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Bird Census News is the Journal of the European Bird Census Council or EBCC. The EBCC exists to promote the organisation and development of atlas, census work and population studies in all European countries; it promotes communication and arranges contacts between organisations and individuals interested in census and atlas work, primarily (but not exclusively) in Europe.

Bird Census News reports developments in census and atlas work in Europe, from the local to the continental scale, and provides a forum for discussion on methodological issues.



Cover illustration by Martí Franch

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**Bird Census News**
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# EDITORIAL

This volume is entirely dedicated to winter land bird monitoring in Europe. On the Kiev EBCC Board meeting in spring 2015, Henning Heldbjerg came up with the idea that EBCC should try to promote winter land bird counting programmes in Europe. Compared to breeding bird schemes, projects targeting winter land birds have received much less attention. Although some schemes have been running for many years and in various countries, there was clearly a need for a good review of former and still running counting programmes. This would be the first step. The Board decided to go ahead with this.

A questionnaire was sent out to the EBCC network and a presentation on the preliminary results was presented in November 2015 at the EBCC Workshop in Mikulov. We tried to stimulate scheme co-ordinators to write an article for a thematic volume of Bird Census News on winter land bird monitoring. All this information could serve as a starting point for possible initiatives of national an European winter monitoring projects on this group of birds, but also for setting up international research using winter land bird data from a wider range. Within the framework of the development of integrated bird monitoring under the EBCC umbrella, working close together with various partners, the winter land bird counts could as well become a useful element within this enlarging data network.

For this volume we received a number of contributions from across the whole of Europe and dealing with a variety of monitoring schemes and their use. First, we present the results of the questionnaire by Henning Heldbjerg and co-authors. Aleksi Lehikoinen analyses the long-term data from winter counts along routes in Finland. Denmark is another country with a long tradition of counting winter birds. Thomas Vikstrøm gives a review of three schemes that have been running using different methods: point counts, line transects and garden bird surveys. Mark Herremans and co-authors report on a small scale point-transect count project that has run for 27 years in Flanders (Belgium). Sergi Herrando and co-authors show the opportunities and constraints of using a common bird monitoring scheme in Catalonia (NE Spain) to develop a multispecies winter indicator. In Great Britain, the Garden BirdWatch project is currently the only national passerine monitoring scheme that runs through winter. Kate Risely and co-authors learn us more about their data and research. From the southeastern limits of Europe, Nicolaos Kassimis and Christos Mammides present the results of their winter bird survey using road transects. We conclude this volume with a winter atlas project. Ran in Spain from 2007 to 2010 and co-ordinated by Juan Carlos Del Moral and co-authors, the results clearly show the importance of this country as wintering area for many birds from north and central Europe.

Enjoy this volume!

Anny Anselin
Editor Bird Census News

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# The status of winter land bird monitoring in Europe

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**Abstract.** During the last 40 years common breeding bird monitoring schemes have spread and improved across Europe. The corresponding winter land bird projects did not receive the same attention. This paper attempts to give an overview of the ongoing winter land bird monitoring projects based on the information provided by respondents of a questionnaire sent out to the EBCC network and a presentation on the preliminary results at the 2015 EBCC workshop in Mikulov, Czech Republic. This information could serve as a starting point for possible initiatives of national and European winter monitoring projects on this group of birds.

## Introduction

Reviews of European breeding bird monitoring schemes show that during the last 40 years, many projects developed across Europe (Hustings 1988, Hustings 1992, Kwak & Hustings 1994, Marchant et al. 1998 a,b, Vorisek & Marchant 2003, Klvaňová & Voříšek 2008). This has been mainly stimulated by the activities of the former International Bird Census Commitee (IBCC), and since 1992 the European Bird Census Council (EBCC), and its partners.

The development of the Pan-European Common Bird Monitoring Scheme (PECBMS) set up in 2002 resulted in a significant increase of new schemes all over Europe during the following decade. The main aim of the PECBMS project was to use common breeding birds as indicators of the general state of nature, using large-scale and long-term monitoring data on changes in breeding populations across Europe (Gregory et al. 2005).

Lacking a similar initiative, monitoring projects targeting wintering land birds received much less attention, although a quick look at the literature and the ”Country Reports” at the EBCC website shows that some schemes have been running for many years, even back to the late 1950-ties (Finland; Lehikoinen 2016) and various countries have gathered substantial long-term data. However, a good review of former and still running winter landbird monitoring schemes is not ready available.

The aim of this paper, initiated by the EBCC board and the editorial group of Bird Census News, is therefore to present an overview of both ongoing and finished winter landbird monitoring programmes across Europe.

## Data collection

Winter land bird monitoring programmes are carried out by different organisations across Europe. The spatial coverage varies from country level to regions or even cities and there is a variety of methods used to describe the abundance and the distribution of different species.

### *Questionnaire*

In order to update information on winter land bird monitoring programmes undertaken across Europe we used the EBCC network and sent out an on-line questionnaire to all national delegates asking them to fill this in and/or forward the link to other relevant people in their country that could complete it.

The questions were related to the following types of programmes:

- Systematic annual common bird monitoring (abundance)

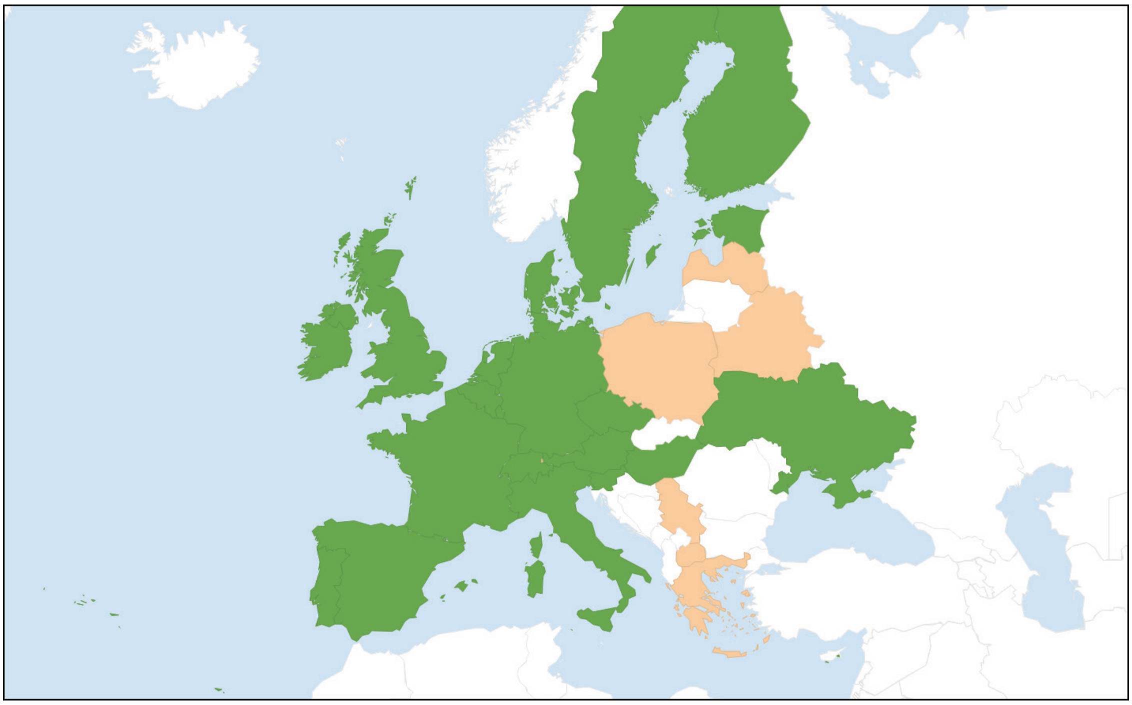

**Figure 1. Map showing the countries with responses to an EBCC Questionnaire plus additional information in October 2015 about winter land bird monitoring programmes. Countries in green have some kind of winter bird monitoring, countries in orange have no winter bird monitoring neither now nor in the past. We have no information on winter land bird monitoring in countries in white.**

- Atlas (distribution)
- Garden bird counts
- Species-focused studies ('Other projects')

For each of these we asked for information on the methods used, the number of participants, the time-span of the project and the timing of the monitoring. We also asked for references to scientific papers and reports plus links to relevant websites.

We spread the questionnaire in October 2015 in order to be able to present the results on the EBCC workshop in Mikulov, Czech Republic in early November 2015 (EBCC 2016, Heldbjerg et al. 2015). Besides giving an updated information to the workshop participants, we wanted to stimulate them to fill the gaps in this overview and to consider the possibility of starting a new winter monitoring scheme in their country. We also asked them to deliver manuscripts on the results of their ongoing winter monitoring projects for a thematic volume of Bird Census News (2016/29:1–2; i.e. this volume).

## Results

We received 53 unique responses from 26 countries to the questionnaire (Figure 1). As suggested and expected, most of these were only replying the parts of the questionnaire that were relevant to their country. In addition, some countries reported they did not have any wintering monitoring yet. After presenting the results of the questionnaire on the PECBMS workshop in Mikulov, we have received additional information on nine other winter monitoring schemes from three countries. In addition, we reviewed literature published on winter monitoring in Europe based on references from researchers. In this paper we joined all information available to us to present as complete overview as possible. For some monitoring projects we have, despite searching for further information, so limited information that we decided to omit it from this paper. Most of these seemed to be related to short-lived projects from smaller areas decades ago.

### *Common Bird Monitoring*

Common winter land bird monitoring schemes have been conducted in 17 areas from 12 countries and the number is still increasing (Figure 2). The Finnish winter monitoring programme was the first, starting already in the winter 1956/1957 followed by two other Nordic countries, Sweden and Denmark in 1975/1976. Slowly, during the following decades, new national programmes

**Table 1. Winter Common Land Bird Monitoring Schemes in Europe, showing countries (and eventually region), method used, number of volunteers, the first year of the study and reference.**

| Region, Country | Method | Volunteers | First Year | Reference |
|---|---|---|---|---|
| Finland | Linear transects | 1000 | 1956/1957 | Fraixedas Nuñez et al. 2015 |
| Sweden | Point counts | 235 | 1975/1976 | Green & Lindström 2015 |
| Denmark | Point counts | 300 | 1975/1976 | Fenger et al. 2015 |
| Netherlands | Point counts | 500 | 1980 | Boele et al. 2008 |
| Estonia | Linear transects | 40 | 1987 | – |
| Belgium, Flanders | Point counts | 60 | 1989 | Herremans 2007 |
| Germany, Hamburg | Linear transects | 50 | 1991/1992 | – |
| Germany , Berlin | 5 ha plots | 35 | 1994 | Witt 2014a, b |
| Germany, Schleswig-Holstein | Linear transects | 60 | 1995 | http://www.ornithologie-schleswig-holstein.de/ |
| Germany, Nordhessen | Linear transects | 55 | 1997 | – |
| Hungary | Point counts | 130 | 2000 | Szép et al. 2012 |
| Portugal | Linear transects | 20 | 2001 | – |
| Spain, Catalonia | Linear transects | 200 | 2002 | www.ornitologia.org |
| Spain | Linear transects | 700 | 2008 | – |
| Germany, Mecklenburg-Vorpommern | Linear transects | 55 | 2010 | www.oamv.de |
| Andorra | Linear transects | 16 | 2011 | http://www.iea.ad/resultats |
| France | Linear transects | 100 | 2013 | http://vigienature.mnhn.fr/ |

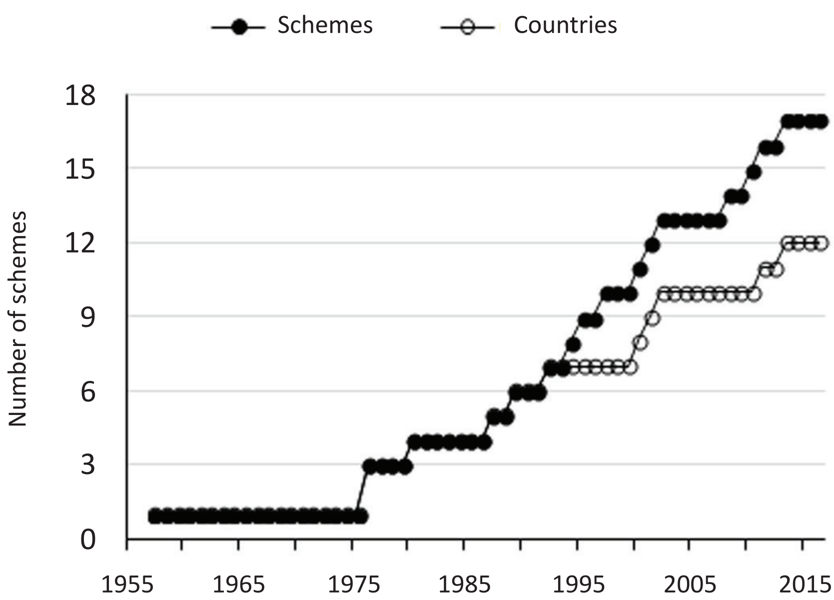


**Figure 2. The number of active Common winter land bird monitoring schemes and the number of included countries across Europe in the winters 1956/1957–2015/2016.**

have started, especially in the West-European countries but also in Estonia and Hungary (see Table 1). The majority of the earlier programmes use point counts as the method whereas most of the recent ones use linear transects. Successful winter monitoring projects attract up to 1000 volunteers in Finland and 700 in Spain annually.

### *Atlas*

We have information on 17 winter atlas studies in 12 countries (see Table 2). In seven European countries early studies were conducted during the the 80's and 90's. Recent atlas studies are from 2006 and hereafter. Almost half of the studies are reported as being genuine atlas studies; the re-

**Table 2. Winter Bird Atlases in Europe, showing countries (and eventually region), type of study, grid size, study period and reference.**

| Country, Region | Type | Grid (km) | Years | Reference |
|---|---|---|---|---|
| Slovenia | Atlas | 10×10 | 1979–1993 | Sovinc 1994 |
| United Kingdom | Atlas | 10x10 | 1981/82–1983/84 | Lack 1986 |
| Czech Republic | Atlas | 10x12 | 1982–1985 | Bejček et al. 1995 |
| Italy, Lombardy | Atlas | 10x10 | 1986/87 | Fornasari et al. 1992 |
| Germany, Baden-Württemberg | Atlas | 11x12 | 1987/88–1992/93 | Bauer et al. 1995 |
| Ukraine, some areas | Atlas | 10x10 | 1980–1990´s | Gorban et al. 1989 |
| France | Atlas | | the 90´s | Yeatman-Berthelot & Jarry 1991 |
| Portugal, Baixo Alentejo | Atlas | 10x10 | 1992/93–1994/95 | Elias et al. 1998 |
| Spain, Madrid | Density studies | 10x10 | 2007–2010 | SEO/BirdLife 2012 |
| Switzerland | Atlas | 10x10 | 2009/10–2014/15 | www.ornitho.it |
| Slovenia, Ljublana | Density studies | 10×10 | 2010–2011 | Tome et al. 2011 |
| Spain, Catalonia | Atlas | 10×10 | 2006–2009 | Herrando et al. 2011 |
| United Kingdom | Atlas | 10×10 | 2007–2011 | Balmer et al. 2013 |
| France | Atlas | 10×10 | 2009–2013 | Issa & Muller 2015 |
| Portugal | Atlas | 10x10 | 2011–2013 | http://www.spea.pt/en/ |
| Netherlands | Atlas/Density studies | 5x5 | 2012–2015 | www.sovon.nl |
| Denmark | Density studies | 5×5 | 2014/15–2017/18 | http://dofbasen.dk/atlas/ |

**Table 3. Garden Bird Projects in Europe, showing countries (and eventually region), project focus, number of volunteers, study period and reference.**

| Country, Region | Project | Volunteers | First Year | Reference |
|---|---|---|---|---|
| United Kingdom | Feeder | 250 | 1970 | http://www.bto.org/gbfs |
| Germany, Hamburg | Garden | 60 | 1987/1988 | Dien 2013, Kubetzki et al. 2012 |
| United Kingdom | Garden | 10,000 | 1995 | http://www.bto.org/gbw |
| Belgium, Wallonia | Garden | >15,000 | 2004 | Paquet et al. 2009 |
| Germany | Garden | 75 | 2005 | http://www.lbv.de/vogels-chutz/2015/01/ |
| Luxembourg | 'Winter' | 400 | 2006 | – |
| Denmark | Garden | 21,000 | 2006–2010 | Meltofte & Larsen 2015 |
| Estonia | Garden | 2,500 | 2010 | www.eoy.ee/talv |
| Austria | Feeder | 5,000 | 2010 | Teufelbauer 2014 |
| France | Garden | 5,000 | 2012 | http://www.oiseauxdesjardins.fr/ |

maining being attempts to estimate the density of the wintering birds. Up to 10,000 bird observers voluntarily participated in the atlas studies in Britain and also the atlas studies in France, The Netherlands and Switzerland involved more than thousand volunteers.

### *Garden Bird projects*

The questionnaire gathered information on 10 garden bird projects from eight countries mainly in West and Central Europe (Table 3). Early feeder/garden projects are found in Britain from 1970 and in Hamburg, Germany from the winter 1987/1988, but the majority date from the last decade. Garden bird projects may attract a very large number of participants and reported numbers as 2,500 from Estonia, 15,000 from Wallonia, Belgium and 76,000 from Germany are amazing.

### *Other projects*

We received information on a number of 'Other projects'. These are monitoring projects focused on special species or groups of species. Thrushes were monitored in UK during two winters 2012/13 and 2013/2014, Buzzards are monitored in the Czech Republic since 1984 (Řepa 2002), raptors in Austria since 2001, raptors in Estonia since 2014 (Väli 2014), Great Grey Shrikes in Slovenia since 2000 (Bombek 2001, 2002), and Lapwings and Golden Plovers in Cyprus since 2005.

## Discussion

This paper presents an overview of wintering bird monitoring schemes in Europe. Most of the schemes are conducted in North and West Europe, which is a similar pattern as in case of breeding bird surveys a few decades ago. The different monitoring projects vary in methods, number of participants and in spatial as well as temporal scale. The results may act as a starting point for spreading the interest in winter monitoring and for a discussion on the potential use of the results. More complex data on the winter period could contribute to explain the causes of population changes as well as changes in distribution in many bird species in relation to climate change. There are several options for collaboration on this, which proves a recent study on climate change covering all winter land bird data from The Netherlands in the south to Finland in the north (Lehikoinen et al. 2016). Within the framework of the development of integrated bird monitoring under the EBCC umbrella, working close together with various partners, the winter land bird counts could as well become a useful element within this enlarging data network.

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# Winter bird counts in Finland

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**Abstract.** Wintering birds have been monitored in Finland using freely chosen line transects (c. 10 km long) since 1956/1957. The survey effort has been relatively constant between 423 and 632 routes annually for more than 50 years. There are three census seasons: 1–15 November (counted since 1975), 25 December to 7 January (since winter 1956–1957) and 21 February to 6 March (since 1967). The counts are done by volunteers (c. 1000 observers annually), often in small groups. All observed birds are counted and habitats of the counted birds as well as the amount of habitat along the routes is measured. The observers are also asked to report weather conditions, crop size of main tree species (especially rowanberries) and in recent years sex ratios of observed species if possible and amount of observed mammals. The main findings show on national level increase of urban species and decrease of forest species, but also strong increase of wintering waterbirds due to climate change. The counts are updated on a daily base by an online feedback system.

## Introduction

Winter bird counts have long tradition in Finland. The idea was adopted from the North American Christmas bird counts and the first pilot counts were conducted during the winter 1956/1957, when altogether 122 routes were counted. The counts became soon popular and since the winter 1958/1959 more than 400 routes (up to 632 routes) have been counted annually. Altogether there are almost 4000 historical routes within Finland (Figure 1).

Bird censuses have been conducted by volunteers using freely chosen routes but the Finnish Museum of Natural History sees to avoid overlap of routes. Counts are mostly done in small groups of two to three persons, which gives also a social aspect. Currently, the winter bird counts (c. 1000 participants annually) are much more popular than breeding counts. Since the censuses can be conducted in groups and the amount of species is limited, it is a good opportunity to train people for more advanced (breeding) censuses.

The Ministry of Environment has economically supported counts by covering travelling costs and accommodation for observers that conducted counts in Åland islands (16 routes), in the southwest corner of Finland. This area has the highest winter bird densities in Finland, but there are hardly any local birders. Especially for wintering waterbirds the Åland islands have become the key area in recent decades. In addition, national coordinators have encouraged to establish certain types of routes depending on the spatial coverage of the routes in the country. At least partly because of this there are no temporal trends in the annual mean latitudinal position of the routes since 1958/1959 (Fraixedas et al. 2015).

