ORNITOLOGIA NEOTROPICAL 21: 507–518, 2010

EUROPEAN STARLING (*STURNUS VULGARIS*): POPULATION DENSITY AND INTERACTIONS WITH NATIVE SPECIES IN BUENOS AIRES URBAN PARKS

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Resumen. – El Estornino Pinto (*Sturnus vulgaris*): estimación de la densidad poblacional e interacciones con especies nativas en parques urbanos de Buenos Aires. – El Estornino Pinto (*Sturnus vulgaris*) fue introducido en Argentina hacia 1987. Los estorninos anidan en cavidades, pero no las construyen, constituyendo una potencial amenaza para otras especies que también las utilizan. Estimamos la densidad de estorninos en los parques de la ciudad de Buenos Aires y examinamos la relación entre características del hábitat con la presencia y densidad de estorninos del parque. También evaluamos las interacciones entre los estorninos y las especies nativas durante la alimentación y en sitios de nidificación. Observamos los nidos de Hornero (*Furnarius rufus*) debido a que los estorninos suelen utilizarlos. Se realizaron 293 transectas distribuidas en 20,8 km^2 correspondientes a 103 parques en los cuales registramos 447 estorninos. La estimación de la densidad poblacional de estorninos en los parques (individuos/ha ± SD) fue 2,21 ± 0,09. La presencia de estorninos del parque estuvo positivamente asociada al área del parque y al número de palmeras y negativamente asociada al número de árboles. También encontramos una asociación positiva significativa entre la densidad de estorninos del parque con el número de tipas. La riqueza de aves del parque no se asoció ni a la presencia ni a la densidad de estorninos del parque. En el 60,3% de las 58 observaciones (464 minutos) los estorninos se alimentaron en bandadas heteroespecíficas, pero sólo se registraron 5 interacciones interespecíficas (siendo los estorninos los perdedores). Veintiún nidos de estorninos fueron construidos en cavidades naturales y nueve en cavidades hechas por carpinteros (*Colaptes* spp.). Ninguno de los 26 nidos de Hornero encontrados fue ocupado por estorninos, pero en tres ocasiones registramos la interrupción de intentos de nidificación del Carpintero Real (*Colaptes melanolaimus*) debido a interacciones agresivas o a la presencia de estorninos cercana a los nidos. Estos resultados pueden ser relevantes en relación a la necesidad de acciones contra los estorninos en Argentina.

Abstract. – The European Starling (*Sturnus vulgaris*) was introduced in Argentina by 1987. Starlings are secondary cavity nesters and may constitute a threat to other cavity nesters. We estimated the density of starlings in Buenos Aires city urban parks and examined the relationships between some habitat characteristics and the presence and abundance of starlings. We also evaluated the interactions between starlings and native species, by observations during foraging and nesting. Because starlings may use Rufous Hornero (*Furnarius rufus*) dome-shaped nests, we also located and observed them. Starlings were recorded in 293 transects distributed in 20.8 km^2 corresponding to 103 Buenos Aires public-access parks, in which 447 individuals were recorded. We found that the relative population density for starlings in parks of Buenos Aires (individuals/ha ± SD) was 2.21 ± 0.09. Starling presence was positively associated with the park area and number of palms and negatively with the number of trees. A positive significant association between starling density and number of tipu trees was also found. Neither the presence nor the abundance of starlings was associated with the park's avian species richness. Although starlings were found to feed in heterospecific flocks in 60.3% of the 58 observations (totally 464 min), only five interspecific interactions were recorded (the starling being always the losing species). Twenty-one starling nests were built in natural cavities and nine in cavities made by woodpeckers (*Colaptes* spp.). None of the 26 Rufous Hornero nests found was occupied by starlings. However, the nestling cycle of the Golden-breasted Woodpecker (*Colaptes melanolaimus*) was recorded to be interrupted in three occasions due either to aggressive interactions or to the presence of starlings near the nests. These findings can be relevant in relation with the need of any action against starlings in Argentina. *Accepted 21 September 2010.*

Key words: European starling, *Sturnus vulgaris*, Argentina, density estimate, invasive species, urban parks.

INTRODUCTION

The European Starling *Sturnus vulgaris* is a species native to Eurasia and the northern-most part of North Africa, which has been introduced and spread successfully in many countries including the United States, New Zealand, Australia, South Africa, and some Pacific and Caribbean islands (Feare 1984, Blackburn *et al.* 2009), and is considered one of the most damaging invasive avian species worldwide (Lowe *et al.* 2000).

