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Notes on the reproduction of the Ultramarine Grosbeak *Cyanoloxia brissonii* in northeastern Brazil

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Abstract

We conducted a study of 21 nests of the Ultramarine Grosbeak *Cyanoloxia brissonii* between May 1986 and April 2018 in the state of Alagoas in northeastern Brazil. Most of our observations were made during the rainy season, particularly in April and May, with additional data gathered at the beginning and end of the season.

The clutch size averaged 2.06 eggs per nest. The eggs measured an average of 20.7×15.7 mm and weighed c. 2.6 g. Both parents shared incubation duties, with an incubation period averaging 13 days. The nestling period was 13–14 days.

Although Ultramarine Grosbeaks typically breed in secondary forests, clearings, and forest edges, we noticed a decline in the local population during the study period. We believe this decline is linked to factors such as capture for cage breeding, illegal wildlife trafficking and the widespread use of pesticides, all of which probably affect the survival of Ultramarine Grosbeak and other seed-eating birds in the region.

There is limited information in the literature about the reproductive biology of Ultramarine Grosbeak; thus, the information presented here contributes to a deeper understanding of the biology of the species. We hope that it will also help to guide conservation efforts for both the Ultramarine Grosbeak and its habitat.

Keywords: Reproductive biology, eggs, incubation, chicks, grosbeak, north-east Brazil.

Introduction

Knowledge of bird biology is essential for understanding natural history patterns, and it can help establish conservation actions for the species and their habitats. However, important reproductive information on nests, eggs, chicks, incubation periods, clutch sizes, and breeding seasons is still insufficiently known for many species (Xiao et al. 2017, Lees et al. 2020, Fierro-Calderon et al. 2021). The genus *Cyanoloxia* (the grosbeaks) is comprised of four species distributed in the Americas, from Mexico southwards to Argentina and Uruguay: Glaucous-blue Grosbeak *Cyanoloxia glaucocaerulea*, Blue-black Grosbeak *Cyanoloxia cianoides*, Amazonian Grosbeak *Cyanoloxia rothchildii* and our study species, the Ultramarine Grosbeak. This has five subspecies. *Cyanoloxia brissonii argentina* occurs in eastern Bolivia to the Chaco of Paraguay, western Brazil and northern Argentina; *Cyanoloxia brissonii brissonii* occurs in the north-east of Brazil, from the states of Piauí and Ceará to the states of Bahia and Minas Gerais, inhabiting forest edges, secondary forests and areas of semi-open shrubbery; *Cyanoloxia brissonii caucae* occurs in western Colombia, in the valleys of the upper Patía River, upper Cauca River and Dagua, *Cyanoloxia brissonii minor* occurs in the mountains of

northern Venezuela, from the Falcón region to the Lara, Sucre and Monagas regions. *Cyanoloxia brissonii sterea* occurs from eastern Paraguay to eastern and southern Brazil and northeastern Argentina (Brewer 2020).

All of them have sedentary populations or migrate over short distances, with fairly well-defined distribution patterns and conservation status of little concern. However, detailed breeding information is lacking for most species (Brewer 2020).

Despite having a relatively wide distribution in South America, information on the reproductive biology of the Ultramarine Grosbeak is limited to descriptions of nests and eggs found in Argentina (Dinelli 1924, Di Giacomo 2005, De La Peña 2013). In Brazil, the primary existing records of nests, eggs and chicks are photographs deposited in a Wiki Aves photo bank (Fenalti 2005, Lima 2005, Gentil 2011, Zurdo 2015). In this article, we present reproductive data and observations on parental care of the nominate subspecies of the Ultramarine Grosbeak *Cyanoloxia b. brissonii,* Our study site was in the state of Alagoas, northeastern Brazil. We found and monitored 21 nests and recorded the characteristics of the nests, eggs, chicks and parental care.

