



BHP



Curtin University

***The eDNA for Global Environment
Studies (eDGES) Program***

Summary

Annual Report 2023-2024

The eDNA for Global Environment Studies (eDGES) Program

Summary

eDGES focuses on developing and applying environmental DNA (eDNA) techniques to address challenges related to biodiversity loss and sustainability.

eDGES consists of six projects being carried out at the Trace and Environmental DNA (TrEnD) Laboratory at Curtin University (Perth, Australia) with an aim of making significant contributions to biomonitoring in terrestrial, subterranean, wetland and marine environments. The projects focus on improving, validating, or applying eDNA techniques to address biodiversity related questions of benefit to the public.



22

publications
2020-2024



6

PhD & Honours
students



10

research staff
supported



1st

complete genome of the
Pilbara Olive Python



391

marine sequences made
available in GenBank



>150

stygofauna mitochondrial
genomes assembled



>1100

samples taken in one of the
largest single port studies



Project 1

eDNA monitoring and conservation genomics of the Pilbara Olive Python

Merges eDNA monitoring with whole genomic analyses to study the Pilbara Olive Python (*Liasis olivaceus barroni*), to obtain deep population genomic insights and evolutionary ecology information to guide conservation priorities.

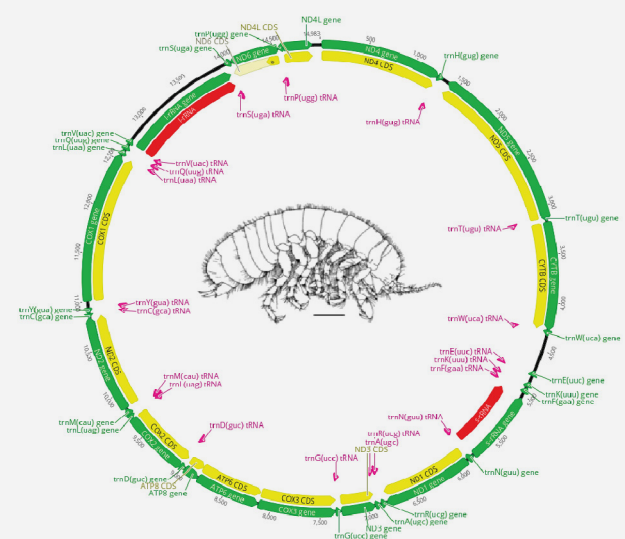
- Sequencing and assemblage of the first complete genome of the Pilbara olive python (*Liasis olivaceus barroni*) in collaboration with the international Vertebrate Genome Project (VGP).
- Demonstrated water in rock pools is an excellent substrate for olive python eDNA monitoring – published as Mousavi-Derazmahalleh *et al.* (2023).
- Developed a high precision species specific assay for olive pythons for rapid testing.

Project 2

Subterranean fauna detection and conservation

Focussed on a range of subterranean taxa collected from the Great Artesian Basin (GAB) and the Pilbara, encompassing invertebrate groups and conservation priority vertebrates. Established an extensive mitochondrial genome dataset that creates a significant technological advancement, providing a critical reference for future eDNA detection efforts. This sets a foundation for continued genomics innovation, conservation strategies and ecological studies by enabling more precise and efficient detection of subterranean biodiversity.

- Sequenced 150 complete or near complete mitochondrial genomes.
- Blind cave gudgeon genomes for *Milyeringa veritas* (Cape Range) and *Milyeringa justitia* (Barrow Island) were sequenced for eDNA marker development.
- 55 aquifer eDNA samples (Wellfields A&B) and 125 spring water eDNA samples from the GAB were metabarcoded with eukaryote and bacterial assays showing springs contain a higher diversity of organisms than aquifers.





Project 3

Functional ecology of Chilean precordillera lakes: towards a Wetland Health Index for birds

Uniquely combined eDNA technology with isotope analysis to investigate wetland biodiversity and characterise ecosystem web dynamics from sediment microbes to the migratory Chilean flamingos. This approach allowed us to understand the food chain and identify keystone species that are indicators of wetland health.

