

Review

The lost world of the moa: Prehistoric life of New Zealand by Trevor H. Worthy and Richard N. Holdaway, illustrated by Rod Morris

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Pp.718. Hardcover. 266 black and white photo, maps and drawings. NZ\$ 165

This richly illustrated and referenced (reference list 59 pages long) book chronicles the geological and evolutionary history of arguably Earth's most bizarre fauna, dominated by birds of a range of persuasions. Its 266 illustrations depict key researchers on New Zealand's palaeo- and neo-fauna, the birds and beasts (especially the former) themselves, key fossils and bones of extinct and extant taxa and their vegetational and climatic settings. However, the heart of the book is a monographic treatment of the moa (both in the singular and plural), an extinct order of ratite (ostrich-like) birds (Dinornithiformes). For me as an avian palaeontologist, the most fascinating aspects of the book were the historical accounts of the discovery of moa and the descriptions of the 11 species, 10 of which were described (and beautifully illustrated anatomically) to science by Richard Owen. Owen was the pre-eminent British palaeontologist of 19th century who coined the terms homology (sameness amongst anatomical structures) and dinosaur, and promoted the establishment of the British Natural History Museum (and was its first director). But the authors do not stop there. In addition to covering the taxonomy and anatomy of these massive (up to nearly 250 kg) birds, they act as evolutionary detectives, deducing aspects of their behaviour, demography, life history, reproductive biology and ecology. They also give what I believe are the most comprehensive reviews of ratite evolution and the possible co-evolution between moa and the vegetation on which they fed.

They then go on to discuss similar aspects of the biology of kiwi (another fascinating group of ratites), waterbirds, raptors (including the huge, 9-13 kg Haast's eagle *Harpagornis moorei*), rails, oceanic birds, shorebirds, parrots and passerines

(including acanthisittid wrens, perhaps the most ancient lineage of extant passerines). In an attempt to "put it all together" they discuss elements of the community ecology and faunal structure of this fascinating avifauna.

The final chapter, appropriately, is on the tragic extinction of a large chunk (76 species, = 31%) of this avifauna. The authors consider a range of hypotheses, including climate change, disease and genetic "senescence", but conclude (p. 536) that "the simple, inescapable fact is that the New Zealand avifauna has been decimated by introduced mammalian predators, including people." The extinction is divided into three "phases". Phase 1 began \pm 2000 years B.P. with the arrival of the Pacific rat (*Rattus exulans*) whose predation was focused on smallish birds. Phase 2 was initiated in the 13th century by the arrival of Polynesian people who "mined" (not "cropped") the moa and many other large birds to extinction. Phase 3 began in the late 18th century with the arrival of European settlers. This resulted in a marked increase in habitat destruction and predation, e.g. by feral cats. The only refuges for indigenous birds were the literally hundreds of small islands surrounding the two main islands. Indeed, some of these islands are now being used to resuscitate populations of extant threatened birds.

The book does not end here, but rather extends into four appendices including a systematic list of the late Holocene avifauna, keys to major limb bones of moa, a list of morphological characters used in cladistic (evolutionary tree) analyses of moa skulls, and maps of Holocene distributions for a selection of New Zealand's characteristic birds.

This magnificent reference book (although parts make fascinating bed-time reading) is a must for

anyone or library interested in the biological history of New Zealand.

TIM CROWE, Percy FitzPatrick Institute, Department of Zoology, University of Cape Town, South Africa.

This book, by featuring in the review pages of prestigious international journals such as *Bioscience* (Martin 2002), *Science* (Steadman 2002) and *Nature* (Pimm 2002), has gone where no other New Zealand ornithological text has ventured. The laudatory reviews there, and elsewhere (e.g. Mead 2002; Cooper 2003), by reviewers who really know a rare bone when they see one, have accorded this publication genuine international recognition and acclaim the like of which no other New Zealand ornithological text, other than L.E. Richdale's two penguin classics (Richdale 1951, 1957) has managed during the past century. Trevor Worthy and Richard Holdaway have authored a stunning book. If they were never to write anything else, their national and international reputations as pioneering ornithologists and astonishingly industrious palaeofaunal sleuths are absolutely assured. By any yardstick, and including bulk and price, this is a monumental book, and it is also a profoundly important one.

Why profoundly important? It is not for the astonishing detail about moa packed into the book's first 215 pages. Nor is it for the exhausting 90 pages devoted to that astonishing moa predator – "the grandest eagle" (check out the stunning photo of talon holes through a moa pelvis on page 327). It is because this book is, in totality, the first genuine synthesis of New Zealand's faunal prehistory. And what makes the book so much more compelling is that its authors have been the architects of a new knowledge wave. The past two decades have seen a most wonderful flowering of palaeofaunal investigation in New Zealand, almost exclusively the result of Worthy's and Holdaway's endeavour (their names appear on 97 of the references in this book from their 15 years of field activity). The transformation in understanding the authors have unveiled is captured in the individually written chapters (each according to expertise) and by their own occasionally idiosyncratic prose, and I find this first-hand accounting to impart genuine life, indeed an explorer's excitement, to the pages.

