

**OBSERVATIONS ON PARENTAL CARE OF THE MASKED WATER-TYRANT (*FLUVICOLA NENGETA*) IN RIO DE JANEIRO, BRAZIL**

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**Abstract** · The Masked Water-Tyrant (*Fluvicola nengeta*) belongs to the family Tyrannidae and inhabits locations close to bodies of water and urban environments. This work aims at describing basic aspects of the breeding biology, specifically the timing of the breeding season and parental care behavior through observations of nestling feeding frequency, identification of food items and nest defense. The study was conducted at Universidade Federal Rural do Rio de Janeiro, Brazil, between October 2012 and June 2014. *Fluvicola nengeta* did not show a defined breeding season, reproducing throughout the year. During 33 hours of observations at 14 nests were recorded 518 feeding records, with an average of 16.7 (SD = 1.85) food items brought to the nest per hour. This feeding rate was high, compared to that of other Tyrannidae, and may be connected to the low levels of nest predation in the study area. The feeding rate increased throughout the day peaking in the middle of the day, declining by the end of afternoon. Both parents participated in feeding and defending the offspring. Food items brought to the nest included: Odonata (N = 3), Lepidoptera (N = 3), Coleoptera (N = 1), Hymenoptera – Formicidae (N = 1), and Arachnida (N = 1). The parents defended its nests against 22 species of birds and this behavior was classified in two categories: display (52%) where the intruder was simply warned using visual warning behaviors and persecution (48%), which resulted in chases. Displays were generally carried out by both pair members while persecutions usually involved only one individual, the other remaining close to the nest.

**Resumo · Observações do cuidado parental da Lavadeira-mascarada (*Fluvicola nengeta*) no Rio de Janeiro, Brasil**

A Lavadeira-mascarada (*Fluvicola nengeta*) é pertencente à família Tyrannidae e habita locais próximos a corpos d'água e áreas urbanas. Este trabalho tem como objetivo descrever aspectos básicos da biologia reprodutiva, especificamente a duração da estação reprodutiva e cuidado parental através da observação da frequência de alimentação dos ninhos, identificação dos itens alimentares e defesa do ninho. O estudo foi conduzido na Universidade Federal Rural do Rio de Janeiro, Brasil, entre outubro de 2012 a junho de 2014. *Fluvicola nengeta* não demonstrou uma estação reprodutiva marcada, reproduzindo ao longo do ano. Em 33 horas de observações em 14 ninhos foram obtidos 518 registros de alimentação, com uma média de 16,7 (DP = 1,85) itens alimentares levados ao ninho por hora. Esta frequência de alimentação foi maior quando comparada a outros tiranídeos e pode estar relacionada ao baixo nível de predação na área de estudo. O fornecimento de alimentos aumentou ao longo do dia, com pico no meio do dia e declínio no final da tarde. O casal participou da alimentação e defesa da prole. Os itens alimentares oferecidos aos ninhos incluíram: Odonata (N = 3), Lepidoptera (N = 3), Coleoptera (N = 1), Hymenoptera - Formicidae (N = 1) e Arachnida (N = 1). Os adultos defenderam o ninho de 22 espécies de aves e este comportamento foi classificado em duas categorias: display (52%) na qual o invasor foi simplesmente avisado através de comportamentos visuais de ameaça e perseguição (48%), que resultou no afastamento do invasor. Displays foram comumente realizados por ambos os membros do casal enquanto as perseguições geralmente envolveram apenas um indivíduo, o outro permanecia próximo ao ninho.

**Key words:** Behavior · Fledglings · Nestlings · Reproduction · Tyrannidae

**INTRODUCTION**

The Masked Water-Tyrant (*Fluvicola nengeta*) is a member of the family Tyrannidae, the most speciose bird family in the Western Hemisphere, comprising ca. 18% of all passerine species in South America (Sick 1997). It has a predominantly white plumage, with a black stripe across its eyes and a light-grey back without sexual dimorphism (Sick 1997). It feeds on insects and lives near muddy water banks, ponds, and lawns (Maciel 2009). It can also be found in other open landscapes, such as pastures, cultivated areas (rice fields), barns, and flooded fields, as well as in urban areas (Straube et al. 2007).

