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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.

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EDITORIAL

Every year thousands of volunteers participate in common bird monitoring schemes not only in Europe but also in other parts of the world. The volunteers are also often observing other wildlife than birds when doing the surveys, but this information is seldom systematically collected. Some countries have however included additional biodiversity monitoring elements into their bird monitoring schemes, which can help us to study changes in the nature. This Bird Census News issue focuses on what kind of additional taxa monitoring than birds is conducted in European bird monitoring programs based on a questionnaire to the national scheme coordinators. The questionnaire revealed that quite a few European countries already have ongoing mammal monitoring in their surveys and can calculate population trends for several species. This issue also presents six national case studies on how countries have adopted mammal monitoring in their bird surveys including analyses and results. I hope these articles will inspire other countries to consider including mammals as a part of their monitoring work, but also to think about mammal monitoring across Europe. Would it be possible to combine mammal trend information similarly as in the Pan-European Common Bird Monitoring Scheme through the national schemes? Many of the monitored mammals are game or non-native species, which is why information about their population trends is important and needed for management purposes.

Aleksi Lehikoinen
Editor Bird Census News

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Mammal and other biodiversity monitoring during common bird monitoring surveys

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Monitoring biodiversity is essential for conservation and management. Bird monitoring schemes are well established in many European countries, and these are producing large amount of information on changes in biodiversity on an annual basis. In Europe national population trends based on common bird monitoring are merged annually through Pan-European Common Bird Monitoring Scheme (PECBMS) of the European Bird Census Council (EBCC) (Brlík et al. 2021). Other taxa than birds, such as fish, butterflies, mammals, amphibians and reptiles, are also monitored in many other countries. However, monitoring of other taxa than birds is often less organised on the European level.

The butterfly monitoring in Europe is very similar to the concept of the PECBMS, where national datasets are gathered through European Butterfly Monitoring Scheme (eBMS) and multi-national population trends as well as multi-species indicators are produced (Butterfly Conservation Europe & the Centre for Ecology & Hydrology 2023). Among mammals, the European Mammal Foundation is coordinating the 2nd European Mammal Atlas (EMMA2), which covers years up to 2023 (European Mammal Foundation 2023), but long-term population abundance information is not regularly collected on European scale. In the aquatic ecosystems, the monitoring data of fish stocks is gathered on European level. However, fish monitoring is typically targeted towards only marine and economically important fish species (European Environmental Agency 2023a). European Union is also collecting information on population trends including amphibians (53 species), reptiles (90), fish (77), arthropods (125), mammals (76) and plant species (677), through the Habitat Directive. However, these only concern species which are listed in Annex II, IV and V and thus this information rarely concerns common species (European Environmental Agency 2023b). Habitat directive reporting information is also restricted to EU countries only.

Although bird monitoring schemes have been developed to survey birds, other taxa are also observed during censuses. Several countries have used this opportunity in recent decades and have asked volunteers to record some other taxa systematically. For instance, the mammal counts in the breeding birds surveys of the UK started in 1995 (Wright et al. 2014). However, the overall situation how mammal or other biodiversity are monitored in European countries along the common bird monitoring surveys is poorly known. To fill this gap in knowledge, EBCC provided a questionnaire to the national coordinators of the common bird monitoring schemes in 2022–2023. This article introduces the results of the questionnaire. Examples how mammal monitoring is conducted in various European countries during the common bird monitoring schemes have been provided in separate articles of this Bird Census News volume (Chodkiewicz et al. 2023, Dijkstra et al. 2023, Haywood 2023, Lehikoinen 2023, Peris-Morente et al. 2023, Vikstrøm & Eskildsen 2023).

The questionnaire

National coordinators were asked to answer questions about systematic data collection on other animal taxa:

1. Do volunteers of your breeding or winter bird surveys collect systematic information on other animal taxa than birds during the bird monitoring (e.g. mammals, amphibians, reptiles)?

If the data is collected, coordinators were asked to provide information on:

i) scheme and season
ii) surveyed taxon
iii) is the survey of these non-bird species voluntary/obligatory?
iv) do observers collect abundance or occurrence data?
v) when did the scheme start?
vi) has distance sampling been conducted?

In addition, the questionnaire included also questions about

2. Do volunteers of your breeding or winter bird surveys collect systematic information on habitat type along the surveys?
3. Do volunteers of your breeding or winter bird surveys collect systematic information on crop size of trees (e.g. rowan berries or cones of conifers)?

Results and discussion

31 countries replied to the questionnaire about the survey of other taxa. Ten of these have also protocol for other taxa than birds in their common bird monitoring scheme (Fig. 1, Table 1). Mammals have been surveyed in all ten countries, although in Switzerland only Red Squirrel *Sciurus vulgaris* has been surveyed. The oldest mammal monitoring schemes are in Denmark (starting in 1984), the Netherlands (1990) and the UK (1995). Three countries used volunteers to monitor amphibians or/and reptiles, but only Alpine Salamander *Salamandra atra* has been surveyed in Switzerland (Table 1). One country (UK) had also butterfly surveys in their BBS sites. In most countries, the monitoring of the other taxa was voluntary and distance sampling was used in five schemes. The mammal monitoring has so far been concentrated in North and West European countries and there is a nice climatic gradient from southwest to northeast. The existing data could be already now used, e.g., for producing large-scale species distribution models. However, this would require synchronising of the data files, which has been practiced, e.g., in PECBMS.

12 countries out of 27 replying countries reported that they are collecting habitat data from their survey sites. In most of these countries it was obligatory. In addition, one country had collected habitat data earlier through volunteers, but now switched using remote sensing data.

Only one country collected information on crop sizes of trees. Volunteers of the Finnish winter bird counts have an option to report magnitude of the crop size in Rowanberry *Sorbus aucuparia*, Norway Spruce *Picea abies* and Scot's Pine *Pinus sylvestris*. This data has been collected since 1987 and used in several studies, e.g. to connect with the annual variation in bird numbers or timing of migration (Fox et al. 2009, Kanerva et al. 2020, Lindén et al. 2011).

Overall, monitoring of other biodiversity than birds can be possible while doing the common bird surveys, but the target taxa should not cause much additional work for the volunteers. Mammal monitoring could be the easiest option to add new taxa to the monitoring scheme. This surely requires some additions to the national protocols and changes to the national databases systems. Communications with the volunteers is highly important and it is important to listen to their opinions on the new monitoring options. Having the participation voluntary will likely increase the acceptance of the new protocol. It would be delighted to see that the coverage of the mammalian surveys would expand to new countries in the future.

Table 1. National bird monitoring schemes, where other taxa than birds are also surveyed. The taxa, starting year of monitoring scheme, is the scheme obligatory or voluntary and is distance sampling used are shown.

Country	Season (scheme)	Taxon and starting year	Obligatory?	Distance
Denmark	Breeding and winter	Mammals 1984	Obligatory	No
Finland	Breeding	Mammals 2018	Voluntary	Yes
Finland	Winter	Mammals 2014	Voluntary	No
France	Breeding	Mammals 2015	Voluntary	Yes
Netherlands	Breeding	Mammals 1990	Voluntary	No
Norway	Breeding	Mammals 2016	Voluntary	No
Poland	Breeding	Mammals 2005	Voluntary	Yes
Spain	Breeding (three schemes)	Mammals 2005, amphibians, reptiles 2005	Voluntary	Yes
Spain, Catalonia	Breeding and winter	Mammals 2006	Voluntary	Yes
Sweden	Breeding, fixed routs	Mammals 2011	Obligatory	No
Sweden	Breeding, night routes	Mammals 2010, amphibians 2019	Obligatory	No
Switzerland	Breeding	Red Squirrel 1999, Alpine Salamander ~2018	Obligatory	No
UK	Breeding	Mammals 1995, butterflies 2009	Voluntary	No

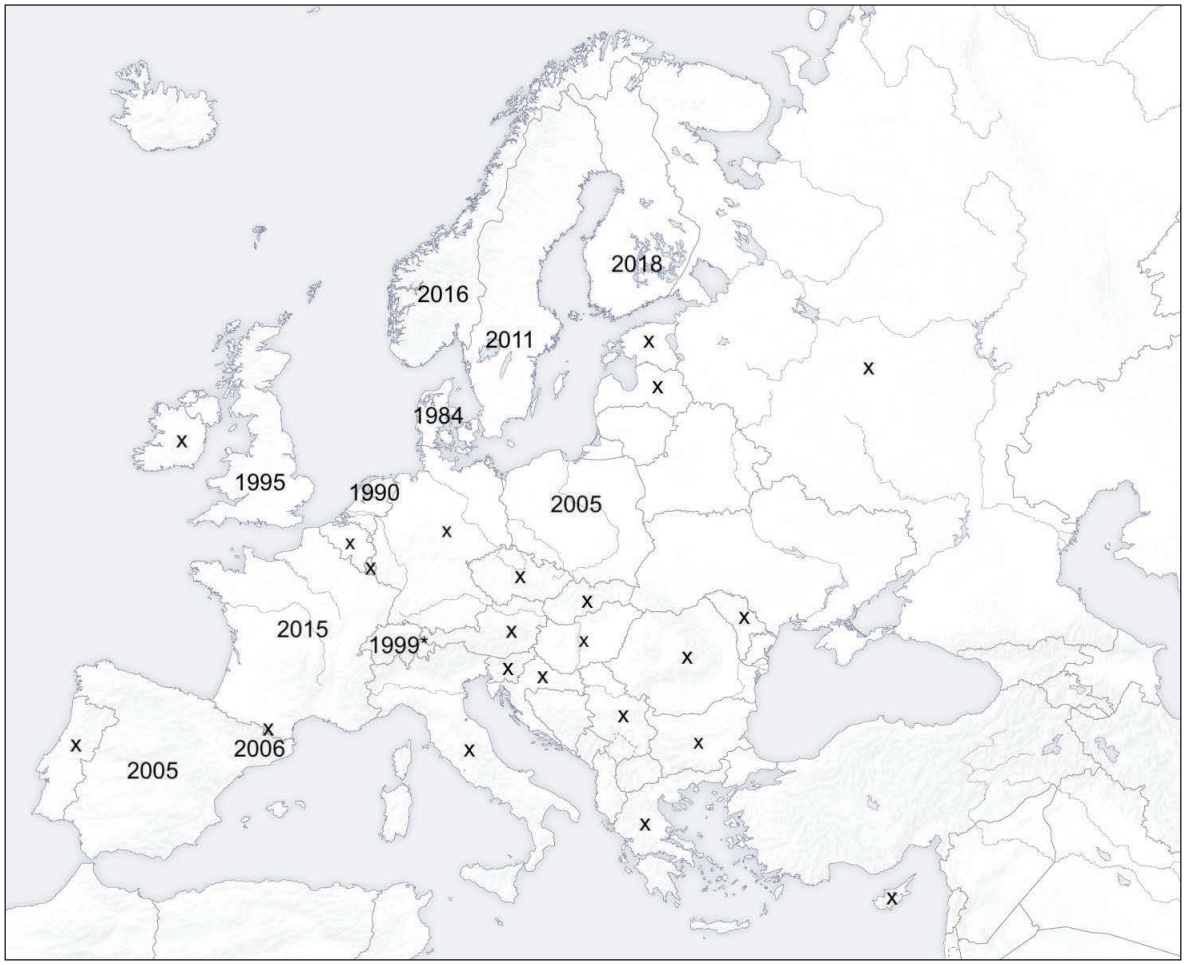

Figure 1. European countries, which have national common bird monitoring scheme and answered to the questionnaire about surveys of other taxa than birds. The years on the map are showing the starting year of the mammal monitoring in the country and 'x' means that the country currently does not have mammals included in the common bird monitoring protocol.

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Mammal monitoring through bird surveys in the UK

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Introduction

The BTO/JNCC/RSPB Breeding Bird Survey (BBS), and its sister survey on rivers and canals, the Waterways Breeding Bird Survey (WBBS) are the primary monitoring schemes that chart the changes of the UK's bird populations during the breeding season (e.g., Harris et al. 2022). The collection of survey data is undertaken almost exclusively by volunteers and has been running, in its current form, since 1994. Prior to this, the UK's breeding birds were monitored using a separate methodology and sampling regime via the Common Birds Census (CBC). Birds, by being diurnal, often highly visible and audible, make excellent subjects for volunteer-based survey methods, added to which there is a large and dedicated population of skilled birdwatchers able to undertake such surveys.

