Introduction

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- One of the developers that worked on on eDNA Biological Heritage Virtual Hub.

Key points

- Modern biodiversity sampling techniques
- Show how it’s being used in our project
- Our biodiversity visualisation tool

What is NZ known for?

- Ask someone from NZ what we’re known for:
- Kiwis, Keas and other cute birds
- Unique landscapes (Lord of the Rings)
- Silver ferns
- It’s a key part of New Zealand’s identity

New Zealand Biodiversity is at risk

- New Zealands nature is at risk from
- Urban expansion
- Agricultural expansion
- Invasive species (Myrtle Rust)
- Predatory species (Rats, Cats)

Public awareness

- People are environmentally mindful
- Activism and efforts towards conservation is not as targeted as it could be
- People do not know where to best focus their efforts in protecting the environments in New Zealand.

National Science Challenge

- MBIE (Ministry of Business Innovation and Employment) became aware of this problem so they created a challenge.
- Public awareness
- Collectively describe/capture
- Monitor/Manage
- Inspire the public to reverse the decline

Create a hub for biodiversity data

- Our response to the Biological Heritage challenge
- Coordinated by Austen Ganley in collaboration with the Centre for eResearch to create a hub for biodiversity data.
- A tool for public access and use
- Easy to understand
- Informative regarding biodiversity

How did we want to monitor biodiversity

- Best way to assess nationally would be a national view of New Zealand.
- We decided a good way to show diversity on a national would be displayed as layers to geographically map the abundances of organisms as well as richness of organisms in an area.
- We would aggregate/collect biodiversity data from researchers that measure biodiversity across New Zealand.

Sampling for Microorganisms

- Take a sample
- Culture the microorganisms
- Count the microorganism within the culture.
- Cultured community is a poor representation of the natural community

Macro-biological Collection

- Macrobial
- observation/sightings/sightings
- Indications based on behaviour that are characteristic of a organism.
- Was difficult to standardise, susceptible to subjectivity.

Modern technology - eDNA

- An emergent method
- In our case PCR (A reaction) was used with amplicon (a similar but still unique region of DNA/RNA) used for identification of organisms
- The product of which of this was then compared to a database which then results in the taxonomic origin of that instance of DNA.

Biodiversity sampling with eDNA

- eDNA is gathered from taking samples from an environment
- Typically within samples, there are traces of DNA (mucus, hair, skin cells) left behind from organisms that have been around a sample.
- The sample is then analysed through the PCR method which generates high-throughput analysis of samples.

eDNA Advantages

- Standardised (less room for subjectivity in measurements. Sample are taken and the rest is computed from shared algorithms)
- Accurate
- Time efficient (no waiting for elusive animals)
- Cost efficient (less time needed in the field)

- Key benefits for us: high throughout biodiversity capturing, only going to become more affordable as technology advances.

eDNA Disadvantages

- Degradation (7-21 days), UVB, Acidity, heat
- Contamination of samples can occur
- Design must account for species-specific qPCR techniques must be used (or else lead to false negatives or false positives)
- The identification is quality dependent on the quality of the comparative database.

eDNA Database

- Gathered and asked researchers capable of getting eDNA data to send in the data they had.
- Initially this started as a singular .csv file which we created a database for.
- Table containing the taxonomic outputs/classifications
- Table containing environmental data such as geographic coords (latitude, longitude)
- Although data differs they still contain taxonomic classification and coordinates
- Table containing joining these taxonomic and environmental records

