Technology helps reveal the hidden lives of rare animals

It sounds straightforward enough: to be able to understand the impact of development on species, or if our conservation management is benefitting them, we need to know what they are and where they are.

Yet many species of conservation interest can be cryptic, or difficult to monitor, or both. Rare and mobile species can be hard to find in vast, remote landscapes. Large marine mammals live the bulk of their lives beyond our easy observation. And for certain groups, such as subterranean fauna, their hidden, underground ecosystems are difficult to access and many of the species living within them have not yet been collected, let alone described.

Innovations in technology are helping conservation scientists to uncover the identities and secret lives of plants and animals. Next generation sequencing is allowing researchers to use the DNA captured in a groundwater sample to survey the diversity of stygofauna living in subterranean cavities, or to trace the pollination of flowers by fruit bats. Advances in acoustic monitoring technology have allowed researchers to remotely and continuously record the calls of the last 150 western ground parrots (*Pezoporus flaviventris*), and track their movements across the landscape with the change of the Noongar seasons. Tiny GPS units glued to the backs of quenda (*Isoodon fusciventer*) are revealing their secret lives in the suburbs of Perth.

These innovations were a special focus of the Resilient Landscapes Biodiversity Conference held in Perth in September 2021. Two highlights of the session were the presentations of Dr Adrian Gleiss. of Murdoch University and Associate Professor Parwinder Kaur of the University of Western Australia, who were joint recipients of the conference's Innovation Prize.

Tracking marine megafauna

Advances in sensor technology are transforming our understanding of the lives of marine megafauna, says Dr Adrian Gleiss. An animal's location, motion, direction and acceleration, along with water pressure and temperature, can be continuously logged. Think Fitbits for whales; dive watches for sharks.

Yet it's one thing to have big data from a plethora of sensors, and another thing to know what it means in terms of animal behaviour. Dr Gleiss and this team are using underwater video cameras to help them 'see' what animals are responding to in their environment. A miniature camera attached to a turtle's shell shows it ducking and diving to avoid the attacks of a shark. Cameras mounted on the sea floor show that when a lemon shark is thrashing its head from side to side, it is breaking up a fish to eat it.

The researchers then use supervised machine learning to link these behaviours to the information gained from sensors on other animals. Better understanding of how animals spend their time, foraging or resting, will help to understand the impacts of human activities on their reproduction, growth and health.

DNA Zoo

DNA analysis is not just for subterranean species that are out of sight. Fewer than one per cent of threatened fauna species have their entire genome published, said Associate Professor Parwinder Kaur, who leads DNA Zoo Australia.

DNA Zoo is a global initiative to generate DNA barcode reference libraries to help better understand and conserve biodiversity. They use a sequencing technique called Hi-C, which allows scientists to visualise the three-dimensional architecture of a species' genome. The technique is also cost effective: a species' genome can be sequenced for only $1000. (By comparison, the human genome project that commenced in 1990 took 13 years to complete, cost US$2.7 billion and required the world's largest collaboration of scientists.)

To date, DNA Zoo Australia has sequenced the genome of the whale shark (*Rhincodon typus*), the Tasmanian devil (*Sarcophilus harrisii*), Gilbert's potoroo (*Potorous gilbertii*), the mala (*Lagorchestes hirsutis*), the black swan (*Cygnus atratus*) and the koala (*Phascolarctos cinereus*), amongst many others. The chromosome-length assemblies for these species shared by DNA zoo will assist researchers to understand their evolution, their response to diseases, and how they may respond to habitat loss and climate change.