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NOTES ON THE ECOLOGY OF THE YELLOW-FACED PARROT (*ALIPIOPSITTA XANTHOPS*) IN CENTRAL BRAZIL

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Resumo. – Notas sobre a ecologia do papagaio-galego (*Alipiopsitta xanthops*) no Brasil central. – O papagaio-galego (*Alipiopsitta xanthops*) é uma espécie endêmica e quase ameaçada do Cerrado e, embora seja amplamente distribuída, existe pouca informação disponível sobre sua ecologia. Neste trabalho eu relato dados sobre diversos aspectos da biologia desta espécie no Parque Nacional das Emas, Brasil central. Informações sobre sua dieta, indicam que a espécie é generalista e alimenta-se frequentemente de frutos, sementes e flores de plantas nativas em paisagens abertas do Cerrado, mas também de plantas cultivadas e cupins. A estação reprodutiva no parque ocorre entre Maio e Outubro. Os ninhos são encontrados em cavidades de cupinzeiros onde a incubação dura de 19 a 22 dias e os filhotes permanecem no ninho por até 45 dias. A espécie foi observada mais frequentemente em áreas abertas como campos e cerrados do que em áreas florestais, quando comparada com outras espécies de psitacídeos, reforçando idéias anteriores sobre aspectos de sua origem associada ao surgimento das paisagens abertas no centro da América do Sul. Ações para a conservação da espécie são necessárias e devem focar em estimativas de populações selvagens ao longo da área de distribuição, na proteção de porções significativas do seu habitat preferido (paisagens abertas) e no estabelecimento de um programa de criação em cativeiro.

Abstract. – The Yellow-faced Parrot (*Alipiopsitta xanthops*) is endemic of the Cerrado biome and, although widely distributed, little information is available about the ecology of this near-threatened species. Here I report data on several aspects of its biology in the Emas National Park in central Brazil. Diet information indicates that the species is a generalist, foraging often on fruits, seeds, and flowers of native species in the open landscapes of the Cerrado but also feeding on cultivated plants and termites. The breeding season in the park occurs from May to October. Nests are found in cavities of termite mounds where incubation lasts for 19–22 days and chicks remain in the nest for up to 45 days. In comparison to other psittacids, the species was seen more frequently in open areas, such as grasslands and Cerrado (savannah-like vegetation) than in forested areas. This supports earlier discussions about its origin being associated with the emergence of the open landscapes in central South America. Conservation actions

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are needed and should focus on estimates of wild populations in the entire distributional range, the protection of significant portions of its preferred habitat (open landscapes), and the establishment of a captive breeding program. *Accepted 28 July 2009.*

Key words: *Alipiopsitta xanthops*, Psittacidae, Cerrado, diet, reproduction, Brazil.

INTRODUCTION

The Yellow-faced Parrot (*Alipiopsitta xanthops*) is one of two parrot species endemic of the Cerrado biome in South America and occurs in the interior of Brazil from southern Maranhão, Piauí through Bahia, Minas Gerais, western Tocantins, Goiás, eastern Mato Grosso, and Mato Grosso do Sul (Sick 1997, Juniper & Parr 1998). It is also found in northern-central Bolívia (Remsen *et al.* 1986) and reported from northernmost Paraguay (Forshaw 2006). This species was recently assigned to the genus *Alipiopsitta* by Caparroz & Pacheco (2006) following the controversial debate about its placement in *Amazona* (Miranda-Ribeiro 1920, Duarte & Caparroz 1995, Miyaki *et al.* 1998, Caparroz & Duarte 2004, Russello & Amato 2004). The Yellow-faced Parrot is listed as Near-threatened (NT) at global (Birdlife International 2009) and national (Machado *et al.* 2005) levels but is considered Vulnerable (VU) in the state of Minas Gerais (Machado *et al.* 1998) and extinct in the wild (EW) in the state of São Paulo (Garcia & Marini 2006). Habitat loss represents the main threat to the species (Birdlife International 2009) as the Brazilian Cerrado has been altered in at least 50% of its original area of 2,000,000 km^2 (Klink & Moreira 2002, Machado *et al.* 2004, Silva *et al.* 2006). In addition, pressure from poaching chicks for the pet trade affects wild populations (Cavalcanti 1988, Brandt 1998, Juniper & Parr 1998, Snyder *et al.* 2000), yet the species is listed under CITES Appendix II. The Yellow-faced Parrot has been poorly represented in captivity in Brazil. Between 1997 and 2006, the numbers of Yellow-faced Parrots in zoological gardens reported by the National Zoo Organization ranged from 6–84 individuals with few breeding records (SZB 2009), while on the ISIS database current numbers indicate 29 individuals (ISIS 2009), one third of these held in Brazilian zoos. Although the species used to breed quite readily by private aviculturists in the United States in the late 1980's and 1990's (Jordan pers. com.), no captive management program focused on its conservation has been initiated. Current estimates of population size for both the wild and captive populations are unknown, yet Birdlife International (2009) considers populations to be declining moderately fast based on the current trends of habitat loss.

