

Introduction to Ile aux Aigrettes, Mauritius, of the Aldabra giant tortoise as an ecological replacement for the extinct Mauritian tortoise

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Introduction

The Mascarene Islands (Mauritius, Rodrigues and Réunion) supported five species of *Cylindraspis* tortoises that became extinct by the mid-1800s, as a result of human exploitation, predation by invasive animals and habitat destruction/modification (Cheke & Hume, 2008). Giant tortoises were the principal herbivore and maintained open savannah habitats, where they played key roles in seed dispersal and maintaining a grazing climax plant community. A suite of native plants co-evolved with tortoises and have developed traits such as large fleshy fruits with hard seeds, to encourage the tortoises to feed on them and for the seeds to survive gut passage, following which the seeds show enhanced germination, leaf heterophylly where the juvenile leaves are highly patterned which discourages

browsing, high silica in grasses to discourage grazing, and an ability to cope with trampling. Effective seed dispersal of some plant species may have been reduced following the extinction of the native tortoises, contributing to their decline. We aimed to reinstate these ecosystem functions through the introduction of an exotic tortoise, the Aldabra giant tortoise (*Aldabrachelys gigantea*), as an



Aldabra giant tortoise © Vikash Tatayah

Reptiles

ecological replacement for the dome shelled grazing Mauritian tortoise (*Cylindraspis inepta*). Although *A. gigantea* is Vulnerable (IUCN) and CITES Appendix II, it is common in captivity on Mauritius derived from animals imported in the 1870s and later. Ile aux Aigrettes (26 ha) was selected as a suitable site to conduct a trial translocation as it supports a restored native forest, is free of mammalian predators and is permanently staffed permitting close monitoring.

Goals

- Goal 1: Introduce tortoises to restore a grazing climax plant community with the tortoises performing the grazing, trampling and seed dispersal functions once performed by the endemic tortoise *Cylindraspis inepta*.
- Goal 2: Study plant-tortoise interactions and their effectiveness at native seed dispersal.
- Goal 3: Study the effect of tortoises on the control of invasive alien plants.
- Goal 4: Establish self-sustaining breeding population of Aldabra tortoises on Ile aux Aigrettes.

Success Indicators

- Indicator 1: Native seeds are consumed, dispersed, germinate, and grow into seedlings.
- Indicator 2: Invasive plants are controlled by tortoise herbivory.
- Indicator 3: Tortoises remain healthy with low rates of mortality, free from diseases, and maintain or improve body condition.
- Indicator 4: The tortoise establish a successful reproducing population.

Project Summary

Feasibility: Ile aux Aigrettes has the last area of coastal forest, once well distributed in Mauritius, where tortoises were common. Sub-fossil bones of the endemic dome shelled grazing tortoise *Cylindraspis inepta* have been found on the island. This low-lying coralline island, situated 600 m of the south-east coast of Mauritius, is managed by the Mauritian Wildlife Foundation that has been

conducting ecological restoration since 1984. The island offers opportunities for restoration using tortoise ecological replacements as it has relatively intact native flora, albeit mainly higher order plants; no large introduced vertebrates or predators of hatchlings; a well-equipped field station and permanent occupation by field staff that conduct long-term ecological monitoring.



Tortoise hatchling © Vikash Tatayah

Four Aldabra tortoises were introduced to a small enclosure on Ile aux Aigrettes in the 1990s where they remained for several years for preliminary studies on food preference and for education purposes. The animals were fed and provided with water daily and maintained good body condition. Animals from other captive collections were loaned or donated. Newly arriving animals were tested for herpes virus and endoparasites, and dewormed. Some animals arrived in poor



Ile aux Aigrettes - release site
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health due to inadequate diets and lack of exercise; they were supplemented with leaves and vegetables, and most improved. All new tortoises were quarantined on the island for a minimum of one month, and integrated into the herd once they reached a satisfactory health status.

In November 2002, the four tortoises were moved to a 1 ha fenced enclosure, and were joined by others to eventually form a herd of 20 animals (Griffiths, 2008; Griffiths *et al.*, 2010, 2011). The impact the tortoises had upon the vegetation was monitored. Copulations were observed and eggs and hatchlings were found within the first year, which has since continued annually. An attempt was made to incubate eggs artificially, but has proved to be unnecessary due to the high hatch rate under natural conditions.

