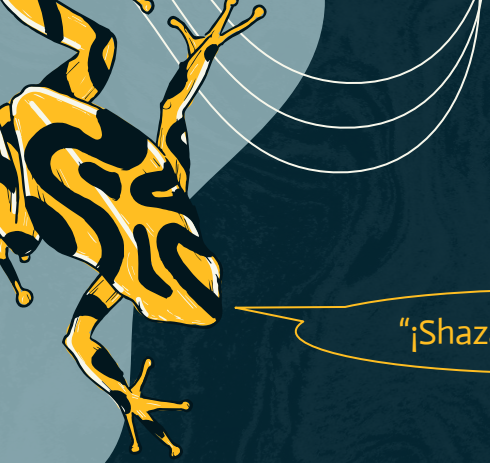
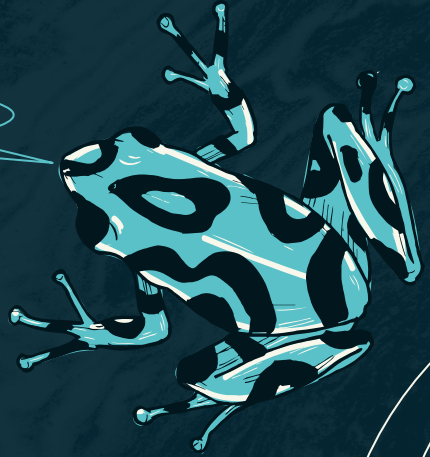


“Shazam para sapos”



“¡Shazam para ranas!”

“شازام للضفادع”

Ribbit

An app for automated frog species identification and classification

“Shazam for frogs!”

Farouk Ghandour
Data engineer

Lia Cappellari
Modeling lead

Modeling

Erica Nakabayashi
ML engineer

Haissam Akhras
MVP lead

MVP

Juliana Gómez Consuegra
PM - SME

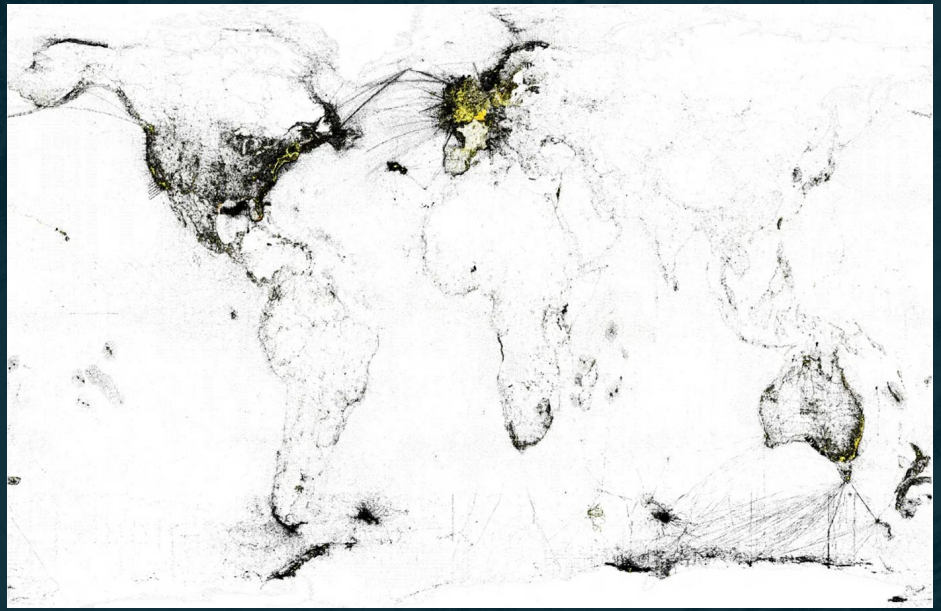
Product manager

01

Problem

Data gaps in the global south complicate conservation policy decisions

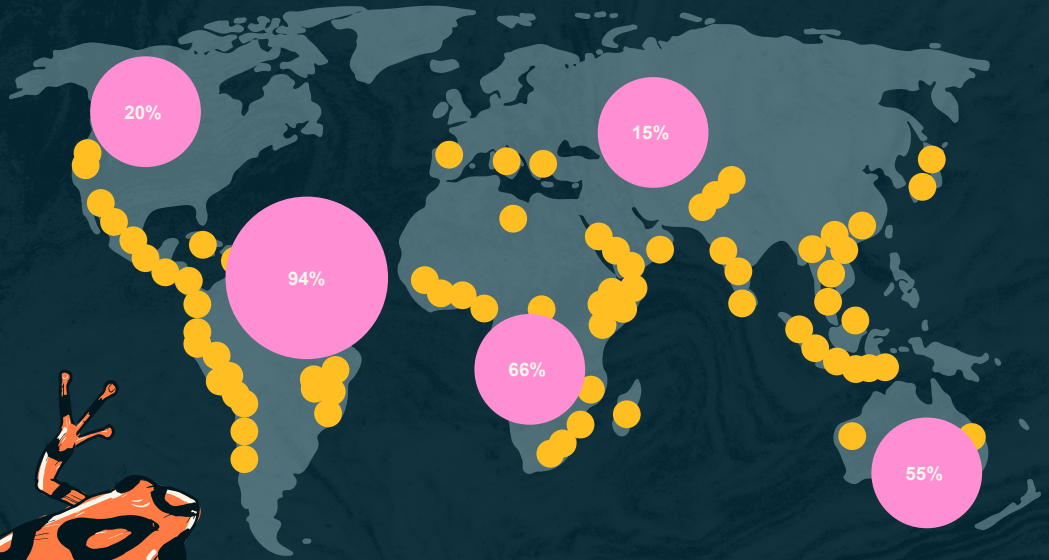
The biodiversity data gap



- Low data
- Medium data
- High data

Geographical bias in major biodiversity databases (GBIF & OBIS records, *Hughes et al., 2021*)

Biodiversity hotspots



Hotspots

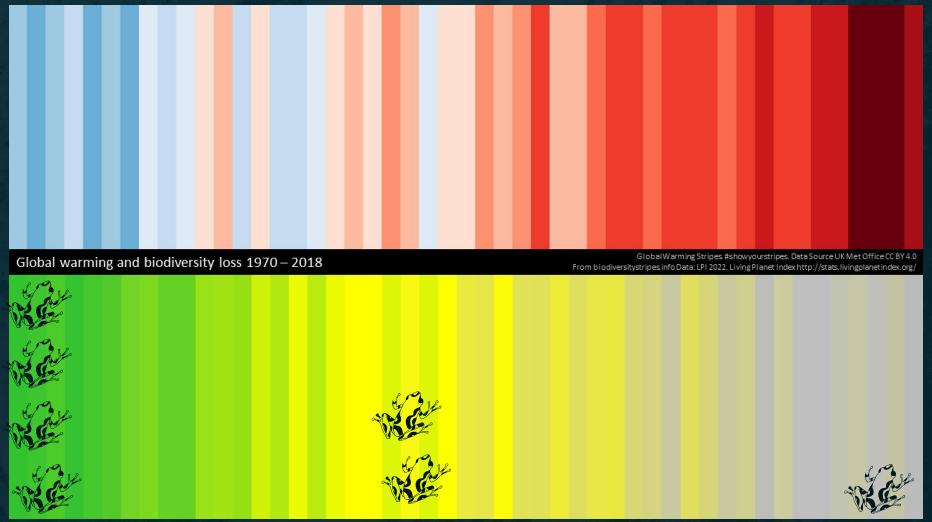
Loss

Adapted from: https://databasin.org/maps

Why frogs?