Despite of the wide distribution of the Yellow-faced Parrot in the Cerrado, there is only one study of the species focusing on foraging habits and acoustic communication (Araújo 2007). Apart from this study, information about its ecology is generally based either on inferences of broad-spectrum observations (Antas & Cavalcanti 1988, Juniper & Parr 1998, Forshaw 2006) or focused on few specific records usually concerning a larger number of parrot species (Carrara *et al.* 2007, Faria *et al.* 2007). Overall the species remains virtually unknown from the ecological perspective, making the assessment of its current status and extinction risk less accurate. Herein I report some novel observations on the ecology of this little-known parrot carried out in the Emas National Park, central Brazil. This information will contribute to the establishment of future conservation actions.

METHODS

The Cerrado is considered the richest savannah in the world (Klink & Machado 2005) and the Emas National Park (hereafter ENP, 18°07'05"S, 52°54'17"W), located in the high southwest plateaus of Goiás state, represents one of its most important reserves. The region has a landscape mostly characterized by flat open uplands that favors the establishment of large agricultural areas, making ENP an isolated fragment of Cerrado surrounded by large soybean plantations and cattle ranches. Up to 80% of the park's 132,000 ha are represented by grassland and open Cerrado forms, yet several gallery forests bordered by palm marshes (known as "veredas") are present along rivers and streams. As for most of the Cerrado, climate in ENP follows a pattern of rainy-dry seasons during the year with rains generally occurring from October to March. At least 11 species of psittacids are resident in the park, including the Yellow-faced Parrot. All the accounts I present here result from opportunistic annotations made between 1996–1998 by direct observation of the parrots and their behavior, followed by the close inspection of plant species or cavity content on each possible occasion. Information about consumption of food items was recorded as feeding bouts, following a similar methodology as described in Galetti (2002). Likewise, data on reproduction provide some valuable information about breeding season, behavior, clutch size, and offspring. Finally, I present some information on group size and habitat use, with some intuitive comparisons with another parrot species as well as comments on the general ecology and conservation.

RESULTS

Diet and foraging behavior. Most of my records of food items consumed by Yellow-faced parrots in ENP (Table 1) are new and none were recorded by Araújo (2007). I found Yellow-faced Parrots feeding on fruits, flowers, and leaves of native species of five plant families (Annonaceae, Erythroxylaceae, Ochnaceae, Palmae, and Sapotaceae) and on fruits and seeds of cultivated plants of three families (Anacardiaceae, Poaceae, and Rosaceae). The consumption of parts of woody native species was recorded between the mid-late dry season and the early rainy season, following a temporal gradient that matches the increase in flower and fruit production for many native plants of Cerrado in ENP (Batalha & Martins 2004, Silva *et al.* 2009). Similarly, parrots feeding on resources of cultivated plants agree with the peak in production of mangos and corn in the region (pers. observ.). Overall, psittacids are reported to be foraging generalists and the flexibility on diet composition is strongly associated with seasonality of food resources (Galetti 1997, Renton 2001, Ragusa-Netto 2005, Ragusa-Netto & Fecchio 2006). The Yellow-faced Parrot was also considered a foraging generalist by Araújo (2007) and the observations presented here, combined with all other records in the literature, support this hypothesis by providing a tallied minimum of 31 different plant species in the diet.

