



NATIONAL STRATEGY FOR THE CONSERVATION OF MAGADASCAR POND HERON (*Ardeola idae*) IN MADAGASCAR

2023 – 2032

SEPTEMBER 2022



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Funding

All the elaboration steps (consultation, workshops and validation) of this document was founded by the GEF/UN-Environment, within the framework of the "Conservation of Key Endemic Threatened Species of Economic Value Project (COKETES)".

Recommended Citation

Pruvot, Y.Z.M. & Rabarisoa, R. 2022. National Strategy for the Conservation of Madagascar Pond Heron (*Ardeola idae*) in Madagascar: 2023-2032. COKETES Project, Ministry of Environment and Sustainable Development, Antananarivo, Madagascar.

Cover photo: Adult in breeding plumage of the Madagascar Pond Heron *Ardeola idae* (Photo © Yverlin PRUVOT)

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Acronyms and abbreviations

AEWA	: African-Eurasian migratory Waterbird Agreement
BNGRC	: Bureau National de Gestion des Risques et des Catastrophes
CBD	: Convention on Biological Diversity
CMS	: Convention on Migratory Species
COBA	: Communauté de Base
COKETES	: Conservation of Key, Endemic, Threatened and Economically valuable Species
CTD	: Collectivités Territoriales Décentralisées
DRAE	: Direction Régionale de l'Agriculture et de l'Elevage
DREAH	: Direction Régionale de l'Eau, d'Assainissement et d'Hygiène
DREDD	: Direction/Directeur Régional(e) de l'Environnement et du Développement Durable
DRPEB	: Direction Régionale de la Pêche et de l'Economie Bleue
EN	: Endangered (En Danger)
GEF	: Global Environment Facility
MAE	: Ministère de l'Agriculture et de l'Elevage
MEAH	: Ministère de l'Eau, d'Assainissement et d'Hygiène
MEDD	: Ministère de l'Environnement et du Développement Durable
MOP	: Meeting of the Parties
MP	: Management Plan
MPEB	: Ministère de la Pêche et de l'Economie Bleue
NGO	: Non-Gouvernemental Organisation
NP	: National Park
PA	: Protected Area
PAG	: Plan d'Aménagement et de Gestion
PAIPE	: Plan d'Action International Par Espèce
PBZT	: Parc Botanique et Zoologique de Tsimbazaza
REBIOMA	: Réseau de la Biodiversité de Madagascar
SSAP	: Single Species Action Plan
TPF	: The Peregrine Fund
UN-Environment	: United Nations Environment
IUCN	: International Union for the Conservation of Nature
ZICO	: Zone Importante pour la Conservation des Oiseaux

FOREWORD

It is difficult to talk about Biodiversity without thinking about Madagascar which is among the 10 hotspots of the world's biological diversity. Unfortunately, the country is also classified among those in an emergency situation in terms of the number of endangered species. The Malagasy Government, through the Ministry of Environment and Sustainable Development (MEDD), with the help of various local, national and international technical-financial partners, has deployed colossal efforts in the implementation of environmental programs for the conservation, management and sustainable use of biodiversity and natural resources. The adherence to international conventions, the creation of new protected areas, the attempts to combine conservation and development, are among others the actions undertaken to try to conserve sustainably these natural resources.

In 2007, Madagascar ratified the African-Eurasian Migratory Waterbird Agreement (AEWA), one of the most important Agreements developed under the Bonn Convention or "Convention of Migratory Species" (CMS). Thus, the country is committed to taking coordinated measures to maintain or restore migratory waterbird species to a favorable conservation status, in accordance with Article II of this Agreement. The Madagascar Pond Heron *Ardeola idae* is one of the species covered by AEWA. It is an endemic breeding species of Madagascar and has been listed as Endangered by the IUCN since 2004. Several actions and initiatives have been taken during the last decades in order to save and improve the conservation status of this species, such as its inclusion among the target species of the COKETES Project.

Many positive results related to the conservation of the Madagascar Pond Heron, such as the improvement of scientific knowledge, the discovery of many nesting sites of the species, the strengthening of the management of protected areas, etc., have been achieved thanks to the efforts of all the concerned stakeholders, such as the MEDD, the DREDD, the DRAE, the conservation NGOs and the Local Authority. Nevertheless, there is also much to be done to better ensure the safeguard of this beautiful and remarkable little migratory and nesting heron of the Big Island.

Today, the consortium of institutions for the conservation of the Madagascar Pond Heron is in the process of updating the National Strategy for the species to further improve its conservation status in Madagascar. This strategy is designed as a national framework to govern the conservation of the Madagascar Pond Heron over the next ten years (2023-2032). The existence of such a national framework with the implementation of the resulting projects further revives our hope for a better future for Madagascar's wonderful biodiversity. Thus, the Ministry urges everyone to be aware of this and to act accordingly.

This National Strategy explains, with exemplary clarity and thoroughness, how to do this; all those associated with this publication deserve our thanks and recognition. However, the challenge is immense. In some ways, it will also require a strong political will and a well-considered and concerted decision about what to do in the event of sectoral disputes. Indeed, the continuing competition between biodiversity conservation and economic and non-rational development contexts calls for policy decisions that respect the principles of sustainable development in order to address persistent poverty.

We hope that the reality presented in this document will incite all the interested parties to seek together to reduce the various constraints and pressures affecting the Madagascar Pond

Heron and Biodiversity in general, and to open new horizons in order to promote even more the conservation and the sustainable use of this Biodiversity. It is a question of combining biodiversity conservation and sustainable economic development and thus improving the quality of life of the Malagasy population and the future of the next generation.



EXECUTIVE SUMMARY

The Madagascar Pond Heron *Ardeola idae* is a migratory waterbird species which mainly breeds in Madagascar. It is classified as "Endangered" on the IUCN Red List, as its global population is estimated and analyzed to be declining and facing several types of threats. Conservation efforts have already been undertaken to reverse this decline and positive results have been achieved, especially during the implementation period of the COKETES Project between 2017 and 2022. Despite these efforts, the species is still exposed to a number of threats, the main ones being habitat loss due to conversion of wetlands to human habitation and cultivation, collection of eggs and chicks from breeding colonies, and disturbance at nesting sites. There are also a number of constraints that make the conservation of the Madagascar Pond Heron difficult, such as the lack of human resources available for the conservation of the species and the non-existence of conservation plans in the occurrence sites outside of protected areas. In order to continue, perpetuate and strengthen the efforts already undertaken, it is important to elaborate a national strategy in order to further improve the conservation status of this species in Madagascar, and even its overall conservation status.

The purpose of this strategy is to provide a national framework governing the conservation of the Madagascar Pond Heron and its habitats throughout its Madagascar's range over the next ten years (2023-2032). It is developed from a global vision of returning the population of this species to a favorable and viable state by 2032, thriving in healthy and well-managed ecosystems. This will be done in harmony with the local socio-economic context and with respect for sustainable development. The strategic goal is to increase the population level of the Madagascar Pond Heron and maintain and/or expand its range in Madagascar, ensuring that the species is promoted to a promising conservation status. To achieve this vision and goal, seven strategic objectives, supported by short-, medium-, and long-term actions, have been identified: (1) minimize the direct causes of mortality of the species, (2) maintain and improve the quality of habitats used by the species (breeding, feeding, resting and roosting habitats), (3) increase awareness of the conservation of the Madagascar Pond Heron and wetlands, and promote the valuation of the species, (4) conduct regular and effective monitoring and research activities, (5) design and implement a plan for the protection and sustainable management of the species outside the Protected Areas, (6) maintain and improve collaboration, consultation and coordination of actions between all stakeholders at the national level, and (7) promote and support the coordination of actions and consultation between the different institutions involved in the conservation of the species at the scale of its geographical distribution (at the international level).

The implementation of the strategy's action plan requires the mobilization and participation of all key actors, from all relevant sectors, including the general public. The progress of implementation, continuity and achievement of actions must be evaluated regularly. Obstacles encountered in the implementation of the action plan must be identified and overcome to achieve the objectives.

INTRODUCTION

In Madagascar, migratory waterbirds are an important part of biodiversity and should be conserved for the benefit of present and future generations. This prompted the Malagasy Government to ratify in 2007 the African-Eurasian Migratory Waterbird Agreement (AEWA), an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats in Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago (AEWA, 2008). This agreement covers 256 species, including the Madagascar Pond Heron (UNEP/AEWA Secretariat, 2022).

The Madagascar Pond Heron is an endemic breeder waterbird species of Madagascar and some neighboring islands such as Mayotte, Seychelles and Europa (Benson & Penny, 1971; Betts, 2002; Rocamora, 2008). During the non-breeding season, between May and September, it migrates to eastern and central Africa, with the majority of individuals returning to Madagascar to breed between October and April (Pruvot, 2020; Rabarisoa *et al.*, 2020). A decline in the population of this species has been reported over the last 50 years, particularly in the Central Highlands (Salvan, 1972; Burger & Gochfield, 1990; Morris & Hawkins, 1998) as a result of loss of natural habitat, collection of eggs and chicks, and disturbance of nesting sites (Ndang'ang'a & Sande, 2008). Thus, the species has been classified as Endangered (EN) on the IUCN Red List since 2004 because of its small remaining population, roughly estimated to be between 2,000 and 6,000 individuals in 2000 (Delany & Scott 2002) and between 1,000 and 2,499 mature individuals in 2020 (BirdLife International, 2021; IUCN, 2022).

Faced with this alarming situation, Madagascar developed in 2008 a first national action plan focused mainly on the conservation of the Madagascar Pond Heron and its natural habitat. This initiative is part of the concretization of the State's commitment to international agreements on the conservation of migratory waterbirds. The main objective of this action plan was to improve the conservation status and basic knowledge of this species for a period of ten years (2008 - 2018). The actions of this plan have focused on resolving the problem of confusing the identification and behavior of Madagascar Pond Heron with its neighboring species, the Squacco Heron *Ardeola ralloides*, improving its image with the public and local communities, gathering information at the sites where the species occurs, and setting up a monitoring

In the same vein, another measure has been taken to strengthen the efforts already made. This is the development of the COKETES Project whose objective is to promote the conservation and sustainable use of biodiversity based on the species approach, complementing the ecosystem approach, through the development, implementation and dissemination of participatory local strategies for key endemic, threatened and economically valuable species. The project, which is being implemented in Madagascar from 2017 to 2022, includes the Madagascar Pond Heron among its conservation target species. It involves conservation stakeholders such as protected area (PA) managers, riparian communities and local and regional authorities.

The implementation of the COKETES Project has led to positive results including various important scientific data and information on conservation, among others: (1) the awareness of the local populations living in the project intervening areas, (2) the improvement of the living standards of these populations through the implementation of economic incentive projects, (3)

the discovery of numerous nesting sites of the species almost in all the Regions of Madagascar, the deepening of knowledge on the population, distribution, biology and ecology of the Madagascar Pond Heron, and (4) the popularization of the conservation of the species in the management of Biodiversity at local, national and global levels. In order to sustain the efforts already undertaken and to ensure the long-term preservation of the Madagascar Pond Heron, the development and implementation of a National Strategy for the conservation of the species is of utmost importance.

The development of this strategy is to provide coherent and strategic guidance to all stakeholders concerned with the conservation of the target species in their efforts to act effectively at the national, regional and local levels, while cooperating at the international level at the species' range. The overall objective is to strengthen and structure collective action on monitoring, awareness raising, protection and surveillance, long-term conservation, including ecosystem restoration, and improved knowledge. This strategy is therefore conceived as a national framework to govern the conservation of the Madagascar Pond Heron over the next ten years (2023-2032). Its implementation, comprising seven strategic objectives, should fill, in a progressive and iterative way, the deficit or gaps of the conservation programs already undertaken, and promote a continuous cross-sector synergy favorable to the realization of the actions included in the action plan.

This document is structured in two main chapters. The first chapter is devoted to the state of knowledge on the target species. The second chapter deals with the conservation strategy itself with its implementation action plan.

CHAPTER I: STATE OF KNOWLEDGE

I.1. GENERAL INFORMATION ON MADAGASCAR POND HERON

I.1.1. Taxonomy

The Madagascar Pond Heron is a wading bird belonging to the family Ardeidae. It was discovered in 1860 by Gustav Hartlaub, a German doctor and ornithologist, on the east coast of Madagascar (Newton, 1877). Since then, this species is known under the scientific name of *Ardeola idae*.

The taxonomic position of the Madagascar Pond Heron has changed over time. For the purposes of this document, the following classification has been adopted

Kingdom	: Animalia
Phylum	: Chordata
Class	: Aves
Order	: Pelecaniformes
Family	: Ardeidae
Genus	: <i>Ardeola</i>
Species	: <i>Ardeola idae</i> (Hartlaub, 1860)

Taxonomic Source : del Hoyo, J., Collar, N. J., Christie, D. A., Elliott, A. & Fishpool, L. D. C. 2014. HBW and BirdLife International illustrated checklist of the birds of the world. Volume 1. Non-passerines. Lynx Edicions BirdLife International, Cambridge, UK.

Madagascar Pond Heron is also known by the following vernacular names:

- in malagasy: its name varies from one region to another: "Mpiandrivotatra" in the Central Highlands, "Kilandinkôva" in the Sofia Region, "Tomaimavo" in the Boeny Region, and "Sikotripotaka" in the Melaky and Menabe Regions
- in french : *Héron Crabier blanc*.

I.1.2. Morphological Description

The Madagascar Pond Heron is a small heron with an adult length of 45-48 cm and a weight of about 350 g (Morris and Hawkins, 1998). It does not exhibit sexual dimorphism, i.e., the male and female are morphologically similar, but their behavior allows them to be differentiated at their nesting site. The adult presents a variation of plumage according to the seasons in relation to its biological cycle.

