Biogeographia – The Journal of Integrative Biogeography 37 (2022): s008
SPECIAL SECTION: Citizen Science in Biogeography
https://doi.org/10.21426/B637154915

Parrots and parakeets in Genoa (Northwest Italy): preliminary report of a census and population dynamic analysis through citizen involvement

STEFANO FERRETTI[1*], GIULIANO DORIA[2], ENRICO BORGO[2], DANIELA CARACCIOLO[3], DARIO OTTONELLO[3], LORENZO SODDU[4], MARCO TOGNONI[4], LORIS GALLI[4]

[1] *Municipality of Genoa, Environmental Department, Via di Francia 1, 16149 Genoa (Italy)*

[2] *Municipality of Genoa, Natural History Museum, Via Brigata Liguria 9, 16121 Genoa (Italy)*

[3] *Ligurian Environmental Protection Agency (ARPAL), Biodiversity Department, Via Bombrini 8, 16149 Genoa (Italy)*

[4] *Department of Earth, Environmental and Life Sciences (DISTAV), Genoa University, Corso Europa 26, 16132 Genoa (Italy)*

**corresponding author, e-mail: stefanoferretti@comune.genova.it*

Keywords: Alien species, *Amazona aestival*, *Amazona ochrocephala*, Citizen science, *Psittacula krameri*, Urban environment.

SUMMARY

In the city of Genoa (NW Italy) three breeding species of Psittaciformes are known to occur: *Psittacula krameri*, *Amazona ochrocephala* and *Amazona aestiva.* We planned to update the knowledge of these alien species involving citizens in a project coordinated and managed by professional scientists and technicians from the University of Genoa, the Natural History Museum "*G. Doria*", the Municipality of Genoa and the Ligurian Environmental Protection Agency (ARPAL). The aims of the research are to highlight and quantify the impact on the urban environment of parrots and parakeets and evaluate which aspects of their presence are most perceived (negatively or positively) by citizens. The data obtained so far, on the basis of 227 observations, have allowed us to outline some aspects of the biology and habits of local Psittaciformes. We have related these characteristics to the impact that these species have on citizens, in terms of hygienic problems and levels of appreciation. The results, if confirmed by further data, will help us to develop targeted management measures but also to improve communication strategies for the future involvement of citizens in data collection.

INTRODUCTION

The fauna of the city of Genoa includes three well settled species of Psittaciformes (Borgo et al., 2005): the Ring-necked parakeet or Rose-ringed parakeet *Psittacula krameri* (Scopoli, 1769) of Asian origin (Jackson et al., 2020), the Yellow-crowned parrot *Amazona ochrocephala* (Gmelin, 1788) and the Blue-fronted amazon *Amazona aestiva* (Linnaeus 1758) both of South-American origin (Forshaw, 2006). Introduced populations of *Psittacula krameri* are known in many countries all over the world, including almost all the Western, Central and Southern European countries (Mori et al., 2013; Pârâu et al., 2016; Calzada Preston & Pruett-Jones, 2021). Populations of *Amazona ochrocephala* are now established in Florida (USA), Barbados, Cayman Islands, Puerto Rico, Peru, Brazil, Spain, Germany, Netherlands, Italy, Singapore (Mori et al., 2013, 2017; Calzada Preston & Pruett-Jones, 2021). Similarly, alien populations of *Amazona aestiva* are located in California and Florida (USA), Puerto Rico, Peru, Brazil, Argentina, Spain, Germany, Italy and South Africa (Mori et al., 2013, 2017; Calzada Preston & Pruett-Jones, 2021). In Italy, large populations of *Psittacula krameri* are recorded in Genoa, Bologna, Rome and Palermo (Pârâu et al., 2016) while reproductive populations of Amazon parrots are known only in Milan and Genoa (Mori et al., 2017).

Psittacula krameri, with a population of some hundreds of individuals, is by far the most abundant species in Genoa (Gereschi, 2018), so much so that it is one of the most frequently hospitalized in the local wildlife recovery center (Dessalvi et al., 2021). It is a medium sized bird with a body length ranging from 38 to 42 cm. It is easily recognised by its bright green body and reddish beak. It also has a rather long pointed tail (more than half the length of the body), with bluish central feathers (Forshaw, 2006). More adept observers can easily recognise males of this species by their dark purplish-coloured ring around their neck (hence the name "Ring-necked parakeet").

Compared to the ring-necked parakeet, the two species of the genus *Amazona* settled in Genoa are more squat and more compact in shape. They are usually around 35 cm long with a short and square tail with red and yellow areas under the base. The plumage is dark green with red areas also on the shoulders, near the junction of the wings, and a yellow spot on the forehead (Forshaw, 2006). The main difference between the two species is the presence of a blue stripe on the head of the Blue-fronted amazon (Forshaw, 2006). This slight difference is not always so evident in the field, making it difficult to distinguish between these species.

The spread of *Psittacidae* in the city of Genoa began with *P. krameri*, already documented at the beginning of 1970 (Borgo et al., 2005). The first couple(s) probably escaped from captivity and settled in *Villa Gruber*, an historic villa surrounded by a large park with monumental trees in the Castelletto area (Centre-East District, see below) (Andreotti, 2009). For both *Amazona* species, the history of their introduction and diffusion in the city is not yet as clear as for *P. krameri* but their presence has been known since 1991 in the Central District of the city (Maranini & Galuppo, 1993; Andreotti, 2009).

