

# EcoHack-2022

Main organiser: Jérémy Froidevaux, University of Stirling, UK.

Co-organiser: Nicolas Farrugia, IMT Atlantique, France.

## Summary

The first edition of EcoHack – a hands-on workshop on ecological sound recording analysis – took place between the 31<sup>st</sup> of October and the 2<sup>nd</sup> of November 2022 at the University of Stirling, United Kingdom. The event was fully sponsored by the UK Acoustic Network and the venue was provided by the University of Stirling.

## 1. Context and objectives

With the advent of low-cost passive detectors and the recent development of new acoustic sampling methods, the collection of ecological sounds in the field has gained momentum amongst researchers and practitioners worldwide to answer key ecological questions. The analysis of sound recordings was traditionally done manually but quickly became a time-consuming process. To overcome this issue, acoustic indices have recently been developed to summarize the sonic environment. Furthermore, the use of sound recognition algorithms based on machine learning now allows to discriminate with high confidence specific sounds of interest. As these modern techniques are evolving rapidly, this workshop provided an opportunity to work collaboratively on projects (hackathon format), learn, discuss, and exchange on state-of-the-art methods in 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. charities and private sector bodies) interested in sound recognition, bioacoustic, and soundscape ecology,
- foster links and collaboration between institutions and across disciplines, as well as encouraging dialogue between the academic and private sector,
- 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,
- work collaboratively on eco-acoustics projects in an intensive, focused three days long “hackathon” format.

## 2. Structure of the workshop

The programme included three workshop talks, one keynote talk, two blitz talk session (unconference event, with 3 short presentation/discussion), one project pitch session (with 15 short presentations), a hackathon, two courses and a project presentation session at the end of the workshop.

### 2.1. Workshop and keynote talks

The workshop talks were designed to introduce the principles behind the use of eco-acoustic indices and machine learning in biological sound analysis. The talks were given by:

- Dr Amandine Gasc, researcher at the French Institute of Research and Development (IRD): ‘*An introduction to eco-acoustic indices*’

- Dr Tom Bradfer-Lawrence, postdoctoral fellow at the University of Stirling: *'Acoustic indices for soundscapes and species'*
- Dr Nicolas Farrugia, associate professor at IMT Atlantique, France: *'Applications of recent advances in machine learning to eco-acoustic indices: transfer, few shot and self-supervised learning'*

The keynote talk was given by Dr Oliver Metcalf who is a postdoctoral fellow at the Manchester Metropolitan University and the UKAN+ Early Career rep for the Bioacoustics Special Interest Group. His talk was entitled *'Acoustic monitoring of Amazon wildlife in human-modified landscapes'*.



**Fig. 1.** Workshop and keynote talks.

## **2.2. Hackathon, project pitch session and final presentation**

Most of the time (11 hours in total) of the workshop was dedicated to the Hackathon, 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 also 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.

We asked the participants during the registration to propose a project for the hackathon and to give a short presentation during the first day. The list of projects can be found here (<https://github.com/brain-bzh/EcoHack-2022>). After some discussions around the 15 different projects, there were a strong will from participants to work on three main projects:

- Developing a Shiny App to visualise eco-acoustic recordings from different sources
- Creating an interactive Acoustic Index Manual that offers a step-by-step breakdown of the index calculations, coupled with example simulated and real-world recordings, to aid wider understanding within eco-acoustics and beyond.
- Using different machine learning techniques for classifying Eurasian Curlew vocalisations to different call types to make inferences on productivity and predation at breeding sites.

Participants presented their results the last day and it was a great opportunity for the community to reflect about the methods used. For instance, three working groups developed different deep learning algorithms for classifying Curlew vocalizations and the final project presentation gave them time to compare and discuss about algorithm performance and validity. Other notable outputs from the Hackathon are (i) the creation of the Acoustic Index Manual that participants plan to submit in a peer-reviewed paper, and (ii) the development of a Shiny App to visualize recordings that will be used for creating the Acoustic Index Manual. We created a slack group for facilitating data/resources sharing during the event and communication post-event: [ecohackgroupe.slack.com](https://ecohackgroupe.slack.com).



Fig. 2. Welcome speech and project pitch session.



Fig. 3. Hackathon.

