Tuhinga 34 2023, 47–56 | DOI 10.3897/tuhinga.34.97731 RESEARCH ARTICLE

PENSOFT

MUSEUM OF NEW ZEALAND TE PAPA TONGAREWA

Augustus Hamilton's fossil collection at the Museum of New Zealand Te Papa Tongarewa

Melanie Ioane-Warren[1], Rodrigo B. Salvador[2,3], Karyne M. Rogers[4], Alan J. D. Tennyson[1]

1 *Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand*

2 *Department of Arctic and Marine Biology, Faculty of Biosciences, Fisheries and Economics, UiT – The Arctic University of Norway, Tromsø, Norway*

3 *The Arctic University Museum of Norway, UiT – The Arctic University of Norway, Tromsø, Norway*

4 *GNS Science, National Isotope Centre, Lower Hutt, Wellington, New Zealand*

Corresponding author: Alan J. D. Tennyson (AlanT@tepapa.govt.nz)

Academic editor: Phil Sirvid ♦ **Received** 20 November 2022 ♦ **Accepted** 21 February 2023 ♦ **Published** 7 March 2023

Abstract

Augustus Hamilton (1853–1913) was a New Zealand ethnologist and naturalist who amassed a significant collection of fossils, mostly of birds, during his career. Today, those fossils are housed in the Museum of New Zealand Te Papa Tongarewa (NMNZ). While some fossils have been catalogued and integrated into the collection of the NMNZ, a large part remained unsorted and uncatalogued. The present study brings an integrated view of Hamilton's collection at the NMNZ, highlighting the most significant fossils. In total, there are 3692 specimen lots collected by Hamilton in the NMNZ representing a large sample of taxa and a wide range of locations around Aotearoa New Zealand. Most fossils are of Holocene age and belong to birds. The collection includes type specimens, circa 250 specimen lots belonging to extinct species, and specimens belonging to otherwise poorly represented species in natural history collections. We hope that our study makes Hamilton's fossils visible and more readily available for future research.

Keywords

Aves, birds, extinct species, Holocene, natural history collections, type specimens

Introduction

Augustus Hamilton (1853–1913; Fig. 1) was a New Zealand ethnologist and naturalist who was the Director of the Colonial Museum of New Zealand in Wellington from 1903 to 1913 (Dell 1993; McCarthy 2008). Despite his main focus being ethnology, Hamilton also amassed a significant collection of fossil bones over his career, mostly of birds. While he published part of his research at the time, his bone collections were only partly registered in the museum long after his death. Many fossils remained uncatalogued and either unidentified or only broadly identified.

The Colonial Museum became the Dominion Museum, then the National Museum, and then the Museum of New Zealand Te Papa Tongarewa (NMNZ, Wellington). All the while, much of Hamilton's uncatalogued fossils have stayed "hidden" from sight, tucked inside cardboard boxes in Te Papa's natural history collection. His collection contains specimens gathered from all over Aotearoa New Zealand, most of which are bird bones of Holocene age. The specimens include well-preserved bones of many extinct species, as well as valuable comparative material of living species. It is a treasure trove of important and still untapped data (morphoanatomical, genetic, chemical, etc.).

The fossils are of considerable historical and scientific value and the academic community and the public at large would benefit if they were made visible again and thus available for further inquiries and research. Therefore, the present study focuses on the identification of all unregistered specimens in Hamilton's collection. This paper presents an account of all of his fossil material and the taxa in his collections, highlighting the most significant fossils.

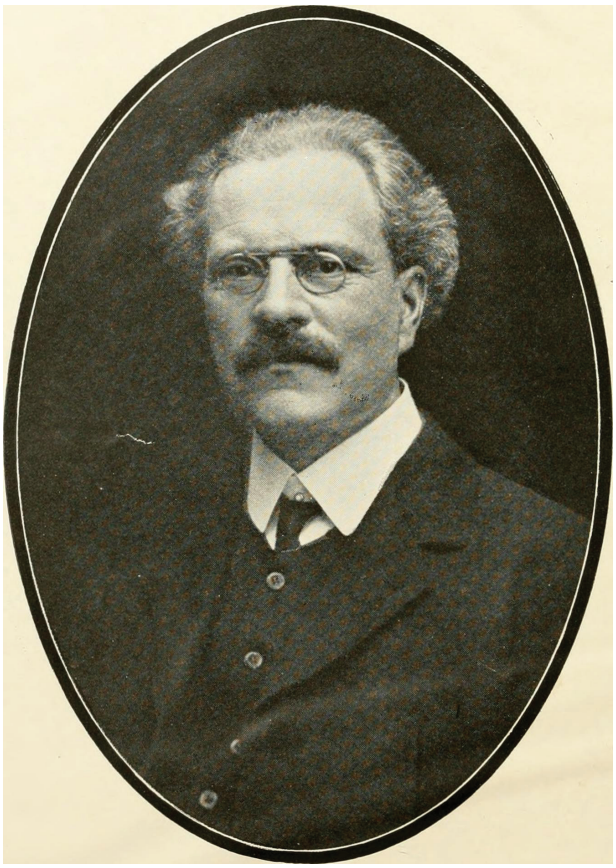

Figure 1. Photo of Augustus Hamilton. Photographer unknown; image reproduced from volume 46 of the Transactions and Proceedings of the New Zealand Institute (1913: frontispiece); no known copyright restrictions.

