

To


Dr Steph Tyler
Conservation Award Manager
African Bird Club

Antananarivo, February 23 2007

Dear Sir,

Please find attached in electronic version my final report on “Conservation biology of Sakalava rail and public awareness in Besalampy wetland” funded by African Bird Club for conservation award I n2006.

Again I apologize for the delay
Yours sincerely,

A handwritten signature in black ink, consisting of a large, stylized 'S' shape followed by several vertical and horizontal strokes, likely representing the name Marc Rabenandrasana.

Marc Rabenandrasana



**Conservation biology of Sakalava rail *Amaurornis olivieri*
an Endangered Malagasy water bird and public awareness
in Besalampy wetlands complex,
Western Madagascar**

Final report

Marc Rabenandrasana

February 2007

ASITY
Ligue Malgache pour la Protection des Oiseaux
BP 7503, Antananarivo Madagascar.

Summary

In 2006, we received partial funding from ABC (African Bird Club) to realize conservation biology study on the Sakalava rail an endangered water bird, and to conduct public awareness campaign surrounding rail habitats in favour of wetland protection in Besalampy site recently identified new IBA.

Field surveys were conducted in two trips: July and then October to November 2006. A total of 51 birds were recorded in the Besalampy wetland, chicks are not included: 39 individuals at Lake Amparihy, 9 individuals at Lake Ampandra and only 3 individuals at Lake Sahapy. The following information on the Sakalava rail natural history are obtained: the Lake Amparihy appeared to be the favourable breeding site of this species in the Besalampy wetland complex. But the reproductive success is too low. This might explained why this species was very rare in its natural habitat. Seven birds were caught and marked using colour and SAFRING rings. This ringing program will serve a baseline data for long term study on Sakalava rail movement between Besalampy wetland complex and to extend our survey sites in another site. There is an evidence of sexual dimorphism between Sakalava rails breeding pairs. Based on two caught pairs, upperparts feathers and tarsi colouration were pale brown green and pale pinkish tarsi for females. These characters are very intense for adults' males which have Rufus upperparts and bright red pinkish tarsi. An additional study will need to confirm this sexual dimorphism hypothesis by comparing DNA of individuals through blood samples obtained actually or using voice record by call analysis of pairs. The future of Sakalava rail conservation is optimistic: two of these three lakes have already management plan involving direct protection with communities groups. But efficient conservation actions need more support of these local partners for establishment of protected area as legally agreed in national level.

Content

Summary

| | |
|---|----|
| I. Introduction..... | 01 |
| II. Public awareness..... | 01 |
| 2.1. Posters..... | 01 |
| 2.2. Public awareness campaigns..... | 04 |
| III. Conservation biology study of Sakalava rail..... | 05 |
| 3.1. Studies area..... | 05 |
| 3.2. Rail census..... | 07 |
| 3.3. Population size..... | 07 |
| 3.4. Population movement..... | 08 |
| 3.5. Breeding season and reproduction..... | 09 |
| 3.6. Distribution..... | 11 |
| IV. Conclusion..... | 13 |
| | |
| References..... | 14 |
| Appendix I..... | 16 |
| Appendix II..... | 17 |
| Appendix III..... | 18 |

I. Introduction

I received a conservation award from the African Bird Club to carry out research about Sakalava rail *Amaurornis olivieri* conservation biology and to conduct public awareness raising activities in communities living near the Besalampy wetlands complex, which was identified to hold the largest breeding colony of this critically endangered species ⁷.

Following the availability of funds by international bank transfer from ABC to ASITY, the delayed delivery of rings from SARFING in South Africa was received in early October 2006. Due to this delay, I decided to divide the project into two phases:

- The first fieldwork phase was conducted from July 14th to August 5th 2006. In this phase, I developed contacts with local partners and ran public awareness raising activities.
- The second fieldwork phase took place from 11 October to 22 November 2006. We surveyed Sakalava rail breeding system, population census and caught birds for a long term study of population movement using colour and numbered rings.

From August 10th to September 25th 2006, I visited Europe to attend the International Ornithological Congress in Hamburg to present results of my Sakalava rail research, then made a collaborative visit to the University of Bath in the UK in order to finalise a paper on conservation biology of the Sakalava rail. This trip to Europe was very important especially for the long-term aspects of my Sakalava rail research programme. I worked with my international advisor Dr Tamás Székely and my colleague Peter Long at the University of Bath to write proposals for funding to extend this project from 2007 to 2009.

II. Public awareness

2.1. Posters

I developed two posters, both written in Malagasy. I used Malagasy for the poster message to facilitate message transmission to local partners and community groups who often have limited education. I designed very simple posters illustrated by photographs supported with little text. In this way we hoped the audience would understand the messages that we tried to communicate.

One poster showed the threatened Malagasy endemic wetland species and important biodiversity including the Sakalava rail. The other poster is a photographic montage accompanied by short messages. English versions of these posters are shown in plate 1 and plate 2. The direct translations are given bellow:

Poster one:

These are threatened and other important biodiversity in and around the Besalampy Wetland complex

Poster two:

We should respect wetlands, for providing us food security and transport facilities. Please do not practice over fishing or burning reeds surrounding wetlands. Just think about our generation and our children.



the threatened biodiversity in Besalampy wetland complex



Tilapia



Big Headed Turtle



Madagascar Squacco Heron



Sakatava rail



Decken Sifaka



Humblot Heron



Madagascar plover



Sacred ibis



Madagascar fish eagle



Photo : Marc RABENANDRASANA Design : Christian RANDRIAMANALINA (ASITY)

Contact
Ligue Malgache pour la conservation des Oiseaux
BP 7503
+261 20 22 249 01
+261 20 24 390 95
Mail : asity@mel.wanadoo.mg
www.asity.org

Respect our wetlands



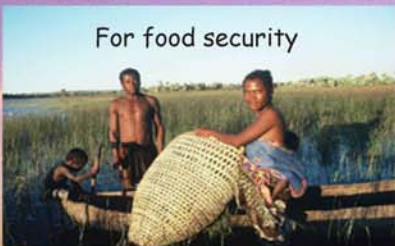
For transport facilities



Providing rice fields



Fishing place for ladies



For food security



Providing big fish



Because



Overfishing isn't good so far



And don't burn wetland

Think about our child future



African Bird Club

Contact
Ligue Malgache pour la conservation des Oiseaux
BP 7503
+261 20 22 249 01
+261 20 24 390 95
Mail : asity@mel.wanadoo.mg
www.asity.org



Photo : Marc RABENDRASANA Design : Christian RANDRIAMANALINA (ASITY)

2.2 Public awareness campaigns

a). Besalampy town

I conducted direct meetings with regional decision makers, authorities and wetland users surrounding the Besalampy region. The following contacts were made before I started fieldwork for Sakalava rail data collection:

- The head of Besalampy region “Sous Prefet”,
- The Ministère d’Eaux et Forêts (Ministry of Water and Forests) representative in Besalampy,
- The public school director in Besalampy’s central town.

I explained my project objectives and discussed the importance of wetland biodiversity. After each meeting I distributed posters. Particular interest was expressed by the Besalampy authorities about the need in the short term to establish local management control for wetlands involving community groups, especially surrounding Sakalava rail breeding habitat.

b). Lake Amparihy

The Lake Amparihy is located in northwest of Amapako Ambalarano commune (Fig 1). I conducted formal and informal meetings with the Mayor of Ampak, local guides, village chiefs and fishermen living around Lake Amparihy.

