EcoHacK-2023

Organisers: Jérémy Froidevaux, University of Stirling & Tom Bradfer-Lawrence, Royal Society for the Protection of Birds.

Summary

The second edition of EcoHacK – a hands-on workshop on ecological sound recording analysis – took place from the 9th - 11th of October 2023 at the University of Stirling, United Kingdom. The event was sponsored by the UK Acoustic Network, Scottish Alliance for Geoscience, Environment & Society and the Company of Biologists. The venue was provided by the University of Stirling.

1. Context and objectives

With the advent of low-cost passive acoustic recorders and the recent development of new sampling methods, recording ecological sounds in the field has gained momentum amongst researchers and practitioners worldwide. Analysing sound recordings was traditionally done manually but quickly became too time-consuming a process. This has been overcome using automated methods; acoustic indices are used to summarise the sonic environment, and sound recognition algorithms based on machine learning can identify specific sounds of interest with high confidence. As these techniques are evolving rapidly, this workshop provided an opportunity to work collaboratively on projects (similar to a hackathon format), learn, discuss, and exchange ideas on state-of-the-art methods in bio/eco acoustics. The main objectives of EcoHacK were to:

- Bring together students, early-career, postdoctoral and senior researchers as well as key stakeholders (e.g., non-governmental and private sector organisations) interested in sound recognition, bio/eco acoustics, and soundscape ecology.
- Foster links and collaboration between institutions and across disciplines, as well as encouraging dialogue between sectors.
- Discuss, exchange, and share experiences and best practices in sound recording analysis,
- Explore novel ways of linking acoustic data with environmental variables at different spatiotemporal scales.

2. Structure of the workshop

The main part of the programme was dedicated to the hackathon, which consists of a project pitch session, hacking time and a project presentation session at the end of the workshop. In addition to the hackathon, the programme included a workshop talk, four keynote talks and a poster session.

2.1. Hackathon, project pitch session and final presentation

Most of the workshop time (12 hours and 15 minutes in total) was dedicated to the hackathon (Figure 1), an event where participants engage in rapid and collaborative programming to find high-quality solution to an emerging issue. The idea of the hackathon was to gather participants to work together during a short period of time on a subject that can be outside of their daily routine, or to learn about other techniques used by other researchers.

When registering, participants were asked to propose a project for the hackathon and give a short presentation on the first day (Figure 2). The list of projects can be found here

(https://github.com/JeremyFroidevaux/EcoHacK/). After some discussion about the different projects, there was a strong interest from the participants to work on four main projects:

- Developing an open-source acoustic classifier for African and British bat species in R,
- Investigating sources of variation and bias in long term acoustic projects,
- Using machine learning techniques for (i) classifying freshwater invertebrates from their sounds and (ii) characterizing oyster bed soundscapes.

Participants presented their results on the final day, and it was a great opportunity to reflect on the methods used and their wider applications.
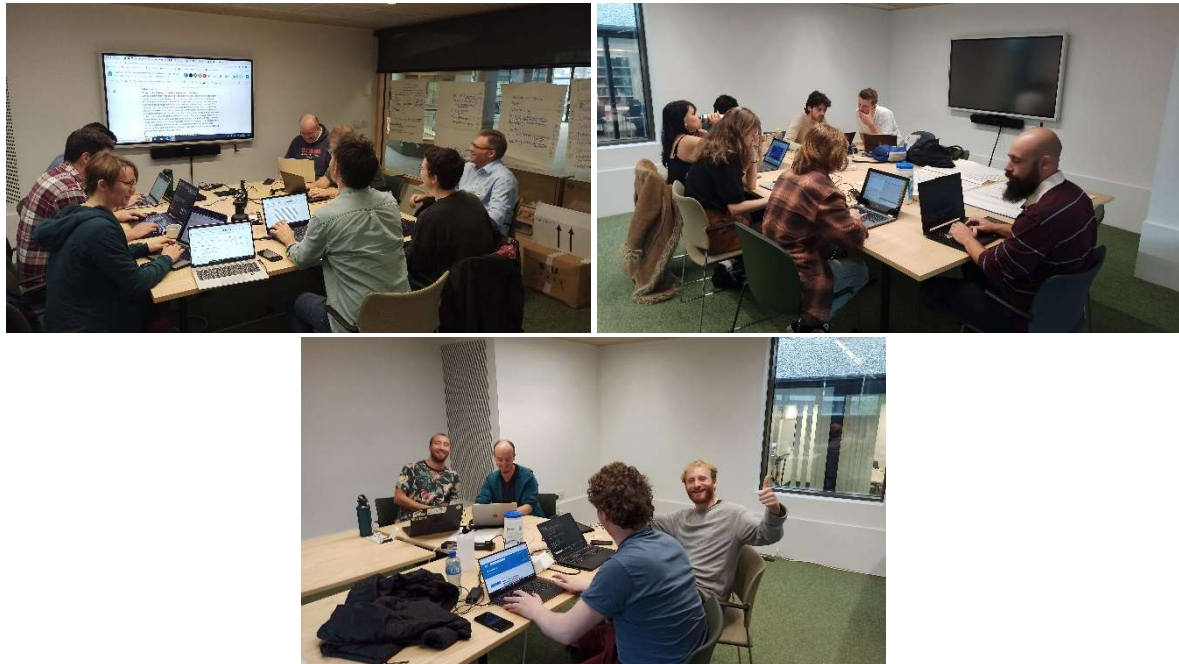

Figure 1. Hackathon.

