Citizen science:

Bringing bird identification into people's pockets

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2. Cornell Lab of Ornithology, Cornell University, Ithaca, NY, USA.
3. Around 200 volunteers annotating bird songs and sounds.
4. Around 800 000 volunteers around the globe registering birds.

Introduction

Citizen science

This is a term used when non-professionals, the public, are doing work that is of scientific value, and registered and/or documented in such a way that it can be used in the future. Citizen scientists have contributed to many areas, from local history, via observations in nature, to astronomy.

Citizen science in biology and biodiversity

Observations of species in nature is an area that is of interest to lots of people. Thus, biology and biodiversity are areas where the citizen scientist can contribute in a significant way. Often, only a few extra pieces of information are needed to enhance an observation from little value to scientific and/or management value. There are several initiatives where citizen scientists can contribute to get better overview of biodiversity, populations and trends, distribution of species, seasonal variations, etc. Two of the most well-known tools and databases for citizen science registrations are iNaturalist (www.inaturalist.org) and eBird (Fig. 1, www.ebird.org), and these are probably the two largest global citizen science projects. Common to both of them is that everyone can look at the registered observations, and can get summaries of what is registered in a country or a region. Documentation, like images, from the different regions are also available. Everyone can also contribute by registering their observations, provided that they first create an account. Simplified, the eBird universe (Fig. 1) consists of three tools and databases: the eBird homepage containing the main registration database (Fig. 1A), the Macaulay documentation library (Fig. 1B), and the Merlin bird identification app that everyone can install on the mobile telephone (Fig. 1C). But most importantly, **you** are needed.

The Merlin app

The Merlin app can identify birds (or more correctly, suggest an identification of birds) in three ways (Fig. 1C): (i) identification by questions (BirdID, upper green button in Fig. 1C); (ii) identification by photos (photo ID button); and (iii) identification by song/sound (sound ID button).

The three modes of identification depends partly on the same resources, and partly on different resources: (i) The eBird registration database (Fig. 1A), indicating which birds are common or rare to observe in the region and in the neighboring regions; (ii) database with description of the birds (size, colour(s), general living envronment, etc.); and (iii) Maculay documentation databases with images and sound recordings (fig. 1B); and (iv) artificial intelligence that have been learnt to identify birds based on *annotated* images and sounds.

The app is available for both iPhone and Android phones.

Annotation

Photos: Machine learning was used. In hundreds of photos for each species, and in varied situations, the bird has been manually indicated in the photos, and the software analyzes the bird for colours, patterns, shape, etc., and learns to distinguish it from the background. The machine learnt results are then combined with the regional database.

*Song/sound: M*achine learning was again used. A hundred (or more) recordings of sounds for each species have been manually marked (Fig. 2). In most recordings, there are also other birds (as in Fig. 2), background noise from people, traffic, animals, and wind, that more or less overlap with the bird in question. The software must learn to distinguish all the unwanted sounds from those that we are interested in. *Please note: You, as a user of the app, never have to think about annotation.*

How to use Merlin

Bird ID: You answer five simple questions: Where and when did you see the bird (e.g., Tórshavn, today); size (as a *kvørkveggja*); main colour(s) (brown-reddish); behaviour (in bushes, etc). The top suggested bird is seen in Fig. 3.

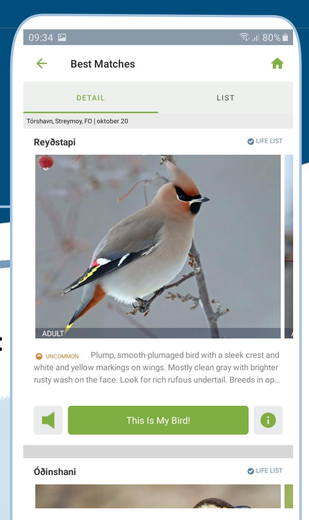


Fig. 3. The top result(s) from answering the questions as described in the text.

PhotoID: You take a photo of the bird with your mobile telephone (or a photo of a photo, like the back of your camera). The app will ask you to zoom in on the picture, so the bird as good as possible fills a given square on the screen, and you confirm your location (Tórshavn) and date (today). Then the app will suggest the most likely birds.

