

Institution: University of Kent
Unit of Assessment: Anthropology and Development Studies UoA 24
Title of case study: Saving Species
<p>1. Summary of the impact</p> <p>Molecular and evolutionary research by Dr Jim Groombridge at the University of Kent, (2003 onwards, lecturer 2003-2008, Senior Lecturer 2008-2012, Reader 2012-), undertaken in partnership with the Mauritius Wildlife Foundation, the Seychelles Islands Foundation and Government Ministries of both states, has identified unexpected evolutionary distinctiveness and established high conservation priority for rare populations of birds and frogs on Mauritius and Seychelles. Subsequent studies have led to the recovery of three critically-endangered species and to the alleviation of problems with wildlife disease. Groombridge's research has led to renewed investment of international conservation resources across the Indian Ocean. His work on island species conservation is particularly important because islands host a high proportion of global biodiversity and help define our understanding of evolutionary science; these 'living laboratories' also host many of the World's rarest species making them a global conservation priority.</p>
<p>2. Underpinning research</p> <p>Groombridge's research interests lie primarily in population restoration, population ecology, conservation genetics and evolutionary studies involving phylogeny reconstruction. A central focus of his research is the theoretical and practical aspects of endangered species conservation and the application of population, genetic, morphological and phylogenetic studies to enhance understanding of the biological processes that guide the conservation trajectory of endangered species. Since 2006 Groombridge has focused his research on conservation of island biodiversity, with an emphasis on the Indian Ocean islands of Mauritius and Seychelles. His work in this area combines the practice of field monitoring and population recovery techniques with the more theoretical approaches of evolutionary phylogenetics and conservation genetics at the population level. This work has had two key outcomes: (i) it has revealed avian biodiversity to be much more evolutionarily ancient (and therefore of heightened conservation value) than previously thought, and (ii) it has successfully tackled challenging conservation problems, such as island-to-island reintroductions and studies of genetics and infectious disease. This resulted in important changes in approaches to conservation. Groombridge led three research initiatives which have had particularly significant impact on conservation policy and practice in the region:</p> <p>(i) Molecular work from 2011-2012 on a newly-discovered population of Seychelles' sooglossid frog. Groombridge's research ruled out the possibility of it being a recent human-mediated introduction and instead confirmed it to be evolutionarily distinct and therefore worthy of conservation investment. This research galvanised efforts to save this species (see section 3, publication iii).</p> <p>(ii) Evolutionary research from 2009-2013 on biogeography, morphology and population genetics confirmed the Seychelles paradise flycatcher to be one of the most evolutionarily distinct species; this finding then justified an ambitious translocation initiative by Groombridge that produced a sustainable 'safety net' population for the species. This reintroduced population established successfully and produced second-generation offspring within two years, along with sustained population growth. This paved the way for a study of the genetic effects of reintroduction that demonstrates how genetic diversity can still be lost even from severely-bottlenecked species. This research led to the recovery of this species (see section 3, publication v).</p> <p>(iii) Molecular studies from 2009-2012 involving sequencing DNA from 200-year-old specimens of extinct species of parrots from Reunion Island and Seychelles. These studies led to a new understanding of the evolutionary distinctiveness of an endangered species of parakeet on Mauritius. Population-level genetic work on the Mauritius parakeet described how long-term</p>

intensive population management had genetically benefitted the recovered population; simultaneous work on a severe disease outbreak amongst those parakeets identified how a novel mutation in the virus most likely led to the outbreak. This was important because it provided field biologists with guidance on how best to manage the parakeet population. The underpinning research led to better management of the parakeet population (see section 3, publications ii & iv).

Between 2009 and 2013 Groombridge secured a total of £1.1 million of external funding for research and assistance in implementing conservation actions for island biodiversity. The awards include a £234,000 grant from the Darwin Initiative (DEFRA, UK, grant number 15-009) to support a translocation of Seychelles paradise flycatchers; £216,000 from the Leverhulme Trust to support research into the disease outbreak amongst Mauritius parakeets; and two NERC CASE PhD studentships (ref # NER/S/A/2006/14144 and F01290X/1) to support conservation genetic and immunological research on endemic and invasive parakeets on Mauritius (details in section 3, points a, b, c, d).

