Population trends in breeding and wintering birds in urban parks: a 15-year study (1998-2013) in Valencia, Spain

Enrique Murgui

Long-term dynamics of bird populations are rarely addressed in ecological research carried out in urban areas. The objective of this study was to document long-term bird population trends in urban parks and to explore some of the processes behind the observed patterns. Birds were censused monthly in 22 public urban parks in Valencia (Spain) from 1998 to 2013. Additionally, the habitat structure of urban parks was investigated in 1999 and 2011. Population trends were calculated for ten breeding and seven wintering species. Of the breeding species, five significantly declined (above all, the House Sparrow *Passer domesticus*) and three increased, while of the wintering species, three declined (e.g. Black Redstart *Phoenicurus ochruros*) and two increased. Overall, populations of woodland birds increased or remained stable, whereas populations of species confined to open habitats decreased. These population trends were only slightly connected to temporal changes in park features. Landscape scale changes such as the gradual increase in the number and total area of urban parks, together with the loss of 20% of wasteland and farmland on the outskirts of the city, are suggested as the main drivers of the observed population changes. In general, bird population trends in these urban parks coincided with trends occurring at large spatial levels in Spain and Catalonia. These results give some support to the idea that population dynamics in urban settings are influenced by factors occurring at different spatial scales. Therefore, in order to enhance urban biodiversity, the management of urban areas should pay attention to both patch and landscape processes.

Key words: bird population dynamics, landscape scale, patch scale, habitat structure, urban development, Comunidad Valenciana

Enrique Murgui, *Grupo para el Estudio de las Aves. G.V. Marqués del Turia, 28, 46005 Valencia (Spain), e-mail: enmurpe@alumni.uv.es*

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Between the years 1700 and 2000 terrestrial biomes shifted from primarily wild to primarily anthropogenic states and today no ecosystem on Earth is free of pervasive human influence (Ellis *et al.* 2010). One of the most extreme examples of land transformation is urbanization, a phenomenon that has increased in an unprecedented fashion in many regions of the world since the 1950s (Seto *et al.* 2010). Accordingly, urban ecological studies have burgeoned in recent decades (Gaston 2010), although the temporal dimension to ecological phenomena in urban areas is frequently lacking (Garden *et al.* 2006, Luck & Smallbone 2010). Similarly, little effort is addressed to the temporal dynamics of urban bird populations and communities (Marzluff *et al.* 2001), a circumstance exacerbated by the fact that urban settings have often been overlooked as habitats in long-term national bird monitoring schemes (e.g. the UK Common Breeding Bird Census, see Newson *et al.* 2005). Our relative ignorance of bird population trends in urban areas is a cause of concern for several reasons. First, the development of ecology (and henceforth of urban ecology) as a discipline is linked to the accumulation of data on the distribution and abundance of species over space and time (Magurran *et al.* 2010). Secondly, monitoring biological populations is a key approach in the assessment of the human impact on nature

(Balmford *et al.* 2003). Finally, the conservation of urban biodiversity may bring benefits for both humans and nature (see Dearborn & Kark 2010) and may be important not only on a city scale but also in wider spatial contexts (Mason 2000).

Ornithological research conducted in Spanish urban areas shows similar patterns to those mentioned above. Despite the pioneering work by Balcells (1960), few subsequent studies of urban bird fauna have ever been conducted (e.g. Alonso & Purroy 1979, Patón *et al.* 2012) and, seemingly, only two studies have ever investigated long-term population trends in urban settings (Murgui & Macías 2010, Herrando *et al.* 2012). In Spain, research on bird fauna in urban areas is necessary because the land cover of urban environments increased by 29.5 % between 1987 and 2000 (OSE 2006) and the effects on bird fauna of such a massive increase are still almost unknown (but see Sánchez & Tellería 1988, Herrando & Brotons 2002).

The first aim of this study was to assess long-term changes in the abundance of several common breeding and wintering bird species in urban parks in Valencia (Spain) over a 15-year period between 1998 and 2013. Research that is focused not only on breeding but on wintering populations of birds is necessary for obtaining a complete picture of population dynamics in the study area because, like other southern European areas (see Tellería 2004), winter in Valencia sees the arrival of a diverse and abundant array of wintering bird species from higher latitudes.