➤ **Breeding Plumage**

During the breeding season, the Madagascar Pond Heron adult is entirely snow white. The crown has a dense crest. Dense plumes also occur on the back of the neck, back, fore neck and breast. These give the bird a characteristic fluffy appearance. The bill is a deep azure blue with a black tip. The irises are yellow and the lores are green with some red on the orbital skin. The legs are rose pink (**Figure 1A**).

➤ **Non-breeding Plumage**

In non-breeding plumage, the crown and back of head of adults are buff, broadly streaked brown. The sides of the head and throat are yellow buff streaked narrowly with blackish-brown. The upper and lower back is brown with white or buff streaks. The rump and tail are white. Upper wings are brown with white or buff streaks. The flight feathers, in contrast, are white and are conspicuous in flight. Underparts are heavily streaked black and buff brown, contrasting with the lower belly and under tail coverts. The bill is green gray with black tip. The lores and irises are yellow are green. The legs are green yellow (**Figure 1B**).

Intermediate plumages between breeding and non-breeding plumages can be observed before and after the breeding season. The intermediate plumage is a mixture of new brown feathers, starting on the back. (**Figure 1C**).

➤ **Juvenile Plumage**

Juveniles are similar to non-breeding adults, but have sooty brown on the outer flight feathers and tail. The iris is pale green. The bill is dull orange, with a dark tip and culmen (**Figure 1D**).

➤ **Identification in relation to other herons**

In breeding plumage, the Madagascar Pond Heron is easily distinguished from other white herons by its short pinkish legs and bright blue bill with black tip. However, it is morphologically quite similar to the Squacco Heron which has also a blue bill with black tip during the breeding season. However, unlike the Madagascar Pond Heron, the Squacco Heron is not totally white; its back, neck and sides of its breast are cinnamon to yellowish. Non breeding and juvenile birds of the Madagascar Pond Heron and Squacco Heron are difficult to separate in the field. The Squacco Heron is however characterized by a general buff or light brown color. It is thinner, with a smaller bill. The brown streaks on the neck are less pronounced and the back is less dark (**Appendix 1**).

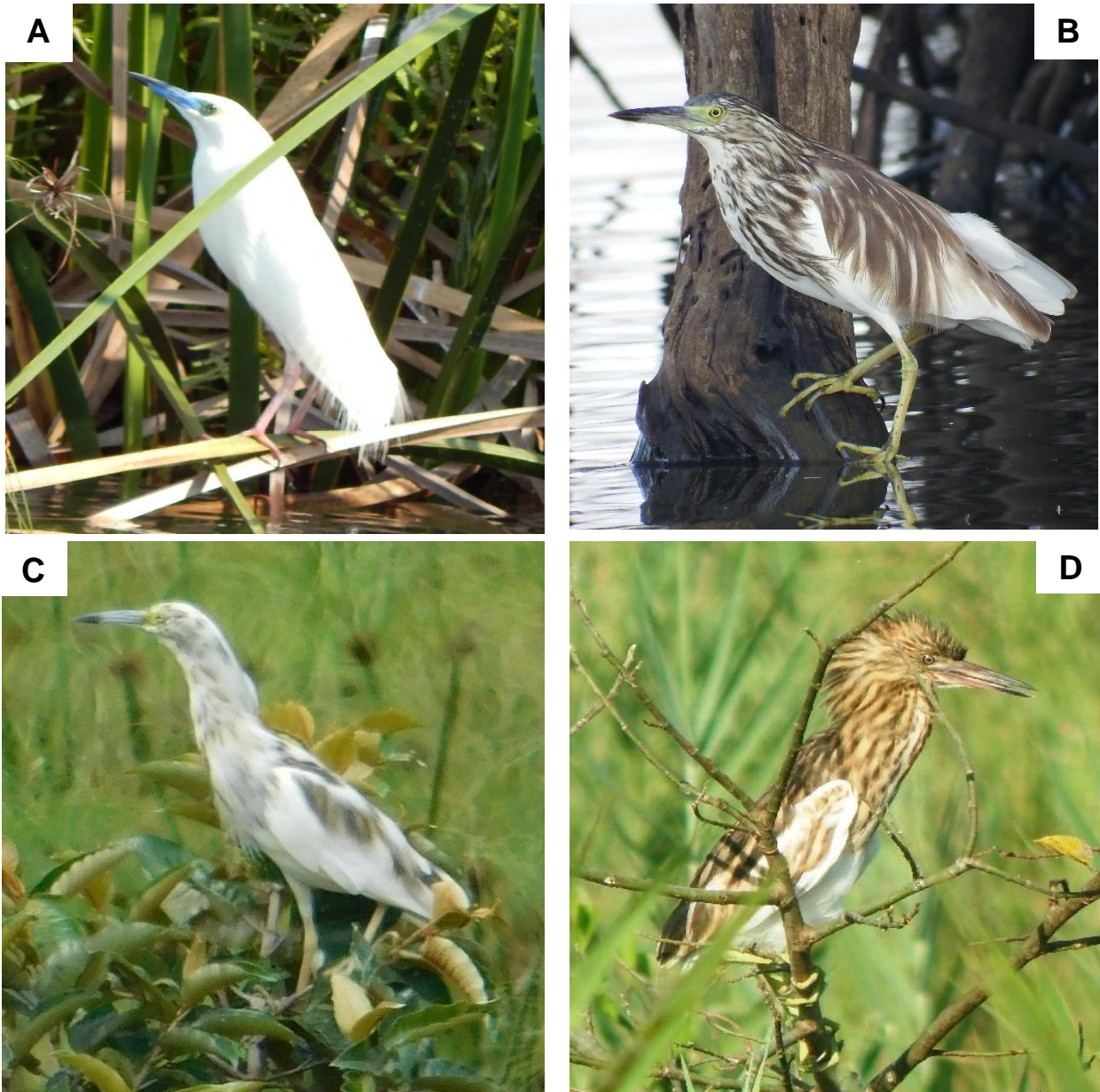


Figure 1. Madagascar Pond Heron : (A) adult in breeding plumage, (B) adult in interbreeding plumage, (C) adult in intermediate feathering, (D) juvenile. (Photos © Yverlin PRUVOT)

I.1.3. Geographic Distribution

The Madagascar Pond Heron is a migratory species that nests mainly in Madagascar. However, five other breeding areas of the species have been identified to date: Aldabra in the Seychelles (Betts, 2002), Mayotte (Rocamora, 2004; 2008), Europa, Comoros Archipelago and Reunion Island (Sartain & Hawkins, 2013). This species has a wide non-breeding range, as individuals migrate to eastern and central Africa to spend the southern winter; the main range includes Kenya, Tanzania, Uganda, Burundi, Rwanda, Zambia, Malawi, Mali, Mozambique, Zimbabwe and the Democratic Republic of Congo (Kushlan & Hancock, 2005; Ndang'ang'a & Sande, 2008; Wetlands International, 2012; UNEP-AEWA, 2012). Additionally, some erratic populations have been observed in Angola, Somalia, South Africa and Yemen

(Dean, 2000). Some individuals may remain at the breeding grounds, notably in Madagascar and Mayotte during the winter (Ndang'ang'a & Sande, 2008; IUCN-SSC, 2012; Pruvot *et al.*, 2022; Rabarisoa *et al.*, 2020).

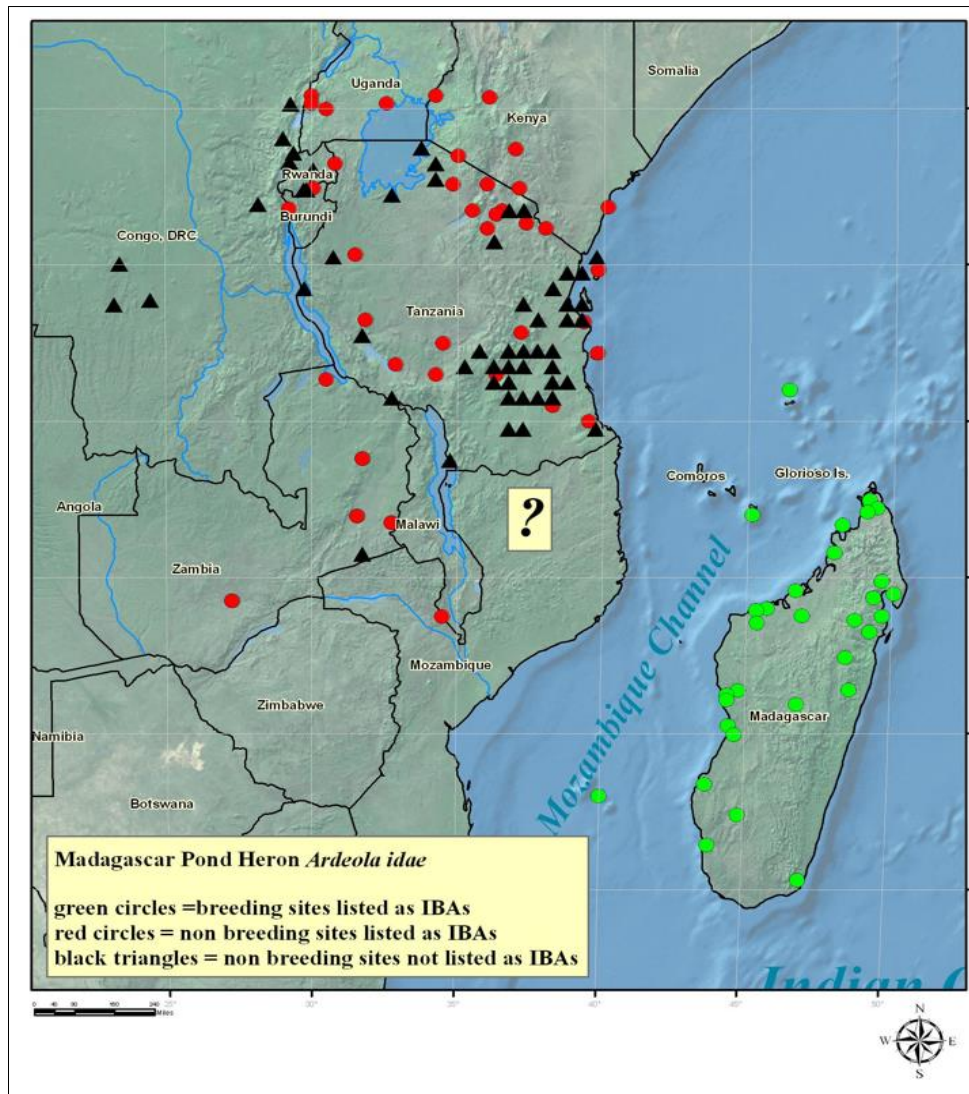


Figure 2. Global distribution map of the Madagascar Pond Heron through its annual cycle (source: Neil & Elizabeth Baker, 2021)

I.1.4. Overall Population

The first assessment of the Madagascar Pond Heron reported a total population decline of between 2,000 and 6,000 individuals (Delany & Scott, 2002; Ndang'ang'a & Sande, 2008), or approximately 1,300-4,000 mature individuals in 2000 (Dodman, in litt). In 2007, the overall population of this species is estimated at 250-1000 mature individuals (Kushlan, 2007). These estimates were only resulted from few observations without a well-defined basis for calculation. An assessment from monitoring data between 2012 and 2016 gave an estimate of 1100 mature individuals, in the breeding grounds, equivalent to 550 pairs in Madagascar and neighboring islands, Mayotte and Europa (Rabarisoa *et al.*, 2020). In 2020, the overall population was estimated to be between 1000 and 2499 mature individuals (BirdLife International, 2021). In 2022, the population size of the species is estimated to be between 1900 and 2600 mature

individuals in its breeding range in Madagascar and neighboring islands (Rabarisoa *et al.* in prep).

The overall population trend for the Madagascar Pond Heron between 1992 and 2022 is significantly decreasing with a moderate decline ($p < 0.01$). Yet, the decline does not exceed 5% per year. A slight population increase ($p < 0.05$) was found between 2018 and 2022 (**Figure 3**).

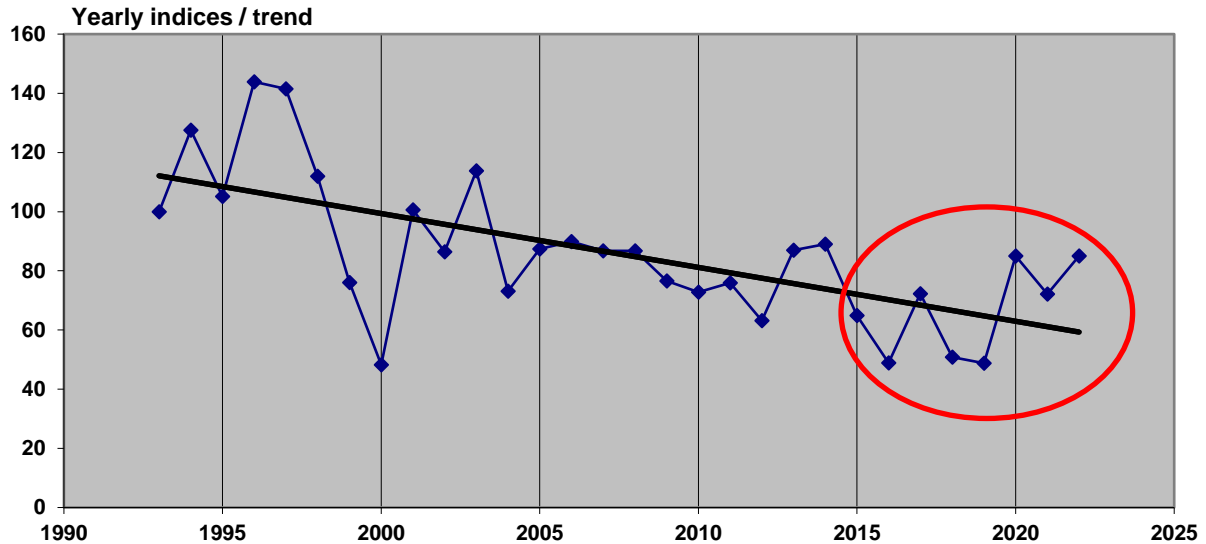


Figure 3. 30-year population trend of the Madagascar Pond Heron (1992-2022)

I.1.5. Biology and Ecology

➤ Behavior

The Madagascar Pond Heron is a discreet and shy species, most often observed in solitary stalks, more rarely in small groups of three to six individuals. Its activity is mainly diurnal and more particularly centered on the morning and twilight hours. It is most often stationary or moves slowly along the shores of lakes, ponds, swamps, rivers, on the edge of aquatic vegetation, on floating vegetation or in shallow water. It is gregarious on resting and dormitory sites, and often associated with other species of Ardeidae (Langrand, 1995). Breeding is colonial; the species usually nests in mixed colonies with other herons (del Hoyo *et al.*, 1992; Kushlan & Hancock, 2005; Pruvot *et al.*, 2020), but monospecific colonies have been observed in the wetlands of the northwestern region of Madagascar (Pruvot *et al.*, 2020).