Background

We present a short biography of Hamilton to provide context to his collecting activities. The text below was summarised from Phillipps (1966) and Dell (1993).

On 1 March 1853, Augustus Hamilton was born in the coastal town of Poole, in Dorsetshire, England. He was a student at Dorset County school and Epsom medical college but did not graduate with a degree. On 16 April 1875, the clipper 'Collingwood' departed England and set sail for Wellington, Aotearoa New Zealand. Those aboard were emigrants, including Augustus and his parents. His father was a doctor, named Augustus Priestly Hamilton, and his mother was Mary Eleanor Hamilton (née Tebbott).

During Augustus' first years in Aotearoa New Zealand, he briefly taught primary school children in Wellington and the coastal settlement of Ōkārito, on the South Island. In 1876, he joined the Wellington Philosophical Society and continued to be a member of the institution through various provincial groups. In 1878, Augustus moved to Petane in Hawke's Bay where he resided and taught until 1890 (Fig. 2). During that time, he married Hope Ellen McKain, with whom he had two children, Harold and Pearl Hamilton.

While in Petane, Augustus also took part in the Hawke's Bay Philosophical Institute business. He worked hard to assist progress at the institute by exhibiting interesting items at gatherings, and also by serving as the honorary secretary between 1884 and 1890. Notably, he also created the Institute's museum (now the MTG [Museum Theatre Gallery] Hawke's Bay Tai Ahuriri), of which he became an honorary curator in 1883, and published scientific papers, predominantly on biology and palaeontology.

In 1890, he became the registrar of the University of Otago and moved to Dunedin with his family. Augustus continued to publish scientific papers that covered topics such as fossils, plants, birds, and marine life. He became increasingly interested in ethnology and was intrigued by the Māori culture, eventually building a large collection of beautiful Māori carvings and art through purchases and exchanges. He went on to publish a bibliography of literature regarding the indigenous people, as well as an exquisite and now rare book titled 'The Art and Workmanship of the Maori Race in New Zealand' (Hamilton 1896b).

In 1903, Augustus became the director of the Colonial Museum in Wellington. Two years prior, an act was passed in the New Zealand Parliament titled 'The Maori Antiquities Act 1901', which sparked recognition of the importance of preserving Māori relics. With this in mind, Augustus put much effort into creating an illustrative collection of Māori art and craftsmanship. He placed his own personal Māori art collection in the Colonial Museum and began to further build the collections within the museum, including natural history. He continued to publish scientific articles and edited the museum's Bulletin. He was greatly interested in New Zealand birds for much of his life, particularly extinct species such as the moa (e.g., Anonymous 1897, 1898, 1899; Hamilton 1889a, 1889b, 1892a, 1892b, 1893, 1894a, 1894b, 1895a, 1895b, 1898, 1902, 1904a, 1904b, 1909), and he also endeavoured to save the now extinct huia (O'Rourke 1997).

Hamilton was also the president of the New Zealand Institute (later rebranded as the Royal Society of New Zealand) from 1909 to 1911 (Fleming 1987; Royal Society Te Apārangi 2022). On 12 October 1913, at the age of 60, Augustus Hamilton suddenly became ill and died in Russell, Bay of Islands. He was laid to rest in the Christ Church yard in Russell.

Material and methods

During a period from 2021 to early 2022, we initially examined and sorted all bones collected by Augustus Hamilton that were kept in the natural history collection of the Museum of New Zealand Te Papa Tongarewa (NMNZ, Wellington, New Zealand). This included about 2500 bones that were kept unsorted and uncatalogued inside nine cardboard boxes kept on shelves with other unsorted material in the collection. The latter specimens were identified to Operational Taxonomic Units (OTU) by AJDT, based on comparative material in the NMNZ

Figure 2. Photo of Augustus Hamilton (centre, in front of the door) with pupils and staff of Petane School. Photographer unknown, 1879; image from MTG Hawke's Bay Tai Ahuriri; public domain.

collection. The OTU identification typically goes to family or genus level only, though some specimens were identified only to the level of order; a few specimens, however, were assigned to species. A more detailed study will be able to identify most or all specimens to the level of species. The systematic arrangement, nomenclature, and common names used herein follow the Checklist Committee OSNZ (2022).

Most of the unsorted specimens lacked accompanying information regarding collection locality and date. However, about 55% of the bones have a two-digit number written on them (Fig. 3); four bones have either a one-digit or a three-digit number on them and seven bones have two sets of numbers written on them. Each of those numbers (Fig. 3) likely refers to a collection event and location, as suggested by previous work on fossils from Castlerock, Southland, and Te Aute, Hawke's Bay (Worthy 1998, 1999). Hamilton was considered a methodical and systematic researcher (Skinner 1913; McCredie 2017), so presumably, his numbering system had a practical purpose.