Study area and methods

The study area was located in the municipality of Quebrangulo, state of Alagoas, northeastern Brazil, in a landscape consisting of transitional vegetation between the Atlantic Forest and the Caatinga (Studer et al. 2015). A forest matrix marks the region's vegetation cover; the best preserved area is the Pedra Talhada Biological Reserve (9° 14′ S, 36° 25 W) (Figure 1), which is surrounded by stretches of regenerating forest with different stages of succession amid pasture areas. The Biological Reserve covers an area of 4,469 ha. It is considered a high marsh, i.e., a submontane ombrophilous forest formation, which persisted due to the local climate, which is much wetter than that of neighbouring regions (Studer et al. 2015). The average altitude of the area is around 700 m, with the highest point at about 860 m. The average annual rainfall is 1,600 mm, with

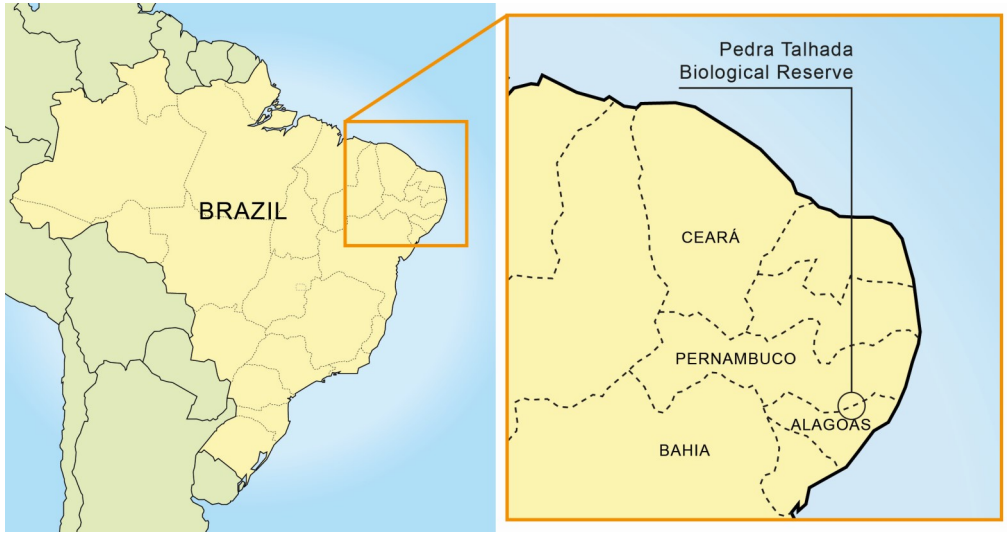

Figure 1: The location of the study area in northeastern Brazil at the Pedra Talhada Biological Reserve (9° 14′ S, 36° 25 W).

temperatures in the range 14°C–36°C. According to Studer et al. (2015), these favourable climatic conditions are maintained because the relief of the Borborema Plateau, which blocks the ocean winds, and captures, through condensation, the moisture in the air that returns in the form of rainfall.

Nest searches were undertaken in the patches of secondary forest, clearings and forest edges surrounding the Biological Reserve; fieldwork was done sporadically between May 1986 and April 2018. We observed the behaviour of the breeding pairs as they approached and left sites at which we suspected nests to be located. Once found, we visited and monitored the nests daily, from nest construction to hatching, and then every two days. We recorded parameters such as nest position, height above ground and supporting plant species. Other variables, such as measurements and weights of nests and eggs, were obtained using a tape measure, a 150 mm graduated calliper, and a 15 g Pesola scale. We also recorded clutch size, nesting phenology and nestling descriptions. We made records of diet whenever possible. Our observations and photographic records were made from a camouflaged hide at distances of c. 6–10 m.

Results and discussion

Nests

We found a total of 21 nests in January (*n*=1), February (3), March (3), April (6), May (7) and September (1). The nests were built at the fork of horizontal branches with thin twigs; according to the nest classification of Simon & Pacheco (2013), they were cup-shaped. The sides of the nests were relatively loose and thin and were made up of roots, tendrils, and leaf stalks (Figure 1). We located most of the nests in the vegetation surrounding the forest and on rocky outcrops in the middle of forested areas. They were built at heights above ground ranging from 85 cm to 520 cm, and at an average height of 239 cm.