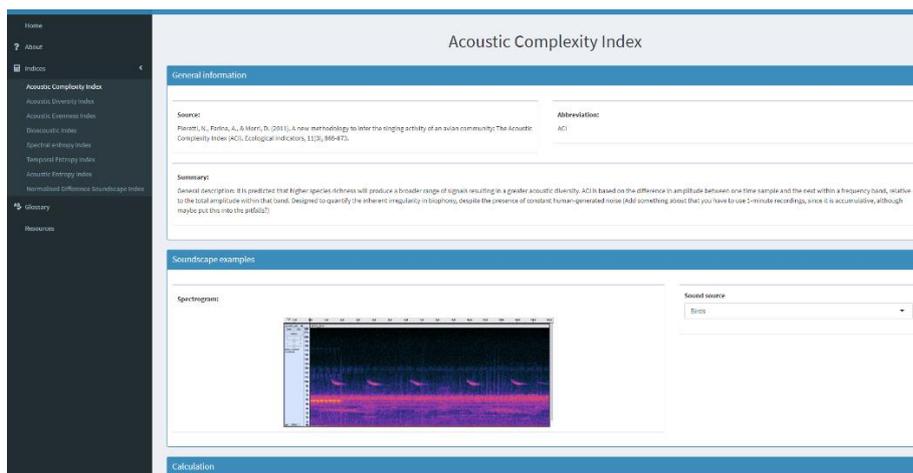


Fig. 4. Development of a Shiny App for the eco-acoustic recording visualization and for the Acoustic Index Manual.

### 2.3. Blitz talks

We dedicated half-hour on the first and last day for blitz talks. This is an open event where attendees can bring up any topic to discuss with their peers. We discussed about (i) minimum sampling effort in terms of duration when deploying recorders in the natural environment to get the most comprehensive picture of the soundscape, (ii) how to remove noises and more generally geophony and anthrophony events when focusing on the biophony, and (iii) how to consider higher frequencies (e.g. ultrasonic soundscape) when deriving eco-acoustic indices.

### 2.4. Courses

We provided two short courses on the use of (i) Pytorch for developing machine learning algorithm (Nicolas Farrugia) and (ii) Tadarida, an acoustic toolbox for labelling and classifying biological sound events (Jérémy Froidevaux). There were also many unformal discussions on the use of semi-automatic software for identifying bird and bat species (BirdNet, BatScope, Audacity, etc.).

## 3. Attendance

23 participants from the UK, Portugal, Switzerland, France, Czech Republic, Norway, and Sweden attended the event. Most of the participants were postgraduate students (N = 14), followed by postdoctoral fellows (N = 4), lecturers (N = 4) and a data scientist (N = 1).



**Fig. 5.** Photo of the group of participants on the last day (not everyone could be present for the photo).

Note that there were 26 registrations in total, but three participants dropped out the week before because of Covid-19, travelling issues or work commitments.

## 4. Feedback from participants

We sent a feedback questionnaire to all participants and received 16 answers (out of 23 participants). The first part regarded the workshop itself, and participants rated their overall experience (Excellent – Very Good – Good – Fair – Poor – Very Poor, Fig. 6).

