Acta Oecologica 44 (2012) 58–66

Contents lists available at ScienceDirect

Acta Oecologica

journal homepage: www.elsevier.com/locate/actoec

Original article

French citizens monitoring ordinary birds provide tools for conservation and ecological sciences

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ARTICLE INFO

Article history:
Received 30 November 2010
Accepted 3 May 2011
Available online 31 May 2011

Keywords:
Agriculture
Breeding bird survey
Climate change
Diversity pattern
Global change
Monitoring

ABSTRACT

Volunteer-based standardized monitoring of birds has been widely implemented in Europe and North America. In France, a breeding bird survey is running since 1989 and offers keen birdwatchers to count spring birds annually during 5 min exactly on 10 fix points within a randomly selected square. The first goal of such breeding bird surveys is to measure temporal trends in order to detect possible species declines. Combining annual indices of species sharing ecological affinities or a protected/red list status further provides biodiversity indicators for policy makers. Because the sampling effort is similar among sites, and because the initial selection of monitored sites is random, the temporal trends can be considered representative of national trends, and spatial comparisons of the obtained metrics are possible. Species abundance, community richness but also community specialization and average trophic level can be estimated for each site and each year and further related to the wide range of habitat and landscape characteristics and to agricultural or forestry practices. The large number of sites allows overcoming the opposition between adaptive and passive monitoring, making such schemes fitted to adaptive monitoring. This provides opportunities to determine which type of management or practices favour biodiversity. The comparison of population fate or community dynamics across a wide range of climates and temperatures, e.g. from southern to northern Europe, revealed how European birds are already affected by climate change. Bird communities are shifting northwards, but at a slower rate than temperatures, while bird populations have larger growth rates away from their hot thermal limit. Finally, such large-scale long-term monitoring data on a complete taxonomic group (Aves) is original and offers the opportunity to compare different measures of biological diversity, such as taxonomic, phylogenetic and functional diversity. Such a citizen science scheme is an efficient scientific tool (numerous papers published in international peer-reviewed journals) which is furthermore highly cost-effective, with a reduced permanent staff in a state insitution coordonating the network and analysing the data, while a similar survey conducted by state staff only would cost more than one million euros annually. The future development of bio-economic dynamic models for providing scenarios of sustainable farming and logging to maintain biodiversity will further highlight the necessity of such volunteer monitoring for policy makers and decision planning. Scientific and logistic partnerships could be proposed to help developing such a monitoring scheme in China.

1. Introduction

In Europe, birds have been monitored for decades by keen observers (Balmford et al., 2005). Rare or emblematic species, such as raptors, water- or game-birds are especially the focus of schemes designed to track changes in their numbers. Indeed, collaborative research by networks of amateurs has a key role in ornithology and conservation science (Greenwood, 2007). While the classical approaches are based on monitoring rare species in most taxa, birds were the focus of an early implementation of monitoring schemes dedicated to ordinary species (Devictor et al., 2010b), namely the breeding bird surveys (BBS), which for example started in the 1960s in Sweden or United Kingdom (Wretenberg et al., 2006). These schemes offer amateur birdwatchers to count spring birds at fixed plots following a standardized protocol. The annually repeated counts at numerous sites provide the necessary data to estimate species temporal trends, and to provide expertise for assessing the fate of common species. Such work is especially successful where

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doi:10.1016/j.actao.2011.05.003

there is a strong partnership between the amateurs and professional scientists, based on their complementary roles. The participation of large numbers of volunteers enables data collection that would otherwise be impossible, and scientists provide the necessary sound statistical framework to make value of the survey data. This tight collaboration also facilitates democratic participation in societal decisions concerning biodiversity conservation. This is part of the so called citizen science, proposing scientifically sound practices and measurable goals for public education (Couvet et al., 2008). Citizen science provided valuable insights into large scale ongoing declines of common species in the ordinary nature (Krebs et al., 1999). The large number of sites allows overcoming the opposition between adaptive and passive monitoring (Lindenmayer and Likens, 2010), making such schemes fitted to adaptive monitoring.