Some behavioral traits are especially interesting and deserve further description. Parrots consumed new leaves and buds of *Pouteria ramiflora* with the left foot, which Araújo (2007) considered an indirect method of food consumption. Parrots are known to be "left-handed" (Sick 1997) and foot use while feeding might be associated with the shape or size of a specific item, which can be small leaves and buds in these particular observations, as well as with the manipulative ability of the bird. Leaves were also reported as an important food item in the diet of the species by Araújo (2007), although none of his observations report parrots using

TABLE 1. Plant species and parts consumed by Yellow-faced Parrot at Emas National Park.

Family	Species	Month	Item	Feeding bouts
Sapotaceae	*Pouteria ramiflora*	August	leaf/bud	4
Palmae	*Mauritia flexuosa*	September	fruit	1
Erythroxylaceae	*Erytroxilum suberosum*	October	fruit	2
Annonaceae	*Annona coriacea*	October	fruit	1
Rosaceae	*Rubus cf. fruticosus*	October	fruit	9
Ochnaceae	*Ouratea hexasperma*	October	flower	2
Anacardiaceae	*Mangifera indica*	November–December	fruit	17
Poaceae	*Zea mays*	December–March	seed	3

a particular foot while foraging on leaves. On 10 September 1996, I observed a group of four parrots feeding on clustered fruits of a "buriti" palm tree *Mauritia flexuosa* that had been exploited by at least three Blue-and-yellow Macaws (*Ara ararauna*) and five Red-shouldered Macaws (*Diopsittaca nobilis*) two to three days earlier. Sick (1997) describes *Mauritia* palms as common resource for many parrots, but there is no previous record of Yellow-faced Parrots foraging on fruits of this palm species. Thus, it is likely that the parrots were feeding opportunistically on that particular source because the pulp had been exposed by mechanical scarification after other species. Mangos are reported as part of its diet (Collar 1997, Juniper & Parr 1998) and in ENP these fruits undoubtedly represent a very important resource, as I observed gatherings of adult and young parrots in large numbers (up to 40 individuals) spending many days foraging between November and December, immediately after the breeding season. Another important food source is represented by the highly productive corn fields surrounding ENP. From December to March I observed parrots feeding on corn and counted numerous flocks entering and leaving the park during early morning and late afternoon. Once I counted at least 200 birds flying from corn fields into the park at dusk. Although some parrot species are known as agricultural pests (Cavalcanti 1988, Bucher 1992), there is no estimate of corn crop damage caused by parrots in the study region, as I am unaware of farmers' complaints against loss of crops due to parrots.

An interesting finding was recorded on 23 October of 1996 when I observed eight Yellow-faced parrots opportunistically feeding on a dense cloud of winged termites while perched on a mango tree after a short rainstorm. Triggered by the first rains in the region, winged termites form flying nuptial clouds to establish new colonies, commonly using a reference point, such as trees or poles (Kitayama pers. com.). Parrots stayed quietly perched while feeding on termites that were flying around their heads and landing on their bodies, sometimes even keeping the mandibles open for a few seconds at a time and shaking their heads in circular movements apparently to catch more insects. During this time, on two different occasions, two and three parrots, respectively, moved to a different branch of the tree performing short sallying flights to follow the path that insects were moving, but without vocalizing. It was not possible to determine the number of insects taken per parrot but the parrots remained feeding for almost half an hour until the termite cloud slowly moved away. Afterwards, all parrots left the tree in a different direction. A similar opportunistic behavior was also observed for the Curl-crested Jay (*Cyanocorax cristatellus,* Bagno pers. com.).

