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Capa: Primeiro registro para a América do Sul do codornizão *Crex crex* (Rallidae; foto de Kleber de Burgos), obtido na Ilha de Fernando de Noronha, estado de Pernambuco. Nesta edição, Burgos & Olmos apresentam e discutem este primeiro registro para a avifauna Neotropical.

Cover: First documented South American record of the Corncrake *Crex crex* (Rallidae; photo by Kleber de Burgos), obtained on the Island of Fernando de Noronha, state of Pernambuco, Brazil. In this issue, Burgos & Olmos present and discuss this unprecedented record for the Neotropics.

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ARTICLE

Rhamphotheca removal by a potassium thioglycolate based solution – a complementary technique for complete cleaning of delicate passerine skulls

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ABSTRACT: The horny sheath known as rhamphotheca covers at least partially four bones of upper maxilla and two from mandible, precluding the observation of their structures and hindering proper osteological studies of the beak. The two main methods currently used for skeleton preparation, viz. the use of dermestid beetles and maceration, can effectively remove the rhamphotheca, however, with possible drawbacks to the material and lasting long to clean it entirely. We developed a new method to remove the rhamphotheca by using a potassium thioglycolate plus calcium hydroxide plus urea based solution (commercially available as chemical depilatory creams), which breaks sulfide bridges of keratin thus softening this structure. Results of our tests with 69 passerine skulls suggest the more efficient proceeding is to apply the cream on bill with intervals of one to two hours, repeating these applications during four to seven hours and then rinsing the material. The remains of rhamphotheca and subjacent dermis can be removed easily with tweezers while the material is still wet. This new method does not damage the material and can be applied in skulls already deposited in osteological collections, besides being faster than the other methods, allowing the removal of the rhamphotheca in less than one day.

KEY-WORDS: chemical depilatory cream, jaw bones, osteological preparation, *Palatum osseum*, horny sheath.

INTRODUCTION

The horny covering of the beak of birds, known as rhamphotheca, is a thick, modified integument, which consists of layers of flattened epidermal cells filled with beta-keratin. These cells also exhibit mineralization, characterized by deposits of calcium salts (*e.g.* calcium phosphate as hydroxyapatite crystals) between the keratin proteins in the cytoplasm, which promote the increase of rhamphotheca strength (Lucas & Stettenheim 1972, Spearman & Hardy 1985, Stettenheim 2000). The rhamphotheca hardness, thickness and flexibility vary among different avian groups and even along the length of a single bill (Lucas & Stettenheim 1972). Subjacent to this external sheath of hard-cornified tissue and separating it from the upper and lower jaw bones, there is a thin and fibrous (Spearman & Hardy 1985) but dense and highly vascularized dermis, that becomes thicker near the tip of the bill (Van Hemert *et al.* 2011). The limits between this dermal tissue and the underlying periosteum, in some cases, are not clearly distinguishable (Van Hemert *et al.* 2011).

The rhamphotheca is composed by two subunits, the rhinotheca and the gnathotheca, which cover both inside and outside surface of most bones forming the upper and the lower maxillae, respectively (Van Hemert *et al.* 2011). The rhinotheca hides completely the *Os premaxillare* and the rostral portions of the *Ossa nasale, maxillare et palatinum*, while the gnathotheca occults at least the rostral halves of the *Ossa dentale et spleniale*, totalizing six bones of impaired visualization (Jollie 1957, A. G. *pers. obs.*). Accordingly, the presence of an intact rhamphotheca on bird skull has always been a limiting factor for osteological studies comprising any of these bones by precluding the complete observation of their structures such as grooves, foramina and processes (*e.g.* Bock 1960).

The two main methods currently used in osteological collections for cleaning skeletons – bacterial maceration and use of dermestid beetles (Dermestidae: *Dermestes* spp.), the latter considered more efficient and effective (Williams & Rogers 1989) and preferred for the preparation of articulate skulls (Alvarenga 1992)

– can effectively remove the rhamphotheca, however with possible drawbacks to the material: maceration techniques, based on the rotting process of tissues of the carcass immersed in water by bacterial action (Hamon 1964), do separate the horny sheath from the subjacent bones (Woolfenden 1970), but produce completely disarticulated skeletons and cannot be used in immature birds (Hamon 1964); during the skeleton preparation at dermestid colonies, which clean the bones while feeding on the soft tissues of dry carcasses (Sommer & Anderson 1974), the larvae are capable to eat and remove the rhamphotheca but, through their random action, commonly attack and destroy bones before consuming the corneous covering (A. G. *pers. obs.*). The negative effects of both methods – promoted by the prolonged exposure often necessary to remove the rhamphotheca completely – are even worse to small and fragile skulls, such as those found in Passeriformes. In addition, both procedures take a long time to remove the entire corneous sheath, and in the case of using dermestids, this time can be quite unpredictable (A. G. *pers. obs.*).

Another limitation to the use of these methods to remove rhamphotheca is that they can hardly be applied to skulls of osteological collections, already cleaned but still retaining this horny sheath. The risks and drawbacks of these methods would affect more severely this kind of material, even more fragile with resected membranes of connective tissue and lacking soft tissues to protect it: dermestid larvae could cause a more intense damage to already exposed delicate bones and maceration would promote a complete disarticulation of palatine bones and other non-fused structures before the time needed to remove the rhamphotheca (A. G. *pers. obs.*).

We developed a complementary method to remove the rhamphotheca of skulls already cleaned by the use of dermestid beetles. The new technique is based on the action of a solution containing potassium thioglycolate, calcium hydroxide and urea – commercially available as chemical depilatory creams for hair removal –, which softens and permeabilizes quickly and efficiently the entire rhamphotheca. This product does not damage even small and delicate skulls (*e.g.* passerines) and can be applied to old skeletal material deposited in osteological collections, besides permitting the cleaning of many skulls at the same time.

MATERIAL AND METHODS

We used in our tests 69 passerine skulls (already cleaned of soft tissues by dermestid colonies, but with the rhamphotheca still intact) deposited at the collection of the Laboratório de Ornitologia of the Universidade Federal do Rio de Janeiro (Appendix). These skulls present a great range of total size and beak length, varying respectively from 26.00 mm (*Xenops rutilans*) to 76.00 mm (*Xiphocolaptes albicollis*) and from 11.40 mm (*Xenops rutilans*) to 50.00 mm (*Xiphocolaptes albicollis*). Their time in the collection also varies, being the oldest skulls prepared in 1995 and the newest ones, in the same week of our tests.

The substance formula used in our tests, found as a chemical depilatory product in the form of a white thick cream, presents three key active ingredients: potassium thioglycolate – $C_2H_4O_2S.K$, at a concentration of 9.5% to 10% –, calcium hydroxide – $Ca(OH)_2$, at a concentration of 3.5% to 4% – and urea 46% – CH_4N_2O, at a concentration of 7% to 9% (Reckitt Benckiser 2009, Abrutyn 2011). Potassium thioglycolate (just as thioglycolic acid and other alkaline salts derived from it) acts breaking the disulfide bonds (S-S) formed between cysteine units of keratin molecules (Abrutyn 2011) present in the rhamphotheca, destabilizing its structure, softening it and making it permeable. This reaction requires a high pH medium to occur, which is guaranteed by calcium hydroxide, a strong alkaline base (Abrutyn 2011). The substance used in this study presents pH between 12.2 and 12.5 (Reckitt Benckiser 2009). The speed of keratin disintegration is increased by the action of urea, which helps the fast penetration of the cleavage agents by swelling the corneous tissue (Abrutyn 2011).

In all tests we used the same chemical depilatory cream for hair removal (VEET ® hair removal cream, sensitive skin), however, other cosmetic products containing similar active ingredients (thioglycolic acid/salt plus hydroxide base plus urea) would be also efficient for this purpose. Due the high alkalinity and keratin destruction promoted by these products, it is recommended to wear nitrile gloves while handling them for a long time (Reckitt Benckiser 2009).

The tested method consisted of successive applications of the cream at the entire surface of rhinotheca followed by scraping off the cream with a small metallic spatula. This alternation between application and scraping was repeated until the corneous sheath became thinner, spongy and opaque, and its color lightened. Then, we rinsed the skulls under running tap water while scraping gently the rhamphotheca. The remaining of rhamphotheca and the entire subjacent dermis were removed with tweezers while the material was still wet. Before leaving the material to dry, we immersed the skulls in ethanol 90% for 30 minutes in order to accelerate drying and thereby prevent the bad smell of the material and weakening of the connective membranes.

It is possible to interrupt the process at any stage, continuing from the stop point days later. It is necessary, however, to wash the cream from the skull and dry it by immersion in ethanol before storage to avoid damages to the material. Before removing the rhamphotheca remains and dermis after drying, it is recommended to

re-hydrate the beak by involving it with wet cotton for two hours.

To determine the optimal interval between applications to obtain the most efficient action of the cream, we initially submitted six skulls to three different protocols, varying the frequency of application of the product: the arbitrary protocols established an interval between cream applications of every half hour, every one to two hours or every three hours. Each pair used in this test involved skulls of *Manacus manacus* and *Passer domesticus*, thus representing both delicate and sturdy beaks. The effective degradation of the rhamphotheca was monitored after each scrape by observing the aspect of the beak, the presence/absence of soft fragments of rhamphotheca mixed with the removed cream and, mainly, the color of the cream scraped from the beak, which acquires tones ranging from light to dark brown – almost black – depending on the amount of keratin and melanin dissolved in the cream, thus staining it.

After determining the most efficient protocol for the cream applications, we adopted it for the large-scale test of the method, applying it to the remainder of the material. During this test, we recorded the number of cream applications and the total time necessary to remove the rhamphotheca of each specimen.

RESULTS

The new method has proven widely effective for removal of the rhamphotheca, promoting a massive flaking and softening of this corneous sheath, thus allowing an easy manual cleaning of its remains. No damage to any skull was observed and, given that the time of contact between skulls and water was very short and the material was not submitted to any mechanical stress (neither during scraping nor during the manual removal of rhamphotheca fragments and dermis), no bones were disarticulated during the process, even in the case of the smaller skulls.

The cream action was more efficient with the intervals of one to two hours between applications. The other tested time intervals presented weaker results or some inconveniences for the efficacy of the method: periods of half hour seemed too short for a satisfactory action of the cream, since the original features of the beak (color, texture and polish) and of the removed cream (color and consistency) remained almost unchanged after the applications; periods of three hours resulted in the dehydration of the cream, hampering the removal of it with the rhamphotheca and affecting the speed of the reaction, which performance was very similar to the observed at intervals of one to two hours (considering the aspects of the beak and of the removed cream after scraping).

The total time needed for the chemical degradation of rhamphotheca varied from four to 30 hours, and the number of applications of the cream ranged from two to 15. Despite this apparent great variation, the majority of the specimens (54 skulls) were completely prepared in the period of four to seven hours, with two to six applications, and for the other skulls, except two, the process lasted from eight to 12 hours. We did not find any association between the total time/number of applications needed to remove the rhamphotheca and the length of the beak or the age of the skull in the collection.

Thereby, we propose as the best protocol for this method: 1-Apply a thick layer of depilatory cream on all surface of rhamphotheca, 2- Wait an interval of one to two hours and then scrape the cream with loose fragments of the rhamphotheca, 3- Repeat the application and the scraping (steps 1 and 2) until the rhamphotheca become thinner, spongy and opaque with a lighter color (on average after two to six applications), 4- Rinse the skull in running water, continuing to scrape the remainder of the rhamphotheca, 5- Remove with tweezers the remains of the rhamphotheca and of the dermis while the skull is wet, in a stereoscope microscope if necessary, 6- Immerse the skull in ethanol 90% for 30 minutes and then, wait the material dry completely.

DISCUSSION

Two specimens curiously required an exceptionally long time of about 30 hours and 15 cream applications for the removal process to be completed. Both skulls, representing *Cymbilaimus lineatus* and *Hypoedaleus guttatus*, were not notably large, nor possessed the longer beaks nor were specially new or old in the collection when compared with the other skulls used in this test. Perhaps this resistance to the method might be related to their characteristic beak, very robust and heavy (Zimmer & Isler 2003). Probably this kind of bill presents a thicker rhamphotheca contributing to this tough structure, since the strength of the whole beak depends on the arrangement of bones and the horny sheath (Spearman & Hardy 1985).

Despite this delay, the new method is still the fastest for removing the rhamphotheca when compared to maceration and the use of dermestid colonies. Besides, this technique makes the preparation of osteological material safer, since it is not necessary to expose skulls any longer to the risk of damage by dermestid beetles and disarticulation by maceration just to remove the rhamphotheca, which can be easily removed at any time by posterior treatment with depilatory cream as presented herein.

The use of this method might be extended to other avian groups, such as hummingbirds (Trochilidae), swifts

(Apodidae), and some small woodpeckers (Picidae), contributing for a better osteological preparation of delicate skulls. Future studies concerning the applicability and efficacy of this technique to larger bird skulls with more massive bills would be interesting, considering the huge diversity of beak morphology in Aves.

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APPENDIX:

Specimens used to test the efficacy of rhamphotheca removal by potassium glycolate based solution (Classification according to Remsen *et al.* 2012):

Order PASSERIFORMES

Suborder TYRANNI

Family THAMNOPHILIDAE

Cymbilaimus lineatus (Leach 1814): UFRJ 1095.

Hypoedaleus guttatus (Vieillot 1816): UFRJ 1083.

Thamnophilus ambiguus Swainson 1825: UFRJ 0294, UFRJ 0295, UFRJ 0296.

Thamnophilus palliatus (Lichtenstein 1823): UFRJ 0289.

Myrmotherula axillaris (Vieillot 1817): UFRJ 0290, UFRJ 0293, UFRJ 0386.

Myrmotherula gularis (Spix 1825): UFRJ 0484.

Myrmorchilus strigilatus (Wied 1831): UFRJ 0690.

Herpsilochmus rufimarginatus (Temminck 1822): UFRJ 0297, UFRJ 0378.

*Herpsilochmus sellowi (*Whitney & Pacheco 2000)*:* UFRJ 0380, UFRJ 0381.

Formicivora iheringi Hellmayr 1909: UFRJ 0325, UFRJ 0327, UFRJ 0328.

Drymophila squamata (Lichtenstein 1823): UFRJ 0372, UFRJ 0375, UFRJ 0530, UFRJ 0766, UFRJ 0767.

Drymophila ferruginea (Temminck 1822): UFRJ 0493, UFRJ 0625.

Pyriglena leucoptera (Vieillot 1818): UFRJ 0251, UFRJ 0254, UFRJ 0506, UFRJ 0534.

Family CONOPOPHAGIDAE

Conopophaga melanops (Vieillot 1818): UFRJ 0267, UFRJ 0876.

Family RHINOCRYPTIDAE

Merulaxis ater Lesson 1830: UFRJ 0872, UFRJ 0877.

Family FORMICARIIDAE

Formicarius colma Boddaert 1783: UFRJ 0397, UFRJ 0398, UFRJ 1239.

Chamaeza ruficauda Cabanis & Heine 1859: UFRJ 404.

Family FURNARIIDAE

Sclerurus scansor (Ménétriès 1835): UFRJ 1015, UFRJ 1019.

Xenops rutilans Temminck 1821: UFRJ 0490, UFRJ 1041.

Furnarius rufus (Gmelin 1788): UFRJ 0763, UFRJ 1081.

Lochmias nematura (Lichtenstein 1823): UFRJ 0867.

Anabazenops fuscus (Vieillot 1816): UFRJ 1034, UFRJ 1042.

*Philydor atricapillus (*Wied 1821)*:* UFRJ 0496, UFRJ 0978.

Automolus leucophthalmus (Wied 1821): UFRJ 0979, UFRJ 1064.

*Phacellodomus erythrophthalmus (*Wied 1821): UFRJ 0399, UFRJ 0400.

Synallaxis albilora Pelzeln 1856: UFRJ 0537.

Sittasomus griseicapillus (Vieillot 1818): UFRJ 1089, UFRJ 1090, UFRJ 1098.

Dendrocincla turdina (Lichtenstein 1820): UFRJ 0410.

Dendrocolaptes platyrostris Spix 1825: UFRJ 1022, UFRJ 1023.

Xiphocolaptes albicollis (Vieillot 1818): UFRJ 1027, UFRJ 1094.

Xiphorhynchus fuscus (Vieillot 1818): UFRJ 0508, UFRJ 1092.

Family PIPRIDAE

Manacus manacus (Linnaeus 1766): UFRJ 504, UFRJ 523, UFRJ 525.

Suborder PASSERES

Family PASSERIDAE

Passer domesticus (Linnaeus 1758): UFRJ 613, UFRJ 694, UFRJ 696.

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ARTICLE

Observations on nesting Straight-billed Woodcreepers *Dendroplex picus* (Furnariidae: Dendrocolaptinae) in French Guiana

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ABSTRACT: The Straight-billed Woodcreeper (*Dendroplex picus*) is largely insectivorous, but sporadically feeds on small vertebrates. It breeds in cavities, which makes it difficult to follow its breeding cycle. We report here on the use of thin dry branches and strips of bark of considerable length to provide a foundation for the actual nest in a deep woodpecker hole, and the use of dry snake skin to line the nest cavity. We also report the first record of nestlings being fed with eggs.

KEY-WORDS: breeding cycle, diet, nest building, reproduction, woodcreepers.

INTRODUCTION

The Straight-billed Woodcreeper (*Dendroplex*, formerly *Xyphorhynchus*, *picus* Gmelin, 1788) is widespread and fairly common to common in Panama and in northern and eastern South America. It is a polymorphic species with *c.*13 subspecies recognized (Marantz *et al*. 2003).

It favours vegetation edges and successional habitats, in a variety of open lowland situations such as arid desert scrub, mangroves, wooded savanna, river islands, gallery forests, forest edges, plantations and rural areas with scattered trees, open woodland, secondary woodland and seasonally flooded forest (Ridgely & Tudor 1994, Marantz *et al*. 2003). Its diet consists chiefly of small arthropods, but occasionally also of small vertebrates, such as small lizards. It mainly takes beetles, ants and insect larvae, less frequently spiders, wasps, hemipteran bugs, scorpions and pseudoscorpions, millipedes, cockroaches, grasshoppers and locusts, snails and alate termites (Marantz *et al*. 2003).

Straight-billed Woodcreepers have been found nesting in an old hole of a woodpecker, in a natural cavity in a hollow trunk, in a tree cactus or in a dead stump, or in a cavity in an arboreal termite nest, even in a gap between palm fronds, bromeliads or epiphytic orchids. The cavity entrance is situated between 1.25 and 9 m above the ground, and the nest-chamber remains either unlined or is lined with bits of bark or stems and down from seed pods or other vegetable matter (Marantz *et al*. 2003).

The nominate race *D. p. picus* occurs from southern Venezuela throughout the Guianas into northern and eastern Brazil (Marantz *et al*. 2003). In French Guiana, this woodcreeper is common in the coastal region, where it prefers mangroves and remnants of lowland forest. It is absent from the forested interior (Tostain *et al*. 1992).

Our knowledge of the breeding biology of the mangrove-dwelling Straight-billed Woodcreepers on the Atlantic coast of north-eastern South America is limited to observations in Suriname and in the region of Belém, Brazil. In Suriname, Haverschmidt found a nest with two nestlings in an arboreal termite nest on 28 March 1947 (Haverschmidt & Mees 1994). In the Belém area, Oniki & Willis found a nest with nestlings in a grove of pupunha palms (*Bactris gasipaes*) far from forest on 7 December 1972 and another nest with nestlings in an isolated tree in a pasture on 30 March 1973. These nests were constructed inside hollow trunks, with the nest entrances at heights of 4 m and 9 m (Oniki & Willis 1983).

METHODS

We report here on a Straight-billed Woodcreeper nest constructed in an old woodpecker nest hole in a dead

awara palm (*Astrocaryum vulgare*) standing in a recently cleared area next to a strip of low forest (05°06'N; 52°35'W) along road D15 in the Marécages de Matiti in the coastal region of French Guiana (Figure 1). Road D15 connects road RN1 and the Dégrad Guatémala, a landing stage on the right bank of the Kourou River, opposite the town of Kourou. The 'marécages' or marshy savannas are a *c*.50 km² area of marshes and savannas with patches of lowland forest, and a few clearings and farms. Parts of the savannas have been converted into pastures for cattle. These marshy savannas are bordered by the Kourou River, road RN1 and the Atlantic Ocean.

The nest tree was visited almost daily in the morning hours between 28 July and 20 September. The nest was observed with Leica 10 x 42 binoculars from a distance less than 20 m for about 30 min per day. Only the more interesting observations are mentioned in the results.

The diameter of the nest tree at the height of the nest hole and of the nest entrance, as well as the length of a strip of bark used in nest construction, were calculated in relation to the total length of 20 cm of a Straight-billed Woodcreeper (18-22 cm in Marantz *et al.* 2003).

FIGURE 1. Site where the Straight-billed Woodcreepers (*Dendroplex picus*) nested. The dead awara palm (*Astrocaryum vulgare*), approximately 7.5 m high, is situated in the middle of the photo, right of a living one. The entrance of the old nest hole of the Spot-breasted Woodpeckers (*Colaptes punctigula*) used by the woodcreepers, is visible about 2 m below the top of the dead trunk (white arrow). Photo by M. G. A.

RESULTS

At the end of July 2012, M. G. A. found a pair of Straight-billed Woodcreepers inspecting an old nest hole of Spot-breasted Woodpeckers (*Colaptes punctigula*) in a dead awara palm. The dead trunk standing a few meters south of the roadside was approximately 7.5 m high and had a diameter of around 13.5 cm at the height of the nest hole. The oval nest entrance was about 5.5 cm x 8.0 cm and was situated about 2 m below the top of the dead trunk (Figure 1).

On 30 July 2012, M. G. A. watched the Straight-billed Woodcreepers bringing parts of thin dry branches and strips of bark to partly fill the deep cavity of the woodpeckers' nest hole (Figures 2). One strip of bark had a length of about 15 cm.

On 1 August, a pair of Brown-crested Flycatchers (*Myiarchus tyrannulus*) tried to occupy the nest hole. One of the flycatchers was seen at the entrance of the nest hole with pieces of dry snake skin, probably used as nest lining (Figure 3). However, the pair of Straight-billed Woodcreepers managed to dislodge the flycatchers.