There is already a local community group responsible for wetland management at Lake Amaparihy. The community group received training from the Water and Forests representative based at Besalampy and Environmental Service Agency (SAGE) from Antananarivo on wetland management and protection of reeds. The community group is **Arovy ny Harena Voajanahary eto Amparihy** (AHVA; *Save the natural resources and wetlands at Lake Amparihy*). I met the AHVA president Mr Delphin Andrianandrasana and his secretary Mr Alphonse. They explained to me their responsibility for controlling all foreign visitors who wish to work and fish in Lake Amparihy.

I explained to the AHVA president the objectives of the Sakalava rail project, the importance of wetlands and biodiversity conservation. Finally I gave some posters to them to be displayed in the public place and offices.

The future of Lake Amaparihy is fairly optimistic because people understand the reasons for wetland management controls and agree to respect fishing periods and mesh size limits at the lake.

c). Lake Ampandra

Lake Ampandra is located in north of Sambaho river and in west of Tanandava Bejofo village (Fig 1). I contacted a fishermen group living periodically at the edge of Ampandra wetland. One of them is Mrs Angelina Christine, known as “Rafotsy”, the only teacher in this village. She introduced me to Mr Said Abdullah and the respected old men in Antanandava Bejofo village who helped me as local guides for the Sakalava rail study.

There is no community group established at Lake Ampandra and the lake appears to suffer from over-fishing. The marsh surrounding the lake has been converted into rice paddies.

We did not meet the Ampandra village chief. He lived permanently in another rice field plantation outside Ampandra wetland.

We explained briefly to Mrs Christine and Mr Abdullah the goals of the Sakalava rail project, especially the importance of threatened species and the need to establish wetland management controls for sustainable use for the benefit of the local community and gave some posters to them. We also went to the Tanandava Bejofo primary school to distribute posters.

d). Lake Sahapy

Lake Sahapy is between Sambaokofa, Anafia and Maroabolay villages (Fig 1). There is a non-formal community group established with help of Water and Forest representative at Besalampy. The Association name is “Fikambanana Mpiaro Matsabory Sahapy (FIMISA; *Association of Sahapy Lake Management*). Members of FIMISA conducted surveys to control fishery activity in communities surrounding Lake Sahapy. Since September 2006, the Environment & Water and Forest representative at Besalampy and the Environmental Management Agency (SAGE; *Service d’Appui a la Gestion de l’Environnement*) have collaborated with FIMISA to set up conservation actions at Lake Sahapy in conjunction with the communities surrounding the wetland. The legal status of FIMISA need to be developed and approved legally by the Mayor of Sambaokofa Commune.

e). Public awareness at national level

During the 2nd Malagasy Birdfair from 27th to 29th October 2006 which at Parc Botanique et Zoologique de Tsimbazaza, I showed a poster describing the preliminary results of our Sakalava rail conservation biology study. The Sakalava rail project was considered an interesting example of an ASITY conservation initiative made by national and international collaboration.

III. Conservation biology study of Sakalava rail

3.1. Study areas

The Besalampy wetland complex is located in the middle of the west coast of Madagascar and belongs to the Melaky region of Mahajanga province. It is a combination of coastal habitat, fresh water lakes and dry forest. In 1999 the extreme north part of the complex was inventoried and designated and IBA, known as Cap Saint André¹⁴.

The survey sites were chosen to represent fresh water lakes between Manombo river near Ambohipaky village in the north and Maningoza river in the south. Sakalava rail occurs only at Lake Ampandra, Lake Sahapy and Lake Amparihy (Fig. 1) where dense *Phragmites* reeds and floating *Salvinia* sp. are present.

According to BirdLife International’s criteria for Important Bird Area (IBA) designation, the Besalampy wetland complex, including coastal area and lakes qualifies as a new IBA. More than 118 birds species were inventoried in the Besalampy wetland complex and surrounding dry forest nearby. 100% of wetland species limited to the western Malagasy Endemic Bird Area¹¹ and 8 to the 10 threatened species presents in the complex are water birds (see annexe III). The combination of Besalampy wetland complex and Cap St André sites make this area the highest priority IBA in mid western of Madagascar. In addition to the bird community, the threatened endemic fresh water turtle *Erymnochelys*

madagascariensis (Big headed turtle) classified as Endangered ¹³ is common at lakes Ampandra, Amparihy and Sahapy.