Reproduction. The breeding season of the Yellow-faced Parrot in ENP occurs before the rainy season as I observed pairs in courtship behavior and exploring cavities by mid May and fledglings ready to leave nests as late as early October. Because the landscape in the park is predominantly open, nests are commonly found in cavities excavated in ground-based termite mounds, particularly of *Cornitermes cumulans*. According to Redford (1984), the simplified structure of open landscapes with a significant lack of trees, makes termite mounds an important component of the ecology of several species in the area, as they serve either as shelter for small mammals, reptiles, and invertebrates or represent functional equivalents of trees for birds as they can be used as roosts or have cavities excavated for nesting. The density of ground-based termite mounds in ENP was estimated as 323 termitaria/ha (Redford 1984) and the majority is made of hard-cemented solid soil varying from 0.3–2.5 m in height. Many mounds have cavities likely excavated by other bird species, such as the Campo Flicker (*Colaptes campestris*), and a significant number of those use them for nesting, including Blue-fronted Parrot (*Amazona aestiva*), Peach-fronted Parakeet (*Aratinga aurea*), American Kestrel (*Falco sparverius*), and White-rumped Monjita (*Xolmis velatus*) (pers. observ.).

On 14 May 1997, I observed a pair of Yellow-faced Parrots in courtship behavior followed by copulation atop of a termite mound (height = 1.5 m). The pair was first noticed perched on the mound and although they became reluctant after my approach, the parrots resumed courtship a few seconds later. The displays included brief tail fanning and wing spreading followed by short calls performed by the male, to which the female responded by lowering her head. In the seconds that followed, the birds copulated slightly different than described by Collar (1997) as the male placed one foot on the females' back and the birds swung their cloacae against each other. Likely because they had been observed, the duration of the entire ritual was shorter than 60 s, after which the birds flew away. Courtship behavior and copulation frequently take place at or near the nest site (Collar 1997) but intense search for nearby cavities was unsuccessful and further visits to that location in the following days failed to find the parrots.

In August 1996, I found three active nests in cavities of ground-based termite mounds. Adults were located by their heads sticking out of the cavity's entrance, but usually flew away once I moved toward the nests. In all three cavities, opening height was ca. 1 m off the ground and cavity depth ranged 30–50 cm. The first nest was found on 15 August 1996 with four eggs that vanished one week later, possibly due to predation as egg remains were absent. Several carnivore species occur in the park and predation on parrots has been recorded even by large species such as the Maned Wolf (*Chrysocyon brachyurus*; Bianchi *et al.* 2000). The second nest was found on 19 August 1996, with an adult incubating three eggs. One week later the eggs were still being incubated and on 11 September 1996 I found two nestlings approximately two weeks old with open eyes but still lacking feathers. The two nestlings remained in the cavity until mid October, when they fledged and left the nest. On 27 August 1996 a third nest with three fledglings was found, all with full crops and plumage almost fully developed. On 11 September only a single fledgling was still in the cavity, which was filled with feces with a strong odor similar to guava *Psidium guajava* (Myrtaceae). Two weeks later the nest was empty and it was not possible to determine if the chick successfully fledged. In summary, clutch size ranges from 3–5 eggs, incubation appears to be 19–22 days, and young birds remain in the nest for up to 45 days after asynchronous hatching. Data from captivity

show clutch sizes of 3–4 eggs and incubation periods of up to 23 days (Jordan pers. com.).

Flock size and habitat use. Records of flock sizes are not well represented in the literature, although Sick (1997) reports that the Yellow-faced Parrot can be locally common. Antas & Cavalcanti (1988) reported flocks of up to 30 individuals in the surroundings of Brasília (central Brazil), except during the breeding season. Carrara *et al.* (2007) described 160 parrots flying into a *Eucalyptus* plantation commonly used as a dormitory by Blue-fronted Parrots in the state of Minas Gerais. Araújo (2007) reported an average number of seven individuals per flock and discussed the relationship between flock size and food availability.

