

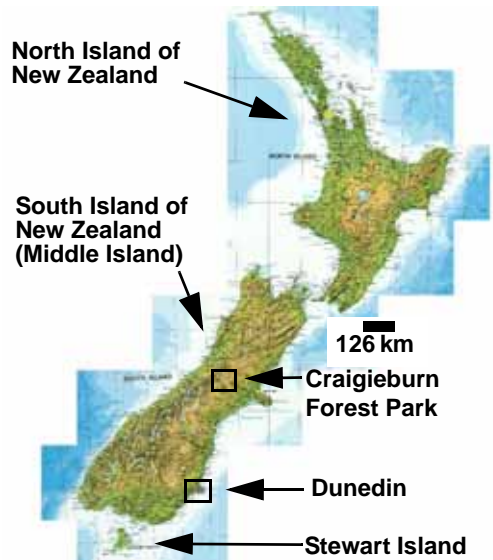


MOA SIGHTINGS 1

WHAT THIS BOOK IS ABOUT

WHY THE BOOK WAS WRITTEN

My interest in moa sightings started after a claim was made that a moa had been seen in the Craigieburn Forest Park in the South Island of New Zealand on 20 January 1993. Initially I was happy to accept the explanation that the report was a publicity stunt by the local publican but after hearing him explain on the radio that his report was serious I was not so sure. When I read further that another member of the party was recovering from a heart attack, a life situation when taking part in a prank might not have a high priority, and that the third member of the party wanted to get a job eventually with the Department of Conservation rather than a reputation for being frivolous, I had some doubt about whether it really was a hoax. As I lived in Dunedin, about one day's travel from the site of the claim, I felt I should go there to check it out and spent five days, 10–14



Map: © Crown; Sheet 1 1996; 1:2 million; Zoom: 4057 km (16%); Produced with Maptaster.

Figure 1.1. Location of the Craigieburn Forest Park and Dunedin in New Zealand.

February 1993, in the area. I saw no evidence of moas but found a report in a hut book claiming that two moas had been seen in the same valley on 19 May 1992. This was an intriguing coincidence. The information about the 1993 claim was aired in the media, the general opinion emerged that it did not involve moas, and the Department of Conservation called off plans to make a search of the area. Later I established that the 1992 claim was a hoax. Even in the cryptozoological community, the 1993 sighting was generally dismissed as a hoax^a and the currently accepted view remains that

^aHyde V. Oddzone: paranormal phenomenal, alien abductions, animal mysteries, psychics and mediums and other weird kiwi stuff. Auckland: New Holland Publishers; 2006. p. 114-5.



although occasional moa “sightings” are still claimed to this day, they are becoming fewer and all have been discredited.^a

However, after I talked to the three people involved in the 1993 sighting and made further examinations of the area where the sighting claim was made, I found there was no definitive evidence that a hoax or misidentification was involved and that, improbable though it seemed, the sighting of a moa as a cause for the claim could not be excluded. When I looked at the material available on moa sightings I found that not all of it had been considered in reaching a conclusion on the status of sightings, with some claims being unpublished and others being only partly published. I found the reasons for dismissing some claims to be inadequate and did not find the current explanation for the claims, based on recent immigrants becoming unwell with the stress of being in a new land and suffering hallucinations, to be convincing.

Taking seriously the motto of the University of Otago, Te Whare Wanaka o Otago, *sapere aude*, that one should dare to be wise and to have the courage to think for oneself, I pursued exploring the possibility some moas have survived longer than accepted in some remote areas, a staggered survival model, rather than that they became extinct about 550–650 years ago, the orthodox view. After considering the moa claim literature *in toto* I found that my doubts about the conclusions that had been reached about moa survival had increased rather than diminished.

Thus, to question the date of extinction of moas might appear to be tilting at windmills but that is where I have been led by my findings and the reader is invited to form their own view as to whether moas did indeed survive into the European era, A.D. 1769 and later, or whether the claims were better understood with a psychological explanation such as “colonial moa,” or as belonging alongside reports of sightings of UFOs, Bigfoot, Yeti and the Loch Ness monster, where misidentification of natural phenomena or fraud are involved rather than something of an extraordinary nature.

As access to much of the primary literature on moa sightings is difficult, I have included in my account some material that is repetitive to enable the reader to assess the reliability of the accounts or the degree to which a person’s story is consistent when told on different occasions. Reading the material may be difficult and I do not expect that sifting through it all will appeal to everyone. The account should be a useful source to those wanting to explore more deeply the question of the timing of moa extinction based on sighting claims and reach their own conclusions. For those who would prefer to avoid the tedium of such a detailed examination it is perfectly respectable to avoid the whole issue and accept the view of the experts who have

^aTennyson A, Martinson P. Extinct birds of New Zealand. Wellington: Te Papa Press; 2006.



looked into the matter and who are united in their view that moas became extinct, in about A.D. 1350–1450. However, what is respectable may not be correct.

In addition to claims involving the sighting of live birds called moas, other claims implying the recent existence of moas have been considered such as those involving birds called other names, e.g. fireman or emu, the sighting of large bird footprints, the discovery of moa bones of apparently recent origin, and the recent existence of the moa predator, Haast’s eagle.

INTRODUCTORY COMMENTS ON NEW ZEALAND AND MOAS

New Zealand was formed from the Zealandia continent which split away from the Australian and Antarctic margins of Gondwanaland about 83 million years ago (Ma). One view is that the Zealandia continent was then completely submerged with the extinction of the life forms on it and that the New Zealand land mass was subsequently formed, 25 Ma, after collisions between the Pacific and Australian plates pushed up about 10% of the continent.^{a,b} How the fauna and flora then arrived in New Zealand is uncertain. Another view is that although the land area has fluctuated greatly, there has always been some, however low and swampy, and so a terrestrial fauna could always find a home somewhere in the New Zealand archipelago.^c Palaeontologist Trevor Worthy, University of Adelaide, commented that it was not widely thought that New Zealand had been totally submerged and that “many geologists consider total drowning absolute tripe.”^d New Zealand has been isolated from overland immigration of fauna and flora from other continents for at least 80 million years.

Moa (Aves: Dinornithiformes) is the name given to a group of large flightless birds that lived in New Zealand. They are called ratites, from the Latin word *ratīs* for raft, because they have a flat or keelless sternum or breastbone (Figure 1.2). Related flightless ratites are the ostriches of Africa (Figures 1.3, 1.4), the emus of Australia (Figures 1.5–1.7), the rheas of South America (Figures 1.8–1.9), the cassowaries of Australia and Papua New Guinea (Figures 1.10), and the extinct elephant birds or aepyornithids of Madagascar. They have attracted interest because of their size—giant moas were the tallest birds ever known to have lived—and the suddenness of their extinction.^e

^aCarter H. How the land got here; the split from Gondwanaland and the development of our unique flora and fauna [CD-ROM]. 2004 Transit of Venus Lecture Series. Wellington: Royal Society of New Zealand and Radio New Zealand;2004. Replay Radio NRP663.1.

^bHicks G, Campell H, editors. Awesome forces: the natural hazards that threaten New Zealand. Wellington: Te Papa Press, Museum of New Zealand in association with the Institute of Geological and Nuclear Sciences and the Earthquake Commission; 1998.

^cWorthy TH, Holdaway RN. The lost world of the moa: prehistoric life in New Zealand. Bloomington: Indiana University Press;2002. p. xviii.

^dHepburn S. Otago fossil findings questioned. Otago Daily Times 2006 Dec 21:8 (col. 1-4).

^eTennyson A, Martinson P. Extinct birds of New Zealand. Wellington: Te Papa Press; 2006.



