Detecting Cusk Eels and Beyond

10 Minute Lightning Talk

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11/21 - Sustainable Living Resources, Biotechnology, and Restoration

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1. What are Cusk Eels?
2. Why we want to detect them?
3. How to detect them?
4. Results
5. Annotation Tool
6. Future directions

Overview

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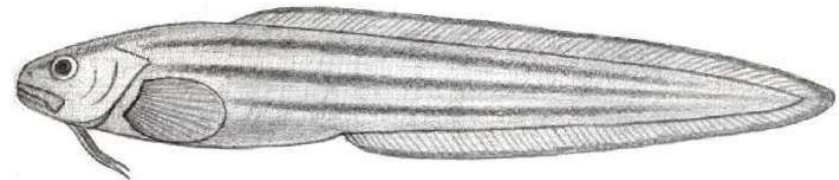RESEARCH AND INNOVATION

Cusk Eels

Not Eels

Marine bony Fish

Cusk eels are demersal fishes

Comprise one of the most widespread families of deep-sea fishes

Generally Active/Forage during night

Direct observation of their behavior is challenging

Preying on invertebrates and other small bottom-dwelling fishes
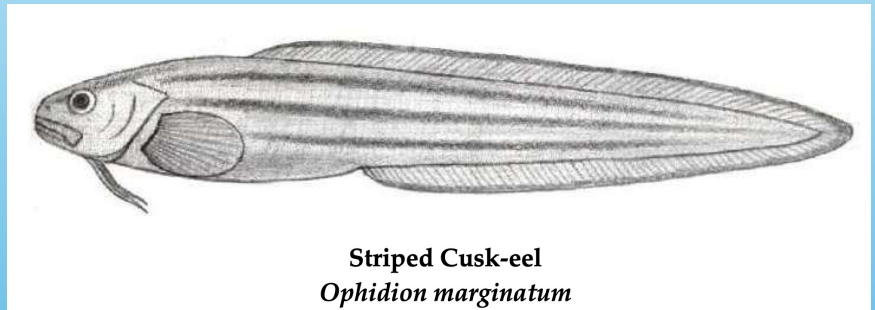
Striped Cusk-eel
Ophidion marginatum

Simpson, R.G., Allen, D.M., Sherman, S.A. and Edwards, K.F., 2015. Fishes of the North Inlet estuary: a guide to their identification and ecology. Belle W. University of South Carolina, USA: Baruch Institute Special Publication.

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Why detect them?

To understand species presence, distribution, and diversity
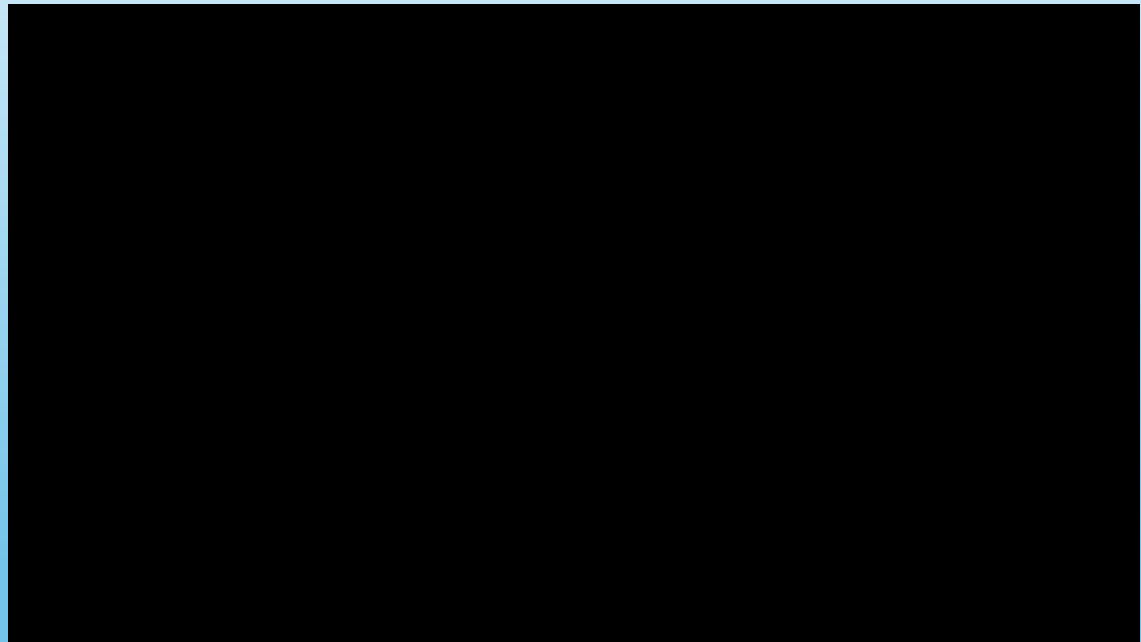

