

SEXUAL DIFFERENCES IN PARENTAL FEEDING EFFORT DURING THE NESTLING PERIOD OF THE WHITE-HEADED MARSH-TYRANT (*ARUNDINICOLA LEUCOCEPHALA*)

César Cestari

Programa de Pós-graduação em Zoologia, Universidade Estadual Paulista (UNESP),
Av. 24 A, 1515, Bela Vista, Rio Claro, SP, CEP 13506-900, Brazil.
E-mail: cesar_cestari@yahoo.com.br

Resumo. – Diferença sexual no esforço parental para a alimentação de filhotes da freirinha (*Arundinicola leucocephala*). – O esforço parental em aves pode influenciar as chances de sobrevivência dos adultos e de seus descendentes para a estação reprodutiva subsequente. Apesar da grande quantidade de informações sobre o esforço parental na alimentação de filhotes em Tyrannidae, ainda existem inúmeras espécies pouco estudadas. No presente estudo, eu analisei o esforço para alimentação de filhotes de um casal de freirinhas (*Arundinicola leucocephala*) em um lago no sudeste do Brasil. Foram realizadas 10,3 h de observações de um ponto alto com visão panorâmica do lago e de um ponto próximo ao ninho da espécie para verificar a distância total de deslocamento dos pais para caça de presas e as suas freqüências de visitas no ninho para alimentarem os filhotes. A fêmea se moveu por uma distância total maior e apresentou maior freqüência de visitas para alimentação dos filhotes do que o macho. O casal (principalmente a fêmea) forneceu uma diversificada quantidade de artrópodes terrestres e aquáticos para os filhotes. Adicionalmente, alguns comportamentos de limpeza do ninho foram pioneiramente registrados para a espécie, tais como: a remoção de sacos fecais pelos pais e a ajuda dos filhotes para a retirada de restos de artrópodes do ninho. Algumas hipóteses não exclusivas que podem explicar o menor esforço do macho para alimentar os filhotes são indicadas, tais como: o maior risco de predação do macho pela coloração conspícuia de sua plumagem, o comprometimento com a defesa de território e o comportamento egoísta do macho pelo efeito indireto da qualidade do seu genótipo aos seus descendentes.

Abstract. – Parental effort may influence the fitness and survivorship of adult birds and their offspring from one breeding season to the next. Although much is known about parental feeding effort in tyrant flycatchers, many species remain understudied. In this study, I examined parental feeding effort of the White-headed Marsh-Tyrant (*Arundinicola leucocephala*) at a pond in southeastern Brazil. I conducted 10.3 hrs of observations from two locations: a high place with all view of the whole pond, that allowed me to observe flight distances of parents hunting for prey; and from near the nest to observe frequency of visits to the nest. The female marsh-tyrant flew farther while hunting prey and made more visits to the nest than did the male. The adults (mainly the female) provided a variety of terrestrial and aquatic arthropods to the nestlings. Additionally, parents removed fecal sacs from the nest and nestlings eliminated arthropod remains from the nest, the first records of nest sanitation activities by this species. Non-exclusive hypotheses that may explain the lower level of parental care provided by the male include: higher predation risk due its more conspicuous plumage, commitment of male to territory defense, and its selfish behavior influenced by indirect genotype fitness inherited by the offspring. Accepted 25 June 2012.

Key words: White-headed Marsh-Tyrant, *Arundinicola leucocephala*, diet, nesting, offspring, parental care, Tyrannidae.

INTRODUCTION

Biparental care predominates in 81% of all bird species (Cockburn 2006) including the tyrant-flycatchers, the largest family with 429 species of birds distributed mainly in the Neotropical region. Although brooding is done only by females, both sexes usually provide food to the nestlings (Skutch 1997, Fitzpatrick 2004). Amount of effort expended in feeding nestlings may, however, differ between sexes. According to Fitzpatrick *et al.* (2004), males play a more active role than do females, however, Skutch (1997) argued that there are also numerous species in which female effort is greater than that of males.

