Oecologia Australis
21(4): 444-449, 2017
10.4257/oeco.2017.2104.08

POPULATION ABUNDANCE OF *Fluvicola nengeta* (LINNAEUS, 1766) (AVES: TYRANNIDAE) IN A URBAN PARK

Giancarlo Ângelo Ferreira[1], Lídian Alves Fernandes[1], Adriano Marcos da Silva[1] & Celine Melo[1]*

[1]Universidade Federal de Uberlândia (UFU), Instituto de Biologia, Laboratório de Ornitologia e Bioacústica. Campus Umuarama, Rua Ceará, s/n, Bairro Umuarama, Uberlândia, Minas Gerais, Brasil. CEP: 38400-902
E-mails: gianbioufu@gmail.com, lidinha31@hotmail.com, adriano.biologia@yahoo.com.br, celinemelo@gmail.com

ABSTRACT
Fluvicola nengeta is a passerine bird of the Tyrannidae family, which usually lives in areas near watercourses, such as rivers or lakes. This bird is quite common in northeastern Brazil but is expanding towards the south of the country and to other countries in South America. This study aimed to observe the population abundance of *F. nengeta* over two periods. For the collection of data on the species abundance in the years 2008/2009 and 2014/2015, we delimited 10 sampling points in the Sabiá Park (Uberlândia, MG). We performed monthly calculations of the Index of Point Abundance (IPA) for each assessed period and carried out measurements of the Frequency of Occurrence (FO) at each point sampled in each period. The sampling points were classified according to their environmental quality. There was a difference in the monthly IPA between the periods, which were higher in the 2014/2015 period. The FO per sampling point did not differ between the two periods analyzed. There was no relationship between the FO per point and the environmental quality of each point in any of the periods analyzed. There was no difference in the monthly IPA between the dry and rainy season in any of the periods analyzed. The constant conversion of natural habitats in to anthropized areas, along with the behavioral characteristics of *F. nengeta,* can be favoring the growth and expansion of its populations in this region.
Keywords: birds; geographic expansion; population fluctuation.

INTRODUCTION

The Masked Water-tyrant, *Fluvicola nengeta* (Linnaeus 1766), is an insectivorous passerine bird of the Tyrannidae family measuring about 15 cm in length. It exhibits striking colors, with a white head accented by a black band similar to a mask, and a gray back and its plumage does not present sexual dimorphism (Sick 2001).This species can be found in many environments, such as swamps, muddy puddles, creeping vegetation, open landscapes, and also in urban areas (Sick 2001, Straube *et al*. 2007, Silva-Junior & Melo 2009).

This bird occurs in eastern Brazil, mostly in the northeastern region. Nevertheless, since the 1950 is it has been in constant expansion towards the south (Willis 1991), having already reached the south-central part of the country, being currently found in Paraná and Mato Grosso do Sul states (Straube *et al.* 2007). Furthermore, it is reaching other countries in South America, particularly Argentina and Paraguay (Klavins & Bodrati 2007). Recently, there are records of its presence in the northern of Tocantins state, Amazon region (Dornas & Pinheiro 2011, Benites *et al*. 2013). Deforestation is considered the primary cause of this expansion (Willis 1991, Quintas-Filho *et al.* 2011), leading to its occurrence in both natural and anthropized areas (Alvarenga 1990, Willis 1991, Pacheco & Simon 1995, Gabriel & Pizo 2005, Straube *et al*. 2007).

The presence of *F. nengeta* in southeastern Brazil can be considered an expansion of its geographic distribution. Such aggrandizement occurs when species coming from another region settle down in environments different from their areas of origin. Upon settling down in these new areas, species can cause an imbalance in these ecosystems and affect many biological processes due to competition for habitat, food, and other factors necessary for their survival. In most extreme cases, the environmental imbalance may drive local native species to extinction (Pivello 2011).

This species can be considered to be a bioindicator of the low quality of aquatic and terrestrial environments since it frequently occurs associated with degraded environments (Silva-Junior & Melo 2006). Moreover, its presence in anthropized areas displays a

scenario of varied levels of degradation of the natural environment (Pacheco & Simon1995).