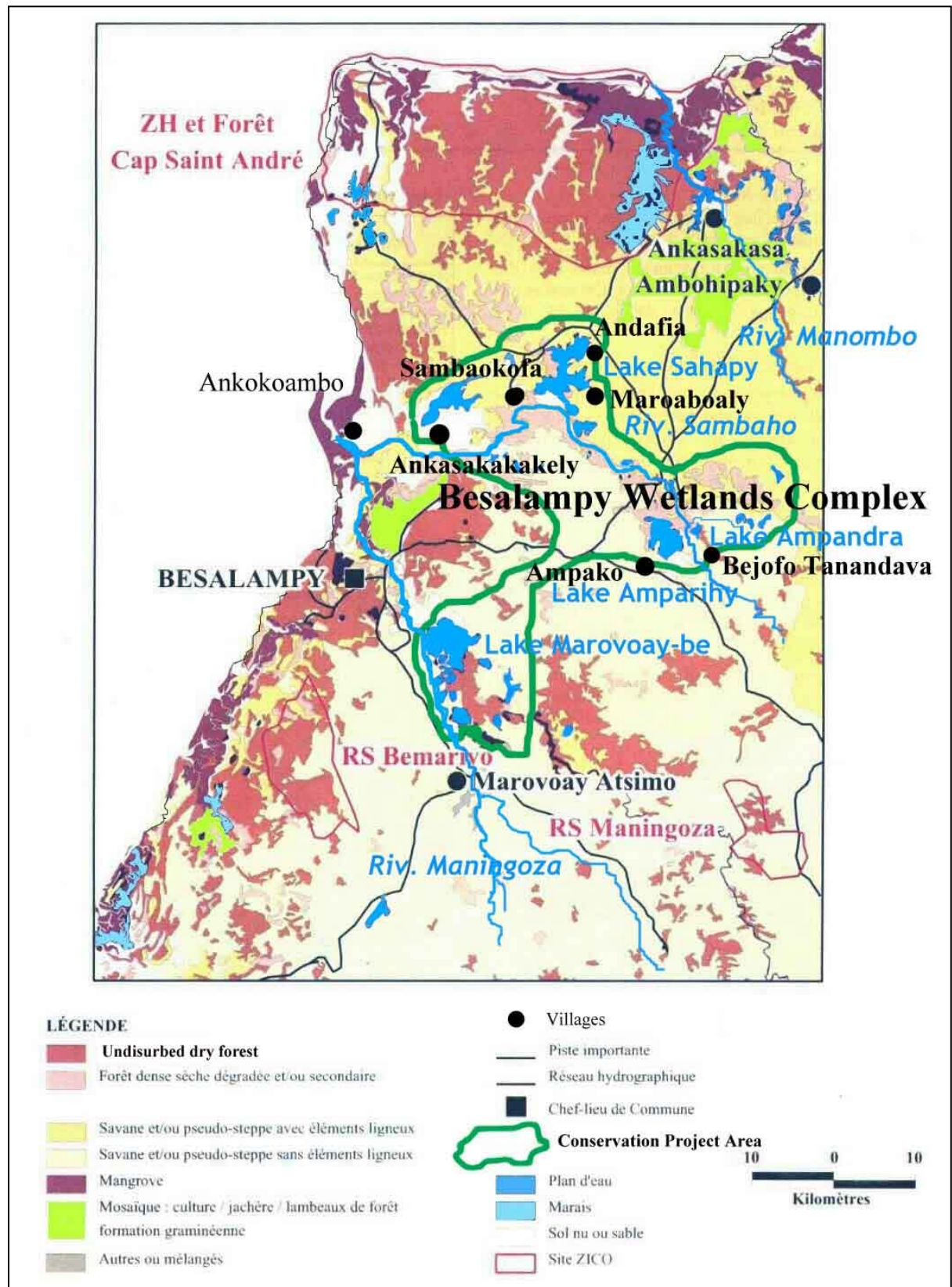


Figure 1 : Study area in the Besalampy wetland complex

3.2. Rail census

I conducted early morning bird census (0530-0830) and late afternoon (1700 to 1830) visits of *Phragmites* reeds using pirogue to observe Sakalava rail and to locate territorial pairs occurring in the study area. I used point counts, listening carefully for a typical call of the species, or direct observation of birds in the *Phragmites* reeds. I recognised Sakalava rail presence by its typical territory contact call “trirererererererererererererer” that can be heard in the distance even birds are hiding in inaccessible reeds. Upon each contact I recorded the number of individuals, sex if possible, age and geographical co-ordinates. I also measured the area of reeds in each study area using a GPS receiver.

To estimate the abundance of Sakalava rail pairs in each study site, I performed at least a two repeated morning or evening censuses within two days. Relative density of Sakalava rail was calculated as the number of individuals observed per unit area of reeds in the study area.

Depending on the area of reeds and the distances between each lake, I conducted a full census of Sakalava rail population 5-7 days per site. I worked from 23 to 27 October 2007 at Lake Ampandra, from 29 October to 05 November 2006 at Lake Amparihy and from 07 to 11 November at Lake Sahapy in the Besalampy wetland complex. During the last survey in 2003 the relative abundance for each site was not considered.

3.3. Population size

Table 1: Sakalava rail population size in Besalampy wetlands complex in 2003 and 2006.

| Year | | 2003 | | | |
|---------------|-----------------------------------|--------------------|-------------------|----------------------------|------------------|
| Site | Survey date | Visual observation | Marsh size (long) | Relative Abundance | Nest observation |
| Lake Ampandra | 15 Sept 2003 (one day) | 12 individuals | --- | --- | none |
| Lake Amparihy | 18 to 22 Sept 2003 (5days) | 21 individuals | --- | --- | none |
| Lake Sahapy | 22 -23 Sept 2003 (2 days) | 22 individuals | --- | --- | none |
| Year | | 2006 | | | |
| Lake Ampandra | 23 - 27 Oct 2006 (5 days) | 9 individuals | 1,21km | 7.438 ind/km ² | none |
| Lake Amparihy | 29 Oct to 05 Nov 2006 (8 days) | 39 individuals | 2.60km | 15.000 ind/km ² | 2 |
| Lake Sahapy | 07 to 11 Nov 2006 (5 days) | 3 individuals | 1.35km | 2.222 ind/km ² | none |

In 2006, a total of 51 individuals were observed at Besalampy wetland complex with a maximum population of 39 individuals at Lake Amparihy, 9 individuals at Lake Ampandra and only 3 individuals at Lake Sahapy. The number of individuals reported does not include chicks in any sites. Lake Amparihy appears to be the most favourable breeding and nesting habitat for Sakalava rail. This site holds the greatest population. I also observed evidence of two nests and four brooding pairs (Appendix 1).

This contrasts with the last survey done in 2003 by Mr Sama Zefania, in which 55 individuals were observed in the Besalampy wetlands complex. In 2003, Lake Sahapy was identified to hold an important population of Sakalava rail with 22 individuals⁷.

The difference in rail population recorded in 2003 and 2006 may be due to many factors including survey period duration, survey method and habitat quality. Habitat change and quality seem to have a significant impact on the Sakalava rail population at lake Sahapy in 2006, where we noticed a significant level of conversion of reed beds to rice fields, especially northeast of Maroaboaly village and southeast of Andafia village (Fig 1). According to villagers, the marsh areas were covered by dense *Phragmites* reeds three years ago.

3.4. Population movement

Marking methods

We established a long-term bird ringing survey by marking birds using Flat Band Cellulosic colour ring and numbered metallic rings from SAFRING.

Trapping methods

We tested two falling traps, but they were very complicated to design and unsuccessful in operation. To catch the Sakalava rail, we needed to find a territory occupied by a brooding pair with chicks, and then used two kinds of methods depending on habitat structure and accessibility: both methods require using dry shrimp scattered on mud, or on floating vegetation in the rail territory to as bait to attract the Sakalava rail for capture.

- Mist-netting

At the edge of the lake where *Phragmites* reeds is accessible by foot, we used Japan mist-net (9m wide to 2m high, 28mm mesh size). We extended it only 0.5m high and the base is touching the ground level. The mist-net is placed and extended on V form crossing in the marsh habitat, when rail are close to the netting area, we disturbed them carefully to go on the nesting direction. We only opened the mist-net in the morning (0600-0800) and removed rails immediately upon capture.

- Hand net

In very deep reeds habitat accessible only by pirogue, we designed a specific hand net (Fig 2). This hand mist net is easy to move in deep *Phragmites* reeds to catch foraging rails between 0.5m-2m from the net user.

We stayed for several minutes to an hour in known Sakalava rail territories. We dispersed dry shrimps in advance and placed the hand mist net horizontally on vegetation layer or water level. Sakalava rails were attracted by dry shrimps, started to peck on them to feed, and then were caught by covering them very carefully using hand mist net. For brooding Sakalava rail pairs it was possible to attract parents by catching chicks first.

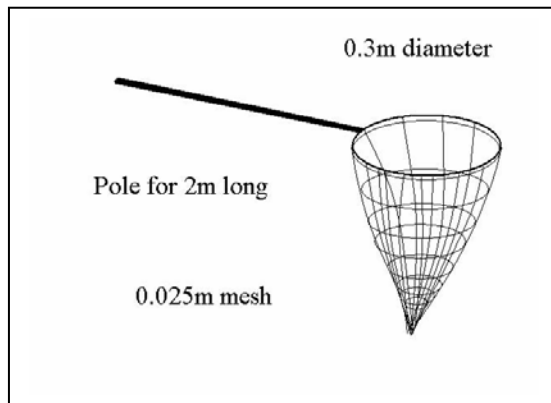


Figure 2: Hand mist net model



Figure 3 : Hand mist net preparation

Results

In all, we caught 7 Sakalava rails during the fieldwork from July to November 2006: one individual on July 28th 2006, one breeding pair and one brooding pairs with 2 chicks in November 2006. All ringed Sakalava rails are at Lake Amparihy site.

We only tested a plastic ring in July 2006 for one bird that we caught to test if the ring diameter and size is appropriate to Sakalava rail tarsus, and then observe the bird in October to know if we use the appropriate size. In November 2006, all caught birds are measured, blood sampled, ringed using numbered metallic rings and plastic coloured rings following the standard SAFRING procedure for bird ringing. Details of Sakalava rails ringed are given in the appendix I at the end of this document.

In 2006 we also set up our long-term wetland bird ringing program in the Besalampy wetland complex with a specific focus on the Sakalava rail population. We propose to extend this aspect of our research to other key breeding sites of Sakalava rail such as Lake Kinkony and Lake Mandrozo for the next 2 to 3 years with visits to observe previously ringed birds.