Due to deforestation, the Masked Water-Tyrant has expanded its distribution from open areas of northeastern Brazil to the south, west, and north of the country (Willis 1991, Scherer-Neto & Carrano 1998, Straube et al. 2007, Aguiar 2010, Quintas

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Filho et al. 2011, Benites et al. 2013). In addition to its expansion in Brazil, *F. nengeta* has been recorded in Argentina (Krauczuk et al. 2003, Klavins & Bodrati 2007, Militello et al. 2010, La Grotteria et al. 2012) and Paraguay (Klavins & Bodrati 2007).

The species builds its nests on vegetation and on urban structures, such as power line posts and spotlights (Silva et al. 2018). The nests are oval-shaped and elongated with a side entrance (Pacheco & Simon 1995). Clutch size varies from one to three eggs, with an incubation period of 15 days and a period of 14 days for nestlings (Tomaz et al. 2009, Silva et al. 2018).

About 75% of all known species of birds exhibit biparental care, in which nestlings are provisioned and/or defended by both members of the pair (Cockburn 2006), and this seems to be the case in *F. nengeta*. However, previous studies indicate that only the female is responsible for the incubation of eggs and brooding of the newly hatched offspring while the male is more engaged in defending the nest (Tomaz et al. 2009), and both sexes participate in feeding the nestlings (Silva-Junior & Melo 2009).

Despite its wide distribution in Brazil and common occurrence in flooded and anthropogenic areas, few studies have been conducted on the reproduction of *F. nengeta* whether in its native habitat or in urban areas (Pacheco & Simon 1995, Silva et al. 2018), with only two studies about its parental care (Silva-Junior & Melo 2009, Tomaz et al. 2009). Here we describe aspects of parental care in *F. nengeta*, including new information regarding offspring feeding and defense behavior, and provide more precise data on the duration of the breeding season.

## METHODS

**Study area.** Nest search and monitoring was conducted on the campus of Universidade Federal Rural do Rio de Janeiro (22°49'–22°45'S, 43°38'–43°42'W) in Seropédica, located in the Baixada Fluminense district, Brazil. The campus lies about 80 km from downtown Rio de Janeiro and covers an area of approximately 3,024 ha, of which 13.2 ha are covered by buildings (Chiquieri et al. 1995). The climate is classified as Aw in Köppen's International System, with tropical savanna climate and a dry season in winter (Mattos et al. 1999). Elevation ranges from 0 to 75 m a.s.l.. The campus is located in an area of Atlantic Forest, bordered by relatively high mountains, such as the Serra do Mar mountain range, Tinguá, and Gericinó-Mendanha massifs. The landscape consists of countryside and grazing areas, forest fragments, lakes, and wetlands (Ferreira et al. 2010).

**Field procedures.** The study took place from October 2012 to June 2014. Nests were located by active seeking and following adult birds carrying nests materials or food items (Martin & Geupel 1993). Nests were monitored one to three days a week during 1 hour between 06:30 to 18:00 h. Observations were conducted with the aid of Tasco 8x42 binoculars and documented with a Nikon P520 camera. Due to the access difficulty and nest failure (abandoned, destroyed, or preyed-upon nests), monitoring of parental care was possible in only 14 (nests with fledglings) of the 44 *F. nengeta* nests found, totaling 33 hours of observations.

We focused on two aspects of parental care: offspring feeding and nest defense. We recorded the number of food items brought to the nest per hour, and in each case we tried to identify the type of food. We also recorded the duration of parental care after the offspring abandoned the nest. Nest defense was classified it in two categories: display and persecution. Display occurred when a bird exhibited a stereotyped threat warning behavior against intruders. Persecution was defined as the aggression itself, when a bird flew after the intruder. In each case of nest defense, we recorded the identity of the species at which it was directed.

