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Spatially-explicit habitat modelling of the brush-tailed rock wallaby in eastern Australia

by Justine Murray, School of Integrative Biology, University of Queensland

Targeting conservation of a threatened species includes management of their habitat at a site-scale, a landscape-scale and at a regional-scale. One particular threatened species, the brush-tailed rock-wallaby (*Petrogale penicillata*), lives in disjunct habitat patches throughout southeast Australia and is particularly suited to research on numerous scales. Brush-tailed rock-wallabies are limited to a set of suitable habitat characteristics that appear sporadically across a landscape. On a site-scale they may be limited by suitable resting and refuge sites and on a landscape-scale by dispersal potential within a landscape.

In my PhD research, I aim to investigate various modelling techniques and their potential usefulness as tools in the identification, conservation and management of *P. penicillata* habitat in southeast Queensland and northeast New South Wales. The research involves extensive surveys of known and potential habitat within the region. Modelling techniques include logistic regression and regression tree analysis, GIS modelling, expert elicitation and spatially explicit population modelling. The population modelling will identify whether metapopulation dynamics occur, as well as model various "what if" scenarios, such as habitat patch loss through local and global catastrophes, thereby allowing better management of individual habitat patches through identification of high quality sites and their connectivity through the landscape. The results will be aimed at management agencies currently in control of BTRW habitat on public lands, with the possibility of extrapolating the resultant models or the model methodologies to other threatened species within the same landscape.

Justine Murray

Age determination and population dynamics of Australian flying-foxes

by Anja Divljan, School of Biological Sciences, The University of Sydney

Grey-headed flying-fox (*Pteropus poliocephalus*) is endemic to the eastern forested areas of Australia, extending into higher latitudes that any other Pteropodid in the world. Flying-foxes feed mainly on fruit, pollen and nectar, and act as important seed dispersers and pollinators in the natural forest communities they inhabit. However, loss of habitat and food resources due to accelerating rates of landscape clearing has been driving the animals into urban areas, where they are often considered as serious pests. Such migrations are also likely to increase the human-induced mortality in flying-foxes due to deaths on power lines and barbed wires, as well as shooting in orchards.

The grey-headed flying-fox has already been listed as vulnerable nationwide, following a substantial decline of up to 35% in the past ten years. Population models based on our best knowledge to date show that flying-fox populations have a very low capacity for increase, even under most ideal conditions. This is supported historically, as the animals are known to have a low reproductive rate (giving birth to a single young per year) and high maternal investment, both indicative of relatively long-lived animals with low natural mortality rates. Thus human-induced mortalities are potentially putting the populations at a risk.

My project focuses primarily on improving the method for ageing individuals, using the cementum growth-layers in their teeth. Subsequently I aim to investigate the parameters necessary for making predictions about the future of the species, namely the age at first reproduction, longevity of flying-foxes in the wild, and the average age of the live population. Ageing individuals and estimating the population growth rates will allow us to assess the effects that the potentially altered mortality patterns have on the sustainability of the population and help us in designing and implementing appropriate recovery steps for the species.

Anja Divljan

Anja Divljan with a grey-headed flying fox baby

The social ecology of the spotted-tailed quoll using faecal DNA

by Monica Ruibal, School of Botany and Zoology, Australian National University

For my project I am using faecal DNA taken from a spotted-tailed quoll population in the Byadbo Wilderness Area of Kosciusko National Park to investigate the social ecology (latrine use) of the spotted-tailed quoll and to examine the efficacy of faecal sampling and genetic identification as a sampling approach for estimating and monitoring populations.

Typically, several quoll droppings can be found on flat, horizontal surfaces at large rocky outcrops, and on bedrock along creeks and rivers (these areas are known as latrines). Due to the deliberate pattern of deposition of quoll faeces, latrines are *thought* to serve as an olfactory communication marker. I have been using forensic DNA techniques to recover DNA from the faeces deposited at the latrines.

Together the forensic techniques and the faecal DNA create a novel opportunity and provide an informative approach to elucidate the following:

1. How many individuals use a single latrine?
2. Do both sexes use faeces to mark?
3. If so, do they mark at the same frequency?

Complementary to the DNA work, I have been investigating scat deposition rates to determine the period when it is most effective to sample and the duration of the sampling period. An important outcome of this project is the development of a non-invasive sampling approach that could be readily used by land managers.

Monica Ruibal

Investigating the role of Chytridiomycosis in the decline of green and golden bell frogs

by Michelle Stockwell, University of Newcastle

The green and golden bell frog (*Litoria aurea*) is a freshwater pond breeding species that was once widespread throughout eastern NSW but has been declining since the 1960's. His decline has occurred most severely in inland populations and the majority of their populations are now found within a few kilometres of the coast or an estuary. His trend is inconsistent with habitat modification, introduced predators and pollution as causal agents in their decline.

Chytridiomycosis is an emergent infectious disease caused by the salt intolerant chytrid fungus (*Batrachochytrium dendrobatidis*) that can result in fatal epidermal infections in amphibians. In Australia chytridiomycosis has been implicated in the decline of several amphibian species and is known to infect and cause mass mortalities in green and golden bell frogs.

My study aims to investigate the role of chytridiomycosis in the decline of green and golden bell frogs and will test the hypothesis that they survive in coastal habitats because the salinity of breeding ponds provides protection against infection by the chytrid fungus. Understanding the processes involved in the decline of the green and golden bell frog will aid in their conservation and will enable effective habitat rehabilitation and management, so that the long term survival of this species can be ensured. The results of this study will also have implications for many other endangered frog species.

Michelle Stockwell

Managing Tasmanian devil (*Sarcophilus harrisii*) populations affected by the Devil Facial Tumour Disease (DFTD): the effect of DFTD on demography, population dynamics and fine-scale population genetic structure

by Shelly Lachish, School of Integrative Biology, University of Queensland

Devil facial tumour disease (DFTD) is a recently emerged disease associated with widespread and major population declines in wild Tasmanian devils (*Sarcophilus harrisii*). Rapidly growing tumours appear on the head region and the progression to death is rapid (4-9 months). The steady geographic spread of DFTD (15km/yr) suggests there is an infectious element to this disease. While, diagnostic work on the nature and cause of the disease is under way, research on its ecology and its effects among individuals and populations is urgently needed. The onset and spread of Devil Facial Tumour disease (DFTD) in wild Tasmanian devil populations has resulted in major demographic changes in affected populations. Diseased populations exhibit heavily female biased adult sex ratios and much higher proportions of juvenile devils (>60%) than healthy populations. Long-term diseased populations are persisting with no adult devils older than 3 years of age (c.f. 7-8 year old adults in healthy populations).

The overall aim of this project is to determine the effect of DFTD on the population dynamics and fine-scale population genetic structure of Tasmanian devils, so as to evaluate the consequences and effectiveness of various management strategies for the recovery of affected populations. The project also aims to study disease-induced changes in host life-history strategies by examining the trade-offs between age-specific reproductive success (fecundity) and survival (longevity) in diseased versus healthy populations and to examine individual dispersal decisions between populations. The data obtained will be used to construct mathematical models showing how populations may behave under different management scenarios, in order to elucidate the most effective management strategies for achieving maximal population growth in affected populations.

Shelly Lachish