



**Open
Eco**acoustics

End to end workflows in Ecoacoustics: verifying AI output

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What is [Open] Ecoacoustics

- Ecoacoustics

- Use sound to understand the environment
- Sensors: cost effective, greater coverage
- Analyze data → understand environment → make decisions

- Open Ecoacoustics

- A platform for continental-scale ecological monitoring and research
- Part of the Machine Observation Data Processing Infrastructure program within the ARDC Planet Research Data Commons



What is the Acoustic Workbench

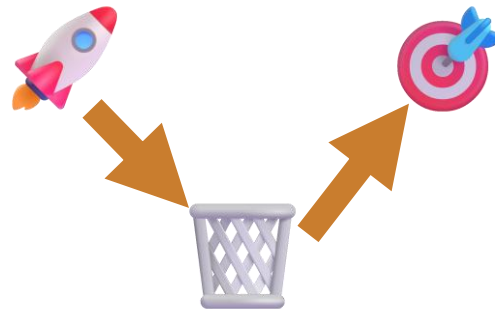
- Open source web management software for Ecoacoustics
- White label application, 2 instances
 - Ecosounds: general data, user managed, public or private
<https://www.ecosounds.org/>
 - The Australian Acoustic Observatory: one big distributed experiment, all CC BY 4.0
<https://data.acousticobservatory.org/>
- Project owners control permissions
 - Individual access, public access, downloading of audio
- Upload, store, share, and download audio data
- Import, create, verify, and download annotations (species detections)
- Run analyses automatically*

Stats

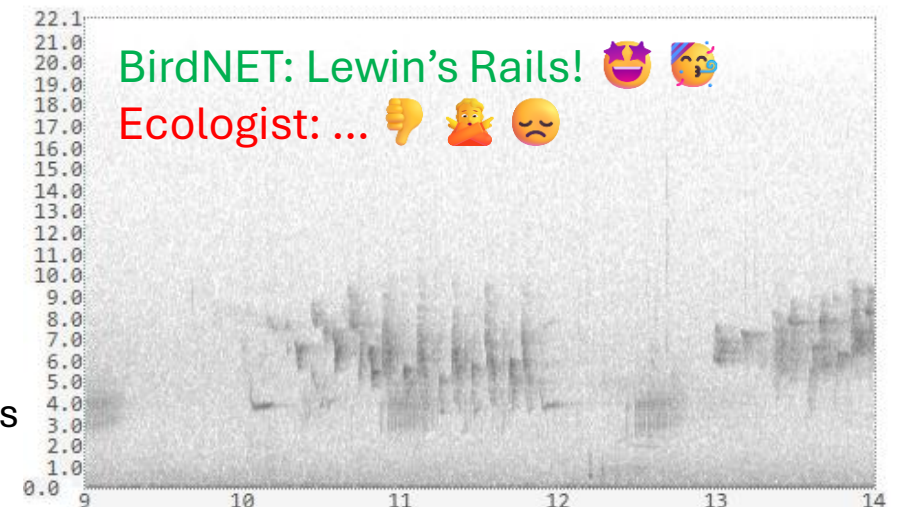
- 261 Projects
- 5600 Sites
- 1001 TB
- 6.5M files
- 713 years of audio
- 4.9M annotations
 - 42k verified



Workflow



Millions of false positives
> 100 detections/hour \times > 6 million hours
 \approx 600 million events???



Verification

- Verifying labels are correct is important
 - Agile learning loops & high-quality data still valuable
 - It must be *fast*
 - It must work for experts and novices
 - Is a distinct task from labelling
 - To integrate with our platform

- But existing software...