On 11 August, a woodcreeper was seen at the entrance of the nest hole with a bit of dry snake skin, probably the one brought to the nest by the flycatchers, which it took back inside to line the nest (Figure 4).

On 20 and 30 August, a woodcreeper was observed sitting in the nest entrance for a long time.

FIGURE 2. The Straight-billed Woodcreepers (*Dendroplex picus*) bringing a thin dry branch, and a strip of bark about 15 cm long, to partly fill the deep cavity of the old woodpeckers nest hole. Photo by M. G. A.

On 6 September, two adults were seen to bring food to the nest. One brought an unidentified arthropod and seconds later the other arrived with a small egg in its bill (Figure 5).

On 19 September, a pair of Green-rumped Parrotlets (*Forpus passerinus*) inspected the nest hole and on September 20th, they were engaged in pre-nuptial feeding at the entrance of the nesthole (Figure 6). They were not disturbed by the Straight-billed Woodcreepers, which had disappeared from the vicinity of the nest tree around 15 September. Therefore we presume that the Straight-billed Woodcreeper nestlings had fledged shortly before that date.

DISCUSSION

Straight-billed Woodcreepers nest in a variety of cavities, often in an old woodpecker nest. Figure 2 shows that thin dry branches and strips of bark of considerable length, sometimes larger than the diameter of the nest entrance and almost up to the size of the adult itself, are used to provide a foundation for the actual nest in a deep woodpecker nesthole. Figure 4 shows that pieces of dry snake skin may be used to line the nest cavity.

Straight-billed Woodcreepers, as all woodcreepers, are chiefly insectivorous. They typically take small arthropods, but they also occasionally take small vertebrates, *e.g.* lizards. Eggs as food items for woodcreepers have until now only been mentioned for the White-throated Woodcreeper (*Xiphocolaptes albicollis)* which was observed to take bird eggs from cavity nests

FIGURE 3. One of the Brown-crested Flycatchers (*Myiarchus tyrannulus*) with a piece of dry snake skin tries to occupy the nest hole of the woodcreepers. Photo M. G. A.

(Marantz *et al*. 2003). We thought that, based on its size, the egg brought to the nest to feed the nestlings was a hummingbird egg, but an egg of an arboreal lizard, *e.g.* an *Anolis* species, cannot be excluded. However, finding bird eggs should be easier than finding lizard eggs.

Woodcreepers nest in natural cavities, which makes it difficult to closely follow the breeding cycle. The incubation and nestling periods of woodcreepers are, therefore, poorly known. These periods are estimated to be, respectively, about 16 days and 18-20 days for similar sized woodcreepers of the genera *Xiphorhynchus*, *Dendroplex* and *Lepidocolaptes* (Marantz *et al*. 2003). After considering the size of food items brought to the nestlings on 6 September, we estimated they were then between 12 and 14 days old. With the above mentioned periods in mind, we calculated that the eggs were laid between 5 and 10 August. With incubation starting thereafter, the

FIGURE 4. One of the Straight-billed Woodcreepers (*Dendroplex picus*) with a piece of dry snake skin in its bill, probably the one brought to the nest by the flycatchers. Later it took the skin back inside the nest hole to line the nest cavity. Photo by M. G. A.

FIGURE 6. A pair of Green-rumped Parrotlets (*Forpus passerinus*) engaged in pre-nuptial feeding at the entrance of the nest hole after the nestlings of the Straight-billed Woodcreepers (*Dendroplex picus*) had flegded. Photo by M. G. A.

FIGURE 5. The Straight-billed Woodcreepers (*Dendroplex picus*) with a large, unidentified insect, and a lizard or hummingbird egg to feed the nestlings. Photo M. G. A.

eggs have hatched around 25 August. Fledgelings left the nest between 10 and 15 September. This breeding thus coincided with the onset of the long dry season, which in French Guiana normally lasts from mid-August to the end of November.

A nest with young was found at the end of March in Suriname, thus in the short dry season of February and March (Haverschmidt & Mees 1994). The nest we found, contained nestlings at the end of August – beginning of September. Therefore we can conclude with Marantz *et al*. (2003) that Straight-billed Woodcreepers on the Guiana Shield *i.e.* the Guianas and adjacent regions, breed in the short and in the long dry season there.

The old Spot-breasted Woodpecker nest hole, in which the Straight-billed Woodcreepers nested, was also claimed by other bird species such as Brown-crested Flycatchers and Green-rumped Parrotlets. This competition between several bird species may reflect an actual shortage of suitable nesting sites for cavity nesting species in areas of marshes and savannas with patches of lowland forest in the coastal region. Here the only suitable cavities for nesting are mainly old woodpecker holes in dead awara palms.

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ARTICLE

The relationship between the feather tuft of the uropygial gland and terrestrial/aquatic birds

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ABSTRACT: The bird´s uropygial gland has a papilla in its caudal end and it can also show a feather tuft. These feathers may have a raquis or not. The purpose of our study was to compare the number, dimensions and types of the tuft´s feathers in aquatic and terrestrial birds, as well as to investigate whether the potential differences are related or determined by their dissimilar habitats. The uropygial glands were removed and the tuft´s feathers were extracted and then measured, prepared for magnifying glass observation and photo shoot. Aquatic birds were found to have not only a larger number of feathers in the tuft but also longer feathers than terrestrial birds. However, the length ratio between calamus/raquis was higher in terrestrial birds. Almost all the species under study presented the same type of feathers except for the three penguin species that showed a peculiar type. The differences found between the tuft´s feathers of the studied species are related with the environment. Aquatic birds have a longer length of the feather tuft because they may produce a greater amount of secretion than terrestrial birds.

KEY-WORDS: down, environment, preen gland, semiplumes

INTRODUCTION

The uropygial is a sebaceous and compact gland placed dorsally over the caudal vertebrae at the base of the bird´s tail (Jacob & Ziswiler 1982). When preening, the lipid secretion is spread over the feathers. It has been suggested that this gland is well developed in aquatic birds, whose uropygial secretion would play an essential role in feather waterproofing (Spearman & Hardy 1985). However, other authors found a lack of correlation between the uropygial gland size and the degree of exposure to water (Montalti & Salibián 2000).

Jacob & Ziswiler (1982), Johnston (1988) and Montalti & Salibián (2000) found that the uropygial gland was heavier in aquatic bird species. Within terrestrial birds, the uropygial gland´s size shows substantial variations (Lucas & Stettenheim 1972) and in some groups it can be vestigial or absent (Struthionidae, Rheidae, Casuariidae, Dromaiidae and in some species of Columbidae and Psittacidae) (Johnston 1988).

The physiologic role of this gland seems to be diverse since it has been attributed to feather waterproofing, pheromone production, prevention of microorganisms growth, preservation of the feather's physical structure, pesticide and pollutant excretion and changes in the plumage appearance related to sex (Jacob & Ziswiler 1982, Kozulin & Pavluschick 1993, Gutiérrez *et al*. 1998, Piersma *et al*. 1999, Montalti & Salibián 2000, Moyer *et al*. 2003, Montalti *et al*. 2005, Reneerkens *et al*. 2005).

Regarding the external morphology, the uropygial gland is a bilobate organ provided with a papilla in its caudal end, which can have at least two ducts in most avian species. Surrounding these ducts, there is usually a feather tuft (Jacob & Ziswiler 1982). The calamus of the tuft´s feathers is completely embedded in the skin (Chandler 1914) and they differ from the typical down feathers because they are briefer (due to the shorter length of the barbs) and the calamus is longer than down feathers (Lucas & Stettenheim 1972).

A classification of the uropygial gland was made on the basis of the presence or absence of the feather tuft. Three types of glands were described based on the degree of development of the tuft: 1.- "naked" (no feathers observable, even with magnification); 2.- "minutely tufted" (feathers visible only with magnification); and 3.- "tufted" (feathers observable without magnification) (Johnston 1988). Most non Passerines birds have tufted glands, while all Passerines and some groups of Non Passerines have naked glands (Johnston 1988).

The tuft´s feathers have been described as "down", "modified down" or "semiplumes", and these may have a raquis or not. Johnston (1988) proposed three types

of tuft's feathers: Type I, "down" and Type II and IIa "semiplumes" (which have a raquis). The difference between these "semiplumes" is the disposition of the barbs along the raquis.

There is a tendency for water birds to have many tuft feathers than terrestrial birds (Jacob & Ziswiler 1982), however, there are no studies related to the dimensions and the types of the tuft feathers related to aquatic or terrestrial birds.

The purpose of our study was to compare the amount, dimensions and types of the tuft´s feathers in aquatic and terrestrial birds, and to investigate whether the potential differences are related or determined by the different environments that birds inhabit.

MATERIALS AND METHODS

We used 12 aquatic bird species and 9 from terrestrial environments. The aquatic birds included: Gentoo Penguin (*Pygoscelis papua*), Adelie Penguin (*P. adeliae*), Chinstrap Penguin (*P. antarcticus*), Neotropic Cormorant (*Phalacrocorax brasilianus*), Night Heron (*Nycticorax nycticorax*), Chilean Flamingo (*Phoenicopterus chilensis*), Black-Necked Swan (*Cygnus melanocoryphus*), Yellow-Billed Pintail (*Anas georgica*), Giant Wood-Rail (*Aramides ypecaha*), South Polar Skua (*Stercorarius maccormicki*), Grey-Headed Gull (*Chroicocephalus cirrocephalus*) and Kelp Gull (*Larus dominicanus*).

Terrestrial birds comprised: Red-Winged Tinamou (*Rhynchotus rufescens*), Spotted Nothura (*Nothura maculosa*), American Kestrel (*Falco sparverius*), Kalij Pheasant (*Lophura leucomelanos*), Scarlet Macaw (*Ara macao*), Monk Parakeet (*Myiospsitta monachus*), Nanday Parakeet (*Nandayus nenday*), Budgerigar (*Melopsittacus undulatus*), and Field Flicker (*Colaptes campestris*) (Table 1).

Most birds were captured in their natural habitats in different localities of Buenos Aires province (permission of the Dirección Provincial de Gestión, Control Agroalimentario y Uso de los Recursos Naturales y Pesqueros, Ministerio de Asuntos Agrarios de la Provincia de Buenos Aires Nº DIP 138/04). Antarctic birds (penguins, skuas) were found dead in Potter peninsula, King George Island and others came from the Botanical Garden and Zoo of La Plata City. All birds were preserved in plastic bags at -20ºC. The gland was removed as described by Montalti *et al*. (1998). The

TABLE 1. Amount of tuft feathers, total length and length ratio between calamus/raquis of aquatic and terrestrial birds. Species are in taxonomic order (Remsen *et al*. 2013) and values are shown as mean ± SD.

Species	Nº of individuals	Amount of feathers	Total length	Calamus/raquis ratio
Rhynchotus rufescens	3	4	12,13±0,17	0,56±0,04
Nothura maculosa	6	3,83±0,41	8,43±0,52	0,47±0,05
Cygnus melancoryphus	2	23±4,24	20,7±0,63	0,14±0,01
Anas georgica	6	25±3,74	10,6±0,32	0,15±0,02
Lophura leucomelanos	1	6	7,11±0,11	0,45±0,01
Phoenicopterus chilensis	3	32,67±4,62	13,42±1,13	0,22±0,02
Pygoscelis papua	3	32±2,83	28,71±1,99	0,25±0,03
P. adeliae	4	30,5±4,95	21,45±0,44	0,22±0,01
P. antarcticus	4	27,5±2,12	20,73±1,41	0,21±0,012
Phalacrocorax brasilianus	2	72±9,89	11,14±0,11	0,21±0,03
Nycticorax nycticorax	2	10,5±2,12	6,48±0,30	0,29±0,07
Aramides ypecaha	2	13,5±0,71	12,18±0,29	0,33±0,08
Stercorarius maccormicki	2	28,5±2,12	18,30±0,31	0,15±0,005
C. cirrocephalus	18	19,33±2,90	10,64±0,45	0,15±0,009
Larus dominicanus	15	22,31±2,39	20,13±1,58	0,09±0,014
Colaptes campestris	6	7,66±2,33	3,99±0,96	0,32±0,04
Falco sparverius	3	10±2,65	7,04±0,14	0,24±0,03
Ara macao	1	13	19,1±0,17	0,71±0,05
Nandayus nenday	1	7	8,24±0,33	0,41±0,02
Miyopsitta monachus	6	6±1,09	8,55±0,42	0,33±0,03
Melopsittacus undulatus	4	9±0,82	5,23±0,13	0,34±0,02

feathers were counted after manual extraction, and then their total length, the calamus length and the raquis length (if present; for Type I feathers we consider the barb portion as raquis) were measured using a digital caliper (accuracy 0.01 mm). For each species some feathers were fixed with Canada Balm and mounted on microscope slides for magnifying observation and photo shoot. By observing the feathers, the types were established following classification of Johnston (1988). Also, the length ratio between calamus and raquis was calculated for each studied species.

The mean values of the amount of feathers and of the length ratio between calamus/raquis were obtained and the results were expressed as mean ± standard deviation. A One-way ANOVA test was used for statistical analysis of results; P values < 0.01 were considered as highly significant and P < 0.05 as significant. The statistical analyses were performed with STATISTICA 7.0 program.

RESULTS

All studied bird species had tufted glands. The tuft´s feathers of the three penguins (*Pygoscelis* sp.) showed a raquis with barbs along all its extension and also a "downy" region originated in the calamus zone, starting just before the raquis onset. We called this feather Type IIb (Figure 1). In the remaining studied species, Type I feathers were documented (Figure 2).

The number of tuft feathers (Table 1) in aquatic birds was significantly higher as compared with that of the terrestrial birds (27.75 ± 15.6 vs. 7.22 ± 3.07; $p < 0.001$). Similar findings were demonstrated with the total length of the feathers (Table 1); in fact, feathers in birds related to aquatic environments were longer than in terrestrial birds (15.75 ± 6.3 vs. 8.8 ± 4.25 mm; $p < 0.01$).

Regarding the length ratio between calamus/raquis (Table 1), it was greater in terrestrial species (0.43 ± 0.14 vs. 0.20 ± 0.07; $p < 0.0001$).

FIGURE 1. Tuft feather of the uropygial gland of an Adelie penguin (*Pygoscelis adeliae*). Photograph taken with a Summar 80 mm objective, scale 10 mm.

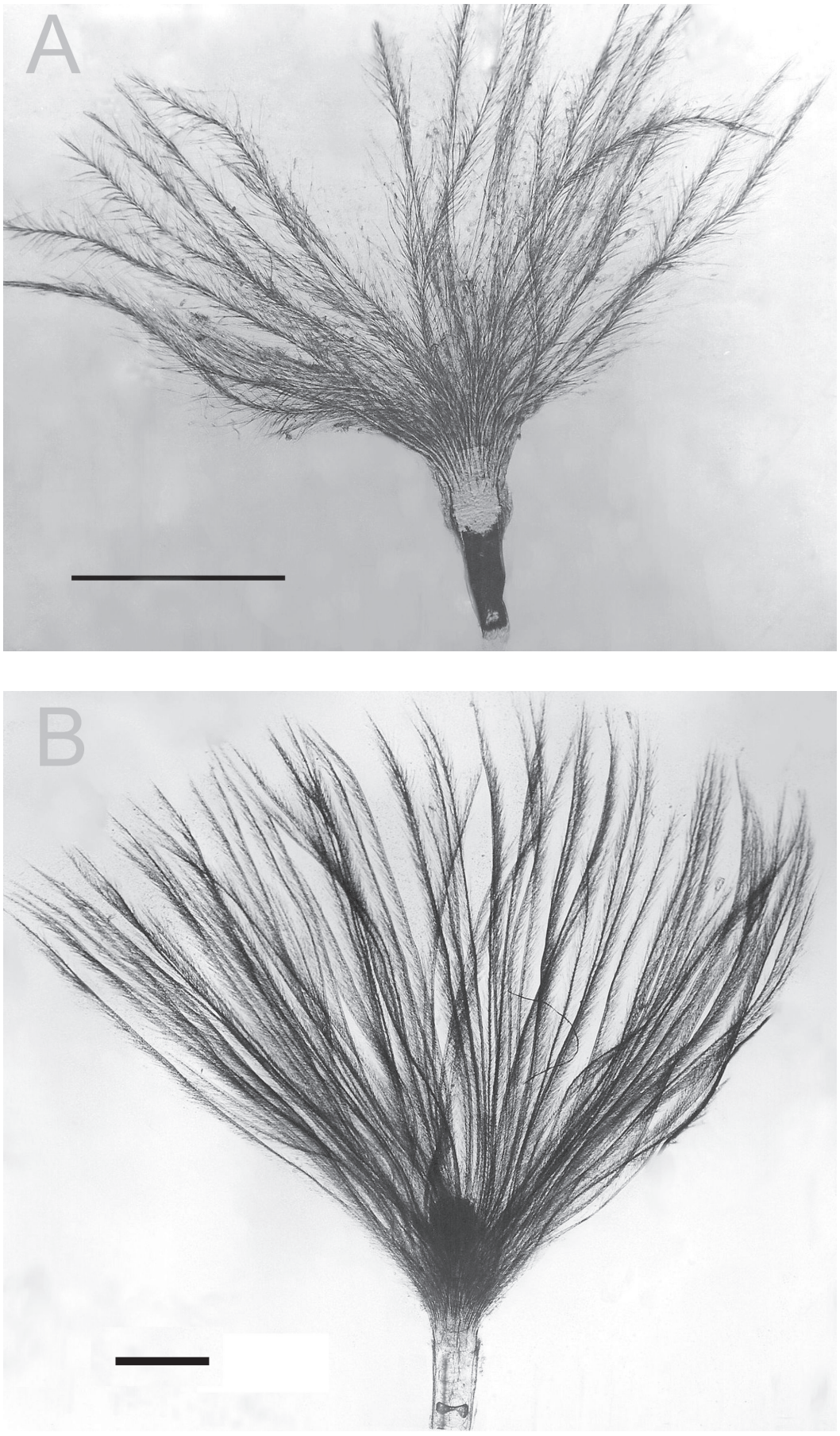

FIGURE 2. Tuft feather of the uropygial gland of: **A)**. Terrestrial bird, Field Flicker (*Colaptes campestris*), photograph taken with Leitz Plan 4 objective, scale 1 mm; and **B)**. Aquatic bird, Neotropical Cormorant (*Phalacrocorax brasilianus*), photograph taken with Luminar 63 mm objective, scale 1 mm.

DISCUSSION

The tuft´s feathers have been classified according to their structure and the presence or absence of a raquis (Johnston 1988). The results of this study indicate that the terrestrial birds have the same type of feathers reported by Johnston (1988) for species of the same families. This also happened for aquatic birds except for the three analyzed penguin species. Johnston (1988) reported that these penguin species had tuft's feathers Type IIa, implying that the middle part of the raquis lacks barbs. Our analysis of the tuft's feathers characteristics in the studied penguin species indicates that some differences do exist. The "downy" region of these feathers (afterfeather named as a cluster of barbs by Lucas & Stettenheim 1972) might have the same function of the cobert's afterfeathers, that is, to increase the bird´s isolation from the environment. In fact, this downy region of the penguin´s feathers may amplify the tuft´s area. Lucas & Stettenheim (1972) observed a hyporaquis in the tuft´s feathers of chickens and kingfishers, and a distinct aftershaft in the plumules of grouses and sandpipers. Conversely, Johnston (1988) did not find afterfeathers in any of the tuft´s feathers he analyzed.

One of the most relevant functions of the uropygial gland is to maintain the feather structure as a mean of preserving its waterproofing properties (Moyer *et al*. 2003) and its isolation from the environment. Aquatic birds have a greater amount of tuft´s feathers and also longer than in terrestrial birds. These results agree with data reported by Jacob & Ziswiler (1982), either for same species or for different species of the same families. It had been observed that this tuft was always saturated with gland secretion (Schumacher 1919), therefore these feathers could not have thermoregulatory functions; this function would be carried out by down feathers that surround the gland. It may be speculated that the feather tuft might act as a container of certain amount of uropygial secretion, which is available when required without the need of extracting the secretion constantly. Therefore, the uropygial gland secretion can be at disposal for the brief periods that aquatic birds spend out of the water for preening activities.

Terrestrial birds have a longer length ratio between calamus/raquis than aquatic birds. As a result, they have less feather area to contain secretion and less raquis area to act as a container. Actually, terrestrial species used to squeeze the uropygial gland to obtain the secretion every time they need because they preen more often than aquatic birds and for this reason the feather tuft is smaller than in aquatic species.

Some terrestrial birds have a longer ratio between calamus/raquis than others. In our material, the Scarlet Macaw (Psittaciformes) had the longest length ratio between calamus/raquis (0.71); to be noted that this specie lives in tropical forests where it is well protected from rain. Other Psittaciformes, such us the Monk Parakeet, with a smaller length ratio between calamus/raquis (0.33), are more exposed to the inclemency of the weather (*e.g.* rain) because they inhabit open areas (Collar 1997). Furthermore, the Red-Winged Tinamou, which lives in more enclosed environment, had a calamus/raquis relation of 0.56, while a smaller calamus/raquis ratio value (0.47) was found in the Spotted Nothura that inhabits in a more exposed region (Cabot 1992).

The differences found for the calamus length/raquis length in aquatic birds might be attributed to different degrees of exposure to water. Penguins (calamus/raquis relation 0.23) spend most of their time inside the water and they only come to the coast during the breeding and moulting seasons (Williams 1995). Therefore, they do not need to preen as often as gulls (0.12) or skuas (0.15) do. In fact, these species obtain their food without having much contact with water (Burger & Gochfeld 1996) and can return to land after getting wet to preen their plumage. Thus, their calamus/raquis ratio values are smaller than that of the penguins. Comparably, herons only have their legs in contact with water (Martínez-Vilalt & Motis 1992) and an observed length ratio between calamus/raquis of 0.296.

As a conclusion, the differences found in the amount and length of the tuft´s feathers and the length ratio between calamus/raquis in different bird's species can be related to the environment; aquatic birds have a larger development of the feather tuft (amount and length of feathers) which might act as a container of uropygial secretion being available when needed. On the other hand, the development of these feathers is less pronounced in terrestrial birds, because they do not need to store secretion since they squeeze the uropygial gland to get secretion whenever it is necessary.