Striped Cusk-eel
Ophidion marginatum

How to detect them? : Sound

They make the sound using specialized drumming muscles attached to their swim bladder


https://dosits.org/galleries/audio-gallery/fishes/cusk-eel/

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How to detect them?: Automatically

- Using the audio files spectrograms

- Focusing on fish-sound frequency

- Using Convolution Neural Network

- 120 seconds 32 audio files

- Break files to 1-sec chunks

- Feed chunks to CNN as time-series

- **Use 5-fold cross-validation:** divide the files to 5 groups **->** use 4 for training and 1 for training **->** 5 times

https://dosits.org/galleries/audio-gallery/fishes/cusk-eel/
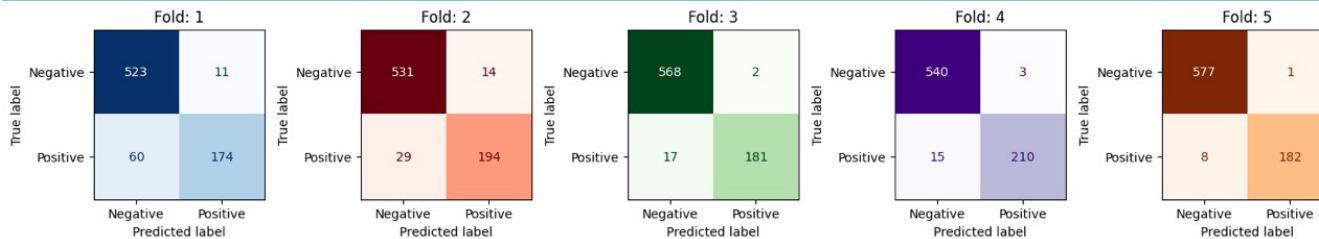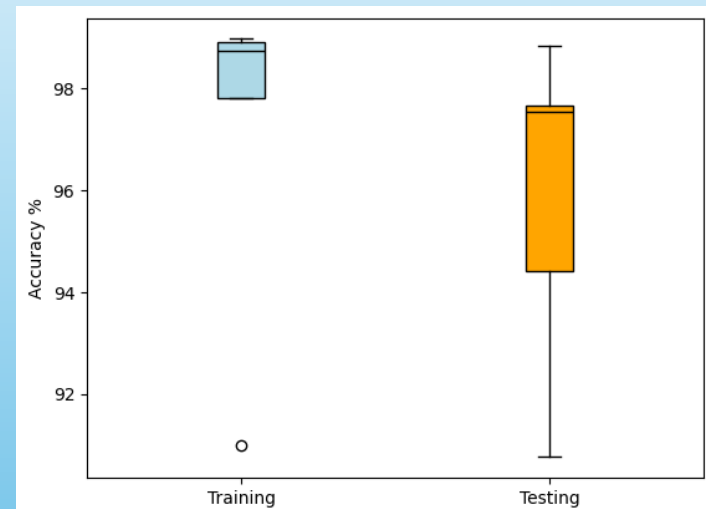

Mel-Spectrogram (dB)
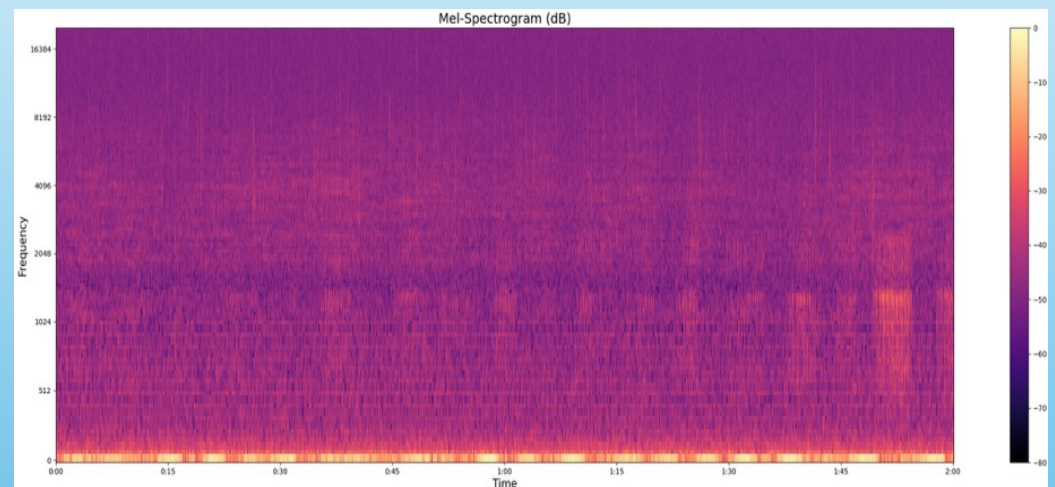
Results (a)