The second objective of the present study was to explore factors that might account for some of the observed changes in the bird abundances. I paid particular attention to two processes: 1) given that the composition and abundance of bird species in woodland and commercial tree plantations is closely related to the development of canopy tree species and vegetation structure (e.g. Wilson *et al.* 2006), it is logical that, if the vegetation in urban parks in Valencia has developed over the past fifteen years, this situation should benefit primarily woodland species, i.e. those associated with the tree and shrub layers (e.g. Great Tit *Parus major*); 2) like many other European cities (Kasanko *et al.* 2006), Valencia has undergone noticeable development over the last fifteen years, a circumstance that has entailed the loss of farmland and wasteland but also an increase in the number and total area of urban parks (see Study Area). These changes on a landscape scale should produce an increase in populations of woodland bird species (e.g. Hashimoto *et al.* 2005) and, conversely, a decrease in farmland species (Filippi-Codaccioni *et al.* 2008), i.e. species confined to open habitats (e.g. White Wagtail *Motacilla alba*) that, aside from urban parks, use other habitats.

Material and Methods

Study Area

The study was carried out in the city of Valencia, Spain (39°28'N 0°23'W), which includes four main types of habitats: buildings and impervious surfaces, private gardens, public urban parks and patches of wasteland (for a full description, see Murgui 2009). According to data in reports by the City Council (Anonymous 1997, 2007), urban development in Valencia entailed the loss of 157 ha of wasteland and 473 ha of cultivated land (i.e. an overall reduction of 20% of undeveloped land) on the outskirts of the city between 1996 and 2007. At the same time, the total area of urban parks increased from 287 to 436 ha as new parks were constructed.

I surveyed the bird fauna of 130 urban parks from September 1998 to August 1999 (Murgui 2007). Twenty-two parks were selected for further long-term bird censuses. These 22 parks cover 118 ha (41% of the total surface area of parks in the city in 1998), ranging in size between 0.07 and 18.6 ha. They cover the whole range of sizes of urban parks in Valencia and their habitat structures were similar to that found throughout the city's parks. Therefore, the 22 selected urban parks can be considered a representative sample of the urban parks in the study area.

Measurement of park features

The habitat structure of the 22 urban parks was sampled in 1999 by means of 145 25-m radius circles distributed every 50 m along the itineraries used for the bird censuses (for details see Murgui 2007). Following the same protocol, the habitat structure was measured again in summer 2011 in 70 sample points, randomly selected from the 145 samples mapped in 1999. The number of sample plots per park ranged from 1

to 15 depending on the size of the park. Habitat structure measurements (Table 1) included several characteristics of the vegetation (e.g. shrub cover) that influence bird populations via different mechanisms (see e.g. Heyman 2010). Additionally, I counted the number of pedestrians and feral cats per park as proxies of human disturbance (see e.g. Fernandez-Juricic & Tellería 2000) and predation, respectively (Lepczyk *et al.* 2003).

To detect changes in habitat characteristics, mean values of habitat structure per plot and the mean number of pedestrians and cats per park were compared between 1999 and 2011 by means of a Student's *t*-Test for paired samples. Previously, I checked the normality of variables with the one-sample Kolmogorov–Smirnov test and variables differing significantly from normality were normalized using the appropriate transformation.

Bird censuses

I surveyed the bird fauna of urban parks from September 1998 to February 2013. Each park was visited three times per season (i.e. once a month, except June 2010) between 08.00 and 11.00 on days of good weather (i.e. avoiding rainy or windy days). The small size of the parks and the scattered distribution of the habitats prevented the use of line transects or point counts as a census method. Therefore, I recorded all the species and individual birds (except overflying birds) by walking through the parks along diffe-

Table 1. Variation in features of urban parks in Valencia between 1999 and 2011. Mean values for 70 circular plots of radius 25 m distributed proportionally in 22 urban parks in Valencia. Number of pedestrians and feral cats refers to the mean number per park (see Methods). d.b.h. = diameter at breast height.
Variació de les característiques dels parcs urbans entre 1999 i 2011. L'estructura de l'hàbitat es va obtenir fent la mitjana dels valors de 70 cercles de 25 m de radi. El nombre de visitants i de gats indica la mitjana per parc (vegeu Mètodes). d.b.h. = diàmetre a l'alçada del pit.