Interactions between native and non-indigenous species have been identified as one of the leading causes of endangerment and extinction of native species (Czech & Krausman 1997, Wilcove *et al.* 1998). Competition in particular is increasingly recognized as a major means through which non-indigenous species impact and displace native species (Byers 2002). In the United States, European Starlings (hereafter starlings) compete with some native birds for food (Wood 1924) but a major problem associated with starlings in this country, and also in Australia, is competition with native species for nesting sites (Wood 1924, Howell 1943, Weitzel 1988, Kerpez & Smith 1990, Ingold 1996, 1998, Pell & Tidemann 1997, Wiebe 2003). Starlings use holes for nesting but are not primary excavators and therefore may constitute a threat to other cavity nesters (Pell & Tidemann 1997, Wiebe 2003). However, not all studies support the hypothesis that starlings have severe impacts on populations of native birds (Brush 1983, Peterson & Gauthier 1985, Koenig 2003). Koenig (2003) found that only one of 27 native cavity-nesting species of the United States exhibited a decline attributable to starling interference. This could be due to the aggression of some native species in defending their nest cavities or their ability to nest successfully later in the season when competition with starlings declines (Koenig 2003).

In Argentina, starlings were first recorded in 1987 (Pérez 1988) and observed breeding in a wooded area of Palermo district (Buenos Aires) the following summer (Schmidtutz & Aguilán 1988). Since then, they were recorded on different occasions around Buenos Aires (Peris *et al.* 2005), feeding or carrying food to their nests, predominantly in urban areas (Di Giácomo *et al.* 1993, Jensen 2008). They were also recorded using Rufous Hornero (*Furnarius rufus*) nests, which are dome-shaped nests made of mud (Aves Argentinas 1999, Narosky & Carman 2008, Rizzo en prensa). The number of starlings in Argentina have increased steadily, which is reflected in the variation of flock size, from flocks of only 3–11 individuals after their introduction to flocks of 950 birds in 2003 (Peris *et al.* 2005). Although the population was initially established in urban environments, they are now spreading into sub-urban and rural environments (Peris *et al.* 2005, Jensen 2008). Nevertheless, until now no standard methodologies have been used to estimate starling abundance.

The aims of this work were: 1) to estimate the relative density of starlings in Buenos Aires city, the urban area where starlings were first recorded in Argentina, 2) to examine the relationships between some urban park characteristics and starling presence and density in order to detect the effect of such characteristics on starling abundance, and 3) to identify native species that could be potentially affected by starling presence due to competition for food and/or nesting sites.

METHODS

Population density estimate. The population density of starlings was estimated from November 2007 to February 2008. All the public-access parks larger than 1 ha (n = 103) were selected with the help of city maps and the programs Google Earth (version 4.2), MapSource (version 6.13.6), and Mapear 4 used to locate the parks and to estimate their area.

To estimate starling density, the line transect with the two-belt method was used (Järvinen & Väisänen 1975, Bibby & Burgess 1993, Virkkala 2004). Birds were recorded separately in a 50 m wide main belt and in a supplementary belt outside this. The supplementary belt consisted of all birds observed outside the main belt without any distance limit. The main and supplementary belts together comprised the survey belt (Järvinen & Väisänen 1975). The number of birds detected decreases with the distance from the observer (Bibby & Burgess 1993) and this is expressed in a decrease in the probability to detect a bird when the distance increases. Then, the probability of detection (P) of a bird at x meters is:

$$P(x) = 1–k(x),$$

where k is a species-specific constant that acts as a correction coefficient of the probability of detection.

The proportion of individuals within the main belt (p) can be calculated as:

$$p = N_i/N,$$

where N_i is the number of individuals inside the main belt and N the number of total birds in the survey belt.

p is also expressed as:

$$p = kw(2–kw),$$

where w is the distance in meters from the observer and the main belt limit. Hence,

$$k = (1 - \sqrt{1 - p})/w$$

and the density (D) is described as:

$$D = 1000Nk/L,$$

where L is the transect length in kilometers.

The standard deviation (SD) of the density estimate was calculated as:

$$SD = \sqrt{D/R}$$

where D is the relative density and R the number of transects included in the subsets that were used to calculate the estimate (Järvinen & Väisänen 1983).