Amphibians are one of the most endangered vertebrate groups in the world, with more than **40%** of the species endangered to extinction

(Cañas et al., 2023)



https://biodiversitystripes.info/globalbiowarming

02

Market research & target users

Primary Users and Use Case

Nature Enthusiasts

- Communities like Wildlabs.net
- Coworkers, friends, family...anybody interested in nature

Researchers and Conservationists

- Ecuador
- Colombia
- Spain

Institute Stakeholders

We have been in contact with members from the following:

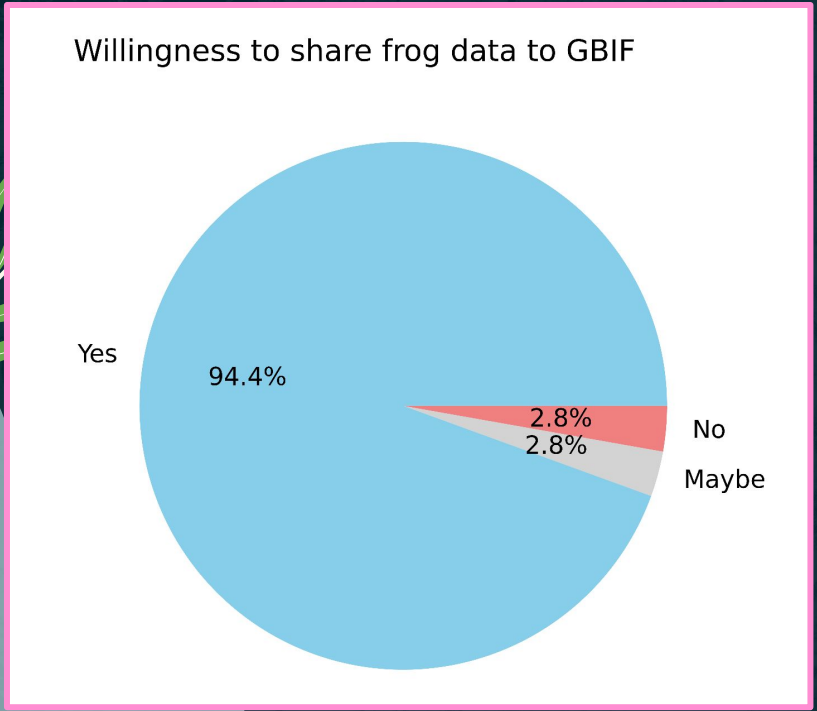
- Humboldt Institute of Biodiversity
- Javeriana University in Colombia

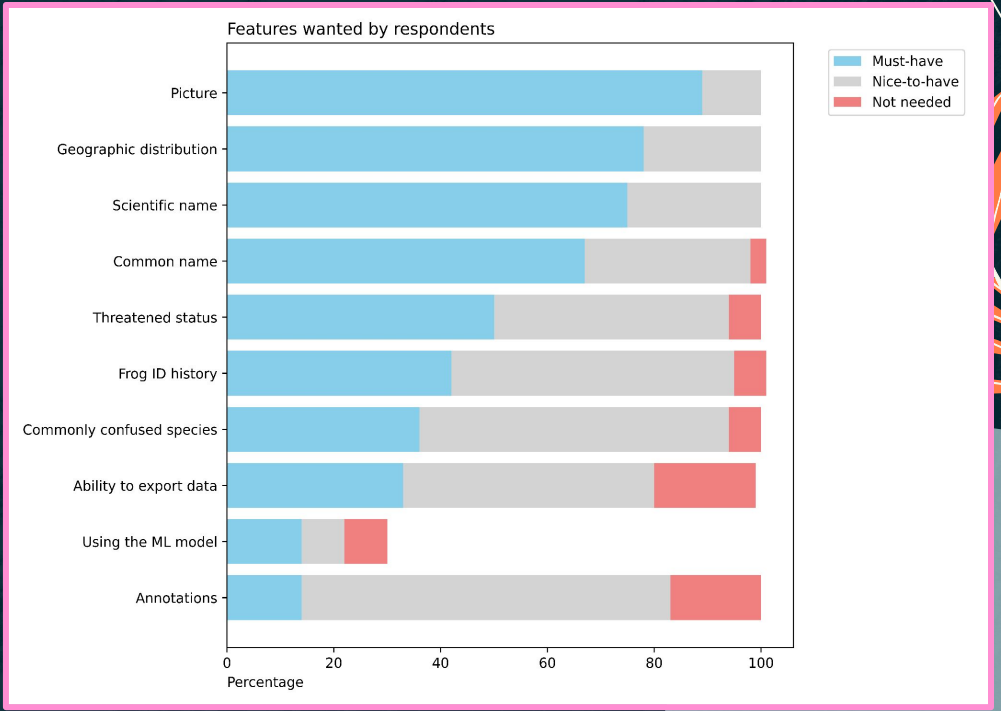
Use Case: Record and classify frog species, and optionally contribute data to global biodiversity repositories

Who’s working on this?

Learning from Potential Users

- Survey → 87 responses
  - 44 Spanish, 27 English, 16 Portuguese
  - 45 left contact information for beta testing