The project to update the census of the local populations of Psittacidae began in April 2021 focussing primarily on the Ring-necked parakeet. The aim of the survey was to identify new roosts in addition to those already known thanks to previous studies, the last of which occurred in 2016-2018 (Gereschi, 2018). At the same time, we decided to monitor the population and evolving range of the Yellow-crowned parrot and the Blue-fronted amazon.

Other aspects included in the in-depth analysis were the feeding habits and the impacts that these species have had on the local environment and on people. Understanding how the Genoese population perceives and tolerates parrots, prompted us to involve Genoese citizens through a *citizen science* project in which they were asked to record and quantify

the parrots' impact (negative or positive) on the urban environment (both in public and private areas). Some problems already associated with these species are the dirt due to their excrements, the risk of spreading disease (e.g., psittacosis), and the ongoing importance of animal welfare. More general problems related to alien species are the importance of protecting habitats and native species. It is especially important to monitor interactions with the native fauna (especially birds), such as those highlighted between the Ring-necked parakeet and the Leisler's bat *Nyctalus leisleri* (Menchetti et al., 2014), the Greater noctule bat *Nyctalus lasiopterus* (Hernández-Brito et al., 2018), the Eurasian nuthatch *Sitta europaea* Linnaeus, 1758 and the European starling *Sturnus vulgaris* Linnaeus, 1758 (Cramp, 1985; Bluekens, 2002; Strubbe & Matthysen, 2007). Another important issue is the impact on local flora in both natural and anthropogenic habitats (e.g. Mentil et al., 2018). Finally, especially when the nesting sites and flight-routes of birds are located near airports, the problems for the safety and protection of air traffic (bird-strikes) should not be underestimated (Montemaggiori 1998; Fletcher & Askew 2007; Klug et al., 2019).

MATERIALS AND METHODS

Based on the scientific and technical support of the University of Genoa (DISTAV), the Municipality of Genoa (Natural History Museum "G. Doria" and Environmental Department) and the Ligurian Environmental Protection Agency (ARPAL), we planned a one-year study, with the aim of extending it further. This preliminary report refers to the first six months of data collection, from March to September 2021.

Dissemination of information on the citizen science project

The start of the project was announced through the media and social networks used by the Municipality of Genoa, such as its institutional website, Instagram and specific press releases–published in local and national newspapers (Website 1). Further prominence to the project was given through the website and the Instagram account of the "G. Doria" Natural History Museum, and by a group of Museum enthusiasts called Associazione Amici del Museo Doria (Website 2). Consequently, we were able to reach most of the Genoese population including those who did not identify specifically as animal rights activist or environmentalist already sensitive to issues associated with the introduction of alien species.

Data collection

Citizens were asked to collect data on the basis of a guided form (Figure 1). Information on place, date and time of sighting was requested with the indication (as accurate as possible) of the species or of the most evident morphological characters (in order to identify it subsequently), the number of specimens and the type of activity observed (e.g., flight and its direction, feeding, courtship, nesting, etc.). The importance of receiving photos was emphasized, as it is a very useful tool for allowing a secure identification of the species and to confirm species' activity. In the additional notes, citizens were invited to express their opinions on the presence of parrots and on any problems related to it.

The collected data, once validated by professional scientists, was uploaded to the Ligurian Biodiversity Observatory - Li.Bi.Oss., managed by the Regional Agency for the Protection of the Ligurian Environment (ARPAL) and equipped with a section specifically dedicated to alien species. The Observatory is a naturalistic database with the aim of acquiring and organizing data on the conservation status of habitats and species, of European, national and regional interest, collected by various subjects operating in the Ligurian territory.

Citizens were also asked to provide some personal data such as their name and an e-

mail address, for periodic updates on the initiative. To facilitate communication with citizens and rationalize data collection, we established a specific institutional e-mail (pappagalli@comune.genova.it).

COMUNE DI GENOVA

Report of parrot species - Municipality of Genoa

DATE / TIME	
NAME / SURNAME (Optional)	
E-MAIL ADDRESS (If you want to be contacted for updates)	
SIGHTING PLACE (Street, Place, etc. or any other points of reference, eg. intersection, street number)	
SPECIES (if recognised, eg. ring-necked parakeet, yellow-crowned parrots)	
N° SPECIMENS	
ROUTE (eg. South-North, following road xxx, etc.)	
ACTIVITIES (ex. in flight, posing, nesting, etc.)	
PHOTO (if done, attach photos to the e-mail sending the card)	
NOTES	

THE OCEAN RACE GENOVA THE GRAND FINALE 2022-23

Comune di Genova |
Assessorato ai Trasporti, Mobilità Integrata, Ambiente, Rifiuti , Animali, Energia |
Via Di Francia 1 - Matitone | 16149 Genova |
mail: assmobilitaeambiente@comune.genova.it;
www.visitgenoa.it |

Figure 1. Report form.