It is important to point out that the transect method allowed us to count mostly starlings foraging in the open in Buenos Aires parks, in contrast with other methods that rely on counting the breeding individuals/pairs.

The smallest park (1 ha) contained only one transect, whereas the largest park (80 ha) contained 22 transects, with a total of 293 transects across all parks studied. Each transect was 100 m in length and was walked in 5 min. The transects were spaced by 100 m to avoid counting the same birds twice and their orientation was SE-NW, in line with the orientation of the Rio de la Plata river shore. Flying birds were not used in our analysis. The line transect censuses were carried out between 07:00 and 12:00 h and were not performed on rainy days (Bibby & Burgess 1993).

Park characteristics and analysis. Within each transect main belt several variables were also recorded: 1) trees: the number of trees higher than 5 m, 2) Tipu tree: the number of *Tipuana tipu* trees, as preliminary observations suggested that starlings are associated with this tree, 3) Palms: the number of palms (*Trachycarpus fortunei*, *Trithrinax campestris*, *Chamaerops humilis*, *Livistona chinensis*, *Washingtonia* sp., *Syagrus romanzoffiana*, *Archontophoenix cunninghamiana*, *Butia* sp., and *Phoenix* sp.), as, in Buenos Aires, starlings use palms for nesting and eat their fruits (Pérez 1988, Aves Argentinas 1999), and 4) avian species: the number of other avian species, to check if starlings may have an impact on other avian species, as the presence or high density of starlings could be associated with a lower number of native avian species. All these variables were found to be non-correlating variables. The starling density was estimated as an average of the density estimates of all transects performed.

The data analysis was performed at two levels. First, a logistic regression on the variables was conducted to analyze the relationship between the park's starling presence (if at least one starling was recorded in a transect = 1, no starlings recorded = 0) and the habitat characteristics, the avian diversity, and the park surface area. The number of trees, tipu trees, palms, avian species, and the park area were continuous predictor variables and the starling presence (0/1) was the response variable. Second, we analyzed if the same predictor variables were associated with the park's starling density. For this analysis, only the parks with presence of starlings were used and a multiple linear regression with a forward stepwise procedure was performed. The starling density variable was normalized by the logarithmic transformation. Statistical tests were performed using STATISTICA 6.0 and PASW Statistics 18. All statistics were two tailed.

Starling behavior and aggressive interspecific interactions. Following the information obtained during the population density estimate in 2007–2008, a 40 ha wooded area in Palermo district (34°33'S, 58°26'W) of Buenos Aires city, in which densities of both starlings and other species were high, was selected.

During the breeding season of 2008 (September–December), the study area was visited twice a week and observations of starlings foraging and at nest sites were performed. Starlings usually forage in groups (Feare 1984, Feare & Craig 1999). Therefore, the number of individuals of the flock was recorded and one individual for focal observations was randomly selected. A total of 58 focal observations, which lasted from 1 to 20 minutes, and reached a total of 464 minutes, were performed. When starlings were in heterospecific flocks, the other species were recorded. The intra- and interspecific aggressive interactions were recorded and in the latter case the winning and the losing species were determined (Pell & Tidemann 1997). These interactions were of the supplanting type, in which the aggressor (the winning individual) approaches the other bird which concedes its position (losing individual) (Pell & Tidemann 1997).

We found starling nests by focusing on individual activity and then by visually following birds to tree cavities. In each nest visit, the behavior of starlings was recorded and a stage in the nesting cycle was assigned (construction: if they entered carrying material, incubation: if they entered the cavity without material/food and stayed inside for more than three minutes, chicks: if they arrived with food). During the observation, interspecific interactions or other signals of competition, such as the presence of other species near the nest, were recorded. Also, Rufous Hornero nests were located to evaluate if starlings use and/or compete for them.

For each nest, we recorded: 1) the tree species, 2) the height of the tree, 3) the type of cavity: natural or built by another species, 4) the cavity entrance height, and 5) the distance to the nearest starling nest.

RESULTS

Population density estimate in Buenos Aires city parks. Starlings were recorded in 293 transects distributed in 20.8 km^2 corresponding to 103 parks in Buenos Aires city (Fig. 1). A total of 447 individuals, with 59.3% in the main belt, were recorded . Mean population density for the European Starling in all parks of Buenos Aires (individuals/ha ± SD) was 2.21 ± 0.09. The starling density varied between 0 and 34.56 individuals/ha. The estimated total number of starlings in all Buenos Aires parks was calculated as c. 4600 individuals.