Figure 2. Project pitch session.

2.2. Workshop and keynote talks

The workshop talk was given by Dr Carly Batist from Rainforest Connection. Carly introduced and presented the ARBIMON platform—a free web interface designed for handling audio data gathered in the field. The ARBIMON web app is specifically tailored to support ecologists and biologists in conducting complex scientific analyses on large volumes of field-recorded audio data.

The keynote talks were given by experts in bio/eco acoustics from different disciplines (Figure 3):

- Prof Alice Eldridge, professor at the University of Sussex, School of Media, Arts and Humanities: *"Where next for soundscape descriptors? From acoustic diversity to acoustic dynamical complexity"*
- Dr Alison Johnston, reader at the University of Saint Andrews, School of Mathematics and Statistics: *"Statistical considerations for biodiversity monitoring with acoustics"*
- Prof Alex Rogers, professor at the University of Oxford, School of Information Technology and Electrical Engineering: *"AudioMoth: A low-cost open-source acoustic logger"*.
- Dr Jack Greenhalgh, postdoctoral fellow at the Pyrenean Institute of Ecology, Spain: *"Freshwater soundscape monitoring: key challenges and prospects"*

Figure 3. Workshop and keynote talks. From top to down, left to right: Dr Carly Batist, Prof Alice Eldridge, Dr Alison Johnston, Prof Alex Rogers, and Dr Jack Greenhalgh.

2.3. Poster session

We dedicated half-hour on the first day for a poster session. There were three posters on display:

- Dr Tom Bradfer-Lawrence, Senior Conservation Scientist, Royal Society for the Protection of Birds: "*Acoustic Indices: An R package for standardised analysis of audible and ultrasonic soundscapes* "

- Dr Oliver Metcalf, Postdoctoral Fellow at the Manchester Metropolitan University: *"Detecting and reducing heterogeneity of error in acoustic classification"*
- Kieran Gibb, PhD student at the University of Sussex: "*Towards interpretable learned representations for Ecoacoustics using variational auto-encoding*"

3. Attendance

We received 25 applications, and 21 delegates attended the event (Figure 4). (Four participants had to drop out because of travelling problems due to adverse weather or work commitments.) They came from institutions in the UK, Italy, France, Spain and the Republic of Ireland. Most of the participants were postgraduate students (nine PhD students and four Master students). Other delegates included field technicians, post-doctoral researchers and academics (lecturers/professors).

Figure 4. Photo of the group of participants on the last day (not all could be present).