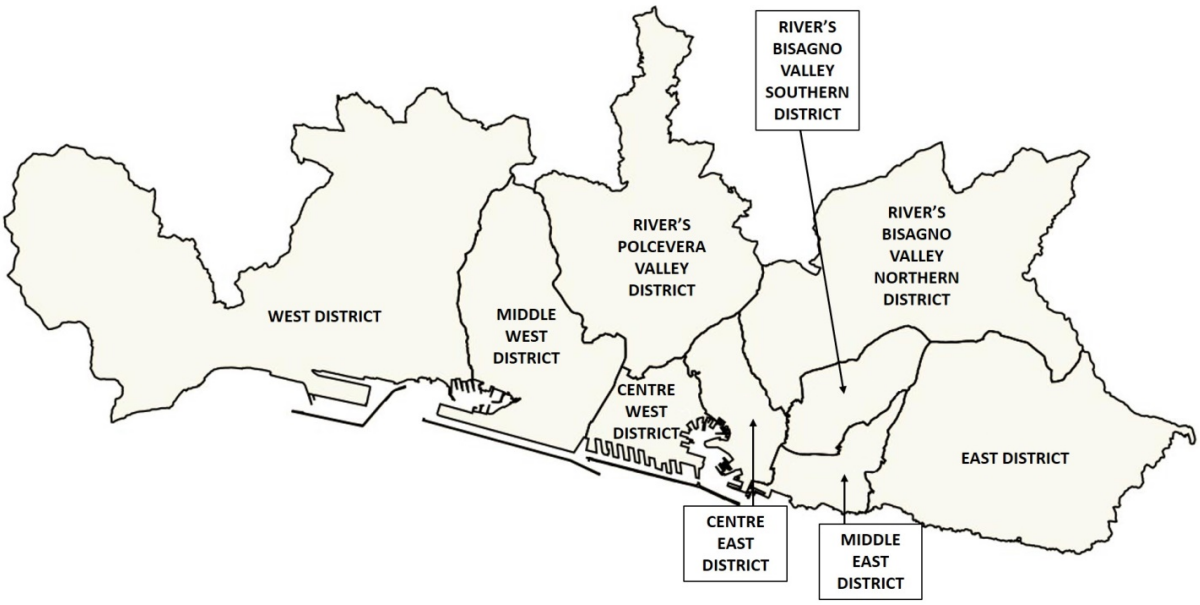

Figure 2. District map of the Genoa Municipality.

Study area

The study area corresponds to the Municipality of Genoa that is divided into nine districts (Figure 2):

- Ponente: West district;
- Medio Ponente: Middle-West district;
- Val Polcevera: River Polcevera's Valley;
- Centro Ovest: Centre-West District;
- Centro Est: Centre-East District, that includes Castelletto and the historical centre of Genoa;
- Medio Levante: Middle-East District;
- Levante: East district;
- Bassa Val Bisagno: River Bisagno's southern district;
- Media Val Bisagno: River Bisagno's northern district.

RESULTS AND DISCUSSION

By 1 September 2021 we had received 227 reports from citizens. In Table 1 the percentage of reports received is compared with that of the human population for each district (see Website 3). However, it should be noted that the number of reports is not strictly related to the population of a District but probably reflects the presence of roosts and flight routes in certain areas.

Citizens communicated their observations in 90% of cases via e-mail, 9% via text message and 1% via Instagram. Each contributor mainly submitted a single report (Figure 3). The trend of the reports is shown in Figure 4: they gradually decreased over time, remaining stable in the last months of the study. *Psittacula krameri* was the subject of 84% of the reports and 12% concerned *Amazona* spp.; only 4% could not be identified to species level. However, although some citizens were not able to accurately identify the observed specimens, they were able to give a correct description, allowing us to identify the species. To overcome this problem, an illustrated, user-friendly dichotomous key for identification of the species was developed and included in a press release in mid-2021.

Table 1. Comparison between the percentage of citizens and reports for each district of Genoa city.

District	Nunmber of reports	% of reports	Population density (pop/ha)	% of citizens
River Bisagno's southern district	22	9.69	169.08	12.10
Centre-East	73	32.16	180.08	14.68
Centre-West	19	8.37	152.02	10.59
East	18	7.93	71.47	10.27
River Bisagno's northern district	3	1.32	50.96	9.03
Middle-East	45	19.82	122.89	9.68
Middle-West	20	8.81	82.13	9.78
West	16	7.05	77.71	9.60
River Polcevera's Valley	11	4.85	50.70	9.86