The starling presence in a park was positively associated with the park area and number of palms and negatively associated with the number of trees (logistic regression model, P = 0.001; Tables 1, 2). The multiple linear regression showed a positive significant association between starling density and the number of tipu trees (multiple regression model, standard error of estimate = 0.51, r^2= 0.18, $F_{5,21}$ = 5.85, P = 0.025, n = 23 parks, number of tipu tree: β = 0.46, t_{21} = 2.42, P = 0.025, constant: t_{21}= 16.73, P < 0.001).

In all the transects, 41 avian species were recorded, but no correlation between the number of avian species and the presence (Table 1 and 2) or density of starlings (multiple regression model, number of avian species: β = –0.20, t_{21} = –0.92, P = 0.37, n = 23 parks) was found. We calculated the occurrence of each species as the number of parks where the species was recorded in relation to the total number of parks (103). The occurrence of starlings was 23.3% and they occupied the eighth place of the most frequently recorded species.

Starling behavior and aggressive interspecific interactions. Starlings fed in heterospecific flocks of 2 to 45 birds in 60.3% of the 58 observations and alone or in flocks of 2 to 12 starlings in 39.7% of the observations. In the mixed flocks, starlings shared the feeding sites with nine native species and one exotic species (Rock Dove *Columbia livia*). Chalk-browed Mockingbird (*Mimus saturninus*), Creamy-bellied Thrush (*Turdus amaurochalinus*), Golden-breasted Woodpecker (*Colaptes melanolaimus*), Monk Parakeet (*Myiopsitta monachus*), Picazuro Pigeon (*Columba picazuro*), and Rock Dove shared the feeding sites with starlings in less than 10% of the 35 mixed flocks observed. Rufous Hornero, Eared Dove (*Zenaida auriculata*), Rufous-bellied Thrush (*Turdus rufiventris*), and Shiny Cowbird (*Molothrus bonariensis*) shared the feeding sites with starlings between 11 and 40% of the mixed flocks observed.

We also found that 70% of a total of 30 starling nests (density = 0.75 nest/ha) were built in natural cavities and that 30% were built in cavities made by woodpeckers (*Colaptes* spp.). Starlings started their breeding at the end of September; the nestlings hatched at the end of October and in the middle of December the nesting cycle had ended. None of the 26 Rufous Hornero nests checked was occupied by starlings and no interactions between these two species were recorded near nests. We recorded 24 intraspecific interactions and 5 interspecific interactions including two with Chalk-browed Mockingbird, two with Rufous Hornero, and one with Shiny Cowbird. In all cases, starlings were the losing species.