Sound ID: Merlin will use the telephone's microphone to record the sound. You will see the recording's sonogram, and if Merlin finds a suggestion, you will see they come up while the recording is taking place (or while you are playing a previously recorded sound), as shown in Fig. 4. If Merlin does not recognise the sounds, no suggestion will be shown.

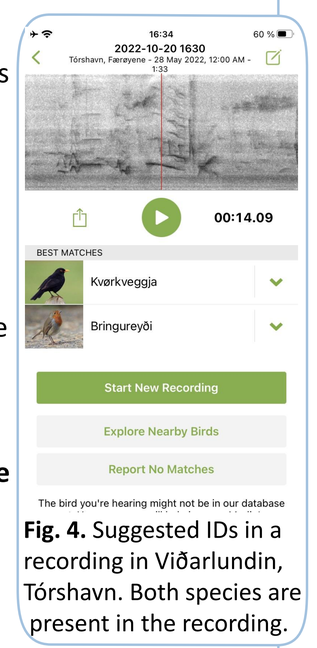


Fig. 4. Suggested IDs in a recording in Viðarlundin, Tórshavn. Both species are present in the recording.

Please note: You may use the Merlin app independently of whether you have an eBird account or not. Be aware that there are millions of hours of work by volunteers and by scientists behind the Merlin app and the eBird universe. You can also contribute in improving our knowledge and overview of birds and nature in general.

Fig. 1. The eBird universe

Fig. 1C. Merlin app

Your help to identify unknown birds

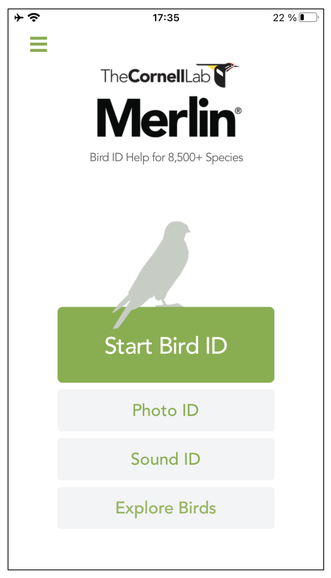


Fig 1B. Macaulay Library

Contains photos, videos and sound recordings. Can search for species, regions (like Faroe Islands), etc.

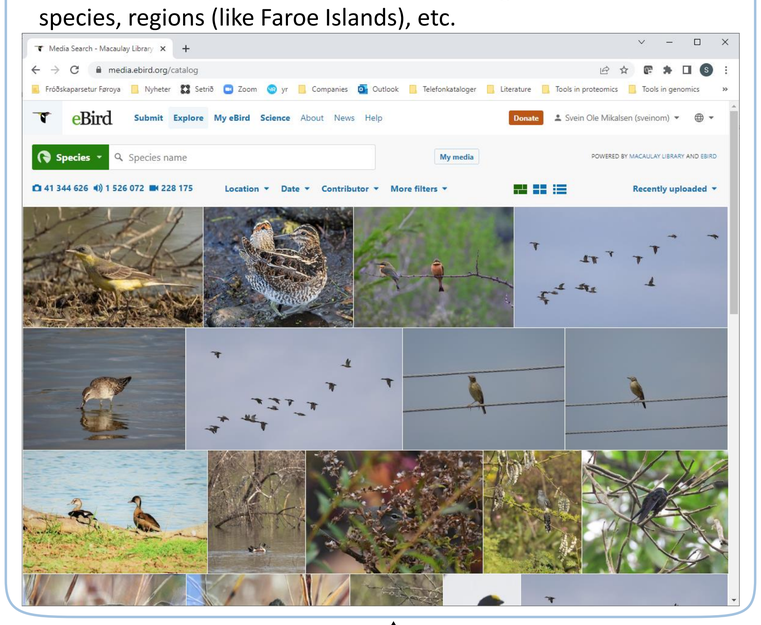
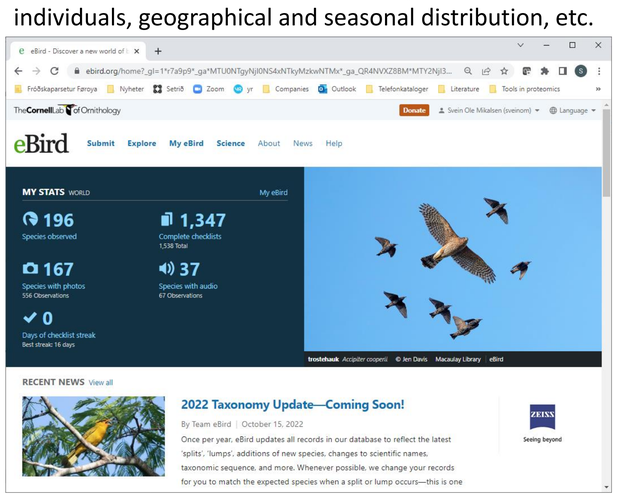


