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Genetic Diversity and Biogeographic History of Fijian Iguanas

The Pacific iguanas of the Fijian and Tongan archipelagos are a biogeographic enigma in that their closest relatives are found only in the New World, separated by 8,000 km of ocean. The Pacific iguanas have been dramatically affected by human activities; two species were eaten to extinction after human arrival in the Pacific some 2,800 years ago. The extant *Brachylophus* species are now under imminent threat due to habitat loss and modification, as well as the strong impact of feral cats, mongooses, and goats, with *B. vitiensis* now extirpated on many islands that it formerly occupied. *Brachylophus vitiensis* is listed as Critically Endangered on the IUCN Red List with only a single secure population remaining on the island of Yadua Taba. The status of *B. fasciatus* in the wild is little known, but large populations still exist on the two uninhabited Aiwa islands in the Lau group.

The Pacific iguanas currently comprise two genera and four species of extinct and extant taxa. The two current

Management Implications:

- Living *Brachylophus* comprise three distinct species rather than two, and this has immediate implications for conservation and land management so that each species is represented in secure long-term reserves.
- With just one exception, every island for which the authors had samples had at least one unique haplotype and represents a distinct lineage.
- Almost 180 years passed between the discovery of the first living Fijian iguana (*Brachylophus fasciatus*), in 1800, and the discovery of the second (*B. vitiensis*). With the addition of *B. bulabula*, scientists now know there have been at least five iguana species, including two extinct iguanas, that evolved within the Fijian and Tongan archipelagos. Iguanas have been little studied there, and more iguana species may remain to be discovered.



Female and male *Brachylophus bulabula* from Kadavu Island, Fiji. Photo courtesy of Paddy Ryan, Ryan Photographic: <http://www.ryanphotographic.com/>

extant species are *Brachylophus fasciatus* from Fiji, Tonga, and Vanuatu, and *Brachylophus vitiensis* from western Fiji. A molecular and morphological analysis was conducted by scientists at the Australian National University, Macquarie University, and U.S. Geological Survey, to reevaluate the phylogenetic and biogeographic relationships within the genus *Brachylophus*. Their study was published recently in the online issue of *Philosophical Transactions of the Royal Society B*.

The authors used mitochondrial DNA for 61 individuals from 13 islands, representing both *Brachylophus* species, and corroborated their molecular findings with morphological and distributional data. Their data demonstrated that living *Brachylophus* comprise three ro-

bust and well-supported clades that do not correspond to current taxonomy. One of these clades comprises *B. fasciatus* from the Lau group of Fiji and Tonga, while a second comprises putative *B. fasciatus* from the central regions of Fiji, which they described as *B. n. sp.* Animals in this clade form the sister group to *B. vitiensis* rather than other *B. fasciatus*. The authors described this clade as a new species, *Brachylophus bulabula*, based on molecular and morphological data.

With only one exception, every island for which there were samples was home to one or more unique haplotypes. Genetic data for *B. vitiensis* were the most extensive, showing that while virtually every island had at least one unique haplotype, the haplotypes were closely related, consistent with recent isolation from sea level rise. Together, the authors' molecular and taxonomic results have important implications for future conservation initiatives for the Fijian iguanas.

An evaluation of two alternative hypotheses regarding the original dispersal of iguanas to these archipelagos suggested that long-distance rafting on a surface current was more likely to have occurred than dispersal by a Melanesian land bridge.

Keogh, J. S., D. L. Edwards, R. N. Fisher, and P. S. Harlow. 2008. Molecular and morphological analysis of the critically endangered Fijian iguanas reveals cryptic diversity and a complex biogeographic history. Philosophical Transactions of the Royal Society B. doi:10.1098/rstb.2008.0120.

[Note: This journal article will also appear in a later print issue of *Philosophical Transactions of the Royal Society B.*]