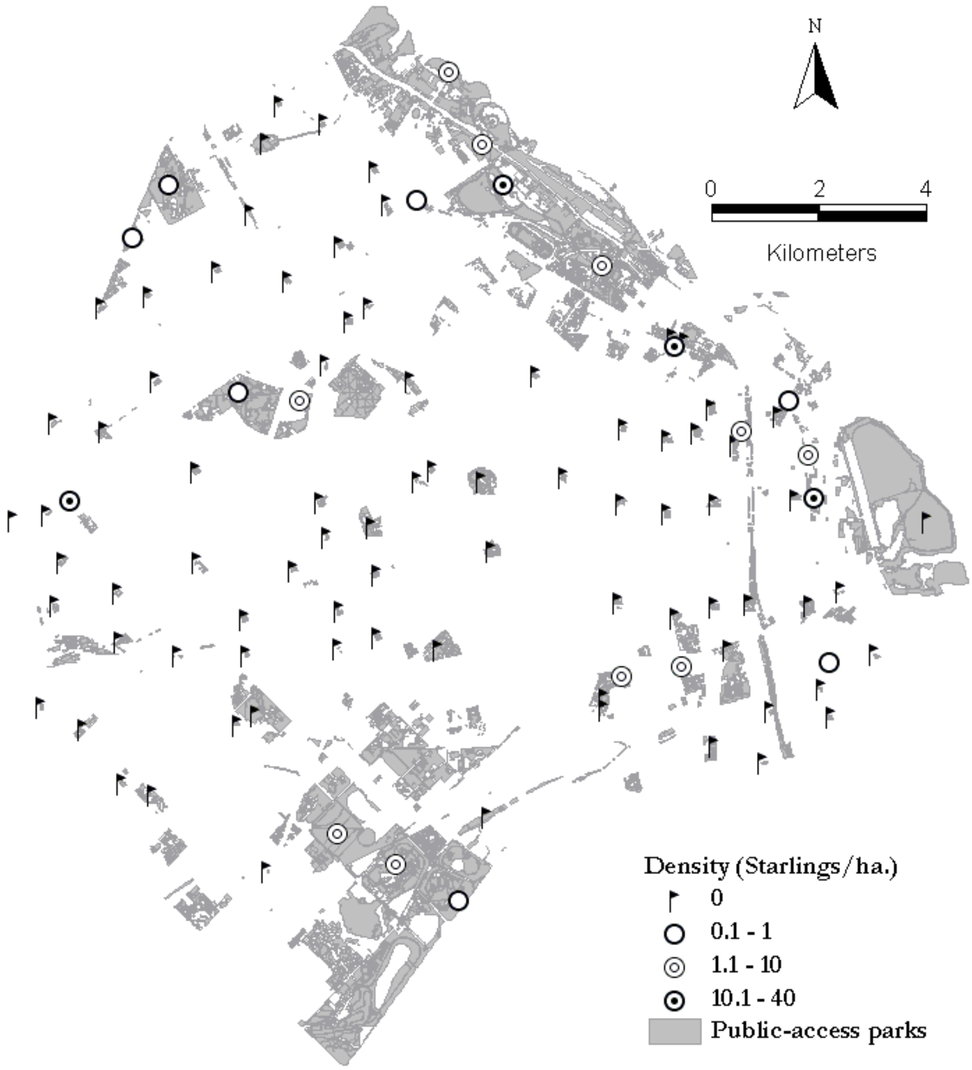

FIG. 1: Estimation of European Starling (*Sturnus vulgaris*) density in 103 public-access parks of Buenos Aires city.

The cavity entrance height varied between 3 and 15 m (mean ± SE: 10.04 ± 3.39 m, n = 30). The tree species with nests found were: London plane (*Platanus acerifolia*) 38%, tipu tree (*Tipuana tipu*) 31%, and other species like palms (*Phoenix* sp.), pine (*Pinus* sp.), and bead tree (*Melia azedarach*) 31%. The tree height where the nest was located varied between 8 and 25 m (mean ± SE: 15.58 ± 4.92, n = 26, because in 4 cases there were two active starling nests in the same tree). The distance to the nearest nest varied between 0 and 285 m (mean ± SE: 49.56 ± 75.07, n = 30).

On three occasions, we recorded the interruption of the nestling cycle of the Golden-breasted Woodpecker due to aggres-

TABLE 1. Regression statistics for the logistic regression analysis performed between European Starling presence and surface area, habitat characteristics, and avian richness in urban parks of Buenos Aires, Argentina (Logistic regression model, log-likelihood = –43.32, χ^2_5 = 22.76, P < 0.001, n = 103 parks)

Variable	β	χ^2	*P*
Park area (km^2)	1.42	7.17	0.01
Number of trees	-0.07	8.08	0.01
Number of tipu trees	0.08	2.99	0.08
Number of palms	0.39	5.24	0.02
Avian species richness	0.17	1.22	0.27
Constant	-1.18	2.22	0.14

sive interactions or to the presence of starlings near their nests. In the first occasion, a pair of woodpeckers defending a cavity was seen to be attacked by four starlings (probably two pairs). The aggressive interactions lasted more than two hours, and when we returned to the nest a week later it was occupied by starlings. In the second occasion, a cavity first recorded as used by woodpeckers was occupied two weeks later by a pair of starlings. In the third occasion, we recorded that in the same tree there were two cavities used by starlings and one by woodpeckers. Seven days later, the starlings continued to use their cavities, but woodpeckers were no longer nesting in this tree.