Fig. 1A. eBird homepage and database

Your interaction site with eBird and Macaulay library. Contains observation database with species, number of individuals, geographical and seasonal distribution, etc.



You

as citizen scientist can provide data

You

can use the data for various (non-commercial) reasons, like personal interest in birds, educational purposes, scientific purposes, basis for managemental decisions, protection of nature, etc.

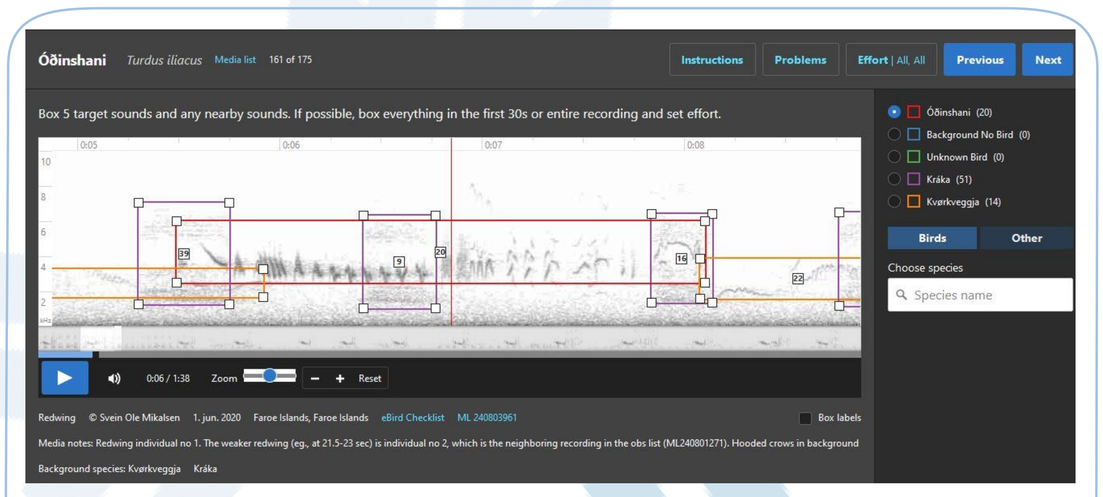


Fig. 2. Learning the bird identification app Merlin to recognise Redwing (*oðinshani*). The recording is from 1. June 2020, Viðarlundin in Tórshavn. The different bird sounds are boxed, and in this part the *oðinshani* is in red, *kráka* in violet, and *kvørkveggja* is in orange.

Why collect data in this way?

- We depend on a functional and healthy nature, only achievable by sustainable exploitation.
- The nature and biodiversity are under strong pressure (IPBES 2019, WWF 2022, BirdLife 2022).
- Birds are easily accessible indicators of the status of nature, with different species being indicators for different parts of nature (e.g., seabirds for the sea).
- We, the society, need to get a better overview of the status of the birds and nature to make better decisions.
- On the personal level, may just find birds fascinating and beautiful.
- Being out in nature promotes health and well-being (e.g., Bratman et al, 2019).
- Listening to birdsongs also promotes health and well-being (e.g., Stobbe et al, 2022).

References

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