Although moa is the word in common use now to describe the large ratites of New Zealand a number of other words, in Latin, Maori and English, have also been used. Worthy and Holdaway note that because moa is a Maori word and no “s” is used at the end of a word to denote the plural in Maori, the word “moa” is commonly used to mean both singular and plural.^a Evison notes that it has been asserted that when writing in English it is culturally insensitive to use the plural or possessive “s” with Maori words because in Maori there is no letter “s”.^b He notes however that in the Maori language, nouns are shown as singular or plural by the definite article that precedes them with “te” for singular and “nga” for plural. In English the definite article “the” is used for both singular and plural, so that the plural requires an inflexion to the noun itself, usually an “s”. As the present work is being written in English, and the word moa has been adopted into the English language together with the plural form of moas,^c the convention used by Evison will be followed in this book with moas rather than moa being used to describe several of the birds.

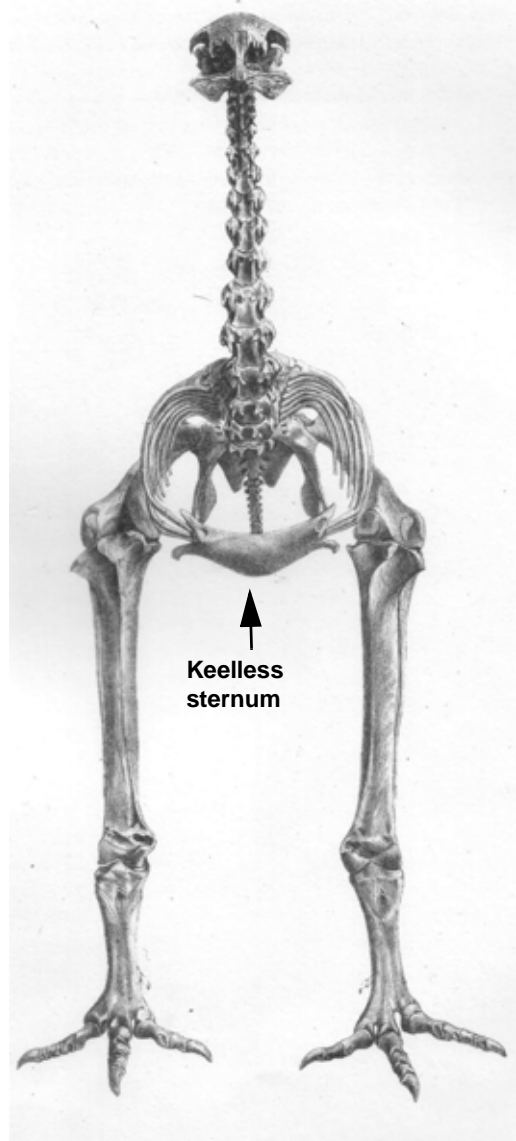


Figure 1.2. Skeleton of *Dinornis parvus* showing the keelless sternum. From Owen R. On *Dinornis* (Part XXIII): containing a description of the skeleton of *Dinornis parvus*, Owen. Transactions of the Zoological Society of London 1885;XI:233-56.

^aWorthy TH, Holdaway RN. The lost world of the moa: prehistoric life in New Zealand. Bloomington: Indiana University Press; 2002. p. 47.

^bEvison HC. The Ngai Tahu Deeds: a window on New Zealand history. Christchurch: Canterbury University Press; 2006. p. 14-5.

^cAllen RE, editor. Fowler HW, Fowler FG, first editors. The concise Oxford dictionary of current English. 8th ed. Oxford: Oxford University Press; 1990. p. 761.



Rather than moa being the name of a bird it refers to a number of species of birds which varied in characteristics such as size and the habitats they lived in.

In *Dictionary of the Maori language*, by HW Williams, moa is defined as *Dinornis gigantea* and other species, and extinct birds of the order Dinornithiformes.^a

Te Rangi Hiroa (Sir Peter Buck) has noted that throughout Polynesia the name moa was applied to the domestic fowl, a descendant of the jungle fowl (*Gallus gallus*) of the Malaysian region.^{b,c}

Although it has undergone various changes, it was considered that there could be no doubt that it had been brought from that area into central

Polynesia, along with the pig and dog, by the early ancestors of the Polynesians. The domesticated fowl (moa) was carried to the Hawaiian Islands in the north and to Easter Island in the far east. In Hawaii some were trained for cock fighting but their main use was for food. Of the three Polynesian introduced animals, only the dog reached New Zealand where, from the presence of the word moa in a few Maori references, it seemed evident, to Te Rangi Hiroa, that the first settlers, having no introduced moa, applied the spare name to a local bird which appealed to them as



Photo by B Spittle.

Figure 1.3. Ostriches in an Australian gamepark.

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^aWilliams HW. *Dictionary of the Maori language*. 7th ed, revised and augmented by the Advisory Committee on the Teaching of the Maori Language, Department of Education. Wellington: Legislation Direct; 1971.

^bTe Rangi Hiroa (Buck P). *The coming of the Maori*. 2nd ed. Wellington: Maori Purposes Fund Board and Whitcombe and Tombs; 1970. p.19–23.

^cTe Rangi Hiroa (Buck PH). *Arts and crafts of Hawaii*. Bernice P Bishop Museum special publication 45. Honolulu: Bishop Museum Press; 1957.



furnishing an even better supply of food than the domesticated fowl which they knew in the homeland.



Photo by B Spittle.

Figure 1.4. Ostrich in an Australian gamepark.

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Photo by B Spittle.

Figure 1.5. Emus in an Australian reserve.



Figure 1.6. Emu at Kings Creek Station, Australia.

Photo by B Spittle.

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Figure 1.7. Emus in the Australian outback.

Photo by B Spittle.



Photo by Tom Davis © 2005.

Figure 1.8. Greater Rhea (*Rhea americana*). Photo taken in Chapada dos Guimarães, Brazil by Tom Davis, 2005. Home page for Tom Davis: <http://www.geometer.org>



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Photo by Tom Davis © 2006.

Figure 1.9. Greater Rhea (*Rhea americana*). Photo taken just outside the Emas National Park in Brazil. by Tom Davis, October 2006. Ema is the Brazilian (Portuguese) word for rhea. Hundreds of the birds are present in the farmed fields outside the park and relatively few in the park itself.





Figure 1.10. Cassowaries at an Australian gamepark.

Photo by B Spittle.

The scientific names, in Latin, continue to change as views change on the number of species. In 1941 Archey^a listed 20 species (Table 1.1), in 1949 Oliver^b found 29 species (Table 1.2), in 2003 the number was reduced from 11 to 10, following work on

^aArchey G. The moa: a study of the *Dinornithiformes*. Bulletin of the Auckland Institute and Museum No. 1. Auckland: Unity Press; 1941.

^bOliver WRB. The moas of New Zealand and Australia. Dominion Museum Bulletin No. 15. Wellington: Dominion Museum; 1949.



ancient mitochondrial DNA sequences which showed that three *Dinornis* species found throughout New Zealand were genetically indistinguishable within each island but formed separate North and South Island clades^{a,b} (Table 1.3), and in a nomenclature proposed in 2006 the number was reduced to 9 (Table 1.4).^{c,d} In addition to there being a variety of common English names (Table 1.5) a number of Maori names exist (Table 1.6) which can not be precisely matched to the scientific names.^e

Paul Martinson has illustrated how the different species may have appeared.^f The colour red does not appear in any of his portrayals although it is mentioned in some of the Maori names and sightings.