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ARTICLE

Distribution and abundance of the Grey-headed Gull *Chroicocephalus cirrocephalus* (Vieillot, 1818) in Rio de Janeiro, Southeastern Brazilian coast

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ABSTRACT: The distribution and movements of the Grey-headed Gull in the Brazilian coast are poorly known. Here, we provide records and data on this species in the environments it uses more frequently, either polluted or non-polluted, in the "Região dos Lagos" and northern Rio de Janeiro state. Counts were carried out during monthly systematic surveys from October 2011 to November 2012 and supplementary observations between February 2009 and October 2011. In total, 76 *C. cirrocephalus* records were made, with mean and maximum numbers of 74.9±145 and 1,500 gulls, respectively. The difference in abundance between "Região dos Lagos" and northern Rio de Janeiro was not significant (Student's test, P = 0.51). In northern Rio de Janeiro, greater numbers were recorded during the dry season (116±220.8) than in the rainy season (16.5±31.6) (Student's t test, P = 0.04). Coastal lagoons and deactivated salt ponds were the most extensively used environments (Tukey test, P < 0.04). On the other hand, large flocks were recorded in environments polluted with sewage. In addition, we present the first documented evidence that *C. cirrocephalus* breeds in northern Rio de Janeiro, which indicates that the species is expanding its range in Rio de Janeiro as in other areas in Brazil.

KEY-WORDS: geographic expansion, habitat use, northern Rio de Janeiro, "Região dos Lagos", Restinga de Jurubatiba.

INTRODUCTION

The Grey-headed Gull *Chroicocephalus cirrocephalus* (Vieillot 1818) inhabits coastal environments in Africa and South America (Harrison 1983, Burger & Gochfeld 1996, Brooke *et al.* 1999). In Brazil, relatively few records have been obtained for the species, which makes it difficult to assess *C. cirrocephalus* range and movements. To date, the species is known to occur along the coast of northern and northeastern Brazil, in the states of Pará, Maranhão, Ceará, Rio Grande do Norte, Alagoas and Pernambuco, as well as irregularly in south and southeastern Brazil, in the states of Rio de Janeiro, São Paulo, Santa Catarina, Paraná and Rio Grande do Sul (Sick 1997, Ruschel & Costa 2003, Azevedo-Júnior *et al.* 2004, Votto *et al.* 2006, Rodrigues *et al.* 2010, Scherer-Neto & Straube 2011, Leal *et al.* 2013, Tavares & Siciliano 2013a). However, the specialized literature cites only one occurrence for the state of São Paulo, which means that, in the southeastern Brazilian coast, the species might be restricted to Rio de Janeiro State (Pacheco & Bauer 2001, Barbieri *et al.* 2010, Tavares *et al.* 2012).

In Rio de Janeiro State, the Grey-headed Gull has been recorded to occur in the central coast by Sick & Pabst (1968) and Pacheco (1988), and in the state's northern coast by Aguirre & Aldrighi (1983), Sick (1997) and Tavares & Siciliano (2013a). Also, only two specimens were collected in the state. The first is the type-specimen, collected at an unspecified location in Rio de Janeiro State, by Pierre Antoine Delalande, as early as 1816. The second specimen was collected in Cabo de São Tomé, on the state's northern coast, and currently it is housed in the Museu Nacional do Rio de Janeiro (Aguirre & Aldrighi 1983). It should be emphasized that although *C. cirrocephalus* is considered probably threatened in the State, there is no previous abundance information for the species, which is an obstacle to the accurate evaluation of its conservation status, as well as with other birds in Rio de Janeiro (Alves *et al.* 2000, Tavares & Siciliano 2013b).

This paper aims to (i) assess *C. cirrocephalus* occurrence patterns in coastal wetlands of "Região dos Lagos" and northern Rio de Janeiro; (ii) identify the most widely used environments by this species; and (iii) test if

it uses polluted water bodies to the same extent as non-polluted environments.

MATERIAL AND METHODS

Study site

This study was carried out in coastal wetlands of two regions of Rio de Janeiro State, "Região dos Lagos" and northern Rio de Janeiro (22°54'S; 42°24'W and 21°37'S; 41°05'W) (Figure 1). "Região dos Lagos" is characterized by active and deactivated salt ponds, mudflats and marshes surrounding the Araruama lagoon, one of the largest hypersaline lagoons in the world (Kjerfve 1986). This lagoon covers 20,000 ha of flooded areas and communicates with the sea by Itajurú Canal, which receives sewage discharges in different points along its course. Northern Rio de Janeiro state comprises numerous coastal lagoons, marshes, mudflats, and the Feia lagoon, the second largest lagoon of Brazil, with 22,000 ha of permanent flooded areas, which communicates with the sea by Flechas Canal. The water levels of most water bodies in the region are regulated mainly (or only) by rainfall regimes, which change drastically between two periods, the dry season (April – September) and the rainy season (October – March) (Carmouze *et al.* 1991, Esteves 1998, Macedo-Soares *et al.* 2010). In addition, the federal protected area which includes coastal lagoons and associated environments is the Restinga de Jurubatiba National Park, located between the municipalities of Macaé and Quissamã (Figure 1).

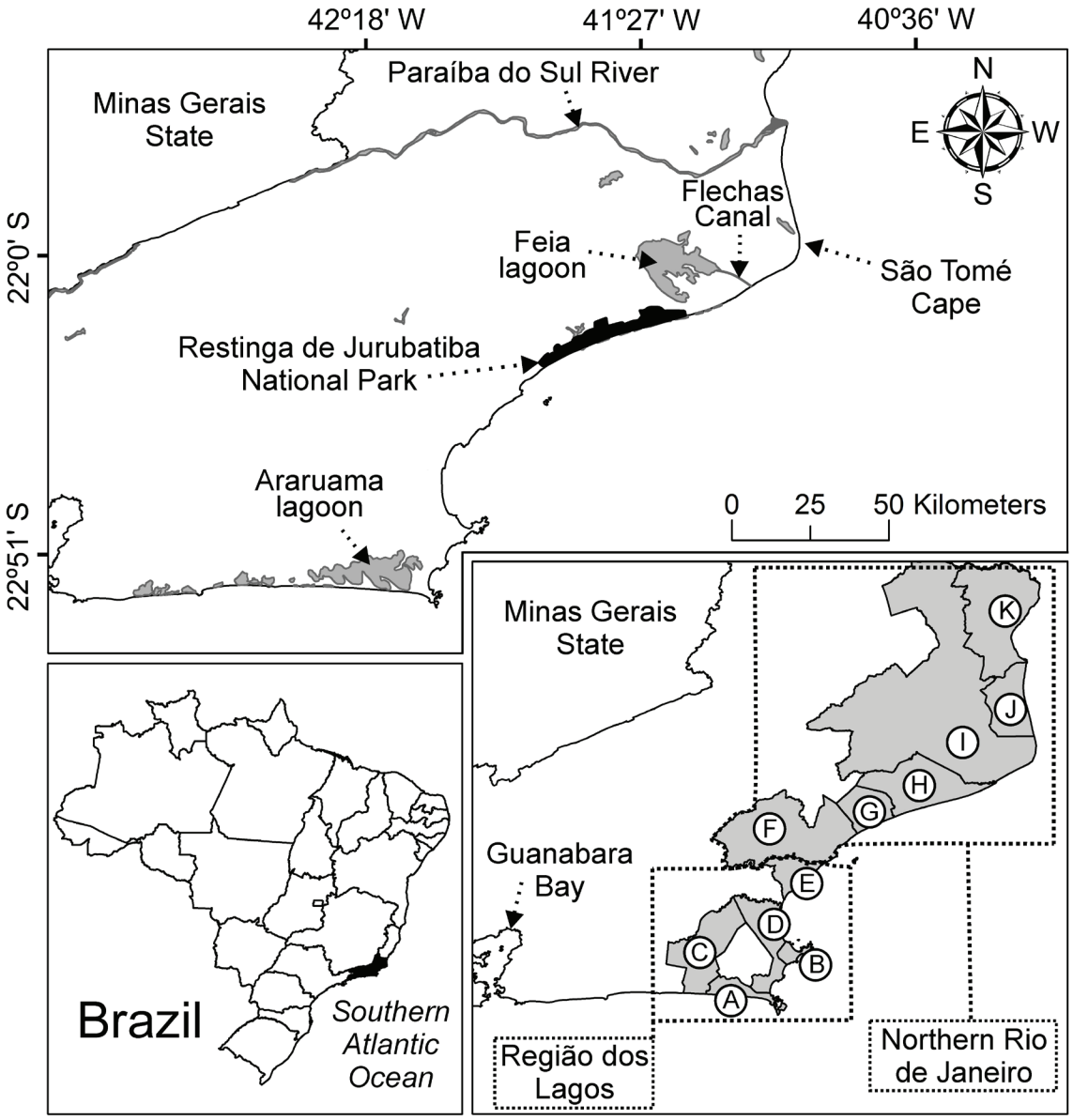

FIGURE 1. Location of the study area, with indication of surveyed municipalities and the most representative water bodies along the coast of Rio de Janeiro. Only environments located within 3 kilometers from the shoreline were visited. Surveyed municipalities: (A) Arraial do Cabo, (B) Armação dos Búzios, (C) Araruama, (D) Cabo Frio, (E) Rio das Ostras, (F) Macaé, (G) Carapebus, (H) Quissamã, (I) Campos dos Goytacazes, (J) São João da Barra, (K) São Francisco de Itabapoana.

Data collection

In total, a 380-h sighting effort was conducted between February 2009 and November 2012. Scheduled monthly excursions were carried out between the municipalities of Araruama ("Região dos Lagos") and São Francisco de Itabapoana (northern Rio de Janeiro), from October 2011 to November 2012 (312-h) (Figure 1). However, the municipalities of Arraial do Cabo and Armação dos Búzios were surveyed only opportunistically (23 h) as well as all the other areas, before October 2011 (45 h). Semi-random points spaced at least 300 m apart were covered in a motor vehicle, along the margins of wetlands located up to 3 km from the shoreline, according to logistics and better use of time (Bibby *et al.* 2000, Accordi 2010). Birds were recorded using 8x42 binoculars and a 20-60x80 spotting scope. When large flocks occurred, the counts were made based on photographs taken using 300 mm *teleobjective* lens. The presence of pollution was evaluated based on the detection of domestic sewage sources. Additionally, surveyed environments were classified into eight groups, according to physiognomy: coastal lagoons, deactivated salt ponds, marshes, mudflats, canals, coastal marine waters, beaches and estuaries (Kjerfve 1986, Esteves 1998).

Data Analysis

The differences in *C. cirrocephalus* abundance between "Região dos Lagos" and northern Rio de Janeiro as well as the difference between dry and rainy seasons and between polluted and non-polluted environments were tested using the Student's t test (Fisher 1939, Sokal & Rohlf 2011). Also, variation in abundance among types of environments was tested using the 1-way analysis of variance (ANOVA) and the post hoc Tukey test for multiple comparisons (Fisher 1936, 1938, Sokal & Rohlf 2011) . We used the Box–Cox transformation to find the best transformation of data (Vernables & Ripley 2002). Results were considered significant at $P < 0.05$. Statistical analyses were performed considering only systematic surveys, using the R software version 3.0.0 (Ihaka & Gentleman 1996).

RESULTS

Between February 2009 and October 2012, 76 records of the Grey-headed Gull were obtained in the surveyed localities (Figure 2A-F), with mean number of 74.9±145 gulls. The numbers of *C. cirrocephalus* were greater in northern Rio de Janeiro (95.9±180) than in "Região dos Lagos" (44.6±75.7) (Figure 3), but this difference was not significant (Student's t test, $t = -0.67$, $P = 0.51$). Besides that, the maximum number (1,500 gulls) was recorded in the municipality of Quissamã on 27 April 2012 in lagoons inside the Restinga de Jurubatiba National Park. Also, on 3 June 2012, 733 grey-headed gulls were counted in the same locality.

The Grey-headed Gull was present along the whole year in "Região dos Lagos" and northern Rio de Janeiro. However, in the latter, greater numbers were recorded during the dry season (116±220.8) than in the rainy season (16.5±31.6) (Student's t test, $t = -2.1$, $P = 0.04$). In fact, during the rainy season, gulls disperse from lagoons inside the Restinga de Jurubatiba National Park to other areas of the State (Figure 4). In "Região dos Lagos", numbers did not differ significantly between the dry (66.4±110.8) and rainy seasons (52.1±52.5) (Student's test, $t = 0.97$, $P = 0.34$).

The number of the Grey-headed Gull varied significantly among different types of environments (ANOVA, $F = 9.99$, $P = 2.1*10^{-9}$) (Figure 5A). More specifically, gulls' abundance was significantly greater in coastal lagoons than on beaches, coastal marine waters, marshes and mudflats (Tukey test, $P < 0.04$). Besides that, *C. cirrocephalus* was more abundant in environments polluted with domestic sewage (105.5±169) than in non-polluted sites (26±75.5) (Student's t test, $t = -2.39$, $P = 0.02$) (Figure 5B).

Additionally, during an opportunistic survey on 28 September 2008, we found eight fledgling chicks in a marsh near the heliport of São Tomé Beach, Campos dos Goytacazes (22°02'18"S;41°03'10"W) (Figure 6). This is the first documented evidence that *C. cirrocephalus* breeds in northern Rio de Janeiro.

DISCUSSION

The Grey-headed gull is expanding its geographic range along the Brazilian coast. In the State of Rio Grande do Sul, only 12 records were reported in the 1980's and 1990's (Belton 1984, Maurício & Dias 1996). However, recent studies indicate that the species is becoming more common along the whole coast of the State (Pacheco & Fonseca 2002, Ruschel & Costa 2003, Votto *et al.* 2006, Petersen & Petry 2011, Accordi & Hartz 2013). In May 2006, Scherer *et al.* (2011) recorded 30 individuals in the municipality of Triunfo, Rio Grande do Sul. Besides that, *C. cirrocephalus* was successively recorded for the first time in the States of São Paulo (April 2009), Alagoas (March 2010) and Pernambuco (October 2011) (Barbieri *et al.* 2010, Leal *et al.* 2013). In Rio de Janeiro State, several previous studies conducted on coastal environments did not list *C. cirrocephalus* (Nacinovic 1982, Maciel 1984, Antas *et al.* 1986, Alves *et al.* 1997, Alves & Pereira 1998, Alves *et al.* 2004a, Alves *et al.* 2004b, Mallet-Rodrigues *et al.* 2008). Given the above, the present records of large flocks and a new breeding site in the northern coast of

FIGURE 2. Records of *Chroicocephalus cirrocephalus* at "Região dos Lagos" and northern Rio de Janeiro, southeastern Brazil. (A) Mixed flock with *Ardea alba* and *Egretta thula* in a costal lagoon in Carapebus; (B) Mixed flock with *Rynchops niger* in a deactivated salt pond in Região dos Lagos; (C) Flock in a polluted coastal lagoon in Região dos Lagos; (D-E) High numbers recorded inside the Restinga de Jurubatiba National Park; (F) Individual resting on the sand beach. (Photos: D. C. T. and J.F. M.).

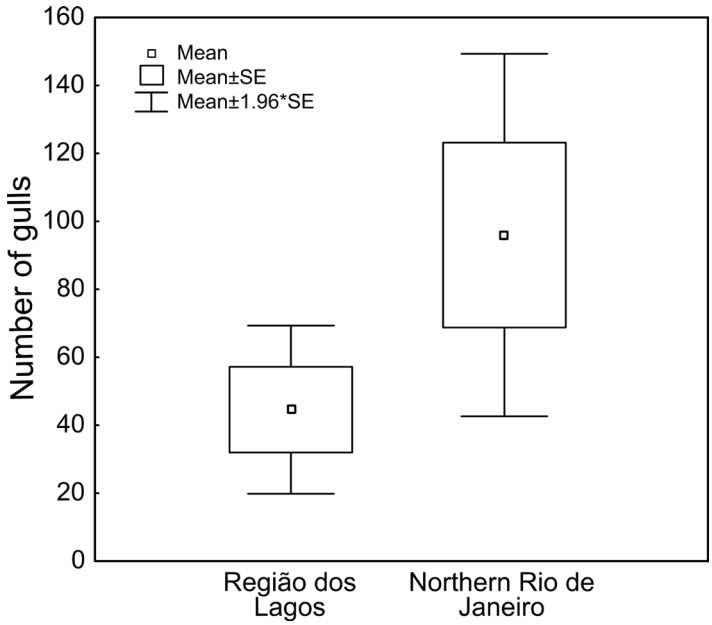

FIGURE 3. Mean numbers of *Chroicocephalus cirrocephalus* in two coastal regions in Rio de Janeiro.

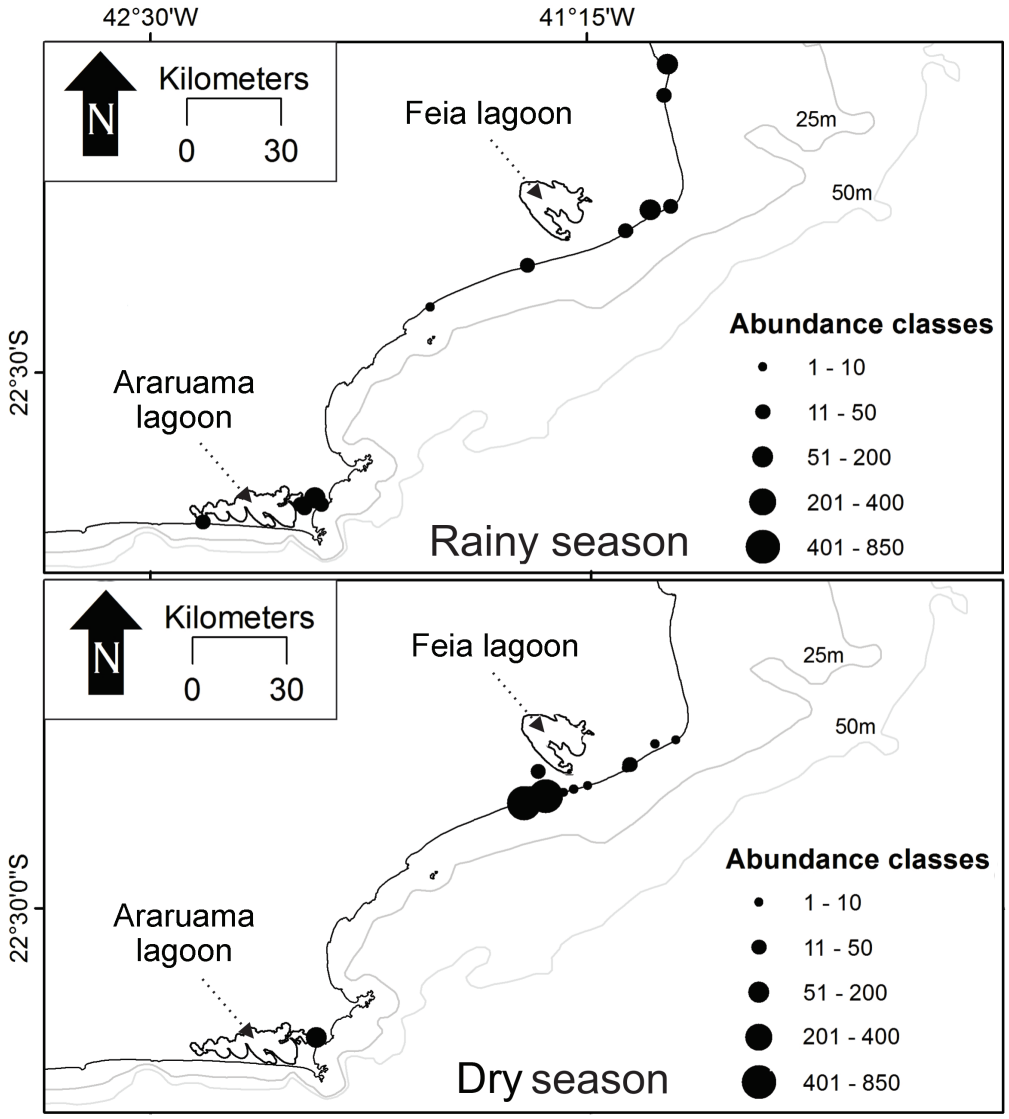

FIGURE 4. Distribution and abundance of *Chroicocephalus cirrocephalus* in Rio de Janeiro, during dry and rainy seasons, between October 2011 and November 2012.

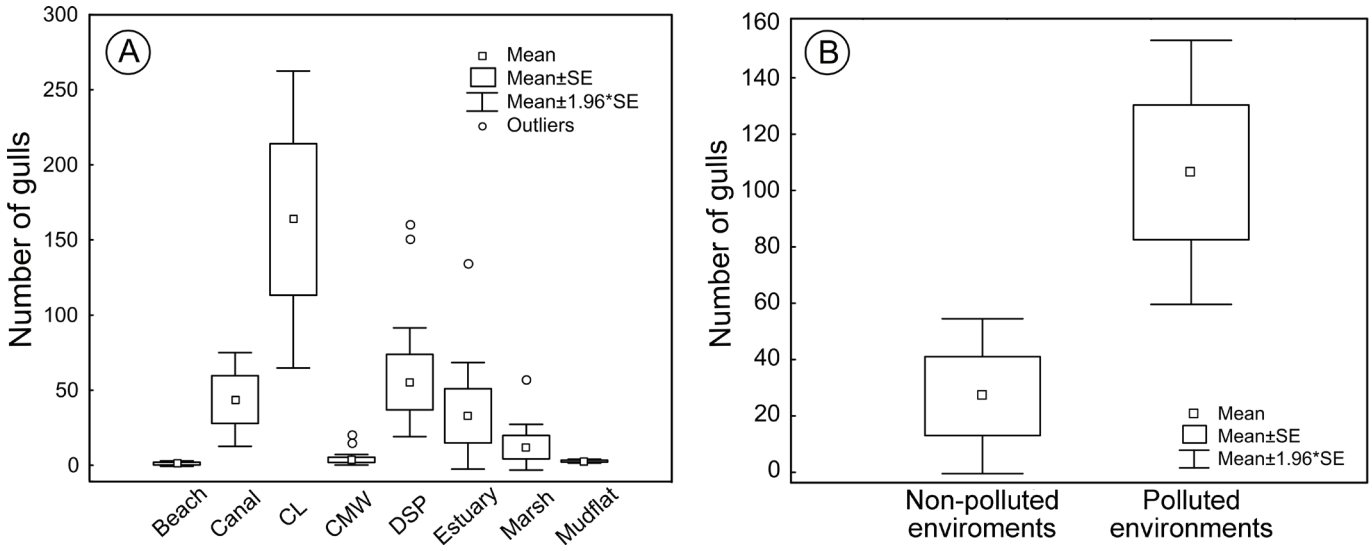

FIGURE 5. (A) - Mean numbers of *Chroicocephalus cirrocephalus* in different types of environments in Rio de Janeiro. CL = coastal lagoons; CMW = coastal marine waters; DSP = Deactivated salt ponds. **(B)** - Mean numbers of *Chroicocephalus cirrocephalus* in environments polluted and non-polluted with sewage in Rio de Janeiro.