## Method

When the counts started in 1950s there was only one census season, but currently there are three applied census periods: early winter, 1–15 November (counted since 1975), mid-winter, 25 December to 7 January (since winter 1956–1957), and late winter, 21 February to 6 March (since 1967). The mid-winter censuses have still the best survey effort and coverage compared to the slightly less popular two other periods.

The census route is typically c. 10 kilometres long and routes are shorter in the north, were the amount of day light is very limited. All birds along the census routes are counted and observers are allowed to use spotting scopes if needed. Nevertheless, the recommendations are to keep to census effort as similar as possible. The maximum number of birds in one route can be tens of thousands of birds during masting years of

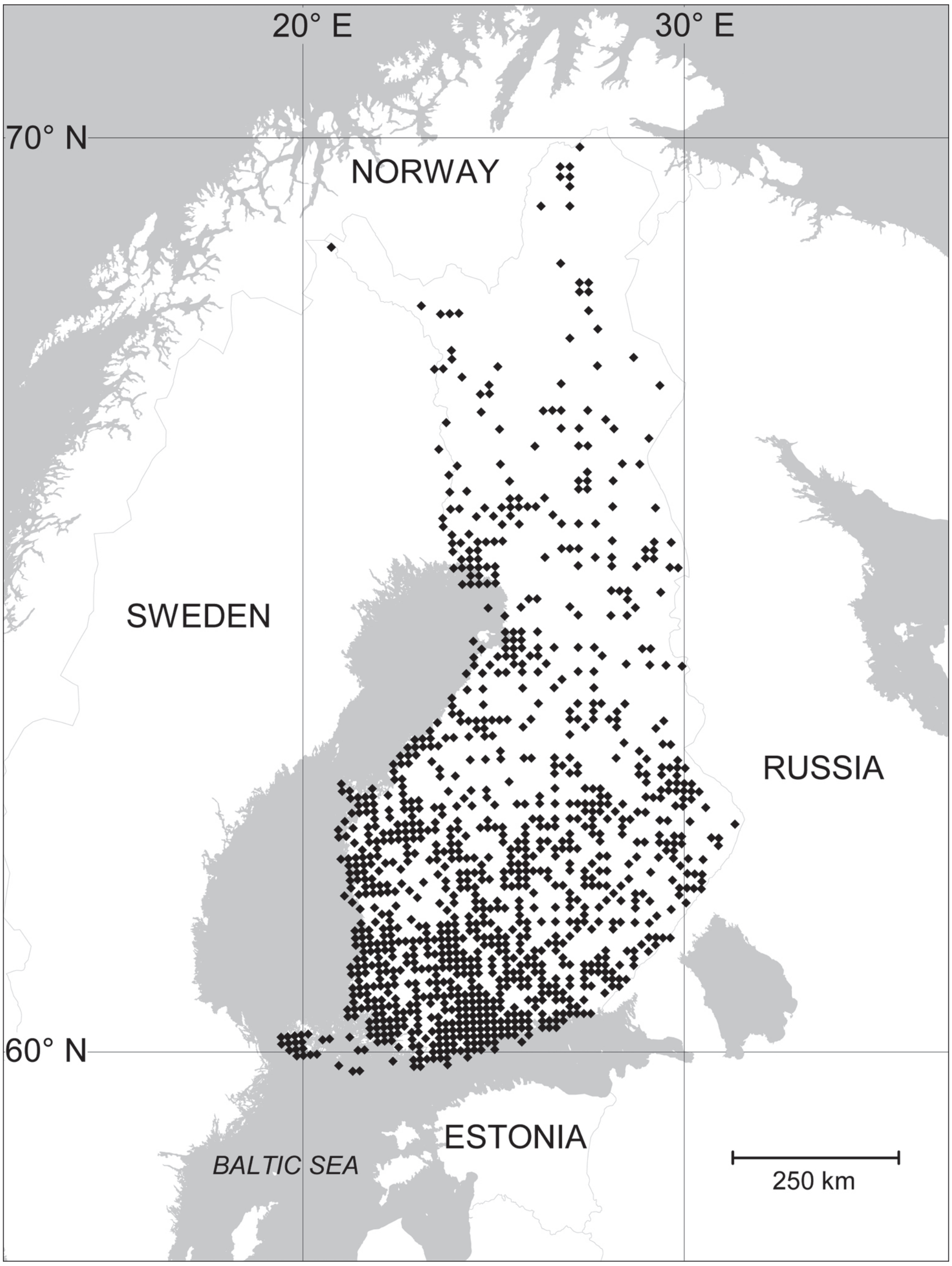


**Figure 1. Location of the winter bird census sites during midwinter counts 1958/1959–2011/2012 (from Fraixedas et al 2015)**

rowanberry due to high waxwing and fieldfare numbers, but also in some routes high waterbird concentrations can observed (especially tufted ducks). On the other hand some northernmost routes have even zero counts due to very low bird densities and very short amount of day light. Average number of birds per count in south and central part of the country is some hundreds of individuals including 15–30 species.

Finnish winter bird counts are also part of the International Waterbird Counts (IWC) that are conducted in various location in the world, especially in January. Other IWC surveys include three ship surveys and the first aerial surveys were started in the winter 2015/2016. Due to climate change the waters of Finland especially in the southwest part of the country have remained ice free and become suitable for wintering waterbirds.

The census methodology has become more accurate during the history of the counts, but the main protocol has been similar since mid-1980s. Since 1986 habitat of the observed birds have been ask to determined in eight categories. In addition, the observer should also determine how the census

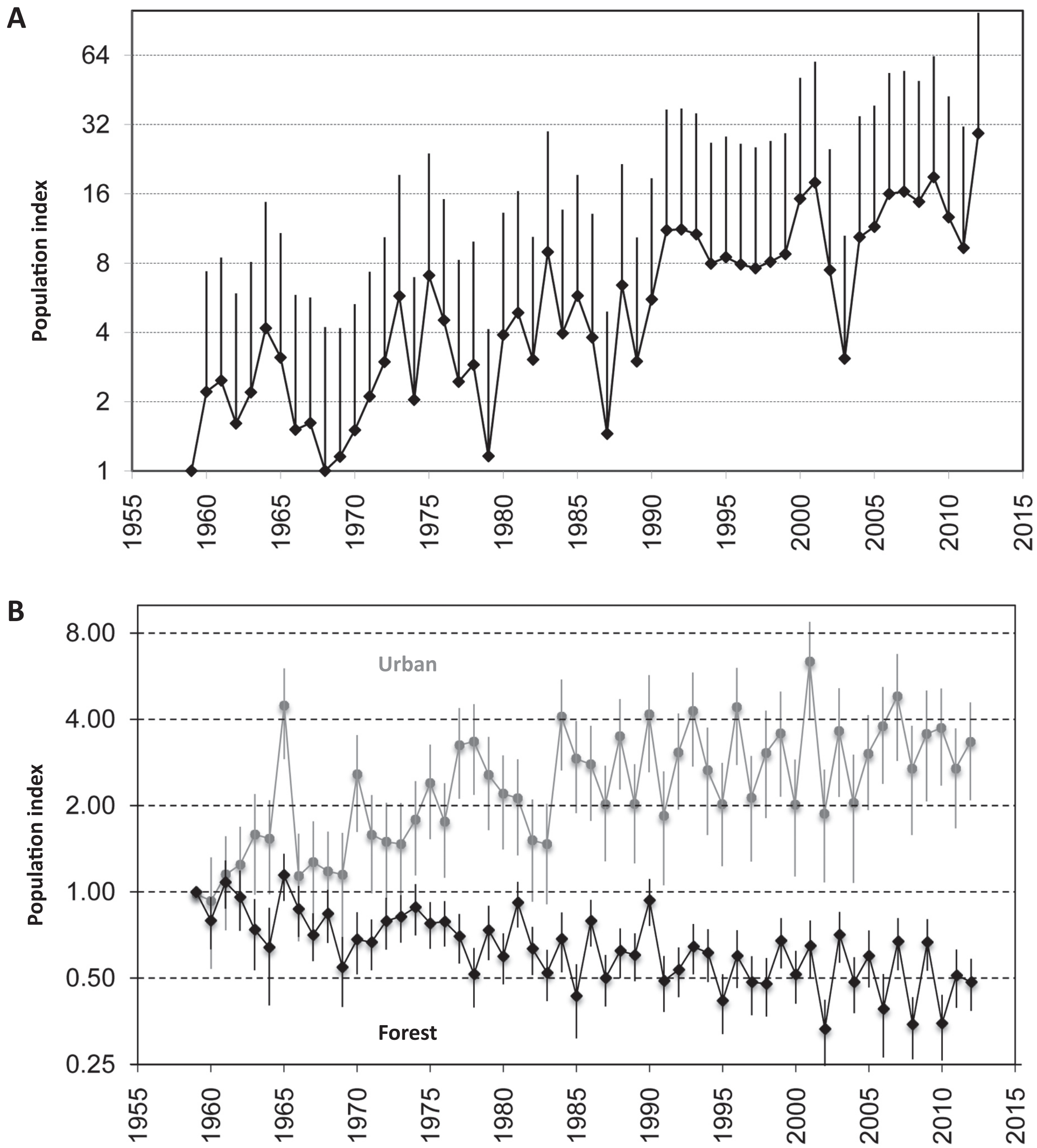


**Figure 2. Combined habitat-specific wintering population indices of (A) 10 southern waterbirds, and (B) 19 urban and 17 forest species, based on the geometric means of annual species-specific abundances in 1959–2012. Annual indices for relative population density always start from 1 (in 1959). All three indices include annual 95% confidence intervals defined as ±1.96 SE of the geometric means (Gregory et al. 2005). Redrawn from Fraixedas et al. 2015.**

route is divided into these eight habitat categories on accuracy of 100 meters. These habitat categories are: a) dumping ground or fur farm; b) urban settlement; c) rural settlement; d) arable land; e) forest; f) clear-cut area or stand of saplings; g) reed-bed or shore scrub; and h) other. The last category contains birds in water areas, in active migration flight and cases in which habitat classification has not been possible to determine. Sex ratios of species have been collected since 2010 and number of observed mammals since 2014, but both of these are not obligatory. Based on habitat data, it is known that census sites are biased towards human settlements compared to forest landscapes, which is logical as majority of people live in towns and cities. However, there are also counts in very rural landscapes conducted by skiing.

Other additional information related to census conditions are e.g. weather conditions (categorical options), snow and ice conditions (categorical options) and crop situation of rowanberry *Sorbus aucuparia*, Norway spruce *Picea abies* and Scots pine *Pinus sylvestris* (amount of berries or cones, categorical options from none to very abundant). In the case of rowanberry the observers are also asked to tell what was the initial rowanberry situation in the early autumn, which is very important information for explaining the influx of frugivorous species. The detailed methodology has been published in English by Koskimies and Väisänen (1991), which is also available on web.

## Results

The data of the counts have been used in several publications, but in general it has been underutilized and mainly published in national reports. In recent years, several papers have been however, published in international scientific journals (Figure 2). The recent trend analyses show that waterbirds and species preferring urban habitats during winter have increased, whereas abundance of forest birds have declined since late 1950s (Fraixedas et al. 2015, Meller et al. 2016). Especially the amount of diving ducks, including tufted duck *Aythya fuligula*, goldeneye *Bucephala clangula,* smew *Mergellus albellus* and goosander *Mergus merganser*, have increased rapidly and simultaneously wintering numbers on the southern edge of the flyway in Central Europe have decreased (Lehikoinen et al. 2013a, Pavón-Jordán et al. 2015). The winter bird counts have also revealed the recent drastic decline of greenfinches *Carduelis chloris* due to trichomonas parasite: the population declined 62% during 2006–2010 (Lehikoinen et al. 2013b).

The most recent publication where data has been used is a joint work together with Swedish, Danish and Dutch colleagues (Lehikoinen et al. 2016). This papers investigated winter population trends of 50 species in these four countries. The results showed that species which breed in cold areas have declined compared to species preferring warmer climatic range during breeding season in all four countries. Furthermore, populations which were situated on the cold side of their wintering range increased compared to population which were situated on the warmer side of the range. In principal, this meant that populations in Sweden and Finland had on average higher population growth rates than in southern countries, Denmark and the Netherlands. In addition, the findings showed that species preferring farmland and urban habitats during winter had declined compared to species preferring woodland habitat during winter.

The counts have an online feedback system, where general annual abundances and trends of species can be seen. The figures are updated daily bases when the volunteers have entered their data into the system. The online statistics can be seen from the web page of the Finnish Museum of Natural History at http://rengastus.helsinki.fi/tuloksia/Talvilintulaskenta/.

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# Land bird winter counts by DOF/BirdLife Denmark

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**Abstract.** For about 30 years DOF carried out land bird winter counts solely through the winter component of our Common Bird Monitoring by point counts. In the years 2007–2011, however, DOF took part in an online winter garden bird survey, and at present, winter line transects form a part of the third Danish bird atlas 2014–2018.The **Point Count Census** (1975– ) is based on a free choice of sites and is conducted by volunteers who select their own route consisting of 10–20 points, which are surveyed annually between December 20th and January 20th. After two **Atlas** winter seasons now more than 1,000 line transects have been carried out by 450 volunteers, corresponding to 59 % of all winter transects in this project and far more than the project goal. During the **Danish winter garden bird survey 2007–2011**, the Danish public was invited to record maximum numbers of birds in gardens and similar areas in January and February. A total of 13,224 people reported 240,756 counts from 16,882 gardens, giving a grand total of more than 9 million individuals of 194 bird species.

## Introduction

Denmark has a 40 year tradition of systematic land bird winter counts. For about 30 years this was solely through the winter component of DOF's Common Bird Monitoring by point counts, but in the years 2007–2011 DOF took part in an online winter garden bird survey, organised by the company ConDidact, and at present, winter line transects form a part of the ongoing third Danish bird atlas 2014–2018. In the following these three projects are described separately.

## Common Bird Monitoring 1975–

The Common Bird Monitoring is run by DOF/BirdLife Denmark with financial support from the Danish Ministry of Environment until 2017. The Point Count Census is based on a free choice of sites at which to conduct point counts, and is conducted by volunteers who select their own route consisting of 10–20 points, which are surveyed annually between December 20th and January 20th. For the past two decades, the number of routes surveyed has been relatively stable (Figure 1), and although the routes are neither randomly nor systematically distributed, they are found in all parts of the country (Figure 2).

In addition to counting birds, the habitat surrounding each point is characterized by ascribing each of the four quadrants around the point to one of nine habitat categories. Data may be submitted to BirdLife Denmark by filling out a paper form or by use of the web-based database DOFbasen. Indices and trends for 80 wintering species are calculated using the software TRIM (TRends and Indices for Monitoring data), which is suitable for analysing long time series of counts with missing values. For each species the index is set to 100 in the first year for which there is sufficient data to calculate an index.
The indices can be found at www.dof.dk/punktindeks. The five species with the most considerable long-term increases are Greylag Goose *(Anser anser)*, Raven *(Corvus corax)*, Canada Goose *(Branta canadensis)* (Figures 3,4 & 5), Cormorant *(Phalacrocorax carbo)* and Whooper Swan *(Cygnus cygnus)*. Of these five species Cormorant, Greylag Goose and Raven have also shown considerable, long-term increases as breeding birds. Greylag Goose has been through a development from being a true migrant wintering in Spain and later the Netherlands to now being a more resident species in Denmark, an increase which can be explained by the generally milder winters, autumn sowing of crops and contraction of the hunting

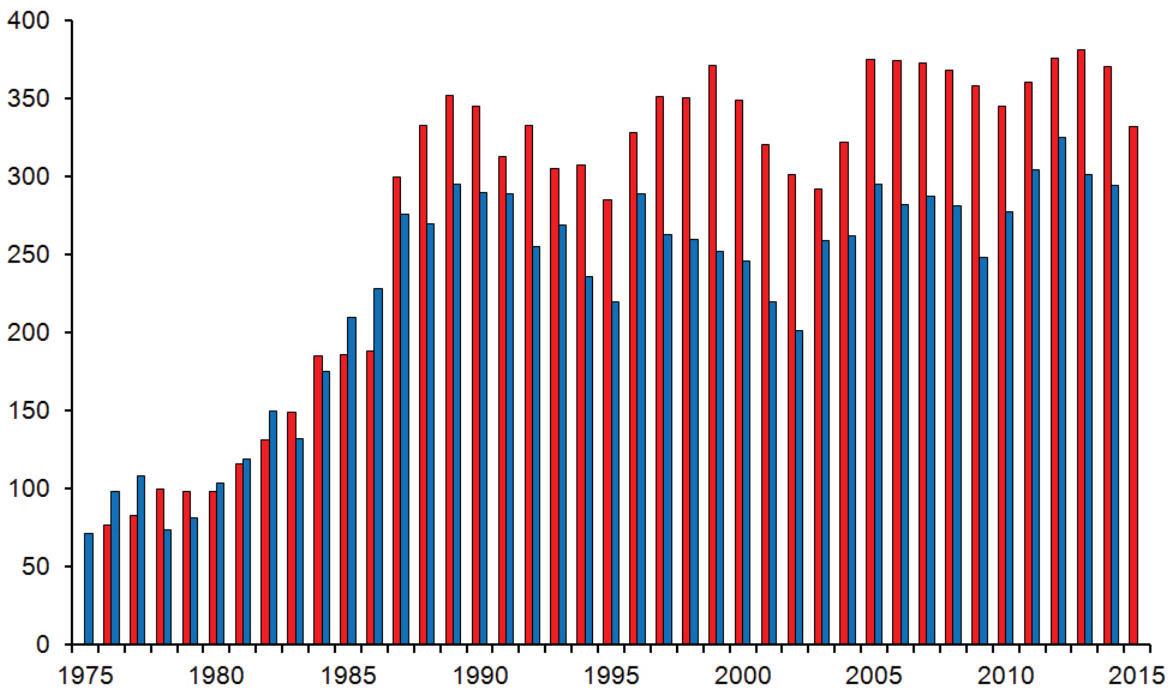


**Figure 1. Numbers of point count routes conducted in the Danish Common Bird Census. Blue columns: Winter counts; red columns: Breeding season counts.**

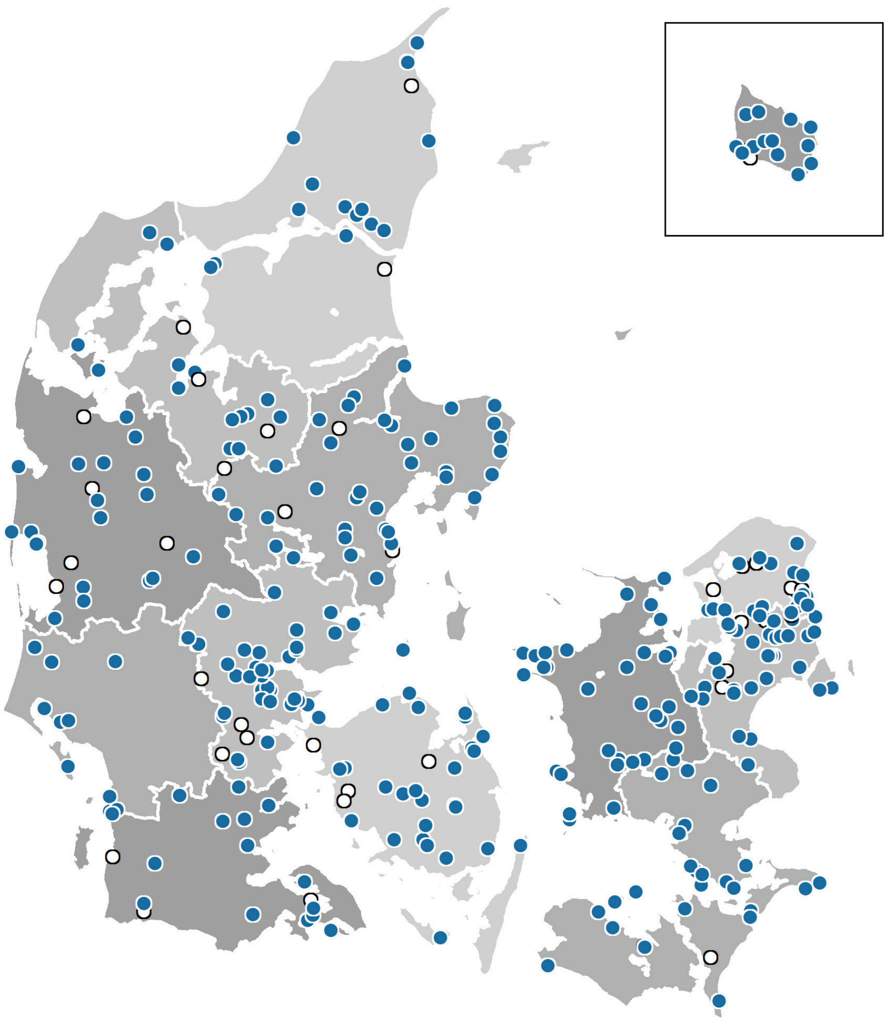

**Figure 2. Distribution of winter counts of the Danish Common Bird Census during the winter 2014–2015.**

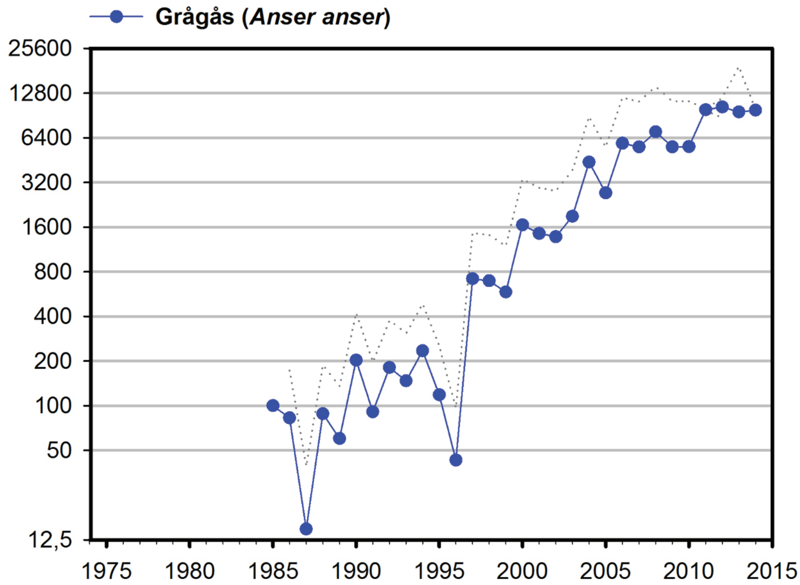


**Figure 3. Long-term increasing trend of Greylag Goose, *Anser anser,* based on the data from the Danish Point Count Census monitoring project.**