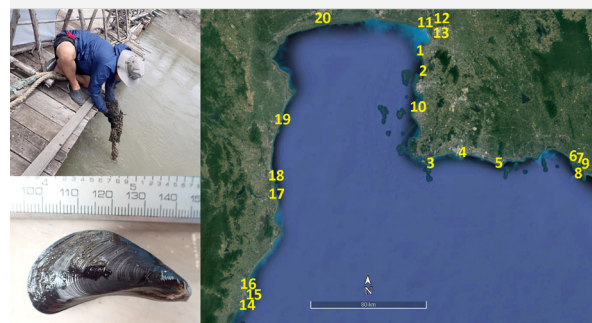
- A pilot study in the hypersaline lakes at Rottneest Island (WA) in 2020 to test the state-of-the-art molecular techniques planned for the Chilean precordillera. This study unveiled bacterial and macroinvertebrate diversity at five different hypersaline lakes in the A-class reserve.
- The first eDNA multi-assay approach investigating hypersaline biodiversity in the Chilean precordillera – a design that enabled detection of flamingos and other endangered species (e.g., *Heleobia atacamensis*) from water samples.
- Literature review on the ecology and preservation of hypersaline wetlands published in the prestigious journal *Biological Reviews* in 2021, and cited 68 times demonstrating the high impact of the research.
- International collaborations with experts in Russia, China and Europe.

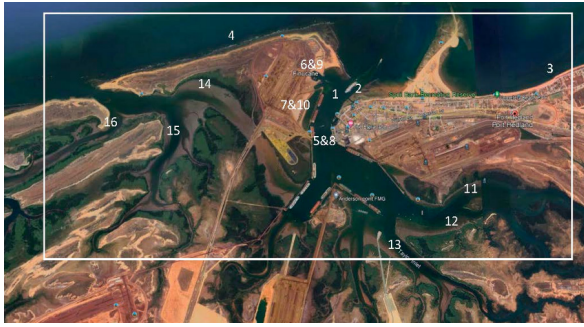
Project 4

Improve the Sensitivity and Specificity of eDNA metabarcoding tools for Invasive Marine Species detection

Contributed to the global reference databases by sequencing gene regions of target invasive marine species (IMS) and their native counterparts from the North West Shelf of Western Australia. Developed and validated new metabarcoding assays to assign species identity with a high level of confidence, allowing the detection of target IMS from a range of biological substrates. Important outcomes for biosecurity monitoring.

- International public database submissions of 31 full mitochondrial genome sequences, 7 partial mitochondrial genomes, 5 chloroplast genome sequences and 348 gene regions.
- Development of a new IMS assay to detect the phyla Arthropoda and Mollusca, and the enhancement of the 16S public DNA reference database.
- Discovery of a previously undescribed species of oyster from remote areas in the Pilbara.
- International collaborations with Thailand and Singapore.





Project 5

Benthic communities associated with port and harbour infrastructure in Port Hedland: targeting invasive marine species

Built around biodiversity surveys of aquatic eDNA in Port Hedland and adjacent non-industrial environments. This location's proximity of high conservation value coastal habitats to regulated and intensively managed industrial activities enables investigation of the biodiversity differences between relatively untouched coastal reserves and a busy port.

- Implementation of innovative marine sampling techniques established using novel high-throughput eDNA drill-powered peristaltic pumps for water filtration, and paint rollers for surface eDNA.
- Application of new DNA metabarcodes developed in project 4.
- One of the largest port eDNA surveys ever conducted, with over 1100 samples collected.
- An unprecedented level of coupled sampling from the water column and submerged substrates was achieved, and temporal variation in water column eDNA was assessed.

Project 6

Terrestrial ecosystem biomonitoring with eDNA across the tree of life: the Olympic Dam case study

Seeks to validate new eDNA molecular tools to assess terrestrial biodiversity of soil microbial communities, plants, invertebrates, and vertebrates, and commence development of an eDNA based metric for evaluating the condition of terrestrial ecosystems. This approach to ecosystem monitoring will advance the study of individual species to understanding entire ecosystems and how species interconnect.

- Over 250 km of transects were covered in a study comparing mobile eDNA collection to fixed eDNA samplers.
- 280 terrestrial samples collected from Roxby Downs and surrounding bushland to examine spatial resolution of different sampling methods.





For more information

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