	Mean ± S.E.		Student's *t*-Test for paired samples
	Year 1999	Year 2011	
% of tree cover *% cobertura arbres*	36.8 ±3.2	40.9 ± 2.9	t_{69} = -3.11, P < 0.01
% of shrub cover *% cobertura arbusts*	10.2 ± 2.3	10.4 ± 2.1	t_{69} = -1.18, P = 0.24
% of lawn cover *% cobertura gespa*	38.3 ± 4.2	40.2 ± 4.2	t_{69} = -1.47, P = 0.14
% of bare ground *% cobertura sòl nu*	11.7 ± 2.7	12.7 ± 2.9	t_{69} = -1.35, P = 0.18
% of impervious surface *% superfícies pavimentades*	49.9 ± 4.7	47.0 ± 4.6	t_{69} = 0.57, P = 0.56
Number of tree species *Nombre d'espècies d'arbres*	4.6 ± 0.3	5.2 ± 0.3	t_{69} = -2.82, P = 0.06
Tree height (m) *Alçada dels arbres (m)*	5.3 ± 0.2	6.5 ± 0.2	t_{69} = -7.48, P < 0.01
Shrub height (m) *Alçada dels arbusts (m)*	0.8 ± 0.1	1.1 ± 0.1	t_{69} = -3.43, P < 0.01
Number of trunks < 30 cm d.b.h. *Nombre de peus < 30 cm diàmetre*	33.2 ± 2.9	22.9 ± 2.7	t_{69} = 3.47, P < 0.01
Number of trunks 30–50 cm d.b.h. *Nombre de peus 30-50 cm diàmetre*	2.5 ± 0.7	11.5 ± 1.8	t_{69} = -7.86, P < 0.01
Number of trunks > 50 cm d.b.h. *Nombre de peus < 50 cm diàmetre*	0.5 ± 0.2	0.8 ± 0.3	t_{69} = -3.92, P < 0.01
Number of pedestrians *Nombre de vianants*	15.2 ± 2.8	14.4 ± 2.5	t_{21} = 0.44, P = 0.66
Number of feral cats *Nombre de gats*	0.4 ± 0.2	0.3 ± 0.2	t_{21} = 0.22, P = 0.83

rent routes in such a way that all (or most) of the park surface was searched (for a similar approach see Ralph *et al.* 1993), taking care to ensure that double counting did not occur. Censuses lasted 5–90 minutes depending on the size and characteristics of the park. Given the small size of the parks and their sparse vegetation cover, it is almost certain that I recorded most of the birds in the park during the visits. I also noted the substrate where each bird was recorded, its behaviour and its sex and age whenever possible.

Bird population trends

I excluded from analyses the following bird groups: exotic bird species whose populations are partially dependent on the number of birds released, aerial feeders whose abundance and use of urban parks was difficult to determine, and raptors and wildfowl because they are very scarce and only associated with a few parks. The remaining species were split into wintering (i.e. present December–February) and breeding birds. Five species (Grey Wagtail *Motacilla cinerea*, White Wagtail, Robin *Erithacus rubecula*, Sardinian Warbler *Sylvia melanocephala* and Blackcap *Sylvia atricapilla*) are rare breeders (< 10 pairs) restricted to a few parks in the city but considerably increase their range and abundance during the winter. Therefore, only data corresponding to the wintering populations of these species were used in the analyses.

Analyses were focused on wintering species in winter (December–February) in 1998–2013, and on breeding species in spring (March–May) in 1999–2012. For each three-month season the maximum number of adult birds recorded per month and park was used as the most reliable estimate of bird abundance in order to rule out the possible effects of results from days of poor detectability caused, for instance, by pedestrian and dog disturbance (see Fernandez-Juricic & Tellería 2000).

Many species only had small populations throughout the study period, which precluded their use in the statistical analyses. Thus, analyses were restricted to the 17 commonest species (those with over 100 individuals recorded). For these, population trends were calculated using TRIM 3.54 (TRends and Indices for Monitoring Data, Pannekoek & van Strien 2001), a statistical package that is widely used to explore bird population trends (e.g. PECBMS 2013). TRIM analyses time-series of counts with missing observations using Poisson regression (loglinear models, van Strien *et al.* 2000). The annual indices are measures that are directly related to the total number of birds counted and are related arbitrarily to a year in order to show relative change and allow comparisons within and between species. A model with effects for each site and year (time-effect model) was used to estimate the overall trends and their standard errors. All models were run taking into account serial correlation and overdispersion.

Results

Changes in the features urban park over the years

The vegetation in urban parks underwent a number of significant changes between 1999 and 2011 (Table 1). Trees grew (the abundance of trees with greater diameters at breast height increased) and tree cover slightly increased. Tree species richness increased but not significantly. Shrubs were on average 30 cm higher, but shrub cover was similar over the years. The number of pedestrians and feral cats did not change during the study period (Table 1).