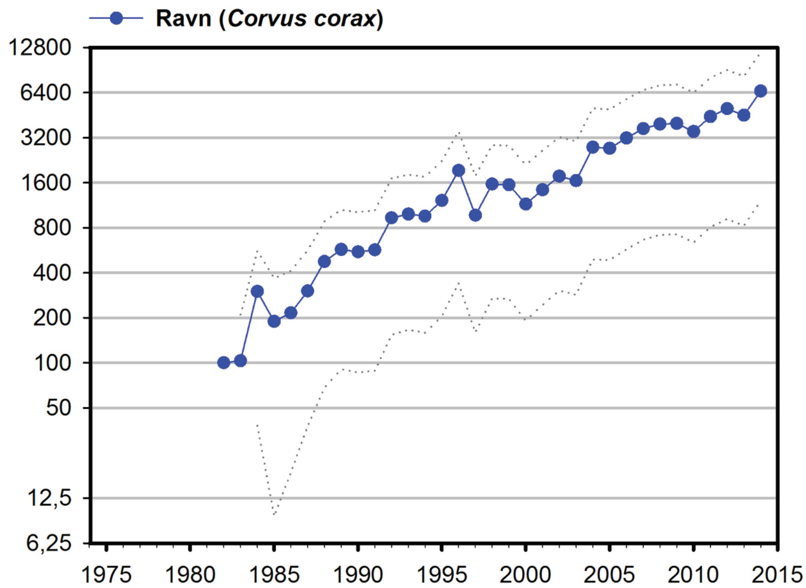


**Figure 4. Long-term increasing trend of Raven, *Corvus corax,* based on the data from the Danish Point Count Census monitoring project.**

season. The same applies for Whooper Swan, while Cormorant and Raven increases are due to intensive persecution of both species ceasing in about 1970.

The five species with the most considerable long-term decreases are Twite *(Carduelis flavirostris)*, Grey Partridge *(Perdix perdix)*, Dipper *(Cinclus cinclus)*, Rough-legged Buzzard *(Buteo lagopus)* and Meadow Pipit *(Anthus pratensis)*.

For Rough-legged Buzzard the decrease is explained by generally low productivity in the Northern Scandinavia breeding area due to low populations of the most important prey species, the lemming. Grey Partridge shows a considerable long-term decrease as a result of intensified agriculture. For Meadow Pipit the trend seems to show that the part of the population that overwinters in Denmark was near to extinction in the hard winter of 2009–2010, but now is recovering. Regarding Dipper, ringing has shown that most of the Danish wintering population comes from Norway; this breeding population is suspected of being in decline. This may be due to local (earlier) acidification and increased regulation of watercourses. Ringing has shown the Danish wintering Twite population breed mainly in Norway, too.

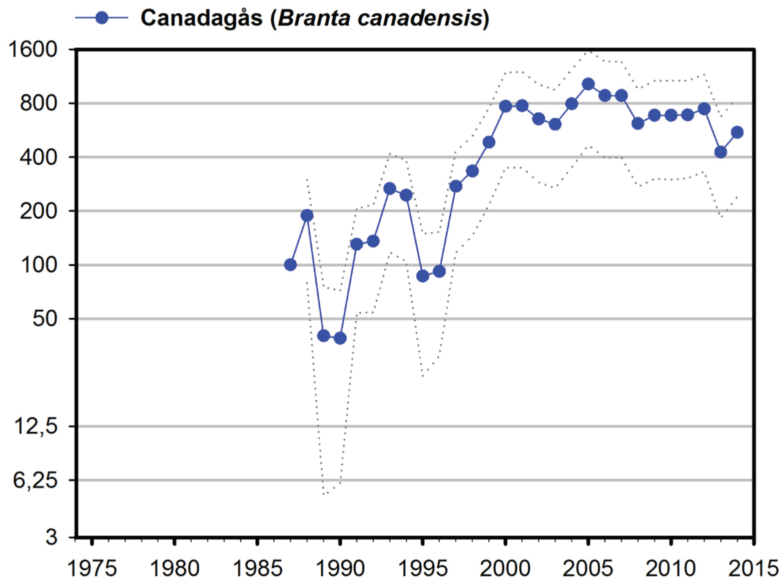


**Figure 5. Long-term increasing trend of Canada Goose, *Branta canadensis,* based on the data from the Danish Point Count Census monitoring project.**

Here the population declined because of pesticides in the 1960s, but since then has been stable. There has been no tendency towards increased overwintering in Norway , hence the decrease of the species in Denmark is not easy to explain.

## Atlas Line Transects 2014–2018

One more fabulous winter season of the Danish atlas has been carried out, and after two seasons now more than 1,000 line transects have been carried out by 450 volunteers, corresponding to 59% of all transects in the project and far more than the project goal.

It is already possible to use the large dataset for preliminary population estimates for seven Danish winter species (Table 1). The results indicate that the most numerous winter species is Tree Sparrow *(Passer montanus)* with 3.5–4.1 mill. individuals, followed by Great Tit *(Parus major)* (2.8–3.1 mill.) and Blackbird *(Turdus merula)* (2.4–2.8 mill.).

During the Atlas III project we expect to deliver winter population estimates for at least 30 species. More transects mean population estimates for more species, but also more precise population estimates. In the seven examples in Table 1 the estimates are rather precise, although the estimates for Tree Sparrow and House Sparrow are less so. One of the purposes of the location and number of transects is to ensure the data collected are representative of the Danish landscape; the more transects are surveyed, the more representative the data collected. This is rather unique for the project — that the transects make up a picture of the Danish landscape in total, not just of where ornithologists are birding. In the winter transects surveyed so far, which these results

**Table 1. Preliminary winter population estimates for the 7 most abundant species wintering in Denmark.**

| Species | | Population estimate (mill. individuals) |
|---|---|---|
| Tree Sparrow | *Passer montanus* | 3.6–4.1 |
| Great Tit | *Parus major* | 2.8–3.1 |
| Blackbird | *Turdus merula* | 2.4–2.6 |
| House Sparrow | *Passer domesticus* | 1.9–2.5 |
| Chaffinch | *Fringilla coelebs* | 2.0–2.3 |
| Blue Tit | *Cyanistes caeruleus* | 1.8–2.0 |
| Yellowhammer | *Emberiza citrinella* | 1.3–1.5 |

are based on, forest and meadow are over-represented while agriculture is under-represented. Hopefully more transects will be carried out, thus making the final estimates more representative.

## Danish winter garden bird survey 2007–2011

During the five winters from 2006/07 to 2010/11, the Danish public was invited to record maximum numbers of birds in gardens and similar areas in January and February. The results have been summarized and presented by Meltofte & Larsen (2015), from whom the following has been extracted.

A total of 13,224 people reported 240,756 counts from 16,882 gardens, giving a grand total of more than 9 million individuals of 194 bird species. Records were from all over the country, but were more concentrated in the eastern, more densely populated parts. Real gardens made up 95% of the sites, the rest being balconies, school playgrounds and parks. The five winters were very different; 2006/07 and 2007/08 were very mild winters, 2009/10 and partly 2010/11 were severe winters.

The average accumulated maximum numbers of bird species and individuals in Danish gardens were 30–35 individuals of 7–8 species per day. The most widespread species was Blackbird (*Turdus merula*), which found at 90% of the count locations with an average maximum count of 3.5 individuals per garden. Second was Great Tit (*Parus major*) at 86% of the count locations and with an average of 3.3 individuals per garden. However, the most numerous garden species was Tree Sparrow (*Passer montanus*) at an average maximum number of 6.7 individuals per garden. The highest numbers were recorded in the severe winter of 2009/10, but high numbers were also recorded in the very mild winter of 2006/07.

Only four species (Greenfinch *(Carduelis chloris)*, Bullfinch *(Pyrrhula pyrrhula)*, Bohemian Waxwing *(Bombycilla garrulous)* and Blackbird) showed statistically significant positive correlations with the national winter Common Bird Census results, whilst the correlation was negative for Great Spotted Woodpecker (*Dendrocopos major)*. Most likely, many birds move to gardens in severe winters and desert the rural areas, where many of the national winter bird census counts are made.

Gardens with many trees and bushes had the most species and individuals, but numbers in open areas and parks were not much lower. Coniferous and deciduous trees and bushes together with perennial and annual plant beds were the most favored by birds. As regards the surrounding countryside, gardens near forests had the most species, while farmland gave the most individuals — probably as a result of having many sparrows.

Finally, it was attempteded to estimate the total numbers of birds in Danish gardens in winter. The most common bird species were categorized according to behavior, i.e. ranging from very territorial birds with only one individual in each garden where there was a record of the species, to highly mobile species moving between gardens. With 1,563,760 gardens in Denmark, these estimations resulted in almost two million birds, to which a similar number should be added for flocking species moving over even larger areas that were not considered in the calculations. For the most numerous species, the Blackbird, about 11% of the birds in Denmark in winter are estimated to live in gardens in mild winters (which may be an underestimate), while a higher ratio is found in severe winters. For Great Tit and Tree Sparrow similar estimates reach 20–25% of the national totals and may be more realistic. Still, the estimates are more likely to be too low than too high.

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Bird Census News 2015, 29/1–2: 20–22

# Winter counts (PTT) in Flanders (Belgium)

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**Abstract.** A small scale point-transect-count project has run now for 27 years in Flanders. A review of the most important bird population changes was published by Herremans (2010). We provide an overview here with additional data on the increase and recent collapse of the wintering Wood Pigeon *Columba palumbus* population.

## Introduction

From 1989 onwards, we used the Dutch point-transect-count system developed by Sovon (Boele 1998) and extended it to Flanders (northern part of Belgium) where it was promoted amongst volunteers of bird clubs.

## Method

Transects were chosen by volunteers: a transect consist of 20 points, each counted during 5 minutes on the same morning. The first 5 years there were 4 counts per year (one each season), but as in the Netherlands, we only continued with the wintercounts afterwards, making PTT become entirely a winter bird count. The count period is between early December and late January, but in practice, most routes have been counted between Christmas and New Year.

## Results

Despite considerable effort in coordination and feedback of results to participants (particularly in the first 15 years), the project never became very popular in Flanders. On average only about 45 transects have been counted each winter (maximum of 70 in 2013–2014) (Figure 1). In total, 169 transects have at some stage been counted but most were only active during a few years: on average 7 count years per route. 45 routes were visited at least during 10 years, but 17% only during one winter (Figure 2). As in many monitoring projects, starting is easier than perseverence. See Boele et al. (2008) for the contrastingly greater success of the project in the Netherlands.
This implies that the resulting data are only meaningful for a limited number of common and widespread species in Flanders. A review of the

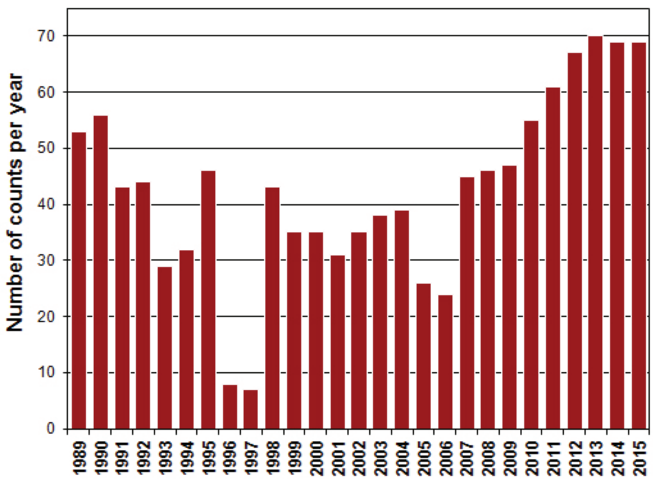


**Figure 1. The number of transects counted per winter in Flanders.**

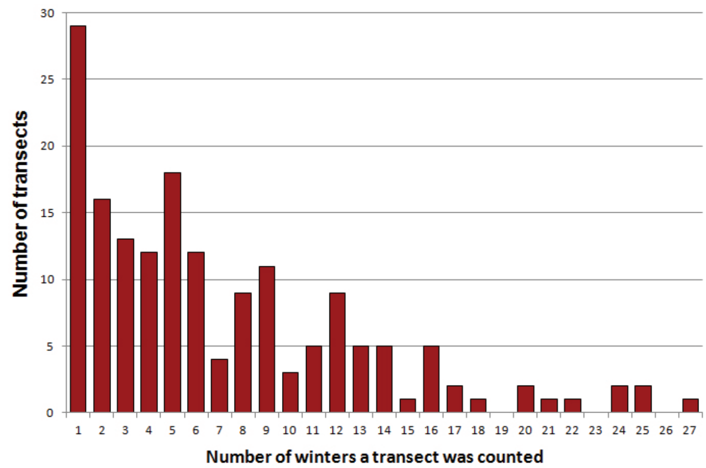


**Figure 2. The number of years transects have been counted in Flanders.**

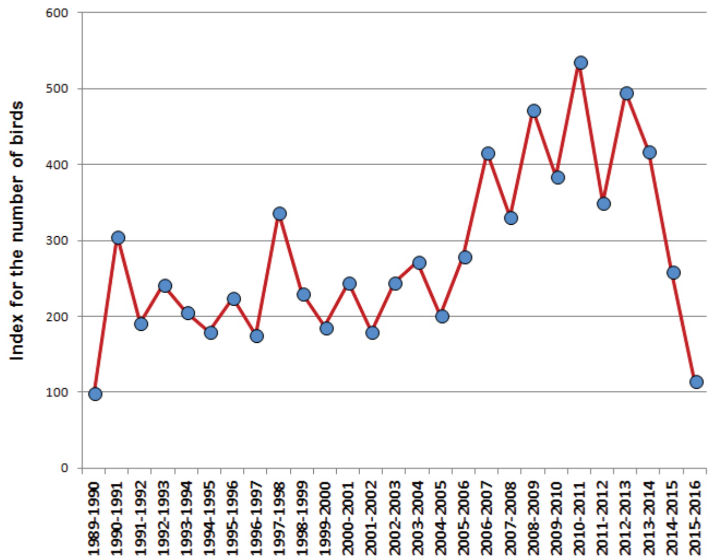


**Figure 3. Gradual increase and sudden collapse of the wintering numbers of Wood Pigeons in Flanders in response to changes in agricultural policy and practices.**

species showing greatest change has been published (Herremans 2010). It was no surprise that birds of agricultural land were the principal losers: e.g. Partridge *Perdix perdix*, Tree Sparrow *Passer montanus*, House Sparrow *Passer domesticus*, Lapwing *Vanellus vanellus* and Starling *Sturnus vulgaris.* Exotic species (Canada goose *Branta Canadensis,* Egyptian goose *Alopochen aegyptiacus,* Eurasian collared dove *Streptopelia decaocto)*, forest birds and birds previously widely persecuted (raptors, Cormorant *Phalacrocorax carbo)* showed the strongest increase in numbers. With a massive decline of 97%, Willow tit (*Poecile montanus)* is a notable exception with opposing trend amongst the forest birds. Mild winters increased bird diversity, even the following winters, because it favours increased overwintering of a set of "winter softies" (Herremans 2010).

The data have also been used to monitor raptors (Herremans & Tutak 2007), particularly to asses the decline of Common Kestrel *Falco tinnunculus* (Herremans 2011, 2015). During the project, the main change in winter bird communities in Flanders was the massive increase in Wood Pigeons *Columba palumbus,* particularly just after the turn of the century, and its sudden dramatic collapse the recent two winters (Figure 3; Herremans 2016). This is a result of the "greening" of agriculture under European policy, making that maïs stubble is now suddenly much less available throughout winter. As a consequence a few million Wood Pigeons had to find new wintering grounds the last two years.

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# Common bird monitoring scheme in winter in Catalonia (NE Spain): opportunities and constraints to enlarge our view for farmland bird indicators

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**Abstract.** The Catalan Common Bird Survey (SOCC) started in 2002 with the aim to monitor both breeding and wintering bird populations in Catalonia. Volunteers have collected data in roughly 275–300 3-km line transects every year, and species population trends have been updated annually for both the wintering and the breeding seasons. A Winter Farmland Bird Index was developed using: i) data from the Catalan Winter Bird Atlas to quantify the habitat preference of bird species in winter and ii) annual population indices from the SOCC surveys carried out in this season. Preliminary research shows that this new multispecies indicator shows a slightly different pattern than its breeding season counterpart.

## Introduction

Common birds can inform on the state of ecosystems beyond the breeding season since they are closely related to the environment at any moment of their life cycles. However, indicators on the state of wintering populations have been much less developed and have mainly focussed on waterbirds rather than common widespread species (Gregory & van Strien 2010). Certainly, the poor development of large scale winter bird monitoring projects should be one of the reasons behind this pattern.

The Catalan Common Bird Survey (acronym SOCC in Catalan language) is an ongoing bird monitoring scheme promoted by the Catalan Ornithological Institute and the Government of Catalonia (NE Spain) which was launched in 2002 with the main aim to determine indicators on the state of birds and their habitats. From the very beginning breeding and winter bird monitoring censuses were considered as two parts of the same project. Winter was included because of the known importance of the Mediterranean Basin as an overwintering ground for many species, both resident and short-distance migrants coming from upper latitudes.

SOCC population indices and trends for wintering bird populations are annually updated for almost as many species as in the breeding season and they have proven to be useful tools for understanding species population dynamics thanks to the broad seasonal perspective achieved. However, the development of multi-species indicators capable to track changes in the state of wintering bird populations have been poorly developed compared to those of the breeding season and still remains in an exploratory research phase. Preliminary winter indicators based on the common bird monitoring scheme were firstly generated after the publication of the Catalan Winter Bird Atlas 2006–2009, a project that provided for the first time quantitative information on bird distribution, population, ecology and migratory patterns for all bird species that spend the cold season in the region (Herrando et al. 2011).

