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***What DNA can do for marine ecosystem assessments***

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DNA has many benefits as a tool for ecosystem monitoring. Nearly every organism in the Southern Ocean contains a unique DNA code which can provide information on its taxonomic identity, function in the ecosystem, and population connectivity. Recently, high-throughput DNA sequencing has provided a step-change in our capability to extract and use this information, as hundreds of samples can now be sequenced in parallel on a single run.

DNA can be used to identify taxa too small or undeveloped to identify by traditional means, such as bacteria and larval zooplankton. Marine predators can be used as 24 hour biological sampling devices thanks to the prey DNA retained in stomach contents or faecal material. Environmental DNA, or eDNA, can be used to non-invasively survey Southern Ocean ecosystems, although the feasibility of this approach in the open ocean remains to be proven. DNA has also provided insights on the prevalence of parasites in Southern Ocean ecosystems, and demonstrated that oceanographic fronts are not always the central determinants of biogeography.

Key challenges that remain in using DNA to monitor marine ecosystems include how to routinely collect and preserve samples from remote Southern Ocean locations, and incorporating information derived from DNA data into ecosystem models and assessments.