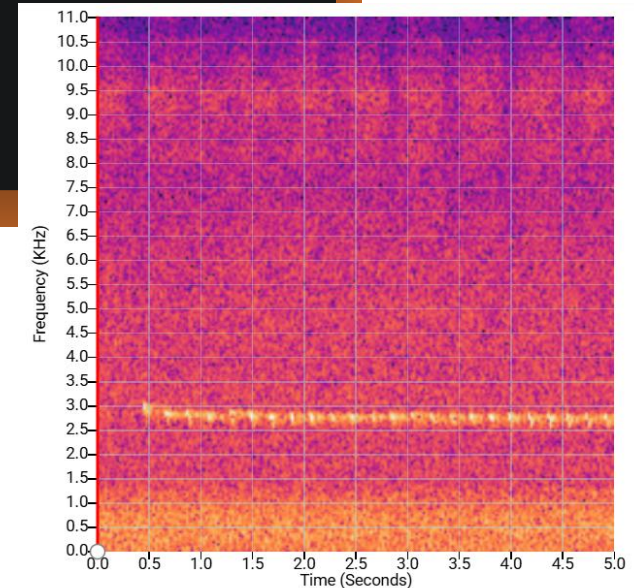
1. Via browser
2. Claimed to be open source but only distributed a Windows binary
3. Top request for expert users
4. Labelling can be customised to a verification task, but it's a hack
5. Reuses labelling functionality
6. Raven is made to work on one file at a time, users need to make a "super cut" of source audio segments – huge hack
7. Files needed locally
8. Files need to be pre-cut
9. "Collaboration" achieved by shipping hard drives of pre-cut audio files and CSV metadata and results collated by scientists manually

	Raven	Kaleidoscope	ARIEL	We need...
Web	✗	✗	✗	✓
Mobile	✗	✗	✗	✓
Desktop	✓	✓	✓	✓ ¹
Open source	✗	✗	? ²	✓
Keyboard shortcuts ³	✓	✓	? ⁴	✓
Made for verification	👉 ⁴	👉 ⁵	✓	✓
View any segment from any file	👉 ^{6 7}	👉 ⁷	✓ ⁸	✓
Multi item (grid view)	✓	✗	✗	✓
Single item view	✓	✓	✓	✓
Collaboration	👉 ⁹	👉 ⁹	👉 ⁹	✓

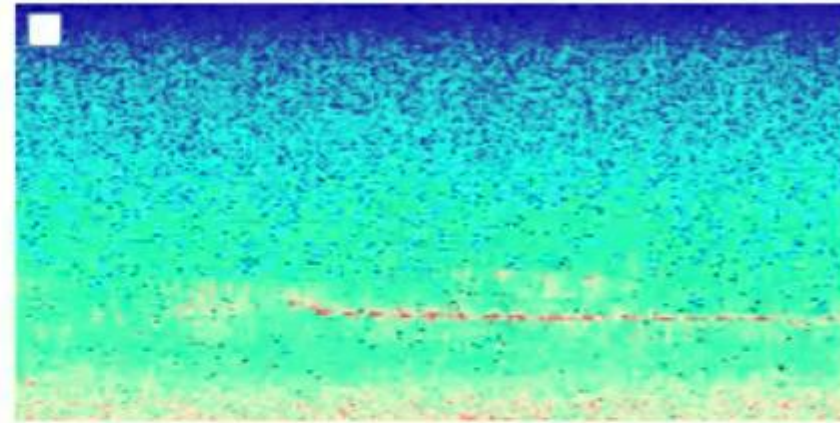
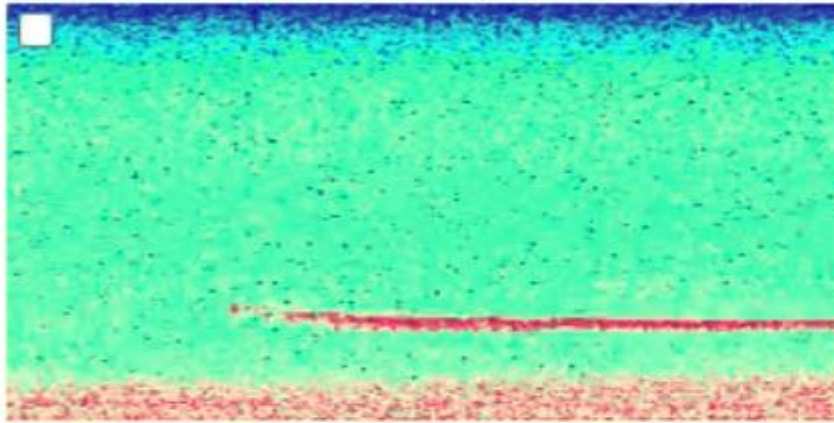
Verification: methodology