During these recent years the development of winter indicators was initiated to focus on multispecies population indices that inform on the general state of birds in their habitats, i.e. farmland, shrubland and woodland, following procedures widely used in PECBMS and at national levels (e.g. Gregory et al. 2005). The information provided for those habitats in winter is probably

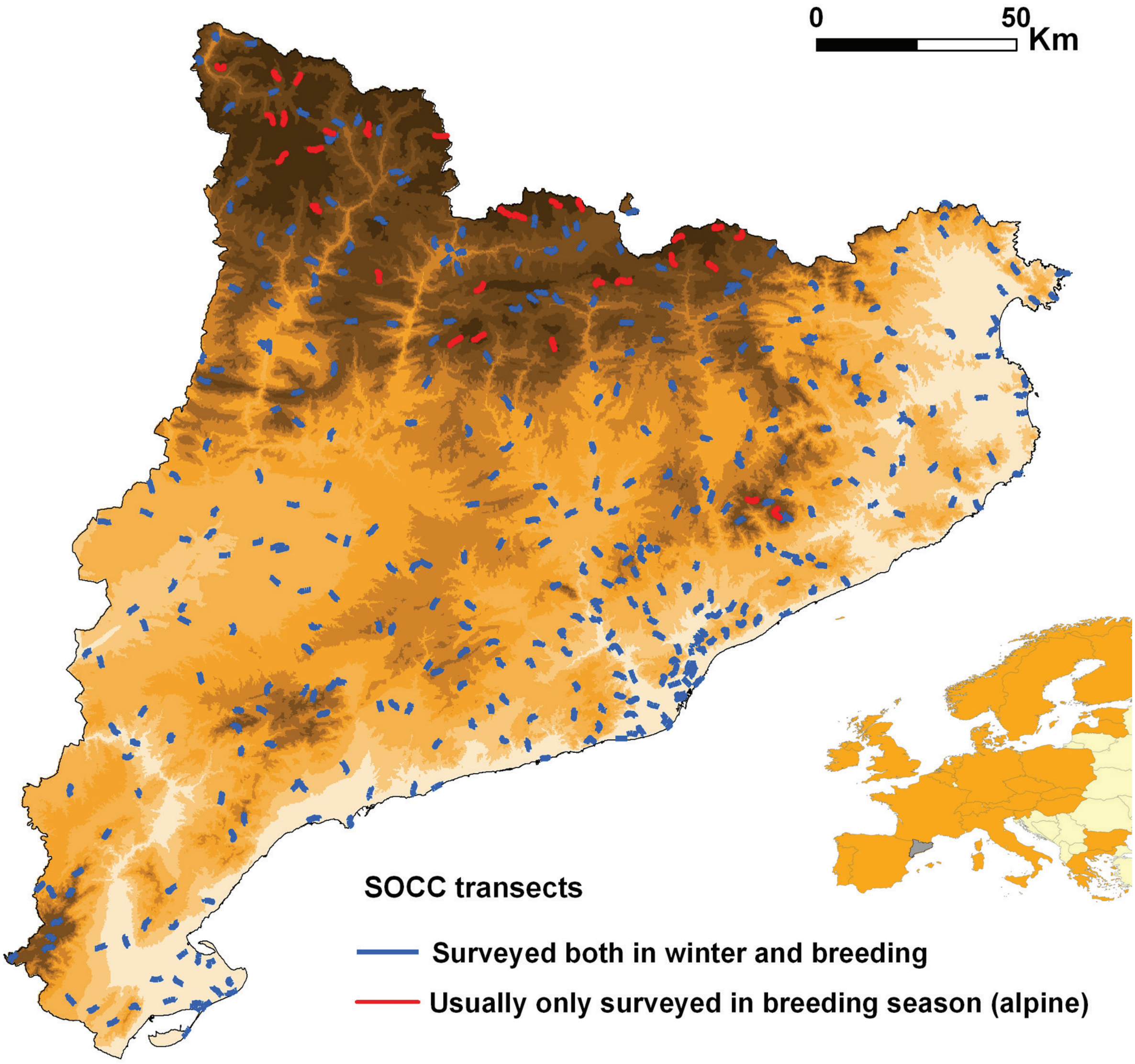


**Figure 1. Location of the 400 SOCC sites (3-km transects) that have been surveyed in winter in Catalonia in the period 2002–2014 (each year data refer to December of the reported year and January of the next one). Taking into account data for the winter periods 2002–2014, an average of 278 of these sites are surveyed annually.**

complementary to that of the breeding season as a result of seasonal changes in farmland habitats (both natural and human-induced) and the bird species seasonal turnover. In addition, exploratory work has been done for developing indicators of functional processes such as seed dispersal, a very relevant ecological process in which wintering birds play a major role in the Mediterranean ecosystems (Herrera 1984).

The aims of this article are: i) to describe particularities of the winter monitoring in this Mediterranean region, ii) to show the results of the Farmland Bird Indicator (FBI) developed for the winter season using the same methodological approach employed in the breeding season, and iii) to discuss pros and cons for these new potential set of indicators for the winter season.

## Winter fieldwork

The SOCC winter fieldwork strategy follows basically the same rules than those carried out in breeding season. In general observers choose one of the line-transects previously selected by stratified random sampling by the central coordination of the project. However, free selection of line-transects is also allowed in some particular cases. For the period Dec 2010/Jan 2011 — Dec 2014/Jan 2015 an average of c. 275 3-km line transects were annually carried out in winter, just slightly fewer than in breeding season (average 293 for the same five years). Similar coverage between seasons suggests that despite the worse weather conditions and lower number of species often detected, monitoring in winter is still attractive enough to ornithologists. The only well-defined exception are alpine areas, where not only weather conditions but also accessibility and risk of being injured in iced or snowed slopes greatly hampers surveying the few birds remaining up there in winter (Figure 1).

Winter censuses are repeated twice in the same walked itinerary, the first in December and the second in January, considered the period when the majority of the birds detected are overwintering in the studied region. It is important to highlight that referring to years for these winter surveys carried out before and after New Year need some clarification. In this study we took the natural year in December as the reference year for a given winter. Thus, for example, the winter censuses done in December 2002 and January 2003 are refereed as year (or winter) 2002.

Winter censuses are exclusively conducted during the morning (as in the breeding season), and despite some initial doubts, a pilot study showed that afternoon censuses yielded fewer detections than morning ones (Herrando et al. 2006). Likewise the breeding period, observers can opt for allocating birds in three counting bands (0–25 m, 25–100 m and >100 m) or not to do this, but most of them actually carry out this distance sampling.

## Population analyses

Although the bird surveys are carried out in the two consecutive months (December-January) when residents and short-distance migrants are considered to basically remain in their wintering grounds, some individuals does not stay in the same sites along this survey period and do more or less nomadic movements. However, we consider that winter population trends are not greatly affected by variations in bird counts related to these bird movements within each winter (Herrando et al. 2011). Thus we proceed as for the breeding bird data and take the maximum count between the two visits as the most reliable estimation of bird population at site level and input this value for TRIM population analyses (Pannekoek & van Strien 2005). Further studies are however needed to clarify the potential impact of differences between the two winter counts on their assessed trends, particularly in a context of constant land use change and global warming.

## Development of winter indicators

Developing robust multi-species indicators greatly depend on a good alignment between their aims and the methodological approach. One of the aspects that affects this process is the selection of species to be included in the indicator. Species can be selected by means of an expert based panel or quantitative analyses on the specific species traits that are considered for the correct tracking of the process under study. Our experience in Catalonia with winter indicators started with indices capable to track changes in habitats by means of their wintering avifauna. To do that we developed an analytical process based on the quantification of habitat preferences for bird species that was assessed using extensive data collected in the framework of the Catalan Winter Bird Atlas (Herrando et al. 2011). This work provided a very complete and standardised dataset for analysing species relationships with their habitats and the species habitat selection was done by considering the relative abundance/occurrence (depending on available data) of the species in a number of habitats. The same process had been was previously done for the breeding bird indicators using the equivalent information gathered in the Catalan Breeding Bird Atlas (Estrada et al. 2004), which allowed more robust comparisons between the derived set of indicators.

In this article we present the results obtained for the Farmland Bird Index (FBI) for wintering birds. We consider that this represents an interesting topic because of its direct link with agricultural practices and its potential impact on bird populations. Therefore, species were classified as farmland species (either in breeding or wintering seasons) using information on habitat preferences reported in both the winter and the breeding bird atlases mentioned above. We classified a species as a farmland species when the mean abundance/occurrence of the species where higher in 1×1 km squares classified as farmland than in 1×1 km squares classified as other habitats (Table 1). In total 41 species were classified as farmland species in winter, a value very similar to that obtained in the breeding season (42 species). The species list selected for winter only partially matches the PECBMS classification for

**Table 1. List of birds included in the Farmland Bird Indicators (FBI) in wintering (W) and breeding (B) seasons. The asterisk means included in PECBMS in the South Europe class. The number of monitoring sites in which the species were recorded (at least two years) during the 13-year study period is shown, together with the trend classification obtained after the TRIM analyses for both seasons. Species winter migratory strategies were classified as mainly Residents (R) or Migrants (M) according data from the winter atlas in the study region. Resident species could be classified as farmland species only on one of the seasons (wintering or breeding) due its different habitat use in these seasons.**

| Species<br>* Included in PECBMS in South Europe class | Population considered in each FBI: Winter (W), Breeding (B) | No. sites analysed | | Trend Class | | Winter Migratory strategy |
|---|---|---|---|---|---|---|
| | | Winter | Breeding | Winter | Breeding | |
| *Bubulcus ibis** | W | 72 | – | Moderate decline | – | R |
| *Circus cyaneus* | W | 67 | – | Moderate decline | – | M |
| *Buteo buteo* | W & B | 302 | 236 | Moderate increase | Moderate increase | M |
| *Falco tinnunculus** | W & B | 248 | 267 | Stable | Stable | R |
| *Falco columbarius* | W | 47 | – | Uncertain | – | M |
| *Alectoris rufa** | W & B | 193 | 193 | Moderate decline | Moderate decline | R |
| *Coturnix coturnix* | B | – | 121 | – | Stable | – |
| *Tetrax tetrax** | W & B | 12 | 17 | Moderate decline | Moderate decline | R |
| *Burhinus oedicnemus** | W & B | 15 | 31 | Uncertain | Moderate decline | R |
| *Vanellus vanellus** | W | 81 | – | Uncertain | – | M |
| *Columba oenas* | W & B | 40 | 62 | Uncertain | Stable | R |
| *Streptopelia turtur** | B | – | 231 | – | Stable | – |
| *Columba palumbus* | W | 360 | – | Stable | – | R |
| *Athene noctua* | W & B | 61 | 72 | Uncertain | Uncertain | R |
| *Coracias garrulus* | B | – | 33 | – | Moderate increase | – |
| *Upupa epops** | W & B | 125 | 251 | Moderate increase | Stable | R |
| *Jynx torquilla* | B | – | 143 | – | Stable | – |
| *Picus viridis* | W & B | 305 | 293 | Moderate decline | Moderate decline | R |
| *Melanocorypha calandra** | W & B | 18 | 13 | Uncertain | Moderate increase | R |
| *Calandrella brachydactyla** | B | – | 16 | – | Steep decline | – |
| *Galerida cristata** | W & B | 172 | 152 | Stable | Moderate increase | R |
| *Lullula arborea** | W & B | 218 | 188 | Stable | Moderate increase | R |
| *Alauda arvensis** | W & B | 144 | 66 | Stable | Stable | M |
| *Anthus pratensis* | W | 279 | – | Moderate decline | – | M |
| *Motacilla alba** | W | 312 | – | Stable | – | M |
| *Phoenicurus ochruros* | W | 328 | – | Moderate increase | – | M |
| *Luscinia megarhynchos** | B | – | 289 | – | Moderate increase | – |
| *Saxicola rubetra* | B | – | 7 | – | Uncertain | – |
| *Saxicola torquata** | W & B | 259 | 241 | Moderate decline | Moderate decline | R |
| *Oenanthe hispanica** | B | – | 48 | – | Uncertain | – |
| *Turdus viscivorus* | B | – | 299 | – | Stable | – |
| *Turdus philomelos* | W | 345 | – | Stable | – | M |
| *Turdus iliacus* | W | 156 | – | Stable | – | M |
| *Cettia cetti** | B | – | 161 | – | Stable | – |
| *Cisticola juncidis** | B | – | 144 | – | Moderate increase | – |
| *Hippolais polyglotta* | B | – | 228 | – | Moderate increase | – |
| *Sylvia atricapilla* | W | 299 | – | Moderate increase | – | M |
| *Sylvia hortensis* | B | – | 70 | – | Moderate increase | – |
| *Lanius collurio** | B | – | 67 | – | Moderate decline | – |
| *Lanius meridionalis* | W & B | 112 | 46 | Moderate decline | Moderate decline | R |
| *Lanius senator** | B | – | 158 | – | Stable | – |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Pica pica** | W | 242 | – | Moderate decline | – | R |
| *Corvus monedula** | W & B | 49 | 44 | Strong increase | Moderate increase | R |
| *Corvus corone** | W & B | 228 | 213 | Moderate increase | Moderate increase | R |
| *Sturnus vulgaris/unicolor** | W | 298 | – | Strong increase | – | M |
| *Passer domesticus** | W & B | 297 | 283 | Moderate decline | Moderate decline | R |
| *Passer montanus** | W & B | 168 | 157 | Moderate decline | Moderate decline | R |
| *Petronia petronia** | W & B | 76 | 76 | Strong increase | Stable | R |
| *Fringilla coelebs* | W | 398 | – | Stable | – | M |
| *Serinus serinus** | W & B | 311 | 339 | Stable | Moderate decline | M |
| *Carduelis chloris** | W & B | 323 | 302 | Moderate decline | Moderate decline | M |
| *Carduelis carduelis** | W & B | 371 | 303 | Moderate decline | Moderate decline | M |
| *Carduelis cannabina** | W & B | 250 | 199 | Moderate increase | Moderate decline | M |
| *Emberiza citrinella* | W & B | 80 | 35 | Uncertain | Uncertain | M |
| *Emberiza cirlus** | W & B | 291 | 259 | Stable | Stable | R |
| *Emberiza calandra** | W & B | 123 | 189 | Moderate increase | Moderate increase | R |

southern Europe (Table 1), which reflects both the particularities of habitat-bird relation at relatively small geographical scales and, overall, the marked changes in habitat preferences that many species exhibit all year around. In winter, 32% farmland species are decreasing over the period 2002–2014 while 24% are increasing (Table 1).

## A Winter Farmland Bird Index

Following the above mentioned procedure for selecting farmland species, the methodology developed in Gregory et al. (2005) to derive multi-species indicators was applied both for the breeding and winter datasets of the SOCC monitoring project. FBI during the breeding season showed a slightly negative trend over the period 2002–2014, more evident during the latest years of the time series, when the 95% confidence interval of the yearly index denoted a significant or marginally significant difference with respect to that of the first year of the study (Figure 2).
The pattern shown by the winter FBI is slightly different. This indicator increased at the beginning of the time series and has remained more or less stable, with values significantly higher than those of the first reference year (2002). From 2008 onwards, however, interannual decreases have become a usual pattern (Figure 2). The reasons that caused a marked increase from 2002 to 2004 and a similar decrease from 2010 to 2012 remained unknown, although variations in weather conditions and land use practices deserve further exploration.

One of the most remarkable differences between the winter and breeding FBI is the degree of uncertainty of the annual indices (Figure 2), which is not associated to the number of species included (roughly the same in both seasons) but probably to the oscillations in their field counts. This variability is much higher in winter than in the breeding season. In winter flocking becomes a typical behaviour for many common birds and that, together with their more usual movements of individuals, produces higher standard errors in species annual indexes than those found in the breeding season. No effort has been done so far to develop a combined FBI for the two seasons, but policy relevant farmland indicators should be as synthetic as possible and exploratory work in that direction should be possibly done. For a different purpose, and after discussions with policy makers in the city of Barcelona, urban bird indicators are currently done averaging two sub–indicators, one for breeding and another for winter bird populations (Barcelona City Council 2013).
Finally, it should be highlighted that state indicators as the presented here do not directly inform on the pressures causing population shifts. Agricultural habitats are highly affected by human management and these have been reported as the main cause of farmland species decline in Europe (Gregory et al. 2005). However, other factors such as climate change may also affect the observed patterns. This could be especially relevant for winter FBI since the occurrence of many bird species do not only depend on habitat quality in the studied sites but on migration

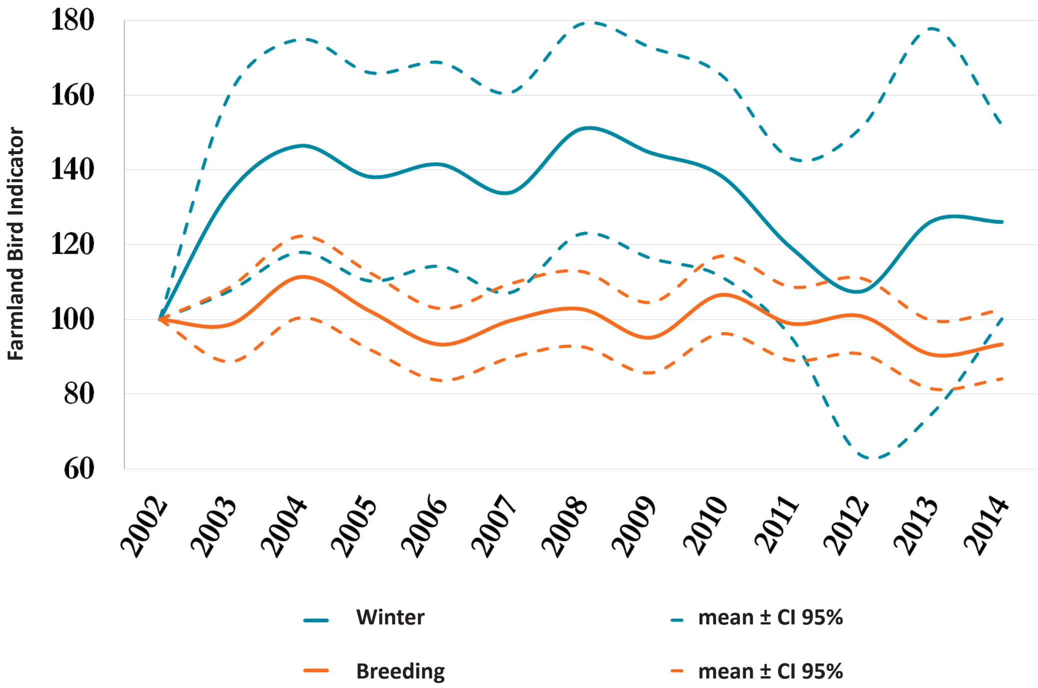


**Figure 2. Farmland Bird Indexes for breeding (42 species) and wintering (41 species) bird populations in Catalonia for the period 2002–2014 (in case of winters, it actually refers to December of the reported year and January of the next one). These indices correspond to the geometric mean of yearly population indices for species included in the indicator (Table 1). Mean + IC 95% values are shown.**

processes initiated in the previous summer or autumn in areas located at higher latitudes (Gordo 2007). Winters are becoming milder in Europe in recent years and this may affect individual decisions to move southwards in short-distance migrants, thus influencing their occurrence pattern in the Mediterranean winter quarters. In order to explore this issue we split the Winter FBI into two sub-indexes, one for the resident species and one for the short distance migrants overwintering in the Mediterranean but coming from central and northern Europe. This species classification was done using ringing recoveries analysed in the winter atlas (Herrando et al. 2011). A total of 23 and 18 species included in the winter FBI were classified as residents and short distance migrants, respectively, in the study area. We generated the FBI for these two subsets and our results do not show a different trend for the two groups of species (Figure 3). This similar temporal pattern between resident and short distance migrants suggests that the migration strategy does not influence trends of wintering populations and so does not support the hypothesis that recent tendency towards mild winters affects the population trend of short-distance migrants differently from that of resident birds.

## Main conclusions

- Our experience with common bird monitoring in winter in Catalonia is positive and suggests that, at least in the Mediterranean Basin, volunteers are happy to participate in such a scheme.
- Multi-species indicators can be easily produced in the same way as those for the breeding season, which allow enlarging our view on the studied patterns.
- The Farmland Bird Index was produced in the study region and the pattern was slightly different than that of the breeding season. Uncertainty in yearly index values and trends was higher in winter.
- We did not find any difference in the responses of overwintering farmland birds when comparing resident species and short-distance migrants.