3.5. Breeding season and reproduction

Evidence of Sakalava rails nesting was found on 28 July 2006 at Lake Amparihy, in the Besalamapy wetland complex. According to the literature and my recent observation at Lake Amparihy, the breeding period appears to be very wide with almost 9 months: from July to March³. But the favourable reproduction season of this species is between September to November. All observations recorded from 2002 to 2006 at Lake Ampandra¹⁰, Lake Mandrozo Tambohorano⁷, Makary marsh at Lake Kinkony⁶ and during this November 2006 fieldwork at Lake Amparihy Besalampy are between September to November.

One active nest was observed from 3 to 6 November 2006 at Lake Amparihy (E 16° 42' 64'' S 44° 49' 34'') before the Sakalava rail pair started to lay. The nest was constructed in a deep tunnel of *Phragmites* reeds 0.7m above water level. The nest was 136.3mm long; 132.7mm wide and 66.5mm deep. The nest contained three pale creamy eggs with brown markings: 33.3mm x 26.5mm, 14.5g; 34.3mm x 27.3mm, 14.0g; 35.2mm x 26.9mm, 14.5g.

The nest was photographed on the second day of the survey (Fig 4). The nest structure was similar to our previous record at Makary marsh in Lake Kinkony two years ago⁶.



Figure 4: First photograph of Sakalava rail nest with 2 eggs (4 November 2006)

Four further brooding pairs with between one and three chicks were also observed at Lake Amparihy on November 2006. One of these brooding pairs were caught and ringed on 4 November 2006, see details in appendix 1.

Through our direct observation, chicks are vulnerable to predation during foraging on the floating vegetation where parents are busy feeding, and had less attention on the brood. Sakalava rails chicks often make very loud calls which might attract predators to the brood, but no evidence of predation was observed.

We noticed significant colour variation (sexual dichromatism) between male and female Sakalava rail. Previously the sexes were considered monomorphic^{4,12}.

Based on the two Sakalava rail pairs that we caught, males are smaller and thinner than females. We also observed copulation in two Sakalava rail pairs, where the smaller birds presumed to be males climbed on the bigger birds presumed to be females.

Sakalava rail males have rufous brown upperparts and very bright red tarsi. These characters are paler in females which have brown green upperparts and pale pink tarsi (figures: 5, 6a and 6b). Juveniles and females of Sakalava rails might be very similar. Additional data are needed to confirm this sexual dimorphism hypothesis in Sakalava rail such genetic sexing using DNA to reliably distinguish male and female or voice analysis of rail pairs.



Figure 5: Sakalava rail male (left) and female (right)



Figure 6 a b: Sakalava rail pair, male (left) and female (right)

3.6. Distribution

Sakalava rail have been recorded in the past between the Mahavavy river in the north and the upper Mangoky wetlands in the south¹². During the recent intensive surveys conducted from 2003 to 2005 in all coastal wetlands in western Madagascar, Sakalava rails occurred only in 5 wetlands sites: Lake Kinkony, Mitsinjo^{5, 9}, three lakes in Besalampy wetlands complex^{7,10}, and in Lake Mandrozo in the north of Maintirano¹⁵. These three lakes in the Besalampy wetland complex are very isolated to the rest of northern and southern Sakalava rail population by more than 200km (Figure 7).

The sakalava rail population in the southern of Morondava might be extinct locally, no observation were recorded since 1962, where nesting were confirmed in upper Mangoky wetland near Nosy Ambositra^{3,4}.

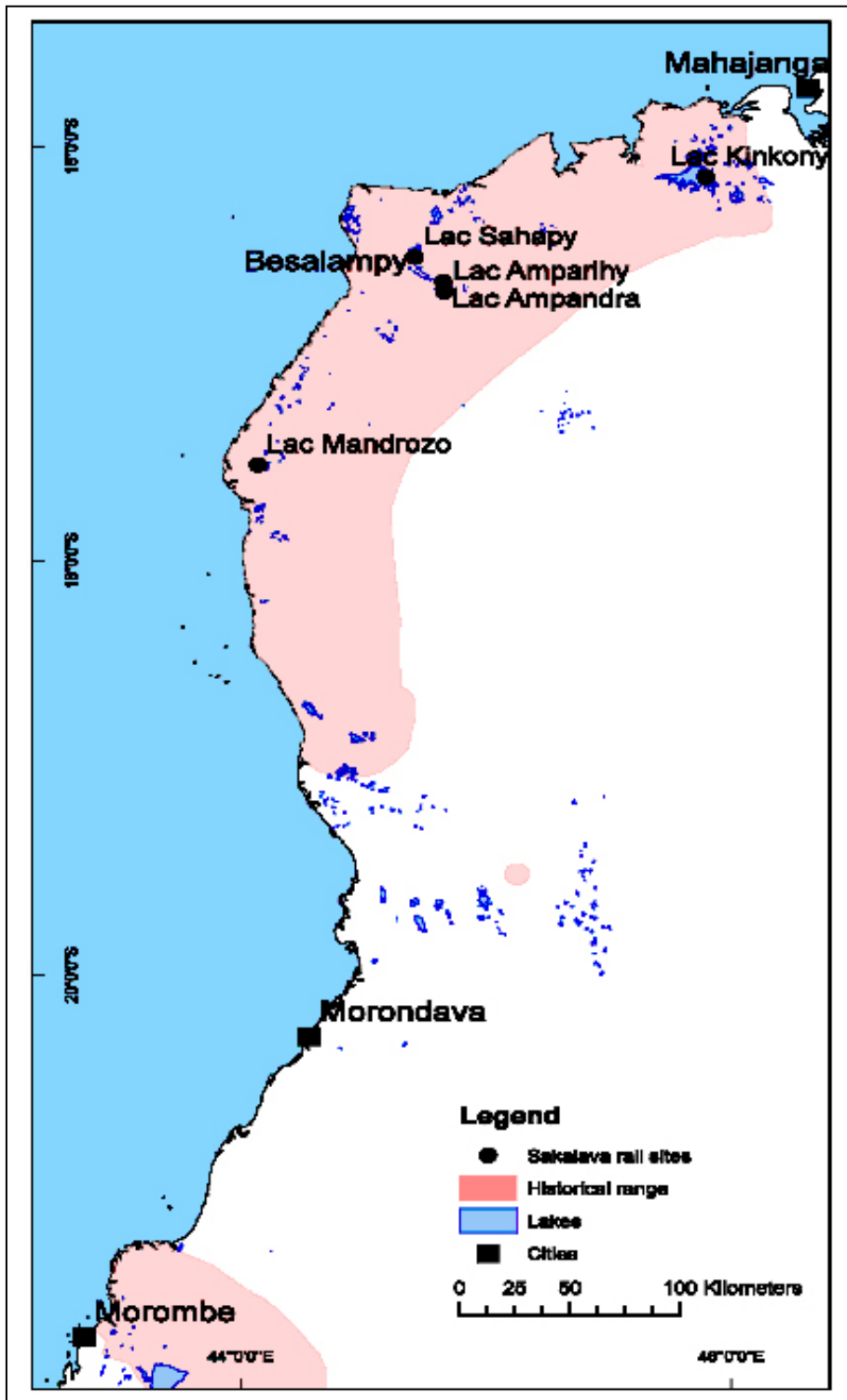


Figure 7: The actual geographical distribution of Sakalava rail in western of Madagascar

IV. Conclusion

The first phase of field work in July 2006 successfully established contacts with regional authorities in the Besalampy wetlands complex and delivered a public awareness campaign in communities surrounding the project area. The second survey in October-November 2006 focused on conservation biology, population census and ringing of the Sakalava rail

This survey provided the following new information concerning Sakalava rail natural history:

- Long breeding period with nesting evidence and brooding activities of several rail pairs were observed at Lake Amparihy in July, October and November 2006. Sakalava rail breeding period is very wide. But the reproductive success is too low, which might be explaining why this species appeared to be very rare in its natural habitat.
- Sakalava rails may be sexually dimorphic. Based on two pair of caught rails, females have generally pale brown-green upperparts and pale pink tarsi. Adult males have very intense rufous upper parts and bright red tarsi.
- Human disturbance and habitat loss by wetland conversion to rice field appear to have a significant negative effect on rail population size.