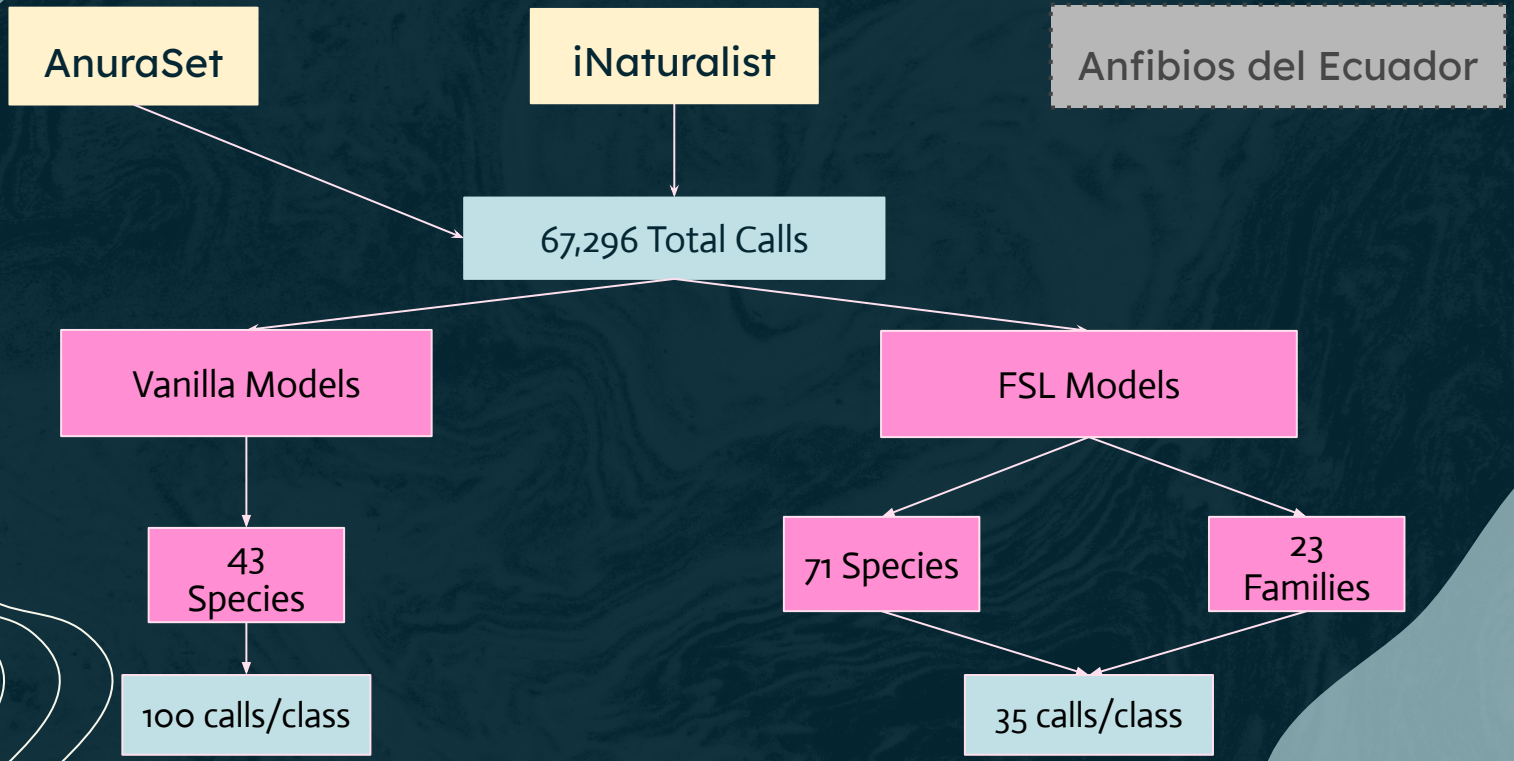




03

Data

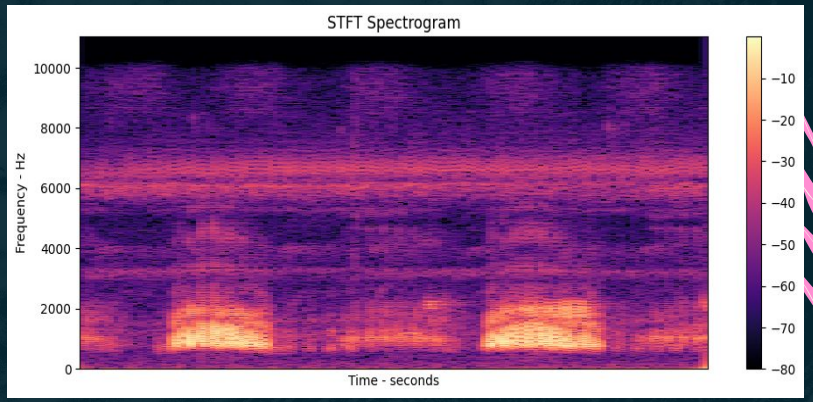
Data


AnuraSet
iNaturalist
Anfibios del Ecuador
67,296 Total Calls
Vanilla Models
FSL Models
43 Species
71 Species
23 Families
100 calls/class
35 calls/class

What our frogs sound like

What a frog call sounds like:

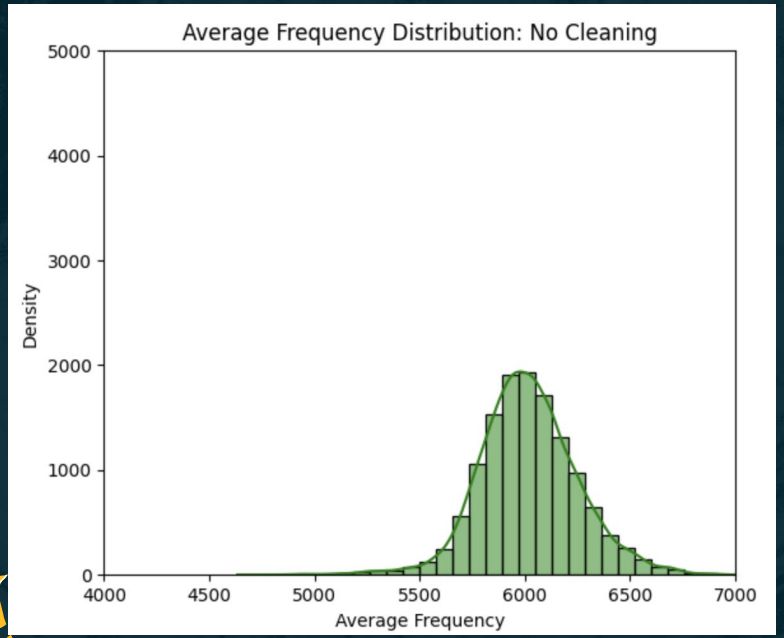
And what it looks like:



By Brocken Inaglory - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=7798416

What our frogs sound like

Frog call frequencies:

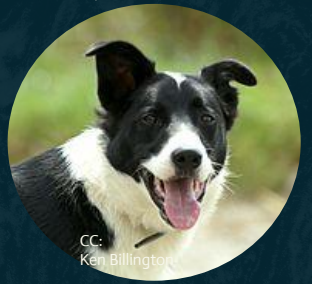


Other species' frequencies:

70,000 Hz

2,700 Hz

3000 Hz



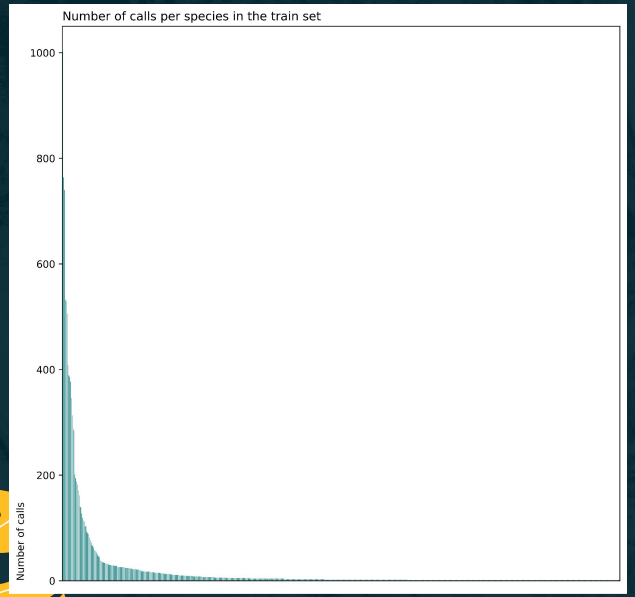
44 Hz

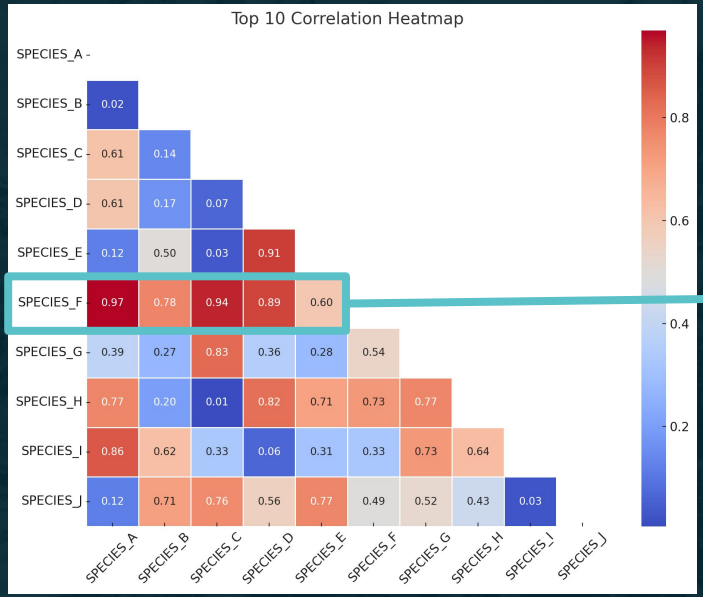
Demo 1:
Uploading a file with a frog recording