Table 1.1 The Archey taxonomy of moas, 1941

Order: Dinornithiformes					
Family: Anomalopterygidae				Family: Dinornithidae	
Subfamily: <i>Anomalopteryginae</i>			Subfamily: <i>Emeinae</i>		
Genus: <i>Anomalopteryx</i> Reichenbach, 1852	Genus: <i>Megalapteryx</i> Haast, 1886	Genus: <i>Pachyornis</i> Lydekker, 1891	Genus: <i>Emeus</i> Reichenbach, 1852	Genus: <i>Euryapteryx</i> Haast, 1874	Genus: <i>Dinornis</i> Owen, 1843
<i>Anomalopteryx didiformis</i> (Owen), 1844	<i>Megalapteryx didinus</i> (Owen), 1883	<i>Pachyornis elephantopus</i> (Owen), 1856	<i>Emeus crassus</i> (Owen), 1846	<i>Euryapteryx gravis</i> (Owen), 1870	<i>Dinornis novae-zealandiae</i> Owen, 1843
<i>Anomalopteryx antiquus</i> Hutton, 1892	<i>Megalapteryx benhami</i> Archey, 1941	<i>Pachyornis pygmaeus</i> (Hutton), 1891	<i>Emeus huttonii</i> (Owen), 1879	<i>Euryapteryx geranoides</i> (Owen), 1848	<i>Dinornis igens</i> Owen, 1844
		<i>Pachyornis mappini</i> Archey, 1941		<i>Euryapteryx exilis</i> Hutton, 1897	<i>Dinornis giganteus</i> Owen, 1844
		<i>Pachyornis oweni</i> (Haast), 1886		<i>Euryapteryx curtus</i> (Owen), 1846	<i>Dinornis torosus</i> Hutton, 1891
					<i>Dinornis robustus</i> Owen, 1846
					<i>Dinornis maximus</i> Haast, 1869

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The names of species have three components: the genus, the species, the author and the date when the species was named may also be given, e.g., *Dinornis robustus* Owen, 1846 means that in 1846 Owen named the species *robustus* in the genus *Dinornis*. When the authors name is in brackets it means the author named the species but did so in a different genus, e.g., *Anomalopteryx didiformis* (Owen), 1844 means that in 1844 Owen named the species or taxon *didiformis* but did not do it in the genus *Anomalopteryx*. In this case he erected it within the genus *Dinornis* as *Dinornis didiformis* Owen.

^aBunce M, Worthy TH, Ford T, Hoppitt W, Willerslev E, Drummond A, Cooper A. Extreme reversed sexual size dimorphism in the extinct New Zealand moa *Dinornis* [letter]. Nature 2003;425:172-5.

^bHuynen L, Millar CD, Scofield RP, Lambert DM. Nuclear DNA sequences detect species limits in ancient moa [letter]. Nature 2003;425:175-8.

^cWorthy TH, Holdaway RN. The lost world of the moa: prehistoric life in New Zealand. Bloomington: Indiana University Press; 2002. p. 78.

^dBunce M, Worthy TH, Ford T, Hoppitt W, Willerslev E, Drummond A, Cooper A. Extreme reversed sexual size dimorphism in the extinct New Zealand moa *Dinornis* [letter]. Nature 2003;425:172-5.

^eBeattie H. The moa: when did it become extinct? Maori traditions and pakeha conjectures. Four main schools of thought. One hundred opinions of Maori and Pakeha. Waimate: Herries Beattie; 1953. p. 6-7.

^fTennyson A, Martinson P. Extinct birds of New Zealand. Wellington: Te Papa Press; 2006.



Table 1.2 The Oliver taxonomy of moas, 1949

Order: Dinornithiformes						
Family: Anomalopterygidae					Family: Dinornithidae	
Subfamily: <i>Anomalopteryginae</i>		Subfamily: <i>Emeinae</i>				
Genus: <i>Anomalopteryx</i> Reichenbach, 1852	Genus: <i>Megalapteryx</i> Haast, 1886	Genus: <i>Pachyornis</i> Lydekker, 1891	Genus: <i>Emeus</i> Reichenbach, 1852	Genus: <i>Euryapteryx</i> Haast, 1874	Genus: <i>Zelornis</i> Oliver, 1949	Genus: <i>Dinornis</i> Owen, 1843
<i>Anomalopteryx oweni</i> (Haast), 1896	<i>Megalapteryx hectori</i> Haast, 1886	<i>Pachyornis (Maiornis) septentrionalis</i> Oliver, 1949	<i>Emeus huttonii</i> (Owen), 1879	<i>Euryapteryx curtus</i> (Owen), 1846	<i>Zelornis exilis</i> (Hutton), 1897	<i>Dinornis gazella</i> Oliver, 1949
<i>Anomalopteryx parvus</i> (Owen), 1883	<i>Megalapteryx didinus</i> (Owen), 1883	<i>Pachyornis (Maiornis) mappini</i> Archey, 1941	<i>Emeus crassus</i> (Owen), 1846	<i>Euryapteryx tane</i> Oliver, 1949	<i>Zelornis haasti</i> (Rothschild), 1907	<i>Dinornis novae zealandiae</i> Owen, 1843
<i>Anomalopteryx didiformis</i> (Owen), 1844	<i>Megalapteryx benhami</i> Archey, 1941	<i>Pachyornis (Pounamua) murihiku</i> Oliver, 1949		<i>Euryapteryx geranoides</i> (Owen), 1848		<i>Dinornis torosus</i> Hutton, 1891
<i>Anomalopteryx antiquus</i> Hutton, 1892		<i>Pachyornis (Pachyornis) australis</i> Oliver, 1949		<i>Euryapteryx gravis</i> (Owen), 1870		<i>Dinornis igens</i> Owen, 1844
		<i>Pachyornis (Pachyornis) elephantopus</i> (Owen), 1856				<i>Dinornis robustus</i> Owen, 1846
		<i>Pachyornis queenslandiae</i> (De Vis), 1884				<i>Dinornis hercules</i> Oliver, 1949
						<i>Dinornis giganteus</i> Owen, 1844
						<i>Dinornis maximus</i> Haast, 1869

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THE CURRENTLY ACCEPTED DATE OF MOA EXTINCTION

The previously accepted date of moa extinction, based on the serial overkill model, of about A.D. 1600–1650 has now been replaced by the currently accepted date, using the rapid “blitzkrieg” extinction model, of about A.D. 1350–1450.^{a,b}

^aHoldaway RN, Jacomb C. Rapid extinction of the moas (Aves: Dinornithiformes): model, test, and implications. *Science* 2000;287:2250-4.

^bTennyson A, Martinson P. Extinct birds of New Zealand. Wellington: Te Papa Press; 2006.



Table1.3 The Worthy and Holdaway taxonomy of moas, 2002

Order: Dinornithiformes Gadow		
Family: Emeidae (Bonaparte)		Family: Dinornithidae Bonaparte
Subfamily: <i>Anomalopteryginae</i> (Oliver)	Subfamily: <i>Emeinae</i> Bonaparte	
<i>Anomalopteryx didiformis</i> (Owen)	<i>Eurapteryx geranoides</i> (Owen)	<i>Dinornis novaezealandiae</i> Owen
<i>Megalapteryx didinus</i> (Owen)	<i>Eurapteryx curtus</i> (Owen)	<i>Dinornis robustus</i> Owen
<i>Pachyornis elephantopus</i> (Owen)	<i>Emeus crassus</i> (Owen)	
<i>Pachyornis mappini</i> Archey		
<i>Pachyornis australis</i> Oliver		

The names of species have three components: the genus, the species, the author, e.g., *Dinornis robustus* Owen means that Owen named the species *robustus* in the genus *Dinornis*. When the authors name is in brackets it means the author named the species but did so in a different genus, e.g., *Anomalopteryx didiformis* (Owen) means that Owen named the species or taxon *didiformis* but did not do it in the genus *Anomalopteryx*. In this case he erected it within the genus *Dinornis* as *Dinornis didiformis* Owen.

Table1.4 The Tennyson and Martinson taxonomy of moas, 2002

Order: Dinornithiformes Gadow		
Family: Emeidae (Bonaparte)		Family: Dinornithidae Bonaparte
Subfamily: <i>Anomalopteryginae</i> (Oliver)	Subfamily: <i>Emeinae</i> Bonaparte	
<i>Anomalopteryx didiformis</i> (Owen)	<i>Eurapteryx curtus</i> (Owen)	<i>Dinornis novaezealandiae</i> Owen
<i>Megalapteryx didinus</i> (Owen)	<i>Emeus crassus</i> (Owen)	<i>Dinornis robustus</i> Owen
<i>Pachyornis elephantopus</i> (Owen)		
<i>Pachyornis geranoides</i> (Owen)		
<i>Pachyornis australis</i> Oliver		

The names of species have three components: the genus, the species, the author, e.g., *Dinornis robustus* Owen means that Owen named the species *robustus* in the genus *Dinornis*. When the authors name is in brackets it means the author named the species but did so in a different genus, e.g., *Anomalopteryx didiformis* (Owen) means that Owen named the species or taxon *didiformis* but did not do it in the genus *Anomalopteryx*. In this case he erected it within the genus *Dinornis* as *Dinornis didiformis* Owen.

