

The rose-ringed parakeet *Psittacula krameri* in a urban park: demographic trend, interspecific relationships and feeding preferences (Rome, central Italy)

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Abstract – During the last decade, rose-ringed parakeet's population of Villa Borghese (an urban park in Rome - Italy) increased dramatically until it reached its maximum in 2010, then stabilising after a slight decrease. From 1999 to 2013 population increased of 70.5% each year, on average. From collected data local population of Piciformes do not seem to be affected. A clear preference for arboreal and shrubby layer of the vegetation was observed when feeding on a variety of non-native species, this confirming the strong relationship of the taxon with anthropic habitats.

Key-words: demographic trend, relationship with other species, trophic niche.

INTRODUCTION

Rose-ringed parakeet *Psittacula krameri*, native of Asia and Africa (Forshaw 2010), was artificially introduced and is now widespread in many more territories (Gillmor 2005, Butler 2003, 2005). In Europe it occurs in many countries including northern ones (Strubbe & Matthysen 2007, 2009a), mostly living in urban areas (Kelcey & Rheinwald 2010). In Italy the species is widespread all over (Bricchetti & Fracasso 2006, Mori *et al.* 2013). In Rome, after first observations (Angelici 1984, 1986), Rose-ringed Parakeet was discovered to breed since 2002 (Fratlicelli & Molajoli 2002). The species is highly adaptable as for food (Dhindsa & Saini 1994, Pithon 1998, Franz & Krause 2003) and it is considered a crops' pest in its native countries (Ali & Ripley 1969, Ramzan & Toor 1972, 1973, Toor & Ramzan 1974, Chakravarthy 2004), as well as in the countries where it was introduced (Lever 1977, Gebhardt 1996, Bendjoudi *et al.* 2005). Rose-ringed Parakeet's occurrence is strictly connected with human density (Hugo & Van Rensburg 2009) and with urban parks (Strubbe & Matthysen 2009b).

Negative impact of the taxon on native species is still controversial. Strubbe & Matthysen (2009c) and Strubbe *et al.* (2010) consider rose-ringed parakeet negatively interfering with hole-nester density in Belgium, especially

with nuthatch *Sitta europaea*. At the same time Weiserbs & Jacob (2010) found no interference in the same area with hole-nesting native birds. Newson *et al.* (2011) also found no negative interactions with native species in England. Hole-nesting birds, also named "cavity nesters", represent a guild of species (such as woodpeckers, nuthatches, tits, treecreepers, starlings, and sparrows) highly dependent on old trees or dead wood for nesting, and secondarily, for roosting and feeding. This guild can be divided in (i) excavators (e.g., woodpeckers), species that excavate cavities secondarily used by insects, reptiles, birds and mammals, and (ii) non-excavators, a large number of species that use natural or previously excavated tree holes for nesting (Martin & Li 1992, Martin & Eadie 1999). Rose-ringed parakeet nests in trees' holes, including woodpecker's nests, and is considered a weak excavator because eventually enlarges the entrance of the cavity with the beak (Katagama & Dunnet 2007). Nevertheless Orchan *et al.* (2013) did not observe negative effects of this parrot on syrian woodpecker *Dendrocopos syriacus*. The species is black listed invasive by Gotti & Baccetti (2009), following Genovesi & Shine (2004).

This paper aims to collect the trend data of the population of an urban park inside Rome, to investigate the feeding habits of this alien species and to assess if there is competition with native species as for trees' holes, which

is usually a limited resource in urban areas (Newton 1994, Davies *et al.* 2009).

STUDY AREA AND METHODS

From February 1998 to June 2013 Rose-ringed Parakeets were recorded along a 700 m transect in Villa Borghese, an 80 ha urban park in the centre of Rome, by using the transect methodology (Merikallio 1946, Järvinen & Väisänen 1973) without lateral limitations (Bibby *et al.* 2000). For a full description of the study area see Fratlicelli (2005) and Gratani & Bonito (2013). Data collected were transformed into Kilometric Abundance Index values (IKA; Ferry & Frochot 1958). The transect was repeated 2,448 times during the study period always in the first hours of the morning, with absence of rain or strong wind (Beaufort value <2), covering a total of 612 hours and 1,713 covered kilometres. Only June's data were considered to estimate the population, due to the fact that the family groups (after juveniles fledging) are more philopatric and show relatively low coefficients of variation (standard deviation expressed as percentage of the average number of individuals recorded in the month). The average number of individuals recorded in the month was preferred to the maximum number, the latter being strongly affected by random simultaneous presence of several family groups. At the same time the high number of transects allowed to obtain less variability. In order to evaluate the possible influence of rose-ringed parakeet on native hole-nester species, only *Picidae* Family, obligated trees' hole-nester, was considered. In the study area great spotted woodpecker *Dendrocopos major*, green woodpecker *Picus viridis* and wryneck *Jynx torquilla* are breeding (pers. obs). IKA values for *Picidae* were calculated by summing the maximum number of recorded individuals of the three species and not their average num-