In France, volunteer ornithologists started to count the common breeding species back in 1989, coordinated by the National Museum of Natural History (MNHN). This survey was consolidated in 2001 with a renewed sampling design and a wider appeal for participation. Scientists proposed a sound methodology to the motivated amateurs, who wished to contribute. In return, scientists published annual reports and analysed historical datasets. The revealed declines of the ordinary species were soon hung upon the front page of main national newspapers, illustrating how the contribution of bird amateurs was of interest to the whole society. Beyond these reports to the amateurs and the wider audience, the breeding bird survey data were also analysed and results published in the scientific literature, with numerous publications in international peer-reviewed journals. Ongoing science includes various PhD or post-doc works in conservation science, global change biology but also more fundamental ecology such as community dynamics and diversity patterns.

The aim of this paper is to focus on and give an overview of the French Breeding Bird Survey (FBBS), from the sampling design and monitoring protocol to the various conservation and scientific outputs. The usual outputs of such schemes are the provision of national species trends, as average long-term population growth rates, and the associated multiple species indicators. The different metrics obtained from bird records can be confronted with data on landscape, habitat and climate over national or continental spatial scales to tackle relationships between land use, practices and climate change and biodiversity.

Such schemes could be criticized for their lack of a-priori hypotheses, to be a waste of efforts. However, the large number of sites make it very powerful, able to test ad-hoc hypotheses (Yoccoz et al., 2001), readily as the effects of global change unfold, a necessity with fast and overarching global changes.

2. Methodological designs

2.1. Counting method

The FBBS started in 1989 based on volunteer skilled ornithologists counting birds following a standardized protocol at the same plot for several years. In each plot, a given observer monitors 10 point counts separated by at least 300 m. All individuals seen or heard are counted on these permanent points during a fixed period of 5 min. To be validated across years, the count must be repeated on approximately the same date of the year (±7 days within April to mid-June), the same time of the day (±15 min within 1–4 h after sunrise) and in the same order, by the same observer. A new sampling design was launched in spring 2001, for which surveyed plots were not freely chosen but selected randomly, ensuring that the sampled habitats were representative: each observer provided his home locality, and a 2 × 2 km plot to be prospected was randomly selected within a 10 km radius (i.e. among 80 possible plots). The national coordinator is in charge of the initial selection of sites to be monitored. Such a random selection ensures the survey of varied habitats across the whole country (including intensive farmlands, forests, suburbs and cities), despite being stratified by declared-volunteering observer density. Post-hoc verification that habitats are globally sampled according to their availability testifies that the obtained trends are representative of national trends. On each square, the observer also monitors 10 point counts, separated by at least 300 m, following the standardized protocol with two sampling sessions realized from 1st April to 8th May, then from 9th May to end of June - in order to detect both early and late breeders, with 4–6 weeks between both counts. Fig. 1 reports the spatial distribution of the 2000 plots surveyed at least once during 2001–2009.

2.2. Sampling design

For each point count, the surroundings within a fixed 100 m radius are classified by the observers themselves as belonging to one of a standardized list of habitats. This list is organized into a 4-levels land use description, adapted from the one developed by the British Trust for Ornithology (Crick, 1992). These habitat classes are especially used to determine the habitat preferences of the surveyed species, and estimate a habitat specialization index for each species (called Species Specialization Index, SSI; Julliard et al., 2003, 2006). Observers also report on meteorological conditions they encounter during the sampling session (clouds, rain, wind, visibility), which can locally influence the detected abundance, but should not bias the overall national dataset as long as such biases have no strong spatial structure (Bas et al., 2008).

2.3. Volunteer participation

When the scheme was restored in 2001, 150 new amateurs joined the network. Part of them had no previous experience of point counting but learned the method rapidly (Jiguet, 2009). Since 2001, 1.300 different observers have participated to the survey, and

Fig. 1. Spatial distribution of the 2000 squares monitored between 2001 and 2009 in continental France by the Breeding Bird Survey scheme.