FIGURE 6. *Chroicocephalus cirrocephalus* fledgling chick (arrow), recorded in the northern coast of Rio de Janeiro, on 28 September 2008. (Photo: S. S.).

the Rio de Janeiro suggests that the Grey-headed Gull is expanding its geographic distribution in the State, as observed in other sites along the Brazilian coast.

The flocks recorded during the dry seasons in coastal lagoons of the Restinga de Jurubatiba National Park are much larger than those reported for other Brazilian regions and important bird sites in South America, especially those located in Peru, Ecuador and Uruguay (Blanco & Carbonell 2001, De Luca *et al.* 2006, Menegheti 2006, Alfaro & Sarroca 2009, Iannacone *et al.* 2010, Alava & Haase 2011). Indeed, when compared to other environments in which the species was recorded in this study, the coastal lagoons surveyed show far greater biological productivity (Kjerfve 1994, Knoppers 1994). During the dry season, these environments become shallower, concentrating greater abundance of food resources that can be easily captured (Macedo-Soares *et al.* 2010, Lisboa *et al.* 2011). Similarly, 13,705 Grey-headed Gulls were reported for the Río Xanáes estuary, on the coast of Argentina, an environment with high productivity (Serra 2009).

The greater abundance of *C. cirrocephalus* during the dry season (winter) in northern Rio de Janeiro coincides with the pre-reproductive period of the species and the period of higher availability of prey in coastal lagoons inside Jurubatiba National Park (Olsen & Larsson 2004, Macedo-Soares *et al.* 2010). On the other hand, lower numbers of gulls were recorded during the rainy season (summer), the breeding season of *C. cirrocephalus,* which was confirmed by the present record of fledglings in September 2008. During this period coastal lagoons become a less suitable feeding environment due to the considerable increase in water levels. So, it is quite possible that the species moves from coastal lagoons inside the Jurubatiba National Park to northern areas to breed, during the rainy season. This is in accordance with the species' habits of dispersing along short distances before and after the reproductive period (Olsen & Larsson 2004, Mata *et al.* 2006). In addition, the non-significant difference in *C. cirrocephalus* abundance in "Região dos Lagos" between the dry and rainy seasons occurred because a resident population remains in the region throughout the year (Sick 1997).

Aggregations of the Grey-headed gull were greater in polluted than in non-polluted environments. Under certain circumstances, organic waste inputs in water bodies may trigger an increase availability of food resources for gulls (O'Connor 1974, Green *et al.* 1993). However, these food sources could change natural patterns of dispersion of individuals, which may choose to feed in polluted environments, where it could be easier to obtain nourishment, as opposed to natural sources, during periods of food shortage (Raven & Coulson 2001). Besides that, by feeding in waters contaminated with sewage, gulls become pathogen reservoirs, which

may have a negative impact in these species' populations (Alderisio & DeLuca 1999, Ferns & Mudge 2000, Moura *et al.* 2012). In the worst scenario, infected gulls can contaminate non-polluted water bodies, as well as waters used by humans and other species (Benton *et al.* 1983). In fact, other birds, including threatened species in the state of Rio de Janeiro, were sighted feeding in the same places with Grey-headed Gulls, such as *Egretta caerulea* (Linnaeus, 1758); *Egretta thula* (Molina, 1782); *Platalea ajaja* Linnaeus, 1758; *Tringa melanoleuca* (Gmelin, 1789); *Thalasseus acuflavidus* (Cabot, 1847); *Charadrius semipalmatus* Bonaparte, 1825; *Rynchops niger* Linnaeus, 1758; *Ardea alba* Linnaeus, 1758; *Pluvialis squatarola* (Linnaeus, 1758); *Himantopus melanurus Vieillot*, 1817; *Larus dominicanus* Lichtenstein, 1823 and *Leucophaeus atricilla* (Linnaeus, 1758).

Finally, based on the 76 sightings of *C. cirrocephalus* recorded in this study, including flocks of up to 842 individuals in northern Rio de Janeiro, and considering the absence of records in previous works conducted in the region, we concluded that the species is expanding its range in the State. However, this expansion could be linked with degradation of natural wetlands due to sewage discharges. It should be stressed that coastal lagoons exposed to the imminent risk of disappearing due to anthropogenic pressure were the environments that the species used most intensely. So, studies focused on restoring and managing habitat conditions at regional level may provide critical information to preserve suitable sites for the Grey-headed Gull and other waterbirds.

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ARTICLE

Birds of Upper Paraná River Basin in the State of Mato Grosso do Sul, Brazil

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ABSTRACT: The Upper Paraná River Basin covers approximately half of the territory of Mato Grosso do Sul state. There are two phytogeographic domains in this region: Cerrado and Atlantic Forest. Despite these domains have a high biological diversity and suffer intense anthropogenic pressure, little is known about their avifauna in this region. Thus, we presented a compilation of the avifauna based on field studies conducted by the authors, supplementary data from literature and institutional material deposited in museum collections. We recorded 472 species of birds belonging to 25 orders and 71 families. Eleven species are endemic to the Cerrado and 26 to the Atlantic Forest. Nine species with Amazonian distribution and four from the Chaco were also found in this region. Sixteen intercontinental migratory species were recorded and 20 species are considered endangered. These endangered species are rare or uncommon in the region, except for *Rhea americana* and *Alipiopsitta xanthops*, which are very common. These data reinforce the importance of the conservation of birds in these areas, as well as additional studies that will allow a better characterization of the avifauna of the region. We recommend the creation of new protected areas in the Upper Paraná River region, in addition to the full maintenance of Permanent Preservation Areas and Legal Reserves. This will ensure the conservation of these birds currently threatened by strong anthropic pressure due to the presence of pastures and large-scale agriculture in the region.

KEY-WORDS: Atlantic Forest, avian communities, biogeography, central-western Brazil, Cerrado.

INTRODUCTION

The state of Mato Grosso do Sul is located in central-western Brazil, and has an area with about 360.000 km^2 (IBGE 2002) originally covered by Cerrado, Pantanal and Atlantic Forest. In addition, there are small portions of Chaco vegetation in low areas of the Paraguay River watershed (Ab'Saber 1977, Mato Grosso do Sul 2010). Two major river basins in the state are the Upper Paraguay River Basin, located to the west, and the Upper Paraná River Basin, located east (Mato Grosso do Sul 2010).

The Upper Paraná River Basin embraces almost half of Mato Grosso do Sul and it is the richest region of the state due to the presence of pastures and agricultural activities, especially monocultures of soy bean, sugar cane, corn and *Eucalyptus* (Mato Grosso do Sul 2010). However, this region has an important role in biodiversity conservation, since it still has well preserved aquatic and terrestrial habitats of Cerrado and Atlantic Forest (Gimenes *et al.* 2007).

Despite the importance of the Upper Paraná River Basin for biogeography and conservation, little is known regarding the composition and distribution of birds, unlike the avifauna of the Upper Paraguay River Basin, which is much better known (Tubelis & Tomas 2003, Nunes *et al.* 2005, Pivatto *et al.* 2006, Straube *et al.* 2006a,b, Nunes *et*

al. 2008, Pivatto *et al*. 2008, Nunes *et al*. 2009, Nunes *et al*. 2010, Tomas *et al*. 2010, Nunes *et al.* 2013).

The main studies of the avifauna in the Upper Paraná River Basin in the state of Mato Grosso do Sul are Silva *et al*. (2006) and Gimenes *et al*. (2007). Silva *et al*. (2006) listed 241 bird species for the sub-basins of the Aporé and Sucuriú rivers in the Cerrado region (northeastern state). Gimenes *et al*. (2007) listed 295 species in the area between the lake of Porto Primavera and the upper region of the Ivinhema River (Atlantic Forest domains and floodplain of the Paraná river and tributaries). In addition, Faxina & Schlemmermeyer (2010) recorded 146 species of birds in the sub-basin of the river Amambaí in the Atlantic Forest in the southern part of the state, and Piratelli & Blake (2006) 99 species of birds in areas of Cerrado in Três Lagoas municipality, eastern of Mato Grosso do Sul.

As a result, the entire region of the Upper Paraná River in Mato Grosso do Sul still has a gap on the knowledge about birdlife. This fact is reinforced by the high frequency of species whose occurrence had not been expected or documented for this region (Zucca *et al*. 2007, Faxina *et al*. 2010, Godoi *et al*. 2011, 2012a, Morante-Filho & Godoi 2012).

Herein we present data on the avian composition, distribution and status of occurrence in the Upper Paraná River Basin in the state of Mato Grosso do Sul, focusing on bird conservation. These data are useful to increase the knowledge on distribution and also to determine the main areas to be preserved in this part of the Mato Grosso do Sul state.

MATERIAL AND METHODS

The Paraná River is the main river of the Plata Basin, responsible for draining the entire south-central part of South America. The Upper Paraná River comprises portions of the states of Goiás, Minas Gerais, São Paulo, Paraná and Mato Grosso do Sul, in the region from the confluence of the Paranaíba and Grande rivers to the Itaipu Hydroelectric dam (Agostinho *et al*. 2002). Its main tributaries on the right bank are the Iguatemi, Amambaí, Ivinhema, Pardo, Verde, Sucuriú, and Aporé rivers (Mato Grosso do Sul 2010).

The Upper Paraná River Basin covers about 170.000 km^2 in Mato Grosso do Sul, which equates to 47.5% of the territory of the state (Figure 1). This region is located on the plateau of the Paraná sedimentary basin, with extensive plateaus and flat surfaces located between 300-1000m above sea level. The climate is mostly tropical and subtropical in the extreme south of the region. It is markedly seasonal, with annual rainfall ranging from 1070-1800mm, concentrated in a rainy season from November to March, with a dry season from April to October (Mato Grosso do Sul 2010).

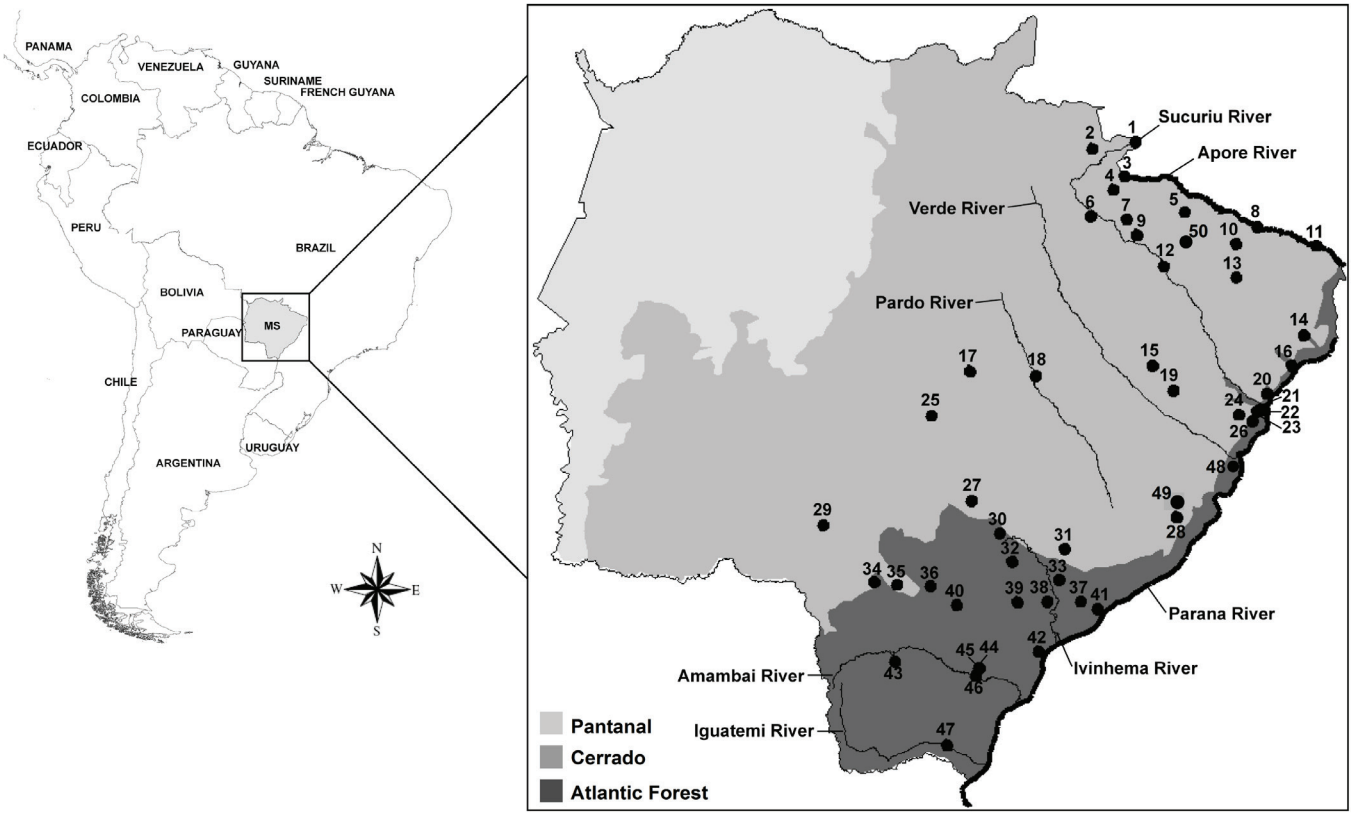

FIGURE 1. Upper Paraná River Basin in the state of Mato Grosso do Sul showing major rivers and phytogeographic domains. The numbers indicate the locations sampled in this study and summarized in Table1.

The phytogeographical domains are: a) Cerrado, distributed mainly in central, east, north and northeast of the Basin and b) Semideciduous forest (Atlantic Forest), present mainly in the south and southeast. Additionally, there are areas of ecotone distributed widely in the region of contact between the Cerrado and the Atlantic Forest (Mato Grosso do Sul 2010) (Figure 1).

The check-list assembled herein is based primarily on data collected in the field by the authors and also data available in the literature (Silva *et al*. 2006, Gimenes *et al*. 2007, Faxina & Schlemmermeyer 2010). Additionally, we used data obtained from: a) specimens deposited at museums (The Field Museum of Natural History -FMNH, Museu de Zoologia, Universidadede São Paulo-MZUSP, and Museu de História Natural Capão da Imbuia - MHNCI); b) photographic material hosted in the WikiAves website (www.wikiaves.com.br); and c) personal communications accompanied by photographic material to evidence the records.

The data collected in the field by the authors and those available in the literature are from 50 locations distributed throughout the study area, sampled between 2001 and 2012, both in Cerrado and in areas of Atlantic Forest (Figure 1). The municipalities sampled are shown in Table 1, which also contains information regarding the sampling methods used, sampling effort, study period and sources used.

The taxonomic list and scientific nomenclature adopted follow the Brazilian Ornithological Records Committee (CBRO 2011), with the exception of some recent deliberations for families Caprimulgidae, Thraupidae and Emberizidae, and temporary situations (incertae sedis) of some groups or species based on the previous edition of the same list (CBRO 2009). Also, we used the concepts and findings of D'Horta *et al*. (2008) and consider *I. pyrrhopterus* (Vieillot, 1819) as a valid species and the local representative of the *Icterus cayanensis* complex in the Paraná Basin.

We adopted Silveira & Straube (2008) and BirdLife International (2009) to identify endangered bird species in Brazil and globally, respectively. The recognition of Cerrado endemic species follows Silva (1995, 1997), while those endemic to the Atlantic Forest follow Goerck (1997) and Brooks *et al*. (1999). Additionally, bird species from the Amazon rainforest (Silva 1996) and Chaco (Straube *et al.* 2006b), which extend their geographic distribution to the Upper Paraná River Basin, were pointed out. The classification of migratory species follows the CBRO (2011).

We used the Index of Frequency of Occurrence, adapted from Naka *et al.* (2002), to determine the status of occurrence of bird species in the Upper Paraná River Basin. This index is based on the ratio between the number of locations where a species was recorded by the total number of sampling sites. The frequency of occurrence does not show how bird species are abundant in the study area in terms of absolute abundance or population density, but allows us to identify which species are rare and more common in the survey area. Thus, bird species were classified as follows: rare-species that occurred in one to five locations (10% of locations); uncommon-species that occurred in six to10 locations (11% - 20% of locations); common-species occurring in 11 to 25 locations (21% - 50% of locations); very common-species occurring in 26 to50 locations (51% - 100% of locations).

RESULTS AND DISCUSSION

We recorded 472 species of birds belonging to 25 orders and 71 families in the sampled area. The richest orders are Passeriformes (236 species), Accipitriformes (27), Apodiformes (23) and Piciformes (19). The richest families were Tyrannidae (60 species), Emberizidae (26), Thraupidae (25), Accipitridae (26), Trochilidae (19), Furnariidae (17), Psittacidae (16), Picidae (16) and Icteridae (16 species) (Table 2).

The Upper Paraná River Basin in the state of Mato Grosso do Sul has high bird richness, accounting for 70% of all bird species recorded in the state (Nunes *et al.* in press) and 23.5% of the birds recorded in Brazil (CBRO 2011). The richness is also high compared to the better preserved and more thoroughly sampled Pantanal floodplains to the west, where at least 582 species of birds were recorded (Tubelis & Tomas 2003, Nunes *et al.* 2008, Nunes 2011). However, the avian richness of the area sampled herein should be higher, since most locations were undersampled, and especially due to the fact that several locations throughout the Upper Paraná River Basin remain unsampled to this day. The avifauna of the Upper Paraná River presents both species typical of the Cerrado as well as of the Atlantic Forest. Eleven endemic species from Cerrado (Silva 1995, 1997) and 26 from the Atlantic Forest were recored in this study (Goerck 1997, Brooks *et al.*1999) (Table 2). This shows the importance of these phytogeographic domains to the regional species composition.

Areas of contact between different vegetations associated with the Cerrado and Atlantic Forest occur at several localities sampled in this study. In these ecotone areas, we can find endemic species of both domains, and this can occur even in the more southern portions of the state, such as sub-basins of Amambaí and Iguatemi rivers (Atlantic Forest). In areas close to the river Amambaí (locality 43), for example, endemic species of the Cerrado (*Antilophia galeata*, *Cyanocorax cristatellus* and *Basileuterus leucophrys*) and Atlantic Forest (*Pyrrhura frontalis*, *Trogon surrucura*, *Baryphthengus ruficapillus*, *Melanerpes flavifrons*, *Automolus leucophthalmus* and *Procnias nudicollis*) co-occur in the same region. As a result, the influence of these ecotone regions and their importance for the characterization and

conservation of birds of the Upper Paraná River deserv especial attention and additional sampling in the future.

The seasonal forests in southern Mato Grosso do Sul (sub-basins of the Ivinhema, Iguatemi and Amambaí rivers), as well as the forests of western Paraná, eastern Paraguay and northeastern Argentina, constitute the western limits of distribution for many Atlantic Forest endemic birds (Straube *et al.* 1996, Pivatto *et al.* 2006). Even in the mid-east and northeast of the state (sub-basins of the Pardo, Verde, Aporé and Sucuriú rivers) there are Atlantic Forest influences due to the presence of semideciduous forests fragments. This probably explains the occurrence of many Atlantic Forest endemic birds into the Cerrado, such as *Florisuga fusca*, *Thalurania glaucopis*, *Trogon surrucura*, *Melanerpes flavifrons*, *Schiffornis virescens*, *Campephilus robustus* and *Hylophilus poecilotis*.

In addition, four species (*Nystalus striatipectus*, *Celeus lugubris*, *Xiphocolaptes major* and *Agelaioides badius*) with their distributions centered in the Chaco (Straube *et al.* 2006b) and nine (*Pionus menstruus*, *Coccycua minuta*, *Hylocharis cyanus*, *Celeus flavus*, *Tityra semifasciata*, *Tyrannopsis sulphurea*, *Hylophilus pectoralis*, *Cyanerpes cyaneus* and *Euphonia laniirostris*) in Amazonia (Silva 1996) occur in the region (Table 2).

The occurrence of Amazonian species in the sampled area can be probably explained by dispersion throughout riparian forests of central Brazil, where they reach the southern part of the Cerrado (Silva 1996). Some Amazonian species recorded seem to occur only in the northern part of the Paraná Basin. This region is possibly the southern limit of distribution of many of them, including *Pionus menstruus*, *Celeus flavus* and *Euphonia laniirostris*, which occurred only in the northeastern portion of the area sampled in this study. For instance, *Tyrannopsis sulphurea* has only recently been recorded in the Paraná Basin (Pacheco *et al.* 2010). Other species (*Coccycua minuta*, *Cyanerpes cyaneus*, *Tityra semifasciata* and *Hylophilus pectoralis*) spread out to the southern Paraná Basin, with at least two recorded in the region by Godoi *et al.* (2011) and Pacheco *et al.* (2011).

Chaco species recorded are distributed mainly in the Upper Paraguay River Basin, both in the Pantanal and its eastern and western edges, and also in neighboring countries, such as Bolivia and Paraguay (Short 1975, Straube *et al.* 2006b). The *Celeus lugubris* and *Xiphocolaptes major* records in the Paraná Basin are unprecedented in this region, as in Mato Grosso do Sul were both found only in the Pantanal (Tubelis & Thomas 2003) and its surroundings, such as Serra da Bodoquena (Pivatto *et al.* 2006) and Serra de Maracaju (Nunes *et al.* 2013 in press).

Nystalus striatipectus and *Nystalus maculatus* were considered two different species recently (Silva 1991). Thus, their distribution in the region is still uncertain. Apparently, *N. striatipectus* is widely distributed throughout Mato Grosso do Sul, while *N. maculatus* seems to be restricted to the east and north-northeastern portion of the state, in a region already pointed out by Silva (1991) as a possible area of contact between the two species. Further studies on these two sympatric species in the region may provide more accurate information on their distributions in Mato Grosso do Sul.