In an attempt to uncover Hamilton's system behind these numbers, we investigated all archival material pertaining to him that we could find, such as diaries, notebooks, letters, and photographs. That material is kept in Te Papa's archives (multiple items contained under the registration number NMNZ CA000403, as well as some of Hamilton's correspondence compiled by O'Rourke (1997)), in the Alexander Turnbull Library (items MS-Papers-0172-008, MS-Papers-10779-053, MS-Papers-12166, and MSX-9384), and the Hocken Collections and Gallery (Otago University; multiple items contained under the registration number P1910-008). Further photographic material was obtained from the Puke Ariki Heritage Collection (https://collection.pukeariki.com/explore).

During this process, all uncatalogued specimens were given a registration number (NMNZ S.53912 to S.56336), added to the NMNZ database, and stored in the Fossil Vertebrate collection in taxonomic order. A full list of specimens can be seen in the Suppl. material 1: table S1.

We also reviewed Hamilton's specimens that had already been incorporated into the NMNZ collection. Specimens only received their current registration numbers beginning in the 1940s, usually by researchers working on specific sites or taxa. A full list of this material can be seen in the Suppl. material 1: table S2. The NMNZ collection also holds specimens collected by Hamilton's son, Harold, but those are not covered in the present study.

Results

Specimens

The NMNZ collection had 1267 of Hamilton's specimen lots that were already registered, labelled, and stored (Suppl. material 1: table S2). While most lots include just a single bone element, many lots contain more than one specimen (e.g., a group of bones from a single individual, or multiple specimens of the same element from several individuals). From his uncatalogued specimens, 2425 lots were created

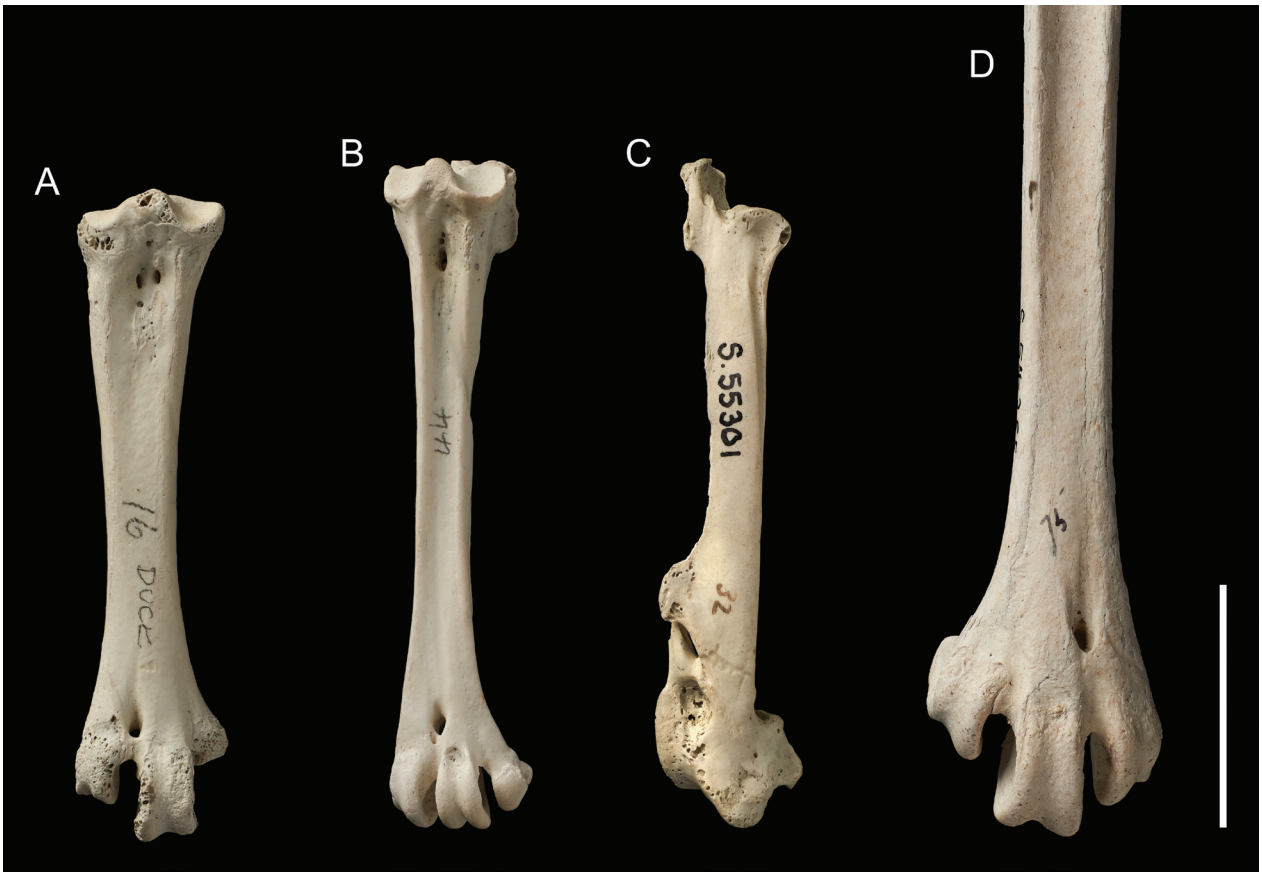

Figure 3. Fossils exemplifying Hamilton's handwritten numbers. **A.** 2-digit number ("16") written in pencil, plus identification ("Duck); right tarsometatarsus of an Anatidae bird, NMNZ S.54262. **B.** 2-digit number ("44") written in pencil; right tarsometatarsus of a Phalacrocoracidae bird, NMNZ S.53956. **C.** 2-digit number ("32") written in ink, plus the NMNZ number written during the present study; left carpometacarpus of a songbird (Passeriformes), NMNZ S.55301. **D.** 2-digit number ("75") written in ink; left tarsometatarsus of a Diomedeidae bird, NMNZ S.54355. Scale bar: 2 cm.