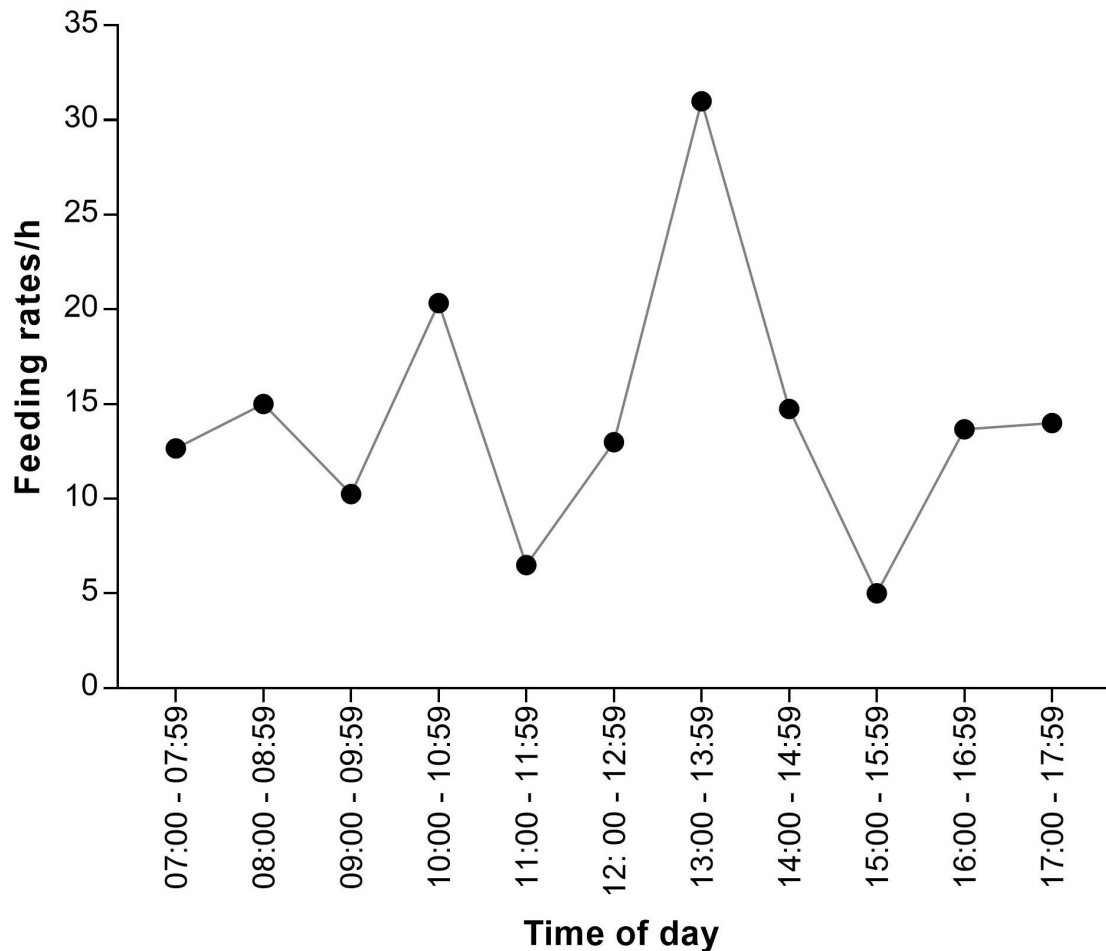
The duration of the reproductive season was defined from the first active nest until to the last nest became inactive. A nest was considered active when there were eggs or nestlings in its interior and inactive when offspring had left the nest. Information on the characterization and reproductive success of the monitored nests is available in Silva et al. (2018).

**Statistical analyses.** Student's *t*-test was used to test whether the average number of nests found in the dry (April to September) differed from the rainy (October to March) season. The assumption of data normality was tested with the Shapiro-Wilk test. We used a Fisher's exact test to test whether the type of nest defense depended on the number of individuals involved (both members of the pair or one individual). Tests were made using the BioEstat 5.3 program (Ayres et al. 2007), adopting a 5% level of significance. Data are presented as means  $\pm$  standard deviation.