The ringing program that we set up in 2006 is very important in allowing us to understand long-term Sakalava rail population dynamics. By resighting of ringed birds in future, we may be able to identify whether exchange with other colonies surrounding Besalampy wetlands occurs or whether long distance migration takes place from other regions such as Lake Kinkony in the north or Lake Mandrozo in the south. Some birds have also already been ringed by our colleague Mr Sama Zefania at Lake Kinkony.

Two of three targeted Sakalava rail breeding sites in the Besalampy wetland complex have an optimistic fate in the near future due to community involvement in wetland management. This opportunity will help us to implement actions to afford long-term protection to wetlands in collaboration with community groups. These relationships established with our partners will serve also to promote wider biodiversity conservation, perhaps using the Sakalava rail as a flagship species. However local partners still need more support to manage and conserve the habitats for which they are responsible since these include some of the rarest undisturbed remaining wetlands in Madagascar. We recommend including the Besalampy wetland complex in Madagascar's protected area network within the next two years.

118 bird species were recorded in the Besalampy wetland complex including Cap Saint André IBA. The site contains 100% of waterbirds which occur in the Western Malagasy EBA, eight of which are threatened species.

The big-headed turtle *Erymnochelys madagascariensis* is a threatened endemic reptile which is common in lakes Ampandra, Amparihy and Sahapy. The big headed turtle is another flagship priority endemic species in western Malagasy wetlands which the Durrell Wildlife Conservation Trust Madagascar program try to save from extinction in his natural habitat.

Acknowledgments

This fieldwork at Besalampy wetland complex was possible due to a conservation award from the African Bird Club 'Sakalava rail conservation and public awareness project', with matching funding from the British Ecological Society Overseas Bursary to Sama Zefania 'Conservation biology of threatened Malagasy wetland birds'. We also thank the following people for their technical help and advice on this study: the two succeeded ASITY presidents Dr Ramanitra Narisoa and Ramanampamonjy Julien; Mr Sam The Seing, ASITY Vice President; Dr Réne de Rolland Lily Arison, ASITY treasurer; Dr Roger Safford, BirdLife International UK; Mr Peter Long and Dr Tamás Székely, University of Bath, UK; Dr Barry Taylor, University of Kwanza Zoulou Natal, South Africa; and Dr Dieter Oschadleus, SAFRING Avian demography unit, Cape Town, South Africa. We specifically thank Dr Steph Tyler, ABC conservation manager and John Caddick, ABC treasurer for their confidence in our work.

References

1. Birdlife International (2004) *Threatened birds of the world*. Cambridge, UK. : Birdlife International.
2. BirdLife International (2006) Species factsheet: *Amaurornis olivieri*. [<http://www.birdlife.org> accessed on 8/5/2006]
3. Collar, N.J. and Stuart , S.N (1985) *The Threatened Birds of Africa and Related Islands*. Cambridge, UK: International Council for Birds Preservation.
4. Langrand, O. (1990) *Guide des oiseaux de Madagascar*. Dealcheaux et Niestlé.
5. Rabenandrasana, M., Virginie, M.C., Sam T.S., Randrinarisoa, M., Zefania, S, Razafindrajaio F, Razafimahatratra, B, Ravelomanana, T, Raharivololoniaina L. (2004) *Evaluation écologique et identification des sites potentiels pour la conservation de la biodiversité des zones humides du complexe Mahavavy/Kinkony (Province de Majunga)*. Unpublished report available from BirdLife International Madagascar Programme, Antananarivo.
6. Rabenandrasana, M. (2004) *Etude sur la distribution, type d'habitat et menaces sur la population de (Amaurornis olivieri) dans les zones humides aux alentours du lac Kinkony et ses environs*. Unpublished report available from Conservation International and BirdLife International Madagascar Programme. Antananarivo.
7. Rabenandrasana, M., Zefania S.(2005) Population size, distribution, habitat use and threats of Sakalava rail *Amaurornis olivieri* surveyed between Mahajanga and Toliary, Western Madagascar (August 2003 – April 2004). Final rapport available at Conservation International Madagascar and ASITY (Malagasy Bird Club). Antananarivo.
8. Rabenandrasana, M., Zefania S., Long. P & Szekely T.(2006) *Survey on population size, distribution, threat and habitat of Sakakava rail Amaurornis olivieri in western Madagascar*. Ligue Malgache pour la protection des Oiseaux, University of Antananarivo, Bath Univeristy U.K. poster presentation at the 24th Ornithological Congress August 2006. Hamburg Germany.

9. Rand, A.L. (1936) A summary of the field notes of the Mission Zoologique Franco-Anglo-Américaine à Madagascar: The distribution and habits of Madagascar birds. *Bull. Amer. Mus. Nat. Hist.* **27**: 134-499.
10. Robertson, I. (2004). First-ever photographs of Sakalava rail *Amaurornis olivieri* and first detailed observations since 1962. *Bulletin of African Bird Club.* 11(1): 18-21
11. Stattersfield, A., Crosby, M. J., Long, A. J., & Wege, D.C. (1998) *Endemic Bird Areas of the World: priorities for biodiversity conservation.* BirdLife International, Cambridge, U.K. BirdLife Conservation series No 7. pp330-341.
12. Taylor, B. & Van Perlo, B. (1999) *Rails: A guide to the rails, gallinules and coots of the world.* Pica Press.
13. UICN. (2004) Threatened vertebrates list, reptiles and mammals groups. www.uicn.org
14. ZICOMA. (1999). Les Zones d'Importance pour la Conservation des Oiseaux à Madagascar. Direction des Eaux et Forêts, Association pour la Gestion des Aires Protégées et BirdLife International. Graphoprint, Antananarivo.
15. Zefania S., Long. P & Szekely T & Richard fFrench Constant. Conservation Biology of endangered wetland birds in Madagascar. University of Antananarivo, Bath University U.K. poster presentation at the 24th Ornithological Congress August 2006. Hamburg Germany

Appendix I

Sakalava rails ringed at Besalampy wetland complex western Madagascar.