(NMNZ S.53912 to S.56336; see Suppl. material 1: table S1, for more details). This brings the total number of Hamilton's specimen lots in the NMNZ collection to 3692. Most specimens are bird fossils of Holocene age.

The majority of bone elements present in Hamilton's collection are the most robust leg bones that are preferentially preserved by fossilisation (also, several species in New Zealand have reduced wings). Thus, the most common bones in the material are femora, tibiotarsi, and tarsometatarsi. These are followed by pelves, crania, and sterna.

In the previously catalogued 1267 specimen lots, the most represented taxa were kiwi (Apterygiformes, *Apteryx* spp.) and moa (Dinornithiformes) (Fig. 4). The majority of Hamilton's previously uncatalogued material was made up of bird bones, but mammal and reptile (tuatara) bones were also present, as well as two marine gastropod shells. The most common taxa in this material were shags (Suliformes, Phalacrocoracidae) and seabirds of the family Procellariidae (Procellariiformes) (Fig. 4). A comparison of the order-level diversity among the birds is presented in Figure 4 but refer to Suppl. material 1: table S3 for exact numbers.

Hamilton's collection includes seven type specimen lots (Fig. 5): the holotype of the moa *Dinornis gazella* Oliver, 1949, now a junior synonym of *Dinornis novaezealandiae* (Owen, 1843) (NMNZ S.00107, from Te Aute); the lectotype and paralectotypes of the coot *Fulica prisca* (NMNZ S.00990 and OR. 00379, from Castlerock; Fig. 5C); the syntypes of the weka *Ocydromus minor* (Hamilton, 1893) now a junior synonym of *Gallirallus australis* (Sparrman, 1786) (NMNZ S.00987 to S.00989, from Oreti River; Fig. 5A, B); and a paratype of *Xenicus yaldwyni* (Millener, 1988) (NMNZ S.23317, from Castlerock).

Hamilton's fossil collecting

During his time in Aotearoa New Zealand, Hamilton worked as a teacher in Wellington, Ōkārito, and Hawke's Bay, then became the curator of the Hawke's Bay Philosophical Institute's museum, the registrar of Otago University in Dunedin and later on, the director of the Colonial Museum in Wellington (Dell 1993).

Hamilton collected most of his specimens in and around the places where he was based, such as Hawke's Bay and, particularly Dunedin (Skinner 1913; Pishief 2017). He also travelled around the country, including Macquarie Island, while collecting a wide range of fossils, natural history specimens, tāonga Māori, and New Zealand art.

