'Preliminary observations on migratory birds on the island of Mandaitivu, Jaffna, Sri Lanka', *International Research Sessions*, University of Peradeniya, Sri Lanka, p. 30.

Rajkumar, P, & Wijesundara, CS 2016, 'Distribution of mangrove species on the islands of Jaffna Peninsula, Sri Lanka', *International Forestry and Environment Symposium 2016*, University of Sri Jayawardenepura, Sri Lanka, Kandalama, Sri Lanka. p. 14.

Rajkumar, P, Wijesunara, CS, & Ranawana, KB 2018, 'Distribution of mangrove species in Anthanathidal and Kapputhu areas in the Jaffna peninsula, Sri Lanka', *International Symposium on Mangrove Ecosystems*, p. 8.

Sekercioğlu, CH 2002, 'Impacts of birdwatching on human and avian communities', *Environ Conservation*, vol. 29, no.3, pp. 282–289.

Steven, R, Morrison, C, Arthur, JM & Castley, JG 2015, 'Avitourism and Australian Important Bird and Biodiversity Areas', *PLoS ONE*, vol. 10, no. 1371, pp. 1-11.

Sutherland, WJ 2006, *Ecological Census Techniques: A Handbook*, 2nd edition, Cambridge University Press, Cambridge.

The National Red List, 2021, *The National Red List 2021: Conservation Status of the Birds of Sri Lanka*. Biodiversity Secretariat, Ministry of Environment, Colombo.

UNESCO, 1994, *Convention on Wetlands of International Importance especially as Waterfowl Habitat*. United Nations Educational, Scientific and Cultural Organization, Paris.

Wait, WE 1925, *Manual of the Birds of Ceylon*, Dulau & Co., Ltd., London.

Warakagoda, D & Sirivardana, U 2006, 'Status of waterfowl in Sri Lanka', In: C. Bambaradeniya, (Ed.). *The Fauna of Sri Lanka*, The World Conservation Union (IUCN), Colombo. PP. 204-215.

Warakagoda, D & Sirivardana, U 2009, 'The avifauna of Sri Lanka: An overview of the current status', *Taprobanica*, vol. 1, pp. 28-35.

Warakagoda, D, Inskipp, C, Inskipp, T, & Grimmett, R 2012, *Birds of Sri Lanka-Helm Field Guide*. Christopher Helm, London.

Weaver, DB 2001, *Ecotourism. Indicators for Sustainable Development for Tourism*

Organizations: *A Guidebook*, World Tourism Organisation, Madrid, Spain.

Weerakoon, D & Dayananda, SK 2021, *Outcome of the Current National Assessment. The National Red List 2021: Conservation Status of the Birds of Sri Lanka*, Biodiversity Secretariat, Ministry of Environment, Colombo.

Wei, DLZ, Bloem, A, Delany, S, Martakis, G & Quintero JO 2009, 'Status of Waterbirds in Asia: Results of the Asian Water Bird Census: 1987-2007', *Wetlands International*, Kuala Lumpur.

Wijesundara, CS, Wanniarachchi, S, Hettiarachchi, T, Galappaththi, S, Weerawardhana, A, & Rajkumar, P 2018, 'Population size and movements of the greater flamingo (*Phoenicopterus roseus*) in the Jaffna peninsula, Sri Lanka: Results from a long-term study', *Ceylon Journal of Science*, vol. 47, pp. 373-378.

Wijesundara, CS, Warakagoda, D, Sirivardana, U, Chathuranga, D, Hettiarachchi, T, Perera, N, Rajkumar, P, Wanniarachchi, S, & Weerakoon, G 2017, 'Diversity and Conservation of Waterbirds in the Northern Avifaunal Region of Sri Lanka', *Ceylon Journal of Science*, vol. 46(Special Issue), pp 143 – 155