There is, however, another hand behind this book, acknowledged in the preface but easily missed. It is the hand of a science funding process that has allowed independent researchers (neither author has the security of a "tenured" income) to be funded and to perform free from institutional bureaucracy. Wallowing as I do in a bureaucracy I simply cannot envisage such astonishing produc-

tivity and outcome emerging any other way.....so hats off to the Public Good Science Fund!

I have read nine reviews of this book, including Tim Crowe's above. What strikes me is the universality of praise. Certainly some reviewers have added brickbats to the bouquets by highlighting perceived inconsistencies and mistakes covering points that seem to me to be extremely trivial (e.g. Gill 2003; Steadman 2002) but I guess a reviewer wouldn't be a reviewer if a split infinitive or a creased page wasn't highlighted. However, I recommend a scan of the reviews identified here because they do convey differing perspectives. For example, a doyen of palaeontology finds the authors "more than entitled to their occasional opinions" (Martin 2002) and doesn't take them to task for opining somewhat provocatively "the lack of understanding by many continental-orientated and, it must be added, Northern Hemisphere-trained, biologists of both the importance of naïveté and the effects of rat and human predation in island faunas has held back the understanding of the cause of extinction on oceanic islands". However, Steadman (2002), a specialist in island extinctions, is less forgiving and, being particularly critical of the "inadequate cultural context" for the book's final chapter on the process of extinction, calls for more evidence to support the hypothesis that rats arrived 1000 years ahead of human settlement. Fair enough, but to suggest that, until this is done, the proposed extinction chronologies for moa "will remain tentative" seems to me to be very wide of the mark. My reading of the book tells me that rats play no part in the proposed moa extinction chronology at all!

Reviewer's comments are obviously coloured by the research interests that lead them to the book in the first place, so I am going to declare mine. After almost four decades having waterfowl as the focus of my ecological obsessions and watching three species reach the cusp of extinction, I have realised that I desperately need a perspective from the past in order to evaluate what I see in the present. That is why this book has become an important crutch for me...even more so because the authors have had the very good sense to devote an entire chapter to waterfowl. I venture the opinion that this book (and especially the final chapters) should be required reading for all contemporary conservation practitioners be they labelled scientist or manager, professional or amateur. If you really want to understand the folly of interpreting the behaviours and habitat selection of conservation-dependent species from their relict distributions (Gray & Craig 1991), read this book.

With one-third of the book devoted to moa, is this the definitive moa book? Yes....but perhaps only for now. It is too brave a call to make...I think back only

14 years to Athol Anderson's *Prodigious birds* (Anderson 1989) which, at the time, I thought told most of what there was to tell about moa. Now, a mere 12 months after *Lost world* was published, has come the astonishing revelation that male and female moa of some species may have been very different in size, perhaps showing greater sexual size dimorphism than has been recorded in any other bird (Huynen *et al.* 2003). What other stories will unfold now that extraction of ancient DNA from moa bones has been perfected? Will the present number of species (11) be reduced further?

Is this book a definitive account of the faunal prehistory of New Zealand? Absolutely! It simply has no rival and it is hard to see it not retaining its premiere status for a long time into the future. However.....there is one important detail, a very important detail, that could muddy the waters. The hypothesis of *Rattus exulans* arriving on both main islands of New Zealand almost 1000 years prior to Polynesian settlement, first proffered by Holdaway (1996), is forcefully chronicled in this book, as it has been elsewhere (Holdaway 1999a,b). This hypothesis seems to have created two camps among the interested....those convinced, and those expressing profound disbelief. The convinced view the hypothesis as a logical explanation for the apparent declines and extinctions of many small bird species and the demise of mainland seabird colonies that appear, from paleofaunal evidence, to pre-date human settlement and exploitation. The disbelievers, on the other hand, either choose to ignore the hypothesis entirely (e.g. Anderson 2002) or have launched very detailed challenges to the radiocarbon dating of the few rat bones upon which the hypothesis is so profoundly anchored (Anderson 2000). That particular challenge appears to have been rebuffed (Hedges 2000; Holdaway *et al.* 2002; Beavan-Athfield in press). More recently, however, some splendid lateral thinking has led to a search for evidence of rat presence that is not dependent on bone dating but on the dating of rat sign e.g. evidence of gnawing on fossil *Placostylus* snail shells (Brooks 2000) or on podocarp seed capsules trapped within ancient peats (Wilmshurst & Higham in submission). Neither from Northland snails nor from two North Island peat chronologies has evidence of rat presence before about 750 years ago accrued. If peat chronologies from South Island sites, and especially those adjacent to former mainland seabird colonies (where rats ought to have been very abundant and also very hungry after the seabirds had departed) fail to reveal gnawed seed capsules from earlier times, then the early rat arrival hypothesis will surely feel the strain. I love good stories and shall follow this ongoing debate with great interest.