4. Feedback from participants

We sent a feedback questionnaire to all participants and received 13 answers (out 21 participants). The first part regarded the workshop itself, and participants rated their overall experience (Excellent – Very Good – Good – Fair – Poor – Very Poor, Figure 5). We also asked the participants a series of questions to help us improve the next EcoHacK edition (Figure 6).
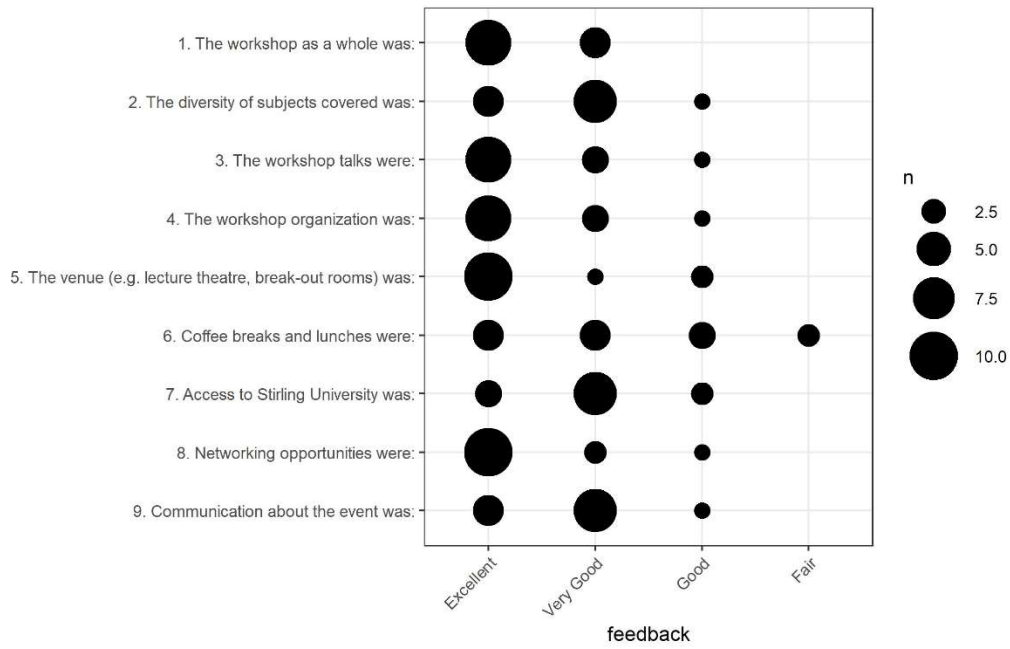
Figure 5. Plot summarizing the feedback received regarding the workshop. No 'poor' or 'very poor' ratings were received.
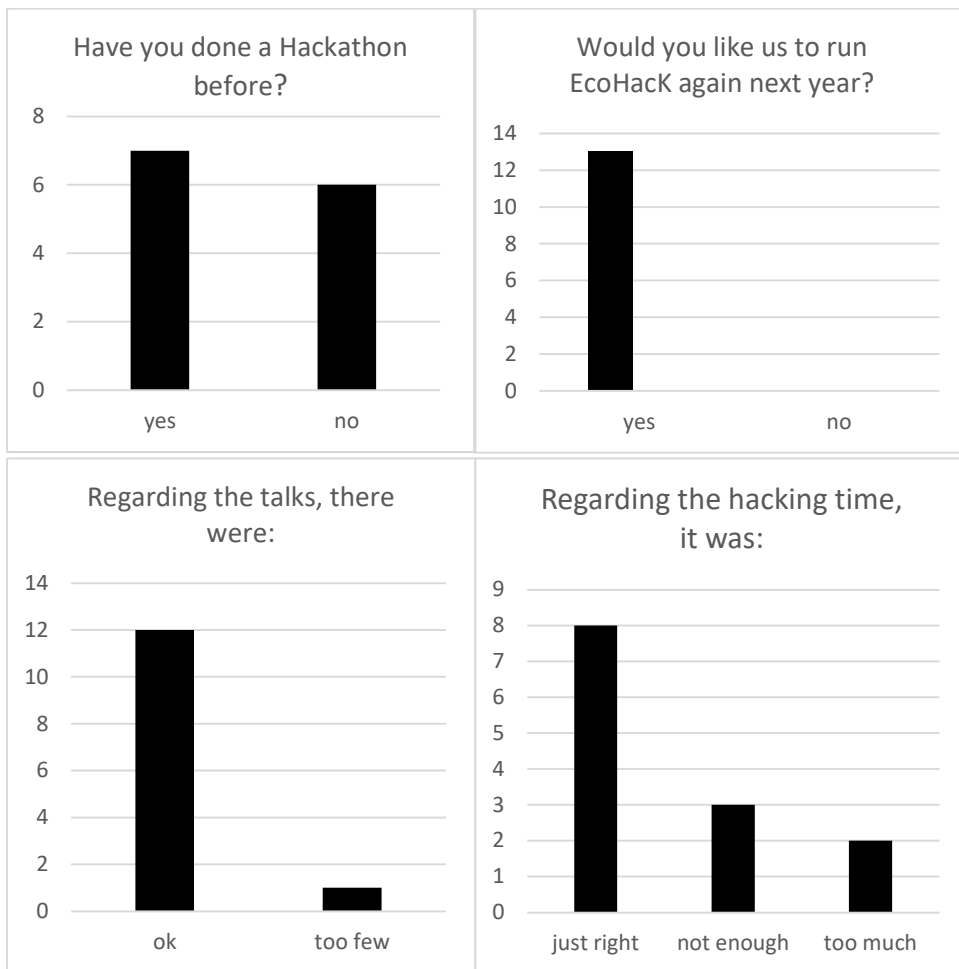

Figure 6. Bar plots summarizing the answers of the participants.

Four participants attended the event last year. Four Participants heard about the event through Twitter and other via email and colleagues. Finally, here are some comments we received from the participants:

"Great workshop, thanks very much! I hope you can run it again next year".
"An additional day or fewer talks would have been great to complete our work and to address the differences of expertise within our team, a full day to do some co-learning - e.g. exploring the challenges of the data we were working with, programming in a common programming language - while implementing the hackathon project would have reaped more rewards in terms of results, cross-collaboration and skill sharing. An additional day would be preferable as all the talks were very interesting and the same number could be more spread out over the additional day".

"I mentioned this at the event but having a short fieldtrip to an ecoacoustics related site e.g. a noted bird or bat-rich habitat would be very enlightening for those of us who don't do much fieldwork"

"Really enjoyed the event. Great venue and a good time of the year for a meeting".

"Loved it, will definitely come again - thanks so much for organising. My only complaints: [the workshop] talk on day 1 was too long, I was struggling by the end. The poster session on day 1 didn't quite work, I was too knackered by that stage to take in the posters! Other than that it was excellent!"

"There should be a short field trip near the event location if the weather permits. However, it is a very good workshop".

"Excellent - maybe more opportunity to interact with the other hacking groups"

"Maybe try and have daily feedback between groups. Two days a more manageable length timewise"