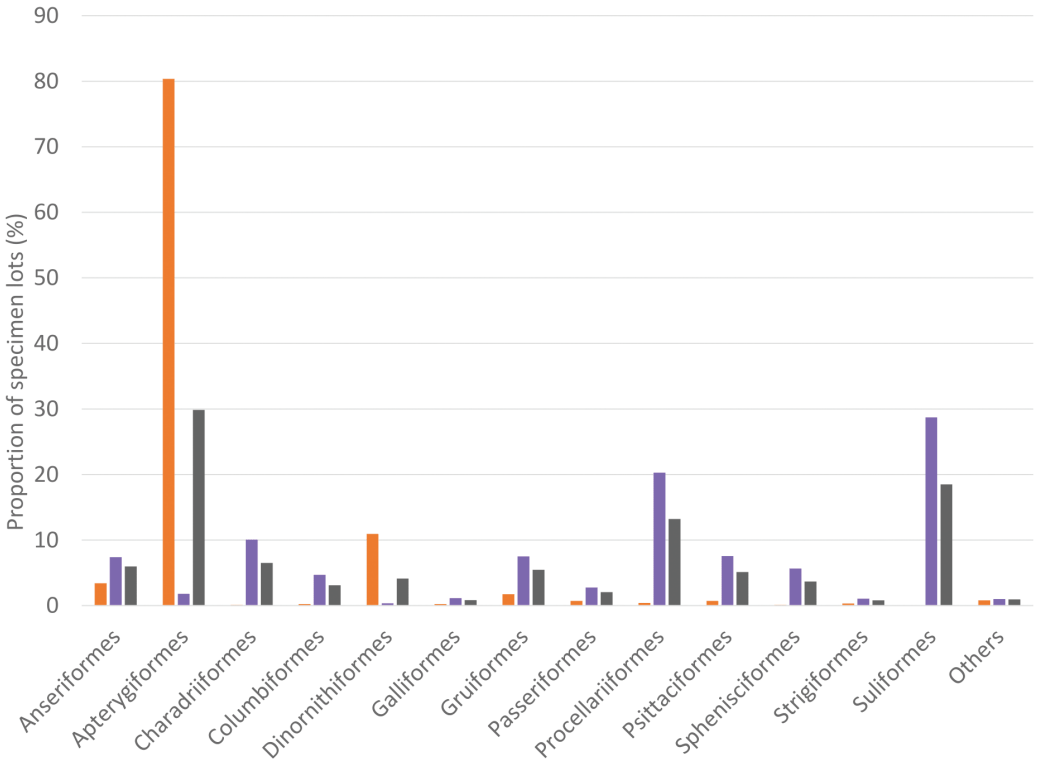

Figure 4. Summary of the proportion of specimen lots from Hamilton's collection, belonging to each avian order, from the previously catalogued material (orange bars), the previously uncatalogued material (purple bars), and total (dark grey bars). The "Others" group brings together data from the following orders: Accipitriformes, Apodiformes, Falconiformes, Pelecaniformes, and Podicipediformes. Refer to Suppl. material 1: table S3 for the exact numbers in each category.

Figure 5. Examples of specimens from Augustus Hamilton's collection. **A, B.** Syntypes of *Ocydromus minor* (junior synonym of *Gallirallus australis*); **A.** NMNZ S.00987. **B.** NMNZ S.00989. **C.** Paralectotype of *Fulica prisca*, NMNZ S.00990. **D.** Specimen of *Podiceps cristatus*, NMNZ S.54834. Scale bars: 1 cm.

This is evident in and supported by his published work and personal diaries. Most of his academic articles were published in the Transactions and Proceedings of the Royal Society of New Zealand and cover aspects of his collecting activities (e.g., Hamilton 1889b, 1893, 1894a, 1895b, 1898, 1904b). It is uncertain whether Hamilton had been to the Chatham Islands; while a few specimens (including in the NMNZ entomological and botanical collections) came from there, their reduced number is strange when compared to the profusion of specimens from elsewhere, so it is possible that he acquired them from someone else.

Using the archival documents, we compiled a list of sites that Hamilton visited and collected natural history specimens at (Fig. 6). They are: **Gisborne:** Wainui. **Hawke's Bay:** Nūhaka (Mangaone), Te Aute, Te Pōhue (Pōhue). **Manawatū-Whanganui:** Makirikiri (in Upokongaro), Tahora. **Wellington:** Island Bay, Lyall Bay, Paremata. **Canterbury:** Broken River, Takiroa Cave. **Otago:** Dunedin, Dunstan Range, Long Beach (Warauwerawera), Macraes (Ōtī), Ngapara, Shag Point (Matakaea), Warrington (Ōkāhau), Wickliffe Bay. **Southland:** Castlerock, Waikaia River. **Islands:** Macquarie Island, Chatham Islands.

Figure 6. Locations in Aotearoa New Zealand that Augustus Hamilton visited, including those where he collected fossils.

The archives also allowed us to work out the dates when he visited some of those places to collect specimens. Table 1 summarises the places where Hamilton lived and the locations where he collected specimens, with the respective dates.

It was only possible to link the handwritten numbers on the bones (Fig. 3) to a few localities, namely: Castlerock (in Southland) is represented by the number 29 and possibly also by the number 78; Te Aute (in Hawke's Bay) is represented by the numbers 12 and 17; Macraes (in Otago) is possibly represented by number 71. In total, there are potentially 59 unique numbers (some are difficult to read) represented in the collection. Unfortunately, despite our extensive research, the majority of those could not be assigned to specific locations.

It is also possible that some of the fossils in Hamilton's material were not collected by him, but represent specimens that he received from others, like the case of the Chatham Islands mentioned above.

Discussion

The circa 3700 specimen lots in Augustus Hamilton's collection represent a large sample of taxa (Fig. 4; Suppl. material 1: table S3) and a wide range of locations around Aotearoa New Zealand (Fig. 6). The high number of specimens means that Hamilton ranks as one of the top collectors of fossil bones in the country.

The collection includes many important specimens. Aside from the type specimens, circa 250 specimen lots belong to species that became extinct since human arrival on Aotearoa New Zealand: the nine species of moa (Dinornithiformes); the waterfowl *Chenonetta finschi* and *Cnemiornis gracilis* (Anseriformes); the quail *Coturnix novaezelandiae* (Galliformes); the owlet-nightjar *Aegotheles novaezealandiae* (Apodiformes); the adzebill *Aptornis defossor*, the waterhen *Tribonyx hodgenorum*, the takahe *Porphyrio mantelli*, and the coots *Fulica chathamensis* and *F. prisca* (Gruiformes); Haast's eagle *Aquila moorei* (Accipitriformes); the laughing owl *Ninox albifacies* (Strigiformes); and the Passeriformes *Xenicus yaldwyni* (stout-legged wren), *Callaeas cinerea* (South Island kokako), *Heteralocha acutirostris* (huia), *Turnagra capensis* (piopio), and *Corvus moriorum* (New Zealand raven). The number of bones from extinct species will be an under-estimate and will grow as more bones are identified to species level.