Strategies for our data

Our data is long-tailed → FSL

Species co-occur → Top 5 accuracy





Species B: 30%
Species C: 10%
Species D: 5%
Species E: 2%
Species F: 1%

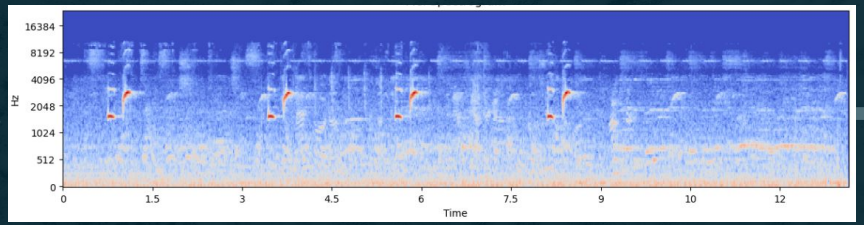
Species F appears as one of the **top 5** most likely species

04

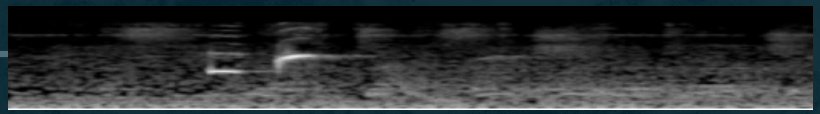
Architecture

Data Pipeline

Raw audio to pipeline



- Trimming to 3 secs
- Conversion to .wav
- Cleaning background
- Resampling 48kHz
- Normalization
- Single channel
- Greyscale and Dimensions



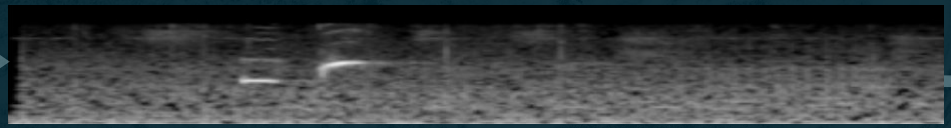
Conversion to np.array

```
array([-0.17477794, -0.23316997, -0.21214505, ..., -0.11492103,
       -0.08918354, -0.04159154], dtype=float32)
```

Data Augmentation

Call following the standard pipeline

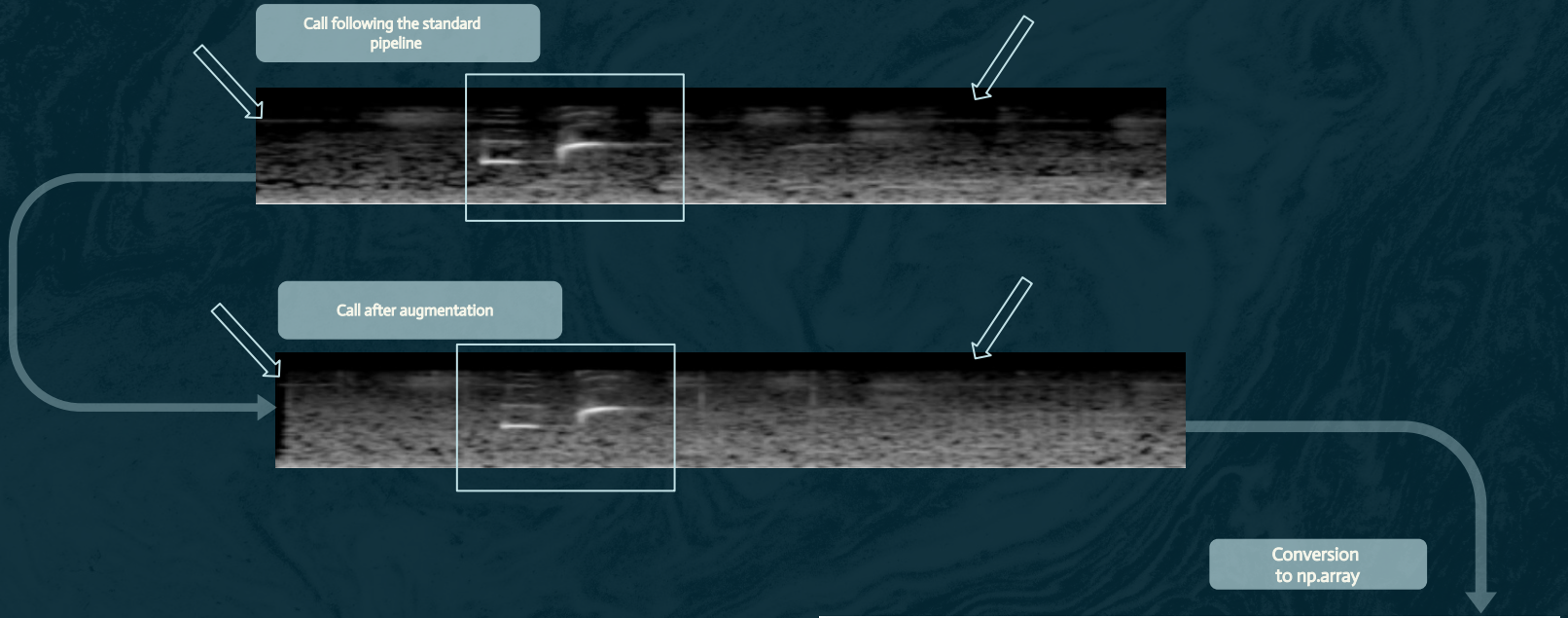
Call after augmentation



Conversion to np.array

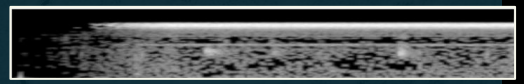
```
array([-0.17477794, -0.23316997, -0.21214505, ..., -0.11492103,
       -0.08918354, -0.04159154], dtype=float32)
```

