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Status Assessment and Population Trends of the Glossy Ibis *Plegadis falcinellus* in Madagascar between 1993 and 2016

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ABSTRACT

The Glossy Ibis *Plegadis falcinellus*, listed as a Least Concern species in the IUCN Red List is a cosmopolitan species present in all continents except Antarctica. The Madagascar population is sedentary and represented by the nominate subspecies *P.f.falcinellus*. Changes in the population of this species were investigated over the last 23 years through literature reviews, field monitoring and surveys undertaken from 1993 to 2016. A total of 232 wetland locations were visited all around Madagascar and Glossy Ibis were recorded in only 58 of the surveyed localities. A higher concentration was recorded in the western parts of the country mostly inside the system of protected areas. In the central and eastern parts of Madagascar, birds were rarely seen or were even absent. We estimate that the current population of the species is between 8,500 to 11,000 birds in Madagascar. Using a loglinear analysis, the overall population trends showed a moderate increase during the study period between 1993 to 2016. The main threats to the Glossy Ibis in Madagascar are habitat destruction and human disturbances at all breeding and foraging habitats. Actions are needed to understand the bioecological needs of the birds to reinforce conservation action at all sites where Glossy Ibis have been recorded.

Introduction

The Glossy Ibis *Plegadis falcinellus* is a cosmopolitan species distributed in Europe, Asia, Oceania, North and South American and Africa where it is found in a variety of wetlands habitats (Hagemeijer and Blair 1997; Young 2003). The species is represented in Madagascar by nominate subspecies *P.f.falcinellus* (Langrand 1990; Delany and Scoot 2002). Glossy Ibis is listed as a Least Concern species in the IUCN Red List according to the global population which is estimated at 230,000-2,220,000 individuals, and it is classified as a migratory species under the Agreement on the Conservation of African-Eurasia Migratory Waterbirds (IUCN 2012; UNEP/CMS 2014). The global population seems to be decreasing but this decline is not believed to be sufficiently rapid enough to approach the thresholds for a Vulnerable classification (IUCN 2012; Birdlife International 2018). In Africa, the population is estimated to be around 40,000 to 75,000 individuals (Wetlands International 2006). In Madagascar, the first record documented was in 19th century by Milne-Edwards and Grandidier between 1879 – 1885, but the species was considered to be common all around the country during the 1930s (Safford and Hawkins 2013). The population remains low, evaluated at less than 5,000

individuals (Delany and Scoot 2002). One of the major threats of the species is the wetlands habitat degradation, mainly destruction of breeding and foraging habitats. This article introduces the current population of the species in Madagascar and its trend during the last 23 years (1993 – 2016).

Study Area

The study area consisted of Madagascar wetlands. We considered and tried to cover all wetlands types such as lakes, marshes, and rivers and especially any location previously known to harbour nesting Glossy Ibis. In addition, transformed wetlands were considered in the study and included rice fields, artificial lakes and ponds, and agricultural channels. All habitat information was recorded on data sheets and included: coordinates, wetland type, vegetation type and cover, wetland use and threats.

Methods

The Glossy Ibis population was evaluated through technical assessments of information from waterbird census data, literature reviews and expert observations collected during field visits. Waterbird censuses have been conducted in Madagascar by non-governmental institutional staff, field managers and volunteers since 1993. During the censuses, all bird species were recorded using International Waterbird Census methods (Perennou 1991) but in the present study, only information related to the Glossy Ibis were used for analysis. Field censuses usually started about sunrise and continued until 10:00 – 11:00 h and as needed from 16:00 h to dusk at roosting sites. All information was entered into a database: site name, georeferenced locality, habitat type, recorded threats, visit date and number of recorded birds. For predicting the population distribution of the Glossy Ibis, the REBIOMA data portal was used based on available habitat types (REBIOMA 2016). This portal predicts the species' distribution based on its presence/absence from all existing data and environmental variables (temperatures, precipitations, etc.) and then, the actual distribution was mapped using ArcGIS. For population trends analysis, the log-linear Poisson regression analysis was used to impute any missing count data from 1993 to 2016 dataset using Trends and Indices for Monitoring data (TRIM) software (Statistic Netherlands version 3.54) (Pannekoek and van Strien 2001). Considering 1993 as the starting year, zero count was considered and sites with less than five data counted were not used for analysis.