3. References to the research

- i. Bristol, R., R. Tucker, D. A. Dawson, G. Horsburgh, R. Prys-Jones, A. Frantz, A. Krupa, N. Shah, T. Burke and **J. J. Groombridge** (2013). Comparison of historical bottleneck effects and genetic consequences of reintroduction in a critically-endangered island passerine. *Molecular Ecology* 22: 4644-62. doi: 10.1111/mec.12429.
- ii. Kundu, S., C. G. Faulkes, A. G. Greenwood, C. G. Jones, P. Kaiser, O. D. Lyne, S. A. Black, A. Chowrimootoo and **J. J. Groombridge** (2012). Tracking viral evolution during a disease outbreak: the rapid and complete selective sweep of a circovirus in the endangered echo parakeet. *Journal of Virology* 86: 5221-9. doi: 10.1128/JVI.06504-11.
- iii. Taylor, M. L., N. Bunbury, L. Chong-Seng, N. Doak, S. Kundu, R. A. Griffiths and **J. J. Groombridge** (2012). Evidence for evolutionary distinctiveness of a newly discovered population of sooglossid frogs on Praslin Island, Seychelles. *Conservation Genetics* 13: 557-566. doi: 10.1007/s10592-011-0307-9.
- iv. Kundu, S., C.G. Jones, R.P. Prys-Jones and **J. J. Groombridge** (2012). The Evolution of the Indian Ocean parrots (family: Psittaciformes): Extinction, eustasy and tectonism. *Molecular Phylogenetics and Evolution* 62: 296-305. doi: 10.1016/j.ympev.2011.09.025.
- v. Bristol, R. M., P-h Fabre, M. Irestedt, K. A. Jønsson, B. Warren and **J. J. Groombridge** (2012). Molecular phylogeny of the Indian Ocean *Terpsiphone* paradise flycatchers: previously undetected evolutionary diversity revealed amongst island populations. *Molecular Phylogenetics & Evolution* 67: 336-47. doi: 10.1016/j.ympev.2013.01.019.

Funding:

- a. Darwin Initiative/DEFRA: 2012-2015 Round 18 Project 19-002: A cutting-EDGE approach to saving Seychelles' evolutionarily distinct biodiversity (£256,000). Jim Groombridge, Principal Investigator; partner organisations: EDGE of Existence Programme, Zoological Society of London, Natural History Museum/University College London, University of Exeter, Government of Seychelles Ministry of Environment and Energy, Seychelles Islands Foundation, Seychelles National Parks Authority, Natural History Museum of Seychelles, Wildlife Clubs of Seychelles, Nature Protection Trust of Seychelles.
- b. Darwin Initiative/DEFRA: 2006-2009 Project 15-009: 'Investing in island biodiversity: restoring the Seychelles Paradise Flycatcher' (£234,000). Principal Investigator Jim Groombridge; project is in partnership with Nature Seychelles, The Government of Seychelles Ministry of Environment and Natural Resources, RARE, RSPB, Wildlife Vets International and Kent Business School. Led to publication v above.
- c. Leverhulme Trust: 2008-2011 (£216,000) 'MHC Diversity and Emerging Infectious Disease in Parakeet Populations on Mauritius'. Principal Investigator Jim Groombridge; project is in partnership with Queen Mary University of London, International Zoo Veterinary Group, Mauritian Wildlife Foundation. Led to publications ii and iv above.
- d. Two NERC CASE PhD studentships (ref # NER/S/A/2006/14144 (£60,000) and F01290X/1

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(£72,117) 1/10/2008-31/9/2011).

- e. European Science Foundation: 2013-2017 (ES1304) 'ParrotNet' €400,000 (£342,500) COST Action ES-1304 to establish a research network on predicting impacts of invasive parakeets.

4. Details of the impact

Groombridge's research has improved the long-term conservation prospects for two critically-endangered bird species and one of the world's most endangered frogs in Mauritius and the Seychelles. The impact is particularly significant because island biodiversity forms an important portion of global evolutionary heritage and these isolated systems also host some of the world's most endangered species.

Impact on practice (see section 5, points A, B, C, D)

Groombridge's approach has galvanised conservation action for specific endangered species and their populations in Mauritius and Seychelles.

On Seychelles, Groombridge negotiated with local and regional government bodies and brokered support for **translocation and establishment of a new population of Seychelles paradise flycatchers**, one of the rarest flycatchers in the world. This was a major political and logistical landmark in the conservation management of this species, as lack of agreement had stalled progress towards translocation since 2001, when the Species Action Plan advocated reintroduction to Denis Island (detailed in section 5, point B). In doing so, Groombridge informed the *Government of Seychelles National Species Action Plan* for the flycatcher and provided a framework for how to successfully carry out reintroductions. This work by Groombridge also paved the way for population genetic work on this species and this has helped to define the emerging field of 'reintroduction genetics' with a **significant impact on conservation practice**. Moreover, phylogenetic work by Groombridge (2009-13) has revealed the Seychelles paradise flycatcher to be one of the most distinctive Indian Ocean species, which not only justifies the field conservation and translocation/reintroduction efforts by the Government of Seychelles, but also highlights a threatened flycatcher population on Mauritius as **sufficiently distinct to warrant conservation** (see letter from Mauritius Wildlife Foundation, section 5, point D).