Due to urbanization, a significant portion of the species population is now restricted to legally protected parks and areas. Immersed in inhospitable scenarios, these sites become the last strongholds that gather characteristics closer to the natural habitats (Franchin & Marçal-Junior 2004, Fontana 2005, Scherer*et al*. 2005, Chace & Walsh 2006, Lopes & Anjos 2006). Many birds seek urban parks not only for shelter but also for food and nesting places (Scherer *et al*. 2005, Valadão *et al*. 2006a,b). Some authors consider that parks and public green spaces, which are traditionally part of the urban vegetation, provide healthy habitats for birds. However, they emphasize that these environments do not meet the natural conditions to furnish shelter for birds under extreme weather conditions (Sander & Voss 1982, Gilbert 1989, Argel-de-Oliveira 1995, Efe *et al.* 2001).

The knowledge and evaluation of the population of *F. nengeta,* whose occurrence and geographic expansion in the region have been registered over the years in an urban park, is paramount to acquire information on the settlement and status of this species. Thus, the objective of this study was to analyze the population abundance of *F. nengeta* in an urban park between 2008/2009 and 2014/2015 periods and test the hypothesis that this is a species tolerant to anthropogenic stress, whose abundance in the study area has increased over the years.

MATERIAL ANDMETHODS

Study area

The study took place in the Sabiá Municipal Park (48°14'02" O, 18°54'52" S), located in the eastern sector of the city of Uberlândia, Minas Gerais state, Brazil. The park has an area of 185 ha, 35ha of which are remnants of native vegetation (Guilherme *et al.* 1998). It is provided with a hydrographic watershed consisting of three springs, which supply seven dams that form a large lake. Also, it has an artificial beach open to the public (PMU). The climate is Aw (Köppen 1931) with a marked seasonality, *i.e.*, dry winter (April-September) and rainy (October-March) summer, with average temperatures ranging from 19ºC to 27ºC and average rainfall of 1500 mm/year (Silva & Ribeiro 2004).

Sampling points

We conducted the observations and data collection in ten points throughout the park, which were georeferenced using GPS and located at least 300 meters apart from each other. The points were determined based on the occurrence of records of *F. nengeta* and are associated with aquatic environments, where individuals are more likely to be found, due to their nesting habits, foraging, and protection techniques (Sick 2001, Silva–Junior & Melo 2009). These points are numbered from 1 to 10.

Characterization of the environmental quality of the sampling points

Each point was characterized based on eight macroscopic parameters, which scored and reflected the level of degradation (Table 1). Each parameter was scored from 1 (best) to 3 (worst), which together indicates the degree of distress and degradation of each point. Thus, the higher the score, the worse the environmental quality of a point (adapted from Rodrigues & Castro 2008).The surrounding vegetation was classified according with the predominance of grass, herbaceous or shrubby in the site that influence directly in the foraging behavior of *F. nengeta*.

Data collection

To estimate species abundance, we utilized the sample point counting method (Simons *et al*. 2007). This method consists of recording the frequency of individuals seen at each of the points for a given time interval (Ralph *et al.* 1993, Anjos *et al.* 2011). It provides only a population estimate (abundance), which is expressed in the form of an index (Index of Point Abundance - IPA) (Bibby *et al.* 1993, Anjos 2007).

The sampling collections occurred in two periods: February 2008 to January 2009 and February 2014 to January 2015. Visits to the points happened every two weeks, in the morning, between 06:30h and 09:30h.

Table 1. Parameters considered for determining the environmental quality of each of the ten points sampled in the Sabiá Municipal Park, Minas Gerais state, Brazil.

Parameters/Punctuation	1	2	3
Color of water	transparent	Clear	dark
Water odor	absent	weak	strong
Surrounding waste area	absent	small	large
Materials floating on water	absent	little	too much
Foam floating on water	absent	little	too much
Oil floating on water	absent	little	too much
Sewer	absent	little	too much
Surrounding vegetation	grass	herbaceous	shrubby

The observation time for each point was approximately 5 minutes and visits to the points did not necessarily occur in the same order. Each day the investigation initiated at a point chosen at random, enabling the inspection of the sampling units at different times. At each point, we recorded the individuals visually with the help of binoculars (Nikon® 10x40) and sonically.

Data Analyses

The monthly IPA was calculated for each period analyzed using the formula IPA = N1/N2 where N_1 is the number of contacts of the species and N_2 is the total number of samples (points X visits). The Frequency of Occurrence (FO) per point for each analyzed period was calculated from the relationship between the number of the species records at each point and the total number of visits. We conducted the paired *t*-test to investigate whether there was a difference in the monthly IPA and FO by point between the analyzed periods. We accomplished the Pearson's correlation coefficient (r) to analyze the relationship between FO per point in each period, as well as the environmental quality of the point. We also conducted *t*-tests to verify whether there was a difference in the monthly IPA between the dry and rainy season in each of the periods analyzed. Furthermore, we conducted a paired *t*-test to ascertain whether the environmental quality of the points varied between periods.