ber because of low density values in the study area. From 2003 to 2011, the years of maximum rose-ringed parakeet increase, the period February-April was selected for great spotted woodpecker and green woodpecker, while for the wryneck it was selected the period May-June, in order to exclude migratory individuals. In the study area, hole-nester species different from *Piciformes* were not considered because less specialised, and therefore more difficult to evaluate as for competition with rose-ringed parakeet. These are great tit *Parus major*, blue tit *Cyanistes caeruleus*, european starling *Sturnus vulgaris*, italian sparrow *Passer italiae* and tree sparrow *Passer montanus* (Fratlicelli 2005). Mann-Whitney U test and Kolmogorov-Smirnov Z test were adopted for statistics with the alpha level <0.05 (SPSS 17.0).

RESULTS AND DISCUSSION

Close observations and the possibility to handle injured or debilitated individuals allowed to assess that *P. krameri manillensis*, Indian and Sri Lanka native (Forshaw 2010), is the rose-ringed parakeet subspecies present in Villa Borghese. In Germany both *P. k. manillensis* and *P. k. borealis* are present (Bauer & Woog 2008).

Demographic trend

After the first record in 1999, rose-ringed parakeet showed in Rome the typical invasive species population exploit (Fig. 1): a slow increase at the beginning, a rapid increase and the stabilisation thereafter (Shigesada & Kawasaki 1997). From 1999 to 2013 population increased of 1.057%; 70.5% each year, on average. During the rapid increase period, from 2003 to 2010, this showed high variability, with peaks of 138% per year.

Annual population increase rate of rose-ringed par-

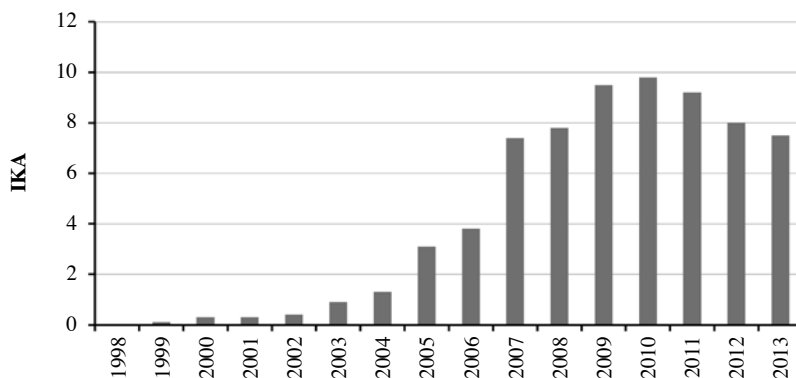


Figure 1. IKA index of rose-ringed parakeet at Villa Borghese in June from 1998 to 2013.

akeet in Belgium was 18% from 2002 to 2006 (Strubbe & Matthysen 2009b) and 9.4% in Bruxelles from 1992 to 2005 (Weiserbs & Jacob 2007). In England from 1995 to 2008 the rose-ringed parakeet population increased of 696% (Holling & Rare Breeding Birds Panel 2011), while from 2009 to 2010 only of 21% (Risely *et al.* 2011).