Sexual differences in parental effort may be reflected in their survivorship. According to Houston & Davies (1985), parental survival decreases as efforts to feed nestlings increases. On the other hand, increased provisioning is likely to increase the survival rate of the nestlings. Alatalo *et al.* (1988) argued that a parent feeding its young often has the potential to increase its effort depending on how much the other parent is prepared to work. In this way, several studies have been questioned if the presence and frequency of nestling feeding activity by both parents in monogamous species are of great value to their young (Gowaty 1983, Bart & Tornes 1989).

Although there is much valuable information on parental feeding activity in flycatchers (Skutch 1997, Fitzpatrick 2004), many species have been little studied. The White-headed Marsh-Tyrant (*Arundinicola leucocephala* Linnaeus, 1764) is common in freshwater marshes, damp grasslands, and river islands in lowlands of the South America (Ridgely & Tudor 2009) but parental activity is not well described. Geographical distribution of the marsh-tyrant encompasses northern and eastern Colombia, Venezuela, Guianas, eastern Ecuador, northeastern Peru, northern and eastern Bolivia, northern Argentina, Paraguay,

and northern to southeastern and southern Brazil (Fitzpatrick 2004, Ridgely & Tudor 2009). This species has a conspicuous sexual dimorphism in plumage: males are mostly black with white head and throat while females are mostly plain ashy-brown above with white forecrown and blackish tail (Ridgely & Tudor 2009). Although definitive studies have not been done, this species presents strong evidence of monogamy. According to Santos (1992), individuals spend most of the time in pairs but once one of the partners disappears, it can be replaced by another individual. The nest, a ball of grass and feathers with a side opening near the top, is built by both sexes in vegetation near or over the water. The clutch varies from two to four eggs; incubation and nestling feeding are conducted by both sexes (Skutch 1985, Fitzpatrick 2004).

In the present study, I observed and quantified the effort both parents expended in feeding nestlings of the White-headed Marsh-Tyrant at a pond in southeastern Brazil. I also estimated the flight distances of foraging parents as one additional estimate of parental effort.

METHODS

Study area. The study was conducted in an artificial pond in Itu municipality, São Paulo state, southeastern Brazil ($23^{\circ}12'03.8''S$, $47^{\circ}23'44.5''W$). The pond encompasses $11,075\text{ m}^2$ and is surrounded by aquatic vegetation dominated by cattail (*Typha* sp.) and water-hyacinth (*Eichornia* sp.). The nearest lake is 3.7 km from the study area. Native semi-deciduous forest fragments and exotic sugarcane monocultures dominate the region's landscape.

Sampling protocol. Observations of parental care activities were conducted on 14, 19, and 20 April 2011 from blind $\sim 7\text{ m}$ from the

nest. I also used a mini-camera (HD Camcorder), placed on a fence post \sim 4 m from the nest to film the parents' activities. The following data were collected in the morning (09:20–12:20 h) and in the afternoon (16:20–18:20 h) of each day: (1) frequency of visits by male and female to feed the nestlings, (2) foraging period of the parents during their absences from the nest, and (3) prey (identified to order) that the parents brought to the nestlings.

I estimated the flight distances of the foraging female (between 08:20–09:20 h and 14:00–15:00 h) and male (between 09:20–10:20 h and 15:00–16:00 h) on 19 and 20 April. Observations were made from a higher point that provided a view of the entire pond. I used colored flags placed at 10-m intervals parallel to the pond to estimate distances and a sketch of the pond to record the birds' routes. Data collected were: (1) total number of perches that the parents landed in the surrounded vegetation of the pond after left the nest, and (2) the total flight distance of the parents.

RESULTS

The nest, which held two nestlings, was attached to an abandoned fence post approximately 20 cm above water (Fig. 1). Previous observations in the area (15 and 16 February 2011) had confirmed the existence of only one pair of adults inhabiting the artificial pond.

The female fed the nestlings more often (13.2 visits/h) than the male (one visit/h) during 6.3 h of observations. The female was also faster in capturing prey and carrying it to the nest (2.88 ± 3.42 min, N = 72 for the female; 19.55 ± 16.48 min, N = 5 for the male). Nestlings were fed a diverse diet including dragonflies (Order Odonata, N = 27), crickets (Order Orthoptera, N = 15), butterflies (Order Lepidoptera, N = 9), beetles (Order Coleoptera, N = 9), flies (Order Diptera, N = 4), bedbug (Order Hemiptera, N = 1), and wasp (Order Hymenoptera, N = 1) (Fig. 1). Arthropod remains and fecal sacs were removed from the nest on 16 visits (15 by female and 1 by male), corresponding to 21% of all visits. In these cases, the parents did not rest on a barbed-wire fence after leaving the nest but flew directly to the margin of the pond to dump the organic material.