Additionally, even some of the living species are not represented by many specimens in museum collections, so the bones in Hamilton's collection are an important addition to the holdings of these species. For instance, we are not aware of fossil bones of the great crested grebe

Table 1. A timeline of Augustus Hamilton's fossil collecting activities, with main events in his life, and references to the archival sources of information (see Material and methods for more detail).

Year	Living location	Events	Reference
1853–1875	England	Born 01/Mar/1853. Emigrates to New Zealand in 1875.	Dell (1993)
1875–1876	Wellington	Arrives in Wellington Jul/1975. Joins Wellington Philosophical Society in 1876.	Anonymous (1875); Dell (1993)
1877	Wellington	Visits Okarito and Petane.	Hamilton (1878)
1878–1882	Wellington / Hawke's Bay	Moves to Petane. Joins Hawke's Bay Philosophical Society in 1878. Marries Hope Ellen McKain 22/Sep/1882.	Dell (1993)
1883–1885	Hawke's Bay	Daughter Pearl Eleanor Douglas Hamilton is born Jul/1883. Son Harold Hamilton is born 09/Feb/1885. Visits Otago in 1885.	www.ancestry.com.au; Hocken Collections and Gallery (P1910-008)
1886–1887	Hawke's Bay	Collecting in Mohaka in 1886.	NMNZ CA000403/1
1888–1889	Hawke's Bay	Collecting in Te Aute in 1888–89.	NMNZ collection data (Suppl. material 1: table S2)
1890	Hawke's Bay / Otago	Moves to Dunedin. Becomes registrar of Otago University. Visits Maraewhenua.	https://nzhistory.govt.nz/; NMNZ MA_I062508
1891–1893	Otago	Collecting in Castlerock, Dunstan Range, and Warrington in 1891; in Castlerock in 1892–93.	NMNZ collection data (Suppl. material 1: table S2)
1894–1895	Otago	Collecting in Macquarie Island and Waikaia River in 1895; in Wainui in 1895.	Hamilton (1894c); NMNZ collection data (Suppl. material 1: table S2); Hocken Collections and Gallery (P1910-008)
1896–1902	Otago	Visits Takiroa in 1896; Ōakura in 1897. Collecting in Macraes.	Hamilton (1896); NMNZ collection data (Suppl. material 1: table S2); Puke Ariki (PHO2008-1665)
1903	Otago / Wellington	Becomes director of the Colonial Museum in Wellington. Collecting in Macraes, Ngapara, and Nuhaka.	Dell (1993); NMNZ collection data (Suppl. material 1: table S2)
1904–1909	Wellington	Visits Christchurch in 1906; Taihape in Oct/1907 and Nov/1908; Featherston in Feb/1908; Lower Wairarapa in Feb/1908; Apiti in Apr/1908; Whanganui in Oct/1908; Taihape and Moawhango in Mar/1909. Collecting in Makirikiri in 1906.	O'Rourke (1997); Neich (2001); NMNZ collection data (Suppl. material 1: table S2)
1910–1912	Wellington	Visits Hastings in May/1910; Bulls in Oct/1910; Tariki in Mar/1911. Collecting in Ngapara and Te Pohue in 1910.	O'Rourke (1997); NMNZ collection data (Suppl. material 1: table S2)
1913	Wellington	Collecting in Mangaone Cave and Nuhaka. Dies in Russell, Bay of Islands, 12/Oct/1913.	Dell (1993); NMNZ collection data (Suppl. material 1: table S2)

(*Podiceps cristatus*) having been found in New Zealand for nearly five decades (AJDT, personal observation). In the NMNZ fossil vertebrate collection, this species was represented by 33 bones from Poukawa (Hawke's Bay) and three other lots (a total of 18 bones). Hamilton's specimens include another six bones of the great crested grebe (Fig. 5D). The laughing owl is a similar case; the NMNZ collection had 62 lots of this species and Hamilton's fossils added another 23 lots to it.

The major problem with Hamilton's collection that remains is his numeric code. About half of the bones have numbers written on them (Fig. 3), but we have been able to link only a handful of numbers to specific localities (see Results above). Some of his "mystery numbers" are particularly important to identify; for instance, the numbers 32 and 63 are the most common, being written on 130 and 109 bones, respectively.

Nevertheless, we are hopeful that future research will be able to identify more of Hamilton's collecting locations. Further original notes by Hamilton may yet be discovered that reveal the locations of the numbered bones. Alternatively, further analyses using forensic techniques (e.g., DNA, elemental content, or stable isotopes) may be able to solve some cases. The state of preservation of the bones already indicates the kind of sites that some of the mystery numbers represent. None of Hamilton's bones are mineralised, indicating that his collection is entirely from Late Pleistocene and Holocene sites. Fossil bird bones in New Zealand are almost always from swamps, caves, or sand dunes. Only a few of Hamilton's mystery bones have staining consistent with being preserved in swamp environments. Likewise, sand grains on some bones clearly indicate an origin in coastal dunes (e.g., numbers 30, 31, 32). In that sense, the use of non-destructive X-ray fluorescence spectroscopy to determine elemental contents offers a potential solution because it may be able to group bones based on ratios of elements that can be linked to sedimentary contaminants adhering to bones or elements transferred into the bones through dietary contributions from certain locations, thus being able to provenance the fossils (e.g., Plummer et al. 1994; Rogers 2019).