DISCUSSION

Our estimate of the European Starling density in Buenos Aires city parks indicates that starlings have been successfully established in the urban area where they were first recorded. This species arrived in Argentina c. 20 years ago and since then the population has been increasing. This relative density estimation, which was performed through a standardized method, will allow comparisons with future starling density estimations and with density estimations of other species. These data may aid future management strategies. Sorace (2001) performed estimations of different avian species in an urban park of Rome, Italy, where starlings are stated as a pest species, and found that starling density was 0.65 individual/ha, a value lower than our estimation of 2.21 individual/ha. On the other hand, Tomialojc (2007) studied the avian density in two urban parks of Legnica, Poland, and found that starling density was 8 individuals/ha in 2004 in a central park (36 ha) and 3.5 individuals/ha in 2007 in another park (20 ha) with younger trees. During 1970–1973, Tomialojc & Profus (1977) found that starling density in two urban parks of Wroclaw city in Poland ranged between 11.64 and 13.34 individuals/ha and that it did not vary much in the last 40 years (L. Tomialojc pers. com.). In Warsaw, the starling density in young parks ranged between 0.6 and 0.8 individuals/ha and in old parks between 2.4 and 3.6 individuals/ha (Nowicki 2001). Therefore, the starling density estimations in Poland, a country included in the natural distribution of starlings, show an extreme variability. In some of the Polish parks the density estimation seems to be similar to or lower than the one obtained in this work in Buenos Aires city parks, whereas in others the density is much higher than in Buenos Aires. Nevertheless, our estimations in some of the parks also reached high values comparable to the ones from Poland. On the other hand, Robinson *et al.* (2005) estimated starling densities in different habitats of Great Britain and found greatest densities in urban (1.79 individuals/ha) and suburban areas (2.20 individuals/ha). Although these estimations are similar to the one found in this work, it would be interesting to perform density estimations in Buenos Aires city, including not only parks but also other places, such as streets and roads, to compare with urban starling densities of other cities. With respect to these comparisons, it is

TABLE 2. Mean ± SE of the predictor variables used in the logistic regression analysis of the European Starling presence (0/1) in urban parks in Buenos Aires, Argentina.

Variable	Starling presence = 0 n = 80 parks	Starling presence = 1 n = 23 parks
Park area (km^2)	0.09 ± 0.04	0.59 ± 0.22
Number of trees	35.57 ± 1.78	27.15 ± 3.21
Number of tipu trees	4.10 ± 0.71	4.56 ± 1.29
Number of palms	1.20 ± 0.17	1.74 ± 0.45
Avian species richness	4.17 ± 0.20	3.99 ± 0.33

important to point out that bird surveys in Europe usually rely on counting the breeding individuals/pairs. In the case of starlings, these are usually the pairs staying in trees and at cavities that are to be counted. In our work, we selected a version of the transect method which counts mostly starlings foraging in open areas of Buenos Aires parks. Individuals foraging in flocks in the park lawns may come from outside of the park. Therefore, the previous comparisons between starling density estimations in different continents rely on different indizes and must be taken with care.

Our results showed that the park area affects the presence of starlings. This relationship could be due to the fact that small parks are more frequently prone to human disturbance (Fernández-Juricic & Jokimaki 2001) and therefore less preferred by starlings. Moreover, small parks are scattered within man-made structures, such as buildings and paved surfaces, preventing starlings from using all potential foraging sites (typically a radius of 500 m around the nest, Feare 1984, Mennechez & Clergeau 2006). Furthermore, it is possible that due to their gregarious habits, starlings need larger parks to accommodate social groups. Our observation of starling presence in larger parks is consistent with the results of Jokimaki (1999), who found that in the city of Oulu, northern Finland, the park area is a significant predictor of the number of bird species and proposed that in the smallest parks the minimum area requirements of the individual bird species could not be fulfilled.

Our findings indicate that the starling presence in Buenos Aires parks was also positively associated with the number of palms. This result may be related to the role that these tree species play during the starling reproductive season. Previous observations have suggested that starlings frequently nest in palm cavities which also provide feeding opportunities to the individuals through their fruits (Pérez 1988). In fact, in our study area starlings also used palms for nesting.

The negative association between starling presence and park's number of trees may be related to the foraging behavior of starlings, as they are essentially grassland feeders, are not territorial on their feeding areas, and, when foraging, prefer open areas which provide them with good all-round visibility (Feare 1984). Therefore, during the breeding season, starlings could prefer parks with suitable cavities for their nests and an open feeding area that provides them with sufficient food. On the other hand, the occurrence of other avian species in the park seems not to be associated with starling presence.

In this study, the number of tipu trees was positively associated with park's starling density. The tipu tree was one of the tree species most used by starlings for nesting. In addition, although no research has been carried out on the diet of starlings in Argentina we hypothesize that the larvae of the homopterous insect *Cephisus seccifolius*, which live in the tree canopy of the tipu tree, could be a food source for starlings. Therefore, starlings may use this tree species both for nesting and feeding.