All analyses were performed on the Systat 10.2 statistical program and conducted at 5% significance level. We tested the data for normality using graphic methods and the Lilliefors test (Zar 1999).

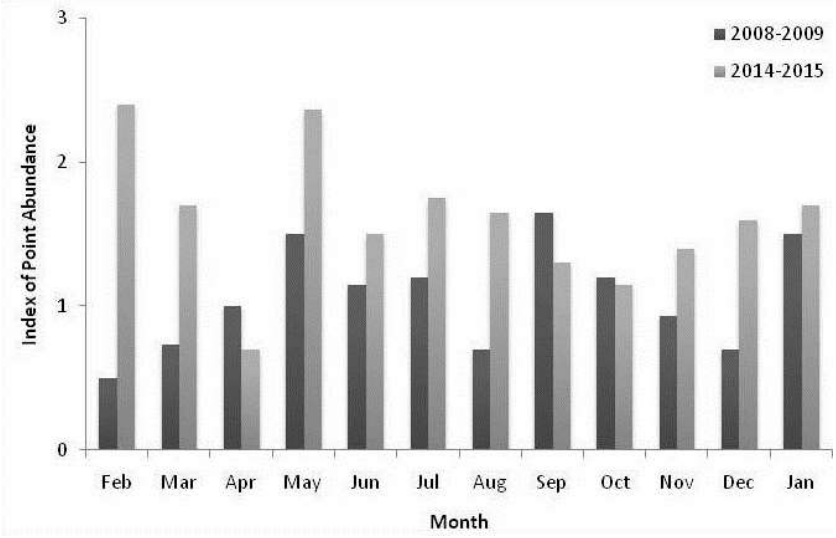

Figure 1. Monthly Index of Point Abundance (IPA) for *Fluvicola nengeta* in each period analyzed in the Sabiá Municipal Park, Minas Gerais state, Brazil.

RESULTS

There were 230 records of *F. nengeta* for the period 2008/2009 (23 samplings) and 403 for the period 2014/2015 (25 samplings). The monthly IPA diverged between the years 2008/2009 and 2014/2015 (t = -2428, N = 12, p = 0.025), and its highest average occurred in the period of 2014/2015 (Figure 1). The FO of each point between the two sampling periods did not differ significantly (t = -1.679, N = 10, p = 0.111).

According to the characterization of environmental quality, sampling point 6 showed the worst quality in both periods analyzed; point 5 the best quality in 2008/2009; and point 7 the best quality in the 2014/2015 period (Table 2). The environmental quality of the points did not differ between the periods (t = 0.896, N = 10, p = 0.394). Although the highest FO per point occurred in the worst environmental quality point in both periods analyzed, there was no correlation between the FO per point and the environmental quality of each point in any of the periods analyzed (2008/2009: r = 0.361, df = 10, p = 0.306; 2014/2015: r = 0.305, df = 10, p = 0.767).

There was no difference in the monthly IPA of *F. nengeta* between the dry and rainy season in the periods analyzed (2008/2009: t = -1.333, N = 10, p = 0.212; 2014/2015: t = 0.416, N = 10; p = 0.686).

DISCUSSION

There was an increase in the abundance of *F. nengeta* in the Sabiá Park between the periods investigated. The highest monthly IPA occurred in the most recent period analyzed suggesting that this population grew in the park. There is no record of *F. nengeta* in Cerrado biome before 1995 (Silva & Santos 2005), and nowadays it is widely spread, especially in the southeast region of this biome (WikiAves 2008). In a bird survey in the study area during 2000, *F. nengeta* was considered an occasional record (Franchin & Marçal-Junior 2004). Less than a decade later, there are several individuals distributed throughout the park.

The geographic expansion of species, such as *F. nengeta*, is usually a consequence of changes in the natural environment (Alvarenga 1990, Willis 1991, Sick 2001, Straube *et al.* 2007). Moreover, it dwells in various kinds of habitats, including both anthropized and natural areas (Gabriel & Pizo 2005). Such features facilitate its geographic expansion and increase its abundance in unnatural habitats (Alvarenga 1990, Willis 1991, Pacheco & Simon 1995, Straube *et al*. 2007).