➤ Habitat

The Madagascar Pond Heron inhabits principally wetland habitats particularly freshwater and brackish lakes, marshes, swamps, rice fields, rivers, streams, ponds, mangroves and coastal beaches (Kushlan & Hancock, 2005; Ndang'ang'a & Sande, 2008; Pruvot *et al.*, 2022; Rabarisoa & Rakotomanana in press). These habitats are usually fringed to trees and bushes. The species has no preference for certain marine and coastal wetlands such as coral reefs, rocky shores, intertidal wetlands and estuaries adjacent to the sea (del Hoyo *et al.*, 1992; Rabarisoa & Rakotomanana in press).

➤ **Reproduction**

The breeding season for the Madagascar Pond Heron is between October and April, with a peak in November and January (Ndang'ang'a and Sande 2008; Pruvot *et al.* 2020). The nest is a bulky, more or less rounded platform constructed of twigs, branches and small, tightly intertwined sticks (Kushlan & Hancock 2005; Pruvot *et al.* 2020). It is usually placed at a low height (between 0.5 and 2.4 m) on a shrub or in a bush located near water (Langrand 1995; Pruvot *et al.* 2020). Nest dimensions are 24 to 32.7 cm long, 9.3 to 18.5 cm wide, and 12.5 to 32.8 cm deep internally (Pruvot *et al.*, 2020).

Clutch size varies from 2 to 4 eggs with a greenish-blue color. The mean size of eggs is 39.18 mm x 28.83 mm with an average weight of 21.4 g (Pruvot *et al.*, 2020). Incubation time is 20-22 days, and chicks can feed on their own at less than four weeks (Kushlan and Hancock, 2005; Pruvot *et al.*, 2020). The young grow rapidly with an average daily growth of 9.02 g for weight, 9.64 mm for body length, 10.66 mm for wing length, and 2.35 mm for tarsal length. They are able to fly from the age of 35 to 38 days (Pruvot *et al.*, 2020). Breeding success is generally 2.06 ± 0.90 young per nest ($n = 158$ nests) (Pruvot *et al.*, 2020).

➤ **Diet**

The Madagascar Pond Heron feeds on fish, insects and small invertebrates as well as frogs and small reptiles including skinks (Scincidae) and geckos (Gekkonidae) (Morris & Hawkins, 1998; Kushlan & Hancock 2005; Pruvot & Rene De Roland, 2021). Analysis of 193 regurgitation pellets collected from the Lake Sofia colony showed that the species consumes a wide variety of prey consisting of, in order of importance, insects (81, 3%), fish (5.6%), spiders (4.7%), frogs (3.4%), small reptiles (2.2%), crustaceans (1.9%) and gastropods (0.9%) (Pruvot & Rene De Roland, 2021). The species also showed remarkable adaptation to prey variation throughout the breeding season (Pruvot & Rene De Roland, 2021).

1.1.6. Conservation status of the species

➤ **International Union for Conservation of Nature (IUCN)**

Around 1900, the Madagascar Pond Heron was considered a common species as it was observed in almost all wetland habitat types in Madagascar (Langrand, 1995; Kushlan, 2007; Sartain & Hawkins, 2013). In 1990, Burger and Gochfield (1990) estimated a drastic decline due to accelerated wetland exploitation; the status of the species changed from Near Threatened (NT) to Vulnerable (VU) between 1986 and 2000. Although the species remains fairly widespread, it has been classified as Endangered (EN) on the IUCN Red List since 2004 (IUCN, 2022) due to its small population size. It is further threatened by: (1) habitat loss due to large-scale conversion of wetlands to agricultural or residential use, (2) collection of eggs and young from breeding colonies, (3) increased competition with other herons, particularly the Squacco Heron (a more common species in Madagascar), and (4) disturbance at breeding sites (Ndang'ang'a & Sande, 2008; IUCN, 2022).

➤ **Agreement on the Conservation of African-Eurasian Waterbirds (AEWA) and Convention on Migratory Species (CMS)**

AEWA is an intergovernmental treaty for the conservation of migratory waterbirds and their habitats in Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. It was developed under CMS with the objective of creating a legal basis for concerted conservation and management policy for migratory waterbird species. AEWA provides for coordinated actions by member countries to maintain or restore migratory waterbird species to a favorable conservation status, with a particular focus on endangered species through the development of an International Single Species Action Plan (ISSAP). The Madagascar Pond Heron is one of the 256 species covered by the agreement (AEWA, 2008). The species is listed in Column A, categories 1b (highly threatened populations) and 1c (populations less than 10,000 individuals) of AEWA Table 1 (UNEP/AEWA Secretariat, 2015) and an ISSAP has been developed for it (Ndang'ang'a & Sande, 2008). It is also listed in Appendix I (migratory species in danger) and Appendix II (migratory species with unfavorable conservation status) of the CMS (CMS, 2018).

I.2. STATE OF KNOWLEDGE IN MADAGASCAR

I.2.1. Distribution in Madagascar

The Madagascar Pond Heron is present in almost throughout Madagascar during the breeding season and frequents almost all types of wetlands (**Figure 4**). It is particularly found in the north, west and central highlands of the Island. The species is rare in the northeast, east, south and southeast. Analysis has shown that about 60% of individuals recorded are found at sites located in the western part of Madagascar and most of the observations are made in protected area systems (Morris & Hawkins, 1998; Rabarisoa *et al.*, 2020).

Ad hoc data confirm the presence of Madagascar Pond Herons in Madagascar during the non-breeding season (between May and September) and they are found solitary, usually foraging in some wetlands in the west of the country (Rabarisoa *et al.*, 2020; Pruvot, 2020; Pruvot *et al.*, 2022).

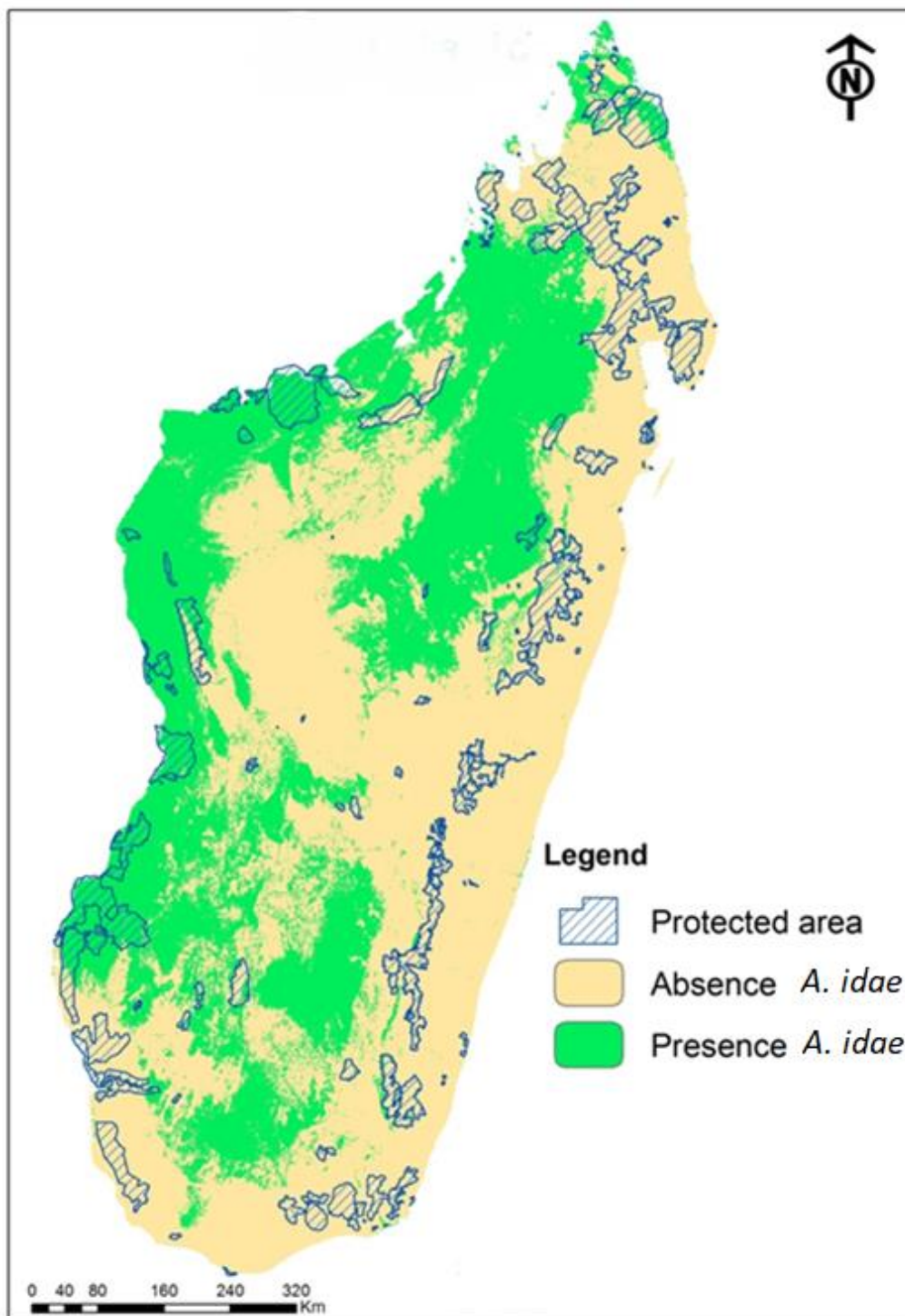


Figure 4. Distribution map of the Madagascar Pond Heron (sources: REBIOMA 2016 ; Rabarisoa *et al.*, 2020)

➤ Number of observation locations

The Madagascar Pond Heron has been observed in 500 localities in Madagascar. The estimations of the Area of Occupancy (AOO) and Extent of Occurrence (EOO) from observation information are respectively 1928 km² and 571,003, 879 km² (**Figure 5**).

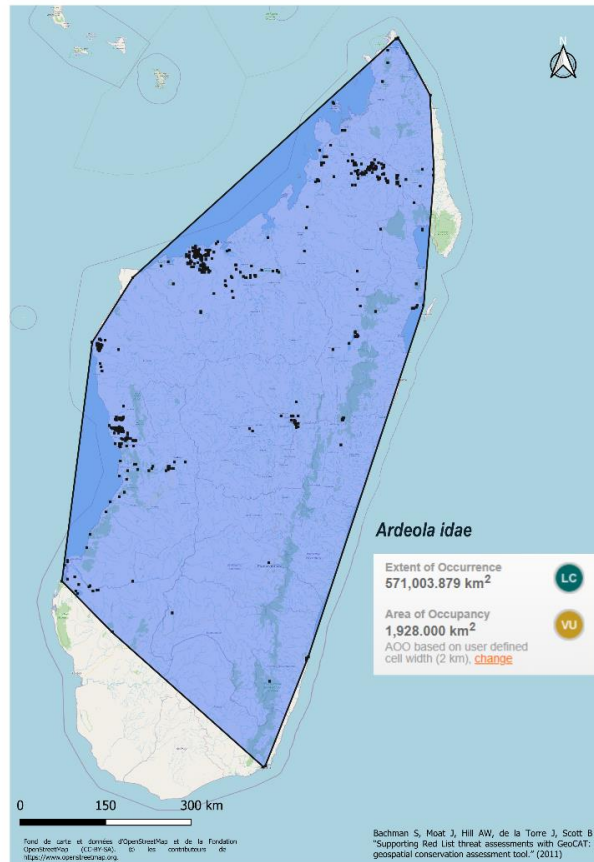


Figure 5. Map of the occurrence area of the Madagascar Pond Heron (source: COKETES, 2022)

I.2.2. Estimation of the breeding population in Madagascar

➤ Data prior to 2017

Observations of the Madagascar Pond Heron between 1993 and 2016 recorded 548 individuals giving a total of 254 breeding pairs at 106 localities (Rabarisoa, 2021). These observations were recorded in six nesting sites namely, PBZT, Tsarasaotra Park, Lake Matsaborimena (PA Bemanevika), Lake Sofia, Lake Ravelobe (Ankarafantsika NP) and Lake Ambondrobe (Rabarisoa *et al.*, 2020).