We recorded 16 migratory species from the Northern Hemisphere (CBRO 2011): *Pandion haliaetus*, *Ictinia mississippiensis*, *Bartramia longicauda*, *Actitis macularius*, *Tringa solitaria*, *Tringa melanoleuca*, *Tringa flavipes*, *Calidris minutilla*, *Calidris fuscicollis*, *Phalaropus tricolor*, *Coccyzus americanus*, *Chordeiles minor*, *Vireo olivaceus*, *Riparia riparia*, *Hirundo rustica* and *Petrochelidon pyrrhonota* (Table 2). Many migratory species from southern South America occur in the Upper Paraná River and apparently some do not have resident populations in the region, such as *Pyrocephalus rubinus*. Other species (*Phimosus infuscatus*, *Xolmis cinereus*, *Myiodinastes maculatus*, *Empidonomus varius*, *Griseotyrannus aurantioatrocristatus*, *Tyrannus savana*, *Myiarchus swainsoni*, *Ictinia plumbea*, *Turdus amaurochalinus*, *Tersina viridis* and some *Sporophila* species) appear to have resident populations that increase seasonally in winter due to the arrival of migrants from southern areas (Nunes & Tomas 2008).

Twenty species are considered nationally (Silveira & Straube 2008) and/or globally endangered (BirdLife International 2009): *Rhea americana*, *Tinamus solitarius*, *Nothura minor*, *Odontophorus capueira*, *Tigrisoma fasciatum*, *Urubitinga coronata*, *Harpia harpyja*, *Primolius maracana, Alipiopsitta xanthops*, *Geositta poeciloptera*, *Procnias nudicollis*, *Euscarthmus rufomarginatus*, *Culicivora caudata*, *Alectrurus tricolor*, *Neothraupis fasciata*, *Poospiza cinerea*, *Sporophila frontalis*, *Sporophila cinnamomea*, *Sporophila palustris* and *Charitospiza eucosma* (Table 2). All endangered species were considered rare or uncommon in the region, except for *Rhea americana* and *Alipiopsitta xanthops*, classified as very common. Considering all species recorded, 183 species (38.8%) are rare, 54 (11.5%) uncommon, 98 (20.7%) common and 137 (29%) very common (Table 2). Concerning the 11 species endemic to the Cerrado, six (54.5%) are common or very common and five (45.5%) are rare. From 26 species endemic to the Atlantic Forest, 24 (92%) are rare or uncommon and only two (8%) are common. Finally, all Chaco and Amazonian species are rare or uncommon, except for *Nystalus striatipectus*, which is common in the region (Table 2).

Thus, the Upper Paraná River Basin in the state of Mato Grosso do Sul has many rare and/or endangered species, indicating the importance of preserving natural vegetation remnants for long-term conservation of these species. The presence of rare and large raptors in grasslands (*Urubitinga coronata*) and forests (*Harpya harpyja*, *Spizaetus ornatus*, *S. tyrannus* and *S. melanoleucus*), indicates that there are still spotted areas of native vegetation capable of maintaining these carnivorous species. Nevertheless,

they require relatively large areas and continuous habitat, and thus may become rare and even extinct regionally due to the lack of massive continuous forest in the Upper Paraná River. In the state of Mato Grosso do Sul, these species have been more commonly found in regions with larger and preserved natural habitats, especially in the Pantanal, Maciço do Urucum and Serras da Bodoquena and Maracajú (Godoi *et al.* 2012b).

Some large frugivorous species occur in the region, such as *Primolius maracana*, *Procnias nudicollis*, *Tinamus solitarius* and *Crypturellus obsoletus*. These species are naturally rare and the Upper Paraná River usually corresponds to the western limit of their distribution. This may partly explain their regional rarity. However, the absence of larger forest tracts also appears to be responsible for the rarity of large frugivorous birds in the region, since they usually depend upon preserved continuous forests (Aleixo & Vielliard 1995, Gimenes & Anjos 2003). The absence of some frugivorous and forest dwelling species, such as *Ramphastos dicolorus* and *Pyroderus scutatus*, present in the Serra da Bodoquena (Pivatto *et al.* 2006), and even *Aburria jacutinga*, with historical records in the region of the Upper Paraná River (Mendonça *et al.* 2009), can also be attributed mainly to the loss and fragmentation of semideciduous forests. These factors are commonly identified as the main cause of loss and reduced diversity of birds in Brazil (Marini & Garcia 2005, Tabarelli & Gascon 2005).

Some endangered and rare species in the region are typical inhabitants of savannas and open grasslands, such as *Nothura minor*, *Geositta poeciloptera*, *Melanopareia torquata*, *Culicivora caudata*, *Euscarthmus rufomarginatus*, *Alectrurus tricolor*, *Neothraupis fasciata*, *Poospiza cinerea* and *Charitospiza eucosma*. The grasslands of the Cerrado are among the world's most threatened environments (Stotz *et al.* 1996) with few remaining tracts (most of them fragmented) in central Brazil. These habitats have been largely converted to pastures and monocultures of soybean, corn and sugar cane. Collar *et al.* (1992) considered this process as one of the greatest ecological catastrophes in South America. Nowadays, the remaining native grasslands in central Brazil are restricted to a few protected areas, such as the Parque Nacional das Emas (Hass 2003). Thus, many typical bird species from these habitats are becoming rare across their entire range (Cavalcanti 1999, Vickery *et al.*1999). This seems to be the case, for example, with the very rare *Nothura minor* and *Geositta poeciloptera*, with historical records for the region (Pinto 1932, Straube 2011).

There are some endangered and rare species typical of humid habitats, such as *Sporophila frontalis*, *S.cinnamomea* and *S. palustris*, which occur in floodplains and swamps, and *Tigrisoma fasciatum*, found in rivers waterfalls, rocky with flagstones and rough waters (Nunes *et al.* 2012). The Upper Paraná River Basin still has large areas of river-floodplain ecosystem (Agostinho *et al.* 2004), not only near the Paraná River, but also in inland portions of the state, such as sub-basins of Ivinhema, Aporé and Sucuriú rivers. However, this whole region was subjected to intense anthropization, including the construction of a large hydroelectric project, such as the Porto Primavera dam. This dam possibly affected the conservation of many birds typically associated with the floodplains (Mendonça *et al.* 2009). Recently, the installation of several projects of small hydroeletrics, especially in sub-basins of the Rio Verde, Sucuriú and Aporé, and also the dry out of wetlands for the expansion of pasture and agriculture, are the main threats to aquatic birds. Many species, especially Emberizidae, are still targets for wildlife trafficking, a factor correlated with the decline and even local extinctions of many species (Marini & Garcia 2005).

Originally, the Cerrado covered approximately 61% of Mato Grosso do Sul territory (Sano *et al.* 2010), while the Atlantic Forest covered 18% (Fundação SOS Mata Atlântica & INPE 2010). However, with the occupation of state from the 1960's onward, there were drastic reductions of native vegetation with only 32% of the original Cerrado (Sano *et al.* 2010) and less than 5% of the original Atlantic Forest remaining (Fundação SOS Mata Atlântica & INPE 2010).

Today, only 0.85% of the Mato Grosso do Sul territory is legally protected by Conservation Units (CUs), with few protected areas in the Upper Paraná River Basin (Mato Grosso do Sul 2010). Thus, we recommend the creation of new CUs in the Upper Paraná River Basin, especially where large areas of native vegetation can be found and are representative of the biodiversity of both the Cerrado and Atlantic Forest domains.

The proper management of the landscape, respecting the Brazilian environmental legislation, maintaining the Permanent Preservation Areas (APP´s) and Legal Reserves (RL's), will ensure the long-term conservation of avifauna of the region. The APP's with riparian forests, Buriti (*Mauritia flexuosa*) palm groves, floodplains, as well as fragments of native vegetation established as RL's, are essential for the conservation of regional biodiversity. In fact they represent refuges for wildlife and act as corridors, allowing the movement and dispersal of different species across the landscape. The riparian forest, for instance, are a very important element in fragmented landscapes by allowing dispersal of forest species between forest fragments (Martensen *et al.* 2008). Keeping wide corridors of riparian forests in fragmented landscapes would provide the conservation of a higher diversity of bird species (Tubelis *et al.* 2004, Lees & Peres 2008). Buriti (*M. flexuosa*) palm groves are relatively continuous natural environments and also allow the dispersion and provide refuge for different species of forest birds, including species strongly associated with these areas, such as *Ara ararauna*, *Orthopsittaca manilata* and *Tachornis squamata* (Tubelis 2009).

TABLE 1. Information on the location, methods, sampling effort and sources of avian surveys carried out and analyzed during this study.

Points	Municipalities	Method and sampling effort	Source
1	Costa Rica	24 hs of observation (2004)	Silva *et al.* 2006
2	Costa Rica	72 hs of observation (2011)	This study
3	Chapadão do Sul	24 hs of observation (2004)	Silva *et al.* 2006
4	Chapadão do Sul	150 hs of observation (2009-2011)	This study
5	Chapadão do Sul	72 hs of observation (2010)	This study
6	Costa Rica	24 hs of observation (2004)	Silva *et al.* 2006
7	Paraíso	24 hs of observation (2004)	Silva *et al.* 2006
8	Cassilândia	67 hs of observation (2007)	This study
9	Chapadão do Sul	24 hs of observation (2004)	Silva *et al.* 2006
10	Cassilândia	72 hs of observation (2010)	This study
11	Paranaíba	24 hs of observation (2004)	Silva *et al.* 2006
12	Chapadão do Sul	128 hs of observation e 600 hs/mist nets (2007-2008)	This study
13	Inocência	24 hs of observation (2004)	Silva *et al.* 2006
14	Aparecida do Taboado	40 hs of observation (2010)	This study
15	Três Lagoas	60 hs of observation (2010-2012)	This study
16	Selvíria	72 hs of observation (2010)	This study
17	Jaraguari	25 hs of observation (2007)	This study
18	Ribas do Rio Pardo	72 hs of observation (2010)	This study
19	Três Lagoas	40 hs of observation (2009)	This study
20	Três Lagoas	30 hs of observation (2009)	This study
21	Três Lagoas	250 hs of observation (2009); 30 hs of point counts (2008-2012)	This study
22	Três Lagoas	70 hs of observation (2009-2011)	This study
23	Três Lagoas	18 hs of observation (2007)	This study
24	Três Lagoas	80 hs of observation (2009)	This study

Points	Municipalities	Method and sampling effort	Source
25	Campo Grande	50 hs of observation (2008)	This study
26	Três Lagoas	25 hs of observation (2011)	This study
27	Nova Alvorada do Sul	300 hs of observation (2009-2011)	This study
28	Bataguassú	20 hs of observation (2007)	This study
29	Maracaju	125 hs of observation (2009-2011)	This study
30	Rio Brilhante	200 hs de observation (2008-2011)	This study
31	Nova Andradina	160 hs of observation (2009-2012)	This study
32	Angélica	260 hs of observation (2009-2012)	This study
33	Nova Andradina	57 hs of observation (2009)	This study
34	Ponta Porã	250 hs of observation (2009-2011)	This study
35	Dourados	166 hs of observation (2010-2012)	This study
36	Fátima do Sul	76 hs of observation (2010)	This study
37	Batayporã	275 hs of observation (2009-2012)	This study
38	Ivinhema	30 hs of observation (2007)	This study
39	Ivinhema	130 hs of observation (2007-2012)	This study
40	Vicentina	300 hs of observation (2008-2011)	This study
41	Taquarussu, Jateí e Naviraí	Unrecorded (1999-2005)	Gimenes *et al.* 2007
42	Taquarussu, Jateí e Naviraí	320 hs of observation (2005-2007)	This study
43	Amambai	80 hs of observation (2011)	This study
44	Naviraí	10 hs of observation (2010)	This study
45	Naviraí	230 hs of observation (2003-2004)	This study
46	Naviraí	23 hs of observation (2007)	This study
47	Mundo Novo, Eldorado e Iguatemi	160 hs of observation and 750 hs/mist nets (2008-2009)	This study
48	Brasilândia	24 hs of observation e 100 hs/mist nets (2008-2010)	This study
49	Bataguassú	12 hs of observation (2012)	This study
50	Cassilândia	60 hs of observation (2012)	This study

TABLE 2. Composition, distribution and frequency of occurrence of birds in the Upper Paraná River Basin in the state of Mato Grosso do Sul. CS (Conservation status) = Threatened species globally (BI = BirdLife International) and in Brazil (IB = IBAMA): EN (endangered), VU (vulnerable), NT (near threatened). ENDEMIC: Endemic species to the Cerrado (CE) and Atlantic Forest (AF). FO (frequency of occurrence) in the region of this study: VC (very common), C (common), U (uncommon) and R (rare). Localities (see Figure 1 and Table 1 for the identity and location of sampling points).

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
STRUTHIONIFORMES						
Rheidae						
Rhea americana	NT				VC	1,2,4,5,8,10,12,13,14,15,16,17,19,20,21,22,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,46,47,49
TINAMIFORMES						
Tinamidae						
Tinamus solitarius	NT			X	R	48
Crypturellus obsoletus					R	6,21,41,48
Crypturellus undulatus					VC	1,2,4,5,7,8,9,10,12,13,14,16,18,20,21,27,29,30,31,32,33,34,35,40,41,42,43,48,50
Crypturellus parvirostris					VC	1,2,4,5,7,10,12,14,15,16,18,20,21,22,23,26,27,29,30,31,32,34,35,36,37,38,39,40,41,42,43,48,50
Crypturellus tataupa					VC	2,4,5,10,12,14,18,21,24,25,27,29,30,31,32,33,34,35,36,37,38,39,41,42,43,48,50
Rhynchotus rufescens					VC	2,3,4,5,10,14,15,20,21,24,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,47,48,49,50
Nothura minor	VU	VU	X		R	FMNH
Nothura maculosa					VC	2,4,5,7,10,12,14,15,17,19,20,21,22,26,27,29,30,31,32,33,35,36,37,38,40,41,42,43,45,46,48,50
ANSERIFORMES						
Anhimidae						
Anhima cornuta					U	12,20,21,26,37,41,42,48,49,50
Chauna torquata					R	29
Anatidae						
Dendrocygna viduata					VC	3,4,9,12,15,19,20,23,24,25,27,29,30,31,32,33,34,35,36,37,38,40,41,42,44,45,46,47
Dendrocygna autumnalis					C	4,12,14,15,16,20,21,23,24,26,27,28,30,32,34,35,36,37,39,40,41,42,48,49
Cairina moschata					VC	2,8,9,14,15,16,18,19,20,21,22,23,27,29,30,31,32,34,35,37,38,41,42,43,46,47,48,49,50
Amazonetta brasiliensis					VC	2,3,4,9,10,12,13,14,15,17,18,19,25,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,47,48,50
Anas bahamensis					R	12
Nomonyx dominica					R	45
GALLIFORMES						
Cracidae						
Penelope superciliaris					VC	1,2,4,5,8,10,11,12,13,16,18,19,20,24,27,29,30,31,32,35,36,37,39,41,42,48,50
Crax fasciolata					VC	2,4,5,6,8,10,12,13,14,15,18,19,20,21,25,27,29,30,31,32,33,34,37,41,42,48,50

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Odontophoridae						
Odontophorus capueira		EN		X	R	MZUSP
PODICIPEDIFORMES						
Podicipedidae						
Podilymbus podiceps					R	9,23,37,45,48
Tachybaptus dominicus					C	3,4,9,22,29,30,35,37,40,45,48
CICONIIFORMES						
Ciconiidae						
Ciconia maguari					U	30,34,35,37,41,42,47,48
Jabiru mycteria					C	3,4,27,29,30,32,34,38,41,42,47,48,49
Mycteria americana					C	9,14,23,26,27,30,32,34,35,37,38,39,40,41,42,47,48
SULIFORMES						
Phalacrocoracidae						
Phalacrocorax brasilianus					MC	4,9,14,16,17,19,21,22,23,24,27,30,31,32,33,34,35,36,37,38,40,41,42,45,47,48,49,50
Anhingidae						
Anhinga anhinga					C	2,6,8,15,16,21,27,30,32,34,37,41,42,43,45,47,48,49,50
PELECANIFORMES						
Ardeidae						
Tigrisoma lineatum					C	2,6,12,13,15,26,27,29,30,31,32,34,35,37,38,39,40,41,42,45,47,48,49
Tigrisoma fasciatum		EN			R	Nunes *et al.* (2012)
Botaurus pinnatus					R	30,34,37
Ixobrychus involucris					R	37
Nycticorax nycticorax					U	23,35,37,41,42,45,47,48
Butorides striata					VC	4,5,7,8,10,12,13,14,15,16,18,19,20,21,22,23,26,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,47,48
Bubulcus ibis					VC	2,5,7,9,11,12,14,15,16,17,22,23,24,27,28,30,31,32,35,36,37,40,41,43,45,46,47,48,49,50
Ardea cocoi					C	14,16,19,20,21,22,23,30,34,36,37,41,42,47,48,49,50
Ardea alba					VC	4,5,8,12,14,15,16,17,19,21,23,24,27,29,30,31,32,33,34,35,36,37,38,40,41,42,43,44,45,47,48,49,50
Syrigma sibilatrix					VC	2,4,5,8,10,11,12,13,14,15,17,18,19,20,21,22,23,24,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45, 46,47,48,49,50
Pilherodius pileatus					R	32,41
Egretta thula					VC	5,8,10,14,15,16,20,21,22,23,24,27,29,30,31,32,34,35,36,37,38,40,41,42,45,47,48,49,50

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Threskiornithidae						
Plegadis chihi					R	48
Mesembrinibis cayennensis					VC	2,3,4,5,7,8,10,11,12,14,15,16,17,18,19,20,21,22,24,25,27,29,30,31,32,34,35,36,37,38,40,41,43,47,48,50
Phimosus infuscatus					U	14,16,24,35,36,37,45,48
Theristicus caudatus					VC	1,2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,24,25,26,27,28,29,30,31,32,33,34,35,36,37,39,40,41,42, 43,45,47,48,49,50
Platalea ajaja					U	19,30,34,37,39,41,42,47
CATHARTIFORMES						
Cathartidae						
Catharters aura					VC	2,4,5,8,9,10,11,12,14,15,16,17,18,19,20,21,22,23,24,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44, 45, 46,47,48,49,50
Cathartes burrovianus					C	2,4,9,11,14,15,19,21,22,24,27,29,30,32,34,35,37,38,41,42,43,48,49,50
Coragyps atratus					VC	2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41, 42,43,44,45,46,47,48,49,50
Sarcoramphus papa					C	7,12,15,29,30,31,33,37,38,39,41,42,46,47,50
ACCIPITRIFORMES						
Pandionidae						
Pandion haliaetus					R	20,41,47,48
Accipitridae						
Leptodon cayanensis					R	20,32,37
Chondrohierax uncinatus					R	27
Elanoides forficatus					U	16,21,27,30,31,32,47,48,50
Gampsonyx swainsonii					R	6,15,48
Elanus leucurus					C	4,27,31,32,34,35,37,40,41,42,43,45,47,48
Harpagus diodon					R	48
Circus buffoni					C	2,4,27,29,30,32,34,37,39,40,41,42,43,47,48,50
Accipiter superciliosus					R	24,48
Accipiter striatus					R	41
Rosthramus sociabilis					C	9,15,16,20,21,22,23,27,30,32,34,35,36,37,41,42,47,48,49,50
Ictinea mississippiensis					R	5,16,18,32
Ictinea plumbea					VC	2,4,8,11,12,13,14,15,20,21,23,25,26,27,29,30,31,32,33,34,36,37,38,39,41,42,43,44,45,47,48,50
Busarellus nigricollis					C	20,21,27,29,30,31,37,41,42,47,48

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Geranospiza caerulescens					U	2,5,14,27,30,34,47,48,50
Heterospizias meridionalis					VC	1,2,4,5,9,10,12,13,14,15,16,17,18,19,20,21,22,24,25,26,27,30,31,32,33,34,35,37,38,39,40,41,42,43,47,48,49,50
Urubitinga urubitinga					U	4,7,20,25,37,41,47,49,50
Urubitinga coronota	EN	VU			R	5,41,43
Rupornis magnirostris					VC	2,3,4,5,6,10,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40,41,42,43,44, 45,46,47,48,49,50
Geranoaetus albicaudatus					VC	2,4,5,10,12,13,14,15,17,18,27,29,30,31,32,33,34,36,39,40,42,43,46,47,50
Buteo nitidus					R	11
Buteo brachyurus					R	27,28,41
Buteo albonotatus					R	42,46
Harpia harpyja	NT				R	Dias, J. H. P. (*pers. comm.*)
Spizaetus tyrannus					R	37
Spizaetus melanoleucus					R	Godoi *et al.* (2012b))
Spizaetus ornatus					R	1,27
FALCONIFORMES						
Falconidae						
Caracara plancus					VC	2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,46,47,48,49,50
Milvago chimachima					VC	2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38,39,40,41, 42,43,45,46,47,48,49,50
Herpetotheres cachinnans					C	3,4,5,6,7,9,12,13,14,15,20,21,27,29,30,32,35,37,39,40,41,42,43,47,48,50
Micrastur semitorquatus					C	2,3,5,10,12,16,30,34,35,40,41,47
Falco sparverius					VC	2,3,4,5,6,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42, 43,44,45,46,48,49,50
Falco rufigularis					U	9,27,41,43,46,50
Falco femoralis					VC	1,2,3,4,5,7,9,12,14,15,17,20,21,22,23,26,27,29,30,31,32,34,37,40,41,42,43,45,46,47,48
GRUIFORMES						
Aramidae						
Aramus guarauna					C	2,12,14,16,20,21,22,23,24,27,30,32,34,35,36,37,38,40,41,42,47,48,49,50
Rallidae						
Aramides cajanea					C	3,4,5,10,13,14,16,21,22,26,27,29,30,32,34,37,41,43,48,49,50
Aramides saracura				X	R	31,35,41,47
Amaurolimnas concolor					R	27