## RESULTS

**Nestlings.** We observed adults feeding the nestlings 518 times, at an overall rate of  $16.7 \pm 1.85$  food items/h. Nests with two nestlings showed higher feeding rate ( $19.71 \pm 2.72$  food items/h) than nests with one nestling ( $14.25 \pm 2.39$  food items/h). Feeding rate increased throughout the day, peaking between 13:00 and 13:59 and declining towards the end of afternoon (Figure 1). Feeding rate also increased with days after hatching, ranging from  $12 \pm 2.51$  (2 days old) to  $17.77 \pm 2.78$  (12 days old) food items/h. At the beginning of the nestling period (day 0–6), food items brought to the nest were too small to be identified but increased in size over time, and by day 8 they were larger than the bill of adults. In this period, we identified mainly insects belonging to Odonata ( $N = 3$ ), Lepidoptera ( $N = 3$ ), Coleoptera ( $N = 1$ ), and Hymenoptera - Formicidae ( $N = 1$ ). Spiders (Arachnida,  $N = 1$ ) were also offered once. Despite the absence of sexual dimorphism, we were able to confirm that both sexes feed their young. Parents were present at the same time during the nestling provisioning. Frequently, when one individual was feeding the young, the other was nearby with food in its beak. However, in one nest just one adult was seen nearby the nest and feeding the nestlings. This nest was successful, producing two fledglings. Extra-pair helpers at the nest were not recorded.

Cleaning the nest consisted of the removal of fecal bags, which were carried away from the nest and dropped. Nestlings begged only during the presence of an adult, remaining in silence when adults were away. Initially, nestlings emitted low chirps that were increasingly louder as they grew. Two to three days prior to leaving their nests, nestlings would put



**Figure 1.** Average hourly pattern of nest feeding rates of Masked Water-Tyrants (*Fluvicola nengeta*) recorded at Universidade Federal Rural do Rio de Janeiro, Brazil during October 2012 to June 2014.

their heads out of the nest and vocalized intensely when the adults approached with food.

**Fledglings.** Fledglings had similar plumage as adults when they left the nest; the only differences were the fledglings' smaller size and the distinct vocalization of adults. After leaving the nest, fledglings were fed often by adults and strongly vocalized when these were nearby, but overall feeding rate declined to  $13 \pm 2.12$  food items/h. The fledglings remained close to the nest 2–3 days after fledging; after this period, they began to move farther in search of food offered by their parents. During this period, in all nests with both parents ( $N = 13$ ) only one adult was seen feeding the fledglings while the other was seen foraging in the distance. As the offspring grew, feeding by adults became less frequent and began changing to stimulate independent foraging by the young. Parental care lasted one to two weeks after the fledglings left the nest. After that, adults started to behave aggressively towards their fledglings and stopped feeding them. However, in one case adults fed the fledglings for five weeks after leaving the nest, at this stage the young were almost the same size as their parents.