Data Augmentation

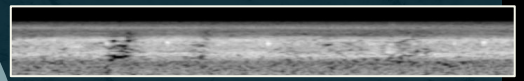


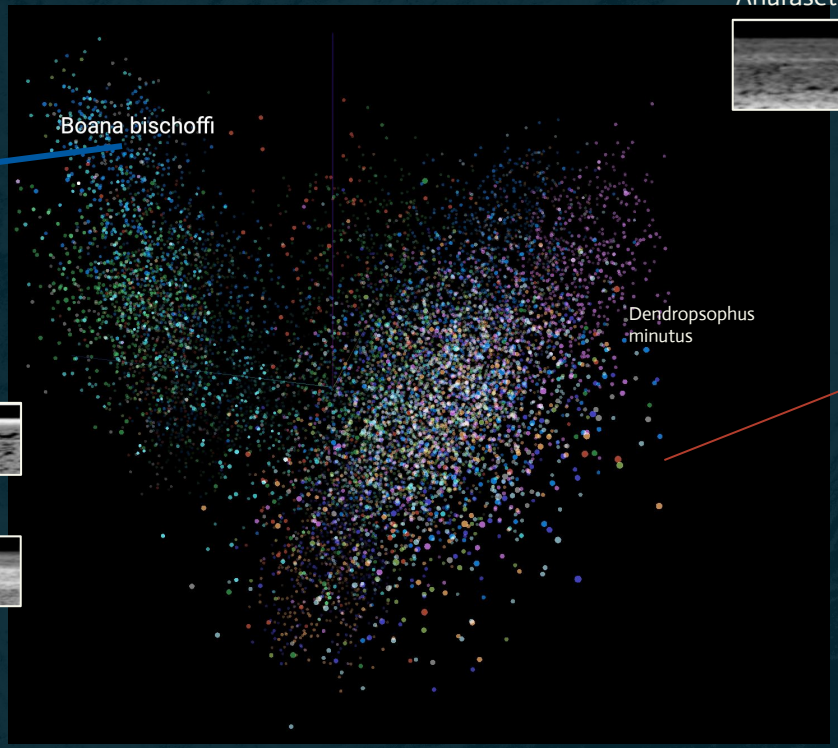
Embedding space

iNaturalist Sample



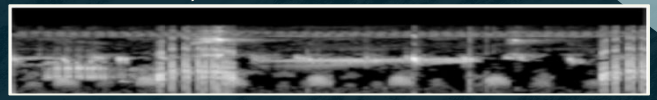
Anuraset Sample



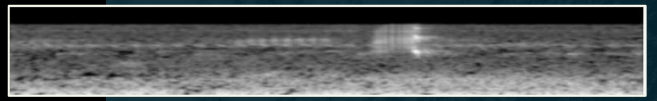


Created with https://projector.tensorflow.org/

iNaturalist Sample



Anuraset Sample



Baseline - BirdNET

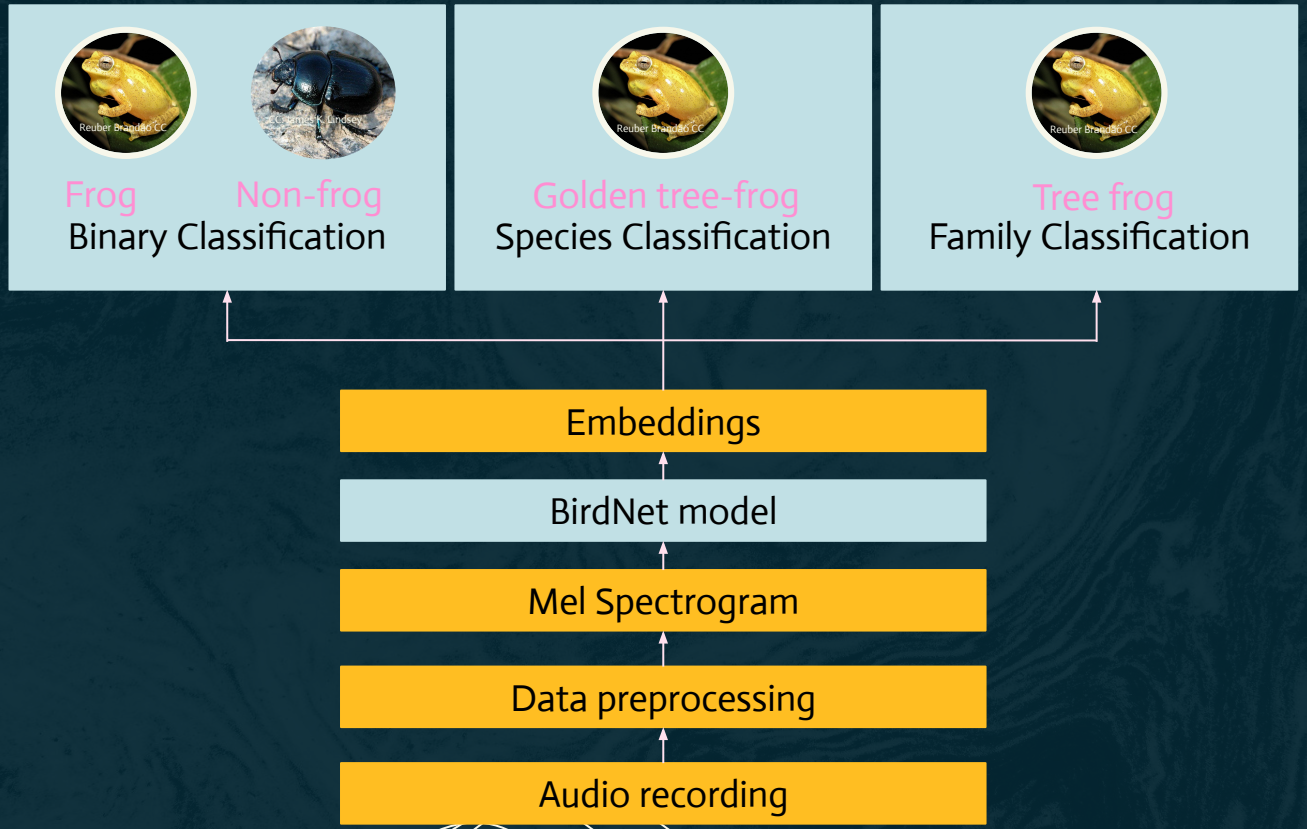
Global birdsong embeddings enable superior transfer learning for bioacoustic classification

Burooj Ghani, Tom Denton, Stefan Kahl & Holger Klinck

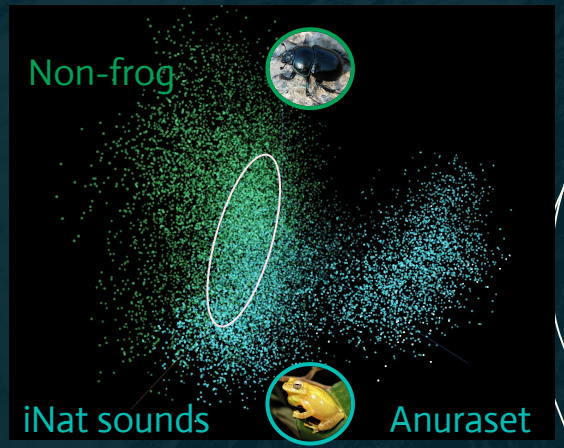
Model	GC		YD		BT		WMMSD		RFCX Frogs		RFCX Birds	
	Top-1	AUC	Top-1	AUC	Top-1	AUC	Top-1	AUC	Top-1	AUC	Top-1	AUC
Perch	**0.92**	**0.99**	**0.87**	*0.91*	**0.86**	**0.97**	**0.83**	**0.98**	**0.74**	*0.96*	**0.83**	**0.97**
BirdNET 2.3	0.91	0.99	0.84	0.91	0.85	0.96	0.81	0.98	0.73	0.95	0.78	0.96