In ENP I recorded flock sizes ranging from 2–40 individuals (mean = 7.3, SD = 4.9, n = 28) and larger flocks were frequently composed of several subgroups of 4–6 individuals. The exception was during the breeding season, when isolated pairs flew more frequently (especially in May) than larger groups. Also, between September and October small flocks of three to four parrots were observed flying closer within larger groups of up to 12 parrots, which may indicate familial groups flying in tighter cohesion. When perched, these sub-flocks remained cohesive and could be identified by the presence of younger birds, which had typically immature plumage with yellow feathers only on the head. From December to March larger flocks of 30, 40, and even more than 100 parrots were seen more regularly, flying between corn fields and open areas within the park.

Yellow-faced Parrots were observed more frequently in open areas (77%, n = 26) than in forested areas (23%, n = 6), based on direct non-systematic sampling records, even though most of the landscape in ENP is formed by open fields. Furthermore, sightings in forested areas seemed to be related to stopover or eventual foraging purposes as parrots were never observed at the same locations in forested areas during subsequent days as they did in open areas.

DISCUSSION

The Yellow-faced Parrot is a widely distributed non-forest species in the Cerrado biome (Silva 1995, Cavalcanti 1999, Silva & Bates 2002). Silva (1997) considers it a paleoendemic form that emerged prior to the Plio-Pleistocene transition 2–3 million years ago associated with the appearance of open landscapes, according to Cole (1986) a habitat type older than forests within the Cerrado region. However, Oliveira-Filho & Ratter (2002) suggest that similar open habitats were already present much earlier in the Cretaceous. My observations on foraging behavior, reproduction, and habitat use in ENP are supportive to the idea of an open habitat species.

Diet and foraging behavior. The first detailed study focusing on feeding habits of the Yellow-faced Parrot was carried out by Araújo (2007), who found 18 plant species as part of its diet. In addition, Faria *et al.* (2007) reported groups of 10 to 12 parrots in ENP feeding on seeds of *Kielmeyera coriacea* (Clusiaceae) in March, while Simon & Hay (2003) reported predation on seeds of *Mimosa clausseni* (Fabaceae) and Juniper & Parr (1998) described the utilization of seeds and fruits of *Salacia crasifolia* (Hippocrateaceae), *Anacardium* sp. (Anacardiaceae), *Astronium fraxinifolium* (Anacardiaceae) and *Psidium guajava* (Myrtaceae).

Araújo (2007) noted that the species is a foraging generalist and most plant species reported by him are widespread in open formations of the Cerrado. Similarly, half of the plant species I recorded is typically found in open landscapes. Exceptions are the fruits of

Mauritia palms, that seem to be consumed occasionally, and cultivated species (mangos, wild blackberry, and corn), which accounted for the majority of feeding bouts reported here. For many animal species, cultivated plants represent an attractive resource because of the massive fruit production available in the short-term and consumption of these cultures may exceed native plants. Particularly in the *cerrado* surrounding ENP, large plantations have replaced natural areas of grasslands and shrub vegetation, therefore the addition of cultivated species in the diet of the Yellow-faced Parrot is somehow expected.

Although feeding on winged termites is a novel observation, this behavior is expected to be more frequent than recorded here because of the high density of termite mounds in ENP and warrants further investigation. Feeding on animal prey is attributed to have a complementary function of dietary needs (Roth 1984), but consumption of invertebrates by parrots is still poorly reported and sometimes considered incidental (Schubart *et al.* 1965). However, this behavior has already been described in the Peach-fronted Parakeet (Sazima 1989, Faria 2007) and the Maroon-bellied Conure (*Pyrrhura frontalis*; Martuscelli 1994).

Reproduction. Data obtained from breeding biology indicate that the Yellow-faced Parrot does not depend on forest sites for breeding, usually nesting in termite mounds located in open landscapes. In contrast, I found nests of the Blue-fronted Parrot more frequently in dead palm trees surrounding gallery forests than in termite mounds in open areas (Bianchi unpubl. data). Therefore, it would be interesting to investigate resource partitioning or overlap of nest sites as both species breed synchronously but using different nesting sites. Further investigation of Yellow-faced Parrot breeding biology is warranted on nest site availability, characteristics of cavities and competition among cavity-nesters. ENP is an ideal site to carry out these studies, as cavities and nests are relatively easy to find and monitor. However, strong anthropogenic pressures in the region have been negatively affected the habitat in the last few decades and their effects on local population dynamics are unknown.