Limited data and only basic information are available in the literature on the reproductive biology of Ultramarine Grosbeak and other species of the *Cyanoloxia* genus. This limits comparisons and discussions on their reproductive parameters. However, our observations largely corroborate descriptions of this species' nests made in Argentina, including the average height above the ground at which the nests were found (Dinelli 1924, Di Giacomo 2005, De La Peña 2013). In Central America, nests of the congeneric species *C. cyanoides* have been observed built between 50–250 cm above the ground (Skutch 1954).

The nests we found had the following dimensions: external diameter 13.6 cm, internal diameter 6.3 cm, external height 7.3 cm, and depth 3.5 cm (*n*=11). Nests weighed 9.4 g (*n*=10). Nests found in Argentina reported smaller dimensions: a total diameter of 9.0 cm, an internal diameter of 5.5 cm, and a depth of 5.0 cm (De La Peña 2013) (Figure 2, Table 1).

Among the plants that served as support for nest construction, we identified *Psidium guineense* (Myrtaceae) (*n*=4), *Vitex polygama* (Lamiaceae) (*n*=3), *Cnidoscolus urens* (Euphorbiaceae) (*n*=2), and the parasitic *Cuscuta racemosa,* (Convolvulaceae) (*n*=4).

Figure 2: Ultramarine Grosbeak nests built in the forks of twigs and branches of an unidentified bush, northeastern Brazil (Nordesta Collection).

Table 1: Nest measurements for Ultramarine Grosbeak *Cyanoloxia brissonii* in the wild.

Nest	Height from ground (cm)	External diameter (cm)	Internal Diameter (cm)	External Height (cm)	Internal Height (cm)	Weight (g)
1	85	10	7	6	3.5	6
2	390	16	6	11	3	17
3	210					
4	110					
5	180	12	7	6	4	6
6	360	17	6	11	5	
7	110	11	6	11	4	12
8	150	13	6	6	4	
9	150	13	6	4	3	6
10	440	18	6	9	4	10
11	150	14	6	8	3	16
12	580					
13	150	16	6	5	3	7
14	440					
15	260	10	7	3.5	2	7
16	360					
17	150					7
18	160					
19	180					
20	330					
21	150					
Mean	**243**	**13.6**	**6.3**	**3.8**	**3.5**	**9**
SD	**137.1**	**2.8**	**0.5**	**2.8**	**0.8**	**4.2**

Eggs

Two eggs were laid in 15 nests and three in one nest, an average of 2.06 eggs per nest. The eggs background colour of the eggs was mostly bluish-white to rusty-white, entirely dotted with small dark rusty -brown spots, more concentrated on the rounded pole (Figure 3); we found one egg with a well-marked crown (Figure 4). Their average size was 20.7×15.7 mm (n=22), and their average weight was 2.6 g (*n*=21). All of them were oval to pointed oval (Table 2).

Figure 3: Nest of Ultramarine Grosbeak with two eggs, northeastern Brazil (Nordesta Collection).

Figure 4: Nest of Ultramarine Grosbeak with two eggs, one having a well-shaped crown, northeastern Brazil (Nordesta Collection).