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Laterallus viridis					R	7,30,37,38,48
Laterallus melanophaius					R	38
Porzana albicollis					C	2,3,4,5,14,15,16,18,21,26,27,29,30,32,34,35,36,37,38,39,40,43,48,49,50
Pardirallus nigricans					U	30,31,32,39,41,42,45,47,48
Gallinula galeata					U	23,29,35,36,37,38,41
Porphyrio martinica					C	5,23,29,30,32,34,37,38,40,41,45,48
Porphyrio flavirostris					R	29,37,41
Heliornithidae						
Heliornis fulica					U	22,27,30,37,41,42,47
CARIAMIFORMES						
Cariamidae						
Cariama cristata					MC	2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,46,47,48,49,50
CHARADRIIFORMES						
Charadriidae						
Vanellus cayanus					R	32,35,40,48
Vanellus chilensis					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39, 40,41,42,43,44,45,46,47,48,49,50
Charadrius collaris					R	41
Recurvirostridae						
Himantopus melanurus					C	2,3,4,14,22,23,26,28,29,30,31,32,35,37,38,40,41,43,45,47,48
Scolopacidae						
Gallinago undulata					R	15
Gallinago paraguaiae					R	18,40,41,45
Bartramia longicauda					R	FMNH
Actitis macularius					R	37
Tringa solitaria					C	14,16,19,26,27,30,31,33,34,35,37,39,40,41,45,46,47
Tringa melanoleuca					R	45
Tringa flavipes					U	14,25,27,38,41,45
Calidris minutilla					R	38
Calidris fuscicollis					R	23,41
Phalaropus tricolor					R	FMNH

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Jacanidae						
Jacana jacana					VC	4,8,12,14,15,17,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,45,46,47,48,49,50
Sternidae						
Sternula superciliares					R	32,37,41,42,48
Phaetusa simplex					U	14,20,21,22,23,37,41,42,47,48
Rynchopidae						
Rynchops niger					R	21,48
COLUMBIFORMES						
Columbidae						
Columbina minuta					C	3,4,8,24,25,30,33,35,37,41,45
Columbina talpacoti					VC	1,2,3,4,5,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,46,47,48,49,50
Columbina squammata					VC	1,2,4,5,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,39,40,41, 42,43,44,45,46,47,48,49,50
Columbina picui					VC	4,5,6,8,10,12,14,16,18,20,21,23,25,27,30,31,32,33,34,35,36,37,38,39,40,41,42,45,46,47
Claravis pretiosa					C	7,16,27,30,35,36,37,38,41,47,48,49
Columba livia					U	16,23,24,32,45,48
Patagioenas speciosa					R	1,10
Patagioenas picazuro					VC	1,2,3,4,5,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,47,48,49,50
Patagioenas cayennensis					VC	1,2,3,4,5,6,7,8,9,10,11,12,14,15,16,17,18,20,21,22,23,24,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42, 43,46,47,48,49,50
Patagioenas plumbea					U	2,7,9,27,31,37,39,45
Zenaida auriculata					VC	2,3,4,8,12,14,15,16,18,19,20,21,22,23,24,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,47,48,49
Leptotila verreauxi					VC	1,2,3,4,5,6,7,8,10,11,12,14,15,16,17,18,20,21,22,23,24,25,26,27,29,30,31,32,34,35,36,37,38,39,40,41,42,43,44, 45,47,48,49,50
Leptotila rufaxilla					VC	1,2,3,4,5,10,13,14,16,18,19,20,27,29,30,31,32,33,34,35,37,38,39,40,41,42,43,47,48,49
Geotrygon montana					R	35,41,48,49
PSITTACIFORMES						
Psittacidae						
Ara ararauna					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,30,31,32,33,37,38,39,40,41,42,45, 48,49,50
Ara chloropterus					C	4,6,8,12,27,29,30,31,32,33,37,38,39,41,42,46

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Orthopsittaca manilata					U	9,13,14,19,26,41,48,49,50
Primolius maracana	NT				R	41,42,48,49
Diopsittaca nobilis					VC	1,2,3,4,5,6,7,8,10,11,12,13,14,15,16,18,20,26,27,28,30,31,32,33,34,37,48,50
Aratinga leucophthalma					VC	2,4,5,7,10,13,14,16,18,20,21,22,23,24,25,26,27,30,31,32,33,34,35,37,38,39,40,41,42,43,44,45,46,47,48,50
Aratinga acuticaudata					R	4
Aratinga aurea					VC	1,2,3,4,5,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,29,30,31,32,33,34,35,36,37,39,40,41,42,43, 44,45,47,48,49,50
Pyrrhura frontalis				X	U	23,38,41,42,43,47
Forpus xanthopterygius					VC	5,8,10,14,16,18,19,20,22,23,24,27,30,31,32,33,35,36,37,39,40,41,42,45,47,48,49
Brotogeris chiriri					VC	1,2,3,4,5,6,7,8,10,12,13,14,15,16,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,39,40,41,43,45, 46,47,48,49,50
Alipiopsitta xanthops	NT		X		VC	1,4,5,8,9,10,12,13,14,15,19,20,22,23,24,25,26,27,30,31,32,33,34,37,39,40,42,48,49,50
Pionus menstruus					R	3,8
Pionus maximiliani					U	23,26,27,32,35,37,41,42,43,45
Amazona amazonica					C	2,4,12,15,20,22,23,27,30,34,35,37,40,48,49,50
Amazona aestiva					VC	1,2,4,5,8,10,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43, 44,45,46,47,48,49,50
CUCULIFORMES						
Cuculidae						
Coccycua minuta					R	30
Micrococcyx cinereus					R	FMNH
Piaya cayana					VC	1,2,3,4,5,7,8,10,11,12,13,14,15,16,17,18,20,21,22,23,24,25,27,29,30,31,32,34,35,36,37,38,39,40,41,42,43,45, 47,48,49,50
Coccyzus melacoryphus					C	5,7,14,16,18,23,27,30,34,35,36,38,39,40,41,45,47,48
Coccyzus americanus					U	40,41,42,45,47,48
Coccyzus euleri					U	12,20,21,24,31,35,39,50
Crotophaga major					C	22,27,29,30,31,32,34,35,37,38,39,41,42,45,46,47,48
Crotophaga ani					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39, 40,41,42,43,44,45,46,47,48,49,50
Guira guira					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39, 40,41,42,43,44,45,46,47,48,49,50
Tapera naevia					C	11,16,20,27,30,31,32,34,35,36,37,39,40,41,42,43,45,47,48,49,50
Dromococcyx phasianellus					R	49
Dromococcyx pavoninus					U	2,27,30,37,41,42,48

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
STRIGIFORMES						
Tytonidae						
Tyto alba					C	1,4,10,12,19,23,26,27,30,32,35,39,40,41,43,46,47,48
Strigidae						
Megascops choliba					C	1,4,13,15,20,21,22,23,27,30,36,37,39,40,41,42,43,47,48,50
Pulsatrix perspicillata					R	27
Pulsatrix koeniswaldiana				X	R	41
Strix huhula					R	4
Glaucidium minutissimum				X	R	MZUSP
Glaucidium brasilianum					VC	2,4,5,6,7,10,12,13,15,18,20,23,27,29,30,32,33,34,35,36,37,38,39,41,42,43,47,48
Athene cunicularia					VC	2,3,4,5,6,8,9,10,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41, 42,43,44,45,46,47,48,49,50
Asio flammeus					R	2
Asio clamator					R	27,32,41
CAPRIMULGIFORMES						
Nyctibiidae						
Nyctibius griseus					U	8,12,20,21,27,30,36,39,42,48
Caprimulgidae						
Nyctiphrynus ocellatus					R	21
Caprimulgus rufus					U	8,13,27,30,38,39,40,41
Caprimulgus parvulus					U	2,4,29,30,41,48,50
Lurocalis semitorquatus					R	35,41
Podager nacunda					C	2,5,9,10,13,14,15,20,21,22,24,26,27,30,32,35,37,38,40,42,43
Chordeiles minor					R	31
Chordeiles pusillus					R	15,48
Nyctidromus albicollis					VC	1,2,4,5,6,8,9,10,11,12,14,15,16,17,18,20,23,25,27,28,29,30,31,32,34,35,36,37,38,39,40,41,42,43,45,47,48,50
Hydropsalis torquata					U	2,23,27,28,30,34,41,43,48
APODIFORMES						
Apodidae						
Steptoprocne zonaris					R	3,4,41,48
Cypseloides senex					R	2,50
Chaetura meridionalis					R	15,50

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Tachornis squamata					U	5,10,14,26,30,41,48,50
Trochilidae						
Phaethornis pretrei					VC	2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,22,23,24,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,46, 47,48,49,50
Eupetomena macroura					VC	2,4,5,6,8,9,10,11,12,15,16,17,18,23,24,25,26,28,30,31,34,37,40,41,48,50
Aphantochroa cirrochloris				X	R	21
Florisuga fusca				X	U	7,23,31,41,48
Colibri serrirostris					U	1,2,5,27,30,34
Anthracothorax nigricollis					VC	5,6,7,8,12,16,19,20,23,24,27,29,30,31,32,34,38,39,40,41,42,45,47,48
Chrysolampis mosquitus					R	22,48,50
Chlorostilbon lucidus					VC	2,4,5,8,10,11,12,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,39,40,41,42,45,47, 48,49,50
Thalurania furcata					C	2,3,4,5,6,8,9,12,19,23,30,34,35,37,50
Thalurania glaucopis				X	R	7,35,48
Hylocharis cyanus					U	14,30,34,37,41,48
Hylocharis chrysura					C	4,7,18,19,23,24,27,30,34,35,36,37,38,39,40,42,43,44,48
Polytmus guainumbi					VC	2,4,5,9,16,18,19,22,27,29,30,32,34,35,37,38,39,40,41,42,45,47,48,50
Amazilia fimbriata					C	1,2,4,5,6,10,12,16,19,22,24,30,31,33,39,42,48,50
Amazilia versicolor					U	16,23,27,35,37,40,47,48
Heliactin bilophus					R	2
Heliomaster squamosus					R	23,50
Heliomaster furcifer					R	48
Calliphlox ametistyna					R	26
TROGONIFORMES						
Trogonidae						
Trogon surrucura				X	C	7,10,12,14,29,30,32,34,35,36,37,38,39,41,42,43,47,48,50
Trogon curucui					U	2,10,16,27,29,30,32,35,36,39
Trogon rufus					R	43
CORACIIFORMES						
Alcedinidae						
Megaceryle torquata					VC	2,4,5,8,12,13,14,15,16,21,22,23,27,29,30,31,32,34,35,36,37,38,40,41,42,45,46,47,48,49,50
Chloroceryle amazona					VC	2,4,8,10,12,13,14,15,16,17,18,20,21,22,23,24,25,27,30,31,32,34,35,37,38,39,40,41,42,43,45,47,48,49,50

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Chloroceryle aenea					R	2,27,30,35,
Chloroceryle americana					C	4,5,6,11,19,23,27,28,30,31,32,34,35,36,39,41,42,45,46,47,48,49
Chloroceryle inda					R	30,37,42,50
Momotidae						
Baryphthengus ruficapillus				X	U	30,34,35,36,38,39,42,43,47
Momotus momota					VC	1,2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,20,21,22,26,27,28,29,30,31,32,33,34,35,36,37,39,40,41,42,43,48,50
GALBULIFORMES						
Galbulidae						
Brachygalba lugubris					R	7,9,12,35,50
Galbula ruficauda					VC	1,3,4,5,6,7,8,9,10,11,12,13,14,15,16,18,19,20,22,23,25,26,27,28,29,30,31,32,33,34,35,36,37,39,40,41,42,43,45, 47,48,49,50
Bucconidae						
Notharchus swainsoni					R	27,30,37,41,43
Nystalus striatipectus					C	2,4,15,16,18,19,26,30,34,37,39,43,50
Nystalus maculatus					U	1,9,48
Nystalus chacuru					C	13,14,15,19,20,22,25,28,36,39,40,42,43,46,48,50
Nonnula rubecula					R	37,43
Monasa nigrifrons					C	4,5,6,7,8,10,11,12,13,14,18,21,22,30,32,34,37,43,48,49,50
Chelidoptera tenebrosa					R	10,16,50
PICIFORMES						
Ramphastidae						
Ramphastos toco					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39, 40,41,42,43,44,45,46,47,48,49,50
Ramphastos vitellinus					R	2,13,42
Pteroglossus castanotis					VC	2,3,4,5,7,10,12,14,15,16,20,27,29,30,31,32,34,35,36,37,38,39,40,41,42,43,45,46,47,48,49,50
Picidae						
Picumnus cirratus					C	7,23,26,29,35,36,40,42,43,45,47,48
Picumnus albosquamatus					VC	2,3,4,5,10,11,12,13,14,15,16,18,19,20,22,23,24,26,27,30,31,32,33,34,35,37,39,40,41,42,47,48,49,50
Melanerpes candidus					VC	2,4,5,6,8,9,10,11,12,14,15,16,17,18,19,20,22,23,25,26,27,29,30,31,32,33,34,35,37,39,40,41,42,43,45,46,47,48, 49,50
Melanerpes flavifrons				X	C	7,10,13,27,30,33,34,35,37,39,41,43,47
Veniliornis passerinus					VC	2,4,5,9,11,14,16,19,22,23,26,27,29,30,31,32,33,34,35,36,37,39,40,41,43,47,48,49,50
Veniliornis spilogaster				X	R	42,45

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Veniliornis mixtus					R	2
Piculus chrysochloros					R	46
Colaptes melanochloros					VC	1,2,4,5,6,7,8,9,10,12,13,14,15,16,18,19,20,21,22,23,25,26,27,30,31,32,34,35,36,37,38,39,40,41,42,43,45,47,48,49,50
Colaptes campestris					VC	2,4,5,6,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50
Celeus flavus					R	2
Celeus flavescens					U	9,13,14,37,41,42,48,50
Celeus lugubris					R	5,10,30
Dryocopus lineatus					VC	1,2,3,4,5,6,8,9,10,11,12,13,15,16,18,19,20,22,23,26,27,30,31,32,33,35,36,37,40,41,42,43,45,47,48,49,50
Campephilus robustus				X	R	12
Campephilus melanoleucos					C	1,4,5,6,10,12,14,17,27,30,31,32,36,37,48,50
PASSERIFORMES						
Thamnophilidae						
Taraba major					VC	2,8,10,11,13,14,16,20,21,23,26,27,28,29,30,31,32,34,35,36,37,38,39,40,41,42,43,44,45,47,48
Hypoedaleus guttatus				X	R	41
Thamnophilus doliatus					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50
Thamnophilus ruficapillus					R	41
Thamnophilus torquatus					R	15
Thamnophilus pelzeni					VC	2,3,5,8,10,11,12,13,14,15,16,19,20,21,22,24,26,27,28,30,31,33,39,48,50
Thamnophilus caerulescens					C	8,12,30,33,34,37,38,39,41,43,48
Dysithamnus mentalis					U	1,2,6,7,9,10,12,30,43,50
Herpsilochmus atricapillus					U	12,14,38,39,48
Herpsilochmus longirostris			X		VC	2,3,4,5,7,10,12,13,14,15,16,18,19,20,21,22,24,25,26,27,29,30,31,32,34,36,37,40,41,42,47,48,50
Formicivora rufa					VC	4,5,6,9,11,12,14,15,16,18,19,20,21,22,23,27,30,31,32,33,34,35,37,38,39,40,41,42,43,45,47,48,50
Melanopareiidae						
Melanopareia torquata			X		R	15
Conopophagidae						
Conopophaga lineata				X	R	41
Scleruridae						
Geositta poeciloptera		VU	X		R	MZUSP

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Dendrocolaptidae						
Sittasomus griseicapillus					VC	2,3,4,5,6,7,9,10,11,12,13,14,15,16,17,18,19,22,23,26,27,30,35,37,38,41,42,43,47,48,50
Dendrocolaptes platyrostris					VC	2,5,6,7,8,9,10,12,13,14,15,16,18,21,26,27,29,30,31,32,33,34,35,36,37,39,40,41,42,43,44,48,50
Lepidocolaptes angustirostris					VC	2,3,4,5,6,7,8,10,11,14,15,16,18,19,20,22,23,24,25,26,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,47, 48,49,50
Campylorhamphus trochilirostris					C	2,3,9,11,12,27,30,34,35,36,38,39,41,42,48
Xiphocolaptes albicollis					R	41,47
Xiphocolaptes major					R	35,40,48
Furnariidae						
Furnarius rufus					VC	2,4,6,7,8,11,12,14,15,17,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46, 47,48,49,50
Automolus leucophthalmus				X	R	30,34,41,43,48
Philydor lichtensteini				X	R	42
Philydor rufum					R	3,7
Pseudoseisura cristata					R	3
Schoeniophylax phryganophilus					U	15,18,27,30,32,34,39,40,48
Synallaxis ruficapilla				X	R	30,41,47,48
Synallaxis frontalis					VC	2,5,6,10,12,14,16,18,19,20,21,22,23,27,30,31,33,36,37,38,39,40,41,43,48,50
Synallaxis albescens					C	4,5,12,15,18,19,20,27,29,30,31,32,34,35,36,37,39,40,50
Synnalaxis hypospodia					R	37,38,46
Cranioleuca vulpina					C	18,20,30,31,32,34,36,41,42,47,48
Certhiaxis cinnamomeus					VC	2,4,10,14,15,16,18,20,22,23,27,29,30,31,32,34,35,36,37,38,39,40,41,42,45,47,48,49,50
Hylocryptus rectirostris					R	2,7,30,41,47
Syndactyla dimidiata					R	19
Phacellodomus rufifrons					U	20,22,23,26,27,28,30,32,48
Phacellodomus ruber					C	5,14,15,19,22,26,27,35,37,41,42,43,47,48,49,50
Xenops rutilans					R	37
Pipridae						
Neopelma pallescens					R	2,4,22,50
Antilophia galeata			X		VC	1,2,3,4,5,6,7,8,9,11,12,13,14,15,16,18,20,22,27,29,30,31,32,33,34,35,39,40,43,45,47,48,50
Pipra fasciicauda					C	2,3,5,7,9,10,11,12,13,27,29,30,34,35,37,39,41,43,47,50
Machaeropterus pyrocephalus					R	21

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Tityridae						
Schiffornis virescens				X	R	12
Tityra inquisitor					C	11,12,20,27,30,31,32,33,35,37,39,40,41,42,47,48,50
Tityra cayana					C	5,6,7,9,12,13,16,20,27,29,30,32,34,35,36,37,38,39,40,41,42,43,47,48,50
Tityra semifasciata					U	2,4,8,10,27,29,30,34,43,50
Pachyramphus viridis					R	23,37
Pachyramphus castaneus					R	48
Pachyramphus polychopterus					C	2,4,10,13,16,18,19,20,22,26,27,29,30,31,32,34,35,37,40,41,43,48,50
Pachyramphus marginatus					R	48
Pachyramphus validus					C	3,4,5,6,7,27,30,34,35,37,39,41,43,47,48,50
Xenopsaris albinucha					R	27
Contingidae						
Procnias nudicollis	VU			X	U	30,34,39,41,43,48
Rhynchocyclidae						
Leptopogon amaurocephalus					C	6,7,11,12,14,26,27,29,30,34,37,41,43,48,50
Corythopis delalandi					R	4,12
Phylloscartes ventralis					R	31,39,42
Tolmomyias sulphurescens					C	2,4,10,11,12,16,20,22,23,26,27,29,30,34,35,40,43,47,48,50
Todirostrum cinereum					VC	2,3,4,8,12,14,15,16,18,19,20,22,23,25,26,27,29,30,31,32,34,35,36,37,38,39,40,41,42,43,45,47,48,50
Poecilotriccus latirostris					C	4,5,14,15,16,20,22,27,30,34,36,37,38,41,48,50
Myiornis auricularis				X	R	41,50
Hemitriccus margaritaceiventer					VC	2,5,6,7,8,10,11,12,14,15,16,18,19,20,21,22,23,24,26,27,29,30,31,32,34,35,36,37,38,39,40,41,42,43,44,45,47, 48,50
Tyrannidae						
Myiopagis gaimardii					R	2,23,50
Myiopagis caniceps					C	2,4,27,29,30,34,37,40,41,43,48,50
Myiopagis viridicata					C	4,16,18,24,27,30,34,37,38,39,41,47,48,49
Capsiempis flaveola					R	35,41,47
Serpophaga subcristata					C	13,15,16,19,20,21,23,25,27,28,29,37,40,41,42,47
Platyrinchus mystaceus					R	1,5,48
Attila phoenicurus					R	35

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Elaenia flavogaster					VC	2,3,4,5,6,9,10,12,13,14,15,16,18,19,20,21,22,23,24,25,26,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44, 45,47,48,49,50
Elaenia spectabilis					C	4,16,18,27,29,30,32,34,37,40,41,48
Elaenia chilensis					R	50
Elaenia parvirostris					R	25,27,41,45,48
Elaenia mesoleuca					R	2,13,41,42
Elaenia cristata					U	2,3,4,16,18,48
Elaenia chiriquensis					C	4,12,15,27,31,33,35,36,37,41,48
Elaenia obscura					R	21
Euscarthmus meloryphus					R	24,38,39,43
Euscarthmus rufomarginatus	NT				R	18
Camptostoma obsoletum					VC	2,4,5,6,9,10,11,14,15,16,17,18,20,21,22,23,25,26,27,29,30,31,32,34,35,36,37,39,40,41,42,43,45,47,48,49,50
Suiriri suiriri					U	2,4,15,23,27,35,48,50
Phaeomyias murina					C	5,12,14,15,16,17,18,22,26,27,30,31,33,34,39,48,50
Culicivora caudata	VU	VU			R	48
Pseudocolopteryx sclateri					R	48
Serpophaga griseicapilla					R	48
Myiophobus fasciatus					C	2,4,5,10,15,16,18,26,27,28,29,30,32,34,37,40,41,43,45,48,50
Sublegatus modestus					R	2,4,15,
Cnemotriccus fuscatus					C	2,5,6,10,11,12,14,16,18,19,20,22,23,24,26,27,30,34,36,39,40,41,43,48
Hymenops perspicillatus					R	30,34
Pyrocephalus rubinus					VC	2,4,5,12,13,15,16,17,18,22,23,27,28,29,30,31,32,33,34,35,36,37,40,41,42,43,45,47,48,49,50
Fluvicola albiventer					R	35,41,48
Fluvicola nengeta					R	48,49
Satrapa icterophrys					C	4,23,27,30,31,32,34,35,39,40,45,50
Xolmis cinereus					VC	1,2,3,4,5,7,8,9,10,12,14,15,16,17,18,19,21,23,24,25,27,28,30,31,34,35,37,40,43,48,50
Xolmis velatus					VC	2,3,4,5,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,37,38,39,40,41,42,43,45, 46,48,49,50
Gubernetes yetapa					VC	2,4,5,6,10,12,13,14,15,16,17,18,19,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,45,46,47,48,49
Alectrurus tricolor	VU	VU			R	5,15
Lathrotriccus euleri					U	11,14,23,37,41,45,48,50
Contopus cinereus					R	2,4,37,50

