

BOOK REVIEW

Tuatara: biology and conservation of a venerable survivor, by Alison Cree. Christchurch, Canterbury University Press, 2014. 584 pp, NZ\$89.99 (hardback). ISBN 978-1-927145-44-9

Oh, tuatara, why do we love you so?

In 2003 I had the thrill of a lifetime, getting to stay for five days on Stephens Island, where toots (as I was told they are called by a mischievous Australian) were so abundant that you had to be careful where you stepped. When I retell the tale of living amid the rhynchocephalians, my listeners swoon with envy. Never have I met someone not visibly impressed that I have actually held one in my hand.

But what is it about *Sphenodon punctatus* that inspires such emotions? Let's face it: the spiny back (the literal translation of the Māori word *tuatara*) is not the prettiest of animals. And at face value, it doesn't seem extraordinary; it looks, to those not in the know, rather like a dowdy lizard, a smaller and duller iguana.

A so-called 'third eye', unusual chewing mechanism and lack of intromittent organ—the tuatara certainly has its fascinating idiosyncrasies. But its trademark feature, its real claim to fame, is its antiquity. Or, to be more precise, the antiquity of its lineage, for the tuatara is the sole surviving member of the Rhynchocephalia, a group of reptiles that evolved about 250 million years ago. It flourished mightily in the Triassic, then petered out, all but disappearing along with the dinosaurs at the end of the Cretaceous. All, that is, but for the tuatara, the last member of the sister group of lizards and snakes, somehow, for some reason, hanging on only in New Zealand.

This history has led the tuatara to be dubbed a 'living fossil'. But if there's one message Alison Cree wants readers to take away from her fabulous new book, *Tuatara: biology and conservation of a venerable survivor*, it is that the tuatara has been miscast. Far from being a survivor from the 'Age of Dinosaurs', an old, ill-adapted species that has managed to persist, unchanged, in its antipodean hideaway, the tuatara is a model of evolutionary adaptation, a thoroughly modern species well adapted to its current conditions, or at least to the conditions it experienced up to the arrival of humans, rats, cats and dogs.

Indeed, misinformation is pervasive. Cree reports that 73% of first-year university students in New Zealand think that the tuatara is more closely related to dinosaurs than to lizards, no doubt a consequence of its 'living fossil' appellation. And even professional herpetologists (well, at least this one) will be surprised to learn that the tuatara's fossil record extends not to the Cretaceous, but only to the late Pleistocene (although Cree notes that a recent palaeontological find may extend the record back into the Miocene). Things were worse a century ago. George Boulenger, curator at the British Museum and perhaps the leading herpetologist of the early twentieth century, called the tuatara the 'oldest existing reptilian type'; Otago University Museum curator William Benham described the tuatara as 'the most ancient reptile on earth', ancestral to crocodiles and turtles. None other than the famed palaeontologist George Gaylord Simpson referred to toots as 'immortals... one of the most remarkable examples of evolutionary stagnation' with essentially no evolution in 140 million years. Unfortunately, this view also pervaded the popular press, which often portrayed the tuatara as an outmoded relic of

a time long past, a species no longer able to cut it in the modern world.

Tuatara will put an end to these misconceptions. Indeed, this book is everything you'd expect from Cree, one of the world's foremost experts on tuatara biology. I expected detailed discussion of what is known about the physiology, behaviour, evolution and other aspects of tuatara natural history, and that's what I got. In addition, there is a thorough exposition of the conservation status of *Sphenodon*, first detailing the sad tale of its decline, and then charting the magnificent conservation measures that have now restored the species not only to many offshore islands, but to five sites on the North and South Islands, marking a jubilant return to mainland New Zealand after an absence of at least many decades, if not many centuries (the most recent fossils date to more than 500 hundred years ago, but unauthenticated reports of scattered individuals continue to the 1940s).

What I didn't expect from this book was the great wealth of information on the history of scientific study of the tuatara and in-depth discussion of how the animal was viewed by Māori and, more recently, by early Europeans. Indeed, at the outset, Cree identifies one of her goals to be to 'explore the story of New Zealand—its geological origins, settlement by people, development of a community of scientists, and growing awareness of the fragility of its biota' through the lens of the tuatara. And in this she succeeds admirably.

Truly, it is hard to think of a question about anything tuatara that is not answered in this book. *Tuatara* immediately has become the authoritative source for information on the biology and conservation of these wonderful animals. But books such as *Tuatara* are great not only because of their comprehensive review and synthesis of knowledge of a particular species or clade, but also for the interesting facts and fun lore that cram its pages. Here are some of my favourites:

- The unusual chewing mechanism of the tuatara involves the lower jaw moving a row of teeth

forward between two rows of teeth in the upper jaw, literally tearing like a steak knife. The fixed quadrate at the back of the tuatara's skull should not be viewed as inferior to the mobile quadrate of lizards, but rather as an adaptation providing stability for the shearing motion of the lower jaw.

- The tuatara has long been equated with the ancestral state for squamates (the clade containing lizards and snakes) because it has a fully diapsid upper skull, a trait not exhibited by any squamate. However, recent palaeontological finds indicate that far from representing an ancestral condition dating back 250 million years in time, this character state is derived within Rhynchocephalia from a morphology similar to that of many living lizards.
- Most of what we know about the tuatara comes from study of the Stephens Island population, but tuatara populations are highly variable in many aspects of their environment and natural history, and thus further comparative study of other populations is warranted.
- Thirty-four genera of Mesozoic rhynchocephalians are now recognized, and fossils come from all continents except Antarctica and Australia. Mesozoic fossils are also unknown from New Zealand.
- Tuatara were considered as dangerous spirits by some Māori, but eaten by others. The epithet 'tuatara' was usually not used as a compliment.
- In the nineteenth century, it was fashionable to keep tuatara as pets in fine homes, and sometimes they were seen nestled in the laps of their mistresses or even perched on their shoulders. Some owners claimed that tuatara could recognize individuals, in some cases ducking into the V-neck sweater of their owner upon the arrival of a stranger.
- Tuatara is both singular and plural.

These are my favourite takeaways from this marvellous volume, but certainly every reader will have her or his own.

In addition to being comprehensive, the book has other virtues. Its reference list is not only exhaustive at 850 references spanning 1817–2013, but also downloadable from the book's website. Moreover, the suggestions of future research areas will be very helpful in directing young researchers. The book is also jam-packed with colourful photos of tuatara, people, places and research techniques. Like any book of this size and scope, a reviewer can nitpick: some photos aren't crisp, and there is a bit of redundancy in topics that crop

up in multiple places in the book. But these are quibbles. This is a fantastic book that does justice to a wonderful, modern and now thriving icon of evolution.

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