Implementation: Monitoring showed that the tortoises were not having a profound negative impact on the native vegetation within the enclosure, and since late 2004 the tortoises have been allowed to roam freely on the island (Griffiths, 2008; Griffiths *et al.*, 2010, 2011). Monitoring has continued researching the movement of the animals, their health status, impacts upon the vegetation, the spread and germination of seeds in their droppings. Animals continued to be weighed and measured regularly to assess their health and growth rates. Water is provided to the animals, although there is no need to feed them since they forage naturally. Almost all animals put on weight and grew, even in the older (60 - 80 years old) animals, as shown by the growth of carapace scutes. However, some geriatric health problems could not be resolved despite medication and supplementary diets, and two animals had to be taken off the island and two euthanized. Two animals were lost or stolen from the island, including the smallest of the cohort, but other adults were donated and by 2017 there were 25 free-roaming individuals breeding on the island. Reproductive output on the island averages 60 - 100 hatchlings found per year. Poaching of hatchlings for sale as pets on the local and international market is a problem and hence were head-started in secure facilities at the captive-breeding centre in Black River or on Ile



Transferring tortoises to the island
© Vikash Tatayah

aux Aigrettes. The head-started animals are disease screened and translocated to Round Island, to establish a second free-living population.

Post-release monitoring:

The 25 tortoises on the island are monitored monthly for survival, movement, health, and bi-annually weighed and measured. Hatchlings are harvested and after head-starting in captivity for 2 - 3 years, are translocated to Round Island. The impact on vegetation

continues to be monitored with tortoise enclosure studies and dietary and behavioral research projects. To identify all the species consumed by the tortoises a PhD student from the Cardiff University, UK, is conducting metabarcoding research on tortoise droppings in relation to a DNA barcode library of all plant species.

Major difficulties faced

- Some of the animals were in poor condition when we received them. Despite veterinary care and supplementary food, some animals had chronic health issues, two were euthanized, and two were removed from Ile aux Aigrettes.
- Two animals disappeared and were suspected to have been stolen.
- Hatchling tortoises have been stolen from the island by visitors and staff, causing a loss in terms of stocking Round Island (current) and other islands in the future (e.g. Gunner's Quoin, Flat Island), in addition to Nature Reserves in Rodrigues.
- Whilst tortoises are controlling some weeds (e.g. *Leucaena leucocephala* seedlings), access to certain areas are limited due to the rugged terrain. Some invasive alien plants (e.g. *Stachytarpheta jamaciensis*) are not eaten by tortoises. Hence manual weeding remains an important management tool for some species.

Major lessons learned

- Ecological replacements can help restore missing ecosystems functions.
- Monitoring and detailed studies are essential to document the impact of ecological replacement projects and to overcome resistance to their use.
- This project has produced a surplus of baby tortoises that have been used to support other translocations to Round Island where a second population has been established.
- The successful experiences from Ile aux Aigrettes (and Round Island) has provided information for the proposed introduction of Aldabra tortoises as an

ecological replacement for *Cylindraspis peltastes* into the Grande Montagne Nature Reserve in Rodrigues.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reason(s) for success/failure:

- Detailed research into the ecological history of the native tortoises, allowed us to pose hypotheses about the impacts tortoises had upon the plant community. These could be tested by releasing Aldabra giant tortoises and measuring their effects.
- The careful choice of ecological replacement species is essential for the success of a rewilding project. The Aldabra giant tortoise was chosen because of its taxonomic closeness to the extinct *Cylindraspis* tortoises, it is in a sister clade, and due to its presumed ecological similarity to *C. inepta* based on morphological similarities between the species.
- Tortoises were chosen to test the idea of ecological replacement since if there were deleterious impacts, they could easily be removed, as well as the tortoises being key-stone species.
- Continuous research and monitoring has allowed the benefits of ecological replacement to be documented.
- Clear leadership and drive to bring the project forward, and well as close collaboration between the private sector, universities and the Mauritian Wildlife Foundation allowed this project to be implemented.

References

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