The serial overkill extinction model

In his scholarly and comprehensive book on the moa, *Prodigious birds: moas and moa-hunting in prehistoric New Zealand*, Atholl Anderson notes that four types of evidence have been considered in assessing the time of extinction: alleged sightings by Europeans, Maori recollections or traditions, apparently recent remains of moas, and archaeological evidence^a (Figure 1.11).

He found 46 European accounts alleging encounters with moas. Direct sightings were involved in 23 of the claimed encounters. He noted that nearly all the alleged sightings occurred in the period 1850–1880 following scientific knowledge of moa becoming available in about 1842.

^aAnderson S. *Prodigious birds: moas and moa-hunting in prehistoric New Zealand*. Cambridge: Cambridge University Press; 1989. p. 171-87.



Table 1.5 Some names used by Maori for moas

Name	English translation and comments	
Tarepo [§]	<i>Strigops habroptilus</i> , owl parrot, ground parrot, kakapo. [†] The kakapo is not a moa however. Taylor reported that Maoris at Waiapu in 1839 described a moa bone as coming from a very large bird called the tarepo.	
Te kiwi-nui*	[nui = large]. [†] The big kiwi. One of the smaller kinds thought to be like a big kiwi. The smallest kind of moa.*	
Te kiwi-papa-whenua*	Beattie commented that Richard Taylor said that the South Island natives also mentioned a great bird called the kiwi-papa-whenua that was some seven feet in height.*	
Te kura-nui*	[kura = red feathers; nui = large]. [†] . The big red or big red feathers. A large bird with a reddish-brown plumage.* A shortened form of Te moa-kuri-nui.*	
Te manu-nui	[manu = bird; nui = large]. [†] The big bird. A common name for all the species.	
Te manu-whakatau	[manu = bird]. [†] A possible meaning of whakatau is making a noise, report or barking sound. A possible meaning is a bird that makes a noise.	
Te moa*. [‡]	The moa generally. [‡] In the South Island the Katimamoe probably brought in the name moa with their predecessors the Waitaha having used the names Pouakai, Poua and Poua-riki.*	
Te-moa-huru-nui [‡]	[huru = hair; nui = large]. [†] The hair-covered or hairy moa. [‡]	
Te moa-iti*	[iti = small]. [†] A little moa. A kind bigger than te kiwi-nui.* The Katimamoe called the smallest moa moa-iti.* A species that had plumage like the tokoweka which was different from the roa with plumage that was light brown, varied and with a small goldy check.* The tokoweka and roa were night birds like the kiwi.*	
1 Te moa-kura*. [‡]	[kura = red feathers]. [†] The moa with red feathers. The handsome (most prized, rare) moa. [‡] Possibly a moa with reddish-brown plumage.* A small moa with plumage that reminded Maori of a weka rather than a kiwi.*	1
1 Te moa-kura-nui [‡]	[kura = ornamented with feathers; nui = large]. [†] The large-feathered or large-quilled moa. [‡] A large moa with plumage that reminded Maori of a weka rather than a kiwi.*	1
13 Te moa-kura-rua [‡]	[kura = ornamented with feathers, rua = two]. [†] The double-feathered or double-quilled moa. [‡]	13
Te moa-nui*. [‡]	[nui = large]. [†] The big moa, the great (largest sized) moa. [‡] A heavy kind. The Katimamoe called the large moa moa-nui.*	
Te moa-rau-nui [‡]	[rau = a cluster or crest of feathers, other than tail feathers which are named remu [†]]. The large-feather-clustered moa. [‡]	
Te moa-riki*. [‡]	[riki = small]. [†] The little moa. [‡] A kind bigger than te kiwi-nui.*	
Te moa-teitei*	[teitei = high, tall, lofty]. [†] The lofty moa.* The Katimamoe called the tallest kinds moa-teitei whereas the Waitaha had called them Poua-kai.*	
Te poua*	[poua = old person, grandfather]. [†] The old man or grandfather. A name for the big kinds. The Waitaha called the bird poua.*	
Te poua kai*	[poua = old person, grandfather; kai = food].The large-feather-clustered moa The old man for food. A name for the big kinds, these having a big appetite and able to eat a lot of food. The Waitaha called the largest kind pouakai.*	
Te poua-riki*	[riki = small]. [†] A smaller kind of moa. The Waitaha called the smallest kind poua-riki.*	
Te weka-nui*	[nui = large]. [†] A term used in a North Island account to describe a bird with plumage reminding Maori of a weka.*	

[§]Taylor R. An account of the first discovery of moa remains. Transactions and proceedings of the New Zealand Institute 1872;V:97-101.

*Beattie H. The moa: when did it become extinct? Maori traditions and pakeha conjectures. Four main schools of thought. One hundred opinions of Maori and Pakeha. Waimate: Herries Beattie; 1953. p. 6-7.

[†]Williams HW. Dictionary of the Maori language. 7th ed. Wellington: Legislation Direct; 1971, reprinted 2001.

[‡]Hongi H (Stowell HM). Kuranui as a name for the moa. Journal of the Polynesian Society 1916;25:66-7.



Table 1.6. Some common names for moas

Common name	Scientific name
Crested moa*†	<i>Pachyornis australis</i>
Eastern moa*†	<i>Emeus crassus</i>
Giant moa*	<i>Dinornis giganteus</i>
Heavy-footed moa*†	<i>Pachyornis elephantopus</i>
Large bush moa,* North Island giant moa†	<i>Dinornis novaezealandiae</i>
Little bush moa*†	<i>Anomalopteryx didiformis</i>
Slender moa*	<i>Dinornis struthoides</i>
Stout-legged moa†	<i>Eurapteryx curtus</i>
Stout-legged moa*	<i>Eurapteryx geranoides</i>
Mantell's moa†	<i>Pachyornis geranoides</i>
Upland moa*	<i>Megalapteryx didinus</i>

*McGlone M, Wardle P, Worthy T. Environmental change since the last glaciation. In: Darby J, Fordyce RE, Mark A, Probert K, Townsend C, editors. The natural history of southern New Zealand. Dunedin: University of Otago Press in association with the Otago Museum; 2003. p. 105-28.

† Tennyson A, Martinson P. Extinct birds of New Zealand. Wellington: Te Papa Press; 2006.

The exception to this was some peculiar tales collected at a later date by a missionary-traveller Rev. Richard Taylor. Anderson observed that nearly all the alleged sightings were made by recently-arrived immigrants and gold-miners rather than by the various explorers, surveyors, missionary-travellers or scientists. The view was given that during the 60 years prior to 1842, from about 1780 to 1840, none of the various explorers, surveyors or missionary-travellers saw anything remotely resembling a moa and that neither they nor any European scientists ever claimed to see a moa at any subsequent stage. In two articles, Anderson discusses the details of a number of sighting claims and concludes that none of the 23 claimed sightings involved Dinornithiformes and thus were of no value in assessing the date of moa extinction.^{a,b}

The Maori evidence is summarized in 60 references. A quarter of the references suggest moa extinction in the remote past, often at the time of fires associated with Tamatea. Anderson considers that the Tamatea Period could be fairly considered as the Maori era prior to about A.D. 1500. Another quarter of the references place moa extinction in the period of early 17th to late 18th centuries. Most accounts (26) however, refer extinction to the time between early European exploration *circa* (c.) 1770 and extensive colonization in the 1840s. Some regional differences were present with the Tamatea Period being suggested as the time for the disappearance of moa in the East Coast-Bay of Plenty area; survival into the 19th century being believed for Wellington, Wanganui, and Taranaki; extinction in the 17th or earlier being reported

^aAnderson A. On evidence for the survival of moa in European Fiordland. *New Zealand Journal of Ecology* 1989;12(Suppl):39-44.
^b



by Canterbury informants; and further south both the Tamatea Period and the 19th century being favoured. Difficulties with interpretation were seen to be present in making distinctions between moa and mythological “moa” and whether or not reference to fathers and grandfathers should be taken literally. The point of greatest difficulty was seen to be in accepting that moa could have survived into the period 1770–1840 without much clearer traditions about moa names, biology or associations with Maoris. He notes that somewhere among the numerous references there may be one or two which are literally accurate but, as in other traditional evidence about moa, it now seemed impossible to extract them. He concluded that the period of moa extinction, or periods, if it occurred at different times between regions or species, could only be investigated, therefore, in terms of tangible evidence.