| date | Bird age and sex | GPS coordinate | Site location | SAFRING reference | Colour ring code |
|-------------------|-----------------------------|--------------------------------|---|--------------------------|-------------------------|
| 30/07/06 11h51 | Pully chick (2 weeks) | S16° 42 23, E 44° 49 49'' | Eastern of Lake Amparihy, Besalampy | ---- | --- , YL |
| 31/10/06 07h20 | Male breeding adult | S16° 42 09'', E 44° 49 16'' | Eastern of Lake Amparihy, Besalampy | 5H 47 801 | DB DB, LB |
| 31/10/06 07h20 | Female breeding adult | S16° 42 09'', E 44° 49 16'' | Eastern of Lake Amparihy, Besalampy | 5H 47 802 | DB LB, LB |
| 04/11/06 11h20 | Pully chick (2 weeks) | S16° 41 47'', E 44° 48 58'' | Northern of Lake Amparihy, Besalampy | 5H 47 805 | YL DB, LB |
| 04/11/06 11h29 | Pully chick (2 weeks) | S16° 41 47'', E 44° 48 58'' | Northern of Lake Amparihy, Besalampy | 5H 47 804 | LG DB, LB |
| 04/11/06 11h30 | Male breeding adult | S16° 41 47'', E 44° 48 58'' | Northern of Lake Amparihy, Besalampy | 5H 47 806 | YL YL, LB |
| 04/11/06 11h30 | Female breeding adult | S16° 41 47'', E 44° 48 58'' | Northern of Lake Amparihy, Besalampy | 5H 47 803 | LP DB, DB |

Colour ring code

| | |
|------------------------|-----------------------------|
| RD Red | OR Orange |
| YL Yellow | MP Mauve=purple |
| LG Light Green | WH White |
| MG Medium Green | DP Dark Pink=magenta |
| DG Dark Green | BL Black |
| LB Light Blue | LP Light Pink |
| DB Dark Blue | HP Hot Pink |

Appendix II
Sakalava rail recorded in Besalampy wetland complex (October-November 2007)

| Locality name | Date and time | GPS co-ordinates | Number | Notes |
|--|-------------------|-------------------------|-----------|--|
| Lake Ampandra Near Tanandava Bejofo village, Besalampy | 23/10/06 8h26 | S16° 39 32" E44° 49 36" | 2 | Breeding pair nest construction |
| | 9h 28 | S16° 39 35" E44° 49 28" | 1 | Juvenile |
| | 24/10/06 6h29 | S16° 39 27" E44° 49 37" | 2 | Breeding pair feeding |
| | 7h 10 | S16° 39 27" E44° 49 32" | 2 | Breeding pair feeding |
| | 8h 19 | S16° 39 19" E44° 49 35" | 2 | Breeding pair feeding |
| | | | 9 | Total |
| Lake Amparihy Marsh near Parikazy village | 30/10/06 16h26 | S16° 42 64" E44° 49 34" | 4 | Breeding pair 2 juveniles |
| | 16h50 | S16° 42 07" E44° 49 11" | 1 | Solitary adult Foraging on floating marsh |
| | 17h09 | S16° 42 12" E44° 49 21" | 2 | Breeding pair nesting |
| Lake Amparihy Marsh near Parikazy village | 31/10/06 07h12 | S16° 42 09" E44° 49 16" | 2 | Breeding pair nest construction |
| | 31/11/06 08h54 | S16° 42 01" E44° 49 09" | 2 | Breeding pair feeding |
| Northern zone Lake Amparihy Marsh near Anosindravato village | 02/11/06 09h51 | S16° 41 45" E44° 48 42" | 2 | Breeding pair feeding |
| | 10h35 | S16° 41 55" E44° 48 17" | 2 | Brooding pair Feeding two chicks |
| | 10h39 | S16° 41 55" E44° 48 18" | 2 | Brooding pair Feeding three chicks |
| | 10h50 | S16° 41 49" E44° 48 16" | 4 | Breeding pair Territory dispute with another sympatric breeding pair |
| | 10h52 | S16° 41 47" E44° 48 17" | 2 | Breeding pair feeding |
| | 11h24 | S16° 41 48" E44° 48 19" | 2 | Breeding pair feeding |
| | 12h31 | S16° 41 42" E44° 48 56" | 2 | Breeding pair feeding |
| Northern zone Lake Amparihy Marsh near Anosindravato village | 04/11/06 05h34 | S16° 42 03" E44° 49 12" | 2 | Breeding pair feeding |
| | 05h59 | S16° 42 03" E44° 49 09" | 2 | Breeding pair feeding |
| | 07h29 | S16° 42 64" E44° 49 34" | 2 | Breeding pair Clutching 3 eggs |
| | 08h04 | S16° 42 09" E44° 49 47" | 2 | Breeding pair feeding |
| | 09h20 | S16° 41 45" E44° 48 54" | 2 | Brooding pair Feeding two chicks |
| | 9h36 | S16° 41 45" E44° 48 54" | 2 | Brooding pair Feeding two chicks |
| | | | 39 | total |
| Lake Sahapy Near Maroaboaly (Antongomena) | 07/11/06 07h17 | S16° 32 25" E44° 41 14" | 0 | |
| | 07h45 | S16° 32 09" E44° 40 59" | 0 | |
| Lake Sahapy Marsh near Andafia village | 09/11/06 07h17 | S16° 32 26" E44° 41 59" | 3 | Breeding pair with one juvenile |
| | 08h12 | S16° 32 17" E44° 41 35" | 0 | Breeding pair with one juvenile |
| | | | 3 | Total |
| Total Sakalava rail population size | | | 51 | Pulleys chicks are not included |

Appendix III
Birds species and other threatened vertebrates group recorded in the Besalampy wetland complex

| | Species | English names | Statut | IUCN status | Lake Ampantra | Lake Amparihy | Lake Sahapy | Ankokoambo Estuary | Cap St Andre IBA |
|----|--------------------------------|--------------------------------------|---------------|--------------------|------------------|------------------|----------------|-----------------------|---------------------------|
| 1 | <i>Tachybaptus ruficollis</i> | Little grebe or Dabchick | B | | | 1 | | | |
| 2 | <i>Tachybaptus pelzelinii</i> | Madagascar little Grebe | E | Vulnerable | | | | | 1 |
| 3 | <i>Phalacrocorax africanus</i> | Reed Cormorant | B | | 1 | 1 | 1 | | 1 |
| 4 | <i>Anhinga melanogaster</i> | African Darter | B | | 1 | 1 | 1 | | 1 |
| 5 | <i>Ixobrychus minutus</i> | Little Bittern | B | | 1 | 1 | 1 | | |
| 6 | <i>Nycticorax nycticorax</i> | Black-crowned night Heron | B | | 1 | 1 | 1 | 1 | 1 |
| 7 | <i>Ardeola ralloides</i> | Squacco Heron | B | | 1 | 1 | 1 | | 1 |
| 8 | <i>Ardeola idae</i> | Madagascar squacco Heron | M,B | Endangered | 1 | 1 | 1 | | |
| 9 | <i>Bubulcus ibis</i> | Cattle Egret | B | | 1 | 1 | 1 | 1 | 1 |
| 10 | <i>Butorides striatus</i> | Green-backed Heron or Striated Heron | B | | 1 | 1 | 1 | 1 | 1 |
| 11 | <i>Egretta ardesiaca</i> | Black Egret | B | | 1 | 1 | 1 | | 1 |
| 12 | <i>Egretta dimorpha</i> | Dimorphic Egret | B | | 1 | | 1 | 1 | 1 |
| 13 | <i>Egretta alba</i> | Great Egret | B | | 1 | 1 | 1 | 1 | 1 |
| 14 | <i>Ardea purpurea</i> | Purple Heron | B | | 1 | 1 | 1 | | 1 |
| 15 | <i>Ardea cinerea</i> | Gray Heron | B | | 1 | 1 | 1 | 1 | |
| 16 | <i>Ardea humbloti</i> | Humblot's Heron | E | Endangered | 1 | 1 | 1 | 1 | |
| 17 | <i>Scopus umbretta</i> | Hamerkop | B | | | 1(*) | 1(*) | | 1 |
| 18 | <i>Mycteria ibis</i> | Yellow-billed Stork | B | | | 1 | 1 | 1 | 1 |
| 19 | <i>Anastomus lamelligerus</i> | African Openbill Stork | B | | 1 | 1 | 1 | | |
| 20 | <i>Threskiornis bernieri</i> | Madagascar sacred Ibis | B | Endangered | | | 1 | 1 | 1 |
| 21 | <i>Plegadis falcinellus</i> | Glossy Ibis | B | | 1 | 1 | 1 | | |
| 22 | <i>Lophotibis cristata</i> | Madagascar crested Ibis | E | Near Threatened | | | | | 1 |
| 23 | <i>Platalea alba</i> | African Spoonbill | B | | | 1 | | | 1 |
| 24 | <i>Phoenicopterus ruber</i> | Greater Flamingo | M | | | | | 1 | |
| 26 | <i>Dendrocygna viduata</i> | White-faced whistling Duck | B | | 1 | 1 | 1 | 1 | 1 |
| | <i>Thalassornis leuconotus</i> | White-backed Duck | B | | | | | | 1 |
| 27 | <i>Sarkidiornis melanotos</i> | Knob-billed Duck | B | | 1 | 1 | 1 | | 1 |
| 28 | <i>Nettapus auritus</i> | African Pygmy Goose | B | | 1 | 1 | 1 | | 1 |
| 29 | <i>Anas bernieri</i> | Bernier's Teal | E | Endangered | | | | 1 | |
| 30 | <i>Anas erythrorhyncha</i> | Red-billed Teal | B | | 1 | 1 | 1 | 1 | |