Bird population trends

A total of 62,775 individual birds belonging to 21 breeding species were recorded in these urban parks between 1999 and 2012. During this period, three new species – Sardinian Warbler (since 2002), Long-tailed Tit *Aegithalos caudatus* (since 2005) and Magpie *Pica pica* (since 2011) – began breeding in the city's urban parks. Woodchat Shrikes *Lanius senator* started to breed again in 2006 after an absence of eight years, but Grey Wagtails became locally extinct in 2006. Hoopoes *Upupa epops*, Nightingales *Luscinia megarhynchos*, Melodious *Hippolais polyglotta* and Olivaceous *I. opaca* Warblers bred sporadically in few of the largest parks.

Population trends were calculated for ten breeding species. Five species declined and three increased significantly between 1999 and 2012; populations of the other two species remained stable (see Table 2, Figure 1). The steepest population declines were recorded for

Table 2. Trend estimates, standard errors, mean annual percentage changes with confidence intervals (CI) and trend classifications for bird species in urban parks in Valencia between 1998 and 2013.
Estimació de les tendències, errors estàndards, percentatge de canvi anual amb intervals de confiança (CI) i classificació de les tendències de les espècies d'aus als parcs urbans entre 1998 i 2013.

Species *Espècie*	**Season** *Estació*	**Trend ± SE** *Tendència ± SE*	**P**	**Mean % Annual Change** *% Mitjana canvi anual*	**95% CI**	**Trend classification** *Classificació tendència*
Collared Dove *Streptopelia decaocto*	Breeding	0.988 ± 0.005	*P* < 0.05	-1	(-2, -0.1)	Moderate decline
Rock Dove *Columba livia*	Breeding	1.049 ± 0.022	*P* < 0.05	5	(0.5,9)	Moderate increase
Blackbird *Turdus merula*	Breeding	1.002 ± 0.004	*n.s.*	0.2	(-0.6, 1)	Stable
Great Tit *Parus major*	Breeding	0.981 ± 0.008	*P* < 0.01	-2	(-3, -0.1)	Moderate decline
Spotted Flycatcher *Muscicapa striata*	Breeding	1.031 ± 0.006	*P* < 0.01	3	(1, 4)	Moderate increase
Spotless Starling *Sturnus unicolor*	Breeding	1.026 ± 0.011	*P* < 0.05	3	(0.2, 5)	Moderate increase
House Sparrow *Passer domesticus*	Breeding	0.897 ± 0.006	*P* < 0.01	-11	(-12,-9)	Steep decline
Serin *Serinus serinus*	Breeding	1.015 ± 0.011	*n.s.*	1	(-0.5, 3)	Stable
Greenfinch *Carduelis chloris*	Breeding	0.944 ± 0.011	*P* < 0.01	-5	(-7, -3)	Moderate decline
Goldfinch *Carduelis carduelis*	Breeding	0.943 ± 0.011	*P* < 0.01	-5	(-7, -3)	Moderate decline
White Wagtail *Motacilla alba*	Wintering	0.971 ± 0.006	*P* < 0.01	-3	(-4,-1)	Moderate decline
Robin *Erithacus rubecula*	Wintering	0.983 ± 0.005	*P* < 0.05	-1	(-3, -0.5)	Moderate decline
Black Redstart *Phoenicurus ochruros*	Wintering	0.977 ± 0.008	*P* < 0.01	-2	(-4, -0.5)	Moderate decline
Sardinian Warbler *Sylvia melanocephala*	Wintering	1.009 ± 0.008	*n.s.*	1	(-0.7, 2)	Stable
Blackcap *Sylvia atricapilla*	Wintering	1.023 ± 0.007	*P* < 0.01	2	(0.7,3)	Moderate increase
Chiffchaff *Phylloscopus collybita*	Wintering	1.015 ± 0.013	*n.s.*	-1	(-1, 4)	Stable
Chaffinch *Fringilla coelebs*	Wintering	1.098 ± 0.021	*P* < 0.05	10	(5, 14)	Strong increase

the House Sparrow, Greenfinch *Carduelis chloris* and Goldfinch *Carduelis carduelis*. Conversely, Rock Dove *Columba livia* and Spotted Flycatcher *Muscicapa striata* populations underwent moderate increases.