➤ Recent data from 2017 to 2022

A reassessment of the population size based on data collected between 2017 and 2022 resulted in a population size of 1990 mature individuals or 995 breeding pairs in Madagascar. This assessment focuses on the maximum number of individuals recorded at 20 nesting sites during the breeding season. A slight increase in the population of Madagascar Pond Heron

was noted between 2018 and 2022. This increase is probably related to research efforts and conservation actions carried out in the main nesting sites of the species in Madagascar (PBZT, Lake Sofia, Ankarafantsika NP, PA Mahavavy Kinkony Complex, PA Ambondrobe, PA Bemanavika and PA Tsimembo Manambolomaty Complex).

I.2.3. Wintering population in Madagascar

Investigations carried out in the wetlands of Madagascar between 2008 and 2022 showed that individuals wintered in the western and northern massifs. The number of individual observed in both zones were respectively 15 in the mangrove area of the Mahavavy Kinkony Complex PA, 57 in the Mangoky Ihotry Complex, 15 in the Loza River, 09 in Baie de Baly (Rabarisoa *et al*, 2020), 17 in the Tsimembo Manambolomaty Complex PA, 13 in the Ambondrobe PA, 08 in the Mandrozo PA (Pruvot *et al.*, 2022) and 61 the Marotolana wetlands, 13 in the Bemanavika PA (COKETES Unpublished data). During this period, individuals were mainly observed alone in resting and feeding areas. They were recorded in different types of wetlands throughout the country: streams, rivers, lakes, marshes, mangroves, wet grasslands and especially rice fields (Pruvot *et al.*, 2022; Rabarisoa & Rakotomanana in press).

I.2.4. Search effort for nesting sites

Since 2008, the year of the integration of Madagascar into AEWA and validation of the International Action Plan for the Madagascar Pond Heron, efforts have been made to locate new nesting sites. These efforts have been strengthened during the implementation of the COKETES Project. While only three nesting sites were known before 2008 (PBZT, Tsarasaotra Park, Lake Ravelobe), about 20 new have been located up to 2022 (**Figure 6**). These new known sites include Andohan'ny Menatsimba in the Manombo Special Reserve and Green Park in Manovoriaka (Fianarantsoa) respectively located in the southeastern and southern highlands of Madagascar respectively. These zones were considered for a long time as not favorable to the nesting of the species.

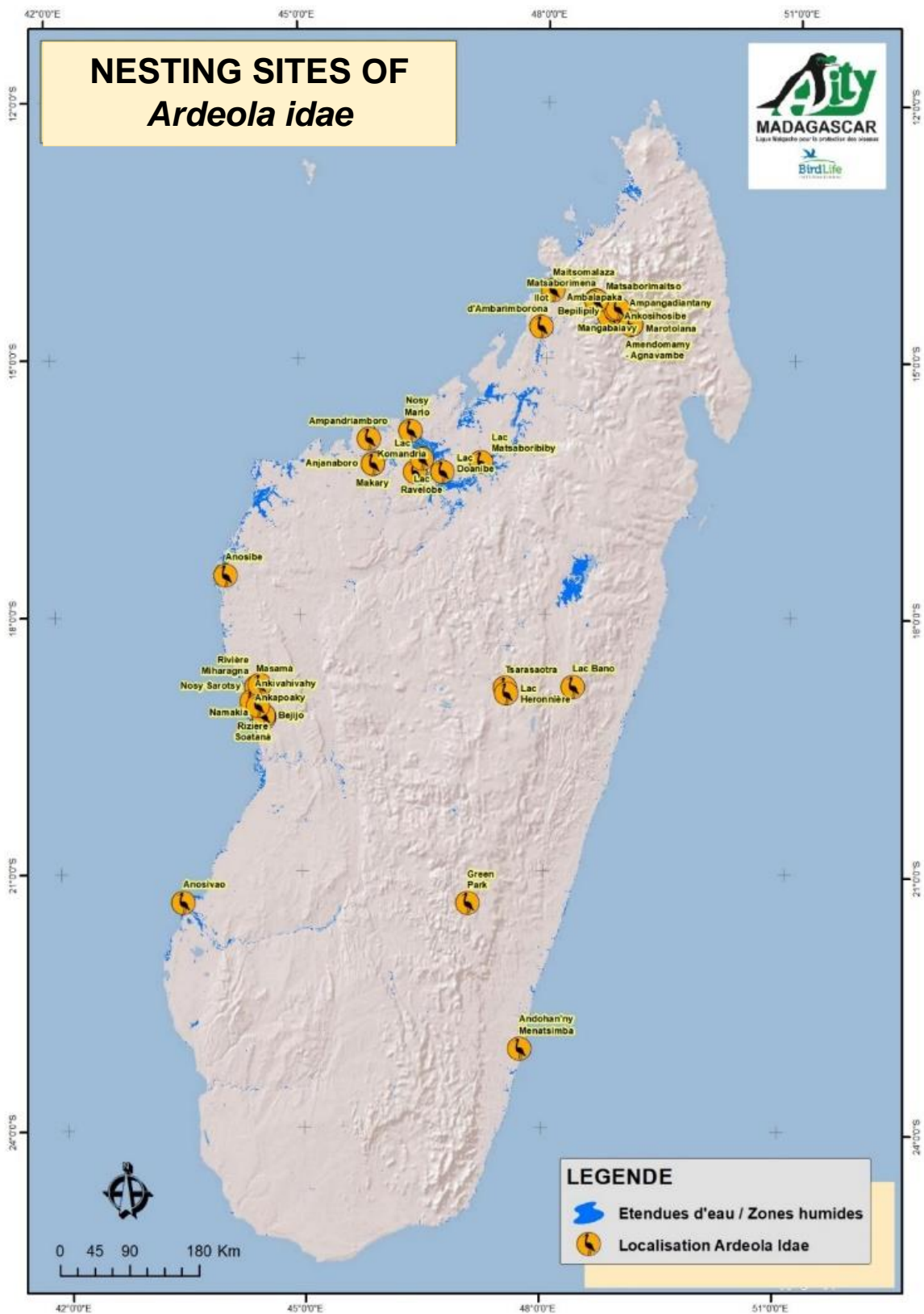


Figure 6. Map of the nesting sites of the Madagascar Pond Heron (March 2022).

I.2.5. Habitat Preference of the Madagascar Pond Heron

The Madagascar Pond Heron frequents all types of wetland habitats in Madagascar, including lakes, marshes, swamps, rice fields, rivers, temporary pools, gallery forests, mangroves, tans and coastal beaches (Kushlan & Hancock, 2005; Pruvot *et al.*, 2022; Rabarisoa & Rakotomanana in press). An evaluation of the sites where the species is found showed that it prefers habitats with a vegetation cover ranging from 25 to 75% of the total area of the site with a vegetation height varying between 2.5 and 22 m depending on the type of vegetation.

Three main factors determine the species' choice of nesting sites: (1) the presence of islands formed either by a cluster of aquatic vegetation erected in the middle of a wetland (case of the colonies of Lake Ravelobe, Lake Kinkony, and Lake Sofia), or by real islands with trees and/or shrubs (case of the estuaries of the Loza and Betsiboka rivers), (2) the remoteness of human presence as reflected in the infrastructure and passage areas (pathway, shipping lane, etc.), and (3) the heterogeneity of habitats, i.e., the presence of several types of sub-habitats, including marshes composed of emergent aquatic flora such as *Cyperus madagascariensis*, *Phragmites mauritianus* and *Typha angustifolia* (del Hoyo *et al.*, 1992; Kushlan & Hancock, 2005; Rabarisoa & Rakotomanana in press). Analysis of nesting habitat selection conducted on 16 colonies in Madagascar showed that the species nests preferentially on papyrus and reed vegetation, with an average cover of 82.5% and average heights of 2.7-4.9 m, being always waterlogged and found close to permanent water bodies and away from human disturbance (Pruvot *et al.*, 2022).

I.2.6. Conservation and management of the species in Madagascar

➤ Policies and legislation relevant to conservation

The Madagascar Pond Heron is protected by international Conventions and Agreements to which Madagascar has adhered, such as CBD, CMS, AEWA and the Ramsar Convention.

Efforts have been made by the Malagasy Government in the conservation of wetlands with the registration of 21 Ramsar sites, as well as the orientation taken in 2008, through the Durban vision, to triple the surface of protected areas. Also, the majority of the main wetlands are included in the protected area system in Madagascar. Among them, we note the sites of frequentation and nesting of the Madagascar Pond Heron such as the PAs Ambondrobe, Bay of Bombetoka, Bemanevika, Mahavavy Kinkony Complex, Mangoky Ihotry Complex, Tsimembo Manambolomaty Complex, Mandrozo and Special Reserve of Manombo

More than 50% of the nesting sites of the Madagascar Pond Heron have a conservation status in protected areas, community management sites (Management Transfer) and Ramsar sites, or a combination of these different statuses (**Table 1**).

Table 1: Conservation status of the nesting sites of the Madagascar Pond Heron (PA: Protected Area, PAG: Development and Management Plan, PG: Management Plan)

Nesting sites	Site status	Management document
Lac Bano	Private Site	-
Ambondrobe	PA & Ramsar site	PAG
Ankapoaky		
Bejjo		
Namakia		
Seranan'i Boatoba		
Amboanara Mainty		
Betongo		
Lac Sofia	Ramsar Site	MP
Amendomamy - Agnavambe	Private Site	-
Ankarafantsika	PA & Ramsar Site(Lac Ravelobe)	PAG
Lac Doanibe		
Lac Komandria		
Lac Matsaboribiby		
Lac Ravelobe		
Bemanevika	PA	PAG
Bombetoka	PA	PAG
Matsaborimena		
Matsaborimaitso		
Zones Humides de Bealanana	No protection status	
Ambalapaka		
Bepilipily		
Mangambaiavy		
Lac Kinkony	PA & Site Ramsar	PAG
Anosivao Ambohibe	PA	PAG
Green Park	Private Site	None
Lac Mandrozo	PA & Ramsar Site	PAG
Parc Tsarasaotra Alarobia	Private Site & Ramsar Site	MP
RS Manombo	Special Reserve	PAG
Parc Tsimbazaza	State Park	MP
Lac Masamà	Community-based management	MP
Tsimembo Manambolomaty	PA & Ramsar Site (Ankivahivavy)	PAG
Ankivahivahy		
Nosy Sarotsy		
Rivière Miharagna		
Rivière Loza	No protection status	MP in process

To support the conservation of the Madagascar Pond Heron, the International Single Species Action Plan, adopted in 2008 under AEWA for a 10-year implementation period (2008-2018), has been renewed for the next 10 years (2019-2028) (Resolution 7.5 at MOP 7). This action plan includes nine objectives and 43 actions (Ndang'ang'a & Sande, 2008).

The conservation of the Madagascar Pond Heron is also part of the priority of the Malagasy Government and the financial partners GEF/UN-Environment during the implementation of the COKETES Project between 2017 and 2022. Thus, conservation actions in favor of the species have been strengthened in eight important breeding sites in Madagascar: Ankarafantsika NP, PA Ambondrobe, PA Bemanevika, PA Mahavavy Kinkony Complex, PA Mandrozo, PA Tsimembo Manambolomaty Complex, PBZT and Lake Sofia (COKETES 2019). These sites have received financial support through the COKETES Project for the implementation of conservation activities focused particularly on the Madagascar Pond Heron and activities to strengthen the management and preservation of biodiversity and natural resources. Among the activities carried out were:

- patrols and controls, to ensure the surveillance and perpetuation of the areas in order to maintain the biodiversity (including Madagascar Pond Heron) and the habitats found there;
- scientific and community-based ecological monitoring of the Madagascar Pond Heron and its habitats;
- Reforestation and habitat restoration, in order to maintain the integrity, viability and originality of ecosystems and to increase the surface area of available and usable habitats for the species;
- the establishment of conservation infrastructure and zoning, in order to strengthen the protection of areas;
- the implementation of awareness, information, communication and environmental education programs to raise awareness and encourage all stakeholders (local communities, key actors) to conserve the species *Ardeola idae*, natural resources and biodiversity;
- Support for local community development, which aims to improve the living conditions of local populations and promote alternative activities to pressure, in order to reduce their negative impacts;
- Research being mainly carried out in protected areas to provide information necessary for their management and the conservation of the target species.

I.2.7. Threat analysis

Despite the conservation measures and deployed efforts, the Madagascar Pond Heron is still exposed to a number of threats, among which the direct threats affecting the mortality of young and the loss of habitat are the most serious. These threats are mainly of anthropogenic origin, although some are natural. The threats have been described in detail in Pruvot (2020), Rabarisoa *et al.* (2020) and Rabarisoa (2021). They were also listed and ranked by participants at the stakeholder workshop in August 2022. Thus, the following paragraphs do not detail these threats in depth but provide an overview to guide the development of the action plan for the implementation of this conservation strategy. The descriptions below are based on all of these sources and on information gathered during the mission to develop this national strategy, as well as on the results of investigations and ecological monitoring during the implementation of the COKETES Project (2017-2022).

➤ Threats directly affecting the species

• Poaching Collection of eggs and chicks by humans

Poaching is a serious threat to the Madagascar Pond Heron; eggs and chicks are harvested in most of the breeding sites, even within protected areas, despite the prohibition and monitoring of the sites. For example, women and children were mainly involved in harvesting eggs and chicks by plundering the nests along the edge of the heronry of Lake Ravelobe and directly from the nests at Lake Sofia. In the case of the Loza River, poaching of nests is done by fishermen in the area. The chicks are used as bait for crab fishing. Eggs and chicks harvesting is not selective, i.e., it does not concern only the Madagascar Pond heron but all species nesting in the same heronry. The nesting colonies in unprotected areas such as Ambalapaka and Bepilipily (Bealanana wetlands) are the most frequently affected.