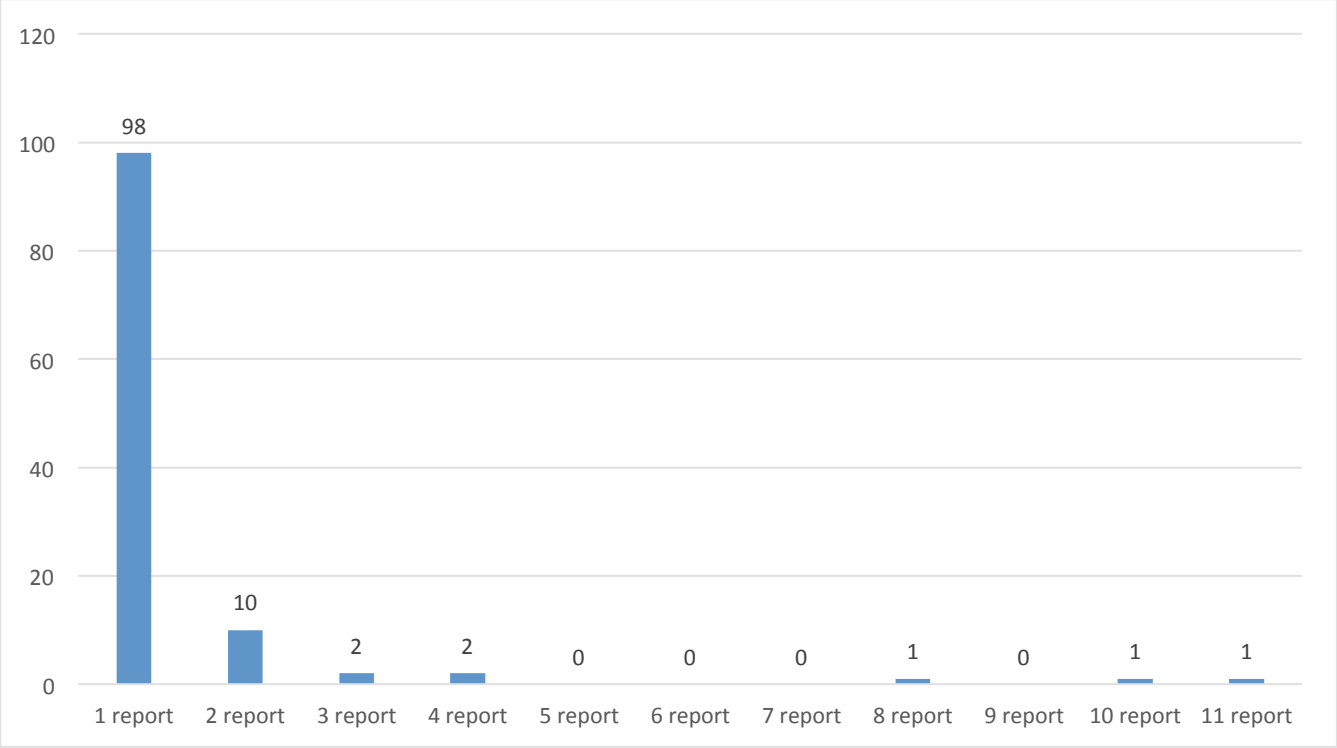

Figure 3. Number or reports per citizen.

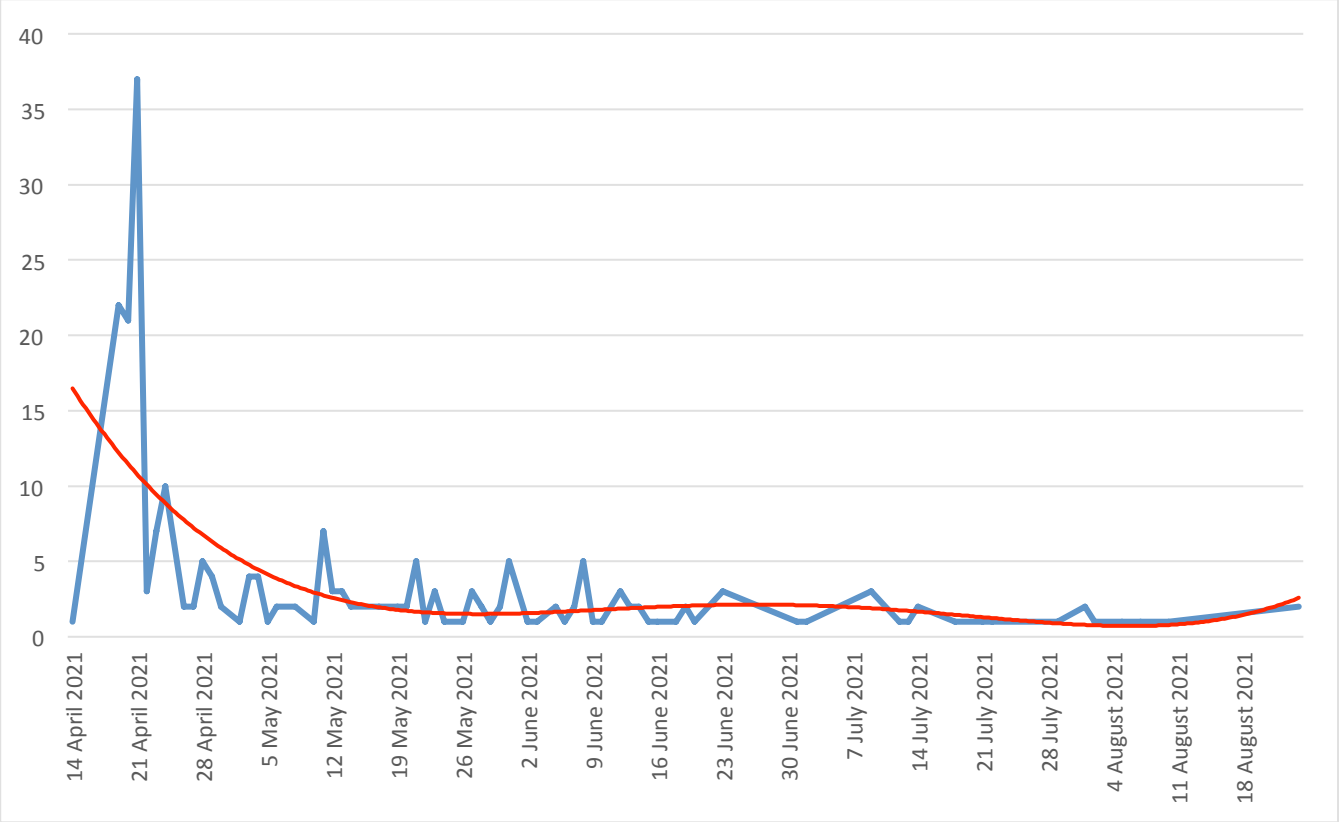

Figure 4. Time series of reports.

The areas where the birds nest and forage are shown in Figure 5 and Figure 6 shows their main flight routes. These results confirm a concentration of roosts in the central and eastern part of the city observed previously (Gereschi, 2018) when conducting field studies on the Ring-necked parakeet, even though some new roosts in the west districts of the city can be hypothesized. In addition, the routes between nesting sites and foraging sites also extended to the two main city valleys. These results show a significant increase in the range and the size of the population (about 600 individuals recorded by Gereschi, 2018) compared to what was observed in the period 1996-2000 (Borgo et al., 2005). A similar increase was recorded for example also in Lisbon (Portugal) (Luna et al., 2016).