By contrast, mammals, which occupy a larger range of body sizes than birds, are much less detectable than birds due to their general tendency to nocturnalism and more limited use of human audible vocalisation. Whilst there is no single survey method that would adequately be able to survey all of the UK's birds, to adequately survey the 51 species of terrestrial mammal would require an even broader range of survey methods than is currently used for the UK's birds (Toms et al. 1999), and would undoubtedly need to make more use of non-visual techniques (e.g. passive sound recording, as is already the case for bats; Middleton et al. 2023, Newson et al. 2020).

These contrasting biological constraints between birds and mammals are reflected in the variety of schemes and organisations that are involved in their monitoring. In the case of birds, there are a relatively small number of schemes that are overseen by a small number of organisations that work collaboratively over them; e.g., BBS, The BTO/RSPB/JNCC Wetland Bird Survey (WeBS) and The BTO/JNCC Seabird Monitoring Programme (SMP). In the case of mammals, there are many organisations collecting data on mammal species or taxonomic groups that are relatively disparate in their coordination (Toms et al. 1999, Massimino et al. 2018 and references therein).

One method to increase the coverage of monitoring for any given group is to ask participants in other schemes to make observations of other taxa. The observations collected on the under-reported taxa (in this case mammals) may benefit from any underlying sampling design and statistical methods employed for the original target group. The use of volunteer ornithological surveyors in BBS and WBBS to collect data in the UK, its constituent devolved nations and even regions therein, is one of the few examples of this. Annually, indices of population abundance and trends for nine species of UK mammal are published alongside those of birds (e.g., Harris et al. 2022). These species are:

- Rabbit *Oryctolagus cuniculus*
- Brown Hare *Lepus europaeus*
- Mountain Hare *Lepus timidus*
- Grey squirrel *Sciurus carolinensis*
- Red Fox *Vulpes vulpes*
- Red Deer *Cervus elaphus*
- Roe Deer *Capreolus capreolus*
- Fallow Deer *Dama dama*
- Reeves' Muntjac *Muntiacus reevesi*

Relative to other UK mammals, these species are at least wholly or partly diurnal, or crepuscular, large bodied and readily identifiable, particularly to a group of volunteers who are already skilled in the identification of birds.

This paper describes the field recording methods, statistical approaches to analysis, and uses of mammal data collected by BBS and WBBS, with a view to it acting as inspiration for other similar schemes in other countries.

Methods

Field surveys and data collection

The recording of mammals by BBS surveyors started in 1995, one year after the scheme com-

menced in its present form. The survey protocol for bird recording used for BBS and WBBS are relatively well known and described elsewhere (e.g., Harris et al. 2022). In summary, surveys are conducted using line transects within randomly allocated 1-km squares across the UK. Birds are recorded against one of three distance bands (plus 'in flight'). Two visits are typically undertaken; an 'early' visit between April and mid-May, and a 'late' visit between mid-May and June, with visits commencing at around 0600h local time and lasting approximately two hours.

Mammal recording is an optional extra of the survey, with mammal recording being completed on around 80% of BBS survey sites on average and up to 90% in any given year.

Within field protocols, surveyors are asked with respect to mammals to:

- To count all live mammals seen during the two core bird survey visits, giving rise to count data (recorded as 'C' on field sheets).
- To make notes of any signs of mammals, with dedicated field recording codes for each of: 'F' — field sign; 'D' — dead; 'L' — Local knowledge of presence; 'S' — sightings of live mammals from other visits. These represent non-count data.

Mammal records are submitted within the same 200m transect sections as for birds, but not within distance bands. Surveyors are asked, when submitting records, to indicate whether or not they recorded mammals during their visits to ensure zero counts are interpreted correctly.

Statistical design and analysis

The sampling strategy of BBS and its rationale is detailed elsewhere (e.g., Gregory & Baillie 1994). The survey design uses a regional stratification to allow coverage to vary geographically in a planned manner to capitalise on larger volunteer pools in different areas of the UK. In each of 83 strata defined by administrative boundaries, the number of 1-km squares that were randomly selected was proportional to the number of potential volunteers. Population changes for mammals are estimated using the same methodology as for birds; a log-linear model with Poisson error terms, with counts modelled as a function of year and site effects and weighted to account for differences in sampling densities. For Red Deer and Fallow Deer, a log-linear model with negative binomial error terms is chosen to account for the over dispersed distribution of counts of these two herding species. Confidence intervals around the population changes are estimated via a bootstrap procedure.

Uses of mammal data

Population trends

Population trends of the above listed nine species of UK mammal are published annually alongside data on birds (e.g., Harris et al. 2022). These trends have been periodically updated and published alone, sometimes using modified statistical methods (e.g., Wright et al. 2013). The publication of national trends opens the poten-

Table 1. Changes in the population of nine species of UK mammal over three time periods as derived from data collected from the UK's Breeding Bird Survey. N = mean number of squares per year on which the species was recorded over the trend period in question. Ch = the percentage change in population size over the time period (* indicate a statistically significant change, where the 95% confidence limits do not overlap zero); CI = 95% confidence intervals.

	25-year trend (1996–2021)			10-year trend (2011–2021)			5-year trend (2016–2021)		
Species†	N	Ch	CI	N	Ch	CI	B	Ch	CI
Rabbit	1463	–67*	–73 ... –59	1657	–36*	–43 ... –28	1668	–16*	–24 ... –8
Brown Hare	766	27*	15 ... 40	914	32*	23 ... 43	990	39*	29 ... 48
Mountain/Irish Hare	55	–61*	–79 ... –32	66	–16	–37 ... 8	73	–40*	–53 ... –25
Grey Squirrel	828	30*	16 ... 41	1052	31*	23 ... 40	1169	27*	20 ... 34
Red Fox	282	–48*	–55 ... –39	285	–36*	–44 ... –26	266	–12*	–23 ... –1
Reeves's Muntjac	121	254*	148 ... 407	181	94*	70 ... 128	218	60*	45 ... 79
(Fallow Deer)	69	2545*	35 ... 629	87	168*	66 ... 300	97	152*	75 ... 277
(Red Deer)	74	89*	14 ... 185	94	39	–5 ... 104	109	31	–1 ... 93
Roe Deer	496	124*	92 ... 155	696	55*	42 ... 71	800	29*	20 ... 40

† Species listed in brackets are reported with the caveat that trends from herding species should be interpreted with caution; the presence or absence of a herd during a recording visit may influence counts in any given year.

tial for research on the causes and consequences of these changes at a national scale, which has hitherto only been possible in pre-selected sites or habitats of interest. These trends are now published at an increasingly more regional scale, with trends for subsets of the above species produced at the level of the UK's constituent countries and regions within England (Newson & Noble 2005). Population changes over different times (25-year, ten-year and five-year; Table 1) and population trends (Fig. 1) for the nine above listed species of UK mammal are reproduced here.

Modelling spatio-temporal trends

In addition to the production of temporal trends for nine species of mammal, as published annually alongside trends for UK birds (e.g., Harris et al. 2022), mammal data collected as part of BBS allowed these temporal changes to be modelled spatially (Massimino et al. 2018). These analyses followed an approach previously applied to bird data from the same scheme (Massimino et al. 2015) with the end product being the production of both abundance maps and maps of spatial variation in the change of relative abundance for the same nine species listed above.

Comparisons with other datasets

In 2011 the Joint Nature Conservation Committee (JNCC) funded work to compare BBS mammal trends between 1995 and 2009 with another annual scheme: the National Gamebag Census (NGC), carried out by the Game and Wildlife Conservation Trust (GWCT). The NGC is a voluntary scheme that collects bag statistics from shooting estates, on average about 650 per year. The aim of the project was to produce an overview of trends in abundance and distribution.

Of nine species tested, none differed significantly in their trends between the two schemes (Noble et al., 2012). For four species where BBS indicated significant increases between 1995 and 2009, the NCG trend was either not significant (Red Deer, Roe Deer and Reeves' Muntjac) or also showed a significant increase (Grey Squirrel). Rabbit showed a significant decline on BBS whereas NGC found no significant change.

This work demonstrated the feasibility of producing joint BBS-NGC trends for assessing population change for statutory purposes where a single figure is needed. Results of the spatial mapping were also useful, in showing areas where species are most often detected and where the most marked changes had occurred. However, due to differences in sampling design and methods, the recommendation is to routinely report temporal and spatial results from the two schemes separately.

Discussion

Collecting data for readily identifiable mammals during bird surveys comes at almost no extra cost to surveyors and does not impinge on the core activity of recording birds. Using this shared effort means that mammal counts inherit some of the benefits of BBS, in particular its robust sampling design and recording protocols. This standardisation, coupled with nationwide coverage, makes the resulting data better suited to monitoring long-term changes in time and space than records from unstructured recording schemes for which trends have to be derived with much caution. There are, however, some limitations worthy of consideration (see Wright et al. 2013 and references therein). The protocols for mammals in BBS do not, unlike the counting of birds, require observers to restrict counts to solely adults, thus the counts will reflect productivity as well as adults in a given year. This may lead to large between-year variation, especially with species that may defer breeding based on food availability (e.g., Grey Squirrel). Variation in species counts (cf. herding versus non-herding species) and sample sizes may give rise to large levels of uncertainty for trends in some species. Trends for Red Deer and Fallow Deer are therefore reported with caveats (Harris et al. 2022). The spatial scale of BBS is also not the most appropriate for some species, with home ranges of the larger species being much larger than the 1km^2 scale of BBS.

Notwithstanding these limitations, the collection of data from two taxa on the same survey site does provide a spatially and temporally matched dataset for birds and mammals. An example where spatially and temporarily paired mammal and bird data have been used comes from Newson et al. (2011), who identified negative associations between a growing deer population in lowland England and populations of several woodland bird species which are associated with dense understorey habitats.

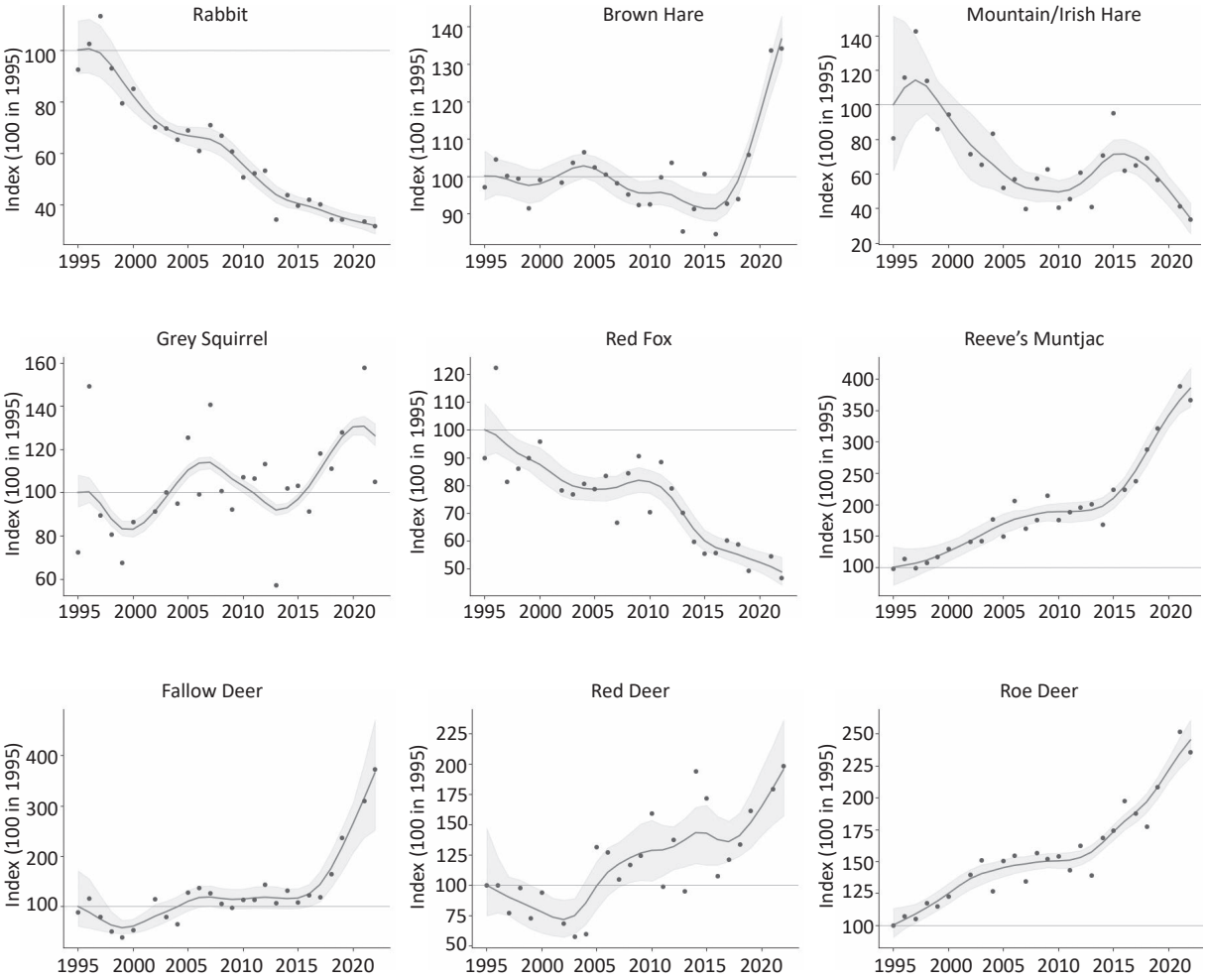

Figure 1. Population trends of the nine species (Rabbit, Brown Hare, Mountain/Irish Hare, Grey Squirrel, Red Fox, Reeve's Muntjac, Fallow Deer, Red Deer and Roe Deer) of UK mammal monitored by BBS since 1995. Plots show unsmoothed indices (dots), smoothed indices (solid lines) and 85% confidence intervals of the smooth index (shaded area). Population indices are set at 100 in the first year of mammal recording (1995).