Anderson noted that evidence of desiccated moa soft tissues, possible moa trails, and moa bones lying on the surface of the ground have been adduced as supporting the proposition that moas survived into recent times. He noted that, as desiccated remains were unable to be dated until the availability of radiocarbon dating and there was general agreement that they could be hundreds of years old, they were not able to contribute substantially to the evidence about the date of moa extinction. It was seen that there was now no way of telling if there was any substance to the assertions that certain tracks or trails had been made by moa. With the survival span for moa bones exposed to the weather being about 15 years, the finding of moa bones lying on the surface of the ground and not apparently exposed by erosion was seen to indicate the very recent survival of the birds.



Photo by permission of The Royal Society of New Zealand

Figure 1.11. Professor Atholl J Anderson, CNZM FRSNZ.



It is noted that some of the surface bones were not fresh at all but “in a very decayed condition” and that it was likely that some surface bones were old bones that had been exposed by increased burning, soil erosion, or landslips or had been better preserved because of dry conditions such as being under a rock shelter.

The period of moa extinction was able to be estimated by carbon dating of archaeological evidence. Since there were numerous dates on all materials which fall into the period 400–500 before the present (yr B.P.), it was concluded that, with the present evidence, moa-hunting probably did not continue later than 400 yr B.P. or A.D. 1600. Anderson commented that how much later all moas were extinct could only be guessed at. With the serial overkill model, the moa-hunting period was estimated to have began about 900 years yr B.P., was most widespread and intensive in both main islands by about 650 yr B.P., and had ceased by 400 B.P. It was considered to be very unlikely that moas survived much longer than that date, about 1600.^{a,b} The date of extinction with the serial overkill model was about 1600–1650.

The rapid “blitzkrieg” extinction model

Peter Buck (Te Rangi Hiroa) considered that the paucity of references to the moa in the traditions of the Fleet ancestors was because they arrived after the moa in New Zealand had been exterminated by the earlier settlers. In his view the earliest human occupants quickly exterminated the moa, first in the North Island and later in the South, and it happened before the great fleet migration of A.D. 1350 brought the ancestors of the present Maori tribes, whose legends have preserved vague accounts of moa from the earlier Polynesian folk who were believed to have already occupied the land for some generations.^c

Holdaway and Jacomb applied a standard Leslie matrix population model, supported by carbon-14 dating of early occupation layers lacking moa remains, to explore the possibility of rapid extinction by human predation.^d They found that human hunting and habitat destruction drove all the species of moa to extinction less than 100 years after Polynesian settlement of New Zealand. This rapid “blitzkrieg” extinction contrasted with the previously held serial overkill view that required several hundred years of gradual population attrition by hunting and habitat loss for extinction to occur.

Holdaway and Jacomb calculated the simulated declines in moa populations, measured by the number of female moa, caused by human predation, with and without habitat loss. The simulations showed that moa, like most long-lived birds were very

^aAnderson A. Mechanics of overkill in the extinction of New Zealand moas. J Archaeol Sci 1989;16:137-51.
^bAnderson A. Prodigious birds: moas and moa-hunting in prehistoric New Zealand. Cambridge: Cambridge University Press; 1989. p. 190-1.
^cBuck P (Te Rangi Hiroa). Vikings of the sunrise. Christchurch: Whitcombe and Tombs; 1954.
^dHoldaway RN, Jacomb C. Rapid extinction of the moas (Aves: Dinornithiformes): model, test, and implications. Science 2000;287:2250-4.



vulnerable to any increase in adult mortality. When subjected to even a low level of human predation, moa required a disproportionate and impossible increase in recruitment to maintain their numbers. Even without habitat loss, the most conservative simulation suggested that moa were effectively extinct within 160 years of human colonization. Substantial areas of habitat were in fact lost in the settlement period together with their moa populations. When the combination of habitat loss and the growth rate of the human population were considered, the “most likely” scenario resulted in moa extinction 50 years after colonization. Whereas the orthodox model for extinction suggested moa numbers began to decline around A.D. 1000 with most of the decline occurring in the period A.D. 1280–1500 years, the Leslie matrix analysis suggested the decline commenced about A.D. 1280 and was complete by A.D. 1330 (200 people with habitat loss) to A.D. 1440 (100 people with no habitat loss).

To test the conflicting orthodox and Leslie matrix models it was necessary to determine when moa hunting ceased. Evidence to support the Leslie matrix model was found in a series of radiocarbon dates establishing a chronology for Monck’s Cave near Christchurch in the South Island. From the artifacts found at this site, it was seen to be a transitional one between the early archaeological sites of the “Archaic” or “Moa-hunter” period where abundant moa remains indicated the birds were major items of diet immediately after colonization, and sites from the later “Classic” Maori period which lacked evidence of moa exploitation and were characterized by earthwork fortifications and occupation deposits indicating reliance on fish, shellfish, and plants for food. Although it was in an area where moa hunting had been extensively practised and was close to a major moa-hunter site at Redcliffs, Monck’s Cave lacked evidence of moa consumption. Dating the occupation layers was able to provide a local terminal date for moa, assuming that people were likely to eat moa meat if it was available within human foraging range of the site. The dates showed that moa were not available to the people in the area from the late 14th century onward. When considered with the evidence of human arrival in the late 13th century, this strongly supported the rapid extinction model rather than the orthodox gradual extinction one.

Holdaway and Jacomb observed that the rapid extinction model implied that the number of moa preserved in a site could be directly related to the moa population in that area. When the population was small enough to be exterminated in less than 10–20 years, as in most parts of the North Island, a site could contain most of the moa population alive in that area when people arrived. The Leslie matrix model suggested moa-hunting occurred in the North Island from A.D. 1280–1350 with most of the activity being in the A.D. 1280–1310. Similarly in the South Island moa-hunting occurred from A.D. 1280–1400 with most activity being from A.D. 1280–1380.



In a perspective on this work, Jared Diamond noted the earlier leisurely time scale of moa extinction had been overturned.^a Whereas it had been thought that Maoris arrived in the first millennium AD and the last moas survived until around the time that the Europeans discovered New Zealand in 1642, it was now considered that the Maoris arrived later and the moa vanished earlier than had been assumed. It was seen that the descendants of a few boatloads of Maori colonists could have wiped out 160,000 moa within a few years because of the nature of the moa life cycle. Moa were long-lived and slow to mature. They did not begin to breed until 5 years of age and laid clutches of only one or two eggs. Their reproductive peak was not reached until 12 years of age and then they could rear barely one chick per year. Diamond commented that, to anyone who had hiked over New Zealand's incredibly rugged terrain, it was staggering to suggest that a few Maoris, in a few decades, could have found and killed every single individual of the dozen moa species, with an initial population estimated at 160,000 birds. However his conclusion was that there was a blitzkrieg and a few people could and did kill every moa. At the time when all the moa had been eliminated from 270,000 km² of some of the world's most rugged territory, the Maori population still numbered under 1000. Diamond states that finding every moa was easy for the Maori and that within a generation they had also found all sources of stones in New Zealand that were useful in toolmaking.