Genoese citizens have observed parakeets and parrots feeding on the fruits and seeds of certain plant species, four of which hitherto unknown as food sources in Genoa (Spanò & Truffi, 1986; Maranini & Galluppo, 1994; Vergano, 1998; Gereschi, 2018): *Citrus lemon* (Lemon tree), *Malus domestica* (Apple tree), *Olea europaea* (Olive tree) and *Thuja occidentalis* (Thuja) (Table 2). These observations are comparable with what is already known for other alien populations of parakeets. For instance, Clergeau & Vergnes (2011) highlighted the opportunistic granivorous-frugivorous character of *P. krameri* and the possible role of human food sources in the success of its establishment in many cities across temperate Europe. More recently, in Barcelona (Spain), the diet of this species was assessed using C and N isotopes, which suggests a diet based on flowers/fruits (44.1%), anthropogenic food (32.4%) and leaves/seeds (23.1%) (Borray-Escalante et al., 2020).

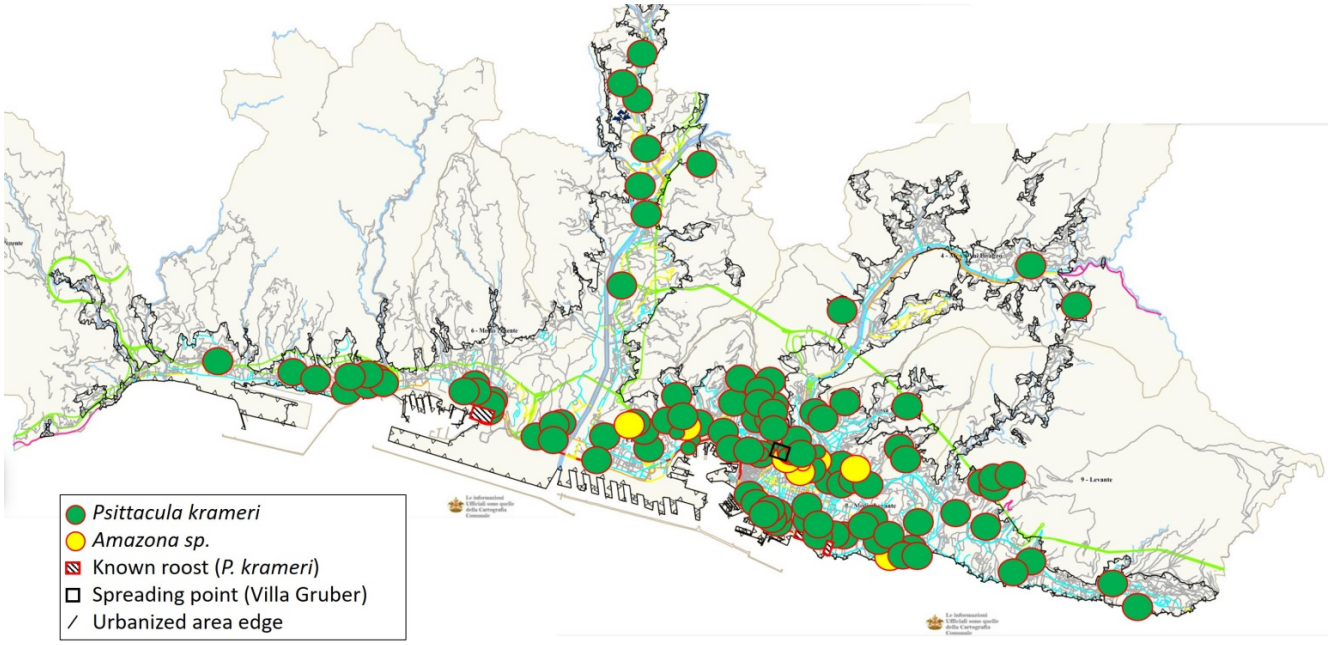

Figure 5. Map of reports.