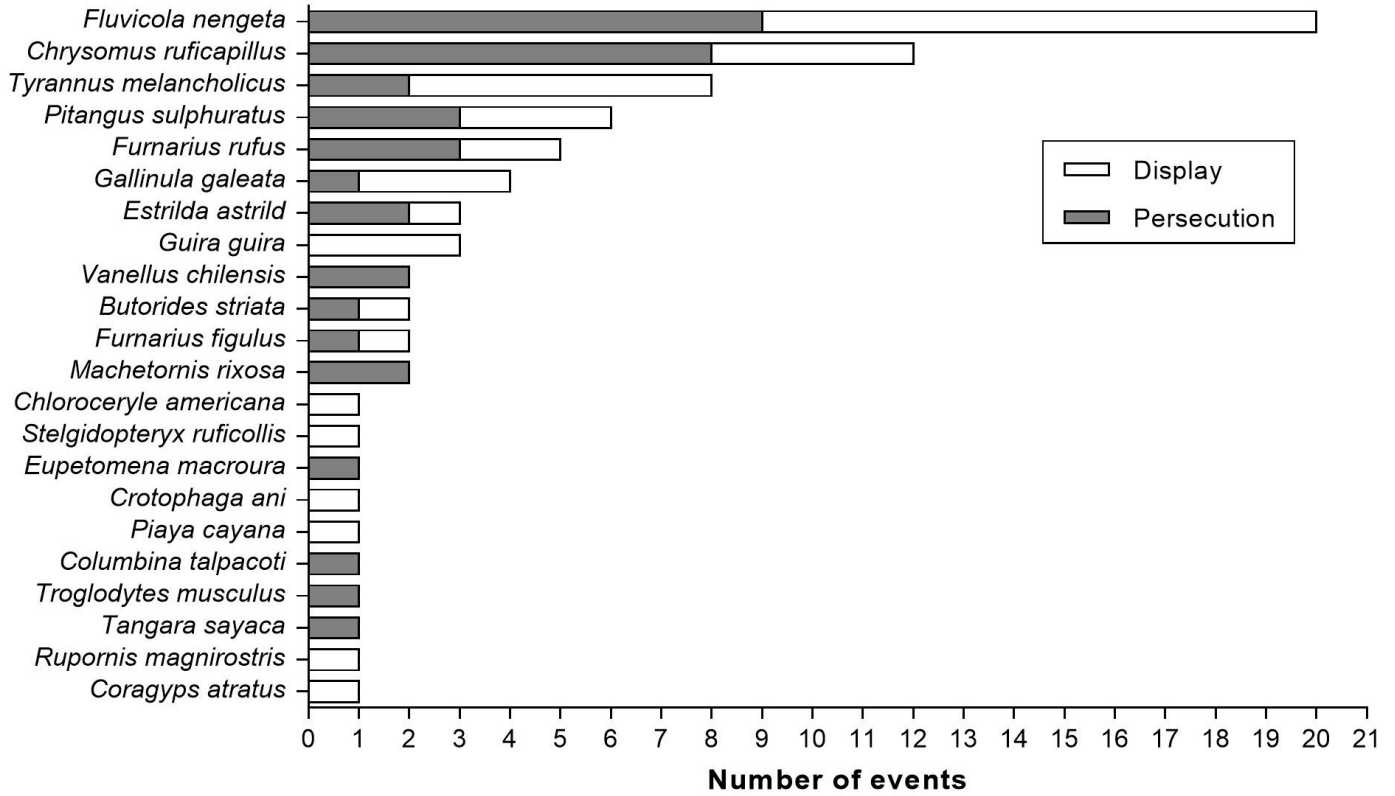
**Nest defense.** During 88 observed nest defense events, *F. nengeta* defended the nest from 22 species of birds, although actions directed at conspecifics were most frequently registered (33.1%,  $N = 29$ ) (Figure 2). Nest defense was classified into two categories, display and persecution. Defense display occurred next to the nest and consisted of spreading

both wings and tail forward, with shaking movements and vocalization in the presence of an invader in its territory. During persecution, the bird would fly after the intruder while vocalizing, performing sharp dives and pecking at the intruder. The display was usually carried out as a first alert to birds approaching the pairs' nest. If the intruder did not leave, the pair or an individual of the pair began the persecution until the intruder was outside their territory. Displays (52%,  $N = 41$ ) were performed more often than persecutions (48%,  $N = 38$ ). Displays were generally carried out by both pair members while persecutions usually involved only one individual, the other one remaining close to the nest (Fisher's exact test,  $P = 0.017$ ) (Figure 3).