- Persona identification
- Requirements gathering
- Codesign, iterative development
 - >4 workshops, > 20 check ins, with \approx 20 people, from 4 organisations
 - Fortnightly sprints
 - Features prioritised by greatest common need
- Web components
 - Web native UI components
 - We were already making them
 - See talk/rant “reimplementing a spectrogram component too many times”
 - Questionable
 - Is it really reusable?
 - Is the added complexity required?
 - Do the developers just like greenfield projects more?
 - Responsibility split:
 - Behaviour belongs to the component
 - Persisting state belongs to the host application

```
1 <oe-axes
2   x-title="Time (Seconds)"
3   y-title="Frequency (KHz)">
4   <oe-indicator>
5     <oe-spectrogram
6       id="playing-spectrogram"
7       src="/public/example.flac"
8     ></oe-spectrogram>
9   </oe-indicator>
10 </oe-axes>
11 <oe-media-controls
12   for="playing-spectrogram"
13 ></oe-media-controls>
```



Verification: iteration

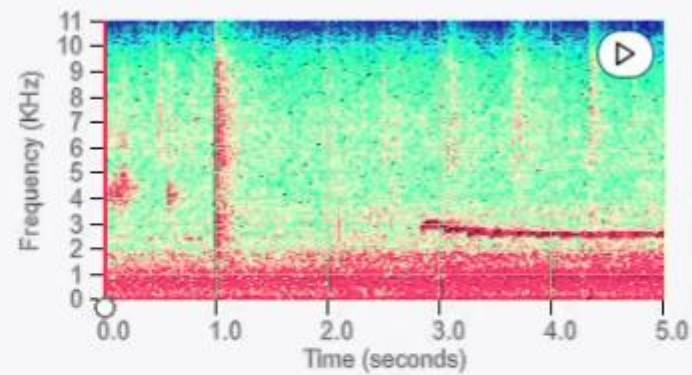
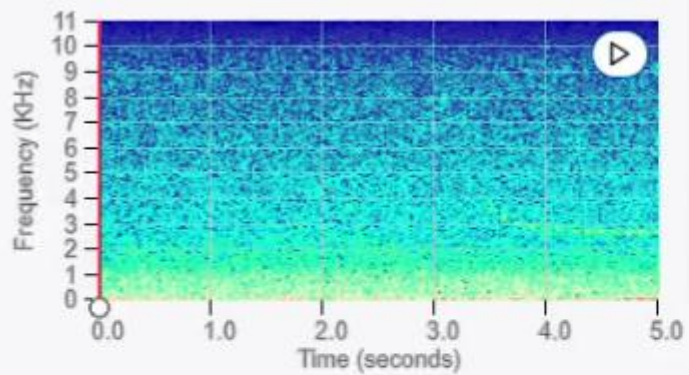


Are all of these a Koala?

Koala (J)

Not a Koala (K)

Verification: iteration



Are all of these a koala, or cow, or *?