This expansion and increase in abundance can be enhanced by *F. nengeta* foraging techniques, since it is insectivorous and feeds almost exclusively on the ground, attacking the prey that are not far from the soil surface (Carlos*et al.* 2000, Gabriel & Pizo 2005, Silva-Junior & Melo 2009). Also, its nesting site preferences allow the species to occupy the most varied habitats available in its area of occurrence (Carlos *et al.* 2000).

Several studies revealed that urban bird communities usually comprise generalist species that benefit from the low structural complexity of the urban vegetation (Franchin *et al*. 2004, Lira-Filho & Medeiros 2006, Valadão *et al*. 2006, Donatelli *et al*. 2007, Torga *et al*. 2007) and that, being less demanding for food and natural resources, these species can thrive in a wide variety of environmental conditions (Höfling & Camargo 1999).

In both periods of analysis, the same point that was regarded as having the worst environmental quality also presented the highest FO. Despite this fact, there was no correlation between the FO of *F. nengeta* and the environmental quality of the point.

Table 2. Characterization of the environmental quality of each sampled point in both periods and Frequency of Occurrence (FO) of *Fluvicola nengeta*. The higher value of the characterization of a point, the worse its environmental quality.

Period/Point		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2008/2009	Quality	14	13	13	13	11	19	12	12	13	12
	FO	0.43	0.30	0.04	0.60	1.95	2.39	0.30	1.47	1.30	1.39
2014/2015	Quality	15	12	13	12	12	17	11	13	12	12
	FO	0.08	2.28	1.32	1.08	1.36	2.64	1.28	2.12	1.80	1.96

Diversely, the findings of Silva-Junior & Melo (2006), who evaluated water bodies of low quality within the Sabiá Park, suggested that this species can serve as a successful bioindicator of the poor environmental quality of aquatic environments. It is likely that the parameters used to classify the environmental quality of the points in this study were not sufficient or relatively significant to determine a substantial correlation between these variables. There are records of the occurrence of *F. nengeta* in places with a high anthropic impact, such as roadsides and nearby residential areas, and in places with frequent events of fire, which shows that the species may inhabit disturbed places (Benites *et al.* 2013).

The monthly IPA of *F. nengeta* did not reveal any difference between the dry and rainy seasons in either sampled periods. In resource-poor times, such as the dry season, climate changes have a greater impact on species in natural areas, intensifying competition for resources, a situation that may not occur in urban areas (Jokimäki & Suhonen 1993, 1998). In this view point, cities are a strong attraction to the species in times of adversity, as the resources made available by human activity are plentiful and constant, regardless of the season (Jokimäki & Suhonen 1993, 1998, Chace & Walsh 2006).

Increased urbanization shows a process of reduction in the wealth of birds due to the modification of natural habitats, which may impair the availability of necessary resources for several species (Lopes & Anjos 2006). Thus, some species can reach extinction and other scan, in the midst of this change, find ways and resources to settle in that environment, as it apparently has occurred with *F. nengeta* in the study area.

ACKNOWLEDGEMENTS

We would like to thank the Federal University of Uberlândia and the direction of the Sabiá Park for their support in the development of this work and also to the reviewers for the criticisms and suggestions that only magnified the final version of this article

REFERENCES

Alvarenga, H. M. F. 1990. Novos registros de expansões geográ-ficas de aves no leste do estado de São Paulo. Revista Brasileira de Ornitologia, 1(1), 115-117.

Anjos, L. 2007. A eficiência do método de amostragem por pontos de escuta na avaliação da riqueza de aves. Revista Brasileira de Ornitologia, 1(2), 239-243.

Anjos, L., Collins, C. D., Holt, R. D., Volpato, G. H., Mendonça, L. B., Lopes, E. V., Boçon, R., Bisheimer, M. V., Serafini, P. P. E., Carvalho, J. 2011. Bird species abundance-occupancy patterns and sensitivity to forest fragmentation: implications for conservation in the Brazilian Atlantic forest. Biological Conservation, 144(1), 2213-2222.

Argel-de-Oliveira, M. M. 1995. Aves e vegetação em um bairro residencial da cidade de São Paulo (São Paulo, Brasil). Revista Brasileira de Zoologia, 12(1), 81-92.

Benites, M., Mamede, S., & Batista, F. 2013. *Fluvicola nengeta* (Linnaeus, 1766): novo registro para a avifauna do Parque Nacional das Emas, Brasil. Ornithologia, 5(2), 115-117.