On Mauritius, conservation efforts for the Mauritius parakeet benefitted from DNA work undertaken by Groombridge et al (2009-2012) on museum specimens of other endangered and extinct parrots in the Indian Ocean by revealing in an evolutionary context the conservation 'value' of the endemic parakeet. Research using different molecular tools revealed how the intensive conservation management of the Mauritius parakeets by the Mauritius Wildlife Foundation has had a beneficial effect on genetic diversity in this species. The Executive Director of the Mauritius Wildlife Foundation states that Groombridge's research has '*made a substantial difference to our outlook*' (detailed in section 5, point D). This brought long-term benefits by **slowing the gradual erosion of genetic diversity and improving the evolutionary viability** of the species, a benefit acknowledged by the Mauritius conservation NGO. Groombridge has also tackled problems of infectious disease in this species. Genetic work on a high-profile disease outbreak of Psittacine Beak and Feather disease virus in this species served as a **leading case-study worldwide for other parrot conservation programmes** to follow where endangered populations have become infected with PBFV virus, for example see Massaro, M., Ortiz-Catedral, L., Julian, L., Galbraith, J. A., Kurenbach, B., Kearvell, J., & Varsani, A. (2012). Molecular characterisation of beak and feather disease virus (BFDV) in New Zealand and its implications for managing an infectious disease. *Archives of Virology*, 157(9), 1651-1663, Groombridge's work is referenced in relation to New Zealand, and see section 5, point C.

Groombridge has galvanised amphibian conservation on Seychelles through field and laboratory-based research on the rare Seychelles sooglossid frogs, known to be one of the most ancient groups of frogs. Genetic work by Groombridge has **identified a recently-discovered frog population on Praslin island as evolutionarily distinct** (section 5, point D). This clarified the need for surveys on additional Seychelles islands, for example Dr Frauke Fleischer-Dogley, Chief

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Executive Office, Seychelles Island Foundation states *'this confirmation has provided much needed clarity and enabled SIF to orientate its conservation activities to focus on conserving this population'* (see section 5, point E). The research also attracted additional conservation funds by local NGOs (notably the Mauritius Wildlife Foundation and the Seychelles Islands Foundation) and developed a 3-year PhD project (by Jim Labisko) on the evolutionary conservation genetics and restoration of sooglossid frogs.

Impact on public awareness and understanding (see section 5, point E)

Groombridge has improved awareness and understanding of his field amongst the public and the policy community through the showcasing of his projects as **examples of best practice in UK Government documents** (DEFRA and the annual report of the Darwin Initiative, section 5 point E) and in books targeted at a wide practitioner audience. A published book on Reintroduction Biology illustrates the work by Groombridge and defines the 'gold standard' for genetic management of reintroductions for conservation (700 copies sold, third highest seller for Wiley in this area).

Impact on policy (see section 5, points A, B, D, E)

Groombridge's work has led to **increased investment by the UK to improve training and capacity-building in conservation** across the Indian Ocean. Darwin Initiative/DEFRA recently provided £256,000 for 2012-2015 to support the work (to train 5 local biologists from Seychelles, with interisland training involving Mauritius), and this re-affirms the UK's commitment to conserving island biodiversity (see section 3, 'funding'). This funding will be used to unite local conservation NGOs with UK-based expertise to develop the skills and capacity of local biologists. Groombridge's leadership of this project has resulted in the additional award of a €400,000 (£342,500) European Science Foundation grant to establish a four-year research network (*'ParrotNet'*: COST Action ES-1304) to coordinate European and international research into the environmental, agricultural and societal issues surrounding invasive parrots. Therefore an important aspect of the impact of Jim Groombridge's work is that he has persuaded a range of organisations to extend and increase funding for conservation work for endangered species in Seychelles and Mauritius.

5. Sources to corroborate the impact

- A. The Government of Seychelles, La Digue Development Board and other local authorities signed agreements pledging support for a translocation of flycatchers (source: Darwin Initiative Final Report).
- B. The National Species Action Plan for the flycatcher states the need for establishment of 3-4 additional reintroduced populations on other islands (source: Seychelles Paradise Flycatcher Species Conservation Assessment and Action Plan). The initial translocation by Groombridge paved the way forward for achieving the SAP target.
- C. The population genetic work is used as a case study in a key planning text to illustrate how timely use of genetic data can inform reintroduction strategy: **Groombridge, J. J., C. Raisin, R. M. Bristol & D. S. Richardson (2011). Genetic consequences of reintroductions and insights from population history. In: *Reintroduction biology: integrating science and management* (Ewen, J.G., Armstrong, D.P., Parker, K.A. & Seddon, P.J., Editors). Wiley-Blackwell, Oxford. ISBN 978-1-4051-8674-2.**
- D. A letter from Mauritius NGO (Mauritius Wildlife Foundation, (source: signed letter from Executive Director of the MWF) confirms their renewed interest in working with the endemic population of Mascarene paradise flycatcher on Mauritius following Groombridge's research, stating that it has made a genuine difference to their approach to conservation.
- E. The local conservation NGO in Seychelles, the Seychelles Islands Foundation, has targeted resources and conservation efforts at these frog populations (see letter from Seychelles Islands Foundation).

The showcasing of this project by DEFRA can be viewed in the DEFRA 13th Annual Report (p.8-9). <http://www.darwin.gov.uk/annual/13thAnnualDarwinReport.pdf>