• Predation of eggs and chicks

Natural predation of eggs and chicks by raptors and rats is one of the main threats affecting directly the survival of the Madagascar Pond Heron. Indeed, it leads to the failure of reproduction and thus contributes to the decrease of the annual productivity of the species. Almost the colonies in all the nesting sites suffer from this natural pressure, but the predators can vary from one site to another. For example, significant numbers of Madagascar Pond Heron chicks were predated by raptors, including Madagascar harrier-hawk (*Polyboroides radiatus*) and Yellow-billed kite (*Milvus aegyptus*) at the Lake Sofia and Lake Ravelobe colonies (Pruvot *et al.*, 2020; Rabarisoa *et al.*, 2020). Predators of eggs observed are Black-crowned Night Heron (*Nycticorax Nycticorax*) and rats (Pruvot, 2020; Pruvot *et al.*, 2020). Madagascar Harrier (*Circus macroscleles*) and Peregrine Falcon (*Falco peregrinus*) attack Madagascar Pond Herons juvenile at Lake Matsaborimena and Tsarasaotra Park, respectively (Rabarisoa *et al.*, 2020).

Although the pressure is natural, the threat level of predation is generally high (**Table 2**), as it determines the mortality of the species. In addition, it also causes significant secondary damage to nesting colonies. Indeed, the arrival of predators in the colonies causes a general panic of the nesting individuals, which often leads to the fall of eggs and small chicks. No adult predation has been observed and reported to date.

• Natural disasters: cyclones and floods

Even if they are occasional and sporadic events, the level of threat by cyclones and floods is high, as they directly cause a significant loss of nests with their contents (eggs and chicks). In Madagascar, the breeding season coincides with the cyclone season. On the one hand, the cyclone acts directly on the nests in height, resulting in the fall of important numbers of nests and their contents to the ground and/or into the water (case of the nesting sites in Green Park and PBZT). On the other hand, the ensuing flooding destroys nests placed at a low height from the water or at the water's edge among aquatic vegetation (case of Lake Sofia and Lake Ambondrobe).

➤ **Loss and disturbance of the species' habitat**

The habitats of the Madagascar Pond Heron at the various sites surveyed are subject to various human pressures leading to their loss and/or disturbance. The most important of these are summarized below.

• **Conversion of wetlands to human habitation and agricultural areas**

The habitat of the Madagascar Pond Heron shows a large-scale ecological change in favor of human habitation and agriculture. At the level of frequentation sites, urbanization is a proven threat in the case of the Antananarivo Capital. Indeed, vast areas of wetlands, mainly the marshy areas of Dorodosy, Sabotsy Namehana and Ambohimanambola, known as the main sites of frequentation of the species in the 90s, are subject to large-scale filling in favor of infrastructure. The rice fields of Masay Marsh and Ambohitrinimanjaka, used as foraging sites by the species, have also been filled in over the past 20 years (Rabarisoa *et al.*, 2020).

Outside of the Capital, conversion of wetlands to cropland, particularly rice cultivation, is also a threat to the species. This is especially the case for wetlands with no conservation status: the case of the Ambalapaka and Bepilipily marshes (Bealanana District), the Loza River, the Amboromalandy lake and watershed, and Mahajamba Bay.) This conversion consists of draining the water and clearing the aquatic plants of these wetlands for cultivation. This considerably reduces and modifies the natural habitats of the species even if it is admitted that the rice fields constitute temporary feeding habitats of the species.

• **Fires**

Fires are one of the most important anthropogenic pressures on the habitat of the species in all its distribution areas in Madagascar. They are mainly observed in marshes (marsh fire) and reed beds (reed fire) bordering lakes. In general, swamp fires are deliberately set to convert swamps and marshes into rice fields. This practice is most common in unprotected wetlands in Bealanana District (Pruvot, 2020), but a few cases have been observed at Lakes Sofia and Kinkony (Rabarisoa, 2021).

As for reed fires, they are either provoked or produced accidentally. In the first case, fires are used to acquire new land for cultivation (case of Lake Ankilivolo and the Ampialiapotaka marsh in Ambondrobe PA), to convert into a cattle grazing area (case of Lakes Kinkony and Maliolio and the Ambolodia marsh in Mahavavy Kinkony PA), and to have more space for eel fishing (case of Lake Ambondrobe). The second case involves uncontrolled fires by fishermen, especially during their night fishing (case of the lakes in the PAs Tsimembo Manambolomaty and Mandrozo Complex). Whether intentionally or accidentally set, the threat of fires is high, as they can lead to the rapid destruction of habitats (resting places, dormitories, and even nesting sites) by wiping out the vegetation in the affected areas in a few hours.

• **Destructive and irrational exploitation of fishery resources**

Irrational exploitation of fisheries resources through destructive fishing methods is also a threat to the Madagascar Pond Heron. Although it is frequently observed in unprotected wetlands, cases have been noted even within areas with a protected status. The use of beach seine and mosquito nets to catch fish and other fishery resources such as crayfish and shrimp are the

most observed. This practice can lead not only to the depletion of these fishery resources, but also to eutrophication and siltation of wetlands, which translates, to a large extent, into a decrease in the number of birds frequenting these environments. In addition to the use of destructive fishing gear, the practice of catching fish by using traditional poisons also disturbs the feeding of birds and could even lead to their poisoning by consuming the poisoned prey (fish and other fishery resources). In addition, fishermen disturb the birds by setting up their camps along the lakeshore, which is a feeding ground for the species.

• Silting and drying of wetlands

Many of the wetlands (lakes, marshes, swamps) frequented by the Madagascar Pond Heron are currently experiencing silting up and have seen their surface area and depth decrease. This phenomenon is often due to the erosion phenomenon following the deforestation upstream in the watersheds.

Drought due to the effects of climate change (because of insufficient rainfall) is also a current threat to the habitat of the species in Madagascar. Indeed, permanent lakes, especially in the western region of Madagascar are drying up and becoming temporary lakes (case of lakes Antsamaka, Andranolava in the PA Tsimembo Manambolomaty Complex) (Pruvot, 2020). This leads to a loss of habitat during part of the life cycle of the species and directly affects its distribution.

• Water pollution

In addition to the pollution of wetland waters because of their daily uses by riparian populations in rural areas (bathing, doing the dishes, laundry), cases of large-scale pollution have also been observed and seriously threaten some wetlands frequented by the species. Rabarisoa, (2021) reported the contamination of Namakia wetlands and Masay Marshes, Lake Ivato and the rice fields of Laniera respectively by pollutants from sugarcane industries and wastewater.

• Excessive collection of aquatic plants

The collection of emergent aquatic plants from the edges of lakes, marshes and swamps, such as Reeds (*Phragmites mauritianus*), Narrow-leaved cattails (*Typha angustifolia*) and *Cyperus*, has been observed in almost all areas where the species occurs. These plants are mainly used by the riparian populations as raw material by handcrafting basket and mat and for roofing houses. Although the overall threat level from this activity remains moderate (**Table 2**), excessive and uncontrolled collection of aquatic plants could lead to long-term disturbance or even destruction of habitats (resting places, dormitories, and even nesting sites). This threat could have direct or indirect impacts on the distribution of the species that requires a certain proportion of vegetation cover.

• Selective and illegal cutting of trees in forests bordering wetlands

Traces of wood cutting in forests bordering lakes, marshes and swampy areas have been observed in some sites where the species is present (PAs Ambondrobe, Mahavavy Kinkony Complex and Mandrozo). The local populations cut woods for daily needs, such as the construction of houses, dugouts, carts, enclosures, firewood, etc. These practices are often favored by the installation of fishermen and farmers camps (temporary or permanent) on the

edges of lakes and marshes. Thus, they lead to the disturbance and destruction of the habitats of the species, because the forests bordering the lakes and marshes constitute resting and feeding sites of the species.

Selective cutting also concerns mangrove wood (cases observed in the mangroves of the Mahavavy Delta and Ambavanantsatra within the Mahavavy Kinkony Complex PA). They are practiced by the riparian populations to satisfy their daily needs (construction of houses, firewood, energy wood, etc.). The destruction and reduction of the species' habitats are the major impacts of this pressure, given that the mangrove constitutes one of the main resting places, dormitories and nesting sites of the species.

• **Grazing and roaming of zebus**

Grazing and roaming of zebu cattle is also a form of pressure on the habitat of the Madagascar Pond Heron. For example, a large area of the Ambolodia marshes and tanne (Mahavavy Kinkony PA) and a certain part of the border of Lake Mandrozo (Mandrozo PA) have been transformed into grazing areas. This practice considerably reduces the natural habitat of the species. In addition, zebu roaming, which consists of letting free herds of oxen in wetlands, also has a significant impact on these habitats. The major impact is the slowing down or even prevention of the regeneration of aquatic border plants, because the young shoots are trampled and grazed. In addition, the penetration of zebus into *Cyperus* marshes (case of Lake Sofia and Analanana marsh in Bealanana) and into shallow reedbeds often leads to the destruction of vegetation and also disturbs the life and behavior of the species. The intensity of degradation varies from site to site, but the overall level of threat is low (**Table 2**).

➤ **Nesting habitat restriction combined with interspecific competition**

Restriction of nesting habitat is a serious and worrisome threat to the Madagascar Pond Heron, especially in the PBZT and Tsarasaotra Park. It favors and accentuates the competition between the Madagascar Pond Heron and other nesting species, in particular the Squacco Heron and the Cattle Egret (*Bubulcus ibis*). This may lead to the total abandonment of these sites by breeding pairs of Madagascar Pond Heron in the medium term, if no immediate action is taken. Indeed, the progressive decrease in the number of breeding pairs of this species observed in recent years in the heronries of Tsarasaotra Park would be linked, without any doubt, to the interspecific competition for the available space for nesting.

➤ **Disturbance to nesting sites**

This type of threat was recorded at 73% of the nesting sites identified through 2016 (Rabarisoa *et al.*, 2020). The Madagascar Pond Heron is a very sensitive species to anthropogenic pressures. The slightest disturbance to its breeding area leads to its displacement or even migration to other less disturbed areas.

I.2.8. Prioritization of threats

Information obtained during the stakeholder workshop in August 2022, baseline data, and information collected during ecological investigations and monitoring during the implementation of the COKETES Project (2017-2022) resulted in the threat prioritization below

(Table 2). This prioritization is based on the model of a BirdLife International form used for IBAs (Important Bird Area).

Thus, each type of threat was evaluated according to three attributes: its timing, its extent, and its severity. For each attribute, a score ranging from 0 to 3 is assigned to each type of threat based on the negative impacts it could have on the survival of the target species.

Timeframe of the threat in question	Score linked to the deadline
Presently occurs	3
Likely in the short time (within 4 years)	2
Likely in the long term (beyond 4 years)	1
Taking place in the past (unlikely to return) and is no longer restrictive	0

Geographical extent of the concerned threat	Score linked to the extent
Whole area or population of birds (> 90 %)	3
Majority of the area or population of birds (50-90 %)	2
Part of the area or population of birds (10-50 %)	1
Small part of the area or some birds (< 10 %)	0

Severity of the concerned threat	Score related to the deadline
Rapid deterioration (> 30% in 10 years or 3 generations)	3
Moderate deterioration (10-30% in 10 years or 3 generations)	2
Slow deterioration (1-10% in 10 years or 3 generations)	1
No or imperceptible deterioration (< 1%)	0

To assess the overall importance of each type of threat, the total score was calculated from the other three scores using the following formula: Total score = maturity + (extent x severity).

Table 2 : Hierarchy of the main threats to the Madagascar Pond Heron *Ardeola idae*

THREAT TYPE	Score			Total Score	Accuracy
	Scale	Extent	Severity		
Direct threats affecting the species					
Poaching	3	1	3	6	Current and serious threat
Predation of eggs and chicks	3	1	1	4	Potential impact to be investigated
Natural disasters: cyclones and floods	2	1	2	4	Current threat with potential long-term impact

THREAT TYPE	Score			Total Score	Accuracy
	Scale	Extent	Severity		
Loss and disturbance of the species' habitat					
Conversion of wetlands to human habitation and agricultural zones	3	2	3	9	Significant and immediate impact
Fire	3	1	1	4	Current threat with potential long-term impact
Destructive and irrational exploitation of fishery resources	3	1	0	3	Current threat with potential long-term impact
Silting and drying of wetlands	3	1	1	4	Current threat with potential long-term impact
Water pollution	3	1	1	4	Potential impact to be investigated
Excessive collection of aquatic plants	3	0	0	3	Current threat with potential long-term impact
Selective and illegal cutting of trees in forests bordering wetlands	3	1	1	4	Current threat with potential long-term impact
Grazing and roaming of zebus	3	1	0	3	Unlikely impact
Nesting habitat restriction combined with interspecific competition	3	0	1	3	Current threat with potential long-term impact
Disturbance to nesting sites	3	2	1	5	Threat with immediate impact

Analysis based on timing, geographic extent, and severity indicates that habitat loss due to conversion of wetlands to housing and agricultural areas, poaching, and disturbance at nesting sites are the most significant threats to the Madagascar Pond Heron. It would therefore be advantageous to focus the conservation actions of the species on the conservation of the habitat and colony sites as well as on the protection against anthropic disturbances.

I.2.9. Constraints for conservation

In addition to the threats outlined above, a number of constraints on the conservation of the Madagascar Pond Heron were also identified. These are factors that may influence the ability and/or willingness to address threats, or they may be necessary precursors to reducing threats. Key constraints identified include: (1) limited integrated planning for conservation and monitoring of the species and its habitat, (2) little or no protection of current nesting sites, especially those outside of protected areas, (3) irregular scientific monitoring with a primary focus on the breeding season, (4) insufficient human resources available for conservation of the species, (5) the low level of awareness at the national level regarding the endangered status of the species, (6) the lack of coordination of conservation actions for the species in the different areas of its distribution, and (7) the non-existence of a conservation plan for the species in its sites of occurrence outside of the protected areas. In addition to these constraints, there is a need to further increase knowledge of the species through research, focusing in particular on monitoring migratory movements, genetic studies and population dynamics.