Biological and evolutionary science seems to have so many wonderful stories to tell. No sooner

does one new contribution appear from the likes of Richard Dawkins, Jared Diamond or E.O.Wilson than others from Tim Flannery, Bryan Sykes or Matt Ridley follow in their wake. Deserting the sterile columns of science journals or the over-priced pages of academic texts for the more universal and reader-friendly format of the popular press has seen many an old biologist re-spark a career and many a new one wander a path not initially intended. While not wishing (publicly at least) to allocate the authors to one or other of these categories, I do think they have another writing task before them. Graeme Stevens' *Prehistoric New Zealand* (Stevens *et al.* 1988) was a wonderful popular account of our geological and biological prehistory – lucidly written, beautifully illustrated with colour, not too large, and certainly affordable. I think *The lost world of the moa* needs a companion volume modelled on Stevens' classic. The authors can clearly write in the necessary lucid and popular style, and they have already used, as their principal illustrator, Rod Morris whom I regard as quite the best wildlife photographer on our shores. *The lost world of the moa* is a story for all New Zealanders, not just for those with the strength to hump around such a heavy tome or the considerable amount of silver it takes to buy.

LITERATURE CITED

- Anderson, A. J. 1989. *Prodigious birds: Moas and moa hunting in prehistoric New Zealand*. Cambridge, Cambridge University Press.
- Anderson, A.J. 2000. Differential reliability of ^{14}C AMS ages of *Rattus exulans* bone gelatine in south Pacific prehistory. *Journal of the royal society of New Zealand* 30(3):243-261.
- Anderson, A.J. 2002. A fragile plenty: Pre-European Maori and the New Zealand environment. Pp. 19-34 in Pawson, E; Brooking, T. (eds) *Environmental histories of New Zealand*. Melbourne, Oxford University Press.
- Beavan-Athfield, N. in press. Reliability of ^{14}C AMS dating of rat and bird bone: Implications for the timing of New Zealand Holocene vertebrate extinctions. *Archaeometry*.
- Brook, F.J. 2000. Prehistoric predation of the landsnail *Placostylus ambagiosus* Suter (Stylommatophora: Bulimulidae) and evidence for the timing of establishment of rats in northernmost New Zealand. *Journal of the royal society of New Zealand* 30 (3): 227-241.
- Cooper, J. H. 2003. Recent ornithological publications. *Ibis* 145(3): 514-527.
- Gill, B.J. 2003. Book review: The lost world of the moa. *New Zealand journal of zoology* 30:161-162.
- Gray, R.D.; Craig, J.L. 1991. Theory really matters: hidden assumptions in the concept of "habitat requirements". *Acta XX congressus internationalis ornithologici*: 2553-2560.
- Hedges, R.E.M. 2000. Appraisal of radiocarbon dating of kiore bones (Pacific rat *Rattus exulans*) in New Zealand. *Journal of the royal society of New Zealand* 30(4):385-398.

- Holdaway, R.N. 1996. Arrival of rats in New Zealand. *Nature* 384:225-226.
- Holdaway, R.N. 1999a. A spatio-temporal model for the invasion of the New Zealand archipelago by the Pacific rat *Rattus exulans*. *Journal of the royal society of New Zealand* 29(2):91-105.
- Holdaway, R.N. 1999b. Introduced predators and avifaunal extinction in New Zealand. Pp. 189-238 in MacPhee, R.D.E.(ed.) *Extinctions in near time: causes, contexts and consequences*. New York, Kluwer/Plenum.
- Huynen, L.; Millar, C.D.; Scofield, R.P.; Lambert, D.M. 2003. Nuclear DNA sequences detect species limits in ancient moa. *Nature* 425:175-178.
- Martin, P.S. 2002. The end of the moa in Aotearoa. *BioScience* 53(4):434-435
- Holdaway, R.N.; Roberts, R.G.; Beaven-Athfield, N.R.; Olley, J.M.; Worthy, T.H. 2002. Optical dating of quartz sediments and accelerator mass spectrometry ¹⁴C dating of bone gelatine and moa eggshell: a comparison of age estimates for non-archaeological deposits in New Zealand. *Journal of the Royal Society of New Zealand* 32(3): 463-505.
- Mead, J.L. 2002. Review of *Lost world of the moa: Prehistoric life of New Zealand*. *Journal of vertebrate paleontology* 23(2): 475
- Pimm, S. 2002. No more moa. *Nature* 420:361
- Steadman, D.W. 2002. Everything you want to know and moa. *Science* 298:2136-2137.
- Stevens, G.; McGlone, M.; McCulloch, B. 1988. *Prehistoric New Zealand*. Auckland, Heinemann Reed.
- Richdale, L.E. 1951, *The sexual behaviour of penguins*. University of Kansas Press.
- Richdale, L.E. 1957. *A population study of penguins*. Oxford, Clarendon Press.
- Wilmshurst, J.M.; Higham, T.F.G. in submission. Rats by proxy: dating the arrival of *Rattus exulans* to New Zealand. *Radiocarbon*.(spoken presentation to 18th Radiocarbon conference, Wellington 1-5 September 2003.

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