Conclusion

Natural history collections are an archive of the history of life on Earth. They can be a source for understanding biodiversity and discovering new species, and now also for studying the impacts we have had on our planet's biota (Allmon 1994; Meineke et al. 2018; Salvador and Cunha 2020). Regrettably, most collections worldwide are perennially underfunded and understaffed (Dalton 2003; Kemp 2015) and thus, their contents remain largely unknown to the scientific community and the public – not to mention the risk of such content being discarded and lost forever.

Our study makes Augustus Hamilton's unregistered fossil bones in the NMNZ available for future research. Every fossil that we know Hamilton collected (and lodged at the NMNZ) is now registered and databased. It will now be much easier for future researchers to increase the value of the collection further by adding more specific taxonomic and locality information.

Authors' contributions

Conceptualisation, Methodology, Funding Acquisition: RBS, AJDT. Investigation: MIW, AJDT. Data Curation, Visualisation, Writing (original draft): MIW, RBS. Writing (Review and Editing): all authors.

Acknowledgements

We are very grateful to Jennifer Twist for her help with Hamilton's archives in the NMNZ; to Kate Guthrie for her assistance with the online Hocken Collections and archives; to Linda McGregor for her assistance in finding Hamilton archives in the Alexander Turnbull Library; to Julia Wilson-Davey (NMNZ) for help in databasing Hamilton's specimens; to Jean-Claude Stahl (NMNZ) for photographs of specimens used herein; and to Brian Gill for the helpful comments and suggestions. This project was partially supported by a Research Support Grant from Friends of Te Papa (New Zealand) to RBS & AJDT.

References

Allmon WD (1994) The value of natural history collections. Curator 37(2): 83–89. https://doi.org/10.1111/j.2151-6952.1994.tb01011.x

Anonymous (1875) Arrival of the ship Collingwood from London at Wellington. The Press 24(3087): 2. [Available from:] https://paperspast.natlib.govt.nz/newspapers/CHP18750715.2.3.2 [Date of access 07/Oct/2022]

Anonymous (1897) Notes on a deposit of moa-bones, &c., at Deep Dell Creek, Macrae's, by A. Hamilton. Transactions and Proceedings of the New Zealand Institute 29: 629.

Anonymous (1898) [Extinct New Zealand geese *Cnemiornis* spp., by A. Hamilton]. Transactions and Proceedings of the New Zealand Institute 30: 581.

Anonymous (1899) On the distribution of *Notornis*, and general notes on the genus, by A. Hamilton. Transactions and Proceedings of the New Zealand Institute 31: 739–740.

Checklist Committee OSNZ (2022) Checklist of the Birds of New Zealand. 5th ed. Ornithological Society of New Zealand Occasional Publication No. 1, Wellington: Ornithological Society of New Zealand, 335 pp.

Dalton R (2003) Natural history collections in crisis as funding is slashed. Nature 423: 575. https://doi.org/10.1038/423575a

Dell RK (1993) Hamilton, Augustus. In: Orange C, Oliver WH (Eds) Dictionary of New Zealand Biography. [Updated July 2013 by Te Ara - the Encyclopedia of New Zealand]. [Available from:] https://teara.govt.nz/en/biographies/2h8/hamilton-augustus [Date of access 11/Aug/2022]

Fleming CA (1987) Science, Settlers and Scholars: The Centennial History of the Royal Society of New Zealand. Royal Society of New Zealand, Wellington, 353 pp.

Hamilton A (1878) The district of Okarito, Westland. Transactions and Proceedings of the Royal Society of New Zealand 11: 386–391.

Hamilton A (1889a) On a specimen of the brown gannet (*Sula fusca*) shot in Napier Harbour, with notes on other New Zealand birds. Transactions and Proceedings of the New Zealand Institute 21: 128–134.

Hamilton A (1889b) Notes on a deposit of moa-bones in the Te Aute swamp, Hawke's Bay. Transactions and Proceedings of the New Zealand Institute 21: 311–318.

Hamilton A (1892a) Notes on moa gizzard-stones. Transactions and Proceedings of the New Zealand Institute 24: 172–175.

Hamilton A (1892b) On the genus *Aptornis*, with more especial reference to Aptornis defossor, Owen. Transactions and Proceedings of the New Zealand Institute 24: 175–184.

Hamilton A (1893) On the fissures and caves at the Castle Rocks, Southland; with a description of the remains of the existing and extinct birds found in them. Transactions and Proceedings of the New Zealand Institute 25: 88–106.

Hamilton A (1894a) Results of a further exploration of the bone-fissure at the Castle Rocks, Southland. Transactions and Proceedings of the New Zealand Institute 26: 226–229.

Hamilton A (1894b) Materials for a bibliography of the Dinornithidae, the great extinct birds of New Zealand, usually called moas. Transactions and Proceedings of the New Zealand Institute 26: 229–257.