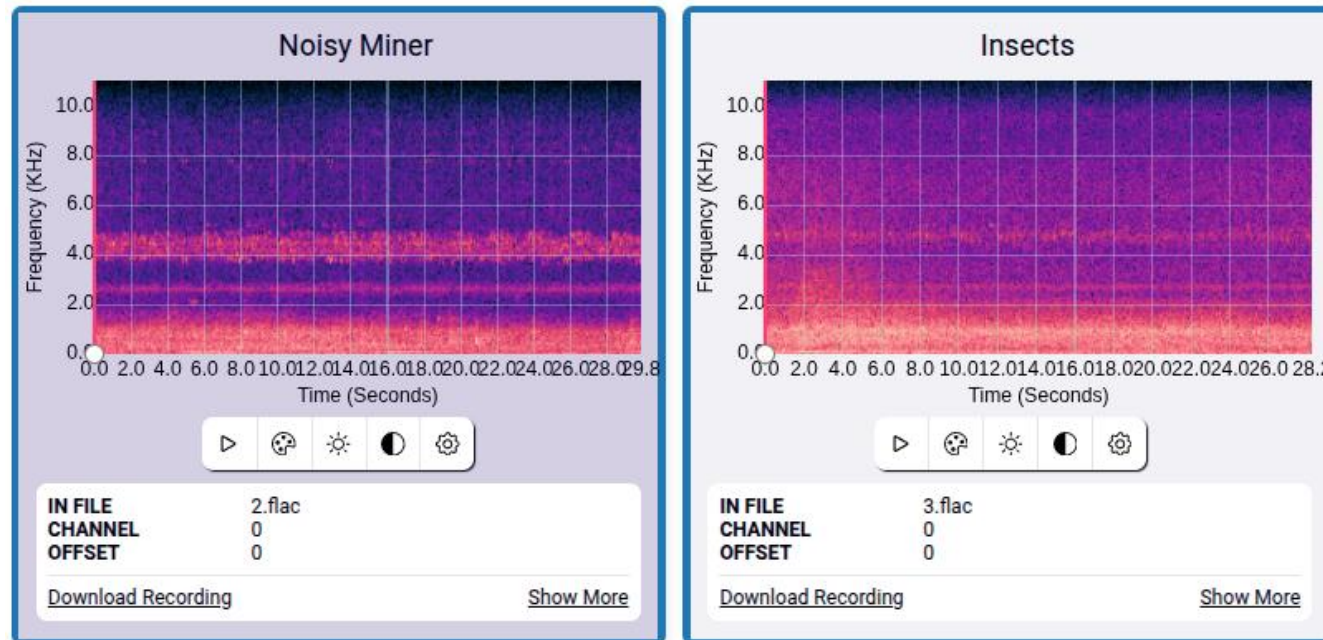
Koala
(female)
H

Koala
(male)
J

Cow
K

Negative
L

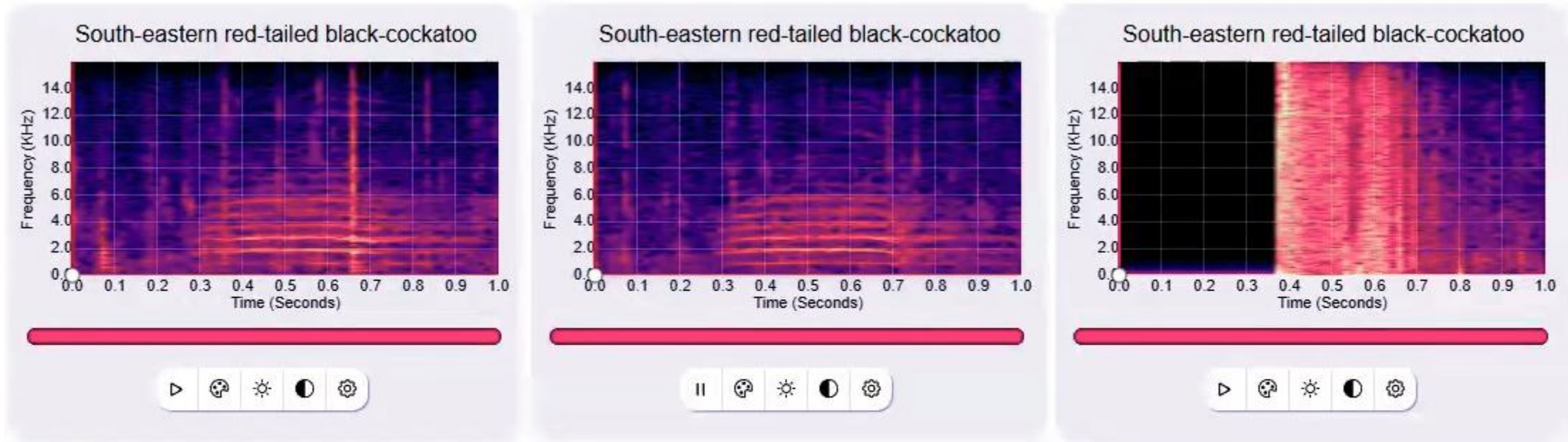
Verification: iteration



Do all of the selected audio segments have the correct applied tag

Yes	No	Skip
<input type="button" value="Y"/>	<input checked="" type="button" value="N"/>	<input type="button" value=""/>

