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The role of citizen science in ornithology

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ORNITHOLOGY AND CITIZEN SCIENCE

For many reasons, the study of wild birds has played a pioneering role in the development of modern biology. Although birds were included as examples in the major syntheses before the 20th century (including the theory of natural selection), their special position strengthened along with the broad change of biology from describing patterns towards explaining processes. In the first half of the 20th century, it was recognized that the bird is a well-suited subject for studies into the problems of functional morphology, physiology, behaviour, and orientation of animals (Haffer, 2007). Since then, birds have provided some of the most significant model systems for testing general hypotheses regarding speciation and in the diverse fields of ecology, including population and community ecology, evolutionary and behavioural ecology (Gill, 2007).

Another distinct feature of ornithology is that, because of the attractiveness of birds, amateurs have always assisted (and outnumbered) professional ornithologists (Greenwood, 2007). In the modern world, such 'citizen science' (the involvement of volunteers in research) provides two great opportunities. First, it enables to widen both the spatial and the temporal scale of field studies beyond the limited reach of individual researchers and short-term project funding. A respectable part of current ornithology – bird surveys involving broad public participation – thus provides pivotal data for developing conservation science and macroecology, and for detecting long-term changes in wild populations, communities, and the wider environment (Greenwood, 2007; Dickinson et al., 2010; Magurran et al., 2010). Secondly, public participation and direct contact with researchers serve as an educational tool for raising awareness about environmental issues and the scientific method (Brossard et al., 2005; Bonney et al., 2009; Devictor et al., 2010). By that,

and by increasing public support, the citizen-science part of ornithology is useful for clever applications of ecological knowledge, particularly in conflict situations of biodiversity conservation.

THE ROLE OF PROFESSIONAL SOCIETIES

Together with its opportunities, a reliable and self-sustaining citizen-science system presents special challenges. One is that managing the contact with the public requires administering capacity and special skills, such as extensive communication and the development of online data storage systems (Bell et al., 2008). Other challenges are methodological: a prerequisite for the inclusion of a large number of volunteers is a clear and simple protocol of data recording, while the data collected will nevertheless be heterogeneous and probably biased for several reasons. Therefore, proper management and analysis of volunteer-collected data typically require professional statisticians to handle the complex sampling designs, error sources, and data structure (Dickinson et al., 2010).

These challenges are best addressed by large non-governmental organizations governed by their (amateur) members but employing professional staff to organize the work; and there are many advantages to having a single national organization at least in the case of ornithology (Greenwood, 2007). As exemplified by the European experience, organized citizen-science approaches can greatly increase study effort and reduce the costs of biodiversity monitoring projects (Schmeller et al., 2009).

In Estonia, citizen ornithology started to organize on 1 May 1921, when 15 persons, led by Professors Johannes Piiper and Henrik Koppel (Rector of the University of Tartu), formed the Estonian Ornithological Society (EOS). Despite being re-organized several times, the society soon became the centre of volunteer-assisted ornithological projects in Estonia with distinct peaks of its activity in the 1930s, 1950s, and 1970s (Kumari, 1976; Mänd, 1992; Leibak et al., 1994). The two last peaks are largely related to the activity of Professor Eerik Kumari, who organized professional teams, published the first field identification guides in Estonian and, in particular, prepared a so far unsurpassed textbook for amateur researchers (Kumari, 1963). Kumari considered smooth management and the dedication of professional scientists as key factors for the blossoming of citizen science (Kumari, 1976). Interestingly, such experience in the small Estonian community also demonstrated a trade-off: during the 1970s peak the necessity for continuous simple feedback to amateurs apparently reduced the research activity of professional ornithologists (Mänd, 1992).

Today, the EOS has approximately 400 members and works in co-operation with universities in the case of specific research issues. Based on its activities during the last decades, three main roles of the EOS for citizen science can be distinguished: (i) synthesizing individual projects and scattered data to assessments of the status and biology of Estonian birds (e.g. Leibak et al., 1994; Elts et al., 2009) and organizing country-wide mapping of bird distribution (Renno, 1993;

Elts, 2007); (ii) providing reliable and comprehensive sources of information for national and EU level conservation (e.g. Lõhmus et al., 2001; Kuus & Kalamees, 2003); and (iii) developing tools for scientific communication within the society, such as national journals (e.g. Lõhmus & Väli, 2008), internet forums, and online databases.

OUTLINE OF THE SPECIAL ISSUE

This special issue is dedicated to the 90th anniversary of the EOS. The issue includes selected contributions of the anniversary conference held in Tartu on 7 May 2011. Together, the five papers represent different sides of citizen ornithology.

Kuresoo et al. (2011) introduce the Estonian common-bird census scheme and the main trends in the species populations during 28 years. Such common species 'that shape the world' are distinct objects of citizen science, because they are readily surveyed by volunteers, yet tend to be neglected in conservation biology (Devictor et al., 2010). Because of the information available from volunteers, common-bird census results are now widely used for constructing general and acknowledged indicators of 'environmental health' (Gregory & van Strien, 2010). Kuresoo et al. (2011) make the first attempt to extract and analyse such multi-species indices in Estonia.

While typical citizen-science projects describe patterns (Dickinson et al., 2010), extensive datasets increasingly allow correlative evidence for the processes involved. Spring arrival of birds is a spectacular and easy-to-record phenomenon that has attracted amateur ornithologists for centuries (Greenwood, 2007). At the same time, phenology is particularly sensitive to climate change. In Estonia, long-term ornithophenological data sets have been previously used for detecting general climate-change trends (Ahas, 1999). Here, Sepp et al. (2011) take a next step and explore the actual weather conditions affecting bird arrival using a novel integrative approach of circulation types. They report rather similar sensitivity of both short- and long-distance migrants, thus highlighting the importance of studying long-term trends in atmospheric circulation to link the long-term and short-term impacts on birds.

A key issue in organizing citizen science is to provide different projects for subsets of observers according to their commitment level and abilities (Bonney et al., 2009). The benefits are illustrated in two papers reporting the generally demanding census of raptorial birds. Tuule et al. (2011) describe a rare 50-year case study by the same dedicated observer, which allows for controlling the observer effect and variation in study effort. The prominent compositional trends detected at stable densities in the raptor assemblage highlight the importance of considering species identities when describing biodiversity change (see Magurran & Henderson, 2010). Being initiated long before landscape-scale threats to biodiversity appeared on public agenda or even in research applications, this study also demonstrates the value of general volunteer-based 'surveillance monitoring' (Dickinson et al., 2010). Väli (2011) demonstrates that a group of focused observers may ultimately

be able to map large bird populations of conservation concern at considerable accuracy, which makes habitat protection for such species much more efficient than in the case of sample-plot surveys. Additionally, this study illustrates fruitful collaboration between scientists and volunteers in discovering hidden population processes of broad interest.

Finally, Lõhmus (2011) analyses population dynamics and predator–prey relationships based on more than 100-year-old raptor-persecution data, collected by Baltic-German landlords and hunters' societies. This study documents short-term fluctuations similar to those known today, which suggests remarkable stability of the main mechanisms operating in the Estonian terrestrial ecosystems under the question. More generally, this retrospective study points to an important issue in the era of modern computers and online databases: How to bring historical data (back) into use (Dickinson et al., 2010)? We can only imagine the undiscovered opportunities of such datasets that are increasingly likely to become forgotten.

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