Another example of where this taxonomic matching occurs, also involving BBS, is the inclusion of BBS squares within the sampling strategy of the UK's Wider Countryside Butterfly Survey (WCBS), which is part of the UK Butterfly Monitoring Scheme (UKBMS). BBS surveyors may visit their square later in the year, using the same transect routes and a similar distance sampling method to record butterflies. The data, alongside those from other surveys within UKBMS, are used to provide population trends of the UK's butterflies (e.g., Fox et al. 2023) and, as for birds, regular updates to Red List status (Fox & Dennis 2022).

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Counting mammals while counting birds: results and perspectives from Catalan Common Bird Survey

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Abstract. Bird monitoring schemes are prevalent throughout European countries. However, despite being less common and more complex to develop, mammal monitoring projects are increasingly more widespread. In recent decades, some bird monitoring schemes have incorporated observations of mammals to increase the amount of standardised large-scale monitoring data for this group. In 2008, the Catalan Common Bird Survey (SOCC) included mammals in their protocol. Standardised observations of mammals were obtained across 336 transects, and population trends for seven mammal species have been calculated. Our results indicate five increasing trends, one stable, and one uncertain. This study points towards the potential benefits of integrating observations of mammals in bird monitoring schemes.

Introduction

Bird monitoring schemes allow to determine relative measurements of abundance and population trends on a yearly basis (Voříšek et al. 2008). Birdwatchers that participate in these projects love identifying and counting birds, but most of them are also naturalists and, as such, are also attracted to other groups of species. This broader interest in life-history possibly contributed to enlarging the scope of some bird monitoring programmes to count mammals and not only birds as they were designed for initially. Since 1995, the British Trust for Ornithology has clearly illustrated this issue by obtaining mammal observations in 80–90% of its survey sites for three of its programs: the BTO/JNCC/RSPB Breeding Bird Survey (BBS), BTO/JNCC/RSPB Waterways Breeding Bird Survey (WBBS), and Garden BirdWatch (GBW) (Battersby & Greenwood 2004). In fact, the data collected by the BBS in the UK currently produces population trends for nine mammal species (Harris et al. 2021). Additionally, NOF BirdLife Norway, the Norwegian Institute for Nature Research (NINA) and the Norwegian Environment Agency have recently expanded their extensive monitoring of breeding birds in Norway to include the observation of mammals (NINA 2022). In this context, and as a direct demand from volunteers, the Catalan Common Bird Survey (SOCC, from their initials in the Catalan language) made a similar decision in 2008 and offered the possibility of counting mammals while conducting bird monitoring line transects.

For quite a long time, this interest did not go much further than the observers' motivation in collecting and storing these data, but this changed considerably in the framework of the development of indicators including not only birds but also other vertebrates. The best contemporary example would probably be the Living Planet Index, a composite indicator that shows the average rate of change in vertebrate population sizes at the global level (Collen et al. 2009), which has also attracted attention at the national level in several European countries (e.g. The Netherlands, van Strien et al. 2016). In Catalonia, the debate about producing such an indicator for animal species

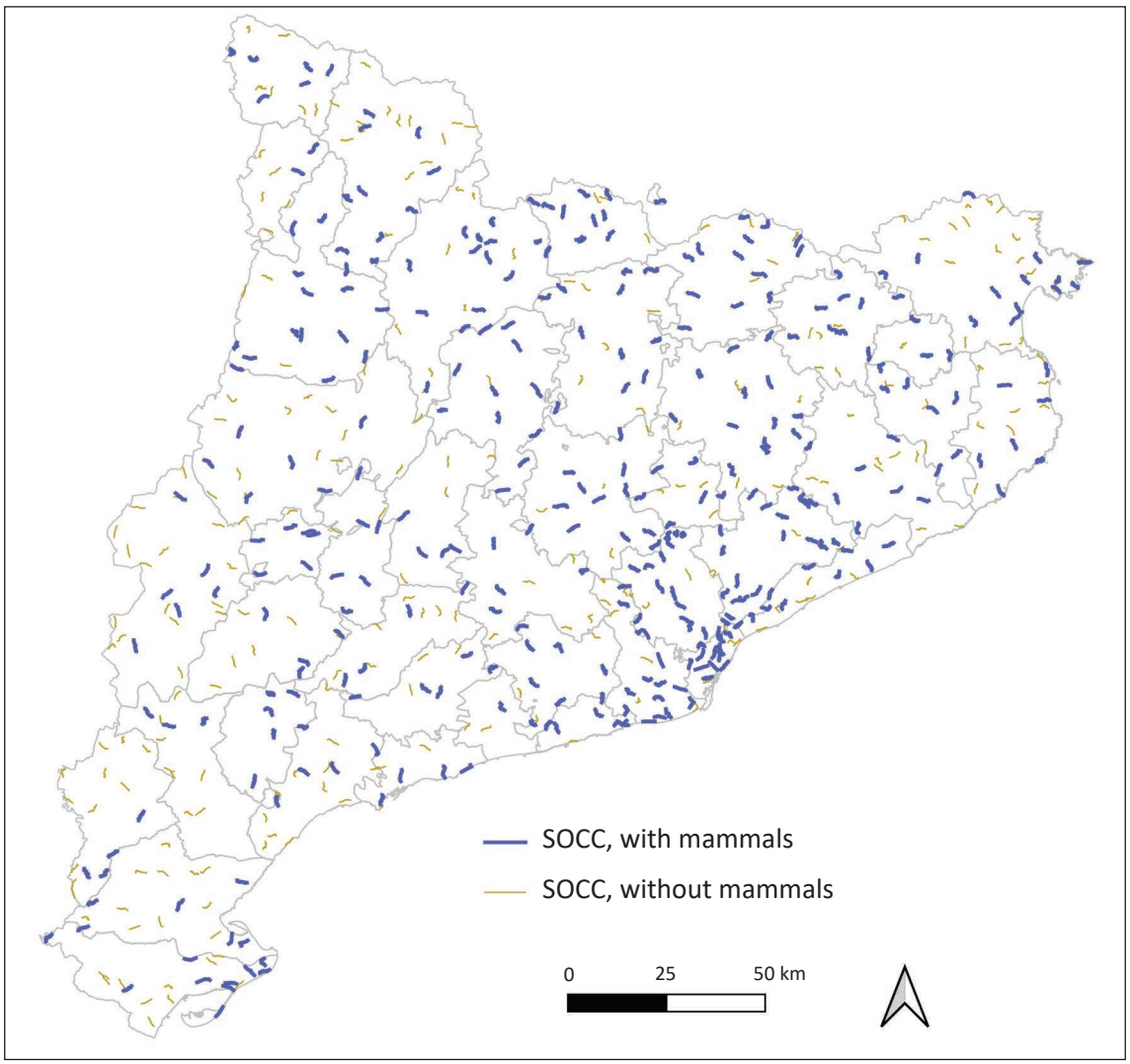

Figure 1. SOCC transects where observers have reported mammal data at least once within the period 2008–2021.

(including vertebrates and invertebrates, as in the Dutch case) unfolded progressively and the SOCC data on mammals was used in the first version of the Living Planet Index for Catalonia (LPI-Cat, ICO 2018). More recently, a science-policy-oriented approach on the situation of biodiversity ended in the constitution of the Observatory of Natural Heritage and Biodiversity and the publication of the State of Nature in Catalonia 2020 (Brotons et al. 2020), a report in which this indicator represented a true backbone.

In this context, what started as a bottom-up initiative by birdwatchers is now one of the pillars of mammal monitoring in Catalonia. In the forthcoming years, the plan is to combine these mammal data from the SOCC with data from other mammal monitoring initiatives for a better estimation of species population trends, and finally, a better estimate of the LPI-Cat.

Methods

Study area and field methodology

The SOCC (Catalan Common Bird Survey) is a region-wide monitoring scheme which aims to survey common bird species in Catalonia, NE Spain, in the long term. Catalonia has a surface of 31.990 km^2, ranging from 0 to about 3100 m.a.s.l. in elevation.

The SOCC started in 2002 and it is constituted by 3-km line transects well distributed over Catalonia with at least one transect in every UTM 10-km square (Fig. 1). The project has more than 600 transects covering all administrative counties as well as all main bird habitats. Each transect is divided into six sections of 500 m which is the real geographical data resolution collected. The bird surveys take place four times a year: two samplings in spring (between the 15th of April and the 15th of May; and the 16th of May and the

15th of June) and two more in winter (in December and January, respectively). All bird surveys should be done within the first four hours after sunrise, which means that the time frame used is optimised for bird detectability rather than for mammals. Two forms of participation are offered to volunteers. The simplest one just counts all individuals heard or observed within the transect, but the observer does not estimate the distance at which the individual stands. The advanced method collects data on the distance between the transect and the detected individual within three distance categories (0–25 m, 25–100 m, and more than 100 m). Regarding the topic of this study, since 2008, all mammals heard or seen within the surveyed area may also be annotated regardless of the method (simple or advanced) chosen, although all tracks (excrements, footprints, or other evidence of the previous passage) are excluded.

The mammal count is optional for volunteers. To properly identify who participated in the mammal count, they are urged to choose one of these three options: "I do not count mammals", "I count mammals, but I have not observed any", or "I count mammals and I have observed at least one". Surveys are mostly reported through the platform "Ornitho.cat", where the observers can enter the mammal species and number of individuals together with the birds: by noting down the section of the transect where the individual was observed, and within which distance category they observed it if they do the advanced form of the survey.

Species' annual indices and trends

To analyse trends in the mammal species, surveys where the observer had indicated they provided data for mammal species were selected

Table 1. Mammal species observed in SOCC surveys between 2008 and 2021, as well as the number observations.

Species (latin name)	Species (common name)	Observations in surveys
Oryctolagus cuniculus	Rabbit	2191
Capreolus capreolus	Roe Deer	1250
Sciurus vulgaris	Red Squirrel	917
Rupicapra pyrenaica	Chamois	808
Marmota marmota	Alpine Marmot	465
Vulpes vulpes	Red Fox	421
Sus scrofa	Wild Boar	260
Cervus elaphus	Red Deer	233
Lepus europaeus	European Hare	215
Capra pyrenaica	Iberian Ibex	192
Dama dama	European Fallow Deer	90
Mustela nivalis	Weasel	28
Myocastor coypus	Coypu	20
Martes foina	Beech Marten	16
Neogale vison	American Mink	16
Lutra lutra	Eurasian Otter	14
Meles meles	European Badger	14
Felis silvestris	European Wildcat	9
Rattus norvegicus	Brown Rat	8
Lepus granatensis	Granada Hare	7
Erinaceus europaeus	European Hedgehog	4
Martes martes	Pine Marten	3
Arvicola sapidus	Southwestern Water Vole	2
Genetta genetta	Common Genet	2
Mustela erminea	Stoat	2
Atelerix algirus	North African Hedgehog	1
Rattus rattus	Black Rat	1

(Figure 1). Using data from these surveys, annual population indices and trends (period 2008–2021) were estimated for those mammal species that 1) have enough data (i.e. appears at least in 10 transects according to similar study cases (Kyek et al. 2017)), 2) have total or partial diurnal behaviour as an assumption of sufficient detection probability during the bird survey, and 3) are large or medium-sized, to ensure the correct identification of the species in the conditions where transects were done.

To run the analysis, only years with the four counts in each transect carried on were used. Then, the maximum count obtained across the four surveys of a year is used for each transect. This protocol assumes that the population is closed all year around and the same mammal is not counted in different transects. Furthermore, trends are calculated using the rtrim package (Boogart et al. 2020) in R (R Core Team 2021), applying a weight to each transect to correct for the relative importance of each transect by taking into account information on the number of transects present on every county, 10-km square, and within a predefined biogeographic strata.