Web Visualisation

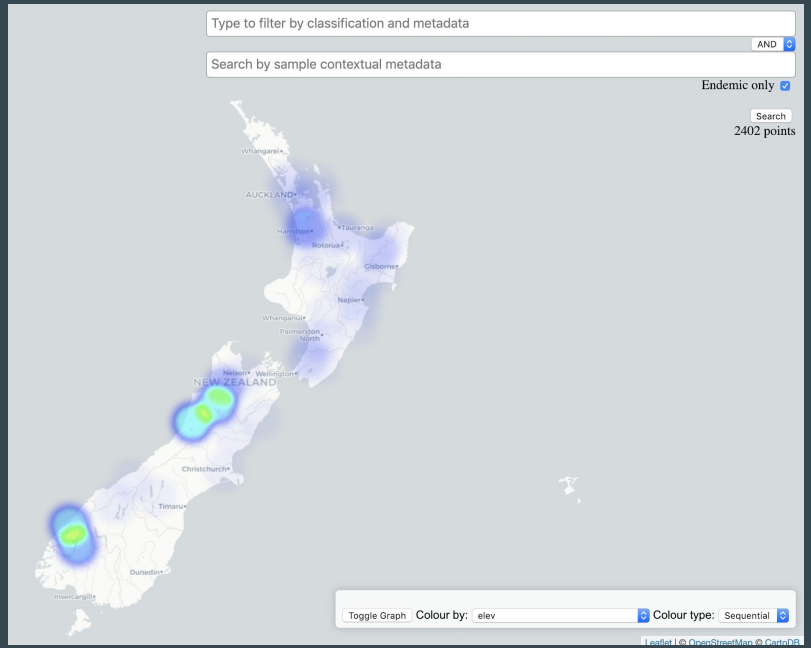
- Revisit our goals
  - Raise public awareness
  - Make capture, monitor, and manage national biodiversity.
- Solution - an online interactive web visualisation tool for monitoring
- Fairly trivial but effective
- Database hosted on Nectar Cloud, front end hosted on github pages

The Visualisation

- Allows for a wide range of search combinations
- Has easy to understand metrics
- Metrics that were important to biodiversity researchers.
- Simple to understand but still useful for monitoring

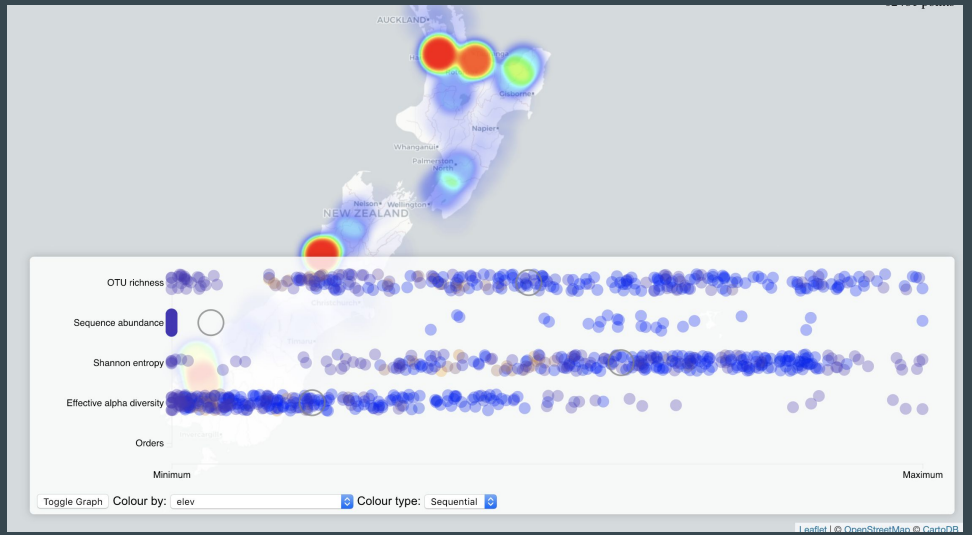
The Visualisation

- Available/accessible to anyone with internet
- Able to be understood with an intuitive heat map showing the diversity
- Taxonomic searching
- Environmental feature filtering
- Adjustable area analysis
- Various layers for metrics such as sample density, richness, abundance



Visualisation (continued) Comparative Plot

- Compares sampling sites within a search result
- Coloured by sampling site metadata such as
- Plot colour scale chosen to allow for colour blind users



Summary

- A brief introduction to eDNA and its use in biodiversity
- An example of how it was a fundamental element in our project
- How we have used research, people, and technology to hopefully inspire more awareness and action for the benefit of New Zealand.
- Thank you