

Taxonomic tools empower management, survey and conservation of small terrestrial mammals

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Introduction

Australia's vertebrate fauna rates globally among the most unique and the most vulnerable to extinction. Many mammal and frog species have already been lost, and many others are highly endangered. At the same time, we continue to discover new species of reptiles and frogs in Australia – 10 or more in an average year – and occasionally even find new species of mammal.

The Taxonomy Research Information Network (TRIN) small terrestrial vertebrates project is exploring the incomplete state of knowledge of Australia's unique and vulnerable vertebrate fauna.

A full inventory of Australia's vertebrate fauna is essential for effective allocation of conservation resources, particularly so for our mammals, that remain vulnerable to predation by introduced cats and foxes, the effects of ongoing habitat degradation, and the uncertain impacts of climate change.

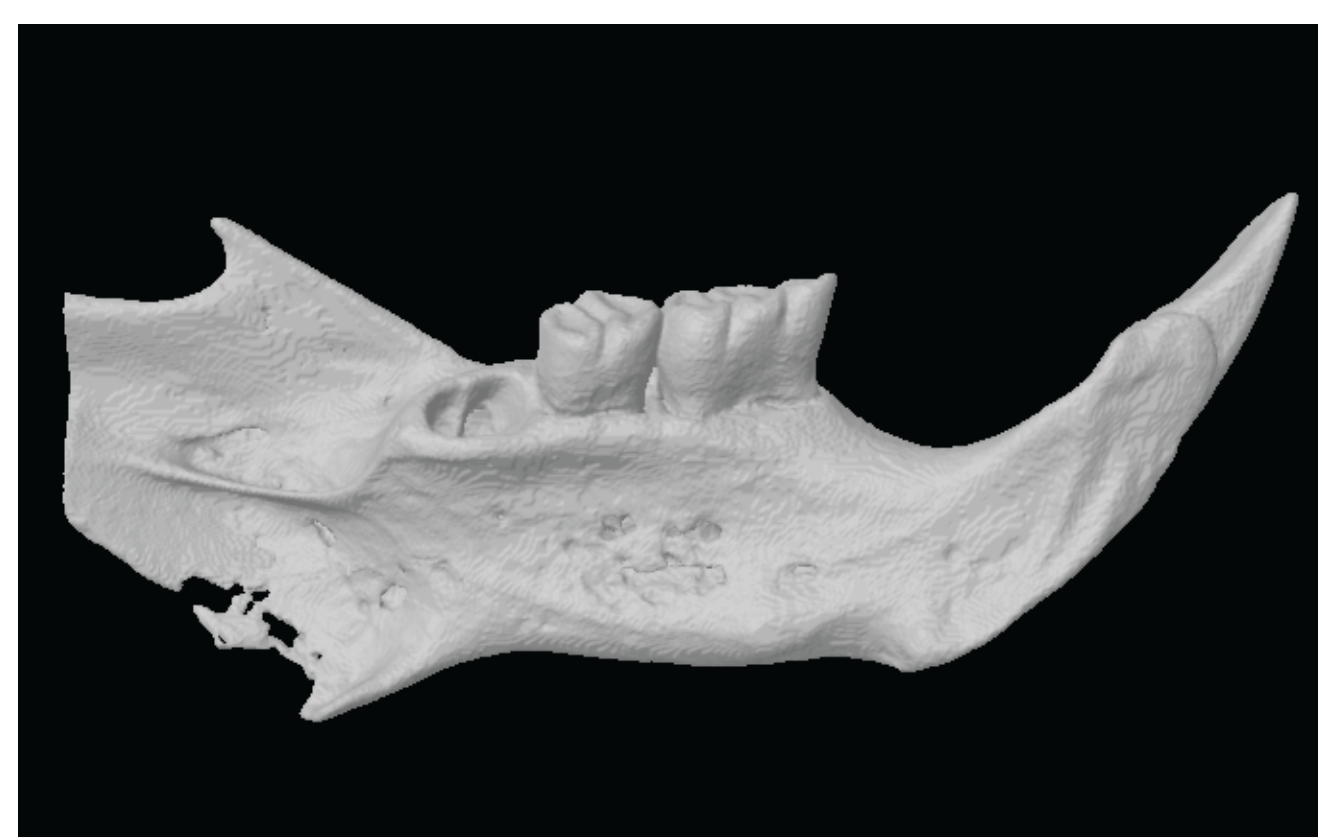
Methods

A combination of methods is accelerating our rate of discovery of vertebrate species and improving our knowledge of their present and past distributions. For all groups, our core methods involve morphological studies of museum specimens and analysis of DNA sequences. For mammals:

- recent bone accumulations to fill gaps in distributional knowledge
- 'ancient' DNA from historic museum specimens and prehistoric bones helps to place surviving populations into a broader ecological context
- addition of micro-CT scanning technology is revolutionizing our morphological studies.