1 Worthy and Holdaway also refer to the work of Holdaway and Jacomb and note that 1
 1 archaeological evidence indicates that moas were rare or nonexistent in the diet of 1
 18 former moa hunters less than a century after human settlement began.^b They observe 18
 that for most North Island areas, whose original vegetation was wet, multistorey forest
 whose carrying capacity seemed to have been rather less than eastern drier areas, the
 period of moa hunting is likely to have been breathtakingly short. On the Coromandel
 Peninsula they suggest that the moa population may have survived for less than a
 decade after human settlement and perhaps for as few as 5 years. Throughout the
 North Island, the biological and archaeological evidence together suggest that the
 period was briefer overall than in the South Island. Their conclusion is that although
 small groups of moas must have survived in more remote locations, the main
 populations were extinct by 600 yr B.P. or A.D. 1400. The authors comment that this
 would have increased the pressure on the relict populations, as hunters sought fewer
 birds. Increased rarity may well have been a challenge that hunters could not ignore.
 There would have been great honour or mana for the hunter who could catch
 something so rare and valuable. It is stated that moas can be heard no more and that
 there were almost certainly no more moas to make any sound by the time Captain
 James Cook landed in New Zealand in 1769. It was considered that if any were to be

^aDiamond J. Blitzkrieg against the moas. *Science* 2000;287:2170-1.

^bWorthy TH, Holdaway RN. The lost world of the moa: prehistoric life in New Zealand. Bloomington: Indiana University Press;2002. p. 546-7.



heard at all, Cook was probably in the right place in Dusky Sound, Fiordland, as one of the remote, wet, upland valleys of that region was where the last moas probably survived. They comment that no believable descriptions of moas have been handed down in Maori mythology and certainly none were recorded until after Owen described the first bones in 1840. Moas were considered to have disappeared from the menu between 400 years and 300 years prior to Cook’s visit, about 650–550 yr B.P., or A.D. 1350–1450

Thus there is a general agreement on the date of moa extinction of about A.D. 1350–1450. What then is to be made of the claims made after A.D. 1500 of live moa being sighted or other evidence indicating the recent existence of moa?

THE CURRENT EXPLANATION FOR SIGHTING CLAIMS AFTER A.D. 1769

The hypothesis of Anderson to explain the sighting claims was that they involved visions of moas or reports of visions rather than actual moa sightings.^a The implication was that the person making the report was experiencing an hallucination in which something was seen without it having any basis in reality or that an illusion was involved in which an object actually present was mistaken for a moa. He proposed the class of ‘colonial moa’ analogous to ‘colonial goose’. Just as ‘colonial goose’ is actually a dish of rolled, stuffed mutton flap which is goose-like but has no goose, so ‘colonial moa’ appears to be a moa but in reality no moa is present.

Anderson’s psychological hypothesis for visions of “colonial moa” starts with the idea that people who see visions or report having seen them are likely to be under some sort of unusual stress. Those reporting the visions were experiencing the stress of migration with the challenges of making a living in difficult circumstances, coping with an unfamiliar landscape and climate, dealing with a new social milieu with different standards of social and moral behaviour, and adjusting to the loss of family and friends. In this setting feelings of helplessness, frustration and aggression might emerge giving rise to an intense longing for the familiar or homesickness. For some this could progress to the illness of migrant psychosis. These anxieties were seen to be likely to be of greater intensity in recent immigrants particularly those who had lacked opportunities for a wider variety of experiences through being poorer or less educated. The balance between colonial opportunities and perils, for such people, was seen to be a fine one. Although in rural districts there was opportunity for social advancement there was also the possibility of rapid social decline. For small subsistence farmers, shepherds or prospectors far from settlements whose only social intercourse was of the most rudimentary kind the distance between their unsocial existence and that of a savage was uncomfortably short.

^aAnderson A. The beast without: the moa as a colonial frontier myth in New Zealand. In: Willis RG, editor. Signifying animals: human meaning in the natural world. London: Unwin Hyman; 1990. p. 236-45.



Anderson saw that the problem was exacerbated by the desire to push across the frontier and farther still from civilization. For the poorer or less clever colonist who was the loser in the brisk competition of colonial life the grass may have appeared greener on the other side of the frontier fence. However, the dreams of what lay there would be accompanied by fears of the unknown. The wilderness was a source of considerable anxiety to the recent colonist. Released from a familiar landscape, society and social order the colonist was confronted with increasing unfamiliarity and disorder as he moved closer to the wilderness, but he was compelled towards that goal by the aspirations, or desperation, that prompted his migration in the first place. His fear was that the geographical and social disorder would upset his own moral and psychological order and that the wilderness would induce in him the appropriate moral degeneracy of a disordered world and reduce him to the status of a savage or wild man.

Anderson considered that the Wild Man was an image of individual moral and material dissolution. It is an image of personal rather than group decline and he is seen to inhabit the immediate confines of the community being just out of sight, over the horizon, or in the nearby forest and to be black, deformed, and covered with hair. He is seen to be an image of man released from social control. The colonial moa was seen to be a sufficient model for the Wild Man image to inhabit. It was seen to be tall, upright, rather slim, bipedal, covered with feathers or having a woolly appearance, and sometimes having large heads or eyes. The colonial moa had sufficient ambiguity to pass for both a degenerate human being and a morphologically adequate moa.

Anderson argued that if our fear of our capacity for uninhibited behaviour, especially violence, was metaphorically designated as the Beast Within, then fear of what we might become in situations beyond our present experience might be regarded as the Beast Without. The fears involved with each of these Beasts could be seen to be the same, involving a loss of civilized standards of social and moral behaviour. The Beast Without was seen to be also the Beast Within. The colonists at the frontier were considered to have feared themselves and sometimes projected their fears into warning visions of quasihuman moa.

Anderson has considered the evidence from alleged sightings by Europeans, Maori recollections or traditions, apparently recent remains of moa, and archaeological evidence and found no evidence that moa-hunting continued later than 400 yr B.P. He found no evidence that any European saw a moa and proposed a complex psychological explanation, involving visual hallucinations in recently arrived settlers under cultural stress in a new land, to account for the sighting claims.

The capacity to entertain beliefs not based in reality appears to be intrinsic to the human condition. When a situation becomes unendurable and appears unable to be changed, one way out may involve altering one's beliefs about the nature of one's



personal world. In classical psychodynamic theory, a person feeling powerless, unnoticed, and insignificant may deal with this by adopting, unconsciously, a paranoid stance and believe that they are the centre of attention of others and being persecuted.^a It may be easier to cope with being persecuted than feeling insignificant. A person struggling to cope with the emptiness of a major loss may change to experience the opposite, believing that they are wealthy and important, feeling on top of the world, and behaving in a disinhibited, extravagant way that causes concern to those who care for them. Being grandiose may be easier to cope with than being hopeless and helpless. When death robs someone of a loved person the wish to remain close may lead to an acceptance of believing in the capacity to communicate with the spirit of the dead person through a medium. At a cultural level certain beliefs about the nature of the world may similarly involve a distortion of reality but be held with sincerity and tenacity and not be open to examination, as if such questioning might lead to a fragmentation of the society. Believing in a realist God and knowing that a heaven will allow reunion with loved ones may for some lessen the pain of loss or the threat of loss. When a belief not based on reality is normal for a social group it is, by definition, culturally acceptable and not considered a delusion, although the mechanisms involved and the function served by the belief system may be similar to those present in a delusional individual.

1 In line with this capacity, the potential exists for unconsciously suspending critical
1 judgement and believing credulously in the existence of a world inhabited by a variety
21 of shadowy, mysterious creatures.

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IS THERE A MYSTERY?