Results

Between 2008 and 2021, 27 species of wild mammals were reported in SOCC surveys (Table 1). Observers reported mammals at least once in 336 transects out of 460, which represent 73% of the total transects carried out during the studied period. Within these transects, mammals were detected on average in 63% (± 34.5% standard deviation) of the surveyed years. The most observed species were Rabbit *Oryctolagus cuniculus*, followed by Roe Deer *Capreolus capreolus* and Red Squirrel *Sciurus vulgaris*.

With the data collected, we calculated trends for seven species (Figure 2): five of them show increasing trends (Brown Hare *Lepus europaeus*, Rabbit, Alpine Marmot *Marmota marmota*, Roe Deer *Capreolus capreolus*, and Chamois *Rupicapra pyrenaica*), one species shows a stable trend (Red Squirrel), and one species had an uncertain trend (Red Fox *Vulpes vulpes*) (Table 2). Remarkably, the Roe Deer has the steepest increasing trend (slope ± SE: 1.156 ± 0.014), followed by the Alpine Marmot (1.092 ± 0.033) and the Rabbit (1.074 ± 0.011).

Discussion

Specific wild mammal monitoring programs based on diurnal line transects usually use signs of activity, such as animal tracks, because the probability of detecting many mammal species during daylight hours is too low to accurately estimate densities (Sutherland 2006). However, using indirect evidence has some limitations since they are difficult to validate, and a certain level of experience is needed to discriminate them (Barea-Azcón et al. 2007), reason why they are not included in the SOCC protocol.

Several medium and large mammals have adapted their behaviour to anthropogenic activity, for example, by becoming more nocturnal in areas with high human frequency (Lewis et al. 2021) or with reduced habitat availability (Gallo et al. 2022). However, some taxa have preserved a certain degree of diurnal activity and individuals can be regularly observed at dawn or just a few hours later, when SOCC surveys are carried out. Despite the field method is certainly not optimal for the study of mammals, part of its disadvantages are compensated, at least to some degree, by the possibility of gathering plenty of standardised data across the whole territory.

Here we presented data on seven mammal species being frequently spotted in our region during bird surveys that are performed within the first daylight hours. All of them are native and common in the study area and most of them have been included in similar analyses (Wright et al. 2014). The species showing the most positive trend is the Roe Deer, coinciding with the results obtained in other European regions (Massimino et al. 2018). The Roe Deer is favoured by the hunting reintroductions conducted in the 90s, as well as the absence of their predators (i.e., large carnivores: Grey Wolf *Canis lupus* and Eurasian Lynx *Lynx lynx*), and the increase of forested areas, where it finds food and refuge. These two latter factors might also explain the positive trend of the Brown Hare, whereas the population of the Rabbit usually fluctuates depending on the impact of viruses that are spread throughout populations (Ruiz-Olmo & Aguilar, 1995).

The relatively large size of the SOCC citizen science network distributed across Catalonia enables not only the possibility to obtain information about the species mentioned above, but also about other more discrete mammals. For instance, the Red Squirrel, despite being the most

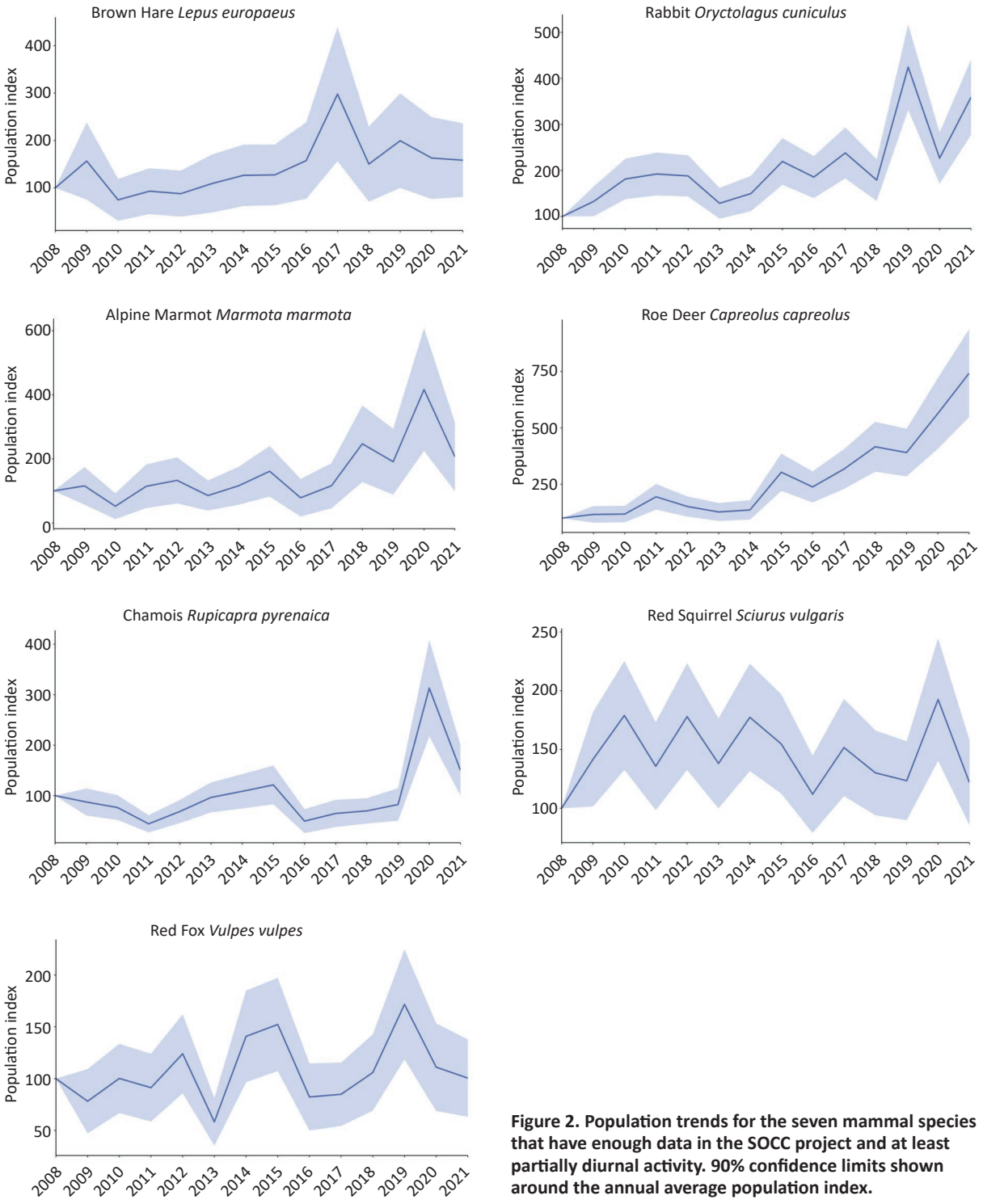

Figure 2. Population trends for the seven mammal species that have enough data in the SOCC project and at least partially diurnal activity. 90% confidence limits shown around the annual average population index.

diurnal mammal species, might be difficult to see due to their arboreal behaviour. However in some countries, its abundance is calculated with a similar methodology (Jokimäki et al. 2017). In Catalonia, the high number of individuals detected in the bird monitoring project represents, at the moment, the only available data to calculate its trend at the Catalan scale.

Furthermore, taxa that have restricted distributions in the region but high densities in the core area, such as the Alpine Marmot or the Chamois, are only possible to study by widespread monitoring programs (Ruiz-Olmo & Aguilar 1995) so can potentially profit from the distribution of the SOCC coverage. Another advantage of including mammal count data in bird surveys is simply the

Table 2. Trends of the populations of mammals in Catalonia in the period 2008–2021, calculated with the data of Catalan Common Bird Survey (SOCC).

Species		Sites	Slope (SE)	Slope classification
Lepus europaeus	Brown Hare	69	1.058 (0.027)	Moderate increase (p<0.05)
Oryctolagus cuniculus	Rabbit	132	1.074 (0.011)	Moderate increase (p<0.01)
Sciurus vulgaris	Red Squirrel	155	1.001 (0.013)	Stable
Marmota marmota	Alpine Marmot	13	1.092 (0.033)	Moderate increase (p<0.05)
Vulpes vulpes	Red Fox	126	1.020 (0.018)	Uncertain
Capreolus capreolus	Roe Deer	143	1.156 (0.014)	Strong increase (p<0.01)
Rupicapra pyrenaica	Chamois	34	1.047 (0.020)	Moderate increase (p<0.05)

efficiency in getting information about another group of fauna with hardly any extra effort, provided the volunteers have sufficient knowledge on the identification of these mammal species.

On the other hand, this lack of specificity might also be a drawback in terms of ensuring that enough observations are gathered to avoid potential biases caused by stochasticity. In fact, most of the large mammal species have extensive home ranges (Ferreras et al. 2016) and thus the technique employed might not be the best strategy to measure their relative abundance, even if some individuals are detected. Besides, as other studies have shown, bird surveys are done at a specific time of the day and year to ensure the detectability of the target species. Meanwhile, mammals may have different life strategies (daily activity, breeding seasons, hibernation periods, etc.) depending on the species and this might influence their detection probability at a specific time of the year (Massimino et al. 2018). Hence, our analysis focuses on the annual peak of species abundance observed across the four surveys within a year, probably encompassing both juveniles and adults. This approach not only provides a more robust estimate of true species abundance but also serves as a proxy for annual productivity.It is crucial to note that the study of mammals presents a unique challenge due to their diverse life cycles, requiring the use of multiple approaches to gain a comprehensive understanding of this heterogeneous group.

Given everything mentioned above, our data should be retained and used to support mammal monitoring projects, as it provides a reliable source of information for several species. In fact, some of this data has already been used to complete other monitoring initiatives. First, a portion of the information has filled in some species distribution gaps of an ongoing large mammal research project (Atlas of Mammals of Catalonia, Observatori del Patrimoni Natural i la Biodiversitat 2022a), whose main goal is to use citizen science to depict the most recent distribution of Catalan wild mammal species. Second, our results were used in the calculation of the Catalan Living Planet Index (LPI-Cat, Observatori del Patrimoni Natural i la Biodiversitat 2022b), which aims to have a major influence on decision-makers and general public attitudes. Moreover, population change indices obtained with SOCC data are similar to those calculated with nocturnal transects applied by field technicians belonging to the Catalan administrations of each of these target species (Generalitat de Catalunya, unpublished data), giving greater consistency and reliability to our data. In conclusion, it is probable that similar initiatives will emerge in the near future, and the information collected should be integrated with other sources to gain a more comprehensive understanding of the distribution and abundance of elusive animal groups.

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Mammal counts in the Breeding Bird Survey in Poland

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Well-planned citizen science projects are a source of valuable scientific data, and an already existing, well-functioning network of observers can be used to collect additional data. That is what is happening in the UK, which has perhaps the largest Breeding Bird Survey in Europe, with almost 3,000 volunteers. In addition to birds, mammals can be counted there as an option, as can butterflies in additional summer visits. In Poland, within our common breeding bird monitoring project, we also have an option to count mammals. The long time series we collected already has encouraged us to share some of the results.

The Breeding Bird Survey in Poland (MPPL) has been carried out since 2000. The programme is based on counts of all bird species seen or heard in randomly selected 1 km × 1 km sampling plots. The counts are carried out by enthusiastic volunteers, who make 2 transects of 1 km length in each plot (about 500 m apart). The observers carry out 2 surveys per breeding season: in early spring (10 April – 15 May) and in late spring (15 May – 30 June). The data obtained allow us to calculate precise trends in the abundance of 110 bird species (Wardecki et al. 2021).

Since 2005, our observers have been given the opportunity to record observations of mammals. We ask them to count all the individuals they see, but not to register tracks or field signs (e.g. mole hills). We don't want anyone to spend more time counting mammals at the expense of collecting bird data. The simple methodology has made observers very enthusiastic about counting mammals. In the first year of the survey, their presence was recorded in 76% of the surveyed plots, while in the next two years this proportion gradually increased and from the fourth year of the mammal survey to the present day it has been around 90% of the surveyed plots.