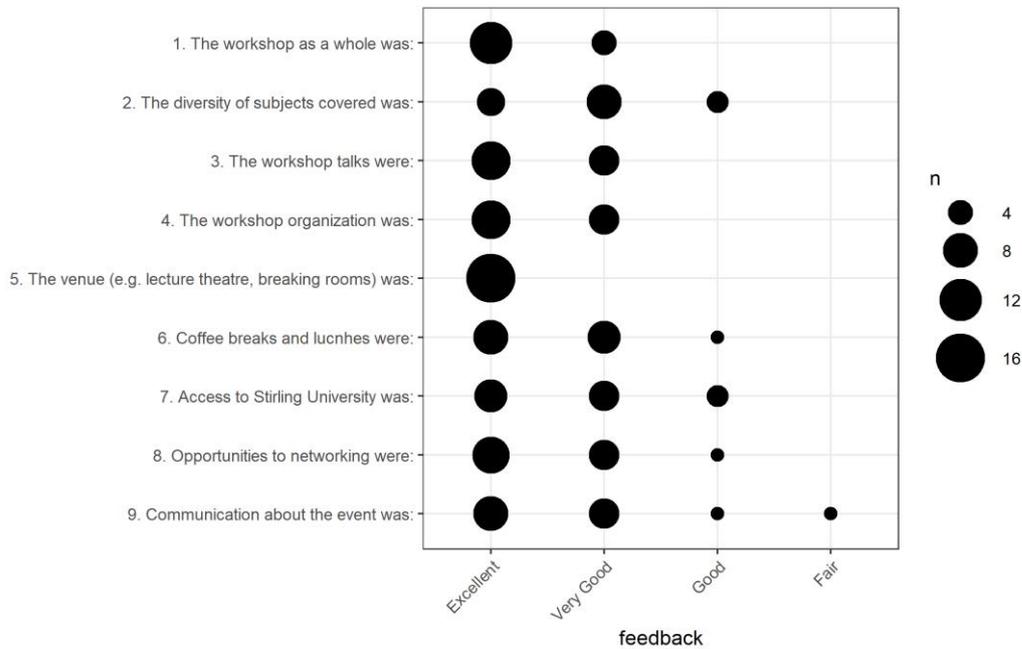


Fig. 6. Plot summarizing the feedback received regarding the workshop.

We also asked the participants a series of questions to help us improve the next EcoHack edition (Fig. 7).

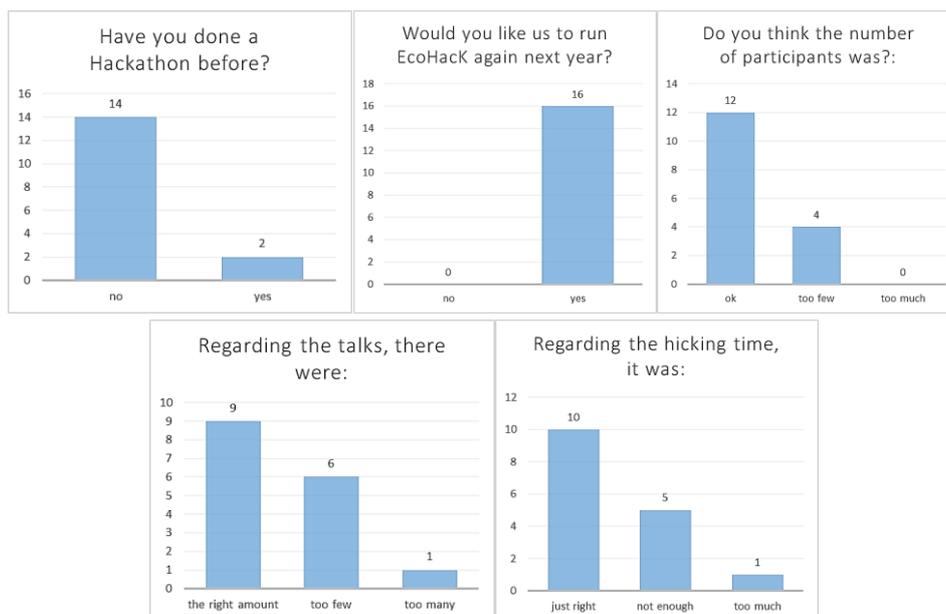


Fig. 7. Bar plots summarizing the answers of the participants.

Nine participants heard about the event through Twitter, four from colleagues and three from the UKAN+ newsletter. Finally, here are some comments we received from the participants:

*"Really enjoyed the event -- thank you very much for organising it, and for offering help for funding with those of us that needed it too. In the future, I would ideally love it to attract from a wider range of people too to have more perspectives beyond the audio/ecology mainstream... thanks for helping us all in this field :)"*

*"I deeply enjoyed Ecohack, and I hope it happens again next year. The hosts were excellent. It was overall a great networking and learning opportunity. I would only have hopped for a little more tutoring on the fundamentals of deep learning."*

*"Diversity of expertise and stages in research created an excellent environment for productive talks and exchanging of ideas - combination of these views made the projects wider and more productive than a more highly specialised hackathon might. An additional day would have been good, but difficulty in then asking people to sacrifice effectively an entire week may lower participation"*

*"It was a very pleasant experience and I enjoyed every minute of EcoHack".  
Maybe some coordination about the hotels that everyone is booking would be needed in the future. Other than that everything was great."*

*"This was a great event, many thanks for organising. I feel like we achieved a lot in a short space of time".*

*"Great event, would definitely join again in the future. My only improvement would be to have some more hacking time, maybe by scrapping the blitz talks, or by adding another day".*