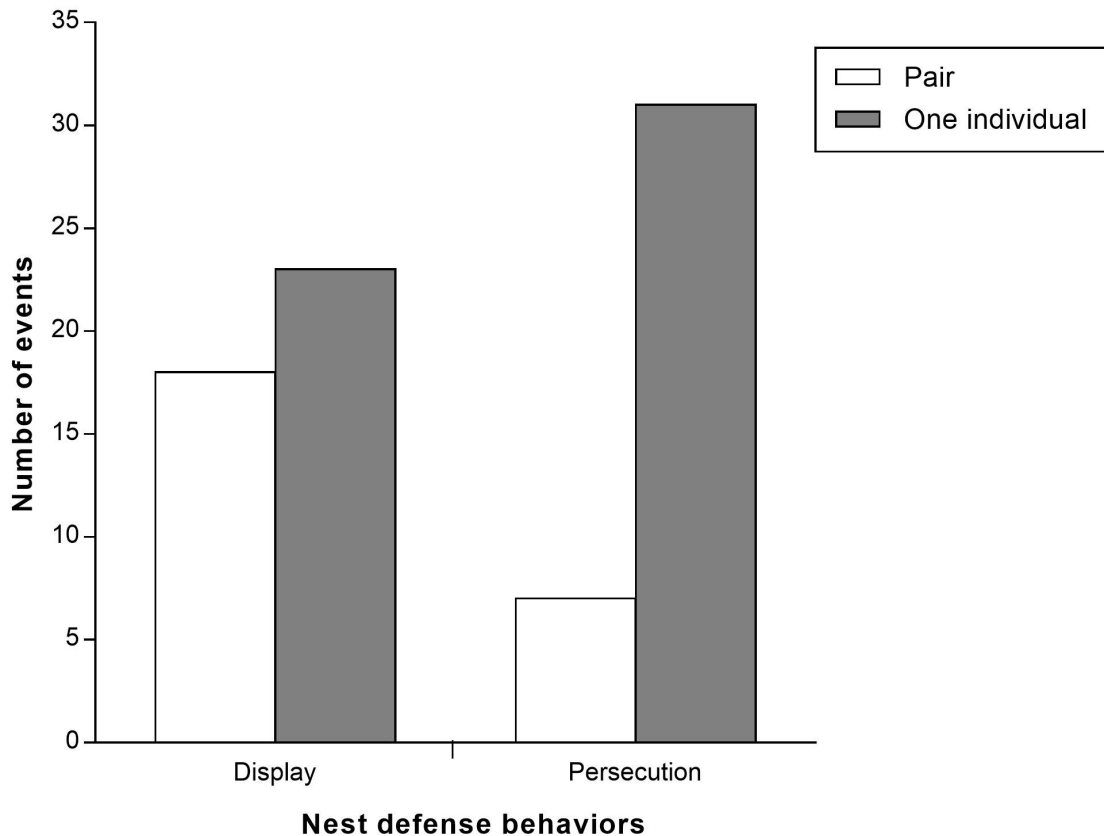
**Breeding season.** *Fluvicola nengeta* did not show a defined breeding season, reproducing throughout the year, with the presence of active nests during the whole monitoring period (Figure 4). The number of nests found varied over the months, with a higher number of nests in November ( $N = 9$ ). There was no significant difference in the average number of nests found per season (dry =  $2.7 \pm 2.2$ , rainy =  $2.5 \pm 1.3$ ) ( $t = 0.254$ ,  $df = 15$ ,  $P = 0.802$ ).

## DISCUSSION

Our observations of parental behavior in *F. nengeta* revealed differences and similarities with patterns reported in the literature. As expected for a socially monogamous insectivorous species, both members of the pair fed the nestlings with