In the study area unusual severe snow of 3rd, 10th and 11th of February 2012 did not affect rose-ringed parakeet population in a statistically significant way (average number of recorded birds from 01.01.12 to 02.02.12 = 6.4 ± 3.2 ; from 12.02.12 to 31.03.12 = 5.6 ± 2.6 ; $U = -0.182$; $P = 0.856$). This is probably because the food was still available above the snow layer. From the end of May to the beginning of June 2012 several tens of old stone pines *Pinus pinea* were felled for public safety. Almost 50 pulli born on those trees were recovered at LIPU Wildlife Rescue Centre at Bioparco, dead and/or alive. Even this accident did not affect local population of rose-ringed parakeet: the average number of individuals recorded soon before (from 01.04.12 to 15.05.12 = 7.0 ± 2.4) and after the trees felling (from 15.06.12 to 31.07.12 = 8.7 ± 1.8) show a not statistically significant decrease ($U = 1.694$; $P = 0.090$). The decrease of 13% of the population compared with the previous year it is probably caused by endogenous factors, as it happened in 2011. Three years with low population size variability were considered (2009-2011) in order to evaluate the circannual rhythms of the population. Data presented in Fig. 2 show similar trends for the three years and, despite apparent fluctuations, by monthly merging the figures, no significant variations appear ($Z = 0.805$; $n = 12$; $P = 0.536$).

In May the lower number of contacts depends on the hatching activity of part of the population. The June's peak is due to juveniles fledging, while in July rose-ringed parakeets probably enlarge their home range because of food

scarcity due to drought, therefore resulting less present in the area. The decrease observed in October could be caused by the departure from this source area of juveniles looking for new territories, once independent.

Relationship with other species

Rose-ringed parakeet is able to enlarge the existing trees' cavities, like woodpeckers' nests, in order to use them for breeding (Kotagama & Dunnet 2007), anyhow no interference was probably observed with *Picidae* in the study area (Fig. 3), their demography not changing during and after the rapid increase of rose-ringed parakeet. Green woodpecker even started to breed in the area from 2004, being an irregular presence before (Fratelli 2005). But we must consider other parameters that may have influenced the event, such as: the low density of the woodpeckers and arising oscillations due to change, the vagility of the species, the greater dynamics than the scale of the studying site, the high availability of the cavity resource, and so on.

The rose-ringed parakeet's preference for more elevated breeding sites, in comparison with other species, could be a good explanation for no competition, as showed by Orchan *et al.* (2013) for the syrian woodpecker and by Dodaro & Battisti (2014) for the starling.

Recently red squirrel *Sciurus vulgaris* population strongly increased in Central Italy (Battisti *et al.* 2013) and in Villa Borghese (personal observation). Rose-ringed parakeet behaves always very aggressively against this potential nests' pest (Gurnell 1987), which is mobbed not only during the breeding season. Every time a rose-ringed parakeet was observed in the vicinity with a red squirrel, it was screaming loudly, attracting until 17 parakeets that were chasing all together the rodent, sometimes up to the ground. Hooded crow *Corvus cornix* was observed 12 times chasing a rose-ringed parakeet, the latter always

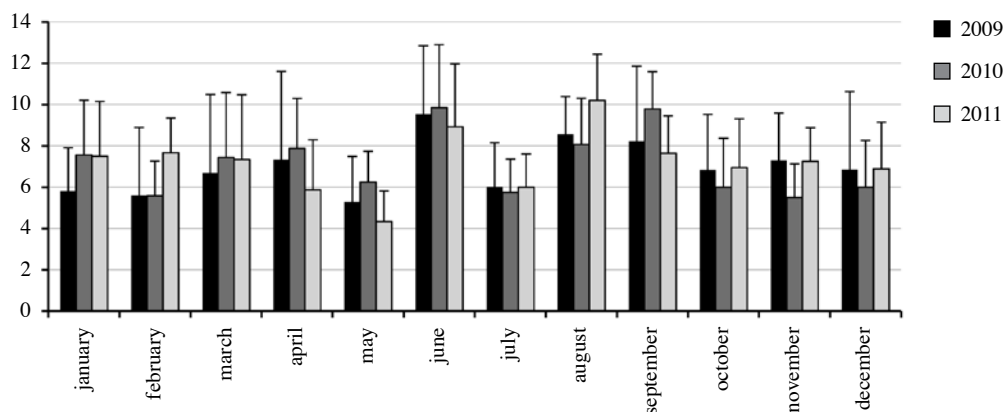


Figure 2. Average number \pm s.d. of individuals during the year in 2009, 2010, and 2011.