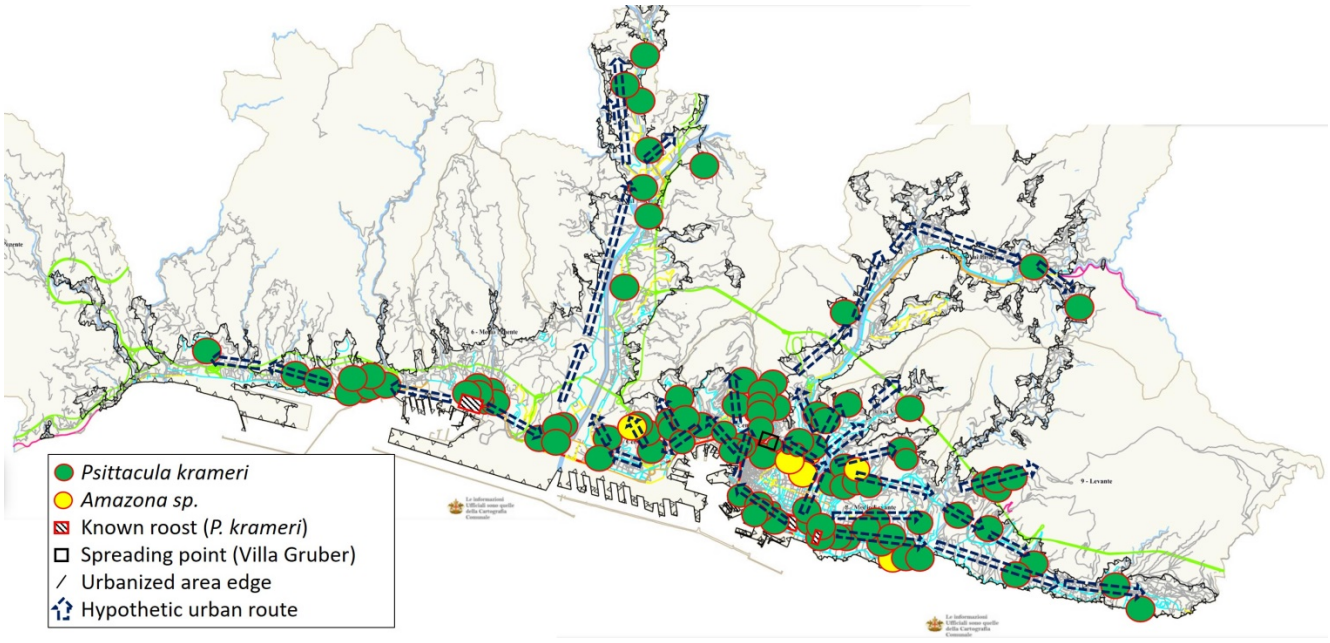

Figure 6. Map of hypothetic flight routes.

Table 2. Plants on which parakeets and parrots are known to forage in Genoa: in the last column, the number of observations on each species by citizen scientists in 2021. *Plants recorded for the first time by citizens in 2021; §Food sources known based on previous studies but not recorded in the current research (Spanò & Truffi, 1986; Maranini & Galluppo, 1994; Vergano, 1998; Gereschi, 2018).

Plant species	Psittacidae	N° Observations
Actinidia deliciosa (Fuzzy kiwifruit)§	*Psittacula krameri*	-
Aesculus hippocastanum (Horse chestnut)§	*Psittacula krameri*	-
Ailanthus altissima (Tree of heaven)§	*Psittacula krameri*	-
Aracaceae sp. (Palm tree)§	*Psittacula krameri*	1
Celtis australis (Hackberry)§	*Psittacula krameri*	1
Cercis siliquastrum (Judas tree)§	*Psittacula krameri*	-
Chamaerops humilis (European fan palm)§	*Psittacula krameri*	-
Citrus aurantium§	*Psittacula krameri*	-
Citrus lemon (Lemon tree)*	*Psittacula krameri*	1
Citrus reticulata (Mandarin tree)§	*Psittacula krameri* & *Amazona aestiva*	2
Citrus sinensis (Orange tree)§	*Psittacula krameri*	4
Corylus avellana (Hazel)§	*Psittacula krameri*	-
Cupressus arizonica (Arizona Cypress)§	*Psittacula krameri*	-
Cupressus sempervirens (Cypress)§	*Psittacula krameri*	-
Diospyros kaki (Kaki persimmon)§	*Psittacula krameri*	-
Eriobothrya japonica (Loquat)§	*Psittacula krameri*	-
Ficus carica (Fig)§	*Psittacula krameri*	1
Juglans regia (English walnut)§	*Psittacula krameri*	-
Laurus nobilis (Laurel)§	*Psittacula krameri*	-
Ligustrum lucidum (Broad-leaf privet)§	*Psittacula krameri*	-
Magnolia grandiflora (Southern magnolia)§	*Psittacula krameri*	-
Malus domestica (Apple tree)*	*Psittacula krameri*	1
Olea europaea (Olive tree)*	*Psittacula krameri*	1
Paulownia tomentosa (Empress tree)§	*Psittacula krameri*	-
Phoenix canariensis (Canary's palm)§	*Psittacula krameri*	-
Pinus pinaster (Maritime pine)§	*Psittacula krameri*	-
Pinus sativum (Stone pine)§	*Psittacula krameri*	-
Platanus acerifolia (London plane)§	*Psittacula krameri*	-
Prunus armeniaca (Apricot tree)§	*Psittacula krameri*	1
Prunus avium (Cherry tree)§	*Psittacula krameri* & *Amazona* sp.	7
Prunus domestica (European plum)§	*Psittacula krameri*	-
Prunus dulcis (Almond)§	*Psittacula krameri*	-

Plant species	Psittacidae	N° Observations
Prunus spinosa (Blackthorn)§	*Psittacula krameri*	-
Pyrus communis (Common pear)§	*Psittacula krameri*	-
Quercus ilex (Holly oak)§	*Psittacula krameri*	-
Robinia pseudoacacia (Black locust)§	*Psittacula krameri*	-
Sequoia sempervirens (coast redwood)§	*Psittacula krameri*	-
Sophora japonica (Chinese scholar tree)§	*Psittacula krameri*	-
Taxus baccata (Common yew)§	*Psittacula krameri*	-
Thuja occidentalis (Thuja)*	*Psittacula krameri*	1
Ulmus minor (Elm)§	*Psittacula krameri*	-
Vitis vinifera (Grape vine)§	*Psittacula krameri*	-
Washingtonia robusta (Mexican fan palm)§	*Psittacula krameri*	-

To date, probably due to the scarce abundance of species occupying the same niche in the city of Genoa, no significant impacts by Psittacidae on native fauna have been recorded. In recent years an apparently peaceful coexistence has been observed in the same roosts between *P. krameri* and the Eurasian jackdaw *Coloeus monedula* (Linnaeus, 1758) (Lorenzo Soddu, unpub.). However, in the course of this research, an interspecific interaction was observed for the first time between *P. krameri* and the Hooded crow *Corvus cornix* Linnaeus, 1758, with the latter attacking the parakeet.