The question arises as to whether there truly is a sense of mystery associated with moa sighting claims in New Zealand. Mystery, like beauty, may lie in the eye of the beholder.^b The essence of mystery is a genuine sense of uncertainty. When Lindsay Buick wrote *The mystery of the moa* in 1931 information about moa was less freely available and the topic could rightly be seen to involve mystery.^c However, in 2009 the area of mystery about the moa, for most naturalists, might be seen to lie more in elucidating developmental lines through the study of ancient DNA rather than considering moa sighting claims. It may be reasonable to consider that the phenomenon of sighting claims has been extensively studied and a sufficient explanation found in the form of a complex psychological mechanism. Interest in reconsidering moa sighting claims might be inspired more by the hope that an idyllic natural world with moa still existed in a remote corner of New Zealand rather than there being evidence to support this possibility.

^aCameron N. Personality development and psychopathology: a dynamic approach. Boston: Houghton Mifflin;1963.
^bMargaret Wolfe Hungerford, 1855–1897, wrote in *Molly Bawn*, 1878, "Beauty is in the eye of the beholder".
^cBuick TL. The mystery of the moa: New Zealand's avian giant. New Plymouth: Thomas Avery & Sons under the auspices of The Board of Maori Ethnological Research; 1931.



Acknowledgement of moa extinction and the need to focus efforts of preserving currently endangered species was made in remarks in 2001 by John W. Fitzpatrick, Louis Agassiz Fuertes Director, Cornell Laboratory of Ornithology and President, American Ornithologists’ Union in the foreword to *The Takahe: fifty years of conservation management and research* with the remarks, “We will never bring back the moa. Lament if you will, but do not give up the effort to save what remains.”^a Similarly in 2006 Alan Tennyson and Paul Martinson note all moa sighting claims have been discredited.^b

Can any case be made for reassessing moa sighting claims? Bernard Heuvelmans wrote “Most zoologists are sceptical about the possibilities of discovering new species of large animals, and some of them do not, with legitimate scientific scepticism, keep an open mind until the species is proved to exist, but categorically deny that it can possibly do so until they have been forcibly proved wrong.”^c He considered that the history of the discovery of an unknown animal almost always follows the same pattern with at first it being utterly unknown to the Western world and then, by questioning the natives, travellers, or merchants come to hear of its existence. It was observed that there was not a single example of a large animal which had remained quite unnoticed by the people who live nearest to its habitat. The local descriptions of the beast were often only roughly accurate and exaggerated in some respects. Sometimes the animal was said to have supernatural powers. Nevertheless, the different versions of the story, even those told by tribes far removed from one another, agreed so well that they eventually aroused the interest of a few naturalists. Finally, white hunters’ or prospectors’ tales confirmed the native legends. However not until the animal was brought back, dead or alive, did the skeptics admit the evidence. The only variation to this pattern was when the animal described by the natives was thought to be a fossil by the Western world, and its bones, or even its mummified hide, appeared in paleontological collections.

In his introduction to Heuvelmans’ book, Gerald Durrell writes that “Nowadays, to say you believe that in some parts of the world there may be quite large animals unknown to science is tantamount to admitting that you are slightly weak-minded. Come back from a remote part of the world and report that you have seen something which does not fit with any category of known animal from that area, and you are branded immediately as a drunkard or a liar – or preferably both.” He noted, ironically, that the indigenous inhabitants are well known to be most unreliable, since they have spent their whole lives on the spot and know most of the local countryside intimately.

^aFitzpatrick JW. Foreword. In: Lee WG, Jamieson IG, editors. *The takahe: fifty years of conservation management and research*. Dunedin: University of Otago Press; 2001. p. 9-10.

^bTennyson A, Martinson P. *Extinct birds of New Zealand*. Wellington: Te Papa Press; 2006.

^cHeuvelmans B. *On the track of unknown animals*. Translated from the French by Garnett R. London: Rupert Hart-Davis; 1962. p. 16-8, 25, 81-2, 219-20. [Originally published in French in 1955 in two volumes as *Sur la Pistes des Bêtes Ignorées* by Librairie Plon].



To him it was curious how little faith was placed in a native report. He considered that the fact that, in the case of large predatory animals, the reports would naturally be highly coloured and exaggerated was surely no reason for dismissing them out of hand.

Heuvelmans noted the observation of Le Souef and Burrell that some rare animals live in country that man seldom penetrates, and when he does so he creates such a noise in getting through the tangled undergrowth that any wary animal makes off.^a He considered that making field observations of large animals, man’s natural rivals, was difficult because they tended to disappear as soon as man arrived on the scene. The degree of difficulty depended on the habitat with it being greater in the water than on land, greater on the land than in the air, greater in the mountains than in the plains, greater in the forest than in the savannah or the bush, and greater in the bush than in a sandy desert. He felt this was why we knew so little about the creatures of the sea and so much about birds—except those species that could not fly. The difficulties were seen to be almost insuperable when two coincided, as they did in mountainous country with thick vegetation. It was seen to be a mere matter of logic that most unknown animals lived in marshy or mountainous forests.

1 In assessing evidence, errors can be made by being insufficiently critical and being
1 overcritical. In statistics, some errors have been classified as Type 1, in racing terms
23 “backing a loser”, in which the null hypothesis is incorrectly rejected, accepting that
1 a significant difference exists between the two situations being studied, when in fact no
1 difference exists. Other errors, called Type 2, involve “missing a winner” and
23 incorrectly accepting the null hypothesis, possibly because the study had insufficient
power, and concluding that no difference was present between the two situations when
in fact a difference existed.

The task is to have the appropriate degree of skepticism when assessing moa sighting claims. Finding the appropriate balance may not be easy and differing approaches may lead to differing results. Whereas Heuvelmans and Durrell give weight to native accounts regarding unknown animals, in considering evidence for the survival of moas in European Fiordland Anderson left aside Maori traditions “because of difficulties over chronology and interpretation”^b and the lack of “clearer traditions about moa names, biology, and associations with Maoris”.^c

Thomas Kuhn has noted that while a particular paradigm or way of looking at the world is in place there may be a degree of bias in interpreting data that lets it fit in with

^aLe Souef AS, Burrell H. The wild animals of Australasia, embracing the mammals of New Guinea and the nearer pacific islands. London: George G Harrap; 1926. p. 329-32. In: Heuvelmans B. On the track of unknown animals. Translated from the French by Garnett R. London: Rupert Hart-Davis; 1962. p. 219. [Originally published in French in 1955 in two volumes as *Sur la Pistes des Bêtes Ignorées* by Librairie Plon].

^bAnderson A. On evidence for the survival of moa in European Fiordland. *New Zealand Journal of Ecology* 1989;12(Suppl):39-44.

^cAnderson A. *Prodigious birds: moas and moa-hunting in prehistoric New Zealand*. Cambridge: Cambridge University Press; 1989. p. 176-7.



the prevailing paradigm.^a The possibility exists that some data have been interpreted to fit in with an extinction date of about 1500–1650 without serious consideration being given to a later extinction date. In discussing moa bones lying on the surface Anderson noted the survival of span of moa bones exposed to the weather was only 15 years and some particular bones implied that there must have been moa alive in the 1840s but that inference seemed altogether unlikely.^b The interpretation that they were old bones that had recently been exposed on the surface by burning or soil erosion was favoured.

The last moa sighting claim listed by Anderson is that by Miss Chell in 1940.^c Further moa sighting claims have been made since that time. One claim, relating to an incident in 1950, was made in 1991.^d George Brasell said “I did not say much about this sighting over the years as I felt people would only think I was putting one across”. A number of other claims have also been made with one, made in 1993,^e being the first involving a photograph (Figures 1.12, 1.14) which will be commented on in more detail in Chapter 151 but can be interpreted as resembling the form of a moa (Figures 1.13, 1.15). These 20th century claims were in relatively inaccessible mountainous forested areas, one of the types of areas noted by Heuvelmans as where unknown animals were likely to live.^f

1 *The staggered survival model* 1

1 An alternative to the rapid “blitzkrieg” extinction and the serial overkill models 1
24 would be a staggered survival model which took seriously the reservations expressed 24
by Diamond that New Zealand’s incredibly rugged terrain would have made it difficult
for a few Maoris, in a few decades, to have found and killed every single individual of
the dozen moa species, with an initial population estimated at 160,000 birds.^g With
this view it is considered that because of the marked variability of the terrain in
different parts of the country it is not possible to generalize from what happened with
moas in one area to other areas differing substantially in the nature of the land and
vegetation. The findings from settlements on the east coast of the South Island could
not be applied to the mountainous bush-covered areas in the northern, western and
southern parts of the island.