## Acknowledgements

The data analysed in this study was obtained by hundreds of volunteers, without whom bird monitoring in Catalonia would not be possible. The Catalan Common Bird Survey (SOCC) receives

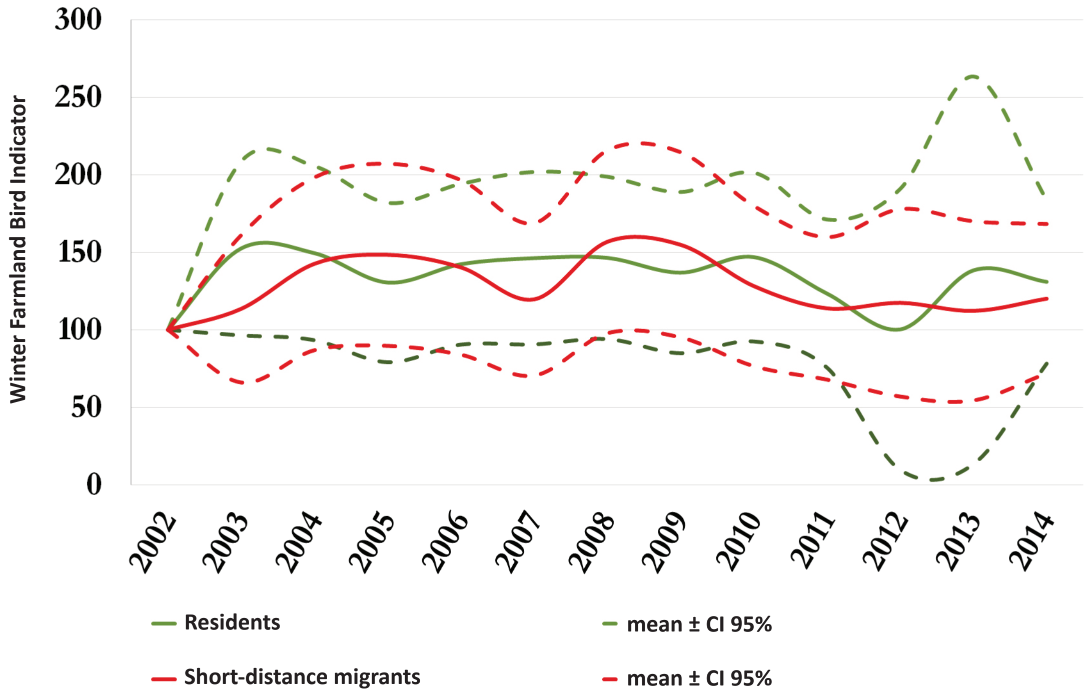


**Figure 3. Winter Farmland Bird Indexes for resident (23 species) and short distance migrants (18 species) wintering in Catalonia for the period 2002–2014 (each year data refer to December of the reported year and January of the next one). These indices correspond to the geometric mean of yearly population indices for species which winter populations in Catalonia are considered to be mainly composed by resident individuals or short distance migrants from northern latitudes (Table 1). Mean + IC 95% values are shown.**

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# The BTO Garden BirdWatch; data and research

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**Abstract.** The British Trust for Ornithology's Garden BirdWatch is a long-term, year-round survey of birds seen in gardens throughout the UK, and currently the only national British passerine monitoring scheme that runs through the winter. Patterns in garden occupancy can be monitored on a weekly basis, using both the percentage of gardens recording a particular species, and average counts per garden. The relationship between Garden BirdWatch counts and habitat features and resources can be explored to answer questions about the effects of urbanisation, and recent research on wintering Blackcaps has shown that this species is becoming increasingly associated with the supplementary foods in British gardens, and that the reliability of bird food supplies is influencing their winter distribution at a national scale.

## Garden Birdwatch

The British Trust for Ornithology (BTO) launched Garden BirdWatch (GBW) in 1995 with the aim of collecting information about how birds use gardens in the UK, and over the last twenty years participants have listed the birds seen in their gardens in every week of the year, throughout summer and winter. The dataset collected has been used for investigations into how birds and other wildlife use human landscapes, and has the potential to answer pressing questions about the effects of urbanisation.

Garden BirdWatch is run as a membership scheme, to which participants pay a £17 (€20) annual subscription. The funds raised go towards the survey administration, as well as BTO research on causes of change on bird populations, including urban research. Another aim of GBW is to help people learn more about wildlife and recording, and all participants receive a book 'Garden Birds and Wildlife' on joining, and thereafter a quarterly magazine with information about wildlife identification, gardening for wildlife, and GBW results and research.

Though focusing on gardens rather than natural habitats, GBW is the only passerine monitoring scheme organised by the BTO in operation throughout the winter. The RSPB also run an annual 1-hour garden-based count, Big Garden Birdwatch, which attracts over 500,000 participants, but this is run over a single weekend in January and therefore has less potential for over-winter monitoring.

## Methods

As a minimum, participants simply make a list of the birds seen in their garden each week. Time spent observing the garden is completely self-determined; some choose a specific time period to make their observations, others note down any sightings during the time they are at home, but overall people are simply asked to remain consistent in the time spent observing their garden week to week. Also for consistency, people are asked to record the same area every week; this may be the whole garden, but could also be a part of the garden that can be seen from the house. Some people record an area of a communal garden, or a small yard, or even a balcony, but the majority of records come from privately owned gardens.

Optionally, participants also record the maximum count of birds of a single species seen together at one time during their weekly observations. Adults and juveniles are all counted, though people are asked to not deduce their maximum counts using individually identifiable birds (e.g. males and females seen at different times). Garden BirdWatchers also record butterflies, mammals, reptiles, amphibians (since 2007) and bumblebees (since 2008), using the same methods as for birds.

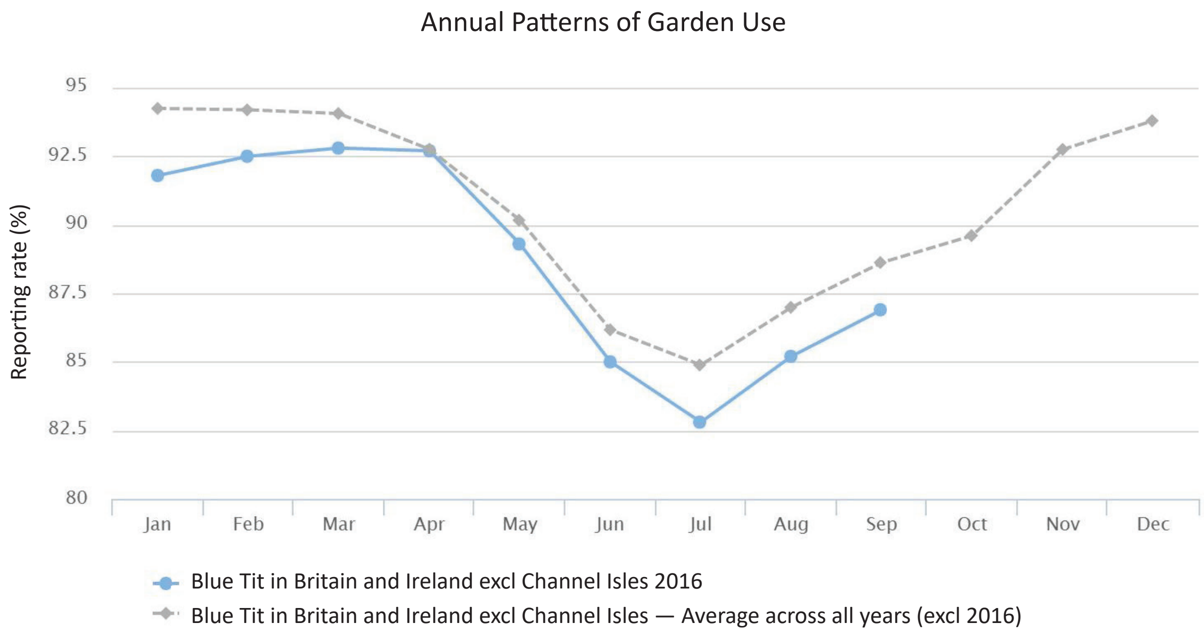


**Figure 1. Percentage of gardens recording Blue Tits throughout the year, by month. The blue line is 2016, while the dotted grey line is the average of all other years.**

On joining the survey Garden BirdWatchers record details of their garden, including areas of lawn, flowerbeds etc., number of trees, and boundaries such as fences, hedges and walls, as well as size and age. On a weekly basis participants record what (if any) bird food they are providing, such as peanuts, sunflower seeds and fats.

## Data submission and participation

Participation rose steadily from the launch of the survey in 1995 to a peak in 2003, when over 12,000 people made submissions during the year, and the maximum people recording in a single week rose above 11,000. Submissions have since fallen, and in 2015 just over 7,000 people took part in the survey, with the maximum number of submissions in a single week being just over 6,500. The fall in participation may be a result of an increase in the subscriptions — £10/£12 (€12/14) in the early years compared to £17/€20 today — and the need to keep pace with expectations users have of online services and systems.

The number of paid subscribers to GBW is currently around 12,000, so it can be seen that a large number of people join without submitting data. These are welcomed as they support the data collection and research through their subscriptions. Those who do submit records do not always submit counts every week of the year, and in practice more submissions are made during the winter months than during the summer. Since participation is open to all, coverage is closely linked to the human population, with better coverage in more densely populated areas (see Figure 5).

Records can be submitted quarterly on paper forms, or via the online data entry system. Abundance can only be recorded using broad categories on the paper forms, while exact maximum counts can be submitted via the online system. There are automatic checks of high counts and rare species built in to the online data entry and data loading systems, but no systematic validation of records. In 2015, 60% of weekly were made online, 98% submissions had associated records of supplementary foods, and 40% of submissions had associated records of non-bird taxa.

## Results

GBW weekly counts allow us to monitor the changing use of gardens by birds and other wildlife throughout each year and over many years. Dynamic graphs and maps can be generated and viewed directly on the GBW website: www.bto.org/gbw. We present here a few examples.

The trichomonad parasite lives in the upper digestive tract of the bird, and its actions progressively block the bird's throat making it unable to swallow food. It has been recorded in a number of garden bird species and is widely acknowledged to be the causal factor in the rapid decline

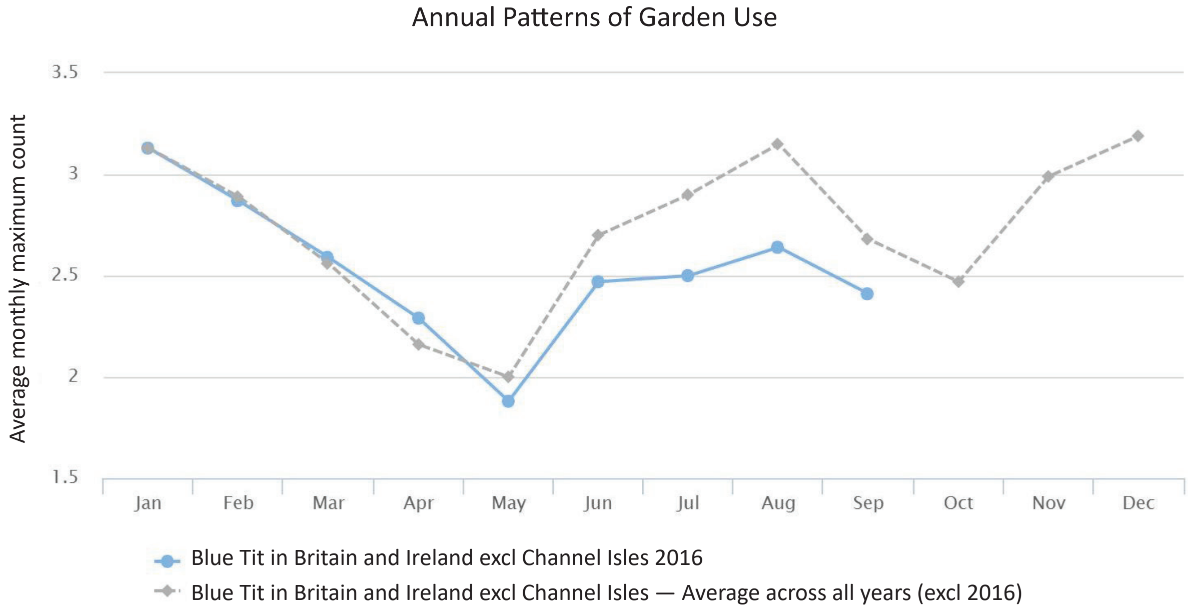


**Figure 2. Average count of Blue Tits in gardens throughout the year, by month. The blue line is 2016, while the dotted grey line is the average of all other years. Information on maximum counts is derived from online data only.**

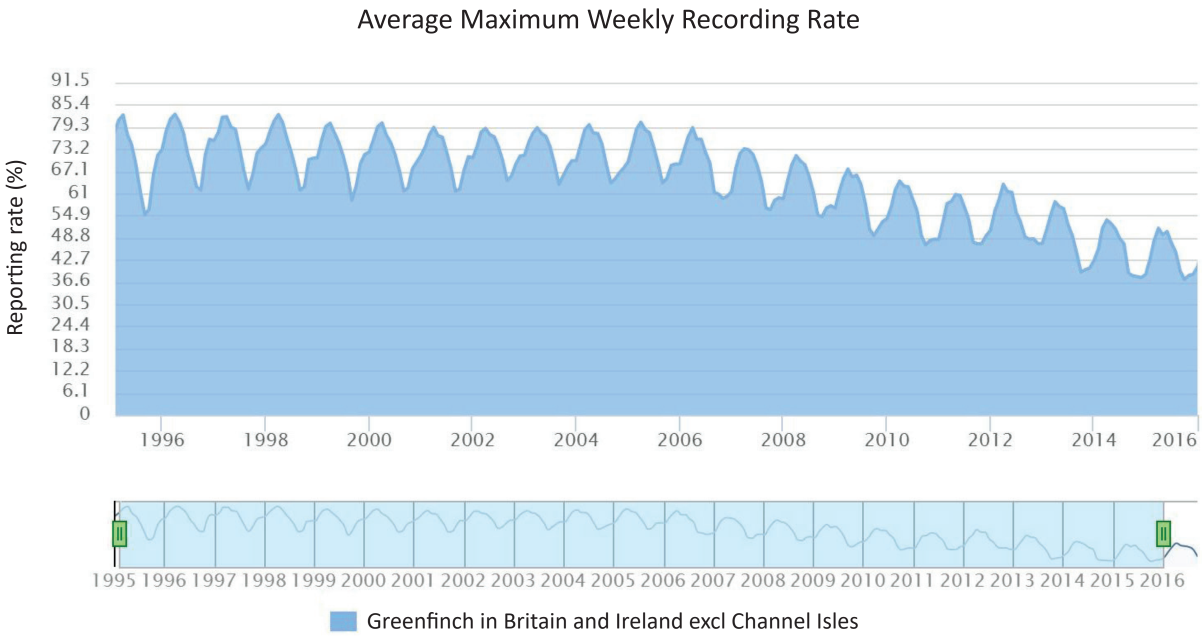


**Figure 3. Percentage of gardens recording Greenfinches from 1995–2016, with details in lower bar, showing the annual fluctuations and the effects of the Trichomonosis outbreak with details in lower bar.**

of the British Greenfinch population that started in 2006 (Lawson 2012). Transmission is most likely to be through contaminated food or water. If a number of birds show symptoms, we recommend stopping feeding for several weeks. This helps to disperse the feeding birds and reduce the contact between sick and healthy individuals, thus slowing down the outbreak. We also recommend following sensible hygiene precautions as a routine measure when feeding garden birds and handling bird feeders and tables.

## GBW research

The GBW dataset offers many opportunities to investigate how, when and why birds use gardens

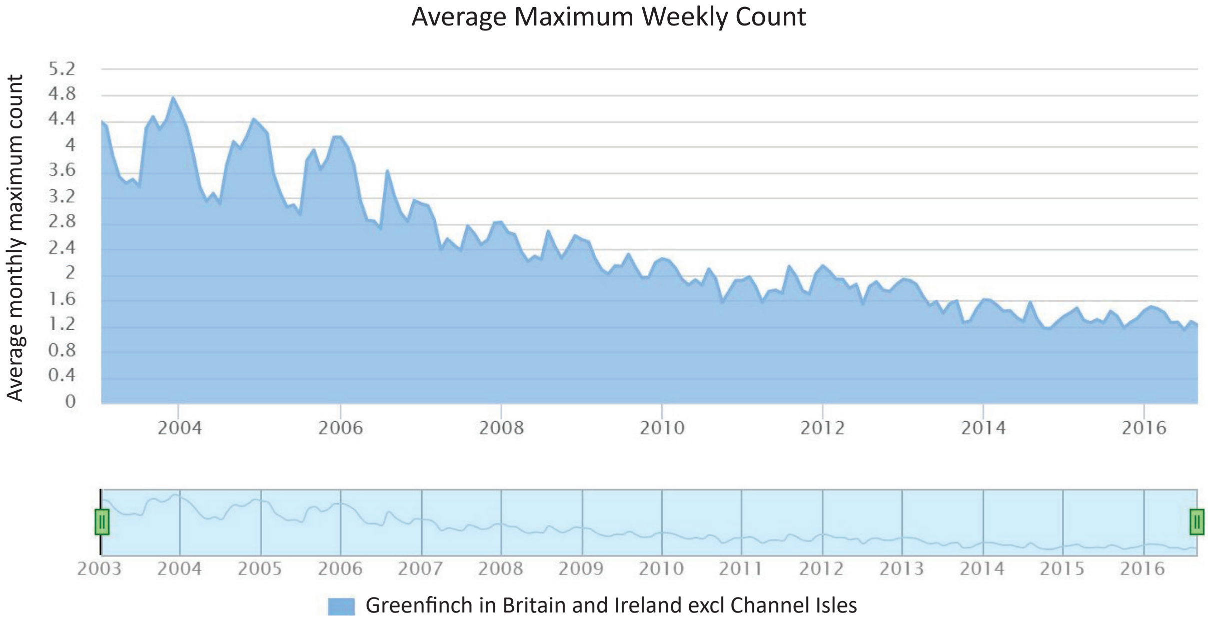


**Figure 4. Average count of Greenfinches in gardens from 2003–2016, with details in lower bar.**

and the resources that they contain. A study by Chamberlain *et al.* (2004) used GBW data to investigate the effects of garden habitats on the birds observed, and another study by McKenzie *et al.* ( 2007) showed that numbers of Siskins and Coal Tits observed at garden feeders in winter were negatively correlated with local spruce seed productivity, indicating that birds were choosing to make use of garden feeders when natural foods were less available.

## *Wintering Blackcaps and supplementary food*

Continuing the investigations into the effect of supplementary food, recent research by Plummer *et al.* using GBW data has linked winter provisioning of food in gardens to changes in Blackcap winter migration routes, the first time that garden bird feeding has been shown to affect large-scale bird distributions.

### *Contemporary evolution of Blackcap migratory behaviour*

Since the 1950s Blackcaps breeding in southern Germany and Austria have increasingly migrated in a north-westerly direction, heading towards Britain for the winter rather than taking the traditional south-westerly route to wintering grounds in southern Spain (Berthold *et al.* 1992). Research by Bearhop *et al.* (2005) revealed that this new migration strategy was genetically encoded, and maintained through reproductive isolation and fitness benefits on the breeding grounds. The result has been a rapid increase in the number of Blackcaps wintering in Britain over the past 60 years, such that the species is now a familiar visitor to garden feeding stations across the country.

### *Have conditions in Britain helped to drive this evolutionary change?*

Early observations of wintering Blackcaps in British gardens coincided with the wider introduction of commercial wild bird foods, while over the same time period winter conditions in Britain have become milder. Both of these changes could have led to improved over-winter survival of Blackcaps wintering in Britain, introducing a selection pressure for the new migration strategy, but it was not previously clear which factor, if either, or both, were driving these observed changes in numbers.