Bibby, C J., Burgess, N. D., & Hill, D. A. 1993. Bird census techniques. London Academic Press: p.257.

Carlos, C. J., Casteleti, C. H. M., & Souza, M. A. 2000. Seleção de habitat por *Fluvicola nengeta* (Aves: Passeriformes) no campus da Universidade Federal de Pernambuco - UFPE. Biota, 1(1), 01-04.

Chace, J. F., & Walsh, J. J. 2006. Urban effects on native avifauna: a review. Landscape Urban Plan, 74(1), 46-69.

Donatelli, R. J., Ferreira, C. D., Dalbeto, A. C., Posso, S. R. 2007. Análise comparativa da assembleia de aves em dois remanescentes florestais no interior do estado de São Paulo. Revista Brasileira de Zoologia, 24(2), 362-375.

Dornas, T., & Pinheiro, R. T. 2011. Aves coligidas por José Hidasi e Manoel Santa-Brígida na Amazônia Tocantinense: implicações para a distribuição geográfica das aves amazônicas brasileiras. Revista Brasileira de Ornitologia, 19(2), 276-301.

Efe, M. A., Mohr, L. V., & Bugoni, L. 2001. Guia ilustrado das aves dos parques de Porto Alegre. Porto Alegre: PROAVES/ SMAM /COPESUL/ CEMAVE: p. 144.

Fontana, C. S. 2005. A ornitofauna em Porto Alegre no século XX: status de ocorrência e conservação. Comunicações do Museu de Ciências – PUCRS Série Zoologia, 18(2), 73-212.

Franchin, A. G., & Marçal-Júnior, O. 2004. A riqueza da avifauna no Parque Municipal do Sabiá, zona urbana de Uberlândia (MG). Biotemas, 17(1), 179-202.

Franchin A. G., Oliveira, G. M., Melo, C., Tomé, C. E. R., Marçal-Júnior, O. 2004. Avifauna do Campus Umuarama, Universidade Federal de Uberlândia (Uberlândia, MG). Revista Brasileira de Zoociências, 6(2), 219-230.

Gabriel, V. A., & Pizo, M. A. 2005. Foraging behavior of tyrant flycatchers (Aves, Tyrannidae) in Brazil. Revista Brasilei-ra de Zoologia, 22(4), 1072-1077.

Gilbert, O. L. 1989. The ecology of urban habitats. London: Chapman and Hall: p. 369.

Guilherme, E. A. G., Nakajima, J. N., Lima, C. A. P., Vanini, A. 1998. Fitofisionomias e a flora lenhosa nativa do Parque do Sabiá, Uberlândia, MG. Daphne, 8(2), 7-30.

Höfling, E., & Camargo, H. E. A. 1999. Aves no campus da cidade universitária Armando de Salles Oliveira. São Paulo: Editora EDUSP: p. 168.

Jokimäki, J., & Suhonen, J. 1993. Effects of urbanization on the breeding bird species richness in Finland: a biogeographical

comparison. Ornis Fennica, 70(1), 71-77.

Jokimäki, J., & Suhonen, J. 1998. Distribution and habitat selection of wintering birds in urban environments. Landscape and Urban Planning, 39(1), 253-263.

Klavins, J., & Bodrati, A. 2007. La viudita enmascarada (*Fluvicola nengeta*): nueva especie para Paraguay y segundo registro en Argentina. El Hornero, 22(1), 43-45.

Köppen,W. 1931. Climatologia. México. Fundo de Cultura Econômica.

Lira-Filho, J. A., & Medeiros, M. A. S. 2006. Impactos adversos na avifauna causados pelas atividades de arborização urbana. Revista de Biologia e Ciências da Terra, 6(2), 1519-1528.

Lopes E. V., & Anjos L. 2006. A composição da avifauna do campus da Universidade Estadual de Londrina, norte do Paraná, Brasil. Revista Brasileira de Zoologia, 23(1), 145-156.

Pacheco, S., & Simon, J. E. 1995. Variações no padrão de nidificação de *Fluvicola nengeta* Linnaeus, 1766 (Aves, Tyrannidae). Revista Brasileira de Biologia, 55(4), 609-615.