A total of 113 species of mammals occur in Poland (IOP 2023), but only 41 of them can be easily recorded. The others are marine mammals, bats, or small mammals of the orders Rodentia and Soricomorpha. Some of the 41 detectable species are difficult to identify, such as the West European Hedgehog *Erinaceus europaeus* and Northern White-breasted Hedgehog *E. roumanicus*, or the Pine Marten *Martes martes* and the House Marten *M. foina*, and are therefore these species pairs are treated as a single taxon in our data. Others are quite rare, like a newcomer to Poland, the Golden Jackal *Canis aureus* or are inconspicuous, such as the Wildcat *Felis silvestris*. In addition, the MPPL collects information on the presence of two species of domestic mammals that roam freely in the wild: the Feral/Stray Cat *Felis catus* and the Feral/Stray Dog *Canis lupus familiaris*.

In total, 26 taxa were detected in MPPL throughout the study period (Table 1). The most common mammal species with prevalence between 9 and 59% were Roe Deer *Capreolus capreolus*, European Hare *Lepus europaeus*, Feral/Stray Cat, Red Fox *Vulpes vulpes* and Feral/Stray Dog. Other mammals with prevalence between 1 and 7% include Red Deer *Cervus elaphus*, Red Squirrel *Sciurus vulgaris*, Wild Boar *Sus scrofa* and both species of marten. The next 17 species were the least common with a prevalence below 1%. The least common mammal was the European Bison *Bison bonasus* with only one observation (Table 1).

The data obtained make it possible to calculate indices and trends of change in the abundance of the most common species. Preliminary analyses were carried out for the ten most common species. They showed that the populations of three species of deer are increasing: Roe Deer (Fig. 1), Red Deer (both of which are hunted in Poland) and Moose. On the other hand, the only mammals that are clearly declining are the Feral/stray Dog (Fig. 2) and martens (Pine & House marten).

Table 1. List of mammal species recorded in MPPL in Poland, 2005–2021.

	English name	Scientific name	Prevalence (%)
1	Roe Deer	*Capreolus capreolus*	58.88
2	European Hare	*Lepus europaeus*	37.92
3	Feral/Stray Cat	*Felis catus*	17.60
4	Red Fox	*Vulpes vulpes*	10.08
5	Feral/stray Dog	*Canis lupus familiaris*	9.82
6	Red Deer	*Cervus elaphus*	6.60
7	Red Squirrel	*Sciurus vulgaris*	5.50
8	Wild Boar	*Sus scrofa*	3.90
9	Pine Marten & House Marten	*Martes martes & M. foina*	1.09
10	Moose	*Alces alces*	0.94
11	European Beaver	*Castor fiber*	0.53
12	European Mole	*Talpa europaea*	0.49
13	European Badger	*Meles meles*	0.39
14	European Fallow Deer	*Dama dama*	0.32
15	West European & Northern White-breasted Hedgehog	*Erinaceus europaeus & E. roumanicus*	0.28
16	Least Weasel	*Mustela nivalis*	0.28
17	European Hamster	*Cricetus cricetus*	0.25
18	Raccoon Dog	*Nyctereutes procyonoides*	0.21
19	European Rabbit	*Oryctolagus cuniculus*	0.18
20	Wolf	*Canis lupus*	0.12
21	European Polecat	*Mustela putorius*	0.10
22	Eurasian Otter	*Lutra lutra*	0.06
23	Stoat	*Mustela erminea*	0.06
24	Common Muskrat	*Ondatra zibethicus*	0.06
25	American Mink	*Neovison vison*	0.04
26	European Bison	*Bison bonasus*	0.01

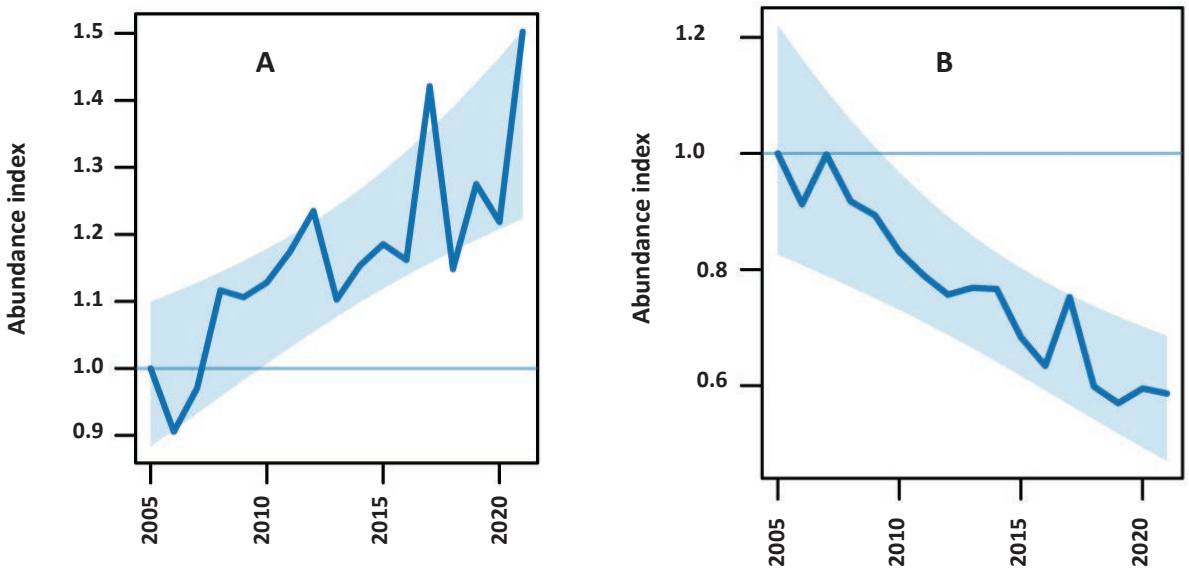

Fig. 1. Changes in the abundance indices of two mammal species: Roe Deer *Capreolus capreolus* **(left panel) and Feral/Stray Dog** *Canis lupus familiaris* **(right panel) according to Breeding Bird Survey (MPPL) data collected in Poland, 2005–2021.**

The data collected allow us to estimate changes in the abundance of the most common mammals in Poland. For the most part, these are animals subject to hunting exploitation, whose abundance and temporal changes in the country are parallelly estimated by hunters and foresters based on the so-called year-round observations and hunting bags (Zalewski et al. 2018). The MPPL results are therefore a good source of comparison for these data, collected by an independent group of observers. An additional value of the mammal data collected during bird monitoring is the information on abundance and changes in the numbers of two free-ranging, domestic animals, Feral /Stray Cats and Dogs, which have a significant, often spectacular, impact on wild bird populations (Krauze-Gryz *et al*. 2019). The information that Feral/Stray Cats were present at least in one in six survey squares was particularly disturbing.

In conclusion, we hope that the selection of data presented here, coming from bird monitoring carried out in Poland will show that it is worth to consider extending fieldwork protocols to include mammal observations.

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Mammals in the Danish Common Bird Census

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Introduction

The Danish Common Bird Census (CBC, aka. Point Count Census) has been running since 1975 (winter) and 1976 (summer), respectively, and today comprises about 400 routes. Since 1984, the project participants (obligatorily) have been registering mammals, too. In total 37 mammal species have been counted (incl. Domestic Cat *Felis catus*, and of these, four species have been counted in numbers allowing calculation of robust population indexes, i.e. Brown Hare *Lepus europaeus*, Red Squirrel *Sciurus vulgaris*, Red Fox *Vulpes vulpes*, and Roe Deer *Capreolus capreolus*. Figs 1–4 shows the population trends for summer and winter for these four species. Some more notable species encountered during CBC include Wild Boar *Sus scrofa* (27 observations since 1984), Pine Marten *Martes martes* (23), European Otter *Lutra lutra* (17), Common Porpoise *Phocoena phocoena* (12), Grey Seal *Halichoerus grypus* (three) and European Beaver *Castor fiber* (two).

Species with population indices calculated

While the Brown Hare seems rather stable in the summer counts and markedly fluctuating in winter (Fig. 1), the Red Squirrel (Fig. 2) and the Red Fox (Fig. 3) numbers seem decreasing in both seasons. In both seasons, the Roe Deer have been increasing until the early 2010s and thereafter stable or decreasing (Fig. 4).

For three of these species the population trends can be compared to trends based on game yield statistics. As the Red Squirrel is not huntable, no game statistics exist for this species, and there are no known reasons for the decrease found in the CBC. Figs 5–7 shows the game yield statistics for Brown Hare and Red Fox 1995–2019 and for Roe Deer 1941–2020. As seen for Brown Hare, there doesn't seem to be any similarity between the CBC and the game yield tendencies. This discrepancy is noted, too, by the authors behind the game yield statistics (Madsen *et al.* 2021), who add that though the game yield of Brown Hare is steeply decreasing, the hunters' own counts like those of the CBC tend to show a stable population trend of the species. The hunters' counts of Brown Hare and a few other huntable species have been carried out by volunteers from the Danish Hunters Association since 2013.

As to the Red Fox, both the CBC and the game yield trends seems to show the same negative tendency for the period in common, 1995–2019. According to Madsen *et al.* (2021), the decrease could be due to diseases as scabies and pupal distemper, which both have been widespread in Denmark, but now seems to have diminished. Despite of this, in 2019 for the first time the Red Fox was red-listed — as near-threatened (NT).

Regarding the Roe Deer, a striking similarity between the CBC and the game yield tendencies are seen. As for the Red Fox, the decrease since about 2011 may be due to diseases, but the decrease is an exclusively Danish phenomenon, which is not found in the neighbouring countries (Sunde *et al.* 2023).

Other statistics

Fig. 8 shows the daily temporal distribution summer and winter in one hour resolution for the 10 species that account for most CBC observations. Not unexpected, most species are most often encountered early in the morning. However, though most CBC counts are carried out in the early morning hours, too, species as Red Squirrel and Fallow Deer *Dama dama* (and Domestic Cat) are most frequently seen in the late morning, and the Roe Deer is seen and heard as well early as late in the morning. This is fully in accordance with the well-known habits of these species (Tonkin 1983, https://www.raavildt.dk/database/biologi/57-dognrytme, https://animaldiversity.org/accounts/Dama_dama/), as is the temporal position of the observations of bats (Chiroptera sp.) before sunrise and after sunset.

Table 1 shows the distribution of the most common

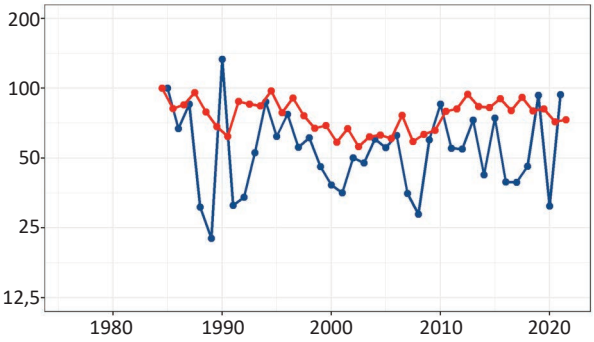

Figure 1. Population index for Brown Hare *Lepus europaeus* in Denmark since 1984 based on summer (red) and winter (blue) CBC surveys.

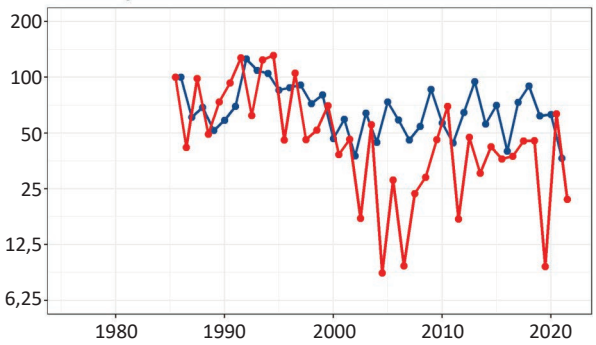

Figure 2. Population index for Red Squirrel *Sciurus vulgaris* in Denmark since 1984 based on summer (red) and winter (blue) CBC surveys.

Table 1. Number of records of the most common mammal species in Common Bird Counts (CBC) on seasons since 1984. SU = Summer (May 1 – Jun 15), W = Winter (Dec 20 – Jan 20), SP = Early spring (Mar 15 – Apr 30, only since 2021), N = Night (May 20 – Jul 10, only since 2021).