A total of 21,771 individual birds belonging to 21 wintering species were recorded in urban parks between 1998 and 2013. Population trends were calculated for seven wintering birds, three of which declined and two increased significantly between 1998 and 2013; populations of the other two species remained stable (see Table 2, Figure 2). White Wagtail and Black Redstart *Phoenicurus ochruros* populations underwent moderate declines; the steepest population increase was in the Chaffinch *Fringilla coelebs*, whose populations grew considerably from 2007 onwards.

Discussion

The results of this study indicate that the populations of species most dependent on the tree and shrub layer (i.e. woodland species in a broad sense) have increased or have remained stable over the last fifteen years (e.g. Spotted Flycatcher, Blackbird *Turdus merula* and Blackcap). Furthermore, colonisation events by breeding species involved mostly woodland/shrubland birds (Long-tailed Tit and Sardinian Warbler). Further evidence of this gradual shift towards woodland bird communities is the recent (spring 2013) addition of Wood Pigeon *Columba palumbus* and Crested Tit *Lophophanes cristatus* to the breeding bird assemblage in the surveyed parks; as well, Western Bonelli's Warbler *Phylloscopus bonelli*

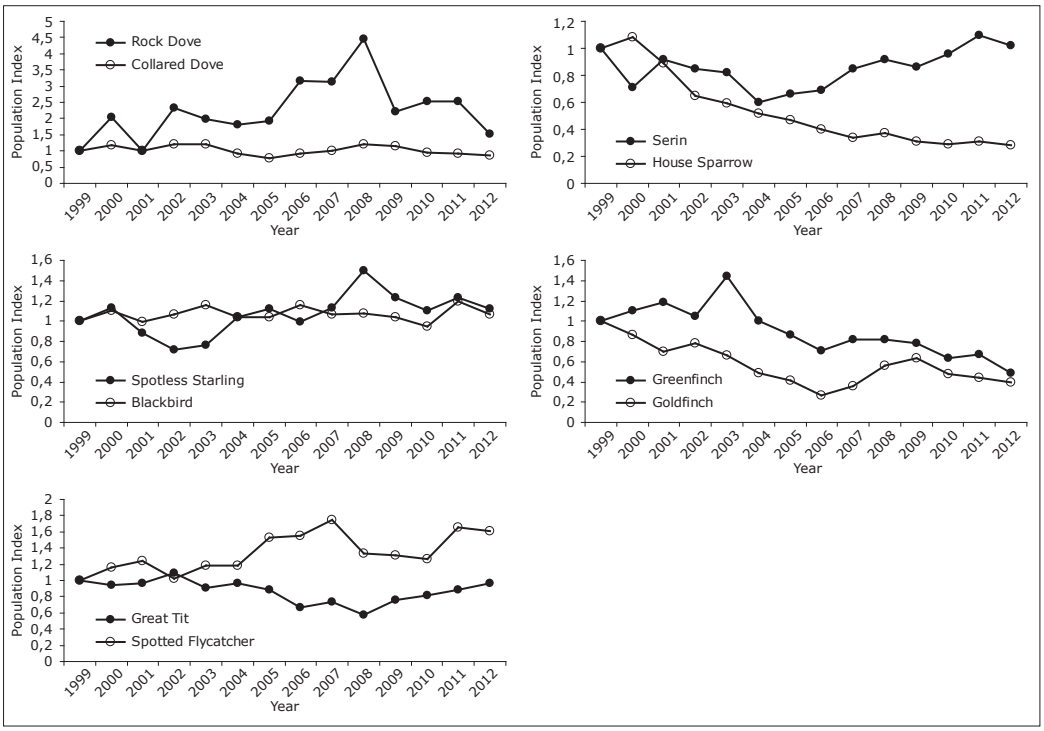

Figure 1. Population trends in 10 common breeding bird species in urban parks in Valencia between 1999 and 2012.
Tendències poblacionals de les aus reproductores (Rock Dove: Colom roquer; Collared Dove: Tórtora turca; Serin: Gafarró; House Sparrow: Pardal comú; Spotless Starling: Estornell negre; Blackbird: Merla; Greenfinch: Verdum; Goldfinch: Cadernera; Great Tit: Mallerenga carbonera; Spotted Flycatcher: Papamosques gris) als parcs urbans de València entre 1999 i 2012.