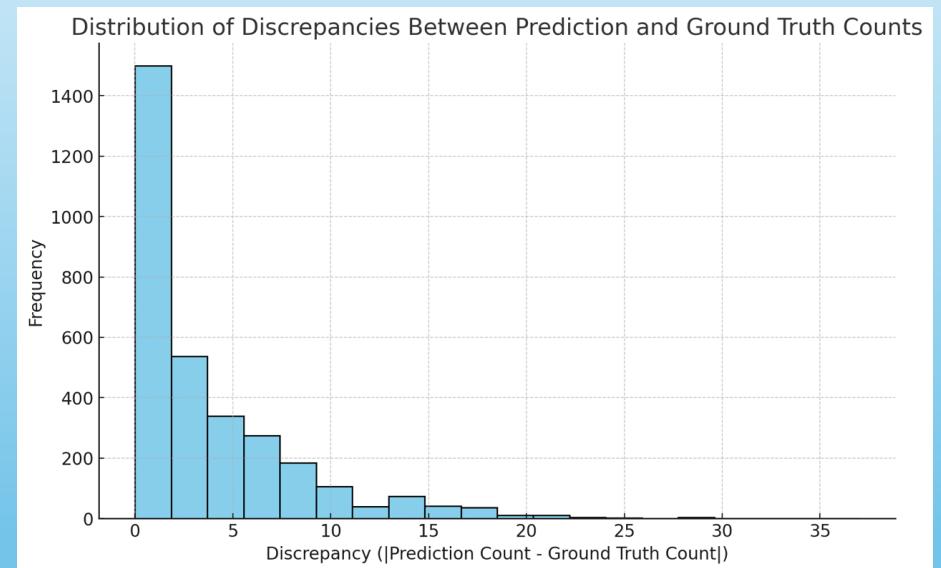- **Initial results:** 93% max <u>training</u> accuracy

- Shuffle the chunks:
  - Avg. Training accuracy: 97.07%
  - Avg. Testing accuracy: 95.84%

Fold: 1 — Negative: 523, 11; Positive: 60, 174

Fold: 2 — Negative: 531, 14; Positive: 29, 194

Fold: 3 — Negative: 568, 2; Positive: 17, 181

Fold: 4 — Negative: 540, 3; Positive: 15, 210

Fold: 5 — Negative: 577, 1; Positive: 8, 182

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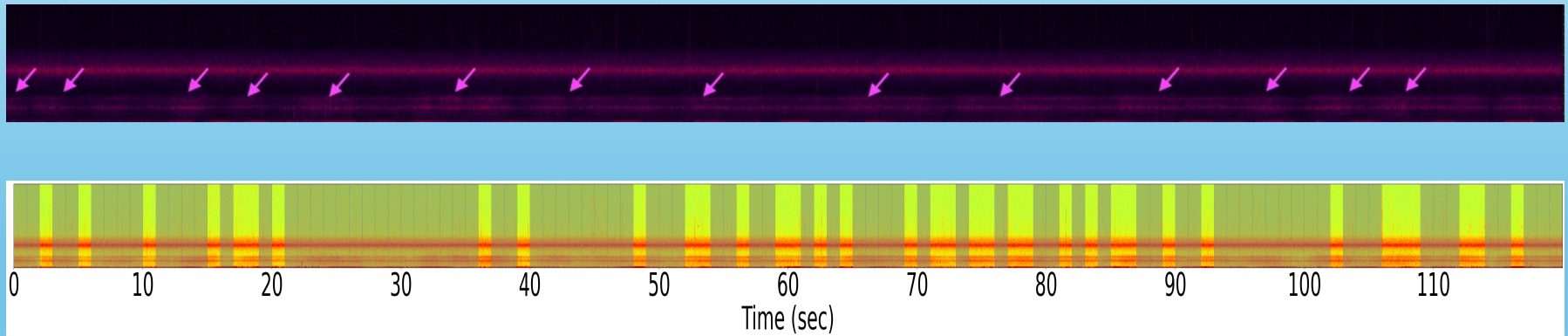RESEARCH AND INNOVATION