Our work spans a variety of groups including:

- mammals (rodents, marsupial mice and insectivorous bats)
- reptiles (blindsnakes, legless lizards and litter and rock-dwelling skinks), and
- various litter-dwelling frogs.



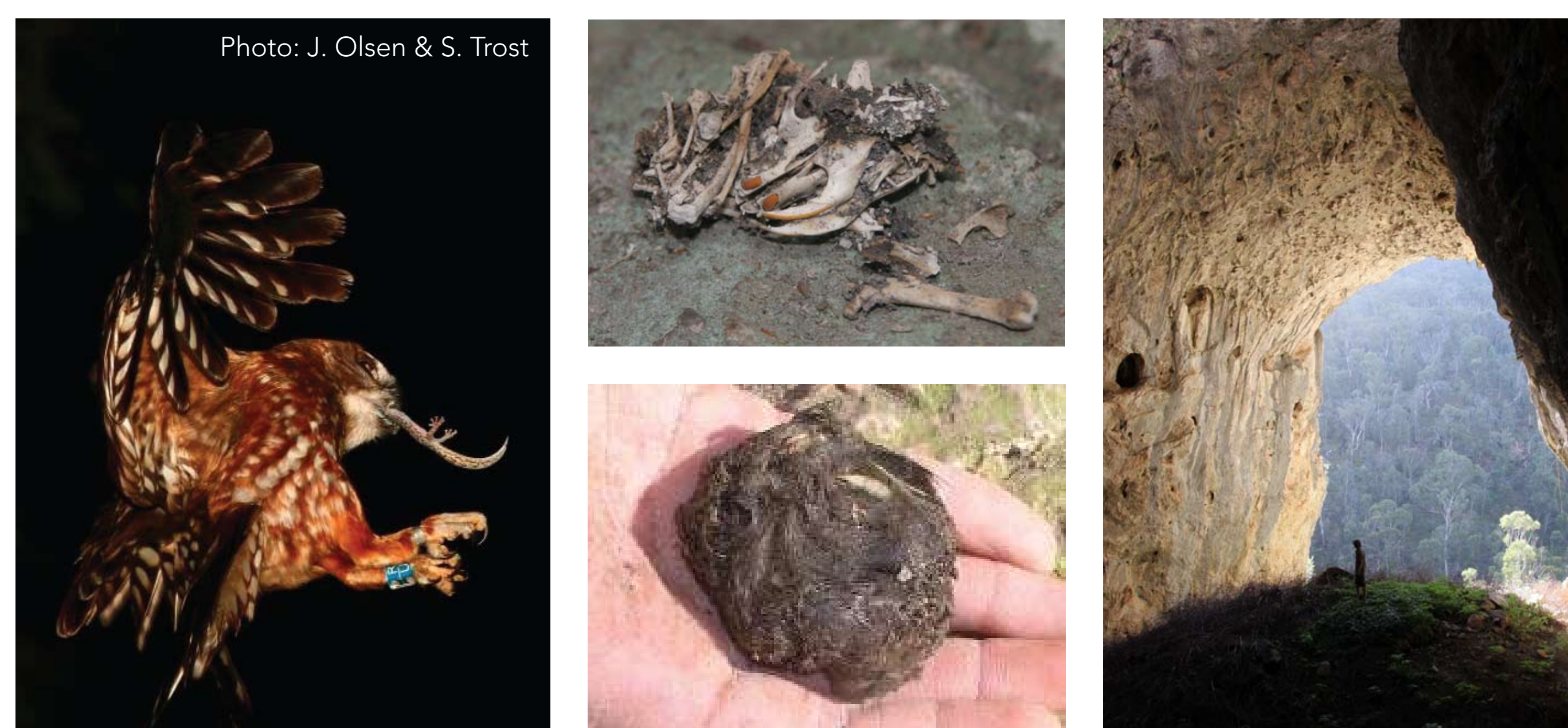
Top: Highly accurate 3D surface micro-CT scan of Hastings River Mouse (*P. Oralis*) jaw (actual size 6 mm). These surfaces form a digital dataset enabling very powerful analyses