has bred since 2011 in two parks not included in this study (author unpubl. data). In contrast to this expansion by woodland species, many species confined to open habitats (e.g. Black Redstart) have declined and several such as the House Sparrow and Goldfinch have decreased dramatically. Overall, this picture is congruent with the increasing suitability of urban parks for woodland species due to growth of the tree and shrub layers (e.g. Wilson *et al.* 2006) and a concomitant reduction in the habitat available for certain open habitats species such as the House Sparrow (Mitschke & Mulsow 2003). Nevertheless, changes in the habitat structure in urban parks between 1998 and 2013 were quite small (e.g. the tree cover only increased by around 2%), which suggests that changes in habitat structure have probably only played a limited part in the observed population trends (for similar conclusions, see Morneau *et al.* 1999).

Some authors have indicated that human disturbance (e.g. Fernandez-Juricic & Tellería 2000) and feral cats (Lepczyk *et al.* 2003) affect urban bird populations. Although the present study did not attempt to obtain precise measurements of either factor, available evidence indicates that they have changed little over the years. Exotic bird populations are small (Murgui & Valentín 2003) and other predators such as the Peregrine Falcon *Falco peregrinus*, Common Kestrel *Falco tinnunculus* and Magpie are either rare or absent (Mustelids) in the study area, thereby suggesting that the impact of predation on the observed patterns is negligible (but see Bradley & Marzluff 2003 for the role of rodents as predators). Obviously, the population trends of some bird species will be affected by variation in other park features not investigated in this study. For instance, population trends of migratory and wintering frugivorous species (e.g. Blackcap) may be dependent on between-year variation in fruit abundance and the timing of

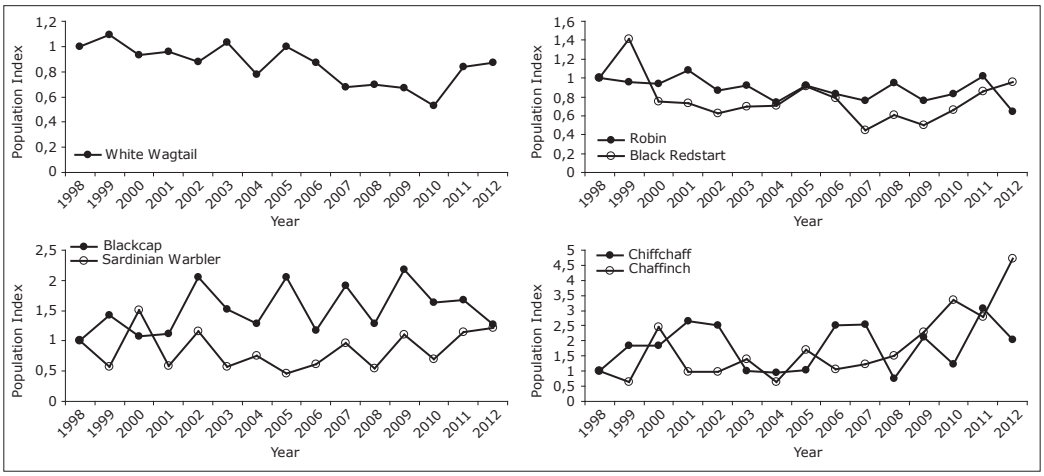

Figure 2. Population trends in seven common wintering bird species in urban parks in Valencia between 1998 and 2013 (January and February 2013 are included in winter 2012).
Tendències poblacionals de les aus hivernants (White Wagtail: Cuereta blanca; Robin: Pit-roig; Black Redstart: Cotxa fumada; Blackcap: Tallarol de casquet; Sardinian Warbler: Tallarol capnegre; Chiffchaff: Mosquiter comú; Chaffinch: Pinsà comú) als parcs urbans de València entre 1998 i 2013 (gener i febrer 2013 estan inclosos a l'hivern 2012).

the ripening of fleshy fruits produced by tree and bush species such as *Ligustrum japonicum* and *Cotoneaster horizontalis* (e.g. Gleditsch & Carlo 2011), and by changes in fruit availability due to pruning aimed at keeping the park tidy, as occurs in Valencia (author pers. obs.).