The perceived acceptance of Psittaciformes by the local Genoese population, can be inferred from the low number of complaints or negative comments received about their noise, dirt due to excrement and/or consumption of fruit from peri-urban gardens. The positive or negative perception of urban parrot species by citizens must be particularly taken into account if the institutions decide to develop management measures for these species. It cannot be excluded that following a further numerical increase, the population of Genoese parakeets may have more significant impacts on habitats, native species and citizens. In fact, Kumschick & Nentwing (2010), estimating the potential impacts related to *P. krameri* in Europe, calculated a rather high economic impact (on agriculture, human health, human social life and infrastructures) and a low/average environmental impact (due to competition and to transmission of diseases). This research was updated and extended to the other alien parrot species by White et al. (2019) and the main (almost 50%) source of a negative impact in Italy comes from the aggressive interactions against native species, followed by damage to infrastructure, disease transmission, influence on human well-being and impact on plants. More recently Rocha et al. (2020) analyzed the possible ecologic and economic impact of the Ring-necked parakeet on Madeira Island (Portugal) and advocated for a "rapid response" intervention to prevent the spread of this potential invader. However, impact of parrots could be at least partly positive. For example, Hernández-Brito et al. (2014) recorded some attacks of Ring-necked parakeets on black rats (*Rattus rattus*) in urban parks in Seville (Southern Spain) and Tenerife (Canary Islands), concluding that some native bird species may benefit from their aggressive behavior against nest predators.

The data collected to date are still being analyzed by professional scientists involved in

the project. Therefore, it is likely that more in-depth information will emerge on the biology of the species studied; especially as our research will continue at least until the end of 2022. Consequently, an additional communication campaign will be implemented that encourages further citizen participation in data collection, which should include questions that seek information concerning the public's tolerance towards the presence and impact of these three species in Genoese peri-urban environments.

ACKNOWLEDGEMENTS

We wish to thank, first of all, the citizens of Genoa for their enthusiastic collaboration. We are grateful to the Associazione Amici del Museo Doria and to all the biologists, naturalists and specialists who took part in the project. A special thanks to Valeria Gereschi for her fundamental help and for sharing the useful data collected during her research for the master's thesis. Special thanks to Tony Molyneux for his thorough revision of the English text and numerous suggestions.

REFERENCES

Andreotti, A. (2009) Nuovi dati sulla presenza di amazzoni (*Amazona* spp.) nella città di Genova. Alula 16, 434–436.

Bluekens, K. (2002) Inleidende studie naar het nestgebruik van halsbandparkieten en de concurrentie met inheemse vogelsoorten. Master's degree thesis, Antwerp University.

Borgo, E., Galli, L., Galuppo, C., Maranini, N. & Spanò, S. (Eds.) (2005) Atlante ornitologico della Città di Genova (1996-2000). Bollettino dei Musei e degli Istituti Biologici dell'Università di Genova 69–70, 320 pp.

Borray-Escalante, N.A., Mazzoni, D., Ortega-Segalerva, A., Arroyo, L., Morera-Pujol, V., González-Solís, J. & Senar, J.C. (2020) Diet assessments as a tool to control invasive species: comparison between Monk and Rose-ringed parakeets with stable isotopes. Journal of Urban Ecology 6, juaa005. DOI: 10.1093/jue/juaa005

Calzada Preston, C.E. & Pruett-Jones, S. (2021) The number and distribution of introduced and naturalized Parrots. Diversity 13, 412. DOI: 10.3390/d13090412

Clergeau, P. & Vergnes, A. (2011) Bird feeders may sustain feral Rose-ringed parakeets *Psittacula krameri* in temperate Europe. Wildlife Biology, 17, 248–252. DOI: 10.2981/09-092

Cramp, S. (1985) Handbook of the birds of Europe, the Middle East and North Africa. Terns to woodpeckers. Oxford University Press.

Dessalvi, G., Borgo, E. & Galli, L. (2021) The contribution to wildlife conservation of an Italian recovery center. Nature Conservation 44, 1–20. DOI: 10.3897/natureconservation.44.65528

Fletcher, M. & Askew, N. (2007) Review of the status, ecology and likely future spread of parakeets in England. Central Science Laboratory, York, UK.

Forshaw, J.M. (2006) Parrots of the world. An identification guide. Princeton University Press, 400 pp.

Gereschi, V. (2018) Il Parrocchetto dal collare a Genova: evoluzione della colonia e interazioni con la popolazione locale. Master's degree thesis in Natural History, Genoa University.

Hernandez-Brito, D., Carrete, M., Ibanez, C., Juste, J. & Tella, J.L. (2018) Nest-site competition and killing by invasive parakeets cause the decline of a threatened bat population. Royal Society Open Science 5, 172477. DOI: 10.1098/rsos.172477

Hernández-Brito, D., Luna, Á, Carrete, M. & Tella, J.L. (2014) Alien rose-ringed parakeets (*Psittacula krameri*) attack black rats (*Rattus rattus*) sometimes resulting in death. Hystrix, the Italian Journal of Mammalogy 25, 121–123. DOI: 10.4404/hystrix-25.2-10992

Jackson, H., Strubbe, D., Tollington, S., Prys-Jones, R. Matthysen, E. & Groombridge, J.J. (2015) Ancestral origins and invasion pathways in a globally invasive bird correlate with climate and influences from bird trade. Molecular

Ecology 24, 4269–4285. DOI: 10.1111/mec.13307

Klug, P., Shiels, A., Kluever, B., Bukoski, W. & Siers, S. (2019) Rose-ringed Parakeet. Wildlife Damage Management Technical Series, 16 pp.