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Knipolegus lophotes					R	8,47
Arundinicola leucocephala					VC	3,4,12,14,15,19,21,22,23,27,29,30,31,32,33,34,35,37,38,39,40,41,42,45,46,47,48,49,50
Machetornis rixosa					VC	1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,46,47,48,50
Legatus leucophaius					VC	2,4,5,6,9,10,11,14,15,16,18,21,27,29,30,32,33,34,35,36,37,40,41,44,47,48,50
Myiozetetes cayanensis					VC	2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,20,21,22,23,24,25,27,29,30,31,32,33,34,35,36,37,40,42,43,44,46,47,48,50
Myiozetetes similis					C	2,4,10,15,16,22,23,27,29,30,31,32,34,35,37,38,39,40,41,43,45,47,48
Pitangus sulphuratus					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39, 40,41,42,43,44,45,46,47,48,49,50
Philohydor lictor					C	8,11,12,25,31,32,33,35,36,45,48
Myiodynastes maculatus					VC	2,3,4,5,6,7,8,9,10,11,12,14,16,17,18,19,20,21,23,24,25,26,27,29,30,31,32,34,35,36,38,39,40,41,42,43,44,45,47, 48,50
Megarynchus pitangua					VC	2,4,5,6,7,8,10,12,13,14,16,17,18,19,20,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44, 45,46,47,48,50
Empidonomus varius					C	2,4,5,8,10,14,16,18,21,26,27,29,31,32,35,37,38,39,40,41,42,47,48
Conopias trivirgatus					R	41
Colonia colonus					C	7,12,14,16,30,35,41,42,47,48,50
Griseotyrannus aurantioatrocristatus					U	4,6,16,20,21,23,26,27,48,50
Tyrannopsis sulphurea					R	5,50
Tyrannus albogularis					C	4,5,7,8,12,14,15,20,21,25,26,27,30,31,33,45,50
Tyrannus melancholicus					VC	2,4,5,7,8,9,10,11,12,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42, 43,44,45,46,47,48,49,50
Tyrannus savana					VC	1,2,4,5,6,8,9,10,11,12,14,15,16,17,18,20,21,23,25,26,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,46, 47,48,50
Casiornis rufus					VC	1,2,4,5,6,10,11,12,13,14,15,16,17,18,19,22,24,26,27,28,29,30,31,32,34,35,36,37,39,40,41,42,43,45,47,48,50
Myiarchus swainsoni					C	2,3,4,5,11,12,16,18,27,30,31,32,33,34,35,37,40,41,42,47,48,50
Myiarchus ferox					VC	2,3,4,5,6,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42, 43,44,45,47,48,49,50
Myiarchus tyrannulus					VC	2,4,5,6,7,10,12,13,14,15,16,18,19,20,21,22,23,24,26,27,28,30,33,34,35,36,37,39,40,41,43,48,49,50
Sirystes sibilator					C	2,4,7,12,17,25,35,36,41,43,48
Vireonidae						
Cyclarhis gujanensis					VC	1,2,3,4,5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40,41, 42,43,45,47,48,49,50

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Vireo olivaceus					C	1,2,3,6,7,9,10,11,13,14,15,16,18,23,27,30,41,47,48
Hylophilus pectoralis					R	37
Hylophilus poicilotis				X	R	16,48
Corvidae						
Cyanocorax cyanomelas					C	30,32,34,35,36,39,40,43,44,45,47
Cyanocorax cristatellus			X		VC	1,2,4,5,7,9,11,12,13,14,15,17,18,19,20,22,23,24,25,27,29,31,32,33,39,40,42,43,46,47,48,49,50
Cyanocorax chrysops					VC	2,5,10,13,14,16,19,20,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49
Cyanocorax cyanopogon					R	50
Hirundinidae						
Pygochelidon cyanoleuca					C	4,6,8,20,23,27,30,32,34,35,37,39,40,41,42,45,48,49,50
Alopochelidon fucata					R	21
Stelgidopteryx ruficollis					VC	1,2,4,5,6,7,10,11,13,15,16,18,22,23,27,30,31,34,35,37,38,39,40,41,42,45,47,48,49,50
Progne tapera					VC	3,4,5,8,10,12,13,14,15,16,17,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,44,46, 47,48,50
Progne chalybea					C	4,13,14,15,16,19,20,23,26,27,29,30,32,34,35,37,38,39,40,41,42,43,48,50
Tachycineta albiventer					C	8,11,21,23,30,33,35,41,42,47,48,49
Tachycineta leucorrhoa					C	4,12,14,15,17,27,30,31,35,37,39,40,41,42,43,45,47,48,49,50
Riparia riparia					R	27,35
Hirundo rustica					C	4,14,27,30,31,34,37,39,40,42,45
Petrochelidon pyrrhonota					R	30,34,38
Troglodytidae						
Troglodytes musculus					VC	4,10,12,15,16,19,20,23,25,26,27,29,30,31,32,34,35,36,37,38,39,40,41,42,43,45,46,47,48,50
Pheugopedius genibarbis					R	30,48
Campylorhynchus turdinus					R	29
Canthorchilus leucotis					U	41,42,47,48,50
Donacobiidae						
Donacobius atricapilla					VC	2,5,7,8,9,10,12,14,16,18,19,22,23,26,27,29,30,31,32,34,35,37,38,39,41,42,43,45,46,47,48,49,50
Polioptilidae						
Polioptila dumicola					C	4,5,6,10,11,14,15,16,18,19,20,21,22,23,24,26,27,28,35,38,48,50
Turdidae						
Turdus rufiventris					VC	2,3,4,5,6,7,8,9,10,11,12,13,14,15,17,18,21,22,23,24,25,26,27,29,30,31,32,33,34,35,36,37,38,39,40,41,43,44,50

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Turdus leucomelas					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,47,48,49,50
Turdus amaurochalinus					VC	1,4,5,6,7,10,11,12,14,16,21,22,23,24,26,27,30,31,32,34,35,36,37,39,40,41,42,43,45,47,48
Turdus albicollis					R	23
Mimidae						
Mimus saturninus					VC	2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,45,46,47,48,49,50
Mimus triurus					R	FMNH
Motacillidae						
Anthus lutescens					VC	2,4,12,13,14,15,17,19,22,24,25,27,28,29,30,31,32,34,37,38,40,41,43,45,47,50
Coerebidae						
Coereba flaveola					C	3,5,7,8,11,12,13,14,16,21,22,23,26,27,30,35,38,44,48
Thraupidae						
Saltator maximus					R	MZUSP
Saltator coerulescens					R	11,48
Saltator similis					VC	2,6,7,8,10,12,14,15,16,17,20,22,23,25,26,27,30,31,32,34,35,39,40,41,42,45,47,48,50
Saltatricula atricollis			X		C	4,5,11,12,15,17,18,19,20,22,24,30,32,39,40,42,45,50
Nemosia pileata					VC	4,8,16,18,20,21,22,23,26,27,30,31,32,34,35,37,38,39,40,41,42,45,47,48,50
Thlypopsis sordida					U	19,24,29,37,40,48
Cypsnagra hirundinacea					R	5,11,15
Trichothraupis melanops					R	MHNCI
Eucometis penicillata					C	1,2,4,6,7,10,12,16,27,29,30,31,33,34,35,36,43,48,50
Tachyphonus rufus					C	6,7,10,11,14,15,16,20,26,27,28,30,31,32,34,37,40,43,48,50
Tachyphonus coronatus				X	R	45,48
Ramphocelus carbo					VC	2,5,7,11,12,14,18,20,21,27,28,30,31,32,33,34,35,36,37,38,39,40,41,42,45,46,47,48,50
Thraupis sayaca					VC	1,2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41, 42,43,44,45,46,47,48,50
Thraupis palmarum					VC	1,3,4,5,6,7,8,9,10,11,12,13,14,15,16,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41, 42,44,45,46,47,48,49,50
Tangara cayana					VC	2,3,4,5,6,7,8,9,10,11,13,14,15,16,18,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,37,38,39,40,41,42,45,47, 48,50
Pipraeidea melanonota					R	27,45,48
Neothraupis fasciata	NT				R	5,11,15

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Cissopis leverianus					R	7,8,12,41
Schistochlamys melanopis					R	6,39,42,45,48
Paroaria capitata					U	30,31,33,41,42,45,47,48,49
Tersina viridis					VC	2,4,5,7,8,10,11,12,13,14,16,17,27,29,30,32,33,34,35,37,39,40,41,42,43,45,47,48,50
Dacnis cayana					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,20,21,22,23,25,26,27,29,30,31,33,34,35,40,41,42,43,44,46,48,50
Cyanerpes cyaneus					U	2,4,5,25,27,31,50
Hemithraupis guira					C	2,4,10,12,13,15,16,17,18,19,21,22,23,24,26,27,29,30,31,33,34,35,48,50
Conirostrum speciosum					C	14,16,22,23,30,35,37,38,40,41,42,45,48,49,50
Emberizidae						
Zonotrichia capensis					U	5,15,23,27,41,42,45,48,50
Ammodramus humeralis					VC	1,2,3,4,5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,29,30,31,32,33,34,35,36,37,38,39,40,41, 42,43,45,46,47,48,49,50
Haplospiza unicolor				X	R	48
Poospiza cinerea	VU		X		R	8,12
Sicalis flaveola					VC	2,3,4,5,6,8,10,11,12,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,30,31,32,33,34,35,36,37,38,39,40,41,42,43, 44,45,46,47,48,49,50
Sicalis luteola					R	30,34,40
Emberizoides herbicola					C	2,4,15,17,20,21,23,27,29,30,31,32,35,36,37,38,39,40,41,43,47,48,49
Emberizoides ypiranganus					R	42
Embernagra platensis					R	23,31,47
Volatinia jacarina					VC	2,3,4,5,7,8,10,11,12,14,15,16,18,19,20,21,22,23,24,26,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45, 46,47,48,49,50
Sporophila frontalis	VU	VU		X	R	23
Sporophila plumbea					C	2,4,5,6,9,15,18,30,34,48,50
Sporophila collaris					C	4,15,20,21,22,23,27,29,30,32,34,35,37,38,39,40,41,42,45,46,47,48,49
Sporophila lineola					C	8,12,16,20,23,26,30,31,32,34,37,42,45,47,48
Sporophila nigricollis					R	10,31,33
Sporophila caerulescens					VC	4,5,6,7,8,10,14,16,18,21,22,23,24,27,30,31,32,34,35,36,37,39,40,41,42,45,47,48,49,50
Sporophila leucoptera					C	4,16,20,21,23,26,27,30,32,34,39,40,41,48,49
Sporophila hypoxantha					R	23,30,34
Sporophila cinnamomea	VU	EN			R	30,34
Sporophila bouvreuil					U	4,19,26,41,42,48

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Sporophila palustris	EN	EN			R	4
Sporophila angolensis					VC	2,5,7,12,15,18,19,20,25,27,30,31,32,34,35,36,37,38,39,41,42,43,46,47,48
Arremon taciturnus					R	13
Arremon flavirostris					C	2,8,16,29,30,31,34,35,36,39,40,43,45,47,48
Charitospiza eucosma	NT		X		R	MZUSP, Bucci (2009)
Coryphospingus cucullatus					VC	2,4,5,6,8,10,11,12,13,14,15,16,18,19,20,21,22,23,26,27,29,30,31,32,33,34,36,37,38,39,40,41,42,43,45,47,48,50
Cardinalidae						
Piranga flava					R	8,17
Habia rubica					R	12,25,30,32
Pheucticus aureoventris					R	45
Cyanoloxia brissonii					R	FMNH
Cyanoloxia glaucocaerulea					R	45
Parulidae						
Parula pitiayumi					C	2,6,12,15,21,23,29,30,31,34,37,39,40,41,42,43,45,47,48
Geothlypis aequinoctialis					C	7,13,14,16,18,27,29,30,32,34,35,36,37,38,40,41,42,45,47,48,50
Basileuterus culicivorus					C	27,30,32,34,35,38,39,41,43,45,47,48
Basileuterus hypoleucus					VC	1,2,4,5,6,7,8,10,12,13,14,15,16,18,22,27,29,30,31,33,34,36,39,40,48,50
Basileuterus flaveolus					VC	1,2,4,5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,22,23,24,26,27,29,30,31,32,33,34,35,36,39,40,42,43,48,50
Basileuterus leucophrys			X		C	1,2,3,4,5,6,7,12,14,15,18,19,22,30,31,34,40,43,45,50
Icteridae						
Psarocolius decumanus					R	9,13,35
Procacicus solitarius					R	7,29,47
Cacicus chrysopterus					R	41,48
Cacicus haemorrhous					C	5,7,12,13,14,18,27,29,30,31,32,34,35,37,38,39,41,42,43,47
Icterus pyrrhopterus					VC	5,7,8,10,11,13,14,15,16,17,18,19,20,22,23,24,27,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48, 49,50
Icterus croconotus					I	21,22,23,30,35,41,42,48
Gnorimopsar chopi					VC	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,4 1,42,43,45,46,47,48,49,50
Amblyramphus holosericeus					R	41,47,48
Agelasticus cyanopus					I	20,26,37,40,41,42,48
Chrysomus ruficapillus					R	23,26,41

SCIENTIFIC NAMES	CS		ENDEMIC			LOCALITIES
	BI	IB	CE	AF	FO	
Pseudoleistes guirahuro					VC	2,3,4,5,7,10,11,12,13,14,15,17,18,19,21,22,23,26,27,28,29,30,31,32,33,34,35,37,38,39,40,41,42,43,45,46,47,48,49,50
Agelaioides badius					I	5,8,18,25,26,48
Molothrus rufoaxillares					C	4,12,14,15,26,27,30,35,37,40,41,43,50
Molothrus oryzivorus					R	41,47
Molothrus bonariensis					VC	2,4,5,6,7,8,10,11,12,13,14,15,16,18,19,20,21,23,24,25,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,45,46,47,48,49,50
Sturnella superciliares					VC	4,5,8,10,12,14,17,18,20,21,23,24,25,27,29,30,31,32,33,34,35,36,37,39,40,41,42,43,44,45,46,47,48,50
Fringillidae						
Sporagra magellanica					R	41,48
Euphonia violacea					R	4,35,48
Euphonia laniirostris					R	3,5
Euphonia chlorotica					VC	1,2,3,4,5,6,8,10,11,12,13,14,15,16,17,18,19,20,21,22,23,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50
Estrildidae						
Estrilda astrild					R	23
Passeridae						
Passer domesticus					C	4,8,12,14,17,22,23,24,26,27,30,32,34,36,37,38,41,42,43,44,45,46,48

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SHORT-COMMUNICATION

First record of Corncrake *Crex crex* (Rallidae) for South America

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ABSTRACT: A juvenile Corncrake *Crex crex* was photographed on Fernando de Noronha Island on 28 November 2012. The reservoir where the bird was found also held two male Pintails *Anas acuta*, also photographed. Fernando de Noronha is a known locality for vagrants from the Palearctic and/or Africa, *Crex crex* being an addition to a growing list.

KEY-WORDS: *Anas acuta*, Brazil, Corncrake, *Crex crex*, Fernando de Noronha, vagrancy

The Corncrake *Crex crex* is a strongly migratory rail with a broad Palearctic breeding range including a broad swathe from coastal north-western Europe to Sinkiang in Western China (Taylor 1998). In those countries Corncrakes inhabit tall pastures and meadows, including hay fields, both dry and wet, with a preference for cooler and damper habitats with dense grass and herb cover 20-50 cm high (Taylor 1998). The conversion of such areas, formerly used for extensive grazing and to produce hay, into intensive, mechanised agriculture has led to a serious decline of the species throughout western Europe (BirdLife International 2004).

After the breeding season Corncrakes migrate mostly to eastern Africa (Walther *et al.* 2012), but there are sparse records covering most of the continent and vagrants have been found in Tibet, India, Pakistan, Sri Lanka, Vietnam and Australia (Bräulich & Rank 1998, Taylor 1998). A few birds sometimes cross the Atlantic, with several records in the eastern seaboard of North America from Newfoundland, New Scotia, St. Pierre et Miquelon, Maine, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Bermuda and Greenland (AOU 1998). Here we present the first record of Corncrake for Brazil and South America (*cf.* SACC 2013).

The islands of Fernando de Noronha and associated islets lie 350 km from the South American mainland, the nearest point being the coast of Rio Grande do Norte. The archipelago is made of 21 islands and stacks summing up to 26 km^2. The main island, the only inhabited one, is about 11 km long and three wide, and mostly protected by a national park and the Atlantic Forest Biosphere Reserve, its main peculiarities being the remnants of a very dry, Caatinga-like, insular Atlantic forest and the sole mangrove on an oceanic island in South Atlantic (MMA/IBAMA 2005, Silva e Silva 2008). The main island also holds the Açude do Xaréu (03°51'60"S; 32°25'42"W), near Baía do Sueste (Figure 1); one of the very few freshwater reservoirs in all the islands, and where birds and other fauna congregate.

On 28 November 2012, K. B. visited Açude do Xaréu with the aim of photographing Northern Pintails *Anas acuta* known to be in the area. This is a vagrant already recorded for this site (Silva e Silva & Olmos 2006) and apparently a regular visitor to Fernando de Noronha. These ducks are very wary of people in this area, requiring a stealthy and slow approach. This allowed the observation and photographic records of one adult male in breeding plumage and another still leaving eclipse (Figure 2).

The pintails were scared by an approaching vehicle and took flight, causing K. B. to stand up. In doing so, he noticed a bird walking fast, but without trying to fly, from the plant-covered reservoir to the surrounding forest and scrub about 15 m from his position. Realising it was a rail, he quickly made a sequence of nine digital photographs before the bird disappeared into the vegetation.

The images were recorded at 10 h 35 min (local time) with a Nikon D300 DSLR camera equipped with a Nikkor 400 mm f/2.8 telephoto lens with a Nikkor TC-17E II 1.7x teleconverter (resulting in an effective

focal length 1,020mm), tripod and GPS Nikon GP-1. The original files were generated in the Nikon proprietary format NEF, also known a digital negative or "raw file". The geographic coordinates from the Nikon GP-1 (connected to the camera thru a cable) were directly recorded/embedded into the source-code of the NEF file, making it a trustworthy source of information regarding the site where the photographs were taken.

This is the first record of *Crex crex* for South America. The photographed individual (Figures 3 to 5) shows little or no grey in its plumage, suggesting a juvenile bird on its first migration. The sunken chest seen in

FIGURE 1. Açude do Xaréu in November 2012 during the dry season. Photo by K. B.

FIGURE 2: Adult male Pintail *Anas acuta* photographed on 28 November 2012 at Açude do Xaréu, Fernando de Noronha. Photos by K. B.

the photograph shows a low fat reserve, suggesting the bird was busy looking for food in the sole wetland of an otherwise dry island.

Fernando de Noronha has previously attracted several Palaearctic and African vagrants (*e.g.* Silva e Silva & Olmos 2006), *Crex crex* now joining this interesting group. Despite *C. crex* being a long distance migrant, Fernando de Noronha lies close to commercial shipping routes, so the possibility of this bird being ship assisted for all or part of its journey cannot be excluded.

FIGURE 3. Immature Corncrake *Crex crex* photographed on 28 November 2012 at the shore of Açude do Xaréu, Fernando de Noronha. Photo by K. B.

FIGURE 4. Immature Corncrake *Crex crex* photographed on 28 November 2012 on the shore of Açude do Xaréu, Fernando de Noronha. Photo by K. B.

FIGURE 5. Immature Corncrake *Crex crex* photographed on 28 November 2012 on the shore of Açude do Xaréu, Fernando de Noronha. Photo by K. B.

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SHORT-COMMUNICATION

First documented record of the Blue-cheeked Amazon *Amazona dufresniana* (Psittacidae) in Brazil

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ABSTRACT: *Amazona dufresniana* is an endemic species to the Guiana Shield, and its occurrence in Brazil lacks documented evidence. Here, we report the first documented record for Brazil, which was made in the Saracá-Taquera National Forest, Trombetas River region, northwest of Pará. Three parrots were recorded on two occasions, in May and October 2012. These records not only document the occurrence of *Amazona dufresniana* in Brazil, but they also extend its distribution to about 420 km south of previously known records.

KEY -WORDS: *Amazona dufresniana*, geographical distribution, Guiana Shield, Pará, Rio Trombetas basin.

The Blue-cheeked Amazon *Amazona dufresniana* (Shaw, 1812) is an endemic species of the Guiana Shield (Wege & Collar 1991), an important area of endemism in the northern South America (Haffer 1974, Cracraft 1985, Hollowell & Reynolds 2005, Silva *et al.* 2005). The species ecology and habitat are poorly known, but its occurrence has been documented in tropical humid and wet lowland forests in Venezuela, Guyana, Surinam, and French Guiana (see Wege & Collar 1991, Forshaw 2006). Besides the lowland habitats in Guyana (altitude between 3 to 560 m), the species also inhabits foothill forests in the Gran Sabana plateau up to 1,700 m of altitude in Venezuela (Wege & Collar 1991, Hilty 2003).

The occurrence of Blue-cheeked Amazon in Brazil has been considered unchecked by specialists. It was based only upon a personal communication by hunters who allegedly shot a pair of birds near the French Guiana and Brazilian border at the state of Amapá (see Wege & Collar 1991, Collar 1995). However, no additional information was provided since then and the occurrence of the species in Brazil remains hypothetical (see CBRO 2011).

Here we report the first documented records of *Amazona dufresniana* in the Brazilian territory. The species was observed in Bela Cruz, a local plateau at Saracá-Taquera National Forest (01°21'S; 56°22'W), a 441,282 ha sustainable use reserve within the limits of the township of Oriximiná, northwest Pará (Figure 1).

The reserve is located in the Rio Trombetas watershed. The vegetation at the Saracá-Taquera National Forest is classified as typical of the dense rainforest region and Amazon low plateaus sub-region (IBGE 1992, Salomão *et al.* 2012). Within the area there is significant mining of bauxite on plateaus, which influences the landscape and creates a mosaic of upland forest amid small and medium tributaries of the Rio Trombetas with heterogeneous reforestation and mining zones.