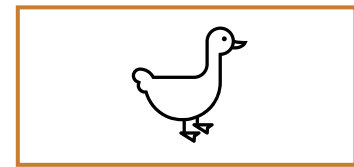
Verification: iteration



Do all of the selected audio segments have the correct applied tag

true false

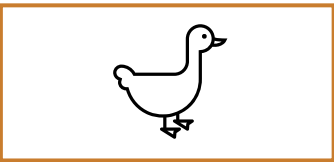
Verification: showing task progress



NO

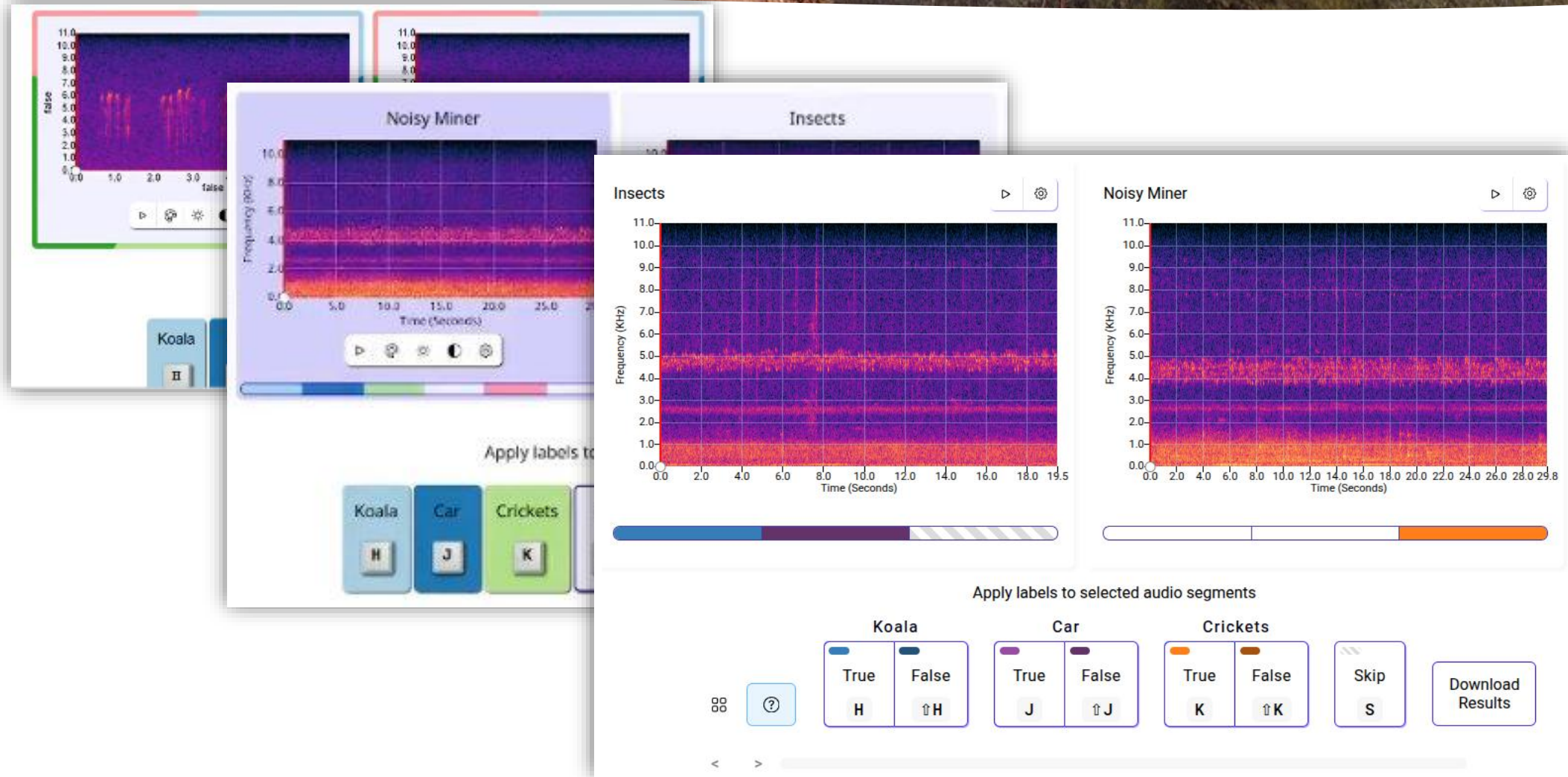
YES

OR



NO

YES



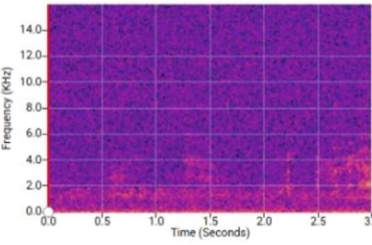
The screenshot displays the Open Ecoacoustics verification interface. It features several spectrograms showing frequency (kHz) over time (seconds). The interface includes playback controls (play, stop, volume, settings) and a progress bar for each audio segment. Below the spectrograms, there are buttons for applying labels to selected audio segments. The labels are categorized by species: Koala (H), Car (J), and Crickets (K). Each label has a 'True' and 'False' option, with a corresponding icon (H, ↑H, J, ↑J, K, ↑K). There is also a 'Skip' button (S) and a 'Download Results' button. The interface is designed to allow users to verify the accuracy of the system's classifications.