Continue appendix III

| | | | | | | | | | |
|----|---------------------------------|-------------------------|---|-----------------|------|------|------|------|---|
| 31 | <i>Anas hottentota</i> | Hottentot Teal | B | | 1 | 1 | | | |
| 32 | <i>Milvus aegyptius</i> | Yellow-billed Kite | B | | 1 | 1 | 1 | 1 | 1 |
| 33 | <i>Haliaeetus vociferoides</i> | Madagascar fish-eagle | E | Critique | | 1 | 1 | | 1 |
| 34 | <i>Polyboroides radiatus</i> | Madagascar Harrier-hawk | E | | 1(*) | 1(*) | 1(*) | 1(*) | 1 |
| 35 | <i>Accipiter francesiae</i> | Frances's Sparrowhawk | B | | | | | | 1 |
| 36 | <i>Accipiter henstii</i> | Henst's Goshawk | E | Near Threatened | 1(*) | | | | |
| 37 | <i>Buteo brachypterus</i> | Madagascar Buzzard | E | | 1(*) | 1(*) | 1(*) | | 1 |
| 38 | <i>Falco newtoni</i> | Masdagascar Kestrel | B | | 1(*) | 1(*) | 1(*) | 1(*) | 1 |
| 39 | <i>Turnix nigricollis</i> | Madagascar Buttonquail | E | | | | | | 1 |
| 40 | <i>Numida meleagris</i> | Helmeted Guineafowl | I | | 1(*) | 1(*) | 1(*) | | 1 |
| 41 | <i>Dryolimnas cuvieri</i> | White-throated rail | B | | 1 | 1 | 1 | 1 | 1 |
| 42 | <i>Amaurornis olivieri</i> | Sakalava rail | E | Endangered | 1 | 1 | 1 | | |
| 43 | <i>Porzana pusilla</i> | Baillon's crake | B | | 1 | 1 | 1 | | |
| 44 | <i>Porphyrio porphyrio</i> | Purple Swampphen | B | | 1 | 1 | 1 | | |
| 45 | <i>Porphyryla alleni</i> | Allen's gallinule | B | | 1 | 1 | 1 | | |
| 46 | <i>Gallinula chloropus</i> | Common Morhen | B | | 1 | 1 | 1 | | 1 |
| 47 | <i>Actophilornis albinucha</i> | Madagascar jacana | E | | 1 | 1 | 1 | | 1 |
| 48 | <i>Rostratula benghalensis</i> | Greater painted snipe | B | | 1 | 1 | 1 | | |
| 49 | <i>Himantopus himantopus</i> | Black-winged stilt | B | | 1 | 1 | 1 | 1 | 1 |
| 50 | <i>Dromas ardeola</i> | Crab plover | M | | | | | 1 | |
| 51 | <i>Charadrius hiaticula</i> | Common ringed plover | M | | | | | 1 | 1 |
| 52 | <i>Charadrius pecuarius</i> | Kittlitz's plover | B | | | 1 | | 1 | 1 |
| 53 | <i>Charadrius thoracicus</i> | Madagascar plover | E | Vulnerable | | | | 1 | |
| 54 | <i>Charadrius tricollaris</i> | Three-banded plover | B | | 1 | 1 | 1 | | 1 |
| 55 | <i>Charadrius marginatus</i> | White-fronted plover | B | | | | | 1 | 1 |
| 56 | <i>Charadrius leschenaultii</i> | Gravelot de Leschenault | M | | | | | | 1 |
| 57 | <i>Limosa limosa</i> | Black-tailed godwit | V | | | | | | 1 |
| 58 | <i>Limosa lapponica</i> | Bar-tailed godwit | M | | | | | | 1 |
| 59 | <i>Numenius phaeopus</i> | Whimbrel | M | | | | | 1 | |
| 60 | <i>Tringa nebularia</i> | Common greenshank | M | | 1 | 1 | | 1 | |
| 61 | <i>Xenus cinereus</i> | Terek sandpiper | M | | | | | 1 | 1 |
| 62 | <i>Actitis hypoleucos</i> | Common sandpiper | M | | 1 | 1 | 1 | 1 | 1 |
| 63 | <i>Calidris alba</i> | Sanderling | M | | | 1 | | 1 | |
| 64 | <i>Sterna caspia</i> | Caspian tern | B | | | 1 | 1 | 1 | |
| 65 | <i>Sterna bergii</i> | Greater-crested tern | B | | | | | 1 | |