English species name	Scientific species name	Season	No. of obs
Brown Hare	*Lepus europaeus*	SU	10442
Roe Deer	*Capreolus capreolus*	SU	6744
Roe Deer	*Capreolus capreolus*	W	4225
Brown Hare	*Lepus europaeus*	W	1500
Red Squirrel	*Sciurus vulgaris*	W	1090
Red Fox	*Vulpes vulpes*	SU	1062
Red Squirrel	*Sciurus vulgaris*	SU	995
Red Fox	*Vulpes vulpes*	W	406
Fallow Deer	*Dama dama*	W	221
Red Deer	*Cervus elaphus*	SU	209
Fallow Deer	*Dama dama*	SU	202
Roe Deer	*Capreolus capreolus*	SP	140
Brown Hare	*Lepus europaeus*	SP	126
Roe Deer	*Capreolus capreolus*	N	44
Red Squirrel	*Sciurus vulgaris*	SP	34
Domestic Cat	*Felis catus*	SU	30
Domestic Cat	*Felis catus*	W	27
Wild Boar	*Sus scrofa*	SU	27
Bats sp.	*Chiroptera*	N	27
Red Deer	*Cervus elaphus*	W	26
Pine Marten	*Martes martes*	SU	23
Bats sp.	*Chiroptera*	SU	22
Pine/Beech Marten	*Martes martes/M. foina*	SU	17
Hedgehog	*Erinaceus europaeus*	SU	15
Eurasian Badger	*Meles meles*	SU	15

species on seasons. Note that the seasons 'early spring' and 'night' were introduced only in 2021 and thus cover just two years. Therefore, when comparing only the 'old' seasons summer and winter, common species as Brown Hare, Roe Deer and Red Fox all are most common in summer, while the opposite is true for Red Squirrel. While this pattern is difficult to explain, it is easily understandable that hibernating species as bats, Hedgehog (*Erinaceus europaeus*) and Eurasian Badger (*Meles meles*) are only found in spring and summer.

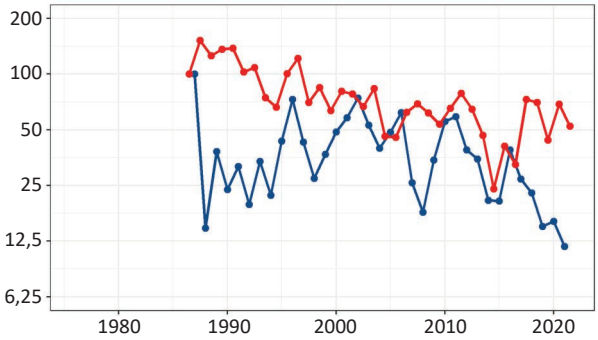

Figure 3. Population index for Red Fox *Vulpes vulpes* in Denmark since 1984 based on summer (red) and winter (blue) CBC surveys.

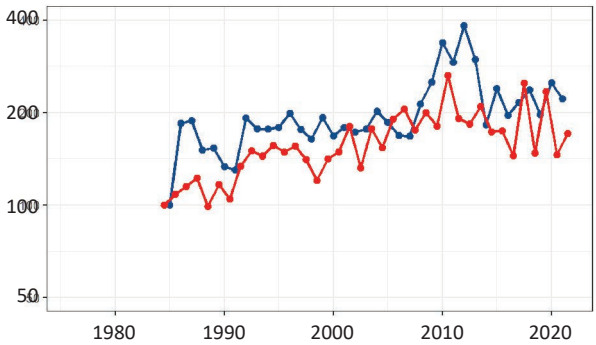

Figure 4. Population index for Roe Deer *Capreolus capreolus* in Denmark since 1984 based on summer (red) and winter (blue) CBC surveys.

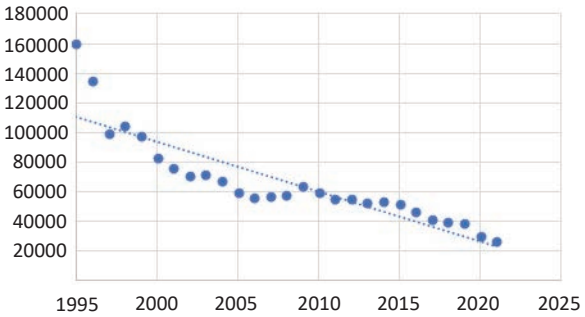

Figure 5. Annual game yield of Brown Hare *Lepus europaeus* in Denmark in 1995–2019 with tendency lines. The long term trend is shown on a dashed line. From Madsen et al. (2021).

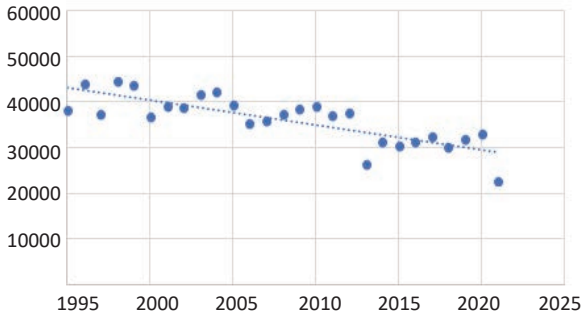

Figure 6. Annual game yield of Red Fox *Vulpes vulpes* in Denmark in 1995–2019 with tendency lines. The long term trend is shown on a dashed line. From Madsen et al. (2021).

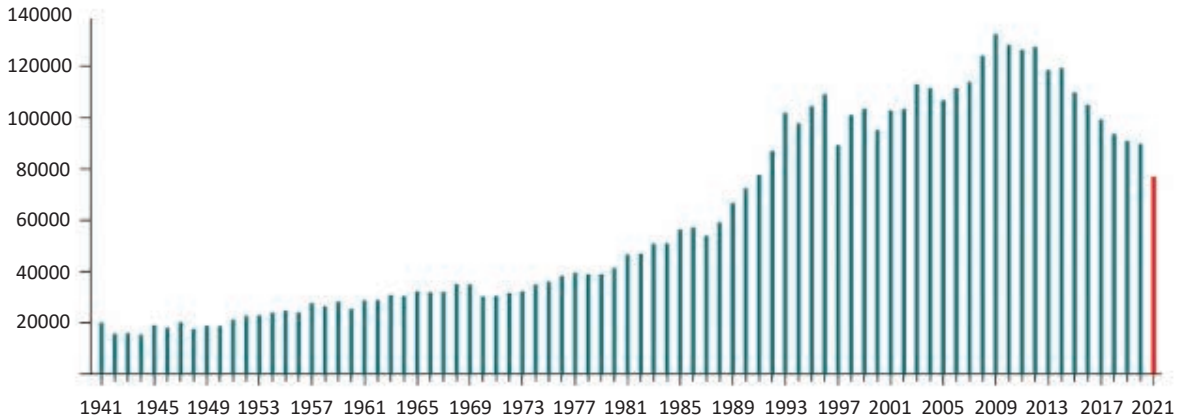

Figure 7. Annual game yield of Roe Deer *Capreolus capreolus* in Denmark 1941–2020. From Sunde et al. (2023).

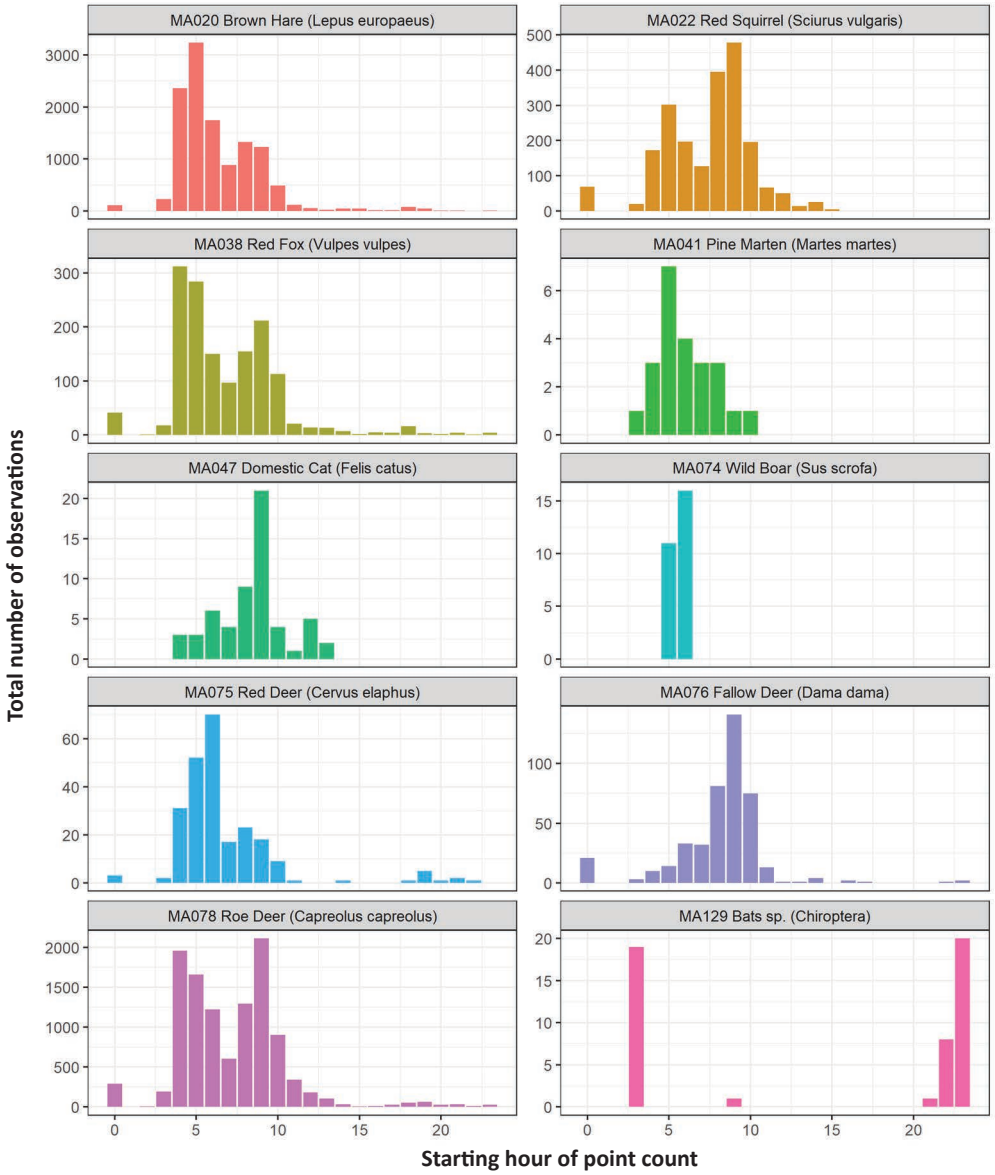

Figure 8. Daily temporal distribution summer and winter in one hour resolution of the Common Bird Counts (CBC) observations of the 10 most common mammal species.

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Mammal monitoring in the Finnish bird survey schemes

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Introduction

Finland has a long tradition of both bird and mammal monitoring. Winter bird counts started in 1956/57 (Fraixedas et al. 2013, Lehikoinen 2016) and annual breeding bird surveys in 1975 (Lehikoinen & Väisänen 2023). The monitoring of larger common mammal species has been conducted through snow track surveys by hunters during winter along so-called wildlife triangle censuses (Pellikka et al. 2005). The wildlife triangles cover most part of Finland and provide population trends for common species especially for hunting management purposes (Helle et al. 2016). Small mammal populations have also been monitored in Finland for decades, using snap traps (Korpela et al. 2013). The fact that wildlife triangles are based on snow tracks and climate change has already decreased the snow cover, especially in South Finland (Deshpande et al. 2022), can make this method vulnerable if winters become snowless in the future. Wildlife triangles are also mainly targeted to forested landscapes and hence the mammals of farmlands and especially in and around urban areas have received less monitoring attention. To complement these existing national mammal schemes, a mammal survey option was added to the Finnish common bird monitoring schemes in 2010s. This happened first to the winter bird counts (since winter 2014/2015) and followed by line transect surveys (2018) and point counts (2019) of the breeding season survey, when database systems of these schemes were updated. The new mammal monitoring components in Finland's bird surveys were inspired by schemes elsewhere in the Europe, e.g. UK (see Haywood 2023) and Sweden (Svensk fågeltaxering 2023). This article will present the first population trends calculated from the mammal surveys conducted during Finnish winter bird counts.

Material and methods

Monitoring of wintering birds in Finland is based on freely chosen line transects (c. 10 km long) surveyed by volunteers. Because most Finns live in the southern half of the country, the survey sites are also biased toward south. The survey effort has been relatively constant for a long time and between 621 and 670 routes have been surveyed annually since 2014/2015 (hereafter 2015). 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) (Lehikoinen 2016). The voluntary option also to count mammals in the surveys was added in winter 2014/2015 and since then c. 75 % of the routes have surveyed mammals on annual basis (min–max 58–92 %, with increasing tendency). The volunteers are required to tick a box if they have reported all the observed (seen or heard) mammal species during the survey. Volunteers have not been given any specific species list of mammals to observe, but all species have been covered, including small-sized species such as rodents and bats; especially small rodents have traditionally high population fluctuations (Hanski et al. 1991), which could be at least in theory picked up in the surveys. Among domestic mammal species, free-roaming Feral Cats *Felis catus* and semi-domestic reindeers *Rangifer tarandus* were also counted.