Results (b)

- **Further Experiments:**
  - 120-sec 3162 files
  - Annotations: count calls without specifying where in the file did they occurred
  - Only 1129 matched the annotation (36%)
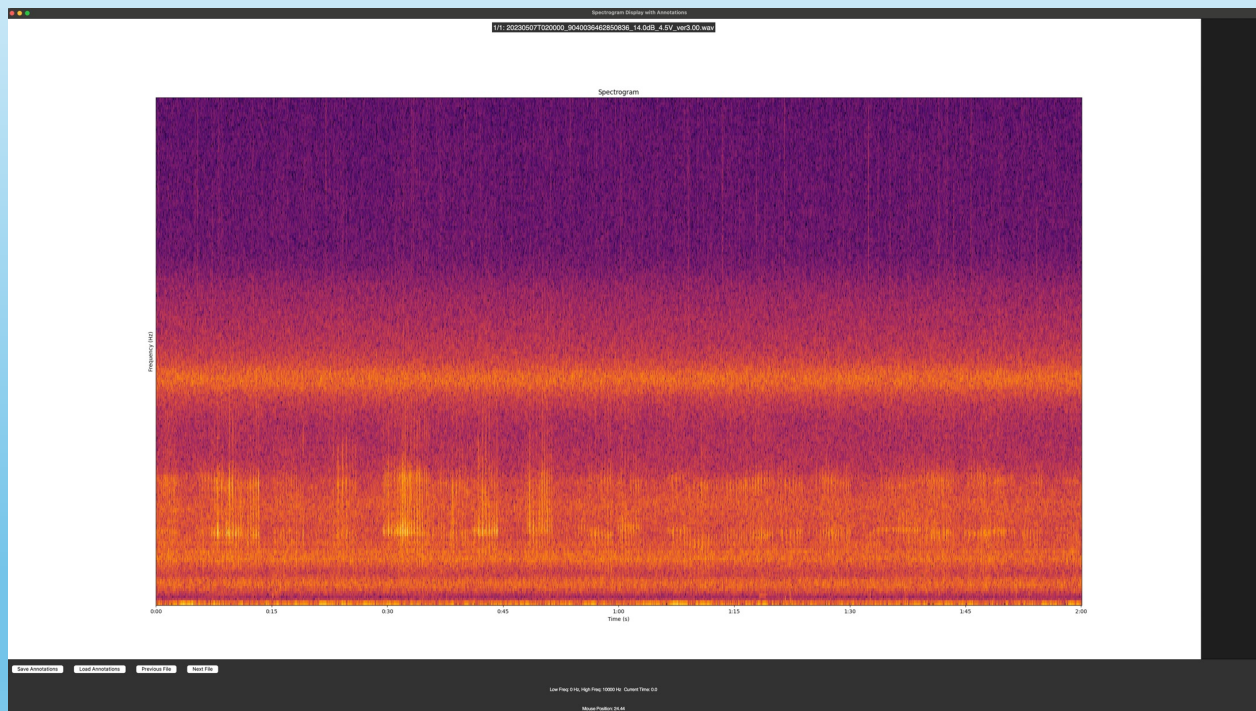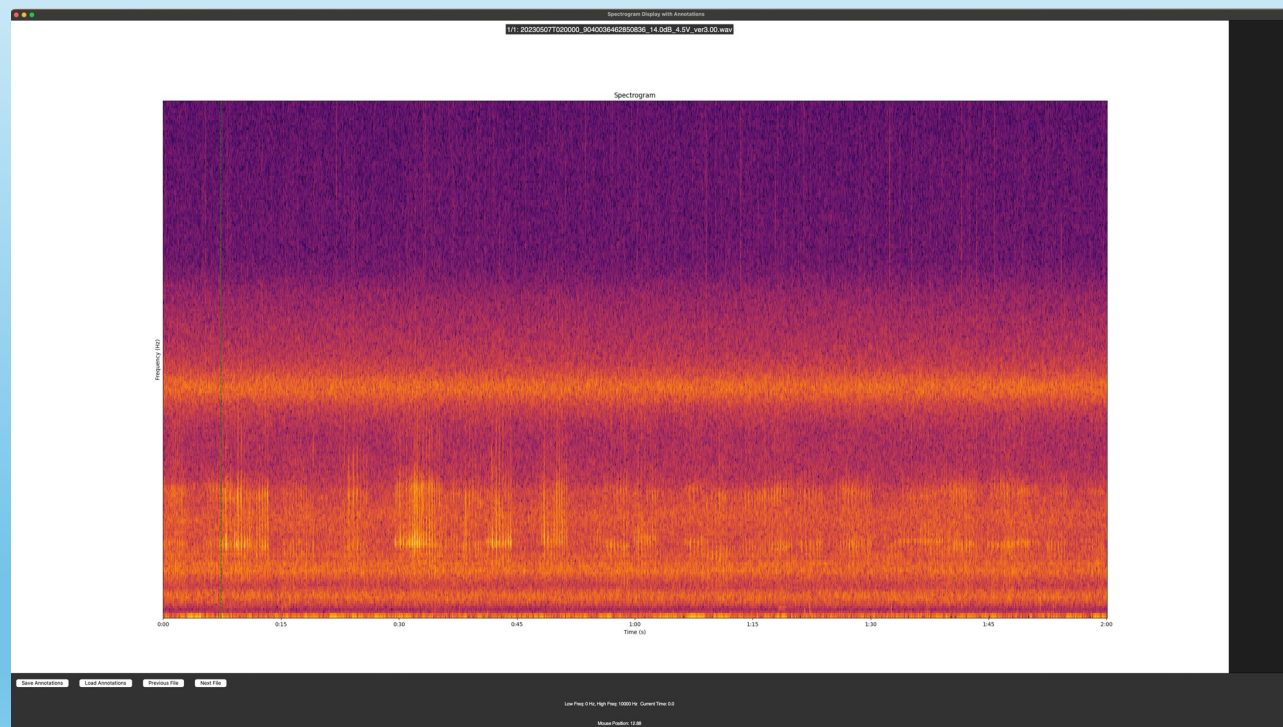 - 2226 differed by less than 5 counts (70.4%)