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I recorded the movements of the parents over the pond during 4 h (2 h each sex) in the morning and afternoon periods. Adults typically flew in a straight line, reaching distances of 8.75 m up to 169.6 m from the nest. The female usually perched once for each flight foraging in the aquatic vegetation and returning to the nest by the same route. In total, it perched 17 ± 1.4 times/h after leaving the nest. The male rarely went to the nest to feed the nestlings. It presented only a mean of 1 perch/h after left the nest and continued moving (14.5 ± 2.1 perches/h) through the surrounded vegetation of the pond (Fig. 2).

The total flight distance of the female was higher (2371.4 m) than the total flight distance of the male (694.9 m). The parents also moved more in the morning period (female: 1555 m; male: 422.6 m) than in the afternoon period (female: 816.1 m; male: 272.4 m) (Fig. 2).

DISCUSSION

The female White-headed Marsh-Tyrant expended greater effort feeding nestlings than did the male. The female frequently made short, straight flights and perched near the nest (8.75–42 m) to capture prey using sally maneuvers to aquatic vegetation, air, and water surface. The male, in contrast, typically stayed farther from the nest (> 42 m) although still within visual contact of the nest and movements of the female. Several



FIG. 1. The female of White-headed Marsh-Tyrant (*Arundinicola leucocephala*) flying to the nest with a dragonfly in its beak to feed its nestlings (Itu municipality, photographed by C. Cestari).

hypotheses may be advanced to explain the low effort of the male to feed the nestlings: (1) increased risk of detection by predators leading to nestling predation (Skutch 1949, Martin *et al.* 2000), (2) males' commitment to territory defense (Fiorini & Rabuffetti 2003), and (3) indirect fitness effect of males' genotype to offspring and/or uncertainty of paternity (Møller & Thornhill 1998).

According to Skutch (1949), predators may use parental activity as a cue to find nests. The male White-headed Marsh-Tyrant, with a pure white head and throat, was more conspicuous against the background formed by water and surrounding vegetation than was the ashy-colored female. Thus, greater activity by the male might have increased the susceptibility of the nest to predation or may have

increased the probability that the male himself would have been preyed on by common raptors in the region [e.g., Southern Crested Caracara (*Caracara plancus*), Yellow-headed Caracara (*Milvago chimachima*), Roadside Hawk (*Buteo magnirostris*)].

Territorial behavior of the male was seen in one agonistic encounter in which it chased and ousted a Masked Water-Tyrant (*Fluvicola nengeta*) from the pond, indicating that the male used part of its time to defend the territory rather than feed nestlings. Fiorini & Rabuffetti (2003) also observed territorial behavior of males in a study of parental care by the Vermilion Flycatcher (*Pyrocephalus rubinus*).