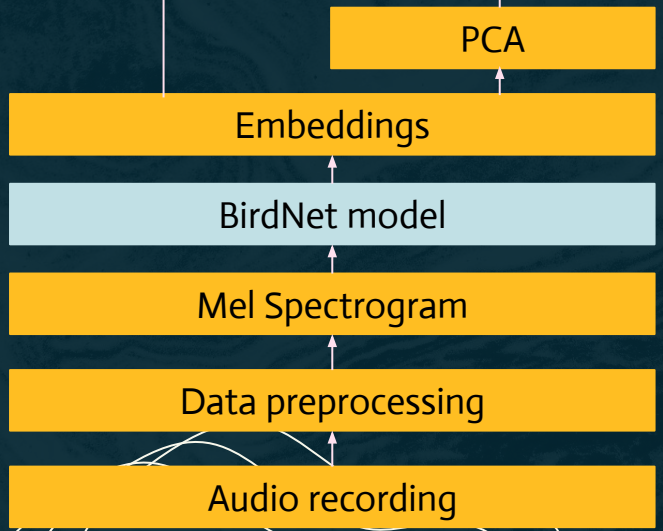
Images taken from:
https://www.nature.com/articles/s41598-023-49989-z

Experiments



Species binary





Species multiclass

Best-performing model: FSL

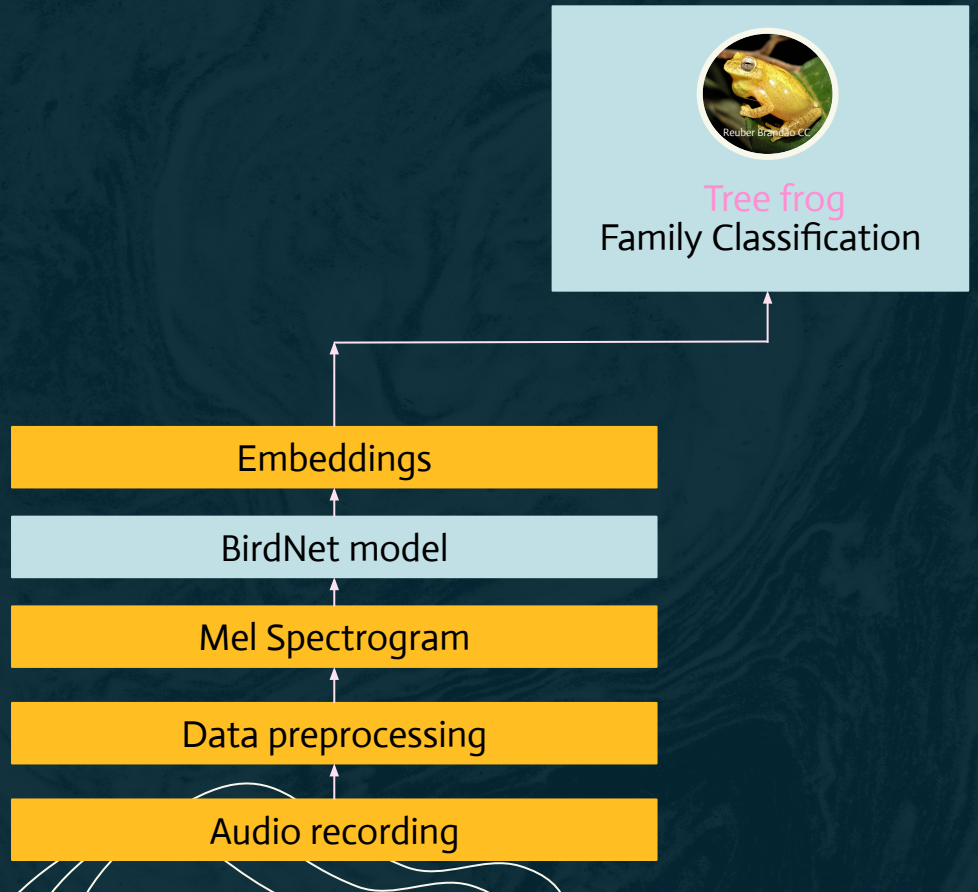
top - 5 accuracy: 91%
top - 1 accuracy: 72%
ROC AUC: 96%

BirdNet top-1 accuracy on frogs: 73%

Family multiclass

Best-performing model: FSL

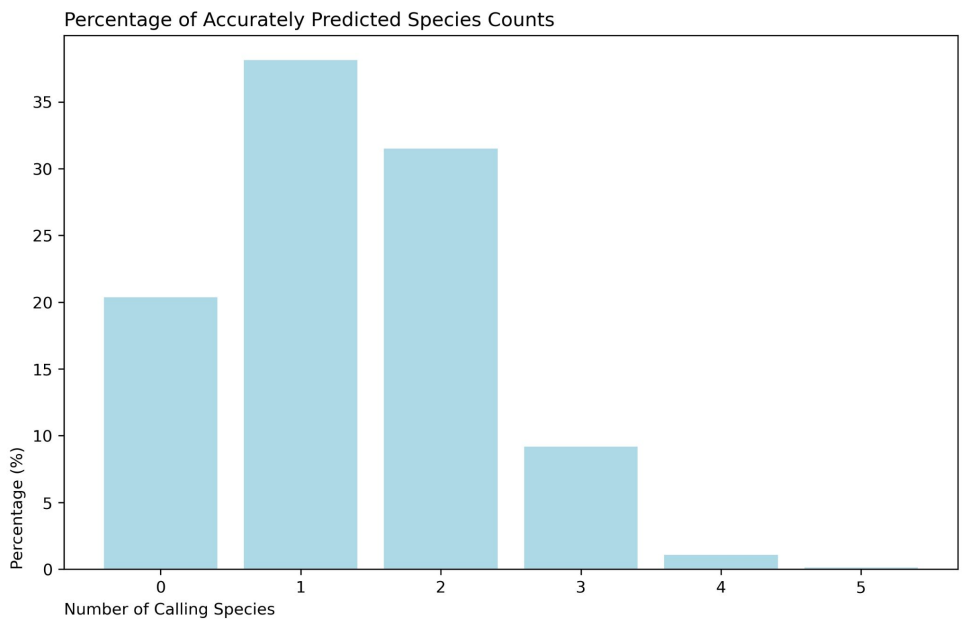
top - 5 accuracy: 95%
top- 1 accuracy: 68%
ROC AUC: 95%



Best-performing model

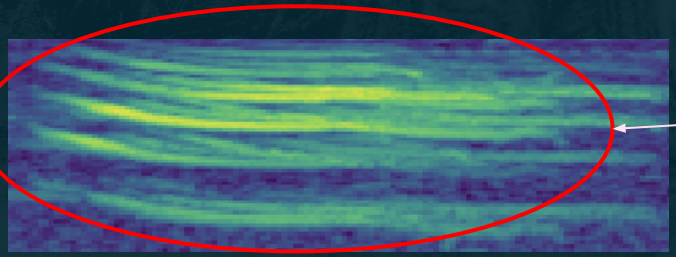
FSL Multiclass Species Model (71 Species)