During fauna monitoring activities in the surroundings of the mining zone, in a total sampling effort of 397 days, between May 2009 and October 2012, we observed three individuals of Blue-cheeked Amazon in two occasions in the Bela Cruz plateau.

The first record was on May 13th of 2012, at 9 h, when T. H. G. A. observed and photographed one individual perched (Figure 2) about 30 m high on a rubber tree *Hevea guianensis* (Euphorbiaceae), together with a flock of five Mealy Amazon *Amazona farinosa*, on the forest edge of the plateau (01°48'09"S; 56°30'23"W, elevation 172 m). The second record was on the 1st of October of 2012, at 07:20 h, during a windy morning with sparse rain showers, when I. P. F. observed (for 10 min) two very quiet and silent parrots perched in the canopy of upland forest at 01°47'53"S and 56°29'44"W (altitude 189 m). All three birds observed had a gray beak with a pink-red at base, and green plumage. The forehead and lores were orange-yellow, with forecheeks beneath eye bright blue, while lower cheeks to ear-coverts blue, in agreement with Forshaw (2006) and Grantsau (2010).

These observations extend the range of Blue-cheeked Amazon to northern Brazil. The Saracá-Taquera National Forest is about 420 km from Acary Mountains

on Guyana's southern border, 760 km southeast from the Brownsberg Nature Park, 820 km southwest from the Pied Saut on the Fleuve Oyapock, and 840 km southeast from the Kopinang camp, four localities reported for the species by Wege & Collar (1991), Ridgely *et al.* (2005), O'Shea *et al.* (2007), and Robbins *et al.* (2007).

The species may also be present in the state of Roraima (Brazil), although Naka *et al.* (2006) have not provided any records of them. However, its presence in the Iwokrama and Kopinang camp (Guyana), and Gran Sabana (Venezuela), and the biogeographic patterns of the region suggest their occurrence in the Brazilian state of Roraima (Ridgely *et al.* 2005, O'Shea *et al.* 2007, Crease 2009, Naka 2011). It is possible that the species is not being noticed because of its associated with *Amazona farinosa* (a common and widely distributed parrot). Alternatively, our effort indicates that Blue-cheeked Amazon is rather rare in the Saracá-Taquera National Forest, which is probably the case for the other areas (Ridgely *et al.* 2005, Robbins *et al.* 2007).

However, to evaluate if Blue-cheeked Amazon occurs in the area throughout the year and make population estimates, new surveys are recommended in the Saracá-Taquera National Forest. Surveys in other nearby reserves, which were only briefly surveyed and no records of the Blue-cheeked Amazon were obtained, such as the Rio Trombetas Biological Reserve, the Trombetas State Forest, the Faro State Forest, and the Grão Pará Ecological Station (see Aleixo *et al.* 2011), are also highly recommended.

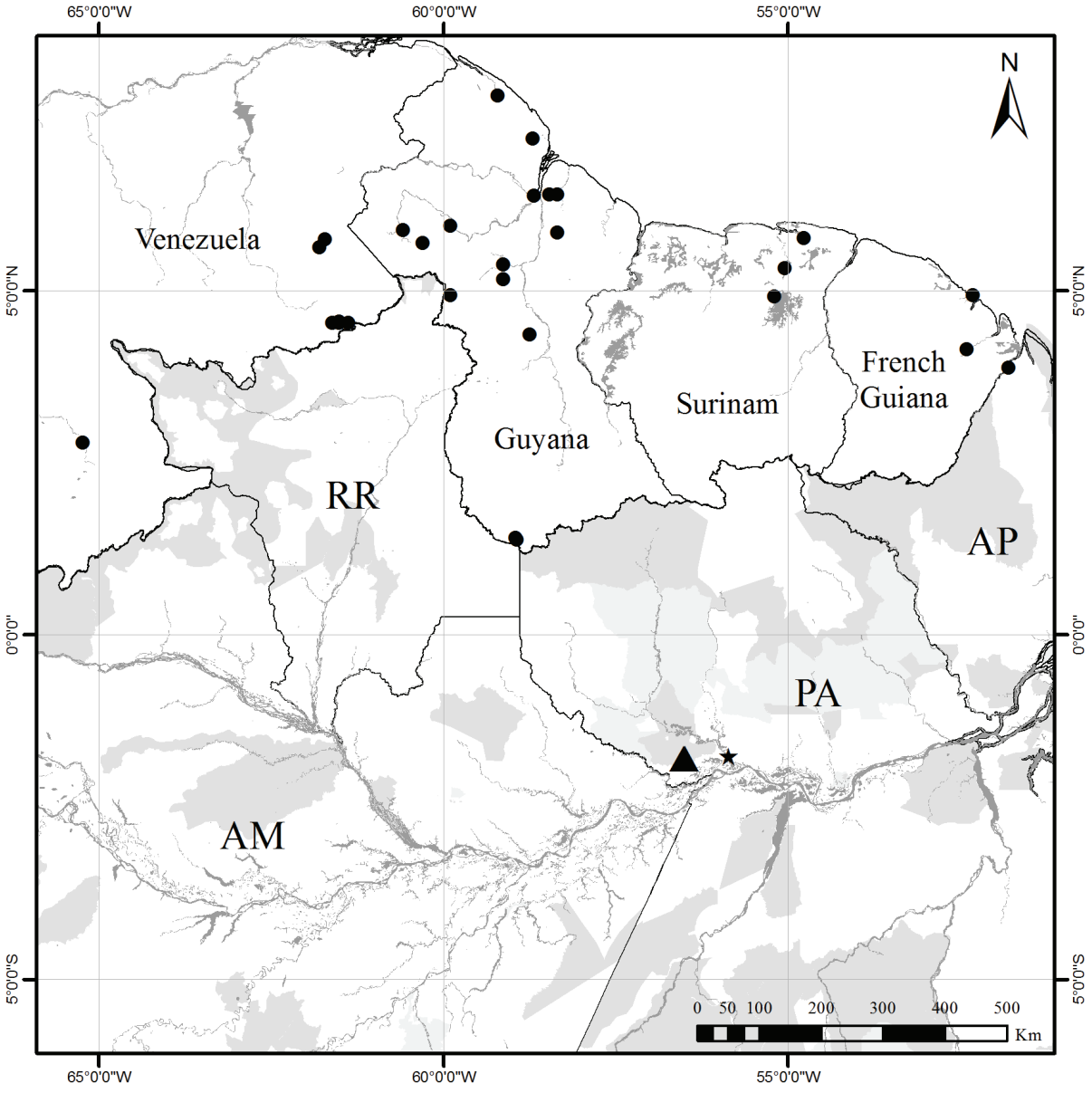

FIGURE 1. Map of northern South America indicating the township of Oriximiná (star), and the Saracá-Taquera National Forest (triangle), where the first records of *Amazona dufresniana* for Brazil were made. Species records (circles) based on literature (Wege & Collar 1991, Ridgely *et al.* 2005, O'Shea *et al.* 2007, Robbins *et al.* 2007, Crease 2009) are also included. The gray areas indicate the Brazilian Conservations Units according to CNUC/MMA (2012), and the Brazilian states with acronyms: Roraima (RR), Amazonas (AM), Pará (PA), and Amapá (AP).

FIGURE 2. Blue-cheeked Amazon (*Amazona dufresniana*, right) and Mealy Parrot (*A. farinosa*, left) observed on a rubber tree, Saracá-Taquera National Forest, Pará, Brazil (Photo by T. H. G. A.).

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SHORT-COMMUNICATION

A Lesser Black-backed Gull *Larus fuscus* in Maranhão: the second Brazilian record

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ABSTRACT: Lesser Black-backed Gulls *Larus fuscus* are being recorded with increasing frequency in the Neotropics, a change in status reflected both in changes of observer behavior and awareness and their westward range expansion in the Northern Hemisphere. The first Brazilian record concerned an individual photographed on the coast of Ceará in November 2006. Here we present details of the second Brazilian record of Lesser Black-backed Gull: a photo-documented record from the state of Maranhão obtained in November 2011.

KEY-WORDS: vagrancy, pseudo-vagrant, Ceará, Old World, Charadriiformes.

The Lesser Black-backed Gull *Larus fuscus*, Linnaeus, 1758, is a member of the large white-headed gull complex, which breeds in northwestern Europe and winters from central and southern Europe south to West Africa (Harrison 1985, Olsen & Larsen 2004). The taxonomy of this species has long been in a state of flux, but three parapatric taxa are currently recognized (subspecies, *fuscus*, *intermedius* and *graellsii*) which differ subtly in their morphometrics, plumage coloration and molt patterns (Sangster *et al.* 1998, Liebers & Helbig 2002). Of these subspecies, populations of *L. f. graellsii* have increased in Western Europe since the early 20th century with subsequent changes in migratory behavior (Baker 1980). The species has subsequently colonized Greenland (Barnes 1961, Boertmann 2008), probably the source of a nominal 'pseudo-vagrant' (*sensu* Gilroy & Lees 2003) wintering population in North America, which has seen a strong surge in records since the first in 1934 (Edwards 1935 *apud* Hallgrimsson *et al.* 2011, Calladine 2004, Hallgrimsson *et al.* 2012). This change in status in the USA and Canada has been followed by a steady trickle of vagrants to Central and South America. The first report of vagrancy to the New World concerned a specimen reported from Argentina (Steullet & Deautier 1939), but this record was subsequently questioned by Post & Lewis (1995). Away from Brazil there are South American records from Ecuador (Ridgely & Greenfield 2001), Colombia (Salaman *et al.* 2008), Venezuela (Fairbank 1999, Ffrench & White 1999), French Guiana (Devillers 1979) and Trinidad and Tobago (Kenefick & Hayes 2006). Despite this upsurge in records along Atlantic-facing coastlines, the first Brazilian record of Lesser Black-backed gull came as late as 2005 (Girão *et al.* 2006) when a single near-adult was photographed on a beach at 4º28'04"S; 37º44'31"W, near the mouth of the Jaguaribe river in the State of Ceará on November 15th. Here we present documentation for the second occurrence of *L. fuscus* in Brazil.

Between 5 and 11 November 2011, B. A., R. R. and D. M. were carrying out shorebird surveys in coastal Maranhão. On November 5th they observed a dark-mantled gull from the ferry between São Luís and Pinheiro cities at 2°31'38.04"S; 44°26'23.49"W (Figure 1). Knowing that no large gulls are regularly present in the region, they obtained a series of images to document the event (Figure 2 and 3; Almeida 2011). The individual formed part of a mixed species feeding flock of Charadriiformes taking advantage of feeding opportunities in the boat's wake. Other species present included Gull-billed (*Gelochelidon nilotica*), Common (*Sterna hirundo*), Roseate (*S. dougallii*) and Royal (*Thalasseus maximus*) Terns; and both Grey-

headed (*Chroicocephalus cirrocephalus*) and Laughing (*Leucophaeus atricilla*) Gulls.

On completing the expedition, D. M. emailed the images to A. C. L. who suspected that the bird was a subadult *L. fuscus*. A. C. L. conferred with gull experts A. Amarillo and P. Adriaens and a consensus was reached that the bird could safely be identified as *L. fuscus*. The only regularly occurring dark-backed gull in Brazil is the Kelp Gull (*Larus dominicanus*), a vagrant on the Atlantic coast north of Espírito Santo, although there are recent photo-documented records of vagrants from Bahia (Patrial 2012) and Fernando de Noronha (Silva & Olmos 2006, Pinto 2010). Besides *L. fuscus*, the only other dark-mantled gull thus far recorded in Brazil is Olrog's Gull (*L. atlanticus*) which is a rare visitor to Rio Grande do Sul (Dias & Maurício, 1998, Pacheco *et al.* 2009) and can be readily ruled out by the presence of a broad black subterminal tail band.

The São Luís gull can be aged as a 3rd cycle bird by the combination of a generally dark mantle (with black outer primaries lacking a white mirror), some retained brownish juvenile scapulars, pale pinkish legs, dark flecks on the belly, head and particularly nape, and a pale grey-green bill with a black subterminal band (*e.g.* Howell & Dunn 2007). This individual was clearly younger than the individual photographed in Ceará (Girão *et al.* 2006), which had obtained near-adult plumage. Separation from *L. dominicanus* is not straightforward but can be achieved by the following characteristics: 1) 3rd cycle *dominicanus* are consistently whiter bodied and tend to lack substantial streaking on the head and underparts; 2) the bill better fits *fuscus*, as *dominicanus* tends to lose the black on the bill earlier; and 3) the nature of the 5th primary (P5) – in *fuscus* there is at most a narrow little crescent dividing the grey of the base with the black of the tip, whilst *dominicanus* has a large white crescent on P5 (A. Jaramillo *in litt.*). The lighter grey mantle suggests this individual is probably of the race *L. f. graellsii,* which is also the more likely vagrant, considering its more western European distribution.

Brazilian birders should be alert to the possibility that *L. fuscus* could be an annual vagrant to the Atlantic coast and to the possible occurrence of other vagrant larids such as Black-headed Gull (*Chroicocephalus ridibundus*), Little Gull (*Hydrocoloeus minutus*), Herring Gull (*Larus argentatus*), Yellow-legged Gull (*Larus michahellis*) and Great Black-backed Gull (*L. marinus*) particularly during the northern winter (October-March) and principally in areas with large concentrations of foraging or loafing gulls and terns such as estuaries and sewage outfalls.

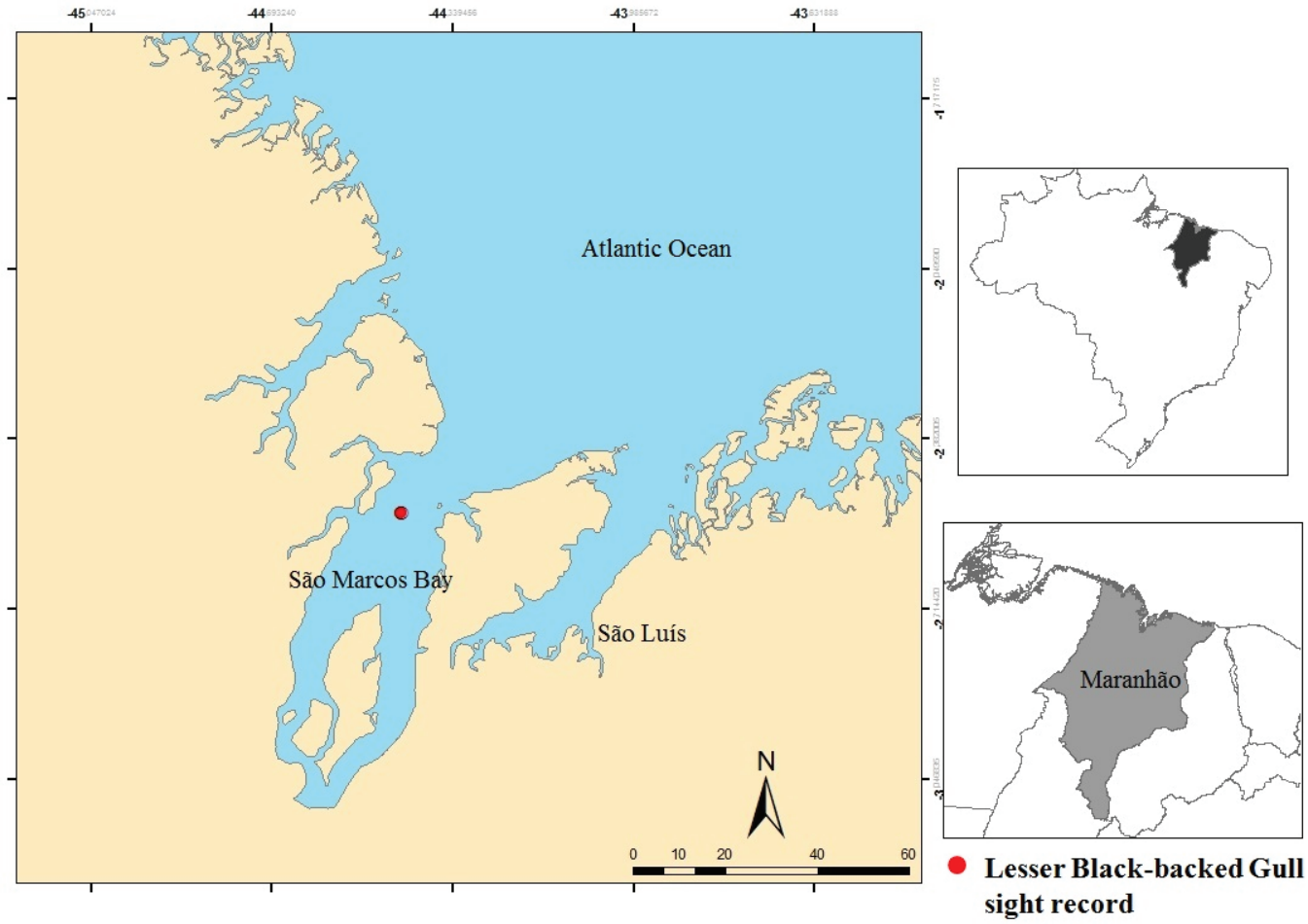

FIGURE 1. Site of the observation of the Lesser Black-backed Gull at São Marcos Bay, Maranhão, Brazil.

FIGURE 2. Field photographs of the Lesser Black-backed Gull (*Larus fuscus*) at São Marcos Bay, Maranhão on 5 November 2011 (B. J. M. A.).

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Each Table should be on a separate page, numbered in Arabic numerals, with its own legend. The legend should be part of the table, and occupy the space made by inserting an extra line at the beginning of the table, in which the cells are merged. Figure legends, occupying one or more pages following the tables, should be numbered successively, also in Arabic numerals. Figures will follow, one to each page, and clearly numbered in agreement with the legends.

As necessary, subsections may be identified and labeled as such. All pages should be numbered in the upper, right hand corner.

The following *abbreviations* should be used: h (hour), min (minute), s (second), km (kilometer), m (meter), cm (centimeter), mm (millimeter), ha (hectare), kg (kilogram), g (gram), mg (miligram), all of them in lowercase (not capitals) and with no "periods" (".”). Use the following *statistical notations:* P, n, t, r, F, G, U, $\chi 2$, df (degrees of freedom), ns (non significant), CV (coefficient of variation), SD (standard deviation), SE (standard error). With the exception of temperature and percentage symbols (e.g., 15°C, 45%), leave a space between the number and the unit or symbol (e.g., n = 12, P < 0.05, 25 min). Latin words or expressions should be written in italics (e.g., *et al., in vitro, in vivo, sensu).* Numbers one to nine should be written out unless a measurement (e.g., four birds, 6 mm, 2 min); from 10 onwards use numbers.

Author *citations* in the text must follow the pattern: (Pinto 1964) or Pinto (1964); two publications of the same author must be cited as (Sick 1985, 1993) or (Ribeiro 1920a, b); several authors must be presented in chronological order: (Pinto 1938, Aguirre 1976b); for two-author publications both

authors must be cited: (Ihering & Ihering 1907), but for more than two authors, only the first one should be cited: (Schubart *et al.* 1965); authors' names cited together are linked by "&". Unpublished information by third parties must be credited to the source by citing the initials and the last name of the informer followed by the appropriate abbreviation of the form of communication: (H. Sick *pers. comm.)* or V. Loskot (*in litt.);* unpublished observations by the authors can be indicated by the abbreviation: (*pers. obs.);* when only one of the authors deserves credit for the unpublished observation or another aspect cited or pointed out in the text, this must be indicated by the name initials: "... in 1989 A. S. returned to the area...". *Unpublished manuscripts* (e.g., technical reports, undergraduate monographs) and *meeting abstracts* should be cited only exceptionally in cases they are absolutely essential and no alternative sources exist. The *reference* list must include all and only the cited publications (titles written in full, not abbreviated), in alphabetical order by the authors' last name:

Articles

Fargione, J.; Hill, J.; Tilman, D.; Polasky, S. & Hawthornez, P. 2008. Land clearing and the biofuel carbon debt. *Science,* 319: 1235-1238.

Santos, M. P. D. & Vasconcelos, M. F. 2007. Range extension for Kaempfer's Woodpecker *Celeus obrieni* in Brazil, with the first male specimen. *Bulletin of the British Ornithologists' Club,* 127: 249-252.

Worthington, A. H. 1989. Adaptations for avian frugivory: assimilation efficiency and gut transit time of *Manacus vitellinus* and *Pipra mentalis. Oecologia,* 80: 381-389.

Books and Monographs

Sick, H. 1985. *Ornitologia brasileira, uma introdução,* v. 1. Brasília: Editora Universidade de Brasília.

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Remsen, J. V. & Robinson, S. K. 1990. A classification scheme for foraging behavior of birds in terrestrial habitats, p. 144-160. In: Morrison, M. L.; Ralph, C. J.; Verner, J. & Jehl Jr., J. R. (eds.). Avian foraging: theory, methodology, and applications. Lawrence: Cooper Ornithological Society (Studies in Avian Biology 13).

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Novaes, F. C. 1970. *Estudo ecológico das aves em uma área de vegetação secundária no Baixo Amazonas, Estado do Pará.* Ph.D. dissertation. Rio Claro: Faculdade de Filosofia, Ciências e Letras de Rio Claro.

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Dornas, T. 2009a. [XC95575, *Celeus obrieni].* www.xeno-canto.org/95575 (access on 25 February 2012).

Dornas, T. 2009b. [XC95576, *Celeus obrieni].* www.xeno-canto.org/95576 (access on 25 February 2012).

Pinheiro, R. T. 2009. [WA589090, *Celeus obrieni* Short, 1973]. www.wikiaves.com/589090 (access on 05 March 2012).

Footnotes will not be accepted.

Illustrations and *tables.* The illustrations (photographs, drawings, graphics and maps), which will be called figures, must be numbered with Arabic numerals in the order in which they are cited and will be inserted into the text. Upon manuscript acceptance, high quality image files (extensions JPG, TIF, PSD, CDR, AI, EPS, WMF or XLS; minimum resolution of 300 DPI) of the original figures will be requested. Tables and figures will receive independent numbering and must appear at the end of the text, as well as all legends to the figures that must be presented on separate sheets. In the text, mentioning figures and tables must follow the pattern: "(Figure 2)" or "... in figure 2." Table headings must provide a complete title, and be self-explanatory, without needing to refer to the text. All figure legends must be grouped in numerical order on a separate sheet from the figures.

All materials must be sent to the editor of the *Revista Brasileira de Ornitologia:*

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