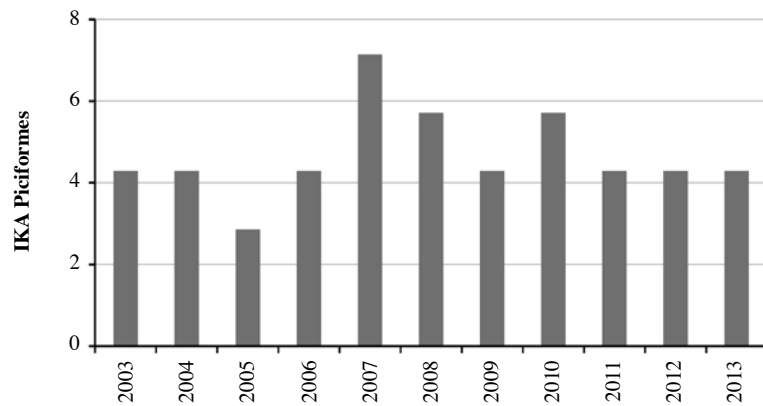


Figure 3. IKA index of Piciformes nesting at Villa Borghese from 2003 to 2013.

shirking by adopting rapid and sharp turns. Even a yellow-legged gull *Larus michahellis* behaved similarly once. It is very difficult to assess if the crows and the gull were attempting to predate or just playing. On 23.04.08 a hooded crow was observed while subtracting one pullus from a rose-ringed parakeet' nest with a particularly large entrance on a stone pine, even if mobbed by one of the parents. All over it can be generally assessed that rose-ringed parakeet is not currently suffering predation from native species, and probably will not for the future.

Feeding preferences

Only 0.26% of 7,955 individual observations resulted in rose-ringed parakeet spotted on the ground. In these cases, when it was possible to understand the animals' behaviour, the birds resulted to drink from a puddle in three cases, while six times they were eating holm oak *Quercus ilex* acorns. Tab. 1 shows the plants used by rose-ringed parakeet as food in the study area (no. 20). The high percentage of non-native species or cultivars could be related with the strong relationship of this parrot with anthropic habitats. This is supported by the habit to enter the accessible cages of captive parrots of the Bioparco Zoo to feed on a resource always available.

The insecticide qualities of white cedar *Melia azedarach* (Volkonsky 1937, Lepage 1946, Nardo *et al.* 1997) did not seem to annoy rose-ringed parakeet, which feeds only on the endocarp, dropping the mucilaginous mesocarp. In March rose-ringed parakeet feed particularly on samaras produced by *Ulmus* sp. trees, by cutting with their beak the sprigs containing the fruits but being able to eat only a small part of them. In a short time the base of the tree results covered by the remains of the meal. The impact of rose-ringed parakeet on these trees looks evident, but difficult to estimate. In any case still unknown results

Table 1. Species of plants and their parts eaten by the rose-ringed parakeet at Villa Borghese.

Species	Eaten part of the plant
<i>Cupressus sempervirens</i>	Endocarp
<i>Quercus ilex</i>	Endocarp
<i>Ulmus minor, U. pumila</i>	Endocarp
<i>Celtis australis</i>	Mesocarp
<i>Morus nigra</i>	Mesocarp
<i>Cinnamomum glanduliferum</i>	Mesocarp
<i>Eriobotrya japonica</i>	Mesocarp
<i>Malus domestica</i>	Mesocarp
<i>Prunus avium</i>	Mesocarp
<i>Sophora japonica</i>	Endocarp
<i>Robinia pseudoacacia</i>	Bud
<i>Melia azedarach</i>	Endocarp
<i>Punica granatum</i>	Mesocarp
<i>Sambucus nigra</i>	Mesocarp
<i>Silybum marianum</i>	Bud
<i>Phoenix canariensis</i>	Mesocarp
<i>Phoenix dactylifera</i>	Mesocarp
<i>Butia capitata</i>	Mesocarp
<i>Washingtonia filifera</i>	Mesocarp

to be the food resource that allows such a large population of rose-ringed parakeet in Villa Borghese, considering that most of the fruits/buds eaten are highly seasonal, and that other food resources, artificially provided by man, are not regularly used.

Finally the carrying capacity of the study area seems to be reached by the rose-ringed parakeet's population living in Villa Borghese, which can be considered a source area from which young individuals emigrate to colonise new territories in Rome.

Acknowledgement – I'm very grateful to Corrado Battisti for important suggestions in text revision.

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Associate editor: **Arianna Aradis**