Pivello, V. R. 2011. Invasões biológicas no cerrado brasileiro: Efeito da introdução de espécies exóticas sobre a biodiversidade. Ecologia Info, 33. Retrieved March 30, 2016, from www.ecologia.info/ cerrado.htm

Quintas-Filho, S. S., Batista, R. C., Carpi, T. F., Sousa, R. A., Costa, M. S. G., Paiva, F. J. F., De-Carvalho, C. B. 2011. Aves, Tyrannidae, *Fluvicola nengeta* (Linnaeus, 1766): new record for Distrito Federal and distribution extension. Check List, 7(1), 310-312.

Ralph, C. J., Geupel, G. R., Pyle, P., Martin, T. E., Desante, D. F. 1993. Handbook of field methods for monitoring landbirds. USDA Nebraska: Forest Service/UNL Faculty Publications: p. 41.

Rodrigues, A. S. L., & Castro, P. T. A. 2008. Adaptation of a rapid assessment protocol for rivers on rocky meadows. *Acta* Limnologica Brasiliensia, 20(4), 291-303.

Sander, M., & Voss, W. A. 1982. Quatro notas sobre aves no Rio Grande do Sul, Brasil. Pesquisas, 33(1), 3-15.

Scherer, A., Scherer, S. B., Bugoni, L., Mohr, L. V., Efe, M. A., Harts, S. M. 2005. Estrutura trófica da avifauna em oito parques da cidade de Porto Alegre, Rio Grande do Sul, Brasil. Ornithologia, 1(1), 25-32.

Sick, H. 2001. Ornitologia Brasileira. Rio de Janeiro: Editora Nova Fronteira: p. 862.

Silva, E. M., & Ribeiro, A. G. 2004. As tendências das variações climáticas na cidade de Uberlândia-MG (1981-2000). Caminhos de Geografia, 9(12), 174-190.

Silva, J. M. C., & Santos, M. P. D. 2005. A importância relativa dos processos biogeográficos na formação da avifauna do Cerrado e de outros biomas brasileiros. In: A. Scariot, J. C. Souza-Silva & J. M. Felfili (Eds.), Cerrado: ecologia, biodiversidade e conservação. pp. 220-233. Brasília: Ministério do Meio Ambiente.

Silva-Júnior, E. L., & Melo, C. 2006. *Fluvicola nengeta* como bioindicador de qualidade negativa do entorno de ambientes aquáticos. In: XIV Congresso Brasileiro de Ornitologia. Ouro Preto, MG.

Silva-Júnior, E. L., & Melo, C. 2009. Cuidados parentales y la alimentación de la viudita enmascarada (*Fluvicola nengeta*). Ornitologia Neotropical, 20(1), 339-346.

Simons, T. R., Alldredge, M. W., Pollock, K. H., Wettroth, J. M. 2007. Experimental analysis of the auditory detection process on avian point counts. The Auk, 124(1), 986-999.

Straube, F. C., Urben-Filho, A., Deconto, L. R., Patrial, E. W. 2007. *Fluvicola nengeta* (Linnaeus, 1766) nos estados do Paraná e Mato Grosso do Sul e sua expansão de distribuição geográfica pelo sul do Brasil. Atualidades Ornitológicas, 137(1), 33-38.

Torga, K., Franchin, A. G., & Marçal-Júnior, O. 2007. A avifauna em uma seção da área urbana de Uberlândia, MG. Biotemas, 20(1), 7-17.

Valadão, R. M., Franchin, A. G. & Marçal-Júnior, O. 2006a. A avifauna no Parque Municipal Victório Siquierolli, zona urbana de Uberlândia (MG). Biotemas, 19(1), 77-87.

Valadão, R. M., Franchin, A. G., Marçal-Júnior, O. 2006b. A avifauna no Parque Municipal Santa Luzia, zona urbana de Uberlândia, Minas Gerais. Bioscience Journal, 22(2), 97-108.

WikiAves – WikiAves, a enciclopédia das aves do Brasil. 2008. Mapa de registros da espécie lavadeira-mascarada (*Fluvicola nengeta*). Retrieved September 28, 2017, from http://www.wikiaves.com.br/mapaRegistros_lavadeira-mascarada

Willis, E. O. 1991. Expansão geográfica de *Netta erythrophthalma*, *Fluvicola nengeta* e outras aves de zonas abertas com a "desertificação" antrópica em São Paulo. Ararajuba, 2(1), 101-102.

Zar, J. H. 1999. Biostatistical analysis. New Jersey: Prentice-Hall: p. 663.

Submitted: 30 May 2017
Accepted: 03 October 2017
Associate Editor: Hugo Bornatowski