Flock size and habitat use. Average flock size of Yellow-faced Parrots varied in different months in ENP but was similar to the size reported by Araújo (2007). Variation in parrot flock size along the year is determined by food availability and breeding season (Chapman *et al.* 1989, Pizo *et al.* 1995, Sick 1997, Gilardi & Munn 1998, Juniper & Parr 1998, Pizo 2002, Araújo 2007). Concordant with this prediction, records of larger groups outside the park from October to April are likely related to substantial availability of food in surrounding farms. Also, this time of year corresponds to the first months of post-breeding season, when fledglings are congregating into larger flocks. Later in the year, between May and September, breeding pairs split from larger groups and are encountered more frequently than the remaining less numerous flocks, which are likely composed of younger birds and non-breeding adults.

Finally, habitat use records also support the association of the Yellow-faced Parrot with open landscapes. The species was virtually absent from forest areas in contrast to several other parrots gathering in this habitat during crepuscular periods. Contrary to other psittacids (e.g., Blue-fronted Parrot), flocks of 6–15 Yellow-faced Parrots were seen roosting or feeding more often in areas of grasslands and Cerrado (*sensu strictu*) with low trees and scrub vegetation than in marshes and gallery forests. Although Yellow-faced Parrots have been also recorded using forest habitats (Antas & Cavalcanti 1988) or even urban areas close to cerrado fragments (Araújo

2007, Bianchi pers. observ.), this may represent an ecological shift resulting from intense transformation of natural open areas that are becoming increasingly scarce, forcing the species to adapt to a new situation and a different landscape. However, it is unknown whether such adaptation can be tolerated by wild populations in the long-term.

Conservation. The Cerrado biome has 856 bird species, of which 30 are considered endemic (Silva & Santos 2005, Leite 2006). Some studies indicate that most bird species in the biome are dependent upon forests to some extent (72%, including 13 endemics; see Silva & Bates 2002, Silva & Santos 2005). However, it is extremely important to consider the open landscapes as a conservation priority. Cavalcanti (1999) stressed that "grassland and Cerrado species are of particular conservation concern," because these areas are "preferred sites for mechanized agriculture," while supporting many threatened or near-threatened species, like migratory *Sporophila* spp. and endemics like the Dwarf Tinamou (*Taoniscus nanus*), the Black-masked Finch (*Coryphaspiza melanotis*), among others. Additionally, the Cerrado biome has been heavily modified and replaced by large plantations and cattle ranches over the last three decades, mostly to supply foreign markets (Klink *et al.* 1995, Machado *et al.* 2004). Areas surrounding ENP clearly indicate such change, being currently dominated by agriculture and pastures. Vegetation remnants in the region are becoming sparser, making it more challenging to maintain corridors between the core area represented by the park and fragments nearby.

The Yellow-faced Parrot depends upon open Cerrado habitats, but there is no estimate of its current population size or even reliable information about movements within its geographical range. In the surroundings of Brasília (which have nearly 60,000 ha of combined Cerrado reserves), the presence of the Yellow-faced Parrot is not constant throughout the year (Collar 1997, Bagno pers. com.) and the same is quite evident in the region of Palmas (Tocantins state, Olmos pers.com.). Because of its possible nomadic behavior (Juniper & Parr 1998), effective planning of reserves should consider the inclusion of large areas of open landscape to guarantee the protection of wild populations, but the implementation of such actions is ever more challenging due to intensification of human pressures. Another line of action is establishing a coordinated captive breeding program, especially while it is still possible to obtain representative samples of individuals from several different natural populations. Parrots are relatively easy to breed in captivity and many institutions in Brazil potentially fulfill the minimum requirements to successfully manage the species. The cooperation between captive programs and research on wild populations can substantially improve the amount of information available about the species and truly promote the conservation of this important Cerrado biome endemic.

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