CHAPTER II : CONSERVATION STRATEGY

II.1. RATIONALE AND SCOPE OF THE STRATEGY

The present strategy for the conservation of the Madagascar Pond Heron is the result of the COKETES Project, supported by GEF and UN Environment. Its elaboration was based on the following question: "In view of the conservation efforts already undertaken before and during the implementation of the COKETES Project, what more feasible ways and means should be resorted to or what adequate actions should still be undertaken to achieve the objectives assigned to the effective conservation of the Madagascar Pond Heron?"

The strategy is conceived as a national framework to govern the conservation of Madagascar Pond Heron over the next decade (2023-2032). It is designed to reorient and/or strengthen actions already undertaken, and to undertake new, realistic and implementable actions identified based on currently available information. By defining a vision, a goal and strategic objectives, this strategy proposes basic principles, orientations and a series of actions likely to further improve the conservation status of the Madagascar Pond Heron. It is therefore intended to serve as a guide for all categories of stakeholders and public and private actors concerned with the conservation and development of this species, as well as for civil society advocating for its implementation.

II.2. PRINCIPLE STRATEGY DEVELOPMENT AND IMPLEMENTATION

The strategy is based on the compilation of conservation strategies agreed by local communities, the scientific basis and uses the most up-to-date knowledge. It responds to national needs and issues on the realization of the state commitment to AEWA and its parent convention CMS. It takes into account and develops synergies with the AEWA strategic plan for the period 2019-2027. It is also based on the Single Species Action Plan for the Madagascar Pond-heron adopted in 2008 for the period 2008-2018 and which has been renewed for the period 2019-2028 in accordance with the Resolution of MOP 7. It also accompanies the implementation of national biodiversity strategies and action plans (2015-2025)

This strategy is built from a global vision defined according to the state of knowledge on the target species and its problems, as well as on the objectives of AEWA. Its materialization is based on a strategic goal, which is surrounded by strategic objectives whose achievement is based on the realization of a number of relevant actions. These actions have been identified by experts and different stakeholders, through workshops and consultations, by making a diagnostic analysis and elaborating a conceptual model related to the conservation of the species ([see Appendix 3 for more details](#)).

The conservation of the Madagascar Pond Heron will depend on the successful implementation of this strategy and its action plan. This requires the mobilization and participation of all key players, from all relevant sectors, including the general public. The progress of implementation, continuity and achievement of actions must be evaluated regularly. Obstacles encountered in the implementation of the action plan must be identified and overcome to achieve the objectives.

II.3. VISION

By 2032, the Madagascar Pond Heron population will be in a favorable and viable state by thriving in healthy and well-managed ecosystems, involving local communities and other stakeholders. This will be done in harmony with the local socio-economic context and in respect of sustainable development.

II.4. GOAL

To increase the population level of the Madagascar Pond Heron and maintain and/or expand its range in Madagascar, to ensure that the species is promoted to a promising conservation status.

II.5. STRATEGIC OBJECTIVES

In order to achieve the vision and goal, seven strategic objectives supported by short, medium and long term actions were defined during the stakeholder workshop.

Strategic Objective 1: Minimize direct causes of mortality to the species

➤ Problem and justification

The collection of eggs and chicks from breeding colonies has been shown to be the main cause of mortality of Madagascar Pond Heron. In addition to the destruction of eggs and chicks, this leads to the abandonment of the site and the interruption of reproduction. The lack, or sometimes absence (especially in unprotected areas), of monitoring actions to combat this pressure is one of the most limiting factors to the conservation of the species. Moreover, the impacts of natural predation and natural disasters are still poorly assessed, although these data are of paramount importance in finding adequate control and/or mitigation measures. It is therefore essential to carry out actions to minimize, or even stop, the direct causes of mortality of the Madagascar Pond Heron to allow the maintenance of the minimum viable breeding population in Madagascar.

To achieve this strategic goal, the following conservation actions are required:

- **Action 1.1:** Strengthen monitoring and surveillance of known breeding sites
- **Action 1.2.** prevent egg and chick harvesting, hunting and trapping
- **Action 1.3.** Promote alternative sources of income-generating activities to egg and chick harvesting
- **Action 1.4:** Identify and assess the impact of predatory species and, in case of proven impact, develop protocols for rat control and raptor predation mitigation with the consultation of experts.
- **Action 1.5.** Conduct in-depth research on other causes of mortality of the species (avian disease, parasites, etc.).

- **Action 1.6.** Conduct awareness campaigns on the conservation issues of the target species among all stakeholders, while providing information on penalties for poaching and illegal hunting.

Strategic Objective 2: Maintain and improve the quality of habitats used by the species (breeding, feeding, resting and roosting habitats)

➤ **Problem and justification**

The surfaces of the habitats frequented by the Madagascar Pond Heron are in regression because of the human-based pressures, and many habitats are abandoned by the species because of their degradation and the deterioration of their quality. Indeed, a large part of the wetlands, nesting and feeding sites have been transformed into cultivated land and human habitation. Although these impacts are mainly observed in unprotected areas, they are also perceived within protected areas. Thus, the maintenance and enhancement of existing wetland habitats within and outside of protected areas is of paramount importance to ensure the preservation of the species. The protection and monitoring of these environments must therefore be ensured. Conservation measures should focus on strengthening habitat protection measures within protected areas and on protecting known nesting sites that do not yet have a conservation status. For the latter case, it is essential to identify realistic designations that are best adapted to the bio-ecological and socio-economic contexts of these sites. Furthermore, the frequentation and use of other potential sites by the species needs to be better assessed. Thus, it will be crucial for the safeguard of the Madagascar Pond Heron to preserve the existing habitats and to prevent any large-scale agricultural development. The restoration of degraded habitats is also one of the priority actions under this national strategy. The objective is to improve the hosting potential of the Madagascar Pond Heron and to naturally bring back the populations in the restored areas where they were previously present.

The actions necessary to achieve this strategic objective are as follows:

- **Action 2.1.** Secure the species' breeding habitats
- **Action 2.2.** Strengthen the conservation of the species' feeding and visitor habitats
- **Action 2.3.** Regulate large-scale conversion of wetlands outside of protected areas and curb the expansion of cropland on wetland margins within protected areas.
- **Action 2.4.** Strengthen the management and control of reed, marsh and bush fires
- **Action 2.5.** Regulate the collection of aquatic plants for commercial and local use
- **Action 2.6.** To limit and prohibit the illicit cutting of trees and deforestation of forests bordering wetlands
- **Action 2.7.** Guarantee the adequate management of fisheries resources in order to ensure their sustainability
- **Action 2.8.** To establish a plan for the sanitation of wetlands by the species in order to maintain the healthy quality of waters

- **Action 2.9.** Prevent and avoid sedimentation and siltation of wetlands
- **Action 2.10.** Restore degraded habitats (wetlands including aquatic plants and surrounding forests)
- **Action 2.11.** Plan strategies to mitigate the impacts of natural disasters and increase the resilience of wetland ecosystems to climate change impacts

Strategic Objective 3: Increase awareness of the conservation of the Madagascar Pond Heron and wetlands, and promote the appreciation of the species

➤ Problem and justification

Many outreach activities have been carried out in the past, particularly during the implementation of the COKETES Project (from 2017 to 2022). However, these were overall perceived as insufficient on their own, and the need to complement them with conservation and monitoring actions was emphasized. For example, large posters depicting Madagascar Pond Herons are placed in several towns and villages bordering the protected areas, but their effectiveness is questionable if conservation actions are not implemented. It was also noted that among the weaknesses in the implementation of the former national action plan and the COKETES Project is the lack of mobilization and commitment of several stakeholders. This is partly due to a lack of information, education and awareness among stakeholders. It was also noted that much information on the conservation of the species does not reach the main actors. In fact, many structures and people admitted not knowing the importance of conserving the Madagascar Pond Heron. This lack of access to information by the main actors and the public is generally considered one of the main causes of the slow implementation of conservation programs for the species and for Biodiversity. Thus, a massive and targeted awareness campaign remains an essential component for the success of the conservation program, in particular to mobilize and involve more of the concerned actors, but also to make the population aware of the importance of the preservation of the species. Communication and awareness tools must be adapted to the target audience and the local context.

Another important factor, related to awareness raising, is the strengthening of the valorization of Madagascar Pond Heron, both culturally and economically. There are different possibilities of development in this sense, for example the valorization through ecotourism. Although the income that could be generated by the development of a tourist activity around the species seems to be very limited, this possibility could be studied during the implementation of the

To achieve this strategic objective, the following actions are required:

- **Action 3.1.** Strengthen information, education, communication and awareness campaigns in all key sites hosting the species and on a national scale
- **Action 3.2.** Mobilize and engage all stakeholders to further contribute to the implementation of the species' conservation program

- **Action 3.3.** Create the conditions for a better flow of information at all levels so that stakeholders are better informed and equipped on the conventions and guidelines as well as the strategies and plans for the conservation of the target species
- **Action 3.4.** Organize meetings, events and training programs focused on the Madagascar Pond Heron
- **Action 3.5.** Create materials and methods for conducting effective outreach activities in local schools
- **Action 3.6.** Strengthen or develop sustainable economic incentives around the Madagascar Pond Heron, in active consultation with local communities
- **Action 3.7.** Promote ecotourism focused on birdwatching and include the White-crowned Night Heron in birdwatching tours in Madagascar.
- **Action 3.8.** Inform the general public about the status, threats and priority conservation actions of the species (radio, television, newspapers and other information media)

Strategic Objective 4: Conduct regular and effective monitoring and research activities.

➤ Problem and justification

Monitoring and research on the Madagascar Pond Heron prior 2008 has already improved our knowledge of its population size, biology and ecology (breeding phenology, habitat preference, diet, etc.). Although the information on the species is relatively improved, there is still a lot of knowledge to be gained. To date, monitoring and research efforts are focused primarily during the breeding season; monitoring and research is not yet regular during the non-breeding season, and knowledge about the status of the species during this season is limited. In addition, regular monitoring of mortality must also be conducted to control the impact of factors limiting the population's growth of this species. All monitoring results must be readily available and analyzed to inform and, if necessary, revise conservation management actions. Also, there is little data on movement and habitat use outside of the breeding season. However, the distribution of the species on a territory scale, its movements on this territory and the monitoring of its population dynamics are important parameters to collect in order to allow the evaluation of its conservation status and thus to answer the national and international commitments. The study of the movements of the species within Madagascar should therefore be one of the research priorities, in order to get a better idea of the distribution and use of the habitat throughout the year. Monitoring the migratory movement of the species using satellite transmitters is also important to know the different stopover sites of this species during its migration, and to know the possible causes of mortality during migration. The research program should also consider improving the productivity of the species by increasing the chance of survival of eggs and chicks (e.g. transferring the eggs of the species to the nests of common species of the same genus such as *Ardeola ralloides*) and through captive breeding.

Eight priority actions are identified to achieve this strategic objective:

- **Action 4.1.** Monitor populations of the species, particularly in the central and eastern parts of Madagascar throughout this action plan

- **Action 4.2.** Monitor the evolution of the species' population and distribution as well as the status of its habitats in Madagascar throughout this action plan
- **Action 4.3.** Characterize the movements of the species during the breeding and interbreeding periods, using satellite monitoring, preferably for at least one full year
- **Action 4.4.** Strengthen research on the biology and ecology of the species
- **Action 4.5.** Study the feasibility and implement a captive breeding program or a program to improve the productivity of the species by increasing the chance of survival of eggs and chicks.
- **Action 4.6.** Conduct research and a pilot program for the creation of artificial breeding sites for the species
- **Action 4.7.** Analyze temporal changes in key habitats for the species using remote sensing
- **Action 4.8.** Resolve the hybridization problem between *Ardeola idae* and *Ardeola ralloides*

Strategic Objective 5: Design and implement a plan for the protection and sustainable management of the species outside the Protected Areas.

➤ Problem and justification

It was noted that some breeding colonies and many of the sites where the Madagascar Pond Heron occurs are in unprotected areas. Therefore, the need to design and implement a plan for the protection and sustainable management of the species and its habitat in these areas was emphasized during the stakeholder workshop, for the long-term survival of this species. Indeed, a crucial element of the conservation strategies is to recognize that the protection of the target species must be done with equal effort both inside and outside the PAs. This implies that even if individuals inside PAs are subjected to rigorous protection efforts, while those outside are left open unprotected, there will still be a gradual loss of part of the species population. Among the different possibilities of conservation strategy that could be undertaken, we point out that based on awareness, education, mobilization of local communities and encouragement of owners of private land to preserve the species, even with compensation in various forms. The implementation of protection statutes for unprotected sites such as community management sites (management contracts), Ramsar sites or even PAs is a priority for strengthening the conservation of the species.

To achieve this strategic goal, the following conservation actions are required:

- **Action 5.1.** Carry out rigorous awareness, information, education and communication campaigns in unprotected areas where the species occurs
- **Action 5.2.** Mobilize and engage local communities in the conservation of the species' habitats through the support of local conservation groups

- **Action 5.3.** Grant protection status with the development and implementation of a sustainable management plan for sites hosting the species' breeding colonies and main feeding grounds in areas not yet protected
- **Action 5.4.** Raise awareness, encourage and find partnership agreements with the owners of private land hosting the Madagascar Pond Heron to preserve the species and its habitat
- **Action 5.5.** Support and accompany local populations, in particular farmers and breeders, in approaches that respect the species' breeding and feeding sites
- **Action 5.6.** Explore sustainable sources of funding for the implementation of the management plan and conservation strategy for the species.