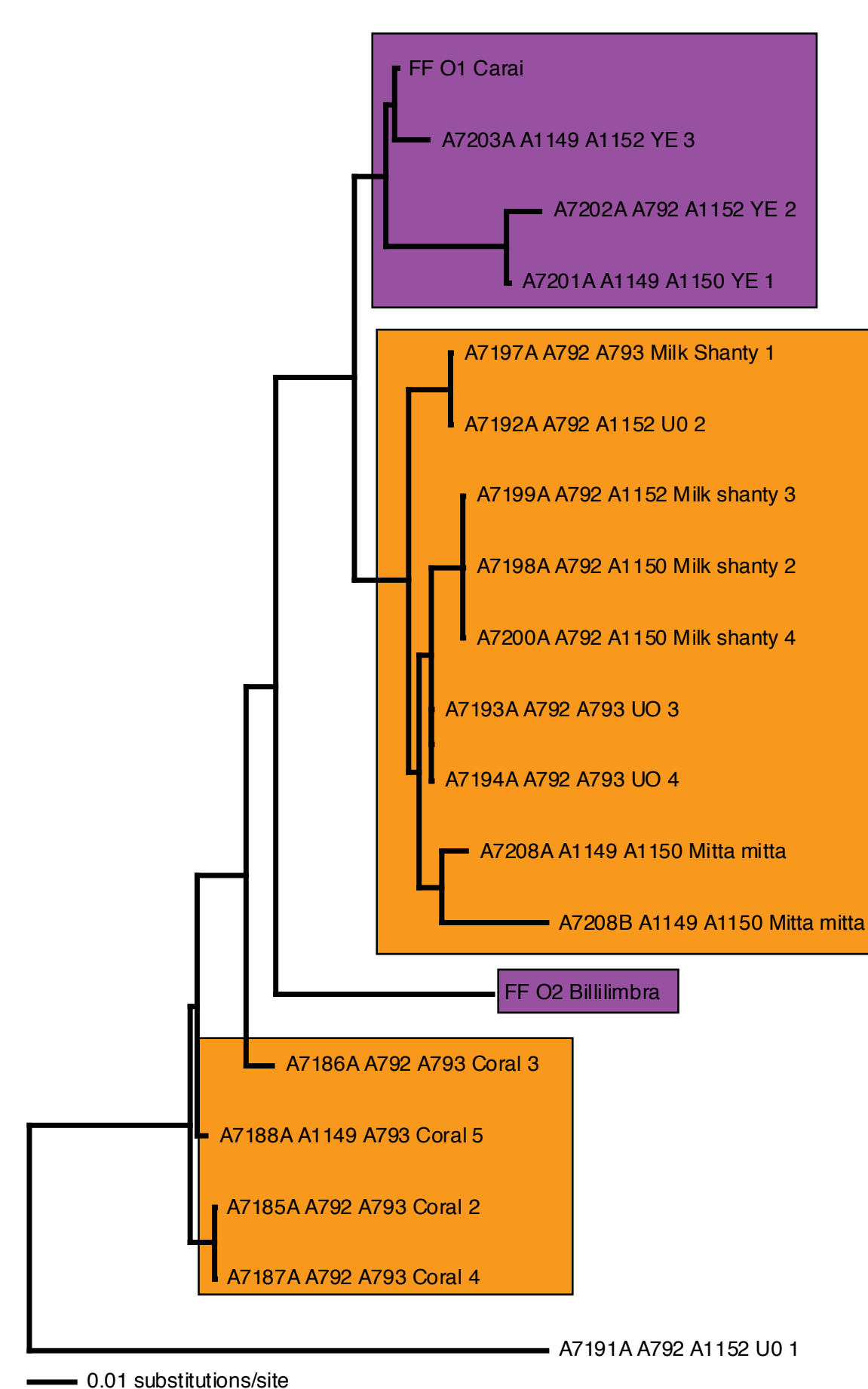
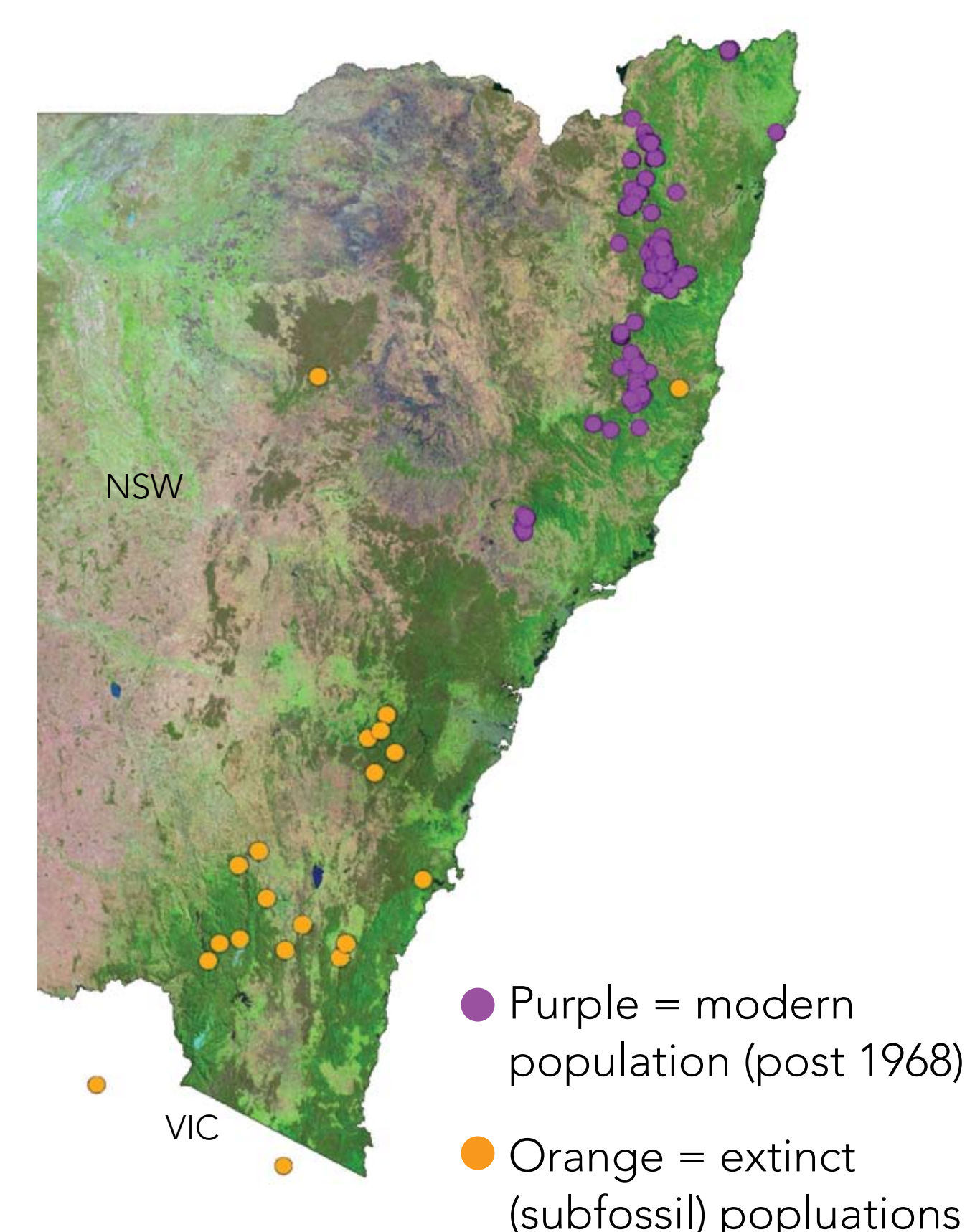
Right: Hastings River Mouse (*P. Oralis*) skull