Table 2: Measurements of 22 eggs of Ultramarine Grosbeak *Cyanoloxia brissonii.*

Place	Date	Eggs Measured	Length (mm)	Width (mm)	Weight (g)
Quebrangulo/AL	2000/05/15	2	21.5	16.8	2.6
	2000/05/15		20.5	15.3	2.3
Quebrangulo/AL	1986/05/11	2	20.3	15.2	2.35
	1986/05/11		19.6	14.7	2.1
Quebrangulo/AL	1996/04/21	2	22.2	15.1	2.9
	1996/04/21		22.1	14.7	2.6
Quebrangulo/AL	1996/04/29	2	19.2	14.8	2.2
	1996/04/29		19.5	15.5	2.4
Quebrangulo/AL	1999/05/11	3	19.4	15.4	2.6
	1999/05/11		19.4	15.6	2.6
	1999/05/11		19.8	15.8	2.6
Quebrangulo/AL	1995/05/02	2	20.1	15.2	2.3
	1995/05/02		20.3	15.2	2.4
Quebrangulo/AL	2001/09/27	2	22.8	16.1	3
	2001/09/27		21.3	16.1	2.9
Quebrangulo/AL	1997/02/17	2	21.3	15.5	2.8
	1997/02/17		20.4	15.6	2.7
Quebrangulo/AL	1992/04/05	2	22.9	17.1	3
	1992/04/05		21.3	17.2	3
Quebrangulo/AL	1992/04/13	1	19.9	14.9	
Quebrangulo/AL	2000/03/02	2	20.7	16.9	2.8
	2000/03/02		21.5	15.6	2.8
		Mean	20.7	15.7	2.6
		SD	1.12	0.76	0.28

In what appears to be a record of a single nest in Argentina, Dinelli (1924) reported a clutch of three eggs, mentioning that the eggs were bluish-white or rusty-white, with more or less intense yellowish spots. He also said that some eggs might have had one end more acute than the other, and others had poles of equal proportions. However, Di Giacomo (2005) and De La Peña (2013) indicated clutches of two eggs, whitish, blue, or greenish-blue, with brown spots on the rounded pole with average dimensions of 22.4×17.0 mm and 3.1 g in weight. The average size of *C. cyanoides* eggs measured in 17 nests in Costa Rica was 23.5×17.3 mm (Skutch 1954). The data we found coincide with the variations in shape and colour described in Argentina, as well as in relation to *C. cyanoides* eggs researched in central America (Figures 3 and 4). However, the average size of the Ultramarine Grosbeak eggs measured in our study was slightly smaller (Table 2).

The minor variations in the number, size, and colouration of the eggs did not allow us to verify any major differences in the reproduction pattern of this species in the localities studied so far. Therefore, more data are needed to understand various aspects of this species' natural history in other areas and habitats, especially by observing possible interference from latitudinal trends and climatic variation in its reproductive phenology, as observed by Marques-Santos et al. (2016).

Most of the nests had already been built when we found them, and the pairs were incubating or had hatchlings. We observed hatching in three nests, with a nestling period of 13–14 days, as recorded during our daily monitoring. We observed a pair building a nest and watched them lay two eggs on consecutive days; the total laid in that nest. During this period, the male often landed on the tip of a branch near the nest and sang melodiously for hours. Both adults incubated the eggs, and the incubation period totalled 13 days. In Costa Rica, the incubation period for the congeneric species *C. cyanoides* was also 13–14 days; however, it was observed that in that region of Central America, only the female incubated the eggs and the hatchlings, which are cared for by the couple, remain in the nest for 11 or 12 days (Skutch 1954).

Nestlings

After the chicks hatched, the frequency and intensity of the male's vocalisations decreased considerably. The hatchlings had dark pink to grey skin, with fine, sparse rust-coloured down. The beak was grey with a white tip, pale-yellow commissures, and a violet-pink throat. The tarsometatarsus and toes were pale violet, with white nails. At 6 days old, the first feathers appeared; they were greyish-brown. The throat remained pink, and the legs and feet became greenish-yellow. When the young left the nest, their plumage colour resembled the female's. The male's brown juvenile plumage gradually changed to the blue colouration of the adult as it matured, as noted by Sick (1997). The pair cared for and fed the nestlings from the moment they hatched until after they left the nest (Figures 5–8). Moreover, the pair remained faithful to their territory after the young fledged.