The London plane was the tree species most frequently used for nesting. Therefore, it would be interesting to analyze if there is an association between this tree and starling density in the remaining Buenos Aires parks.

To date, starlings are established in urban environments but will probably spread into suburban and rural environments (Peris *et al.* 2005, Jensen 2008), where the food availability and/or food quality is expected to be higher than in urban areas (Whitehead *et al.* 1995, Mennechez & Clergeau 2006). Gammon & Maurer (2002) found that in the United States groups of individuals moved out ahead of the rest of the invasion front into isolated habitats. They suggested that dispersing populations seek out favorable habitats and settle there. If they disperse in a similar manner in Argentina, it would be expected that they will shortly be established in rural areas near cities. However, other factors, such as encounters with new ectoparasites, interspecific competition, and predation, may affect starling densities in these new environments (Blackburn *et al.* 2009, MacLeod *et al.* 2009). Rollins *et al.* (2009) who studied the starling invasion in Australia pointed out the importance of using the information that genetic techniques provide to aid management techniques. They found that 60% of the identified dispersers were females and concluded that because females spent more time feeding chicks than males, performing breeding culls at nesting sites may be more effective in reducing levels of dispersal than through flocking culls. For Argentina, this work is the first on the invasion of starlings and its effects. However, ecological and genetic studies would be necessary to adopt effective management strategies.

Our data showed that starlings frequently forage in association with other species, but that they do not have a high number of aggressive interactions with them. Starlings used natural cavities but also built 9 of their 30 nests in cavities made by woodpeckers. On one occasion, a direct interaction between starlings and Golden-breasted Woodpecker was recorded and in two other occasions they displaced woodpeckers from their nests. Such a rate of displacement is likely an underestimation because we normally detected nests once they were occupied by starlings. Therefore, our data suggest that the Golden-breasted Woodpecker would be susceptible to antagonistic interactions with starlings during the reproductive season. On the other hand, we were unable to find starlings using Rufous Hornero nests as well as no interaction was recorded between both species. Rufous Horneros (61 g) are smaller than starlings (75 g) and the entrance width of their nests (3–4 cm, de la Peña 2005) is smaller than that of cavities normally used by starlings (6.6 cm; Kerpez & Smith 1990). Other studies in the United States and Australia found that starlings are capable of evicting other cavity nesters, including larger species, such as Gila Woodpeckers (*Melanerpes uropygialis*) (Kerpez & Smith 1990) and Eastern Rosellas (*Platycerus eximius*) (Pell & Tidemann 1997). Therefore, it is not surprising that starlings compete with the Golden-breasted Woodpecker (104–150 g) and take over their nests. Cavity excavators are limited in the time and energy they can spend on creating new cavities (Strubbe & Matthysen 2007), suffering from competition with other hole nesters, notably with starlings (Ingold 1998, Kotaka & Matsuoka 2002, Smith 2006). Kerpez & Smith (1990) concluded that the competition for cavities between European starlings and the Gila

Woodpecker, a native species in the United States, decreases the number of woodpeckers that nest in areas invaded by starlings. Because Gila woodpeckers do not excavate new cavities in the area once the starlings usurp their cavities and because there are six other native species that use woodpecker cavities, Kerpez & Smith (1990) propose that the presence of starlings in the area could affect the entire cavity nesting guild. In our study area, there are also other species which use cavities but do not excavate them. Therefore, it is possible that competition for cavities is not limited to woodpeckers, but also occurs with other native species, such as nuthatches, swallows, and wrens.

Buenos Aires starling populations may be still too young (too small, not dense enough) to exert any serious influence on native species. From this point of view, at present it may be too early to evaluate the possible negative influences of this alien species. Only after another decade or beyond it may become an important practical problem. Nevertheless, our findings could be relevant in relation with the possible need of action against starlings in Argentina.

ACKNOWLEDGMENTS

We are grateful to Clara Enrique and Eugenia Herwig for their help during the field work, to Juan Carlos Reboreda for his comments on a previous version of the manuscript, and to the two anonymous reviewers and André Weller for their comments which greatly contributed to the improvement of the manuscript. We thank Ludwik Tomialojc for providing information about starling densities in Poland. VDF was supported by a fellowship from the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) and NRI was supported by a Sadosky fellowship from University of Buenos Aires. VDF is a Research Fellow of CONICET.

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