# Longest-ever eDNA study offers important insights into ocean health

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Sampling for plankton and eDNA using a net. Credit: IMOS-CSIRO/Julian Uribe

Tiny genetic 'breadcrumbs' left behind by marine organisms offer unprecedented insights into ocean biodiversity and how it changes over

time and in response to our changing climate, new research at Curtin University, in collaboration with CSIRO, has revealed.

Researchers developed new environmental DNA (eDNA) biomonitoring methods using samples collected off the coast of Rottnest Island near Perth, Western Australia, as part of Australia's Integrated Marine Observing System (IMOS).

IMOS scientists collected and froze filtered seawater samples over a five-year period. These 'time capsules' provided a unique opportunity to study changes in our oceans and marine life that occur seasonally and in response to climate anomalies such as the marine heatwave that struck WA in 2011.

The study, published in journal *PLOS Genetics*, demonstrated how a zooplankton community – the larvae and eggs of fish – responds normally to seasonal change in contrast to heatwave conditions.

The study is the longest multi-year marine eDNA study yet conducted and showcases the power of eDNA technologies to monitor our ocean health.

Ph.D. student Tina Berry and Professor Michael Bunce, from Curtin's School of Molecular and Life Sciences, led the research team.

"It is incredibly rare to find a series of samples from such a long time period that are also suitable for DNA analysis," Ms Berry said.

"The scientists at IMOS had the foresight to biobank a set of samples that allowed us to travel back through time and see how the ocean responded to a marine heatwave.

"After some hard work in the lab to isolate and sequence the DNA, a

significant and revealing story appeared. The end result was a holistic window into our marine life that would otherwise be impossible to see."

Professor Bunce said environmental DNA was fast emerging as an effective way to study our oceans and the technique hit the headlines in 2018 as researchers went searching for the Loch Ness Monster using eDNA.

"We didn't find any monsters either, unless you count two samples with trace amount of humpback whale in them. But to be honest, it's the small creatures that live in our oceans that provide the greatest clues to our ocean's wellbeing."

Professor Bunce said the eDNA signatures mapped out which marine organisms were present at different times of the year and identified those that first appeared when sea surface temperatures spiked during the heatwave.

"Being able to track thousands of marine species at a time using eDNA offers important clues regarding how our oceans are changing as they warm, it's a glimpse into the future that we can't see using other methods," Professor Bunce said.

"Australia has the Earth's third largest ocean territory and every year the nation derives an estimated $47.2 billion from its 'blue economy' so understanding how it is changing is of high national importance.

"Using eDNA, we are detecting sharks, corals, seahorses and marine mammals and the DNA toolkit we are developing in our wider research program is a road-map for long-term ocean monitoring around the world. We urgently need better ways to perform health-checks on our marine environments and eDNA is responding to this need."

**More information:** Tina E. Berry et al. Marine environmental DNA biomonitoring reveals seasonal patterns in biodiversity and identifies ecosystem responses to anomalous climatic events, *PLOS Genetics* (2019). DOI: 10.1371/journal.pgen.1007943

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