GBW data were used to explore the spatial distribution and between year variation in Blackcap wintering behaviour, allowing examination of both of these components in relation to the availability of supplementary food and local climate. If the provision of supplementary food had influenced Blackcap migration, we might predict that Blackcaps would be observed more frequently where there is a reliable source of garden bird food and that there may be evidence of an increased association with food over time. If climate limited the Blackcap's winter range, we might predict that Blackcaps would be observed

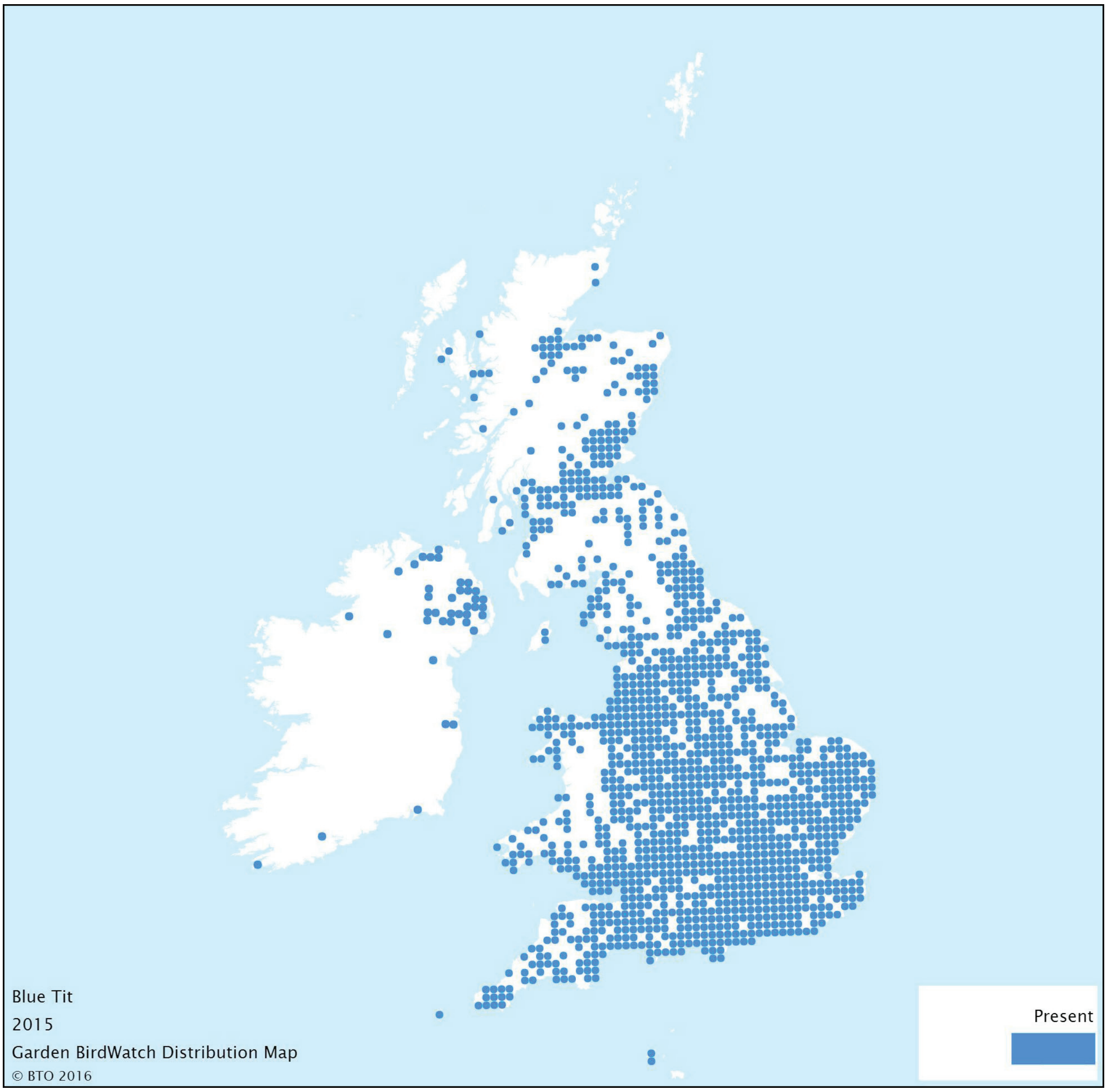


**Figure 5. Distribution of Blue Tits, one of the most commonly recorded species, in 2015. This is broadly representative of GBW coverage. Though the survey is primarily restricted to the UK, there are a few participants in the Republic of Ireland.**

more often at sites where the winter climate is warmer.

*How were the data analysed?*

Kate Plummer and colleagues (2015) extracted data for Blackcap presence and absence per site for 12 winters (1999/2000 to 2010/2011), the period when they are most strongly associated with garden habitats. The final data set included 3,806 Garden BirdWatch sites and was based on those sites from which at least 16 weekly submissions in a minimum of nine winters had been received. Garden BirdWatch participants record the food provided at their sites each week, but to find out which of the provided foods were being used by Blackcaps, a questionnaire was circulated to participants who had recently had Blackcaps using their gardens. This revealed that fats and sunflower hearts were the preferred foods for visiting Blackcaps.

The analyses also included a measure of local habitat, derived from the Centre for Ecology and Hydrology Land Cover Map, used to test for any potential 'heat island effect', whereby urban areas are warmer than rural areas because of the waste heat escaping from buildings and shops. Also included were mean monthly temperature data extracted from the Met Office UK Climate Projections dataset, latitude/longitude and year. Generalized linear mixed models were then used to examine the predictors of variation in Blackcap wintering behaviour.

*The patterns revealed*

Blackcaps showed higher occupancy of sites in the south and west of Britain, where wintering conditions are milder. This study found strong evidence that Blackcap occupancy rates are influenced by both supplementary food and climatic temperature; Blackcaps were recorded more often at sites that provisioned food more frequently and, interestingly, Blackcap occurrence has become more strongly associated with supplementary feeding over time. The birds showed a preference for wintering sites that had a warmer local climate, with the use of GBW sites reduced in those years when the winter weather was milder.

This work provides the first direct evidence of the underlying mechanisms that have influenced the contemporary evolution of migratory behaviour in Blackcap. Over a 12-year period, Blackcaps have become increasingly associated with the provision of supplementary foods in British gardens and the reliability of that provisioning is influencing their distribution at the national scale. The findings suggest that climate amelioration is also likely to have enabled Blackcaps to expand their wintering range into Britain.

The increasing association with supplementary food over time suggests that Blackcaps are adapting their feeding habits to exploit human-provisioned foods, complementing recent evidence that those Blackcaps migrating to Britain in winter are diverging phenotypically, as well as genetically, from those that winter in Spain. Blackcaps wintering in Britain have relatively narrower and longer beaks than those wintering in Spain, suggesting that British migrants have adapted to a more generalist diet (Rolshausen *et al.* 2009).

The study provides new and timely evidence of the role that human activities can play in shaping the evolutionary trajectories of wild bird populations. This work was funded by an appeal to Garden BirdWatch participants, who give generously of their time and money.

## Future plans

Following the 2015 research on Blackcaps, Kate Plummer is working on the question of whether supplementary feeding has influenced the increase in the UK population of Goldfinches, using GBW and other BTO survey data. We plan to continue to use the GBW dataset to monitor the status of birds and other wildlife in garden habitats, and to investigate the impact of human activities on bird populations in urban areas. We would welcome collaborations with similar schemes in other European countries.

## Acknowledgements

We are very grateful to all the Garden BirdWatch volunteers for the support of the survey. More information and results can be found on the Garden BirdWatch website: www.bto.org/gbw.

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# Winter bird surveys in Cyprus, 2007–2016. Analysis of the population trends

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**Abstract.** Cyprus is an important area for birds, hosting over 400 species. To protect the island's rich avifauna effectively, it is important that the population status and trends in bird populations are monitored. The Game and Fauna Service has been conducting a series of bird surveys annually, for more than a decade, covering a range of habitats. In this report, we present the preliminary findings of the systematic winter bird surveys for the years 2007 to 2016. Surveys were conducted on an annual basis, from January through February, along fifty-five road transects, covering a total length of 488.8 km. Using Poisson regression models, we analyzed the population trends of twenty selected species. Eight species showed statistically significant positive trends, whereas three species showed statistically significant negative trends. Nine species showed either weak trends or were stable.

## Introduction

Cyprus is the third largest Mediterranean island, after Sicily and Sardinia, covering an area of 9251 km². It is located at the northeast end of the Mediterranean basin, 75 km from the nearest mainland (Turkey). The island is dominated by two mountain ranges, the central Troodos Mountains and the smaller Pendathaktylos Range with the large, flat central plain of Mesaoria in between (Flint and Stewart 1992). Cyprus is characterized by a typical Mediterranean climate with dry, hot summers and wet, mild winters (Giannakopoulos et al. 2010).

The island is important for birds, both at the European and global scale. Over 400 bird species have been recorded in Cyprus. Being on one of the major bird migration routes across the Mediterranean and at the crossroads linking Europe with Africa and the Middle East, over 200 species occur as regular passage migrants (Flint and Stewart 1992). Millions of migrants use the island as a resting and refueling point during each migratory season, including significant numbers of birds of prey such as the Red-footed falcon (*Falco vespertinus*) and the Pallid harrier (*Circus macrourus*). Cyprus is well known for its large numbers of wintering Greater flamingos (Phoenicopterus roseus) and other waterbirds. Around 90 species are regular winter visitors with another 30 being classified as irregular (Flint and Stewart 1992).

To monitor the bird populations on the island, the Game Fauna Service has been conducting various systematic bird surveys annually, for more than a decade, covering a wide range of areas and habitats. One of those surveys is the winter survey, first started in 2005, and later expanded in 2007 to cover more sites and species. Winter surveys are carried out annually, from January through February, after the end of the hunting season, with the aim to assess the population status of the resident game species (e.g. Chukar partridge *Alectoris chukar cypriotes*, Black francolin *Francolinus francolinus*, Common woodpigeon *Columba palumbus*) before the beginning of the nesting season. It should be noted that a summer population count is also conducted, at the same survey sites, to quantify the level of productivity for that year. This report summarizes and discusses the preliminary results of the analyses of the winter surveys, using data from 2007 to 2016, for twenty selected species.

## Methods

Surveys were carried out along fifty-five roadside transects covering a total length of 488.8

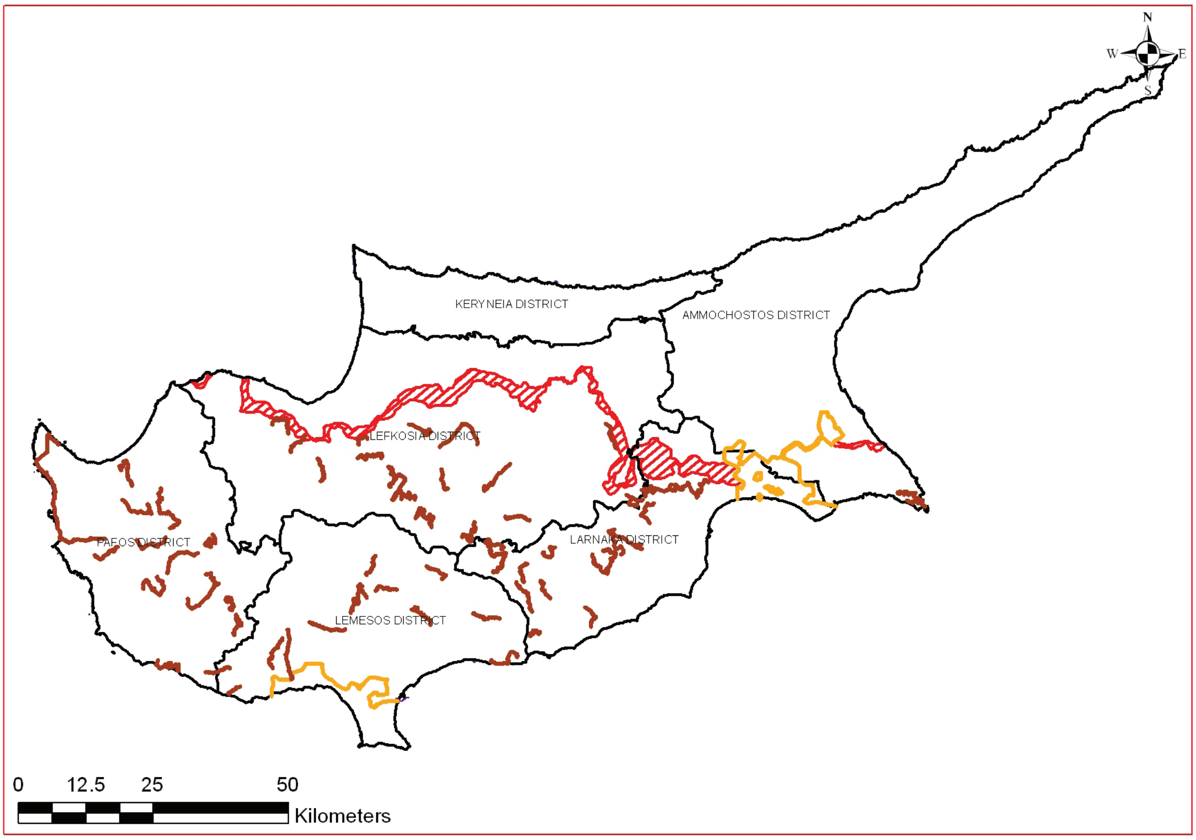


**Figure 1. Map of Cyprus showing the road transects (brown lines) used for the annual winter bird surveys. Surveys are conducted only in the southern part of the island where the Government of Cyprus exercises effective control. The Turkish-occupied northern part is not surveyed. The red line across the island indicates the UN Buffer zone between the Government-controlled area and the Turkish-occupied north. The two yellow lines indicate the UK Sovereign Bases Areas.**

km (Figure 1). The roadside count method was chosen because it is time-efficient and can traverse through large parts of habitats in a relatively short time. Roadside surveys are used primarily in North America to assess breeding (Sauer et al. 2005) and wintering wildlife (Sauer and Link 2002), and are considered cost-effective by many of the U.S. state wildlife agencies (Sands and Pope 2010) because they allow for a large area, a wide range of habitats, and multiple species to be sampled in a relatively short time period (Tapper 1988). Two important assumptions are that roadside surveys sample habitats in proportion to their availability and that they are equivalent to counts in roadless sites (Rosenberg and Blancher 2005, Thogmartin et al. 2006, Thogmartin 2010). For that reason, the survey routes were selected on the basis of (a) broad geographic coverage and representation of all major habitat types, (b) the existence of secondary, dirt roads with very low traffic so observers could have the time needed to identify and count species (Pandolfino et al. 2011a, 2011b). Although it is possible that for practical reasons the chosen survey routes do not meet the assumptions fully, it is unlikely that any resulting bias was large enough to have affected the validity of the results.

The length of the survey routes varied from 5–20 km (the average length was 8.9 km). Each route was surveyed by the same two teams of two observers to minimize inter-observer bias. Observers drove along each route, in the same direction each time, at a slow speed (~10 km/hour), counting all the birds that were seen while driving and at pre-selected stops (approximately every 200 m). All surveys were conducted during the first 3 hours after sunrise. Surveys were postponed or terminated during unsuitable weather conditions, such as heavy fog, precipitation, or strong winds.

Using Poisson regression models, we ran a preliminary analysis on the population trends of twenty species, selected to represent a wide range of orders (e.g. Accipitriformes, Galliformes, Columbiformes and Passeriformes) with different status on the island (i.e. species with winter-

**Table 1. List of the twenty species, selected for the trend analysis, and their relevant status**

| Common Name | Scientific name | Status in Cyprus |
|---|---|---|
| Northern (hen) harrier | *Circus cyaneus* | Localized winter visitor to Cyprus and scarce passage migrant |
| Western marsh harrier | *Circus aeruginosus* | Common passage migrant and localized winter visitor mostly in major wetlands |
| Eurasian sparrowhawk | *Accipiter nisus* | Scarce winter visitor and passage migrant, breeding in very small numbers in some years |
| Common buzzard | *Buteo buteo* | Fairly common passage migrant (especially subspecies *Vulpinus* in fall migration) whereas is a fairly common winter visitor |
| Long-legged buzzard | *Buteo rufinus* | Fairly common resident, expanding during the last 20 years and scarce passage migrant |
| Common kestrel | *Falco tinnunculus* | Common resident and passage migrant |
| Chukar partridge | *Alectoris chukar* | Very common resident |
| Common woodpigeon | *Columba palumbus* | Common resident and winter visitor |
| Woodlark | *Lullula arborea* | Localized resident and common winter visitor |
| Eurasian skylark | *Alauda arvensis* | Common passage migrant and winter visitor |
| European robin | *Erithacus rubecula* | Very common passage migrant and winter visitor |
| Western black redstart | *Phoenicurus ochruros* | Common passage migrant and winter visitor |
| Common stonechat | *Saxicola torquata* | Common winter visitor |
| Finsch's wheatear | *Oenanthe finschii* | Localized winter visitor in small numbers, mostly in open, rocky areas |
| Common chaffinch | *Fringila coelebs* | Common resident of forests and winter visitor |
| European serin | *Serinus serinus* | Locally common resident, winter visitor and spring passage migrant |
| European greenfinch | *Carduelis chloris* | Common resident, passage migrant and winter visitor |
| European goldfinch | *Carduelis carduelis* | Common resident, passage migrant and winter visitor |
| Common linnet | *Carduelis cannabina* | Common resident, passage migrant and winter visitor |
| Corn bunting | *Miliaria calandra* | Common resident, Passage migrant and winter visitor |

ing populations only, species with wintering and resident populations, and species with resident populations only) (Table 1). Models were fitted to annual totals summed from all 55 transects, all of which were counted in every year of the study period. It should be clarified at this point that the data on one of the species included, the Western marsh harrier (*Circus aeroginosus*), were not collected during the aforementioned road transect surveys but during the monthly wetland monitoring census, which are also conducted by the Game Fauna Service. It was decided that the species should be included so that a comprehensive overview on the trends of the wintering raptors in Cyprus could be attained. To make the results of the Western marsh harrier comparable to the other species, we used only counts from December, which for most years was the month with the maximum count. All statistical analyses were conducted using the R programming language (R Core Team 2016).

## Results

Table 2 presents the minimum, maximum, mean, and the standard deviation of the number of individuals for each of the twenty species. According to the results of the regression analyses (Table 2), eight species showed statistically significant positive trends (p-value <0.05); the Chukar Partridge, the Common woodpigeon, the Woodlark (*Lullula arborea*), the European robin (*Erithacus rubecula*), the Common chaffinch (*Fringilla coelebs*), the Common linnet (*Carduelis cannabina*), the European Goldfinch (*C. carduelis*) and the European Greenfinch (*C. chloris*) (Figure 2). Three species showed statistically significant negative trends; the Western black redstart (*Phoenicurus ochruros*), the European serin (*Serinus serinus*) and the Corn Bunting (*Miliaria calandra*) (Figure 3). Nine species, including all the wintering and resident raptors, showed no statistically significant trend (Figure 4).

**Table 2. Results of the regression analyses for each of the species analyzed. The minimum, maximum, mean values, and standard deviation of the number of individuals recorded are also presented. Species with statistically significant trends are shown in bold.**

| Species | Min | Max | Mean | Standard deviation | Regression Coefficient | Standard error (SE) | p-value |
|---|---|---|---|---|---|---|---|
| Western marsh harrier | 1 | 11 | 4.7 | 3.35 | 0.04 | 0.03 | 0.108 |
| Northern (hen) harrier | 1 | 13 | 5.3 | 3.62 | 0.04 | 0.05 | 0.352 |
| Eurasian sparrowhawk | 0 | 14 | 4.4 | 4.14 | 0.08 | 0.05 | 0.130 |
| Common buzzard | 0 | 14 | 5.9 | 5 | 0.07 | 0.05 | 0.109 |
| Long-legged buzzard | 7 | 19 | 12.4 | 3.98 | 0.06 | 0.03 | 0.057 |
| Common kestrel | 67 | 107 | 91.7 | 13.29 | 0.00 | 0.01 | 0.913 |
| **Chukar partridge** | **422** | **1568** | **904.3** | **363.04** | **0.10** | **0.00** | **0.000*****|
| **Common woodpigeon** | **783** | **2931** | **1607.4** | **705.57** | **0.03** | **0.00** | **0.000***** |
| **Woodlark** | **138** | **399** | **236.2** | **80.75** | **0.05** | **0.01** | **0.000***** |
| Eurasian skylark | 70 | 810 | 317.7 | 216.9 | 0.00 | 0.01 | 0.672 |
| **European robin** | **179** | **674** | **389.5** | **156.07** | **0.12** | **0.01** | **0.000***** |
| **Western black redstart** | **39** | **98** | **65.3** | **19.26** | **–0.03** | **0.01** | **0.031*** |
| Common stonechat | 196 | 415 | 291.9 | 60.93 | 0.01 | 0.01 | 0.123 |
| Finsch’s wheatear | 2 | 17 | 6.6 | 4.2 | –0.08 | 0.04 | 0.067 |
| **Common chaffinch** | **1551** | **3186** | **2448.4** | **512.89** | **0.03** | **0.00** | **0.000***** |
| **European serin** | **569** | **1142** | **875.8** | **215.64** | **–0.04** | **0.00** | **0.000***** |
| **European greenfinch** | **104** | **486** | **259.3** | **99.7** | **0.08** | **0.01** | **0.000***** |
| **European goldfinch** | **354** | **781** | **560.1** | **146.5** | **0.04** | **0.00** | **0.000***** |
| **Common linnet** | **230** | **872** | **481.8** | **188.4** | **0.04** | **0.01** | **0.000***** |
| **Corn bunting** | **419** | **852** | **642.3** | **144.11** | **–0.02** | **0.00** | **0.000***** |

Significance levels: * <0.05, **<0.01, ***<0.001

## Discussion

Winter is a critical period for many species, since is often a period of food shortage and sometimes of extreme weather conditions. These adversities may affect birds’ survival rates, fitness, and ability to return to their breeding grounds, if migratory. Winter counts are thus important because many species are limited by their ability to survive this period (Ralph et al. 1995). An understanding of their population ecology and trends requires monitoring programmes in wintering areas. This paper presents the preliminary population trends, for twenty selected species, demonstrating how a robust and representative monitoring scheme, for resident and wintering birds established in Cyprus, can be used to monitor population trends.