^aKuhn TS. The structure of scientific revolutions. 2nd ed. In: Neurath O editor-in-chief, Carnap R, Morris C, associate editors. International Encyclopedia of Unified Science, Vol 2(2).Chicago: University of Chicago Press; 1970.
^bAnderson A. Prodigious birds: moas and moa-hunting in prehistoric New Zealand. Cambridge: Cambridge University Press; 1989. p. 177-8.
^cAnderson A. The beast without: the moa as a colonial frontier myth in New Zealand. In: Willis RG, editor. Signifying animals: human meaning in the natural world. London: Unwin Hyman; 1990. p. 236-45.
^dBrasell G. Boats and blokes. Wellington: Daphne Brasell Associates Press; 1991. p. 114-5.
^eWilson D. Three claim sighting of moa. The Press. 1993 Jan 25.
^fHeuvelmans B. On the track of unknown animals. Translated from the French by Garnett R. London: Rupert Hart-Davis; 1962. p. 219-20. [Originally published in French in 1955 in two volumes as *Sur la Pistes des Bêtes Ignorées* by Librairie Plon].
^gDiamond J. Blitzkrieg against the moas. Science 2000;287:2170-1.



The course of the inquiry

Progress in science has been seen to proceed by disproving null hypotheses. To disprove the rapid “blitzkrieg” extinction and the serial overkill models it would be necessary to show that it was probable that a moa was alive after A.D. 1350–1450 and about A.D. 1650 respectively. This involves the consideration of circumstantial evidence and for this it has been suggested that the appropriate model is a bundle of sticks rather than a chain. Whereas a bundle of sticks retains some strength when some of the sticks are broken, a chain collapses once a single link gives way.



Photo by Paddy Freaney © 1993.

Figure 1.12 Photograph of an object claimed be a live moa in the Harper River, Craigieburn Forest Park, 20 January 1993.



Figure 1.13. Skeleton of *Dinornis parvus* from the Oblique side view of the skeleton of *Dinornis parvus*, Plate LVIII, Owen R. On *Dinornis* (Part XXIII): containing a description of the skeleton of *Dinornis parvus*, Owen. Transactions of the Zoological Society of London 1885;XI:233-56. The image has been horizontally flipped to match the posture in the photograph in Figure 1.1, which if a moa, would be likely to be of a different species such as *Megalapteryx didinus* with relatively shorter legs.

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Photo by Paddy Freaney © 1993.

Figure 1.14 Photograph of an object claimed be a live moa in the Harper River, Craigieburn Forest Park, 20 January 1993.



Figure 1.15. Digitally adjusted skeleton of *Dinornis parvus* from the Oblique side view of the skeleton of *Dinornis parvus*, Plate LVIII, Owen R. On *Dinornis* (Part XXIII): containing a description of the skeleton of *Dinornis parvus*, Owen. Transactions of the Zoological Society of London 1885;XI:233-56. The image has been horizontally flipped, vertically compressed, and horizontally enlarged to more closely match the posture of the object in the photograph in Figure 1.3.

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In *The lost world of the moa* (2002), Trevor Worthy and Richard Holdaway give Atholl Anderson in *Prodigious birds: moas and moa-hunting in prehistoric New Zealand* (1989) as the reference for the statement that “Moa had disappeared from the menu between 400 and 300 years ago.”^{a,b} In his book Anderson notes that he has considered the details of moa sightings in a paper^c (1989) and a book chapter^d (1990), Alan Tennyson and Paul Martinson in *Extinct birds of New Zealand* (2006)^e state that all moa sighting claims have been discredited and refer, in their notes and references, to the work by Trevor Worthy, Richard Holdaway, and Chris Jacomb on

^aWorthy TH, Holdaway RN. The lost world of the moa: prehistoric life in New Zealand. Bloomington: Indiana University Press;2002.

^bAnderson A. Prodigious birds: moas and moa-hunting in prehistoric New Zealand. Cambridge: Cambridge University Press; 1989. p. 176-7.

^cAnderson A. On evidence for the survival of moa in European Fiordland. New Zealand Journal of Ecology 1989;12(Suppl):39-44.

^dAnderson A. The beast without: the moa as a colonial frontier myth in New Zealand. In: Willis RG, editor. Signifying animals: human meaning in the natural world. London: Unwin Hyman; 1990. p. 236-45.

^eTennyson A, Martinson P. Extinct birds of New Zealand. Wellington: Te Papa Press; 2006.



the causes of moa extinction and to Richard Wolfe on present day sightings.^a Wolfe gave a brief account of the 1993 sighting claim and noted that the Department of Conservation put the chance of it being genuine at a “billion to one.” He commented that claimed “moa sightings” themselves almost became extinct in the 20th century with the 1993 one being the most notable. Wolfe did not give a figure for the number of 20th century sighting claims that had been made but the number is at least ten.

Atholl Anderson is the accepted authority on moa sightings and in order to relate the present account of moa sightings to his work I will, in general, follow his order in examining the material and then introduce the claims that he did not refer to.

Anderson,^{b,c,d} Beattie,^e Brewster,^f de Quatrefages,^g Field,^h Richardsⁱ and others have done pioneering work in assessing moa sighting claims and in reassessing this area one is standing on the shoulders of giants rather than starting afresh. However, the availability of more information relevant to the earlier claims and the occurrence of new reports are reasons for the area to be reviewed.

In 1955 Bernard Heuvelmans described New Zealand’s large ancient ratite as “The moa, a fossil that may still thrive.”^j Clearly moas are not thriving at present. After consideration of the data in this book the reader may be in better position to consider the strength of the proposed staggered survival model and form a view as to whether or not any moas survived into the European era in New Zealand. If any survivors were present the question arises as to whether or not some remnants of the family may still exist, such as some subalpine moas in a remote area, that may form the basis of a population that may thrive in the future.

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^aWolfe R. Moa: the dramatic story of the discovery of a giant bird. Auckland: Penguin Books; 2003.
^bAnderson S. Prodigious birds: moas and moa-hunting in prehistoric New Zealand. Cambridge: Cambridge University Press; 1989. p. 171-87.
^cAnderson A. On evidence for the survival of moa in European Fiordland. New Zealand Journal of Ecology 1989;12(Suppl):39-44.
^dAnderson A. The beast without: the moa as a colonial frontier myth in New Zealand. In: Willis RG, editor. Signifying animals: human meaning in the natural world. London: Unwin Hyman; 1990. p. 236-45.
^eBeattie H. The moa: when did it become extinct? Maori traditions and pakeha conjectures. Four main schools of thought. One hundred opinions of Maori and Pakeha. Waimate: Herries Beattie; 1953.
^fBrewster B. Te moa: the life and death of New Zealand's unique bird. Nelson: Nikau Press, 1987.
^gde Quatrefages A. The moas and moa-hunters. Transactions and proceedings of the New Zealand Institute 1892;XXV (eighth of new series):17-49.
^hField HC. The date of extinction of the moa. Transactions and proceedings of the New Zealand Institute 1893;XXVI (ninth of new series):560-8.
ⁱRichards R. Which pakeha ate the last moa? A preliminary re-examination of the traditional, scientific and historical evidence, and of the need for their integration. Wellington: Paremata Press; 1986.
^jHeuvelmans B. On the track of unknown animals. Translated from the French by Garnett R. London: Rupert Hart-Davis; 1962. [Originally published in French in 1955 in two volumes as *Sur la Pistes des Bêtes Ignorées* by Librairie Plon]. p. 221-45.