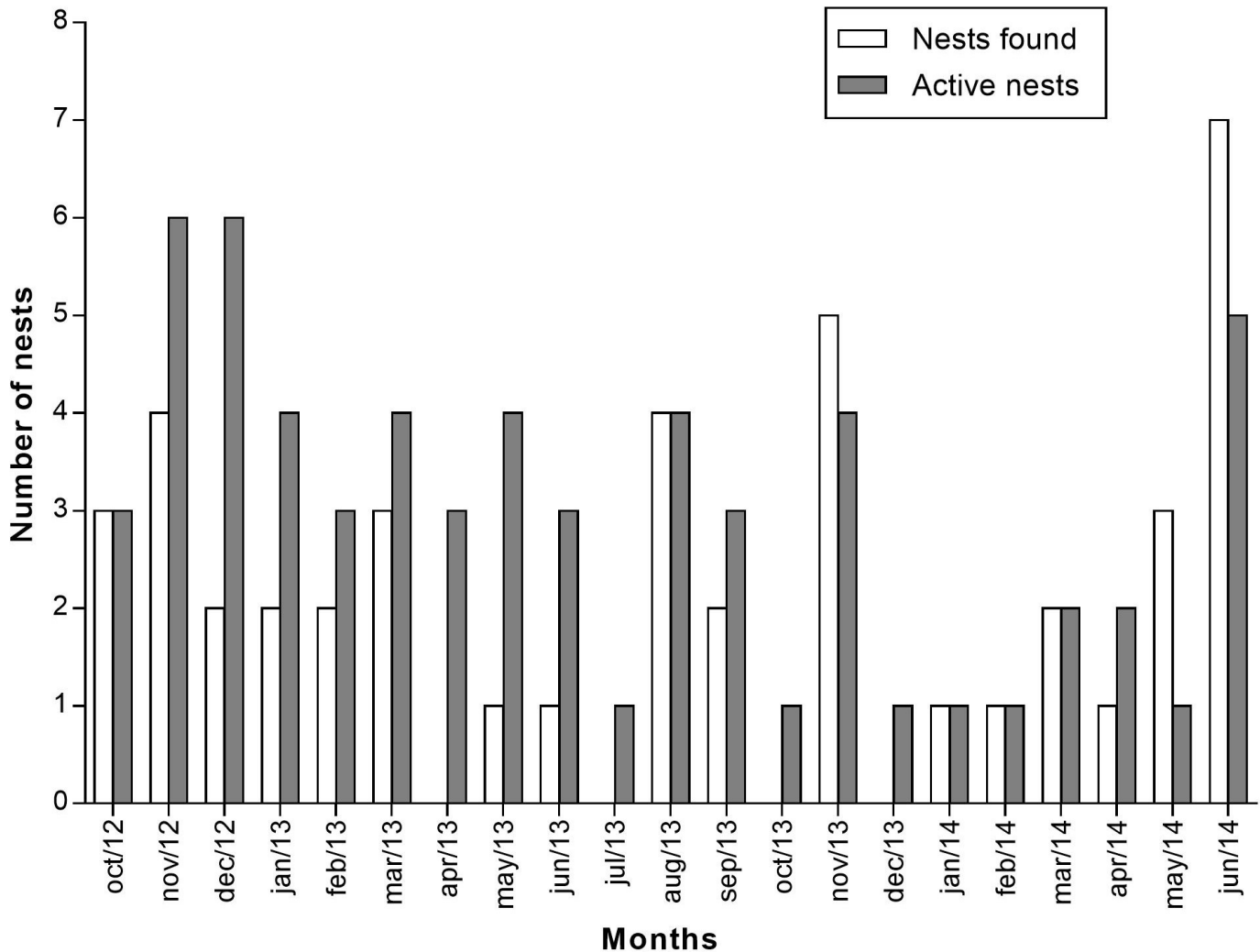
**Figure 2.** Number of nests defense events (display or persecution) conducted by nesting Masked Water-Tyrants (*Fluvicola nengeta*) in response to 22 species of birds at the Universidade Federal Rural do Rio de Janeiro, Brazil during October 2012 to June 2014 .



**Figure 3.** Number of display and persecution nest defense events performed by the pair or one individual Masked Water-Tyrants (*Fluvicola nengeta*) at the Universidade Federal Rural do Rio de Janeiro, Brazil during October 2012 to June 2014.

arthropods. The highest levels of nestling feeding activity occurred during the afternoon, which differed from the study by Silva & Melo (2009) on the same species where the peak was during the morning.