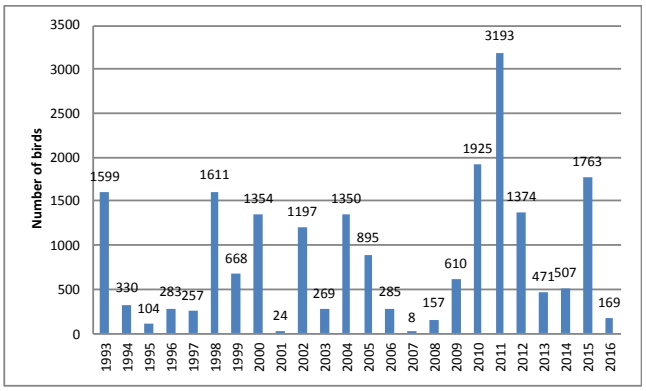
Results

Numbers and distribution of occurrence sites

During the survey from 1993 to 2016, a total of 232 wetlands localities where visited in Madagascar. Only, 58 localities (25% of surveyed area) were recorded with Glossy Ibis. These localities were dispatched inside 19 wetland sites of which nine were protected area sites, nine sites were without legal statute and one Ramsar site. The species occurred throughout the country except the middle east and some parts of the high plateau. Greater numbers were seen in the western and central parts of the island with higher concentrations recorded inside five protected areas including the Mahavavy Kinkony Wetland Complex (with 1,763 individual birds in 2015), the Alaotra Lake (896 birds in 2000), the Ankarafantsika National Park (838 birds in 2011), the Manambolomaty complex (801 birds in 2004) and the Mandrozo Andranovaobe wetlands (504 birds in 2011). Particular attention was given to sites outside of protected areas which host important concentrations of the species such as Bemamba Lake (1,265 birds in 1993) and Loza River (500 birds in 2004), both located along the western part of the country. Except at Alaotra Lake, the biggest lake in Madagascar, few birds were recorded in the high plateau and the eastern part of Madagascar. No birds were seen both at Itasy Lake (S 19° 04' 14'', E 46° 46' 17''), one of the important lakes in the high plateau and Torotorofotsy wetland (S 18° 51' 04", E 48° 21' 30"), the largest marsh area in central eastern part of the country. No ringed birds were seen during the census period. Glossy Ibis were seen in all types of wetland habitats with shallow and fresh water such as lakes, river shores with aquatic vegetation, marshes, floodplains and rice fields. Birds were never seen on saltwater coastal areas such as mangroves and

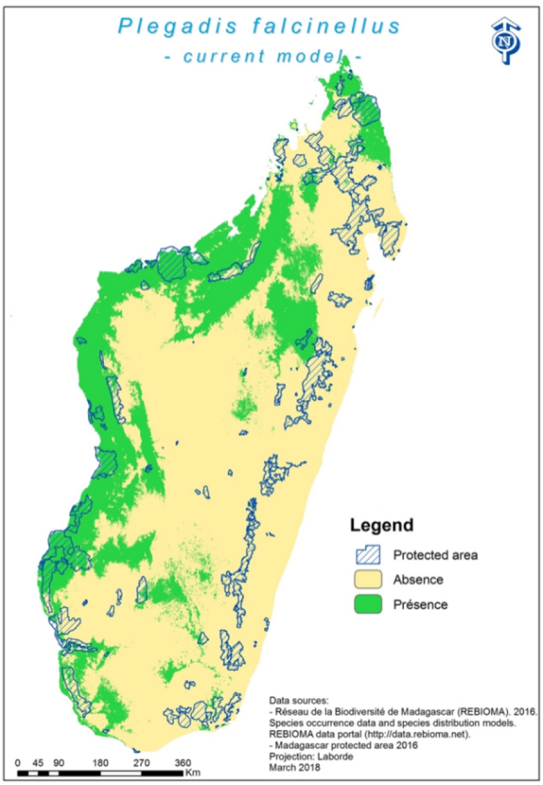
estuaries. The number of birds surveyed in Madagascar from 1993 to 2016 is summarized in Figure 1.

Figure 1. Number of individual Glossy Ibis birds (Y-Axis) surveyed in Madagascar from 1993 to 2016. All sites were not surveyed in all years



Based on this information, most of the current distribution and population of the species, representing about 70% of recorded birds is located in the western part of Madagascar with most of them being included inside the protected area system (Figure 2).

Figure 2. Current distribution of the Glossy Ibis in Madagascar using data from 23 years (1993-2016)



Estimate and trends of populations

In making population estimates and identifying trends, most of the censused population of Glossy Ibis occurred in the Western part of Madagascar. Taking maximum values recorded at each site during the visit period from 1993 to 2016, a total of 8,706 birds were recorded in all of the 19 sites (58 localities). We assumed that 80% of important wetlands were visited and censused (data in appendix 1). Our analysis showed that a maximum estimation of 10,882 birds were probably present in Madagascar. Using TRIM software, a log-linear Poisson regression analysis, our study confirmed that a moderate Glossy Ibis population increase ($p<0.05$) occurred in Madagascar during the last 20 years.

Species threats

The main threats to the Glossy Ibis recorded at the 19 sites are mainly habitat degradation, disturbance of breeding and foraging habitats by human

overexploitation of wetlands due to conversion of marshes and lake shores to agricultural land and infrastructure settlement. The collection of eggs and fledgling birds exists but the impact was not evaluated, in the case of the two known nesting sites at Ravelobe Lake (National Park of Ankarafantsika) and Kinkony Lake (Protected Area of Mahavavy Kinkony Wetland Complex).

Discussion

The actual population of Glossy Ibis is estimated to be between 8,500 to 11,000 birds in Madagascar which is higher than the 5,000 birds previously estimated in 2002 by Delany and Scoot (2002). The species is considered to be a migratory, nomadic bird (del Hoyo and al 1992). However, the absence of banded birds during the census period indicates that no movement occurred from the Africa-Asian population to Madagascar. The Malagasy sub-population referred as *P.f.falcinellus* is probably an isolated sub-population but further investigation is needed to clarify this situation. The bird frequents all types of wetland habitats with shallow and freshwater. They were seen foraging in high numbers (more than 10 birds) in rice fields. The species was not seen in mangroves and estuaries with saltwater. Even if the global population in Africa is decreasing according to Wetlands International (2006), our results spanning 23 years (1993 to 2016) show a moderate increase in the Glossy Ibis population. The reason is probably because a high concentration of birds (> 80%) were recorded inside the protected area system, where wetland habitat use is more regulated than areas without legal statute. All known nesting sites are located inside the protected area. This is important to maintain the population of the species in adequate numbers. However, research action is needed to better identify the bioecological needs of the birds and its movements within the country to understand the unequal population distribution in Madagascar and also to reinforce conservation action.

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