Top 5 Accuracy: 91%



Confused Species

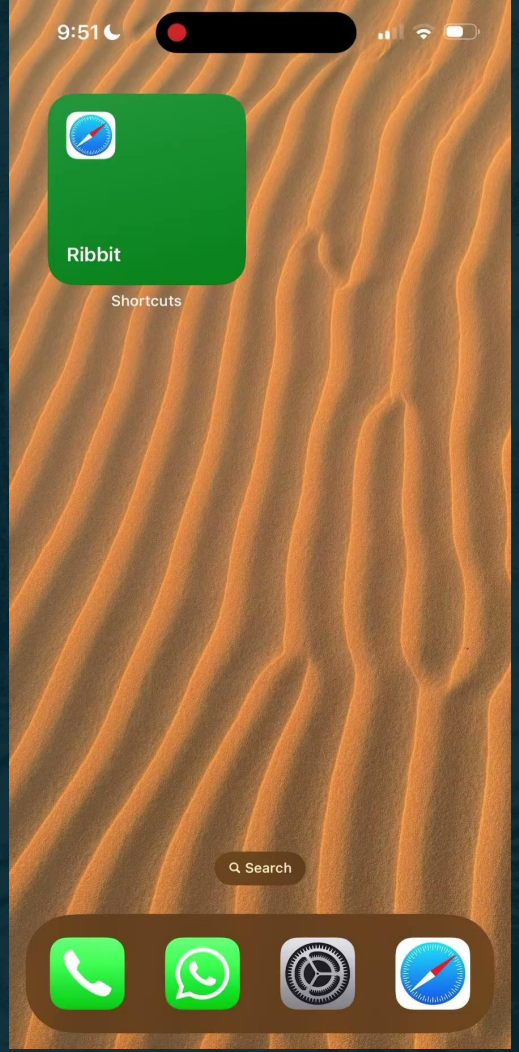
Physalaemus albonotatus



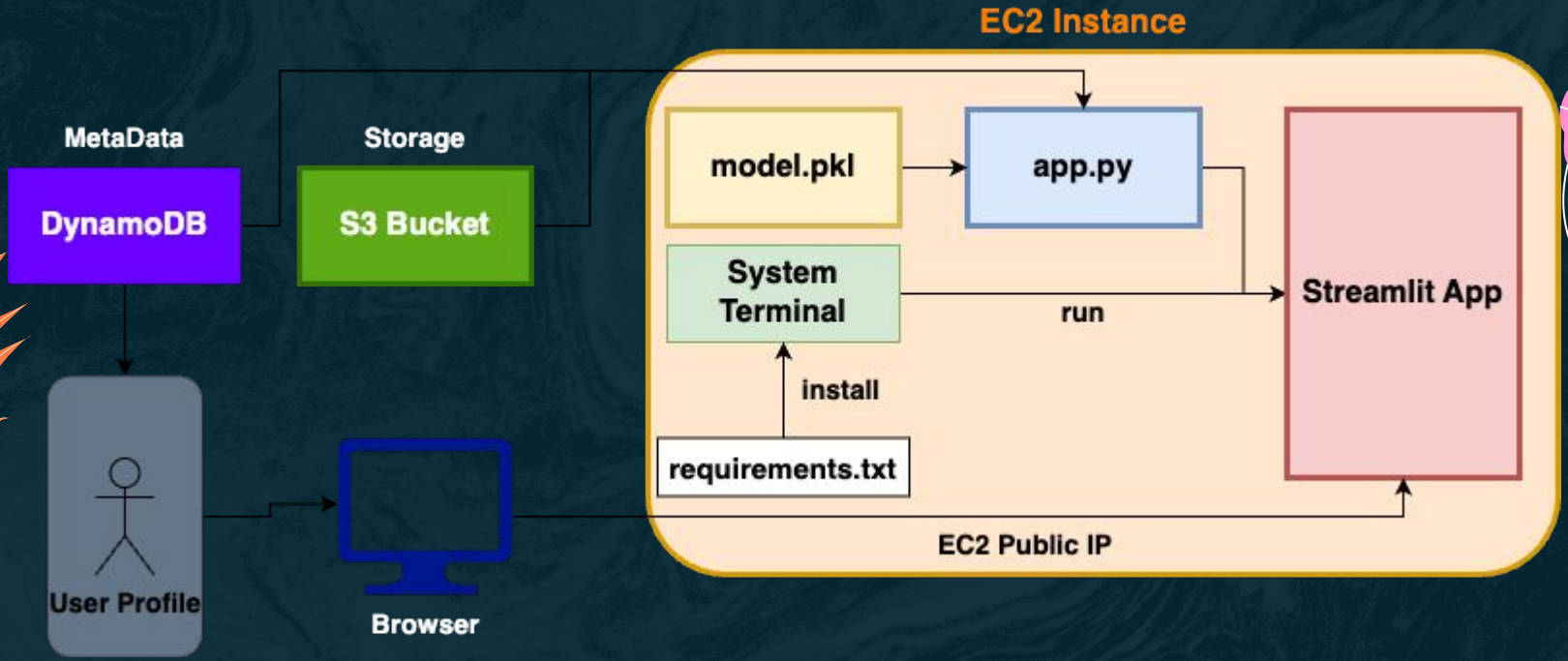
Scinax nasicus

Demo 2:
recording a live frog

Demo



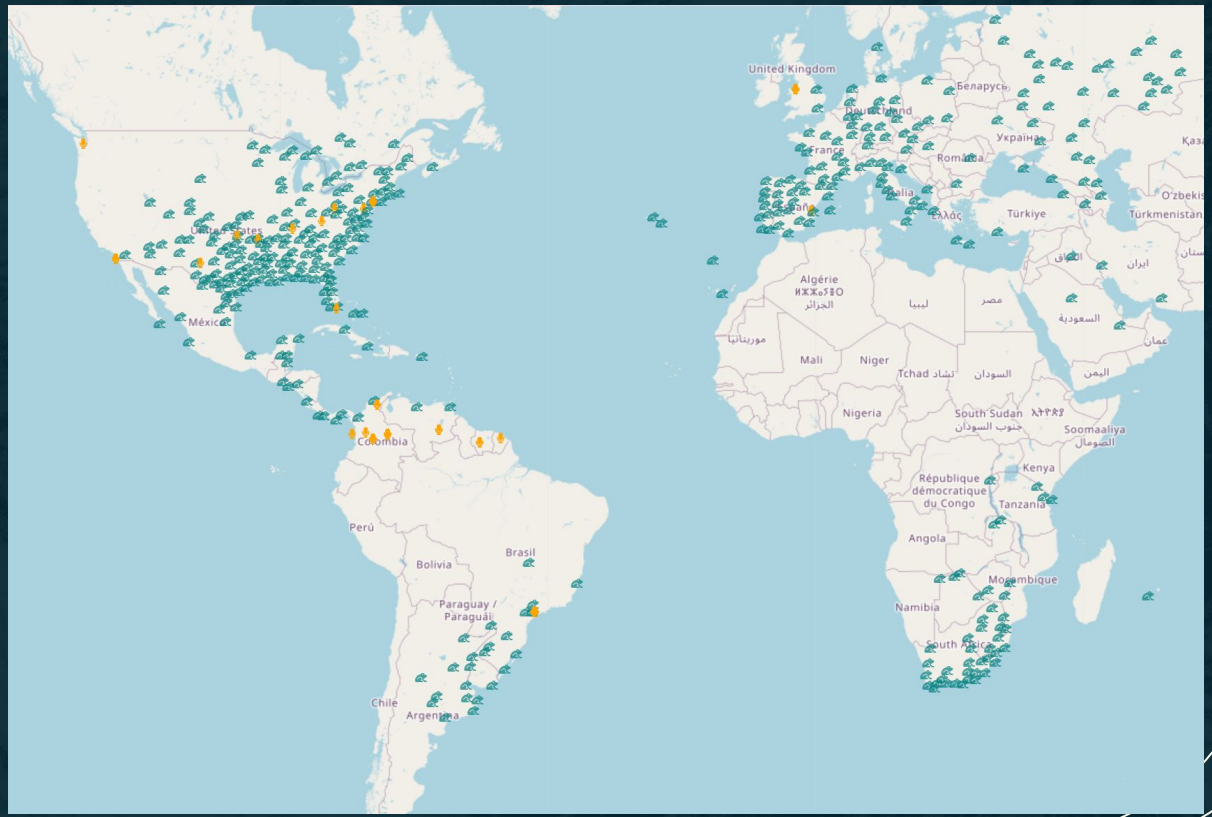
Cloud-based Infrastructure



05

Key takeaways

Ribbitback User feedback on our webapp



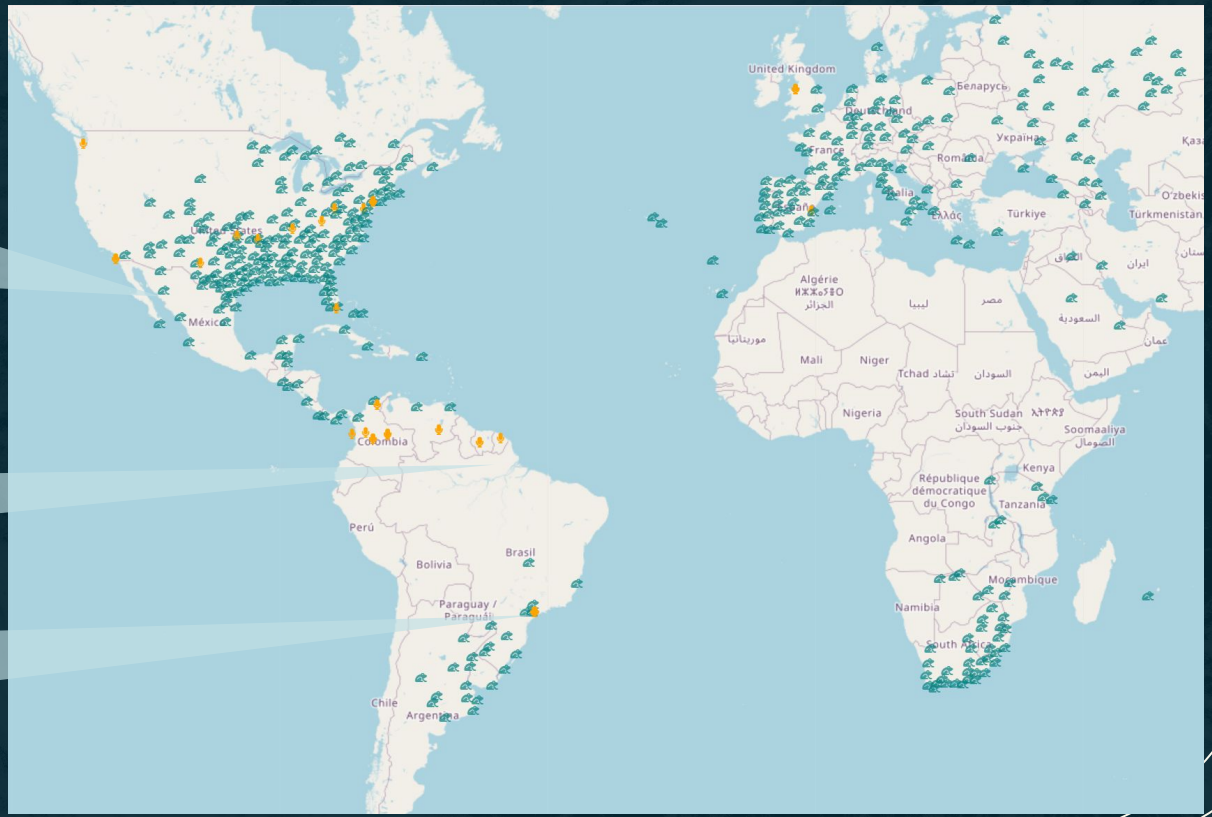
Ribbitback User feedback on our webapp

New Features

It would be wonderful to see where in the world my recordings were taken or where in the world the Frog of the Day or the Explore Frogs are

I'd love a way to add notes to my recordings.

I liked the scientific detailing of each frog; however, I believe it would be interesting to include the common name of each frog/how it is known or where it is found.



Ribbitback

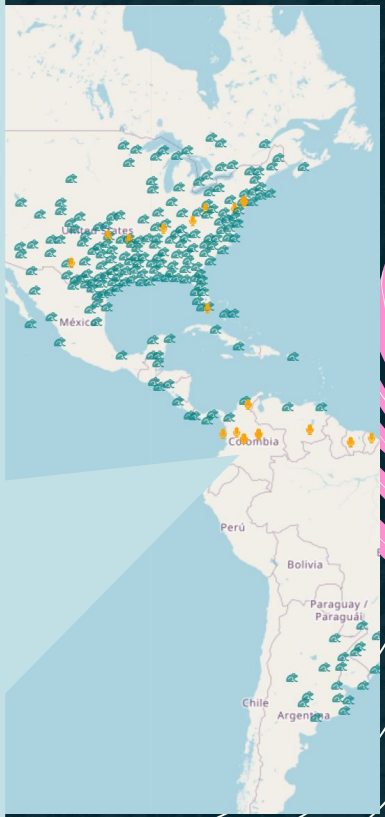
Hello Ribbit creators,

I want to congratulate you on the development of Ribbit. I am a biodiversity scientist working in Colombia, and have had the opportunity of witnessing first hand the impact that eBird has had for the monitoring, and the social appropriation of birds in Colombia and people always ask… ***why only birds? My answer is usually because they are the easiest for non-scientists to encounter and identify but through apps like Ribbit this does not need to be the case for ever!***

Relying on sounds for identification, which are a lot easier to record with a regular phone vs trying to take an actual picture of a frog on the wild, is an excellent idea and just like it happened with eBird, the more that people use the app, the better the information it will provide. ***A question as "simple" as what species live where/when is still a challenge in megadiverse countries like Colombia****, so all data generated by Ribbit will be useful in meeting this challenge.*

Keep working hard and let us know if we can help in any way

Lina M Sánchez-Clavijo, PhD
Principal Researcher
Scientific Information Office
Instituto Humboldt



Roadmap

Species distribution map

Increase training data

Share recordings

GBIF Global Biodiversity Information Facility

Our Mission

Acknowledgements

Pontificia Universidad JAVERIANA Colombia

Anfibios del Ecuador

FrogID

Conservation Metrics

Dr. J. Nicolás Urbina

Dr. Santiago Ron

Dr. Juan Sebastián Ulloa

Juan Sebastián Cañas

Dr. Jodi Rowley

Dr. Stefan Kahl

Dr. Matthew McKown

.....and to all of our beta testers

For more information, visit:
https://ribbit.edi.eco/