Verification: result

Projects / Mangrove Listening / Search Annotations / Verify Annotations

Ecosounds Projects Listen Library Research Contact Us Admin Logout

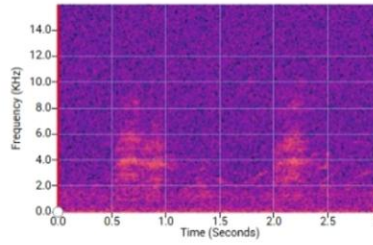
Apostlebird



Frequency (kHz) vs Time (Seconds)

Go To Source Show More

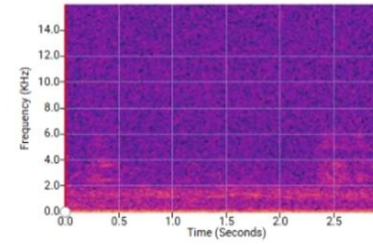
Apostlebird



Frequency (kHz) vs Time (Seconds)

Go To Source Show More

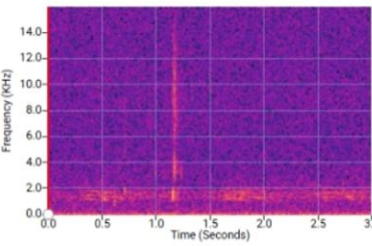
Apostlebird



Frequency (kHz) vs Time (Seconds)

Go To Source Show More

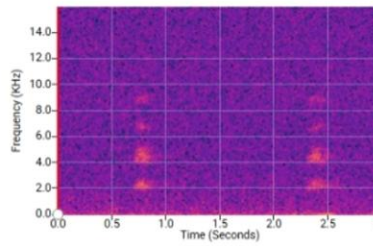
Australasian Darter



Frequency (kHz) vs Time (Seconds)

Go To Source Show More

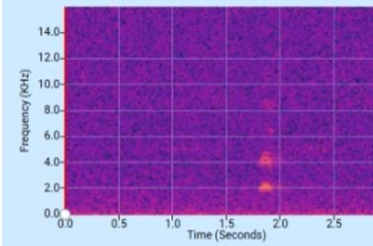
Australasian Swamphen



Frequency (kHz) vs Time (Seconds)

Go To Source Show More

Australasian Swamphen



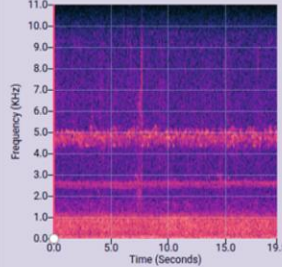
Frequency (kHz) vs Time (Seconds)

Go To Source Show More

Do all of the selected audio segments have the correct applied tag

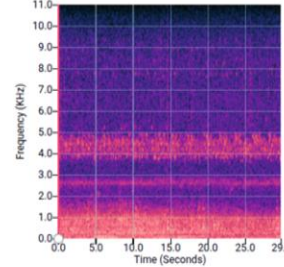
<input checked="" type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Unsure	<input type="checkbox"/> Skip
Y	N	U	.

Insects



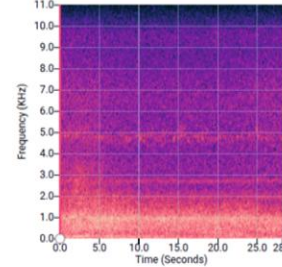
Frequency (kHz) vs Time (Seconds)

Noisy Miner



Frequency (kHz) vs Time (Seconds)

Insects

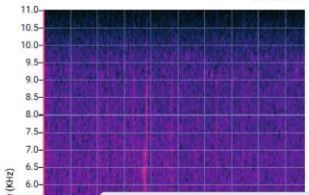


Frequency (kHz) vs Time (Seconds)