The average feeding rate of the nestlings (16.7 food items/h) was similar to that reported by Tomaz et al. (2009) (16.2 food items/h) for *F. nengeta*. However, feeding rates were relatively high when compared to other species in the



**Figure 4.** Number of found and active nests of Masked Water-Tyrants (*Fluvicola nengeta*) found from October 2012 to June 2014 at Universidade Federal Rural do Rio de Janeiro, Brazil.

family Tyrannidae. Stawarczyk et al. (2012) reported a maximum feeding rate of 8.6 food items/h for the Smoky Bush-tyrant (*Myiotheretes fumigatus*), while Fiorini & Rabuffetti (2003) and Llambías & Ferretti (2003) observed a maximum feeding rate of 15.4 food items/h for the Vermilion Flycatcher (*Pyrocephalus rubinus*) and 9.4 food items/h for the Great Kiskadee (*Pitangus sulphuratus*), respectively.

These differences in feeding rates are probably due to the different number of nestlings fed in each study. According to Slagsvold (1997), allocation to parental care is highly dependent on the number of hatchlings, where a greater number of offspring correspondingly results in an increase in the care demonstrated by their parents. In addition, higher feeding rates may also be associated to the risk of predation because parents may reduce provisioning with regard to this (Ghalambor et al. 2013). In our study population, the risk of nest predation was relatively low (12.5%) (Silva et al. 2018), and this could explain the high rates of nest visitation.

Helpers at the nest assist in the parental care of an individual other than its mate (Skutch 1961). They can increase total feeding rates and reduce parental effort in male breeders (Manica & Marini 2012). Generally, helpers in tyrannids are rare (Brown 2014). However, besides *F. nengeta* (Silva-Junior & Melo 2009) they have been recorded in White-Bearded Flycatcher (*Conopias inornata*) (Thomas 1979) and *M. fumigatus* (Stawarczyk et al. 2012). We observed only one

or two adults provisioning nestlings in *F. nengeta*, but since individuals were not individually marked the involvement of helpers cannot be completely disregarded.

Nest defense is classified as mobbing, an anti-predatory behavior performed by one or more individuals belonging to one or more species in the presence of potential predators (Curio 1978). Mobbing can occur silently or with stereotyped behaviors, high and repeated calls, and physical attacks on the potential predator (Altmann 1956, Krams et al. 2008). In our study, only 18% (N = 4) of the species mobbed by *F. nengeta* represented some danger to their nests: Roadside Hawk (*Rupornis magnirostris*), Smooth-billed Ani (*Crotophaga ani*), Guira Cuckoo (*Guira guira*), and *P. sulphuratus* (Sick 1997, Tomaz et al. 2009). The mobbing of other non-predatory species is likely related to species territoriality, probably exacerbated when nests are active. Nevertheless, the highest proportion of nest-defense events were directed at conspecifics. The extensive defense of the nest contributes to the high reproductive success of the species in the study area (Silva et al. 2018).

Both members of the pairs participated in nest defense and mobbed intruders. This was especially the case when nest defense was restricted to aggressive displays. Since the display was mostly held close to the nest, the individual incubating the eggs would leave the nest and join its mate to display together. However, when nest defense involved per-

secution the individual involved would fly a distance from the nest to actively repel the intruder from its territory, while its companion would remain close to the nest. Consequently, most events of nest defense involving a persecution would be carried out by only one member of the pair.

At our study site, the reproductive period of *F. nengeta* extended throughout the year, similar to what was found by Silva-Junior & Melo (2009) in Uberlândia, Minas Gerais State, Brazil. This differed from the results by Pacheco & Simon (1995) in Viçosa, same state, where reproduction occurred mainly during September to April. These authors explained the low frequency of nests in the months from November to December to high rainfall, which led to nest failure during construction. We did not observe high loss of nests during the rainy months. This reproduction throughout the year can reduce failures due to competition for food resources or nesting materials with those species that reproduce with greater intensity in the rainy season (Silva-Junior & Melo 2009).

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