Seedbanks for Animals – Wildlife BioBanks are a missing tool in addressing the Australian Faunal Extinction Crisis.

A Submission to the Environment and Communications References Committee of the Australian Senate Inquiry into Australia's Faunal Extinction Crisis on behalf of the FAUNABank Network (FAUNA Research Alliance).

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1 FAUNABank (National Wildlife Genome Storage Network)

FAUNABank is a network formed under the auspices of the FAUNA Research Alliance following a national workshop in 2016. The meeting was attended by Australian, New Zealand and international participants from genome storage facilities, museums, zoos, universities, NGO's and conservation agencies.

This submission is made on behalf of the FAUNA Research Alliance (Attachment 1) and the FAUNABank network (Attachment 2). FAUNA research Alliance (parent organisation of the FAUNABank network) is a consortium of wildlife professionals (researchers and practitioners) from across Australia and New Zealand organisations (agencies, zoos, NGOs, farming, environmental consulting, veterinary, universities and CSIRO) committed to fostering, resourcing and implementing research to secure wildlife against current and emerging threats, and to rebuilding healthy populations where they are lost or in decline

2 Summary of the Submission

This submission addresses the need to use **all available tools** to address the current Australian faunal extinction crisis, and takes the position that one of the available tools currently not being deployed to a significant extent is the use of biobanking to store living genomes of our native wildlife species. This represents **a lost opportunity** for the conservation of native faunal genetic and biological diversity. Wildlife biobanking has the

potential to retrievably store genomes of native animals so that living animals can be restored from cells and tissues held in biobanking facilities.

The applications of wildlife biobanking include:

- Insurance against species extinction
- Insurance against the loss of wildlife genetic diversity
- Management and restoration of the genetic diversity of threatened species, especially small and highly threatened populations.

The submission outlines the need for **a national approach to co-ordinate, support and promote the activities of genome storage** facilities and stakeholders to make the most of opportunities to use this tool to prevent the further loss of species and genetic diversity.

3 Terms of Reference addressed

The following terms of reference are addressed in this submission:

a) the ongoing decline in the population and conservation status of Australia's nearly 500 threatened fauna species;
h) the adequacy of existing funding streams for implementing threatened species recovery plans and preventing threatened fauna loss in general;
l) any related matters.

4 Nature of ongoing declines and extinctions – unpredictable, stochastic and sometimes unstoppable

The loss of Australian species is not restricted to just historical events associated with the loss of habitat and the introduction of invasive species like rabbits and foxes. Importantly, the pattern of declines and extinctions since the 1980s indicates how poorly equipped Australian conservation agencies, scientists and others have been to anticipate the loss of populations and species, or to reverse declines when these become apparent. There are a number of examples that reinforce this:

(1) The extinction of Australian frogs. The decline of Australian frogs was apparent from the 1980s, but the reasons for this process (a disease, chytridiomycosis) was not apparent until the pathogen responsible was described in 1998. Despite excellent science, at least 5 Australian species are extinct since 1980, and a large number of species are now recognised as threatened and declining, with no simple solution.
(2) The unanticipated extinction of three species since 2013. The recent extinction of two mammals (the Christmas Island pipistrelle and the Bramble Cay melomys) and one reptile (Christmas Island forest skink) are examples of how poorly equipped we remain at predicting and identifying the most susceptible species before their decline and extinction.
(3) Threatening processes that are currently driving the declines of large cohorts of species but are poorly understood, and for which no clear way forward to ameliorate declines is apparent. These include the declines of the eastern Australian woodland birds, and the recent decline of northern Australian mammals.

(4) The threat of emerging diseases (unknown unknowns). The extinction of Australian frogs was a lesson that we have not heeded well. The potential for the rapid emergence of new diseases in wildlife species, based on recent experience of frogs, Tasmanian devils, and the Bellinger River snapping turtle, reinforce our lack of tools to predict or deal effectively with emerging diseases. The threat to all taxa and species from this source is real. For example, we would be poorly equipped to respond should a new disease develop in one or more of our monotremes, given that surveillance systems, understanding of reproductive biology and our experience with captive breeding is limited.

It is in the context of rapid and unexpected species declines that wildlife biobanks offer the potential to pre-empt species crises and even extinctions through holding living genomes that can be called upon to restore living animals and lost genes to populations and species.

5 Wildlife Genome Storage (National Biobanks for Wildlife) – the missing tool.

The application of biobanks are well established in human health (IVF clinics/biobanks for human sperm, eggs and embryos; biomedical biobanks for cancer and tissues from other diseases), agriculture (livestock) and in botanical conservation (botanical seed banks). Paradoxically, the potential of biobanks for the conservation of fauna has been largely overlooked, despite the enormous potential to contribute.

A number of relevant points can be made with respect to this approach:

(1) **Some wildlife genome storage capacity and facilities do exist** at a basic level in Australia including the Animal Gene Storage and Resource Centre of Australia, the coral biobank at Taronga Zoo, and the Ian Potter Australian Wildlife Biobank (Melbourne). As well, individual laboratories in some universities (e.g. University of Newcastle, University of Queensland) either research or hold some wildlife genomes. Taken together, all of these facilities have varying capacities to store reproductive (sperm, eggs, embryos) and somatic cells and tissues, and potentially to reproduce live animals from the materials they hold.

(2) **Long-term funding for existing facilities, their activities and further development is tenuous** at a national level, and often reliant on philanthropy and limited resources of the institutions involved.

(3) **There is great potential for expanding the national network of facilities and participating researchers and practitioners at modest costs** through the utilisation of existing resources in zoos and museums (operating as biobanking facilities), and potentially through national infrastructure initiatives such as NCRIS (National Collaborative Research Infrastructure Strategy). These facilities could be effectively linked to managers and practitioners in NGOs, agencies and species recovery programs, and to researchers in universities to further develop the technological capabilities to store genomes and recover these as living animals. Many museums already have cryostorage facilities, database and governance systems in place, that may become highly effective with appropriate upgrades.

(4) A co-ordinated national approach (currently lacking) is needed to bring together stakeholders if the potential for wildlife biobanks to contribute to reducing the loss of species and genetic diversity of Australian fauna is to be realised. The establishment of FAUNABank is a small initiative in this direction.

6 Recommendations

It is recommended that:

Recommendation 1 Federal environment, science and innovation agencies coordinate, fund and support the implementation of a national wildlife biobanking strategy for the conservation of native wildlife.

Recommendation 2 A national strategy be based on the development of a network of facilities utilising existing and newly funded infrastructure, database and governance systems in museums and major zoos as an efficient mechanism for establishing a strong and cost-effective infrastructure base.

Recommendation 3 A national strategy for wildlife biobanking should include all relevant stakeholder groups including zoos/museums, state and federal conservation agencies and NGOs, and university researchers.

Recommendation 4 Funding of a federal initiative be considered through national research and innovation infrastructure funding mechanisms such as NCRIS.