Strategic Objective 6: Maintain and improve collaboration, consultation and coordination of actions among all stakeholders at the national level

➤ Problem and justification

Despite the existence of collaboration between the different stakeholders involved in the conservation of the species, a lack of coordination of actions between conservation actors in the different areas of distribution of the species in Madagascar has been noted. The different local, regional and national structures responsible for the implementation of the species' conservation project do not yet coordinate their efforts enough in the pursuit of their respective activities. This lack of synergy explains the lack of communication, information sharing, multi-sectoral cooperation between actors at different levels (local, regional and national), programmatic integration and harmonization of policies and legal frameworks. However, one of the sine qua non conditions for the success of the conservation of the species is the good coordination of actions and the dialogue between the main actors throughout the range of the species.

Ensuring the proper implementation of this national strategy with its action plan implies putting in place good coordination, animation and regular monitoring of the progress of actions during the 10 years of actions. For this, it is important to maintain and improve the collaboration between the different partners and organizations that already collaborate, and to consult the different partners that could collaborate in the future in the implementation of research, monitoring and conservation actions for the species. Ensuring the effective implementation of conservation actions will also require the development of the skills of local partners, through training in good governance and natural resource management. In parallel, it will be necessary to ensure that all partners have the necessary means to achieve the objectives defined in this national strategy. Thus, the creation of an "*Ardeola idae*" platform to ensure the conservation of this species in the distribution areas in Madagascar is recommended. This platform will have the mandate to hold regular meetings of members and stakeholders, to seek sustainable funding for conservation actions, to share information through the online database COKETES and to strengthen the skills of local partners on the conservation and management of the species and natural resources.

The following actions are necessary to achieve this strategic objective:

- **Action 6.1.** Create an "*Ardeola idae*" platform to ensure the conservation of the species in its distribution areas in Madagascar
- **Action 6.2.** Organize regular meetings of stakeholders.
- **Action 6.3.** Create and make operational a mechanism of synergy in the implementation of the conservation program for the species
- **Action 6.4.** Coordinate actions with local, regional, national and international public policies (National Biodiversity Protection Strategy, etc)
- **Action 6.5.** Maintain partnerships and seek sustainable funding for the species' conservation actions
- **Action 6.6.** Develop and strengthen the skills of local partners in the conservation and management of the species and natural resources
- **Action 6.7.** Ensure the sharing and exchange of data, information and experiences between actors and stakeholders in Madagascar.

Strategic Objective 7: To promote and support the coordination of actions and dialogue between the different institutions involved in the conservation of the species at the scale of its geographical distribution (on an international scale)

➤ **Problem and justification**

The seasonal variation in the numbers of the Madagascar Pond Heron population shows that most individuals migrate to other areas outside the breeding season. Thus, it is also necessary to promote and support the coordination of conservation actions and the consultation between the different institutions concerned in the conservation of the species at the international level. This international collaboration could be facilitated by the existence of a PAIPE for the Madagascar Pond Heron adopted in 2008 within the framework of AEWA and which has been renewed for a period of 10 years (2019-2028) starting in 2019.

To achieve this strategic objective, the following actions are required:

- **Action 7.1.** Promote the sharing and exchange of information and experiences between the different countries in the species' range to improve its conservation
- **Action 7.2.** Create and/or integrate an international platform or network for collaboration with conservation actors in the species' host countries
- **Action 7.3.** Carry out actions that are directly related to or promote the conservation of the species at the international level.

II.6. ACTION PLAN FOR THE IMPLEMENTATION OF THE STRATEGY

Table 3 : Actions and priorities, indicators, timelines, approximate cost and responsibilities for implementing the action plan

Action	Priority	Indicators	Timeline	Cost (low, medium, high)	Implementers
Strategic Objective 1: Minimize direct causes of mortality to the species					
1.1. Strengthen monitoring and surveillance of known breeding sites	Very High	Decrease in the number of violations and disturbances in the breeding sites	The entire duration of the action plan (2023-2032)	High Elevé	MEDD/DREDD Conservation NGOs, COBAs, Gendarmerie, Local Authorities
1.2. Prevent egg and chick collection, hunting and trapping	Very High	No interference with human access to the species' home range during the breeding season	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, COBAs, Local Authorities
1.3. Promote alternative sources of income-generating activities to egg and chick collection	Medium	Alternative livelihoods applied; Decreased reliance on heron eggs and chicks as a food source	2023 à 2027	Medium	MAE/DRAE Conservation NGOs, COBAs, Gendarmerie, Local Authorities
1.4. Identify and assess the impact of predatory species and, in case of proven impact, develop protocols for rat control and raptor predation mitigation with the consultation of experts.	Medium	Quantified evidence of predator effects on survival and recruitment of White-crowned Night Herons	2023-2024	High	Conservation NGOs, Research institutions, Universities
1.5. Conduct in-depth research on other causes of mortality of the species (avian disease, parasites, etc.).	Low	Quantified evidence on the causes of mortality of the species	2024-2025	Low	Conservation NGOs, Research institutions, Universities
1.6. Conduct awareness campaigns on the conservation issues of the target species among all stakeholders, while providing information on penalties for poaching and illegal hunting	Very High	Level of awareness of stakeholders and local communities on the conservation issues of the species	2023 à 2032	High	MEDD/DREDD Conservation NGOs, Local Authorities, Research Institutions (PBZT)
Strategic Objective 2: Maintain and improve the quality of habitats used by the species (breeding, feeding, resting and roosting habitats)					
2.1. Secure the species' breeding habitats	Very High	No human-caused destruction in the species' breeding habitats	The entire duration of the action plan (2023-2032)	High	MEDD/DREDD Conservation NGOs, COBAs, Gendarmerie, Local Authorities
2.2. Strengthen the conservation of the species' feeding and visitor habitats	High	Means and regulatory tools of protection put in place	The entire duration of the action plan (2023-2032)	High	MEDD/DREDD Conservation NGOs, COBAs, Gendarmerie, Local Authorities
2.3. Regulate large-scale conversion of wetlands outside of protected areas and curb the expansion of cropland on wetland margins within protected areas	Very High	Number and area of existing wetlands maintained	The entire duration of the action plan (2023-2032)	High	Malagasy Government, MEDD/DREDD Conservation NGOs, COBAs, Gendarmerie, Local Authorities.
2.4. Strengthen the management and control of reed, marsh and bush fires	Very High	Fire fighting structure defined, written and distributed;	The entire duration of the action	Medium	Malagasy Government, MEDD/DREDD, ,

Action	Priority	Indicators	Timeline	Cost (low, medium, high)	Implementers
		Decrease in the area of burned reeds, marshes and forests	plan (2023-2032)		Local Authorities Conservation NGOs, COBAs
2.5. Regulate the collection of aquatic plants for commercial and local use	Medium	Regulatory tools created and/or reinforced (laws, Dina, etc) applied	The entire duration of the action plan (2023-2032)	Low	Malagasy Government, MEDD/DREDD, Local Authorities Conservation NGOs, COBAs,
2.6. To limit and prohibit the illicit cutting of trees and deforestation of forests bordering wetlands	High	Increase in the number of illegal activities prosecuted; Reduction of illegal logging crimes in natural habitats	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD, Ministry of Justice Conservation NGOs, COBAs,
2.7. Guarantee the adequate management of fisheries resources in order to ensure their sustainability	Medium	Increased stocks of fish products in wetland feeding habitats of the species	The entire duration of the action plan (2023-2032)	Medium	MPEB/DRPEB, MEDD/DREDD Conservation NGOs, COBAs,
2.8. To establish a plan for the sanitation of wetlands by the species in order to maintain the healthy quality of waters	Medium	Existence of data on the physical and chemical parameters of water; Consequent sanitation plan developed and implemented by local communities	The entire duration of the action plan (2023-2032)	High	MEAH/DREAH, MEDD/DREDD Conservation NGOs, Local Authorities, COBAs,
2.9. Prevent and avoid sedimentation and siltation of wetlands	High e	Area of watersheds protected; Appropriate erosion control devices; Evidence of improved wetland substrate quality	2023 à 2028	High	MEDD/DREDD Conservation NGOs, COBAs, Research Institutions
2.10. Restore degraded habitats (wetlands including aquatic plants and surrounding forests)	High	Area (ha) of habitat restored and/or regenerated annually	2026-2027	Medium	MEDD/DREDD Conservation NGOs, Research Institutions, COBAs,
2. Plan strategies to mitigate the impacts of natural disasters and increase the resilience of wetland ecosystems to climate change impacts	Medium	Strategy developed and implemented by region; Database on impacts and resilience of wetlands to climate change	2028 à 2032	Medium	MEDD/DREDD, BNGRC Conservation NGOs, Research Institutions, COBAs,
Strategic Objective 3: Increase awareness of the conservation of the Madagascar Pond Heron and wetlands, and promote the appreciation of the species					
3.1. Strengthen information, education, communication and awareness campaigns in all key sites hosting the species and on a national scale	Very High	Number of IEC campaigns carried out; Increase in the number of people aware of the	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, COBAs, PBZT, Local Authorities

Action	Priority	Indicators	Timeline	Cost (low, medium, high)	Implementers
		importance of conservation of the species			
3.2. Mobilize and engage all stakeholders to further contribute to the implementation of the species' conservation program	Very High	Number of people actively involved in the conservation of the species	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, COBAs, PBZT
3.3. Create the conditions for a better flow of information at all levels so that stakeholders are better informed and equipped on the conventions and guidelines as well as the strategies and plans for the conservation of the target species	High	Operational information flow systems and tools in place	2023-2024	Medium	MEDD/DREDD Conservation NGOs, PBZT, Local Authorities
3.4. Organize meetings, events and training programs focused on the Madagascar Pond Heron	Medium	Number of meetings and events organized	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, PBZT, Local Authorities
3.5. Create materials and methods for conducting effective outreach activities in local schools	Medium	Increase the level of knowledge about the Madagascar Pond Heron and its conservation in schools.	2023-2024	Medium	MEN/DREN, Schools, MEDD/DREDD, Conservation NGOs, PBZT
3.6. Create materials and methods for conducting effective outreach activities in local schools	Low	Number of economic incentive projects completed	2025 à 2030	High	MEDD/DREDD Conservation NGOs, COBAs, PBZT, Local Authorities
3.7.. Promote ecotourism focused on birdwatching and include the Madagascar Pond Heron in birdwatching tours in Madagascar	Medium	Increase in birding tours including the Madagascar Pond Heron	The entire duration of the action plan (2023-2032)	Medium	Ministry of Tourism, ONTM/ORTM, Park and PA managers, private sector
3.8. Inform the general public about the status, threats and priority conservation actions of the species (radio, television, newspapers and other information media)	Medium	Number of information published and behavior change	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, PBZT, Local Authorities
Strategic Objective 4: Conduct regular and effective monitoring and research activities					
4.1. Monitor populations of the species, particularly in the central and eastern parts of Madagascar throughout this action plan	High	Number of monitoring carried out ; Spatio-temporal data of the species in the central and eastern parts of Madagascar	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, Research Institutions, COBAs
4.2.. Monitor the evolution of the species' population and distribution as well as the status of its habitats in Madagascar throughout this action plan	Very High	Population size and trend determined; Updated distribution map and habitat status data	The entire duration of the action plan (2023-2032)	Medium	Conservation NGOs, research institutions, University
4.3. Characterize the movements of the species during the breeding and interbreeding periods, using satellite monitoring, preferably for at least one full year	High	Movement map of the species ; Number of monitoring carried out	2024-2025	High	Conservation NGOs, research institutions, University

Action	Priority	Indicators	Timeline	Cost (low, medium, high)	Implementers
4.4. Strengthen research on the biology and ecology of the species	High	Results of research and scientific investigations	2023-2025	Medium	Conservation NGOs, research institutions, University
4.5. Study the feasibility and implement a captive breeding program or a program to improve the productivity of the species by increasing the chance of survival of eggs and chicks.	Low	Results of research and scientific investigations	2028-2032	High	Conservation NGOs, research institutions, University
4.6. Conduct research and a pilot program for the creation of artificial breeding sites for the species	Low	Results of research and scientific investigations	2028-2032	High	Conservation NGOs, research institutions, University
4.7. Analyze temporal changes in key habitats for the species using remote sensing	Low	Results of research and scientific investigations	2028-2032	Medium	Conservation NGOs, research institutions, University
4.8. Resolve the hybridization problem between <i>Ardeola idae</i> and <i>Ardeola ralloides</i>	Medium	Results of research and scientific investigations	2028-2032	Medium	Conservation NGOs, research institutions, University
Strategic Objective 5: Design and implement a plan for the protection and sustainable management of the species outside the Protected Areas.					
5.1. Carry out rigorous awareness, information, education and communication campaigns in unprotected areas where the species is found	Very High	Number of IEC campaigns carried out ; Increase in the number of people aware of the importance of conservation of the species	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, Local Authorities
5.2. Mobilize and engage local communities in the conservation of the species' habitats through the support of local conservation groups	Very High	Number of local communities involved in the conservation of key habitats	The entire duration of the action plan (2023-2032)	High	MEDD/DREDD Conservation NGOs, Local Authorities
5.3. Grant protection status with the development and implementation of a sustainable management plan for sites hosting the species' breeding colonies and main feeding grounds in areas not yet protected	High	Number of sites with protected status	2027-2032	Medium	Malagasy Government, MEDD/DREDD, Local Authorities
5.4. Raise awareness, encourage and find partnership agreements with the owners of private land hosting the Madagascar Pond Heron to preserve the species and its habitat	Medium	Agreements and conventions signed with private landowners	2024, 2027, 2030, 2032	Medium	Malagasy Government, MEDD/DREDD Conservation NGOs, Local Authorities
5.5. Support and accompany local populations, in particular farmers and breeders, in approaches that respect the species' breeding and feeding sites	Medium	Decreased disturbance to the species' breeding and feeding grounds	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD, MAE/DRAE Conservation NGOs, Local Authorities
5.6. Explore sustainable sources of funding for the implementation of the management plan and conservation strategy for the species	Medium	Number of funding acquired and number of sites supported	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs,
Strategic Objective 6: Maintain and improve collaboration, consultation and coordination of actions among all stakeholders at the national level					