The population trends were calculated using rtrim-package (Bogaart et al. 2018) in R (version 4.0.5., R Core Team 2021), which is commonly used tool in bird monitoring work in Europe. The package calculates annual population indices and long-term trend using Poisson regression models. The number of individuals in a given route is the dependent variable, and year and route ID are the explanatory variables. The data from mid-winter (Dec-Jan) survey season only were used as this

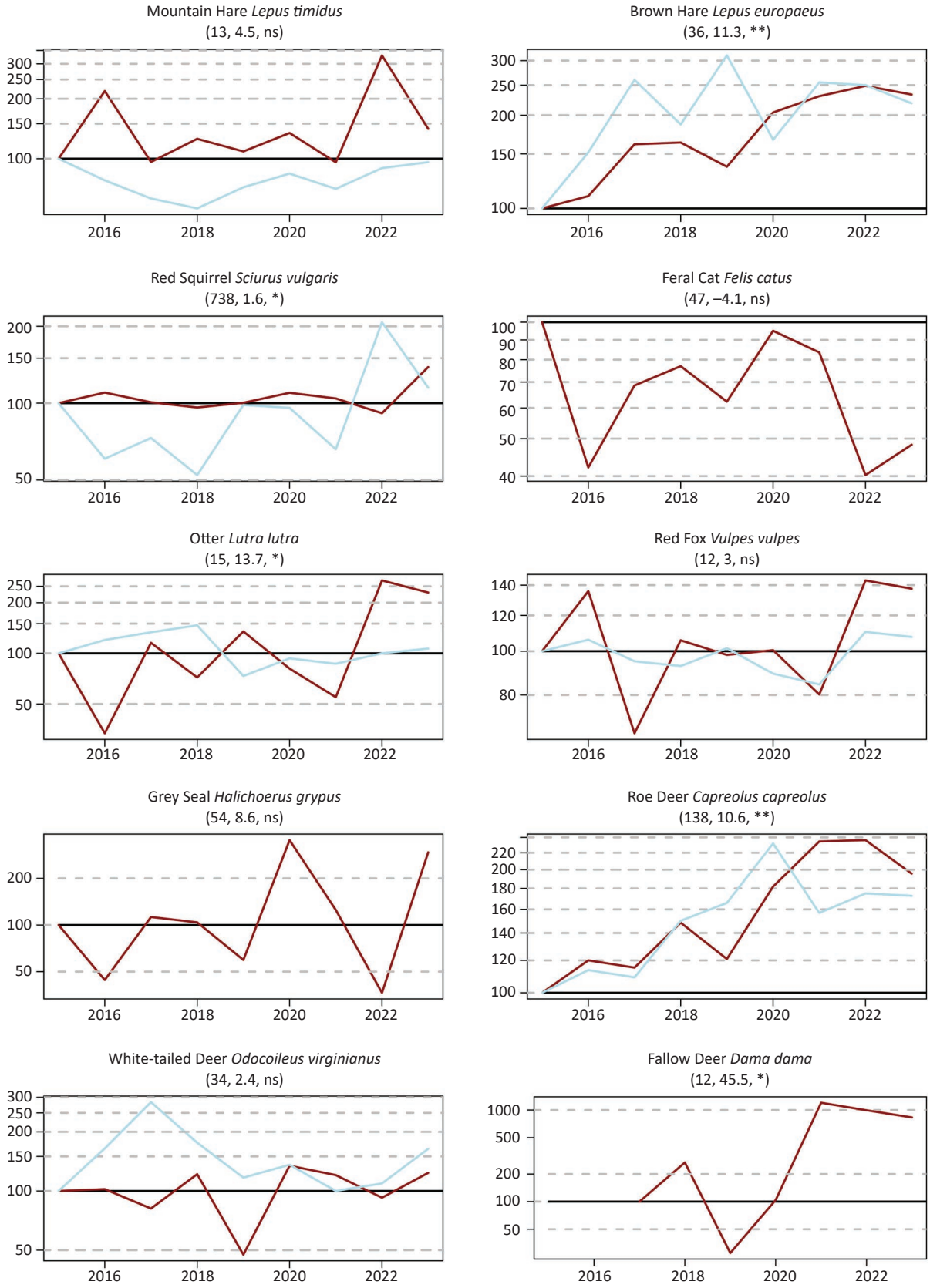

Figure 1. Population trends for ten mammal species in the Finnish winter bird counts (in red) during 2014/2015–2022/2023 and the corresponding abundance indices based on snow track surveys of wildlife triangles (in blue). For three species the wildlife triangles did not give decent data and the data is not shown (Feral Cat *Felis catus,* Grey Seal *Halichoerus grypus* and Fallow Deer *Dama dama*). The values in the brackets shows the annual sample sizes, annual population growth rate of the winter bird survey data and asterisk shows the significancy of the trend (ns = not significant, * = P < 0.05, ** = P < 0.01).

Table 1. List of species observed in the Finnish winter bird counts during 2014/2015–2022/2023. The number of individuals in all three seasons and during the mid-winter period only are given.

Species name	All seasons	Mid-winter
Sciurus vulgaris	20830	6641
Capreolus capreolus	3884	1245
Odocoileus virginianus	1069	307
Felis catus	984	425
Lepus europaeus	949	324
*Rangifer tarandus**	826	54
Halichoerus grypus	539	482
Lepus timidus	354	120
Dama dama	292	108
Vulpes vulpes	266	107
Alces alces	248	85
Lutra lutra	217	134
Oryctolagus cuniculus	59	12
Rattus norvegicus	54	37
Myodes glareolus	49	23
Apodemus flavicollis	42	15
Neovison vison	38	20
Mustela nivalis	33	10
Mustela erminea	27	12
Arvicolinae	20	9
Ondatra zibethicus	20	2
Nyctereutes procyonoides	11	5

Species name	All seasons	Mid-winter
Microtus agrestis	10	5
Sorex araneus	10	5
Soricidae	10	5
Martes martes	8	4
Arvicola amphibius	7	4
Mus musculus	6	3
Eptesicus nilssonii	5	2
Lynx lynx	5	1
Myotis nattereri	4	1
Myotis mystacinus/brandtii	3	0
Talpa europaea	2	0
Myotis daubentonii	2	1
Pteromys volans	2	1
Meles meles	1	0
Apodemus agrarius	1	0
Neomys fodiens	1	1
Erinaceus europaeus	1	0
Plecotus auritus	1	0
Myodes rufocanus	1	0
Pusa hispida	1	1
Microtus	1	1
Myodes rutilus	1	0

*includes both forest reindeer *Rangifer tarandus fennicus* (Central Finland) and semi-domestic reindeer (North Finland).

has had the best coverage among all three seasons. The trends were calculated for all species which had at least 100 individuals observed in nine study years. The annual abundance indices were plotted together with snow track survey results for those species which had decent annual abundance indices produced based on the the wildlife triangles (available at https://luonnonvaratieto.luke.fi/numerotieto/raportit?panel=lumijalkilaskennat). The original snow track results are tracks per 10 km route, which has been standardised over the species so that the every species get an abundance index set at 100 in 2015 (see Fig. 1).

Results

Altogether 41 mammal species were observed in the surveys, but most of them were observed in very small numbers (Table 1). Twenty-three species were observed at least ten times and 12 species had more than 100 individuals observed in all surveys altogether (Table 1).

The population trends were calculated for the ten most abundance species, which had more than 100 individuals observed during the mid-winter season surveys. Among these ten species six showed increasing population trends: Red Squirrel *Sciurus vulgaris*, Roe Deer *Capreolus capreolus*, Brown Hare *Lepus europaeus*, Grey Seal *Halichoerus grypus*, Fallow Deer *Dama dama* and Otter *Lutra lutra* (Fig. 1, Table 2).

Discussion

The data collected on the winter bird counts provides useful information on population trends of common mammal species. Nine years of monitoring already shows that some species have had significant population changes and several species have increased their population sizes, including nationally poorly monitored non-native Feral Cat and Fallow Deer. Coarse comparisons based on Fig. 1, suggest that the increasing trends seem to be consistent in both winter bird count and wildlife triangle data in Red Squirrel, Roe Deer

Table 2. Population trends of ten most abundant mammal species in the Finnish winter bird counts during 2014/2015–2022/2023. The annual population growth rates and their standard errors are given. The species with significant population changes are bolded.

Species	slope	se
Sciurus vulgaris	0.016	0.006
Capreolus capreolus	0.106	0.021
Odocoileus virginianus	0.024	0.041
Felis catus	–0.041	0.024
Lepus europaeus	0.113	0.027
Halichoerus grypus	0.086	0.042
Lepus timidus	0.045	0.055
*Dama dama**	0.455	0.159
Vulpes vulpes	0.030	0.041
Lutra lutra	0.137	0.049

*trend only from winter 2016/2017 onwards.

and Brown Hare. However, no comparable statistics were conducted due to lack of raw data from the wildlife triangle surveys.

Data on the habitat types is collected in the winter bird counts, which could also help to examine if the population changes differ between habitats. The coverage of the surveys are improving, especially in human settlement habitats. The collection of mammal data in the breeding bird surveys of the Finnish line transect and point count schemes has only been occurring for six and five years respectively, but will be able to complement the trend analyses in the coming years.

Acknowledgements

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Monitoring mammals during the Dutch breeding bird monitoring program

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Since 1984 the Sovon Dutch Center for Field Ornithology has run a monitoring scheme for breeding birds (BMP) in the Netherlands (Van Turnhout et al. 2010). Since 1994 volunteers from Sovon were asked by the Dutch Mammal Society (ZV) to also collect data from those mammals that can easily be spotted in early daylight during their monitoring rounds for breeding birds: day-active mammals. This was the start of a cooperation between two NGO's in collecting data for two species groups in one monitoring scheme. Since 2009 mammal data from a second bird monitoring scheme coordinated by Sovon (Monitoring Urban Species, MUS), was incorporated in the monitoring scheme for mammals. The bird survey BMP consists of territory mapping. Both schemes include multiple visits to the study plot annually. The mammal data were selected by using the maximum number of animals per species per year. Data include only living mammals, so roadkill or traces of mammal presence, like faeces or footprints are not included. Statistics Netherlands (CBS) analyses the data and calculates trends and indices using the specially developed R-package RTRIM (Bogaart et al. 2020). Trends and indices are calculated for the entire period of data collecting and for the last 12 years.

Over the years, the number of plots where data on mammals are collected grew significantly from about 200 in 1994 to over 1,600 in 2022 (Figure 1). This growth is the result of a growing number of volunteers involved in bird and nature monitoring, stimulated by an increasing awareness of threats to nature and continuous technical developments in collecting and processing data, to make data reporting easier for volunteers and to improve feedback. The general distribution of the

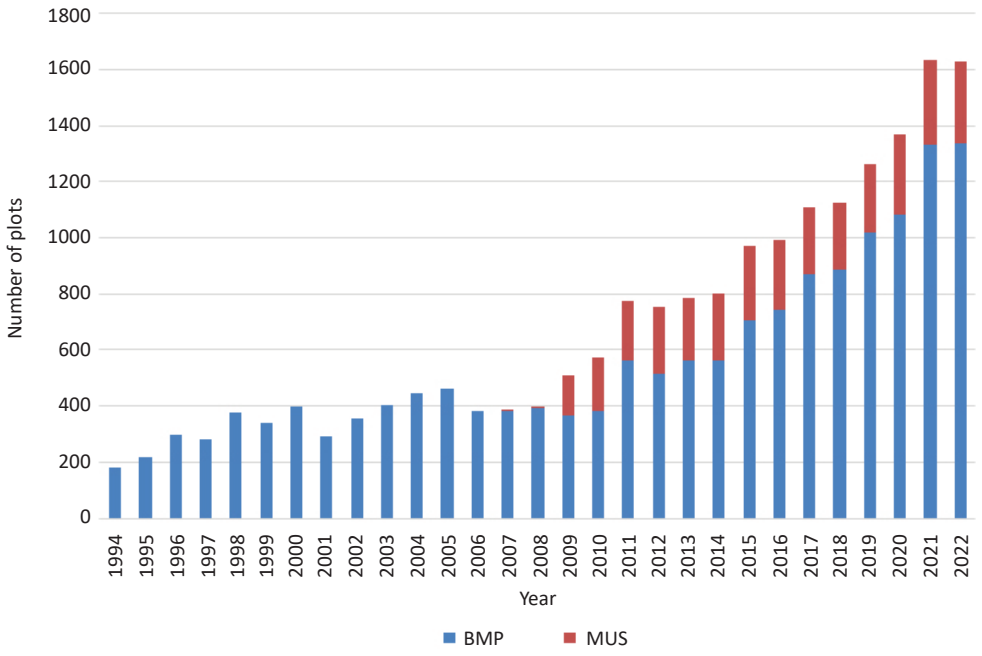


Figure 1. Annual number of plots where mammal data has been collected in the Netherlands. Two monitoring schemes on birds are incorporated in the monitoring scheme for mammals; BMP = Breeding Bird Survey and MUS = Monitoring Urban Species.