Continue appendix III

| | | | | | | | | | |
|-----|-------------------------------------|-----------------------------|-----|--|------|------|------|------|---|
| 66 | <i>Sterna bengalensis</i> | Lesser-crested tern | M | | | | | 1 | |
| 67 | <i>Chlidonias hybridus</i> | Whiskered tern | B | | 1 | 1 | 1 | | |
| 68 | <i>Pterocles personatus</i> | Madagascar Sandgrouse | E | | 1(*) | 1(*) | | 1 | |
| 69 | <i>Streptopelia picturata</i> | Madagascar turtle Dove | B | | 1 | 1 | 1 | | 1 |
| 70 | <i>Oena capensis</i> | Namaqua Dove | B | | 1(*) | 1(*) | 1(*) | 1(*) | 1 |
| 71 | <i>Treron australis</i> | Madagascar green Pigeon | B | | 1(*) | 1(*) | | | |
| 72 | <i>Coracopsis vasa</i> | Greater Vasa parrot | B | | | | | | 1 |
| 73 | <i>Coracopsis nigra</i> | Lesser Vasa parrot | B | | 1(*) | 1(*) | | | 1 |
| 74 | <i>Agapornis cana</i> | Gray-headed Lovebird | E | | 1(*) | 1(*) | | | 1 |
| 75 | <i>Cuculus rochii</i> | Madagascar lesser Cuckoo | M,B | | 1(*) | 1(*) | 1 | | 1 |
| 76 | <i>Coua gigas</i> | Giant Coua | E | | | | | | 1 |
| 77 | <i>Coua cursor</i> | Running Coua | E | | 1(*) | | | | 1 |
| 78 | <i>Coua coquereli</i> | Coquerel's Coua | E | | | | | | 1 |
| 79 | <i>Coua ruficeps</i> | Red-capped Coua | E | | 1(*) | | | | 1 |
| 80 | <i>Coua cristata</i> | Crested Coua | E | | 1(*) | 1(*) | | | 1 |
| 81 | <i>Centropus toulou</i> | Madagascar Coucal | B | | 1 | 1 | 1 | | 1 |
| 82 | <i>Otus madagascariensis</i> | Western scops owl | E | | | 1 | 1 | | 1 |
| 83 | <i>Asio madagascariensis</i> | Madagascar owl | E | | | | | | 1 |
| 84 | <i>Ninox supercilialis</i> | White-browed owl | E | | | 1(*) | | | |
| 85 | <i>Caprimulgus madagascariensis</i> | Madagascar nightjar | B | | 1(*) | 1(*) | 1(*) | | 1 |
| 86 | <i>Zoonavena grandidieri</i> | Malagasy spine-tailed swift | E | | | | | | 1 |
| 87 | <i>Cypsiurus parvus</i> | African palm swift | B | | 1(*) | 1(*) | 1(*) | | |
| 88 | <i>Alcedo vintsioides</i> | Malagasy kingfisher | B | | 1 | 1 | 1 | 1 | 1 |
| 89 | <i>Merops superciliosus</i> | Madagascar bee-eater | B | | 1(*) | 1(*) | 1(*) | 1(*) | 1 |
| 90 | <i>Eurystomus glaucurus</i> | Broad-billed roller | M,B | | 1(*) | 1(*) | 1(*) | | 1 |
| 91 | <i>Leptosomus discolor</i> | Cuckoo-roller | B | | 1(*) | 1(*) | | | 1 |
| 92 | <i>Upupa marginata</i> | Hoopoe | E | | 1(*) | | 1 | | 1 |
| 93 | <i>Mirafra hova</i> | Madagascar bush lark | E | | | 1(*) | | | 1 |
| 94 | <i>Motacilla flaviventris</i> | Madagascar wagtail | E | | 1(*) | 1(*) | 1(*) | 1 | 1 |
| 95 | <i>Hypsipetes madagascariensis</i> | Madagascar bulbul | B | | 1(*) | 1(*) | 1(*) | | 1 |
| 96 | <i>Berniera madagascariensis</i> | Long-billed greenbul | E | | 1(*) | | | | 1 |
| 97 | <i>Copsychus albospectularis</i> | Madagascar magpie-robin | E | | 1(*) | 1(*) | 1(*) | | 1 |
| 98 | <i>Nesillas typica</i> | Madagascar bush-warbler | B | | 1(*) | 1(*) | 1(*) | | 1 |
| 99 | <i>Acrocephalus newtoni</i> | Madagascar swamp-warbler | E | | 1 | 1 | 1 | | |
| 100 | <i>Newtonia brunneicauda</i> | Common newtonia | E | | 1(*) | 1(*) | | | 1 |

Continue appendix III

| | | | | | | | | | |
|--|---------------------------------------|--------------------------------|---|------------|----------------------------|------|------|----|----|
| 101 | <i>Cisticola cherina</i> | Madagascar cisticola | E | | 1(*) | | | | 1 |
| 102 | <i>Neomixis tenella</i> | Common jery | E | | 1(*) | 1(*) | 1(*) | | 1 |
| 103 | <i>Neomixis striatigula</i> | Stripe-throated jery | E | | 1(*) | | | | |
| 104 | <i>Terpsiphone mutata</i> | Madagascar paradise flycatcher | B | | 1(*) | 1(*) | 1(*) | | 1 |
| 105 | <i>Nectarinia souimanga</i> | Souimanga sunbird | B | | 1(*) | 1(*) | 1(*) | 1 | 1 |
| 106 | <i>Nectarinia notata</i> | Long-billed green sunbird | E | | 1(*) | | | | 1 |
| 107 | <i>Zosterops maderaspatanus</i> | Madagascar white-eye | B | | 1(*) | 1(*) | 1 | | |
| 108 | <i>Calicalicus madagascariensis</i> | Red-tailed Vanga | E | | 1(*) | | | | |
| 109 | <i>Vanga curvirostris</i> | Hook-billed Vanga | E | | 1(*) | 1(*) | 1(*) | | 1 |
| 110 | <i>Falcoea palliata</i> | Sickle-billed Vanga | E | | 1(*) | 1(*) | 1(*) | | 1 |
| 111 | <i>Leptopterus viridis</i> | White-headed Vanga | E | | 1(*) | 1(*) | 1(*) | | 1 |
| 112 | <i>Leptopterus chabert</i> | Chabert's Vanga | E | | | | | | |
| 113 | <i>Dicrurus forficatus</i> | Crested drongo | B | | 1(*) | 1(*) | 1(*) | 1 | 1 |
| 114 | <i>Corvus albus</i> | Pied crow | B | | 1(*) | 1(*) | 1(*) | | 1 |
| 115 | <i>Acridotheres tristis</i> | Common Myna | I | | 1(*) | 1(*) | 1(*) | | |
| 116 | <i>Ploceus sakalava</i> | Sakalava Weaver | E | | 1(*) | 1(*) | 1(*) | | 1 |
| 117 | <i>Foudia madagascariensis</i> | Madagascar red Foudy | B | | 1 | 1(*) | 1(*) | | 1 |
| 118 | <i>Lonchura nana</i> | Madagascar Mannikin | E | | | 1(*) | 1(*) | | 1 |
| Birds species richness | | | | | 81 | 83 | 71 | 38 | 82 |
| Water birds | | | | | 36 | 43 | 39 | 29 | 34 |
| Threatened species | | | | | 7 | 9 | 7 | 4 | 6 |
| Other threatened vertebrates groups | | | | | | | | | |
| Reptiles | | | | | | | | | |
| | <i>Boa madagascariensis</i> | Western Madagascar boa | E | Vulnerable | 1 | 1 | | | 1 |
| | <i>Erymnochelys madagascariensis</i> | Big headed turtle | E | Endangered | 1 | 1 | 1 | | |
| Primates | | | | | | | | | |
| | <i>Hapalemur griseus occidentalis</i> | Western grey Bamboo Lemur | E | Vulnerable | | | | | 1 |
| | <i>Propithecus verreauxi dekceni</i> | Decken's Sifaka | E | Vulnerable | 1 | | | | 1 |
| Lake Ampandra | | | | | S16° 39-42 ; E44° 49-50 | | | | |
| Lake Amparihy | | | | | S16° 41-42 ; E44° 48-49 | | | | |
| Lake Sahapy | | | | | S16° 31-32 ; E44° 41-42 | | | | |
| Ankokoambo Estuary | | | | | S16° 32-36 ; E44° 25-29 | | | | |
| Cap St Andre IBA | | | | | S16° 11-20 ; E44° 26-45°00 | | | | |
| B, breeding; E, endemic; I, introduced; M, migrant; V, vagrant , (*), woodland or dry forest remnants nearby | | | | | | | | | |