The influence of the park features outlined above does not seem to satisfactorily explain the population trends occurring in many bird species and so other factors operating at larger spatial scales are probably involved (e.g. Litteral & Wu 2012). In Valencia, an immediate candidate

Table 3. Comparison of population trends in breeding bird species at different spatial levels (Valencia-Catalonia-Spain). Given values are the mean annual percentage of change. Data obtained from Escandell (2011) and ICO (2013). RC: recent colonization.
Tendències poblacionals de les espècies d'aus reproductores a diferents nivells espacials (València-Catalunya-Espanya). Els valors mostrats són mitjanes anuals de canvi. Dades obtingudes d'Escandell (2011) i ICO (2013). RC: colonització recent.

Species ***Espècies***	**Spain [1998-2011]**	**Catalonia [2002-2012]**	**Valencia [1998-2012]**
Collared Dove *Streptopelia decaocto*	15.3	3	- 1
Rock Dove *Columba livia*	0.3	1	5
Blackbird *Turdus merula*	1.2	1	0.2
Sardinian Warbler *Sylvia melanocephala*	- 0.3	2	RC
Long-Tailed Tit *Aegithalos caudatus*	- 1.2	1	RC
Great Tit *Parus major*	1.2	1	- 2
Spotted Flycatcher *Muscicapa striata*	- 1.2	1	3
Magpie *Pica pica*	- 1.1	0	RC
Spotless Starling *Sturnus unicolor*	1.2	1	3
House Sparrow *Passer domesticus*	- 1.2	- 2	- 11
Serin *Serinus serinus*	- 1.7	- 3	1
Greenfinch *Carduelis chloris*	1.8	- 3	- 5
Goldfinch *Carduelis carduelis*	- 1.4	- 4	- 5

would be the conversion of 20% of farmland and wasteland on the outskirts of the city into built-up areas and urban parks (see Study Area). An increase in the number of urban parks implies greater availability and spatial connectivity of this habitat type, which will benefit population sizes and the dispersal of woodland species (Tremblay & St. Clair 2011). On the other hand, given that populations of species confined to open habitats use wasteland and farmland on the outskirts of the city for feeding, a loss of these habitats will entail fewer plant resources for granivorous species, which may lead to reduced survival rates in winter (Siriwardena *et al.* 1999), and a shortage of invertebrates during the breeding season, which will negatively affect the feeding of nestlings (e.g. Peach *et al.* 2008). Furthermore, a decrease in the surface area of wasteland and farmland may reduce the size of the breeding and wintering bird populations inhabiting these habitats, which could act as population sources for urban parks (e.g. McKenzie *et al.* 2007, Hedblom & Söderström 2010). Not all population trends corresponding to species confined to open habitats, however, can be satisfactorily explained by a reduction in wasteland and farmland on the city's periphery. Population trends of Serins were stable, while Chaffinch numbers greatly increased, which can probably be explained by their use of resources provided by grass lawns (unlike Goldfinches). Furthermore, I believe that Chaffinch populations may have taken advantage of the decline in House Sparrow numbers, which could have led to a decrease in the competitive interactions between these two species in winter (for an example of competition between House Sparrows and other granivorous species, see McClure *et al.* 2011), although this issue still needs further work.

Population dynamics in urban green spaces may also reflect population trends operating at much larger spatial levels (Cannon *et al.* 2005). In Valencia, overall breeding bird population trends coincide with those reported for Catalonia (ICO 2013) and Spain (Escandell 2012), in which a decrease in species linked to open habitats and an increase in woodland species has been observed (Table 3). These coincidences suggest that population dynamics in urban parks may occur quite independently of changes in habitat features and in the landscapes surrounding parks. For instance, the increase of Magpies in the urban parks of Valencia is mostly related to the expansion of this species into Spanish coastal areas (Martínez *et al.* 2003). Similarly, the warmer winters occurring in recent decades have probably led to a northwards shift in the wintering grounds of some species, as has been documented elsewhere (e.g. in the Blackcap; Doswald *et al.* 2009). It should be noted that not all patterns at local and large spatial scales coincide. For instance, the Spotted Flycatcher population underwent no significant increase or decline in Europe in 1990–2013 (PECBMS 2013) but populations have increased significantly in the urban parks in Valencia. Nevertheless, this discrepancy could have arisen because, as previous research has indicated, Spotted Flycatcher breeding success is greater in gardens than in woodland and farmland (Stevens *et al.* 2007). This example illustrates well the need for detailed ecological studies in order to obtain a full understanding of the observed population trends.