### *Raptors*

Surveys for raptors often have been conducted along roads where raptors are observed and counted from vehicles. These surveys have been used to describe raptor distribution (Andersen et al. 1985, Yosef et al. 1999, Bak et al. 2001) and to assess changes in raptor abundance through time (Hubbard et al. 1988, Herremans and Herremans-Tonnoeyr 2001, Goldstein and Hibbitts 2004). Though in our case the wintering raptors have not exhibited any statistically significant trend over the time period examined, and their numbers were generally low, some comments about their annual abundance can be made. Usually, raptor abundance is driven by food availability. Eurasian sparrowhawk, Common buzzard, and Northern (hen) harrier maxima were reached during 2013, a year that coincided with high numbers of Common chaffinch, Corn bunting and Common woodpigeon. The maximum number for the Western marsh harrier was recorded in December 2012, when the highest number of waterbirds was observed (>25000) (Ministry of Interior Annual Report 2012). The same winter was also when the maximum number of individuals was recorded for the other wintering raptors (counted in Jan-Feb 2013).

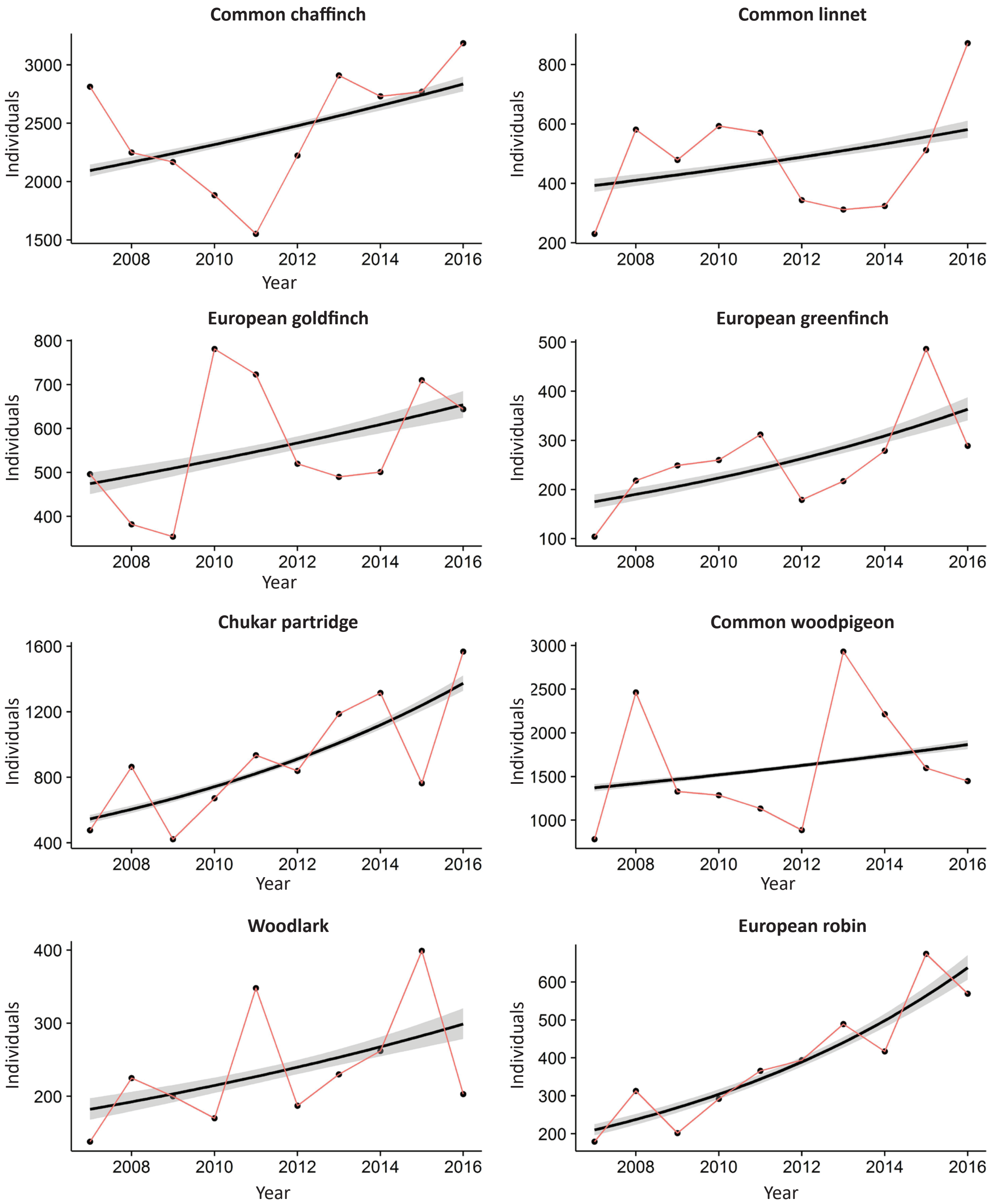


**Figure 2. Poisson regression plots for the eight species with statistically significant positive trends, showing the actual number of individuals over time and the slope. Shaded area represents 95% CI's.**

The Long-legged buzzard is a relatively new breeding bird on the island with the first nest found in 1992 (Kourtellarides 1998). Its increasing trend (Figure 4), although not significant (p-value = 0.057), is consistent with the species' expanding range mostly during the last decade when nesting territories doubled from 34 in 2005 (Kassinis 2009) to more than 70 in 2015 (Kassinis unpublished data). Stable numbers (or absence of a significant trend over the decade examined) of Common kestrel match the species stable population status, for the period 2008–2012, reported in the National Summary submitted to the European Union in 2014 (European Commission 2014) under Article 12 of the Birds Directive (2009/147/EC).

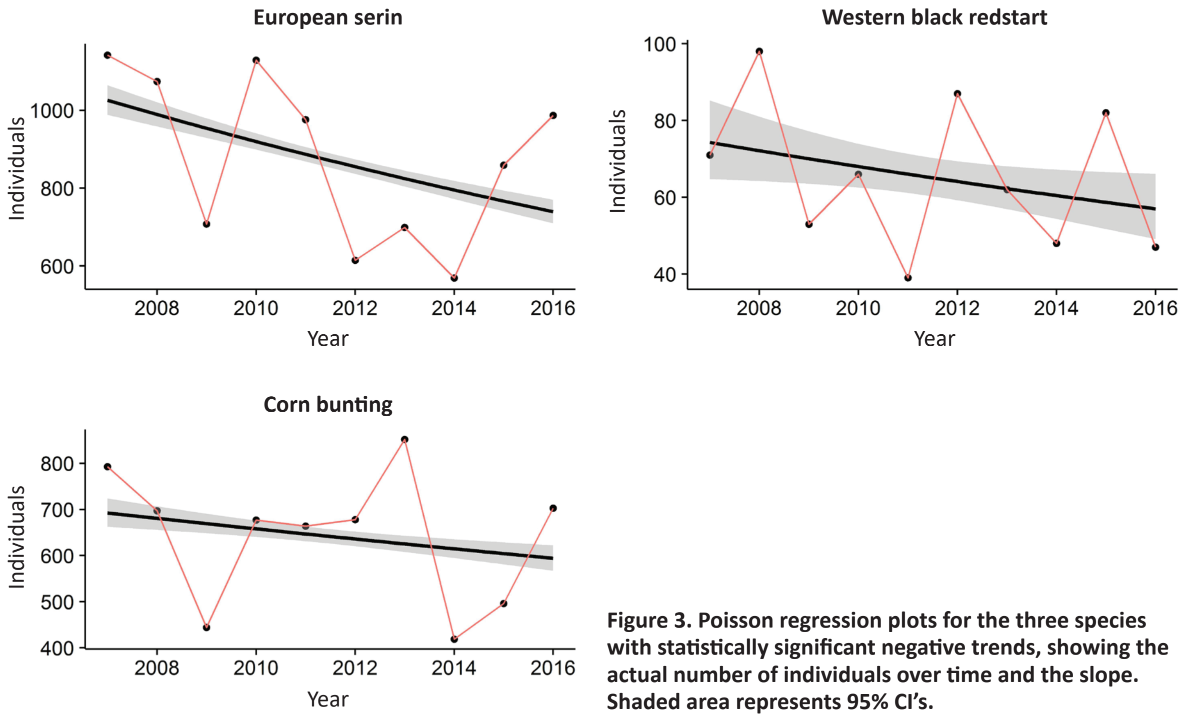


**Figure 3. Poisson regression plots for the three species with statistically significant negative trends, showing the actual number of individuals over time and the slope. Shaded area represents 95% CI's.**

### *Finches*

Common chaffinch's positive trend is different from the species' breeding population status, which has been reported as stable (European Commission 2014). A possible explanation could be that the breeding population is being augmented by wintering conspecifics that in some years are in large numbers European greenfinch's increasing trend also matches the species' increasing breeding population status on the island (European Commission 2014). Common linnet and European goldfinch's positive trends, however, do not agree with the species' breeding population statuses reported as declining (10–20%) in the National Summary (European Commission 2014). As with Common chaffinch, a possible explanation for this could be increasing immigration of wintering conspecifics that compensate for the small decline that the breeding populations show. European serin's negative trend also differs from the reported species' breeding population status, which is considered to be strongly increasing (50–75%).

### *Other Species*

The European robin showed a strong positive trend, which was expected considering the species trend in Europe from 1980–2011 (BirdLife International 2016). Based on provisional data from twenty-seven European countries, collected for the purposes of the Pan-European Common Bird Monitoring scheme, the overall species' population was increasing (BirdLife International 2016). Chukar partridge's positive trend is consistent with the species' breeding population status reported in the National Summary (European Commission 2014). It had its lowest population numbers in winter 2009, after a severe drought year in 2008 when the total precipitation recorded on the island was 272.3 mm, or 54% of the long-term mean (Department of Meteorology 2008). Common woodpigeon's positive trend differs from the species breeding population status that has been reported as stable. A possible explanation, like in the case of the Common chaffinch, is that Common woodpigeon's breeding population is being augmented by wintering conspecifics that are also in large numbers in some years. Woodlark's positive trend, on the other hand, cannot be compared to the species breeding status, since there are no reliable estimates for this species and its trend as a breeding bird remains unknown, according to the National Summary (European Commission 2014). Similarly, it is unclear what the reason is for Western black redstart's negative trend (Figure 3) and therefore it's worth examining in the future its population numbers in more detail. The same is true for the Corn bunting, which is also decreasing according

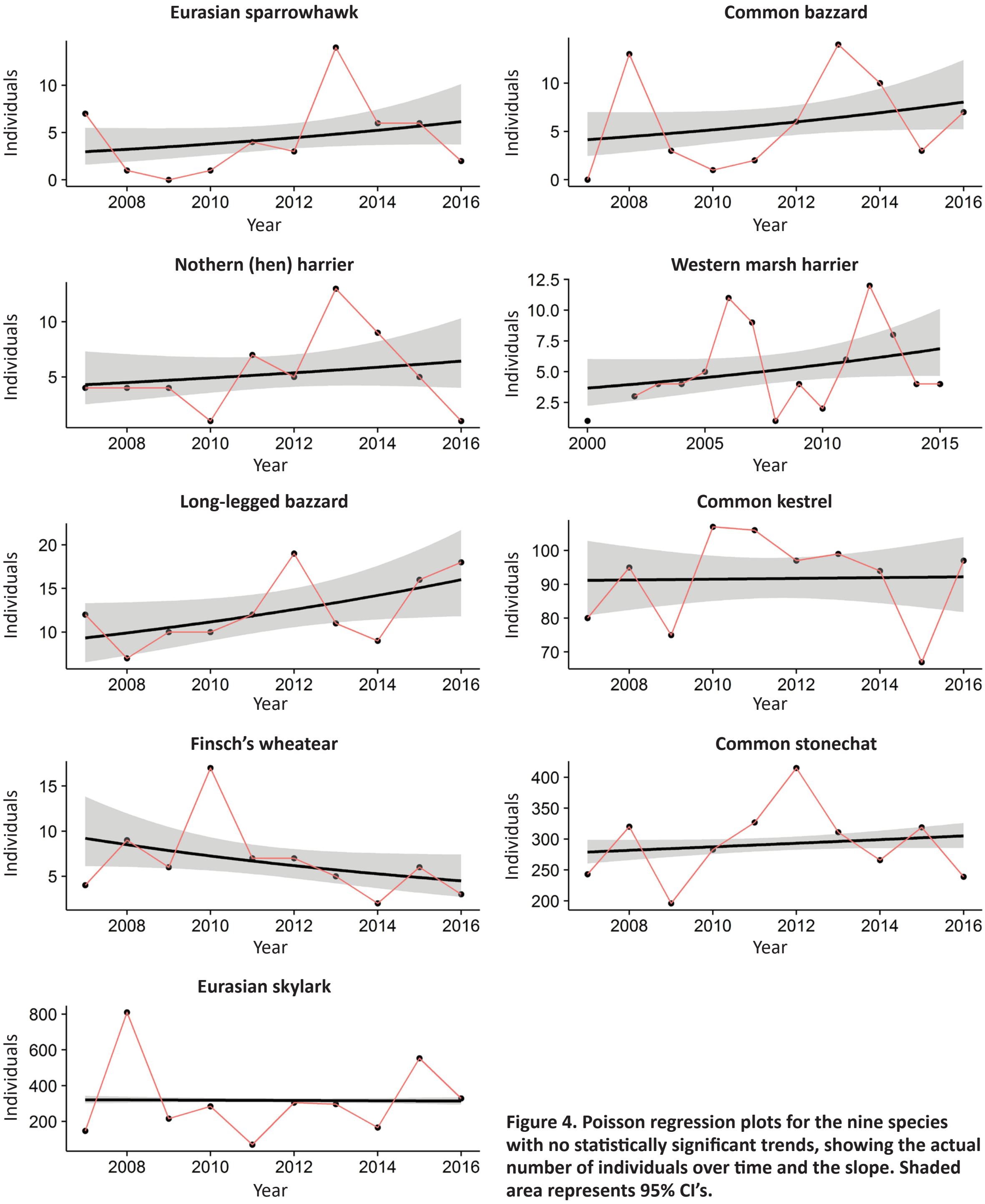


**Figure 4. Poisson regression plots for the nine species with no statistically significant trends, showing the actual number of individuals over time and the slope. Shaded area represents 95% CI's.**

to our analysis, although according to the National Summary its breeding trend is strongly increasing (75–150%).

## Conclusion

In summary, based on the results of the trend analyses, eight of the twenty species showed strong positive trends whereas three species showed negative trends. The rest showed either weak trends or were stable. It is worth highlighting that, in some cases annual counts fluctuated noticeably (Table 2; Figure 4). Unfortunately, the statistical method chosen to analyze the trends does not allow us to test for significant annual changes. In the future, we will be analyzing the data, combined with the data from the summer surveys, using more robust tools, such as the "TRends and Indices for Monitoring data" (TRIM) software (Pannekoek and van Strien 2001). Such

tools will allow us to explore the annual fluctuations in more detail.
It is likely that parts of the observed fluctuations in the population numbers can be explained by climatic factors. Although for the purposes of this report, weather related parameters (such as temperature, rainfall, and snow) were not tested for any correlations with the recorded trends; climatic factors are probably affecting several of the species examined. Cold fronts, strong winds, floods or droughts have been shown to seasonally shape the environment birds live in and affect their presence and abundance. For example, climate change has been suggested as the cause of many recent changes in species distributions (Stenseth et al*.* 2002, Walther et al*.* 2002). The Eastern Mediterranean's progressively warmer climate and drier conditions are possibly causing some wintering visitors to stay to the north of Cyprus, or attract other species that are adapted to these new conditions.
The expansion of Long-legged buzzard over the last 2 decades might be partly explained by this factor. A case of a species that has changed its status from migrant breeder to resident and winter visitor is the Spur-winged Lapwing (*Vanellus spinosus*), which has established a resident population during the last decade (Kassinis et al. 2010).
Some caution, however, must be exercised when interpreting the results for some of the species, such as the finches (i.e. Common chaffinch, Common linnet, European serin and European goldfinch), Woodlark, Corn Bunting and Common woodpigeon, because they have both a resident and wintering bird status and their numbers are frequently augmented by wintering conspecifics.

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# Atlas of Birds in Spain in Winter (2007–2010)

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**Abstract.** In 2006, SEO/BirdLife decided to set up an ambitious winter bird atlas project aiming at carrying out a detailed inventory, covering the whole of the country. In the winter 2006–2007 a pilot project was carried out which resulted in the use of line transects within 10 × 10 km National Grid squares as the standard methodology. Routes were chosen by the volunteers but had to be selected in a way that they covered proportionally all habitats present within the square. Fieldwork was carried out in the winters 2007–2008, 2008–2009 and 2009–2010, between 15 November and 15 February. The data from the transects were completed with records on less common birds, owls and nightjars, seabirds, endangered species, scarce and rare species and exotic birds. The maps and the habitat selection graph were obtained using bootstrapping techniques. The atlas presents information on 407 species. The majority of them (314) are taxa occurring in Spain on a regular base during the winter period. We present here a summary of the methods and some important results and conclusions of this winter bird atlas project, which was published as a book in 2012. For more details, we refer to this publication (SEO/BirdLife 2012).

## Introduction

In Spain, for decades, SEO/BirdLife has put considerable effort into collecting data on the three basic parameters established by the International Union for the Conservation of Nature (IUCN) which determine the overall picture of the state of conservation of each bird species: area of distribution, population size and population trend. Two national breeding bird atlases (Purroy, 1997; Martí and Del Moral, 2003), 41 countrywide species-specific censuses since 2004 (coordinated by Del Moral and Molina, see http://www.seo.org/2012/04/09/censos-de-especies/) and some long-term monitoring programmes (e.g. Del Moral et al. 1998: SEO/BirdLife, 1999; Escandell, 2011), provided good information on distribution, habitat preferences and, in many cases, population size of breeding birds. For a limited number of species/groups these censuses collected also information in winter.

It is generally accepted that the whole Mediterranean region is an important wintering area for a large number of intra-European migrating birds (e.g. Handrinos and Akriotis, 1997, Cramp and Simmons, 1998, Berthold, 2001, Spina and Volponi, 2008). Spain — as part of the Iberian Peninsula — is a wintering destination for many birds from north and central Europe. However, overall and detailed data on presence and abundance of these birds in winter was, until recently, still lacking. Exceptions were wintering waterbirds (Marti and Del Moral, 2002) and a limited number of land bird species or species groups (see SEO website), and only a few regions or provinces had published winter bird atlases: Madrid (Del Moral et al., 2002), Álava (Gainzarain, 2006) and Catalonia (Herrando et al., 2011).

Improving the knowledge on distribution and abundance of wintering birds in Spain would not only benefit the development of future ornithological research, conservation projects and serve as a base for advising on environmental policy on a national level. It would also substantially increase the general information on wintering birds in the Mediterranean region and open ways to investigate species occurrence and abundance in relation to climate change and migration patterns of trans-saharian migrants on a broader scale.

In 2006, SEO/BirdLife decided to set up an ambitious winter bird atlas project aiming at carrying out a detailed inventory, covering the whole of the country. Non-mainland territories such as the Canary and Balearic Islands were also included in the project.