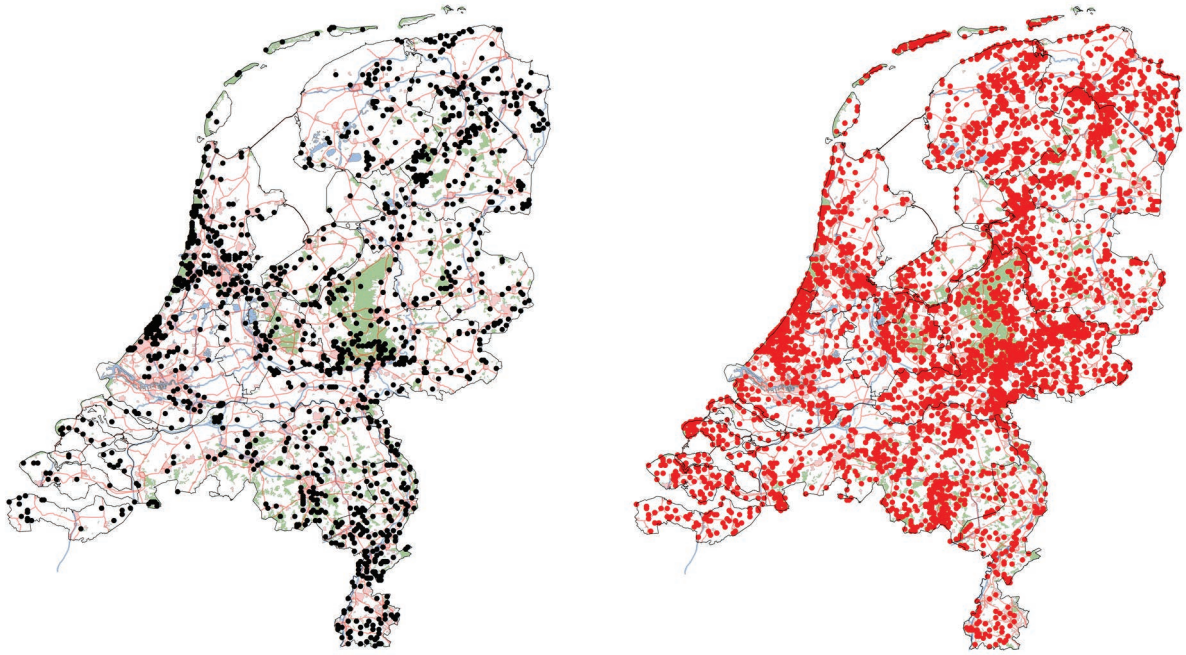


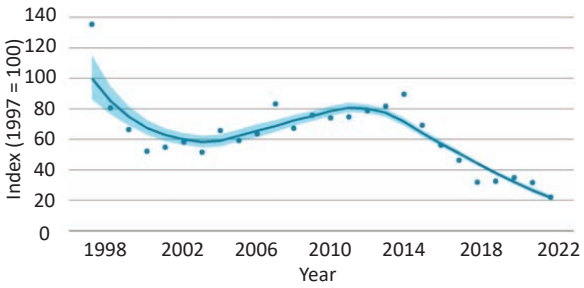
Figure 2. Distribution of plots where mammal data has been collected in the Netherlands during monitoring schemes for birds (2a left; black dots 1994–2010, 2b right: red dots 2011–2022).

Table 1. An overview of population trends and other technical data on seven mammal species in the Netherlands until 2022.

	Starting year	Trend entire period	Standard error	Trend category	Number of plots	Trend last 12 years	Standard error	Trend category	Number of plots
European hare *Lepus europeaus*	1997	0.989	0.002	Moderate decrease (p<0.01)	3366	1.008	0.003	Moderate increase (p<0.05)	2187
Rabbit *Oryctolagus cuniculus*	1997	0.968	0.004	Moderate decrease (p<0.01)	1884	0.884	0.005	Strong decrease (p<0.01)	896
Red Squirrel *Sciurus vulgaris*	1996	0.992	0.004	Moderate decrease (p<0.05)	1044	1.028	0.008	Moderate increase (p<0.05)	548
Red Fox *Vulpes vulpes*	1994	0.990	0.005	Moderate decrease (p<0.05)	1386	0.991	0.008	Stable	730
Roe Deer *Capreolus capreolus*	1994	1.007	0.002	Moderate increase (p<0.05)	2711	1.010	0.003	Moderate increase (p<0.05)	1728
Hedgehog *Erinaceus europaeus*	1994	0.961	0.007	Moderate decrease (p<0.01)	459	1.004	0.017	Stable	172
Muskrat *Ondatra zibethicus*	1995	0.915	0.008	Strong decrease (p<0.01)	273	0.881	0.020	Strong decrease (p<0.05)	61

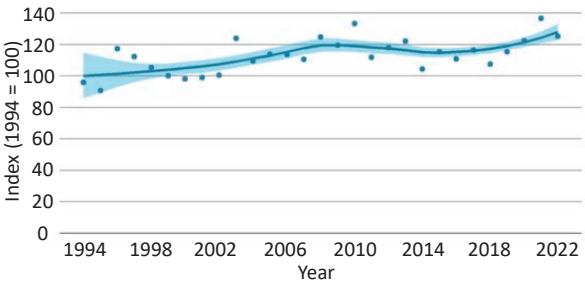
plots in the Netherlands is nowadays almost ideal and is shown in Figure 2.

At the moment national trends can be generated for seven mammal species. An overview of these species with trends until 2022, trends over the last 12 years (2011–2022) and other information is given in Table 1. Five of these species have a trend in the category moderate decrease for the entire period of data collecting (European Hare *Lepus europaeus*, Rabbit *Oryctolagus cuniculus*, Red Squirrel *Sciurus vulgaris*, Red Fox *Vulpes vulpes* and European Hedgehog *Erinaceus europaeus*). While four of those species have stable or increasing trends for the last 12 years (Euro-



Bron: NEM (Zoogdiervereniging, CBS), 2023

Figure 3. Indices (spots) and trendline of the population development of Rabbit *Oryctolagus cuniculus* in the Netherlands (source: ZV/CBS). The blue band represents the 95% confident intervals of the trend.



Bron: NEM (Zoogdiervereniging, CBS), 2023

Figure 4. Indices (spots) and trendline of the population development of Roe Deer *Capreolus capreolus* in the Netherlands (source: ZV/CBS). The blue band represents the 95% confident intervals of the trend.

pean Hare, Red Squirrel, Red Fox and European Hedgehog), the downfall of the Rabbit population has been even stronger for the last 12 years (Figure 3). This is due to the Rabbit Haemorrhagic Disease virus (RHD). The non-native Muskrat *Ondatra zibethicus* shows a strong decrease in population numbers because of the culling activities by a few hundred professional trappers to protect Dutch dikes and water banks. The only species that shows an increase in numbers for both periods is Roe Deer *Capreolus capreolus* (Figure 4).

In addition to national trends and indices, for some species there are also trends calculated on a more detailed geographic level, such as for provinces or natural versus agricultural areas. The extent to which this results in reliable and plausible trends varies per species and is mainly influenced by number of plots and counts and the representativity of the plots for the distribution of the species involved. For other mammal species, like European Beaver *Castor fiber*, European Badger *Meles meles* and some ungulates, the number of plots and consistency of counts is too low to calculate robust trends, but these counts are still valuable because they can be used to determine the distribution of species.

The results of this monitoring scheme are used to compile the national Red List of threatened mammals. Besides that, trends are used for the national Living Planet Index and determine nature quality in the agricultural landscape. The results are also used for hunting policy and fauna management plans in some provinces.

We thank Sovon and its volunteers for making this mammal monitoring scheme possible.

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EUROPEAN MONITORING NEWS

Introducing the EBCC board: Mark Eaton

Aleksi Lehikoinen

What is your title and the current working position?

I am a freelance ornithological consultant, but most of my work time is occupied as Secretary of the UK's Rare Breeding Birds Panel (RBBP).

Could you tell more about the work of the British Rare Breeding Bird Panel. How it is structured, how it contributes to bird monitoring and where the data is used?

The RBBP was founded in 1973 as an independent organisation for monitoring the UK's rarest breeding birds. It's funded by the RSPB and the UK government, with additional support from the British Trust for Ornithology, which supports the work of a professional Secretary whose work is steered by a Panel of experts. The Panel collates data from a wide range of sources — site monitoring, ringing, nest recording, species surveys and, most importantly, from the records of birdwatchers — about 85–90% of the data we receive comes from volunteers. We maintain an archive of 200,000 records covering 183 species (so far) which we make available for research and conservation purposes, generate population estimates and trends, and publish annual reports — see www.rbbp.org.uk for more information.

What is your current role in the EBCC?

I've been on the board of the EBCC since 2010 — initially as observer for the RSPB, then eventually as Chair. I stood down as Chair in April, but have remained on the board, and I have a new role — I'll be taking over from Aleksi as Editor of BCN.

Your PhD thesis was dealing with habitat use and potential human influence on turnstones and purple sandpipers. Can you please tell more about your thesis and your later research themes?

It was a long time ago! The thesis was related to changes in the disposal of sewage and how this might affect wader populations, but I was more interested in looking at feeding behaviour and interactions between individual birds, particularly how dominance hierarchies influenced the foraging strategies of individuals. More mature, and male, Turnstones were able to occupy the best intertidal feeding locations meaning that subordinate (younger, female) have to feed for longer over high tide, when the predation risk was higher. Purple Sandpipers from Scandinavia arrived in my study area in early autumn and settled into sites, but when birds from Greenland and Canada — which are larger — arrived two-three months later they would displace the Scandinavian birds to sites with lower food densities. I think I remember that right!

In which monitoring programs have you participated in the field and in which scheme(s) do you participate on annual basis?

I've worked on a lot of surveys of rare and localised species, mostly in my former role as Principal Conservation Scientist in Monitoring at the RSPB Centre for Conservation Science. Most of this was as a supervisor so done from the comfort of my office, but I always tried to get out to train and visit fieldworkers and do some surveying myself — on a wide range of species such as Common Scoter, Capercaillie, Black Grouse, Red- and Black-throated Divers, Whimbrel, Dotterel, Golden Eagle, Hen and Marsh Harrier, Merlin, Woodlark and Cirl Bunting. Nowadays I volunteer for the BTO, surveying a couple of sites for the Wetland Bird Survey every month, and doing Breeding Bird Survey and Waterways Breeding Bird Survey plots every spring. My BBS square is in the hills straddling the English and Scottish border, and often only has four species in it! I also spend a lot of time looking for nocturnal birds — Nightjars and Long-eared Owls are a particular interest of mine.

Do you have a favourite bird or birding habitat/location?

My favourite birding locations are on the coast of Northumberland, near my home in Northeast England — it's a great place for finding rare migrants and watching seabird passage, and I spend a lot of time out with my two dogs looking for interesting birds — I found a Radde's Warbler earlier this week. This is the area I did my PhD fieldwork in, and Purple Sandpipers are still a great favourite of mine, although numbers have declined since my studies in the 1990s, probably due to climate change-related range shifts.

Your text in the next issue?

Bird Census News is meant as a forum for everybody involved in bird census, monitoring and atlas studies. Therefore we invite you to use it for publishing articles and short reviews on your own activities within this field such as (preliminary) results of a regional or national atlas or a monitoring scheme, species-specific inventories, reviews or activity news of your country (as a delegate: see also below).

Instructions to authors

– Text in MS-Word.
– Author name should be with full first name. Add address and email address.
– Add short abstract (max 100 words).
– Figures, pictures and tables should not be incorporated in the text but attached as separate files.
– Provide illustrations and figures both in colour.
– The length of the papers is not fixed but should preferably not exceed more than 15 pages A4 (including tables and figures), font size 12 pt, line spacing single (figures and tables included).
– Authors will receive proofs that must be corrected and returned as soon as possible.
– Authors will receive a pdf-file of their paper.
– References in the text: Aunins (2009), Barova (1990a, 2003), Gregory & Foppen (1999), Flade et al. (2006), (Chylarecki 2008), (Buckland, Anderson & Laake 2001).
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