Summarizing, this study demonstrates that bird monitoring programs carried out in cities are necessary for detecting the decline of certain species (the House Sparrow as a paradigmatic example) and may provide information on the processes operating behind observed patterns. My results also give some support to the idea that population dynamics in urban settings are influenced by factors operating at different spatial scales (for a review, see Evans *et al.* 2009). Therefore, integrative management of urban areas that pays attention both to patch scale and large-scale processes (Hostetler 1999, Goddard *et al.* 2009) is likely to be the most judicious approach for implementing policies addressing the conservation of bird fauna in cities.

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Resum

Tendències poblacionals de les aus reproductores i hivernants als parcs urbans: un estudi al llarg de 15 anys (1998-2013) a València, Espanya

Les dinàmiques a llarg termini de les poblacions d'aus constitueixen un tema rarament tractat en estudis

ecològics de zones urbanes. L'objectiu d'aquest estudi és documentar les tendències poblacionals de les aus als parcs urbans i identificar alguns del processos que produeixen els patrons observats. Des de 1998 fins a 2013 les aus foren censades mensualment en 22 parcs urbans públics de València (Espanya). A més, l'estructura de l'hàbitat als parcs urbans fou obtinguda al 1999 i al 2011. De les deu espècies reproductores, de les quals fou possible obtenir tendències poblacionals, cinc mostraren una disminució dels seus efectius, i va ser especialment notable en el cas del Pardal comú *Passer domesticus*. De la mateixa manera, de set espècies hivernants (per exemple la Cotxa fumada *Phoenicurus ochruros*), tres mostraren davallades. En conjunt, les espècies lligades a ambients forestals van incrementar o romandre estables alhora que les espècies pròpies d'ambients oberts van disminuir. A l'escala dels parcs, aquestes tendències poblacionals van ocórrer en paral·lel a lleugers canvis en les característiques del parcs. A l'escala del paisatge, la pèrdua d'un 20% de solars i conreus a les rodalies de la ciutat i un increment concomitant de la superfície de parcs urbans probablement influïren sobre els patrons observats. Addicionalment, les tendències poblacionals registrades als parcs coincideixen en línies generals amb les tendències observades en àmbits geogràfics més amplis (Espanya i Catalunya). Aquests resultats donen suport a la idea que les dinàmiques poblacionals de les aus hivernants i reproductores a les àrees urbanes estan influenciades per factors que operen a diferents escales espacials. Per tant, a fi i efecte d'augmentar la biodiversitat urbana, la gestió de les zones urbanes hauria de tenir en compte processos que operen tant a les parcel·les d'hàbitat com al paisatge que les envolta.

Resumen

Tendencias poblacionales de las aves invernantes y reproductoras de los parques urbanos: un estudio a lo largo de 15 años (199-2013) en Valencia, España

Las dinámicas a largo plazo de las poblaciones de aves constituyen un tema pocas veces abordado en las investigaciones ecológicas realizadas en las áreas urbanas. El objetivo de este estudio es documentar las tendencias poblacionales de las aves en parques urbanos e identificar algunos de los procesos que dan lugar a los patrones observados. Entre 1998 y 2013 las aves fueron censadas mensualmente en 22 parques urbanos públicos de la ciudad de Valencia (España). Además, la estructura del hábitat en los parques urbanos se obtuvo en 1999 y 2011. De las diez especies reproductoras, de las cuales fue posible obtener las tendencias poblacionales, cinco disminuyeron (en especial el Gorrión común *Passer domesticus*); similarmente, de las siete especies invernantes (por ejemplo, el Colirrojo tizón *Phoenicurus ochruros*) tres decrecieron. En conjunto, las especies ligadas a medios forestales aumentaron o permanecieron estables, mientras que las propias de espacios abiertos disminuyeron. A la escala del parque, estos resultados coincidieron con pequeños cambios en la estructura del hábitat; a escala del paisaje, se dieron en paralelo a la pérdida de un 20% de superficie de solares y cultivos en la periferia y a un aumento concomitante de la superficie de parques urbanos, factores que probablemente influyeron en los patrones observados. Adicionalmente, las tendencias poblacionales registradas en los parques coincidieron en líneas generales con las observadas en ámbitos territoriales amplios (Cataluña y España). Estos resultados apoyan la idea de que las dinámicas poblacionales de las aves reproductoras e invernantes en las áreas urbanas están influidas por factores que operan en diferentes niveles espaciales. Por tanto, con el fin de aumentar la biodiversidad urbana, la gestión de las áreas urbanas debería tener en cuenta los procesos que operan tanto en las parcelas de hábitat como en el paisaje que las rodea.

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