Kumschick, S. & Nentwing, W. (2010) Some alien birds have as severe an impact as the most effectual alien mammals in Europe. Biological Conservation 143, 2757–2762. DOI: 10.1016/j.biocon.2010.07.023

Luna, Á., Monteiro, M., Asensio-Cenzano, E. & Reino, L. (2016) Status of the rose-ringed parakeet *Psittacula krameri* in Lisbon, Portugal. Biologia 71, 717–720. DOI: 10.1515/biolog-2016-0083

Maranini, N. & Galuppo, C. (1993) Nidificazione di Amazzone fronte blu *Amazona aestiva* nella città di Genova. Picus 19, 133–134.

Maranini, N. & Galuppo, C. (1994) Ulteriori notizie sul Parrocchetto dal collare *Psittacula krameri* e sul Pappagallo monaco *Myiopsitta monachus* a Genova. Picus 20, 85–89.

Menchetti, M., Scalera, R. & Mori, E. (2014) First record of a possibly overlooked impact by alien parrots on a bat (*Nyctalus leisleri*). Hystrix, the Italian Journal of Mammalogy 25, 61–63. DOI: 10.4404/hystrix-25.1-9989

Mentil, L., Battisti, C. & Carpaneto, G.M. (2018) The impact of *Psittacula krameri* (Scopoli, 1769) on orchards: first quantitative evidence for Southern Europe. Belgian Journal of Zoology 148, 129–134. DOI: 10.26496/bjz.2018.22

Montemaggiori, A. (1998) The importance of bird monitoring at airports: the case of Fiumicino, Rome. International Bird Strike Committee, 11 pp.

Mori, E., Di Febbraro, M., Foresta, M., Melis, P., Romanazzi, E., Notari, A. & Boggiano, F. (2013) Assessment of the current distribution of freeliving parrots and parakeets (Aves: Psittaciformes) in Italy: a synthesis of published data and new records. Italian Journal of Zoology 80, 158–167. DOI: 10.1080/11250003.2012.738713

Mori, E., Grandi, G., Menchetti, M., Tella, J.L., Jackson, H.A., Reino, L., van Kleunen, A., Figueira., R. & Ancillotto, L. (2017) Worldwide distribution of non–native Amazon parrots and temporal trends of their global trade. Animal Biodiversity and Conservation 40.1, 49–62. DOI: 10.32800/abc.2017.40.0049

Pârâu, L.G., Strubbe, D., Mori, E., Menchetti, M., Ancillotto, L., van Kleunen, A., White, R.L., Luna, Á., Hernández-Brito, D., Le Louarn, M., Clergeu, P., Albayrak, T., Franz, D., Braun, M.P., Schroeder, J. & Wink, M. (2016) Rose-ringed parakeet *Psittacula krameri* populations and numbers in Europe: a complete overview. The Open Ornithology Journal 9, 1-13. DOI: 10.2174/1874453201609010001

Rocha, R., Reino, L., Sepúlveda, P. & Ribeiro, J. (2020) Introduced population of ring-necked parakeets *Psittacula krameri* in Madeira Island, Portugal – Call for early action. Management of Biological Invasions 11, 576–587. DOI: 10.3391/mbi.2020.11.3.15

Spanò, S. & Truffi, G. (1986) Il Parrocchetto dal collare, *Psittacula krameri*, allo stato libero in Europa, con particolare riferimento alle presenze in Italia, e primi dati sul Pappagallo monaco, *Myiopsitta monachus*. Rivista italiana di Ornitologia, 56, 231–239.

Strubbe, D. & Matthysen, E. (2007) Invasive ring-necked parakeets *Psittacula krameri* in Belgium: habitat selection and impact on native birds. Ecography 30, 578–588. DOI: 10.1111/j.2007.0906-7590.05096

Vergano, C. (1998) Psittaciformi naturalizzati nella città di Genova, con particolare riferimento al Parrocchetto dal Collare *Psittacula krameri* (Scopoli, 1769). Master's degree thesis in Biology, Genoa University.

White, R.L., Strubbe, D., Dallimer, M., Davies, Z.G., Davis, A.J.S., Edelaar, P., Groombridge, J., Jackson, H.A., Menchetti, M., Mori, E., Nikolov, B.P., Pârâu, L.G., Pečnikar, Z.F., Pett, T.J., Reino, L., Tollington, S., Turbé, A. & Shwartz, A. (2019) Assessing the ecological and societal impacts of alien parrots in Europe using a transparent and inclusive evidence-mapping scheme. NeoBiota 48, 45–69. DOI: 10.3897/neobiota.48.34222.

Website 1: https://www.ansa.it/canale_ambiente/notizie/animali/2021/04/19/genova-invasa-dai-pa

ppagalli- comune-dispone-censimento_abd0a911-5d17-4712-aa63-af544cdf960b.html

Website 2: https://www.museidigenova.it/it/censimento-pappagalli

Website 3: http://statistica.comune.genova.it/pubblicazioni/download/not_stat/not_3_2018/testo%20integrale%203-2018.pdf

Submitted: 29 September 2021

First decision: 11 November 2021

Accepted: 5 January 2022

Guest editor for the special section Citizen Science in Biogeography: Stefano Martellos