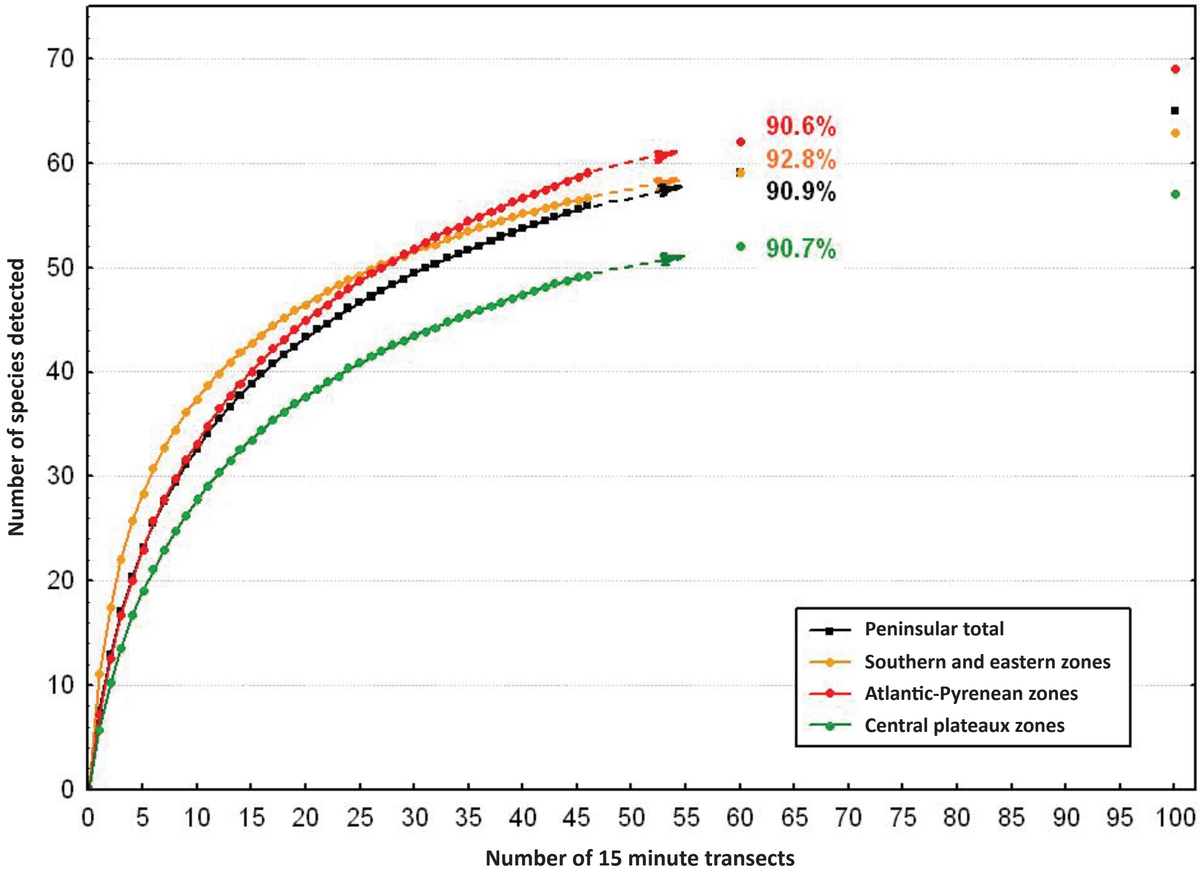


**Figure 1. Accumulation curves of different species in different regions according to census times. After 60 transects only a few more species were detected.**

We present here a summary of the methods and some important results and conclusions of this winter bird atlas project, which was published as a book in 2012. For more details, we refer to this publication (SEO/BirdLife 2012).

## Methods

### *The pilot project*

In the winter 2006–2007 we carried out a pilot project to determine the effort needed which would best adjust to a compromise between obtaining sufficient data for the necessary analyses, and to facilitate as much as possible the field work for the volunteers taking part in the atlas project. We opted for a grid of 10 × 10 km squares (UTM). Within this grid we tested and checked methods that allowed to survey the largest area in the shortest possible time and still obtain sufficient information on the presence of species (distribution) and their numbers (abundance).

In order to cover the largest possible area in each square per census hour we selected transects over point sampling (Tellería, 1986; Bibby et al., 2000; Gillings, 2008). After testing and analysing the results of the pilot project counts, we decided that a total of 15 hours of census time, spread over 5 hours/winter in three consecutive winters, was needed to cover a 10 × 10 km square sufficiently.

The examination of the species' accumulation curves in the square as the number of transects, confirmed that investing more time showed no significant increase in the number of species detected (Figure 1). Based on the long experience of SEO/BirdLife working with volunteer ornithologists we decided that three days of 5 hours fieldwork would be a feasible time investment for the majority of volunteers interested in this type of project. The mean of the data gathered during three consecutive winters, although a shorter period than recommended for these investigations (Gibbons et al., 2007; Dunn and Weston, 2008), would however show the actual patterns of winter distribution of the birds in our country with reasonable precision.

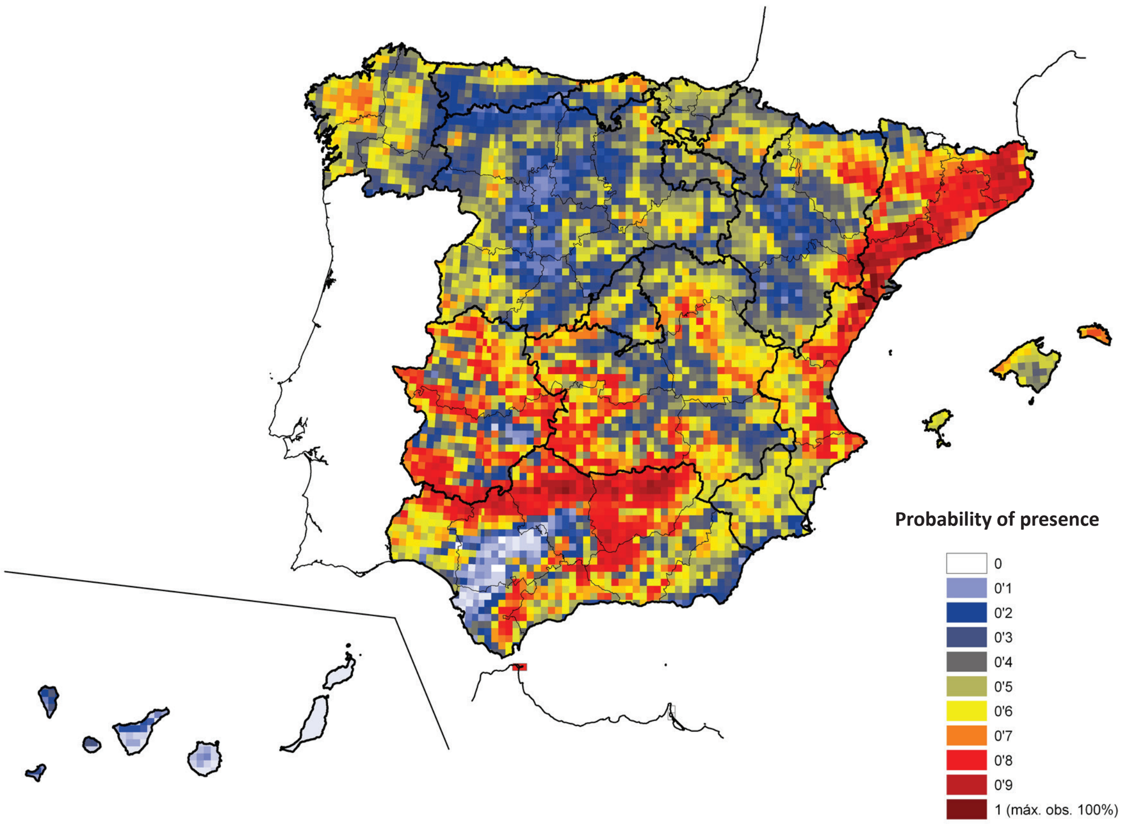


**Figure 2. Distribution of the Common Chaffinch *Fringilla coelebs* in winter in Spain in UTM 10 × 10 km squares according to the probability of observation if searched for in all the available habitats in a proportional way.**

### *The final atlas standardised methodology*

Fieldwork was carried out in the winters 2007–2008, 2008–2009 and 2009–2010, between 15 November and 15 February. This period was also applied in the Balearic Islands but not in the Canary Islands, where due to the particular phenology of the avifauna (Martín and Lorenzo, 2001) the census period was reduced to the months of November and December only. The national territory was divided into 5.600 squares of 10 × 10 km. A number of squares had a smaller area because of unequal grid geographical zones or their overlap with the coastline or national borders.

Each winter, per 10 × 10 km square, the participants had to carry out a minimum of 20 transects of 15 minutes each. They had to use either a quantitative or a semi-quantitative method. With the quantitative method the number of birds within as well as outside a 25 meter width-belt was counted in order to generate density estimates. With the semi-quantitave method, only the species presence was recorded in both belts, and no data on numbers collected. To determine the habitat choice of species, routes had to be selected in proportion to the habitats present in a square. To this end SEO/BirdLife used 45 different main bird habitats to be found in Spain and calculated for each square the percentage of each habitat present and the number of transects to be carried out in each habitat. This information was provided to all participants.

### *Methodology for other species*

- Seabirds: Costal censuses are carried out by the Iberian Seabird and Marine Mammal Monitoring Network. The samples consist of the total number of birds observed of each species from fixed counting points along the coast (Figure 3).
- Wintering Waterbird censuses: The records obtained in January according to the normal censuses of wintering water birds in Spain, compiled annually by SEO/BirdLife.
- Censusing nocturnal species: owls and nightjars. The generic methodology for the atlas consisted of at least 5 listening points of 10 minutes each distributed within the 10 × 10 km UTM square, each at least separated by

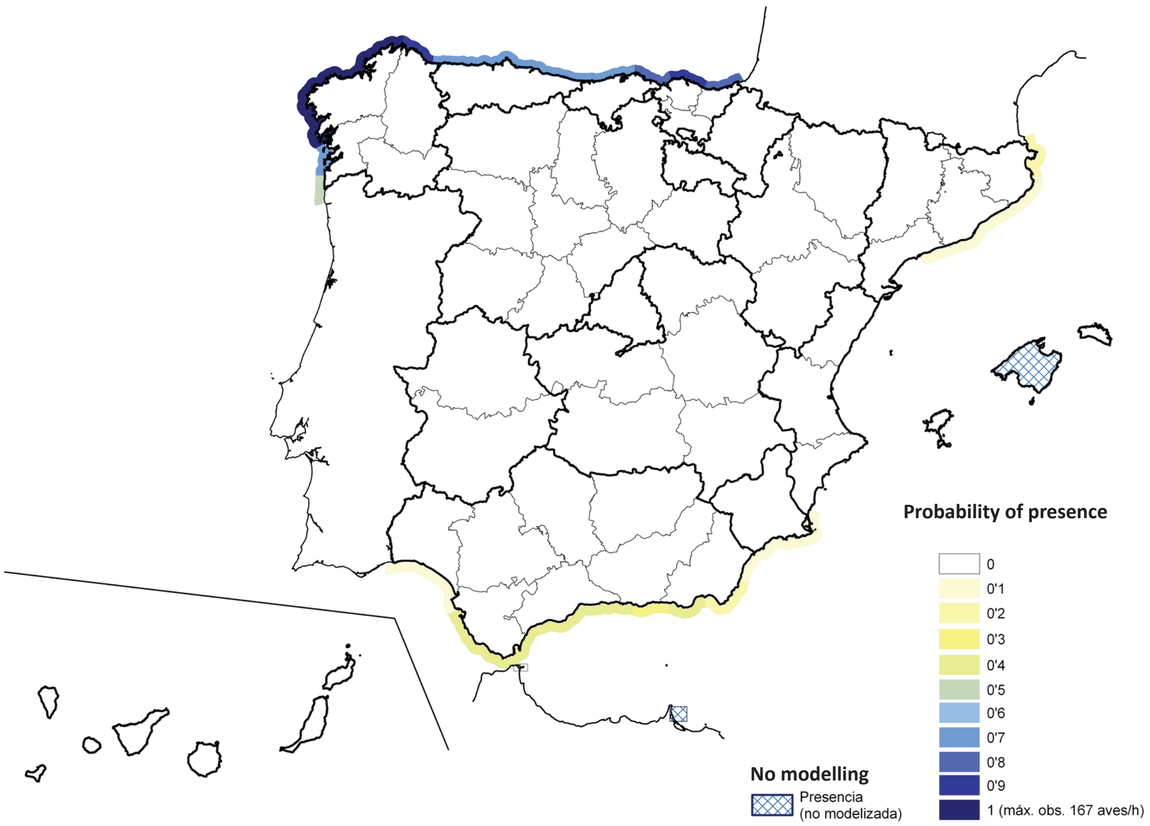


**Figure 3. Distribution of the Northern Gannet *Morus bassanus* in winter in Spain. The Spanish coastline was divided into 41 sections of approximately 50 km (based on the UTM grid of 50 × 50 km).**

1.5 km and at a different site each year. The census had to be carried out not later than two hours after sunset.

- Specific censuses of cranes, gulls and herons. Three specific censuses were carried out in order to obtain species numbers.
- Data from endangered species, scarce and rare species and exotic birds were obtained from different sources: additional observations in the squares, published records, the ringing database, and information provided by species' specialists (Figure 4).

### *Statistical analysis and modelling*

The pilot study showed that it was impossible to cover the whole national territory in only three winters and therefore we needed to apply a predictive methodology for the distribution maps (Guisan and Zimmerman, 2000; Rodríguez et al., 2007; Elith and Leathwick, 2009) which would involve mathematical modelling of the relationship between the relative frequency of the birds in the squares and the principal conditioning environmental factors (basically geographical, climatic and land use variables). From the models obtained we could statistically predict the abundance of each species in the areas where censusing was impossible.

The maps and the habitat selection graph presented in the atlas were obtained using bootstrapping techniques (De'ath, 2007). We used a number of variables representing geographical position, climate, topography, land-use and landscape that resulted in 75 descriptors calculated for each 10 × 10 km square. "Boosted regression trees" were used for the common and abundant species and the quality of the maps obtained was evaluated by considering the correlation (by an R by Spearman) between the registered observation frequencies in the field transects and those predicted by the model for the 1,880 adequately sampled squares. The "boosted classification trees" method was used for the less common and non-abundant species (De'ath and Fabricius, 2000; De'ath, 2007; Elith et al., 2008). The quality of the maps obtained was evaluated considering the area below the ROC curve (Hanly and McNeil,


**Figure 4. Distribution of Short-toed Eagle *Circaetus gallicus* (Example of presence map).**

1982). This procedure compares the presence/absence registered in the field and the probabilities predicted by the model for the 1,180 squares which were adequately censused. All the analyses were performed with Statistica 10.0 (StatSoft, 2010).

Seabirds were mapped using data of the Iberian Seabird and Marine Mammal Monitoring Network. The Spanish coastline was divided into 41 sections of approximately 50 km (based on the UTM grid of 50 × 50 km) for the modelling of the number of seabirds observed per hour from 49 watch points.

The presence of very scarce species was mapped with little squares.

## Results and discussion

### *Census effort*

The enormous effort carried out by some 1,000 volunteer fieldworkers in the three winters resulted in a detailed sampling along 120,317 transects in 2,121 10 × 10 km squares, covering about 33% of the national area (Table 1). Each winter an average of 1,800 squares was censused. During the final winter 2009–2010 additional sampling was carried out by professional field workers to fill gaps, especially in sparcely populated areas and high mountain zones.

Although in general, the provinces with a higher number of collaborators or a longer ornithological tradition had a better coverage, the prospected and non-prospected squares were spread across the country in a fairly homogeneous way. The data collected were sufficient to carry out the modelling process for the distribution of species aimed at during the initial planning of the atlas.

### *Species and species richness*

This atlas presents information on 407 species (Figure 2, 3 and 4). The majority of them (314) are taxa occurring in Spain on a regular base during the winter period. Of this group, 238 are considered as common and there were enough data to produce their distribution maps by modelling. For these species sufficient data could also be collected in order to asses in detail their environmental preferences, their approximate population size based on actual censuses and their important areas of concentration. Another 76 species, although regularly

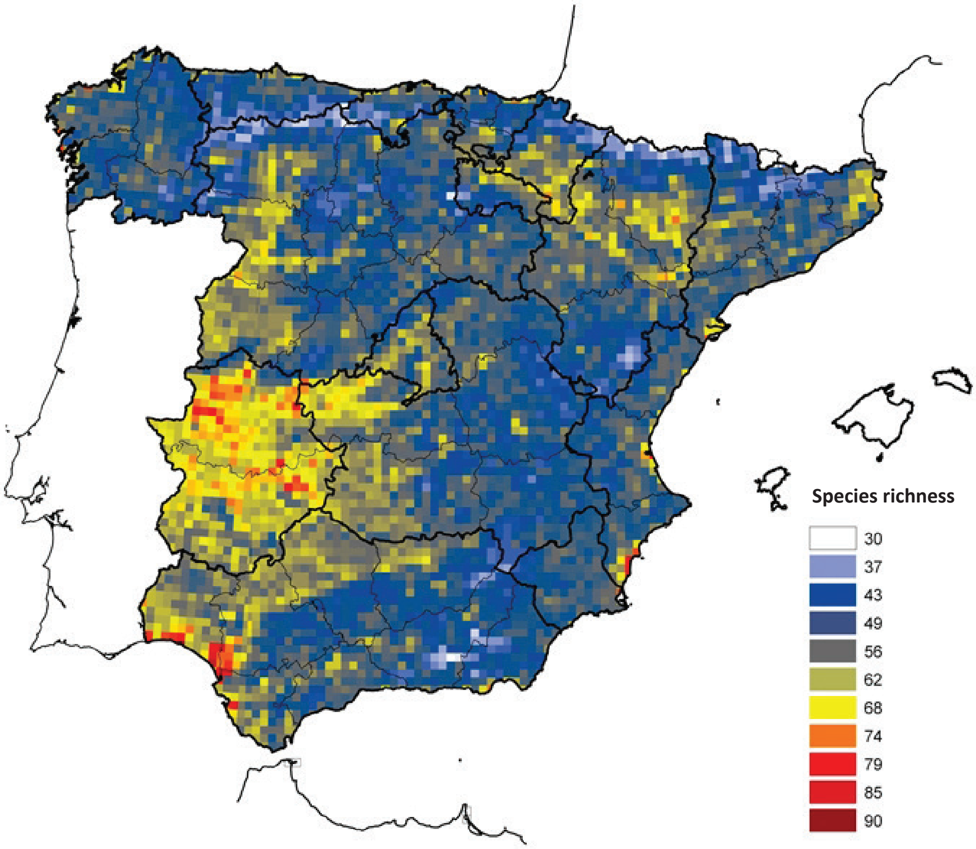


**Figure 5. Geographical variation of the total number of species of wintering birds in UTM quadrats of 10 × 10 km (species observed in 945 minutes of prospection). The values were obtained from the 'boosted regression trees' prediction models of 1,628 quadrats for which there was sufficient quantitative data.**

**Table 1. Number of 10 × 10 km UTM squares sampled each winter, with the number of transects carried out.**

| Winter | UTM number with transects | Number of transects |
|---|---|---|
| 2007–208 | 1.749 | 36.350 |
| 2008–2009 | 1.774 | 38.022 |
| 2009–2010 | 1.881 | 45.945 |
| Total | 2.121 | 120.317 |
| Annual Mean | 1.801 | 40.106 |

wintering in Spain, are less common and in general also less additional information could be collected. Apart from this 314 regularly wintering species, 35 were only occasionally seen and 58 more species were considered alien (exotic).

The number of species within a 10 × 10 km square ranges from 30 to 90. The regions with the highest diversity in wintering species can be found in south-western Spain (Extremadura, Huelva and adjacent districts in neighbouring provinces), in the northernmost areas of the central and western provinces (León, Zamora and Salamanca) and in a large part of the Ebro Delta in Catalonia (Figure 5). A large number of species also congregate, on a more local basis, in the major coastal wetlands. The important mountain ranges with altitudes above 2,000 metres show the lowest species diversity.

### *Environmental factors and species abundance patterns*

Habitat is the environmental factor that explains best the geographical patterns of abundance of species in winter. Overall, the number of species increases with a higher variety of habitat cover of wetlands, Holm Oak forests (dense or scattered over farmland-dehesas), and grassland habitats (both natural and as crops). Contrary to this, the diversity of species declines with higher coniferous and deciduous forest cover, scrubland and arboreal crops. The abundance of species also sharply decreases with altitude. In contrast, the effect of the climate variables themselves (except those linked to other environmental factors, like altitude) have little impact on the distribution of winter bird diversity across the Peninsula.

## Conclusions

The atlas project of birds in Spain in winter fills an important gap in the study of the country's avifauna but is also important within a broader international scale, providing information on the presence of wintering birds from central and northern Europe in the Mediterranean region.
Although the main goal of the atlas was to illustrate the spatial patterns of winter distribution/abundance of the species through maps, there is also a detailed analysis of the environmental factors that determine these patterns.

The information presented in the atlas is based on hundreds of thousands of records from thousands of transects collected countrywide by the many volunteer participants. It can be regarded as a key reference point for new ornithological studies and an essential tool for the management of protected areas and the conservation of the biodiversity. Furthermore, the recorded changes in short- and long-term distribution of birds give keys clues to the possible effects of global change and other factors, such as land-use change, farming activities and other human pressures.

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