Action	Priority	Indicators	Timeline	Cost (low, medium, high)	Implementers
6.1. Create an " <i>Ardeola idae</i> " platform to ensure the conservation of the species in its distribution areas in Madagascar	High	An operational platform	2023	Low	MEDD/DREDD Conservation NGOs, Local Authorities
6.2. Organize regular meetings of stakeholders	Medium	Number of meetings held per year ; Minutes of meetings written and distributed	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs,
6.3. Create and make operational a mechanism of synergy in the implementation of the conservation program for the species	High	National Committee and Regional Focal Points set up	2024	Medium	MEDD/DREDD Conservation NGOs, , Local Authorities, COBAs
6.4. Coordinate actions with local, regional, national and international public policies (National Biodiversity Protection Strategy, etc)	Low	Number of actions on the conservation of the species aligned with public policies	The entire duration of the action plan (2023-2032)	Medium	MEDD/DREDD Conservation NGOs, , Local Authorities, COBAs
6.5. Maintain partnerships and seek sustainable funding for the species' conservation actions	High	MOUs/agreements signed and evaluated annually	The entire duration of the action plan (2023-2032)	Low	MEDD/DREDD Conservation NGOs, Local Authorities, COBAs,
6.6. Develop and strengthen the skills of local partners in the conservation and management of the species and natural resources	High	Number of training sessions and/or workshops held	The entire duration of the action plan (2023-2032)	High	MEDD/DREDD Conservation NGOs,
6.7. Ensure the sharing and exchange of data, information and experiences between actors and stakeholders in Madagascar	High	Information systems implemented ; Number of conferences/workshops conducted	The entire duration of the action plan (2023-2032)	High	MEDD/DREDD Conservation NGOs,
Strategic Objective 7: To promote and support the coordination of actions and dialogue between the different institutions involved in the conservation of the species at the scale of its geographical distribution (on an international scale)					
7.1. Promote the sharing and exchange of information and experiences between the different countries in the species' range to improve its conservation	High	Number of exchanges made ; Number of publications of information and results	The entire duration of the action plan (2023-2032)	Medium	Malagasy Government, MEDD, Conservation NGOs, research institutions, foreign partners
7.2. Create and/or integrate an international platform or network for collaboration with conservation actors in the species' host countries	Medium	At least one collaborative platform in place and operational	2023-2024	Medium	Malagasy Government, MEDD, Conservation NGOs, foreign partners
7.3. Carry out actions that are directly related to or promote the conservation of the species at the international level.	Medium	Number of participation of Madagascar in international actions related to the Madagascar Pond Heron	The entire duration of the action plan (2023-2032)	High	Malagasy Government, MEDD, Conservation NGOs,

II.6.1. Implementation of the action plan

➤ Principles of implementation

This action plan has a duration of 10 years (2023-2032). Responsibility for its implementation rests with all categories of national (State, technical services), non-governmental (NGOs), civil society (farmers' organizations, socio-professional corporations, local elected officials, local populations), and international (cooperation partners, international organizations, international NGOs) actors.

The implementation of the action plan will be structured on five levels of intervention: national, regional, prefectural, communal and local. The definition of the various projects for the implementation of this plan will have to systematically take into account these levels of intervention, and their design will have to take into account the means and operational approaches required at each of these levels. It should also take into account the gender approach in order to have a participatory and multidimensional dimension, and generate impacts at the individual level and a collective dynamic of change.

The implementation of the action plan can be carried out either through projects that take charge of one or more action components, or through the insertion of operational elements from the action plan into existing projects or projects in other sectors.

➤ Human and financial resources

The implementation of the Action Plan will require the mobilization of human and financial resources. Human resources will be mobilized through existing organizations (village, professional), NGOs, national consulting firms, and through central and decentralized technical services.

The actions outlined in this action plan will require significant funding. No funding is available at this time for the implementation of this plan. Short-term funding requirements may be partially met through the agreement between the various institutions and their donors, while the Malagasy government through the Ministry of Environment and Sustainable Development may be able to support the search for funds for a pilot project to implement part of the action plan. However, it is necessary to identify sustainable funding that will enable the implementation of the plan in the medium and long term.

The financial means to ensure the implementation of this action plan can be mobilized from

- The Malagasy state's own resources: efforts must be made to increase the state's contribution to the implementation of actions in line with the country's international commitments
- Possible contributions from national and international NGOs;
- Contributions from private sector companies;
- Contributions from the population to the implementation of actions;
- international organizations, especially AEW and GEF, which have already financed some conservation actions for the species in the past;

- Bilateral cooperation, through projects implemented in different sectors, which will internalize the provisions of the Action Plan in their intervention modalities.

It is certainly premature at this stage to define the financial means necessary for the execution of all the actions of the Action Plan. However, the evaluation of these resources must be carried out rapidly at the same time as the identification of the priority action program. This evaluation should take into account the actions already in place and/or under investigation.

➤ **Monitoring and Evaluation**

A regular monitoring and evaluation system is necessary for this action plan to be effective. This can only be achieved by ensuring that the plan has been approved by the Malagasy Government and all partners. Thus, a national steering committee for the conservation of the Madagascar Pond Heron, led by the MEDD, will be responsible for overseeing the implementation and conducting an annual monitoring and evaluation of the plan.

In this action plan, an indicator(s) is associated with the actions of each strategic objective. The implementation of the actions will be monitored and evaluated on a line-by-line basis as described in the action table. A column will be added to this table to explain the assessment of progress (activity against indicators).

Note that this action plan is designed to be a flexible document with the possibility, if certain strategic objectives are not met, to revisit it so that the objectives are ultimately met. Of course, since this action plan is not a fully resourced project but simply a plan, some objectives may not be met if resources are not identified in terms of funding or support for the proposed actions. Annual monitoring of the action plan, guided by the indicators provided, will help the steering group (or equivalent) prioritize new approaches in terms of funding or other support.

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APPENDICES

APPENDIX 1 : Photos showing the morphological characteristics of the Squacco Heron (*Ardeola ralloides*)



Figure 7. Squacco Herons: adult in breeding plumage (top), adult in non breeding plumage (bottom left) and juvenile (bottom right) (Photos © Yverlin PRUVOT)

APPENDIX 2: Overview of the stakeholder workshop

The workshop for the development of the strategy and action plan for the conservation of the Madagascar Pond Heron was organized between Partners and key stakeholders on 02 and 03 August 2022 in Antananarivo (Madagascar). To ensure the implementation of the strategy, the process emphasized multi-stakeholder participation in accordance with IUCN guidelines. The workshop was attended by 38 participants including Government representatives, conservation NGOs, regional authorities, specialists and other key stakeholders. The workshop was structured around presentations and working group to define the vision, goal, objectives and actions to form the core of the Strategy and Action Plan for the target species to conserve its population in Madagascar.

The workshop was organized by the COKETES Project (with the financial support of the GEF), in collaboration with the different Partner NGOs (Asity Madagascar, Durrell Wildlife Conservation Trust, Madagascar National Parks, Botanical and Zoological Park of Tsimbazaza and The Peregrine Fund. It was introduced by Mr. RABENASOLO SOLOFONIAINA Eric Olivier (National Director of the COKETES Project) and Ms. RAZAFINDRAKOTO Yvette (Coordinator of the wildlife component, COKETES Project).



Figure 8. Stakeholder workshop Participants (Photos © Yverlin PRUVOT)

APPENDIX 3: Methods for identifying proposed conservation actions

➤ Analysis of existing conservation actions

This analysis aims to determine the conservation measures currently in place that contribute to maintaining the survival of the Madagascar Pond Heron and the integrity of its habitats in the different distribution areas of the species in Madagascar. To do this, documents (activity reports, PAGs of the PAs) relating to conservation activities carried out in these areas were collected from their respective managers. Through the consultation of these documents, we proceeded to the synthesis of the existing conservation actions, while trying to evaluate the contribution of each action realized to the maintenance of the survival of the target species in the long term. The objective of this analysis is to identify, among the existing actions, those that need to be redirected or strengthened, or changed, taking into account the current threats and the ecological requirements of the species.

➤ Identification of actions to propose for the conservation of the species

The actions to be proposed for the conservation of the target species were identified through group discussions at the stakeholder workshop by conducting the diagnostic analysis and developing a conceptual model for the conservation of the species. The group discussions are described as a preparatory activity to specify the actions to be proposed. The principle is to bring in all the information (from the literature and group work) available on the target species. This allows first to define the links between the available scientific knowledge, the main known threats, and the existing conservation actions, then to determine their impacts on the target species and its habitats, and finally to determine the conservation strategies and actions to be implemented.

➤ Development of the conceptual model of threat analysis

The principle is first to identify and evaluate all the pressures and threats, then to analyze the causes from which the pressures arise. This allows us to define the strategies and actions to counter the threats through the development of a conceptual model (Figure 8). This conceptual model was created using the software "yEd Graph Editor version 3.19.1".

In general, the identified anthropogenic and natural pressures are causing adverse effects on the population and habitat of the Madagascar Pond Heron. Thus, the actions aimed at countering the threats outlined in this document can be summarized as either mitigation or adaptation measures. These actions are listed in the diagram of the conceptual model below and grouped into the following six main points: (1) direct conservation activities, (2) alternatives supporting local development, (3) strengthening control and monitoring as well as the enforcement of laws and regulations, (4) information, education and communication, (5) planning strategies to deal with climate change, and (6) participatory management. In addition to these actions to combat threats, there are actions that are identified based on available scientific knowledge and the identification of certain constraints to the conservation of the target species.

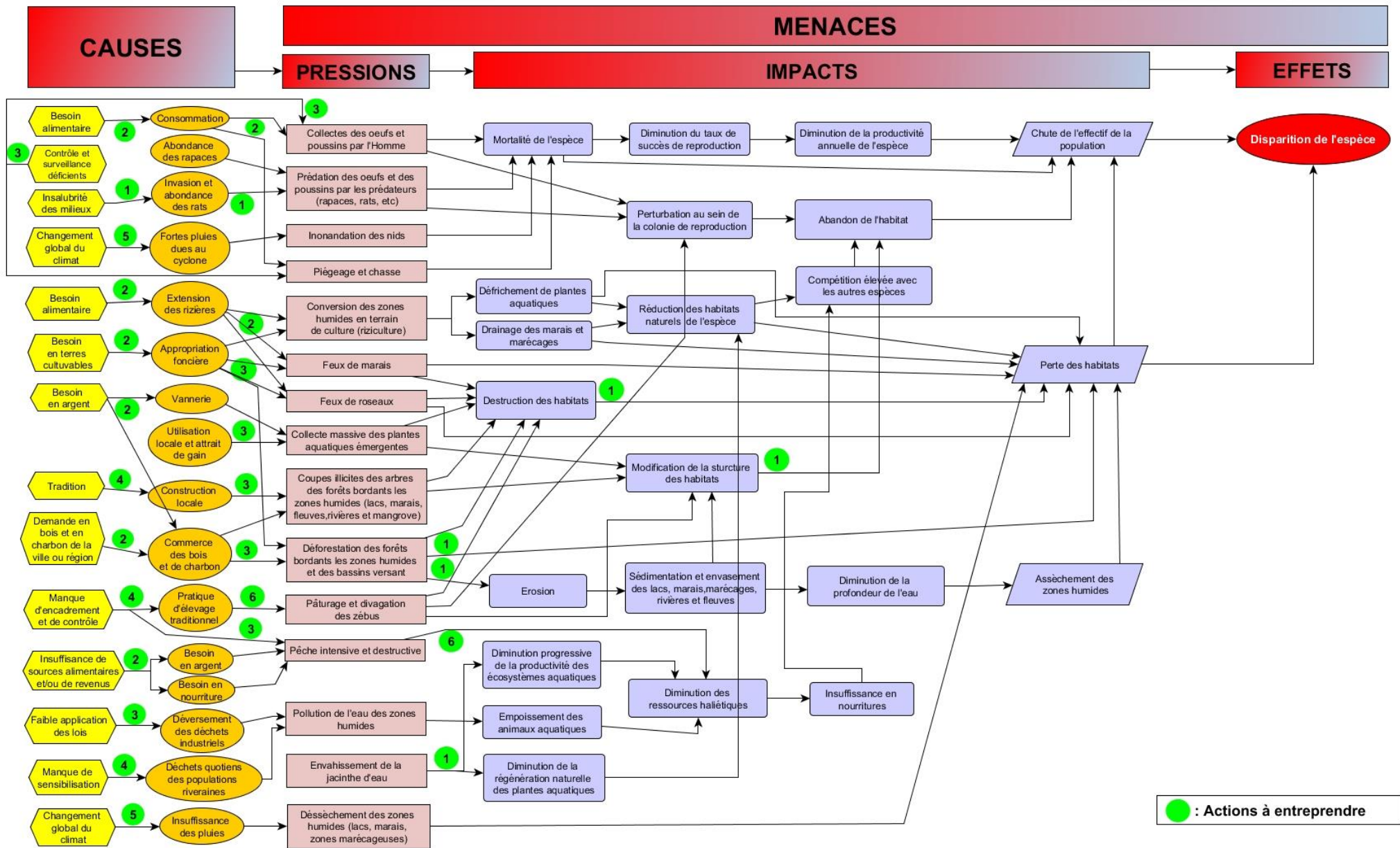


Figure 9. Diagram of the conceptual model of threats and conservation actions for the Madagascar Pond Heron