Distribution of Discrepancies Between Prediction and Ground Truth Counts

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Results (c)

- One manual validation:
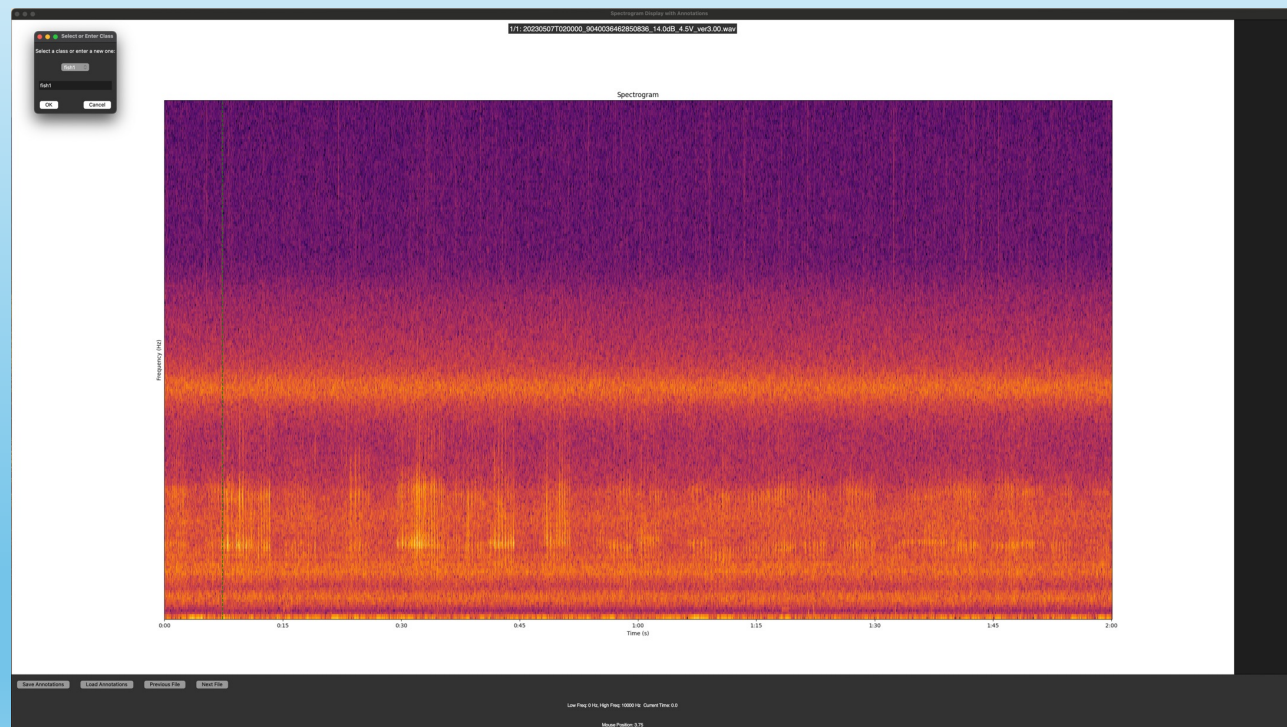 - Annotation: 0 calls
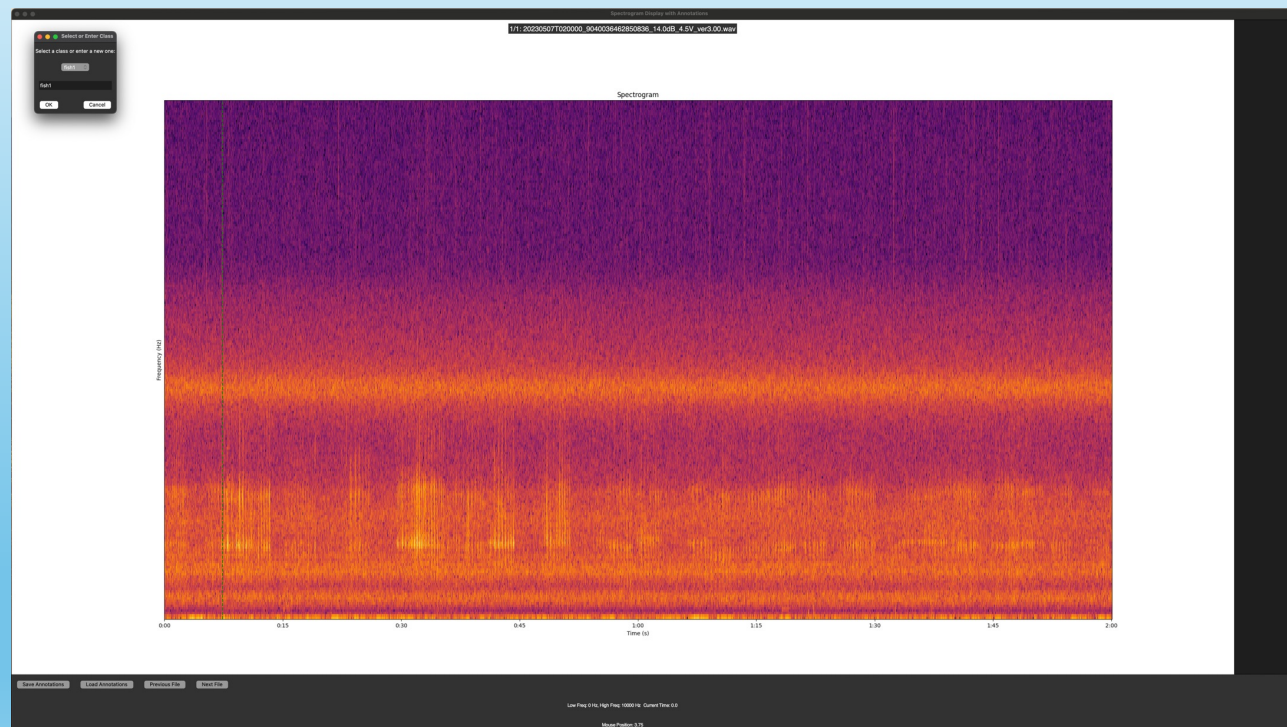 - Model: 28 calls