The lower effort by the male White-headed Marsh-Tyrant to feed nestlings may

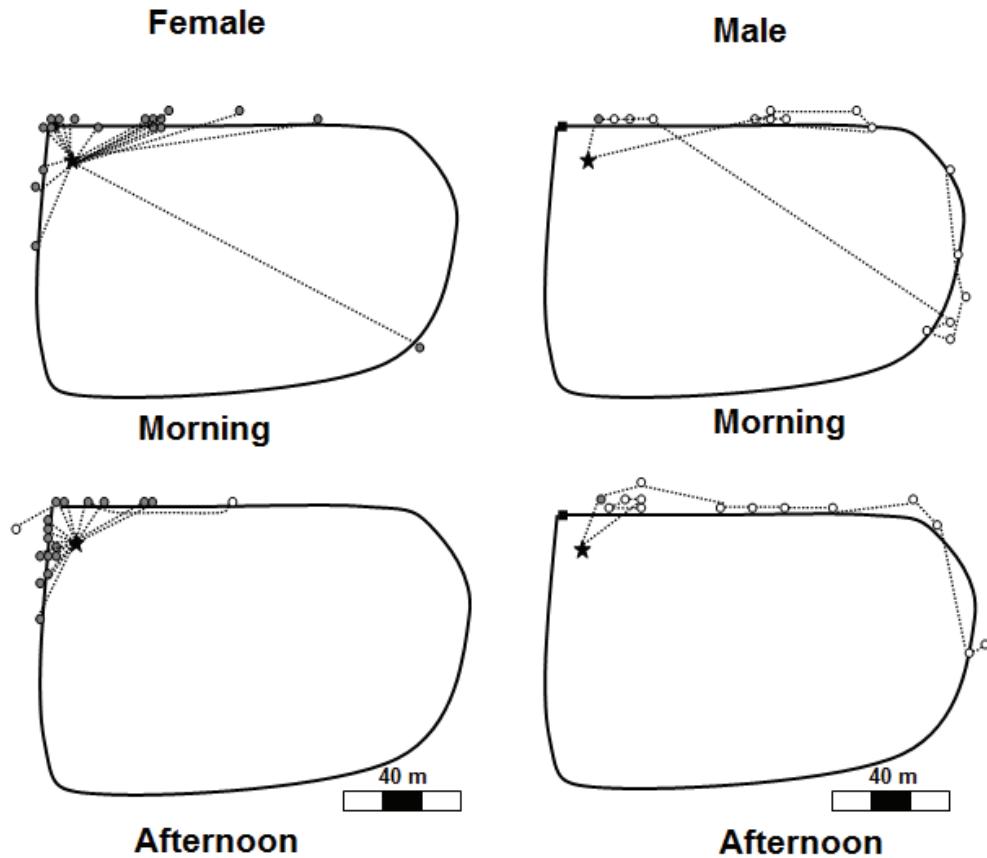


FIG. 2. Flight routes of the female (on the left) and the male (on the right) of a pair of White-headed Marsh-Tyrant in the morning (female: 08:20–09:20 h; male: 09:20–10:20 h) and afternoon (female: 14:00–15:00 h; male: 15:00–16:00 h) at the pond in Itu municipality. The continuous line indicates the contour of the pond. Dashed line indicates the parents' routes. Star indicates nest location. Filled circle indicates the first perch used by the adult after leaving the nest. Empty circle indicates the perches that the parents continued landing on the course of their routes.

also be explained by the indirect fitness of its genotype to the offspring. Females of this species may choose more vigorous and attractive males as a mate in order to obtain a net indirect-fitness benefit (Møller & Thornhill 1998). Such behavior occurs mainly in polygamous species in which males usually have elaborate courtship displays and conspicuous plumage. However, it is also likely to occur in the monogamous White-headed Marsh-

Tyrant males which also have pronounced dichromatic coloration and pre-nuptial flights (Fitzpatrick 2004). This hypothesis is in accordance with Verner & Willson (1969) who argued that males of species with pronounced sexual dimorphism tend to provide less parental care. More studies about the courtship behavior and parental effort of the White-headed Marsh-Tyrant need to be conducted to resolve this issue.

Uncertainty of paternity also may lead to a reduction in effort by males. In this case, however, the absence of other males at the pond for at least two months before the nest construction, combined with the supposed monogamy of this species (see Santos 1992), weakens the hypothesis that possibility of extra-pair paternity may have led to the lower effort of the male to feed the nestlings (Møller & Thornhill 1998).

It was not possible to determine which one of the two nestlings was fed by parents because of the closed nest architecture of the White-headed Marsh-Tyrant. Assuming that parents fed the two nestlings equally, each nestling would have received 7.1 arthropods/h, provided mainly by the female. This amount is within the range of 0.3–18.3 meals/nestling/h found for other flycatchers (Skutch 1997, Fitzpatrick 2004). The female also carried fecal sacs far from the nest more frequently than did the male. Nestlings also helped to clean the nest by passing arthropod remains to the beak of the adults. This nest sanitation probably reduced the likelihood of infestation by parasites or pathogens (Welty & Baptista 1988).

Results of this study demonstrate a strong sexual difference in the parental effort of the White-headed Marsh-Tyrant towards feeding their nestlings. This study can be considered as a first step to a better understanding of the species' breeding biology, and I encourage more studies (if possible with more pairs and nests) on its courtship behavior and parental care.

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