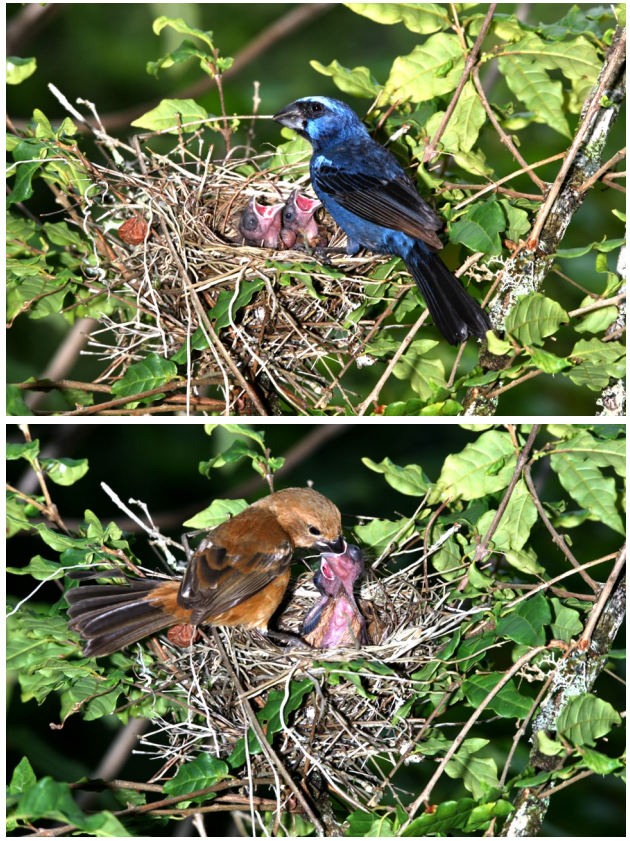

Figure 5: Male Ultramarine Grosbeak (top) and female (bottom) alternately feeding the chicks, northeastern Brazil (Nordesta Collection) .

Figure 6: Female Ultramarine Grosbeak removing and swallowing the faecal sacs (top) and brooding the nestlings after feeding (bottom), northeastern Brazil (Nordesta Collection).

Nesting Behaviour and Breeding Observations:

In the study area, Ultramarine Grosbeak began to build its nests and lay its first eggs in February, and, according to our observations, this continued until September. Photographic records deposited in the Wikiaves image bank indicated that in Brazil, the species has already been observed breeding in February in the state of São Paulo (Zurdo 2015), in April, in the state of Bahia, where a nest with three eggs was recorded (Lima 2005) in November, in Rio Grande do Sul (Fenalti 2005) and in December in Rio de Janeiro, when a photographic record of the species copulating was made (Gentil 2011). In Argentina, it is reported that Ultramarine Grosbeak nests between late October and early February (Di Giacomo 2005, De La Peña 2013).

Figure 7: A female Ultramarine Grosbeak feeding three chicks, northeastern Brazil (Nordesta Collection).

Figure 8: Male Ultramarine Grosbeak removing faecal sacs before flying with them away from the nest, northeastern Brazil (Nordesta Collection).

We often observed the pairs feeding on seeds, foraging close to the ground or about 2 meters from the ground. Of the plant species visited, *Cnidoscolus urens* (Euphorbiaceae) and *Cyperus rotundus* (Cyperaceae) were identified. Other researchers have recorded Ultramarine Grosbeak feeding on the flowers of *Zornia diphylla* (Fabaceae) and a fruit or flower from the Leguminosae family in the Serra da Capivara National Park, Piauí, Brazil (Olmos & Albano 2012).

Summary of Parental Care Observations

Across four observed nests of Ultramarine Grosbeak, the frequency of feeding sessions by males and females was recorded and averaged. The observations were standardised to 100-minute periods to allow for consistent comparison. The average and standard deviation of feeding frequencies for both males and females were calculated as follows:

25 May 1995: A nest with two five-day old chicks was observed for 100 minutes, from 06:20 to 08:00. During this period, there were 13 feeding sessions at intervals of between 2 and 10 minutes. The male arrived at the nest with food six times, and the female seven times. The food was offered quickly; mostly, it was white seeds or small, unidentified whole fruits, which the adults seemed to crush with their beaks before feeding the chicks. On two occasions, the female swallowed the chicks' droppings and remained in the nest for a few minutes.