Apply labels to selected audio segments

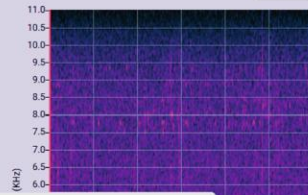
<input checked="" type="checkbox"/> True	<input type="checkbox"/> False	<input checked="" type="checkbox"/> True	<input type="checkbox"/> False	<input checked="" type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Skip	Download Results
H	↑H	J	↑J	K	↑K	S	

Insects Abbots Babbler



Frequency (kHz) vs Time (Seconds)

Noisy Miner



Frequency (kHz) vs Time (Seconds)

New Tag

Type to search for tags

- Abbots Babbler
- Brush Turkey
- Noisy Miner

Do all of the selected audio segments have the correct applied tag

<input checked="" type="checkbox"/> True	<input type="checkbox"/> False	<input type="checkbox"/> Skip	<input checked="" type="checkbox"/> Choose a Tag	Download Results
1	2	S	3	

Verification: objectives

Objectives achieved

- Web
- Mobile
- Desktop
- Open source
[ecoacoustics/web-components](https://github.com/ecoacoustics/web-components)
- Keyboard shortcuts
- Made for verification
- Load any segment from any file
- Multi item (grid view)
- Single item view
- Collaboration
 - Simply Share a URL

Bonus features

- We record *incorrect*, *correct*, *unsure*, and *skip* responses
 - → rich data
- Support overrun to form consensus
- Customisable tasks
 - Verify only
 - Verify and correct label
 - Classification tasks
- Reusable
- Has a basic standalone mode
- Themeable

Deployed in July 2025

- ≈12 months of work with 1.2 FTE
- 42,000 verifications already
- 55 codesign features complete, 67 more...
- Already used for agile learning for AI

Future work

- Sampling strategies
 - e.g. find one correct label per day then don't show me anything else from the current day
- Showing history / resuming sessions
- Enhance export of verification data

Microsites & Call Detective

Dedicated websites for citizen engagement

- Simple
- Content heavy
- Focused
- Hides management platform (Ecosounds)
- Primarily targeting verification tasks
- One built, more to come
- Reuses the verification component and customises it for audience

The screenshot shows the homepage of the 'Eavesdropping on Wetland Birds' website. At the top, there is a navigation bar with 'About', 'Admin', and 'Verify Calls' links. The main header features a large image of a wetland with the text 'Can you hear an Australasian Bittern?' and a logo for 'eavesdropping ON WETLAND BIRDS'. Below this, a paragraph explains that the Australasian Bittern is a threatened species and that the site's mission is to track and identify its calls. A 'Research Objectives' section lists goals such as understanding the distribution of little-known wetland bird species and improving artificial intelligence training datasets. A 'Progress So Far' section shows a 0% completion rate with a 'Contribute your verifications' button. The 'Meet the Team' section introduces three team members: Dr. Elizabeth (Liz) Znidarsic, Dr. Michael Towsey, and Professor David M Watson, each with a small photo and a brief bio.

The screenshot shows the 'Call Detective' verification interface. At the top, there is a navigation bar with 'About', 'Admin', and 'Verify Calls' links. The main content area displays a spectrogram of an 'Australasian Bittern' call. The y-axis is labeled 'Frequency (kHz)' and ranges from 0.0 to 22.0. The x-axis is labeled 'Time (Seconds)' and ranges from 0.0 to 7.97. Below the spectrogram, there is a question: 'Does the shown audio segment have the correct applied tag'. There are three buttons: 'Yes' (with a green indicator), 'No' (with a red indicator), and 'Skip'. At the bottom, there is a footer with 'Blog', 'Ecosounds Project', 'Project Home', and 'Support / Donate' links, along with the text 'Copyright 2025. All rights reserved.' and 'Created by Open Ecoacoustics'. The Open Ecoacoustics logo is also present, along with the text 'In collaboration with the Call Detective project.'

Questions



Open
Ecoacoustics



- Special thanks to:
- Hudson Newey, primary developer for this project
 - Our codesign users for feedback
 - QUT eResearch



Open Ecoacoustics is a co-investment partnership with the Australian Research Data Commons (ARDC) through the Planet Research Data Commons (DOI: [10.3565/ts8c-ee10](https://doi.org/10.3565/ts8c-ee10)). The ARDC is enabled by the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS).