Annotation Tool
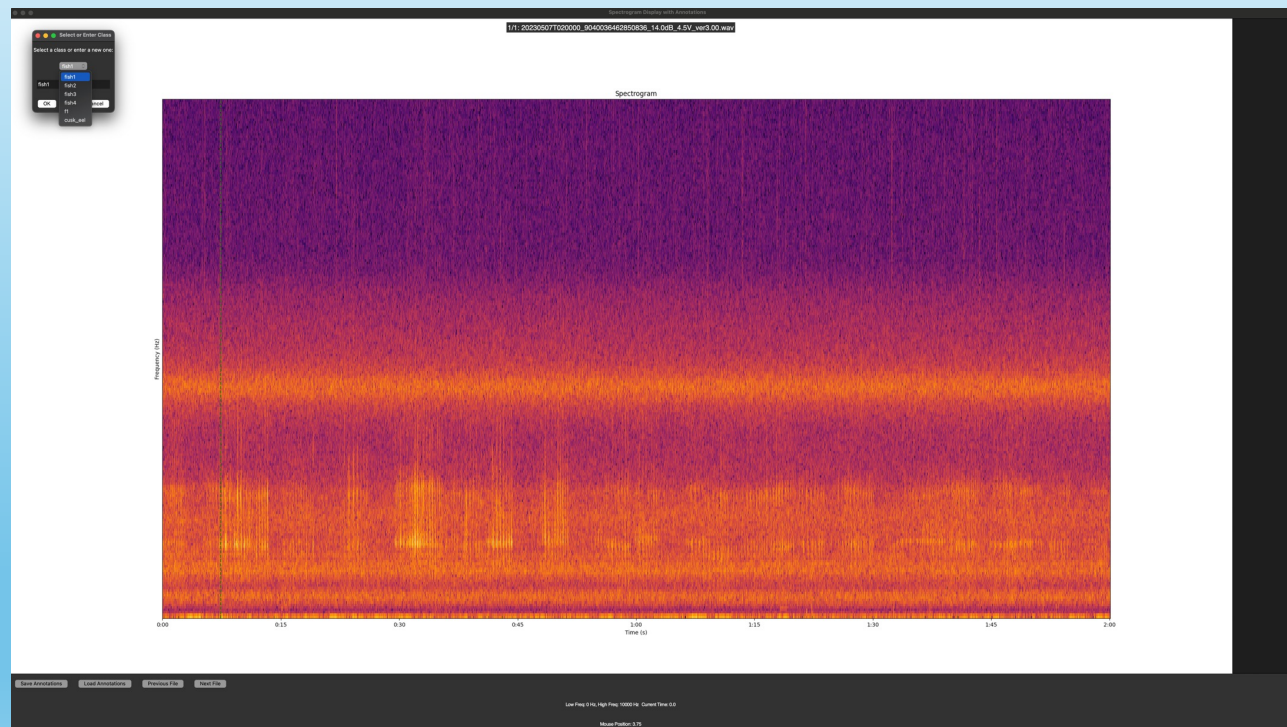
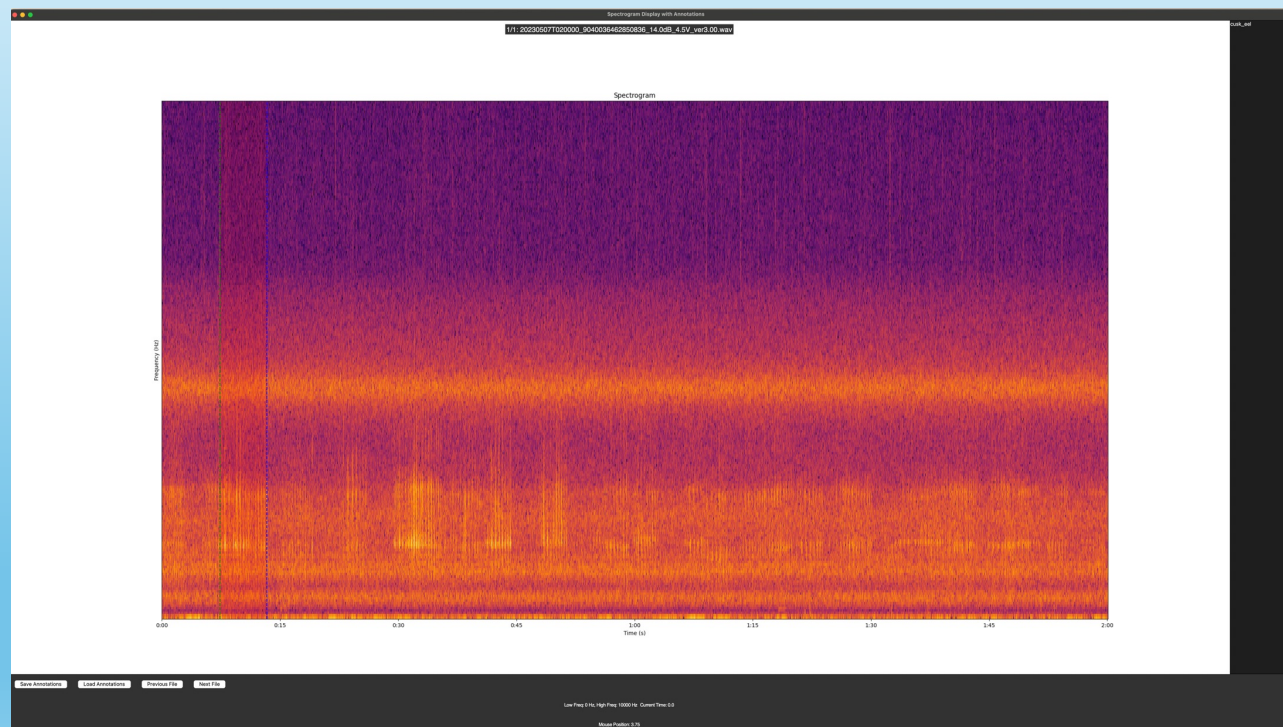# Annotation Tool
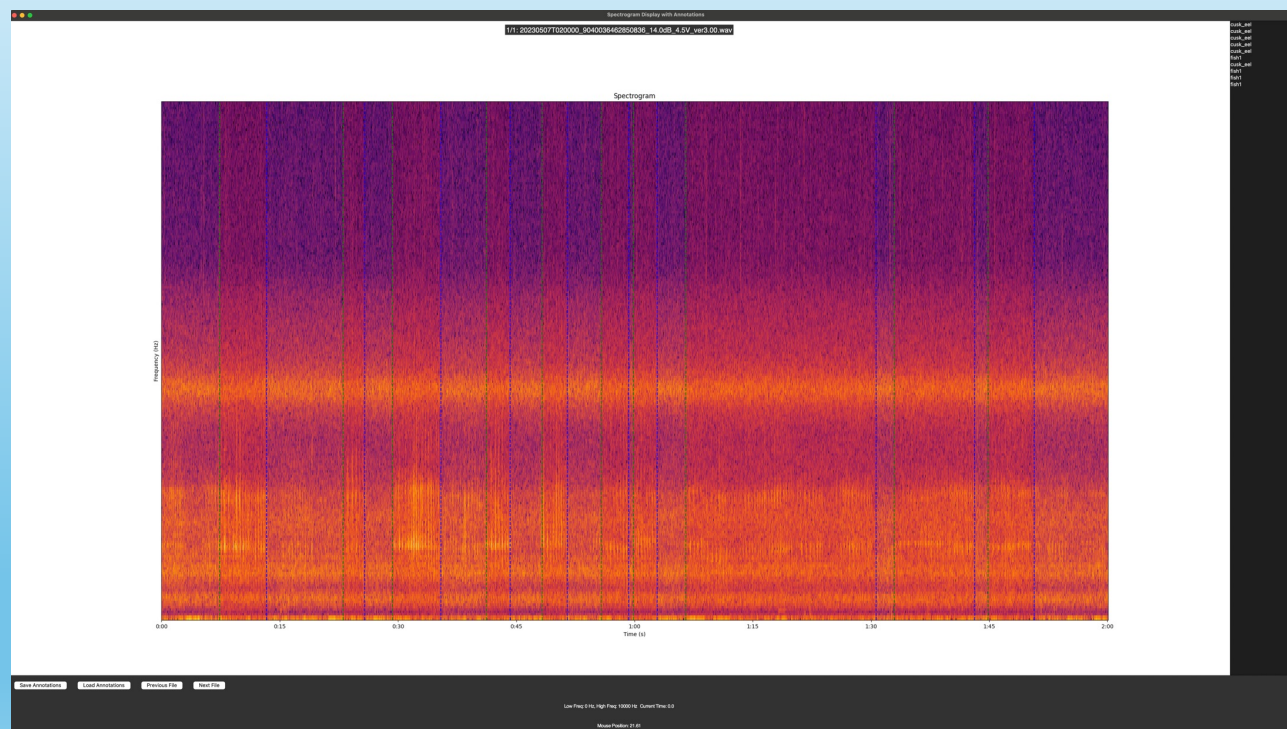
Annotation Tool

Annotation Tool

Annotation Tool

Annotation Tool

Annotation Tool

Future Directions

- More marine-life detection:
- *fish & mammals*
- Maritime vessels
- Audio – Imagery – Time Series – Multimodal

Questions

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