Hamilton A (1894c) Notes on a Visit to Macquarie Island. Transactions and Proceedings of the Royal Society of New Zealand 27: 559–578.

Hamilton A (1895a) Further contributions towards a bibliography of the Dinornithidae, the great extinct birds of New Zealand, usually called moas - supplement no.1. Transactions and Proceedings of the New Zealand Institute 27: 228–231.

Hamilton A (1895b) On the feathers of a small species of moa (*Megalapteryx*) found in a cave at the head of the Waikaia River; with a notice of a moa-hunter's camping-place on the Old Man Range. Transactions and Proceedings of the New Zealand Institute 27: 232–238.

Hamilton A (1896a) Notes from Murihiku. Transactions and Proceedings of the Royal Society of New Zealand 29: 169–178.

Hamilton A (1896b) The Art Workmanship of the Maori Race in New Zealand: A series of illustrations from specially taken photographs, with descriptive notes and essays on the canoes, habitations, weapons, ornaments, and dress of the Maoris, together with lists of words in the Maori language used in relation to the subjects. Fergusson & Mitchells, Dunedin, 438 pp.

Hamilton A (1898) Notes on a specimen of Euryapteryx from Southland. Transactions and Proceedings of the New Zealand Institute 30: 445–446.

Hamilton A (1902) On the septarian boulders of Moeraki, Otago. Transactions and Proceedings of the New Zealand Institute 34: 447–451.

Hamilton A (1904a) Second supplement to the "Materials for a bibliography of the Dinornithidae". Transactions and Proceedings of the New Zealand Institute 36: 471–473.

Hamilton A (1904b) Notes on remains of some of the extinct birds of New Zealand found near Ngapara. Transactions and Proceedings of the New Zealand Institute 36: 474–477.

Hamilton A (1909) Hand-list of the birds inhabiting New Zealand. Dominion Museum, Wellington, 19 pp.

Kemp C (2015) The endangered dead. Nature 518: 292–294. https://doi.org/10.1038/518292a

McCarthy C (2008) Displaying natural history. Colonial Museum. In: Natham S, Varnham M (Eds) The Amazing World of James Hector. Awa Science, Wellington, 49–61.

McCredie A (2017) Augustus Hamilton - creating a visual database. Journal of the Royal Society of New Zealand 47: 138–144. https://doi.org/10.1080/03036758.2016.1217244

Meineke EK, Davies TJ, Daru BH, Davis CC (2018) Biological collections for understanding biodiversity in the Anthropocene. Philosophical Transactions of the Royal Society B 374: 20170386. https://doi.org/10.1098/rstb.2017.0386

Neich R (2001) Carved Histories: Rotorua Ngāti Tarawhai Woodcarving. Auckland University Press, Auckland, 450 pp.

O'Rourke RB (1997) The huia files of the late Augustus Hamilton 1907–1911 in the Museum of New Zealand Te Papa Tongarewa: a chronological document bank. Museum of New Zealand Te Papa Tongarewa, Wellington, unpaginated. [unpublished]

Phillipps WJ (1966) Hamilton, Augustus. In: McLintock AH (Ed.) An Encyclopaedia of New Zealand. [Available from:] http://www.teara.govt.nz/en/1966/hamilton-augustus [Date of access 11/Aug/2022]

Pishief E (2017) Augustus Hamilton's 'scientific specimens' or 'Māori Art': agency and the social life of things. Journal of the Royal Society of New Zealand 47: 132–137. https://doi.org/10.1080/03036758.2016.1244087

Plummer TW, Kinyua AM, Potts R (1994) Provenancing of hominid and mammalian fossils from Kanjera, Kenya, using EDXRF. Journal of Archaeological Science 21(4): 553–563. https://doi.org/10.1006/jasc.1994.1054

Rogers KM (2019) Provenance, authentication and residue analysis of some Māori taonga using portable X-ray fluorescence. Tuhinga 30: 256–268.

Royal Society Te Apārangi (2022) Presidents. [Available from:] https://www.royalsociety.org.nz/who-we-are/our-people/our-council/presidents [Date of access 11/Aug/2022]

Salvador RB, Cunha CM (2020) Natural history collections and the future legacy of ecological research. Oecologia 192: 641–646. https://doi.org/10.1007/s00442-020-04620-0

Skinner HD (1913) Obituary, Augustus Hamilton. Transactions and Proceedings of the Royal Society of New Zealand, 46, unnumbered page.

Worthy TH (1998) The Quaternary fossil avifauna of Southland, South Island, New Zealand. Journal of the Royal Society of New Zealand 28(4): 537–589. https://doi.org/10.1080/03014223.1998.9517575

Worthy TH (1999) Two late-Glacial avifaunas from eastern North Island, New Zealand - Te Aute Swamp and Wheturau Quarry. Journal of the Royal Society of New Zealand 30(1): 1–25. https://doi.org/10.1080/03014223.2000.9517607

Supplementary material 1

Specimen data on Hamilton's fossil collection

Authors: Melanie Ioane-Warren, Rodrigo B. Salvador, Karyne M. Rogers, Alan J. D. Tennyson
Data type: table (Excel file)

Link: https://doi.org/10.3897/tuhinga.34.97731.suppl1