2 April 1997: A nest with three three-day old chicks was observed for 100 minutes, from 08:30 to 10:10. The chicks were fed small, unidentified white seeds by their parents. The female fed six times, and the male only twice. After the feeding session, the female remained with the chicks in the nest for a few minutes, and the male flew away twice with the faecal sacs.

21 May 2001: In a nest with three eight-day old chicks, during 100 minutes of observation from 08:20 to 10:00, the male fed the chicks 12 times and the female eight times. They brought the chicks some

seeds and small unidentified whole fruits. The feeding sessions lasted from 12 to 33 seconds.

25 February 2002: A nest with two five-day old chicks was observed for 120 minutes, from 05:47 to 07:47. Each adult came to the nest six times with white seeds and small unidentified black and red whole fruits. Both adults also flew away with the droppings, and the male vocalised on arrival and departure from the nest. (To standardise this to a 100-minute period, the feeding sessions were adjusted to five feedings each for both the male and female).

On average, the females fed the chicks an average of 6.5 times per 100 minutes (average interval between visits, 15.4 minutes). For males, the equivalent value was 6.0 times per 100 minutes (16.7 minutes per visit). The range in number of feeds per 100 minutes was five to eight for females, and one to 12 for males. Larger samples are needed to evaluate whether the feeding frequency of males is more variable than that of females.

Conservation concerns:

Over the years of observing Ultramarine Grosbeak in secondary forest areas, clearings and forest edges, we have found that populations of Ultramarine Grosbeak have decreased in the study area, possibly due to animal trafficking. This situation has also been observed in other locations, where this species is among the most sought-after birds in the illegal wild bird trade (Sick 1997). The illegal capture and trade of birds in Brazil have been extensively documented. A study analysing the dynamics of wild bird trade in northeastern Brazil found that this illicit activity significantly impacts various bird species, including granivorous passerines (Bencke & Mauricio 2006, Ortiz-von Halle 2018, Charity & Ferreira 2020). A BirdLife analysis stated that out of 25 identified threats for the 163 Important Bird Areas (IBAs) in the Mata Atlántica region, 25% were affected by the capture of birds for trade (Bencke & Mauricio 2006, Ortiz-von Halle 2018).

We also suspect that the indiscriminate use of pesticides in the region may interfere locally with the survival of some populations of Ultramarine Grosbeak and other granivorous passerines. The indiscriminate use of pesticides is a significant threat to avian populations in northeastern Brazil. Scientific studies have highlighted the detrimental effects of these activities on bird species, including granivorous passerines such as the Ultramarine Grosbeak. Pesticides, particularly those used in agriculture, pose substantial risks to bird populations. For instance, a study on the use of dry bean fields in Brazil examined the impact of pesticides on birds and mammals, providing insights into the risks associated with pesticide application in agricultural settings (Li et al. 2020, Santos et al. 2024). Additionally, research on the effects of pesticide use in rice fields indicates that certain chemicals are extremely toxic to birds, leading to mortality and potential reproductive issues (Parsons et al. 2010)

Considering the above, we believe that environmental education and enforcement programs aimed at curbing the illegal capture and trade of birds should be prioritised. Additionally, controlling the use of herbicides should be intensified and systematised to reverse this situation, which appears to be a threat to many bird populations and communities in this study area in northeastern Brazil.

Conclusion and Future Research

Further studies on the reproduction of Ultramarine Grosbeak are needed to fill the information gaps in this neotropical bird species, especially in northeastern Brazil. Addressing these gaps would help better understand the species' reproductive behaviour and help develop conservation strategies to protect it from threats such as habitat loss, pesticide use and illegal trafficking. Considering the above, we believe that environmental education and enforcement programs aimed at curbing the illegal capture and trade of birds should be prioritised. Additionally, controlling the use of herbicides should be intensified and systematised to reverse this situation, which appears to be a threat to many bird populations and communities in this study area in northeastern Brazil" (Studer et al. 2015, 2023).

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