Case study - The 'original' mammal fauna of south-eastern NSW

Owls are nature's collectors. Large collections of bones and pellets have been spewed onto the floors of caves for thousands of years. The teeth and bones that remain in the owl pellet provide an excellent source of morphological and genetic material that allows assessment of notable morphological variation observed in modern and subfossil specimens.



The Hastings River Mouse (*Pseudomys oralis*) was discovered in the 1840's but not seen again until the late 1960's. It is a very rare animal now known to occur between Barrington Tops and Lamington National Park (NSW). Molecular work on these modern populations shows that they comprise two conservation units. However, dated bones from subfossil deposits reveal that 150 years ago it occurred as far south as the Victorian Alps and as far inland as Coonabarabran.



Relationships of modern (purple) and extinct (orange) sub-populations of Hastings River Mouse inferred from mitochondrial DNA

Extending the molecular dataset to include the former distribution of species using ancient DNA has shown that:

- for reintroduction into the species former range the Hastings River Mouse of the southern conservation unit is the most appropriate
- some extinct populations show such genetic diversity that they may represent a new species.

The next step in the study is to extend the dataset to include as many extinct populations as possible and match that set to a micro-CT morphological dataset to provide a complete taxonomic and population genetics framework for management of currently known populations, those awaiting discovery, and future reintroduction programs.